Best Quality.

Made in Germany – SOLON's Quality Pledge.

SOLON

Solar Quality that Pays Off.

In many ways, a solar power plant is an investment in the future: through active environmental protection, independence from increasing energy prices and fossil resources, and high outputs for the long term. Take advantage of SOLON quality for your solar power plant: our products feature premium materials and innovative processing technologies. Over one gigawatt of installed solar power worldwide speaks for itself!

We are raising the bar: It goes without saying that SOLON is certified in the ISO 9001 and ISO 14001 environmental management systems and tested by bureau veritas. In addition, numerous test seals from e.g. TÜV and Ökotest also attest to our high quality standards. To date, SOLON is ranked #1 in the independent PV+Test – with SOLON's standard modules scoring the highest in all categories – including durability and quality. This is just another way in which SOLON puts its exceptional focus on quality to the test. From purchasing to delivery, all our components and modules are tested for safety, longevity, and efficiency – far beyond the required guidelines.

SOLON sets quality standards industry-wide – find out for yourself: on the following pages, we present an overview of how we meet the stringent standards we set for ourselves in order to give you all the advantages of solar power with the best possible product quality.

SOLON Solar Power Systems – Award-winning and Certified

Product Quality

All SOLON products are certified by well known test bodies such as TÜV, ETL, MCS for the European or US market and are manufactured in accordance with the ISO 9001 quality standard. Numerous test seals serve as proof of our high quality requirements.

ISO 9001:2008 BUREAU VERITAS Certification

TÜVRheinland

BROOF (t3) FIRE TEST APPROVED

APPROVED PRODUCT MCS BRE GLOBAL LISTED

Independent Photovoltaics Module Test by Solarpraxis and TÜV Rheinland
PV Test
Solon Solon Blue 230/07-235W
EXCELLENT
pv magazine 11/2011

ÖKO-TEST RICHTIG GUT LEBEN
Photovoltaic modules SOLON Blue 230/07, 225 W
Excellent
Edition 05/2010

Environmental Management

To protect the environment, all our locations have been certified according to the ISO 14001 environmental management system. In addition we offer free module recycling.

ISO 14001:2005 BUREAU VERITAS Certification

· SOLON · free module recycling

Highest Quality – Without Compromise.

SOLON consistently delivers on quality and performance. This is because the only guarantee for high outputs – and our customers' lasting satisfaction– is the long-term reliability of our solar modules. We voluntarily subject our products to the strictest quality tests, which even go beyond the stringent TÜV guidelines. Our Motto: TÜV Times Two.

SOLON modules are put through their paces not only in our technical center, but in real-life conditions in our outdoor test fields, too. A wide range of different testing methods ensures that every component is scrutinized – both individually and in combination with the other system parts.

We then use the findings from these tests in our next generation innovations and in our continual optimization of SOLON products. And we keep our quality promises even after delivery: SOLON Customer Service also guarantees your system's lifespan, performance, and energy outputs during operations.

- Our module concepts are always based on the latest scientific research.
- We only put SOLON modules into production after successful passing of comprehensive pre-tests.
- Field tests ensure the modules' performance in real-life conditions.

- Only impeccable materials are used in a SOLON module.
- Each individual part is subjected to stringent checks on reception.
- Suppliers must meet a strict series of requirements and pass continuous supplier examinations.

- The production process is accompanied by a series of quality tests.
- Modules that do not meet SOLON's standards are automatically rejected.
- A rigorous checklist of errors constitutes the foundation for consistently high quality.

- Post-production checks ensure that only perfect modules leave our premises.
- All products are subjected to performance and quality checks prior to delivery.
- Special transport packaging protects the modules on their way to our clients.

- After installation, SOLON Customer Service guarantees further support and guidance.
- SOLON's numerous test fields in various climate zones ensure continuous optimization under extreme conditions.
- The results of ongoing tests are adopted in the further development of SOLON systems.

We Lay Our Cards on the Table!

At SOLON, quality is the highest priority – and we back that statement up. Find out for yourself by taking part in one of the monthly tours of our production facility in Berlin. We look forward to seeing you there!

For more information and to register: **www.solon.com/tour**

Stable Performance – Whatever the Weather.

