Crystalline Silicon PV Modules

State-of-the-art Technology
Highly Skilled Personnel
HIGHEST QUALITY
PHOTOVOLTAIC MODULES manufactured by BISOL are a result of intensive research and development efforts of highly skilled BISOL's personnel possessing comprehensive professional know-how. The modules are engineered and manufactured under state-of-the-art automated production environment delivering the highest power output and energy yield. Beginning of 2009, production capacity of BISOL was 40 MW equaling to 170,000 modules of peak power between 230 and 240 Wp produced every year.

BISOL PRODUCTS | BISOL produces high quality mono- and multicrystalline silicon photovoltaic modules designed for both commercial and residential applications suitable for grid connected and stand alone systems. High output power modules consist of high quality, proven, and certified materials. In addition to delivering high power density with high module efficiency, BISOL modules are designed for the highest solar power plant system voltages of 1000 Vdc. Relying on the extremely high quality level of BISOL products being based on strict criteria of quality control at each step of the production process, BISOL modules are well accepted for their excellent long-term electric stability. In addition, BISOL would like to underline that all modules are produced in disabled people friendly manufacturing environment and labeled “Made in Europe, Slovenia”.

Highest Quality Worldwide
NATURE OF BISOL’s TECHNOLOGY PERCEPTION

Permanent investments into research and development dictate the future of the photovoltaic industry. In aspiration for sustainable energy supply, BISOL accelerates technological innovations by industry-led research and development of the photovoltaic technology offering outstanding long-term performance. At BISOL, we try to propose solutions that demonstrate their cost-effectiveness, added value, and go beyond the business-as-usual scenario.

To the above aim, BISOL is able to process ever thinner solar cells and is one of the first companies worldwide successfully implementing three bus-bar and back-contact solar cells. In the beginning of 2008, BISOL has launched new Glass-Glass collection of photovoltaic modules named BISOL VISTA. The first VISTA project was the facade of BISOL’s new headquarters in Laskova vas, Slovenia.

Main Features & Benefits

- High-power, high-quality, and high efficiency
- Outstanding long-term performance
- Withstanding rigorous operating conditions
- Proven, highest quality, and certified materials
- Excellent long-term stability
- High voltage operation (1,000 V_{oc})
- 5 years product warranty
- 12 years warranty on 90% power output
- 25 years warranty on 80% power output
- IEC 61215:2005 Ed. 2 certified
- IEC 61730
- Heavy load 5,400 Pa approved
- 44°C NOCT
- Pre-sorting according to $P_{INV}$ and $I_{MPP}$

Quality approval:

- Certified IEC 61215 Ed.2
- Certified IEC 61730 Ed.1
- TÜV Rheinland

Member of:

- ZEP
- OEPiA
- SET plan

Partnering at:

- BISOL
- Other R&D projects

All-inorganic nano-crystalline thin-film c-Si solar cells
**BUSINESS EXCELLENCE OF HONEST INTERESTS**

BISOL's photovoltaic modules find their place predominantly in diverse international markets where BISOL has proven to be a well established trade mark. The latter applies especially to adherents of high-quality products among which BISOL products bear the label of "PREMIUM QUALITY".

<table>
<thead>
<tr>
<th>Common Characteristics</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Cell Type</td>
<td>Multicrystalline silicon</td>
</tr>
<tr>
<td>Solar Cell Dimensions</td>
<td>156 x 156 mm (6&quot;+)</td>
</tr>
<tr>
<td>No. of Cells and Connection</td>
<td>60 in series</td>
</tr>
<tr>
<td>Power Output Tolerance</td>
<td>± 3 %</td>
</tr>
<tr>
<td>Current Temperature Coefficient</td>
<td>$\alpha$ = + 5.5 mA/K</td>
</tr>
<tr>
<td>Voltage Temperature Coefficient</td>
<td>$\beta$ = - 120 mV/K</td>
</tr>
<tr>
<td>Power Temperature Coefficient</td>
<td>$\gamma$ = - 0.40 %/K</td>
</tr>
<tr>
<td>NOCT</td>
<td>44° C</td>
</tr>
<tr>
<td>Maximum System Voltage</td>
<td>1,000 V (IEC)</td>
</tr>
<tr>
<td>Length x Width x Thickness</td>
<td>1,649 x 991 x 40 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>18.5 kg</td>
</tr>
<tr>
<td>Solar Cell Efficiency</td>
<td>$\eta_c$ = 14.7 % - 16.8 %</td>
</tr>
<tr>
<td>Module Efficiency</td>
<td>$\eta_m$ = 13.1 % - 15.0 %</td>
</tr>
</tbody>
</table>

### Power Classes

<table>
<thead>
<tr>
<th>MPP Power</th>
<th>$P_{\text{MPP}}$</th>
<th>214 Wp</th>
<th>221 Wp</th>
<th>227 Wp</th>
<th>233 Wp</th>
<th>245 Wp</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPP Voltage</td>
<td>$V_{\text{MPP}}$</td>
<td>28.5 V</td>
<td>28.7 V</td>
<td>29.1 V</td>
<td>29.3 V</td>
<td>29.9 V</td>
</tr>
<tr>
<td>MPP Current</td>
<td>$I_{\text{MPP}}$</td>
<td>7.50 A</td>
<td>7.70 A</td>
<td>7.80 A</td>
<td>7.95 A</td>
<td>8.20 A</td>
</tr>
<tr>
<td>Open Circuit Voltage</td>
<td>$V_{\text{OC}}$</td>
<td>36.6 V</td>
<td>36.8 V</td>
<td>36.9 V</td>
<td>37.0 V</td>
<td>37.3 V</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>$I_{\text{SC}}$</td>
<td>8.20 A</td>
<td>8.30 A</td>
<td>8.40 A</td>
<td>8.50 A</td>
<td>8.70 A</td>
</tr>
</tbody>
</table>

All electrical characteristics are at Standard Test Conditions (AM 1.5; 1,000 W/m²; 25° C).

**BISOL HAS SUNSHINE ALREADY IN THE NAME**

BISOL photovoltaic modules are built according to the highest quality standards to last a lifetime and continue to give years of faithful service with excellent energy yield. The goal of BISOL is to offer the mankind the prime-class elementary benefits – the green electricity!

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