

Haringey Council
10 Station Road
Wood Green
London
N22 7TR

21st August 2023

Our Ref: 22-E066-018
Application Ref: HGY/2022/2293

Dear Sir/Madam,

45-47, GARMAN ROAD, LONDON, N17 0UN – CONDITION 14 & 15

Planning permission was granted for the *redevelopment of the site to provide a self-storage facility (Use Class B8) with associated car and cycle parking, refuse storage, landscaping and other associated works ancillary to the development* (Application Ref: HGY/2022/2293) on the 15th August 2022.

A Carbon Management Response was received on the 26/07/2023 relating to the approval of details reserved by a Condition 14 (Energy) and Condition 15 (Be Seen). A number of actions are listed as part of the feedback, the below seeks to provide the necessary additional detail in relation to the points raised.

Action 1 – Appropriate Building Regulations

It has been requested that the energy strategy should be submitted under Part L 2013.

As stated in the Carbon Management Letter dated 22nd December 2022 sent to the Council, Ensphere confirmed:

'As of 20/12/22, the GLA states the following: "now that the accompanying Part L software is available and functional, all planning applicants are encouraged to follow the 2022 Energy Assessment guidance and use the 2022 Carbon Emissions Reporting Spreadsheet (version 2)" (source- <https://www.london.gov.uk/programmes-strategies/planning/planning-applications-anddecisions/pre-planning-application-meeting-service/energy-planning-guidance>). As the software is available and functional at the time of assessment, and in line with the GLA's latest advice, the application reports emissions under Part L 2021 and has attached the revised GLA's Carbon Emissions Reporting Spreadsheet (version 2) which has been released.'

Furthermore, the Part L 2021 approved document states that the regulations took effect on 15th June 2022 for use in England. This application (HGY/2022/2293) was submitted post the 15th June, with a validation date of the 15th August 2022, and thus the new Building Regulations applied.

It is noted that the Council has referenced the 2013 Regulations multiple times in previous communications. Whilst this might allow for the use of old carbon factors and therefore increased allowable solutions offset, this is considered inconsistent with the planning policy that should apply and might be construed as an effort to leverage further payment from the applicant. No revised Energy Statement using Part L 2013 or GLA's Carbon Emission Reporting Spreadsheet are therefore deemed required, in line with the above.

Action 2 – Mechanical Ventilation and Heat Recovery (MVHR) Details

The specification and efficiency of the proposed Mechanical Ventilation and Heat Recovery (MVHR), with plans showing the rigid MVHR ducting and location of the unit were requested.

The mechanical equipment schedule has been provided from the M&E Consultant, Atelier Ten, detailing the MVHR unit specification as a Nuaire XBC25-H-NNT. This confirms the minimum heat exchanger efficiency of the unit is 80%. Plans showing the MVHR unit and duct are included in Appendix A, along with the specification details.

Action 3 – Fabric Target Applicability

An action was included in the Carbon Management Response from the Council to provide '*the average % improvement on the FEES*'. The Fabric Energy Efficiency Standard (FEES) metric sets the benchmark for a building through its 'notional building' and minimum u-values for fabric standards.

For Part L 2021; Volume 1, there is a dwelling fabric energy efficiency rate, which is the dwelling fabric energy efficiency (FEE), expressed as kWh/(m²·year). For a non-residential development, as per Part L 2021: Volume 2, the energy performance is assessed against the target primary energy rate and target emission rate only, with no set fabric target given.

In line with Action 1 whereby the building requires assessment under Part L 2021, the fabric target does not apply as this is a non-domestic development. The London Plan Be Lean target of 15% improvement over the TER has, however, been achieved showing the Energy Hierarchy has been followed for the development (see Revised Energy Statement dated June 2023 provided).

Action 4 – Building Emission Rate

The '*individual end use BER for specific end users in line w CIBSE Guide F*' was asked to be submitted. There is only one end user for the site (Shurgard) and thus the BER is applicable to the building owner only. As per the Revised Energy Statement dated June 2023, the BER of the latest (Be Green) model of the development is 0.37 kgCO₂/m².annum.

Action 5 – Cooling Requirements

The Council response requested the following: '*Model the energy demand for the active cooling. Then include these energy demands into the carbon footprint of the development and update any offsetting requirements based on this*'.

Cooling is already included in the energy model under the ASHP system (see BRUKL appended, as per the revised Energy Statement provided). As explained in previous correspondence, the cooling system is small as it is used for just the shop, breakroom & IT room. As the heat pump is already in the energy model, the carbon emissions associated with the system are accounted for and are thus included as part of the carbon offset contribution. Please see the BRUKL appended to the Revised Energy Statement (dated June 2023) submitted previously and attached to this document for reference.

Action 6 – PV Details

Appendix C includes a roof plan showing the solar PV area. The performance specification for the PV has also been provided in Appendix D by the M&E consultant.

The 'Carbon Management Response' from the Council states that '*a living roof should be installed under the solar PV, or if this is not feasible, the roof should be light coloured to reduce solar heat gains and to improve efficiency of the solar panels*.' As shown on roof plan provided in the appendices, a biodiverse roof is to be installed under the PV panels. This plan also demonstrates that available roof space has been maximised for solar PV installation, which contributes to total cumulative savings of ~49% at the Be Green stage relative to the Baseline (see Revised Energy Strategy for further details). Other biodiversity measures and planting are proposed on the remaining roof space.

Action 7 – Heat Pump Details

Appendix D includes the ground floor layout plans which indicate where the internal and external parts of the air source heat pump (ASHP) will be located. The outdoor unit will likely be wall mounted at a high level in the car park. The heat pump will provide heating/cooling to shop, breakroom & IT room, and will meet all of the heating demand. A radiant panel will also be used for space heating within WC.

Hot water will be provided by instantaneous electric heaters, as also indicated on the plans in Appendix D, and will cover the hot water demand of the development. Hot water demand will be negligible for the site as the only use will be for the occasional hand wash. Instantaneous electric heaters are to be applied on hot water on the basis that demand is low and this type of system avoids significant storage losses.

The front of house space will be mitigated in terms of visual and noise impact as given the size of ASHP unit and in the context of the site uses and general aesthetic, visual impact and noise are considered minimal. The impact is negligible due to the small scale of system which blends in with the industrial aesthetic of the development.

Action 8 – Be Seen: Automatic Meter Reading Devices Specification and Details

Attached in Appendix F are the datasheets of the energy meter and power meters are anticipated to be used in this development (same or equal and approved, subject to availability). The power meter (PM5110) will be fitted to the main LV Panel which provides real-time power measurements and will also account for commissioning and optimizing electrical systems whilst also ensuring their safe and efficient operation.

The energy meters fitted to the TPN distribution boards (EM3255, subject to contractors review) will help users better manage and control power usage. By knowing the total energy consumed, users can develop more effective energy management strategies to save on electricity bills and reduce environmental impact. Additionally, pulse output measurement method will be utilised for monitoring consumption specifically.

In appendix G is the indicative LV schematics for the scheme which shows distribution boards at every other floor along with metering. The distribution boards are proposed only on every other floor to reduce the overall embodied carbon of the scheme, capitalising more with less instruments.

I trust the above is to your satisfaction. Should you have any questions or comments, please do not hesitate to contact me.