Whether subjected to snow and ice or hail and sandstorms, PV plants must be capable of withstanding any weather condition while still generating high outputs for the long term. SOLON solar modules can do it all: their resilience is as diverse as the climatic challenges they face. Our modules are also prepared to face the most severe outside conditions.

Heat and Frost.

Even a hot, sunny summer day has its dark side: this is because the cooler a solar module stays, the more output the solar cells generate. The higher the mercury climbs, the higher the power losses. At the same time, a cold but sunny winter day also presents a challenge for a solar module. This is because extreme temperatures and temperature change can lead to damage to the materials, which are subjected to significant strain caused by repeated freezing and thawing. We are continuously working on improving the performance of SOLON modules and select materials that can handle even the most extreme temperature fluctuations.

Snow and Wind.

At just 0.18 mm, a solar cell is only slightly thicker than a piece of paper and is exceptionally fragile. The cells are primarily protected by the solar glass. Solar modules must be able to withstand extreme conditions caused by snow loads and wind pressure to ensure that the cells do not break under the glass and that the frame that stabilizes the glass panes remains intact. While one meter of dry powder snow only puts a pressure strain of 50 to 60 kg per square meter on the modules, the surface load can reach up to half a ton per square meter with the same height of very wet old snow – which corresponds to the weight of a horse. Thanks to the materials we select and our proven manufacturing system, even the snowiest winters and stormiest winds need not be a cause for alarm.

Dust and Sand.

Incident sunlight hits the solar cells through the solar glass. But if a layer of dust or sand covers the solar glass surface, less sunlight can be converted into electric energy. Coastal and desert regions with frequent sandstorms have the added factor that sand can cause long-term damage to the solar glass: the abrasive effect of grains of sand strips away the anti-reflective coating and leaves the module surface blank, which means that less light reaches the solar cells and output is thus diminished. This is why SOLON places great importance on using high-quality solar glass with optimized anti-reflective and self-cleaning properties when choosing the materials used.

Climate Chamber

Snow Loads

Desert Climate

A solar module faces many major challenges. SOLON puts a great deal of time and effort into module development and production: We inspect our products on an ongoing basis, both on free-standing plants and in the lab, to make sure that they are up to the difficult challenges of long-term use. And we do so to ensure that SOLON modules always generate the best possible outputs, whatever the weather.

Hail.

A solar power plant is also repeatedly subjected to powerful storms with hail throughout the course of its decade-long lifespan. Large hailstones that strike the module with considerable force present a significant risk, especially for the solar glass. SOLON safety glass ensures that even hailstones of one inch in diameter at speeds of over 50 mph cannot harm our modules. This means optimum protection for sensitive solar cells.

Moisture.

Moisture – whether caused by rain, fog, dew, snow, or high humidity – can also mean particular challenges for a solar module. If moisture gets into the voltage-carrying parts of a module, it can lead to corrosion and short circuits – and ultimately to a safety risk if touched. In addition, the individual materials in the solar module can also come apart due to module delamination. One of SOLON's main priorities is the perfect connection between the components and their optimum interaction as the basis for a long lifespan.

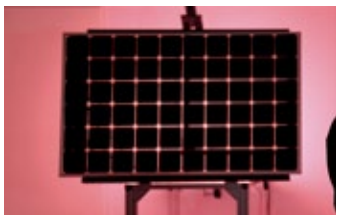
Insolation.

Maximum energy output requires optimum solar insolation. However, this insolation depends on factors such as region, season, and weather conditions. This is why solar modules often work in low light conditions – not just in northern Europe. We take this into account in our research and development: to ensure that outputs are not just dependent on blue skies and sunshine, we continuously optimize the low-light behavior of SOLON modules. Independent test results have repeatedly confirmed our modules' exceptional low-light behavior.

Chemical Stresses.

Whether ammonia-charged air over buildings used for agricultural purposes or salty ocean air: chemical stresses can, over time, cause strain on solar modules. The ramifications can be material damage, delamination, and consequential performance losses. We use only the highest-quality materials and perfect connections to ensure that our solar modules are resistant to chemical attack. All SOLON product series have passed the TÜV Rheinland Group's new ammonia test as well as the independent salt-fog spray test.

Hail



Electroluminescence

Wet Insulation

Insulation Test

SOLON Testing Sites – Field Tests with No Strings Attached.

