

39 QUEEN STREET, TOTTENHAM

VERITY TRUSTEES LTD

BUILDING SERVICES SPECIFICATION
ELECTRICAL SERVICES
PERFORMANCE SPECIFICATION

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REV: T03 · DATE: 05-03-26

DOC NO. 6753-CBC-LW-SP-E-000002



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CONTENTS

RECORD OF REVISIONS	4
C PARTICULAR SPECIFICATION.....	5
C.1 INTRODUCTION	5
C.2 EXISTING SITE & SERVICES	7
C.2.1 EXISTING SITE.....	7
C.2.2 SURVEY WORKS.....	7
C.2.3 MODIFICATIONS TO EXISTING SERVICES	7
C.2.4 RISKS TO HEALTH AND SAFETY	7
C.3 SCOPE OF WORKS	8
C.3.1 GENERAL	8
C.3.2 SCOPE OF WORKS	8
C.3.3 EXTENT OF THE WORKS	8
C.3.4 WORK BY STATUTORY AUTHORITIES/UNDERTAKERS	9
C.3.5 REGULATIONS AND STANDARDS	9
C.3.6 WORK BY STATUTORY AUTHORITIES/UNDERTAKERS	9
C.4 DESCRIPTION OF THE WORKS.....	10
C.4.1 LOW-VOLTAGE DISTRIBUTION SYSTEMS	10
C.4.2 EARTHING AND BONDING SYSTEMS.....	13
C.4.3 SMALL POWER	14
C.4.4 DISABLED ALARM SYSTEM	16
C.4.5 REFUGE ALARM SYSTEM	16
C.4.6 GENERAL LIGHTING.....	17
C.4.7 TELECOMMUNICATIONS	18
C.4.8 EXTERNAL LIGHTING	19
C.4.9 PHOTOVOLTAIC SYSTEM.....	22
C.4.10 ELECTRIC VEHICLE CHARGING.....	27
C.4.11 ACCESS CONTROL & INTERCOM SYSTEM.....	29
C.4.12 FIRE DETECTION & ALARM SYSTEMS	30
C.4.13 Uninterruptible Power Supply	31
C.4.14 LIGHTNING PROTECTION SYSTEM.....	32
C.4.15 amr (automatic metering system)	33
C.4.16 TESTING & COMMISSIONING	35
C.4.17 ELECTRICAL WIRING	35
C.5 WORKING DRAWINGS AND BUILDERS WORK	36
C.5.1 WORKING DRAWINGS.....	36
C.5.2 BUILDERS WORK PROVIDED.....	36
C.5.3 BUILDER'S WORK RESPONSIBILITIES	36

C.5.4	SCOPE OF BUILDER'S WORK.....	37
C.5.5	MARKING OUT OF BUILDER'S WORK HOLES ON SITE	37
C.5.6	BUILDER'S WORK INFORMATION TO BE PROVIDED	37
C.5.7	STRUCTURAL STEELWORK.....	38
C.5.8	PRE-CAST CONCRETE	38
C.6	INFORMATION TO BE PROVIDED BY THE SERVICES CONTRACTOR	38
C.6.1	RISK ASSESSMENTS	38
C.6.2	METHOD STATEMENTS.....	39
C.6.3	PLANT & EQUIPMENT MAINTENANCE AND REPLACEMENT STRATEGY:	40
C.6.4	PROGRAMME OF WORKS	40
C.7	COMMISSIONING & TESTING	40
C.7.1	DEFINITIONS	40
C.7.2	PROGRAMME.....	41
C.7.3	COMMISSIONING SPECIALIST	41
C.7.4	STATIC TESTING	42
C.7.5	PLANT AND EQUIPMENT PERFORMANCE TESTING	42
C.7.6	PRE-COMMISSIONING CHECKS	42
C.7.7	COMMISSIONING AND TESTING	42
C.7.8	FUEL FOR TESTING	44
C.7.9	SYSTEM DEMONSTRATION:	44
C.7.10	INSPECTIONS AND TESTS	44
C.7.11	TEST CERTIFICATES AND RECORDS.....	44
C.8	RECORD DRAWINGS AND DOCUMENTS	45
C.8.1	GENERAL	45
C.8.2	RECORD DRAWINGS.....	45
C.8.3	OPERATING AND MAINTENANCE MANUALS	46
C.8.4	END USER TRAINING	48

RECORD OF REVISIONS

Date	Revision	Description of change
08/09/25	T01	Tender Issue
13/10/25	T02	Tender Issue
05/03/26	T03	Tender Issue – AMR monitoring system added

C PARTICULAR SPECIFICATION

C.1 INTRODUCTION

This project is a construction of 3 No. industrial units located on 39 Queen Street, in the heart of Tottenham. The existing site is a comprises of a single unit for Booker wholesale Cash & Carry Distribution Centre. The contractor shall be responsible for the complete detailed design and build, including liaison with the statutory services.

The Contractor shall be responsible for the disconnection of any redundant services and any necessary diversions on the existing site and the Contractor shall liaise directly with the statutory services for the disconnection and diversion or modification of any existing service.

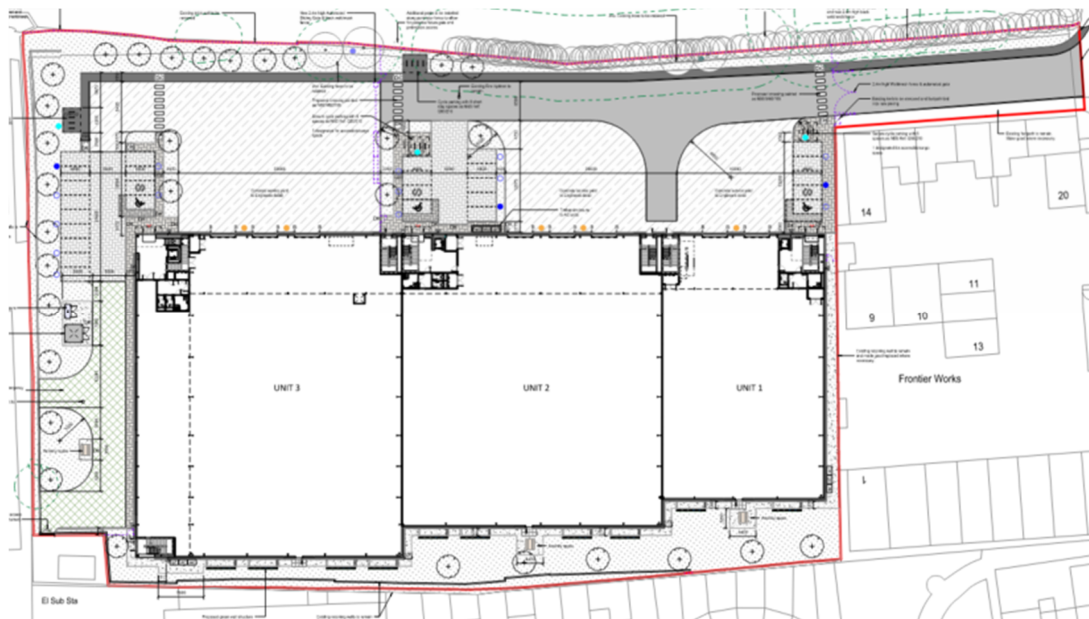


FIGURE 1 PROPOSED SITE PLAN

The development of the site is to comprise of a range of an industrial / warehouse and associated works including vehicle parking, ancillary structures and landscaping.

The contractor shall be responsible for complying with the BREEAM and EPC requirements stated within the electrical BREEAM section and within the electrical performance specifications.

The building will be certified BREEAM v6.1 Outstanding and shall achieve an EPC A+ Rating. Any works related to achieve such rating shall be completed accordingly.

This Specification shall be read in conjunction with all other documentation produced by the Employer, Architect, Quantity Surveyor, Structural Engineer and the Developers Specification.

All aspects of the Electrical systems design, supply, installation, setting to work and testing and commissioning shall also be read in conjunction with and comply fully with the following:

- Cudd Bentley Consulting Standard Electrical Services Specification
- Electrical Services Drawings as indicated on the Cudd Bentley Drawing Issue Sheets
- Cudd Bentley Consulting Mechanical & Public Health Services Tender Documents/drawings
- Employers Requirements
- Electrical BREEAM Specifications

39 QUEEN STREET, TOTTENHAM

ELECTRICAL SERVICES PERFORMANCE SPECIFICATION



This specification sets out the principle requirements of the installation but does not relieve the Contractor of their responsibilities for any part of the installation to achieve the necessary performance.

The installation shall be complete in every respect, including all ancillaries and works, whether specifically mentioned in this document or not, necessary for the systems to be tested, balanced, commissioned, and perform correctly as intended in the design intent. Where trade names are used, the intention is to indicate a standard. Equipment of equivalent manufacture and performance may be included, provided such equipment is submitted in accordance with the specified procedure.

During the tender period, any anomalies or discrepancies shall be brought to the attention of the Project Manager, who shall direct the Contractor. The Contractor is deemed to have allowed within their price for all items to ensure that the installation is complete in every respect and in accordance with the design intent.

For clarity, the specification sections take precedent over the general specification sections.

C.2 EXISTING SITE & SERVICES

C.2.1 EXISTING SITE

The existing site is situated on 39 Queen St which forms part of a wider industrial estate park, located close to white heart lane station in the heart of Tottenham.

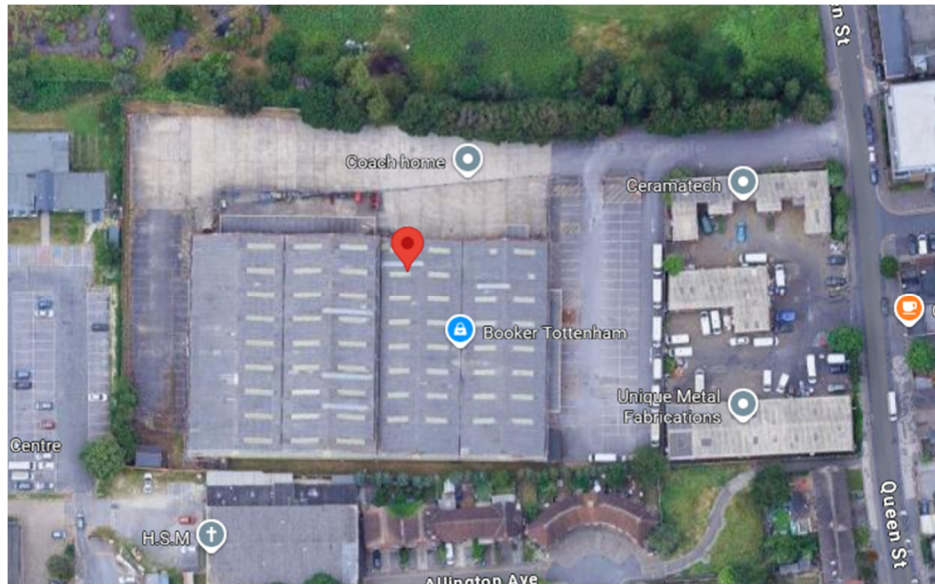


FIGURE 2 EXISTING SITE PLAN

C.2.2 SURVEY WORKS

The Contractor shall ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works. The Contractor shall visit site and survey the premises. No claim arising due to want of knowledge in this respect shall be entertained.

