

**INSTALLATION USE AND
MAINTENANCE MANUAL OF
MICRON PHOTOVOLTAIC
MODULES by CAPPELLO
ALLUMINIO**

Index

03 Introduction

Disclaimer

Warranty certificate of Micron photovoltaic modules by Cappello Alluminio

General precautions

04 Warning

05 Structure of the modules

06 Mechanical installation

09 Electrical wiring

Maintenance

10 Disposal and end of life cycle of the modules

Certifications

INSTALLATION USE AND MAINTENANCE MANUAL OF MICRON PHOTOVOLTAIC MODULES by CAPPELLO ALLUMINIO

Introduction

This manual contains instructions and recommendations for the installation, use and maintenance of MICRON photovoltaic modules by CAPPELLO ALLUMINIO, so you should give a careful reading, since the failure of precautions can cause damage or injury and may void the warranties for MICRON photovoltaic modules by CAPPELLO ALLUMINIO.

Disclaimer

CAPPELLO ALLUMINIO s.r.l. , as producer of MICRON photovoltaic modules, disclaims any responsibility for any breakages, losses or damages caused by an incorrect installation, maintenance or erroneous handling of the product.

It's possible to download the updated version of this manual and the datasheets of MICRON photovoltaic modules by CAPPELLO ALLUMINIO our website: www.micronsun.it (DOWNLOAD section).

Warranty certificate of micron photovoltaic modules by Cappello Alluminio

Cappello Alluminio s.r.l. respects the highest standards of quality, assures and guarantees that their products comply with all the technical specifications and regulations about quality. Cappello Alluminio s.r.l. certifies quality and performance of the photovoltaic modules, in the terms and conditions listed below.

The warranty certificate is available on the internet site www.micronsun.it (DOWNLOAD section).

General precautions

The installation and maintenance of any component of a photovoltaic system must be performed in accordance with all current regulations and must only be done by experienced and qualified personnel to meet the requirements prescribed by the law, technicians must use isolated equipment, to reduce the risk of electrical shock, and specially designed and guaranteed instruments.

The contact with damaged conductive parts of photovoltaic modules can generate electric arcs, primers of fire or fatal shock: then, during installation or disassembly, check that the photovoltaic modules are intact and that they are not subjected to voltage.

Even when a photovoltaic module is not connected to the photovoltaic system, it generates electricity whenever it is exposed to solar radiation: during the assembly or disassembly operations, it is recommended to completely cover the surface of the photovoltaic module, for example, with opaque sheets.

In addition, it is recommended to not disconnect the cables of the photovoltaic modules when connected to a photovoltaic system which is under tension: possibly, remove the sectioning devices before disconnecting the cables.

If there is a broken or damaged photovoltaic module, it is recommended to remove it immediately with the greatest caution. If the solar glass or the back layer of the photovoltaic module is broken or cut, the contact with the module could cause an electric shock.

Do not wear jewelry or metal objects during installation or maintenance of photovoltaic modules, because they can induce electrical discharges.

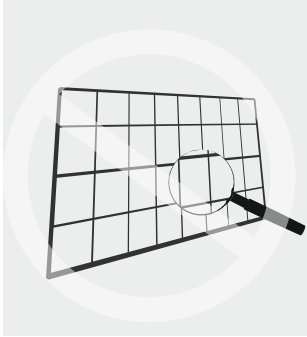
Do not change in any way the photovoltaic module. Within the MICRON photovoltaic modules there are no serviceable parts, therefore do not attempt to repair parts of photovoltaic modules.

The MICRON photovoltaic modules should not be exposed to sun rays artificially concentrated.

Do not move the photovoltaic modules if they are wet or in the presence of strong wind.

The MICRON photovoltaic modules were designed and built to withstand heavy loads up to 5400 Pa (about 550 kg/sq m). It is advisable to avoid submitting the photovoltaic module to loads beyond this: walking over the photovoltaic modules can overcome this limit.

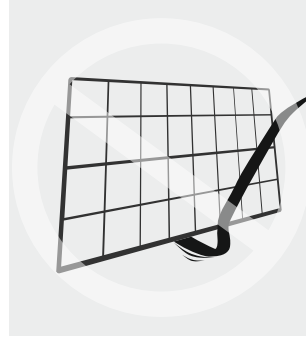
WARNING



DO NOT use mirrors or lenses magnification for focus sunlight on the modules.