From Arizona's desert to Germany's temperate climate: SOLON modules withstand any environmental conditions and produce high output for the long term. We conduct a series of long-term tests under real conditions, both in our own testing fields and at independent institutes: all in an effort to ensure that nothing stands in the way of the long-term use of the PV plant, even under the most adverse conditions.

On our testing sites, we pay particular attention to:

- Cell technology efficiency and reliability
- High module material quality (anti-reflective glass, cell embedding)
- Analyzing degradation effects caused by light incidence, voltage potential difference and aging
- Testing new product designs and technologies

We spare no time or expense in our continuous effort to optimize SOLON modules' performance, output behavior, and long-term stability.

Additional external test sites:

- Cologne, Germany (moderate climate)
- Arizona, USA & Negev, Israel (hot, dry, sand)
- Indonesia (hot, humid)
- Gran Canaria (warm, humid, wind, salt)

Location	Moisture	Temperature	Insolation
Tucson (desert)	dry	high	high
Carmigniano (subtropical)	humid	medium	medium
Berlin (temperate zones)	humid	low	low

SOLON Technical Center – Long Service Life under Extreme Conditions.

SOLON modules stand for longevity, quality and the highest outputs. To ensure our peak performance, we test and evaluate our solar modules beyond all applicable standards. At our central laboratory in Berlin, the SOLON Technical Center, we subject all new products to a series of testing procedures. Only durable, high-performance modules pass through our internal quality assurance process before undergoing the TÜV testing process.

Climate Chamber.

SOLON modules stand up to the worst conditions that mother nature has to offer. Frost and heat, humidity, and temperature fluctuations –the climate puts solar modules through their paces. SOLON only uses materials that can stand up to the most severe weather conditions for its solar modules and offers a 25-year performance guarantee.

Widely varying climate conditions are realistically simulated in the climate chamber in order to reveal weak points on the module and to be able to make a prediction about the module's behavior when in use.

Various tests are conducted to prove that the modules are weather-proof; SOLON also doubles the required standard times and cycles: In the temperature change test, the module is exposed to temperature fluctuations between -40°C and +85°C (-40°F to +185°F) throughout 400 cycles. Starting at +25°C (+77°F), the solar modules are operated with nominal current in order to detect electrical contact faults. In the humidity-frost test, the modules are subjected to 20 cycles of the following process: After 20 hours at +85°C (+185°F) and 85% relative humidity, the temperature is dropped to -40°C (-40°F) and kept there for at least 30 minutes. In the humidity-heat test, the modules are subjected to a strain of +85°C (+185°F) and 85% relative humidity for 2,000 hours.

Climate Chamber

Mechanical Load Test.

SOLON modules are exceptionally resilient. Whether subjected to snow, wind pressure or suction, layers of ice or other static loads – SOLON modules can stand up to even the snowiest of winters and the most violent of storms.

In a specially developed process, we simulate wind and snow loads to test and ensure the modules' load capacity. The suction and pressure loads created during testing are several times greater than the actual loads.

In the mechanical load test, modules are subjected to a consistent pressure load of 2,400 pascals (approx. 245 kg/m²) for one hour. In order to create the same load, a rooftop would need to be covered in half a meter (1.6 feet) of old, wet snow or wind would have to reach speeds of 130 km/h (80 mph) (hurricane-force winds; wind strength of 12 on the Beaufort scale).

The same conditions are used for testing the process for wind suction.

This process is performed a total of three times. During the last cycle, the load is more than doubled (5,400 pascals, approx. 550 kg/m²) in order to prove the load capacity for even thicker snowpack: it would take a layer of old, wet snow over one meter (3.3 feet) deep to create the same pressure load.

The module is subjected to further testing to test the effects of the process. The load test is considered passed when there is no visible damage to the module and the efficiency loss is not over three percent compared with the initial state. In addition, the insolation resistance must correspond to the initial measurements.