Yours faithfully



Pete Jeavons
DIRECTOR

Appendix A - Mechanical Ventilation and Heat Recovery (MVHR) System Specification and Layout

EQUIPMENT SCHEDULE

HEAT RECOVERY UNITS

REFERENCE	HRU 01			
Location	Shop			
Unit Type	Heat Recovery			
Supply Air volume (m ³ /s)	0.182			
Supply External Static Press. (Pa)	110			
Extract Air Volume (m ³ /s)	0.115			
Extract External Static Press. (Pa)	110			
Min. Heat Exchanger Efficiency (%)	>80			
Heater Battery Type	None			
Heater Battery Duty (kW)	n/a			
Heater Battery Full Load Current (A)	n/a			
Condensate Connection (mm)	8			
Fan Max SFP (W/l/s)	1.6			
Breakout dBA @ 3m	37			
ELECTRICAL DETAILS				
Electrical Supply (V/ph/Hz)	230/1/50			
Power (kW)	1			
Starting Current (A)	6.4			
Full Load Current (A)	6.4			
SUPPLIER DETAILS				
Manufacturer	Nuaire			
Model Reference	XBC25-H-NNT			
Dimensions L x W x H (mm)	1773x1160x346			
Duct Spigot Connection Size (mm)	252 x 302 (intake/extract) 471 x 302 (supply/discharge)			
Weight (kg)	231			
Controls	Full Ecosmart with Trend BMS interface			
Accessories	Attenuators 1000mm inlet & discharge			
Notes	-			

Appendix B – Latest BRUKL (as per Revised Energy Statement)

BRUKL Output Document

Compliance with England Building Regulations Part L 2021



Project name

Garman Road - Be Green

As designed

Date: Thu Jun 15 10:27:40 2023

Administrative information

Building Details

Address: 45-47 Garman Road, Tottenham, N17 0UR

Certifier details

Name: Ensphere Group Ltd

Telephone number: +44 (0) 20 7846 9040

Address: 55A Catherine Place, London, SW1E 6DY

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.21

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 46.65

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² :annum	0.72
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	0.37
Target primary energy rate (TPER), kWh _e /m ² :annum	7.85
Building primary energy rate (BPER), kWh _e /m ² :annum	3.85
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.2	0.21	GF000002_W0_A0
Floors	0.18	0.12	0.12	GF000002_F
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	GF000002_C_A0
Windows** and roof windows	1.6	1.4	1.4	GF000002_W-1_O0
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- ASHP space heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.93	6.45	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- SYST0002-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.01
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
GF - SHOP		0.3	-	-	-	0.3	-	-	-	-	0.9	N/A
GF - IT ROOM		0.3	-	-	-	0.3	-	-	-	-	0.9	N/A
GF - OFFICE		0.3	-	-	-	0.3	-	-	-	-	0.9	N/A
GF - TOILET		0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
GF - SHOP		120	100	1.35
GF - IT ROOM		120	-	-
GF - OFFICE		120	-	-
GF - REFUSE		120	-	-
GF - PLANT		120	-	-
GF - CIRCULATION		120	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
GF - CIRCULATION		120	-	-
GF - WAREHOUSE		130	-	-
GF - TOILET		120	-	-
GF - CLEANERS		120	-	-
1F - CIRCULATION		120	-	-
1F - CIRCULATION		120	-	-
1F: WAREHOUSE		130	-	-
2F - CIRCULATION		120	-	-
2F - CIRCULATION		120	-	-
2F: WAREHOUSE		130	-	-
3F - CIRCULATION		120	-	-
3F - CIRCULATION		120	-	-
3F: WAREHOUSE		130	-	-
4F - CIRCULATION		120	-	-
4F - CIRCULATION		120	-	-
4F: WAREHOUSE		130	-	-
5F - CIRCULATION		120	-	-
5F - CIRCULATION		120	-	-
5F: WAREHOUSE		130	-	-
6F - CIRCULATION		120	-	-
6F - CIRCULATION		120	-	-
6F: WAREHOUSE		130	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF - SHOP	YES (+75.2%)	NO
GF - IT ROOM	N/A	N/A
GF - OFFICE	N/A	N/A
GF - REFUSE	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	11531.2	11531.2
External area [m ²]	29817.9	29817.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	4328.12	4980.33
Average U-value [W/m ² K]	0.15	0.17
Alpha value* [%]	8.28	19.7

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.04	0.11
Cooling	0.05	0.03
Auxiliary	0.01	0.02
Lighting	4.46	5.28
Hot water	0.06	0.02
Equipment*	0.91	0.91
TOTAL**	4.62	5.45

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	2.01	0.13
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>2.01</i>	<i>0.13</i>

Energy & CO₂ Emissions Summary

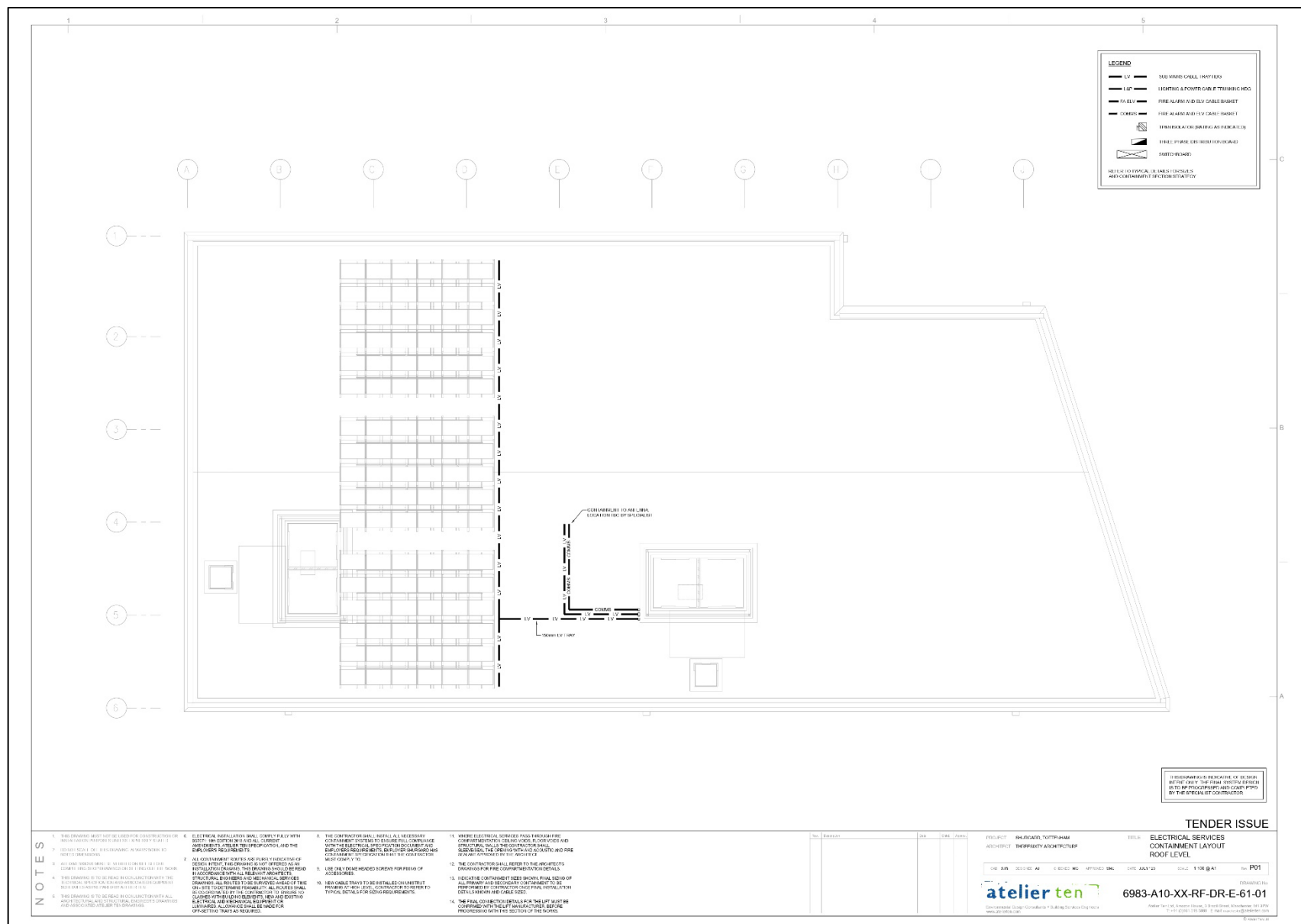
	Actual	Notional
Heating + cooling demand [MJ/m ²]	110.85	119.44
Primary energy [kWh _{PE} /m ²]	3.85	7.85
Total emissions [kg/m ²]	0.37	0.72