During the Tender period the Contractor shall visit site to understand the extent, quality and nature of the existing/surrounding services that will affect the works and make appropriate allowances in their tender. Prior to commencement, the Electrical Services Contractor shall examine all available drawings of the engineering services and report any discrepancies to the CA.

C.2.3 MODIFICATIONS TO EXISTING SERVICES

The Contractor shall be responsible for the disconnection of any redundant services and any necessary diversions/lowering on the site and the Contractor shall liaise directly with the statutory services for the disconnection and diversion or modification of any existing services.

C.2.4 RISKS TO HEALTH AND SAFETY

The nature and condition of the existing services cannot be fully and certainly ascertained before opening.

The Employer or the CA do not guarantee the accuracy and sufficiency of this information.

The Contractor shall undertake responsibility to obtain any information required to ensure the safety of all persons and the Works.

The Contractor shall comply with the requirements of the CDM Regulations by:

- Compiling risk assessments for the contract work.
- Providing information on the contract works which might affect the health or safety of any person.

- Providing appropriate input to the health and safety plan and file for the work

C.3 SCOPE OF WORKS

C.3.1 GENERAL

This section outlines the extent of the works and provides a description in a brief manner of the scope of each of the building services installation.

C.3.2 SCOPE OF WORKS

The works by the Electrical Services Contractor includes:

- Design.
- Specialist design.
- Management.
- Programming.
- Co-ordination.
- Working Drawings.
- Supply & Delivery.
- Installation.
- Setting to work & testing and commissioning.
- Operating and Maintenance Documentation.
- Final handover of the complete Installation.
- Spares and tools.
- Rectification of any defects within 12 months of practical completion.

The whole of the work shall be carried out in accordance with this specification and associated indicative drawings and the Electrical Services Contractor shall ensure the installation complies with the latest editions of all relevant statutory codes and regulations including those that may become current during the course of the contract.

C.3.3 EXTENT OF THE WORKS

The works should include:

- New internal lighting.
- New external lighting (including estate sign if any).
- New electric vehicle chargers with relevant ducting for active and passive.
- New fire alarm.
- New refuge alarm.
- New disabled alarm.
- New small power.
- New lift.
- New distribution boards.

- New utility supplies
- New photovoltaics system.
- New UPS for Lifts.
- New lightning protection.
- New metering.
- New mechanical supplies.
- New access control & gate automation.
- First year maintenance of the installed services installation
- Works to be coordinated by or carried out by the main contractor
- Builder's work.
- Fire stopping.

C.3.4 WORK BY STATUTORY AUTHORITIES/UNDERTAKERS

The Contractor shall liaise with utilities provider for the isolation of the incoming supply to enable the replacement of the main incoming electrical switch panel.

C.3.5 REGULATIONS AND STANDARDS

Comply with all current versions of:

- CIBSE Design Guides.
- All Relevant British & EU Standards.
- Health & Safety at Work Act.
- HSE Guidance and Safety Regulations.
- Local Authority by-laws and regulations.
- Fire Officers requirements.
- Building Regulations.
- BS 7671 IET Wiring Regulations.
- Electricity at Work Regulations 1989.
- Construction Design Management Regulation 2015.
- CIBSE Commissioning Codes.
- BSRIA Commissioning Codes.
- Manufacturers' recommendations.

C.3.6 WORK BY STATUTORY AUTHORITIES/UNDERTAKERS

The Contractor shall liaise with DNO/IDNO/ICP and other utility providers for the coordination of works and any replacement of the main incoming electrical cables.

C.4 DESCRIPTION OF THE WORKS

C.4.1 LOW-VOLTAGE DISTRIBUTION SYSTEMS

The new electrical services shall be derived from the Distribution Network Operator's (DNO) existing HV network. A new proposed high voltage (11kV/6.6kV) 1000kVA point of connection will run in the ground to serve 1No. substation, as depicted on the site layout.

The utility provider's low voltage supplies shall derive from the new substation to serve new cutouts located within the warehouse and landlord kiosk. The anticipated maximum demand is 1000kVA and fuse sizes are as follows:

Landlords	100A at 50kVA
UNIT 1	400A at 250kVA
UNIT 2	600A at 350kVA
UNIT 3	600A at 350kVA
Total	1000kVA

The substation and any HV switchgear shall be provided by an Independent Connection Provider (ICP), and this is to be adopted by the Independent District Network Operator (IDNO).

The Contractor shall be responsible for the coordination and management of all trenching and ducting requirements within the site boundary. In addition, the Contractor shall provide all trenching, ducting, formation of penetrations, backfilling and marking of utilities as necessary to allow non-contestable works to be carried out by others. The Contractor shall allow for all labour and materials for the excavation of holes, penetration, access chambers and draw pits in accordance with the utilities supplier's requirements. The Contractor shall be responsible for the back filling, marking and coordination of services. The Contractor shall be responsible for the services entry point into the buildings, plant bases and all ancillary works.

The Contractor shall provide a price within the mechanical and electrical form of contract for liaison with the utilities for the provision of incoming services into the buildings. The Contractor shall include in the price all works necessary for the installation of the electrical and telecommunications incoming services.

The Contractor shall review and confirm all the sizes and ratings of all Heavy Duty Cut Outs (HDCO) and distribution boards to make sure that suitable as part of the detailed design.

The Contractor shall acquire all meters via an approved meter distributor/manufacturer. The Metering shall be half hourly (HH) meter type regardless of the HDCO size. The meter shipper shall be Renewable Energy Guarantees of Origin (REGO) qualified.

The incoming point of supply for each unit would be located in the ground floor warehouse on the core wall. The Contractor shall be responsible for coordinating the detailed final location and establish the spatial requirements for the Electricity Distributor's equipment and any metering. The overcurrent device rating at incoming point of supply would be varied depending on the load of each unit. The main service fuse or circuit breaker protective device would be rated above the incoming fuse size.

Distribution Boards

The following types of panel boards would be required based on the specific loads of each unit:

Unit 1:

- Hager (or an equivalent and approved brand) 400A Form 3B, Type 2, TP&N panel board complete with main isolator, shall be installed for sub distribution boards.

Unit 2&3:

- Hager (or an equivalent and approved brand) 630A Form 3B, Type 2, TP&N panel board complete with main isolator, shall be installed for sub distribution boards.

Landlord's kiosk:

- Hager (or an equivalent and approved brand) 125A TP&N distribution board, complete with a main isolator, shall be installed for external lighting and mechanical power requirements.

All panel boards shall be fed from the main meter located in the main incoming services on the ground floor.

The MCCB panel boards for all units shall include, but are not limited to the following:

- Lighting and Power Distribution Boards.
- Mechanical Distribution Boards.
- Fire Alarm & Refuge alarm.
- Lift Supplies.
- Photovoltaic (PV) system.
- Surge Protection (SP).
- Spare ways for future tenants' services (25%).

The distribution boards shall include, but are not limited to the following:

- Internal lighting.
- Internal emergency lighting.
- External and emergency lighting associated with the unit.
- Internal small power & ancillary supplies.
- Warehouse power supplies.
- Surge Protection.
- Electric Vehicle Charging Points (EVCP).
- Electric Cycle charging Points
- Spare ways for future tenant's services (25%)

The mechanical distribution board shall include but not limited to:

- Electric Panel Heaters
- Overdoor Heaters
- Water Heaters / Shower Units
- Outdoor Heat Pump Units
- Indoor Fan Coil Units & Ancillaries
- Ventilation & Extract Fan Units
- Branch / Flow Selector Boxes
- Smoke-Fire / Fire Dampers

A switched lockable disconnecter shall be provided after each incoming electrical cut-out (cut-out by statutory service provider).

The landlords' services shall be in GRP Kiosk and should consist of:

Hager (or equivalent & approved brand) Multiway form type B distribution board with lockable metal door and dual MID meter with pulsed output serving but not limited to:

- External lighting associated with the common access road lighting and estate signage.
- Access control and gate automation power supplies.
- Pump (where applicable).
- Petrol Interceptor.

All panel and distribution boards shall include a typed circuit chart schedule, on the inside of the front cover and enclosed in plastic envelope. The Contractor shall ensure separate metering for all the sub-services which include EV, PV, Small Power, Lighting and Mechanical. The meters shall be pulsed output, which would accommodate a future Building Management System (BMS) or automatic meter reading

The distribution boards shall be by Hager (or equivalent & approved):

Contact:

Hager Limited
Patrick Armour
Project Sales Manager
Sales & Marketing Europe
M: +44 7341 864 111
T: +44 1952 677 899
E: patrick.armour@hager.com

C.4.2 EARTHING AND BONDING SYSTEMS

The earthing system on the substation shall be undertaken and completed by the utility provider, as shown on their drawing. The main earthing for each of the units shall be carried out by the utility provider.

The Contractor shall make provision for all electrical main, and equipotential bonding which form part of this work contract and shall include but not limited to the following:

- Connection to supply authority earth (earthing arrangement provided by the Utility Provider).
- Water connections.
- Gas connections.
- Lift guide rails.
- Connection to earth bar adjacent to the distribution board.
- Structural steelwork (includes all exposed metal work).
- Mechanical services.
- Lightning protection system.
- Photovoltaic system.
- Spare ways.

The main earth bar shall be positioned adjacent to each of the statutory providers incoming service head within the unit(s) and shall be a minimum of a 12-way removable link earth bar (Furse or similar).

The earthing type is to be confirmed with utility provider, refer to latest utility provider's quote for more details.

C.4.3 SMALL POWER

The Electrical Services Contractor shall design the extra low voltage system in accordance with BS:7671, relevant Electrical British standards and IET Wiring Regulations.

The Contractor shall install the following, but not be limited to:

Small power within the **kitchen/tea point** is as follows and shall be installed as per the architect's layout:

- 20A double pole isolator for water heater.
- 13A switched double sockets above kitchen worktop.
- 13A unswitched single sockets for kitchen appliances below worktop.
- 13A switched fused spurs for kitchen appliances above worktop.
- Cleaner's socket to ensure full coverage of space with a maximum 10m radius from outlet to outlet. To be mounted at 450mm AFFL
- Any other mechanical supplies as required.

Small power within the **WCs/Disabled WCs**:

- 13A switched fused connection unit for the Electric Panel Heaters.
- 13A fused connection unit and outlet plate for future the hand dryer.
- 50A double pole isolator for shower outlet plate.
- 20A double pole isolator for the electric water heater.
- 13A fused connection unit for solenoid valve (associated with BREEAM credits).
- 13A fused connection unit for Cisterniser.
- 13A connection unit for disabled alarm.
- Any other mechanical supplies as required

Small power within the **shower**:

- 50A double pole isolator for shower.
- 20A double pole isolator for the electric water heater.