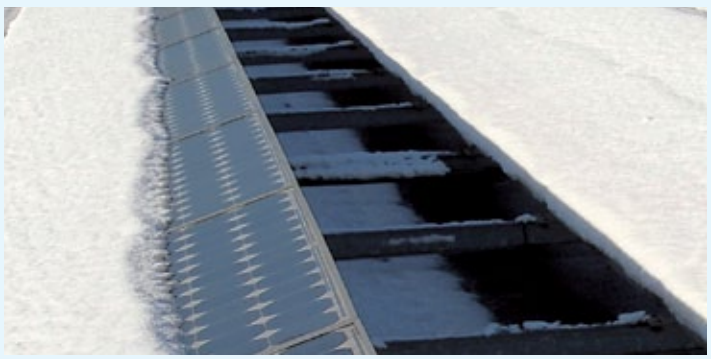
Suction and Pressure Loads

Material Tests.

SOLON modules feature high-quality workmanship. Decades of intended use set the bar high for solar modules, especially because they need to be able to withstand extreme weather conditions. Only the highest-quality materials and components are carefully turned into SOLON modules – which is the reason why they are able to stand up to any type of weather.

Various testing methods are used to determine the maximum load thresholds, in order to select suitable materials (e.g. cells, rear film, glass), the cell torsion test for example measures the solar cells' fracturing behavior. The test is conducted for two reasons: first, to compare cells from different manufacturers, and second, to measure cell batches' fracture behavior in non-soldered and soldered states.

The connections between the plastic coating and the support material are also examined. The peel test measures the retention force between the various materials. The glass take-off test examines the adhesive strength between the embedding material and the solar glass as well as the strength within the material itself. SOLON performs these tests to ensure that the various materials achieve an optimum degree of connectivity and that the modules do not delaminate.



Climatic Conditions

Transport Simulation.

SOLON modules stand up to considerable transport strain. Solar modules are exposed to significant loads not only on rooftops, but on their way there too. SOLON knows no limits when it comes to minimizing the risk of transport damage and ensuring that we only deliver intact products to our customers – from module design to our packaging systems.

An oscillation test, known as the shaker test, simulates vibration that can occur during transport of the packaged solar modules, whether by -truck (or semitruck), train or boat. The method serves a twofold purpose: first, it constitutes a way to test the packaging for transport suitability; second, it allows for a differentiation between breakable and more robust solar cells.

To perform the test, the modules are first examined for cell damage such as fractures or microcracks invisible to the human eye using an electroluminescence camera. The modules packaged with the packaging system to be tested are then subjected to vertical vi-brations on the shaker table for one hour. An electro-luminescence test is then conducted again at the end of the test; the results of the test are then compared with the initial state. The selection of non-sensitive cell and module designs and the optimum packaging system are chosen based on these results.

Shaker-Table

Electroluminescence Test.

SOLON modules stand for long-term functional cells. Even the most minor damage to cells, known as microcracks, can decrease output and solar cells' lifespans. The SOLON quality test detects even the slightest damage to cells throughout the entire production cycle, thereby ensuring error-free cell workmanship in the module.

The electroluminescence test reveals that which cannot be seen with the naked eye. In the test, inactive zones in solar cells and modules, e.g. microcracks, fractures, short-circuits, and interrupted conductor paths, are visually displayed in a way comparable to an x-ray. On the images, the functioning parts of a cell appear light; the non-functioning parts appear dark. Electroluminescence is the inverse of the photovoltaic effect: the solar module is stimulated by electricity instead of by light. Instead of absorbing light and converting it into electrical energy, a solar cell converts electrical energy into light – but only where it works. The method is primarily used in quality assurance tests for incoming and outgoing goods inspections and in our test center, but it is also indispensable when it comes to finding the cause of performance loss in the course of our continuous efforts to improve our modules.

Electroluminescence Test

Hail Test.

Hail cannot harm SOLON modules. Violent storms with hail place high demands on a solar module. SOLON uses only robust materials and the highest-quality workmanship to ensure that module surfaces remain unscathed and that the solar cells do not break in such extreme weather conditions.

