

Proposed Residential Development at Worcester Close, Istead Rise, Gravesend

Energy Statement



Low-carbon consultancy and energy performance certification

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Introduction

This Energy Statement has been written to accompany the planning application for the proposed residential development in Istead Rise village of 8 flats on a site bounded to the east by Worcester Close, to the north by Downs Way medical practice and to the west and south by existing housing. The proposal consists of a mix of 1-bed and 2-bed flats within a 2-storey building.

Istead Rise village lies within the administrative area of Gravesham Borough. Gravesham's planning policy is based upon its Local Plan (adopted September 2014), with the Core Strategy covering the period April 2011- March 2028.

Of particular relevance to this report are policies CS18 (Climate Change) and CS19 (Development and Design Principles), which the Council states that it needs to *"interpret in accordance with the new housing technical standards"*.

The new Housing Standards in turn state, *"Therefore, for Gravesham, Local Plan Core Strategy policies CS18 Climate Change and CS19 Development and Design Principles, Local Plan First Review saved policies H5 and AP10 and associated guidance in the Residential Layout Guidelines Supplementary Planning Guidance (SPG), should be interpreted by reference to the nearest equivalent new national technical standard. This is set out in Table 1 below."*

It is noted however that Table 1 refers to water consumption, space standards and so on, but makes no mention of energy efficiency, renewables or carbon reduction – which are the areas covered by this statement.

In line with the requirements of the National Planning Policy Framework (2019), Gravesham Borough Council undertook a 5-year review of its Local Plan policies. The review recommended no changes to be made to policies CS18 and CS19.

Therefore essentially Gravesham's current planning policy guidance in relation to climate change, carbon reduction, energy efficiency and renewables remains as per para 5.14.42 of the Local Plan, being summed up as follows:

- Seek to reduce the carbon footprint of the Borough through national policy on the transition to zero carbon development, via amendments to Part L of the Building Regulations;
- Require development proposals in Key Site (and other major development elsewhere in the Gravesend Town Centre Opportunity Area) to consider the potential and include proposals for low carbon and renewable energy generation including combined heat and power - unless not technically or financially feasible, or that improved fabric energy efficiency or an allowable solution results in improved carbon saving benefits;
- Support stand-alone decentralised, renewable or low carbon energy development where it is compatible with national policies for protecting the Green Belt and where it accords with other policies in the plan;
- Support other proposals which lead to a reduction in carbon footprint including retrofitting existing homes and businesses and local initiatives based on carbon off-setting via allowable solutions

Figure 1, taken from the Local Plan Policies Map document shows that Istead village is neither identified in the Local Plan as a Key site, nor does it lie within the Gravesend Town Centre Opportunity Area – however it is considered that Gravesham Borough Council's intention is that *all* development proposals are designed and constructed to the highest standards, including minimising their environmental impact through energy efficiency and the inclusion of renewables as appropriate. The recent (2021) revision to Part L of the Building Regulations (introduced in June 2022) not only tightens the level of dwelling carbon emission reductions (DER<TER) compared to the previous edition but also includes requirements to meet efficiency targets (DFEE<TFEE) and primary energy targets (DPER<TPER). The step change which is represented by the introduction of Part L2021 therefore goes a long way towards ensuring that developers progress along the path that accords with the policy intentions of Gravesham Borough Council.

