Bosch quality

BOSCH
Invented for life

CE

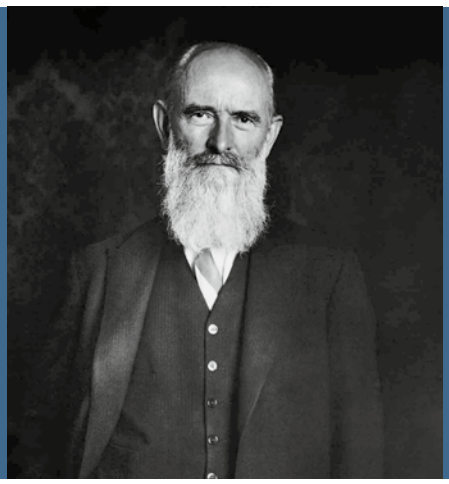
www.tuv.com
TÜVRheinland
ID.0000025912
- Qualified, IEC 61215
- Safety tested, IEC 61730
- Salt corrosion resistance tested
- Periodic inspection

APPROVED PRODUCT
MCS
BRE GLOBAL LISTED

ASSOCIATION PV CYCLE

PLUS X AWARD
ausgezeichnet für:
High Quality
Design
Ökologie

Trust
The key for a long-term partnership



"It has always been an unbearable thought to me that someone could inspect one of my products and prove that I supply an inferior product in some way. That's why I have always tried to only deliver products which withstand the closest scrutiny – products which prove themselves superior in every respect."

(Robert Bosch, 1918, Grundsätze)

Bosch has been synonymous with credibility, quality, and reliability since its founding. These values are clearly stated in Bosch's quality principles. It goes without saying that these guidelines also apply to Bosch Solar Energy.

Bosch's quality principles

1. Our goal is to fully satisfy our customer's expectations through the quality of our products and services.
2. We believe that striving for quality is the responsibility of each individual – from the board of directors to trainees.
3. Our guidelines and processes are based on international standards, customer requirements, our knowledge, and our experience. Knowledge of and strict compliance with these guidelines and processes form the basis of our quality.
4. For us, quality means doing things in the right way from the very beginning. Process quality reduces costs and increases profitability.
5. Defects must be prevented rather than corrected. We systematically apply preventive quality assurance methods and tools. We learn from our mistakes and eliminate their root causes without delay.
6. Our suppliers contribute substantially to the quality of our products and services. For this reason, we expect the same high quality standards from them as we have defined for ourselves.

Bosch Solar Energy's headquarters in Arnstadt, Germany

Keeping control
We produce everything under a single roof

It is Bosch Solar Energy's aim to ensure that photovoltaics play a key role in the future energy mix. To achieve this, we are constantly improving performance in our cells and modules, while also working to reduce production costs and to develop future concepts for our cells and modules. We develop and produce everything under a single roof at our Center of Expertise in Arnstadt, Germany: from wafers, cells and monocrystalline ingots through to ready-to-install modules. This allows Bosch to maintain full control over quality at every single stage in the production process.

Everything from a single source: from monocrystalline ingots to ready-to-install modules