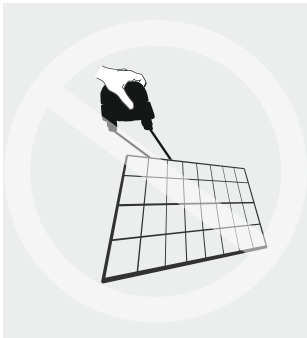
DO NOT paint the module or connect anything to the back of module.



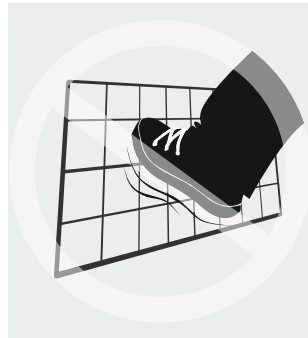
DO NOT disassemble modules and do not remove any attached labels or components by the modules.



DO NOT cut cables of junction box.



DO NOT lift or move the module holding the junction box or



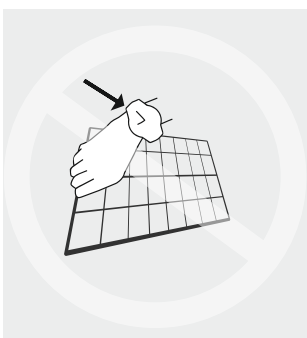
DO NOT place anything on the module or press on surface of



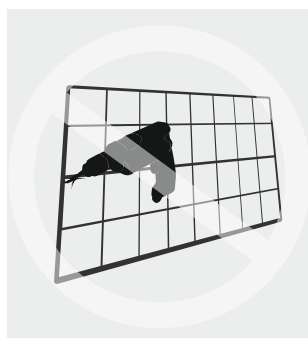
DO NOT drop the module or dropping objects over module.



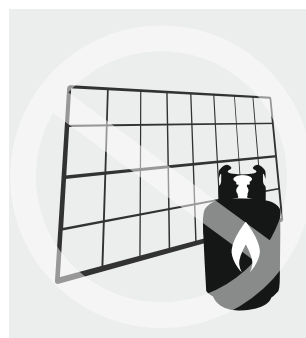
DO NOT open the cover of the junction box.



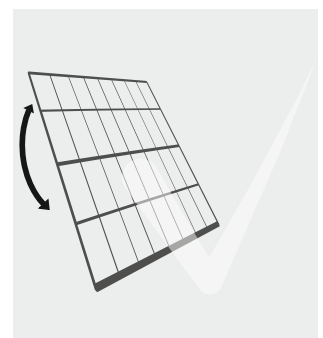
DO NOT wear jewelry or metal objects during installation or maintenance of photovoltaic modules.



DO NOT drill holes in the frame.



DO NOT use the modules closeness places where flammable gases may have



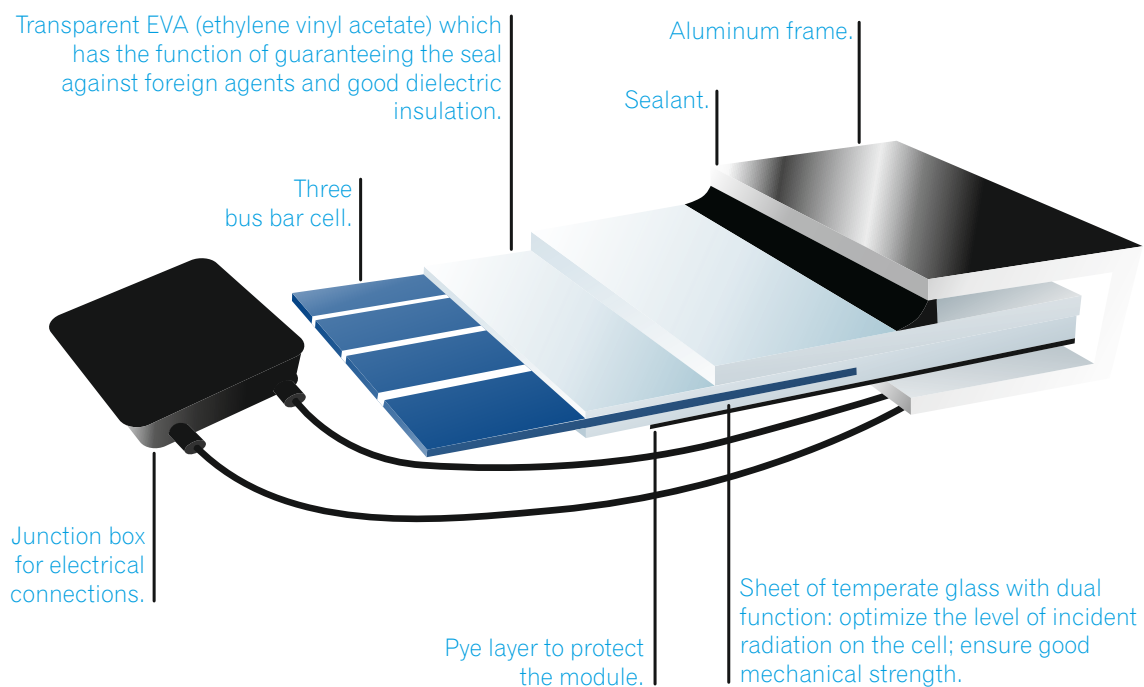
Wear insulated gloves during installation and manipulation of the modules.

