INSTALLATION AND WARRANTY MANUAL

ARTsolar photovoltaic modules
(Type designation "ARTXXX-XX, ARTXXX-XXX, ARTXXX-XXM, ARTXXX-XXXM, ARTXXX-XXH, ARTXXX-XXXH, ARTXXX-XXMH AND ARTXXX-XXXMH")
Carefully read the following product manual and safety instructions. Failure to follow these instructions will result in a loss of your module warranty.

1. Purpose of this document

This guide contains basic information regarding ARTsolar (Pty) Ltd photovoltaic modules, their installation and safe handling. All instructions should be read and understood before attempting installation. If there are any questions, please contact your dealer or ARTsolar for further information.

This document refers to the PV-modules and is not meant to be a complete installation manual for personnel not specifically trained to install PV-modules. It serves as a general reference.

The installer must conform to all safety precautions in this documentation, as well as the applicable national codes and standards when installing ARTsolar PV-modules. Before installing a solar photovoltaic system, the installer must be familiar with the mechanical and electrical requirements for photovoltaic systems.

Keep this document in a safe place for future reference.

2. System components

(Modules and mounting system; standard scope of delivery)

- ARTsolar's photovoltaic modules are manufactured with TUV. Including; glass/foil laminates, EVA, crystalline solar cells, IP65 or IP67 rated junction boxes that include up to 1m double insulated 4mm2 solar wire (depending on the model) and a pair of MC4 connectors (male and female) and an anodised aluminium frame (silver or black).
- The mounting system does not form part of ARTsolar's supply.
- Either mounting screws should be used through the provided mounting holes or industry certified overhead clamps should be used for fixing the module. Module fixing is done along the length of the module.
- Recommended supplier for mounting systems: Schletter GmbH, S:FLEX GmbH or Renusol GmbH.

3. General safety relevant aspects

Do not attempt to disassemble the module, and do not remove any attached nameplates or components. Doing so will void the product warranty.

- The modules are qualified for application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated.
- Installing solar photovoltaic systems requires specialized skills and knowledge. It should be performed only by qualified and specially instructed personnel. The installer assumes all risk of injury, including risk of electric shock.
- Use only equipment, connectors, wiring and mounting hardware specifically designed for use in a photovoltaic system.

3.1. Transportation and storage

- Handle boxes with extreme care, considered a fragile commodity.
- Do not tilt the boxes more than 15o during handling.
- Take special note of instruction labels on the packaging boxes, outlining how to handle and store packaging.
- Never place boxes upside down / face down in transit.
- Avoid heavy pressure / jolting of the boxes during transit, use strapping to secure boxing.
- Packaging should be protected from rain.
- Transportation should also adhere to the specifications of handling depicted on the packaging box.

3.2. Precautions for mechanical installation

- Very fragile commodity - Take care when handling, transporting, storing and unpacking the modules. Do not carry modules using cables. Do not stand modules on their corners / face down.
- ARTsolar modules are designed for installation with specific photovoltaic mounting systems. Other uses or installation methods will void the warranty.
- The mounting system must be capable of securely fixing ARTsolar modules exposed to uplift or load pressures of more than 2'400 N/m2.
- When mounting modules, do not cover the drain holes with other components.
- The junction box should be at the top of the installed module (portrait view) in order to facilitate correct positioning of ventilation holes.
- The mounting structure and hardware must be made of durable, corrosion- and UV-resistant material.

- Observe all instructions and safety precautions included with the mounting system to be used with the module.
- If modules are installed on roofs (non-integral modules or panels), a fireproof underlay is needed. If modules are installed in roofs (so-called BIPV application), all applicable local, regional and national codes and regulations must be observed.

