V10 ELECTRICAL GENERATION

PERFORMANCE OBJECTIVES

Provide an on-site renewable electricity generation system to generate electricity from the sun, and reduce the carbon footprint of the building.

To ensure benefits from Feed-in Tariffs can be gained, the installer must be fully MCS certified.

PERFORMANCE PARAMETERS

- The Building Regulations
- IET Wiring Regulations 17th Edition, as amended (BS7671:2008+AMD1:2011+AMD2:2013)
- All relevant British Standards.
- UKPN and Local Electricity Utility supplier requirements (incl. PME Requirements).
- Local Authority and other statutory requirements
- Electricity at Work Act
- Health and Safety
- Plant/equipment life - a minimum of 20 years without major replacement. System life - in excess of 25 years.
- BS EN 61194 Characteristic parameters of stand-alone photovoltaic (PV) systems
- BS EN 61215 Crystalline silicon terrestrial photovoltaic (PV) modules. Design qualification and type approval
- BS EN 61727 Photovoltaic (PV) systems. Characteristics of the utility interface
- BS EN 61000 Electromagnetic compatibility (EMC). Testing and measurement techniques
- Photovoltaics in Buildings - Testing Commissioning and Monitoring Guide
- Photovoltaics in Buildings - Safety and the CDM regulations
- Photovoltaics in Buildings - Guide to the Installation of PV systems
- Engineering recommendation G771/1 is to be consulted.

Phase	Block	Gross Area m^2	Rated Power kW	Azimuth from south	Inclination from horizontal	Annual output kWhrs/year	CO_2 offset kgCO2/year	Improvement on TER
1	A	83.1	16.8	9^0 or 6^0	10^0	14923	6648	9.9%
	F	0.0	0.0	67^0	10^0	0	0	0.0%
2	G	61.9	12.5	67^0	10^0	10627	4734	13.9%
	H	97.8	19.8	23^0	10^0	17486	7790	21.5%

SYSTEM DESCRIPTIONS

The information prepared for the tender has been developed to a RIBA stage E level to establish; the scope of works for MEP installations for this phase, the design strategies, space requirements and distribution routes.

The Contractor is to design, supply, install, test and commission the new installation in line with the intent described in this specification, U-series drawings, schematics and schedules. All design responsibility for the correct operation and compliance with the performance objectives and design parameters within the specification rests with the contractor.

Any information relating to the size and duty of equipment that has been included within the tender information, has been included to indicate the assumptions used to establish the space requirements and distribution routes, and should not be relied upon for the purposes of the contractors design.

Engage a PV specialist to design, supply, install and commission a complete photovoltaic system. To ensure benefits from Feed-in Tariffs can be gained, the installer must be fully MCS certified

Phase 1

Block A: Shall have approximately 83 m2 of photovoltaic panels located on the roof. Panels shall be mounted on free standing non penetrative 'big foot' ballasted galvanised steel universal frame. Panels shall be near to south facing, orthogonal with the roof parapet, with an approximate incline of 10°; as shown in the MFllp Dwg No 4726-MF-A-07-V20-P-Bldg and No 4726-MF-A-06-V20-P-Bldg drawings. The panels shall have an efficiency of at least 20.3% with a minimum peak array output of 16.8 kWp, at least 14923 kWh/year. The design of the PV system must account for sun path, overshadowing, cable lengths and power losses in cables, etc. The generation shall feed into the landlord's distribution boards DB\A\PV1 and DB\A\PV2.

Phase 2

Block F: None, roof used for solar thermal collection.

Block G: Shall have approximately 62m2 of photovoltaic panels located on the roof. Panels shall be mounted on free standing non penetrative 'big foot' ballasted galvanised steel universal frame. Panels shall be near to south facing, orthogonal with the roof parapet, with an approximate incline of 10°; as shown in the MFllp Dwg No 4726-MF-G-06-V20-P-Bldg drawing. The panels shall have an efficiency of at least 20.3% with a minimum peak array output of 12.5 kWp, at least 10627 kWh/year. The design of the PV system must account for sun path, overshadowing, cable lengths and power losses in cables, etc. The generation shall feed into the landlords distribution board DB\G\PV1.

Block H: Block G: Block G: Shall have approximately 98 m2 of photovoltaic panels located on the roof in arrays of 12. Panels shall be mounted on free standing non penetrative 'big foot' ballasted galvanised steel universal frame. Panels shall be near to south facing, orthogonal with the roof parapet, with an approximate incline of 10°; as shown in the MFllp Dwg No 4726-MF-H-05-V20-P-Bldg drawing. The panels shall have an efficiency of at least 20.3% with a minimum peak output of 19.8 kWp per, at least 17486 kWh/year. The design of the PV system must account for sun path, overshadowing, cable lengths and power losses in cables, etc. The generation shall feed into the landlords distribution boards DB\H\PV1 and DB\H\PV2.