Structure of the modules

The MICRON photovoltaic modules by CAPPELLO ALLUMINIO, use full-squared monocrystalline or polycrystalline silicon cells (156x156 mm), which have 3 bus-bar, allowing to reduce the series resistance of the module and to limit the operating temperature of the module, reducing the overheating due to electrical current being generated by the photovoltaic cells. The cells integrate, moreover, Anti PID technology and systems of protection from hot spots. To connect the cells together is used a copper ribbon coated by Sn 68 %, Pb 30 %, Ga 2 %.

The photovoltaic module consists of different layers, they are in sequence:

1. sheet of glass
2. first sheet of EVA (ethylene vinyl acetate)
3. strings of solar cells connected in series with each other
4. second sheet of EVA
5. Pye backsheet



The panel is assembled in a aluminum frame and in the rear side is connected to a junction box, produced by Tyco Electronics, which allows the electrical connection between the various modules and integrates the systems of protection from the shadowing. The cables of connection have a minimum section of 4 mm² with a maximum sustainable voltage equals to 1000V.



Each module is tested through a solar simulator which identifies the actual electrical power produced by the photovoltaic panel; each test is associated with a single module, and then connected in a unique way to each serial number of the panel. During testing are defined then the electrical performance of each module in Standard Test Condition (solar radiation: 1000 W/sq m, temperature of the module: 25 °C, Air Mass: 1.5), a special label is applied on the back of the module that is classified as a function of the power detected. Below an example of the electrical characteristics of a Micron 72 monocrystalline module. It's possible to download all the datasheets of MICRON photovoltaic modules by CAPPELLO ALLUMINIO from our website: www.micronsun.it (DOWNLOAD section).

Mechanical installation

The mechanical installation must be done according to the procedures described in this manual. The support structure of the photovoltaic modules must be designed and built according to all the current regulations. To install the photovoltaic module in a support structure, use and properly combine screws, bolts, washers and similar, possibly in stainless steel; all these must be firmly secured in the supporting structure of the photovoltaic modules.

The frame of the photovoltaic module is made of anodized aluminum or prepainted, therefore can occur corrosion effects if the module is subject to action of sea water in contact with structures of another type of metallic material (electrolytic corrosion). To prevent actions of electrolytic corrosion between the frame of the photovoltaic module and its support structure, it is recommended to use washers made of PVC or stainless steel.

The photovoltaic module is equipped with 4 holes in the rear side of the frame that facilitate the fixing of the module to the supporting structure. Do not use holes of grounding system to secure the modules to the support structure.

We recommend that you leave a space of 20 mm between two modules to take account of the linear thermal expansion of the frames at high temperatures; the photovoltaic module must be installed in such a manner as to allow the free movement of the air around it, even in order to lower the temperature of the module, and, consequently, to foster greater producibility of the entire photovoltaic system.

The modules can be mounted in either vertical or horizontal position, the minimum angle should be at least 10 degrees to allow the rainwater to eliminate dirt or dust with greater effectiveness.