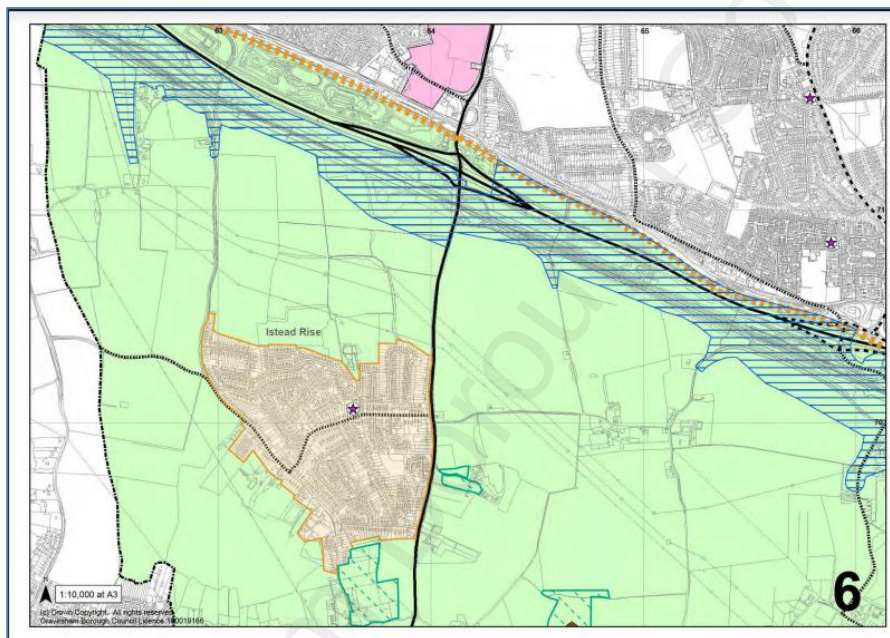


Figure 1

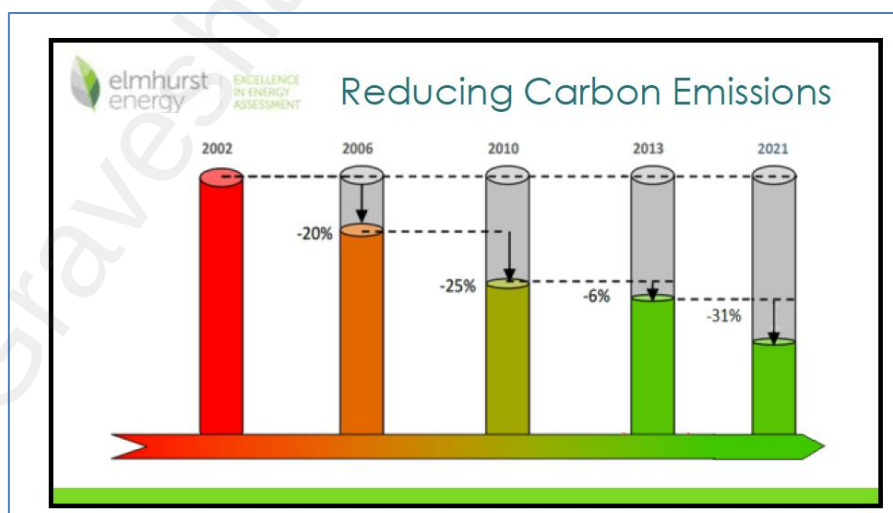


Figure 2: The introduction of PartL 2021 continues the trend of reducing building carbon emissions

Figure 3 provides an aerial photo of the proposed site while figure 4 provides the proposed site plan.