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
Actual	130.9	221.5	9.4	12.8	2.4	3.86	4.82	3.93	6.45	
Notional	248	108.1	26.1	6.8	5.6	2.64	4.4	----	----	
[ST] No Heating or Cooling										
Actual	90	19.9	0	0	0	0	0	0	0	
Notional	100.2	18.2	0	0	0	0	0	----	----	

Key to terms

Heat dem [MJ/m2] = Heating energy demand
 Cool dem [MJ/m2] = Cooling energy demand
 Heat con [kWh/m2] = Heating energy consumption
 Cool con [kWh/m2] = Cooling energy consumption
 Aux con [kWh/m2] = Auxiliary energy consumption
 Heat SSEEF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
 Cool SSEER = Cooling system seasonal energy efficiency ratio
 Heat gen SSEFF = Heating generator seasonal efficiency
 Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
 ST = System type
 HS = Heat source
 HFT = Heating fuel type
 CFT = Cooling fuel type

Appendix C – Roof Plan Showing Solar PV



Appendix D – PV Performance Specifications

Photovoltaic Performance Specification
6983 Shurgard Tottenham

Stage 4 Issue
P02

18 August 2023



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Ss_70_10_70_35

Grid-connected photovoltaic systems

Systems

Ss_70_10_70_35 Grid-connected photovoltaic systems

1. Description: This specification details a new 200sqm array of Photovoltaic Panels to be fitted on the roof at the new Shurgard Tottenham self-storage facility. The photovoltaic array is to be positioned facing southwards for optimum efficiency and to reduce the carbon emissions of the building to satisfy the energy model and Part L of Building Regulation Compliance.

The specialist contractor will liaise with local DNO to apply for G99 compliance connection to the grid.

The new photovoltaic array will be designed and installed by specialist contractor meeting the performance requirements detailed within this specification.

The photovoltaic array will be securely installed on the roof via a ballasted support base and fill material that is to be designed and installed by specialist contractor.

The array will be interfaced to a new AC/DC G99 compliant inverter, capable of monitoring and protecting the installations energy export to the grid. The new inverter will be installed within the Level 05 electrical riser.

The export from the photovoltaic array will be connected to the buildings LV network via a local distribution board located in Level 06 Electrical riser. Contractor to design and install distribution board connection and submit proposals.

All containment and electrical accessories associated with the photovoltaic installed, including HDG cable tray from array to inverter and DC isolator will be specified, provided and installed by specialist contractor.

2. System performance: Ss_70_10_70/210 Design of photovoltaic systems;
Ss_70_10_70/220 Structural and weatherproofing considerations;
and Ss_70_10_70/230 Photovoltaic arrays.
3. System manufacturer: Submit proposals .
4. Input source: Pr_60_70_65_63 Photovoltaic modules.
5. Mounting: Pr_80_77_27_07 Ballasted mounting frames for solar modules.
6. d.c. side equipment: Pr_60_70_48_47 Low-voltage switch-disconnectors.
7. Switchgear and controls: Pr_65_72_43_42 Inverters.
8. a.c. isolation switches: Pr_60_70_48_47 Low-voltage switch-disconnectors.
9. Energy meters: 90-65-55/340 Energy meter.
10. Cable type: Pr_65_70_48_90 Thermosetting-insulated and thermoplastic-sheathed (LSHF) armoured cables.
11. Cable sizes: String cables should be rated for 1.25 x string short circuit current, and 1.15 x string open circuit voltage. Due to the (usually) low voltage of the PV string, d.c. currents may be much larger than expected. Note that some PV modules are supplied with flexible connecting cable sealed into the module. Main d.c. cables should be rated for 1.25 x number of strings x string short circuit current, and 1.15 x string open circuit voltage. As a general rule of thumb, voltage drop in the cables between the PV array and the PCU should be less than 2.5%. Voltage drop on the a.c cables between the PCU and the mains connection should be less than 1%, to avoid nuisance tripping of the PCU.
12. Rewireable installation: Required.
13. Concealed installation: Required.
14. Cable containment: Pr_65_70_11_71 Rigid conduit type A.
15. System accessories: Pr_65_72_27_48 Low-voltage power supply protection devices type A.

16. Execution: Ss_70_10_70/620 Installing photovoltaic systems generally;
Ss_70_10_70/630 Installing PV module arrays;
Ss_70_10_70/660 Installing d.c. isolation switches;
Ss_70_10_70/670 Installing PV array junction boxes;
Ss_70_10_70/680 Installing PV generator junction boxes;
Ss_70_10_70/690 Installing a.c. isolation switches;
Ss_70_10_70/700 Installing batteries and battery charge controllers;
Ss_70_10_70/720 Installing power conditioning units;
Ss_70_10_70/730 Installing energy meters;
Ss_70_10_70/740 Connection to electricity distribution network;
Ss_70_10_70/750 Earthing and equipotential bonding;
Ss_70_10_70/760 Connection to lightning protection system;
and Ss_70_10_70/770 Labelling.
17. System completion: Ss_70_10_70/810 Testing and commissioning photovoltaic systems;
Cleaning and general inspection;
Ss_70_10_70/815 PV array performance tests;
Ss_70_10_70/820 Documentation;
Ss_70_10_70/830 Spares and consumables;
and Ss_70_10_70/840 Maintenance.

System performance

Ss_70_10_70/210 Design of photovoltaic systems

1. Design: Complete the design of the photovoltaic system.
2. Standards: To BS 7671, BS EN 62124 and in accordance with ENA 59/2-1 and To BS 7671, BS EN 62124 and in accordance with ENA G83/1. In accordance with BS 7671, BS IEC 62548 and EREC G99.
3. Testing and commissioning: Incorporate adequate measures to allow full testing and commissioning of the completed system.
4. Proposals: Submit detailed design drawings, manufacturers' literature and technical information, and calculations showing estimated annual energy yield using the Photovoltaic Geographical Information System (PVGIS) calculator.
5. Approvals: Obtain written approval of the Electricity Distributor that export to is achieved via G99 compliance.

Ss_70_10_70/220 Structural and weatherproofing considerations

1. Supports and fixings
 - 1.1. Requirement: No impairment to the thermal and weatherproofing performance of the building fabric.
 - 1.2. Arrangement of fixings or proposed supporting structure: Submit proposals .
 - 1.3. Submittals to include: Electronic drawing in dwg format and two no. A3 paper prints together with written confirmation of compliance with requirement.
 - 1.4. Timing of submittals: In alignment with project programme.

Ss_70_10_70/230 Photovoltaic arrays

1. Nominal output
 - 1.1. Peak power: 21,078 kWh
 - 1.2. Number of strings: Submit proposals . A minimum of two strings is required.
 - 1.3. String voltage (maximum): Submit proposals .

Products

90-55-10/320 Cable bands

1. Manufacturer: Submit proposals .

2. Format: Perforated metal bands.
 - 2.1. Material: Steel.
 - 2.2. Protective covering: LSZH.

90-55-15/321 Underground plastics cable protection covers

1. Manufacturer: Submit proposals .
2. Material: Polyethylene.
3. Size:
 - 3.1. Length: Manufacturer's standard .
 - 3.2. Width: 150 mm.
 - 3.3. Thickness: 6 mm.
4. Jointing method: Peg.
5. Identification: Laminate underground cable marker tape to top face.

90-55-15/333 Underground cable marker tape

1. Manufacturer: Submit proposals .
2. Standard: To [EN 12-23](#).
3. Material: Polyethylene.
4. Size:
 - 4.1. Width: 150 mm.
 - 4.2. Thickness: 0.1 mm.
5. Format:
 - 5.1. Background colour: Yellow.
 - 5.2. Text colour: Black.
6. Labelling: "CAUTION ELECTRIC CABLE BELOW" continuous along the tape length.