Each roof shall have several groups of PV strings. Each group of PV strings shall be fitted with a DC disconnect, inverter, and AC isolator. Inverters shall be chosen to match the PV array. Cables etc. shall also be chosen to match the PV array's output. These groups will then connect to a PV distribution board located within the services riser at the highest floor. The PV distribution board shall be separated from the landlord's distribution board associated with that core by a G59 relay, isolator and meter. An exporting long term parallel connection shall be provided. Cables shall be armoured cables to BS6724 and run externally within a galvanised steel tray or where approved clipped neatly direct to building and internally within the services riser.

T15 SOLAR THERMAL COLLECTORS

PERFORMANCE OBJECTIVES

To provide a supplementary zero carbon heat source to the LTHW system for space heating and domestic hot water generation, to help meet heat losses inherent in the pipe network, and to reduce the carbon footprint of the building.

To contribute towards the PHPP primary energy metric.

PERFORMANCE PARAMETERS

- BS EN 12975-1:2006+A1:2010 Solar thermal systems and components
- BS EN 15316-4-3:2007 Heat generation systems – thermal solar systems
- CIBSE guide G – public health engineering
- Building Regulations Approved Document Part L1a
- Building Regulations Approved Document Part J BSRIA Guide To Renewable Technologies
- CIBSE Guide F Energy efficiency in buildings NEW 2012
- CIBSE Guide B Heating, Ventilating, Air Conditioning and Refrigeration
- CIBSE Guide J Weather, Solar and Illuminance Data
- Thermomax Mounting and Wind Load Guide
- Pressure Equipment Regulations 1999
- Domestic Building Services Compliance Guide: 2013 edition
- BS 6880:1998 code of practice for low temperature hot water heating systems of output greater than 45kW.
- BS EN 12828:2003 Heating systems in buildings – Design for water based heating systems
- BS EN 12831:2003 Heating systems in buildings – Method for calculation of the design heating load
- BS EN 14336:2004 Heating systems in buildings Installation and commissioning of water based heating systems
- Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999
- BSRIA Guide BG12/2011 Energy Efficient Pumping Systems
- SAV Systems FlatStation Design Guide
- The Renewable Heat Incentive Scheme Regulations

Design temperatures 70°C / 50°C

Maximum pipework pressure drop per meter length 250 Pa/m

Phase	Block	Gross Area m^2	Azimuth from south	Inclination from horizontal	Annual output kWhrs/year	CO_2 offset kgCO2/year	Improvement on TER
1	A	46.8	6^0	20^0	28562	5257	7.8%
2	F	63.8	67^0	20^0	35843	6597	26.2%
	G	0.0	67^0	20^0	0	0	0.0%
	H	0.0	23^0	20^0	0	0	0.0%

MAX FORDHAM

SYSTEM DESCRIPTIONS

The information prepared for the tender has been developed to a RIBA stage E level to establish; the scope of works for MEP installations for this phase, the design strategies, space requirements and distribution routes.

Install Kingspan DF100 Direct Flow Vacuum Tube Solar Collectors or approved equivalent. Employ Solstice Energy or other approved specialist to design, provide, install, test and commission a complete vacuum tube solar thermal heating system in line with the intent described in this specification, T-series drawings, schematics and schedules, comprising of all necessary pumps, pipework, antifreeze, safety valves, filling loop, heat dump, solar panels and controls. To ensure benefits from the Renewable Heat Incentive (RHI) can be gained, the installer must be fully MCS certified. All design responsibility for the correct operation and compliance with the performance objectives and design parameters within the specification rest with the contractor.

Any information relating to the size and performance of equipment that has been included within the tender information, has been included to indicate the assumptions used to establish the space requirements ability to meet CO^2 offset targets and should not be relied upon for the purposes of the contractors design.

The CONTRACTOR shall be responsible for the design, supply installation testing and commissioning of the entire solar thermal water heating system in accordance with; the standards listed.

The PHPP metric of 120 kWh/m2.yr drives the need to offset the primary energy consumption by use of a solar thermal heating system.

The solar collector system is designed to provide a supplementary zero carbon source of heat to the low temperature hot water (LTHW) system. The solar thermal system will contribute heat via a storage calorifier/buffer tank and will remain a closed loop system, separate to the LTHW system. The boilers will hold responsibility for delivering the required LTHW for heating and domestic hot water (DHW), with the solar collectors providing heat input whenever weather condition and demand allow this to be viable as can be seen in MFllp Dwg No 4726-MF-A-SC-T10-E-Bldg.

The storage tank will heated by a solar thermal system, the aim being to maintain the buffer vessel at 70^{0}C. In accordance with the SAV FlatStation design guide for a district heating (DH) system the boilers will be sized so as to allow a storage tank reheat within a 1 hour time period (with the storage tank(s) sized to, at minimum, meet a peak demand period of 15 minutes), not to provide instantaneous reheat of hot water under peak use conditions, see section T10. It is therefore necessary to ensure the storage tanks are maintained at a suitable temperature to allow the boilers to meet peak instantaneous heat demands. This will be achieved using a temperature sensor at the top of the tank, connected to a motorized control valve to allow recirculation of boiler heated water into the storage tank when the solar thermal is not contributing sufficiently (deemed to be the case when the recorded temperature drops below 60^{0}C).