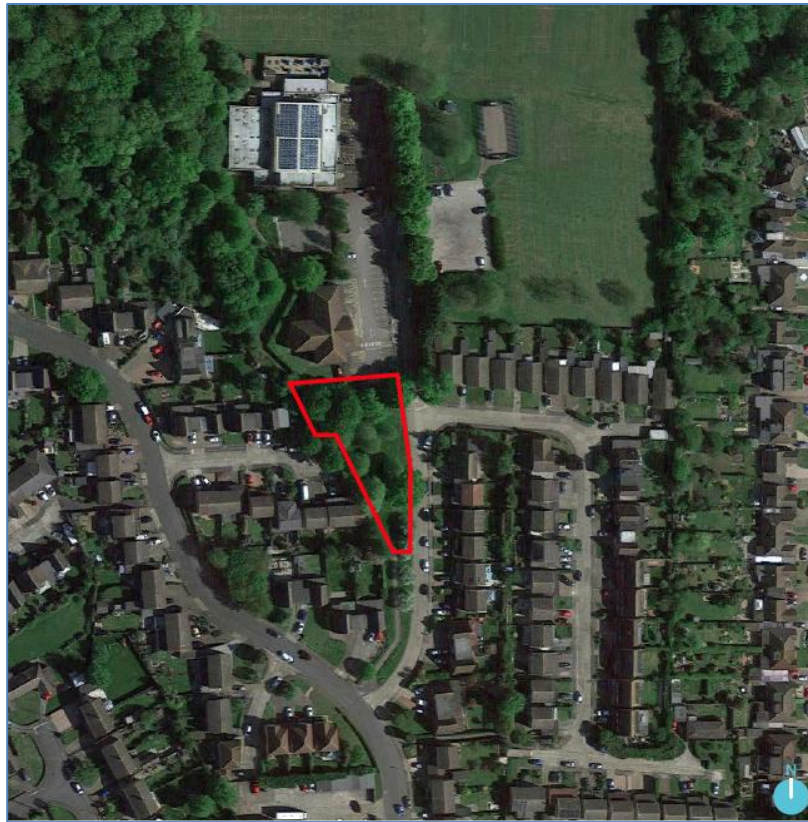


Figure 3



Figure 4

Minimising energy demand

Energy efficiency measures are always the most cost-effective and long-lasting means of reducing carbon emissions from buildings, and the early design stage is the most cost-effective time to incorporate design and technological measures to this end. Once built-in to the structure, energy-efficiency measures will continue to provide carbon savings and reduced heating bills for the lifetime of the building. It is essential therefore, before any consideration is given to the use of renewables that particular attention is paid to making new buildings as thermally-efficient and air-tight as possible, by specifying high standards of design and construction.

SAP calculations have been carried out for the 8 flats to enable a proposed thermal specification to be tested for compliance and to enable the contribution from renewables to be calculated. It is however recognised that at this early stage of design, details of the thermal specifications and the HVAC systems and lighting designs have yet to be finalised and so some assumptions have had to be made. The results provided within this report are therefore subject to change once these details become finalised, and therefore do not constitute definitive design guidance, they do however provide adequate confirmation at this stage that the planning targets will be met.

Thermal envelope

In line with the principle of “Fabric First”, energy efficiency measures will be built in to the fabric of the new building so that the benefits of reduced energy bills and lower carbon emissions are realised for the lifetime.

Table 1 shows the proposed thermal specification for the building which will ensure that the fabric energy efficiency criteria for new dwellings, that are an integral part of the 2021 Part L1 Building Regulations, are exceeded¹.

Element	Specified U-value (W/m ² K)
Roof (insulated joists)	0.11
Walls	0.18
Ground floor/exposed floor	0.13
Windows and doors	1.20
Thermal bridging	Better than accredited details equivalent
Air permeability @50pa	3.50

Table 1: Summary of proposed thermal envelope specifications

Services

Table 2 shows the proposed mechanical and electrical specifications for the flats, which will ensure that energy is used efficiently for heating, hot water and lighting.

Element	
Heating	Air-source heat pumps, radiators, programmer and TRVs
Hot water	Air-source heat pumps supplying HW cylinder
Lighting	LED throughout

Table 2: Summary of proposed M&E specifications

¹ Compliance is based upon the block average, see Appendix for results

Renewable energy technologies

Introduction

As already stated, Gravesham Borough Council encourages the inclusion of certain renewable energy technologies where appropriate.

The “fabric first” approach has been followed by the developer, with different renewable technologies being considered afterwards. Different technologies offer differing advantages and disadvantages in the built environment and these are examined in this report, as the suitability of each technology to this particular development is considered. The study concludes by making a recommendation for the most appropriate technology which will enable the dwellings to meet the requirements in a cost-effective and acceptable manner.