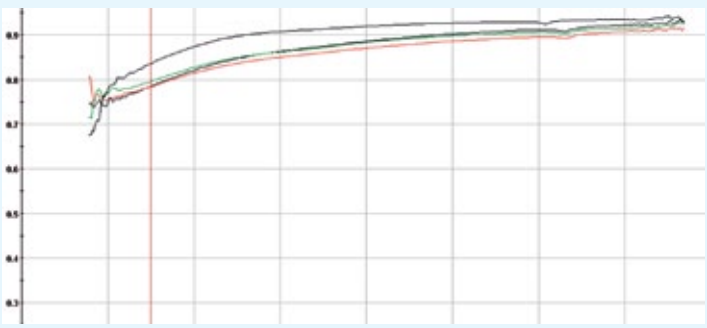
Hailstorms are considered one of the natural events with the greatest potential for damage. Rooftop solar power plants are particularly exposed to hailstone impact. For this reason, it must be assured that both the stabilizing and protective module frames remain intact in the event of a hailstorm – and that the sensitive solar cells are not damaged.

SOLON uses a special hail impact system to test the stability of the glass. In test conditions, the components are set up as realistically as possible and pelleted with artificially-created, yet incredibly realistic balls of ice. The hail test is considered as passed when the modules remain undamaged at eleven different points after withstanding an impact of 25 mm (1 inch) hailstones fired at a speed of 83 km/h (52 mph). The successive tests – a visual inspection as well as a performance review and insulation measurements – show that hailstones of this size have no effect on SOLON modules.

Hail Test

Transmission Measurements.

SOLON modules do not compromise. PV plants are exposed to extreme climate and weather conditions, which is why the solar cells need to be well protected. At the same time, the compo-nents need to remain transparent to the sun's rays. SOLON modules contain only materials with these characteristics and are designed in such a way that nothing stands in the way of the best possible energy outputs with a high degree of robustness at the same time.



Transmission Measurements

To provide protection against environmental conditions, the solar cells used in PV models are generally embedded between glass, EVA film, and rear-side film. At the same time, light transmission on the front should remain intact in order to avoid reducing the cells' performance.

The transmission measurements determine loss of irradiation transmissibility, both in a module's initial state and when various aging processes are taken into account. The measured transmission loss is evaluated in terms of the impact on solar cell efficiency. The measurement results provide information about the selection of suitable materials for constructing solar modules in order to achieve optimum light transmission.

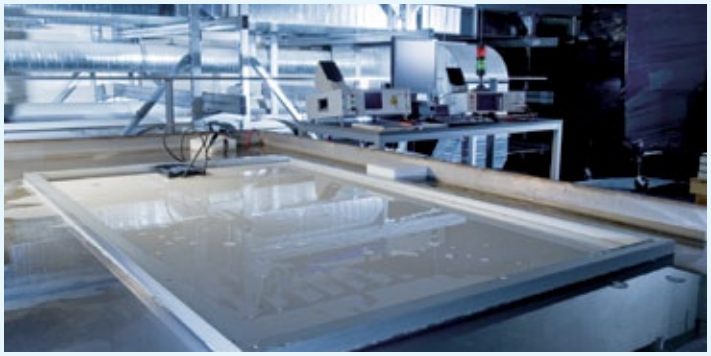
Insulation Test.

SOLON modules take electrical safety very seriously. Moisture caused by inclement weather places significant demands on solar modules – this does not just potentially impair the modules' functionality: penetrating moisture can also pose a safety risk. SOLON modules feature optimum protection and can resist the significant effects of rain, fog, ice, snow and condensation on a long-term basis.

Insufficient solar module insulation can lead to electrical shorts or arcing, i.e. current flows through the insulator, and can cause material damage. In addition, if moisture penetrates the module circuit, it can lead to corrosion or can cause the inverter to shut off. The insulation test checks whether the solar module is adequately insulated between the current-carrying parts and the module frame and/or the environment.

The voltage applied to the module is increased to 1,000 V plus double the maximum system tension (generally a total of 3,000 V). The module must be able to withstand high voltage without leading to an electric flashover and surface mark formation.

A similar test is performed in wet conditions. The module is placed in a water bath mixed with a soap solution (to reduce surface current and to increase conductivity) so that all surfaces are covered by the solution with the exception of the junction box. Measurements taken are compared with those from the dry test, with the maximum system voltage applied (generally 1,000 V) and the insulation's resistance is determined. This value may not be less than 40 megaohms; if it is, creepage current that flows along the surface of the insulating material can endanger safety upon contact or cause the inverter to shut off. In no case is there any risk of fire.



Insulation Test

Sun Simulator.

