

Photovoltaic Module
ES - 190 M48 B



**More Yield.
Efficiency
You Can Feel!**

- ◆ **selected components**
- ◆ **reliable workmanship**
- ◆ **value added**



Photovoltaic Module ES - 190 M48 B



Electrical Data at 1000 W/m², 25 °C and AM 1.5 (STC in Accordance with EN 60904-3)

rated power at STC ¹	195 Wp	200 Wp	205 Wp	210 Wp ²
module efficiency at STC ³	14.7 %	15.1 %	15.4 %	15.8 %
cell efficiency	17.4 %	17.7 %	18.0 %	18.3 %
open-circuit voltage V _{oc}	29.50 V	29.81 V	30.10 V	30.40 V
short-circuit current I _{sc}	8.48 A	8.61 A	8.73 A	8.86 A
rated voltage V _{mpp}	24.38 V	24.64 V	24.88 V	25.12 V
rated current I _{mpp}	8.00 A	8.12 A	8.24 A	8.36 A

¹ The measurement tolerance of the rated power is ± 3%. The modules delivered are sorted in a range of ± 2.5 Wp. ² Available in limited amounts upon request. ³ At low irradiance (200 W/m², 25 °C and AM 1.5) the module yields at least 97% of the STC efficiency.

Electrical Data at 800 W/m², NOCT, 1m/s Wind Speed and AM 1.5

rated power P _{max}	158.0 W	162.0 W	166.1 W	170.1 W
open-circuit voltage V _{oc}	29.22 V	29.53 V	29.82 V	30.11 V
short-circuit current I _{sc}	6.81 A	6.91 A	7.02 A	7.12 A
rated voltage V _{mpp}	24.47 V	24.73 V	24.97 V	25.21 V
rated current I _{mpp}	6.46 A	6.56 A	6.65 A	6.75 A

Thermal Data

temperature coefficient open-circuit voltage	-0.36%/K
temperature coefficient short-circuit current	+0.02%/K
temperature coefficient rated power	-0.47%/K
noct (normal operating cell temperature)	48 °C ± 2K

Mechanical Data

number of cells and cell type	48 monocrystalline solar cells (semi-square, 156 x 156 mm, 3-Bus-Bar)
cell manufacturer	Bosch, Germany
dimensions: length x width	1,340 mm x 991 mm
frame thickness	50 mm anodized aluminum
weight	21.3 kg (Albarino S) / 18.9 kg (Albarino G)
front glass	4 mm Albarino S or G (Saint Gobain Solar)
embedding	EVA (Solutia Solar)
back sheet	TPT Tedlar®/Polyester/Tedlar® (Krempel) KPK Kynar®/Polyester/Kynar® (Krempel)
junction box	Spelsberg/Lumberg; plastic, protection class IP 65, 141 x 101 x 28 mm
number of bypass diodes	3
cables	4 mm ² solar cables, length 920 mm
connectors	MC4/LC4



The distinctive feature of **ES-190 M48** is the standard application of Albarino G of Saint-Gobain Solar as front glass. The special surface texture of this glass traps the light in the modules and provides a **surplus of at least 3% annually**.

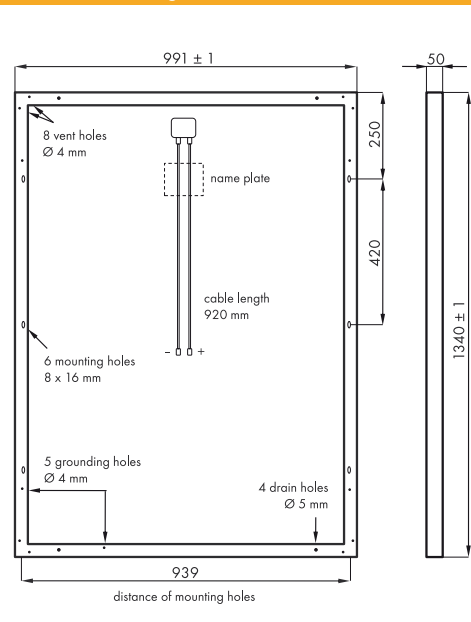
Permissible Operating Conditions

operating temperature range	-40 °C to 85 °C
max. system voltage	1000 V DC
max. reverse current	15 A
maximum surface load capacity	5400 Pa or 550 kg/m ²
resistance against hail	maximum diameter of 24 mm with impact speed of 83 km/h
protection class	II

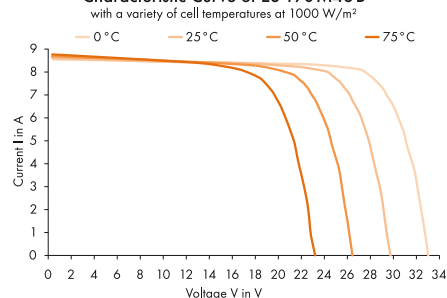
Warranty and Certificates

product warranty	10 years
performance warranty	90% up to 10 years, 80% up to 25 years
certifications	IEC 61215 Ed. 2 & IEC 61730 TÜV Rheinland; MCS accredited; ISO 9001 & ISO 14001

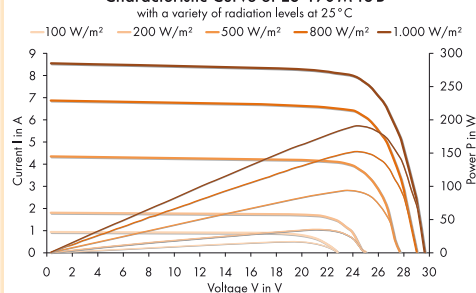
Technical Drawing – All Dimensions in mm



Characteristic Curve of ES-190 M48 B



Characteristic Curve of ES-190 M48 B



Your Retailer:



- Qualified, IEC 61215
- Safely tested, IEC 61730
- Periodic Inspection



For more details, see Installation Manual.
Datasheet according to EN 50380.