Several renewable energy technologies offer the potential to reduce carbon emissions from homes – examples would be CHP, biomass heating, district heating schemes, solar panels, heat pumps and wind turbines. In this section, the different available technologies have been assessed for their suitability to this development. Some have been rejected at an early stage as being unsuitable:

Unsuitable technologies

Ground source heat pumps

Ground source heat pumps provide an energy-efficient, low-carbon means of providing space and hot water heating, however they also require either extensive ground space for trenching or vertical boreholes. Neither of these requirements can be easily met with this scheme – there is insufficient space available for horizontal trenches, and the high cost of drilling boreholes is likely to make this option unviable.

Biomass heating

Biomass boilers offer large carbon savings at relatively low cost compared with other renewable energy systems, however they require regular intervention to ensure their continued and correct operation. While small, single room, wood-burning stoves are popular with many home-owners, occupants of modern homes are likely to be less keen to live with the demands of a complete solid-fuel based central heating system, with the inherent inconvenience of manual operation, and the need to order and store fuel supplies and to remove ash. Hence, the environmental advantages of biomass heating have to be balanced against the practical issues for the occupants. There may also be concerns about potential air pollution from biomass systems particularly in built-up areas where air pollution levels may already be high.

For these reasons, biomass is not considered to be a feasible option for this development.

Wind Turbines

Small horizontal-axis wind turbines (HAWTs) mounted onto the roofs of buildings are not generally recommended in urban and sub-urban areas as there is a high risk of meeting local and planning opposition, for questionable benefit. Research carried out into the effectiveness of roof-mounted

wind turbines has found that their performance in practice tends to fall well short of manufacturers' claims, this is because the wind speeds needed to produce useful amounts of energy are found only in open areas and not in built-up areas. Furthermore, most turbines are designed to operate in a clear air stream, free of the turbulent airflows that occur around buildings and obstacles. As such, when placed upon a building, their performance is generally poor and less predictable.

For this reason, small wind turbines are not considered to be a feasible option for this development.

CHP

Combined heat and power provides the simultaneous on-site generation of electricity and heating, and can be usefully deployed in the right setting to provide both economic and carbon savings. However it is very sensitive to correct load demands, and so the use of CHP is generally not advised on small, residential-only developments such as this one. For this reason, CHP is not considered to be a feasible option for this development.

District Heating / Communal Heating

District heating describes the supply of heating to a number of separate buildings within a site, from a single energy centre, possibly connected to (or with the potential to connect to in the future) other buildings outside of the site, and possibly using a low-carbon fuel such as biogas. It is regarded as a more efficient (and hence lower carbon-emitting) energy supply system than conventional individual heating systems, particularly those using fossil fuels. On a smaller scale, a single communal heating system can provide heating to all dwellings within a block of flats and there can be benefits to this in terms of space saving within the flats, and overall carbon emissions. However, this requires plant space and so, for this reason communal heating is not considered to be a feasible option for this development.

Potentially suitable technologies

The following technologies are regarded as being potentially suitable for use within this development.

Air Source heat pumps

Air source heat pumps offer the same advantages as ground-source heat pumps (energy and carbon savings compared to conventional heating systems) but without the need for costly and disruptive ground works. This makes them suited to new housing developments, particularly for well-insulated houses and flats.

Air source heat pumps operate on the same principle as ground source heat pumps, with the important difference that they use an outdoor fan unit to collect energy from the ambient air. This low-grade heat is then “upgraded” into heat suitable for supplying heating and hot water systems, through the use of an electric pump and refrigerant compression circuit. An internal immersion heater provides a boost to the system on the coldest days.

Figure 5 shows examples of typical outdoor fan units, which are situated in a discrete outdoor location and coupled either to an indoor hot water storage cylinder for use with underfloor heating, or directly via refrigerant pipework to indoor condenser units providing heating or cooling. Underfloor heating can provide benefits to the occupant including a more even room temperature and more freedom to locate furniture.