Crystalline value chain

Ingot

Wafer

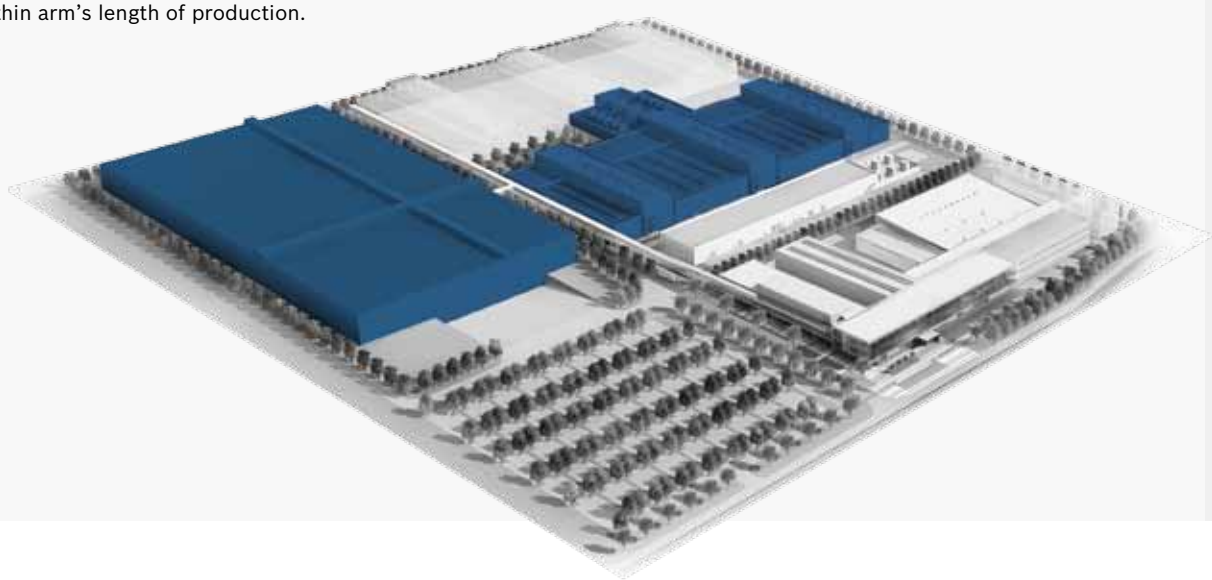
Solar cell

Modules

Solar power plant Germany, Stuttgart

Center of Expertise for crystalline photovoltaics in Arnstadt, Germany

In our Center of Expertise, developers are working within arm's length of production.



Making sure –
We test under tougher conditions than industrial standards require

Bosch Solar Energy's in-line production tests are far more demanding than those required by industrial standards. Our modules must endure all environmental chamber tests for twice as long as the periods specified in standards, whether they are submitted to a temperature cycle, damp heat or humidity frost test. This means, for example, 400 cycles in a temperature cycle test, not just 200 cycles, or 2,000 hours in a dry heat test and not just 1,000 hours. It goes without saying that we also do salt spray climate tests, check on cell and string solder connections and laminations, or assess the performance in weak light and the temperature coefficients – even if they are not a requirement.

We further develop our own test methods on a continuous basis to ensure long-term stability in our PV products.

Function	Requirements specified in standards	Bosch SE
Solderability		
Cell connectors	**None**	Hot air soldering; 180° peel off test with tensile test machine; micrograph; environmental chamber 125°C (24h); micrograph after precipitation heat treatment
String connectors	**None**	Inductive soldering; 180° peel off test with tensile test machine; micrograph; environmental chamber 125°C (24h); micrograph after precipitation heat treatment
Verified by Fraunhofer ISE		
Performance under STC	**None**	Precision measuring under STC with correction of spectral responsivity (SR)
Temperature coefficients	**None**	IEC EN 61215-10.4
Performance in weak light	**None**	Irradiation level: 100-1,000 W/m² in 100 W/m² increments
Micro-cracks due to		
String handling before lamination	**None**	EL images of string and matrix
Lamination	**None**	EL images of laminate
Dimensional stability of string	None	Graphikon Vision System

Test	Requirements specified in standards	In-house test at Bosch SE
TCT climatic test	**200 cycles**	**In-house test at Bosch SE** **400 cycles** (performance test + EL images before starting test, after 200 and 400 cycles)
DHT climatic test	**1,000h**	**2,000 h** (performance test + EL images before starting test, after 1,000 hours and 2,000 hours)
HF climatic test	**10 cycles**	**IEC EN 61215-10.12 with 20 cycles** (performance test + EL images before starting test, after 10 cycles and 20 cycles)
Salt spray test	**None**	**Salt spray test in compliance with IEC 61701** Duration: 96 h Temperature: 35 °C 35°C Salt solution concentration: 5% (weight %) Position angle: 15 – 30 °
PID	**None**	**Conditions: 25°C -1,000V 168h**
"Test to death" 1,000h (until decrease in output > 5%, delamination appears, or similar)	**None**	**EC EN 61215-10.11 (TCT)** **IEC EN 61215-10.13 (DHT)** with performance test + EL images after 200 cycles or 1,000h

Quality assured

Bosch solar modules meet even the highest demands. The crystalline modules c-Si M 60 EU 3117 and c-Si M 60 S EU 3117 were honored with a prestigious Plus X Award in 2011, when they impressed in the High Quality, Design, and Ecology categories.