The photovoltaic modules should be installed away from chimneys or from any element of expulsion of vapors, fumes and gases that can foul the solar glass. Install photovoltaic modules in an area exposed to the sun, and shadow-free.

Do not install the photovoltaic modules in the presence of flammable gases or vapors, because the presence of sparks may cause fire.

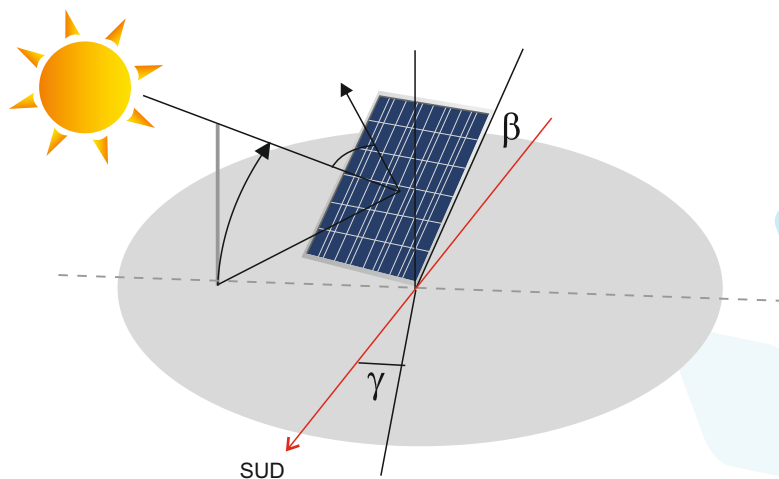
The installation of photovoltaic modules on the roof can affect the fire safety of the building, please prepare adequate walkways, with a width of not less than 60 cm, to allow access to any area of the roof to the Fire Department. In case of fire in the building, you can, if necessary, install a button or switch, located near the modules on the DC cable, so that the modules are disconnected automatically by the release of the button, in case of intervention of the Fire Department. It should also be noted that even when a PV module is not connected to the PV system, it still generates electricity when exposed to sunlight, it is therefore recommended extreme caution when releasing the button.

The process of installation of PV modules must comply with all relevant standards and regulations, general and specific for the installation of photovoltaic systems, regarding safety and construction.

Every installation must be performed in compliance with the static parameters of construction only using mounting systems that meet the loads and stresses expected in the specific installation site.

The azimuth angle for the installation of the PV modules must be chosen in order to optimize the radiation incident on the active surface during all the months of the year. In the Northern Hemisphere the better azimuth angle is 0 degrees, corresponding to an orientation to the south. In the southern hemisphere the better azimuth angle is 180 degrees, corresponding to an orientation to the north. The optimal inclination of the modules should be selected according to the presence of possible sources of shadowing; in Italy, in the absence of shadow area, the better angle of inclination equal to 30 degrees.

