Contents

1. Scope of Works / Description of Systems of Plant & Equipment

1. Scope of the works and Emergency Information

Brief Project Description of works completed

General

The photovoltaic installation comprises of a 50.16 kW peak system with 114 solar panels located on the roof fixed utilising a proprietary rail system. The system is located between gridlines A/01-03 and A1/01-03.

The system has 1 No 80A MCCB located at the main LV Panel at gridline B/03.

From the main LV panel, the electrical contractor has provided the submains cable and the inverter isolator. The isolator is located on the warehouse wall backing at gridline C/1.

There is 1 No Solis S5-GC40K (40 kW) inverter mounted on a channel support system located adjacent to the isolator

DC cables (PV string) are routed from the inverter locations to the PV panels on the roof. DC Cables within the warehouse are enclosed in 75x75 trunking risers. Roof mounted DC cables are fixed to hot dipped galvanised cable tray.

Roof penetration for the DC cables is located as follows:
Gridline C/03

The PV system incorporates a fire shut down following activation of the fire alarm system. The electrical contractor has provided a cable from a fire alarm interface into the shutdown terminals within the inverter.

Testing, Commissioning & Certification

Test certification and commissioning has been carried in accordance with relevant British Standards or Code of Practice.

List of locations of the items installed

Site Address

Panattoni Poyle 80
Horton Rd
Slough
SL3 0BB

Photovoltaic Installation

Independent Energy Group
Marshall House
West Street
Glenfield
Leicester
LE3 8DT

Job Number

P23025

Job Name

Panattoni Poyle 80

Building Owner Documentation

Certification	Details
DC Cables	Site Wide

2. Suppliers and Manufacturers Directory

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Services / Suppliers contact details.

This section provides the manufacturers' name, address, telephone number and fax number (where applicable) for all major plant/equipment items that have been provided for the electrical services installation.

Services/Manufacturer/Suppliers	**Plant/Equipment Description**
Independent Energy Group Marshall House West Street Glenfield Leicester LE3 8DT	Photovoltaic Installation
Solis 1 Church Street Bootle Liverpool L20 1AF Tel: 0113 328 0870 Email: europesales@solisinverters.com (Sales)	Inverter
Canadian Solar Canadian Solar UK Projects, LTD 33 St James's Square London SW1Y 4JS UK	PV Modules
MCG Industrial Unit 1 Railway Court Ten Pound Walk Doncaster South Yorkshire DN4 5FB Tel: +44 (0) 1302 342642 Email: info@mcg.co.uk	Isolator
Clenergy Clenergy Court Blisworth Hill Farm Stoke Road Blisworth Northampton NN7 3DB Tel: 01604 857 674 Fax: 01604 858 620 E-mail: sales_uk@clenergy.com	Roof Mounted fixings

3. Manufacturers Information

Health and Safety and Environment Information

It is the prudent and legal duty of the maintenance authority and/or building owner to ensure as far as is reasonably practical the health and safety of all maintenance staff and other people using the premises. This section of the manual is a guide to some of the precautions to be taken by both management and staff to achieve this.

The equipment and materials referred to in the section should be used, operated and maintained strictly in accordance with these operating instructions or manufacturers literature as appropriate.

It is the duty of every member of the maintenance team to take reasonable care for their own health and safety and that of other people who may be affected by their acts or omissions whilst at work. It is strongly recommended that at least one copy of the Health and Safety at Work Act (1974) is available on the premises and has been read and understood by all maintenance personnel.

Maintenance staff should ensure they are aware of and understand "IN HOUSE" rules and regulations which will have been formulated by the maintenance authority and will incorporate additional safety precautions found to be necessary for local conditions.

It is also incumbent on all persons including building owners, end users, maintenance authorities and maintenance staff, whether resident or visiting, to ensure that they are kept informed about current and pending legislation with respect to health and safety. Management plays an important role in this matter by ensuring that appropriate training/induction courses are given to employees and visiting personnel.

"Risk assessment is a continuous procedure and responsibility"

CDM Regulations

To improve the management of the health and safety aspect of a construction project the Construction (Design and Management) Regulations 2007, or CDM Regulations for short, have been introduced to establish new duties and build upon those imposed by the Management of Health and Safety at Work Regulations 1999.

The Management of Health and Safety at Work Regulations 1999 make more explicit the requirement of Sections 2 and 3 of the Health and Safety at Work Act 1974.

The CDM Regulations affect most construction projects and impose duties throughout all stages on clients, designers, professionals, contractors and site workers including the self employed.

The CDM Regulations also introduced a new level of management to be carried out by the project "Planning Supervisor". If known the Planning Supervisor for this project is listed with the Design / Constructions Team Members in Section 1.

The Planning Supervisor is responsible for notification to the Health and Safety Executive and for co-ordinating the health and safety aspects of the design and planning phase. The Planning Supervisor also has to ensure that a health and safety plan is prepared, monitor the health and safety aspects of the design, advise the client on the satisfactory allocation of resources for health and safety and prepare a health and safety file.

The health and safety plan is primarily concerned with the construction phase and is implemented by the Principal Contractor. However, aspects that arise from the plan and/or are encountered during the construction phases that have possible implications on the future aspects of the project, i.e., maintenance and demolition, must be recorded in the Health and Safety File.

The Health and Safety File is a document that has been progressively enhanced and added to, commencing from the concept/design stage, through construction phase, to final handover. The file is a record of information for the client/end user, which tells those who might be responsible for the structure in the future of the risks that have to be managed during maintenance, repairs or renovation.

It is the responsibility of the Planning Supervisor to ensure that the completed Health and Safety File is made available to the client/end user at the time of handover. The client/end user has to make the file available to those who will work on any future design, building maintenance or demolition of the structure.

This document is not the Project Health and Safety File but may well be an appendix to such a file.

General Precautions

Working Conditions

The requirements of the Health & Safety at Work Act also include, and are relevant to, maintaining the installation in a safe working condition and also to the safety of maintenance personnel themselves.

There is, for example, very little need for maintaining equipment or carrying out repairs whilst equipment is live. Only fault-finding procedures and machinery adjustments are likely to be carried out under this condition.

When measurements need to be taken with covers removed, then proper approved and fused test probes should be used, and adequate warning notices displayed.

Exposed live conductors should never be left unattended.

Good working practice also means that the work place should be kept clean and tidy and that proper procedures are followed, and dangerous short cuts avoided.

Remember: Do **NOT** work on live equipment.

Remove supply first by local isolators and/or removal of MCBs or fuses.

Check that circuit is dead before starting work.

Live Electrical Parts

All guards, screens, shields, covers and lids must be secured with all screws and nuts before machinery is operated. Do not leave unattended live exposed parts. Ensure that all test equipment has proper insulated test probes. All live terminals must be marked accordingly.

Moving Parts

Make sure that all moving parts are properly guarded so that inadvertent contact is avoided. Particular attention must be given to items that can catch clothing.

Avoid working on machinery with guards removed.

Electric Tools/Equipment

The IEE Code of Practice gives specific guidance on procedures for maintaining the safety of portable and transportable electrical equipment. The table below details the frequency of inspection and testing.

Operating Environment	**Type of Appliance**	**Combined Inspection and Testing**	
		Class 1	**Class II**
Construction	Moveable (110V) Portable (110V) Hand - held (110V)	} 3 months	} 3 months
Industrial / Commercial	Stationary Info. Technology Moveable Portable Hand - held	12 months 12 months 12 months 6 months 6 months	12 months 12 months 12 months 6 months 6 months
Equipment used by Public	Stationary Info. Technology Moveable Portable Hand - held	12 months 12 months 6 months 6 months 6 months	12 months 12 months 12 months 12 months 12 months

In addition to the above recommendations, all portable tools should be regularly checked for frayed or damaged leads, and the condition of plugs.

When using drills and other cutting equipment, ensure that the correct safety equipment is used, i.e., gloves, safety glasses.

Do not cut or drill walls immediately above or below accessories, or other electrical equipment without carrying out prior checks.

Hand Tools

Always use the correct tools.

Incorrect tools can cause injury and can result in damage to equipment.

Lifting and Access

To gain access to equipment installed in difficult locations or at high level, ladders steps and scaffolding will often be required.

Make sure that such equipment is kept in good condition. It should be examined regularly and any defective parts repaired or replaced. It must always be used in the approved manner.

Ladders should be secured at the top, or if this is not possible, firmly fixed at the bottom or footed by a second person.

Check chains, ropes, slings, hooks, eyebolts, shackles, etc., regularly, and also before use, to ensure their suitability and condition and that the safe working load is clearly marked. This should be on an insurance schedule.

Do not exceed the safe working load.

Working Area

Make sure that access-ways, corridors and stairs are clear and free of materials likely to cause a person to slip.

Ensure that tools and equipment, spare parts etc., are put away after use.

Check that guard rails and handrails are secure and make sure that they are provided where required.

Guard rails must be provided wherever a person could fall. For maintenance purposes, footholds and handholds should be provided wherever the maintenance staff are liable to fall more than two metres.

Access to equipment should always be by approved means.

Protective Clothing

Ensure that adequate protective clothing is available for use during normal maintenance tasks and for possible emergencies. It should be of the correct size and readily available for new staff and visitors.

Items required will include:

a) Overalls of sufficient quantity to allow for laundering.
b) Hard hats.
c) Adequate protective boots or shoes.
d) Heavy duty industrial gloves.
e) Plastic or PVC gloves.
f) Face masks with spare filters.
g) Eye protection.

Dangerous Chemicals

Where dangerous chemicals are used on an electrical installation, battery electrolyte for example, make sure you know how to deal with spillage and emergencies.

Petrol, paraffin and white spirit are often used for cleaning in electrical installations. Make sure that spillages are dealt with promptly and do not allow any chemicals to run into the wastewater systems and drains.

Where batteries are stored or maintained, personnel should be made aware of the risk of an explosion and signs similar to below should be displayed:

CAUTION - No exposed lights or smoking

CAUTION - Exposed battery connections and bus bars.

Protective clothing and eye protection should be worn when dealing with other stronger cleaning chemicals.

Protective gloves, plastic aprons and eye protection should be worn when dealing with electrolyte and clean water should be available for emergency use in the event of accidental contact.

Where smoking is prohibited and when chemicals are in use, make sure all safety instructions are adhered to.

Permit to Work

One of the most important aspects of safety, but often neglected, is to let others know what work is proceeding and where the staff are located. This is all the more important when dealing with electrical circuits that may affect plant and equipment being operated by others. Additionally, circuits being worked on must be made safe and remain safe throughout the maintenance task.

The best method to ensure that everyone using, operating or maintaining a system is aware of work that is being carried out, is to operate a Permit to Work system. Not only will this improve safety, but it will also enhance the efficiency of the maintenance function by encouraging better planning.

Before any work on a system or piece of equipment is carried out, the operative is required to complete a Permit to Work form which is agreed and signed by the supervisor in charge. The supervisor will ensure that other persons who need to know of the work are informed.

One copy of the form should be put on display whilst the work is proceeding and then filed for future reference.

An example of a Permit to Work is given on the following page and further advice on safe methods of working with electrical power supplies can be found in BS6423, BS6626 and BS6867.

Notes on Permit to Work

Part 1 should be completed by the person authorising the work before issue to the person for the switching isolation, testing and earthing operations. Where the person authorising the work is responsible for the switching etc., they should issue this to themselves as a check on procedure.

Part 2 should be completed by the person responsible for the switching, isolating, testing and earthing operations after their completion.

Part 3 both the original and the duplicate should be signed by the person actually in charge of the work on the apparatus. The original should be retained by the person actually in charge of the work until the work is stopped or completed. The duplicate should be retained by the person authorising the work.

Part 4 should be signed by the person actually in charge of the work when the work has been stopped or completed and then handed back to the person who authorised the work.

Part 5 should be signed by the person responsible for signing Part 2, or in their unavoidable absence, by a person of equivalent status.

Example of Permit to Work -

Permit to Work on Electrical Equipment ..... **No.**.....

Part 1 Authorisation for Work.

A. This permit is issued for the following work .....
By.....To ....
being an authorised person in charge of switching and earthing operations.

B. Switching and Isolating. The apparatus to be disconnected from all live conductors by the following operation .....

C. Potential Tests and Earthing. Potential indicator test to be applied before fixing earths at the following points .....

D. Danger Notices are to be posted at:- .....

E. Caution Notices are to be posted at:- .....

Time.....Date.....Signed.....….....……
…

Rank .....

Part 2 Declaration

I hereby declare that the operations detailed in Parts 1, B, C & D have been completed and the apparatus detailed in Part 1, A, is safe to work on and any adjacent live equipment is securely padlocked. It will not again be made "live" until the Clearance certificate in Part 4 is completed.

ALL OTHER APPARATUS IS DANGEROUS

Time.....Date.....Signed.....……..
...

Rank .....

Part 3 Receipt

I hereby declare that I accept responsibility for doing the work on the apparatus detailed in Part 1, A, of this permit and that no attempt will be made by me or by men under my control to work on any other apparatus.

Time.....Date.....Signed.....…….....
...

Rank ..... …

Part 4 Clearance of Work

This is to certify that the work detailed in Part 1, A above has been (stopped/completed)* men, gear and tools have been withdrawn and local earths removed.

Time.....Date.....Signed.....….....……
…

Rank .....

(*Delete the word that does not apply.)

Part 5 Cancellation

I hereby declare this Permit to Work cancelled, and the earth connections applied at points indicated in Part 1, C. The apparatus is now ready for switching into service.

Time.....Date.....Signed.....…….....
...

Rank .....

General Items

a) **Keys:**
Access to all plant rooms, electrical cupboards and equipment therein which requires a key to open for access, should be controlled and restricted to authorised personnel only.

b) **First Aid:**
First aid boxes should be provided in accessible positions. These should be kept clean and in good repair. Contents of the boxes should be regularly checked and any missing items replaced.

c) **Protective Clothing:**
Where appropriate, wear protective clothing and equipment, i.e., goggles, respirators, safety harnesses. Protective screens should be provided when arc welding is in progress.

d) **Drive Guards and Housings:**
Never work on moving parts of machinery. Exercise caution if working on the stationary parts. Ensure that moving parts are protected by suitable guards. Be aware of warning notices such as:

"REMOTELY CONTROLLED PLANT"

Do not put hands or objects on any item of stationary rotating machinery as this may start automatically at any time.

WARNING:- Before commencing maintenance work on any item of plant, ensure the plant is mechanically isolated from the system and that the electrical supply has also been isolated and locked off. Ensure that all control and ancillary electrical circuits have been made dead.

Fire Precautions

a) All extinguishers must be periodically examined and the contents renewed as required. A separate log listing all types of extinguisher, their location and dates of examination should be kept with the maintenance authority.

b) Each fire alarm associated with the building should be tested weekly.

c) Care must be taken, and adequate protection provided, to prevent fire when welding or carrying out operations involving the application of heat.

The table below shows the various extinguishers and their uses.

FIRE EXTINGUISHERS types and uses

Fire Class as European Standard EN2 and EN3

F**ire class**	**Class "A"** Wood, cloth, paper or similar combustible materials	**Class "B"** Flammable liquids, petrol, oils, grease and fats	**Class "C"** Fires involving gases	**Class "D"** Fires involving metals, magnesium Sodium, Titanium, Zirconium	**Fires involving electrical hazards**
Water **RED**	Most suitable	Do **not** use **DANGEROUS**	Do **not** use **DANGEROUS**	Do **not** use **DANGEROUS**	Do **not** use **DANGEROUS**
A.B.C. all purpose powder **BLUE**	Most suitable	Most suitable	Suitable	Do **not** use **DANGEROUS**	Suitable (non-conductor)
Monnex & B.C. dry powder **BLUE**	Not suitable except for small surface fires	Most suitable	Suitable	Do **not** use **DANGEROUS**	Suitable (non-conductor)
metal powder **BLUE**	Not suitable	Not suitable	Not suitable	Most suitable	Not suitable
Carbon Dioxide **BLACK**	Not suitable except for surface fires	Most suitable leaves no deposits	Suitable	Do **not** use **DANGEROUS**	Most Suitable (non-conductor)
Foam **CREAM**	Suitable	Most suitable	Not suitable	Do **not** use **DANGEROUS**	Not suitable

In accordance with the latest standards all extinguishers should be red with the type being identified by coloured text, etc., as indicated

Warning and Safety Notices

Whenever hazards cannot be avoided or adequately reduced, employers are obliged to ensure that safety and/or health signs are prominently displayed. The signs should conform to BS5378/BS5499 Part 1:1990 and The Health and Safety (Safety Signs and Signals) Regulations 1996.

The principal of the regulations is that signs should be of a distinctive colour and shape with the use of a pictogram to provide the essential details and these fall into the categories shown on the following page:

Emergency Escape and First Aid	Rectangular or square in shape with a white pictogram and/or words on a green background. The green area should account for at least 50% of the sign.
Fire Fighting Equipment	Rectangular in shape with a white pictogram and/or words on a red background. At least 50% of the sign must be red.
Mandatory	These signs should be round in shape with a white pictogram on a blue background. The blue area must account for at least 50% of the sign. Additional words can be given using white characters on a blue background.
Warning	These signs should be triangular in shape with a black pictogram on a yellow background with black edging. The yellow area must account for 50% of the sign. Additional wording can be given using black characters on a yellow background.

The following recommendations should also be observed:

1. At all times warning and safety notices must be maintained and properly displayed and worded to give clear instructions.

2. Notices covering First Aid and Resuscitation from Electric Shock must be displayed in all switch rooms and plant rooms.

3. Proper fire precautions must be observed within switch rooms, plant rooms and building.

4. Notices must be displayed stating:

NO SMOKING or SMOKING PROHIBITED IN THIS AREA

5. All fire fighting equipment must be clearly marked and available for use.

A warning notice stating the maximum voltage present should be fixed to every item of equipment (or enclosure) which contains circuits operating at voltage in excess of 250 volts (usually 3-phase circuits) where such voltage would not normally be expected.

Where accessories, control gear or switchgear are wired on different phases of a three phase supply, but can be reached simultaneously, a notice must be placed in a position where anyone removing an accessory, or gaining access to the terminals of control gear, switchgear etc., is warned of the maximum voltage.

In addition, all live terminal blocks that are not rendered safe by switching off an equipment isolator should be labelled accordingly.

Particular attention should be paid to control circuits which are fed from a separate source that remain live even after operation of the main switch. In these circumstances, a separate label should be fitted and marked:

DANGER - CONTROL CIRCUIT ALIVE ISOLATE ELSEWHERE

All rooms containing switchgear above 230 volts should carry a warning label "400 Volt Switchgear" or similar.

It is also useful to have a stock of temporary labels with suitable means of attachment. Typical labels required would be:

DANGER - 400 VOLTS - EQUIPMENT UNDER REPAIR

DANGER - OUT OF ORDER - DO NOT USE

DANGER - CIRCUIT UNDER REPAIR - DO NOT SWITCH ON

Designers Risk Assessment

Activity Element	Significant Potential Hazard	Severity (S)	Likelihood (L)	Initial Risk Rating (SxI)	Design Actions To Be Taken	Residual Risk Rating	Reduced Risk Factors	Who Is Affected
Installation of DC cabling to solar panel etc.	Slips, trips or falls Electric shock, burns or explosion	4	2	8	Review of location / accessibility	1	Ensure sufficient space to allow installation. Maintained suitable access paths and clear working area. Edge protection to be provided	CO
Offloading and moving PV panels	Back strain & foot injury	2	2	4	Operatives advised of risks and told to avoid manual handling which may cause injury, lifting aids used when practical, hand protection to be worn and when necessary two men to lift.	2		CO
Work adjacent to high drops	Fall of personnel	3	2	6	No operatives to work closer than 3m from edge of building, operative working on roof to communicate via 2 way radio or mobile phone with operatives working on the ground	2		CO
Working around rooflights	Fall of personnel	3	2	6	Rooflights to be surrounded by warning cones and tape, operatives to be secured to man-safe system via lanyard	2		CO
High level services installation	Risk of falling	2	1	2	Reduce number of high-level services where possible. Ensure all services are accessible	2	Operatives advised to use safe working platforms where required	CO
Working near or in heavy traffic	Risk of falls or electric shock	2	1	2	Reduce number of services near public access and close to site boundary	1	Ensure sufficient space to allow installation. Maintained suitable access paths and clear working area	CO
Working on Roof	Slip hazard working on metal roofs in wet or frosty conditions	2	3	6	No operatives to work closer than 3m from edge of building, operatives to be secured to man-safe system via lanyard	2	Maintained suitable access paths and clear working area. Edge protection to be provided	CO
High level services installation	Risk of falling	2	1	2	Reduce number of high-level services where possible. Ensure all services are Accessible. Ensure correct access equipment is used and suitable for the relevant works and working surfaces are clear, firm and level. Do not lean out from access equipment, or allow it to be overloaded. Hard hat with a Chin strap to	2	Operatives with the necessary training and qualifications are only to use access equipment. Check access equipment is safe to use and if a tower check the PASMA ticket is valid.	CO

					be worn at all times and harnesses to be connected to the correct anchor points			
High level services installation	Risk of falling objects/equipment	2	1	2	Reduce number of high-level services where possible. Ensure all services are accessible. Ensure no materials hang over the basket or platform of the access equipment and check kick boards are in place for towers. Do not overreach from the platform and ensure tooling is tethered where practical/possible	2	Operatives advised to use safe working platforms & sectioned off area of work with clearly visible 'work in progress' type signs, Where possible ensure a banksman is at ground level.	CO
Manual handling	Lifting of inverter,solar panel or other equipment to allow installation. Slips, trips or falls	2	2	4	Assess the weight of materials before trying to lift and see if materials can be split into smaller groups? Where possible use powered lifting equipment	2	RAMS to be reviewed to ensure that installation requirements are meet and suitable lifting equipment has been allowed for.	CO
Working at height	Falls, electric shock, burns or explosion.	4	2	8	Detail of equipment with installation requirements and equipment weights.	1	RAMS to be reviewed to ensure that installation requirements are meet and suitable lifting / access equipment has been allowed for.	CO
Working at height	Equipment, materials or tools being dropped from height	4	2	8	Controlled work zones to keep other site personnel outside of the area	1	RAMS to detail required for a barrier off safe zone below the proposed work area.	CO
Cable selection to meet equipment loads	Fault tripping or fire / explosion	4	2	8	Ensure that the , cable or circuit protection device meet the imposed designed load.	1	Ensure that the final installation loads don't exceed the design load plus spare capacity requirements.	CO
Protective devise selection	Fault tripping or fire / explosion	4	2	8	Correct selection of protection devices to meet the proposed loads.	2	Fault tripping or poor discrimination for protection of circuits.	CO / MP
Electrical Equipment location & Point of isolation	Fault tripping or fire / explosion	4	2	8	Accessible and clearly labelled/identified isolation points.	2	Secure isolation methods used such as lock off signs. Ensure no work is carried out in wet areas. Check for signs of damaged cabling or installation.	CO / MP
Maintenance / servicing	Accessibility	4	2	8	Ensure that there is sufficient space to allow installation and maintenance	1	Not being able to install the equipment.	CO/ MP
Working on, or near to electrical systems	Electric shocks	4	1	4	Isolate electrical supplies following the correct procedures and ensure they are locked off and proven dead before starting works. Treat all cables and supplies as live until proven otherwise	1	Only person with the relevant competence, knowledge and competence should carry out isolations or work near electrical services. Ensure test equipment used to check supplies are isolated are operating correctly and have been calibrated. Only	CO

							used tooling which has been tested to 1000v and has BS/BSEN markings.	
Installing of cables	Risk of cables falling	2	1	3	Ensure cable drum jacks are used to pull cables on containment and the correct number of persons are used at relevant locations (cable drum, cable end, change of direction). Do not let the weight of the cable hang down. Ensure areas are coned off to prevent others walking under cables being pulled. Do not used powered access equipment to pull the cables.	1	Ensure cables are pulled in a steady manor and twists and bends in the cable are avoided.	CO
Cutting containment with powered disk tooling (hand angle grinder/chop saw)	Risk of fire	2	2	6	Ensure materials are cut in an agreed working area with no flammable material present. Ensure the correct type of fire extinguisher is used and the person cutting has the necessary competence and qualifications to use the extinguisher.	1	Obtain a hot works permit from main contractor and ensure the last hot cutting is carried out 1 hour before the end of the shift. Keep the working area clear and tidy and do not store flammable/combustible materials in the area. Wear non flammable clothing, goggles, hearing protection and gloves when cutting. Fit warning signs to the area.	CO
Hand cutting containment/support framework	Risk of injury (cuts)	2	3	3	Ensure the correct type of gloves are worn when handling/cutting materials. Remove burrs and sharp edges.	2	Wear the correct type of gloves and safety equipment	CO
Installing lighting/heavy/awkward equipment	Risk of injury (back)	2	3	4	Assess materials before trying to lift and use mechanical/powered lifting equipment where possible. See if equipment can we split into sections to reduce weight/size. Ensure working area is clear to prevent trips/slips when moving lifting equipment.	3	Assess equipment before trying to lift and the method of installation and confirm if weight could be split into smaller sizes.	CO
Noise	Contractors may suffer discomfort and potential hearing damage if working in noisy areas or using noisy equipment	2	2	4	Where ear defenders and knows how to use them effectively and maintain them properly. Contractors instructed to wear suitable hearing protection when the job exposes them to loud noise.	2	Do not carry out any works with powered access equipment without assessing if noise protection equipment is required to be worm.	CO
Tools (power tools/leads)	The use of electrically powered equipment with risk of electric shock / death	4	1	4	Before using powered equipment make a visual check of the equipment they are to use. If there is any evidence of damage to the case, cabling or plug return to toolbox for off-site inspection / repair Use only 110v tools with transformer / RCD	2		CO

The use of hand tools	The use of hand tools with risk of cut, abrasion, personal injury	4	1	4	Ensure all tools used in accordance with manufacturer instructions. Damaged or worn tools must not be used. Ensure that gloves are worn to EN388 standard. Store tools safely and cover where appropriate. All tools to be used by competent personnel.	2		CO
Dead testing	Electrocution	4	2	8	Provide cable schedules for production of testing sheets	2	Db to be isolated and locked of by electrician and supervisor	CO / MP
Live testing	Electrocution	4	2	8	Provide cable schedules for production of testing sheets. Follow the correct testing procedures as laid by BS7671 and HSE. Use the correct type of test equipment with the necessary fused leads. Fit barriers around electrical DB's and warning notices and fit covers when not at the DB.	2	Ensure supplies are locked off until testing is required and have a Permit to Work in place. Only persons with the necessary competence, knowledge and qualifications should carry out the testing process. Warning notices to be fitted whilst testing and also afterwards to indicate supplies are live..	CO / MP
Equipment selection	Fault tripping or fire / explosion	4	2	8	Ensure that the cable or circuit protection device meet the designed load	2	Ensure that the final installation loads don't exceed the design load plus spare capacity requirements.	CO / MP

COSHH Data Report

The Control of Substances Hazardous to Health Regulation 1999 (CoSHH) requires that no work which is liable to expose anyone to substances hazardous to health shall be carried on unless an assessment has been made. This means:

- Evaluating the risks to health arising from work involving substances hazardous to health and safety.

- Establishing what has to be done to meet the requirements of the whole of the CoSHH Regulations.

The assessments have to be "suitable and sufficient" in relation to both of these elements.

It is an essential requirement and duty for employers to make an assessment of the health risks created in the work place and of the measures to be taken.

CoSHH also requires employers to introduce "health surveillance" to an appropriate level where substances are present that may damage health. As part of the CDM Regulations, CoSHH assessments will have already been carried out for the construction phase and these are likely to remain relevant for maintenance procedures and future modifications carried out to the installation.

However, assessments must be continually reviewed and, if necessary, updated should work procedures alter or if it becomes apparent that the original assessment is no longer valid.

Further advice on CoSHH can be found in the following publications:

- CoSHH - Construction Industry Advisory Committee
- A step-by-step Guide to CoSHH Assessment
- Health Surveillance under CoSHH - Guidance for Employers.

The above publications are available for HSE Books.

The HVCA and ECA both publish CoSHH data sheets covering a range of substances commonly used in the industry and which can be obtained for use as a guide.

Plant Equipment Asset Register

Manufacturer	Description/s	Catalogue Number/s	Area Installed
Solis	40KW Inverter	Solis S5-GC40K	Warehouse
Canadian Solar	440W PV panel	TOPHiKu6 CS6R-440T	Roof
Clenergy	Roof Mounting system	PV-ezRack	Roof
MCG Industrial	100A Isolator	SMI100-4	Warehouse
United Industries	DC Cable	H1Z2Z2-K	Warehouse/Roof

Description and Operating Procedures, manufacturers literature pre commissioning reports, checklists for equipment installed

Brief Project Description of works completed

General

The photovoltaic installation comprises of a 600KW peak system with 1464 solar panels located on the roof fixed utilising a proprietary rail system. The system is split into 2 with 732 panels located at gridline D/9-32 and 732 panels located at gridline J/9-32.

The PV system has 2 No 630A PV panelboard located on the wall of Distribution Office 1 at gridline C/21-22 and located on the wall of Distribution Office 2 at gridline K/23-24.

From each of the PV panel boards there are 2 x4c95mm cables routed on cable ladder to the local Main LV panel. At each Main LV panel there is a 630A 4 pole MCCB with an export meter.

There are 6 No Solis Pro 80KW inverters in total, 3 at Distribution Office 1 and 3 at Distribution Office 2. The inverters are located adjacent to the PV panelboards and are mounted on a channel support system. From each of the PV panelboards 4c35mm cables are routed on tray to each of the inverters with 160A rated local isolator.

DC cables (PV string) are routed from the inverter locations to the PV panels on the roof. DC Cables within the warehouse are enclosed in 150x150 trunking risers. Roof mounted DC cables are fixed to hot dipped galvanised cable tray.

Roof penetration for the DC cables are located as follows:
Gridline C/22
Gridline K/24

The PV system incorporates a fire shut down following activation of the fire alarm system. The electrical contractor has provided a cable from a fire alarm interface to a PV control box within the warehouse which is connected to roof mounted relay boxes. The relay box on roof shuts off the DC cable supply from the roof mounted solar panels.

Testing, Commissioning & Certification

Test certification and commissioning has been carried in accordance with relevant British Standards or Code of Practice.

Solis

solis

GINLONG TECHNOLOGIES CO.,LTD.

S5-GC(25-40)K

Solis Three Phase Grid-Tied Inverters

Efficient

- Max. efficiency 98.7%
- String current up to 16A
- 3/4 MPPT design, supports multiple orientation system design
- Night time PID recovery function, increases overall system yield (optional)
- Wide voltage range and low startup voltage

Safe

- IP66
- AFCI protection, proactively reduces fire risk
- Globally recognised branded componentry for longer life
- Intelligent redundant fan-cooling

Smart

- Supports export power control
- Intelligent string monitoring, smart I-V curve scan
- Supports RS485, WiFi, GPRS
- Scan to register on SolisCloud, supports remote upgrade and control

Economic

- Supports GPRS/WiFi communication with less wiring and reduced installation costs
- > 150% DC/AC ratio
- Supports high power modules for lower installation costs

Models:

S5-GC25K / S5-GC30K

S5-GC33K / S5-GC36K

S5-GC40K

360º View

DATASHEET

S5-GC(25-40)K

Models	25K	30K	33K	36K	40K
Input DC					
Recommended max. PV power	37.5 kW	45 kW	49.5 kW	54 kW	60 kW
Max. input voltage	1100 V				
Rated voltage	600 V				
Start-up voltage	180 V				
MPPT voltage range	200-1000 V				
Max. input current	32 A / 32 A / 32 A			4*32 A	
Max. short circuit current	40 A / 40 A / 40 A			4*40 A	
MPPT number/Max. input strings number	3/6			4/8	
Output AC					
Rated output power	25 kW	30 kW	33 kW	36 kW	40 kW
Max. apparent output power	27.5 kVA	33 kVA	36.3 kVA	39.6 kVA	44 kVA
Max. output power	27.5 kW	33 kW	36.3 kW	39.6 kW	44 kW
Rated grid voltage	3/N/PE, 220 V / 380 V, 230 V / 400 V				
Rated grid frequency	50 Hz / 60 Hz				
Rated grid output current	38.0 A / 36.1 A	45.6 A / 43.3 A	50.1 A / 47.6 A	54.7 A / 52.0 A	60.8 A / 57.7 A
Max. output current	41.8 A	50.2 A	55.1 A	60.2 A	66.9 A
Power factor	>0.99 (0.8 leading - 0.8 lagging)				
THDi	<3%				
Efficiency					
Max. efficiency	98.5%		98.6%	98.7%	
EU efficiency	98.1%		98.2%	98.3%	
Protection					
DC reverse-polarity protection	Yes				
Short circuit protection	Yes				
Output over current protection	Yes				
Surge protection	DC Type II / AC Type II				
Grid monitoring	Yes				
Anti-islanding protection	Yes				
Temperature protection	Yes				
Strings monitoring	Yes				
I/V Curve scanning	Yes				
Integrated AFCI (DC arc-fault circuit protection)	Yes (1)				
Integrated PID recovery	Optional				
Integrated DC switch	Optional				
General Data					
Dimensions (W*H*D)	647*629*252 mm				
Weight	38.2 kg			42.1 kg	
Topology	Transformerless				
Self-consumption (night)	<1 W				
Operating ambient temperature range	-25 ~ +60°C				
Relative humidity	0-100%				
Ingress protection	IP66				
Cooling concept	Intelligent redundant fan-cooling				
Max. operation altitude	4000 m				
Grid connection standard	G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530				
Safety/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4				
Features					
DC connection	MC4 connector				
AC connection	OT terminal				
Display	LCD				
Communication	RS485, Optional: Wi-Fi, GPRS				

(1) Activation required.

Ginlong Technologies Co., Ltd.
No. 57 Jintong Road, Binhai Industrial Park, Xiangshan, Ningbo,
Zhejiang, 315712, P.R.China.
Tel: +86 (0)574 6578 1806
Fax: +86 (0)574 6578 1606
Email:info@ginlong.com
Web:www.ginlong.com

Please adhere to the actual products in case of any discrepancies in this user manual.

If you encounter any problem on the inverter, please find out the inverter S/N and contact us, we will try to respond to your question ASAP.

Solis S5 Three Phase Inverter

S5-GC(25-50)K Installation and Operation Manual

Ver 1.3

Ginlong Technologies Co., Ltd.

Contents

1.1 Product Description

Solis three phase inverter is suitable for utility-scale PV projects .
This manual covers the three phase inverter model listed below:
S5-GC25K, S5-GC30K, S5-GC33K, S5-GC36K, S5-GC40K, S5-GC40K-HV,
S5-GC50K-HV, S5-GC15K-LV, S5-GC20K-LV, S5-GC23K-LV
The following one model is specially supplied for Brazil market:
S5-GC37.5K
The following one model is specially supplied for Brazil market:
S5-GC30K-BE

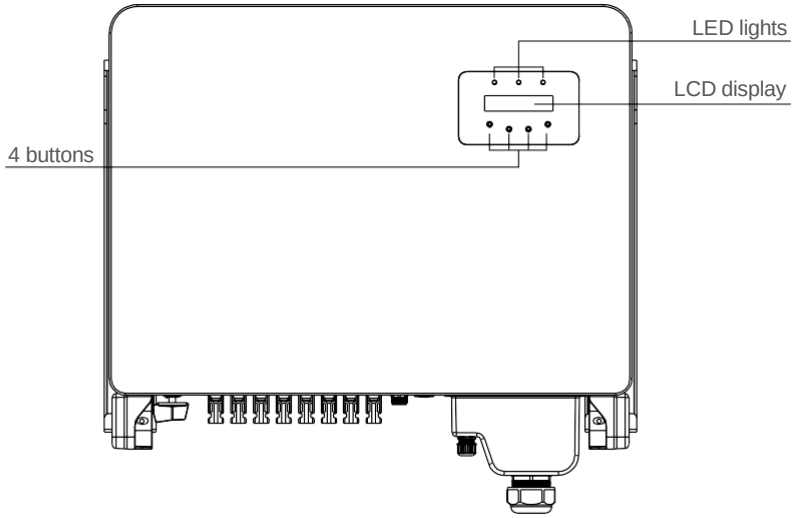


Figure 1.1 Front view

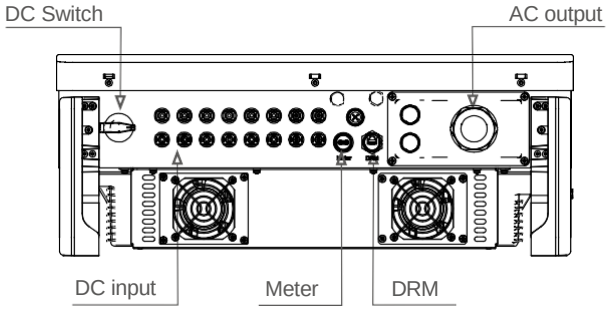
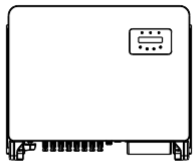


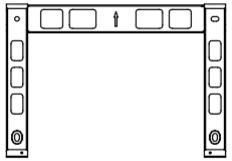
Figure 1.2 Bottom view

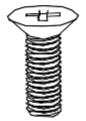
1. Introduction

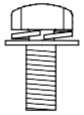
1.2 Packaging

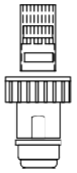
When you receive the inverter, please ensure that all the parts listed below are included:

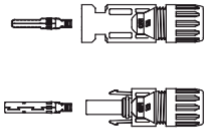

Inverter x1

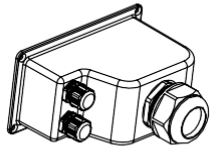

Back plate x1


Cross screws x4


Hex screws x2


RJ45 connector x1


DC connectors x6 or x8
(On basis of actual string number of inverter)


AC terminal cover x1

User manual x1

If anything is missing, please contact your local Solis distributor.

2.1 Safety Symbols

Safety symbols used in this manual, which highlight potential safety risks and important safety information, are listed as follows:

WARNING:
WARNING symbol indicates important safety instructions, which if not correctly followed, could result in serious injury or death.

NOTE:
NOTE symbol indicates important safety instructions, which if not correctly followed, could result in some damage or the destruction of the inverter.

CAUTION:
CAUTION, RISK OF ELECTRIC SHOCK symbol indicates important safety instructions, which if not correctly followed, could result in electric shock.

CAUTION:
CAUTION, HOT SURFACE symbol indicates safety instructions, which if not correctly followed, could result in burns.

2.2 General Safety Instructions

WARNING:
Please don't connect PV array positive(+) or negative(-) to ground, it could cause serious damage to the inverter.

WARNING:
Electrical installations must be done in accordance with the local and national electrical safety standards.

WARNING:
To reduce the risk of fire, over-current protective devices (OCPD) are required for circuits connected to the Inverter.
The DC OCPD shall be installed per local requirements. All photovoltaic source and output circuit conductors shall have disconnects that comply with the NEC Article 690, Part II. All Solis three phase inverters feature an integrated DC switch.

CAUTION:
Risk of electric shock. Do not remove cover. There is no user serviceable parts inside. Refer servicing to qualified and accredited service technicians.

CAUTION:
The PV array (Solar panels) supplies a DC voltage when they are exposed to sunlight.

CAUTION:
Risk of electric shock from energy stored in capacitors of the Inverter.
Do not remove cover for 5 minutes after disconnecting all power sources (service technician only). Warranty may be voided if the cover is removed without unauthorized.

CAUTION:
The surface temperature of the inverter can exceed 75℃ (167℉).
To avoid risk of burns, DO NOT touch the surface when inverter is operating.
The inverter must be installed out of reach of children.

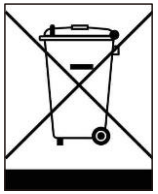
2.3 Notice For Use

The inverter has been constructed according to the applicable safety and technical guidelines. Use the inverter in installations that meet the following specifications only:

1. Permanent installation is required.
2. The electrical installation must meet all the applicable regulations and standards.
3. The inverter must be installed according to the instructions stated in this manual.
4. The inverter must be installed according to the correct technical specifications.
5. To startup the inverter, the Grid Supply Main Switch (AC) must be switched on, before the solar panel's DC isolator shall be switched on. To stop the inverter, the Grid Supply Main Switch (AC) must be switched off before the solar panel's DC isolator shall be switched off.

2.4 Notice for Disposal

This product shall not be disposed of with household waste. They should be segregated and brought to an appropriate collection point to enable recycling and avoid potential impacts on the environment and human health. Local rules in waste management shall be respected .



3. Overview

3.1 Front Panel Display

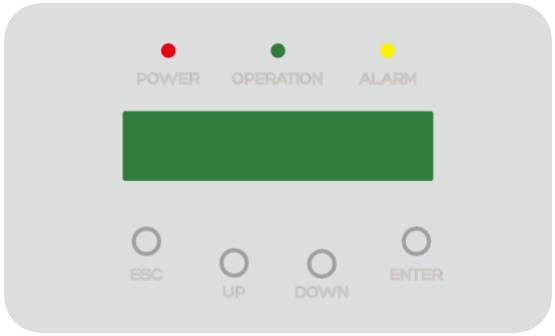


Figure 3.1 Front Panel Display

3.2 LED Status Indicator Lights

	Light	Status	Description
①	POWER	ON	The inverter can detect DC power.
		OFF	No DC power or low DC power.
②	OPERATION	ON	The inverter is operating properly.
		OFF	The inverter has stopped to supply power.
		FLASHING	The inverter is initializing.
③	ALARM	ON	Alarm or fault condition is detected.
		OFF	The inverter is operating without fault or a larm.

Table 3.1 Status Indicator Lights

3.3 Keypad

There are four keys in the front panel of the Inverter(from left to right): ESC, UP, DOWN and ENTER keys. The keypad is used for:

- Scrolling through the displayed options (the UP and DOWN keys);
- Access to modify the adjustable settings (the ESC and ENTER keys).

3.4 LCD

The two-line Liquid Crystal Display (LCD) is located on the front panel of the Inverter, which shows the following information:

- Inverter operation status and data;
- Service messages for operator;
- Alarm messages and fault indications.

4. Product handing and storage

4.1 Product handling

Please review the instruction below for handling the inverter:

1. The red circles below denote cutouts on the product package.
   Push in the cutouts to form handles for moving the inverter (see Figure 4.1).

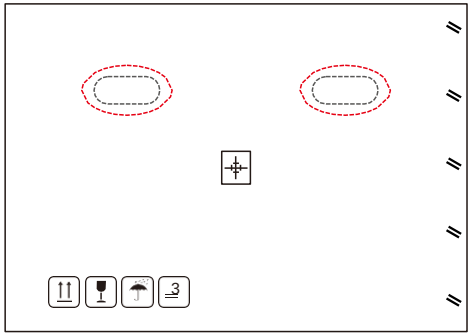


Figure 4.1 move the inverter

2. Open the carton, then two people handle both sides of inverter through the area denoted dotted line. (see figure 4.2).

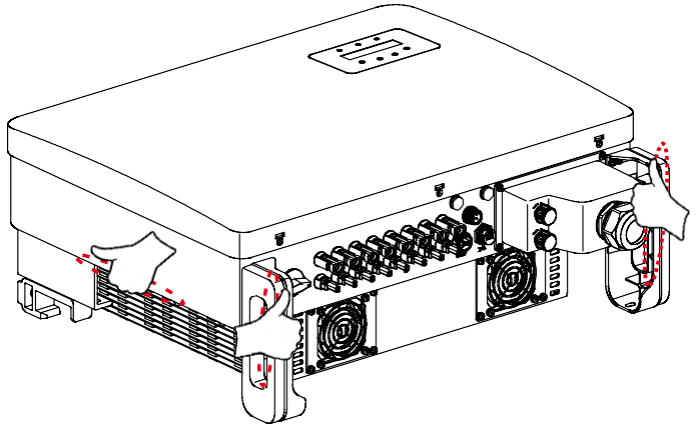


Figure 4.2 Inverter handles

NOTE:
Be careful to lift the inverter. The weight is around 45kg.

