



Electricity costs are on the rise, increasing more than 21% during the past five years. Rates spiked 10.3% in 2006 alone. Fossil fuel supplies are dwindling, which means energy costs will continue to grow. The average American household generates 7.4 tons of carbon dioxide (CO₂) per year through electrical use. This equates to 185 tons of CO₂ over 25 years. Carbon Dioxide creates global warming which is dramatically affecting our climate causing glacier loss, shoreline erosion, and endangering many animals around the world.

The benefits of solar energy are proclaimed every day from rooftops around the world. Solar energy is dependable. Solar energy emits no pollution or greenhouse gasses. Solar energy generation peaks in the same places and times as major residential and industrial loads. Solar photovoltaic (PV) systems are highly modular, making them suitable for use on the demand side of the electric meter. As one of the largest vertically integrated PV manufacturers in the US, SolarWorld is intimately involved with every step of the solar PV value chain from raw silicon to installed systems to end of life recycling.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. SolarWorld Sunmodule.
- B. Related Accessories.

1.2 REFERENCES

All equipment and calculations shall comply with requirements of the latest revision of the relevant standards of:

- A. NEC: National Electric Code.
- B. NEMA: National Electric Manufacturers Association.
- C. ANSI: American National Standards Institute.
- D. IEC: International Electro Technical Commission.
- E. NFPA: National Fire Protection Association.
- F. ASTM: American Society for Testing and Materials.
- G. ASCE (7-05 or 7-10): Minimum Design Loads for Buildings and Other Structures.
- H. IBC (2006, 2009 or 2012): International Building Codes.

1.2.1 Testing Sources

- A. IEC 61215: Crystalline Silicon Terrestrial Photovoltaic Modules.
- B. IEC 61730: Photovoltaic Module Safety Qualification.

- C. IEC 61701: Salt Mist Corrosion Testing of Photovoltaic Modules.
- D. UL 1703: Flat-Plate Photovoltaic Modules and Panels.

1.3 DESIGN / PERFORMANCE REQUIREMENT

- A. Structural Performance:
 - 1. Design in accordance to ASCE (7-05, 7-10) – Minimum Design Loads for Buildings and other Structures.
 - 2. Design all materials, component and claddings to resist snow, wind, suction and uplift loading at any point without damage. Solar Panels do not need to be designed for live loads as they are not meant to be walked upon.
- B. The design for the package shall be in agreement with the appropriate codes, standards and regulations.
 - 1. Drawings specifying package envelope along with manufacturer's data sheets.
 - 2. Weight and other interface.
 - 3. Technical specifications.
 - 4. Schedule of Manufacturing and delivery.
 - 5. Consistency and convenience of gathering data.
 - 6. Clarifications and exclusions.
 - 7. Recommended spare parts list.

1.4 SUBMITTALS

- A. Submit under supervision of SolarWorld Americas, LLC.
- B. Product Data: Provide Manufacturer's documents on products, containing:
 - 1. Data sheets.
 - 2. Installation instructions.
- C. Shop Drawings: Physical and electrical layout and drawings including details (where applicable) for permitting purposes.
- D. Design Data: Structural design calculations with signature of professional engineer licensed to practice in the state with respect to project's location.
- E. Manufacturer's Certificates: Certify products exceed specified specifications.
- F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer qualifications: SolarWorld Americas, LLC.
- B. Installer qualifications: SolarWorld ISO 9001 certified installer with documented experience in installing comparable systems.

C. Pre-Installation Meeting:

Convoke at job site beforehand to the scheduled beginning of construction of this section, to review specifications of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle and store materials in conformance with the manufacturers printed instructions.
- B. Stock products under protection cover, in manufacturer's unopened packaging until the installation's start.
- C. Stock supplies in a locations in accordance to manufacturer's guidelines. Protect materials from exposure to moisture.
- D. Roof Placement: Avoid overloading the roof structure by spreading the bundles and crates. Recommended location is over major supports such as beams (girders) or trusses.