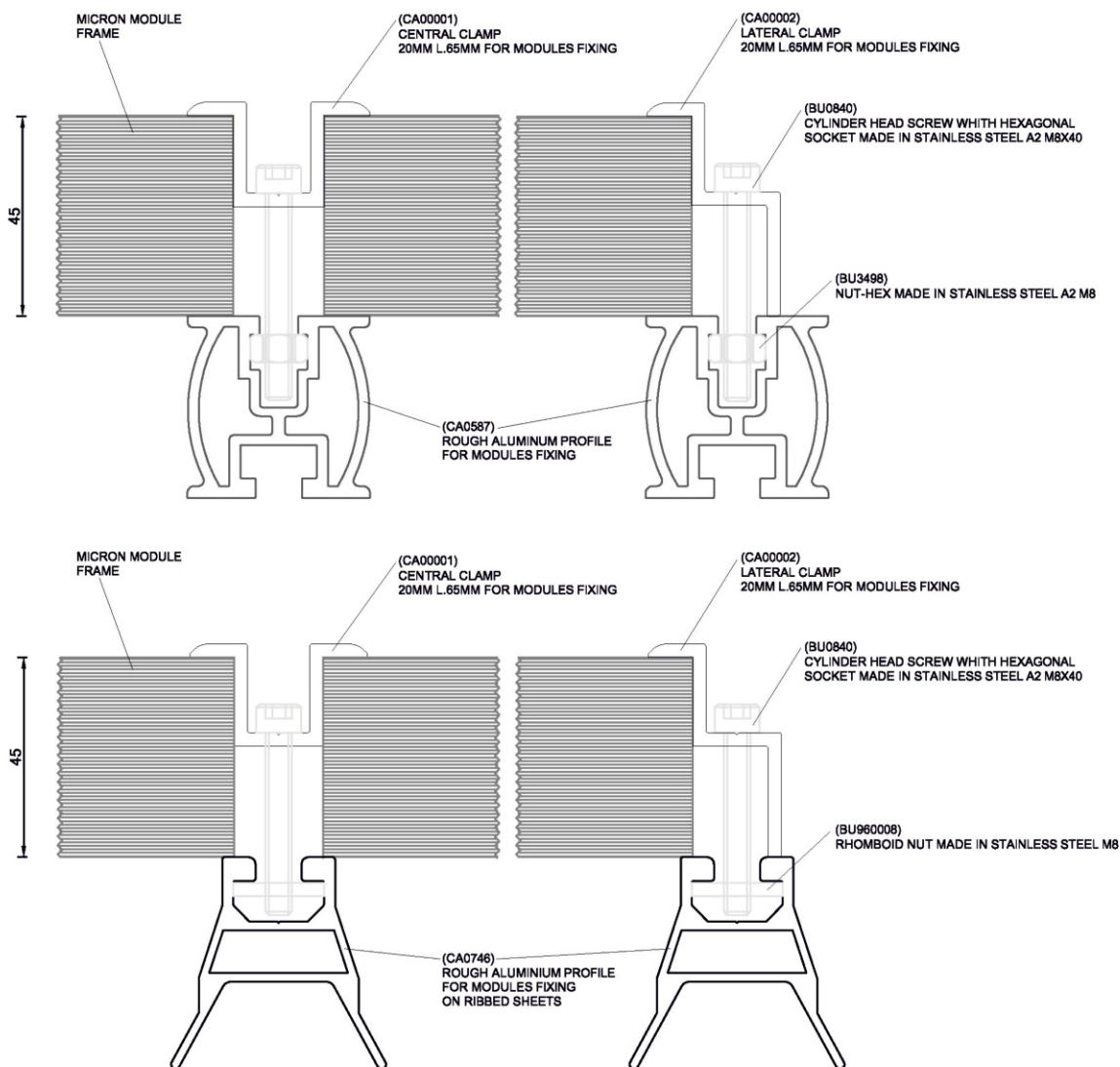
All the modules connected in series must have the same angle of inclination and azimuth to standardize as much as possible the energy generated.



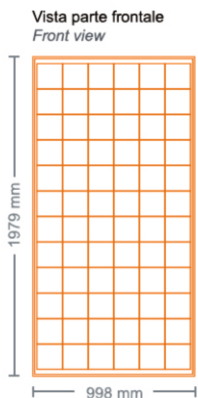
The installation, both mechanical and electrical, must be carried out by experienced and qualified staff in possession of the requirements prescribed by law.

Must always keep in mind that by connecting the modules in series, positive connector of a module connected to the negative of the next one, the voltages add up, while the total current will be equal to the rated current of the single module. In the case of parallel connection, positive connectors connected together between them and negative connectors connected together between them, the total current generated will be equal to the sum of the current of all the modules connected in parallel. We recommend using string diodes coupled to the bypass diodes already present in the single module.

It is recommended to install the photovoltaic modules blocking them in at least 4 different points so as to balance fixing the module in a uniform and symmetrical way. According to the specific environmental conditions may be required more clamps to support greater loads, for example, snow or strong wind.

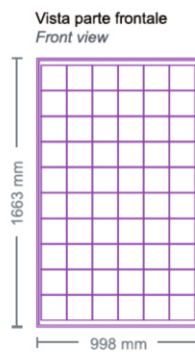
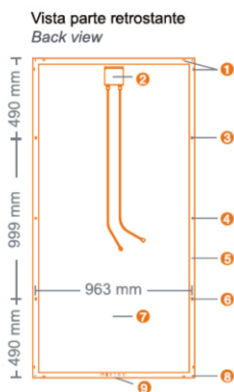


The module must be installed in such a way that the airflow can circulate freely around it, favoring the reduction of the working temperature of the cells with resulting in increased efficiency.
 The size of standard modules of 72 cells and 60 cells are shown below:



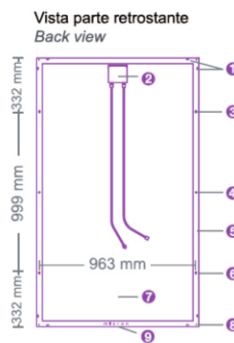
Legenda/Key:

- 1) Asola (dim. 15x5 mm) per il drenaggio profilo interno cornice;
Buttonghole (dim. 15x5 mm) for the drainage of the internal frame;
- 2) Scatola di giunzione; Junction box;
- 3) Asola (dim. 12x7 mm) per il fissaggio modulo;
Buttonghole (dim. 12x7 mm) for the fixing of the module;
- 4) Asola (ø 6 mm) per la messa a terra del modulo;
Buttonghole (ø 6 mm) for the grounding of the module;
- 5) Cornice in Alluminio anodizzato;
Anodized aluminum frame;
- 6) Asola (dim. 12x7 mm) per il fissaggio modulo;
Buttonghole (dim. 12x7 mm) for the fixing of the module;
- 7) Back-Sheet bianco/nero/colorato/trasparente;
White/black/colored/transparent Back-Sheet;
- 8) Asola (dim. 5x5 mm) per drenaggio della cornice;
Buttonghole (dim. 5x5 mm) for the drainage of the frame;
- 9) Marchio di originalità Micron.
Brand of originality Micron.



Legenda/Key:

- 1) Asola (dim. 15x5 mm) per il drenaggio profilo interno cornice;
Buttonghole (dim. 15x5 mm) for the drainage of the internal frame;
- 2) Scatola di giunzione; Junction box;
- 3) Asola (dim. 12x7 mm) per il fissaggio modulo;
Buttonghole (dim. 12x7 mm) for the fixing of the module;
- 4) Asola (ø 6 mm) per la messa a terra del modulo;
Buttonghole (ø 6 mm) for the grounding of the module;
- 5) Cornice in Alluminio anodizzato;
Anodized aluminum frame;
- 6) Asola (dim. 12x7 mm) per il fissaggio modulo;
Buttonghole (dim. 12x7 mm) for the fixing of the module;
- 7) Back-Sheet bianco/nero/colorato/trasparente;
White/black/colored/transparent Back-Sheet;
- 8) Asola (dim. 5x5 mm) per drenaggio della cornice;
Buttonghole (dim. 5x5 mm) for the drainage of the frame;
- 9) Marchio di originalità Micron.
Brand of originality Micron.



Electrical wiring

The electrical wiring must be done according to the current regulations and in the manner described in this manual.

For safety, if necessary, all modules must be connected to the grounding system and the connection between the modules and the ground plant must be carried out and approved by a qualified electrician, the section of the ground cable must be at least equal to that of electrical conductors and still not less than 4 mm². In the back of the photovoltaic module, are positioned two holes through which you can make the electrical connection of the photovoltaic module to the grounding system.

The MICRON photovoltaic module complies with the regulations CEI EN 61730-1 and 61730-2 and is qualified in SAFETY CLASS II - APPLICATION CLASS "A".

In a series connection of the module voltage is added, the parallel connection the currents add up, then you will reach a high overall voltage and current that can be dangerous especially for unskilled personnel; isolated equipment must be used to reduce the risk of electric shock.

A partial shading of the module can cause a current consumption of the shaded cells and a significant reduction of the electric current generated by the series of photovoltaic modules, to reduce this disadvantage, the MICRON photovoltaic modules are equipped with bypass diodes inserted in antiparallel to a string of cells; each of them allows the current produced by the cells not shaded to flow without it is absorbed by the shaded cells. In this way, it is minimized even the module overheating due to localized shading of photovoltaic cells. The bypass diodes are inserted in the junction box positioned in the rear side of photovoltaic module, and each bypass diode is placed in antiparallel to 20 photovoltaic cells in the modules MICRON 60M/P and a 24 photovoltaic cells in the modules MICRON 72M/P.

The junction box must never be opened, for no reason, worth the decadence of any protection guarantee on the product and on the performance of the product. The junction box is supplied with cables of length 60 cm, 90 cm or 120 cm, with connectors positive and negative, in order to a correct operation, it is necessary to observe the polarity of the connections between the cables of the modules.