4. Product handing and storage

4.2 Product Storage

If the inverter is not to be installed immediately, storage instructions and environmental conditions are below:

- Use the original box to repackage the inverter, seal with adhesive tape with the desiccant inside the box.
- Store the inverter(s) in a clean and dry place, free of dust and dirt.
- Storage temperature must be between -40℃ and 70℃ and the humidity should be between 0 and 95% non-condensing.
- Stack no more than three (3) inverters high.
- Keep box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect packaging regularly. If packaging is damaged(wet, pest damage, etc), repackage the inverter immediately.
- Store the inverter(s) on a flat, hard surface - not inclined or upside down.
- After long-term storage, the inverter needs to be fully examined and tested by qualified service or technical personnel before using.
- Restarting after a long period of non-use requires the equipment to be inspected and, in some cases, the removal of oxidation and dust that has settled inside the equipment will be required.

5. Installation

5.1 Select a Location for the Inverter

To select a location for the inverter, the following criteria should be considered:

WARNING: Risk of fire

Despite careful construction, electrical devices can cause fires.

- Do not install the inverter in areas containing highly flammable materials or gases.
- Do not install the inverter in potentially explosive atmospheres.
- The mounting structure where the inverter is installed must be fireproof.

- Do not install in small closed spaces where air can not circulate freely. To avoid overheating, always make sure the flow of air around the inverter is not blocked.
- Exposure to direct sunlight will increase the operational temperature of the inverter and may cause output power limiting. Ginlong recommends inverter installed to avoid direct sunlight or raining.
- To avoid over heating ambient air temperature must be considered when choosing the inverter installation location. Ginlong recommends using a sun shade minimizing direct sunlight when the ambient air temperature around the unit exceeds 104°F/40°C.

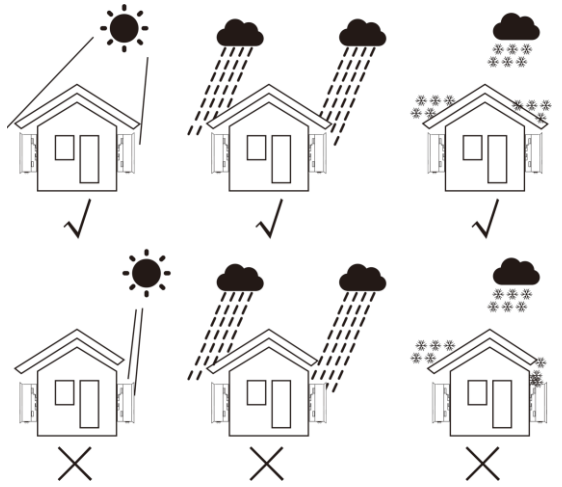
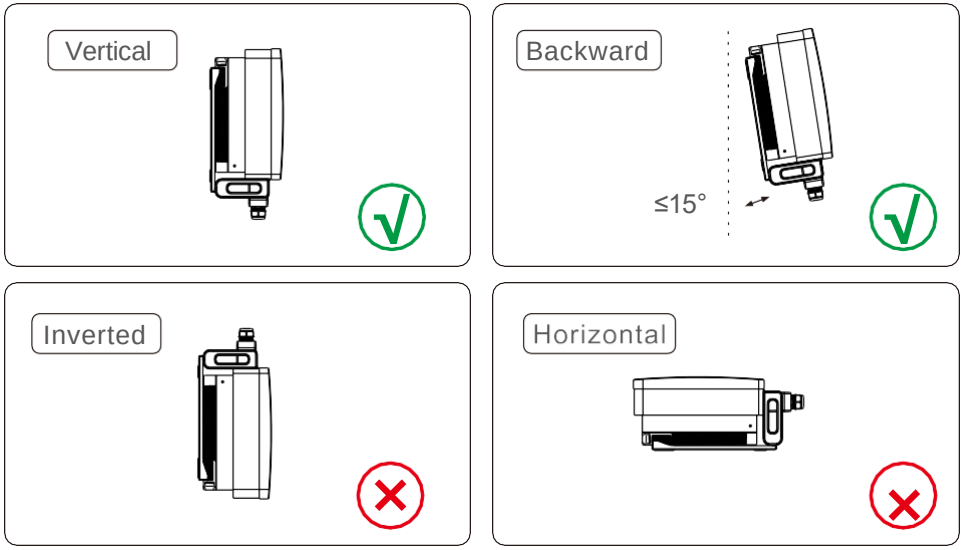


Figure 5.1 Recommended Installation locations

NOTE:

Nothing should be stored on or placed against the inverter.



- Install on a vertical surface or structure capable of bearing the weight.
- Please install the inverter vertically. If the inverter cannot be mounted vertically, it may be tilted backward to 15 degrees from vertical.
- For multiple inverters are installed on site, a minimum clearance of 500mm,should be kept between each inverter and any other mounted equipment. The bottom of the inverter must be at least 500mm from the ground or floor. See figure 5.2.
- Visibility of the LED status indicator lights and LCD display screen should be considered.

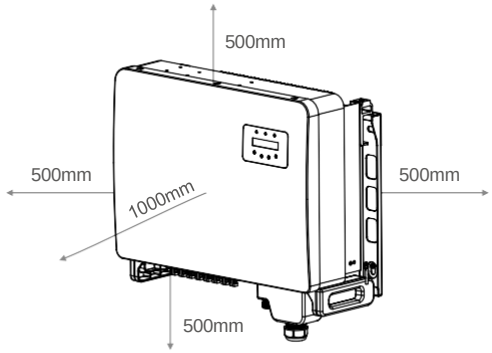


Figure 5.2 Inverter Mounting clearance

5.2 Mounting the Inverter

Back hanging plate size:

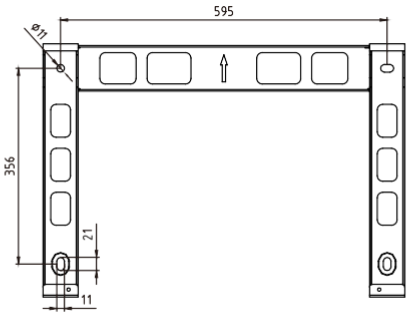


Figure 5.3 Inverter wall mounting

Refer to figure 5.4 and figure 5.5. Inverter shall be mounted vertically.
The steps to mount the inverter are listed below.

1. Refer to Figure 5.4, the holes for expansion bolt based on the hole diameter of bracket (M10*70) , using the percussion drilling with the 10mm drill need to stay vertically on the wall. And the drill hole must be vertically on the wall. And all drill holes' depth is 60mm.
2. Make sure the bracket is horizontal. And the mounting holes (in Figure 5.4) are marked correctly. Drill the holes into wall at your marks.
3. Use the suitable expansion screws to fix the bracket on the wall.

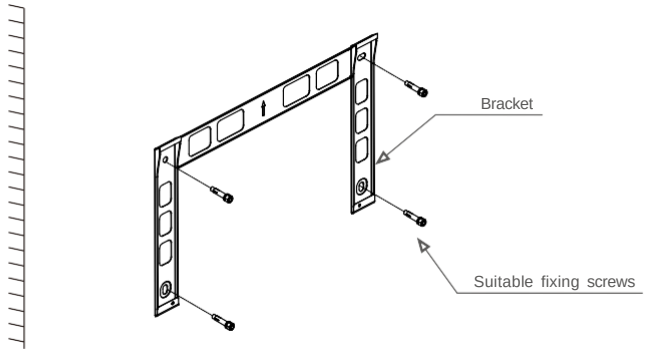


Figure 5.4 Inverter wall mounting

WARNING:
The inverter must be mounted vertically.

4. Lift the inverter and hang it on the bracket, and then slide down to make sure they match perfectly.

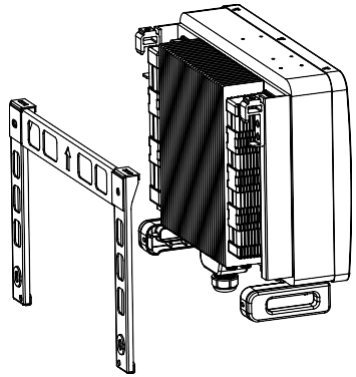


Figure 5.5 Install the inverter

5. If the installation position is high, the inverter cannot be directly mounted on the mounting plate, and the hoisting rope is hoisted through the two lifting holes.

(The rope needs to meet the load-bearing requirements of this product) .

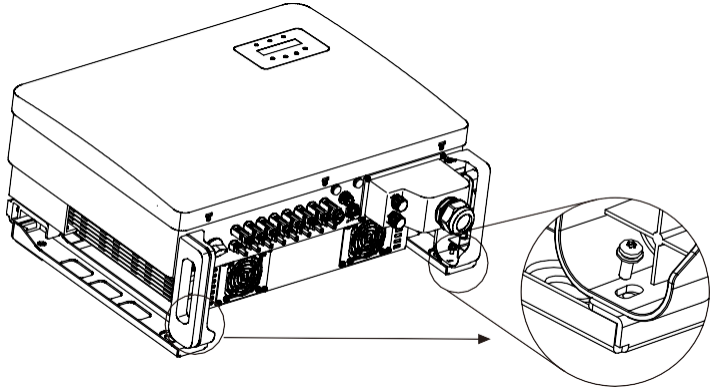


Figure 5.6

5.3 Electrical Connections

Inverter designs quick-connect terminal, so top cover needn't open during electrical connection. The sign meaning located the bottom of inverter, as shown below in table 5.1. All electrical connections are suit for the local or national standard.

DC 1 ~ DC 8	DC input terminal
ON	Switch on the DC switch
OFF	Switch off the DC switch
COM1	COM port for monitoring
METER	COM port for Meter
DRM	COM port for DRM

Table 5.1 Electrical connection symbols

The electrical connection of the inverter must follow the steps listed below:

1. Switch the Grid Supply Main Switch (AC) OFF.
2. Switch the DC Isolator OFF.
3. Connect the inverter to the grid.
4. Assemble PV input connector to the Inverter.

5.3.1 Grounding

To effectively protect the inverter, two grounding methods must be performed.
Connect the AC grounding cable (Please refer to section 5.3.3)
Connect the external grounding terminal.

To connect the grounding terminal on the heat sink, please follow the steps below:

1. Prepare the grounding cable: recommend to use the ≥ 16mm² outdoor copper-core cable.
2. Prepare OT terminals: M6.

Important:
For multiple inverters in parallel , all inverters should be connected to the same ground point to eliminate the possibility of a voltage potential existing between inverter grounds.

3. Strip the ground cable insulation to a suitable length(see Figure 5.7).

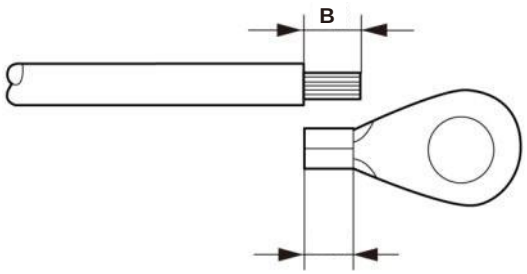


Figure 5.7 Suitable length

Important:
B (insulation stripping length) is 2mm~3mm longer than A (OT cable terminal crimping area) 2mm~3mm.

4. Insert the stripped wire into the OT terminal crimping area and use the hydraulic clamp to crimp the terminal to the wire (see Figure 5.8).

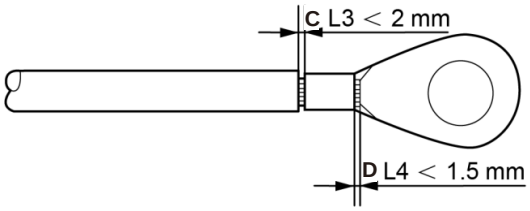


Figure 5.8 Strip wire

Important:
After crimping the terminal to the wire, inspect the connection to ensure the terminal is solidly crimped to the wire.

5. Remove the screw from the heat sink ground point.
6. Connect the grounding cable to the grounding point on the heat sink,and tighten the grounding screw, Torque is 3-4Nm(see figure 5.9).

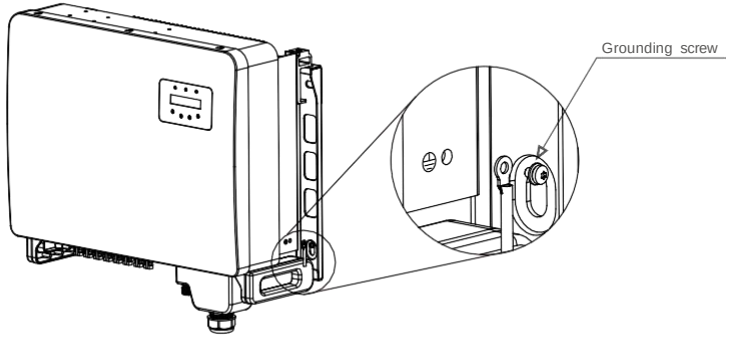


Figure 5.9 Fixed cable

Important:
For improving anti-corrosion performance,
after ground cable installed, apply silicone or paint is preferred to protect.

5.3.2 Connect PV side of inverter

Before connecting inverter, please make sure the PV array open circuit voltage is within the limit of the inverter.

Before connection, please make sure the polarity of the output voltage of PV array matches the“DC+”and“DC-”symbols.

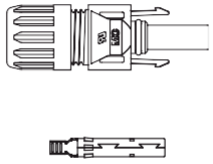


Figure 5.10 DC+ Connector

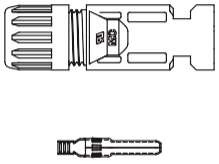


Figure 5.11 DC- Connector

Please use appropriate DC cable for PV system.

Cable type	Cross section（mm²）	
	Range	Recommended value
Industry generic PV cable (model:PV1-F)	4.0~6.0 （12~10AWG）	4.0（12AWG）

The steps to assemble the DC connectors are listed as follows:

1. Strip off the DC wire for about 7mm, disassemble the connector cap nut. (see Figure 5.12)
2. Insert the wire into the connector cap nut and contact pin. (see Figure 5.13)
3. Crimp the contact pin to the wire using a proper wire crimper. (see Figure 5.14)
4. Insert metal connector into top of connector, and tighten nut with torque 3-4 Nm (see figure 5.15).
5. Measure PV voltage of DC input with multimeter, verify DC input cable polar (see figure 5.16), and ensure each string of PV voltage in range of inverter operation. Connect DC connector with inverter until hearing a slight clicking sound indicates connection succeed. (see figure 5.17)

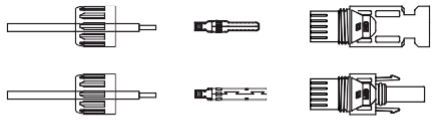


Figure 5.12 Disassemble the Connector Cap nut

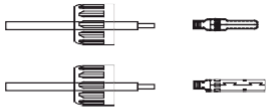


Figure 5.13 Insert the Wire into the Connector Cap nut and contact pin

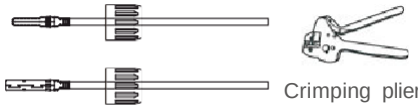


Figure 5.14 Crimp the contact pin to the wire

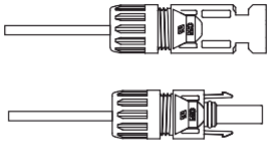


Figure 5.15 Connector with Cap nut Screwed on

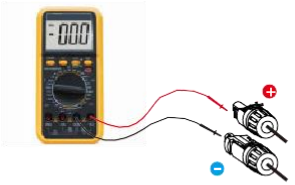


Figure 5.16 Multimeter measurement

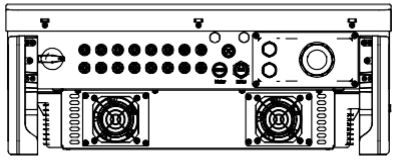


Figure 5.17 Connect the DC Connectors to the Inverter

Caution:

If DC inputs are accidently reversely connected or inverter is faulty or not working properly, it is NOT allowed to turn off the DC switch. Otherwise it may cause DC arc and damage the inverter or even lead to a fire disaster.
The correct actions are:
*Use a clip-on ammeter to measure the DC string current.
*If it is above 0.5A, please wait for the solar irradiance reduces until the current decreases to below 0.5A.
*Only after the current is below 0.5A, you are allowed to turn off the DC switches and disconnect the PV strings.

* In order to completely eliminate the possibility of failure, please disconnect the PV strings after turning off the DC switch to aviod secondary failures due to continuous PV energy on the next day.
Please note that any damages due to wrong operations are not covered in the device warranty.

5.3.3 Connect grid side of inverter

For the AC connection, 10-35mm² cable is required to be used.
Please make sure the resistance of cable is lower than 1.5ohm.

Cable specification		Copper-cored cable
Traverse cross sectional area (mm²)	Range	10~35
	Recommended	25
Cable outer diameter (mm)	Range	22~32
	Recommended	27

NOTE:
For reliable connection, recommend customer select corresponding Euro type connectors based on wiring specification to connect the terminal.

The steps to assemble the AC grid terminals are listed as follows:

1. Strip the end of AC cable insulating jacket about 80mm then strip the end of each wire. (as shown in figure 5.18)

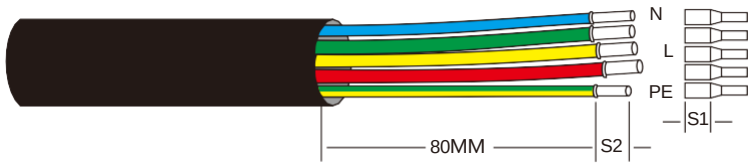


Figure 5.18 Strip AC cable

NOTE:
S2 (insulation stripping length) should be as long as S1 (AC terminal cable compression area).

2. Strip the insulation of the wire past the cable crimping area of the OT terminal, then use a hydraulic crimp tool to crimp the terminal. The crimped portion of the terminal must be insulated with heat shrinkable tube or insulating tape.
3. Leave the AC breaker disconnected to ensure it does not close unexpectedly.
4. Remove the 4 screws on the inverter junction box and remove the junction box cover .
5. Insert the cable through the nut, sheath, and AC terminal cover. Connect the cable to the AC terminal block in turn, using a socket wrench. Tighten the screws on the terminal block. The torque is 3~4Nm (as shown in Figure 5.19).

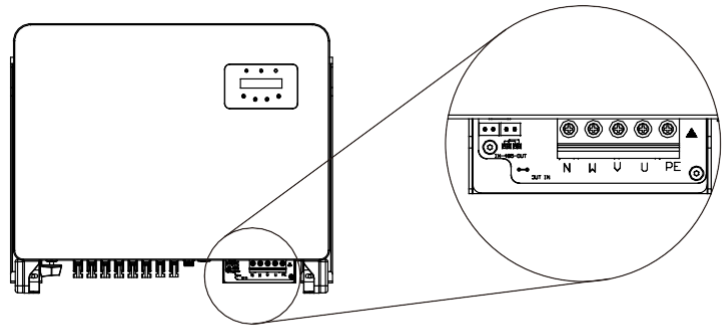


Figure 5.19 wiring

NOTE
Solis three phase inverters integrate neutral connection point.
However, with or without neutral connected won't affect the normal operation of inverter itself. Please refer to the local grid requirement if need neutral cable connected.

5.3.4 Inverter monitoring connection

The inverter can be monitored via Wi-Fi or GPRS. All Solis communication devices are optional (Figure 5.20). For connection instructions, please refer to the Solis Monitoring Device installation manuals.

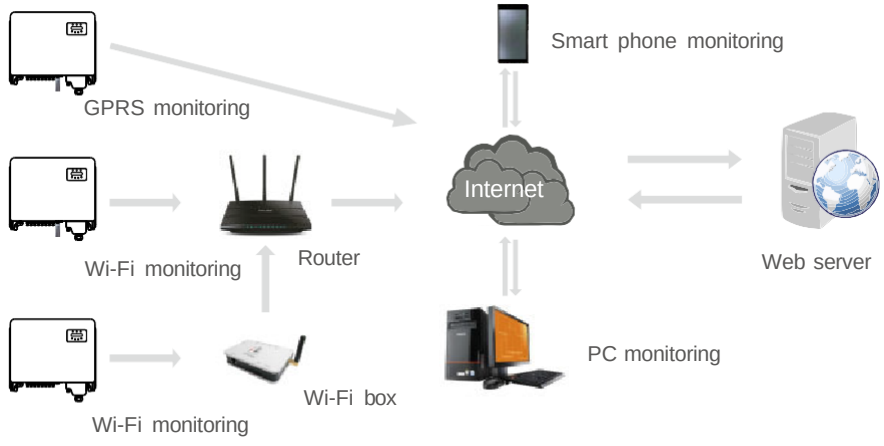


Figure 5.20 Wireless communication function

5. Installation

Monitoring system for multiple inverters

Multiple inverters can be monitored by RS-485 daisy chain configuration. (See figure 5.26).

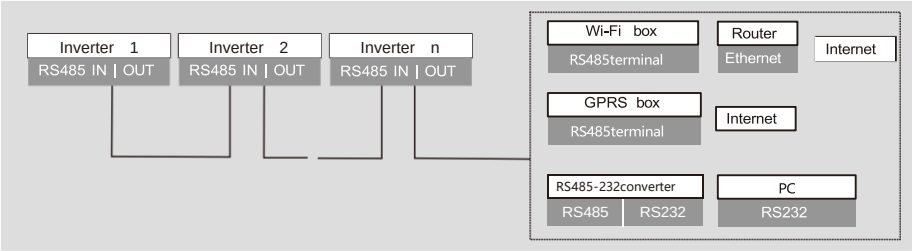


Figure 5.21 Multiple inverter monitoring system

5.3.4.1 RS485 Connection

Install the RS485 communication cables through the terminal block as shown in Figure 5.22. Recommended cable cross sectional area is 0.2 - 1.5mm , the cable outer diameter is 5mm -10mm.

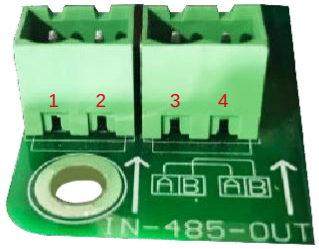


Figure 5.22 RS485 Terminal Definition

NO.	Port definition	Description
1	RS485A1 IN	RS485A1,RS485 differential signal+
2	RS485B1 IN	RS485B1,RS485 differential signal-
3	RS485A2 OUT	RS485A2,RS485 differential signal+
4	RS485B2 OUT	RS485B2,RS485 differential signal-

Table 5.2 Port definition

Terminal block connection

a. Use a wire stripper to peel off the insulation layer of the communication cables to a certain length as shown in Figure 5.23.

b. Screw off the covers of "COM2" and "COM3" on the inverter as shown in Figure 5.24.

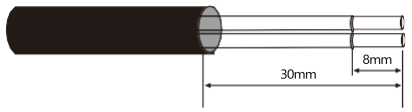


Figure 5.23

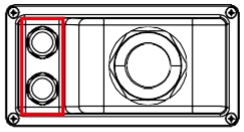


Figure 5.24

c. Insert the communication cables into the "COM2" and "COM3" ports.

d. Fasten the cables onto the pluggable terminals provided in the accessory package.

e. Match the pluggable terminals to the terminal block in the inverter and press to fasten it. After cable installation, please remember to fasten the screws of the AC terminal cover in case of water damage.

5.3.5 Max. over current protection device (OCPD)

To protect the inverter's AC grid connection conductors, Solis recommends installing breakers that will protect against overcurrent. The following table defines OCPD ratings for the inverters.

Inverter	Rated voltage(V)	Rated output current (Amps)	Current for protection device (A)
S5-GC25K	220/380,230/400	38.0/36.1	50
S5-GC30K	220/380,230/400	45.6/43.3	63
S5-GC33K	220/380,230/400	50.1/47.6	63
S5-GC36K	220/380,230/400	54.7/52.0	80
S5-GC37.5K	220/380,230/400	57.0/54.1	80
S5-GC40K	220/380,230/400	60.8/57.7	80
S5-GC40K-HV	480	48.1	63
S5-GC50K-HV	480	60.1	80
S5-GC15K-LV	220	39.4	63
S5-GC20K-LV	220	52.5	80
S5-GC23K-LV	220	60.4	80
S5-GC30K-BE	220/380,230/400	45.6/43.3	63

Table 5.3 Rating of grid OCPD

5.3.6 Meter Connection(optional)

The inverter can work with a three phase smart meter to achieve Export Power Management function and/or 24hour consumption monitoring function.

NOTE

To achieve Export Power Management function, the smart meter can be installed on either grid side or load side.

To achieve 24hour consumption monitoring function, the smart meter can only be installed on grid side.

Two types of meters are supported:

Direct Insert Type Meter - Max input current 80A(DTSD1352-Direct Insert Type).

External CT Type Meter - 150A/5A CTs are supplied(DTSD1352-External CT Type).

Customer can place the order for a suitable meter from Solis Sales Reps.

Below are the connection diagrams of different meters connecting to different locations.

Detailed settings please refer to Section 7.5.12

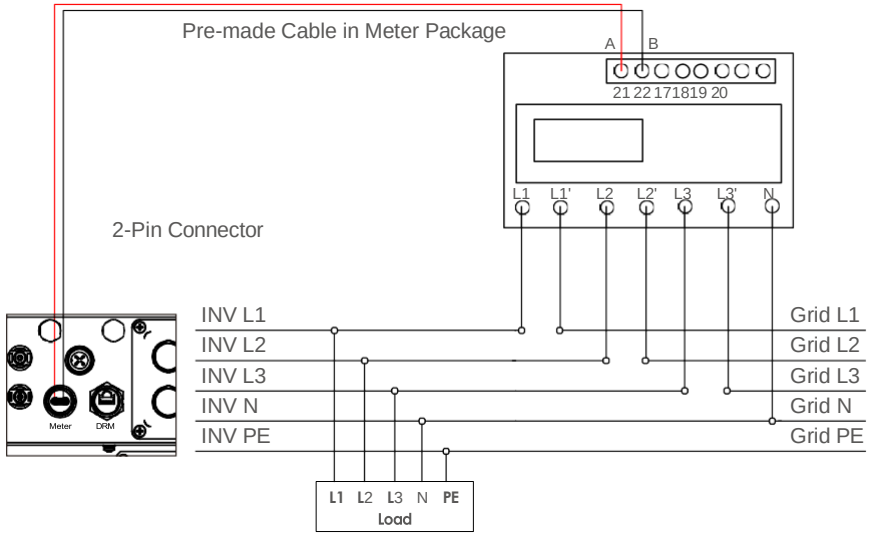


Figure 5.25 Direct Insert Type Meter - “Meter in Grid”

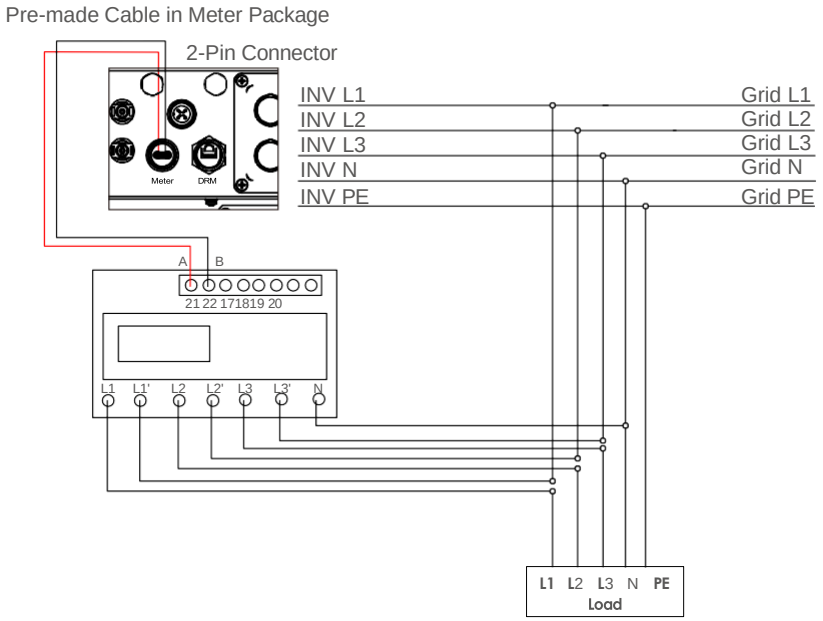


Figure 5.26 Direct Insert Type Meter - “Meter in Load”

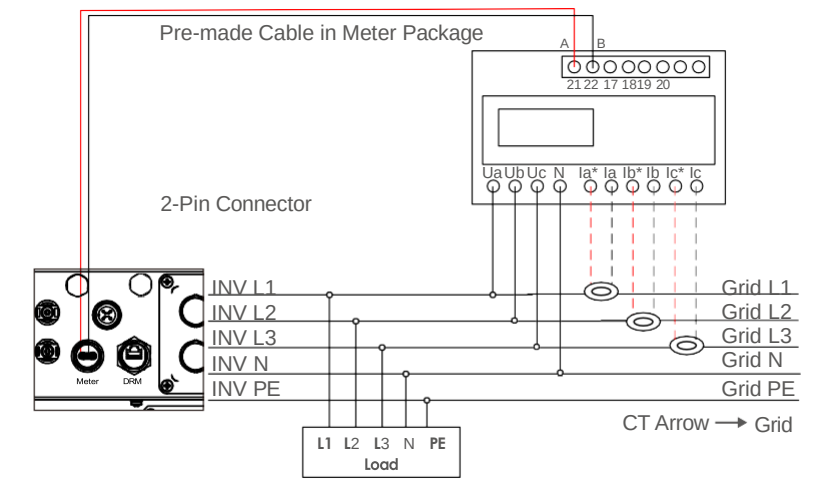


Figure 5.27 External CT Type Meter - “Meter in Grid”

5. Installation

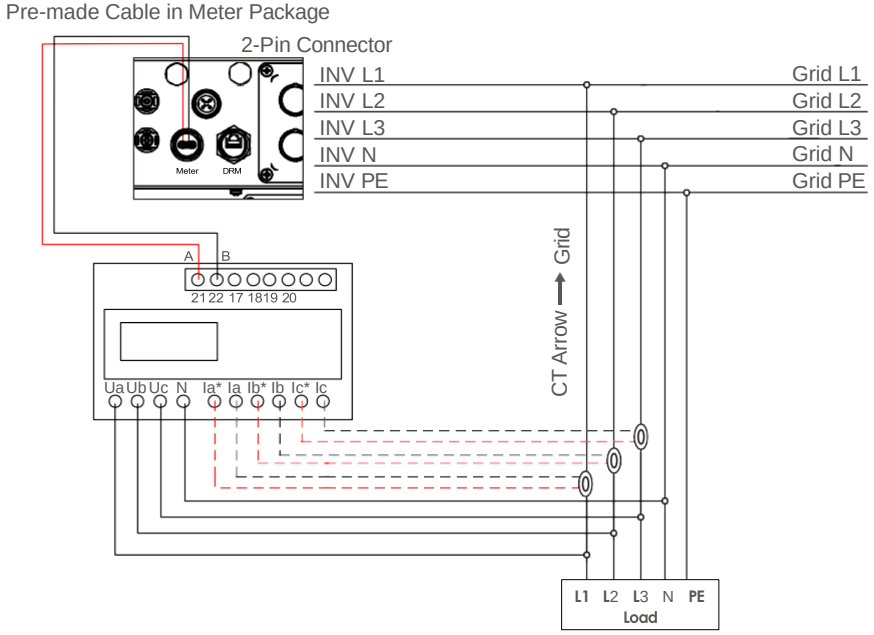


Figure 5.28 External CT Type Meter - “Meter in Load”

5.3.7 Logic interface connection

Logic interface is required by some local regulations that can be operated by a simple switch or contactor(Not available in South Africa).

When the switch is closed the inverter can operated normally. When the switch is opened, the inverter will reduce it’s output power to zero within 5s.

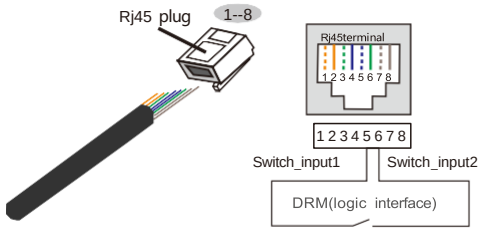
Pin5 and Pin6 of RJ45 terminal is used for the logic interface connection.

Please follow below steps to assemble RJ45 connector.

1. Insert the network cable into the communication connection terminal of RJ45.

Figure 5.29 RJ45 communication connection terminals

2. Use the network wire stripper to strip the insulation layer of the communication cable. According to the standard line sequence of figure 5.30 connect the wire to the plug of RJ45, and then use a network cable crimping tool to make it tight.



Correspondence between the cables and the stitches of plug, Pin5 and Pin6 of RJ45 terminal is used for the logic interface, other Pins are reserved.

Pin 1: Reserved; Pin 2: Reserved

Pin 3: Reserved; Pin 4: Reserved

Pin 5: Switch_input1; Pin 6: Switch_input2

Pin 7: Reserved; Pin 8: Reserved

Figure 5.30 Strip the insulation layer and connect to RJ45 plug

3. Connect RJ45 to DRM (logic interface) .

After wire connection, please refer chapter 7.5.9.1 to enable the logic interface function.

6. Start & Stop

6.1 Start the Inverter

To start up the Inverter, it is important that the following steps are strictly followed:

1. Switch the grid supply main Switch (AC) ON first.
2. Switch the DC switch ON. If the voltage of PV arrays are higher than start up voltage, the inverter will initialize. The red LED power will light.
3. When both the DC and the AC sides supply to the inverter, it will be ready to generate power. Initially, the inverter will check both its internal parameters and the parameters of the AC grid, to ensure that they are within the acceptable limits. At the same time, the green LED will flash and the LCD displays the information of INITIALIZING.
4. After 30-300 seconds (depending on local requirement), the inverter will start to generate power. The green LED will be on continually and the LCD displays GENERATING.

WARNING:
Do not touch the surface when the inverter is operating. It may be hot and cause burns.

6.2 Stop the Inverter

To stop the inverter, it is mandatory that the steps below are followed in the exact order outlined.

1. Select "Grid Off" in the Advanced Setting of Inverter LCD.
2. Turn off the AC Switch between Solis inverter and Grid.
3. Wait approximately 30 seconds (during this time, the AC side capacitors are dissipating energy). If the inverter has DC voltage above the start-up threshold, the red POWER LED will be lit. Switch the DC switch OFF.
4. Confirm all LED's switch OFF (~one (1) minute).

CAUTION
Although the inverter DC disconnect switch is in the OFF position and all the LED's are OFF, operators must wait five (5) minutes after the DC power source has been disconnected before opening the inverter cabinet. DC side capacitors can take up to five (5) minutes to dissipate all stored energy.

7. Operation

In normal operation, LCD screen alternatively shows inverter power and operation status (see Figure 7.1). The screen can be scrolled manually by pressing the UP/DOWN keys. Pressing the ENTER key gives access to Main Menu.

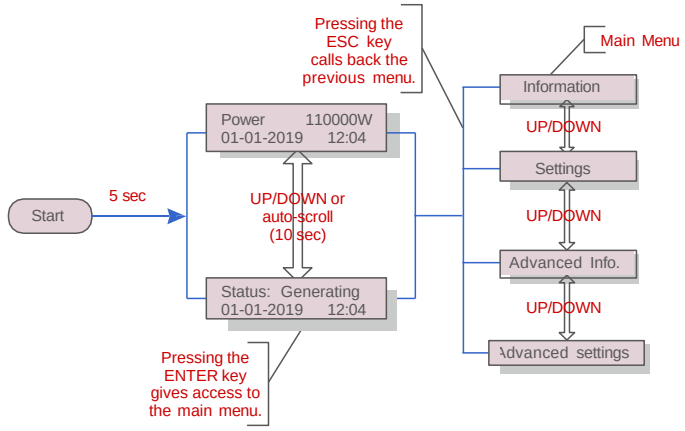


Figure 7.1 Operation Overview

7.1 Main Menu

There are four submenus in the Main Menu (see Figure 7.1):

1. Information
2. Settings
3. Advanced Info.
4. Advanced Settings

7.2 Information

The Solis three Phase Inverter main menu provides access to operational data and information. The information is displayed by selecting "Information" from the menu and then by scrolling up or down.

Display	Duration	Description
V_DC01: 0000.0V i_DC01: 0000.0A	10 sec	V_DC01: Shows input DC voltage. I_DC01: Shows input DC current.
V_A: 000.0V I_A: 000.0A	10 sec	V_A: Shows the grid's voltage value. I_A: Shows the grid's current value.
V_C: 000.0V I_C: 000.0A	10 sec	V_C: Shows the grid's voltage value. I_C: Shows the grid's current value.
Status: Generating Power: 0000W	10 sec	Status: Shows instant status of the Inverter. Power: Shows instant output power value.
Rea_Power: 0000Var App_Power: 0000VA	10 sec	Rea_Power: Shows the reactive power of the inverter. App_Power: Shows the apparent power of the inverter.
Grid Frequency F_Grid 00.00Hz	10 sec	F_Grid: Shows the grid's frequency value.
Total Energy 0000000 kwh	10 sec	Total generated energy value.
This Month: 0000kwh Last Month: 0000kwh	10 sec	This Month: Total energy generated this month. Last Month: Total energy generated last month.
Today: 00.0kwh Yesterday: 00.0kwh	10 sec	Today: Total energy generated today. Yesterday: Total energy generated yesterday.
Inverter SN 00000000000000	10 sec	Display series number of the inverter.
Work Mode: NULL DRM NO.:08	10 sec	Work Mode: Shows current working mode. DRM NO.: Shows DRM Number.
I_PV01: +05.0A I_PV02: +04.9A ... I_PV08: +05.2A	10 sec	I_PV01 : Shows input 01 current value. I_PV02 : Shows input 02 current value. ... I_PV08 : Shows input 08 current value.

Table 7.1 Information list

7.2.1 Lock screen

Pressing the ESC key returns to the Main Menu. Pressing the ENTER key locks (Figure 7.2(a)) or unlocks (Figure 7.2 (b)) the screen.

(a) (b)

Figure 7.2 Locks and Unlocks the Screen of LCD

7.3 Settings

The following submenus are displayed when the Settings menu is selected:

1. Set Time
2. Set Address

7.3.1 Set Time

This function allows time and date setting. When this function is selected, the LCD will display a screen as shown in Figure 7.3.

NEXT=<ENT> OK=<ESC>
01-01-2019 16:37

Figure 7.3 Set Time

Press the UP/DOWN keys to set time and data. Press the ENTER key to move from one digit to the next (from left to right). Press the ESC key to save the settings and return to the previous menu.

7.3.2 Set Address

This function is used to set the address when muti inverters are connected to three monitor. The address number can be assigned from “01”to “99”(see Figure 7.4). The default address number of Solis Three Phase Inverter is “01”.

YES=<ENT> NO=<ESC>
Set Address: 01

Figure 7.4 Set Address

Press the UP/DOWN keys to set the address. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

7.4 Advanced Info - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only. Enter menu “Advanced Info.” and “Advanced settings” (need password).

Select “Advanced Info.” from the Main Menu. The screen will require the password as below:

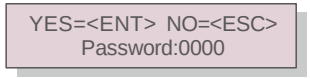


Figure 7.5 Enter password

The default password is “0010".
Please press “down” to move the cursor, press “up” to select the number.
After enter the correct password the Main Menu will display a screen and be able to access to the following information.

1.Alarm Message 2. Running message 3.Version 4. Daily Energy 5. Monthly Energy 6. Yearly Energy 7. Daily Records 8.Communication Data 9. Warning Message

The screen can be scrolled manually by pressing the UP/DOWN keys. Pressing the ENTER key gives access to a submenu. Press the ESC key to return to the Main Menu.

7.4.1 Alarm Message

The display shows the 100 latest alarm messages (see Figure 7.6). Screens can be scrolled manually by pressing the UP/ DOWN keys. Press the ESC key to return to the previous menu.

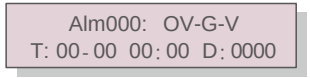


Figure 7.6 Alarm Message

7.4.2 Running Message

This function is for maintaince person to get running message such as internal temperature, Standard No.1,2,etc.
Screens can be scrolled manually by pressing the UP/DOWN keys.

7.4.3 Version

The screen shows the model version of the inverter. And the screen will show the software ver by pressing the UP and DOWN at the same time.(see Figure 7.7).

Figure 7.7 Model Version and Software Version

7.4.4 Daily Energy

The function is for checking the energy generation for selected day.

Figure 7.8 Select date for daily energy

Press DOWN key to move the cursor to day, month and year, press UP key to change the digit. Press Enter after the date is fixed.

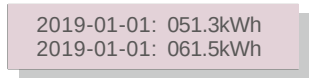


Figure 7.9 Daily energy

Press UP/DOWN key to move one date from another.

7.4.5 Monthly Energy

The function is for checking the energy generation for selected month.

Figure 7.10 Select month for monthly energy

Press DOWN key to move the cursor to day and month, press UP key to change the digit. Press Enter after the date is fixed.

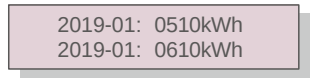


Figure 7.11 Month energy

Press UP/DOWN key to move one date from another.

7.4.6 Yearly Energy

The function is for checking the energy generation for selected year.

Figure 7.12 Select year for yearly energy

Press DOWN key to move the cursor to day and year, press UP key to change the digit. Press Enter after the date is fixed.

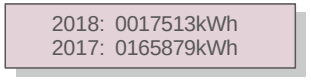


Figure 7.13 Yearly energy

Press UP/DOWN key to move one date from another.

7.4.7 Daily Records

The screen shows history of changing settings. Only for maintance personel.

7.4.8 Communication Data

The screen shows the internal data of the Inverter (see Figure 7.14), which is for service technicians only.

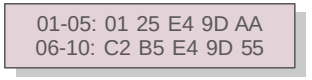


Figure 7.14 Communication Data

7.4.9 Warning Message

The display shows the 100 latest warn messages (see Figure 7.15). Screens can be scrolled manually by pressing the UP/ DOWN keys. Press the ESC key to return to the previous menu.

Figure 7.15 Warning Message

7.5 Advanced Settings - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only. Please follow 7.4 to enter password to access this menu.

Select Advanced Settings from the Main Menu to access the following options:

1. Select Standard 2. Grid ON/OFF 3. 24H Switch 4. Clear Energy
5. Reset Password 6. Power Control 7. Calibrate Energy 8. Special Settings
9. STD. Mode Settings 10. Restore Settings 11. HMI Update 12. Internal EPM Set
13. External EPM set 14. Restart HMI 15. Debug Parameter 16. Fan Text
17. DSP Update 18. Compensation Set 19.I/V Curve

7.5.1 Selecting Standard

This function is used to select the grid's reference standard (see Figure 7.16).

Figure 7.16

Press the UP/DOWN keys to select the standard (G59/3, UL-480V, VDE0126, AS4777-15, AS4777-02, CQC380A, ENEL, UL-380V, MEX-CFE, C10/11 and “User-Def” function).
Press the ENTER key to confirm the setting.
Press the ESC key to cancel changes and returns to previous menu.

NOTE:
This function is for technicians use only.

Selecting the “User-Def” menu will access to the following submenu (see Figure 7.17),

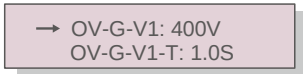


Figure 7.17

NOTE:
The " User-Def" function can be only used by the service engineer and must be allowed by the local energy supplier.

Below is the setting range for “User-Def”. Using this function, the limits can be changed manually.

OV-G-V1: 220---374V	OV-G-F1: 50.1-65Hz
OV-G-V1-T: 0.01---300S	OV-G-F1-T: 0.01---300S
OV-G-V2: 220---374V	OV-G-F2: 50.1-65Hz
OV-G-V2-T: 0.01---300S	OV-G-F2-T: 0.01---300S
UN-G-V1: 110---277V	UN-G-F1: 45-59.9Hz
UN-G-V1-T: 0.01---300S	UN-G-F1-T: 0.01---300S
UN-G-V2: 110---277V	UN-G-F2: 45-59.9Hz
UN-G-V2-T: 0.01---300S	UN-G-F2-T: 0.01---300S
Startup-T: 10-600S	Restore-T: 10-600S

Table 7.2 Setting ranges for User-Def (L-N)

Press the UP/DOWN keys to scroll through items. Press the ENTER key to edit the highlighted item. Press the UP/DOWN keys again to change the setting. Press the ENTER key to save the setting. Press the ESC key to cancel changes and returns to the previous menu.

NOTE

For different countries, the grid standard needs to be set as different according to local requirements. If there is any doubt, please consult Solis service technicians for details.