90-65-55/340 Energy meter

1. Manufacturer: Submit proposals .
2. Standard: To [BS EN 62052-11](#) and Ofgem Approved
3. Certification: [Ofgem](#) accredited.
4. Format: Large format digital display.
5. Display the following conditions: Building total energy consumption;
Electricity imported into the building;
and Electricity exported from the building.
6. Phases: Manufacturer's standard .
7. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment.](#)

Pr_60_70_48_47 Low-voltage switch-disconnectors

1. Manufacturer: Submit proposals .
2. Standards: To [BS EN 60947-3](#).
3. Arrangement: Switch-disconnector.
4. Rated operational voltage (Ue): As Circuit Schedules
5. Rated operational current (In): As Circuit schedules.
6. Rated operational frequency: 50 Hz.
7. Number of poles: As Circuit schedules.
8. Rated short-time withstand current (Icw) for 1 s: Manufacturer's standard .
9. Rated short-circuit making capacity (Icm): Manufacturer's standard .

10. Rated short-circuit breaking capacity (Icu): Manufacturer's standard .
11. Utilization category: AC-23B.
12. Terminals: Suitable for the connection of copper conductors.
13. Mechanical interlocking: Rotary handle.
14. Enclosure
 - 14.1. Ingress protection (minimum): To [BS EN 60529](#), IP rating to be appropriate for the environment.
 - 14.2. Impact protection (minimum): To [BS EN 62262](#), IK10.
 - 14.3. Material: Sheet steel.
 - 14.4. Finish: Manufacturer's standard .
 - 14.5. Colour: Manufacturer's standard .
15. Fuses: Not required.
16. Execution: [Pr_60_70_22/665 Installing switchgear generally](#).

Pr_60_70_65_63 Photovoltaic modules

1. Manufacturer: Submit Proposals
2. Cell type: Monocrystalline to [BS EN 61215](#);
Polycrystalline to [BS EN 61215](#);
and Thin film amorphous silicon to [BS EN 61646](#).
3. Format: Manufacturer's standard .
4. Framework
 - 4.1. Material: Manufacturer's standard .
 - 4.2. Colour: Manufacturer's standard .
5. Degree of protection: To [BS EN 61140](#), Class II.
6. Module interconnections
 - 6.1. Type: Factory fitted plugs and sockets with pre-fitted insulated tails.
 - 6.2. Module connectors: Polarized and suitably rated for the applicable d.c. voltage and current.
 - 6.3. Ingress protection (minimum): Manufacturer's standard .
7. Nominal output of module
 - 7.1. Peak power: [255Wp@STC](#) and [193Wp@NOCT](#)
 - 7.2. Power output tolerance: 0/3%.
8. By-pass diodes: Four, integral to panel.
9. Output warranty: 80% power output after 25 years.

Pr_65_70_11_13 Cable cleats

1. Manufacturer: Submit proposals .
2. Standard: To [BS EN 61914](#).
3. Format: Two piece twin fixing clamps.
4. Material: Composite.
5. Temperatures for permanent installation
 - 5.1. Maximum: 40 °C.
 - 5.2. Minimum: -15 °C.
6. Resistance to impact: Very heavy.
7. Type of retention or resistance to electromechanical forces: Resistant to electromechanical forces, withstanding more than one short circuit.
8. Environmental influences
 - 8.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 8.2. Metallic and composite components: High resistance to corrosion.

Pr_65_70_11_15 Cable ties

1. Manufacturer: Submit Proposals
2. Standard: To [BS EN 62275](#).
3. Format: Wrap around self-locking non-releasable.
4. Material: Submit Proposals
5. Contribution to fire : Non-flame-propagating.

Pr_65_70_11_17 Cable trays

1. Standard: To [BS EN 61537](#).
2. Material: Steel.
3. Resistance against flame propagation: Non flame propagating.
4. Electrical properties
 - 4.1. Continuity characteristics: With electrical continuity.
 - 4.2. Conductivity characteristics: With electrical conductive system component.
5. Coating material: Hot dip galvanized.
6. Temperature properties for transport, storage, installation and application
 - 6.1. Minimum: -5 °C.
 - 6.2. Maximum: 40 °C.
7. Mechanical properties
 - 7.1. Cable tray free base area: Class D.
 - 7.2. Resistance to impact: Up to 20 J.
8. Width: Submit proposals .
9. Features
 - 9.1. Flange type: Return.
 - 9.2. Segregation: Not required.
 - 9.3. Protective cover: Not required.
10. Execution: [Pr_65_70_11/650 Multiple cable runs](#) and [Pr_65_70_11/661 Cable support zones](#).

Pr_65_70_11_30 Flexible conduit

1. Manufacturer: Submit proposals .
2. Standards: To [BS EN 61386-23](#).
3. Material: PVC-U.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): -5 °C.
 - 5.2. Upper temperature (maximum): 40 °C.
6. Resistance to bending: Flexible.
7. Electrical characteristics: With electrical insulating properties.
8. Ingress protection (minimum): To [BS EN 60529](#), IP x4.
9. Resistance to corrosion: Manufacturer's standard .
10. Tensile strength: Medium.
11. Resistance to flame propagation: Required.
12. Suspended load capacity: Medium.

13. Sizes (OD): 20 mm and 25 mm.
14. Special features: None.
15. Execution: [Pr_65_70_11/715 Installing pliable and flexible conduit](#)

Pr_65_70_11_71 Rigid conduit type A

1. Standards: To [BS EN 61386-21](#).
2. Material: Steel.
3. Mechanical properties
 - 3.1. Resistance to compression: Very heavy.
 - 3.2. Resistance to impact: Very heavy.
4. Transport, installation and application
 - 4.1. Lower temperature (minimum): -25 °C.
 - 4.2. Upper temperature (maximum): 40 °C.
5. Resistance to bending: Rigid.
6. Electrical characteristics: With electrical continuity properties.
7. Ingress protection (minimum): To [BS EN 60529](#), IP x4.
8. Resistance to corrosion: To [BS EN 61386-1](#), Class 4.
9. Tensile strength: Very heavy.
10. Resistance to flame propagation: Required.
11. Suspended load capacity: Very heavy.
12. Sizes (OD): 20 mm;
25 mm;
and 32 mm.
13. Execution: [Pr_65_70_11/721 Installing rigid metallic conduit](#);
[Pr_65_70_11/735 Installing conduit connections to equipment](#);
and [Pr_65_70_11/765 Conduit, trunking and ducting zones](#).

Pr_65_70_11_96 Wall and ceiling-mounted cable trunking and ducting

1. Protection against corrosive and polluting substances: High protection outside and inside.
2. Standards: To [BS EN 50085-1](#) and [BS EN 50085-2-1](#) or to [BS 4678-4](#).
3. Material: Steel.
4. Construction: To include means of preventing contact between liquids and insulated conductors and live parts.
5. Format: 2.
6. Resistance to compression: Manufacturer's standard .
7. Resistance to impact: 20 J.
8. Temperature properties
 - 8.1. Storage and transport temperature (minimum): -25 °C.
 - 8.2. Installation and application temperature (minimum): -25 °C.
 - 8.3. Application temperature (maximum): +40 °C.
9. Resistance to flame propagation: Required.
10. Electrical properties: With electrical continuity characteristics.
11. Protection by enclosure
 - 11.1. Ingress protection (minimum): To [BS EN 60529](#), IP x4.
12. Access method: With tools.
13. Screening: Required in multi-compartment trunking
14. Sizes: 100 x 100 mm

15. Compartments: One.
16. Accessories and fittings
 - 16.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 16.2. Types: Hanger brackets..
17. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) and [Pr_65_70_11/741 Installing trunking generally](#).