Figure 5: Mitsubishi example ASHP external fan units

Air source heat pumps are the preferred heating solution for this development, with the external fan units being located within either the demise of the ground floor flats’ amenity space (for the ground floor flats) and in a secure dedicated external communal area to the rear of the building (for the upper floor flats) as shown on the architect’s ground floor plan.

Waste Water Heat Recovery Systems

Waste water heat recovery (WWHR) systems are a relatively novel technology. They offer the potential to reduce building carbon emissions without the need for external renewable energy systems such as solar PV. This can be an advantage in some situations where PV may be visually unacceptable or too expensive.

WWHR systems work by using a heat exchanger to recover heat from the waste water leaving showers and baths, and using this recovered heat to pre-heat the cold water supply either to the boiler or the mixer. Some systems can be extremely simple, for example the Showersave system is based around a simple pipe, with no moving parts. The performance of such systems can be tested using SAP (and SBEM).

Previous testing has show that systems such as Showersave can produce carbon emission reductions equivalent to other, more mature technologies such as solar panels, particularly in larger dwellings with high hot-water demands. They need to be carefully implemented alongside water supply and drainage pipework and hence there can be practical difficulties with layouts in buildings, particularly in blocks of flats. Although a potentially suitable technology, WWHR is therefore not being considered for this development.

Solar thermal

Solar thermal systems are a mature technology, which uses the sun's energy to generate hot water for use within buildings. This is used to provide a proportion (typically in the UK, up to 50-60%) of the building's annual hot water demand, with the remainder being provided by a boiler or other heating system. A dual-coil cylinder is used to combine the hot water from the panel and the boiler, and to store it for use throughout the day.

Solar thermal systems are ideally suited to new dwellings and to certain non-dwellings, provided that a suitable roof surface is available. Ideally, the roof must be pitched around 30-45 degrees and be oriented between south-east and south-west. In instances where the roof is flat, solar thermal panels can be mounted directly onto the roof (in the case of evacuated tubes), or mounted onto A-frames to improve the efficiency of collection (in the case of flat-plate systems).

Solar thermal systems require dwellings to have a suitable hot water storage cylinder in order to combine the hot water from the panel with hot water from heat sources, and to provide storage until it is needed. The flats will use air-source heat pumps for space and water heating and so a storage cylinder is available for solar thermal connection. From a practical perspective, each flat would have its own individual panel array on the roof, with connections directly to its own cylinder. There are therefore additional installation considerations, in terms of space and cost, which need to be taken into account at the design stage.

Solar photovoltaics

Solar photovoltaic (PV) systems are a mature technology which generate electricity from sunlight, this is then used to reduce the amount of electricity bought from the grid. The generated electricity is converted from direct into alternating current and connected to the incoming grid supply at the consumer unit. This means that any surplus power generated and not used on site can be exported back to the grid.

Solar PV systems work successfully on a wide variety of building types in the UK. The requirements for roof space, pitch and orientation are the same as for solar thermal.

SAP calculations show that an amount of PV equivalent to approximately 0.3kWp per flat (2.4kWp total array size) would be sufficient to provide a comfortable Building Regulations pass, on a block compliance basis.² This can be provided with 8no. 300W panels, such as those referred to in the Appendix.

Figures 6 and 7 show the potential arrangement of the PV proposed array on the south-east roof pitch where they would receive good levels of sunlight for much of the day.