Small power within the **open plan office**:

- Floor boxes shall be every 10m²(To be fitted by tenant/occupier). This includes four compartment recessed floor boxes complete with 2x double socket outlet and 2x double euro module blanks outlets fed via busbar.
- Cleaner's socket to ensure full coverage of space with a maximum 10m radius from outlet to outlet. To be mounted at 450mm AFFL.
- Any other mechanical supplies as required.

Small power within the **reception/core**:

- Red double pole isolator with a key switch for the fire alarm panel (engraved with FIRE ALARM).
- Red double pole isolator for the disabled alarm panel (engraved with REFUGE ALARM).
- 13A switched fused connection unit for the Electric Panel Heater.
- 13A double switched socket outlets throughout for general use.

- 13A double pole switch for overdoor heater.
- 13A single switched socket outlets for Cleaner's use every 10m and to be mounted 450mm AFFL.
- TP&N commando outlet, GSM and isolator for the lift.
- Any other mechanical supplies as required.

Small power within the **stair core/corridor/lobby areas**:

- 13A switched fused connection unit for the Electric Panel Heater.
- Cleaner's socket to ensure full coverage of space with a maximum 10m radius from outlet to outlet. To be mounted at 450mm AFFL.
- Any other mechanical supplies as required.

Small power within the **warehouse**:

- TP&N Rotary isolators for each level access door, roller shutter doors and dock levellers supplied via busbar trunking (location and position are to be agreed with the manufacturer and architect).
- New supplies for electric vehicle chargers.
- 13A switched fused connection unit below the distribution boards mounted adjacent to incoming BT Openreach DP point.
- DC PV Emergency Stop Button.
- Any other mechanical supplies as required.

Small power for **external** use:

- Electric Vehicle Chargers (EVC's).
- Electric Cycle chargers
- Rotary isolators suitable sized for external air conditioning plant (Refer to the mechanical specifications for location and sizing requirements).
- Any associated pumps.
- Any other mechanical supplies as required.

The Contractor shall install 1No. of Cleaners' every 10 meters within common access areas and office spaces. Each outlet shall consist of a single switched socket outlet, engraved with the label "Cleaners" and wired to a dedicated circuit.

The Contractor shall install one dual socket and one 10-inch LCD screen capable of displaying live local transport information. In lieu of a live Wi-Fi connection, the Contractor shall provide a pre-loaded £50 GSM. All installations must comply with the BREEAM TRA02 credit requirements, including the development of a travel plan and transport assessment as outlined in the BREEAM guidelines, where applicable.

The mechanical equipment shall be served from the distribution board located within the ground floor incoming services location. The electrical contractor shall fit the manufacturer's plug and connect to the designated power circuit to feed the Fan coil units via a 13A switched fused connection unit (FCU).

C.4.4 DISABLED ALARM SYSTEM

The contractor shall install within all toilet areas designated for disabled person's usage, an assistance to meet the requirements of Part M of the building regulations and BS 8300.

Each disabled toilet alarm system shall comprise:

- Power supply unit c/w reset button.
- Pull cord complete with two triangular pull rings and integral re-assurance lamp located within easy reach of a person using the WC and shower.
- Local wall mounted reset unit.
- Illuminated beacon and sounder mounted outside the room above the door.
- A local reassurance sounder within the WC.

All units shall be flush mounted. The finish shall be brushed stainless steel (to be agreed with the architect). All wiring shall be contained within metallic containment. and installed flush within the building fabric.

The system shall operate as follows:

- Alarm pull cord is operated.
- Reassurance and over door light are automatically activated.
- Indicator lamp and warning sounder is automatically activated on the alarm panel.
- When local reset button is operated the system returns to its normal operating conditions.

Upon completion the system installation shall be fully tested and commissioned

C.4.5 REFUGE ALARM SYSTEM

The Contractor shall install where indicated on the drawings, an Emergency Voice Communication (EVC) system. This enables a two-way communication system that helps people evacuate safely during emergencies and allows communication between firefighters and others during emergency situations. The system shall allow communication between disabled people taking refuge at the designated refuge location and the central control location which is usually located in the reception area of each unit. The system shall meet the requirements of Approved Document M of the Building Regulations.

The system shall include:

- Master control panel shall be installed in the reception area on the ground floor.
- Recessed outstations shall be installed at each floor level of the stair cores adjacent designated refuge locations as detailed on the drawings.

C.4.6 GENERAL LIGHTING

The general lighting installation shall meet the requirements of the Chartered Institution of Building Services Engineers (CIBSE) Lighting Guides, including emergency lighting where required.

Minimum lux levels shall be as per the following areas and the general lighting criteria shall apply:

- Corridors: 200 lux at finished floor level (FFL)
- Office areas: 450 lux at 0.75 m (AFFL)
- Stairs: 150 lux at centre tread
- WCs: 200 lux at FFL
- Reception: 300 lux at 0.75 m (AFFL)
- Lobbies: 200 lux at FFL

Office Areas:

Office floors will feature 600x600mm LED panels, IP44 rated at 4000k, DALI2 / DALI2 E3 dimmable driver, arranged in a ceiling grid. These will deliver at least 450 lux at 0.75 m AFFL, with a uniformity of 0.4 and a glare rating (UGR) of 19, suitable for office tasks. The panels will connect to lighting control modules for a flexible plug-and-play system. Lighting will be controlled by recessed presence detectors and include daylight harvesting. Each exit door will have a recessed, non-maintained blade-type LED emergency exit sign. Emergency lighting will be provided using 3-hour inverter packs integrated with standard luminaires. These will be identified by a discreet green LED indicator.

Kitchenette / Tea Point Areas:

These areas will have circular LED downlights, IP44 rated at 4000k, DALI2 / DALI2 E3 dimmable driver, installed in a ceiling grid. Fixtures will be connected to lighting control modules in the ceiling void and controlled by recessed presence detectors. Emergency lighting will use 3-hour inverter packs, integrated into standard fittings, with green LED indicators. Each exit door will have a recessed, non-maintained blade-type LED emergency exit sign.

Toilet (WC/disabled WC) Areas:

Toilets will have recessed circular IP65 rated at 4000k DALI2 / DALI2 E3 dimmable driver, LED downlights installed in a grid formation. These will connect to ceiling-mounted control modules and be operated by recessed presence detectors. Emergency lighting will use 3-hour inverter packs with green LED indicators. Each exit door will have a recessed, non-maintained blade-type LED emergency exit sign.

Reception Areas:

Reception lighting will have recessed circular LED IP44 rated DALI dimmable driver downlights in a grid formation. These will connect to lighting control modules and be controlled by recessed presence detectors. Emergency lighting will be provided by 3-hour inverter packs, integrated with general fittings, and indicated by green LEDs. Each exit door will have a recessed, non-maintained blade-type LED emergency exit sign.

Corridor/Lobby Areas:

Corridors will have recessed circular LED IP44 rated at 4000k DALI2 / DALI2 E3 dimmable driver downlights in a ceiling grid. These will connect to lighting control modules and be controlled via recessed presence detectors. Emergency lighting will use 3-hour inverter packs with discreet green LED indicators. Each exit door will have a recessed, non-maintained blade-type LED emergency exit sign.

Stair core Areas:

Stair core shall have white wall mounted LED IP66 rated at 4000k DALI2 / DALI2 E3 dimmable bulkhead. These will connect to a lighting control module and be connected via an inbuilt presence detector. All stair core lighting shall use a 3-hour inverter pack with discreet green LED indicator.

Warehouse Areas:

Each exit door will have a recessed, non-maintained surface mounted type LED emergency exit sign. These will be powered by 3-hour emergency packs and identified with green LED indicators.

General Requirements

The electrical contractor shall design, supply, install, test, and commission all lighting systems in accordance with:

- BS 7671 (IET Wiring Regulations)
- Building Regulations Part L
- CIBSE Lighting Codes
- BS 5266 for emergency lighting
- SLL Code for lighting

Emergency Lighting

Emergency lighting will include manual key switches for testing. Self-contained non-maintained luminaires with 3-hour battery packs will be installed in all areas.

All emergency lighting shall comply with Fire Officer requirements and BS 5266.

All circuits with emergency fittings must include a test facility. The test switches will simulate a mains failure by isolating general and charging circuits. Where possible, emergency lighting will be integrated with general lighting. Test key switches will be installed near distribution boards.

Emergency and exit signs will have discrete neon indicators to show charging status.

In all areas, emergency lighting shall provide an average of 1 lux at FFL for escape routes.

Emergency exit signs shall be:

- Recessed 'blade' type in offices and core areas
- Surface-mounted in warehouse areas

The Contractor shall be responsible for submitting the lighting calculations for all the areas for approval prior to procurement of luminaires.

All new internal general and emergency lighting shall be Artech Lighting or equal and approved.

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C.4.7 TELECOMMUNICATIONS

Any relevant applications such as new applications have been submitted to BT Openreach for the provision of new telecommunication services to each unit.

The Contractor shall arrange with the utility company site attendance and coordination. The Contractor shall allow for all labour and materials for the pre-digging of holes access chambers and draw pits in accordance

with the Utilities supplier's stipulations. The contractor will then be responsible for back filling, marking and coordination of services.

The Contractor shall install the required cable ducts and access chambers necessary to provide a ducted route into the warehouse for the telecommunication service provider cabling. An additional spare 90mm green duct, and associated access chambers shall be installed to the unit, for the future provision by other telecommunication providers.

The Contractor shall register the site with the utility company and service provider and liaise with the new site representative to arrange the installation of the free issue ductwork and the new incoming telecommunication lines. The second Green coloured spare telecoms duct shall be connected into a site wide distribution system to allow future connection by independent telecoms/cable operators. (Note – spare telecoms duct and chambers to be a separate colour and independent to the main utility service provider ducts and chambers).

Duct colours shall be in accordance with:

- NJUG GUIDELINES ON THE POSITIONING & COLOUR CODING OF UNDERGROUND UTILITIES APPARATUS.

All new telecommunication services are to be provided by the tenant / occupier.

C.4.8 EXTERNAL LIGHTING

The Contractor shall be responsible for the design, supply, testing, and commissioning of the complete external lighting installation, as outlined below.

The external lighting system shall be designed to ensure adequate illumination for both safety and security, in accordance with the *Society for Light and Lighting (SLL), Lighting Guide 6: The Exterior Environment (2016)*. The installation shall include LED luminaires, associated wiring, and control devices to illuminate all relevant external areas.

Performance and Compliance

- All external luminaires for the building, access routes, and pathways shall have a minimum luminous efficacy of 80 lumens per watt and a Colour Rendering Index (CRI or Ra) not less than 60.
- Lighting shall be provided at all final escape exits, as well as for general illumination of the goods yard, car parks, and pedestrian routes.