3.3. Precautions for electrical installation

- Prior to performing any adjustments on a PV plant, ensure to switch the system off first on the AC-side followed by the DC- side of the inverter or the charge controller.
- When disconnecting wires connected to a photovoltaic module that are exposed to light, an electric arc may occur. Arcs can cause burns, start fires or otherwise create safety (up to lethal electric shock) problems.
- Check for remaining voltage before starting the installation and observe the local safety relevant regulations for such working conditions.
- Make connections only in dry conditions.
- Under normal conditions, a photovoltaic module can produce more current and/or voltage than reported at standard test conditions.
- Accordingly, the values of ISC and VOC marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output. In the USA, refer to Section 690-8 of the National Electrical Code (NEC) for an additional multiplying factor of 125 percent (80 percent de-rating) which may be applicable.
- Contact with a DC voltage of 30V or more is potentially hazardous. It is advised that when wiring and installing the PV array that it be done under sun-sheltered areas/covers.
- Only connect modules with the same rated output current in series. If modules are connected in series, the total voltage is equal to the sum of the individual module voltages.
- Only connect modules or series combinations of modules with the same voltage in parallel. If modules are connected in parallel, the total current is equal to the sum of individual module or series combination currents.
- Always use the same type of module within a particular photovoltaic system.
- With a serial interconnection of the modules, the sum of the open circuit voltage at Standard Test Conditions (Voc @ STC) must not pass over the maximal system voltage, indicated both on the module label and on the modules datasheet.
- If the sum of short circuit currents of the parallel connected modules passes over the reverse current (indicated in the module data sheet), string diodes or fuses must be used in each string of modules connected in parallel. These string diodes or fuses must be qualified for the maximum expected current and voltage.
- Read the instructions and safety precautions for all other components used in the system, including wiring and cables, connectors, DC-breakers, inverters, etc.
- Use appropriate safety equipment (insulated tools, insulating gloves, etc) approved for use on electrical installations.

3.4. General prescriptions for installation

- Do not apply paint or adhesive to the modules.
- Do not use mirrors or other hardware to artificially concentrate sunlight on the module.
- When installing modules, observe all applicable local, regional and national codes and regulations. Obtain a building and/or electrical permit where required.
- Keep children well away from the system while transporting and installing mechanical and electrical components.
- Do not wear metallic rings, watchbands, ear, nose, or lip rings or other metallic devices while installing or troubleshooting photovoltaic systems.
- Do not drill holes in the glass surface of the module. Doing so will destroy the module and make the warranty void.
- Do not drill additional mounting holes in the module frame. Doing so will void the warranty.
- Do not lift the module by grasping the module's junction box or electrical leads.
- Do not stand or step on the module. There is the danger of breaking the glass or slipping with the possibility of severe injury or death!
- Do not drop the module or allow objects to fall on the module.
- Do not place any heavy objects on the module.
- Inappropriate transportation and installation may damage the module.

- Ensure you read the mounting instructions carefully as tightening too much will cause the glass to break.
- All installations are to comply with SANS 10142-1/SANS 10142-1-2

4. Mechanical Installation

4.1. Robustness of modules and mounting system

ARTsolar's photovoltaic modules have been tested to withstand loads as per the specific module datasheet. Tests were conducted with a static load for one hour. The modules must not be mounted in regions where higher wind and snow loads are expected than specified in the module datasheet. The whole support structure needs to be strong enough to cope with the above loads. Load calculations to check for the applicability for the actual installation are within the responsibility of the system planner or installer.

4.2. Selecting the location

- Select only suitable locations for installation of the modules.
- In most cases, optimum performance is achieved if the modules face true south in northern latitudes and true north in southern latitudes.
- For detailed information on optimal module orientation, refer to standard solar photovoltaic installation guides or a reputable solar installer or systems integrator. The module should not be (partly) shaded at any time of the day.
- Do not install the module near equipment or in locations where flammable gases can be generated or collected.

4.3. Mounting methods

4.3.1. Mounting with bolts

- The module must be attached and supported by at least four bolts M6 or M8 (depending on the situation) through the indicated mounting holes.
- Most installations will use the four inner mounting holes on the module frame.
- Depending on the local wind and snow loads, additional mounting points may be required.