A motorised control valve will activate a bypass route to deliver water from the boilers directly back to the storage tank, a pressure sensor downstream of a variable speed driver pump signalling it to compensate for the additional water demand. To ensure the pump maintains sufficient capacity to meet all SAV unit heat requirements under peak demand this bypass will be fitted with a regulating valve.

Primarily the system sizing is based on meeting heat demands during the period of the year when the demand tends to its lowest and the solar thermal heat generation it's highest. This occurs in summer when, in tandem with the solar thermal input being high and the space heating requirement low, the domestic cold water (DCW) input temperature is high resulting in a reduction in the heat input required from the LTHW system.

A secondary consideration in regards to system sizing is the water storage volume available. A below-specification storage tank capacity would require a proportional drop in solar thermal collector area to avoid heat waste. Calorifier tanks also act as buffer tanks for the gas boiler LTHW system, see section T10, and the tank volume is not to drop below the requirement for the LTHW system.

Phase 1

Provide a complete solar thermal heating system for 38 dwellings to be located on the eastern roof of block A and to meet the design specifications. Access to the eastern roof is via the eastern stair core that has been extended to the roof to provide personnel access, maintenance and component replacement. Panels shall be mounted on free standing non penetrative 'big foot' ballasted galvanised steel universal frame. Panels shall be installed flat with an internal tube orientation of 20^0,near to south facing, orthogonal with the roof parapet; as shown in the MFllp Dwg No 4726-MF-A-07-T90-P-Bldg. The system shall consist of an array of about $33m^2$ absorber area, made up evacuated tube collectors, with an aperture efficiency of no less than 77.9% and a first order heat loss coefficient of no greater than 1.07, generating at least 28562 kWhrs/year. Such a system could be created using 11 x $3m^2$ Kingspan DF100 panels. The design of the solar thermal system must account for sun path, overshadowing, pipe lengths and heat losses in pipes, etc. A pumping station shall be installed capable of producing a flow of approximately 1.41 m^3/h and head of approximately 93kPa.

Phase 2

Provide a complete solar thermal heating system for 62 dwellings to be located on the roof of block F and to meet the design specifications. This solar thermal array is to provide a heat input to the calorifier located in the block G plant room which provides an input to the F,G,H LTHW system, see MFllp Dwg No 4726-MF-G-SC-T10-E-Bldg. Blocks G and H are to have no roof top solar thermal array. Panels shall be mounted on free standing non penetrative 'big foot' ballasted galvanised steel universal frame. Panels shall be installed flat with an internal tube orientation of 20^0,near to south facing, orthogonal with the roof parapet; as shown in the MFllp Dwg No 4726-MF-F-04-T90-P-Bldg. The system shall consist of an array of about 45m2 absorber area, made up evacuated tube collectors, with an aperture efficiency of no less than 77.9% and a first order heat loss coefficient of no greater than 1.07, generating at least 35843 kWhrs/year. Such a system could be created using 15 x 3m2 Kingspan DF100 panels. The design of the solar thermal system must account for sun path, overshadowing, pipe lengths and heat losses in pipes, etc. A pumping station shall be installed capable of producing a flow of approximately 1.9 m3/h and head of approximately 129kPa.

Although this system has been designed for the panels to be flat mounted and angle of approximately 2^0 is recommended to ensure proper air removal during commissioning. Flat mounting negates inter-panel shading, but where panels are arranged in banks a minimum spacing of 500mm between rows shall exist to allow servicing access. Where panels are located near a roof edge there shall exist a gap of approximately 1 meter or greater so as to avoid wind turbulence issues. Where a parapet exists consideration shall be given to raising the panels to avoid shading from the parapet.

Each solar thermal array shall be connected in parallel with an air handling unit (AHU) which is to act as a heat dissipater when there is a lack of capacity within the calorifier and LTHW system to accept the full heat output from the solar thermal. The heat dissipater shall be no less than 420 W/m2 of collector area.

Collectors shall not be left exposed for long periods prior to commissioning.

Class 2 heat meters are required for each solar thermal system in order to meet with renewable heat incentive requirements. Meters must be installed in line with manufacturer's instructions and be appropriate for the system they are monitoring.

The collectors shall be inspected annually.

Pipework

Pipework for the Kingspan thermomax collector array shall be sized based on a solar loop volume flow rate of 40 l/hr/m2, or as appropriate for an alternative evacuated tube solar collector system. Suitable pipe materials for solar thermal systems are smooth bore copper, black mild steel or stainless steel. Under no circumstances should plastic or PEX pipe be used. Corrugated stainless steel is also unsuitable due to the high pressure loss per length of pipe for this material.

Features (such as large loops, horseshoes or changes in direction) are to be included in the pipework to allow for thermal expansion. If bellows or gland type joints are used they must be rated for the high temperatures