Lighting Scheme Components

Wall-mounted LED bulkheads fitted with 3-hour non-maintained emergency packs and weatherproof hoods, positioned adjacent to all external exit doors. These fittings shall provide both general illumination and emergency lighting of at least 1 lux on the escape route FFL.

Building-mounted LED floodlights are installed near loading bay doors to provide task-specific lighting.

Building and column-mounted streetlights installed to illuminate car parking bays.

Column-mounted lighting is designed in line with *Secured by Design* principles to ensure safe and adequate lighting for all roadways.

Each unit's car parking area must be lit independently, achieving the required lux levels without reliance on adjacent units.

External Lighting Controls

All external luminaires shall be controlled using a digital time clock and photocell system to comply with BREEAM requirements. Control strategy shall include:

- Automatic shutdown of non-essential external lighting (excluding safety and security lighting) between 23:00 and 07:00 hours.
- A programmable time switch set to the above operating hours.
- Combined photocell, digital time clock, and manual override controls, where required.
- The external lighting system shall be fully automated. Lighting for the common access roads shall operate independently from unit-specific lighting systems.

Cables and Containment:

Cables feeding external lighting columns shall be LSF/SWA/XLPE installed within the cable ducts.

All new external lighting and emergency lighting shall be Lighting Project Solutions (LPS) or equal and approved.

39 QUEEN STREET, TOTTENHAM
ELECTRICAL SERVICES PERFORMANCE SPECIFICATION



Cudd Bentley
Consulting

James Fletcher
Dru Designs Ltd
T: +44 (0) 7859 027 099
james@drudesigns.co.uk
www.drudesigns.co.uk

C.4.9 PHOTOVOLTAIC SYSTEM

The Contractor shall be responsible for the design, supply, installation and setting to work of a new photovoltaic (PV) system in its entirety to each individual unit. The design shall be in accordance with:

- Cudd Bentley Consulting Energy & Sustainability Statement
- Electricity at Work Act.
- Electricity Supply Regulations.
- IEE Regulations.
- BS 7671:2018.

Any conflicting requirements between the employers and purchasers' requirements shall be brought to the attention of the CA. The Contractor shall be responsible for making application and providing details as below:

- G99 applications to the Statutory Provider.
- All costs associated with the G99 application forms shall be the responsibility of the Contractor.
- PV Panels Installation Details.
- 5-Year O&M agreement.
- Roof penetrations.

The new PV installation shall comprise:

- Infinity RT 440-460W panel.
- Poly/Mono crystalline PV cells.
- DC/AC three phase output G99 Type Tested SolarEdge inverter complete with P801 Panel Optimisers to provide module level MMPT tracking and safe DC voltage levels in the event of AC interruption providing enhanced safety to the building, occupants and emergency services.
- Overcurrent Protective Device (MCCB/MCB).
- All interconnecting AC and DC cabling and metallic containment.
- KWh meter.
- 30-year product warranty.
- 30-year performance warranty to panel (on 87% of nominal power).
- Rotary 4 pole isolator for the AC supplies.
- Rotary 4 pole isolator for the DC supplies.
- Proprietary galvanised steel support system.
- "Gateway" that connects the inverter with a Cloud based BEA database.
- Fireman's switch (located in entrance lobby)
- PV cabling containment and junction boxes.
- The Contractor will be responsible for the sub-metering of photovoltaic panels to all units. Metering shall be visible on an online portal and available for review at Practical Completion. Where PAYG sim cards are required to facilitate automatic readings, the Contractor shall pre-load these with a minimum of years of 'credit'.

PV Cabling Containment and Junction Boxes

Containment for PV cabling shall be via heavy duty galvanized tray complete with a cover (or trunking). Containment covers shall be labelled at 3m intervals with a self-adhesive vinyl which denotes "DANGER PHOTOVOLTAIC DC CABLING". Photovoltaic containment is to be installed in the warehouse only and shall not be installed via the office areas.

All junction boxes (PV generator and PV array boxes) shall carry a warning label indicating that parts inside the boxes may still be live after isolation from the PV convector.

Rate DC cables for the maximum voltage and current of the PV array. Ensure account is taken of the system voltage/currents of the series/parallel connected modules making up the array. Include maximum output of the individual modules.

Select cables to withstand the environmental, voltage and current conditions for which they may be expected to operate. Ensure the heating effects of current and solar gain are considered.

Ensure that cables routed behind a PV array are rated for a minimum temperature of 80°C.

Ensure external cables are UV-stable, waterproof, and flexible (multi-stranded) to allow for thermal/wind movement of arrays/modules.

Minimise the length of DC cable runs to minimize voltage drop and maximise safety.

Route DC cabling separately from AC cabling.

Connect AC cables from the PV array (inverter) connection point to the LV switchboards / Distribution boards.

Ensure cables are capable of withstanding the environmental conditions in which they operate, e.g. UV-stable, waterproof, armoured, etc.

Reverse current

Provide protection against reverse current within each parallel strings and between the entire PV array and the inverter.

Ensure protective devices are located in both positive and negative legs of each string.

Establish the reverse current rating from the module manufacturer.

Overcurrent

Provide a suitably rated overcurrent device.

Ensure protective devices are located in both positive and negative legs of string cables for all strings.

Overvoltage/surge protection

Provide overvoltage/surge protection within system inverter.

DC isolation/Firemans Switch

The Contractor shall be responsible for the supply, installation, and commissioning of a photovoltaic (PV) emergency stop button. The PV Stop Button shall serve as an emergency stop mechanism, immediately halting the operation of the photovoltaic system upon activation. The PV Emergency Stop Button shall be a normally closed (NC) push-button switch. The button shall be installed in the warehouse area of each unit.

The PV Stop Button shall be clearly labelled as "PV Emergency Stop Button." The button shall be linked to a contactor, ensuring that activation will result in the automatic opening of the contactor feeding the PV inverters. Wherever an installation is supplied from more than one supply, a suitable main switch (e.g. switch disconnector) should be used for isolating each supply. The PV systems should both be isolated on AC and DC sides of the inverter with a switch disconnector. The installation shall comply with the latest edition of BS 7671 (IET Wiring Regulations), BS EN 61439, and all other applicable regulations governing PV system safety. A permanent warning label shall be affixed to the PV Stop Button in a position that any person intending to operate the button will be warned for the function and purpose of it. The warning notice should be in accordance with BS7671 826.1.1.4 and best industry practices.

Grid connection

Comply fully with the requirements of ENA Engineering Recommendation G99, to facilitate parallel operation of the PV system with the public utility supply. Allow for the PV system to synchronise with the main electricity supply and ensure that all protection devices, relays and the installation comply with ENA Engineering Recommendation G99.

AC isolation

Provide a means to manually isolate the entire PV array from the public utility supply and remainder of the electrical system.

The PV system shall be interlinked to the main fire alarm system to ensure safe AC & DC isolation in the event of a fire.

Metering

Provide import/export metering in accordance with the requirements of the metering section of this specification.

Provide an inverter output meter to display/record, the following:

1. Energy delivered by the PV system (kWh).
2. Instantaneous power output (kW).

Lightning protection and Earthing

Provide protection against a lightning strike in accordance with the requirements of the lightning protection section of this specification.

Liaise with the installers of the LPS; provide the correct number and location of air rods to afford the protective angle required for effective protection of the PV system from direct strikes.

Provide lightning electromagnetic pulse (LEMP) protection for electrical/electronic systems within the building in accordance with BS EN 62305.

Ensure that every surge protection device (SPD) complies with BS EN 62305; is suited for the location; is suited for the application; and operates with 'line to earth', 'line to neutral', 'neutral to earth', or 'line to line' mode of protection according to the application.

Confirm to the Contract Administrator that the proposals for LEMP protection contained in this specification meet the requirements of BS EN 62305.

Connect all exposed and extraneous conductive parts of the PV system to earth in accordance with BS 7671, BS 7430.

Bond all simultaneously accessible conductive parts to the protective conductor system using supplementary equipotential bonds.

Agree on site with the Contract Administrator the extent of equipotential bonding prior to commencement of the installation.

Responsibilities

The PV system installer is responsible for integrating the photovoltaic system with all other works and building systems in order to provide a fully operational and coordinated installation.

Elements of the work include:

Coordinate the installation of the PV system with all architectural requirements.

Provide all necessary containment, controls and cabling for the system.

Agree all safety latching or harness fixings for compliance with CDM.

Interface between PV system and building LV system.

Coordinate with lightning protection specialist.

Detail coordination

Agree all proposed methods of construction, location, installation, and fixing and co-ordination with other

services and building structural elements, with the Contract Administrator.

Agree the colours and finishes of all exposed materials of the system(s) with the Contract Administrator.

Provide details of how the PV modules and equipment is to be supported, whether by upstands or with pedestals fixed to the paving slab.

The contractor shall ensure that all photovoltaic (PV) panels are installed with a minimum clearance of 1.2 meters from any fire compartment wall. A minimum separation of 1.2 meters shall also be maintained between PV panels and party wall on units sharing the same structural frame. Where possible, the contractor shall allow 1.2 meters between the PV panels and the internal compartment walls. Refer to RC62 recommendations for fire safety with PV panel installations for further clarification.

System Components - General

Supply, install, commission, test and demonstrate a complete and functioning PV installation comprising the following main components (not exhaustive):

- Structural components.
- Foundations and fixings.
- PV modules.
- Inverter
- Isolation.
- Cables.
- Earthing.
- Lightning protection.
- Fall arrest and fall restraint access systems.

Provide double insulation and appropriate barriers and separation to all parts to all PV systems with an open-circuit voltage of greater than 120 V dc.

Include all components required for a complete PV installation which may comprise one or more arrays, together with all necessary auxiliary equipment.

Photovoltaic cells and modules

Provide photovoltaic modules guaranteed for an overall 30-year product warranty, and guaranteed to provide 87% of nominal power over 30 year period. Panels are to be glass-glass composite for increased mechanical strength and longevity.

Provide each module complete with flying lead, and multi-contact weatherproof dc-rated asymmetrical connector.

Provide all PV modules with a data sheet giving details of power output (specified within given tolerance limits), values for short-circuit current, open-circuit voltage and temperature variation.

Provide for each PV module a type-test certificate from the European Solar Test Installation at the European Commission's Joint Research Centre at Ispra, or a similar recognised test institution.

Photovoltaic arrays

Provide a PV system comprising 'N' parallel connected strings, with each formed of 'M' series connected modules as shown on the layout drawings.

Match the string arrangement such that voltage drop between the photovoltaic modules and each inverter does not exceed 2.5% of the rated input voltage.

Where three or more strings or arrays are connected in parallel, provide overcurrent protection to each string or array cable.

Connect the supporting structure for the PV array to earth in accordance with BS 7671.