4.3.2. Mounting with clamping hardware

- If module clamps are used to secure the module, the torque on the clamp bolt should be around 8–10 Nm.
- A minimum of four module clamps should be used, two on each long frame side.
- Depending on the local wind and snow loads, additional module clamps may be required.
- Take note not to cover the cells with the clamping structure.

4.3.3. Other

- Other specific photovoltaic mounting methods are acceptable provided that the minimum requirements as described in chapter **4.1** are met.

5. Electrical Installation

5.1. Grounding

- All module frames must be properly grounded in countries where grounding of modules is mandatory. Observe all local electrical codes and regulations.
- For safety reasons it is recommended all module frames should be prepared for grounding.
- A bolted or screwed connection is required, it incorporates:
- a screw size of at least an M4.
- a star washer under the screw head or a serrated screw must penetrate non-conductive coatings like anodized frame
- screw and star washer in stainless steel
- 2 or more screws or 2 full threads of a single screw shall engage the metal
- Devices listed and identified for grounding metallic frames of PV modules are permitted to ground the exposed metallic frames of the module to grounded mounting structures.
- When using lay-in lugs, the grounding conductor should be inserted into the opening, and secured using the set screw.
- Functional grounding is not foreseen for the ARTsolar modules. If it is performed, local electrical codes and regulations must be observed, and used grounding means must be isolated from live parts by reinforced insulation.
- In any case the grounding screws, bolts or other parts must be used separately from mounting parts of the module.

5.2. General electrical installation

WARNING! Electrical shock hazard! Do not touch bare conductors or other potentially energized parts.

- Photovoltaic modules convert light energy to direct-current electrical energy. They are designed for outdoor use.
- Do not use modules of different configurations in the same system.
- ARTsolar / OEM modules are supplied with IEC certified cables and connectors for serial electrical connections.
- Use only additional cables which are qualified for the expected maximum current, maximum voltage and environmental conditions. Minimum cross section 4mm2 (#12 AWG).

- The PV-DC-connectors must never be disconnected under load! Adhere to the first rule of chapter 3.3.
- Refer to the relevant standards in your country to determine over current, conductor ampacity and size requirements.
- For best performance, ensure that positive and negative DC wires run closely together avoiding loops, which will also reduce the strength of inductive impacts of nearby lightning strikes.
- Following the installation of a module string, the performance of the string is checked to ensure proper functioning. At least, ISC and VOC need to be checked with appropriate equipment and circuit breakers.

6. Maintenance

ARTsolar recommends the following maintenance items to ensure optimum performance of the module:

- Clean the glass surface of the modules as required.
- Dust accumulating on glass surface will result in a reduction of power output. Before applying water, check for any cracks in the glass - If there are do not apply water and contact the installer/ARTsolar for further advice.
- Use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used if necessary. Do not use dishwasher detergent.
- Electrical and mechanical connections and the general condition of an installed PV-system should be checked periodically by qualified personnel to verify that they are clean, secure and undamaged.
- Any problems must only be investigated by qualified personnel.
- Also observe also the maintenance instructions for all other components used in the system.

7. Shutting down the system

- Disconnect the system from all power sources in accordance with instructions for all other components used in the system.
- The PV-DC-connectors must never be disconnected under load! Use switches designed for being disconnected under the prevailing DC-load or stick to the first rule of chapter 3.3.
- The system should now be out of operation and can be dismantled. In doing so, observe all safety instructions as applicable to installation.

8. Typical electrical ratings of the concerned modules

For further information please refer to the module data sheet.

9. Disclaimer of liability

For the use and purpose of this documentation, the conditions or methods of installation, operation, use and maintenance of photovoltaic products are beyond ARTsolar's control, ARTsolar does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance. No responsibility is assumed by ARTsolar for any infringement of patents or other rights of third parties, which may result from the use of the PV product. No license is granted by implication or otherwise under any patent or patent rights. The information in this documentation is based on ARTsolar's knowledge and experience and is believed to be reliable, but such information including product specification (without limitation) and suggestions does not constitute a warranty, expressed or implied. ARTsolar reserves the right to change the manual, the product, the specifications, or product information sheets without prior notice.