Pr_65_70_48_90 Thermosetting-insulated and thermoplastic-sheathed (LSHF) armoured cables

1. Manufacturer: Pirelli, AEI or equal and approved
2. Standard: To [BS 6724](#).
3. Third-party certification: British Approvals Service for Cables (BASEC) certified.
4. Cable type: Multi-core XLPE/ SWA/ LSZH and Single-core XLPE/ AWA/ LSZH.
5. Size: As cable schedule
6. Insulation: Cross-linked polyethylene GP 8.
7. Rated voltage: 600/ 1000 V.
8. Conductors: Copper.
9. Execution: [90-55-15/640 Extra low and low voltage cable routes](#);
[90-55-15/650 Extra low and low voltage cables in accessible roof spaces](#);
[90-55-15/655 Extra low and low voltage surface mounted cables](#);
[Pr_65_70_48/680 Installing low-voltage armoured cables](#);
[Pr_65_70_48/720 Cables in ducts](#);
[Pr_65_70_48/725 Cables in trenches](#);
 and [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#).

Pr_65_70_48_91 Thermosetting-insulated and thermoplastic-sheathed (LSHF) cables

1. Manufacturer: Pirelli, AEI or equal and approved
2. Standard: To [BS 7211](#).
3. Third-party certification: British Approvals Service for Cables (BASEC) certified.
4. Rigid thermosetting insulated single core cables (LSZH singles, H07Z):
 - 4.1. Construction: To table 3a.
5. Size: As cable schedule
6. Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles):
 - 6.1. Construction: To table 5.
 - 6.2. Size: As cable schedule
7. Thermosetting insulated and sheathed cables with circuit protective conductor (LSZH/ LSZH with CPC):
 - 7.1. Construction: To table 7.
 - 7.2. Size: As cable schedule
8. Execution: [Pr_65_70_48/635 Installing low-voltage cables](#);
[90-55-15/640 Extra low and low voltage cable routes](#);
[90-55-15/645 Low voltage cables concealed in walls and partitions](#);
[90-55-15/650 Extra low and low voltage cables in accessible roof spaces](#);
[90-55-15/655 Extra low and low voltage surface mounted cables](#);
[Pr_65_70_48/660 Installing low-voltage cables in conduit and trunking](#);
 and [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#).

Pr_65_72_27_48 Low-voltage power supply surge protection devices type A

1. Manufacturer: Furse or equal and approved
2. Standard: To [BS EN 61643-11](#), Type 1;
To [BS EN 61643-11](#), Type 2;
and To [BS EN 61643-11](#), Type 3.
3. Operating voltage and frequency (nominal): 400 V at 50 Hz.
4. Number of poles: Three.
5. Surge current (minimum) between any two conductors: 10 kA.
6. Let-through voltage (maximum): 600 V.
7. Current rating: See mains schematic
8. Maximum continuous operating voltage (Uc): 500 V.
9. Mode of protection: Lines to earth, lines to neutral, neutral to earth.
10. Thermal overload protection: Manufacturer's standard .
11. Protection status indicators: Full protection status.
12. Remote monitoring: Not required.
13. Effect on mains power supplies during normal operation: No corruption to normal mains supply.
No break or shutdown of mains supply.
No excessive earth leakage current.
14. Enclosure: Within distribution board or consumer unit.
15. Execution: [Pr_70_75_88/620 Installing surge protective devices for telecommunications and signalling networks](#).

Pr_65_72_43_42 Inverters

1. Manufacturer: Submit proposals .
2. Standard: In accordance with [EN 61555-2-1](#) and In accordance with [EN 61555-1-1](#). In accordance with [Energy Networks Association EREC G99/1-6](#).
3. Input
 - 3.1. Voltage range: 200–500 V d.c.
 - 3.2. Current (maximum): 32 A.
4. Output
 - 4.1. Power rating: Submit proposals .
 - 4.2. Nominal voltage: 230 V a.c.
 - 4.3. Nominal frequency: 50 Hz.
 - 4.4. Voltage harmonic distortion: < 4% with linear load.
 - 4.5. Overall efficiency (minimum): 93% at rated capacity.
5. Topology: Manufacturer's standard .
6. Enclosure
 - 6.1. Ingress protection (minimum): To [BS EN 60529](#), IP 65.

Pr_80_77_27_07 Ballasted mounting frames for solar modules

1. Manufacturer: Submit Proposals
2. Material
 - 2.1. Type: High-density polyethylene (HDPE).
 - 2.1.1. Standard: UV-stabilized in accordance with [BS EN ISO 4892-1](#).
 - 2.2. Recycled content (minimum): 100% to [BS EN ISO 14021](#).
3. Tilt angle: Submit Proposals
4. Dimensions: As per PV panel to achieve yield required as detailed in specification.

Execution

90-55-15/640 Extra low and low voltage cable routes

1. Cables generally:
 - 1.1. Concealed cable runs to wall accessories: Run vertically from the accessory.
 - 1.2. Exposed cable runs: Galvanised Steel Conduit
2. Distance from other services running parallel (minimum): 150 mm. Position cables below heating pipes.

90-55-15/645 Low voltage cables concealed in walls and partitions

1. Position: In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc.
2. Protection: [Pr_65_70_11_71 Rigid conduit type A](#);
Cover with galvanized steel channel nailed to substrate;
and .

90-55-15/650 Extra low and low voltage cables in accessible roof spaces

1. Cables running across ceiling joists: [Pr_65_70_11_17 Cable trays](#).

90-55-15/655 Extra low and low voltage surface mounted cables

1. Fastening: Direct to surface.
2. Orientation: Dress cables flat, free from twists, kinks and strain.
3. Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Pr_60_70_22/665 Installing switchgear generally

1. General requirements: [Pr_60_70_22/675 Labelling switchgear](#) .
2. Switchgear cubicles: Arrange in modular form to facilitate future extension.
3. Clearance (minimum)
 - 3.1. Front access switchgear: 1000 mm in front of switchgear.
4. Fixing equipment
 - 4.1. Generally: Fix independently of wiring installation with zinc electroplated fasteners.
 - 4.2. Indoor equipment: Fix using internal lugs.
 - 4.3. Outdoor equipment: Fix using external lugs.
5. Orientation: Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
6. Extension boxes: Provide where necessary.
7. Gland plates: Non-ferrous for single core cables.
8. Interconnection of close coupled switchgear
 - 8.1. Cable type: Copper busbar links.
 - 8.2. Containment: [Pr_65_70_11_96 Wall and ceiling-mounted cable trunking and ducting](#).
9. Identification
 - 9.1. Neutral and earth bar terminals: Label with the outgoing circuit reference.
 - 9.2. Cable terminations: Label with circuit reference, with push-on plastics markers.

Pr_60_70_22/675 Labelling switchgear

1. Switchgear terminals: To [BS EN 60445](#).
2. Spare fuses: Label, describe their rating and associated outgoing ways.

Pr_65_70_11/650 Multiple cable runs

Pr_65_70_11/661 Cable support zones

1. Ceiling voids:
 - 1.1. Clear distance between underside of cable supports and brackets and topside of ceiling (minimum): 100 mm.

Pr_65_70_11/700 Installing conduit, trunking and ducting

1. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
2. Protection of metallic conduit, trunking and ducting
 - 2.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint.
 - 2.2. Protective paint
 - 2.2.1. Generally: Paint immediately following installation.
 - 2.2.2. Type: Match factory finish;
Galvanizing zinc rich paint, two coats;
and Air drying black enamel paint, two coats.
3. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
4. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
5. Distance from other services running parallel (minimum)
 - 5.1. Generally: 150 mm.
6. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
7. Fire barriers: Provide to maintain integrity of fire compartments.
8. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
9. Support: Independently fix and support conduit, trunking and ducting from building structure.
10. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
11. Cabling: Install when conduit, trunking and ducting enclosure is complete.
12. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Pr_65_70_11/710 Installing conduit generally

1. Fixing: Fix securely. Fix accessory and outlet boxes independently of conduit.
2. Changes of direction: Conduit boxes or bends site formed by machine. Do not use manufactured elbows, tees or inspection bends.
3. Joints
 - 3.1. Generally: Solid couplings and lockrings.
 - 3.2. Number of joints: Minimise.
 - 3.3. Lengths of conduit: Maximise.
 - 3.4. Open ends: Install brass slotted plugs.
 - 3.5. At movement joints in structure: Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
4. Connections to boxes, trunking, equipment and accessories: Solid coupling, serrated washers, hexagonal locknuts and male brass bushes.
5. Conduit boxes
 - 5.1. Generally: Install flush with finished surfaces. Provide extension rings if required.
 - 5.2. Fixing screws: Countersunk, or round-headed screws.
 - 5.3. Number of fixings (minimum): Two.