Inverters

Inverters to be supplied c/w roof level individual panel optimisers, Solar Edge (or equal and approved)

Ensure that all inverters have a current ENA ER G98 or ENA ER G99 type test certificate, unless specifically agreed with an engineer who is employed and appointed by the DNO for this purpose and comply with all other parts of ENA Engineering Recommendation G98 or ENA Engineering Recommendation G99 as appropriate. Provide a copy of this agreement, in writing, to the Contract Administrator.

Ensure inverters are certified to meet relevant EMC standards including BS EN 61000-6-1 and BS EN 61000-6-3.

Provide inverters with a traffolyte label with the wording "Inverter – Isolate AC and DC before carrying out work". Ensure labelling is clear, located so as to be easily visible, and constructed so as to remain legible and in place for the design life of the system.

Identification

Install appropriate labelling which satisfies the requirements of the DNO to identify that a dual supply is in operation. As a minimum, provide labelling at the incoming power supply connection point, the meter position and the PV system isolator.

Testing and Commissioning

Test and commission the electrical elements of the installation in accordance with BS 7671.

Follow the procedure set out in Photovoltaics in Buildings – Testing, Commissioning and Monitoring Guide as published by ETSU for the Department for Trade and Industry.

Ensure commissioning of the PV system is carried out by a competent person.

Conduct a thorough visual examination of the system to ensure components have not been damaged during installation. Test all AC and DC isolation devices to prove their proper function.

Verify the correct operation of any inverters and associated control and protection systems before the PV system is connected to the grid.

Perform a full system site acceptance test after commissioning during hours of daylight. Ensure that final commissioning of the PV system is undertaken with a minimum irradiation level of 600 W/m².

As part of witnessing, measure solar irradiance and demonstrate that the output of the PV systems equals or exceeds the manufacturer's declared performance for those conditions.

Demonstrate that the instantaneous efficiency of the installed solar PV system meets that specified using a calibrated reference device to measure incident irradiance falling on the PV system. Use either a pyranometer, PV reference cell or other solar irradiance tool as the calibrated reference device and allow for any temperature-related compensation effects.

Record the testing and commissioning results and include within the operating and maintenance instruction manuals. Include full details of all protection and other settings of the system within the operating and maintenance instruction manuals.

Submit the following to the Contract Administrator for comment;

- Full specification of the system and all auxiliary plant and equipment to be supplied, including:
- Detailed general arrangement drawings of all plant and equipment.
- Individual component specifications, including PV modules and inverters.
- Electrical schematics, including any switchgear and control system detail design drawings.
- Builders' work drawings taking account of all site details known at the time.

Four weeks before handing over the completed installation submit the following documents to the Contract Administrator for comment:

- Works test certificates.
- Certificates for type-tested components.
- Site commissioning certificates.
- Record drawings.
- Warranty certificates for the installation and individual components.
- Operation and maintenance instruction manuals.

The breakdown of kWp values is shown below for EPC A+:

Reference	kWp
Unit 1	90
Unit 2	110
Unit 3	180
Total	380

The peak power of the overall PV system across the development would be 380 kWp.

A quotation has been sourced for this project via IGen - Energy, contact:

Peter Hewart

IGen (Photovoltaic Contractor)

07960348438 | 01615071593

Phewart@igen-energy.com

www.igen-energy.com

C.4.10 ELECTRIC VEHICLE CHARGING

The Contractor shall design and install the electric vehicle charging system, as indicated on the drawings and in the specification.

The Vehicle Charging Points and installation shall be in accordance with the following standards:

- IEE Wiring Regulations BS7671
- IEC 62196 "Plug, sockets-outlets, vehicle connectors & vehicle inlets
- IET Code of Practice for Electric Vehicle Charging Equipment Installation
- IEC 61439-1 Short time withstand current
- IEC 60664-1 Overvoltage Category III
- OCPP 1.6 or higher, for optimal charging scheduling

Prior to procurement the contractor shall obtain from the EVC manufacturer a written declaration of conformity stating their equipment meets the requirements of Regulation 722.411.4.1 (iii), (iv) or (v).

The contractor shall include for the supply and installation of dual charging outlets for electric vehicle charging.

Electric Vehicle (EV) Charging Units shall be dual outlet pillar, floor standing type with true Integral Open Pen conductor protection, complete with OZEV approved hardware.

Charging outlets to be rated at 7.4kW and provide Mode 3 charging via a Type 2 socket.

Each Electric Vehicle Charging Unit should be IP65 and IK10 rated (Screen IK08) with integral electronic Type A 30mA AC & 6mA DC Protection, with auto reset on removal of fault condition.

The EV Charger outlets must have a maximum of 40A 10kA overcurrent protection device integral to the charge point.

Type A RCDs shall only be permissible where the charging module is provided complete with RDC-DD (Residual Direct Current Detection Device). EV Pillar enclosures shall be Die Cast Aluminum and Galvanized Steel construction. Colour to be black, RAL 9005 with customizable side panels RAL 9006.

The Dual Charger must be compliant with PAS 1899:2022 Accessibility Standards. Each Unit shall have in-built temperature Monitoring, along with Class B MODBUS MID Meters. The Pillar must be Class 1 with Class (II) Insulated Housing. Standard configuration is a Loop-in-loop-out input terminals, supplied with brass gland plate for SWA connection as standard.

Charging sessions shall be controlled by a Pay Terminal, App, QR Code and/or RFID card.

The charging network shall communicate to a Cloud back-end management system that shall have the functionality to monitor charger usage, individual usage, offering charging as a free service or as a PAYG tariffed service.

Software to be Open Charge Point Protocol to allow an alternative back-office system to be used in the future if required.

The group of chargers shall be configured and programmed as part of a load balanced group to ensure the maximum supply available is not exceeded at any one time. Software shall be integral to the charge points

In the event of data connection failure, the EV charge point output shall reduce to a 'failsafe' level of 1.6kW. Warranty to be minimum of 5 years and include onsite response and repair.

The charging network shall be tested and commissioned by the installer. The installer shall commission the system via the use of GSM communication protocols. Once commissioned and witnessed/accepted, the installer shall leave the system in a 'dumb' status i.e., without a comms link. The system shall however remain in full readiness for the end user/tenant to recommission and provide data connectivity via 4G GSM communications link as standard with the ability for Wi-Fi or hard-wired network back up.

System performance:

Mounting: Floor

Outlet type: Double, Type 2 socket, to BS EN 62196 series for use with mode 3 charging.

Input voltage: 220-240v (Single Phase) & 400-415v (Three Phase)

Input current: Manufacturer's standard.

Rated frequency: 50-60 Hz.

Quantity: 3 dual outlets (1 per unit)

Power output: 7.4kw

Impact protection (minimum): Manufacturer's standard.

Ingress protection (minimum): Manufacturer's standard.

Circuit protection: Manufacturer's standard plus inbuilt PEN Fault Protection, compliance with BS7671

Accessories: Manufacturer's standard.

The charging system shall be supplied by Sync Energy (or equivalent and approved).

W: www.sync.energy

E: Sean.wright@sync.energy

T: 07814 778 392

Luceco PLC

Caparo House, 103 Baker Street, London W1U 6LN

C.4.11 ACCESS CONTROL & INTERCOM SYSTEM

The Contractor shall be responsible for the design supply an installation of the access control and intercom system. The main access control panel shall be located in the landlord kiosk.

Access Control

The vehicle gate automation to the site entrance shall be by Came (or equal and approved) and work in such a manner that during normal working hours (08:00 – 18:00), the gate is to be held in the 'open' position by the access control system. During the remainder of the hours, the gate shall work via a key fob, pin code, or via the audio only intercom system.

External Voice Entry Panel Specification

Entry panels shall be located at each vehicle gate entrance (final positions are to be agreed with the architect).

- Entry panels shall be as CAME VRMSH2 range.
- Dual panels to accommodate lorry and car entry double height plinth mounted
- Brushed stainless steel finish
- Vandal resistant minimum IK09
- Ingress protection minimum of IP54
- Key fob entry (a minimum of 10 No. fobs shall be provided at practical completion per gate)
- Push to Exit button on every pedestrian gate
- Green emergency break glass for all pedestrian gates

Internal Voice Entry Intercom Specification

- Internal receivers shall be as CAME Peral Audio IP
- Surface mounted
- White PVC
- Provision for future doorbell input
- Vehicle gate/pedestrian gate opening facility

Control Unit PSU

- Power supplies as required

The Contractor shall provide permanent metallic signage for entry panel. The sign should be prominently displayed, ensuring that all visitors and personnel can easily understand the instructions on how to use the entry panel efficiently and safely. This should be located next to the entry panel intercom and at vehicular height.

The access control system shall be supplied by Came UK Limited or equal and approved:

Contact:

Came UK Limited
Simon Hawes
Project Sales Consultant
T: +44 (0)115 921 0430
F: +44 (0)115 921 0431
E: shawes@came.com

C.4.12 FIRE DETECTION & ALARM SYSTEMS

A complete new addressable fire alarm system shall be designed, coordinated, supplied, installed, tested, commissioned and set to work to the following categories, unless directed otherwise by the Fire Strategy from the Fire Engineer:

Category L2 system within the office, reception, corridors and core areas; comprising smoke/heat detectors, combined smoke, sounder and visual aid units, electronic sounders and manual break glass units.

Category M to the warehouse; comprising electronic sounders and manual break glass units, as defined by BS 5839 Part 1.

The fire alarm system shall include Fire Alarm Interface (FAI) on any evacuation lifts and Smoke Fire Dampers (SFD) through the core and warehouse areas.

The new system shall be located within the reception. The system equipment shall be selected to comply with BS EN 54-3 and shall be an open protocol system. The design and layout of the system will need to meet the requirements of the local Building Control Officer.

The new fire alarm panel shall be recessed type, 4 zone Advanced (or equivalent and approved).

A zoning chart shall be installed next to the main fire alarm panel, clearly identifying relevant zones throughout the unit.

The electrical services contractor shall employ the services of a specialist Fire Alarm Contractor LPS 1014 or BAFA approved to supply, install and commission the fire alarm system as indicated on the stage 3 drawings.

All system wiring shall be in red soft skin LSOH-sheathed fire-rated cable approved to BS5839 and FP200 Gold or similar BS: 7629-1 compliant cable, run via the dedicated fire alarm containment system.

All detectors shall be subject to a two-week soak test prior to Practical Completion. A full set of operating, maintenance and record information, as described below, shall be available at the time of the demonstration.

The electrical contractor shall include for one full year's comprehensive service, maintenance and breakdown cover for all the fire alarm systems, commencing from the date of Practical Completion. This shall include for all consumables within this period, with all equipment covered by a warranty. The arrangement shall include for a 24/7 emergency call-out facility, with a guaranteed 4-hour response time.