7.5.2 Grid ON/OFF

This function is used to start up or stop the power generation of Solis Inverter.

→ Grid ON
Grid OFF

Figure 7.18 Set Grid ON/OFF

Screens can be scrolled manually by pressing the UP/DOWN keys. Press the ENTER key to save the setting. Press the ESC key to return to the previous menu.

7.5.3 24H Switch

This function controls the 24H hours consumption function enable or disable.

– Enable
Disable

Figure 7.19 Set 24H ON/OFF

NOTE:

When this is enabled, the inverter LCD will still be alive at night with the power LED light on. If the grid is in malfunction at night, the system can’t recover even after the grid is back to normal but the consumption data will still be recorded in the meter. Until the sunrise, the system will start to work again while the meter data can be uploaded to the Solis monitoring system to calibrate the load consumption data.

7.5.4 Clear Energy

Clear Energy can reset the history yield of inverter

These two functions are applicable by maintenance personnel only, wrong operation will prevent the inverter from working properly.

7.5.5 Reset Password

This function is used to set the new password for menu “Advanced info.” and “Advanced information” (see Figure 7.20).

YES=<ENT> NO=<ESC>
Password: 0000

Figure 7.20 Set new password

Enter the right password before set new password. Press the DOWN key to move the cursor, Press the UP key to revise the value. Press the ENTER key to execute the setting.
Press the ESC key to return to the previous menu.

7.5.6 Power control

Active and reactive power can be set through power setting button.
There are 5 item for this sub menu:

1. Set output power 2. Set Reactive Power 3. Out_P With Restore
4. Rea_P With Restore 5. Select PF Curve

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.7 Calibrate Energy

Maintenance or replacement could clear or cause a different value of total energy. Use this function could allow user to revise the value of total energy to the same value as before. If the monitoring website is used the data will be synchronous with this setting automatically.

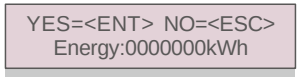


Figure 7.21 Calibrate energy

Press the DOWN key to move the cursor, Press the UP key to revise the value. Press the ENTER key to execute the setting. Press the ESC key to return to the previous menu.

7.5.8 Special Settings

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.9 STD Mode settings

There are 6 setting under STD. Mode settings.

1. Working Mode Set 2. Power Rate Limit 3. Freq Derate Set
4. 10mins Voltage Set 5.Power Priority 6.Initial Settings

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.9.1 Enable logic interface settings

When select G98 or G99 standard to use the logic interface function, please follow below settings to enable the **DRM**. DRM default setting is “OFF” , if DRM set “ON”, but the logic interface un-connected to the switch or the switch is open, the inverter HMI will display “Limit by DRM” and the inverter output power will be limited to zero.

1. Select **Initial Settings**
2. Select **DRM** and set it **“**ON**”**

7.5.10 Restore Settings

There are 5 items in initial setting submenu.
Restore setting could set all item in 7.5.8 special setting to default.
The screen shows as below:

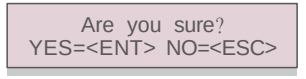


Figure 7.22 Restore Settings

Press the Enter key to save the setting after setting grid off.
Press the ESC key to return the previous mean.

7.5.11 HMI Update

This function is used for updating the LCD program.

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.12 Internal EPM Set

NOTE:

This section includes two functions related to the smart meter.

Please refer to section 5.3.6 for detailed connection diagrams.

Function 1: Internal Export Power Management Function

Inverters can work with a smart meter to dynamically limit the export power of the system. Zero injection can be achieved.

Smart meter can be installed either on the grid side OR the load side.

Function 2: 24 Hour Consumption Monitoring Function

Only applicable if Solis monitoring system is used.

Inverters can work with a smart meter to monitor the load consumption data for the whole day and the data will be displayed on the Solis monitoring system.

Smart meter can only be installed on the grid side.

NOTE:

Please refer to below instructions for different user scenarios.

Scenario 1. Only Function 1 is required

Step 1: Refer to Section 5.3.6 to connect the smart meter on the grid side or load side.

Step 2: Select the Section 7.5.12.1 Mode Select as Option 2(Meter in Load) or Option 3 (Meter in Grid) accordingly.

Step 3: Configure the Section 7.5.12.2 to set the allowed backflow power.

Step 4: Configure the Section 7.5.12.3 to enable the failsafe function (If necessary).

Step 5: Configure the Section 7.5.12.4 to modify the work mode (If necessary).

Scenario 2. Both Function 1 and 2 are required

Using a Smart Meter:

Step 1: Refer to Section 5.3.6 to connect the smart meter on the grid side.

Step 2: Select the Section 7.5.12.1 Mode Select as Option 3(Meter in Grid).

Step 3: Select the Section 7.5.3 24H Switch as "Enable".

Step 4: Configure the Section 7.5.12.2 to set the allowed backflow power.

Step 5: Configure the Section 7.5.12.3 to enable the failsafe function (If necessary).

Step 6: Configure the Solis monitoring system (Please refer to the manual of monitoring device).

If customer does not want to enable the export power control function, please change the "backflow power" to the max output power of the inverter in Step 4 OR simply select the mode as "consumption monitor" in Step 2 and skip Step 4-5.

Select EPM Settings from the Main Menu to access the following options:

1. Mode Select 2. Backflow Power 3. Fail safe ON/OFF 4. Backflow Work Mode

7.5.12.1 Mode Select

There are 4 settings in this menu as below:

1. OFF 2. Meter in Load 3. Meter in Grid 4.Consumption Monitor

OFF: Functions are disabled

Meter in Load: Solis Smart Meter is connected in the load branch circuit.

Meter in Grid: Solis Smart Meter is connected in the grid connection point (The backflow power is default as 0W).

Consumption Monitor: Solis Smart Meter is connected in the grid connection point (The backflow power setting is not applicable).

7.5.12.2 Backflow Power

The setting is used to define the allowed export power into the grid.

The setting range is between 00000W to 29900W.

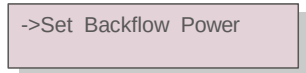


Figure 7.23 Set the backflow power

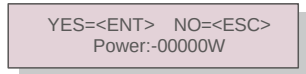


Figure 7.24

Press the UP/DOWN keys to set data.Press the ENTER key to set backflow power.

Then press DOWN keys to move the cursor, press UP to change the number.

Press the ESC key to save the settings and return to the previous menu.

7.5.12.3 Fail safe ON/OFF

This setting is used to give out an alarm (stop inverter generation as well) when the Meter connection is lost during operation.

It can prevent potential backflow power into the grid when the system loses control.

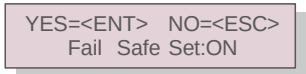


Figure 7.25 Set the Fail Safe ON/OFF

It is only mandatory to turn on this function when the inverter is installed in UK due to the G100 regulation. For other regions,customers can enable or disable the function as they desire.

NOTE:
When the failsafe function is ON and CT/Meter is disconnected somehow, the inverter will stop generation and give "Failsafe" alarm on the LCD.
When the failsafe function is OFF and CT/Meter is disconnected somehow, the inverter will keep the output power as the last moment when the CT/Meter is still connected. After a restart, the inverter will output at full power without limit.

7.5.12.4 Backflow Work Mode

This submenu is used for set backflow work mode: 01, 02. “01” is the default mode.

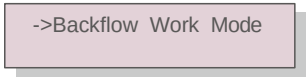


Figure 7.26 Set the Backflow work mode

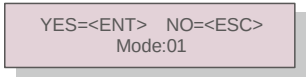


Figure 7.27

Mode “01”, As shown in the figure 7.28, the average limiting mode, the output power of each phase is the average of the three-phase load power, and it is more than the phase of the lowest power in three phases.

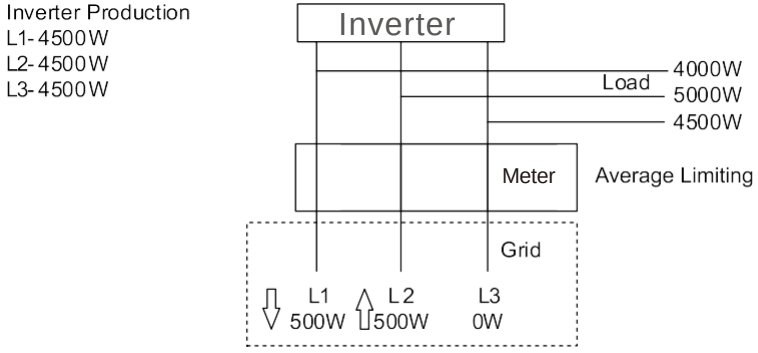


Figure 7.28

Mode “02”, As shown in the figure 7.29 the per phase limiting mode, the inverter only generate the power that equals to one of three-phase load power that is the lowest load power of a certain phase.

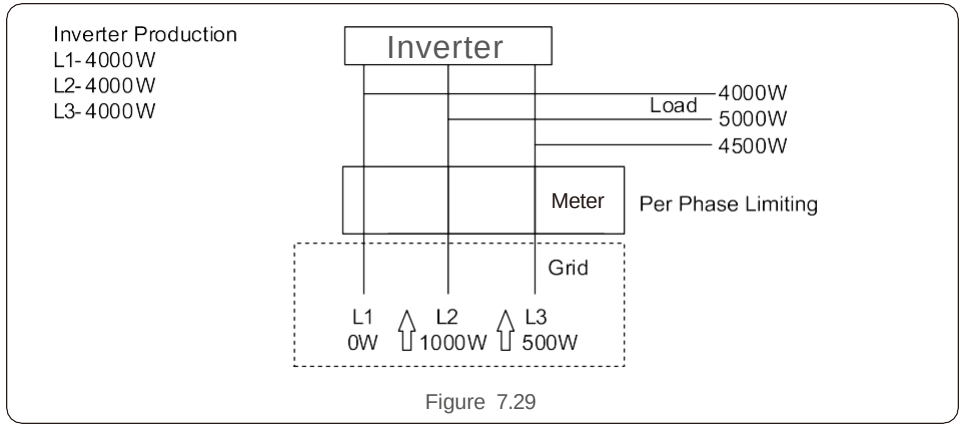


Figure 7.29

7.5.13 External EPM Set

This setting should only be turned on when Solis external EPM device is used.
Two options are available : 5G-EPM and Others-EPM.

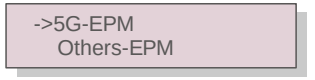


Figure 7.30

5G-EPM Failsafe Option should be turned ON when 5G series EPM device is used
Others-EPM Failsafe Option should be turned ON when 2G series EPM device is used
Only one option can be activated each time.

7.5.14 Restart HMI

The function is used for restart the HMI.

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.15 Debug Parameter

This function is used for manufacturer maintenance personnel only.

7.5.16 FAN Test

This section is applicable to maintenance personnel only.

Selecting “Fan Test” displays the sub-menu shown below:

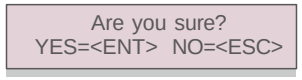


Figure 7.31

Fan Test is a factory test function. Press the ENTER key to start the test.
Press the ESC key to return to the previous menu.

7.5.17 DSP Update

The function is used for update the DSP.

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.18 Compensation Set

This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

7.5.19 I/V Curve

This function is used to scan the I/V characteristic curves of each PV strings.

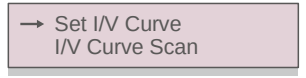


Figure 7.32 I/V Curve

7.5.19.1 Set I/V Curve

This setting can set the scanning voltage start point and the voltage interval.

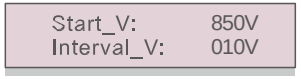


Figure 7.33 Set I/V Curve

Start_V: The start voltage of the I/V scan. (Adjustable from 300V-1000V)
Interval_V: The scanning voltage interval.(Adjustable from 1-100V)
In total, 60 data points can be scanned.

7.5.19.2 I/V Curve Scan

Press “ENT” to start the I/V curve scan.

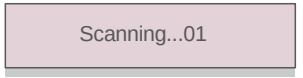


Figure 7.34 I/V Curve Scan (1)

After it is completed, the screen will display “Scan OK” and then enter the following section.

Figure 7.35 I/V Curve Scan (2)

Figure 7.36 I/V Curve Scan (3)

7.6 AFCI function

Solis inverters have the built-in AFCI function which can detect the arc fault on the DC circuit and shut down the inverter to prevent a fire disaster.

7.6.1 Enable the AFCI function

The AFCI function can be enabled in the following.

Path: Advanced Setting -> Password: 0010 ->Special Settings -> AFCI Set -> AFCI ON/OFF -> ON

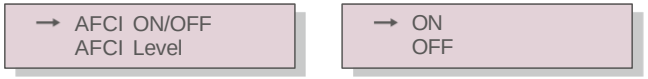


Figure 7.36 Set AFCI

Warning:
The "AFCI Level" is reserved for Solis technicians ONLY. Do not change the sensitivity otherwise it will lead to frequent false alarms or malfunctions. Solis is not responsible for any further damages caused by unauthorized modifications.

NOTE:
The setting corresponds to the current status as well which can be used to inspect the ON/OFF state of the AFCI function.

7.6.2 Arc Fault

During the normal operation, if an DC arc is detected, the inverter will shut down and give out the following alarm:

Figure 7.37 Arc Fault

Installer needs to thoroughly inspect the DC circuit to ensure all the cables are correctly fastened.

Once the DC circuit issue has been fixed or it is confirmed to be OK, press “ESC” for 3s and wait for the inverter to restart.

Solis Three Phase Inverter does not require any regular maintenance. However, cleaning the dust on heat-sink will help the inverter to dissipate the heat and increase its life time. The dust can be removed with a soft brush.

CAUTION:
Do not touch the inverter's surface when it is operating. Some parts of the inverter may be hot and cause burns. Turn off the inverter (refer to Section 6.2) and wait for a cool-down period before any maintenance or cleaning operation.

The LCD and the LED status indicator lights can be cleaned with a damp cloth if they are too dirty to be read.

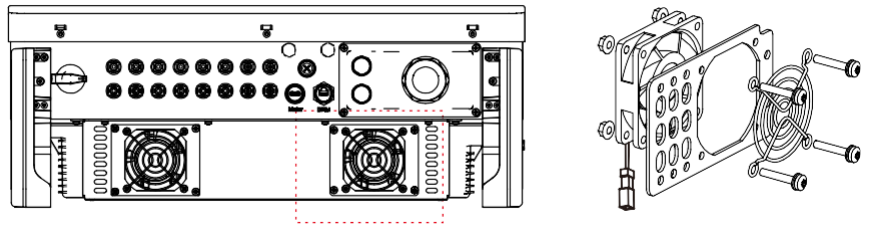
NOTE:
Never use any solvents, abrasives or corrosive materials to clean the inverter.

8.1 Fan Maintenance

If the fan does not work properly, the inverter will not be cooled effectively. and it may affect the effective operation of the inverter .

Therefore, it is necessary to clean or replace a broken fan as follows:

1. Disconnect the AC power.
2. Turn the DC switch to "OFF" position.
3. Wait for 10 minutes at least.
4. Disconnect all electric connection.
5. Place the inverter on the platform.
6. Remove the 4 screws on the fan plate and pull out the fan assembly slowly.



7. Disconnect the fan connector carefully and take out the fan.
8. Clean or replace the fan. Assemble the fan on the rack.
9. Connect the electrical wire and reinstall the fan assembly. Restart the inverter.

The inverter is designed in accordance with the most important international grid-tied standards and safety and electromagnetic compatibility requirements. Before delivering to the customer, the inverter has been subjected to several tests to ensure its optimal operation and reliability.

In case of failure, the LCD screen will display an alarm message. In this case, the inverter may stop feeding into the grid. The failure descriptions and their corresponding alarm messages are listed in Table 9.1:

Alarm Message	Failure description	Solution
No power	Inverter no power on LCD	1. Check PV input connections 2. Check DC input voltage (single phase >120V, three phase >350V) 3. Check if PV+/- is reversed
LCD show initializing all the time	Can not start-up	1. Check if the connector on main board or power board are fixed. 2. Check if the DSP connector to power board are fixed.
OV-G-V01/02/03/04	Over grid voltage	1. Resistant of AC cable is too high. Change bigger size grid cable 2. Adjust the protection limit if it's allowed by electrical company.
UN-G-V01/02	Under grid voltage	1. Use user define function to adjust the protection limit if it's allowed by electrical company.
OV-G-F01/02	Over grid frequency	
UN-G-F01/02	Under grid frequency	
G-IMP	High grid impedance	
NO-GRID	No grid voltage	1. Check connections and grid switch. 2. Check the grid voltage inside inverter terminal.
OV-DC01/02/03/04	Over DC voltage	1. Reduce the module number in series
OV-BUS	Over DC bus voltage	1. Check inverter inductor connection 2. Check driver connection
UN-BUS01/02	Under DC bus voltage	
GRID-INTF01/02	Grid interference	1. Restart inverter 2. Change power board
OV-G-I	Over grid current	
IGBT-OV-I	Over IGBT current	
DC-INTF OV-DCA-I	DC input overcurrent	1. Restart inverter 2. Identify and remove the string to the fault MPPT 2.Change power board
IGFOL-F	Grid current tracking fail	1.Restart inverter or contact installer.
IG-AD	Grid current sampling fail	
INI-FAULT	Initialization system fault	1.Restart inverter or contact installer.
DSP-B-FAULT	Comm. failure between main and slave DSP	
12Power-FAULT	12V power supply fault	

Alarm Message	Failure description	Solution
OV-TEM	Over Temperature	1. Check inverter surrounding ventilation. 2. Check if there's sunshine direct on inverter in hot weather.
PV ISO-PRO 01/02	PV isolation protection	1. Remove all DC input, reconnect and restart inverter one by one. 2. Identify which string cause the fault and check the isolation of the string.
ILeak-PRO 01/02/03/04	Leakage current protection	1. Check AC and DC connection 2. Check inverter inside cable connection.
RelayChk-FAIL	Relay check fail	1. Restart inverter or contact installer.
DCinj-FAULT	High DC injection current	
AFCI self-detection (model with AFCI module)	AFCI module self-detect fault	1. Restart inverter or connect technician.
Arcing protection (model with AFCI module)	Detect arc in DC circuit	1. Check inverter connection whether arc exists and restart inverter.
Screen OFF with DC applied	Inverter internally damaged	1. Do not turn off the DC switches as it will damage the inverter. 2. Please wait for the solar irradiance reduces and confirm the string current is less than 0.5A with a clip-on ammeter and then turn off the DC switches. 3. Please note that any damages due to wrong operations are not covered in the device warranty.

Table 9.1 Fault message and description

NOTE:

If the inverter displays any alarm message as listed in Table 9.1; please turn off the inverter (refer to Section 6.2 to stop your inverter) and wait for 5 minutes before restarting it (refer to Section 6.1 to start your inverter). If the failure persists, please contact your local distributor or the service center. Please keep ready with you the following information before contacting us.

1. Serial number of Solis Three Phase Inverter;
2. The distributor/dealer of Solis Three Phase Inverter (if available);
3. Installation date.
4. The description of problem (i.e. the alarm message displayed on the LCD and the status of the LED status indicator lights. Other readings obtained from the Information submenu (refer to Section 6.2) will also be helpful.);
5. The PV array configuration (e.g. number of panels, capacity of panels, number of strings , etc.);
6. Your contact details.

10. Specifications

Model	S5-GC25K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	25000
Max. output power (Watts)	27500
Max. apparent output power (VA)	27500
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	38.0/36.1
Max. output current (Amps)	41.8
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.5%
EU efficiency	98.1%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC30K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	30000
Max. output power (Watts)	33000
Max. apparent output power (VA)	33000
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	45.6/43.3
Max. output current (Amps)	50.2
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.5%
EU efficiency	98.1%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC33K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	33000
Max. output power (Watts)	36300
Max. apparent output power (VA)	36300
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	50.1/47.6
Max. output current (Amps)	55.1
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.6%
EU efficiency	98.2%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC36K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	4*32
Max short circuit input current (Amps)	4*40
MPPT number/Max input strings number	4/8
Rated output power (Watts)	36000
Max. output power (Watts)	39600
Max. apparent output power (VA)	39600
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	54.7/52.0
Max. output current (Amps)	60.2
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.7%
EU efficiency	98.3%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC37.5K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	4*32
Max short circuit input current (Amps)	4*40
MPPT number/Max input strings number	4/8
Rated output power (Watts)	37500
Max. output power (Watts)	37500
Max. apparent output power (VA)	37500
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	57.0/54.1
Max. output current (Amps)	57.0
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.7%
EU efficiency	98.3%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC40K
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	4*32
Max short circuit input current (Amps)	4*40
MPPT number/Max input strings number	4/8
Rated output power (Watts)	40000
Max. output power (Watts)	44000
Max. apparent output power (VA)	44000
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	60.8/57.7
Max. output current (Amps)	66.9
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.7%
EU efficiency	98.3%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC40K-HV
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	4*32
Max short circuit input current (Amps)	4*40
MPPT number/Max input strings number	4/8
Rated output power (Watts)	40000
Max. output power (Watts)	44000
Max. apparent output power (VA)	44000
Rated grid voltage (Volts)	3/PE, 480
Rated grid output current (Amps)	48.1
Max. output current (Amps)	53.0
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.8%
EU efficiency	98.4%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC50K-HV
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	4*32
Max short circuit input current (Amps)	4*40
MPPT number/Max input strings number	4/8
Rated output power (Watts)	50000
Max. output power (Watts)	55000
Max. apparent output power (VA)	55000
Rated grid voltage (Volts)	3/PE, 480
Rated grid output current (Amps)	60.1
Max. output current (Amps)	66.2
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.8%
EU efficiency	98.4%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC15K-LV
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	15000
Max. output power (Watts)	16500
Max. apparent output power (VA)	16500
Rated grid voltage (Volts)	3/PE, 220
Rated grid output current (Amps)	39.4
Max. output current (Amps)	43.3
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	97.8%
EU efficiency	97.3%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC20K-LV
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	20000
Max. output power (Watts)	22000
Max. apparent output power (VA)	22000
Rated grid voltage (Volts)	3/PE, 220
Rated grid output current (Amps)	52.5
Max. output current (Amps)	57.7
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	97.8%
EU efficiency	97.3%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC23K-LV
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	23000
Max. output power (Watts)	25000
Max. apparent output power (VA)	25000
Rated grid voltage (Volts)	3/PE, 220
Rated grid output current (Amps)	60.4
Max. output current (Amps)	65.0
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	97.8%
EU efficiency	97.3%
Dimensions (W*H*D)	647*629*252mm
Weight	42.1kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

10. Specifications

Model	S5-GC30K-BE
Max. DC input voltage (Volts)	1100
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	180
MPPT voltage range (Volts)	200~1000
Max. input current (Amps)	3*32
Max short circuit input current (Amps)	3*40
MPPT number/Max input strings number	3/6
Rated output power (Watts)	30000
Max. output power (Watts)	30000
Max. apparent output power (VA)	30000
Rated grid voltage (Volts)	3/N/PE, 220/380, 230/400
Rated grid output current (Amps)	45.6/43.3
Max. output current (Amps)	50.2
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Max.efficiency	98.5%
EU efficiency	98.1%
Dimensions (W*H*D)	647*629*252mm
Weight	38.2kg
Topology	Transformerless
Self consumption (night)	< 1W
Operating ambient temperature range	-25℃~+60℃
Relative humidity	0~100%
Ingress protection	IP66
Cooling concept	Intelligent redundant fan-cooling
Max.operation altitude	4000m
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530
Safty/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4
DC connection	MC4 connector
AC connection	OT Terminal
Display	LCD, 2×20 Z
Communication connections	RS485, Optional: Wifi, GPRS,USB*
Warranty	5 years (extand to 20 years)

Optional USB* :only for the brazilian market

Canadian Solar

NEW

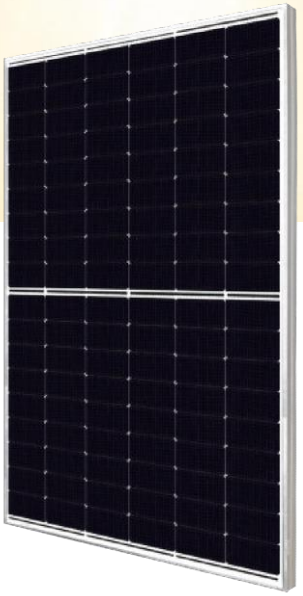
CanadianSolar

TOPHiKu6

N-type TOPCon Technology

420 W ~ 440 W

CS6R-420|425|430|435|440T



*Black frame product can be provided upon request.

MORE POWER

Module power up to 440 W
Module efficiency up to 22.5 %

Excellent anti-LeTID & anti-PID performance.
Low power degradation, high energy yield

Lower temperature coefficient (Pmax): -0.29%/°C, increases energy yield in hot climate

Lower LCOE & system cost

MORE RELIABLE

Minimizes micro-crack impacts

Heavy snow load up to 5400 Pa, wind load up to 2400 Pa*

12 Years **Enhanced Product Warranty on Materials and Workmanship***

30 Years **Linear Power Performance Warranty***

1st year power degradation no more than 1%
Subsequent annual power degradation no more than 0.4%

*According to the applicable Canadian Solar Limited Warranty Statement.

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
ISO 45001: 2018 / International standards for occupational health & safety
IEC62941: 2019 / Photovoltaic module manufacturing quality system

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730 / CE / INMETRO / MCS / UKCA
UL 61730 / IEC 61701 / IEC 62716 / IEC 60068-2-68
Take-e-way

* The specific certificates applicable to different module types and markets will vary, and therefore not all of the certifications listed herein will simultaneously apply to the products you order or use. Please contact your local Canadian Solar sales representative to confirm the specific certificates available for your Product and applicable in the regions in which the products will be used.

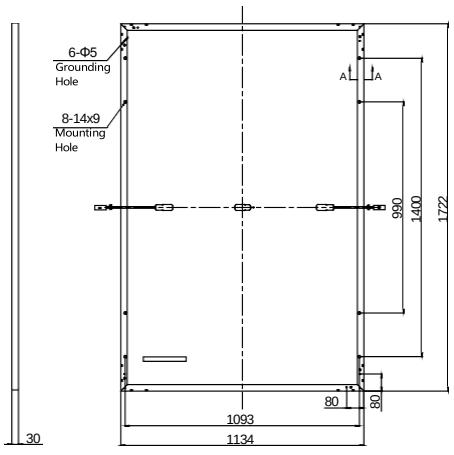
CSI Solar Co., Ltd. is committed to providing high quality solar photovoltaic modules, solar energy and battery storage solutions to customers. The company was recognized as the No. 1 module supplier for quality and performance/price ratio in the IHS Module Customer Insight Survey. Over the past 22 years, it has successfully delivered around 100 GW of premium-quality solar modules across the world.

* For detailed information, please refer to the Installation Manual.

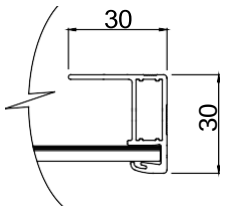
CSI Solar Co., Ltd.
199 Lushan Road, SND, Suzhou, Jiangsu, China, 215129, www.csisolar.com, support@csisolar.com

ENGINEERING DRAWING (mm)

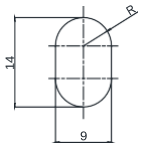
Rear View



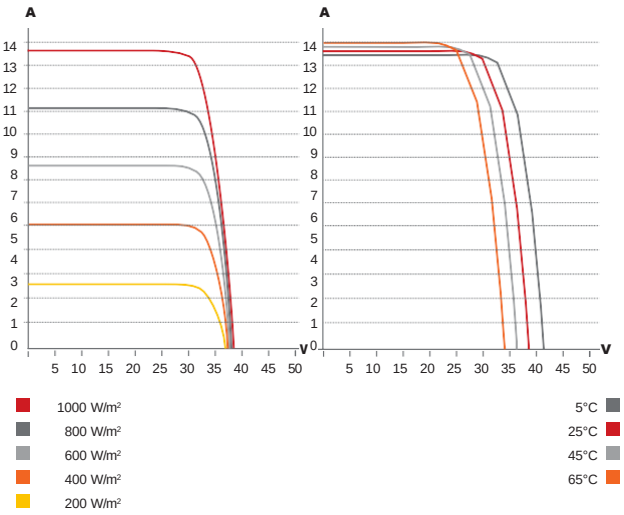
Frame Cross Section A-A



Mounting Hole



CS6R-420T / I-V CURVES



ELECTRICAL DATA | STC*

CS6R	420T	425T	430T	435T	440T
Nominal Max. Power (Pmax)	420 W	425 W	430 W	435 W	440 W
Opt. Operating Voltage (Vmp)	31.6 V	31.8 V	32.0 V	32.2 V	32.4 V
Opt. Operating Current (Imp)	13.30 A	13.37 A	13.44 A	13.51 A	13.59 A
Open Circuit Voltage (Voc)	38.6 V	38.8 V	39.0 V	39.2 V	39.4 V
Short Circuit Current (Isc)	13.71 A	13.78 A	13.86 A	13.94 A	14.01 A
Module Efficiency	21.5%	21.8%	22.0%	22.3%	22.5%
Operating Temperature	-40°C ~ +85°C				
Max. System Voltage	1500V (IEC/UL) or 1000V (IEC/UL)				
Module Fire Performance	TYPE 1 (UL 61730 1500V) or TYPE 2 (UL 61730 1000V) or CLASS C (IEC 61730)				
Max. Series Fuse Rating	25 A				
Application Classification	Class A				
Power Tolerance	0 ~ + 10 W				

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

MECHANICAL DATA

Specification	Data
Cell Type	TOPCon cells
Cell Arrangement	108 [2 X (9 X 6)]
Dimensions	1722 × 1134 × 30 mm (67.8 × 44.6 × 1.18 in)
Weight	21.3 kg (47.0 lbs)
Front Cover	3.2 mm tempered glass with anti-reflective coating
Frame	Anodized aluminium alloy,
J-Box	IP68, 3 bypass diodes
Cable	4 mm² (IEC), 12 AWG (UL)
Connector	T6 or MC4 or MC4-EVO2 or MC4-EVO2A
Cable Length (Including Connector)	Portrait: 350 mm (13.8 in) (+) / 250 mm (9.8 in) (-); landscape: 1100 mm (43.3 in)*
Per Pallet	35 pieces
Per Container (40' HQ)	910 pieces or 840 pieces (only for US & Canada)

* For detailed information, please contact your local Canadian Solar sales and technical representatives.

ELECTRICAL DATA | NMOT*

CS6R	420T	425T	430T	435T	440T
Nominal Max. Power (Pmax)	318 W	321 W	325 W	329 W	333 W
Opt. Operating Voltage (Vmp)	29.9 V	30.1 V	30.3 V	30.4 V	30.6 V
Opt. Operating Current (Imp)	10.63 A	10.69 A	10.75 A	10.81 A	10.87 A
Open Circuit Voltage (Voc)	36.5 V	36.7 V	36.9 V	37.1 V	37.3 V
Short Circuit Current (Isc)	11.05 A	11.11 A	11.18 A	11.24 A	11.30 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.29 % / °C
Temperature Coefficient (Voc)	-0.25 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	41 ± 3°C

PARTNER SECTION

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. CSI Solar Co., Ltd. reserves the right to make necessary adjustment to the information described herein at any time without further notice.
Please be kindly advised that PV modules should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

CSI Solar Co., Ltd.
199 Lushan Road, SND, Suzhou, Jiangsu, China, 215129, www.csisolar.com, support@csisolar.com

CanadianSolar

INSTALLATION MANUAL OF STANDARD SOLAR MODULES

For professional use only

CONTENTS

1.0 GENERAL INFORMATION

This general manual provides important safety information relating to the installation, maintenance and handling of CS-series solar modules.

Professional installer must read these guidelines carefully and strictly follow these instructions. Failure to follow these instructions may result in death, injury or property damage. The installation and handling of PV modules require professional skills and should only be performed by qualified professionals. The installers must inform end-users (consumers) the aforesaid information accordingly. The word "module" or "PV module" used in this manual refers to one or more CS-series solar modules.

This manual is only valid for the standard module types CS1V-MS, CS1VL-MS, CS1U-MS, CS1H-MS, CS1Y-MS, CS3U-P, CS3K-P, CS3W-P, CS3L-P, CS3W-MS, CS3L-MS, CS3LA-MS, CS3LB-MS, CS1HA-MS, CS3Y-MS, CS3Y-P, CS3N-MS, CS3SA-MS, CS6W-MS, CS6R-MS-HL, CS6R-MS, CS7L-MS, CS7L-MS-R and CS7N-MS.

Please retain this manual for future reference. We recommend checking www.csisolar.com regularly for the most updated version.

1.1 INSTALLATION MANUAL DISCLAIMER

The information contained in this manual is subject to change by Canadian Solar without prior notice. Canadian Solar gives no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.

In the event of any inconsistency among different language versions of this document, the English version shall prevail. Please refer to our product lists and documents published on our website at: www.csisolar.com as these lists are updated on a regular basis.

1.2 LIMITATION OF LIABILITY

Canadian Solar shall not be held responsible for damages of any kind, including – without limitation – bodily harm, injury or damage to property, in connection with handling PV modules, system installation, or compliance or non-compliance with the instructions set forth in this manual.

2.0 SAFETY PRECAUTIONS

Warning

Before attempting to install, wire, operate and/or service the module and other electrical equipment, all instructions should be read and understood. PV module connectors pass direct current (DC) when exposed to sunlight or other light sources. Contact with electrically active parts of the module, such as terminals, can result in injury or death, irrespective of whether or not the module and the other electrical equipment have been connected.

Avertissement

Toutes les instructions devront être lues et comprises avant de procéder à l'installation, le câblage, l'exploitation et/ou l'entretien des panneaux. Les interconnexions des panneaux conduisent du courant continu (CC) lorsque le panneau est exposé à la lumière du soleil ou à d'autres sources lumineuses. Tout contact avec des éléments sous tension du panneau tels que ses bornes de sortie peut entraîner des blessures ou la mort, que le panneau soit connecté ou non.

General Safety

All modules must be installed by licensed electricians in accordance to the applicable electrical codes such as, the latest National Electrical Code (USA) or Canadian Electric Code (Canada) or other national or international applicable electrical codes.

Protective clothing (non-slip gloves, clothes, etc.) must be worn during installation to prevent direct contact with 30 V DC or greater, and to protect hands from sharp edges.

Prior to installation, remove all metallic jewelry to prevent accidental exposure to live circuits.

When installing modules in light rain, morning dew, take appropriate measures to prevent water ingress into the connector.

Do not allow children or unauthorized persons near the installation site or module storage area.

- **Do not** install modules in strong wind.
- Use electrically insulated tools to reduce the risk of electric shock.
- If the disconnects and over current protection devices (OCPDs) cannot be opened or the inverter cannot be powered down, cover the fronts of the modules in the PV array with an opaque material to stop the production of electricity when installing or working on a module or wiring.
- **Do not** use or install damaged modules.
- Contact with module surfaces or frames may cause electric shock if the front glass is broken or the backsheet is torn.
- The PV module does not contain any serviceable parts. **Do not** attempt to repair any part of the module.
- Keep the junction box cover closed at all times.
- **Do not** disassemble a module or remove any module part.
- **Do not** artificially concentrate sunlight on a module.
- **Do not** connect or disconnect modules when current from the modules or an external source is present.

3.0 MECHANICAL / ELECTRICAL SPECIFICATIONS

Module electrical ratings are measured under Standard Test Conditions (STC) of 1000 W/m^2 irradiance, with an AM1.5 spectrum, and a cell temperature of 25°C. Detailed electrical and mechanical characteristics of Canadian Solar crystalline silicon PV modules can be found in Annex A (Module Specifications) on www.csisolar.com. Main electrical characteristics at STC are also stated on each module label. Please refer to the datasheet or the product nameplate for the maximum system voltage.

Under certain conditions, a module may produce more current or voltage than its Standard Test Conditions rated power. As a result, the module short-circuit current under STC should be multiplied by 1.25, and a correction factor should be applied to the open-circuit voltage (see Table 1 below), when determining component ratings and capacities. Depending on your local regulations, an additional 1.25 multiplier for the short-circuit current (giving a total multiplier of 1.56) may be applicable when sizing conductors and fuses.

Table 1: Low temperature correction factors for open-circuit voltage

Lowest Expected Ambient Temperature (°C/°F)	Correction Factor
24 to 20 / 76 to 68	1.02
19 to 15 / 67 to 59	1.04
14 to 10 / 58 to 50	1.06
9 to 5 / 49 to 41	1.08
4 to 0 / 40 to 32	1.10
-1 to -5 / 31 to 23	1.12
-6 to -10 / 22 to 14	1.14
-11 to -15 / 13 to 5	1.16
-16 to -20 / 4 to -4	1.18
-21 to -25 / -5 to -13	1.20
-26 to -30 / -14 to -22	1.21
-31 to -35 / -23 to -31	1.23
-36 to -40 / -32 to -40	1.25

Alternatively, a more accurate correction factor for the open-circuit voltage can be calculated using the following formula:

$$C_{Voc} = 1 - \alpha_{Voc} \times (25 - T)$$

T (°C) is the lowest expected ambient temperature at the system installation site.

α_{Voc} (%/°C) is the voltage temperature coefficient of the selected module (refer to corresponding datasheet).

Electrical calculations and design must be performed by a competent engineer or consultant.

Please contact Canadian Solar's technical support team for additional information pertaining to engineering optimization and approval of project specific module string lengths.

4.0 UNPACKING AND STORAGE

NOTICE

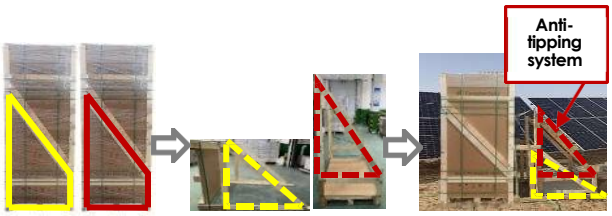
PRECAUTIONS

- Modules should be stored in a dry and ventilated

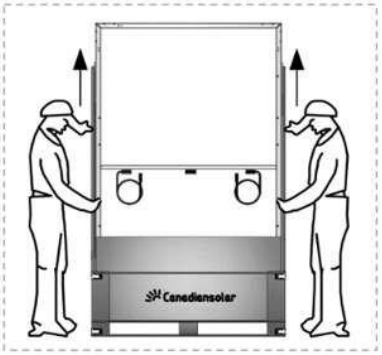
environment to avoid direct sunlight and moisture. If modules are stored in an uncontrolled environment, the storage time should be less than 3 months and extra precautions should be taken to prevent connectors from being exposed to moisture or sunlight, like using connector endcaps. Protect the package from damage. In any circumstance, for pallets of modules packaged in landscape orientation, stacking of no more than two layers is allowed, for pallets of modules packaged in portrait orientation, stacking is not allowed.

- When unloading modules pallets from flat truck, please use a crane or a forklift to remove the module pallets. When unloading modules pallets from containers, please use a forklift to remove the module pallets from the container or trailer. Do not move any pallets within the container or trailer without properly lifting them first. The forklift should be close to the ground in order to avoid the top of module pallets touching the top of the cabinet door. The thickness of forklift teeth should be less than 75mm, and the length of the forklift teeth should be longer than 2300mm, when unloading 6W-MS module pallets from the short side. For unloading CS7N-MS and CS7L-MS modules, the thickness of forklift teeth should be less than 75mm, the length of the forklift teeth should be longer than 1250mm and the width of forklift teeth should be wider than 600mm (from middle to middle of the forklift teeth). Visit our website or consult your Canadian Solar representative for more detailed CS7N and CS7Lunloading instructions.
- Unpack module pallets carefully, following the steps shown on the pallet. Unpack, transport and store the modules with care.
- Modules must always be unpacked and installed by two or three people. Always use both hands when handling modules.

For modules vertically packed lying on the short side (CS7L and CS7N), it is recommended to support the unpacked modules by one person during the unpacking process. Please use an anti-tipping structure that can be built with the pallet's own wooden frame according to the instructions below:



- During unpacking, the unpacked modules should be properly fixed. After unpacking, it is recommended to place the remaining modules in the pallet shall be placed horizontally on a pallet not exceeding the total number 12 of in one stack. Visit our website or contact your Canadian Solar representative for more detailed unpacking requirements.



- **Do not** lift modules by their wires or junction box, lift them by the frame.
- **Do not** allow the panels to sag or bow under their own weight when being carried.
- Stacks of modules should contain no more than 12 modules, and the frames should be aligned.
- **Do not** place excessive loads on the module or twist the module frame.
- **Do not** stand, step, walk and/or jump on modules under any circumstances. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void Canadian

Solar's warranty.

- **Do not** leave the module backsheet directly in contact with the support structure underneath when handling or installing the module.
- **Do not** carry modules on your head.
- **Do not** drop or place objects (such as tools) on the modules.
- **Do not** use sharp instruments on the modules. Particular care should be taken to avoid module backsheets being damaged by sharp objects, as scratches may directly affect product safety.
- **Do not** leave modules unsupported or unsecured.
- **Do not** change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry at all times.
- **Do not** expose the modules and its electrical contacts (junction boxes, connectors) to any unauthorized chemical substance (e.g. oil, lubricant, pesticide, petrol, white flower oil, activating collaterals oil, mold temperature oil, machine oil (such as KV46), grease (such as Molykote EM-SOL, etc.), lubricating oil, anti-rust oil, stamping oil, butter , cooking oil, propyl alcohol, ethyl alcohol, essential oil, bone-setting water, Tianna water, mold release agent (such as Pelicoat S-6, etc.), glue and potting glue that can generate oxime gas (such as KE200, CX-200, Chemlok, etc.), TBP (plasticizer), cleaning agents, pesticide, paint strippers, adhesives, antirust agent, disincrustant, emulsifying agent, cutting oils and cosmetics, etc.) as modules may incur damages. Please contact your Canadian Solar representative for more detailed requirements.

PRODUCT IDENTIFICATION

Each module has three identical barcodes (one in the laminate under the front glass, the second on the rear side of the module and the third on the frame) that act as a unique identifier. Each module has a unique serial number containing 14 digits or 16 digits.

A nameplate is also affixed to the rear of each module. This nameplate specifies the model type, as well as the main electrical and safety characteristics of the module. It also includes the barcode with the module unique serial number as mentioned above.

5.0 MODULE INSTALLATION

PRECAUTIONARY MEASURES AND GENERAL SAFETY

- Prior to installing modules please obtain information about any requirements and necessary approvals for the site, installation and inspection from the relevant authorities.
- Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) can bear the module system load.
- Canadian Solar modules have been qualified for Application Class A (equivalent to Safety Class II requirements). Modules rated under this class should be used in systems operating at voltage above 50V or power above 240W, where general contact access is anticipated.
- Canadian Solar standard modules have been certified as Type 1 or Type 2 according to UL 61730 and Class C according to IEC 61730-2 for fire class performance, please refer to the datasheet or the product nameplate for the detailed types.
- Consult your local authority for guidelines and requirements for building or structural fire safety.

UL 61730 SYSTEM FIRE RATING REQUIREMENTS

- Photovoltaic systems composed of UL 61730 certified modules mounted on a UL 2703 certified mounting system should be evaluated in combination with roof coverings in accordance with UL 61730 standard, with respect to meeting the same fire classification as the roof assembly.
- Mounting systems with a System Fire Class Rating (Class A, B or C), tested in conjunction with "Type 1" or "Type 2" fire rated modules, are considered acceptable for use with Canadian Solar modules, provided that the

mounting system does not violate any other requirements of this manual.

- Any mounting system limitations on inclination or accessories required to maintain a specific System Fire Class Rating should be clearly specified in the installation instructions and UL 2703 certification of the mounting system supplier.
- When installing modules, ensure the assembly is mounted over a fire-resistant roof covering rated for the application.
- The fire rating for this module is only valid when the product is installed as specified in the mechanical mounting instructions.

ENVIRONMENTAL CONDITIONS

- PV modules are intended for use in general open-air climates, as defined in IEC 60721-2-1: Classification of environmental conditions Part 2-1: Environmental conditions appearing in nature. Temperature and humidity.
- It is recommended that PV modules are installed in an environmental temperature range of -40°C to + 40°C. The 98th-percentile of the module operational temperature must be of 70°C or lower under any mounting conditions. CS7L-MS-R and CS6R-MS modules are designed for application where the 98th-percentile of the module operational temperature is up to 80°C.
- This environmental temperature range encompasses many locations and installation styles in these locations. Annex B provides the reader with modelled PV module temperature examples, at the 98th-percentile depending on different mounting methods and worldwide locations.
- Please consult the Canadian Solar technical support department for more information on the use of modules in special climates, such as an altitude greater than 2000m.