SOLON modules are also well prepared to handle poor light conditions. The perfect solar conditions for maximum output cannot be counted on. To ensure that output is also satisfactory when the skies are cloudy or when the sun's rays come at an angle, SOLON modules are tested under an „artificial sun" and optimized accordingly.

The sun simulator irradiates the solar modules with a spectrum of light similar to that of the sun in laboratory conditions. This allows measurements to be defined accurately and climate-independent conditions to be performed and replicated. The measurement results serve both to compare different module types and to test the output guaranteed by SOLON. To do so, the characteristic module values such as short-circuit current (I_{SC}), open circuit voltage (V_{OC}), and power (P_{max}) are determined under standard test conditions (25 °C, irradiation intensity: 1,000 W/m^2, reference solar spectrum: AM1.5) corresponding to solar insolation in Germany on a beautiful spring or fall day at noon.

The sun simulator is also used to analyze solar modules low-light behavior by changing the insolation, i.e. by placing different filters between the light source and the module.

SOLON On Site: Products Made in Germany.

SOLON has opened up entirely new dimensions of work with its administration, production, and research headquarters covering more than 27,000 square meters. Our headquarter meets all expectations for a renewable energy technology provider in every regard: the most modern production facilities with the lowest possible resource consumption. At the same time, the facilities in Berlin Adlershof provide a workplace that focuses on personal well-being, serving both people and the environment.

At SOLON headquarter, production and administration are combined under one roof. The reason? One simply cannot exist without the other. And this proximity is the only way to achieve the personal exchange of ideas that forms the basis for keeping up with rapid innovation cycles in the solar industry.

We invite you to take a tour of our production facilities:
www.solon.com/quality

Production

Every day, in our state-of-the-art production facilities, we produce thousands of solar modules, optimize our products, and work toward creating innovation. On assembly lines, using both robots and handcraftsmanship, complete solar modules are created from individual solar cells in sequence: the first step toward creating a finished module is always a meticulous receiving inspection of the cells to ensure that every solar cell is capable of performing at full capacity. The individual cells are then soldered into rows, which are called strings. Several strings – placed next to one another and correctly arranged – comprise the basis of a solar module and are fused with a transparent plastic film in a laminator beneath special glass to protect against environmental influences. Finally, the module is given an aluminum frame to guarantee the necessary stability. As a final step, a junction box is added at the contacts.

Berlin Adlershof: SOLON's Headquarter

It goes without saying that none of our solar modules leaves our production facilities before comprehensive tests have confirmed its performance and durability in our modern test laboratory. Through the combination of cutting-edge technology, expertise, and experience, we are carrying on the tradition of legendary SOLON quality – every single day.

Work Stations

To the video: **www.solon.com/quality**

Summary: Unsurpassed SOLON Quality.

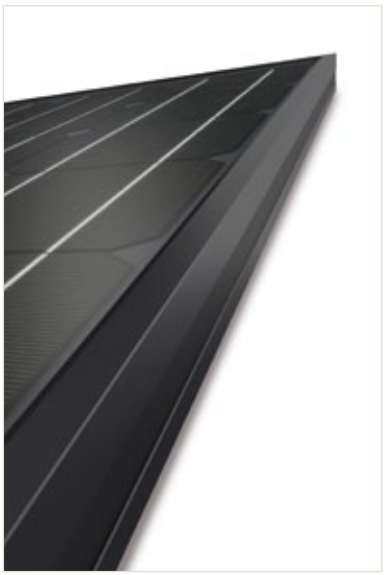
Do not just take our word for it. Independent institutes regularly put SOLON modules through their paces. That they receive above-average results is a fact also substantiated by the numerous awards and certificates that our modules receive. But in the end, it is our customers who benefit from the TÜV-tested components. This is the only way for the module quality to constitute the basis of long-term outputs and the reason why we can offer a 25-year performance guarantee and a 10-year product warranty.

All SOLON module series recently passed the TÜV Rheinland Group's ammonia test with the highest possible score. This makes the modules particularly well suited for agricultural structures where the ammonia caused by farming affects the modules and can lead to material corrosion. In addition, our standard module (SOLON 230/07) is the test winner of the PV+Test conducted by the TÜV Rheinland Group, which particularly underscores SOLON modules' long service life and premium quality.