A typical fire detection & alarm system includes the following configuration:

- Main fire alarm control panel located in the communal core are on the ground floor or near the main entrance, situated for ease of access for the fire brigade as indicated on the drawings. Any final locations would be coordinated and agreed with the architect. The Main fire alarm control panel should be modular, recessed, microprocessor-based and to be analogue addressable type.
- High Sensitivity Smoke Detection Systems are preferred to be used where there are complex structures at ceiling/ roof level, and in deep voids, as testing is difficult, or impossible without this type of system.
- The cabling for the fire alarm should be fire rated and fully complying with BS:5839
- Any Mechanical plant including smoke fire dampers shall be integrated with the fire alarm system.
- Lifts shall be interlinked with the fire alarm system.
- PV systems shall be interlinked with the fire alarm system.
- Allow for detection within 1.5m of flue like structure openings.

The fire alarm panel (FAP) shall be:

- Fully automatic
- Fully addressable.
- Recessed mount.
- Multi-Loop (minimum 4 loop).

All interfaces shall automatically reset plant after the fire alarm condition.

The Electrical Contractor and the specialist fire alarm contractor shall liaise with specialist plant installers to ensure correct operation of plant and equipment is maintained during a fire condition.

Input and Output interfaces shall be connected onto the detection loops and be line powered (i.e. shall not require an external power supply). The interfaces shall be provided with 24V DC monitored addressable inputs and addressable output volt free changeover contacts rated at 2 Amps.

Ensure each input/output way is fully programmable from the control panel and fully monitored for open- and short-circuit conditions.

Ensure that routine testing of the fire detection and alarm system does not have any undesirable effect on other systems interfaced to it.

The Fire Alarm Control Equipment (Taktis) & System Devices (K-System) shall be supplied by Kentec Electronics Ltd

Contact:

Mike Estall AIFireE MIFSM
Senior Specifications Development Manager
M: +44 07895 206 924
Kentec Electronics Ltd.
25-26 Fawkes Avenue, Questor, Dartford, Kent DA1 1JQ

C.4.13 UNINTERRUPTIBLE POWER SUPPLY

The UPS system shall be provided for the evacuation lift as means of a secondary supply that shall automatically become active when the primary power supply is interrupted.

The UPS arrangement shall be inclusive of maintenance bypass (inclusive of manufacturer recommended interlocking) to allow removal of the system for major maintenance replacement or maintenance. The arrangement shall be provided with remote indication at the lift ground floor lobby to provide visual indication of system operation under 'Normal Mains' or 'Standby UPS supply'. The remote indicator shall also provide audio visual indication of UPS fault indication.

The lift UPS shall generally comprise:

- Regen load box
- Open steel battery racks
- Three phase input / output batteries
- Automatic Transfer Switch (ATS)
- Brick / GRP plant room
- Power supplies for air conditioning, lighting and small power
- Mechanical services as required
- Diverse cable routing in accordance with BS5839
- FP600 cabling

The contractor shall allow electrical equipment such as adequate lighting, fire detection, mechanical and small power required, within the UPS enclosure.

Contact:

Riello UPS Limited

Jeremy Hulse

T: 07816 240574

E: jeremy.hulse@riello-ups.co.uk

C.4.14 LIGHTNING PROTECTION SYSTEM

The contractor shall employ an approved lightning protection specialist contractor, who shall be a member of the Association of Technical Lightning and Access Specialists (ATLAS) or equivalent recognised industry body. The specialist shall undertake a Lightning Protection Risk Assessment (LPRA) in accordance with BS EN 62305-2, prior to commencing detailed design or installation works. The contractor shall be BS EN ISO 9001 certified for quality assurance to provide all required technical advice, installation and monitoring services to ensure a complete installation as outlined in this specification

The Specialist Lightning Protection Contractor shall provide a lightning protection risk assessment to BS EN 62305-2 to identify and quantify all risks in order to determine the appropriate level of lightning protection required to meet this specification before any works commence on site to confirm the requirements to relevant standards.

The specialist lightning protection company shall be responsible for the design, supply and installation, test and commissioning of the lightning protection system as described below.

- The complete system shall comply with BS EN 62305 (Parts 1-4) – Protection against Lightning.
- The level (class) of protection required shall be determined based on the results of the risk assessment in accordance with BS EN 62305-2.

System Components:

Air Termination Network:

At roof level, the metallic roofing system may be used as part of the air termination system if it meets the conductivity and continuity requirements set out in BS EN 62305-3. Where required, this shall be supplemented with a grid of 25mm x 3mm high conductivity copper tape with PVC insulation, colour to be agreed with the Employer prior to ordering.

The layout and spacing of the air termination network shall ensure complete coverage of the structure in accordance with the rolling sphere, mesh, or protective angle method defined in the standard.

Down Conductors:

Where practical, the structural steel framework of the building shall be utilised as natural down conductors, subject to verification of electrical continuity and compliance with BS EN 62305-3.

Where additional down conductors are necessary, routes shall be designed and installed to integrate with the building facade in a coordinated manner.

Earthing and Earth Termination System:

The down conductors shall be connected to dedicated earth electrode systems, designed to achieve a resistance to earth in line with BS EN 62305-3 requirements, typically less than 10 ohms per electrode system, or as required to meet equipotential bonding.

Connections to earth electrodes shall be made using PVC insulated copper tapes, via accessible, wall-mounted test clamps, located typically at 1,000mm above finished floor level (AFFL). Test clamps shall be installed inconspicuously and with tamper protection as appropriate.

Equipotential Bonding:

Equipotential bonding shall be provided to all external metalwork and plant, including rooftop mechanical and electrical services, in order to eliminate dangerous potential differences and flashover risk during a lightning strike.

Particular attention shall be paid to rooftop equipment, metallic ducts, cable trays, and other conductive elements within the protected volume.

Surge Protection Measures:

Transient overvoltage protection devices (SPDs) shall be installed to protect electrical and electronic systems in accordance with BS EN 62305-4 and BS EN 61643 series.

- SPDs shall be installed at all main incoming electrical supplies, including the main LV switchboard.
- Additional SPDs shall be provided at distribution boards supplying sensitive or critical equipment and all external connections, including data and communication services.
- SPDs shall be Type 1 at service entrances and Type 2 or 3 at sub-distribution and terminal points as appropriate, selected based on coordination and energy handling capacity.

A surge protection coordination study shall be undertaken to define the correct type, rating, and placement of SPDs throughout the electrical installation.

C.4.15 AMR (AUTOMATIC METERING SYSTEM)

The works comprise the design, supply, installation, commissioning and handover of an Automatic Meter Reading (AMR) system utilising the Be Seen AMR platform supplied by Rayleigh Connect Smart Metering Equipment, equal and approved. , Be Seen addresses operational performance to demonstrate how a building performs once it is occupied along with offsite GSM monitoring via a platform which shall be supplied by the Contractor.

The system shall be installed in accordance with BS-7671.

The system shall provide:

- Remote automated collection of utility consumption data
- Remote automated collection of various Electrical & Mechanical load consumption data
- Secure cloud-based data hosting and reporting
- Real-time and historic monitoring capability
- Integration capability with BMS systems
- Operate independently of landlord's IT where required

Utilities to be monitored (as applicable to project):

- Electricity
- Gas
- Water (potable and non-potable)
- Photovoltaics
- Sub-metering of electrical and mechanical plant

The AMR system shall comprise:

Equipment

- RPS15-DC Power supply
- M-Bus masters/slaves
- Modbus TCP/RTU
- Modbus cable links RS485
- GSM / Ethernet gateways
- Antennas (where GSM utilised)

Head-End System

- Secure Be Seen cloud platform
- Web-based portal access
- API interface capability

The Contractor shall make an allowance for fuse connection unit outlet to be installed at the incoming services location to enable a secure power supply for the gateway and pulse collector.

C.4.16 TESTING & COMMISSIONING

The electrical services contractor shall test and commission all Electrical services in accordance with the BS7671 and CIBSE commissioning codes. The Contractor will provide a fully operational system which will be demonstrated to the Contract Administrator for approval. The system will not be approved until a set of commissioning figures is provided which can be fully validated.

The electrical services contractor shall make the allowance for all final wiring of plant from local switch spurs. The wiring of all plant shall be in accordance with the BS7671:2018 - 18th Edition of the IET Wiring regulations.

The Contractor shall demonstrate that the systems have been set up correctly and that all control routines are working fully in accordance with the Engineer's requirements and Contractor's proposals.

The Building Regulation requirements about commissioning necessitate the Contractor's liaison with the company he proposes to commission and certify the works.

The Electrical Services Contractor shall note the requirement to comply with the Commissioning Requirements of Building Regulations including provision of a Report a Commissioning Plan and tabulated results. The Contractor shall refer regarding qualifications.

The Electrical Services Contractor shall note the safety requirements for certification of both the soundness of the gas supply and the quality of the water, the latter requiring sampling as detailed under Sterilisation of Water Services.

C.4.17 ELECTRICAL WIRING

Where systems are specified as being maintained under fire conditions ensure wiring selected is suitable for the temperatures to be encountered.

All cabling shall be LSX or, Twin & Earth and Steel Wired Armoured (externally)

All electrical design & installation works shall be undertaken to comply with BS 7671:2018.

Cable containment systems shall be medium duty, galvanised steel and supported at centres not less than the manufacturers' recommended spacing's. Support bracket shall be fabricated from uni-strut and suspended from the structural slab using 8mm threaded rod. Cable containment shall be sized for 25% spare capacity.

All power & control wiring shall be sized for the design duty of the equipment it will be serving and take account of external influences, length of run, internal temperatures and mechanical stresses. In addition, cables shall only be selected with Low Smoke & Zero Halogen (LSOH) outer sheaths were installed within buildings. Where systems are specified as being maintained under fire conditions, wiring shall be selected for the temperatures to be encountered.

Cable calculations along with a wiring schematic drawing shall be submitted to the Engineers for their comment prior to works commencing on site.

Cables shall be neatly clipped on cable containment systems tie-wrapped at regular intervals. At each point of termination, the cable shall be identified by means of a label system, such as Critchley, giving details of size, equipment served and origin of supply.

Control & power cabling installations shall be fully co-ordinated with all other building services systems along with structural building elements.

Non sheathed cables for fixed wiring shall be enclosed in galvanised steel conduit, ducting or trunking.

Upon completion of the electrical wiring works, an electrical test & completion certificate shall be issued and be included as part of the record documentation to be enclosed within the mechanical services Operation & Maintenance manual.

C.5 WORKING DRAWINGS AND BUILDERS WORK

C.5.1 WORKING DRAWINGS

For all projects the electrical services contractor is required to produce Working Drawing. The drawings are intended to portray the following:

- That the services fit into the allocated spaces provided and that there is sufficient space to perform service and maintenance
- That the services can be commissioned
- The services co-ordinate with the structure, architecture and other services.
- For the basis of Builders work drawings.
- To provide clear and specific information to fabricators and site installers.

The working drawings shall be fully detailed and drawn to a scale such that clear information is provided. Any system or service which is on view shall be detailed such that the Architect, Client and CA as appropriate is given a clear indication of what will be seen.