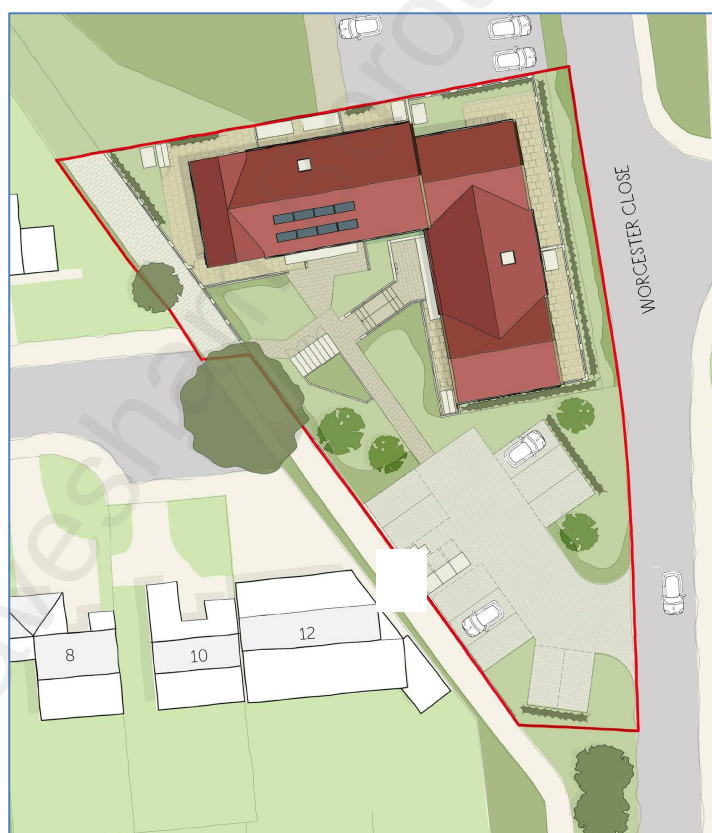


Figure 6: Roof plan, showing proposed location of PV panels on SE pitch

² See Appendix for calculations. Information is provided for guidance, based on assumed build specifications – compliance with relevant regulations will be checked at the full design stage, with known specifications.



Figure 7: 3D image, showing proposed location of PV panels on SE pitch

Conclusion

In conclusion, air-source heat pumps provide benefits in terms of low-carbon space and water heating, and are the preferred technology for this development. Additionally, a roof-mounted solar PV array of 2.4kWp will provide further carbon reductions required to pass Building Regulations - PV being preferred over solar thermal owing to it being more easy to implement. A high standard of thermal insulation within the building envelope will ensure that the energy efficiency requirements of Part L 2021 are exceeded (subject to confirmation at detailed design stage).

Appendix A: SAP calculations

Block Compliance

Block Reference	Worcester Close Block	Issued on Date	04/01/2023
Block Name	Worcester Close Block		
Calculation Type	New Build (As Designed)		
Assessor Details	Mr. Jeremy Dicker	Assessor ID	C045-0001
Client			

Block Compliance Report - DER

Block Reference: Worcester Close Block	Block Name: Worcester Close Block			
Property-Assessment Reference	Floor area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
1B2P ET GF flat - ASHP+PV	53.54	5.25	14.67	64.21 %
1B2P MT GF flat - ASHP+PV	53.54	4.83	13.36	63.85 %
2B4P MT GF flat - ASHP+PV	70.01	4.47	11.76	61.99 %
2B4P ET GF flat - ASHP+PV	70.01	4.66	12.38	62.36 %
1B2P ET TF flat - ASHP+PV	56.20	5.06	13.32	62.01 %
1B2P MT TF flat - ASHP+PV	56.20	4.75	12.46	61.88 %
2B4P MT TF flat - ASHP+PV	73.10	4.46	11.25	60.36 %
2B4P ET TF flat - ASHP+PV	73.14	4.65	11.74	60.39 %
Totals:	505.74	38.13	100.94	
Average DER = 4.74 kgCO ₂ /m ²	% DER/TER	PASS		
Average TER = 12.50 kgCO ₂ /m ²	62.09 %			