- 5.4. Lids: Fasten with brass slot pan head screws.
6. Rear outlet boxes: Locate where surface conduits pass through walls to external equipment.
7. Draw-in boxes
 - 7.1. Spacing (maximum): 10 m.
 - 7.2. Number of bends between draw-in boxes (maximum): Two.
 - 7.3. Floors: Do not install draw-in boxes in floors.
8. Conduit in walls: Avoid concealed horizontal runs.
9. Suspended ceiling installations: Fasten outlet boxes to structure above ceiling.

Pr_65_70_11/715 Installing pliable and flexible conduit

1. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
2. Joints: Threaded.
3. Connections to trunking: Male adaptors, lockrings, solid couplings, serrated washers, hexagonal locknuts and male brass bushes.
4. Connections to equipment: Threaded bush.

Pr_65_70_11/721 Installing rigid metallic conduit

1. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
2. Fixings: Saddle.
3. Joints: Screwed.
4. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
5. Conduit connections to boxes and items of equipment, other than those with threaded entries: Solid coupling, serrated washers, hexagonal locknuts and male brass bushes.

Pr_65_70_11/735 Installing conduit connections to equipment

1. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
2. Surface mounted equipment
 - 2.1. Concealed conduit: Terminate in concealed conduit outlet box, installed behind equipment, conceal final cable connection.
 - 2.2. Exposed conduit: Terminate in surface mounted conduit outlet or accessory outlet box. Final cable connection to be installed in metallic flexible conduit or installed in free air.
3. Connections to external equipment: [Pr_65_70_11_30 Flexible conduit](#).

Pr_65_70_11/741 Installing trunking generally

1. Supports and mounting arrangement: Suspension rods and steel channels.
2. Changes of direction: Manufacturer's bends and tees.
3. Joints
 - 3.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 3.2. Number of joints: Minimize.
 - 3.3. Lengths of trunking: Maximize.
 - 3.4. Open ends: Blank using manufacturer's removable end caps.
 - 3.5. Metal edging: Protect with PVC edging strip.
 - 3.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
4. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.

5. Connections to trunking covers: Minimize.
6. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
7. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
8. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
9. Cable retaining straps: Required except when trunking cover is on top.

Pr_65_70_11/765 Conduit, trunking and ducting zones

1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting.](#)
2. Ceiling voids:
 - 2.1. Clear distance between underside of conduit, trunking and ducting and topside of ceiling (minimum): 100 mm.

Pr_65_70_48/635 Installing low-voltage cables

1. Standard: To [BS 7671](#).
2. Timing: Do not start internal cabling until building enclosure provides permanently dry conditions.
3. Preparation: Store cables above 5 °C for 24 hours before installation.
Clear cable path of debris.
4. Installation temperature (minimum): 5 °C.
5. Cables: Install in one length.
6. Cable pulling: Do not overstress. Prevent kinks and twisting of the cable.
7. Cable protection: Sleeve with conduit or pipeduct. Bush at both ends.
8. Cables surrounded or covered by insulation: Derate.
9. Jointing and termination
 - 9.1. Final circuit cables: At electrical accessories only.
 - 9.2. Core connections: Using compression lugs to equipment without integral clamping terminals.
10. Mechanical protection: Provide anti vandal capping to surface run cables to 2 m above finished ground level.

Pr_65_70_48/660 Installing low-voltage cables in conduit and trunking

1. Cable installation: Orderly and capable of being withdrawn.
2. Single core wiring: Arrange using the loop-in method.
3. Cables within trunking: Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
4. Cables in vertical conduit: Provide cable clamps in accessible conduit boxes at 10 m intervals.
5. Extra-low-voltage cables: Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Pr_65_70_48/680 Installing low-voltage armoured cables

1. General requirements: [Pr_65_70_48/635 Installing low-voltage cables .](#)
2. Earthing: Bond armour to equipment and main earthing system.
3. Connections to apparatus: Moisture proof, sealed glands and shrouds.

Pr_65_70_48/720 Cables in ducts

1. Cable installation from cable drums: Submit method statement.
2. Single core trefoil cable groups and protective conductors: Install within a single duct and bind at 1 m intervals.

Pr_65_70_48/725 Cables in trenches

1. Base: All cables and ducts to be surrounded by 75 mm sand, free of any sharp stones or flints.
2. Multiple cables in same trench: Set 150 mm apart.
3. Cable formation within trench: Space cables apart by a distance of half the cable diameter.
4. Trefoil cable groups and protective conductors: Bind at 1 m intervals.
5. Cables below roads and hardstandings: Install within duct and derate cable if longer than 10 m. Extend ducts 1 m each side of hardstanding.
6. Cable identification and protection: [90-55-15/321 Underground plastics cable protection covers](#) and [90-55-15/333 Underground cable marker tape](#).

Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket

1. Cabling: Install when cable supports are complete.
2. Position: Place single and multi-core cables side by side.
3. Fastening
 - 3.1. Fastenings generally: Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - 3.2. Submain cables <95 mm²: [90-55-10/320 Cable bands](#).
 - 3.2.1. Spacing (maximum): 600 mm.
 - 3.3. Submain cables >95 mm²: [Pr_65_70_11_13 Cable cleats](#).
 - 3.3.1. Spacing (maximum): 600 mm.
 - 3.4. Final circuit cabling: [Pr_65_70_11_15 Cable ties](#).
 - 3.4.1. Spacing (maximum): 600 mm.
 - 3.5. Extra-low-voltage, communications and fibre-optic cabling: Velcro ties.
 - 3.5.1. Spacing (maximum): 600 mm.

Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies

1. Standards: To [BS 7671](#);
To [DD CLC/TS 61643-12](#);
and To [DD CLC/TS 61643-22](#).
2. Equipment: Provide electrical supplies to equipment requiring power.
3. Fixings: Non-corroding and compatible with the environment where they are installed.

Pr_70_75_88/620 Installing surge protective devices for telecommunications and signalling networks

1. General requirements: [Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies](#).
2. Point of installation: At each CCTV camera;
At main low voltage switchboard;
and At main telephone distribution panel.
3. Transient overvoltage suppression devices: Interconnect.
4. Control cables between transient overvoltage suppression devices and BMS: Interconnect.
5. Interconnecting cable:
 - 5.1. Cable type: Device manufacturer's standard.
 - 5.2. Cable size: Device manufacturer's standard.
 - 5.3. Cable length (maximum): 250 mm.
 - 5.4. Cable installation: Tightly bind connecting leads together.
6. Fuse protection: Provide fuse protection to transient overvoltage surge suppression devices.

7. Isolation: Required.

Pr_80_51_51/620 Installing electrical monitoring and metering equipment

1. Standard: In accordance with [BS 7671](#).
2. Digital metering equipment: Connect to building management system.

Ss_70_10_70/620 Installing photovoltaic systems generally

1. Standards: To [BS 7671](#);
To [EN 59/2-1](#);
and To [EN 683/1-1](#).
2. Installer: [Microgeneration Certification Scheme](#) accredited.
3. Materials: Separate dissimilar metallic materials to prevent bi-metallic corrosion.
4. Fixing equipment: Fix independently of any other systems installation with zinc electroplated fasteners indoors and stainless steel fasteners outdoors.
5. Orientation: Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
6. Cable installation
 - 6.1. Timing: Complete installation of d.c. cabling before connecting to PV array.
 - 6.2. Routes and arrangement: Minimize length of d.c. cable runs and install positive and negative conductors from the same string together.
7. Interconnection of close coupled switchgear:
 - 7.1. Cable type: [Pr_65_70_48_91 Thermosetting-insulated and thermoplastic-sheathed \(LSHF\) cables](#).
 - 7.2. Containment: [Pr_65_70_11_71 Rigid conduit type A](#).
8. Identification:
9. Cable terminations: Label main incoming d.c. and outgoing a.c. cables at power conditioning unit with push-on plastics markers showing unique circuit reference.