For guidance the Working Drawings shall at minimum be the following scales:

- | | |
|-----------------------------|------|
| • Risers and service Voids | 1:20 |
| • Plans | 1:50 |
| • Details and Co-ordination | 1:20 |

All drawings shall be dimensioned for setting out and heights from set points which will be in existence when the services are being installed. The electrical services contractor shall discuss such setting out points with the Main Contractor, prior to starting the working drawings.

The services shall be fully co-ordinated with the structure, architecture and other services and systems. The mechanical services Contractor shall take the lead role in co-ordinating services in areas where other services are being installed, such as ceiling voids, combined risers and plantrooms and areas, regardless of whether the other services are part of their contract or not. The mechanical services contractor shall hold, and lead co-ordination meetings as required with the other services installers and set zones where the other services can be run and installed.

C.5.2 BUILDERS WORK PROVIDED

Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory, and adequate for the purpose and confirm same in writing to the CA within 4 weeks of award of contract.

Where alternative equipment or materials has been offered that the CA has accepted and which subsequently varies the works in any way whatsoever, then the Contractor shall undertake the redesign of the associated builder's work.

C.5.3 BUILDER'S WORK RESPONSIBILITIES

The requirements for and responsibilities regarding builder's work items are in addition to that normally provided as is normal custom and practice in the building industry.

The Contractor shall:

- Provide builder's work information, appropriate to the stage of design development. Revise, supplement and/or issue final information, drawings/details for the actual requirements of the contract works.

- Provide fully dimensioned drawings showing both size and position of builder's work referring to the structural engineering and architectural final dimensioned detailed drawings.
- If approved by the CA Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built-in sleeves or similar items.

All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.

All materials provided for fixing by others are to be included in the contract works cost and supplied in accordance with the programme.

The Electrical Services Contractor shall co-ordinate and provide all builders' work details required for incoming and connecting gas and water services, regardless of whether they form part of their contract.

C.5.4 SCOPE OF BUILDER'S WORK

Builder's work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and such work is included in the electrical services contract works.

The electrical services contractor shall also supply and install the following as necessary for the complete installation:

- All supporting secondary steelwork.
- Brackets, clamps and fixings.
- Pipe, duct and cable sleeves through walls, floors, slabs etc.
- Supply all sleeves and hand-over to others for fixing.
- Making good around sleeves to provide correct fire barrier protection.
- Supply all puddle flanges and hand over to the main Contractor for fixing.

The electrical services contractor shall liaise with other Contractors to try to minimise the amount of builder's work required by sharing openings, bases steelwork and secondary supports.

C.5.5 MARKING OUT OF BUILDER'S WORK HOLES ON SITE

If approved by the CA, mark on site actual locations of minor non-structural holes through walls, partitions, floors etc. and chase in non-fair-faced walls, etc. for conduits, pipes and the like in preference to providing drawings of such builder's work requirements. The CA is to be given the opportunity to inspect prior to work being carried out.

The CA shall inspect all marking out on site prior to work commencing.

Establish a method of working with the CA to ensure the works may proceed without hindrance.

The maximum size for a non-structural hole for marking on site shall be 150mm diameter or equivalent.

C.5.6 BUILDER'S WORK INFORMATION TO BE PROVIDED

All builders' work drawings shall be fully dimensioned and provided in accordance with the following:

- Details of all bases for plant formed in concrete, brickwork or blockwork to a scale of not less than 1:20.
- Details of all attendant builder's work, holes, chases, etc. for conduits, cables and trunking etc. and any item where access for a function of the installation is required to a scale of not less than 1:50.

- Details of all types of purpose made brackets for supporting service or plant/equipment to a scale of not less than 1:20.
- Details of all access to ceilings, ducts, etc. to a scale of not less than 1:50.
- Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc. to a scale of not less than 1:20.
- Details of all sleeves, puddle flanges, access chambers to a scale not less than 1:20

C.5.7 STRUCTURAL STEELWORK

The requirements with respect to structural steelwork are follows:

- No steelwork shall be cut, drilled or welded on site without written approval from the CA.
- All holes required through structural steelwork shall be pre-determined and made at the steelwork fabricators works.
- Fixing steelwork shall be an approved clamp type.
- All fixings shall be of the correct size and type for the fixing load applied and the type shall be approved prior to commencement of the works.

C.5.8 PRE-CAST CONCRETE

Holes may not be cut in precast concrete without written approval from the CA.

Under no circumstances will holes be cut in pre-stressed concrete.

C.6 INFORMATION TO BE PROVIDED BY THE SERVICES CONTRACTOR

C.6.1 RISK ASSESSMENTS

Risk assessments (RAMS) shall be undertaken for all works activities undertaken by the services Contractor, including but not limited to the following:

- Unloading and storage of materials
- Fabrication on site
- Moving materials and plants
- Installation works
- Safe use of tools, machinery and access equipment
- Cutting and drilling
- Crane Lifts
- Working in confined spaces
- Working in exposed locations or on roofs.
- Operating Electrical handling and access equipment
- Testing and Commissioning
- Setting to work

All risk assessments shall be specific to the project, the conditions on site, taking account of the contractual arrangements etc. Risk assessments shall be available at any time for review by the Main Contractor, CA, Client representatives and Health and safety officers.

Evidence shall be provided that all operatives and managers relevant to the risk assessments have read and understood them and that measures are in place to ensure that they are followed.

This statement does not override any measures which have to be followed under legislation, site rules or requirements by the Main Contractor.

C.6.2 METHOD STATEMENTS

As required by the main Contractor or the CA the electrical services contractor shall provide method statements for any aspect of the works, in particular critical operations such as plant placement, works within occupied areas or on equipment which is required to be maintained fully operational.

Method statements shall include but not limited to the following:

- Description of the works to be undertaken
- Reason for the works
- Programme and sequence of works
- Identify Risks
- Mitigation of Risks
- Organisation Diagram of operatives and managers responsible for the works
- Contact telephone numbers. (With out of hours contact as appropriate).
- Method statements shall be submitted at least 10 days prior to the works being commenced and shall not proceed unless acceptance of the method statement is given by those requesting it.

C.6.3 PLANT & EQUIPMENT MAINTENANCE AND REPLACEMENT STRATEGY:

As part of an ongoing commitment to ensure that works undertaken can be maintained and replaced in the future, at any point during the contract the CA can may request a statement from the electrical services contractor on how any or all the plant and equipment can be accessed for maintenance or replaced in the future. The electrical services contractor shall within 15 working days of any such request, prepare a report with drawings and sketches as required to show what access arrangements have been made for maintenance, and how plant and equipment can be replaced in the future.

If requested maintenance access shall be demonstrated on site by the Services Contractor.

If arrangements for maintenance and/or replacement are deemed not to be acceptable by the CA, the electrical services contractor shall at no cost to the Contract ensure that acceptable means of maintenance and replacement is incorporated into the project.

The strategy for maintenance and replacement shall be included in the operating and maintenance documents for the project.

C.6.4 PROGRAMME OF WORKS

All works undertaken by the electrical services contractor shall be pre-programmed.

The programme shall integrate with the overall programme for the project and those produced by other Contractors working on the project.

The Programme shall show critical dates and a critical path. As requested by the CA and /or Main Contractor the programme shall be marked up with progress which shall show areas ahead or behind programme. Should works be behind programme, the electrical services contractor shall indicate how the activities shall be brought back on target to achieve completion.

C.7 COMMISSIONING & TESTING

C.7.1 DEFINITIONS

Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Commissioning: The advancement of an installation from the stage of static completion to working order to the specified requirements
- Testing: The measurement and recording of specified quantifiable characteristics of an installation or parts thereof and includes off-site testing.
- Setting to work: The process of setting a static system in motion
- Regulation: The process of adjusting the rates of fluid flow in a distribution system to achieve specified values
- Environmental testing: The measurement and recording of internal environmental conditions.
- System proving: the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values.
- System demonstration: Demonstrating the capability of the installation to achieve and maintain the specified performance criteria.
- Fine-tuning: The adjustment of the system where usage and system proving has shown such a need and includes the reassessment of design values and control set points to achieve the required system performance.
- Seasonal Commissioning: The Contractor shall return to site approximately 6 months from the original commissioning date to review the system performance and set points with respect to differing outside conditions. The Contractor shall seek comment from the occupiers and owner of the building on the

performance of the systems and to consider if any adjustments are appropriate to the system. The cost of the return visit and for considering and adjusting shall be included in the Contract sum.

C.7.2 PROGRAMME

The electrical services contractor shall prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works. The programmes shall be prepared at the start of the project, to ensure that sufficient time is incorporated into the overall contract.

The programme shall be reviewed and updated to suit the progress of the contract works.

It should be noted that Practical Completion may not be given unless the systems and services are fully tested and commissioned.

C.7.3 COMMISSIONING SPECIALIST

Unless the necessary expertise is retained in house the electrical services contractor shall employ an independent company who specialises in testing and commissioning of building services to undertake the following:

- All commissioning and testing activities associated with the contract works.
- Overseeing specialist testing and commissioning
- Supervision and overseeing of works testing.
- Preparing final testing and commissioning documentation.

The electrical services contractor shall submit with the tender, details of the in-house specialist or independent company to be employed.

The commissioning specialist / company shall be a member of The Commissioning Specialists Association (CSA).

C.7.4 STATIC TESTING

Progressive static testing shall include the following tests, but other tests may be required and witnessed:

- Hydraulic / Pneumatic

Sufficient advance notice of the tests shall be given to the CA there is an opportunity to witness all static tests.

C.7.5 PLANT AND EQUIPMENT PERFORMANCE TESTING

Critical and or important equipment shall be tested at the works of the manufacturer or in a recognised and approved testing facility to demonstrate the performance complies with the stated and specified duties.

These tests shall be in addition to standard works tests that may be performed as part of manufacture.

The tests shall be conducted to simulate design conditions and all ancillary plant and equipment needed to support the tests together with all instrumentation shall be provided and included in the contract cost. The Contractor shall submit to the CA, a full method statement supported by risk assessments detailing the procedures for carrying out the tests 10 days prior to the tests being carried out. Should the method statement be rejected by the CA it shall be re-submitted. Acceptance of the method statement by the CA must be obtained prior to the tests being undertaken.

Up to three representatives from the Client's team plus representatives from the Contractors team may inspect and witness the works tests. All costs associated with this visit, including travelling and overnight accommodation as appropriate must be borne by the manufacturer of the equipment. The Commissioning Manager is expected to also witness the test.

Upon successful completion of the performance tests the plant and equipment shall be thoroughly cleaned and returned to its new condition and correctly packaged for delivery to site.

Test certificate records of the tests shall be issued to the CA within 10 days of the test.

C.7.6 PRE-COMMISSIONING CHECKS

Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up.

All necessary notices shall be displayed.