Do not install modules near open flames or flammable materials.

Do not immerse modules in water or constantly expose modules to water (either fresh or salt, i.e. from fountains, sea spray).

- Exposing modules to salt (i.e. marine environments) or sulfur (i.e. sulfur sources, volcanoes) incurs the risk of module corrosion.

NOTICE

- Canadian Solar modules have passed salt mist corrosion resistance test according to IEC 61701, but the corrosion may still occur on where the modules frame is connected to the bracket or where the grounding is connected. Should the installation location be near the ocean, Canadian Solar recommends stainless steel or aluminum materials be used in the areas with direct contact with the PV modules, and the connection point should be protected with anti-corrosion measures. For more information, please contact Canadian Solar technical support team.

INSTALLATION REQUIREMENTS

- Ensure that the module meets the general technical system requirements.
- Ensure that other systems components do not damage the module mechanically or electrically.
- Modules can be wired in series to increase voltage or in parallel to increase current. To connect modules in series, connect the cables from the positive terminal of one module to the negative terminal of the next module. To connect in parallel, connect the cables from the positive terminal of one module to the positive terminal on the next module.
- The quantity of bypass diodes in the module's junction box provided may vary depending on the model series.
- Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. In addition, modules must not be connected together to create a voltage higher than the maximum permitted system voltage stated on the module nameplate, even under the worst local temperature conditions (see Table 1 for the correction coefficients that apply to open-circuit voltage).

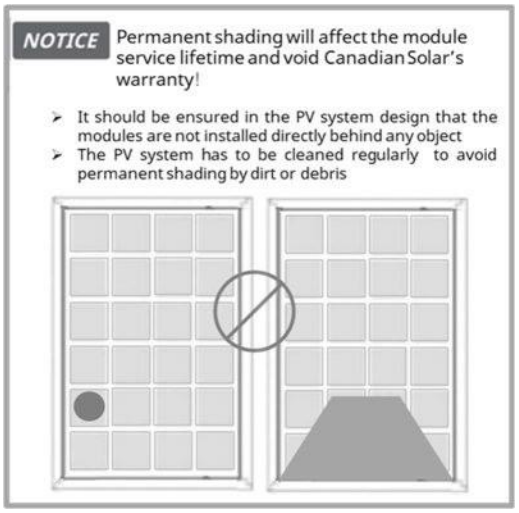
- A maximum of two strings can be connected in parallel without using an over-current protection device (fuses, etc.) incorporated in series within each string. Three or more strings can be connected in parallel if an appropriate and certified over-current protection device is installed in series within each string. And it shall be ensured in the PV system design that the reverse current of any particular string is lower than the module maximum fuse rating at any circumstances.
- Only modules with similar electrical parameters should be connected in the same string to avoid or minimize mismatch effects in arrays.
- To minimize risk in the event of an indirect lightning strike, avoid forming loops with the wiring when designing the system.
- The recommended maximum series fuse rating is stated in a table in the Annex A.
- Modules should be safely fixed to bear all expected loads, including wind and snow loads.
- A minimum clearance of 6.5 mm (0.25 in) between modules is required to allow for thermal expansion of the frames.
- The drainage holes on the underside of the module must not be blocked.

OPTIMUM ORIENTATION AND TILT

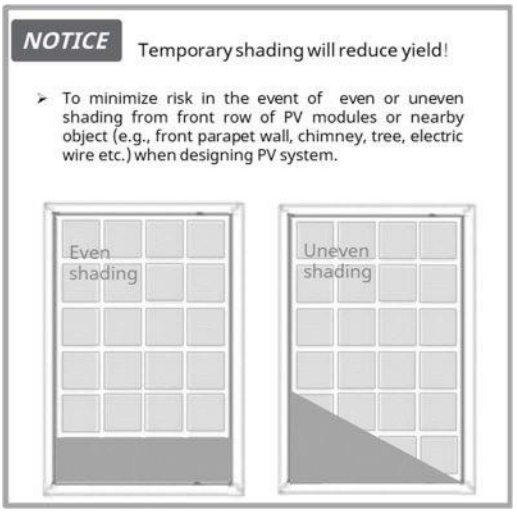
- To maximize the annual yield, please calculate the optimum orientation and tilt for PV modules in that specific installation site. The highest yields are achieved when sunlight shines perpendicularly onto the PV modules.

AVOID SHADING

Modules shall not be permanently shaded (including partial shading, spot shading, even shading or uneven shading) under any circumstance. Permanent shading includes shading of the same cell, cell row, or module portion for extended and repeated periods of time (e.g. more than 200 daylight hours over the warrantied service lifetime). Power dissipated in fully or partially shaded cells will result in power loss, reduced yield and can cause localized overheating, which in turn may negatively impact the module service lifetime. Permanent shading may cause accelerated ageing of the encapsulation material and place thermal stress on the bypass diodes. This would void the module's warranty unless properly mitigated through the use of Module Level Power Electronic (MLPE) devices.



- Regular maintenance is required to keep modules clean. Particular measures should be taken to avoid permanent shading from dirt or debris (e.g., plants, bird droppings, etc).
- Do not install modules directly behind any object (e.g., tree, antenna, etc) to prevent occurrence of permanent shading.
- Even temporary partial shading will reduce the energy yield A module can be considered to be unshaded if its entire surface is free from shading all year round, including on the shortest day of the year.



RELIABLE VENTILATION

- Sufficient clearance (at least 102 mm (4.02 in)) between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. This also allows condensation or moisture to dissipate.
- According to UL 61730, any other specific clearance required for maintaining a system fire rating should prevail. Detailed clearance requirements pertaining to system fire ratings must be provided by your racking supplier.

5.1 MODULE WIRING

CORRECT WIRING SCHEME

- Cable management scheme should be reviewed and approved by the EPC contractor; in particular required cable lengths should be cross-checked considering the specificities of the tracker structure like bearing house gaps. If longer cable or additional jumper cables are requested, please contact Canadian Solar's sales representative in advance.
- Ensure that the wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, this indicates that there is a wiring fault.
- When modules have been installed but the system has not been connected to the grid yet, each module string should be kept under open-circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.
- In case where a cable connection method not included in the below table is used, please confirm the suitable cable length with Canadian Solar's sales representative.
- For different Canadian Solar module types, Canadian Solar offers optional cable lengths to match various system configurations.
- Recommended system cable schemes are shown in table 2 & 3 below:

Table 2: System Cable Scheme for CS3U/CS3K/CS3W/CS3L/CS3LA/CS3LB/CS3Y/CS3N/CS3SA/CS6W/CS6R/CS7N/CS7L modules

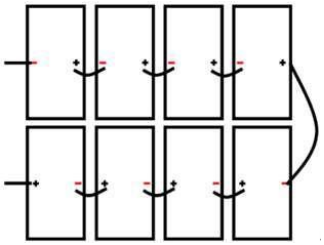
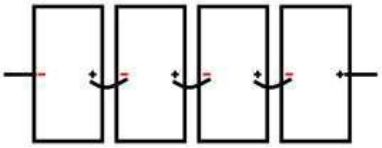
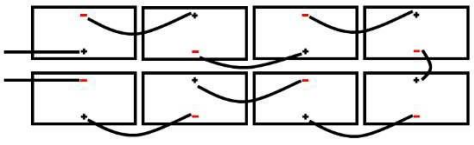
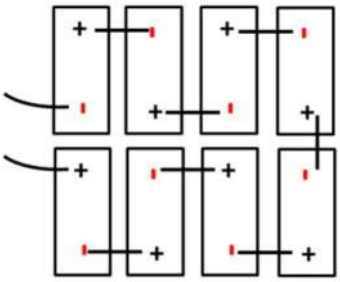
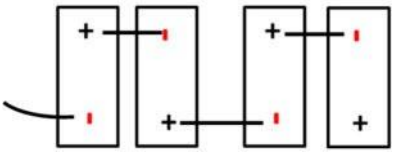
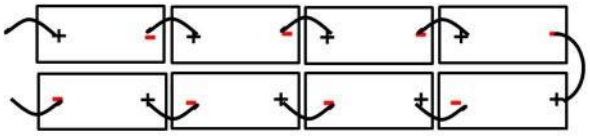
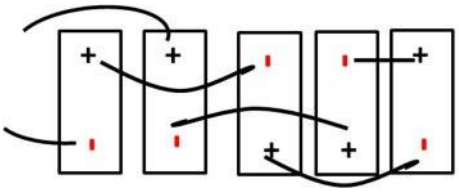
Module types	Standard cables
CS3U-P, CS3K-P, CS3W-P, CS3W-MS, CS3L-P, CS3L-MS, CS3LA-MS, CS3LB-MS, CS3Y-P, CS3Y-MS, CS3N-MS, CS3SA-MS, CS6W-MS, CS6R-MS, CS6R-MS-HL, CS7N-MS, CS7L-MS, CS7L-MS-R	 Portrait two rows installation Note: Adjacent two modules (up and down) need to be rotated 180 degrees
	 Portrait one row installation
	 Landscape installation Note: Adjacent two modules (left to right) need to be rotated 180 degrees

Table 3: System Cable Scheme for CS1V/CS1VL/CS1H/CS1HA/CS1U/CS1Y modules

Module types	Standard cables
CS1V-MS, **CS1VL-MS,** **CS1H-MS,** **CS1HA-MS,** **CS1U-MS,** **CS1Y-MS**	 Portrait two rows installation Note: Adjacent two modules (left to right) need to be rotated 180 degrees
	 Portrait one row installation Note: Adjacent two modules (left to right) need to be rotated 180 degrees
	 Landscape installation Note: Adjacent two modules (up and down) need to be rotated 180 degrees
	 Leapfrog

The maximum distance between two adjacent module frames should be within 50 mm (1.96 in) for the side with mounting clamps, and 25 mm (0.98 in) for the side without mounting clamps, in order to meet the system cable scheme.

CORRECT CONNECTION OF CONNECTORS

- Make sure that all connections are safe and properly mated. PV connectors should not be subject to stress from the exterior. Connectors should only be used to connect the circuit. They should never be used to turn the circuit on and off.
- Connectors are not waterproof when unmated. When installing modules, connector should be connected to each other as soon as possible or appropriate measures (like using connector endcaps) should be taken to avoid moisture and dust penetrating into the connector.
- **Do not** connect different connectors (manufacturer and type) together.
- **Do not** clean or precondition the connectors using lubricants or any unauthorized chemical substances.
- If end caps are present on un-mated connectors, carefully remove by hand the end caps before connecting the connectors. Do not use any sharp tool which may damage the connector. The use of tools is not needed.

Positive connector endcap

Negative connector endcap

USE OF SUITABLE MATERIALS

- Only use dedicated solar cable and suitable connectors (wiring should be sheathed in a sunlight-resistant conduit or, if exposed, should itself be sunlight-resistant) that meet local fire, building and electrical regulations. Please ensure that all wiring is in perfect electrical and mechanical condition.
- Installers may only use single-conductor cable listed and labeled as or PV wire which is 90°C wet rated in North America, and single conductor cable with a cross section area of at least 4 mm² (12 AWG), 90°C wet rated in other areas (i.e. IEC 62930 approved), with proper insulation which is able to withstand the maximum possible system open-circuit voltage. For CS7N-MS, CS7L-MS and CS7L-MS-R, Canadian Solar recommends the use of a copper wire of at least 6 mm² (10AWG) section.
- Only copper conductor material should be used. Select a suitable conductor gauge to minimize voltage drop and ensure that the conductor ampacity complies with local regulations (i.e. NEC 690.8(D)).

CABLE AND CONNECTOR PROTECTION

- Secure the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage by taking appropriate precautions (e.g. placing them inside a metallic raceway like EMT conduit). Avoid exposure to direct sunlight.
- A minimum bending radius of 60 mm (2.36 in) is required when securing the junction box cables to the racking system.
- Protect exposed connectors from weathering damage by taking appropriate precautions. Avoid exposure to direct sunlight.
- Do not place connectors in locations where water could easily accumulate.

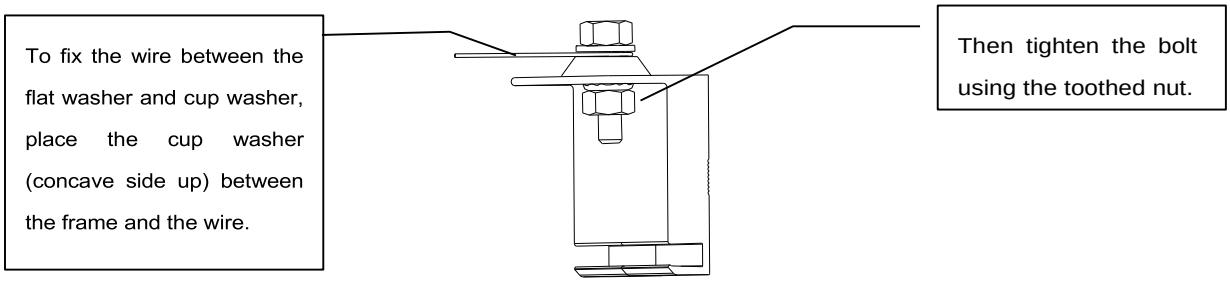
5.2 GROUNDING

- For grounding requirements in North America, a module with exposed conductive parts is considered to comply with UL 61730 only when it is electrically grounded in accordance with both the instructions presented below and the requirements of the National Electrical Code. Any grounding means used with Canadian Solar modules should be NRTL certified to UL 467 and UL 2703 standards. Please consult our technical service team for the formal approval process.
- For grounding requirements in other areas, although the modules are certified to Safety Class II, we recommend them to be grounded and that module installation should comply with all applicable local electrical codes and regulations. Minimum size of equipment grounding conductors for ground raceway and equipment from NEC 690.8(D) should be considered. Grounding connections should be installed by a qualified electrician. Connect module frames together using adequate grounding cables: the use of 4-14 mm² (AWG 6-12) copper wire is recommended. Holes provided for this purpose are identified with a

grounding symbol ⏚ (IEC 61730-1). All conductive connection junctions must be firmly fixed.

- Do not drill any extra ground holes for convenience as this will void the modules warranty.
- All bolts, nuts, flat washers, lock washers and other relevant hardware should be made of stainless steel, unless otherwise specified.
- Canadian Solar does not provide grounding hardware.
- The grounding method described below is recommended by Canadian Solar.

GROUNDING METHOD: BOLT + TOOTHED NUT + CUP WASHER.



- A grounding kit containing an M5 (3/16") SS cap bolt, an M5 (3/16") SS flat washer, an M5 (3/16") SS cup washer, and an M5 (3/16") SS nut (with teeth) is used to attach copper grounding wire to a pre-drilled grounding hole on the frame (see image above).
- Place the wire between the flat washer and the cup washer. Ensure that the cup washer is positioned between the frame and the wire with the concave side up to prevent galvanic corrosion. Tighten the bolt securely using the SS toothed nut. A wrench may be used to do this. The tightening torque is 3-7 Nm (2.2-5.2 ft-lbs).

6.0 MOUNTING INSTRUCTIONS

The applicable regulations pertaining to work safety, accident prevention and securing the construction site must be observed. Workers and third party personnel shall wear or install fall arrest equipment. Any third party need to be protected against injuries and damages.

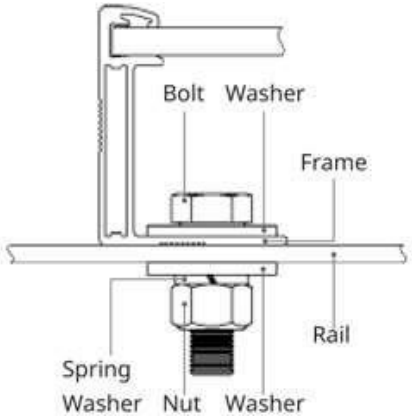
- The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with all applicable local codes and requirements from all relevant authorities.
- The module is considered to be in compliance with UL 61730 and IEC 61215 only when the module is mounted in the manner specified by the mounting instructions included in this installation manual.
- The system designer and installer are responsible for load calculations and for proper design of support structure.
- Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 61730 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field Inspection certifying that the installed module complies with the requirements of UL 61730.
- Canadian Solar does not provide mounting hardware.
- Standard modules can be mounted onto a support structure using one of several approved methods as described below. For information about other installation methods, please contact your local representative. Failure to use a recognized installation method will void the Canadian Solar warranty.
- Use appropriate corrosion-proof fastening materials. All mounting hardware (bolts, spring washers, flat washers, nuts) should be hot dip galvanized or stainless steel.
- Use a torque wrench for installation.

- Do not drill additional holes or modify the module frame. Doing so will void the warranty.
- Standard modules can be installed in either landscape or portrait orientations. Refer to the detailed instructions for further guidance. Please note that in areas with heavy snowfall (> 2400 Pa) further countermeasures such as the use of additional support bars should be considered to avoid snow loads damaging the lowest row of modules.
- In cases where an additional support bar is recommended to improve both mechanical stability and long-term module performance, we recommend selecting a sufficiently resistant material. Canadian Solar recommends bars with a minimum thickness of 50 mm (1.97 in). The support bar centerline should be positioned within 100 mm (3.94 in) of the side frame centerline (slight shifts may be necessary to access module grounding holes).
- The loads described in this manual correspond to test loads. For installations complying with IEC 61215-2:2016 and UL 61730, a safety factor of 1.5 should be applied for calculating the equivalent maximum authorized design loads. Project design loads depend on construction, applicable standards, location and local climate. Determination of the design loads is the responsibility of the racking suppliers and/or professional engineers. For detailed information, please follow local structural code or contact your professional structural engineer.

6.1 MOUNTING METHOD: BOLTING

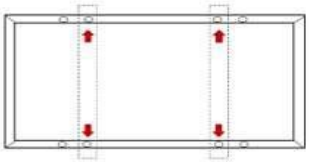
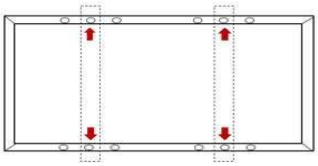
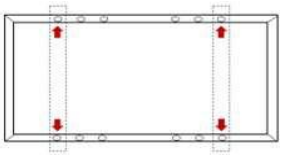
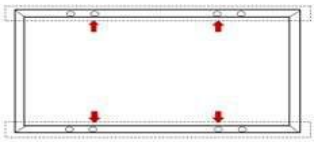
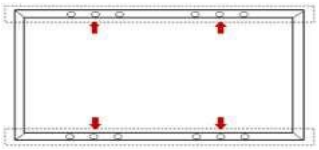
- The mechanical load test with these mounting methods were performed according to IEC 61215.
- Modules should be bolted to supporting structures through the mounting holes in the rear frame flanges only.
- Each module must be securely fastened at a minimum of 4 points on two opposite sides.
- M8 X 1.25 - Grade 8.8 (5/16”-18 Grade B7) galvanized or A2-70 stainless steel bolt and nut should be used.
- The yield strength of bolt and nut should not be less than 450 MPa.
- Tightening torques should be 16~20 Nm (11.8~14.75 ft-lbs) for M8 (5/16”-18) coarse thread bolts, depending on bolt class.
- In areas with heavy wind loads, additional mounting points should be used. The system designer and the installer are responsible for correctly calculating the loads and ensuring that the supporting structure meets all the applicable requirements.

Mounting method: Bolting



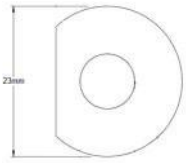
- Modules should be bolted at the following hole locations depending on the configuration and loads:

Table 5: Approved bolting methods

Inner four holes installation method A 	**Middle four holes installation method A** 	**Outer four holes installation method A** 
Inner four holes installation method B 	**Middle four holes installation method B** 	

Installation Method / Module Types	Inner four holes installation method A	Inner four holes installation method B	Middle four holes installation method A	Middle four holes installation method B	Outer four holes installation method A
CS1V-MS/CS1VL-MS/CS3K-P/CS1HA-MS	+5400Pa/-2400Pa	+4000Pa/-2400Pa	--	--	--
CS3U-P	--	--	+5400Pa/-2400Pa	+5400Pa/-2400Pa	--
CS3W-MS/CS3W-P/CS1U-MS	--	--	+5400Pa/-2400Pa	+3600Pa/-2400Pa	--
CS3N-MS (F30 Frame)	+5400Pa/-2400Pa	+3600Pa/-2400Pa	--	--	--
CS3N-MS (F23 Frame)	+5400Pa/-4000Pa*	+5400Pa/-4000Pa*	--	--	--
CS3L-MS/CS3L-P/CS3LA-MS/CS3LB-MS/CS1H-MS	+5400Pa/-2400Pa	--	--	--	--
CS6R-MS	+5400Pa/-2400Pa				+5400Pa/-2400Pa
CS1Y-MS	+5400Pa/-2400Pa	+5400Pa/-2400Pa	--	--	--
CS3Y-MS/CS3Y-P/CS3SA-MS/CS6W-MS/CS7L-MS/CS7N-MS	--	--	--	--	+5400Pa/-2400Pa
CS6R-MS-HL	+5400Pa/-3200Pa**	+5400Pa/-3200Pa**	--	--	--

Note: The bolting installation method is based on the experimental results, "--" means not tested. *: D-type (clipped) washer with outer diameter 23mm should be used for this bolting method;**: D-type washer with outer diameter 23mm should be used when uplift load 4000 Pa is required.

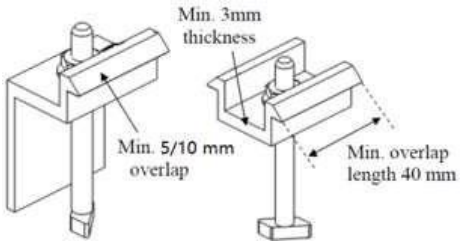


D type washer

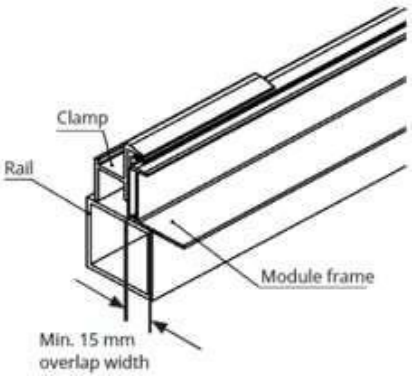
6.2 MOUNTING METHOD: CLAMPING

- The mechanical load test with these mounting methods were performed according to IEC 61215.
- Clamping methods will vary and are dependent on the mounting structures. Please follow the mounting guidelines recommended by the mounting system supplier.
- Each module must be securely fastened at a minimum of four points on two opposite sides. The clamps should be positioned symmetrically. The clamps should be positioned according to the authorized position ranges.
- Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer. M8 X 1.25 (5/16") bolt and nut are used for this clamping method.
- Tightening torques should be within 16~20 Nm (11.8~14.75 ft-lbs) for M8 (5/16") coarse thread bolts, depending on the bolt class. For the bolt grade, the technical guideline from the fastener suppliers should be followed. Different recommendations from specific clamping hardware suppliers should prevail.
- The system designer and installer are responsible for load calculations and for proper design of support structure.
- Canadian Solar's warranty may be void in cases where improper clamps or unsuitable installation methods are found. When installing inter-modules or end-type clamps, please take the following measures into account:

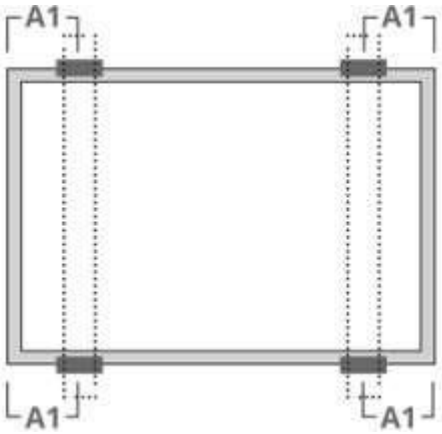
1. Do not bend the module frame.
2. Do not touch or cast shadows on the front glass.
3. Do not damage the surface of the frame (to the exception of the clamps with bonding pins).
4. Ensure the clamps overlap the module frame by at least **10 mm (0.4 in) for CS6W, CS7N and CS7L**, 5mm (0.2in) for the rest module types.
5. Overlap in length by at least
   a) 80 mm (3.15 in) when uplift load > 2400 Pa is required.
   b) 40 mm (1.57 in) when uplift load ≤ 2400 Pa is required.
6. Ensure the clamp thickness is at least 3 mm (0.12 in).



- Clamp material should be anodized aluminum alloy or stainless steel.
- Clamp position is of crucial importance for the reliability of the installation. The clamp centerlines must only be positioned within the ranges indicated in table below, depending on the configuration and load. For configurations where the mounting rails run parallel to the frame, precautions should be taken to ensure the bottom flange of the module frame overlaps the rail by 15 mm (0.59 in) or more.

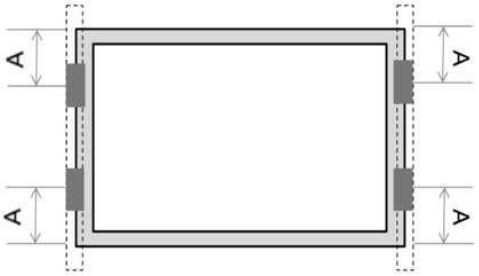


6.2.1 Four clamps on long side of frame and rails perpendicularly to the long side frame



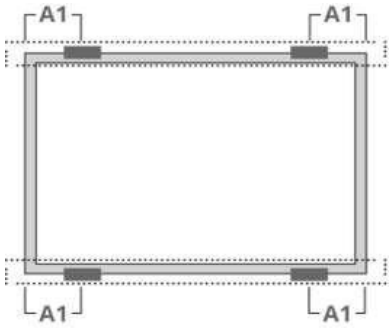
Module Types		Max Mechanical Load (Pa)					
	+2000/ -2000	+2400/ -2400	+3600/ -2400	+5400/ -2400	+5400/ -3600	+7000/ -5000	+7000/ -5400
		A1 Range (mm)					
CS1H-MS	0-219	220-440	/	/	270-330	/	/
CS1VL-MS/CS1HA-MS	0-219	220-440	/	270-330	/	/	/
CS1V-MS	0-239	331-550	/	240-330	/	/	/
CS3K-P	0-239	331-550	/	/	240-330	/	/
CS3U-P/CS3W-MS/CS3W-P	/	340-550	/	/	410-490	/	/
CS1U-MS	/	340-550	/	410-490	/	/	/
CS1Y-MS	/	/	300-600	/	350-550	/	400-500
CS3L-MS/CS3L-P/CS3LA-MS/CS3LB-MS	0-240	331-550	/	/	240-330	/	/
CS3N-MS（**F30 Frame**）	/	300-600	/	/	400-500	/	/
CS3N-MS（**F23 Frame**）	/	/	200-650	/	300-600	/	450-550
CS3Y-MS/CS3Y-P/CS6W-MS/CS7L-MS	/	300-600	/	400-500	/	/	/
CS7N-MS	/	300-600	/	450-550	/	/	/
CS3SA-MS	/	/	300-600	400-500	/	/	/
CS6R-MS	0-100	100-600	200-500	300-400	/	/	/
CS6R-MS-HL	/	0-100	100-600	250-550	/	400-500	/

6.2.2 Four clamps on short side of frame and rails perpendicular to the long side frame.



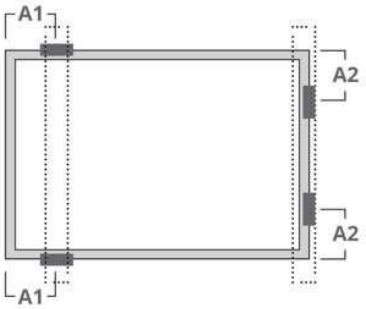
Module Types	A Range (mm)	
	0-200	200-250
	Max Mechanical Load (Pa)	
CS3U-P	+1200/-1200	+1400/-1400
CS3W-MS/CS3W-P	+1000/-1000	+1200/-1200
CS3L-MS/CS3L-P	+2000/-2000	+2200/-2200
CS1Y-MS	+1600/-1600	+1800/-1800
CS3N-MS（**F30 Frame**）	+2000/-2000	+2200/-2200
CS3N-MS（**F23 Frame**）	+2200/-2000	+2400/-2200
CS6R-MS	+2200/-2200	+2400/-2400
CS6R-MS-HL	+2400/-2400	+2600/-2400

6.2.3 Four clamps on long side of frame and rails parallel to the long side frame.



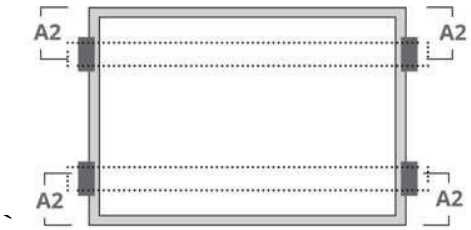
Module Types	Max Mechanical Load (Pa)		
	+3200/-2400	+4000/-2400	+5400/-2400
	A1 Range (mm)		
CS3U-P	/	/	410-490
CS3K-P/CS1V-MS	/	240-330	/
CS1VL-MS/CS1HA-MS	/	270-330	/
CS3N-MS（**F30 Frame**）	/	400-500	/
CS3N-MS（**F23 Frame**）	/	200-600	450-550
CS6R-MS	200-600	200-300	/
CS6R-MS-HL	/	100-600	450-550

6.2.4 Two clamps on the long side and two clamps on the short side of frame. Rails run perpendicular to the long side frame.



Module Types	Max Mechanical Load (Pa)	
	+2400/-2400	
	A1 Range (mm)	A2 Range (mm)
CS3U-P	300-550	200-250
CS3K-P	100-550	200-250
CS3W-MS/CS3W-P	600-800	20-250
CS3L-MS/CS3L-P	400-600	20-250
CS3N-MS（**F23 Frame**）	400-600	200-250
CS6R-MS	400-600	200-250
CS6R-MS-HL	350-650	100-300

6.2.5 Four clamps on short side of frame and rails parallel to the long side frame.

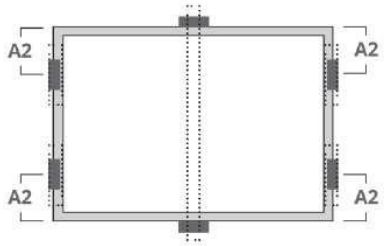


Module Types		A2 Range (mm)				
	0-200	170-210	200-250	200-300	250-300	230-250
		Max Mechanical Load (Pa)				
CS1VL-MS/CS1HA-MS	/	/	+2400/-2400	/	/	/
CS1V-MS	/	+2400/-2400	/	/	/	/
CS3K-P	/	/	+2000/-2000	/	/	/
CS3L-MS/CS3L-P	/	/	/	/	/	+2200/-2200
CS1Y-MS	+1600/-1600	/	+1800/-1800	/	/	/
CS3N-MS（**F30 Frame**）	+2000/-2000	/	+2200/-2200	/	/	/
CS3N-MS（**F23 Frame**）	+2200/-2000	/	/	+5400/-2400	/	/
CS6R-MS	+2200/-2200	/	+2400/-2400	/	/	/
CS6R-MS-HL	+2400/-2400	/	/	/	+5400/-2400	/

6.2.6 Four clamp mounting on short side of frame.

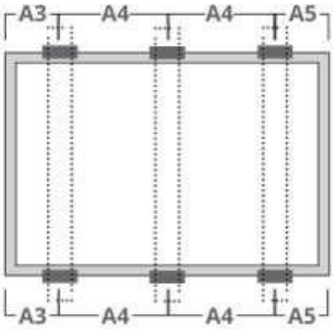
Module Types	Max Mechanical Load (Pa)						
	+1000/-1000	+1200/-1200	+2000/-2000	+2200/-2200	+2200/-2000	+2400/-2400	+2600/-2400
	A2 Range (mm)						
CS1VL-MS/CS1HA-MS	/	/	/	/	/	0-250	
CS1V-MS	/	/	0-210	/	/	/	
CS3K-P	/	/	0-200	200-250	/	/	
CS3L-MS/CS3L-P	/	/	0-200	200-250	/	/	
CS3W-MS/CS3W-P	0-200	200-250	/	/	/	/	
CS3N-MS（**F23 Frame**）	/	/	/	/	0-200	/	
CS3N-MS（**F30 Frame**）	/	/	0-200	200-250	/	/	
CS6R-MS	/	/	/	0-200	/	200-250	
CS6R-MS-HL	/	/	/	/	/	0-200	200-250

6.2.7 Four clamp mounting on short side of frame, and an additional support bar placed below the center of the module.



Module Types	Max Mechanical Load (Pa)		
	+4000/-3000	+4000/-4000	+5400/-2400
	A2 Range (mm)		
CS1VL-MS/CS1HA-MS/CS3K-P/CS3U-P	/	/	200-250
CS1V-MS	/	/	170-210
CS3N-MS（**F30 Frame**）	/	0-200	/
CS6R-MS	0-200	/	/
CS6R-MS-HL	/	0-200	/

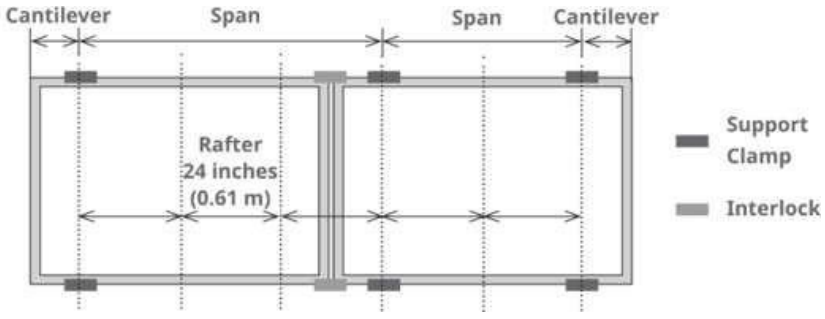
6.2.8 Six clamps on long side of frame and rails perpendicularly to the long side frame



Module Types		Max Mechanical Load (Pa)					
	+5400/-2400	+5400/-3600	+6000/-3600	+6000/-4000	+7500/-5400	+8100/-5000	+8100/-6000
		A3 & A5 Range (mm)					
CS1H-MS	80-380	/	/	0-250	/	/	/
CS1U-MS	250-350	/	/	/	/	/	/
CS3L-MS/CS3L-P	/	140-440	/	/	/	/	/
CS3K-P	/	/	/	80-380	/	/	/
CS3N-MS（**F23 Frame**）	/	/	/	/	300-550	/	350-450
CS6R-MS	/	/	80-380	/	/	/	/
CS6R-MS-HL	100-600	/	/	300-550	/	350-450	/

6.2.9 Rail-less clamping

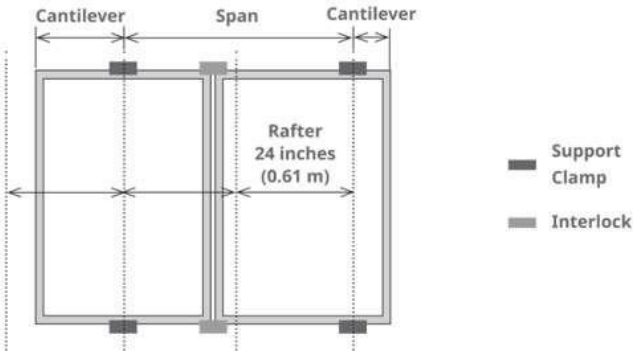
* Clamp overlap length of 40mm (or 1.50 in) when uplift load > 2400 Pa is allowed.



Landscape installation, clamping on long side frame

Modyle Type	Max Span	Max Cantilever length	Downforce	Uplift
CS3K-P/CS1H-MS	72 inches (1.83 m)	24 inches (0.61 m)	2200 Pa	1400 Pa
	64 inches (1.63 m)	21.3 inches (0.54 m)	2400 Pa	1400 Pa
	48 inches (1.22 m)	16 inches (0.41 m)	3400 Pa	1800 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	4800 Pa	2400 Pa
CS1Y-MS	72 inches (1.83 m)	24 inches (0.61 m)	2650 Pa	2400 Pa
	64 inches (1.63 m)	21.3 inches (0.54 m)	2800 Pa	2400 Pa
	48 inches (1.22 m)	16 inches (0.41 m)	3850 Pa	3600 Pa

	32 inches (0.81 m)	10.7 inches (0.27 m)	5400 Pa	3600 Pa
CS3N-MS (F30 Frame)*	72 inches (1.83 m)	24 inches (0.61 m)	2200 Pa	2200Pa
	64 inches (1.63 m)	21.3 inches (0.54 m)	2400 Pa	2200 Pa
	48 inches (1.22 m)	16 inches (0.41 m)	3000 Pa	2400 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	3600 Pa	3600 Pa
CS3N-MS (F23 Frame) *	72 inches (1.83 m)	24 inches (0.61 m)	2650 Pa	2400 Pa
	64 inches (1.63 m)	21.3 inches (0.54 m)	2800 Pa	2400 Pa
	48 inches (1.22 m)	16 inches (0.41 m)	3600 Pa	3600 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	4000 Pa	3600 Pa
CS6R-MS-HL*	72 inches (1.83 m)	24 inches (0.61 m)	2650 Pa	2400 Pa
	64 inches (1.63 m)	21.3 inches (0.54 m)	2800 Pa	2400 Pa
	48 inches (1.22 m)	16 inches (0.41 m)	3600 Pa	3600 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	4000 Pa	3600 Pa



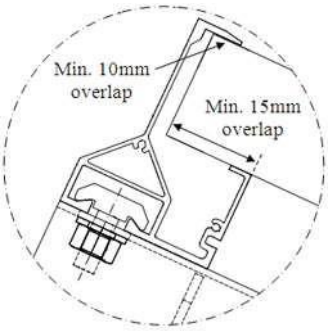
Portrait installation, clamping on short side frame

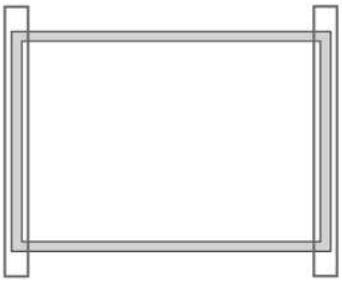
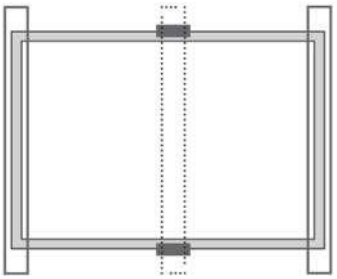
Modyle Type	Max Span	Max Cantilever length	Downforce	Uplift
CS3K-P/CS1H-MS	48 inches (1.22 m)	16 inches (0.41 m)	1800 Pa	800 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	1800 Pa	1200 Pa
	24 inches (0.61 m)	8 inches (0.2 m)	1800 Pa	1800 Pa
CS1Y-MS	48 inches (1.22 m)	16 inches (0.41 m)	1800 Pa	1800 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	1800 Pa	1800 Pa
	24 inches (0.61 m)	8 inches (0.2 m)	2000 Pa	2000 Pa
CS3N-MS（F30 Frame）*	48 inches (1.22 m)	16 inches (0.41 m)	1600 Pa	1600 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	1600 Pa	1600 Pa
	24 inches (0.61 m)	8 inches (0.2 m)	1800 Pa	1800 Pa
CS3N-MS（F23 Frame）*	48 inches (1.22 m)	16 inches (0.41 m)	1800 Pa	1800 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	1800 Pa	1800 Pa
	24 inches (0.61 m)	8 inches (0.2 m)	2000 Pa	2000 Pa
CS6R-MS-HL*	48 inches (1.22 m)	16 inches (0.41 m)	1800 Pa	1800 Pa
	32 inches (0.81 m)	10.7 inches (0.27 m)	1800 Pa	1800 Pa
	24 inches (0.61 m)	8 inches (0.2 m)	2000 Pa	2000 Pa

6.3 INSERTION SYSTEMS

- This mounting method has been certified by VDE and CSA, or qualified by Canadian Solar.
- Insertion methods can vary and depend on the mounting structures. The installer needs to follow the mounting guidelines recommended by the mounting system supplier. Each module must be securely maintained through all its length on two opposite sides. Install and tighten the insertion profiles to the support structure using the hardware and instructions provided by the mounting system manufacturer. The system designer and installer are solely responsible for load calculations and for the proper design of support structure.
- Canadian Solar warranty may be void in cases where improper insertion systems or unsuitable installation methods are found. When installing insertion profiles, please take the following measures into account:

1. Do not bend the module frame.
2. Do not touch the front glass or cast shadow onto it.
3. Do not damage the surface of the frame.
4. Ensure that the insertion profiles overlap the module frame by at least 10 mm (0.39 in).
5. Ensure that the module frame (C-shape) overlaps the insertion profiles by at least 15 mm (0.59 in).
6. Ensure insertion profile thickness and tolerances suit module thickness.



Insertion Method A	Insertion Method B	Insertion Method C
		
Two insertion profiles run parallel to long side frame.	Two insertion profiles run perpendicularly to long side frame.	An additional support bar used with clamps

Installation Method / Module Types	Insertion Method A	Insertion Method B	Insertion Method C
CS3U-P	+5400Pa/-2400Pa	+1400Pa/-1400Pa	+5400Pa/-2400Pa
CS1H-MS	+2400Pa/-2400Pa	/	+5400Pa/-2400Pa
CS3W-MS/CS3W-P	+4000Pa/-2400Pa	+1200Pa/-1200Pa	/
CS3L-MS/CS3L-P	+4000Pa/-2400Pa	+2200Pa/-2200Pa	/
CS6R-MS	+4000Pa/-2400Pa	+2200Pa/-2200Pa	/
CS6W-MS (F35A Frame)	+4000Pa/-2400Pa	+1500Pa/-1200Pa	+5400Pa/-2400Pa
CS1Y-MS	+5400Pa/-2400Pa	+1800Pa/-1800Pa	/
CS3N-MS (F30 Frame)	/	+1600Pa/-1600Pa	/
CS6R-MS-HL	+5400Pa/-2400Pa	+2400Pa/-2400Pa	+5400Pa/-2400Pa

7.0 MAINTENANCE

- **Do not** make modifications to any component of the PV module (diode, junction box, connectors or others).
- Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots, and dust.
- Modules with sufficient tilt (at least 15°), generally may not require cleaning (rain will have a self-cleaning effect). If the module has become soiled, wash with water and a non-abrasive cleaning implement (sponge) during the cool part of the day. Do not scrape or rub dry dirt away, as this may cause micro scratches.
- Snow should be removed using a soft brush.
- Periodically inspect the system to check the integrity of all wiring and supports.
- To protect against electric shock or injury, electrical or mechanical inspections and maintenance should be performed by qualified personnel only.

8.0 MODULE CLEANING GUIDELINES

This manual covers the requirements for the cleaning procedure of Canadian Solar photovoltaic modules. The purpose of these cleaning guidelines is to provide general information for cleaning Canadian Solar modules. System users and professional installers should read these guidelines carefully and strictly follow these instructions.

Failure to follow these instructions may result in death, injury or damage to the photovoltaic modules. Damages induced by inappropriate cleaning procedures will void Canadian Solar warranty.

SAFETY WARNING

- Cleaning activities create risk of damaging the modules and array components, as well as increasing the potential electric shock hazard.
- Cracked or broken modules represent an electric shock hazard due to leakage currents, and the risk of shock is increased when modules are wet. Before cleaning, thoroughly inspect modules for cracks, damage, and loose connections.
- The voltage and current present in an array during daylight hours are sufficient to cause a lethal electrical shock.
- Ensure that the circuit is disconnected before starting the cleaning procedure as contact with leakage of electrically active parts can result in injury.
- Ensure that the array has been disconnected to other active components (such as inverter or combiner boxes) before starting with the cleaning.
- Wear suitable protection (clothes, insulated gloves, etc.).
- **Do not** immerse the module, partially or totally, in water or any other cleaning solution.
- Rear side cleaning of the modules is not required. If cleaning the rear of a module is desired, care should be taken to ensure there is no damage caused to the backsheet by simply clearing the contaminant by hand or with a soft sponge.