Information about manufacturer

ARTsolar (Pty) Ltd
124 Escom Road, New Germany, Durban KwaZulu Natal (Head Office)
Tel +27 31 100 1019
sales@artsolar.net
www.artsolar.net South Africa

10) Limited Warranty

ARTsolar (Pty) Ltd (ARTsolar) hereby grants the following Limited Warranty to the customer in respect of any installation (for its own use) (the original "Buyer") of ARTsolar/OEM brand models of solar photovoltaic modules including factory assembled junction box and cables and components listed below including any kits or installations (the "Products"):

Item	Product	Type	Warranty Duration (years)
1	Solar PV Modules	Refer to invoice provided	30
		Structural	12
2	OEM Solar PV Modules	Refer to invoice provided	30
3	Controller& Inverter	Refer to invoice provided	Refer to item warranty
4	Battery Pack	Battery	Refer to item warranty
		Battery Holder	Refer to item warranty

5	Electrical Box	Box	Refer to item warranty
		Electrical Equipment	Refer to item warranty
6	Cable	Refer to invoice provided	Refer to item warranty
7	Accessory	Wire connector	Refer to item warranty
		Galvanized Grounding Rods	Refer to item warranty
		Self-locking nylon band	Refer to item warranty

10.1) Limited Product Warranty ARTsolar warrants that for a period set out above, commencing on the Warranty Start Date (as defined in clause 3 below) the Product(s) will be free from defects in design, material, workmanship or manufacture that materially impede their functioning, and will conform to the specifications and the drawings applicable thereto. Any deterioration in appearance of the product (including, without limitation, any scratches, stains, mechanical wear, rust, or mould), or any other changes to the product(s) which occur after delivery to the original Buyer, do not constitute a defect under this warranty unless it materially impairs the product's functioning. A claim in the event of glass breakage arises only to the extent that there was no external cause of the breakage.

10.2) Limited Power Output Warranty In addition, ARTsolar warrants that for a period of thirty (30) years commencing on the Warranty Start Date (refer clause 10.3 below) loss of power output of the nominal power output specified on the module and ARTsolar's computer systems and measured at Standard Test Conditions (STC) for the Product(s) shall not exceed: 3.0 % in the first year, thereafter 0.58% per year, ending with a combined maximum loss of 20% in the 30th year after the Warranty Start Date. The actual power output of the module shall be determined for verification using Standard Testing Conditions (STC) only. The actual power output measurement is either carried out by an ARTsolar facility or by an ARTsolar recognized 3rd party testing institute. Testing equipment tolerances will be applied to all actual power output measurements.

10.3) Warranty Start date The Warranty Start Date is the *date of delivery* of the Product(s) to the original Buyer.

10.4) Exclusions and Limitations *This warranty will not apply in the event that any amounts due to ARTsolar have not been paid, or in the event that the components have not been installed by a properly certified electrical contractor in strict compliance with the specifications and drawings applicable thereto. The aforementioned "Limited Warranty" does not apply to any Products which have been subjected to:* ***a)*** *Modification, customer repair, misuse, abuse, neglect or accident;* ***b)*** *Installation and/or service by service technicians (Installers) who are not qualified under the relevant law and/or applicable regulations at the place of installation;* ***c)*** *The Product's type, nameplate or module serial number is changed, erased or made illegible.* ***d)*** *The Product's installation in a mobile device (except photovoltaic tracking system), such as vehicles or marine environments;* ***e)*** *Exposure to voltage in excess to the maximum system voltage, power surges or abnormal environmental conditions (such as acid rain or other pollution);* ***f)*** *Installation not compliant to ARTsolar's standard installation manual;* ***g)*** *Defective components in the construction on which the module is mounted;* ***h)*** *Exposure to mould discoloration or similar external effects;* ***i)*** *Exposure to any of the following: extreme thermal or environmental conditions or rapid changes in such conditions, corrosion, oxidation, unauthorized modifications or connections, unauthorized opening, servicing by use of unauthorized spare parts, accident, force of nature (such as lightning strike, earthquake), influence from chemical products or other acts beyond ARTsolar's reasonable control (including damage by fire, flood, etc.);* ***j)*** *Non A graded or refurbished modules;* ***k)*** *Use of the Products in such a manner as to infringe ARTsolar`s or any third party's intellectual property rights (e.g. patents, trademarks)*