C.7.7 COMMISSIONING AND TESTING

When the contract works or parts thereof are ready for testing and commissioning the Contractor shall notify the CA in writing.

The following shall be in place to allow the commissioning to commence:

- All necessary facilities shall be provided to enable tests to be witnessed and inspections carried out including all necessary instruments and recorders to monitor systems during commissioning system proving and environmental testing.
- Provide information where access is required into ceiling voids, service risers etc. and ensure these points are not closed until the commissioning and testing is complete.
- Full set of schematic layouts indicating the required duties and flow rates etc.
- Where commissioning, testing, balancing, adjustment, is undertaken in an area of the building taken over and occupied by the Employer, then take all necessary precautions against and be responsible for any damage caused whilst working in such areas for that purpose.

Prior to witnessing and inspection by the CA the contract works shall be fully tested, commissioned and be fully operational.

Where portions of the work are required to be commissioned and tested separately, then upon final completion, demonstrate to the CA that all the several portions are capable of proper simultaneous operation in accordance with the requirements of the specification.

If commissioning and testing demonstrates that the plant system or equipment is not properly installed and/or not functioning correctly the Contractor shall carry out such remedial measures and adjustments as may be necessary and repeat the commissioning and testing procedure to the satisfaction of the CA.

The Contractor shall ideally complete all tests before any paint; cladding or similar materials are applied or before services are concealed.

Ensure all requirements such as cleanliness, protection from harmful external and internal elements are provided prior to commencement of commissioning.

The Contractor shall undertake to:

- Comply with the requirements of the Building Regulations (Approved Document Part L2) for the inspection and commissioning of the building services systems. Prepare all necessary submittals including commissioning plans and reports. Obtain all compliance approvals from the building control bodies.
- Provide all specialist personnel including manufacturer's representatives and coordinate their activities, together with providing any attendance required.
- Provide reports detailing progress of testing and commissioning activities at intervals agreed with CA.
- Maintain a diary/log of significant commissioning and testing activities.
- Measure and reconcile noise levels at agreed locations to verify compliance with design criteria.
- Submit to the CA all certification documents prior to any system being offered for final acceptance.
- Confirm in writing to the CA that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
- Ensure all certification is attained and witnessed as necessary for inclusion in the record documentation.
- Submit a report for every test, demonstration, balance or commissioning activity witnessed, together with an engineering appraisal on the performance, either on or off-site.
- Co-ordinate and liaise with the Employer's representative.
- Maintain on site full records of all testing, commissioning and performance testing.

The extent and proportion of results to be witnessed by the CA will be at the discretion of the CA.

The CA will only witness test proceedings to establish a level of confidence in the commissioning results being presented, except for the life safety systems which shall be fully witnessed.

C.7.8 FUEL FOR TESTING

Fuel for testing and operating the contract works shall be included within the contract price and due allowance made within the tender.

C.7.9 SYSTEM DEMONSTRATION:

After the completion of all testing and commissioning to the satisfaction of the CA and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.

The systems shall be fully run and operated to demonstrate correct function in accordance with the requirements of the specification for a period of 4 weeks prior to practical completion.

C.7.10 INSPECTIONS AND TESTS

The electrical services contractor shall submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification.

Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.

Provide method statements supported by risk assessments detailing the procedures for carrying out on site testing and commissioning.

Agree in advance with all parties' procedures for inspections and tests including periods of notice.

Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and details for corrective action.

Maintain records of all specified inspections and tests performed including third party and works testing. Maintain all records on site for inspection.

C.7.11 TEST CERTIFICATES AND RECORDS

Ensure that test certificates include:

- Project title.
- Details and date of test.
- Instruments used, serial numbers, calibration dates.
- Signature of those witnessing test.
- Installers name.
- Specific location of the item in the contract works.
- It is required to provide 2 copies of each test certificate to be issued to the CA within 10 working days of each test.

C.8 RECORD DRAWINGS AND DOCUMENTS

C.8.1 GENERAL

Each building demise shall be provided a separate standalone operating and maintenance manual and set of record drawings. The Contractor shall produce a set of O&M manuals for the works completed and the manuals shall be set out in accordance with BSRIA Application BG 1/2007 "Handover, O&M Manuals and Project Feedback".

Record drawings and operating and Maintenance manuals shall be produced, and final draft issued as part of the practical completion sign off, for the project. Note that the CA reserves the right to refuse Practical Completion should the documents and drawings not be available.

The documents and drawings shall be issued in draft but near completed form for review at least 6 weeks prior to practical completion, with final updated versions being made available at practical completion.

C.8.2 RECORD DRAWINGS

Record drawings shall portray the final installation, generally being the working drawings updated as the works proceed on site to take account of variations and changes. The drawings must be drawn on the latest architectural background, and if this is not available at time of practical completion, it shall be updated when available at no additional cost to the project.

The drawings must reflect accurately the works undertaken, fully cross referenced to the O&M manuals.

For Contractor designed Projects the design drawings must also be updated and issued as part of the Record Drawing set.

Record drawings must include, but not limited to the following:

- 1:50 - Floor Plans and sections for each system and service as appropriate. With reference to all system components. Pipework and ductwork etc. shall be sized, and each drawing shall be cross-referenced with the adjacent areas and with drawings covering other systems and services. Drawings to include locations of controls and wiring routes and components associated with the Electrical services works.
- 1:20 - Plant areas and sections, with reference to all plant and equipment. All ducts and pipes to be sized, valves shall be numbered and cross referenced to a valve chart drawing. Drawings to include locations of controls and wiring components associated with the Electrical services works.
- 1:20 - Risers and Voids plans and sections, with reference to all plant and equipment. All ducts and pipes to be sized, valves shall be numbered and cross referenced to a valve chart drawing. Drawings to include locations of controls and wiring components associated with the Electrical services works.
- Schematic layouts for all systems including design flow rates. Note: the drawings shall also be used as a basis for the commissioning works. Plant references should be indicated and cross referenced to the O&M manuals. Schematics shall include the location in the system for all controls, sensors and actuators etc.
- External services layout. Note external drainage shall be portrayed at 1:50 but incoming services such as gas water and telecoms can be indicated at 1:100. Note The electrical services contractor shall obtain information on external Electrical services and provide record information on those systems even though they do not form part of his works. This is to provide a complete picture of the services installation for future reference.
- Controls wiring schematics fully cross referenced to the Plans and sections.
- Controls logic Diagrams, points schedules and full description of operation.
- Electrical Controls and Power wiring diagrams.

- Control panel and MCC wiring diagrams.
- Control Panel and MCC fabrication and layout drawings.
- Fire damper and barrier layout, showing access arrangements. Note full schedule of all items which require regular inspections to be included.

C.8.3 OPERATING AND MAINTENANCE MANUALS

The electrical services contractor shall supply a comprehensive set of Operating and Maintenance Manuals to cover all aspects of the services installation.

Before the anticipated completion date, the electrical services contractor shall supply draft copies of the Operating and Maintenance Manuals to the EA and CBSE for comments.

The final Operating and Maintenance Manuals shall be submitted to the EA and CBSE in sufficient time to ensure the complete O&M documentation is complete by practical completion.

If during the defects liability period any discrepancies are found within the documentation, then all copies of the manuals shall be amended at the Contractor's expense.

The electrical services contractor shall note that all the services manuals shall be incorporated into the overall building manual for the project.

The electrical services contractor shall include for instructing the Client's staff in the operation and maintenance of all equipment installed. This instruction shall include attendance by specialist suppliers and shall only be required to be performed once. The Contractor shall also allow for a guided tour of the installation for the Client's benefit.

The operation and maintenance demonstration and guided tour shall be undertaken within 3 months following practical completion. However, the Client can, at his discretion, postpone such instructions to a later date provided the re-arranged date is within the defect's liability period.

The arrangement of the manual shall generally be as follows:

Section One: Contents

Section Two: Description of Services

- Detailed description of each system, basis of design and principal components.
- Date of installation.
- Names of all relevant parties.
- Design specifications.
- Performance specifications.
- System schedules, tables, etc.
- Key design parameters.

Section Three: Operating Instructions

- Functional explanation of all components, switches, controls, etc.
- Start/stopping procedures via step-by-step instructions for each plant/system.
- Step-by-step instruction procedure for shutting down each plant/system in an emergency.
- Adjustment and regulation.
- Description of operational routines including points of isolation for all incoming services.

- Fault finding and trouble shooting.
- Safety precautions and emergency procedures.
- Switching schedules.

Section Four: Inspection and Maintenance

- Inspection schedule and planned maintenance instructions (to include step-by-step instructions on the maintenance of all items of plant, clearly indicating daily, weekly, monthly, quarterly, 6 monthly and annual procedures).
- Maintenance and lubrication schedules and procedures.
- Inspection and maintenance records.
- Periodic maintenance requirements for all plant.
- Data for ordering plant replacements, components and spares.
- All information to satisfy all Health and Safety and Statutory Regulations in clearly defined text.
- Legend for colour coded services.
- Risk Assessments for method statements for all maintenance activities.
- Schedule of normal consumable items.
- List of spares.

Section Five: Test and Commissioning Certificates

- Electrical, Fire Alarm, Refuge Alarm, Access Control, Lighting, Emergency lighting, Lightning Protection System, Main Switch panels Torque Test and Generator.
- All test and commissioning sheets to be typed.

Section Six: Service

- Manufacturers' names, addresses and telephone numbers.
- Local Authority names, addresses and telephone numbers.
- Sub-Contractors' names, addresses and telephone numbers.
- Emergency procedures include telephone numbers for emergency services (including utility supply companies).

Section Seven: Manufacturer's Literature

- Full list of manufacturer's recommended spares.
- Full details of spares provided together with their storage location.
- Manufacturer's literature of all plant and equipment, including their maintenance instructions, wiring diagrams and typical fault-finding routines.
- The manufacturer's literature shall be actual copies; photocopies will not be acceptable.
- Copy of all manufacturers guarantees, warranties and maintenance agreement offered by sub-contractors and manufacturers.

Section Eight: Drawings

- List of the record drawings.

Section Nine: Equipment Schedule

- Full detailed schedule of all plant and equipment identifying their locations, duties, commissioning performance figures, reference numbers, serial numbers, unique identification number (cross referenced to the record drawings) plus the manufacturers name, address and telephone number.
- Schedule of keys.

Section Ten: Maintenance/Replacement Strategy

- Details of maintenance and replacement strategy for all items of plant and equipment.

C.8.4 END USER TRAINING

Unless otherwise detailed the electrical services contractor shall provide training for the end users staff in the operation of all Systems installed. Training for staff shall be in the form of a course, lasting for two days, held on two occasions (to allow for approximately six people). The course shall cover, as a minimum, the following:

- A detailed explanation of the operation of each system.
- The indication of alarms, status and faults on each system.
- The use of all manual controls.
- The operational sequence and interfacing to other systems
- Procedures for routine testing.
- Procedures for repo



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