HANDLING NOTICE

NOTICE

- Use a proper cleaning solution and suitable cleaning equipment.
- **Do not** use abrasive or electric cleaners on the module.
- Particular attention should be taken to avoid the module backsheet or frame to come in contact with sharp objects, as scratches may directly affect product safety.
- **Do not** use abrasive cleaners, de-greasers or any unauthorized chemical substance (e.g. oil, lubricant, pesticide, Gasoline, white flower oil, active oil, mold temperature oil, machine oil (such as KV46), grease (such as Molykote EM-SOL, etc.), lubricating oil, anti-rust oil, stamping oil, butter , cooking oil, propyl alcohol, ethyl alcohol, essential oil, bone-setting water, Tianna water, mold release agent (such as Pelicoat S-6, etc.), glue and potting glue that can generate oxime gas (such as KE200, CX-200, Chemlok, etc.), TBP (plasticizer), cleaning agents, pesticide, paint strippers, adhesives,

antirust agent, disincrustant, emulsifying agent, cutting oils and cosmetics etc.) on the module. Please contact your Canadian Solar representative for more detailed requirements.

- **Do not** use cleaning corrosive solutions containing hydrofluoric acid, alkali, acetone, or industrial alcohol. Only substances explicitly approved by Canadian Solar are allowed to be used for cleaning modules.
- For cleaning methods using rotating brush, please consult with Canadian Solar's technical support before using.
- Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratches on the glass surface. The module damage due to improper dry cleaning method will void Canadian Solar's warranty.
- Improper cleaning equipment design may cause localized heavy loads onto the module. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void Canadian Solar's warranty. Please consult the Canadian Solar technical support department for information on the use of cleaning solutions and loading specifications.

OPERATION PREPARATION

- Noticeable dirt must be rubbed away by gentle cleaning implement (soft cloth, sponge or brush with soft bristles).
- Ensure that brushes or agitating tools are not abrasive to glass, EPDM, silicone, aluminum, or steel.
- Conduct the cleaning activities avoiding the hottest hours of the day, in order to avoid thermal stress on the module.

CLEANING METHODS

Method A: Compressed Air

Canadian Solar recommends cleaning the soft dirt (like dust) on modules just with air pressure. This technique can be applied as long as the method is efficient enough considering the existing conditions.

Method B: Wet cleaning

If excessive soiling is present on the module surface, a non-conductive brush, sponge, or other mild agitating method may be used with caution.

- Ensure that any brushes or agitating tools are constructed with non-conductive materials to minimize risk of electric shock and that they are not abrasive to the glass or the aluminum frame.
- If grease is present, an environmental-friendly cleaning agent may be used with caution.
- Canadian Solar recommends the following to be used:
  - Water with low mineral content
  - Near neutral pH water
  - The maximum water pressure recommended is 4 MPa (40 bar)

ANNEX A: MECHANICAL AND ELECTRICAL RATINGS

Standard Test Conditions are: Irradiance of 1000 W/m^2, AM1.5 spectrum, and cell temperature of 25°C. The tolerance of electrical characteristics is respectively within ±3% for Pmax, and ±5% for Isc & Voc. Specifications are subject to change without notice.

Table A: Mechanical and electrical ratings under STC

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3U-310P	310	37.2	8.34	44.7	8.88	30	2000 x 992 x 40/35 (78.7 x 39.1 x 1.57/1.38 in)	22.6 / 22.5 (49.8 / 49.6 lbs)
CS3U-315P	315	37.4	8.43	44.9	8.96	30		
CS3U-320P	320	37.6	8.52	45.1	9.04	30		
CS3U-325P	325	37.8	8.60	45.3	9.12	30		
CS3U-330P	330	38.0	8.69	45.5	9.20	30		
CS3U-335P	335	38.2	8.77	45.7	9.28	30		
CS3U-340P	340	38.4	8.86	45.9	9.36	30		
CS3U-345P	345	38.6	8.94	46.1	9.44	30		
CS3U-350P	350	39.2	8.94	46.6	9.51	30		
CS3U-355P	355	39.4	9.02	46.8	9.59	30		
CS3U-360P	360	39.6	9.10	47.0	9.67	30		
CS3U-365P	365	39.8	9.18	47.2	9.75	30		
CS3U-370P	370	40.0	9.26	47.4	9.83	30		
CS3U-375P	375	40.2	9.34	47.6	9.91	30		
CS3U-380P	380	40.4	9.42	47.8	9.99	30		
CS3U-385P	385	40.6	9.50	48.0	10.07	30		
CS3U-390P	390	40.8	9.56	48.6	10.17	30		
CS3U-395P	395	41.0	9.64	48.8	10.24	30		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3U-400P	400	41.2	9.71	49.0	10.30	30		
CS3U-405P	405	41.4	9.79	49.2	10.37	30		
CS3U-410P	410	41.6	9.86	49.4	10.43	30		
CS3U-415P	415	41.8	9.93	49.6	10.49	30		
CS3U-420P	420	42.0	10.00	49.8	10.55	30		
CS3K-250P	250	30.0	8.34	36.7	8.98	30	1675 x 992 x 40/35 (65.9 x 39.1 x 1.57/1.38 in)	18.5 (40.8 lbs)
CS3K-255P	255	30.2	8.45	36.9	9.06	30		
CS3K-260P	260	30.4	8.56	37.1	9.14	30		
CS3K-265P	265	30.6	8.66	37.3	9.22	30		
CS3K-270P	270	30.8	8.77	37.5	9.30	30		
CS3K-275P	275	31.0	8.88	37.7	9.38	30		
CS3K-280P	280	31.2	8.98	37.9	9.47	30		
CS3K-285P	285	31.4	9.08	38.1	9.56	30		
CS3K-290P	290	32.3	8.98	38.9	9.49	30.		
CS3K-295P	295	32.5	9.08	39.1	9.57	30.		
CS3K-300P	300	32.7	9.18	39.3	9.65	30.		
CS3K-305P	305	32.9	9.28	39.5	9.73	30.		
CS3K-310P	310	33.1	9.37	39.7	9.81	30.		
CS3K-315P	315	33.3	9.46	39.9	9.89	30.		
CS3K-320P	320	33.5	9.56	40.1	9.97	30.		
CS3K-325P	325	33.7	9.65	40.9	10.21	30.		
CS3K-330P	330	33.9	9.74	41.1	10.29	30		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3K-335P	335	34.1	9.83	41.3	10.37	30		
CS3K-340P	340	34.3	9.92	41.5	10.45	30		
CS3K-345P	345	34.5	10.00	41.7	10.52	30		
CS3K-350P	350	34.7	10.09	41.9	10.60	30		
CS1V-240MS	240	28.3	8.48	34.7	9.15	15	1638 x 826 x 40 (64.5 x 32.5 x 1.57 in)	15.4 (34.0 lbs)
CS1V-245MS	245	28.6	8.58	34.9	9.22	15		
CS1V-250MS	250	28.8	8.68	35.1	9.29	15		
CS1V-255MS	255	29.0	8.79	35.3	9.37	15		
CS1V-260MS	260	29.2	8.89	35.5	9.44	15		
CS1V-265MS	265	29.4	9.00	35.7	9.51	15		
CS1V-270MS	270	29.6	9.11	35.9	9.59	15		
CS1V-275MS	275	29.8	9.22	36.1	9.66	15		
CS1V-280MS	280	30.0	9.33	36.3	9.74	15		
CS1V-285MS	285	30.2	9.44	36.5	9.82	15		
CS1VL-190MS	190	22.5	8.45	27.6	9.10	15	1322 x 826 x 35 (52.05 x 32.5 x 1.38 in)	12.6 (27.8 lbs)
CS1VL-195MS	195	22.7	8.58	27.8	9.22	15		
CS1VL-200MS	200	22.9	8.73	28.0	9.34	15		
CS1VL-205MS	205	23.1	8.88	28.2	9.46	15		
CS1VL-210MS	210	23.3	9.01	28.4	9.58	15		
CS1VL-215MS	215	23.5	9.15	28.6	9.70	15		
CS1VL-220MS	220	23.7	9.28	28.8	9.82	15		
CS1VL-225MS	225	23.9	9.41	29.0	9.97	15		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS1K-310MS	310	35.2	8.82	43.1	9.37	20	1675 x 992 x 35 (65.9 x 39.1 x 1.38 in)	18.5 (40.8 lbs)
CS1K-315MS	315	35.4	8.91	43.2	9.44	20		
CS1K-320MS	320	35.6	9.00	43.3	9.51	20		
CS1K-325MS	325	35.8	9.09	43.4	9.58	20		
CS1K-330MS	330	36.0	9.18	43.5	9.65	20		
CS1K-335MS	335	36.2	9.27	43.6	9.73	20		
CS1K-340MS	340	36.4	9.35	43.7	9.81	20		
CS1K-345MS	345	36.6	9.43	43.8	9.88	20		
CS1K-350MS	350	36.8	9.51	43.9	9.95	20		
CS1K-355MS	355	37.0	9.60	44.0	10.02	20		
CS1H-315MS	315	36.2	8.85	44.0	9.60	16	1700 x 992 x 35 (66.9 x 39.1 x 1.38 in)	19.2 (42.3 lbs)
CS1H-325MS	325	36.6	8.88	44.1	9.64	16		
CS1H-330MS	330	37.0	8.92	44.2	9.68	16		
CS1H-335MS	335	37.4	8.96	44.3	9.72	16		
CS1H-340MS	340	37.8	9.00	44.5	9.76	16		
CS1H-345MS	345	38.2	9.04	44.6	9.80	16		
CS1U-385MS	385	43.5	8.86	53.1	9.45	15	2078 x 992 x 35 (81.8 x 39.1 x 1.38 in)	23.4 (51.6 lbs)
CS1U-390MS	390	43.7	8.93	53.2	9.50	15		
CS1U-395MS	395	43.9	9.01	53.3	9.55	15		
CS1U-400MS	400	44.1	9.08	53.4	9.60	15		
CS1U-405MS	405	44.3	9.16	53.5	9.65	15		
CS1U-410MS	410	44.5	9.23	53.6	9.70	15		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS1U-415MS	415	44.7	9.30	53.7	9.75	15		
CS1U-420MS	420	44.9	9.37	53.8	9.80	15		
CS1U-425MS	425	45.1	9.44	53.9	9.85	15		
CS1U-430MS	430	45.3	9.51	54.0	9.90	15		
CS1Y-380MS	380	42.7	8.89	51.5	9.74	16	2021 x 996 x 35 (79.6 x 39.2 x 1.38 in)	24.0 (52.9 lbs)
CS1Y-385MS	385	42.9	8.97	51.7	9.78	16		
CS1Y-390MS	390	43.1	9.05	51.9	9.82	16		
CS1Y-395MS	395	43.3	9.13	52.1	9.86	16		
CS1Y-400MS	400	43.5	9.20	52.3	9.90	16		
CS1Y-405MS	405	43.7	9.27	52.5	9.94	16		
CS1Y-410MS	410	43.8	9.37	52.7	9.98	16		
CS1Y-415MS	415	44.0	9.44	52.8	10.02	16		
CS3W-385P	385	38.1	10.11	46.6	10.66	20	2108 x 1048 x 40/35 (83.0 x 41.3 x 1.57/1.38 in)	24.3 (53.6lbs)
CS3W-390P	390	38.3	10.19	46.8	10.74	20		
CS3W-395P	395	38.5	10.26	47.0	10.82	20		
CS3W-400P	400	38.7	10.34	47.2	10.90	20		
CS3W-405P	405	38.9	10.42	47.4	10.98	20		
CS3W-410P	410	39.1	10.49	47.6	11.06	20		
CS3W-415P	415	39.3	10.56	47.8	11.14	20		
CS3W-420P	420	39.5	10.64	48.0	11.26	20		
CS3W-425P	425	39.7	10.71	48.2	11.29	20		
CS3W-430P	430	39.9	10.78	48.4	11.32	20		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3W-435P	435	40.1	10.85	48.6	11.35	20		
CS3W-440P	440	40.3	10.92	48.7	11.40	20		
CS3W-445P	445	40.5	10.99	48.8	11.45	20		
CS3L-320P	320	31.8	10.07	38.8	10.66	20	1765 x 1048 x 40/35 (69.5 x 41.3 x 1.57/1.38 in)	20.5 (45.2lbs)
CS3L-325P	325	32.0	10.16	39.0	10.74	20		
CS3L-330P	330	32.2	10.24	39.2	10.82	20		
CS3L-335P	335	32.4	10.34	39.4	10.90	20		
CS3L-340P	340	32.6	10.43	39.6	10.98	20		
CS3L-345P	345	32.8	10.52	39.8	11.06	20		
CS3L-350P	350	33.0	10.61	40.2	11.24	20		
CS3L-355P	355	33.2	10.70	40.4	11.31	20		
CS3L-360P	360	33.4	10.78	40.6	11.37	20		
CS3L-365P	365	33.6	10.87	40.8	11.44	20		
CS3L-370P	370	33.8	10.95	41.0	11.51	20		
CS3L-375P	375	34.0	11.03	41.2	11.59	20		
CS3L-380P	380	34.2	11.12	41.4	11.68	20		
CS3W-415MS	415	39.7	10.46	47.7	11.22	20	2108 x 1048 x 40/35 (83.0 x 41.3 x 1.57/1.38 in)	24.3 (53.6lbs)
CS3W-420MS	420	39.9	10.53	47.9	11.27	20		
CS3W-425MS	425	40.1	10.60	48.1	11.32	20		
CS3W-430MS	430	40.3	10.68	48.3	11.37	20		
CS3W-435MS	435	40.5	10.75	48.5	11.42	20		
CS3W-440MS	440	40.7	10.82	48.7	11.48	20		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3W-445MS	445	40.9	10.89	48.9	11.54	20		
CS3W-450MS	450	41.1	10.96	49.1	11.60	20		
CS3W-455MS	455	41.3	11.02	49.3	11.66	20		
CS3W-460MS	460	41.5	11.09	49.5	11.72	20		
CS3W-465MS	465	41.7	11.16	49.7	11.78	20		
CS3W-470MS	470	41.9	11.22	49.9	11.84	20		
CS3L-345MS	345	33.1	10.43	39.8	11.23	20	1765 x 1048 x 40/35 (69.5 x 41.3 x 1.57/1.38 in)	20.5 (45.2 lbs)
CS3L-350MS	350	33.3	10.52	40.0	11.28	20		
CS3L-355MS	355	33.5	10.61	40.2	11.33	20		
CS3L-360MS	360	33.7	10.69	40.4	11.40	20		
CS3L-365MS	365	33.9	10.78	40.6	11.47	20		
CS3L-370MS	370	34.1	10.86	40.8	11.54	20		
CS3L-375MS	375	34.3	10.94	41.0	11.61	20		
CS3L-380MS	380	34.5	11.02	41.2	11.68	20		
CS3L-385MS	385	34.7	11.10	41.4	11.75	20		
CS3L-390MS	390	34.9	11.18	41.6	11.82	20		
CS3LA-290MS	290	26.9	10.78	32.5	11.47	20	1424 x 1048 x 35 (56.1 x 41.3 x 1.38 in)	17.0 (37.5 lbs)
CS3LA-295MS	295	27.2	10.86	32.6	11.54	20		
CS3LA-300MS	300	27.4	10.94	32.8	11.61	20		
CS3LA-305MS	305	27.7	11.02	33.0	11.68	20		
CS3LB-240MS	240	22.4	10.71	27.1	11.47	20	1765 x 709 x 35 (69.5 x 27.9 x 1.38 in)	14.5 (32.0 lbs)
CS3LB-245MS	245	22.7	10.82	27.2	11.54	20		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3LB-250MS	250	22.9	10.94	27.3	11.61	20		
CS3LB-255MS	255	23.1	11.05	27.5	11.72	20		
CS1HA-265MS	265	29.9	8.86	36.1	9.45	15	1395 x 992 x 35 (54.9 x 39.1 x 1.38 in)	15.8 (34.8lbs)
CS1HA-270MS	270	30.3	8.92	36.3	9.49	15		
CS1HA-275MS	275	30.6	8.99	36.5	9.53	15		
CS1HA-280MS	280	30.9	9.07	36.8	9.57	15		
CS1HA-285MS	285	31.2	9.14	37.2	9.61	15		
CS3Y-420P	420	41.2	10.20	50.4	10.98	20	2252 x 1048 x 35 (88.7 x 41.3 x 1.38 in)	25.7 (56.7 lbs)
CS3Y-425P	425	41.4	10.27	50.6	11.03	20		
CS3Y-430P	430	41.6	10.34	50.8	11.08	20		
CS3Y-435P	435	41.8	10.41	51.0	11.13	20		
CS3Y-440P	440	42.0	10.48	51.2	11.18	20		
CS3Y-445P	445	42.2	10.55	51.4	11.23	20		
CS3Y-450P	450	42.4	10.62	51.6	11.28	20		
CS3Y-455P	455	42.6	10.69	51.8	11.33	20		
CS3Y-460P	460	42.8	10.75	52.0	11.38	20		
CS3Y-465P	465	43.0	10.82	52.2	11.43	20		
CS3Y-470P	470	43.2	10.88	52.4	11.48	20		
CS3Y-475P	475	43.4	10.95	52.6	11.53	20		
CS3Y-480P	480	43.6	11.01	52.8	11.58	20		
CS3Y-485P	485	43.8	11.08	53.0	11.63	20		
CS3Y-490P	490	44.0	11.14	53.2	11.68	20		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3Y-495P	495	44.2	11.20	53.4	11.73	20		
CS3Y-465MS	465	43.6	10.67	52.3	11.42	20	2252 x 1048 x 35 (88.7 x 41.3 x 1.38 in)	25.7 (56.7 lbs)
CS3Y-470MS	470	43.8	10.74	52.5	11.47	20		
CS3Y-475MS	475	44.0	10.81	52.7	11.52	20		
CS3Y-480MS	480	44.2	10.87	52.9	11.57	20		
CS3Y-485MS	485	44.4	10.94	53.1	11.62	20		
CS3Y-490MS	490	44.6	11.00	53.3	11.67	20		
CS3Y-495MS	495	44.8	11.06	53.5	11.72	20		
CS3Y-500MS	500	45.0	11.12	53.7	11.77	20		
CS3Y-505MS	505	45.2	11.18	53.9	11.82	20		
CS3Y-510MS	510	45.4	11.24	54.1	11.87	20		
CS3SA-320MS	320	33.5	9.57	40.1	10.22	20	1680 x 996 x 35 (66.1 x 39.2 x 1.38 in)	18.8 (41.4 lbs)
CS3SA-325MS	325	33.7	9.66	40.3	10.30	20		
CS3SA-330MS	330	33.9	9.75	40.5	10.38	20		
CS3SA-335MS	335	34.1	9.84	40.7	10.46	20		
CS3SA-340MS	340	34.3	9.93	40.9	10.54	20		
CS3N-385MS	385	36.6	10.52	43.9	11.32	20	1940 x 1048 x 35 (76.4 x 41.3 x 1.38 in)	22.5 (49.6 lbs)(F30 Frame) or 23.4 (51.6 lbs)(F23 Frame)
CS3N-390MS	390	36.8	10.60	44.1	11.38	20		
CS3N-395MS	395	37.0	10.68	44.3	11.44	20		
CS3N-400MS	400	37.2	10.76	44.5	11.50	20		
CS3N-405MS	405	37.4	10.83	44.7	11.56	20		
CS3N-410MS	410	37.6	10.92	44.9	11.62	20		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS3N-415MS	415	37.8	10.98	45.1	11.68	20		
CS3N-420MS	420	38.0	11..06	45.3	11.74	20		
CS3N-425MS	425	38.2	11.13	45.5	11.80	20		
CS6W-515MS	515	40.3	12.78	48.2	13.65	25	2261 x 1134 x 35/30 (89.0 x 44.6 x 1.38/1.18 in)	28.2/27.6 (62.2 /60.9lbs)
CS6W-520MS	520	40.5	12.84	48.4	13.70	25		
CS6W-525MS	525	40.7	12.90	48.6	13.75	25		
CS6W-530MS	530	40.9	12.96	48.8	13.80	25		
CS6W-535MS	535	41.1	13.02	49.0	13.85	25		
CS6W-540MS	540	41.3	13.08	49.2	13.90	25		
CS6W-545MS	545	41.5	13.14	49.4	13.95	25		
CS6W-550MS	550	41.7	13.20	49.6	14.00	25		
CS6W-555MS	555	41.9	13.25	49.8	14.05	25		
CS6W-560MS	560	42.1	13.31	50.0	14.10	25		
CS6R-380MS	380	30.0	12.69	36.0	13.55	25	1722 × 1134 × 30 (67.8 × 44.6 × 1.18 in)	21.3 (47.0 lbs)
CS6R-385MS	385	30.2	12.77	36.2	13.63	25		
CS6R-390MS	390	30.4	12.84	36.4	13.70	25		
CS6R-395MS	395	30.6	12.91	36.6	13.77	25		
CS6R-400MS	400	30.8	12.99	36.8	13.85	25		
CS6R-405MS	405	31.0	13.07	37.0	13.93	25		
CS6R-410MS	410	31.2	13.15	37.2	14.01	25		
CS6R-415MS	415	31.4	13.23	37.4	14.09	25		
CS6R-420MS	420	31.6	13.31	37.6	14.17	25		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS6R-380MS-HL	380	30.0	12.69	36.0	13.55	25	1722 × 1134 × 35 (67.8 × 44.6 × 1.38 in)	22.4 (49.4 lbs)
CS6R-385MS-HL	385	30.2	12.77	36.2	13.63	25		
CS6R-390MS-HL	390	30.4	12.84	36.4	13.70	25		
CS6R-395MS-HL	395	30.6	12.91	36.6	13.77	25		
CS6R-400MS-HL	400	30.8	12.99	36.8	13.85	25		
CS6R-405MS-HL	405	31.0	13.07	37.0	13.93	25		
CS6R-410MS-HL	410	31.2	13.15	37.2	14.01	25		
CS6R-415MS-HL	415	31.4	13.23	37.4	14.09	25		
CS6R-420MS-HL	420	31.6	13.31	37.6	14.17	25		
CS7N-635MS	635	37.3	17.03	44.4	18.27	30	2384 × 1303 × 35/33 (93.9 × 51.3 × 1.38/1.3 in)	34.4/33.9 (75.8/74.7 lbs)
CS7N-640MS	640	37.5	17.07	44.6	18.31	30		
CS7N-645MS	645	37.7	17.11	44.8	18.35	30		
CS7N-650MS	650	37.9	17.16	45.0	18.39	30		
CS7N-655MS	655	38.1	17.20	45.2	18.43	30		
CS7N-660MS	660	38.3	17.24	45.4	18.47	30		
CS7N-665MS	665	38.5	17.28	45.6	18.51	30		
CS7N-670MS	670	38.7	17.32	45.8	18.55	30		
CS7L-575MS	575	33.9	16.97	40.3	18.22	30	2172 x 1303 x 35/33 (85.5 × 51.3 × 1.38/1.30 in)	31 (68.3 lbs)
CS7L-580MS	580	34.1	17.02	40.5	18.27	30		
CS7L-585MS	585	34.3	17.06	40.7	18.32	30		
CS7L-590MS	590	34.5	17.11	40.9	18.37	30		

Model Type	Maximum power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimensions <mm>	Weight <Kg>
CS7L-595MS	595	34.7	17.15	41.1	18.42	30		
CS7L-600MS	600	34.9	17.20	41.3	18.47	30		
CS7L-605MS	605	35.1	17.25	41.5	18.52	30		
CS7L-610MS	610	35.3	17.29	41.7	18.57	30		
CS7L-575MS-R	575	33.9	16.97	40.3	18.22	30	2172 x 1303 x 35 (85.5 x 51.3 x 1.38 in)	31 (68.3 lbs)
CS7L-580MS-R	580	34.1	17.02	40.5	18.27	30		
CS7L-585MS-R	585	34.3	17.06	40.7	18.32	30		
CS7L-590MS-R	590	34.5	17.11	40.9	18.37	30		
CS7L-595MS-R	595	34.7	17.15	41.1	18.42	30		
CS7L-600MS-R	600	34.9	17.20	41.3	18.47	30		
CS7L-605MS-R	605	35.1	17.25	41.5	18.52	30		
CS7L-610MS-R	610	35.3	17.29	41.7	18.57	30		

ANNEX B: GUIDANCE ON MODULE TEMPERATURE FOR SEVERAL LOCATIONS

- The operational temperature of a PV module changes during the day and also from day to day throughout the year. The 98th-percentile temperature represents the temperature that is larger than 98% of all the temperatures, and consequently it is met or exceeded only 2% of the time.
- The 98th-percentile temperature is to be determined from measurements taken on hourly-basis, or even more frequently. For a standard year, the 98th-percentile temperature would be met or exceeded 175.2 hours.
- The operational module temperature is influenced by the environmental temperature but also by how the module is installed (e.g. mounting distance to rooftop, array size, array spacing and anti-nesting features), as it may allow a more efficient ventilation. The graphics below from IEC 63126 show this influence, the maps presented here are a general guidance and assumed conservative, please contact your local sales representative for further information.
- For Open-rack it can be seen how the 70°C are never exceeded in any of the locations, while for parallel to the roof mounted modules (not in-roof) this value can be surpassed for some locations.

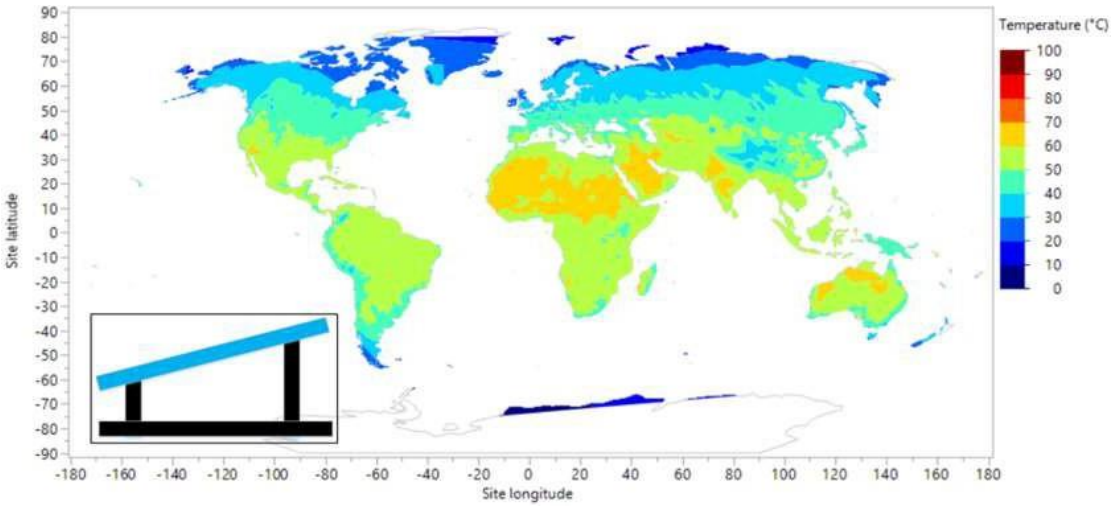


Figure B.1 – 98th-percentile temperature for an open-rack, or thermally unrestricted

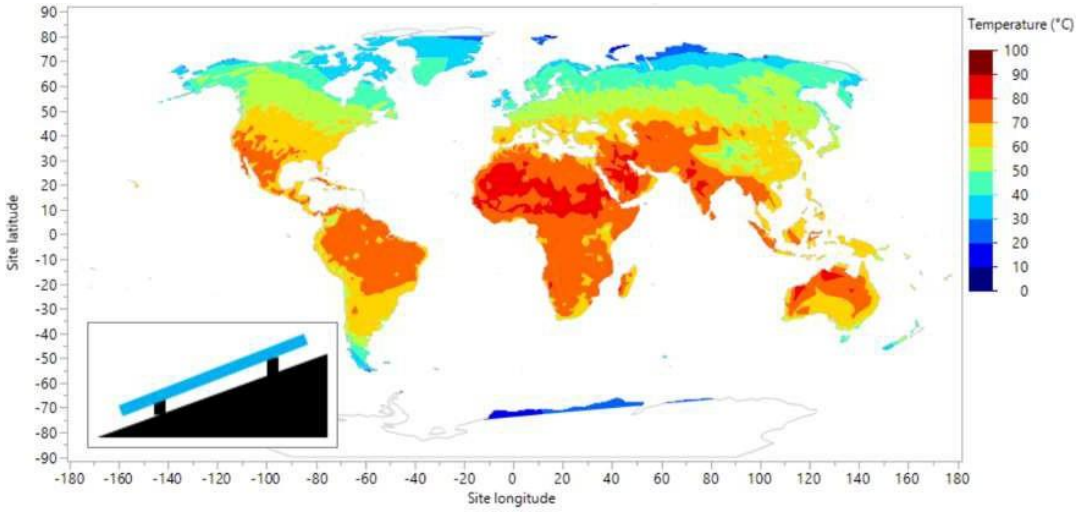


Figure B.2 – 98th-percentile temperature for a close-roof mounted

ANNEX C: INSTALLATIONS USING MODULE LEVEL POWER ELECTRONICS

- This section is applicable to all Canadian Solar standard module types referred to in this installation manual.
- Module-level power electronics (MLPE) are devices that can be incorporated into a solar system to improve its performance in certain conditions (especially where shade is present) and to reduce shock hazard for emergency responders. MLPE devices can be supplied as a 'retro-fit' system made by third-party supplier.
- Module certification testing does not include MLPE devices.
- When installing MLPE devices with Canadian Solar modules, follow the instructions of the MLPE supplier and the specific requirements given below. Ensure electrical parameters and limitations of the MLPE devices and the Canadian Solar modules are suitable for one another.
- Failure to comply with these instructions will void the Canadian Solar warranty.

INSTALLATION

- When choosing to mount the MLPE device to the module frame, follow the MLPE supplier instructions to ensure optimal mounting of the MLPE device and prevent any slippage during operation.
- Canadian Solar recommends the MLPE device be installed close to a corner of the module frame.
- When choosing to mount the MLPE device to the mounting structure, please refer to the instructions provided by the MLPE supplier.
- **Do not** cover the module nameplate or junction boxes when installing the MLPE devices on the rear of the modules.
- **Do not** use frame mounting holes to install the MLPE device.
- **Do not** drill extra holes in the frame to install the MLPE device.
- The distance between the MLPE device and the module backsheet should be larger than 20mm.

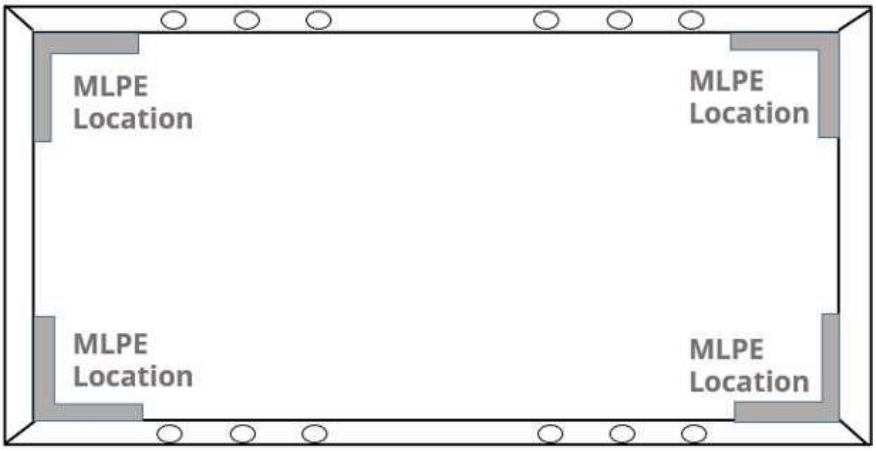


Figure C.1 - MLPE device installation zones

ANNEX D: COASTAL AREA ANTI-CORROSION INSTALLATION GUIDELINES

D.1.0: GENERAL INFORMATION

- According to the specific conditions stipulated in the Canadian Solar installation manual and general warranty statement, Canadian Solar PV modules are not allowed to be installed in coastal areas. Coastal areas are defined as places located within 100m of the defined coastline.
- This annex has been created to facilitate approval for customer PV installations located within 20 m and 100 m of the coastline. It lays down general requirements to ensure that Canadian Solar PV modules are installed properly and reliably in coastal areas, which include but are not limited to relevant anti-corrosion principles for both the modules and associated mounting systems. This annex summarizes the key technical requirements stipulated by well-known international standards and explains how they apply to photovoltaic systems.
- Please read this annex carefully and strictly follow any relevant instructions prior to installing Canadian Solar modules in coastal areas. Failure to follow these instructions and other general anti-corrosion principles may result in corrosion damage to the photovoltaic modules and/or their racking systems, and will void the Canadian Solar standard product and performance warranty. For further inquiries, please contact our customer service department or our local representatives for more information.
- The reliability of photovoltaic modules strongly depends on their distance from the coastline. Different coastal land areas are defined according to how far away from the coastline they are; Canadian Solar generally classifies seashore PV installations according to four different groups:

Distance from the coastline (X: meters)	Requirements
X ≤ 20m	Installation strictly prohibited by Canadian Solar due to concerns of salt-mist corrosion.
20m < X ≤ 100m	Installations must comprise of Canadian Solar "special-anti-corrosion" modules. These installations must comply with the instructions listed below section D.2.1/D.2.2/D.2.3/ D3.0.
100m < X ≤ 500m	We recommend installing Canadian Solar "special-anti-corrosion" modules. We recommend following the instructions listed under sections D.2.1/D.2.2/D.2.3/D.3.0
X > 500m	Follow section 7.0

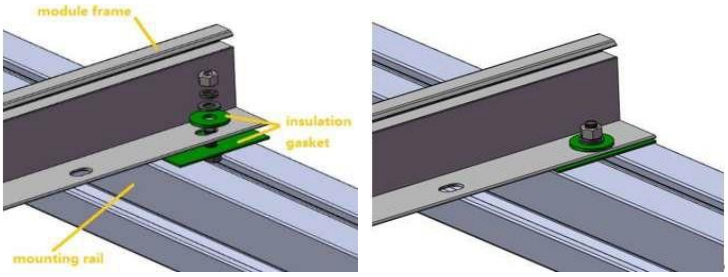
- Local conditions strongly influence the salt deposition rate, which is particularly, but not exclusively, dependent on specific regions and local wind patterns. Canadian Solar reserves the right to adapt the above definition to individual cases. Please contact your local representative to confirm which category your PV system falls under.
- The word “coastline” in this manual refers to the area where the land meets the sea during high tide.
- In this manual, “distance to the coastline” refers to the shortest distance between the photovoltaic module array and the coastline.
- Please consult the Canadian Solar technical support department or your local representative for more information on installing "special anti-corrosion" modules.

D.2.1 : GENERAL ANTI-CORROSION METHODS

- **Do not** scratch or break the corrosion-resistant coating on the modules or mounting systems during installation.
- **Do not** change the structure of the module, i.e. by drilling holes into the module frame.
- Process specifications for the different components must comply with relevant international anti-corrosion standards.
- All general requirements listed in the Canadian Solar standard manual should be applied when installing "special-anti-corrosion" modules.

D.2.2 : SPECIAL ANTI-CORROSION METHODS FOR MOUNTING

- Use mounting components that contain the same metals or metals with a similar electrochemical potential. The metal's coating also should be taken into account. There may be a big difference between the electrochemical potentials of two different coating materials.
- If mounting components consist of two metals with a big difference in electrochemical potential, please add insulating washers (e.g. bi-metallic washers or insulation gaskets) to isolate the metals from each other.
- Copper/aluminum bi-metallic washers are commonly available to prevent electrochemical corrosion. These washers are made in a process called explosion welding.
- Concerning insulation gaskets, mica laminate, or other silicone or fluoride-based insulating materials are recommended.

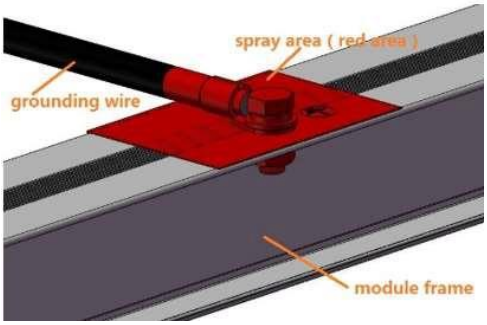


D.2.3 : ANTI-CORROSION METHODS FOR GROUNDING DEVICES

- Two special anti-corrosion methods for protecting the system's grounding devices are recommended. Please refer to the instructions in the table below:

Item	Method A	Method B
Coating components	Fluorocarbon varnish (one layer)	Layer 1 (metal side): epoxy zinc rich primer Layer 2 (middle layer): fluorocarbon finish paint Layer 3 (air side): fluorocarbon varnish
Coating thickness	40μm	Layer 1 (metal side): 40μm Layer 2 (middle layer): 40μm Layer 3 (air side): 40μm
Painting interval	/	Follow the supplier's general requirements when painting the three coating layers. Apply the middle layer 24 hours after painting layer 1. Paint the air side layer 6 hours later after painting the middle layer.

General requirements	Clean the grounding components and make sure that they are dry and clean. The coating must cover all of the grounding components and junction areas of the module frame or mounting system. Please refer to the figure below for more details. The coating should be applied in a dry atmosphere (at least 24 hours) under the following conditions: relative humidity RH≤75%, ambient temperature T>5°C.	
Maintenance period	Three months	Five years



D.3.0: ANTI-CORROSION SUGGESTIONS FOR RACKING SYSTEMS

- The warranty does not cover the damage to the mounting system caused by corrosion if the mounting system is not provided by Canadian Solar. The requirements below apply to two main mounting systems: aluminum alloy-based and Al-Mg-Zn alloy-based racking for rooftops and galvanized steel-based structures for ground-mounted solar farms. To prevent salt-mist corrosion, Canadian Solar requires strict compliance with the following principles:
- Use approved corrosion-resistant materials (e.g. stainless steel SUS 316 or carbon steel with a hot-dip galvanized coating) for any racking or BOS components used in coastal areas.
- Process specifications for the different components must comply with relevant international anti-corrosion standards.
- Minimum coating thicknesses for hot-dip galvanized and anodizing oxide components must comply with the standard minimum requirements stipulated in JIS8641 and JIS8601.

Process	Minimum coating thickness	Standard
Hot-dip galvanizing (carbon steel)	HDZ55 (76um)	ISO1461 JIS8641
Anodizing oxide (aluminum alloy)	AA20 (20um)	ISO7599 JIS8601

- Use mounting components that contain the same metals or metals with a similar electrochemical potential. The metal's coating should also be taken into account. There may be a big difference between the electrochemical potentials of two different coating materials.

D.4.0: Precautions and General Safety

Before installing any modules, contact the appropriate authorities to obtain any relevant approvals and learn of any site, installation and inspection requirements.

- All instructions contained within this standard module installation manual should be followed.
- When applying coating materials, workers must follow applicable health and safety legislation and apply all respective preventive and proactive measures described within.
- Canadian Solar shall not be held responsible for damages of any kind, including, but not limited to, bodily harm, injury and damage to property as a result of handling modules, installing systems, or compliance or non-compliance with the instructions set forth in this manual.

D.5.0: LIMITATION OF LIABILITY

AMENDED EDITIONS AND DATES

- Rev 1.6 was amended and released on Apr, 2019
- Rev 1.7 was amended and released on May, 2019
- Rev 1.8 was amended and released on Sep, 2019
- Rev 1.9 was amended and released on Oct, 2019
- Rev 2.0 was amended and released on Dec, 2019
- Rev 2.1 was amended and released on Apr, 2020
- Rev 2.2 was amended and released on July, 2020
- Rev 2.3 was amended and released on Oct, 2020
- Rev 2.4 was amended and released on Jan, 2021
- Rev 2.5 was amended and released on March, 2021
- Rev 2.6 was amended and released on April, 2021
- Rev 2.61 was amended and released on April, 2021
- Rev 2.62 was amended and released on April, 2021
- Rev 2.7 was amended and released on June, 2021
- Rev 2.71 was amended and released on June, 2021
- Rev 2.8 was amended and released on July, 2021
- Rev 2.81 was amended and released on December, 2021
- Rev 2.82 was amended and released on January, 2022
- Rev 2.9 was amended and released on March. 2022
- Rev 2.91 was amended and released on May.2022
- Rev 3.0 was amended and released on August. 2022
- Rev 3.1 was amended and released on September 2022

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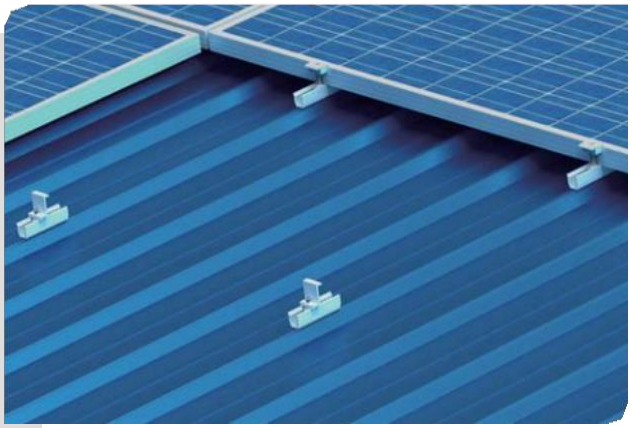
PV-ezRack Trapezoidal

The most simple and cost-effective industrial roof mounting system

Clenergy's PV-ezRack Trapezoidal is a roof mounting solution suitable for most trapezoid metal sheet roofing, the whole system only contains 4 different components. One of these components is our module clamp, this incorporates our innovative z-module which makes the clamp quick to locate and for very fast installation of the modules. PV-ezRack Trapezoidal is the most advantageous and cost-effective solution for trapezoidal sheet.



Specifications

Function	Mounting PV modules to trapezoidal roofs
Trapezoidal sheet classification	Steel/aluminiumfrom 0.04mm to 1.5mm thickness
Roof Pitch	5-45°
Maximum Building Height	20m
Module Type	Suitable for all PV Modules from 28mm to 57mm deep
Watertight	Pre-assembled EVA seal
Module Orientation	Landscape
Standards	DIN 1055
Material	Anodised aluminium
Weight	58 grams
Warranty	10 years

Key Benefits

Easy and fast Installation

Short mounting times of only two minutes per module is achieved as only four different components are used per module fixing:

- U-Profile base; lightweight and replacing the need for rails.
- Stainless steel self-drilling screws; no pilot hole or fixing template required.
- Clenergy's standard End and Intermediate clamps; using our unique z module for fast module mounting.
- Lightweight space saving design

Optimum multi-purpose design

- 20mm base makes it suitable for all trapezoidal profiles.
- Suitable for top sheets of 0.4mm to 1.5mm.
- Suitable for composite, built up and single skin industrial roof designs.
- Suitable for the high wind uplift associated in particular with low pitch roofs.
- Suitable for all module heights from 28mm to 57mm
- 32mm high for optimum cooling of modules.

Outstanding performance

Components are anodized aluminium, aluminium or stainless steel to prevent corrosion and ensure long term effectiveness. Clenergy provides a 10-year product warranty.

Clenergy Court, Blisworth Hill Farm, Stoke Road, Blisworth, Northampton, NN7 3DB, UK Tel: +44 (0) 1604 857 674 Fax: +44 (0) 1604 858 620 E-mail: sales_uk@clenergy.com

CLENERGY
ENDLESS ENERGY SOLUTIONS

www.clenergy.uk.com

Key Components

- U-Support

Designed to mount PV modules in combination with Clenergy's standard module clamps.