The connection between the photovoltaic modules must be done exclusively with the cables that are connected to the junction box or through cables provided with original connectors produced by TYCO ELECTRONICS; the section of conductors used in the part of photovoltaic system in direct current, must ensure that the voltage drop is less than 1% of the rated voltage overall.

The MICRON photovoltaic modules may be used in systems operating at voltages higher than 120 Volts DC and less than 1,000 Volts DC. At normal operating conditions, the MICRON photovoltaic module can operate at voltage values and/or current higher than the values of voltage and/or current determined at standard conditions (solar radiation: 1000 W/sq m, temperature of the module: 25 °C, air mass: 1.5). As a result, the values in the STC of the short-circuit current I_{sc} , the current at maximum power I_{mp} , the open-circuit voltage V_{oc} and the voltage at maximum power V_{mp} , must be increased by at least 5% for the current values and 15% for the voltage values when determining the boundary conditions of current and voltage of each subfield of the photovoltaic system.

When sizing a photovoltaic system, it is recommended to insert in series not more than 18 MICRON 72M/P photovoltaic modules or not more than 22 MICRON 60M/P photovoltaic modules.

When you connect modules in series or in parallel is important to install a fuse in series, by minimum 12A, between the inverter and each string.

Maintenance

One of the most important maintenance operations for a photovoltaic system is the cleaning of the photovoltaic modules. A photovoltaic module that has a matte or dirty surface, delivers an electric current considerably lower than that produced by a photovoltaic module with a clean solar glass; therefore, it is recommended that you periodically clean the photovoltaic modules, possibly on a monthly basis. To clean the photovoltaic modules is recommended to use distilled or demineralized water. It is recommended not to clean the photovoltaic module with lime water.

Another important maintenance operations for a photovoltaic system is inspection of the modules, in order to detect any broken glass or damage in the back-sheet that, if cut or damaged, for example as a result of wrong unpacking or of a faulty installation of the module, could cause the oxidation of the photovoltaic cells, with a consequent deterioration of electrical performance of the photovoltaic module, that would not be protected by product or electrical performance warranty.

It is recommended to check, at least every 6 months, the state of the fastening system of the modules to the support structure, the connections between the modules, as well as the electrical characteristics of each PV module.

Disposal and end of life cycle of the modules

It is recommended that you do not disperse the packaging materials of photovoltaic modules in the environment and to confer such waste in the appropriate collection centers. Regarding the disposal of faulty or at the end of life cycle, is absolutely prohibited disperse the modules in the environment, they must be conferred in the authorized consortia that deal with the disposal.

CAPPELLO ALLUMINIO s.r.l. , as a producer of Italian MICRON photovoltaic modules, adheres to the COBAT (mandatory consortium for the disposal of photovoltaic modules at the end of life cycle) as required by the DM 05/07/2013 (Quinto Conto Energia); as a result of this agreement for the disposal of the Micron modules by Cappello Alluminio, you can address it to the COBAT (www.sole.cobat.it).

Certifications

In the Download section of the website www.micronsun.it are always available and updated certificates for MICRON photovoltaic modules by CAPPELLO ALLUMINIO.

Cappello Alluminio s.r.l. releases also the CE Certificate of Conformity of the MICRON photovoltaic modules and has obtained the following certifications:

- 1 UNI EN ISO 9001/2008: Quality management systems;
- 2 UNI EN ISO 14001/2004: Environmental management system;
- 3 OHSAS 18001/2007: Occupational health and safety;

The MICRON photovoltaic modules have also obtained the following certifications:

- 1 IEC 61215/2005 edition 2: Certificates of conformity of the photovoltaic modules MICRON, issued by TUV and by EUROTTEST LABORATORIES;
- 2 IEC 61730-1/2007 and IEC 61730-2/2007: Certificates of qualification of safety in SAFETY CLASS II - Application Class "A" of the MICRON photovoltaic modules for plants with photovoltaic voltages up to 1,000 Volts DC;
- 3 Attestation TUV INTERCERT no. 11-PPI-0008009/01 -06-W01-ICT: Certificate of producer "Made in Europe" as a result of factory inspection at the factory in Ragusa (Italy);

Ragusa (Italy), January 2, 2013

**Cappello Alluminio S.r.l.
Board Chairman
(Giorgio Cappello)**