Product certificates

Bosch Solar Energy solar modules are able to withstand all wind and weather, even in coastal areas. TÜV Rheinland has tested our modules and confirmed that they can support a load of over 5,400 pascals, or about 550 kilograms per square meter, which corresponds to about 880 kilograms of weight acting across the surface of a crystalline module. Whether they are exposed to snow, hail, rain, or wind, our modules are able to withstand almost all conditions.

Bearing and wind suction load successfully tested

The **bearing and wind suction load test** as per IEC 61215 Edition 2 certifies the suitability of our crystalline solar modules to withstand wind, snow, ice, and structural loads up to 5,400 pascals.

Salt spray resistance successfully tested

The **salt spray test as per IEC 61701** certifies resistance of our crystalline solar modules against corrosion due to salt spray.

Ammonia resistance successfully tested

The **ammonia test as per IEC 62716** certifies resistance of our crystalline solar modules to high exposure to ammonia, a condition found in places such as agricultural buildings.

Bosch Solar Energy values the utmost quality in production processes. A commitment that we have recorded in writing.

Company certificates

Quality management: From crystals and high-performance solar cells to long-lasting solar modules, Bosch Solar Energy's superior quality standard has been tested during production and certified according to DIN EN ISO 9001:2008.

Environmental management: We show our commitment to sustainability and corporate responsibility not only through our products. They are a natural, integral part of all our business activities, as confirmed by our compliance with DIN EN ISO 14001:2009.

Guarantees
for you and your future

As a long-established company with a successful history stretching back over more than 125 years, Bosch is able to offer its customers a long-term, solid partnership. This commitment is also evident in our Bosch Solar Energy warranties.

We provide all our customers with a **25-year performance** warranty* for our crystalline modules, thus guaranteeing that our crystalline solar modules supply at least 90% of their designated minimum output over a period of 10 years and at least 80% over a period of **25 years.** We will also provide you with a product warranty valid for ten years* for crystalline solar modules and five years* for thin film modules.

Product warranty*:
guarantees absence of material and processing defects

Performance warranty*:
guarantees the minimum module performance specified on the data sheet over a specified period of time

Warranties* with real value to ensure your satisfaction

- Bosch Solar Energy is synonymous with quality, safety and reliability. We take great care when developing, testing, and manufacturing our solar modules. We also perform in-line production tests to ensure the high quality of our products. Nevertheless, should you need to make a warranty claim, we will, of course, offer you every assistance.

  This means: In the case of a valid warranty claim, Bosch Solar Energy will replace a faulty module with a fully functional one of the same type, rectify the fault or compensate the customer for earnings lost due to failure of the module in question. If the module type is no longer produced when the warranty claim is made, we will supply you with an alternative.

* This is only a basic outline of our warranty coverage. You can find the full warranty conditions for photovoltaic modules at www.bosch-solarenergy.de, or request them from your installer. .

Quality
from the very beginning

Each module is tested before dispatch. A complete check for complete assurance.

At Bosch, quality starts as early as the development stage: all new products must pass through quality gates right from the very beginning. To carry out such checks, we use quality management methods such as DOE (design of experiments) and FMEA (failure modes and effects analysis). Our new products do not go into production until they comply with all quality gate standards.

The defect prevention systems in our production process feature optimum quality. This is assured by systematic checking and continual improvement to our processes.

This allows us to maintain consistent high quality in our production process in each and every product. And that's not all we guarantee you: each module is

tested before it is dispatched to our customers. This complete check comprises full testing of warranted properties, including both the module's electric output and its outward appearance. We also check and ensure the performance stability and long service life of our modules by performing quality and reliability tests in our quality laboratory on a continuous basis.

100% quality – from Bosch, of course

Here to help you

If you have any more questions or would like more information material, please do not hesitate to contact us using the contact details below.

You can also visit us online at **www.bosch-solarenergy.com**, where you can download all the information that you need free of charge.

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