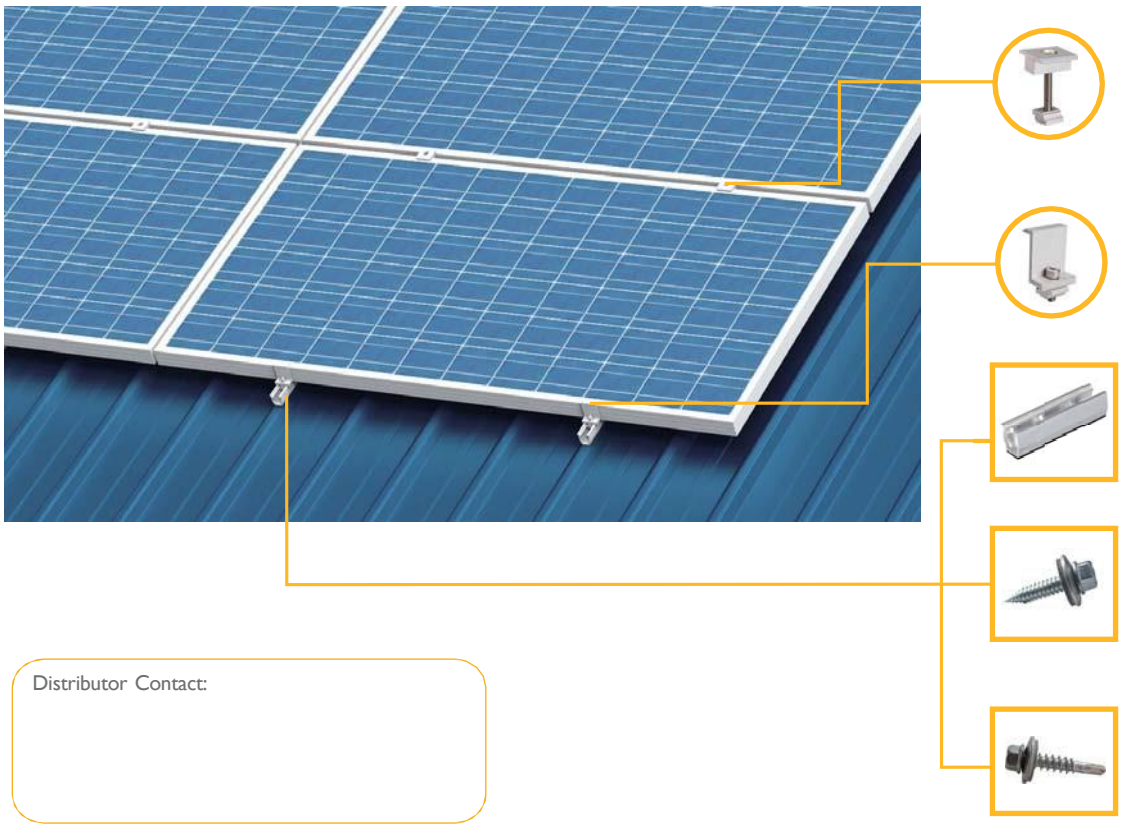
- EJOT sharp point Screw JF3-5.5x25

For metal top sheets from 0.4mm to 0.63mm.

- SFS self-drilling Screw SFS-SX3-S16-6.0 X 29

For metal top sheets greater than 0.63mm. Use SFS fixing attachment to avoid over tightening.

Assembly Illustration



Distributor Contact:

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MCG Industrial

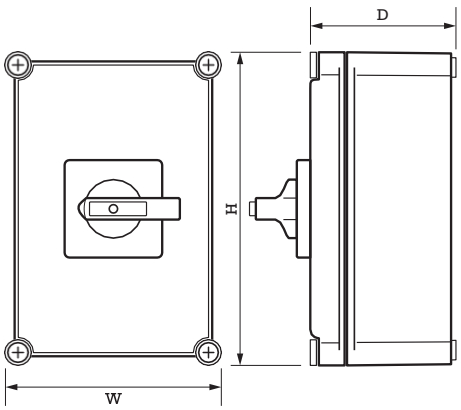
DATASHEET

100A 4 Pole Surface Mounting
Rotary Isolator Plastic Enclosure IP65

Product Ref: **SMI100-4**

Technical Features:

- Insulated enclosure flame retardant material
- Low smoke and halogen free
- Easy access and switch removal
- Padlockable for added security
- Knockout cable entries
- Switch ratings at AC21



Product Specification

Voltage Rating	**690V**
Current Rating	**100A**
IP Rating	**IP65**
Weight	**1.720kg**
Number of Poles	**4 Pole**
Mounting	**Surface**
Cable Entry	**Knockout Cable Entries**
Lockable	**Yes**
Colour	**Red/Yellow/Grey**
Material	**PC**
Operating Temperature Range	**-5°C to 40°C**
Compliance	**UKCA, CE**
Guarantee	**1 Year**
Standards	**IEC/EN 60947-1, IEC/EN 60947-3**
Depth	**130mm**
Height	**280mm**
Width	**190mm**

Terminal Cross Section	
Single / Multi Strand Wire	**2.5 - 50mm²**
Fine Strand Wire with Sleeve	**4 - 50mm²**
American wire gauge	**AWG 1**
Recommended Tightening Torque for Terminals	**2.5Nm**

Cables

A 450/750 volt elastomeric insulated and sheathed flexible trailing cable in single core and multicore.The mechanical and chemical characteristics of the rubber compound provides good abrasion resistance and the ability to withstand many oils and chemicals. The construction and performance enables the product to be used in arduous and low temperature conditions.

Single core and large cross section multicore cables are used **for** energy distribution for both temporary and fixed applications.

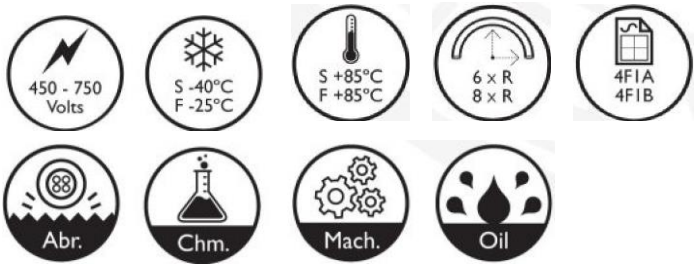
CONSTRUCTION

Plain copper class 5 conductor ethylene propylene rubber (EPA) insulation with HAR colour code designation. Cores twisted together with polychloroprene (PCP) black sheath overall.

TECHNICAL DATA

BS 7919 BS EN 50525-2-21

Nominal Voltage	450nsov 1kv (for fixed installation)
Test Voltage	3000v
Operating Temperature Static	-40°Cto +85°C
Operating Temperature Flexing	-25'Cto +85'C
Bending Radius	**Diameter less than 25mm 6 x Diameter greater than 25mm 8 x**
Current Rating Table	**4F1A** & **4F1B**



H07RN-F DIMENSIONS

Cores x mm²	NomOD mm	Weight kg/km
1 x 1.5	6.9	51
1 x 2.5	7.4	75
1 x 4.0	7.9	115
1 x 6.0	9.1	140
1 x 10.0	10.8	212
1 x 16.0	12.2	305
1 x 25.0	14.1	425
1 x 35.0	15.9	540
1 x 50.0	18.5	720
1 x 70.0	21.2	960
1 x 95.0	23.9	1220
1 x 120.0	25.8	1510
1 x 150.0	28.8	1822
1 x 185.0	31.5	2170
1 x 240.0	35.1	2804
1 x 300.0	38.8	3400
1 x 400.0	43.6	4310
1 x 500.0	47.8	5340
1 x 630.0	51.5	6980
2 x 1.0	5.9	105
2 x 1.5	6.6	130
2 x 2.5	7.8	189
2 x 4.0	9.6	296
2 x 6.0	11.8	380
2 x 10.0	14.5	650
2 x 16.0	16.5	860
3 x 1.0	9.5	130
3 x 1.5	10.5	160
3 x 2.5	12.2	225
3 x 4.0	14.4	335
3 x 6.0	16.6	450
3 x 10.0	22.2	750
3 x 16.0	24.9	1012
4 x 1.0	10.8	160
4 x 1.5	12.4	190
4 x 2.5	13.9	275
4 x 4.0	16.2	428
4 x 6.0	19.1	578
4 x 10.0	24.8	960
4 x 16.0	27.8	1312
4 x 25.0	33.4	1740
4 x 35.0	37.5	2334
4 x 50.0	43.9	3040
4 x 70.0	49.8	4110
4 x 95.0	48.8	5350

Cores x mm²	NomOD mm	Weight kg/km
5 x 1.0	11.4	190
5 x 1.5	12.8	220
5 x 2.5	14.8	330
5 x 4.0	17.6	520
5 x 6.0	21.2	716
5 x 10.0	26.9	1190
5 x 16.0	30.7	1558
5 x 25.0	37.2	2260
5 x 35.0	41.5	3295
5 x 50.0	48.8	4235
7 x 1.5	13.4	440
7 x 2.5	14.4	490
12 x 1.5	14.2	540
12 x 2.5	16.6	754
19 x 1.5	24.4	755
19 x 2.5	27.4	1110

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Gateshead
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F: 0191 417 9200

Manchester
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F: 0161 653 **7184**

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london.016@ukcables.co.uk

aberdeen.001@ukcables.co.uk lintgan .U< OJ.U(gas;pi.61 .uk.011@kales.oo.li< IIIJ')JI)SU

Table 4F1A
60°C thermosetting insulated flexible cables with sheath, non-armoured (Copper Conductors)

CURRENT-CARRYING CAPACITY (amperes):

Ambient temperature ; 30°C
Conductor operating temperature: 60°C

Conductor Cross sectional area	Single-phase a.c. or d.c.	Three-phase a.c.	Single-phase a.c. or d.c.
	1 Two core cable, with or without protective conductor	1 Three core, four core or five core cable	2 Single core cables
	2	3	
(mm²)	(A)	(A)	(A)
4	30	27	
6	39	34	
10	51	47	
16	73	63	
25	97	83	
35		102	140
50		124	175
70		158	216
95		192	258
120		222	302
150		255	347
185		291	394
240		343	471
300		394	541
400			644
500			738
630			861

NOTES:

1. The current ratings tabulated are for cables in free air but may also be used for cables resting on a surface. If the cable is to be wound on a drum on load the ratings should be reduced in accordance with NOTE 2 below and for cables which may be covered, NOTE 3 below

2. Flexible cables wound on reeling drums.

The current ratings of cables used on reeling drums are to be reduced by the following factors:

a) Radial type drum
ventilated: 85%
unventilated: 75%

b) Ventilated cylindrical type drum
1 layer of cable: 85%
2 layers of cable: 65%
3 layers of cable: 45%
4 layers of cable: 35%

A radial type drum is one where spiral layers of cable are accommodated between closely spaced flanges; if fitted with solid flanges the ratings given above should be reduced and the drum is described as non-ventilated. If the flanges have suitable apertures the drum is described as ventilated.

A ventilated cylindrical cable drum is one where layers of cable are accommodated between widely spaced flanges and the drum and end flanges have suitable ventilating apertures.

3. Where cable may be covered over or coiled up whilst on load, or the air movement over the cable restricted, the current rating should be reduced.

It is not possible to specify the amount of reduction but the table of rating factors for reeling drums can be used as a guide.

Table 4F1B

VOLTAGE DROP (per ampere per metre) Conductor operating temperature: 60°C

Conductor Cross sectional area	Two core cable d.c.	Two core cable, Single-phase a.c.			1 Three core, four core or five core cable, Three-phase a.c.			2 Single core cables, touching			
								d.c.	Single-phase a.c.•		
								5	6		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/Alm)	(mV/A/m)		
4	12	**12**			10						
6	7.8	**7.8**			6.7						
10	**4.6**	**4.6**			**4.0**						
16	2.9	**2.9**			2.5						
		x	y		x	y					
25	1.80	1.80	0.175	**1.85**	1.55	0.150	1.55				
35					1.10	**0.145**	1.15	1.31	1.31	0.21	1.32
50					**0.83**	0.140	0.84	0.91	0.91	0.21	0.93
70					0.57	0.135	0.58	**0.64**	**0.64**	0.20	0.67
95					**0.42**	0.135	0.44	0.49	0.49	0.195	0.53
120					0.33	0.135	**0.36**	**0.38**	**0.38**	0.190	**0.43**
150					0.27	0.130	0.30	0.31	0.31	0.190	0.36
185					**0.22**	0.130	**0.26**	**0.25**	0.25	0.190	0.32
240					0.170	0.130	0.21	0.190	0.195	0.185	0.27
300					0.135	0.125	0.185	**0.150**	0.155	0.180	**0.24**
400								0.115	0.120	0.175	0.21
500								**0.090**	**0.099**	**0.170**	**0.20**
630								**0.068**	**0.079**	**0.170**	**0.185**

NOTE: • A larger voltage drop will result if the cables are spaced

SINGLE WIRE ARMOURED ENERGY CABLE LSOH 694_B

A 600/1000 Volt Low Smoke Zero Halogen (LSOH) sheathed energy distribution cable with steel wire armour providing mechanical protection. The cable is suitable for situations where fire conditions, resulting in acid gas and smoke emissions, are a consideration for public safety and safe evacuation of the building.

The cable may be installed in air, on tray, clipped direct to a surface or buried directly in the ground, the cable is weatherproof and durable.

CONSTRUCTION

Plain stranded copper conductor with cross linked polyethylene (XLPE) insulation, cores laid up, extruded LSOH inner sheath, a single layer of galvanised steel wire (aluminium wire for single cores) and LSOH sheath black overall.

TECHNICAL DATA

BS 6724 IEC 60502-1

Nominal Voltage	600/1000V
Test Voltage	5000V
Operating Temperature	-20°C to +90°C
Bending Radius	6 times O/D circular conductors 8 times O/D shaped conductors
Flame Propagation	BS EN 60332-1-2 BS EN 60332-3-24 Cat C (Cat A to order)
Smoke Density	BS EN 61034-2
Halogen Emission	BS EN 60754-2
Current Rating Table	4E4A 4E4B

Note - Minimum installation temperature 0°C

LS0H 694_B DIMENSIONS

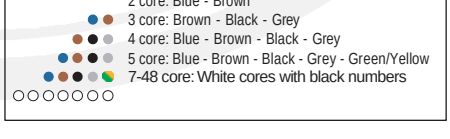
Single Core x mm²	Nom OD mm	Weight kg / km
50.0	17.5	758
70.0	20.2	960
95.0	22.3	1240
120.0	24.2	1510
150.0	27.4	1900
185.0	30.0	2320
240.0	32.8	2930
300.0	35.6	3580
400.0	40.4	4600
500.0	44.2	5770
630.0	48.8	7250

Cores x mm²	Nom OD mm	Weight kg / km
2 x 1.5	12.1	302
2 x 2.5	13.6	346
2 x 4.0	14.7	410
2 x 6.0	15.9	499
2 x 10.0	17.0	648
2 x 16.0	20.2	978
2 x 25.0*	20.4	1290
2 x 35.0*	23.3	1500
2 x 50.0*	25.8	1890
2 x 70.0*	29.0	2450
2 x 95.0*	33.1	3300
2 x 120.0*	36.1	3800
3 x 1.5	12.6	330
3 x 2.5	14.0	390
3 x 4.0	15.3	464
3 x 6.0	16.6	568
3 x 10.0	19.0	866
3 x 16.0	21.6	1152
3 x 25.0	26.0	1800
3 x 35.0	28.0	2230
3 x 50.0*	29.5	2490
3 x 70.0*	33.2	3290
3 x 95.0*	37.0	4440
3 x 120.0*	40.0	5470
3 x 150.0*	45.5	6930
3 x 185.0*	49.8	8040
3 x 240.0*	55.1	10150
4 x 1.5	13.0	365

Cores x mm²	Nom OD mm	Weight kg / km
4 x 2.5	15.0	438
4 x 4.0	16.0	532
4 x 6.0	18.0	764
4 x 10.0	20.0	1013
4 x 16.0	22.9	1360
4 x 25.0	27.6	2160
4 x 35.0	30.4	2690
4 x 50.0*	32.0	3130
4 x 70.0*	38.0	4500
4 x 95.0*	41.7	5600
4 x 120.0	46.0	7400
4 x 150.0*	51.0	8780
4 x 185.0*	55.6	10630
4 x 240.0*	62.0	13390
4 x 300.0*	67.5	16290
4 x 400.0*	76.5	19800
5 x 1.5	14.3	410
5 x 2.5	16.3	470
5 x 4.0	17.8	710
5 x 6.0	20.0	876
5 x 10.0	22.9	1165
5 x 16.0	26.6	1742
5 x 25.0	31.5	2323
5 x 35.0	33.8	2932
5 x 50.0*	40.4	4192
5 x 70.0*	46.3	5336
5 x 95.0*	52.0	7700
7 x 1.5	14.9	508
7 x 2.5	16.8	620
7 x 4.0	19.8	910
7 x 6.0	21.4	1110
7 x 10.0	25.6	1720
12 x 1.5	18.6	855
12 x 2.5	21.5	1088
12 x 4.0	27.6	1550
19 x 1.5	21.0	1120
19 x 2.5	25.8	1574
27 x 1.5	26.8	1635
27 x 2.5	30.2	2050
37 x 1.5	28.8	1970
37 x 2.5	33.8	2540
48 x 1.5	33.9	2390
48 x 2.5	38.8	3430

*Shaped Conductor, All others circular

Core identification chart -



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Current Rating Table

TABLE 4E4A
Multicore 90ºC armoured thermosetting insulated cables (Copper Conductors)

Ambient temperature : 30°C
Ground ambient temperature: 20°C
Conductor operating temperature:90°C

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross sectional area	Reference Method C (clipped direct)		Reference Method E (in free air or on a perforated cable tray horizontal or vertical		Reference Method D (direct in groundor in ducting in ground, in or around buildings)	
	1 two core cable, single phase a.c. or d.c.	1 three- or fourcore cable, three-phase a.c.	1 two core cable, single phase a.c. or d.c	1 three- or fourcore cable, three-phase a.c.	1 two core cable, single phase a.c. or d.c.	1 three- or fourcore cable, three-phase a.c.
1	2	3	4	5	6	7
(mm²)	(A)	(A)	(A)	(A)	(A)	(A)
1.5	27	23	29	25	25	21
2.5	36	31	39	33	33	28
4	49	42	52	44	43	36
6	62	53	66	56	53	44
10	85	73	90	78	71	58
16	110	94	115	99	91	75
25	146	124	152	131	116	96
35	180	154	188	162	139	115
50	219	187	228	197	164	135
70	279	238	291	251	203	167
95	338	289	354	304	239	197
120	392	335	410	353	271	223
150	451	386	472	406	306	251
185	515	441	539	463	343	281
240	607	520	636	546	395	324
300	698	599	732	628	446	365
400	787	673	847	728	-	-

NOTES
1. Where a conductor operates at a temperature exceeding 70°C it must be ascertained that the equipment connected to the conductor is suitable for the conductor operating temperature (see Regulation 512.1.2).

2. Where cables in this table are connected to equipment or accessories designed to operate at a temperature not exceeding 70°C, the current ratings given in the equivalent table for 70°C thermoplastic insulated cables (Table 4D4A) must be used (see also Regulation523.1)

Current Rating Table

TABLE 4E4B

VOLTAGE DROP (per ampere per metre) Conductor operating temperature: 90°C

Conductor cross sectional area	Two-core cable, d.c.	Two-core cable, single-phase a.c.			Three- or four-core cable, three-phase a.c.		
1	2	3			4		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
1.5	31	31			27		
2.5	19	19			16		
4	12	12			10		
6	7.9	7.9			6.8		
10	4.7	4.7			4.0		
16	2.9	2.9			2.5		
		r	x	z	r	x	z
25	1.85	1.85	0.160	1.90	1.60	0.140	1.65
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15
50	0.98	0.99	0.155	1.00	0.86	0.135	0.87
70	0.67	0.67	0.150	0.69	0.59	0.130	0.60
95	0.49	0.50	0.150	0.52	0.43	0.130	0.45
120	0.39	0.40	0.145	0.42	0.34	0.130	0.37
150	0.31	0.32	0.145	0.35	0.28	0.125	0.30
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26
240	0.195	0.20	0.140	0.24	0.175	0.125	0.21
300	0.155	0.16	0.140	0.21	0.140	0.120	0.185
400	0.120	0.13	0.140	0.190	0.115	0.120	0.165

4. As Built Drawings

3.4.2 AB PDF PV Panels

3.4.2 AB DWG PV Panels

3.1 AS-BUILT DRAWINGS

Please note that all drawings below are hyperlinked to the drawings listed in the below register. Please click on the drawing title to go directly to the drawing you wish to view.

Drawing Register: Independent Energy Group

PV PANELS

DRAWING NUMBER	DRAWING TITLE	REV
P23025-IEG-XX-RF-DR-X-001	PV Layout as Proposed	AF
P23025-IEG-XX-XX-DR-X-001	PV Schematic as Proposed	AF
P23025-IEG-XX-XX-DR-X-002	PV Inverter Location as Proposed	AF

N

DRAWING NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, STRUCTURAL, AND ALL OTHER RELEVANT BUILDING INFORMATION DRAWINGS AND DOCUMENTATION.
2. ALL DIMENSIONS ARE IN (MILLIMETERS, MM) UNLESS SPECIFICALLY DETAILED WITHIN THE LAYOUT/SUPPORTING DOCUMENTATION.
3. THE ELECTRICAL INSTALLATION SHALL COMPLY WITH THE 18TH EDITION OF THE IET WIRING REGULATIONS (BS 7671:2018) REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

LEGEND

114 x 440W Photovoltaic Panels
Providing a 50.16kWp System

100mm Cable Tray

REV.	DESCRIPTION	DATE
AF	As Fitted	30.08.24

INDEPENDENT ENERGY GROUP

PROJECT
Panattoni
Horton Road, Poyle

CLIENT
winvic

TITLE
PV Layout
As Fitted

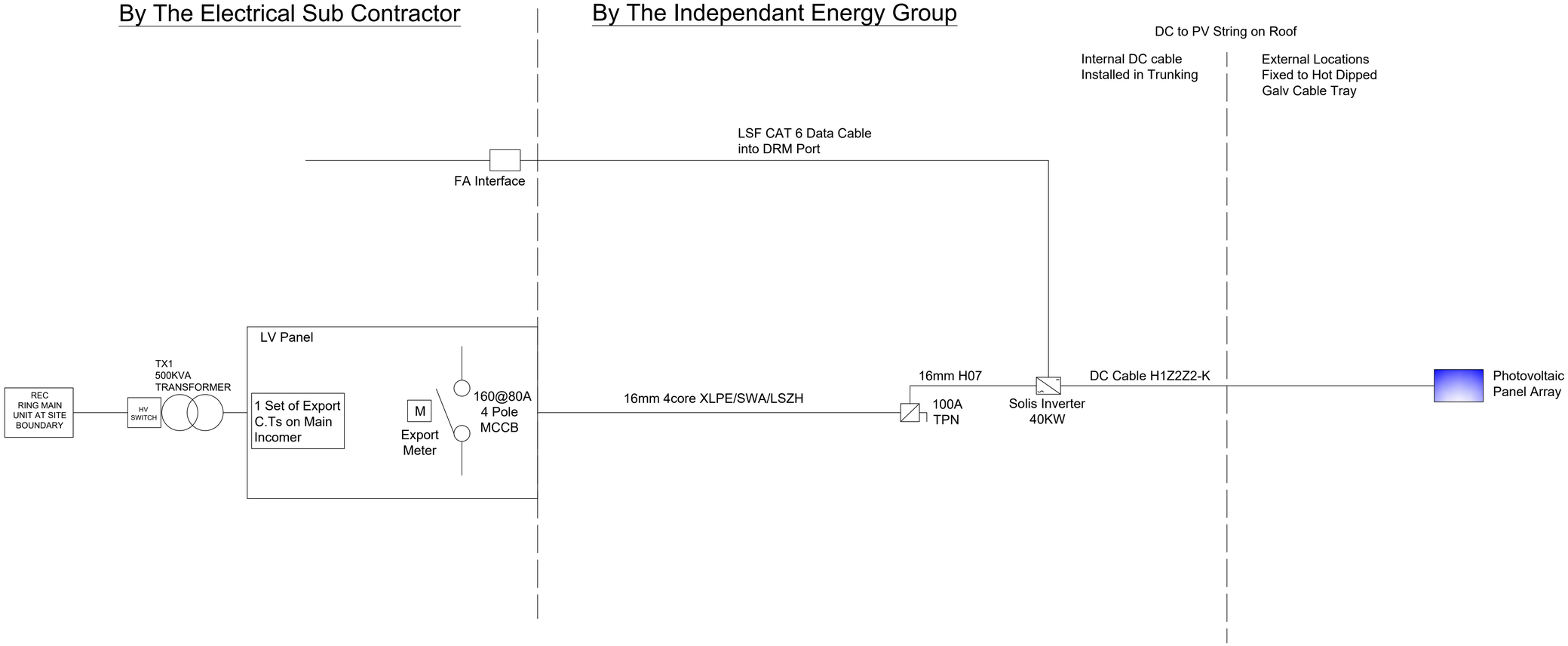
DRAWN	DATE	SCALE
P.M.	April 2024	1:200 @ A1

DRG No. P23025-IEG-XX-RF-DR-X-001

REV. AF

DRAWING NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, STRUCTURAL, AND ALL OTHER RELEVANT BUILDING INFORMATION DRAWINGS AND DOCUMENTATION.
2. ALL DIMENSIONS ARE IN (MILLIMETERS, MM) UNLESS SPECIFICALLY DETAILED WITHIN THE LAYOUT/SUPPORTING DOCUMENTATION.
3. THE ELECTRICAL INSTALLATION SHALL COMPLY WITH THE 18TH EDITION OF THE IET WIRING REGULATIONS (BS 7671:2018) REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.



AS FITTED

REV.	DESCRIPTION	DATE

INDEPENDENT ENERGY GROUP

PROJECT
Panattoni
Horton Road, Poyle

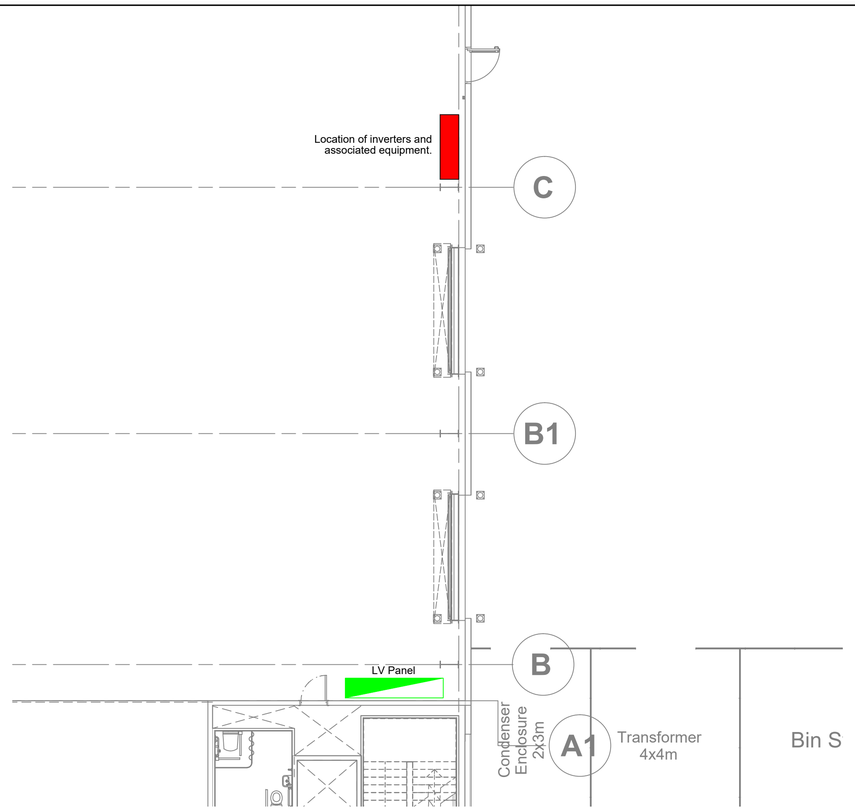
CLIENT
winvic

TITLE
PV Schematic
As Fitted

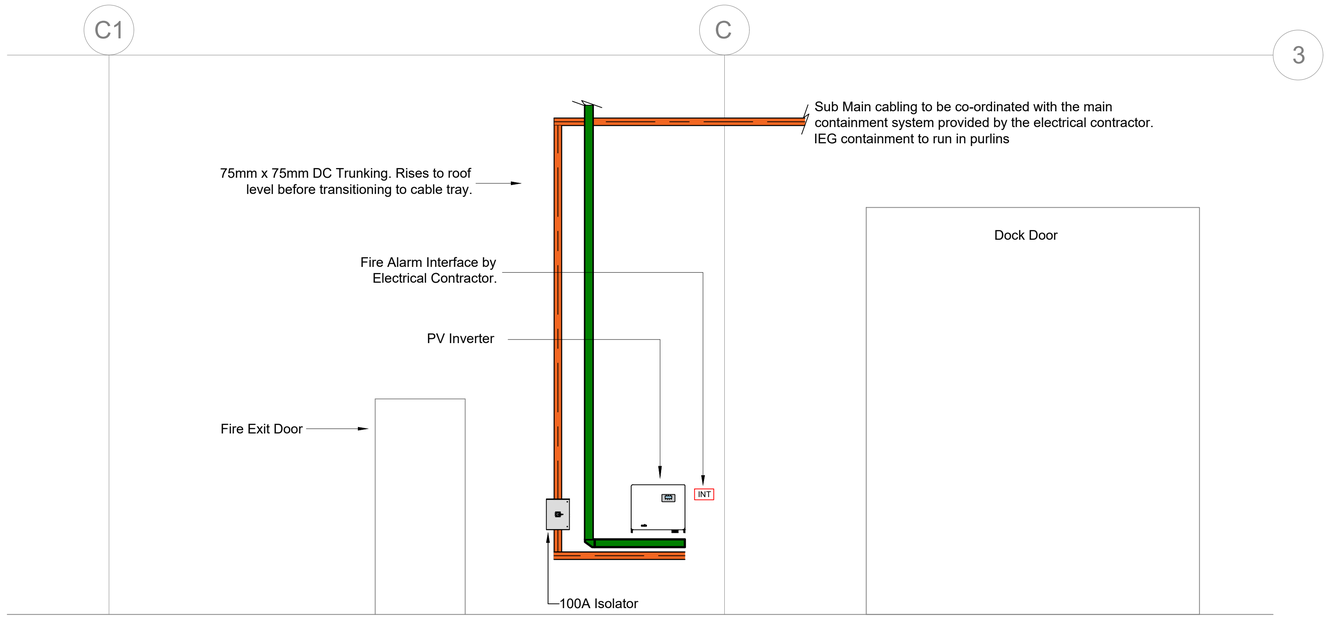
DRAWN	DATE	SCALE
R.M.	Sept 2024	N.T.S.

DRG No. P23025-IEG-XX-XX-DR-X-001

REV. AF



PV Inverter Location
1:100



PV Inverter Section View
1:40

DRAWING NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, STRUCTURAL, AND ALL OTHER RELEVANT BUILDING INFORMATION DRAWINGS AND DOCUMENTATION.
2. ALL DIMENSIONS ARE IN (MILLIMETERS, MM) UNLESS SPECIFICALLY DETAILED WITHIN THE LAYOUT/SUPPORTING DOCUMENTATION.
3. THE ELECTRICAL INSTALLATION SHALL COMPLY WITH THE 18TH EDITION OF THE IET WIRING REGULATIONS (BS 7671:2018) REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

REV.	DESCRIPTION	DATE
AF	As Fitted	30.08.24

INDEPENDENT ENERGY GROUP

PROJECT
Panattoni
Horton Road, Poyle

CLIENT
winvic

TITLE
PV Inverter Layout
As Fitted

DRAWN	DATE	SCALE
P.M.	March 2024	As Stated @ A1

DRG No. P23025-IEG-XX-XX-DR-X-002

REV. AF

5. Testing & Commissioning Results and Certificates

DC Test Certificates

Independent Energy Group Ltd

Solar PV System DC Commissioning Test Results

Job Reference	P23025
Customer Name	Winvic Construction
Installation Address	Horton Road, Poyle, West Berkshire. SL3 0BB

Contractors Name	Independent Energy Group Ltd
Contractors Address	Marshall House, West Street, Gelnfield, Leicseter LE3 8DT
Comissioned By	

Comissioned Date	30/08/2024
System Size (kW)	50.16kWp

Solar Module Details		Generation Meter Details		Test Instruments	
Make	Canadian Solar	Make	Seaward	Multimeter	
Model	CS6R-440T	Model	PV150	Light Meter	
MCS No.		Serial No.	BTM12134	Multifunction	
Voc (STC)	39.40	Reading		Temperature	
Isc (STC)	14.01				
Panel Wattage	440				
No. of Panels	114				

Inverter							
Inverter Make & Model		Solis S5-GC40K		Inverter Number		1	
Inverter Serial Number							
Functionallity Tested		Yes		Country/Language Set		GB	
String		1.1.1	1.2.1	1.3.1	1.3.2	1.4.1	1.4.2
Number of Modules		20	21	21	20	20	20
Array Parameters	Voc (STC)	788.00	827.40	827.40	788.00	788.00	788.00
	Isc (STC)	14.01	14.01	14.01	14.01	14.01	14.01
Wiring	Pos (mm2)	6	6	6	6	6	6
	Neg (mm2)	6	6	6	6	6	6
Polarity Check		Correct	Correct	Correct	Correct	Correct	Correct
String Test	Voc (V)	776	709	556	570	715	702
	Isc (A)	13.54	13.373	6.86	10.28	14.49	9.54
	Temp (C)	21					
	Irradiance	65					
Insulation Resistance		>199	>199	>199	>199	>199	>199

PV SYSTEM VERIFICATION CERTIFICATE

Project: Panattoni Poyle

PV SYSTEM VERIFICATION CERTIFICATE		✓ Initial verification ☐ Periodic verification
Client: Winvic Construction	**Reference**	Poyle-PVSVC
Installation address Horton Road Poyle West Berkshire. SL3 0BB	**Date**	30/08/2024
	Description of installation	50.16kWp PV System
Contractor's name and address IEG Ltd Marshall House West St Glenfield Leicester LE3 8DT	**Location**	Warehouse-LV Panel
	Rated power – kW DC	50.16kWp
	Circuits tested	Solar PV Board

BS 7671 – IET WIRING REGULATIONS	
Electrical Contracting Certification Scheme (e.g. NICEIC, ECA, ELECSA etc.)	NIC/EIC
Electrical Contracting Certification Scheme – Contractor's Reference Number	617658000
Electrical Installation Certificate – Serial Number	30086628 EIC19.3c
Electrical Installation Certificate – Schedule of items inspected – Page Number(s)	3
Electrical Installation Certificate – Schedule of circuit details – Page Number(s)	4
Electrical Installation Certificate – Schedule of test results – Page Number(s)	5
The Microgeneration Certification Scheme – Installer's Certificate Number	N/A>50kWP
PV System Inspection Report – Reference	PVSIR
PV Array Test Report – Reference	String Test Results

DESIGN, CONSTRUCTION, INSPECTION AND TESTING

I/we, being the person(s) responsible for the design, construction, inspection and testing of the electrical installation (as indicated by the signature(s) below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design, construction, inspection and testing, herby certify that the said work for which I/we have been responsible is, to the best of my/our knowledge and belief, in accordance with.....

Signature(s): Name(s):	**Next inspection recommended after not more than:** 12 Months
N. Mills	**Comments:**
Date: **(The extent of liability of the signatory(s) is limited to the work described above)**	

PV SYSTEM INSPECTION REPORT

Project: Panattoni Poyle

PV SYSTEM INSPECTION REPORT	✓ Initial verification ☐ Periodic verification
Installation address Horton Road, Poyle, West Berkshire SL3 0BB	**Reference** Poyle-PVSIR **Date** 30/08/2024
Circuits inspected	**Inspector / Signature** *N. Mills*

1.0 GENERAL	
1.1 The entire system has been inspected to the requirements of BS 7671 and an inspection report to meet the requirements of BS 7671 is attached	✓
2.0 DC SYSTEM – GENERAL	
2.1 The DC system has been designed, specified and installed to the requirements of BS 7671 and IEC TS 62548	✓
2.2 The maximum PV array voltage is suitable for the array location	✓
2.3 All system components and mounting structures have been selected and erected to withstand the expected external influences such as wind, snow, temperature and corrosion	✓
2.4 Roof fixings and cable entries are weatherproof (where applicable)	
3.0 DC SYSTEM – PROTECTION AGAINST ELECTRIC SHOCK	
3.1 Protective measure provided by extra low voltage (SELV / PELV) – yes / no	No
3.2 Protection by use of class II or equivalent insulation adopted on the DC side – yes / no	Yes
3.3 PV string and array cables have been selected and erected so as to minimize the risk of earth faults and short circuits. Typically achieved by the use of cables with protective and reinforced insulation (often termed “double insulated”) – yes / no	Yes
4.0 DC SYSTEM – PROTECTION AGAINST THE EFFECTS OF INSULATION FAULTS	
4.1 Galvanic separation in place inside the inverter or on the AC side – yes / no	No
4.2 Functional earthing of any DC conductor – yes / no	No
4.3 PV Array Earth Insulation Resistance detection and alarm system is installed – to the requirements of IEC TS 62548	Yes
4.4 PV Array Earth Residual Current Monitoring detection and alarm system is installed – to the requirements of IEC TS 62548	Yes
5.0 DC SYSTEM – PROTECTION AGAINST OVERCURRENT	
5.1 For systems <u>without</u> string overcurrent protective device:	
a) $I_{MOD\_MAX\_OCPR}$ (the module maximum series fuse rating) is greater than the possible reverse current	N/A
b) String cables are sized to accommodate the maximum combined fault current from parallel strings	N/A
5.2 For systems <u>with</u> string overcurrent protective device:	
a) String overcurrent protective devices are fitted and correctly specified to the requirements of IEC TS 62548	N/A

5.3	For systems with array / sub-array overcurrent protective devices:	
	a) Overcurrent protective devices are fitted and correctly specified to the requirements of IEC TS 62548	N/A
5.4	For systems where the inverter(s) can produce a DC back-feed in to the array circuits:	
	a) Any back-feed current is lower than both the module maximum fuse rating and the string cable ampere rating	Yes
6.0	**DC SYSTEM – EARTHING AND BONDING ARRANGEMENTS**	
6.1	Where the PV system includes functional earthing of one of the DC conductors:	
	a) The functional earth connection has been specified and installed to the requirements of IEC TS 62548	N/A
6.2	Where a PV system has a direct connection to earth on the DC side:	
	a) A functional earth fault interrupter is provided to the requirements of IEC TS 62548	N/A
6.3	Array frame bonding arrangements have been specified and installed to the requirements of IEC TS 62548	N/A
6.4	Where protective earthing and / or equipotential bonding conductors are installed:	
	a) They are parallel to, and bundled with, the DC cables	N/A
7.0	**DC SYSTEM – PROTECTION AGAINST THE EFFECTS OF LIGHTNING AND OVERVOLTAGE**	
7.1	To minimize voltages induced by lightning, the area of all wiring loops has been kept as small as possible	Yes
7.2	Measures are in place to protect long cables (e.g. screening or the use of SPDs)	Yes
7.3	Where SPDs are fitted, they have been installed to the requirements of IEC TS 62548	Yes
8.0	**DC SYSTEM – SELECTION AND ERECTION OF ELECTRICAL EQUIPMENT**	
8.1	The PV modules are rated for the maximum possible DC system voltage	Yes
8.2	All DC components are rated for the continuous operation at DC and at the maximum possible DC system voltage and current as defined in IEC TS 62548	Yes
8.3	Wiring systems have been selected and erected to withstand the expected external influences such as wind, ice formation, temperature, UV and solar radiation	Yes
8.4	Means of isolation and disconnection have been provided for the PV array strings and PV sub-arrays – to the requirements of IEC TS 62548	Yes
8.5	A DC switch disconnector is fitted to the DC side of the inverter to the requirements of IEC TS 62548	Yes
8.6	If blocking diodes are fitted, there reverse voltage rating is at least 2 x V_{OC} (stc) of the PV string in which they are fitted (see IEC TS 62548)	N/A
8.7	Plug and socket connectors mated together are of the same type and from the same manufacturer and comply with the requirements of IEC TS 62548	Yes
9.0	**AC SYSTEM**	
9.1	A means of isolating the inverter has been provided on the AC side	Yes
9.2	All isolation and switching devices have been connected such that PV installation is wired to the “load” side and the public supply to the “source” side	Yes
9.3	The inverter operational parameters have been programmed to local regulations	Yes
9.4	Where an RCD is installed to the AC circuit feeding an inverter, the RCD type has been verified to ensure it has been selected according to the requirements of IEC TS 62548	N/A

10.0	LABELLING AND IDENTIFICATION	
10.1	All circuits, protective devices, switches and terminals suitably labelled to the requirements of BS 7671 and IEC TS 62548	Yes
10.2	All DC junction boxes (PV generator and PV array boxes) carry a warning label indicating that active live parts inside the boxes are fed from a PV array and may still be live after isolation from the PV inverter and public supply	N/A
10.3	Means of isolation on the AC side is clearly labelled	Yes
10.4	Dual supply warning labels are fitted at point of interconnection	Yes
10.5	A single line wiring diagram is displayed on site	Yes
10.6	Installer details are displayed on site	Yes
10.7	Shutdown procedures are displayed on site	Yes
10.8	Emergency procedures are displayed on site (where relevant)	Yes
10.9	All signs and labels are suitably affixed and durable	Yes

NOTES

1) All entry boxes on the schedules must be completed.

2) '✓' shall indicate that an inspection was undertaken and the result was satisfactory.

3) 'YES' or 'NO' shall be entered as required.

4) 'N/A' shall indicate that an inspection was not applicable to the installation.

AC Test Certificates

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628** **EIC18.3c**

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 1 : DETAILS OF THE CONTRACTOR, CLIENT AND INSTALLATION

DETAILS OF THE CONTRACTOR (*Where applicable)

Registration No: 617658000 Branch No*: 000

Trading Title: BHK Electrical Ltd

Address: 21 Gadsby Road

Postcode: LE67 2HL Tel No: 07984563441

DETAILS OF THE CLIENT

Contractor Reference Number (CRN): N/A

Name: Independent Energy Group

Address: Marshall House, West Street, Glenfield, Leicester, Leicestershire

Postcode: LE2 0QS Tel No: N/A

DETAILS OF THE INSTALLATION

Occupier: Winvic Construction

Unique Property Reference Number (UPRN): N/A

Address: Panattoni 80 Poyle, Slough

Postcode: SL3 0BB Tel No: N/A

PART 2 : DETAILS OF THE ELECTRICAL WORK COVERED BY THIS INSTALLATION CERTIFICATE

Date works completed: 28/08/2024 **The installation is** New: (✔) An addition: (N/A) An alteration: (N/A) Replacement of a distribution board: (N/A)

Description and extent of the installation covered by this certificate: Installation of a ac sub main to an inverter. Solar Pv installed on roof and dc strings connected into an inverter.

Where necessary, continue on a separate numbered page: Page No(s) (N/A)

PART 3 : COMMENTS ON THE EXISTING INSTALLATION (in the case of an addition or alteration see Regulation 644.1.2)

N/A

Where necessary, continue on a separate numbered page: Page No(s) (N/A)

PART 4A : DECLARATION FOR THE ELECTRICAL INSTALLATION WORK (use where the design, construction, inspection & testing have been the responsibility of one person)

DESIGN, CONSTRUCTION, INSPECTION & TESTING (the extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the design, construction, inspection and testing of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the design, hereby CERTIFY that the design, construction, inspection and testing for which I have been responsible is to the best of my knowledge and belief in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any (Regulations 120.3, 133.1.3 and 133.5), detailed as follows:

N/A

where required, continued on attached separate page(s) (N/A)

- Permitted exception applied (411.3.3): Yes/NA (N/A) Risk assessment attached: (N/A) Page No(s) (N/A)

I, being the designer of the electrical installation, also RECOMMEND that this installation is further inspected and tested by: N/A (date)

The proposed date for the next inspection should take into consideration any legislative or licensing requirements and the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life. The period should be agreed between relevant parties

Name (capitals): N/A Organisation: N/A Registration No*: N/A

Address: N/A

N/A

Signature: Date: N/A Postcode: N/A Tel No: N/A

REVIEWED BY QUALIFIED SUPERVISOR

Name (capitals): BEN ADCOCK Signature: Date: 30/08/2024

This certificate is based on the model forms shown in Appendix 6 of *BS 7671: 2018 (as amended)*

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

Please see the 'Notes for Recipients'

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628** **EIC18.3c**

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 4B : DECLARATION FOR THE ELECTRICAL INSTALLATION WORK (to be completed where different parties are responsible for the design, construction, inspection & testing)

DESIGN (The extent of liability of the signatories is limited to the work detailed in PART 2)

I/We being the person(s) responsible for the design of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the design, hereby CERTIFY that the design work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3, 133.1.3 and 133.5).