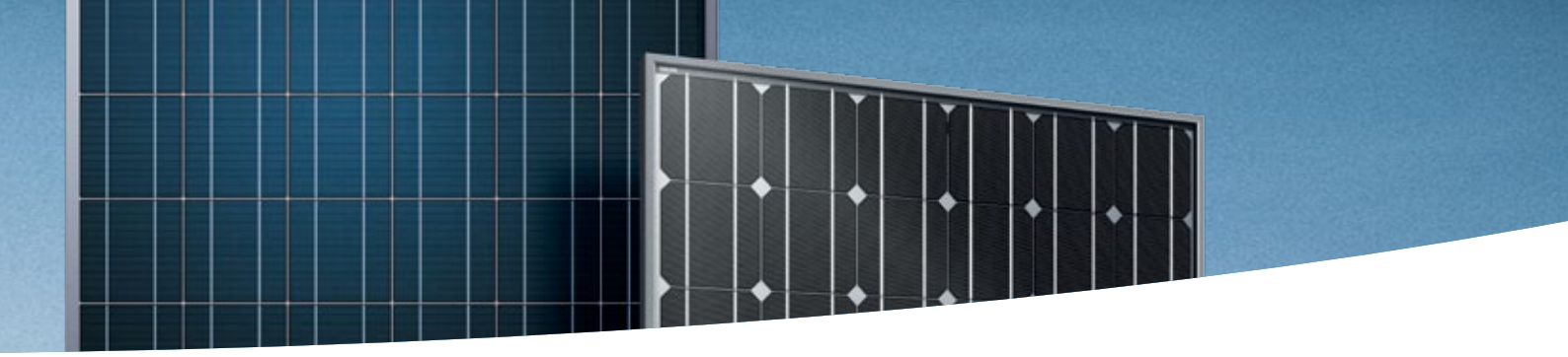
Find out more about SOLON's solarsystems and modules on:
www.solon.com

SOLON SOLitaire Black

SOLON SOLbond Blue



SOLON Black 230/02



SOLON Checklist

Reliable, Efficient Cell Technology.

- ✓ Use of the latest cell technologies from the world's leading manufacturers
- ✓ High efficiency and excellent low-light behavior

Stable, Long-lasting Frame.

- ✓ Robust 45 mm anodized aluminum hollow chamber frame profile
- ✓ Drainage holes for preventing water retention for a high degree of resistance to atmospheric conditions

Highly Transparent, Robust Solar Glass.

- ✓ Ultra-hardened, low-reflection 4 mm solar glass
- ✓ Exceptional transparency for optimum yields

Resilient, Secure SOLON Junction Box.

- ✓ Meets the highest safety standards
- ✓ Metal lid with integrated cooling ribs for optimum heat transfer

Weatherproof, Sturdy Module Components.

- ✓ High degree of temperature- and moisture-resistance
- ✓ Approved for use in all wind- and snow-load zones in Germany

Above-average, Lasting Outputs.

- ✓ High efficiency guarantees high performance
- ✓ Positive binning: modules guaranteed to meet nameplate output, and typically more

Guaranteed Safety.

- ✓ Double TÜV loads; in addition to safety, SOLON also tests for long service life (PV+Test award)
- ✓ High-quality materials and workmanship
- ✓ Reclamation rate below 0,01 %

Comprehensive Warranties and Photovoltaic Insurance Included.

- ✓ 10-year product warranty, 5-level performance guarantee for 25 years
- ✓ Free, two-year photovoltaic insurance (all-risks insurance) for rooftop installations in Europe *)

*) *excl. SOLON 220/16*

Comprehensive and Committed Service.

- ✓ Ongoing specialist training courses for partners and installers
- ✓ Less environmental strain thanks to free module recycling

SOLON Solar Power Systems – Award-winning and Certified

Product Quality

All SOLON products are certified by well known test bodies such as TÜV, ETL, MCS for the European or US market and are manufactured in accordance with the ISO 9001 quality standard. Numerous test seals serve as proof of our high quality requirements.

ISO 9001:2008 BUREAU VERITAS Certification

TÜVRheinland

BROOF (t3)

APPROVED PRODUCT MCS BRE GLOBAL LISTED

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pv magazine 11/2011

ÖKO-TEST RICHTIG GUT LEBEN
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