Block Compliance Report - DFEE

Block Reference: Worcester Close Block	Block Name: Worcester Close Block			
Property-Assessment Reference	Floor area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
1B2P ET GF flat - ASHP+PV	53.54	40.67	42.19	3.60 %
1B2P MT GF flat - ASHP+PV	53.54	34.00	35.49	4.18 %
2B4P MT GF flat - ASHP+PV	70.01	33.42	34.73	3.75 %
2B4P ET GF flat - ASHP+PV	70.01	36.67	38.13	3.82 %
1B2P ET TF flat - ASHP+PV	56.20	37.81	36.52	-3.53 %
1B2P MT TF flat - ASHP+PV	56.20	32.96	32.07	-2.77 %
2B4P MT TF flat - ASHP+PV	73.10	33.73	32.72	-3.09 %
2B4P ET TF flat - ASHP+PV	73.14	37.21	35.67	-4.34 %

SAP 10 Online 2.2.8
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Block Compliance



Totals:	505.74	286.47	287.50	
Average DFEE = 35.73 kgCO ₂ /m ²	% DFEE/TFEE	PASS		
Average TFEE = 35.82 kgCO ₂ /m ²	0.25 %			

Block Compliance Report - DPER

Block Reference: Worcester Close Block		Block Name: Worcester Close Block		
Property-Assessment Reference	Floor area (m ²)	DPER (kWh/m ² /yr)	TPER (kWh/m ² /yr)	% DPER/TPER
1B2P ET GF flat - ASHP+PV	53.54	55.88	77.14	27.56 %
1B2P MT GF flat - ASHP+PV	53.54	51.72	70.18	26.30 %
2B4P MT GF flat - ASHP+PV	70.01	47.51	61.50	22.75 %
2B4P ET GF flat - ASHP+PV	70.01	49.40	64.74	23.69 %
1B2P ET TF flat - ASHP+PV	56.20	53.94	69.87	22.80 %
1B2P MT TF flat - ASHP+PV	56.20	50.78	65.32	22.26 %
2B4P MT TF flat - ASHP+PV	73.10	47.38	58.77	19.38 %
2B4P ET TF flat - ASHP+PV	73.14	49.27	61.29	19.61 %
Totals:	505.74	405.88	528.81	
Average DPER = 50.42 kgCO ₂ /m ²	% DPER/TPER	PASS		
Average TPER = 65.45 kgCO ₂ /m ²	22.97 %			

Appendix B: PV panel

Harvest the Sunshine



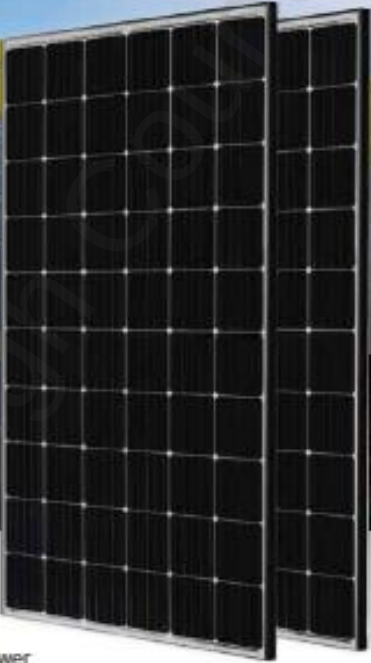
Mono

330W PERC Module

JAM60S09 310-330/PR Series

Introduction

Powered by high-efficiency PERCUM cells, this series of high-performance modules provides the most cost-effective solution for lowering the LCOE of any PV systems large or small.





5 busbar solar cell design



Higher output power



Excellent low-light performance



Lower temperature coefficient

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty



■ JA Linear Power Warranty ■ Industry Warranty

Comprehensive Certificates

- IEC 61215, IEC 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- OHSA 18001: 2007 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval



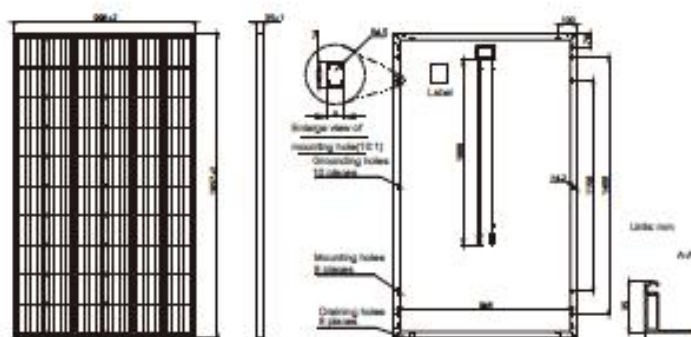

JA SOLAR

www.jasolar.com

Specifications subject to technical changes and tests.
JA Solar reserves the right of final interpretation.