- Permitted exception applied (411.3.3): ~~X~~/NA Risk assessment attached: (N/A) Page No(s) (N/A)

DESIGNER 1 Name (capitals): TONY MEREDITH Signature: [redacted] Date: 30/08/2024

DESIGNER 2 (where there is divided responsibility for design) Name (capitals): N/A Signature: N/A Date: N/A

I/we, being the designer(s) of the electrical installation, also RECOMMEND that this installation is further inspected and tested by: ..... (date) (*Where applicable)

The proposed date for the next inspection should take into consideration any legislative or licensing requirements and the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life. The period should be agreed between relevant parties.

Organisation (Designer 1): Independent Energy Group Registration No*: 617658000 Organisation (Designer 2): N/A Registration No*: N/A

Address: 94B London Road Leicester Leicestershire Address: N/A

Postcode: LE2 0QS Tel No: 07984563441 Postcode: N/A Tel No: N/A

CONSTRUCTION (The extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the construction of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the construction, hereby CERTIFY that the said work for which I have been responsible is, to the best of my knowledge and belief, in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3 and 133.5).

Name (capitals): BEN ADCOCK Organisation: BHK Electrical Ltd Registration No*: 617658000

Address: 21 Gadsby Road COALVILLE

Signature: [redacted] Date: 30/08/2024 Postcode: LE67 2HL Tel No: 07984563441

INSPECTION & TESTING (The extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the inspection and testing of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the inspection and testing, hereby CERTIFY that the said work for which I have been responsible is, to the best of my knowledge and belief, in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3 and 133.5).

Name (capitals): BEN ADCOCK Organisation: BHK Electrical Ltd Registration No*: 617658000

Address: 21 Gadsby Road COALVILLE

Signature: [redacted] Date: 30/08/2024 Postcode: LE67 2HL Tel No: 07984563441

REVIEWED BY QUALIFIED SUPERVISOR (for the Contractor detailed in PART 1)

Name (capitals): BEN ADCOCK Signature: [redacted] Date: 30/08/2024

Where the electrical work to which this certificate relates includes the installation of a fire alarm system and/or an emergency lighting system (or a part of such systems), this electrical safety certificate should be accompanied by the particular certificate(s) for the system(s).

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

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ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 5 : SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

System type and earthing arrangements

TN-C: (N/A) TN-S: (✔) TN-C-S: (N/A)

TT: (N/A) IT: (N/A)

Supply protective device

BS EN: (60947-2) Type: (MCCB) Rated current: (800) A

Number and type of live conductors

AC 1-phase, 2-wire: (N/A) 2-phase, 3-wire: (N/A)

3-phase, 3-wire: (N/A) 3-phase, 4-wire: (✔)

DC 2-wire: (N/A) 3-wire: (N/A) Other: (N/A)

Confirmation of supply polarity: (✔)

Other sources of supply (Schedule of Test Results) Page No: (N/A)

Nature of supply parameters

Nominal voltage between lines, U [1]:	(400) V	[1] By enquiry
Nominal line voltage to Earth, U_0 [1]:	(230) V	[2] By enquiry or by measurement
Nominal frequency, f [1]:	(50) Hz	
Prospective fault current, I_{pf} [2]*:	(24.2) kA	
Earth fault loop impedance, Z_e [2]*:	(0.04) Ω	

PART 6 : PARTICULARS OF INSTALLATION REFERRED TO IN THIS CERTIFICATE

Maximum demand (load): (800) ~~XX~~A

(delete as appropriate)

Means of Earthing

Distributor's facility: (✔)

Installation earth electrode(s): (N/A)

Earth electrode type – rod(s), tape, etc: (None)

Location: (N/A)

Electrode resistance to Earth: (N/A) Ω

Main protective conductors

Earthing conductor:

(material Copper)

csa (300) mm² Connection/continuity verified: (✔)

Main protective bonding conductors:

(material Copper)

csa (50) mm² Connection/continuity verified: (✔)

Main protective bonding connections

Water installation pipes: (✔)

Gas installation pipes: (✔)

Structural steel: (✔)

Oil installation pipes: (N/A)

Lightning protection: (✔)

Other (state):

N/A (N/A)

N/A (N/A)

Main switch / Switch-fuse / Circuit-breaker / RCD

Location: (Warehouse)

BS EN: (60947-2) Type: (ACB) Rating / setting of device: (800) A

No. of poles: (4) Current rating: (800) A Voltage rating: (400) V

Where an RCD is used as the main switch

RCD rated residual operating current, $I_{\Delta n}$: (N/A) mA RCD Type: (N/A)

Rated time delay: (N/A) ms Measured operating time: (N/A) ms

PART 7 : SCHEDULE OF ITEMS INSPECTED (enter ✓or N/A, as applicable)

		Outcome
1.	Condition of consumer's intake equipment (visual inspection only)	(✔)
2.	Parallel or switched alternative sources of supply	(N/A)
3.	Protective measure: Automatic disconnection of supply (ADS)	(✔)
4.	Basic protection	(✔)
5.	Protective measures other than ADS	(✔)
6.	Additional protection	(N/A)
7.	Distribution equipment	(✔)
8.	Circuits (distribution and final)	(✔)
9.	Isolation and switching	(✔)
10.	Current-using equipment (permanently connected)	(✔)
11.	Identification and notices	(✔)
12.	Location(s) containing a bath or shower	(N/A)
13.	Other special installations or locations	(✔)
14.	Prosumer's low voltage installation(s)	(✔)

Schedule of Items Inspected by

Name (capitals): BEN ADCOCK

Signature: Date: 30/08/2024

PART 8 : SCHEDULES AND ADDITIONAL PAGES (the pages identified are an essential part of this report (see Regulation 653.2))

Schedule of Circuit Details and Schedule of Test Results for the installation (PARTS 9A & 9B)	Additional pages, including data sheets for additional sources	Special installations or locations (indicated in item 13 of PART 7)	Schedules relating to Prosumer's installations (indicated in item 14 of PART 7)	Continuation sheets
Page No(s): (4 & 5)	Page No(s): (None)	Page No(s): (6)	Page No(s): (7)	Page No(s): (None)

**Where the installation is supplied by more than one source, the higher or highest values of prospective fault current, I_{pf}, and external earth fault loop impedance, Z_e, must be recorded.*

This certificate is based on the model forms shown in Appendix 6 of *BS 7671: 2018 (as amended)*

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628**

EIC18.3c

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 9A : SCHEDULE OF CIRCUIT DETAILS (GO TO Part 9B 'Schedule of Test Results' to enter test results for the corresponding circuit listed in this part)

Circuit number	Circuit description	Type of wiring (see footer to PART 9B)	Reference Method (BS 7671)	Number of points served	Circuit conductor (number & csa)		Max. disconnection time (BS 7671)	Overcurrent protective device					RCD			
					Live (mm²)	cpc (mm²)	(s)	BS (EN)	Type	Rating (A)	Short-circuit capacity (kA)	Maximum permitted Zs* (Ω)	BS (EN)	Type	Rating (A)	Operating current, $I_{\Delta n}$ (mA)
Q2.9	Inverter 1	G	E	1	16	Arm	5	60947-2	MCCB	63	50	0.79	N/A	N/A	N/A	N/A

DISTRIBUTION BOARD (DB) DETAILS (complete in every case)

DB designation: LV1

Location of DB: Warehouse

Z_{db}: 0.04 (Ω) I_{pf} at DB†: 1.9 (kA)

Confirmation of supply polarity: (✔) Phase sequence confirmed†: (✔)

SPD Details** Types: T1 (✔) T2 (✔) T3 (N/A) N/A (N/A)

Status indicator checked (where functionality indicator is present): (✔)

**SPD Type.

Where combined T1 + T2 or T2 + T3 device is installed, indicate by ticking both Type brackets.

Where T3 devices are installed on a circuit to protect sensitive equipment, enter details in 'Comments' (PART 9B), (See Section 534 for further details).

Note that not all SPDs have visible functionality indication.

TO BE COMPLETED ONLY IF THE DB IS NOT CONNECTED DIRECTLY TO THE ORIGIN OF THE INSTALLATION

Supply to DB is from: N/A

Overcurrent protective device for the distribution circuit

BS (EN): (N/A) Type: (N/A) Nominal voltage: (N/A) V Rating: (N/A) A No. of phases: (N/A)

Associated RCD (if any)

BS (EN): (N/A) RCD Type: (N/A) $I_{\Delta n}$: (N/A) mA No. of poles: (N/A) Operating time: (N/A) ms

Enter a (✓) or value in the respective fields, as appropriate. Where an item is not applicable insert N/A

† Where applicable. *Where figure is not taken from *BS 7671*, state source: N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628** **EIC18.3c**

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 9B : SCHEDULE OF TEST RESULTS (MUST reflect circuits entered into 'Schedule of Circuit Details' in Part 9A)

Circuit number	Continuity (Ω)					Insulation resistance			Polarity	Max. measured earth fault loop impedance, Zs	RCD		AFDD**	Comments and additional information, where required
	Ring final circuits only (measured end to end)			All circuits (complete at least one column)		Live / Live	Live / Earth	Test voltage DC			Operating time*	Test button	AFDD test button	
	(Line) r_1	(Neutral) r_n	(cpc) r_2	$(R_1 + R_2)$	R_2	(MΩ)	(MΩ)	(V)	(✓)	(Ω)	(ms)	(✓)	(✓)	
C2.9	N/A	N/A	N/A	0.21	N/A	999	999	500	✔	0.23	N/A	N/A	N/A	

Circuits/equipment vulnerable to damage when testing (where applicable): Inverters

TESTED BY Name (capitals): BEN ADCOCK Position: QS Signature: Date: 30/08/2024

TEST INSTRUMENTS (ENTER SERIAL NUMBER AGAINST EACH INSTRUMENT USED)

Multi-function:	Continuity:	Insulation resistance:	Earth fault loop impedance:	Earth electrode resistance:	RCD:
5110093	N/A	N/A	N/A	N/A	N/A

* RCD effectiveness is verified using an alternating current test at rated residual operating current ($I_{\Delta n}$)

** Where installed. Note, not all AFDDs have a test function. Where a circuit contains an AFDD this should be stated in the field for that circuit in the 'Comments and additional information, where required' column.

CODES for Type of wiring	(A) Thermoplastic insulated / sheathed cables	(B) Thermoplastic cables in metallic conduit	(C) Thermoplastic cables in non-metallic conduit	(D) Thermoplastic cables in metallic trunking	(E) Thermoplastic cables in non-metallic trunking	(F) Thermoplastic / SWA cables	(G) Thermosetting / SWA cables	(H) Mineral-insulated cables	Other (state): N/A

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628** **N18.3c**

GENERAL CONTINUATION SHEET

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

NOTES

13. Other special installations or locations

Solar PV on roof

Solar Pv installation on roof. 49KwP system installed to amendment 3 BS7671.Methods of protection for DC cables are galvanised metallic trunking. Another method of protection used is double insulation for DC cables throughout the installation . The inverter station is located in the warehouse. The inverter is linked to a fire alarm interface to shut it down in the event of a fire. ✔

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628** **N18.3c**

GENERAL CONTINUATION SHEET

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

NOTES

14. Prosumer's low voltage installation(s)

Solar PV on roof	Solar PV on roof	✔

NOTES FOR RECIPIENT

THIS CERTIFICATE IS AN IMPORTANT AND VALUABLE DOCUMENT WHICH SHOULD BE RETAINED FOR FUTURE USE

This safety certificate has been issued to confirm that the electrical installation work to which it relates has been designed, constructed, inspected and tested in accordance with the national standard for the safety of electrical installations, *BS 7671: 2018 (as amended)* - Requirements for Electrical Installations.

You should have received the certificate marked 'Original' and the contractor should retain a duplicate. If you were the person ordering the work, but not the owner or user of the installation, you should pass this certificate, or a full copy of it, immediately to the owner or user of the installation.

The 'Original' certificate should be retained in a safe place and shown to any person inspecting, or undertaking further work on the electrical installation in the future. If you later vacate the property, this certificate will demonstrate to the new user that the electrical installation works complied with the requirements of *BS 7671: 2018 (as amended)* at the time the certificate was issued.

The Construction (Design and Management) Regulations require that, for a project covered by those Regulations, a copy of this certificate, together with schedules, is included in the project health and safety documentation.

For safety reasons, the complete electrical installation will need to be inspected and tested at appropriate intervals by a skilled person or persons competent in such work. The maximum interval recommended before the next inspection is stated in PART 4A or 4B. With the exception of domestic (household) premises, there should be a notice at or near the main switchboard or distribution board indicating the date when the next inspection is due.

Only an NICEIC* contractor responsible for the construction of the electrical installation is authorised to issue this NICEIC Electrical Installation Certificate.

This certificate is intended to be issued only for a new electrical installation or for new work associated with an addition or alteration to an existing installation, or for the replacement of a distribution board (or consumer unit). It should not have been issued for the inspection of an existing electrical installation. An 'Electrical Installation Condition Report' should be issued for such a periodic inspection.

The certificate, which consists of at least five numbered pages, is only valid if the Schedule of Items Inspected has been completed to confirm that all relevant inspections have been carried out and the Schedule of Circuit Details and Test Results is attached. The certificate has a unique serial number which is traceable to the contractor to which it was supplied by NICEIC.

For installations having more than one distribution board (or consumer unit) or more circuits than can be recorded on Page 5, one or more additional Schedules of Circuit Details and Test Results, should form part of the certificate.

This certificate should not have been issued for electrical work in a potentially explosive atmosphere (hazardous area) unless the contractor holds an appropriate extension to their NICEIC registration for such work.

Page 1 and 2 of this certificate provide details of the electrical installation, together with the name(s) and signature(s) of the person(s) certifying the three elements of installation work: design, construction and inspection and testing, and page 3 identifies the organisation(s) responsible for the work certified by their representative(s).

Certification for inspection and testing provides an assurance that the electrical installation work has been fully inspected and tested, and that the electrical work has been carried out in accordance with the requirements of *BS 7671: 2018* (as amended) (except for any departures sanctioned by the designer and appended to the certificate).

Where responsibility for the design, the construction and the inspection and testing of the electrical work is divided between the contractor and one or more other bodies, the division of responsibility should have been established and agreed before commencement of the work. In such a case, NICEIC considers that the absence of certification for the construction, or the inspection and testing elements of the work would render the certificate invalid. If the design section of the certificate has not been completed, NICEIC recommends that you question why those responsible for the design have not certified that this important element of the work is in accordance with *BS 7671: 2018* (as amended).

Where the installation includes a residual current device (RCD) it should be tested every six months. by pressing the button marked "T" or "Test". The device should switch off the supply and should then be switched on to restore the supply. If the device does not switch off the supply when the button is pressed, seek expert advice. For safety reasons it is important that this instruction is followed.

Where the installation includes an arc fault detection device (AFDD) having a manual test facility, it should be tested six-monthly by pressing the test button. Where an AFDD has both a test button and automatic test function, manufacturer's instructions should be followed with respect to test button operation.

Where the installation includes a surge protection device (SPD) the status indicator should be checked to confirm it is in operational condition in accordance with manufacturer's information. If the indication shows that the device is not operational, seek expert advice.

Where a number of sources are available to supply the installation, and where the data given for the primary source may differ from other sources, an additional page should have been provided which gives the relevant information relating to each additional source, and to the associated earthing arrangements and main switchgear.

Where the electrical work to which this certificate relates includes the installation of a fire alarm system and/or an emergency lighting system (or a part of such systems) in accordance with British Standards *BS 5839* and *BS 5266* respectively, this electrical safety certificate should be accompanied by a separate certificate or certificates as prescribed by those standards.

Should the person ordering the work (e.g. the client, as identified on Page 1 of this certificate), have reason to believe that any element of the work for which the Contractor has accepted responsibility (as indicated by the signatures on this certificate) does not comply with *BS 7671: 2018* (as amended), the client should in the first instance raise the specific concerns in writing with the contractor. If the concerns remain unresolved, the client may make a formal complaint to NICEIC, for which purpose a standard complaint form is available on request.

The complaints procedure offered by NICEIC is subject to certain terms and conditions, full details of which are available upon application. NICEIC does not investigate complaints relating to the operational performance of electrical installations (such as lighting levels), or to contractual or commercial issues (such as time or cost).

For further information about electrical safety and how NICEIC can help you, visit:

www.niceic.com

** NICEIC is operated by Certsure LLP, a partnership between the Electrical Contractors' Association and the charity, Electrical Safety First. NICEIC maintains and publishes registers of electrical contractors that it has assessed against particular scheme requirements (including the technical standard of electrical work).*

Adveco Ltd t/a AO Smith
Unit B8 Armstrong Mall,
Southwood Bus. Park,
Farnborough, Hampshire,
GU14 0NR

Tel: 01252 551540
Email: enquiries@adveco.co
Web: www.adveco.co
VAT Reg. No. 215954456
Gas Safe Reg # 22227

Commissioning report No. 2237
Date of Visit: 04/09/2024

Site Details	
Name	Poyle Horton Road
Address	New Warehouse Horton Road Poyle Slough SL3 0BB
Contact	Cy Betts
Telephone	07525 462084
Mobile	
Email	

Customer Details	
Name	WM Building Services Ltd
Address	657 Melton Road Thurmaston Leicester LE4 8EB
Contact	WM Building Services Ltd
Telephone	0116 3112477
Mobile	
Email	leesutton@wmbuildingservices.com

Equipment Commissioning Result

System/ Equipment	Make	Model	Serial Number	Location	Result
Site: Solar Commissioning					**Pass**

Important Information

Attending Engineer: Jason Proctor

Adveco Ltd t/a AO Smith
Unit B8 Armstrong Mall,
Southwood Bus. Park,
Farnborough, Hampshire,
GU14 0NR

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Commissioning Data

All yes/no answers on the following commissioning report should be answered with YES. Any answers of NO have the following further works recommendation level:

*: Items that are good practice and/or maximise efficiency, performance, serviceability, or lifespan and are recommended to be rectified

**: Items that may prevent the system from operating correctly or at all, or may affect lifespan and warranty of the unit and should be rectified

***: Items that could lead to unsafe situations and must be rectified before using the installation.

It is a requirement of the Building Regulations in England and Wales to notify the installation of all heat-producing gas appliances (water heaters, boilers, fires, air heaters etc.) and related heating systems, confirming that the work complies with all aspects of the Building Regulations. This is a requirement of the installer and has not been carried out by Adveco Ltd. on your behalf. Please ensure that this has been done. A Building Regulations Compliance certificate will be issued to the customer as proof.

Equipment Test Data - Site: Solar Commissioning				
				Pass/ Fail
				Pass
Test Notes:	Tyfocor LS used. HWS Anti Legionella pump controlled by BMS, recommend once a week for 1 hour around 1.00am. Hot water cylinder not Adveco / AO Smith- Joule Cyclone CY 500 L twin coil.			

Are the Schematic drawings available at the time of the visit?	No
Installation correct as per schematic diagrams?	Yes
Collector Manufacturer?	AO Smith
Collector Type and Model?	FKA 240 H Cu/Cu
Solar collector Qty?	2
Solar collector Serial No/s:	20241175, 20241174
Solar collector arrangement?	SPFR 02 H DB x 1
Solar Collector total aperture area? (M Square)	5.4
Zero loss efficiency: Flat plates: 0.778 (EN 12975)	0.778
Heat loss efficiency - Flat plate: 3.59 (EN 12975)	3.59
Solar collector absorber Type	Flat plate
Individual capacity of collectors?	2.7 litre (horizontal)
Solar collectors securely fixed to roof?	Yes
Confirm that all roof penetrations (cables, pipe and brackets) have been suitably sealed against movement and temperature fluctuations?	Yes
Is external pipe work insulated with bird-resistant insulation?	Yes
Solar Pump Model?	Grundfos UPM3 Solar
Solar pump serial #:	G00000531699
Booster pump Fitted?	No
Booster pump model:	Na
Booster pump serial #:	Na
High limit stat fitted to isolate pump?	Yes
Safety valve setting? (Bar)	6

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Expansion vessel size? (ltr)	24
Expansion vessel pressure? (Bar)	1
Expansion capacity suitable for system?	Yes
Differential temperature Controller Model:	PAW SC3.5
(Single-phase 50Hz) Volts - measured:	238
Location of electrical isolator:	Above solar pump station
Fuse/CB rating of Solar pump electrical circuit? (Amps)	13
Evidence of "Mains equipotential bonding?"	Yes
Solar pump operates correctly?	Yes
Differential controller operates correctly??	Yes
Differential controller Delta on:	10
Differential controller Delta Off:	2
Drain Back?	Yes
Solar Limit temperature?	70
Solar difference?	10
System pressure?	0.4
Pump speed?	Auto
Flow rate? (ltrs/Min)	2
Is the noise of pump when running at Max acceptable?	Yes
Transfer fluid Tyfocor L (40%)? (Frost protection to -21C)	Other? Add details to notes
Quantity of fluid used	40
Estimated frequency of fluid change? (Months)	36 - 60
Pipe work insulated with temperature-rated material?	Yes
Are all clearances suitable for maintenance? (Make comments in notes if not)	Yes
Maximum recorded solar collector temperature? (degrees C)	50.3
Maximum recorded Preheat vessel temperature? (degrees C)	24.9
Is a "Sterilisation" pump fitted and working? (Add additional info to Notes as required)	Yes - working correctly
Are anti-scalding controls fitted to the system?	Yes
Solar contribution for DHW only? (if not, mention in notes)	Yes
Has a MIS 3001 label been fitted (MCS installations only)	N/A
Solar commissioning completed? - if "No" - explain in the notes	Yes
System operation demonstration given to customer at the time of the commissioning?	Yes
Failure Point:	

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VAT Reg. No. 215954456
Gas Safe Reg # 22227

The above works have been completed to my satisfaction.

Customer: Cy Betts

Print Name | Signature

The above works have been carried out to company standards

Technician: Jason Proctor

Print Name | Signature

Independent Energy Group Ltd

Solar PV System DC Commissioning Test Results

Job Reference	P23025
Customer Name	Winvic Construction
Installation Address	Horton Road, Poyle, West Berkshire. SL3 0BB

Contractors Name	Independent Energy Group Ltd
Contractors Address	Marshall House, West Street, Gelnfield, Leicseter LE3 8DT
Comissioned By	

Comissioned Date	30/08/2024
System Size (kW)	50.16kWp

Solar Module Details		Generation Meter Details		Test Instruments	
Make	Canadian Solar	Make	Seaward	Multimeter	
Model	CS6R-440T	Model	PV150	Light Meter	
MCS No.		Serial No.	BTM12134	Multifunction	
Voc (STC)	39.40	Reading		Temperature	
Isc (STC)	14.01				
Panel Wattage	440				
No. of Panels	114				

Inverter							
Inverter Make & Model		Solis S5-GC40K		Inverter Number		1	
Inverter Serial Number							
Functionallity Tested		Yes		Country/Language Set		GB	
String		1.1.1	1.2.1	1.3.1	1.3.2	1.4.1	1.4.2
Number of Modules		20	21	21	20	20	20
Array Parameters	Voc (STC)	788.00	827.40	827.40	788.00	788.00	788.00
	Isc (STC)	14.01	14.01	14.01	14.01	14.01	14.01
Wiring	Pos (mm2)	6	6	6	6	6	6
	Neg (mm2)	6	6	6	6	6	6
Polarity Check		Correct	Correct	Correct	Correct	Correct	Correct
String Test	Voc (V)	776	709	556	570	715	702
	Isc (A)	13.54	13.373	6.86	10.28	14.49	9.54
	Temp (C)	21					
	Irradiance	65					
Insulation Resistance		>199	>199	>199	>199	>199	>199

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

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ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 1 : DETAILS OF THE CONTRACTOR, CLIENT AND INSTALLATION

DETAILS OF THE CONTRACTOR

(*Where applicable)

Registration N°: 617658000 Branch N°*: 000

Trading Title: BHK Electrical Ltd

Address: 21 Gadsby Road

Postcode: LE67 2HL Tel No: 07984563441

DETAILS OF THE CLIENT

Contractor Reference Number (CRN): N/A

Name: Independent Energy Group

Address: Marshall House, West Street, Glenfield, Leicester, Leicestershire

Postcode: LE2 0QS Tel No: N/A

DETAILS OF THE INSTALLATION

Occupier: Winvic Construction

Unique Property Reference Number (UPRN): N/A

Address: Panattoni 80 Poyle, Slough

Postcode: SL3 0BB Tel No: N/A

PART 2 : DETAILS OF THE ELECTRICAL WORK COVERED BY THIS INSTALLATION CERTIFICATE

Date works completed: 28/08/2024 **The installation is** New: (✔) An addition: (N/A) An alteration: (N/A) Replacement of a distribution board: (N/A)

Description and extent of the installation covered by this certificate: Installation of a ac sub main to an inverter. Solar Pv installed on roof and dc strings connected into an inverter.

Where necessary, continue on a separate numbered page: Page No(s) (N/A)

PART 3 : COMMENTS ON THE EXISTING INSTALLATION (in the case of an addition or alteration see Regulation 644.1.2)

N/A

Where necessary, continue on a separate numbered page: Page No(s) (N/A)

PART 4A : DECLARATION FOR THE ELECTRICAL INSTALLATION WORK (use where the design, construction, inspection & testing have been the responsibility of one person)

DESIGN, CONSTRUCTION, INSPECTION & TESTING (the extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the design, construction, inspection and testing of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the design, hereby CERTIFY that the design, construction, inspection and testing for which I have been responsible is to the best of my knowledge and belief in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any (Regulations 120.3, 133.1.3 and 133.5), detailed as follows:

N/A

where required, continued on attached separate page(s) (N/A)

- Permitted exception applied (411.3.3): Yes/NA (N/A) Risk assessment attached: (N/A) Page No(s) (N/A)

I, being the designer of the electrical installation, also RECOMMEND that this installation is further inspected and tested by: N/A (date)

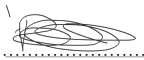
The proposed date for the next inspection should take into consideration any legislative or licensing requirements and the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life. The period should be agreed between relevant parties

Name (capitals): N/A Organisation: N/A Registration No*: N/A

Address: N/A

Signature: N/A Date: N/A Postcode: N/A Tel No: N/A

REVIEWED BY QUALIFIED SUPERVISOR

Name (capitals): BEN ADCOCK Signature:  Date: 30/08/2024

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

Please see the 'Notes for Recipients'

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

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ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 4B : DECLARATION FOR THE ELECTRICAL INSTALLATION WORK (to be completed where different parties are responsible for the design, construction, inspection & testing)

DESIGN (The extent of liability of the signatories is limited to the work detailed in PART 2)

I/We being the person(s) responsible for the design of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the design, hereby CERTIFY that the design work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3, 133.1.3 and 133.5).

- Permitted exception applied (411.3.3): ~~Yes~~/NA Risk assessment attached: (N/A) Page No(s) (N/A)

DESIGNER 1 Name (capitals): TONY MEREDITH Signature: [signature] Date: 30/08/2024

DESIGNER 2 (where there is divided responsibility for design) Name (capitals): N/A Signature: N/A Date: N/A

I/we, being the designer(s) of the electrical installation, also RECOMMEND that this installation is further inspected and tested by: ..... (date) (*Where applicable)

The proposed date for the next inspection should take into consideration any legislative or licensing requirements and the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life. The period should be agreed between relevant parties.

Organisation (Designer 1): Independent Energy Group Registration No*: 617658000 Organisation (Designer 2): N/A Registration No*: N/A

Address: 94B London Road Leicester Leicestershire Address: N/A

Postcode: LE2 0QS Tel No: 07984563441 Postcode: N/A Tel No: N/A

CONSTRUCTION (The extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the construction of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the construction, hereby CERTIFY that the said work for which I have been responsible is, to the best of my knowledge and belief, in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3 and 133.5).

Name (capitals): BEN ADCOCK Organisation: BHK Electrical Ltd Registration No*: 617658000

Address: 21 Gadsby Road COALVILLE

Signature: [signature] Date: 30/08/2024 Postcode: LE67 2HL Tel No: 07984563441

INSPECTION & TESTING (The extent of liability of the signatory is limited to the work detailed in PART 2)

I, being the person responsible for the inspection and testing of the electrical installation, particulars of which are described in PART 2, having exercised reasonable skill and care when carrying out the inspection and testing, hereby CERTIFY that the said work for which I have been responsible is, to the best of my knowledge and belief, in accordance with *BS 7671: 2018* amended to N/A (date) except for the departures, if any, detailed on attached page(s) (N/A) (Regulations 120.3 and 133.5).

Name (capitals): BEN ADCOCK Organisation: BHK Electrical Ltd Registration No*: 617658000

Address: 21 Gadsby Road COALVILLE

Signature: [signature] Date: 30/08/2024 Postcode: LE67 2HL Tel No: 07984563441

REVIEWED BY QUALIFIED SUPERVISOR (for the Contractor detailed in PART 1)

Name (capitals): BEN ADCOCK Signature: [signature] Date: 30/08/2024

Where the electrical work to which this certificate relates includes the installation of a fire alarm system and/or an emergency lighting system (or a part of such systems), this electrical safety certificate should be accompanied by the particular certificate(s) for the system(s).

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

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EIC18.3c

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 5 : SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

System type and earthing arrangements

TN-C: (N/A) TN-S: (✔) TN-C-S: (N/A)

TT: (N/A) IT: (N/A)

Supply protective device

BS EN: (60947-2) Type: (MCCB) Rated current: (800) A

Number and type of live conductors

AC 1-phase, 2-wire: (N/A) 2-phase, 3-wire: (N/A)

3-phase, 3-wire: (N/A) 3-phase, 4-wire: (✔)

DC 2-wire: (N/A) 3-wire: (N/A) Other: (N/A)

Confirmation of supply polarity: (✔)

Other sources of supply (Schedule of Test Results) Page No: (N/A)

Nature of supply parameters

Nominal voltage between lines, U [1]: (400) V

Nominal line voltage to Earth, U_0 [1]: (230) V

Nominal frequency, f [1]: (50) Hz

Prospective fault current, I_{pf} [2]*: (24.2) kA

Earth fault loop impedance, Z_e [2]*: (0.04) Ω

[1] By enquiry

[2] By enquiry or by measurement

PART 6 : PARTICULARS OF INSTALLATION REFERRED TO IN THIS CERTIFICATE

Maximum demand (load): (800) ~~kVA~~/A

(*delete as appropriate*)

Means of Earthing

Distributor's facility: (✔)

Installation earth electrode(s): (N/A)

Earth electrode type – rod(s), tape, etc: (None)

Location: (N/A)

Electrode resistance to Earth: (N/A) Ω

Main protective conductors

Earthing conductor:

(material Copper)

csa (300) mm² Connection/continuity verified: (✔)

Main protective bonding conductors:

(material Copper)

csa (50) mm² Connection/continuity verified: (✔)

Main protective bonding connections

Water installation pipes: (✔)

Gas installation pipes: (✔)

Structural steel: (✔)

Oil installation pipes: (N/A)

Lightning protection: (✔)

Other (state):

N/A (N/A)

N/A (N/A)

Main switch / Switch-fuse / Circuit-breaker / RCD

Location: (Warehouse)

BS EN: (60947-2) Type: (ACB) Rating / setting of device: (800) A

No. of poles: (4) Current rating: (800) A Voltage rating: (400) V

Where an RCD is used as the main switch

RCD rated residual operating current, $I_{\Delta n}$: (N/A) mA RCD Type: (N/A)

Rated time delay: (N/A) ms Measured operating time: (N/A) ms

PART 7 : SCHEDULE OF ITEMS INSPECTED (enter ✓or N/A, as applicable)

		Outcome
1.	Condition of consumer's intake equipment (visual inspection only)	(✔)
2.	Parallel or switched alternative sources of supply	(N/A)
3.	Protective measure: Automatic disconnection of supply (ADS)	(✔)
4.	Basic protection	(✔)
5.	Protective measures other than ADS	(✔)
6.	Additional protection	(N/A)
7.	Distribution equipment	(✔)
8.	Circuits (distribution and final)	(✔)
9.	Isolation and switching	(✔)
10.	Current-using equipment (permanently connected)	(✔)
11.	Identification and notices	(✔)
12.	Location(s) containing a bath or shower	(N/A)
13.	Other special installations or locations	(✔)
14.	Prosumer's low voltage installation(s)	(✔)

Schedule of Items Inspected by

Name (capitals): BEN ADCOCK

Signature: Date: 30/08/2024

PART 8 : SCHEDULES AND ADDITIONAL PAGES (the pages identified are an essential part of this report (see Regulation 653.2))

Schedule of Circuit Details and Schedule of Test Results for the installation (PARTS 9A & 9B)

Page No(s): (4 & 5)

Additional pages, including data sheets for additional sources

Page No(s): (None)

Special installations or locations (indicated in item 13 of PART 7)

Page No(s): (6)

Schedules relating to Prosumer's installations (indicated in item 14 of PART 7)

Page No(s): (7)

Continuation sheets

Page No(s): (None)

**Where the installation is supplied by more than one source, the higher or highest values of prospective fault current, I_{pf}, and external earth fault loop impedance, Z_e, must be recorded.*

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

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ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 9A : SCHEDULE OF CIRCUIT DETAILS (GO TO Part 9B 'Schedule of Test Results' to enter test results for the corresponding circuit listed in this part)

Circuit number	Circuit description	Type of wiring (see footer to PART 9B)	Reference Method (BS 7671)	Number of points served	Circuit conductor (number & csa)		Max. disconnection time (BS 7671)	Overcurrent protective device					RCD			
					Live (mm²)	cpc (mm²)	(s)	BS (EN)	Type	Rating (A)	Short-circuit capacity (kA)	Maximum permitted Zs* (Ω)	BS (EN)	Type	Rating (A)	Operating current, $I_{\Delta n}$ (mA)
Q2.9	Inverter 1	G	E	1	16	Arm	5	60947-2	MCCB	63	50	0.79	N/A	N/A	N/A	N/A

DISTRIBUTION BOARD (DB) DETAILS (complete in every case)

DB designation: LV1

Location of DB: Warehouse

Z_{db}: 0.04 (Ω) I_{pf} at DB†: 1.9 (kA)

Confirmation of supply polarity: (✔) Phase sequence confirmed†: (✔)

SPD Details** Types: T1 (✔) T2 (✔) T3 (N/A) N/A (N/A)

Status indicator checked (where functionality indicator is present): (✔)

**SPD Type.

Where combined T1 + T2 or T2 + T3 device is installed, indicate by ticking both Type brackets.

Where T3 devices are installed on a circuit to protect sensitive equipment, enter details in 'Comments' (PART 9B), (See Section 534 for further details).

Note that not all SPDs have visible functionality indication.

TO BE COMPLETED ONLY IF THE DB IS NOT CONNECTED DIRECTLY TO THE ORIGIN OF THE INSTALLATION

Supply to DB is from: N/A

Overcurrent protective device for the distribution circuit

BS (EN): (N/A) Type: (N/A) Nominal voltage: (N/A) V Rating: (N/A) A No. of phases: (N/A)

Associated RCD (if any)

BS (EN): (N/A) RCD Type: (N/A) $I_{\Delta n}$: (N/A) mA No. of poles: (N/A) Operating time: (N/A) ms

Enter a (✓) or value in the respective fields, as appropriate. Where an item is not applicable insert N/A

† Where applicable. *Where figure is not taken from *BS 7671*, state source: N/A

NICEIC APPROVED CONTRACTOR

BHK ELECTRICAL LTD

This certificate is not valid if the serial number has been defaced or altered **30086628**

EIC18.3c

ELECTRICAL INSTALLATION CERTIFICATE

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

PART 9B : SCHEDULE OF TEST RESULTS (MUST reflect circuits entered into 'Schedule of Circuit Details' in Part 9A)

Circuit number	Continuity (Ω)					Insulation resistance			Polarity	Max. measured earth fault loop impedance, Zs	RCD		AFDD**	Comments and additional information, where required
	Ring final circuits only (measured end to end)			All circuits (complete at least one column)		Live / Live	Live / Earth	Test voltage DC			Operating time*	Test button	AFDD test button	
	(Line) r_1	(Neutral) r_n	(cpc) r_2	$(R_1 + R_2)$	R_2	(MΩ)	(MΩ)	(V)	(✓)	(Ω)	(ms)	(✓)	(✓)	
Q2.9	N/A	N/A	N/A	0.21	N/A	999	999	500	✔	0.23	N/A	N/A	N/A	

Circuits/equipment vulnerable to damage when testing (where applicable): Inverters

TESTED BY Name (capitals): BEN ADCOCK Position: QS Signature: Date: 30/08/2024

TEST INSTRUMENTS (ENTER SERIAL NUMBER AGAINST EACH INSTRUMENT USED)

Multi-function:	Continuity:	Insulation resistance:	Earth fault loop impedance:	Earth electrode resistance:	RCD:
5110093	N/A	N/A	N/A	N/A	N/A

* RCD effectiveness is verified using an alternating current test at rated residual operating current ($I_{\Delta n}$)

** Where installed. Note, not all AFDDs have a test function. Where a circuit contains an AFDD this should be stated in the field for that circuit in the 'Comments and additional information, where required' column.

CODES for Type of wiring	(A) Thermoplastic insulated / sheathed cables	(B) Thermoplastic cables in metallic conduit	(C) Thermoplastic cables in non-metallic conduit	(D) Thermoplastic cables in metallic trunking	(E) Thermoplastic cables in non-metallic trunking	(F) Thermoplastic / SWA cables	(G) Thermosetting / SWA cables	(H) Mineral-insulated cables	Other (state): N/A

Enter a (✓) or value in the respective fields, as appropriate.
Where an item is not applicable insert N/A

NICEIC APPROVED CONTRACTOR

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GENERAL CONTINUATION SHEET

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

NOTES

13. Other special installations or locations

Solar PV on roof	Solar Pv installation on roof. 49KwP system installed to amendment 3 BS7671.Methods of protection for DC cables are galvanised metallic trunking. Another method of protection used is double insulation for DC cables throughout the installation . The inverter station is located in the warehouse. The inverter is linked to a fire alarm interface to shut it down in the event of a fire.	✔

GENERAL CONTINUATION SHEET

Issued in accordance with *BS 7671: 2018* (as amended) – Requirements for Electrical Installations

Original (to the person ordering the work)

NOTES

14. Prosumer's low voltage installation(s)

Solar PV on roof	Solar PV on roof	✔

NOTES FOR RECIPIENT

THIS CERTIFICATE IS AN IMPORTANT AND VALUABLE DOCUMENT WHICH SHOULD BE RETAINED FOR FUTURE USE

This safety certificate has been issued to confirm that the electrical installation work to which it relates has been designed, constructed, inspected and tested in accordance with the national standard for the safety of electrical installations, *BS 7671: 2018 (as amended)* - Requirements for Electrical Installations.

You should have received the certificate marked 'Original' and the contractor should retain a duplicate. If you were the person ordering the work, but not the owner or user of the installation, you should pass this certificate, or a full copy of it, immediately to the owner or user of the installation.

The 'Original' certificate should be retained in a safe place and shown to any person inspecting, or undertaking further work on the electrical installation in the future. If you later vacate the property, this certificate will demonstrate to the new user that the electrical installation works complied with the requirements of *BS 7671: 2018 (as amended)* at the time the certificate was issued.

The Construction (Design and Management) Regulations require that, for a project covered by those Regulations, a copy of this certificate, together with schedules, is included in the project health and safety documentation.

For safety reasons, the complete electrical installation will need to be inspected and tested at appropriate intervals by a skilled person or persons competent in such work. The maximum interval recommended before the next inspection is stated in PART 4A or 4B. With the exception of domestic (household) premises, there should be a notice at or near the main switchboard or distribution board indicating the date when the next inspection is due.

Only an NICEIC* contractor responsible for the construction of the electrical installation is authorised to issue this NICEIC Electrical Installation Certificate.

This certificate is intended to be issued only for a new electrical installation or for new work associated with an addition or alteration to an existing installation, or for the replacement of a distribution board (or consumer unit). It should not have been issued for the inspection of an existing electrical installation. An 'Electrical Installation Condition Report' should be issued for such a periodic inspection.

The certificate, which consists of at least five numbered pages, is only valid if the Schedule of Items Inspected has been completed to confirm that all relevant inspections have been carried out and the Schedule of Circuit Details and Test Results is attached. The certificate has a unique serial number which is traceable to the contractor to which it was supplied by NICEIC.

For installations having more than one distribution board (or consumer unit) or more circuits than can be recorded on Page 5, one or more additional Schedules of Circuit Details and Test Results, should form part of the certificate.

This certificate should not have been issued for electrical work in a potentially explosive atmosphere (hazardous area) unless the contractor holds an appropriate extension to their NICEIC registration for such work.

Page 1 and 2 of this certificate provide details of the electrical installation, together with the name(s) and signature(s) of the person(s) certifying the three elements of installation work: design, construction and inspection and testing, and page 3 identifies the organisation(s) responsible for the work certified by their representative(s).

Certification for inspection and testing provides an assurance that the electrical installation work has been fully inspected and tested, and that the electrical work has been carried out in accordance with the requirements of *BS 7671: 2018* (as amended) (except for any departures sanctioned by the designer and appended to the certificate).

Where responsibility for the design, the construction and the inspection and testing of the electrical work is divided between the contractor and one or more other bodies, the division of responsibility should have been established and agreed before commencement of the work. In such a case, NICEIC considers that the absence of certification for the construction, or the inspection and testing elements of the work would render the certificate invalid. If the design section of the certificate has not been completed, NICEIC recommends that you question why those responsible for the design have not certified that this important element of the work is in accordance with *BS 7671: 2018* (as amended).

Where the installation includes a residual current device (RCD) it should be tested every six months. by pressing the button marked "T" or "Test". The device should switch off the supply and should then be switched on to restore the supply. If the device does not switch off the supply when the button is pressed, seek expert advice. For safety reasons it is important that this instruction is followed.

Where the installation includes an arc fault detection device (AFDD) having a manual test facility, it should be tested six-monthly by pressing the test button. Where an AFDD has both a test button and automatic test function, manufacturer's instructions should be followed with respect to test button operation.

Where the installation includes a surge protection device (SPD) the status indicator should be checked to confirm it is in operational condition in accordance with manufacturer's information. If the indication shows that the device is not operational, seek expert advice.

Where a number of sources are available to supply the installation, and where the data given for the primary source may differ from other sources, an additional page should have been provided which gives the relevant information relating to each additional source, and to the associated earthing arrangements and main switchgear.

Where the electrical work to which this certificate relates includes the installation of a fire alarm system and/or an emergency lighting system (or a part of such systems) in accordance with British Standards *BS 5839* and *BS 5266* respectively, this electrical safety certificate should be accompanied by a separate certificate or certificates as prescribed by those standards.

Should the person ordering the work (e.g. the client, as identified on Page 1 of this certificate), have reason to believe that any element of the work for which the Contractor has accepted responsibility (as indicated by the signatures on this certificate) does not comply with *BS 7671: 2018* (as amended), the client should in the first instance raise the specific concerns in writing with the contractor. If the concerns remain unresolved, the client may make a formal complaint to NICEIC, for which purpose a standard complaint form is available on request.

The complaints procedure offered by NICEIC is subject to certain terms and conditions, full details of which are available upon application. NICEIC does not investigate complaints relating to the operational performance of electrical installations (such as lighting levels), or to contractual or commercial issues (such as time or cost).

For further information about electrical safety and how NICEIC can help you, visit:

www.niceic.com

** NICEIC is operated by Certsure LLP, a partnership between the Electrical Contractors' Association and the charity, Electrical Safety First. NICEIC maintains and publishes registers of electrical contractors that it has assessed against particular scheme requirements (including the technical standard of electrical work).*

6. Operation

Recommended Safety Operating Procedures

LV Switchgear

Systems Covered

- Main LV switchboards.

Associated Systems

- Sub main electrical distribution system
- Earthing and bonding system.

Safety

Read the Warnings, Cautions and Notes in Clause.

Pre-Operation Checks

Prior to switching on for the first time or following a long period of shut down, it will be necessary to carry out a general inspection of the switchboard, incomer and outgoing switches and the circuits served to ensure they are safe and suitable to operate.