10.5) Repair, Replacement or Refund Remedy a) As a Buyer's Sole and exclusive remedy under this Limited Warranty, ARTsolar will, in its sole discretion, either, with regard to the applicable Product (or component thereof):
i) Make up such a loss in power by providing customers(s) additional modules/components (subject to section 10.5b); or ii) repair the defective Product(s) at no charge (subject to section 10.5b); or iii) replace the defective Product(s) or part thereof by a new or remanufactured equivalent at no charge (subject to section 10.5b). **b)** The warranty period(s) as defined in section 10.1 and 10.2 shall not be extended or renewed upon the repair or replacement of a defective Product by ARTsolar. The warranty period for replaced or repaired Product(s) is the remainder of the warranty on the original new Product(s). **c)** All other claims under this Limited Warranty against ARTsolar shall be excluded. *Under this Limited Warranty, ARTsolar is not responsible for any special, incidental or consequential damages (including loss of profits, harm to goodwill or business reputation, or delay damages) whether such claims are based in contract, warranty, or negligence. This exclusion applies to the extent permissible by law, and even if the remedies set forth below herein are deemed to have failed of their essential purpose.*

10.6) Rights and Remedies against Third Parties This Limited Warranty shall be construed as a separate warranty and independent from any other contractual arrangement with third parties relating to the Product(s). It shall not affect any rights, obligations and remedies of the Buyer, if any, with regard to third parties for defects or non-conformity or non-compliance of the Products, notwithstanding its legal basis. The rights and remedies provided hereunder are in addition to any other rights and

remedies against third parties to which Buyer may be entitled by agreements with such third parties or by law.

10.7) Claims Procedure, Notice Periods, Expiration of Warranty Claims and Limitations A Buyer ***a)*** *Shall notify ARTsolar immediately after discovery of any claim under this Limited Warranty by e-mail to the customer support centre:* ***sales@artsolar.net*** *specifying each alleged claim including evidence of the claims and the serial numbers of the Product(s) at issue.* ***b)*** *Any claim for breach of this Limited Warranty must be brought within 30 (thirty) days after discovery of the breach.* ***c)*** *The return of any defective Product(s) will not be accepted unless prior written authorization has been given by ARTsolar.*

10.8) Force Majeure ARTsolar shall not be responsible or liable in any way to the Buyer for any non-performance or delay in performance under this Limited Warranty due to occurrences of force majeure such as, war, riots, strikes, unavailability of suitable and sufficient labour, material, or capacity or technical or yield failures and any unforeseen event beyond its control, including, without limitation, any technological or physical event or condition which is not reasonably known or understood at the time of the sale of the defective Product(s) or the notification of the relevant warranty claim under this Limited Warranty.

10.9) Warranty Assignment This Limited Warranty is transferrable when the Products remain installed in their original installation location and is subject always to the terms hereof.

10.10) No other Warranty Unless modified in writing and signed by a senior managing officer of ARTsolar, the Limited Warranty set forth herein is the only express warranty (whether written or oral) applicable to the Products and no one is authorized to restrict, expand or otherwise modify this Limited Warranty. *No implied warranty will be considered, and you confirm that you have waived any common law warranty that you may have had.*

10.11) Miscellaneous If any provision of this Limited Warranty is held invalid, unenforceable or contrary to law then the validity of the remaining provisions of this Limited Warranty shall remain in full force and effect. You have carefully read this document and confirm that you understand the document completely. You confirm that you are conducting business with ARTsolar on this basis. *You have been advised to take independent legal advice before concluding any agreement with ARTsolar.*