Ss_70_10_70/630 Installing PV module arrays

1. Fixings: Suitable for wind loading and Minimum of four clamps per module, placed symmetrically.
2. PV modules
 - 2.1. Layout: Landscape.
 - 2.2. Mounting: Allow adequate ventilation between building fabric and underside of PV module.
 - 2.3. Electrical connection: Interconnect between PV modules using integrated connection cables, connector plugs and string cables to form an array consisting of two strings, each string consisting of four modules.
3. Interconnecting string cable routes: Submit proposals .

Ss_70_10_70/660 Installing d.c. isolation switches

1. Position: Conveniently accessible for operation inspection and maintenance.

Ss_70_10_70/670 Installing PV array junction boxes

1. Position: Conveniently accessible for operation inspection and maintenance.
2. Separate positive and negative junction boxes: Required.

Ss_70_10_70/680 Installing PV generator junction boxes

1. Position: Adjacent to power conditioning unit. Conveniently accessible for operation inspection and maintenance.

Ss_70_10_70/690 Installing a.c. isolation switches

1. Position: Next to point of connection to a.c. grid;
Next to power conditioning unit;
and Conveniently accessible for operation inspection and maintenance.

Ss_70_10_70/700 Installing batteries and battery charge controllers

1. Position:

Ss_70_10_70/720 Installing power conditioning units

1. Position: Conveniently accessible for operation inspection and maintenance.

Ss_70_10_70/730 Installing energy meters

1. Position: Main Electrical Switchroom
2. Meters to show: a.c. energy exported from the premises;
a.c. energy imported into the premises;
and a.c. output of complete PV system.

Ss_70_10_70/740 Connection to electricity distribution network

1. Interconnection: Connect between a.c. switch disconnecter and the supply side of the protective device at the main board.

Ss_70_10_70/750 Earthing and equipotential bonding

1. Standards: In accordance with [BS 7671](#) and [BS 7430](#).

Ss_70_10_70/760 Connection to lightning protection system

1. Standards: To [BS EN 62305-3](#) and [BS EN 62305-4](#).

Ss_70_10_70/770 Labelling

1. Dual supply warning notices (grid-connected systems only)
 - 1.1. Requirement: Provide danger warning notices stating that the system has a dual supply and is energized from more than one source.
 - 1.2. Position: Electricity supplier's meter;
At distribution board to which output from power conditioning unit is to be connected;
and PV a.c. isolation switch.
 - 1.3. Electricity Distributor's approval of text: Obtain.
2. PV modules: 'Danger, do not disconnect under load. Isolate a.c. supply first'. Label with warning notices describing the presence of live terminals.
3. Connectors: Label with notices stating 'Do not disconnect d.c. plugs and sockets under load – turn off a.c. supply first'.
4. d.c. switch disconnecter: 'PV array d.c. isolator- Danger - contains live parts during daylight'.
5. d.c. junction boxes: Label with notices stating 'PV array d.c. junction box - Danger, contains live parts during daylight'.
6. Power conditioning units (PCUs): Label with notices stating 'Isolate a.c. and d.c. before carrying out work'.
7. a.c. isolation switches: Label with notices stating 'PV system – main a.c. isolator'.
8. Circuit diagram: Provide at point of interconnection to a.c. distribution board.
9. Details of protective settings incorporated in the PCU: Provide at PCU.
10. Contact telephone number for the maintainer of the system: Provide at point of PCU.
11. Fuses, terminal blocks and other assembly components: Label describing their purpose.
12. Spare fuses: Label, describe their rating and purpose.

System completion

Ss_70_10_70/810 Testing and commissioning photovoltaic systems

1. Standards: To BS 7671;
In accordance with ENA 59/2-1;
In accordance with ENA G83/1-1;
and In accordance with DTI publication *Guide to the installation of PV systems, 2nd edition*, Appendix A and B.
2. Notice before commencing tests (minimum): 2 Weeks
3. Witnessing of testing and commissioning: Required.
4. Approval: Obtain written approval of the Electricity Distributor.
5. Specialist commissioning engineer: System manufacturer.

Ss_70_10_70/815 PV array performance tests

1. Standard: To BS EN 62446-1, Annex C.
2. Test conditions: Minimum irradiation level 600 W/m².

Ss_70_10_70/820 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: General arrangement drawings showing the location of modules, PV array junction boxes, d.c. isolation switches, PV generator junction boxes, power conditioning units, energy meters, a.c. isolation switches and point of connection to a.c. distribution network. Include cabling routes, conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - 2.2. Format: A1 paper print drawing and Electronic drawing.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover.
4. Site test results and system performance analysis: Submit.
5. Test equipment calibration certificates: Submit.
6. System commissioning completion certificate: Submit.
7. Approval of Electricity Distributor (grid-connected systems only): Submit.
8. Warranty for system: Submit.
9. Microgeneration Certification Scheme: Submit certificate.

Ss_70_10_70/830 Spares and consumables

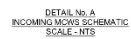
1. Supply the following spares:
2. Supply the following spares: Two of each type and rating used.

Ss_70_10_70/840 Maintenance

1. Servicing and maintenance: Undertake.
2. Duration: Until 12 months after completion.

Ω End of System

Appendix E – Ground Floor Layout Showing ASHP



TITLE PUBLIC HEALTH SERVICES
WATER DISTRIBUTION LAYOUT
GROUND FLOOR

DATE JULY 20 SCALE 1:100 (B1) Rev P01

6983-A10-XX-00-DR-P-53-01

Author: Tom Ikin, Amanda Hulse, 3 United Street, Northcote, VIC 3070

6983-A10-XX-00-DR-P-53-01

Appendix F – Energy and Power Meter Datasheets

Product data sheet

Characteristics

A9MEM3255

iEM3255 energy meter - CT - Modbus - 1 digital I - 1 digital O - multi-tariff



Product availability: Non-Stock - Not normally stocked in distribution facility



Main

Range	Acti 9
Range of product	Acti 9 iEM3000
Device short name	IEM3255
Product or component type	Energy meter

Complementary

Poles description	3P + N 1P + N 3P
Type of measurement	Active and reactive energy Active and reactive power Current Voltage
Metering type	Active, reactive, apparent energy (signed, four quadrant)
Device application	Multi-tariff Partial meter Sub billing
Accuracy class	Class 0.5S active energy IEC 62053-22 Class 0.5S active energy IEC 61557-12 Class C active energy EN 50470-3
Input type	External CT 1 A or 5 A
Line Rated Current	5 A 1 A
Rated voltage	100...277 V 173...480 V
Network frequency	60 Hz 50 Hz
Technology type	Electronic
Display type	LCD display
Sampling rate	32 samples/cycle
Measurement current	1...32767000 mA
Maximum value measured	99999999 MWh
Tariff input	Tariff 4)
Communication port protocol	Modbus RTU 9.6, 19.2 and 38.4 kbauds even/odd or none 4000 V
Communication port support	Screw terminal block RS485
Local signalling	Green indicator light power ON Yellow flashing LED accuracy checking Alarm overload Yellow indicator light communications are active on the Modbus port (Modbus)
Number of inputs	1 digital 0...5 V/11...40 V 24 V DC
Number of outputs	1 digital (static)
Output voltage	5...40 V DC@50 mA
Mounting mode	Clip-on
Mounting support	DIN rail