The LV distribution system may also have been partially isolated for maintenance work therefore, before preceding with the following, check all maintenance work has been completed.

1. Carry out pre-operation checks on the switchboard in accordance with the procedure detailed in the manufacturer's literature scheduled in Section 4.4.
2. Confirm incoming supply is at the correct voltage and frequency.
3. Confirm there are no earth faults on the switch panel or sub main distribution system.
4. Confirm load circuits are ready to receive power and all outgoing isolators are OFF.

Switching On

1. Close the mains incomer switch and confirm voltage is present on all three phases.
2. Make the appropriate outgoing way MCCBs.

General Electrical Systems

Systems Covered

LV sub main distribution systems
Small power circuits.

Associated Systems

Earthing and bonding system.

Pre-Operational Checks

Prior to switching on for the first time or following a long period of shut down, it will be necessary to carry out a general inspection of the systems to ensure they are safe and suitable to operate. The systems may have been partially isolated for maintenance work therefore, before proceeding with the following, check all maintenance work has been completed.

1. Check earthing and equipotential bonding system in accordance with BS7671:2018.
2. Test all circuits in accordance with BS7671:2018.
3. Carry out pre-start checks on distribution boards as detailed in the relevant manufacturer's literature.

Switching On

Putting any electrical installation into operation must be carried out by a qualified person and in accordance with BS7671:2018.

Normal Operation

It is advisable that, in the first few hours of operation, all systems and equipment are checked to ensure that they are operating correctly. This can usually to carried out a simple visual inspection and general awareness. For example, are all instruments indicating normal readings? Are there any unusual noises or burning smells?

System Shut Down

For temporary shut down on an individual circuit or appliance, isolate at the respective distribution board by switching MCB to Off or at local isolator. In either case padlock in the Off position.

Emergency Shut Down

To shut down the complete electrical system in an emergency, isolate at the LV switchboard located in the relevant switch room.

PV Inverter Startup And Emergency Shutdown Procedure

Startup Sequence

1. Ensure all isolators and MCB's in the main panel and PV panel (if fitted) are on
2. Ensure power to firefighter switches is ON
3. Switch the AC switch ON.
4. Switch the DC switch ON. If the PV array (DC) voltage is higher than the inverter's start-up voltage, the inverter will turn on. The red DC POWER LED and LCD will be continuously lit.
5. Solis inverters are powered from the DC side. When the inverter detects DC power that is within start-up and operating ranges, the inverter will turn on. After turn on, the inverter will check internal parameters, sense and monitor AC voltage, hertz rate and the stability of the supply grid. During this period, the green OPERATION LED will flash and the LCD screen will show INITIALIZING. This tells the operator that the inverter is preparing to generate AC power.
6. After the locally mandated delay (300 seconds for IEEE-1547 compliant inverters), the inverter will start generating AC power. The green OPERATION LED will light continuously and the LCD screen will show GENERATING.

Emergency Shutdown

1. System will turn off automatically in the event of the fire alarm being activated and all DC cable inside the building will be isolated
2. Inverters will switch off and go into sleep mode when no DC is present

Disconnection Sequence

1. Turn off the AC Switch between Solis inverter and Grid.
2. Wait approximately 30 seconds (during this time, the AC side capacitors are dissipating energy). If the inverter has DC voltage above the start-up threshold, the red POWER LED will be lit.
3. Switch the DC switches underneath the inverter to OFF.
4. Confirm all LED's switch OFF (-one (1) minute).

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7. Maintenance Procedures and Planned Maintenance

INDEPENDENT ENERGY GROUP

Photovoltaic Maintenance Regimes

This maintenance schedule Panattoni Poyle 80 is to be followed from 19th September 2024 year on year to ensure all plant and equipment is kept within warranty.

Please keep a log of these inspections so that records can be checked should an issue arise.

Code; ✓ Blue – Best Practice ✓ Red – Compulsory to warranty

Item	Daily	Weekly	Monthly	3 Months	6 Months	9 Months	Annually	2 Yearly	3 Yearly	Certificates	Regime
AC Isolators							✓				Remove covers and check connections/operation
DC Isolators							✓				Remove covers and check connections/operation
String Tests							✓				Test voltage and current on individual strings. Test irradiance and module temperature and record results
Inverter Cleaning							✓				Check heat sink is free from dirt Turn off DC string isolators and switch inverter DC isolator on and off to clear carbon
Inverter running status								✓			Check for normal sound emitted while running Check inverter settings are correct Test G59 disconnection and re-connection speed is in line with DNO requirements

Item	Daily	Weekly	Monthly	3 Months	6 Months	9 Months	Annually	2 Yearly	3 Yearly	Certificates	Regime
Inverter Wiring							✓				Check connections are secure Check wiring for insulation damage Check port covers are in place
Generation Meter							✓				Check LED status and CT clamps Record meter reading and analyse
PV Modules							✓				Check condition of PV modules and recommend cleaning where required Check MC4 connector plugs are not exposed Check array shading and make recommendations
Thermal Imaging									✓		Use thermal imaging camera to test panels for hot spots Take thermal images of any modules with suspected hot spots and record position Thermal image inverters and electrical components
Mounting System								✓			Check mountings are secure and tighten if required
Containment								✓			Check cable containment fixings are secure and condition of cable trays Check cables secure in containment
Fireman Switches							✓				Test switch off and re-energise
Reports							✓				Service paperwork and maintenance recommendations issued

Operating and Maintenance Notes

Notes on System Operation

Warnings, Cautions and Notes

WARNING LV SYSTEMS AND SWITCHGEAR CARRIES VOLTAGES WHICH ARE LETHAL.

CAUTION PROTECTION RELAYS AND REMOTE INDICATION AND ALARM CIRCUITS MUST BE DISCONNECTED AND CT's SHORT-CIRCUITED BEFORE TEST VOLTAGES ARE APPLIED TO BUSBARS.

CAUTION PROTECTION RELAYS CONTAIN ELECTROSTATIC SENSITIVE DEVICES (ESSD). CARE MUST BE TAKEN NOT TO CAUSE DAMAGE TO THESE DEVICES DURING HANDLING, STORAGE OR TRANSPORTATION. CONSULT BS 5783 AND IEC 147-0F FOR FURTHER INFORMATION.

General

A regular and organised scheme of maintenance work, planned to cover all details of the installation, within given maintenance periods, will ensure continued satisfactory operation with a minimum liability to interruptions to supply due to equipment faults.

Careful attention must be given to securing the safety of personnel and equipment while maintenance or repair work is in progress. A code of safety rules based on a "Permit to Work" system is recommended, as detailed in Section 2 of this manual.

A planned maintenance scheme should include a system of logging so that records are kept for inspection, maintenance and repair on all items of plant and equipment.

Switch rooms should be kept clean and the practice of using switch room space for storage must not be permitted.

Tools and instruments for maintenance work should be properly housed in racks or cupboards and, if of a special character, their purpose and method of use should be clearly indicated. The tools and instruments should be regularly checked against an inventory.

Manufacturers provide instruction books, which set out clearly the manner in which the apparatus functions, the methods of adjustment and how maintenance should be given. Such books should be made available to the maintenance staff in every switch room, and a place should be provided for their safekeeping, together with the inventory of tools and instruments. For details of the various literature provided by the manufacturers, refer to Section 9.

The maintenance of certain systems, because of the requirement for particular knowledge and possibly the use of special equipment and methods should only be undertaken by a specialist. Such items considered to come under this scope of activity are:

Operation of Switchgear during Maintenance

It is important that maintenance personnel should be fully familiar with the operation of the various devices that they are called upon to handle. Incorrect or unauthorised operation of switchgear during maintenance is when most accidents and problems occur.

Make sure that all staff are aware of what work is being carried out and that the switching operations are in accordance with the manufacturers recommended instructions and that voltage is not applied to incomplete or un-commissioned systems.

All voltage indicators should be tested on a known "**live**" source immediately before and after use. The use of improvised voltage indicators should be discouraged.

On low and medium voltage circuits where filament lamps in series are employed as portable voltage indicators, they should be adequately guarded by insulation material and should be provided with high breaking capacity fuses in both leads. The leads should terminate in well-guarded test prods.

Pre-maintenance Checks

Before any work is carried out on or near components that are normally live, or where danger would arise to men working, it is essential that the apparatus be proved dead.

The operation of an external handle or lever of an isolator or circuit breaker should not be assumed to have opened all or any of the contacts, as cases of mechanical failure have been known to occur. In particular, this may happen where a handle is operated against a mechanical interlock.

Tests should therefore be carried out to ensure that equipment is dead, that all the contacts of the device are open, and all the correct fuse carriers removed. These should include tests between each phase and earth to cover the possibility of wrong connection.

Operation of Live Equipment

If it is necessary for live equipment to be observed with the covers removed while operating, only authorised persons should be permitted to do this, and no one should do this work alone. The companion to the authorised person should be made aware beforehand of exactly what work has to be done and what he should do if an accident occurs.

Maintenance of Earthing Connections

All equipment other than those of the all insulated type should be adequately earthed. It is very important to ensure that earthing connections are mechanically sound, free from corrosion, and that all contact screws are tight making good contact.

After maintenance, all bolts and screws should be replaced, together with any locking devices.

Precautions regarding Auxiliary Circuits

Precautions should be taken to ensure that circuits controlling automatic equipment are disconnected from the supply before work is commenced.

It should not be assumed that the isolation of the main supply to the equipment isolates auxiliary circuits. For example, a voltage transformer may be made "**live**" from an alternative source.

When isolating auxiliary circuits, care should be taken that the tripping supplies to other units are not affected.

All safety precautions and general recommended procedures relating to the maintenance of switchgear are contained in BS6423, 6626 and 6867 and these should be read in conjunction with the instructions for routine periodic maintenance given within this manual.

Frequency of Maintenance

Frequency of maintenance will depend on a number of factors, the most important being the conditions under which the equipment operates and the severity of duty.

For the purposes of this manual, the normal anticipated periods have been assumed but this does not preclude more frequent checks and/or maintenance should it be found necessary from experience.

For continually operating equipment, it may be necessary to co-ordinate routine maintenance with the demands on building usage, but where there are regular periods during which the system is shut down, maintenance schedules may be arranged to coincide with these periods.

Switchgear

For equipment to operate satisfactorily, it is essential that it is kept clean. Before removing covers and opening doors, loose dirt and dust resting on the top of enclosures should be removed with a brush.

When air is used for cleaning, a suction type device with a dust receptacle should preferably be employed. Cleaning down by blown air is not preferred as it spreads contamination. If it is necessary to use air, it is preferable to employ a portable type blower.

If rags are used, they should be chemically clean and free from loose fibres. Cotton waste should not be used.

When solvents are used for cleaning or degreasing they should be of a non-flammable and non-toxic nature whenever possible, and at all times precautions against fire should be observed.

After maintenance work, all covers and doors including those of instruments and relays should be securely replaced so as to exclude dust.

Electrical Checks

Regular checks of the tightness of all terminations and connections are required in the switchgear including those on the main busbar systems.

Check the instrumentation and controls including voltmeter switches for correct operation and replace fuses and switches as necessary.

In addition, vacuum cleaning of the interior of the switchgear whenever possible is desirable.

Marking of Covers and Connections

All covers, cables and shields, etc., should be marked carefully before removal to ensure correct replacement. If connections are disturbed or temporary connections made for testing purposes, they should be clearly marked to facilitate reconnection and the permanent connection must be restored, and the temporary connections removed, before the unit is returned to service.

After maintenance work, bolts, screws and locking devices of all current carrying/earth connections should be securely replaced.

Connections which have not been disturbed should be checked for soundness. It is not sufficient for nuts and bolts to be assumed to be tight.

Switches, MCBs and Fuses

Circuit wiring and terminal connections must be checked for signs of overheating; replace parts where there is the slightest doubt that this may have occurred.

MCBs must always be of the correct size for the circuit.

Where cartridge fuses are used, replacements should be of the same type and pattern as the original and in no circumstances should attempts be made to use, permanently or temporarily, any other fuse device.

Where a locking device holds the fuse in position, it should be remembered that fuse links incorrectly chosen or badly fitted might contribute to overheating.

Switchblade contacts should be lightly smeared with petroleum jelly or other suitable lubricant but should never be lubricated with grease or oil.

Control Circuit MCBs and Fuses

The reliability of equipment can be seriously impaired by control faults and it is therefore most important to locate and correct immediately any fault which causes the operation of rupture of any control circuit fuse and to report the occurrence.

Each MCB and fuse link should be tested for continuity each time a routine inspection is carried out, where this is not an inevitable part of the final running test.

Clear labelling of MCBs and fuses in agreement with connection diagrams, is also desirable. Such labelling should also indicate the fuse ratings.

General Maintenance

Only a regular and organised scheme of maintenance work, planned to cover all details of the installation within given maintenance periods, can you ensure continued satisfactory operation with a minimum liability to interruptions to supply due to equipment faults. This would include carrying out the routine inspection, testing and cleaning, adjustments and early detection of incipient trouble likely to cause breakdown.

The efficient manner in which this is done can be assessed by freedom from breakdown and behaviour of plant under abnormal fault conditions. Since most of the equipment is normally static, attention is not always drawn to the dangers which can result from general neglect and it follows that a properly organised system of maintenance is essential.

A planned maintenance scheme should include a system of logging, wherein records are kept of inspection, maintenance and repair on all items of plant and equipment. To enable such records to be implemented it is recommended that a specialist maintenance contractor is employed to perform such duties.

Maintenance problems are influenced by site and atmospheric conditions, system design and type of plant in use. The installation, testing and commissioning of equipment is all important and must be properly supervised.

Statutory regulations must be observed by those engaged on maintenance.

MAINTENANCE – GENERAL

Generally, operation and maintenance of the electrical services equipment and plant detailed below is considered self evident and therefore requires no special training.

Operation: Testing the emergency lighting.

Testing Regime.

Testing by key switch

Testing using switched fused connection units

Maintenance: Health and Safety Notices.

Maintaining the luminaires.

Maintaining the Fire Alarm System

Maintenance Requirements.

During its operating life, the plant and equipment will e subject to the effects of dirt, water, corrosion and stress. Unless these are combated, they will individually or in combinations, affect the efficiency and performance of the installation, eventually leading to failure of plant with the possibility of costly repair and loss of service.

The following sub-headings describe the effects listed above and the measures that need to be taken to combat them.

DIRT

- If preventive measures are not taken, dirt will become a major cause of loss in plant efficiency and foreshortening of its operational life. The abrasive nature of grit and dust, especially when combined with moisture, oil or grease (these providing an excellent bonding medium for dirt) should not be underestimated.
- In order to minimise the time and effort spent in combating these effects, consideration should be given to ways of preventing the entry of dirt into plant areas and its build upon the plant itself.
- To minimise the entry of dirt, all doors and panels within the plant area must be kept closed and all internal floor and wall surfaces should be treated with a suitable sealant to prevent the ingress of grit dust into the atmosphere by abrasion.
- Build up of dirt can be prevented to a great deal by ensuring all plant surfaces are dry and free of any oil or grease film, especially around bearing houses and lubrication points.
- All louvered and gridded openings, such as on motor cases, must be kept free of any build up of dirt or dust.
- When removing traces of dirt and dust, care must be taken to prevent displacement into other, perhaps crucial, parts of plant.

- Keeping plant and the areas in which, they are situated clean, forms a vital part of maintenance work. The build up of dirt will not be tolerated in a properly maintained installation.

Wear

Although wear is inevitable, the rate at which it occurs is very much dependant on maintenance. The rate will be minimised providing correct lubrication and cleanliness is maintained It is important to note that excessive, as well as insufficient lubrication, can be detrimental to wear.

Stress

It should be borne in mind that additional and unacceptable stresses can be created by a simple component fault such as a pipe support or anti-vibration mounting failure. Such faults can only be found through regular and meticulous inspection.

Maintenance Inspection

All plant rooms/service areas and any plant within them should be visually checked at least once a month for the following:-

- Correct functioning
- Noise and/or vibration not normally associated with the item of plant
- Temperature in excess of normal operating parameters
- Unusual odours
- Unusual stains and blemishes
- Security of connection and fixings

Any abnormalities should be noted and correct measures put into place.

Specialist maintenance contractors should carry out maintenance of any other plant and equipment that form part of the electrical services installations.
General Maintenance Instructions

Routine maintenance and testing shall be carried out generally as described previously within this section. Further attention should be drawn to the requirements of the IEE Wiring Regulations BS 7671, Electricity at Work Regulations 1989, Health and Safety Executive requirements and any requirements of insurance companies etc.

Inverter Maintenance

Solis Three Phase Inverter does not require any regular maintenance. However, cleaning the dust on heat-sink will help the inverter to dissipate the heat and increase its life time. The dust can be removed with a soft brush.

CAUTION:
Do not touch the inverter's surface when it is operating. Some parts of the inverter may be hot and cause burns. Turn off the inverter (refer to Section 6.2) and wait for a cool-down period before any maintenance or cleaning operation.

The LCD and the LED status indicator lights can be cleaned with a damp cloth if they are too dirty to be read.

NOTE:
Never use any solvents, abrasives or corrosive materials to clean the inverter.

8.1 Night Time PID-Recovery Function

Solis Three phase Inverters integrates optional Night Time PID-Recovery module and it can recover the PID effect during night thus protect the PV system from degradation.

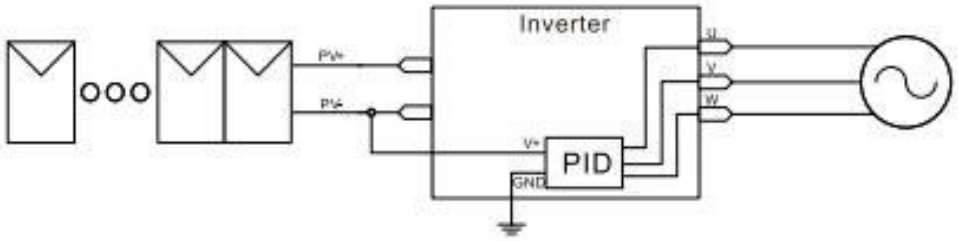

Figure 8.1

The Night Time PID-Recovery module repairs the PID effect of the PV model at night. When operating, the inverter LCD screen displays " PID-repairing " information, and the red light is on. The Night Time PID-Recovery function is always ON when AC is applied. If maintenance is required and turn off the AC switch can disable the Night Time PID-Recovery function.

WARNING :
Due to the similar functional logic, when the night time PID-Recovery function is integrated, the night time var compensation function can not be used. Also, the negative grounding option is not available for inverters with night time PID-Recovery function.

WARNING :
The PID function is automatic. When the DC bus voltage is lower than 50Vdc, the PID module will start creating 450 Vdc between PV- and ground.
No need any control or settings

NOTE:
If you need to maintain the inverter at night, please turn off the AC switch first, then turn off the DC switch, and wait 5 minutes before you do other operations.

8.2 Fan Maintenance

If the fan does not work properly, the inverter will not be cooled effectively.
and it may affect the effective operation of the inverter .
Therefore, it is necessary to clean or replace a broken fan as follows:

1. Turn off the "Grid ON/OFF" switch on the inverter LCD.
2. Disconnect the AC power.
3. Turn the DC switch to "OFF" position.
4. Wait for 15 minutes at least.
5. Remove the 8 screws on the fan plate and pull out the fan assembly slowly.

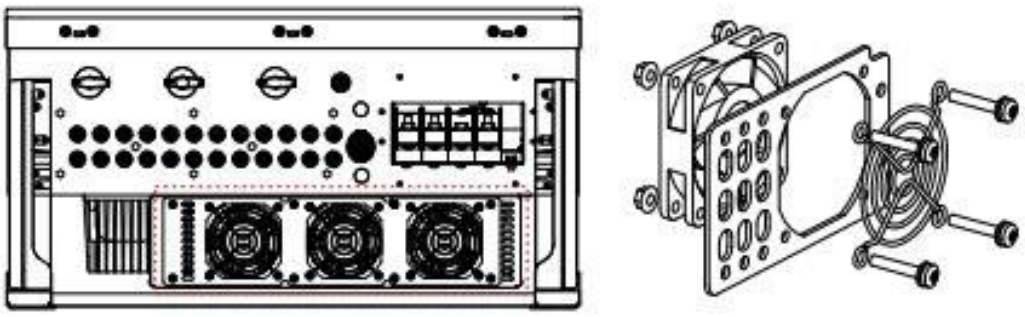

Figure 8.2

6. Disconnect the fan connector carefully and take out the fan.
7. Clean or replace the fan. Assemble the fan on the rack.
8. Connect the electrical wire and reinstall the fan assembly. Restart the inverter.

8. Spares Information

See 10. Replacement Strategy

9. Guarantees and Warranties

2. Certificates, Warranties, Guarantees

Description of Guarantees and Extended Warranties

All products supplied have a standard manufacturers 12 months guarantee from point of PC which is 2nd September 2024.

Product Guarantees

All products supplied have a standard manufacturers 12 months guarantee from point of install which is 2nd September 2024.

Building Owner Certification

DC Certificates

AC Certificates

Client Training

Key Schedule

INDEPENDENT ENERGY GROUP

Customer Warranty for Installation Services

The Warranty sets out the terms upon which The Independent Energy Group offers warranty cover for the Products supplied by it to its Customers, and for the installation services provided by The Independent Energy Group Registered Installers. Terms defined in The Independent Energy Group Terms and Conditions bear the same meaning when used in this warranty. Your attention is drawn to The Independent Energy Group Terms and Conditions, which includes provisions relevant to the warranty set out below.

1. Installation services

1.1. The Independent Energy Group warrants to you that the Installation Services will be performed by the appropriately qualified and trained personnel using reasonable care and skill, to such high standard of quality as it is reasonable for you to expect.

1.2. The Warranty Period for the Installation Services shall be two years from completion of the Installation Services

2. Remedial Action

2.1. If you make a valid claim about our service in accordance with The Independent Energy Group Terms and Conditions, The Independent Energy Group may arrange for the relevant products to be reinstalled or refund to the Customer the charge for the relevant part of the Installation Service (or a proportionate part of such charge).

3. Exceptions

3.1. This Warranty will only apply:
3.1.1 If the Product has been installed by The Independent Energy Group has been properly used and maintained throughout the Warranty Period.
3.1.1. If you have informed The Independent Energy Group of the alleged defect within the Warranty Period and within a reasonable period of discovery.

4. General conditions

4.1. You will promptly provide all information and support including access to site and services) reasonably necessary to enable The Independent Energy Group to evaluate any alleged defect and to perform its obligations under this Warranty.

4.2. You agree that all premises, plant, power, fuel support services and other inputs that you provide for the installation and use of the Products are reasonable, are fit for purpose and will be properly used and provided.

5. Expertise

5.1. Any dispute as to whether a defect is covered by this warranty shall be immediately referred at the request of either party to the RECC Conciliation Service as detailed in RECC Consumer Code.

6. Third Party Rights

6.1. When The Independent Energy Group has installed a system in a property that is sold within the Warranty Period the warranty will pass to the new legal owner of the property. It may not be transferred to or exercised by any third party.

7. Law

7.1. This warranty is governed by English law and the English courts or by the law and the courts governing where your property is if this is outside England or Wales.

8. Manufacturer's Product Warranty

8.1. Most Products supplied by The Independent Energy Group come with the benefit of a manufacturer's product guarantee. Where a claim in respect of any of the Products is notified to The Independent Energy Group by you in accordance with the The Independent Energy Group Terms and Conditions, The Independent Energy Group will liaise with the manufacturer and use all reasonable endeavors to secure a replacement of the Product or the part in question) or a refund of the price of the Product (or a proportionate part of the price).

LIMITED WARRANTY STATEMENT
PHOTOVOLTAIC MODULE PRODUCTS
TOPHIKU SERIES

For the photovoltaic solar module products of the following module types delivered under the sales contract or purchase order signed on and after March. 20th, 2024, CSI Solar Co., Ltd. (hereinafter referred to as "CSI Solar") will provide warranty in accordance with this <LIMITED WARRANTY STATEMENT PHOTOVOLTAIC MODULE PRODUCTS TOPHIKU SERIES> (hereinafter referred to as "Limited Warranty Statement").

This Limited Warranty Statement applies only to the following module types ("Products") of CSI Solar: CS6W-XXXT, CS6R-XXXT, CS6.1-72TD-XXX, CS6R-XXXT (Black Frame & All Black) , CS6.1-54TM-XXXH (All Black), CS6.1-54TD-XXX, CS6.1-54TD-XXX (Black Frame), CS6.1-60TM-XXX, CS6.1-60TM-XXXH (All Black) , CS7L-XXXT , "XXX" in the aforementioned module type denotes the rated output of the module (Pmax), for example "CS6W-550T".

This Limited Warranty Statement does not apply to Products sold to and installed in Australia, New Zealand, and P.R. China.

TWELVE (12) YEAR LIMITED PRODUCT WARRANTY

Subject to the limitations & exclusions contained herein, CSI Solar warrants to the original buyer (the "Buyer") of the Products listed above that, for twelve (12) years after the Warranty Start Date, the Products shall be free from defects in materials and workmanship which have an adverse effect on Products functionality under normal application, installation, use, and service conditions as specified in CSI Solar's standard product documentation such as the installation manual and its annexes.

Claims under the above warranties will only be accepted if the Buyer can prove that the malfunctioning or non-conformity of the Products results exclusively from defects in materials and/or workmanship under normal application, installation, use and service conditions specified in CSI Solar's standard product documentation. This Limited Product Warranty does not warrant a specific power output of the Products, which shall be exclusively covered under the Limited Performance Warranty elaborated below.

TWENTY-FIVE (25) YEAR LIMITED PRODUCT WARRANTY

For the specified products listed below and only when they are installed on the rooftops in below specified regions, the limited product warranty period is 25 years. All the limitations and exclusions and other considerations included in this Limited Warranty Statement still apply.

For Europe:

-CS6R-XXXT (Black Frame & All Black)

-CS6.1-54TDXXX (Black Frame)

For Japan:

-CS6R-XXXT (Black Frame & All Black)

-CS6.1-54TDXXX (Black Frame)

-CS6.1-42TM-XXX (Black frame)

-CS6.1-36TM-XXX (Black frame)

For US/Canada

-CS6.1-54TM-XXXH (All Black)

-CS6.1-60TM-XXXH (All Black)

THIRTY (30) YEAR LIMITED PERFORMANCE WARRANTY

CSI Solar warrants that for a period of thirty (30) years from the Warranty Start Date, all products listed in this warranty will maintain a level of performance as set forth below:

- During the first year, CSI Solar warrants the actual power output of the Products will be no less than 99% of the labeled power output.
- From year 2 to year 30, the actual annual power decline will be no more than 0.4%; by the end of year 30, the actual power output will be no less than 87.4% of the labeled power output.

The actual power output of the Products shall be determined for verification using Standard Testing Conditions only. Testing measurement uncertainty shall be taken into account and applied to all actual power output measurements.

WARRANTY START DATE

The foregoing "LIMITED PRODUCT WARRANTY" and "LIMITED PERFORMANCE WARRANTY" are respectively and jointly referred to as "limited warranty" or "warranty". The Warranty Start Date shall be the day after the completion of the first installation of the Products or 90 days after the delivery (Incoterms of 2020) of the Products to the Buyer, whichever date is earlier.

The warranty period is calculated based on calendar years. For example, the first year of the warranty period is from the Warranty Start Date to the 365th day, and so on.

EXCEPTIONS

The limited warranties set forth herein **DO NOT** apply to any Products: 1) for which CSI Solar has not received all or part of the due payments from the Buyer; 2) unable to provide the purchase proofs, Products information and other information or materials that can prove the claim is valid; 3) which have been subject to negligence in transportation, handling, storage or use; 4) which have been repaired without CSI Solar's authorization or in any way tampered with; 5) which have been subject to extraordinary hot, salt or chemical exposure; 6) which have been subject to improper installation, application, alteration or unauthorized service according to the local laws and regulations or CSI Solar's standard product documentation, or improper system design which caused constant shading or external stress to the Products; 7) which have been subject to power failure or surges, flood, fire, direct or indirect lightning strikes, accidental breakage, vandalism, explosions, acts of war, or other events outside CSI Solar's control; 8) which have been moved from its original installation location; 9) third party components that are connected with the Products or the components of the construction on which the Products are mounted have defects; or 10) installed on mobile units (except photovoltaic tracking system), such as vehicles, ships or offshore-structures (except water surface floating systems).

In addition, the limited warranties do not apply to any deterioration in the appearance of the Products (including, without limitation, any scratches, stains, rust, discoloration, or mold) or any other changes to the Products in appearance stemming from the normal wear and tear over time of product materials. Also, no warranty claim may be made if the product label, type or serial number of the applicable Products has been altered, removed or made illegible.

REMEDIES

In respect of the Twelve (12) Year Limited Product Warranty, if CSI Solar verifies in its reasonable judgment that the Products fail to conform to the terms of the Limited Product Warranty set forth herein, CSI Solar, at its option, will provide one of the following remedies: 1) repair the Products; 2) replace the Products with new products whose labeled power wattages equal to or exceed the Warranted Wattages of replaced Products (the Warranted Wattages is defined as the labeled power wattages of the Products minus the permissible accumulated degradation); or 3) provide a refund of the fair market value of the Products assessed based on the Warranted Wattages at the time of claim.

In respect of the Thirty (30) Year Limited Performance Warranty, if CSI Solar verifies in its reasonable judgment that the Products fail to conform to the terms of the Limited Performance Warranty set forth herein, CSI Solar, at its option, will provide one of the following remedies: 1) repair the Products; 2) replace the Products with new products whose labeled power wattages equal to or exceed the Warranted Wattages of replaced Products; 3) provide additional Products to make

up the wattage difference between the actual measured power output wattages at the time of claim and the Warranted Wattages; or 4) provide a refund of the fair market value of the wattage difference between the actual measured power output wattages at the time of claim and the Warranted Wattages.

All remedies under this limited warranty statement shall be calculated based upon the Warranted Wattages of the Products at the time of first reporting of the warranty claim.

CSI Solar will not accept any return of Products without CSI Solar's prior authorization. Once accepted, CSI Solar will cover reasonable transportation costs (except for insurance, any taxes, duties, demurrages, or any other costs and expenses related to custom clearance or Buyer's failure to cooperate) for shipping the Products under a claim back from the Buyer to a designated location of CSI Solar, and for shipping the additional, repaired or replacement Products to the original installation location. If CSI Solar opts for repair as the remedy, CSI Solar shall cover reasonable material and labor costs related to the repair. In any event, the costs and expenses for the removal, installation, and/or reinstallation of the Products, including fees, levies, taxes or other financial duties due in relation to any applicable electronic waste disposal regulation, shall remain with the Buyer, unless otherwise agreed to by CSI Solar in a signed writing. CSI Solar will not pay any cost of any fees, levies, taxes or other financial duties imposed on the remedies implemented by CSI Solar or imposed on the Products subject to such remedies, that are due to regulatory, government or judicial decisions not existing at the time of purchase of the affected Products.

Any repair or replacement of the affected Products shall not increase the applicable warranty period. The warranty period for replaced or repaired Products is the remainder of the warranty for the affected Products. CSI Solar reserves the right to deliver a similar product (of similar size, color, shape, and/or power output) in replacement of the affected Products if production of the affected Products is discontinued or such product is otherwise unavailable. Unless instructed by CSI Solar otherwise, Buyer shall dispose of Products in accordance with all local applicable regulations on electronic waste treatment and disposal at its own cost. Products having been replaced shall not be sold, reworked or reused in any way, unless expressly authorized by CSI Solar.

EXCEPT AS OTHERWISE PROVIDED BY APPLICABLE LAW, THE FOREGOING REMEDIES STATE CSI SOLAR'S SOLE AND EXCLUSIVE OBLIGATION AND THE BUYER'S SOLE AND EXCLUSIVE REMEDY FOR A BREACH OF THE FOREGOING LIMITED WARRANTIES.

CLAIM PROCESS

If the Buyer believes that it has a justified claim covered by the limited warranties set forth above, then the Buyer shall submit such claim in writing without undue delay, with supporting information including but not limited to the claimed quantity, serial numbers, purchasing invoices and proofs, to CSI Solar within the applicable warranty period specified above to the following address, or such future address as CSI Solar may provide from time to time:

Asia Pacific
CSI Solar Co., Ltd.
Customer Service Department
199 Lushan Road, Suzhou New District Jiangsu
China, 215129
Tel: +86 512 66908088
E-mail: service.cn@csisolar.com

Europe, Middle East & Africa
Canadian Solar EMEA GmbH
Customer Service Department
Radlkoferstraße 2, 81373 Munich, Germany
Tel: +49 89 5199689 0
E-mail: service.emea@csisolar.com

Americas
Canadian Solar (USA) Inc.
Customer Service Department
1350 Treat Blvd. Suite 500, Walnut Creek, CA 94598
Tel: +1 855 315 8915
E-mail: service.ca@csisolar.com

South Korea
Canadian Solar Korea Ltd.
#906 Dongwoo Building, 328 Teheran ro Gangnam-gu
Seoul, Korea
Tel: +82 2 539 7541
E-mail: service.kr@csisolar.com

LATAM
Canadian Solar Brazil
Customer Service Department
999 Roque Petroni Junior Avenue, 4th floor ,Vila Gertrudes, São Paulo 04707-910
Tel: +55 11 4637-2276 or 0800 878 3587
E-mail: service.latam@csisolar.com

Upon receipt of such written claim, CSI Solar may seek further verification of the Buyer's claim of a breach of one of the foregoing limited warranties. If it is necessary to send the Products to a third-party testing institute for verification, the testing institute shall be ISO/IEC 17025:2017 accredited and mutually agreed in advance.

WARRANTY ASSIGNMENT

This Limited Warranty is transferrable to a party taking legal title to the Products, provided that the Products remain installed in their original installation location.

DISPUTE RESOLUTION

In case of any dispute related to warranty claims, such dispute shall be referred to and finally resolved pursuant to the governing law clauses and dispute resolution procedures under the purchase agreement between the Buyer and CSI Solar to which the relevant Products belong.

FORCE MAJEURE

Force majeure refers to unforeseeable, unavoidable and insurmountable objective conditions, including but not limited to war, riot, strike, epidemic situation, quarantine, traffic control and other social events; Natural disasters such as earthquake, fire, flood, snowstorm, hurricane, thunder and lightning, etc.; Or due to the lack of appropriate or sufficient labor force, shortage of raw materials or inability in production capacity, technology or output; Or delay caused by national laws, regulations, administrative rules or orders, and any unforeseen events beyond the control of CSI Solar.

Due to the occurrence or continuation of force majeure, CSI Solar may be unable to perform or may have delays in performing its obligations under this limited warranty statement. In this case, CSI Solar's obligations to perform will be wholly or partly excused according to the relevant applicable laws or contracts with the Buyer. However, CSI Solar shall timely inform the Buyer of the occurrence of force majeure and negotiate with the Buyer to take necessary measures to minimize the impact of force majeure.

NOT INDEPENDENT WARRANTIES

The Buyer has the right to pursue claims under each of the warranties set forth above; provided that if claims arise under multiple limited warranties from a single defect, then if CSI Solar remedies that defect as set forth above, CSI Solar shall be deemed to have resolved all applicable warranty claims arising from that defect.

DISCLAIMERS

THE LIMITED WARRANTIES SET FORTH HEREIN ARE IN LIEU OF AND EXCLUDE ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION, AND ALL OTHER OBLIGATIONS ON THE PART OF CSI SOLAR UNLESS SUCH OTHER WARRANTIES AND OBLIGATIONS ARE AGREED TO IN WRITING BY CSI SOLAR. SOME JURISDICTIONS LIMIT OR DO NOT PERMIT DISCLAIMERS OF WARRANTY, SO THIS PROVISION MAY NOT APPLY TO THE BUYER IN SUCH JURISDICTIONS.

LIMITATION OF LIABILITY

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, CSI SOLAR HEREBY DISCLAIMS, AND SHALL HAVE NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR, DAMAGE OR INJURY TO PERSONS OR PROPERTY OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATED TO ANY OF ITS PRODUCTS OR THEIR USE. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, UNDER NO CIRCUMSTANCES SHALL CSI SOLAR BE LIABLE TO THE BUYER, OR TO ANY THIRD PARTY CLAIMING THROUGH OR UNDER THE BUYER, FOR ANY LOST PROFITS, LOSS OF USE, OR EQUIPMENT DOWNTIME, OR FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND, HOWSOEVER ARISING, RELATED TO THE PRODUCTS, EVEN IF CSI SOLAR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, CSI SOLAR'S AGGREGATE LIABILITY, IF ANY, IN DAMAGES OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID TO CSI SOLAR BY THE BUYER FOR THE PRODUCT IN THE CASE OF A WARRANTY CLAIM.

THE BUYER ACKNOWLEDGES THAT THE FOREGOING LIMITATIONS OF LIABILITY ARE AN ESSENTIAL ELEMENT OF THE AGREEMENT BETWEEN THE PARTIES AND THAT IN THE ABSENCE OF SUCH LIMITATIONS THE PURCHASE PRICE OF THE PRODUCTS WOULD BE SUBSTANTIALLY DIFFERENT. SOME JURISDICTIONS LIMIT OR DO NOT PERMIT DISCLAIMERS OF LIABILITY, SO THIS PROVISION MAY NOT APPLY TO THE BUYER IN SUCH JURISDICTIONS. SOME JURISDICTIONS DO NOT ALLOW LIMITATIONS ON THE EXCLUSION OF DAMAGES SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO THE BUYER IN SUCH JURISDICTIONS.

YOU MAY HAVE SPECIFIC LEGAL RIGHTS OUTSIDE THIS WARRANTY, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE OR COUNTRY TO COUNTRY. THIS LIMITED WARRANTY DOES NOT AFFECT ANY ADDITIONAL RIGHTS YOU HAVE UNDER LAWS IN YOUR JURISDICTION GOVERNING THE SALE OF CONSUMER GOODS. SOME STATES OR COUNTRIES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE LIMITATIONS OR EXCLUSIONS IN THIS LIMITED WARRANTY STATEMENT MAY NOT APPLY TO YOU IN THOSE AREAS.

NOTE

In the event of any inconsistency among different language versions of this warranty statement, the English version shall prevail.
The installation and handling of PV Products requires professional skills and should only be performed by qualified professionals. Please read the safety and installation instructions before using the Products.

SOLIS INVERTER WARRANTY

Ginlong(Ningbo) Technologies Co., Ltd.

No. 57 Jintong Road, Binhai Industrial Park, Xiangshan, Ningbo, Zhejiang 315712, China
Tel: (+86) 574 6578 1806 Email: sales@ginlong.com

Solis Inverter are manufactured by Ginlong (Ningbo) Technologies Co., Ltd. (The Company) (referred to as Ginlong) provides the following Warranty to the purchaser (The Customer) of the Solis 4G and 5G Inverters (The Goods). (The Customer is deemed to be the owner of the installed Goods at first sale.

****

1. Warranty Terms

The Company warrants all Goods to be free from defects in material or workmanship under normal use and service for a period of 5 years from the date of sale to the Customer.

The Warranty covers the cost of unit repair or replacement parts. The Goods must be returned to the Company for inspection.

The company may repair or replace faulty components at its discretion.

This warranty extends the Customer's statutory rights and cannot be construed so as to diminish such statutory rights.

2. Warranty Extension

The purchaser may apply for a warranty extension within 12 months of purchase by providing the serial number of the unit along with proof of purchase.
An extended warranty can be purchased for a further –
5 Years (Total 10 Years)
7 Years (Total 12 Years)
10 years (Total 20 years)

3. Warranty Limitations

The Warranty is valid only for Goods purchased either directly from the Company or from an authorised reseller of the company.

The Warranty is not transferable and applies to brand new Goods only.

Defective parts replaced under Warranty become the property of the Company.

All accessories receive two year warranty cover – DLS-W, DLS-LAN, DLS-G, DLB-W, DLB-G, EPM3, 4G-CT.

The Warranty does not cover:

(a) Access, labour or transport costs;

(b) Consequential damages including but not limited to loss of revenue;

(c) Claims by third parties other than the Customer;

(d) Defects of installation. (Except where the installation is performed by the Company);

(e) Goods damaged as a consequence of incorrect installation. (Except where the installation is performed by the Company);

(f) Items ancillary to installation not supplied by the Company;

(g) Duties, import/export fees or costs and other general administrative costs;

(h) Damage to Goods caused by misuse, improper handling or unauthorized modification;

(i) Loss or damage occurring whilst in transit;

(j) Accidental or willful damage;

(k) Any Goods described in a quotation or delivery note as 'ex-display' or 'reconditioned'. (A separate Warranty extension may have been issued to cover such Goods.)

Labour, travel and delivery (to and from customer) will be charged if goods returned found to be not faulty following a warranty claim.

4. Warranty Claims Procedure

To make a warranty claim the following information needs to be provided:

- Completed RTM Inspection Form
- Product Model (ie. Solis 4G 3.6kW) and Product Serial Number (ie. 36101010101)
- Copy of the invoice for the inverter
- Copy of the installation report/certificate

The authorised reseller will liaise with the Company regarding repair or replacement. The cost of unit repair or provision of replacement unit will be borne by the Company provided the Warranty has been validated and the Warranty period has not expired.

Where repairs must be effected at the Company's headquarters, the Company will endeavor to minimize the down time for the Goods.

CLENERGY

PV-ezRack Trapezoidal Installation Manual

Roof mounting system for PV modules

For trapezoidal sheet roofs

5. Warranty

10 Years Standard Warranty Terms and Conditions, 20 Year Designed Service Life

Clenergy international co. Ltd warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, except for the anodised finish, which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years, from the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser ("Finish Warranty").

The Finish Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. The Finish Warranty is VOID if the practices specified by AAMA 609 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance with Clenergy's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Clenergy IN WRITING, or if the Product is installed in an environment for which it was not designed. Clenergy shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Purchaser under any circumstances.

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Clenergy shall repair or replace the defective Product, or any part thereof, in Clenergy's sole discretion. Such repair or replacement shall completely satisfy and discharge all of Clenergy's liability with respect to this limited Warranty. Under no circumstances shall Clenergy be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Clenergy's limited Warranty covers only its Product, and not any related items.

10. Replacement Strategy

Replacement Parts

An adequate stock of spare parts must be maintained in order to ensure that all routine maintenance and repairs can be carried out. Make sure that the correct spare parts are stocked and checked again upon issue to maintenance staff.

If temporary repairs are necessary using incorrect materials, make sure that the proper materials are installed as soon as practicable.

This is most important where fuses and circuit breakers are concerned. Incorrect MCBs/fuses can lead to failures, increased danger and fires.

11. Demolition Decommissioning or Disposal

Post Contract Building Services, verifications and building regulations, disposal instructions and building change and plant modification information.

Post Contract Building Services

Verifications and Building Regulations

Disposal Instructions

General

The overriding factor of any demolition or disposal work is to ensure that it is carried out in a safe and proper manner with due consideration for the prevailing Health and Safety regulations and disposal procedures.

In all cases, proper consideration must be given to the protection of the natural environment.

Under the Environmental Protection Act 1990 – Duty of Care, building owners have a responsibility to dispose of all waste in a safe and proper manner.

In most cases disposal should be carried out by a registered waste carrier to a properly licensed site.

At the time of publication there were no known "special" procedures or regulations that applied to this element of the works.

If in doubt contact the local authority's environmental office.

At the time of disposal all items should be considered for recycling especially if they have a metal content which is the most recycled material in the UK.

Batteries

Rechargeable batteries can be recycled once they have reached the end of their useful lives. REBAT (see below) was set up in 1998 to manage and collect the main types of portable rechargeable batteries in the UK. Their website contains a list of company contact details and collection points.

Batteries contain a range of metals which can be reused as a secondary raw material. There are well-established methods for the recycling of most batteries containing lead, nickel-cadmium, nickel hydride and mercury. For some, such as newer nickel-hydride and lithium systems, recycling is still in the early stages. Currently, the UK has only very limited facilities able to recycle secondary consumer and industrial batteries, other than lead-acid cells.

Footnote:

REBAT stands for Recycling Batteries. REBAT is an initiative managed by the British Battery Manufacturers Association to encourage collection of nickel cadmium batteries in the UK, as required under European legislation.

Website: www.rebat.com
Website: www.bbma.co.uk