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	18.4kg±3%
Dimensions	1657±2mm×998±2mm×35±1mm
Cable Cross Section Size	4mm ²
No. of cells	60(6x10)
Junction Box	IP67, 3 diodes
Connector	MC4
Packaging Configuration	31 Per Pallet

ELECTRICAL PARAMETERS AT STC

TYPE	JAM60S09 -310/PR	JAM60S09 -315/PR	JAM60S09 -320/PR	JAM60S09 -325/PR	JAM60S09 -330/PR
Rated Maximum Power(P _{max}) [W]	310	315	320	325	330
Open Circuit Voltage(V _{oc}) [V]	40.30	40.53	40.76	41.04	41.30
Maximum Power Voltage(V _{mp}) [V]	32.60	32.69	33.17	33.44	33.75
Short Circuit Current(I _{sc}) [A]	10.04	10.11	10.18	10.25	10.32
Maximum Power Current(I _{mp}) [A]	9.51	9.58	9.65	9.72	9.78
Module Efficiency [%]	18.8	19.1	19.4	19.7	20.0
Power Tolerance	0~+5W				
Temperature Coefficient of I _{sc} (α _{Isc})	+0.06%/°C				
Temperature Coefficient of V _{oc} (β _{Voc})	-0.300%/°C				
Temperature Coefficient of P _{max} (γ _{Pmp})	-0.370%/°C				
STC	Irradiance 1000W/m ² , cell temperature 25°C, AM1.5G				

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer. They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

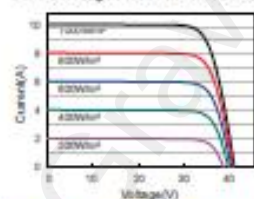
TYPE	JAM60S09 -310/PR	JAM60S09 -315/PR	JAM60S09 -320/PR	JAM60S09 -325/PR	JAM60S09 -330/PR
Rated Max Power(P _{max}) [W]	229	233	237	241	244
Open Circuit Voltage(V _{oc}) [V]	37.95	38.25	38.56	38.85	39.15
Max Power Voltage(V _{mp}) [V]	30.67	31.00	31.32	31.64	31.96
Short Circuit Current(I _{sc}) [A]	7.03	7.07	7.01	7.05	7.09
Max Power Current(I _{mp}) [A]	7.48	7.52	7.58	7.60	7.64
NOCT	Irradiance 800W/m ² , ambient temperature 20°C, wind speed 1m/s, AM1.5G				

OPERATING CONDITIONS

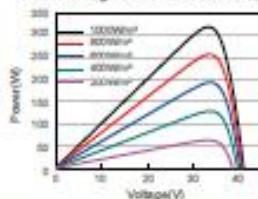
Maximum System Voltage	1000V/1500V DC(IEC)
Operating Temperature	-40°C~+85°C
Maximum Series Fuse	20A
Maximum Static Load, Front	5400Pa
Maximum Static Load, Back	2400Pa
NOCT	45±2°C
Safety Class	Class II

CHARACTERISTICS

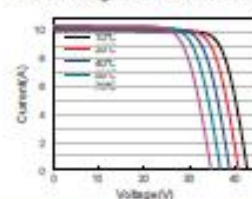
Current-Voltage Curve JAM60S09-320/PR



Power-Voltage Curve JAM60S09-320/PR



Current-Voltage Curve JAM60S09-320/PR



Premium Cells, Premium Modules

Version No. : Global_EN_20200305A