Jan 14, 2020

The information provided in this documentation contains general descriptions and/or technical characteristics of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric Industries SAS nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

Connections - terminals	Current circuit screw terminals 0.01 in ² (6 mm ²) Voltage circuit screw terminals 0.00 in ² (2.5 mm ²)
Overvoltage category	III
Standards	IEC 61036 IEC 62053-23 UL 61010-1 IEC 61010 IEC 62053-22 IEC 61557-12
Product certifications	CE IEC 61010 safety) CE EN 61557-12 power monitor) CE IEC 61326-1 EMC) CULus UL 61010 safety) CULus ANSI C12.20 sub-meter) EAC sub-meter) RCM NMI M 6-1 sub-meter) UL MID EN 50470-3 sub-meter) MID EN 62052 sub-meter)

Environment

IP degree of protection	Front panel IP40 IEC 60529 Body IP20 IEC 60529
Pollution degree	2
Relative humidity	5...95 % 122 °F (50 °C)
Ambient air temperature for operation	-13...131 °F (-25...55 °C) - MID -13...140 °F (-25...60 °C) - NMI -13...140 °F (-25...60 °C) - IEC
Ambient air temperature for storage	-40...185 °F (-40...85 °C)
Operating altitude	< 6561.68 ft (2000 m)
Color	White
9 mm pitches	10
Width	3.54 in (90 mm)
Height	3.74 in (95 mm)
Depth	2.72 in (69 mm)

Ordering and shipping details

Category	09786 - SE ENTRY POWER METER
Discount Schedule	PL1
GTIN	03606480481574
Package weight(Lbs)	0.04 kg (0.08 lb(US))
Returnability	No
Country of origin	CN

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: This product can expose you to chemicals including: Carbon-black extracts and Bisphenol A (BPA) which is known to the State of California to cause Carcinogen and Reproductive harm. For more information go to www.p65warnings.ca.gov
REACH Regulation	REACH Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS Declaration
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End Of Life Information
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins.

Contractual warranty

Warranty	18 months
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Product datasheet

Specifications



PM5110 Meter, modbus, up to 15th H, 1DO 33 alarms

Local distributor code: 398144322 METSEPM5110

EAN Code : 3606480613982

Main

Range	PowerLogic
Product name	PowerLogic PM5000
Device short name	PM5110
Product or component type	Power meter

Complementary

Power quality analysis	up to the 15th harmonic
Device application	Power monitoring
Type of measurement	Current Voltage Frequency Power factor Energy Active and reactive power
Supply voltage	90...450 V AC 45...65 Hz 100...300 V DC
Network frequency	50 Hz 60 Hz
[In] rated current	1 A 5 A
Type of network	1P + N 3P + N 3P
Maximum power consumption in VA	10 VA at 415 V
Ride-through time	80 ms 120 V AC typical 100 ms 230 V AC typical 100 ms 415 V AC typical 50 ms 125 V DC typical
Display type	Monochrome graphic LCD
Display resolution	128 x 128 pixels
Sampling rate	64 samples/cycle
Measurement current	50...8500 mA
Analogue input type	Voltage (impedance 5 MOhm) Current (impedance <= 0.3 mOhm)
Measurement voltage	35...760 V AC 45...65 Hz between phases 20...440 V AC 45...65 Hz between phase and neutral
Frequency measurement range	45...65 Hz

Disclaimer: This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications

Number of inputs	0
Measurement accuracy	Active energy +/- 0.5 % Reactive energy +/- 2 % Active power +/- 0.5 % Apparent power +/- 0.5 % Frequency +/- 0.05 % Power factor +/- 0.5 Current +/- 0.5 % Voltage +/- 0.5 % Apparent energy +/- 0.5 % Reactive power +/- 2 %
Accuracy class	Class 0.5S active energy conforming to IEC 62053-22
Number of outputs	1 digital
Communication port protocol	Modbus RTU and ASCII at 9.6, 19.2 and 38.4 kbauds even/odd or none - 2 wires, insulation 2500 V JBUS
Communication port support	RS485
Data recording	Time stamping Min/max of instantaneous values
Connections - terminals	Voltage circuit: screw terminal block4 Control circuit: screw terminal block2 Current transformer: screw terminal block6 Input/output circuit: screw terminal block6 RS485 link: screw terminal block4
Mounting mode	Flush-mounted
Mounting support	Framework
Standards	UL 61010-1 EN 50470-3 EN 50470-1 IEC 62053-22 IEC 60529 IEC 62053-24 IEC 61557-12
Product certifications	CE conforming to IEC 61010-1 CULus conforming to UL 61010-1
Width	96 mm
Depth	72 mm
Height	96 mm
Product weight	380 g

Environment

Electromagnetic compatibility	Voltage dips and interruptions immunity test class A conforming to IEC 61000-4-11 Limits for harmonic current emissions class A conforming to IEC 61000-3-2 Electrostatic discharge level 4 conforming to IEC 61000-4-2 Conducted RF disturbances level 3 conforming to IEC 61000-4-6 Magnetic field at power frequency level 4 conforming to IEC 61000-4-8 Conducted and radiated emissions class B conforming to EN 55022 Immunity to conducted disturbances - test level: 150 kHz...80 MHz conforming to IEC 61000-4-6 Electrical fast transient/burst immunity test conforming to IEC 61000-4-4 Radiated radio-frequency electromagnetic field immunity test conforming to IEC 61000-4-3 Surge immunity test conforming to IEC 61000-4-5 Voltage dips and interruptions immunity test conforming to IEC 61000-4-11
IP degree of protection	IP54 display: conforming to IEC 60529 IP30 rear: conforming to IEC 60529
Relative humidity	5...95 % at 50 °C non-condensing
Pollution degree	2
Ambient air temperature for operation	-25...70 °C meter -20...70 °C display -25...-20 °C (with reduced performance) display
Ambient air temperature for storage	-40...85 °C
Operating altitude	2000 m CAT III

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	11.467 cm
Package 1 Width	12.979 cm
Package 1 Length	12.544 cm
Package 1 Weight	449.0 g
Unit Type of Package 2	S03
Number of Units in Package 2	12
Package 2 Height	30.0 cm
Package 2 Width	30.0 cm
Package 2 Length	40.0 cm
Package 2 Weight	7.19 kg
Unit Type of Package 3	P12
Number of Units in Package 3	288
Package 3 Height	105.0 cm
Package 3 Width	80.0 cm
Package 3 Length	120.0 cm
Package 3 Weight	206.4 kg

Offer Sustainability

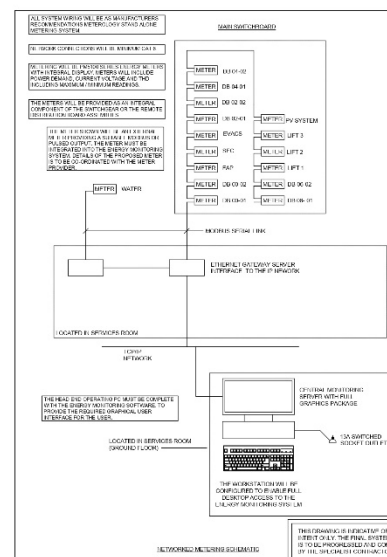
Sustainable offer status	Green Premium product
REACH Regulation	REACH Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
China RoHS Regulation	China RoHS declaration
RoHS exemption information	Yes
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End of Life Information
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins

Contractual warranty

Warranty	18 months
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Recommended replacement(s)

Appendix G – Metering Schematic



- PROJECT: 6-HAROLD, TOTTERHAM TITLE: ELECTRICAL SERVICES
 AND FILE: TRILLIUMBY ARCHITECTURE MAINLY SCHEMATICS
 CAD: 5.0 DESIGNED: AJ DROPPED: ENG APPROVED: SGA DATE: 2/23/22 SCALE: 1/8" @ 1' PLOT: P01
 atelier ten 6983-A10-XX-XX-DR-E-61-01

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