1.7 SEQUENCING

- A. Confirm that appropriate information required for installation of products of this section are well-appointed in time to avoid interruption of construction.
- B. Confirm that products of this section are provided in time to avoid interruption of construction.

1.8 WARRANTY

- A. Manufacturer Limited Warranty: Ten (10) years product warranty.
- B. Manufacturer Limited Warranty: Twenty-Five (25) years service warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: SolarWorld Americas, LLC, which is located at:
 - 1. 4650 Adohr Lane; Camarillo, CA 93012; Tel: 805-388-6590; Email: request info (customerservice@solarworld-usa.com); Web: www.solarworld.com.
 - 2. 25300 NW Evergreen Road; Hillsboro, OR 97124; Tel: 503-844-3400;
- B. Substitutions: Not permitted

1.2 MATERIALS

- A. Metals: Aluminum sheets and plates used in the construction of modules shall be compliant to ASTM B209.
- B. Backsheet: Thin polymer sheets to be used which provide the following key functions:
 - 1. Physical protection from puncture and abrasion.
 - 2. Moisture protection and low thermal resistance.
 - 3. Electrical insulation to isolate the cells and connections from the environment.

4. UV and moisture stability over the life of the module. Prevent ingress of water or water vapor.
 5. Improve efficiency through optimized internal reflection.
- C. Glass Cover: Anti-reflective tempered glass to be used as the protective shield for the active surface area of the module. To be carefully chosen for high impact and thermal shock resistance.
 - D. Encapsulation: The encapsulant shall fill all spaces inside the module and shall adhere to the front glass and the backsheet. The encapsulant should be stable at elevated temperature and high UV exposure.
 - E. Cell Material: All the photovoltaic cells within the module are made from crystalline silicon. These cells are produced through advanced printing technology and using proprietary surface texturing to enhance sunlight capture.
 - F. Junction Box: Each module shall have a sealed junction box. This box shall not extend more than one and three-quarters inch (1¾") from the backsheet of the module. This junction box shall contain both the positive and negative output terminal posts. The junction box shall contain a small replaceable cover for easy access for replacement of the blocking diode. The junction box shall be completely filled with a soft, clear, removable, self-healing, room temperature cure, dielectric potting gel leaving no air gaps.
 - G. Intercell Connections: Intercell connections contained by the module shall be ready to allow for thermal expansion and to discharge mechanical stress. Intercell electrical contacts to the collector grid contact area of one cell and the back contact area of the next cell shall be provided. These connections shall be designed such that failure of any contact shall not degrade the individual cell electrical output by more than 5% from its output under Standard Test Conditions (STC). Solder shall cover the contact area where the intercell connection overlays the front cell area of one cell and the back contact area of the next cell.
 - H. The positive and negative of cell outputs usually drive through the backsheet of the module. After the positive and negative outputs are soldered onto the outside of the solar panel, it is essential to connect the positive and negative outputs with positive and negative output cables inside the Junction Box.

1.3 FABRICATIONS

- No fabrication or alteration to the module without prior express written consent of the module manufacturer.

2.4 CERTIFICATIONS

- A. IEC 61701: Sunmodule Plus and Sunmodule off-grid; Salt Mist Corrosion certificate by SGS.
- B. IEC 61730: Sunmodule Plus and Sunmodule Off-grid; photovoltaic module safety qualification by TUV Rheinland; ID: 0000022848.
- C. IEC 61215: Sunmodule Plus and Sunmodule Off-grid; crystalline silicon terrestrial photovoltaic modules by TUV Rheinland; ID: 0000022848.
- D. Intertek Listing (UL 1703): Standard for Flat-Plate Photovoltaic Modules and Panels.
- E. ISO 9001-14001: Design and sales of photovoltaic equipment and systems.
- F. UL 1703: Standard for Safety for Flat-Plate Photovoltaic Modules and Panels.

G. UL 4703: SolarWorld’s proprietary IP-65 junction box.

H. UL 1581: SolarWorld’s PV Wire cables.

2.5 Electrical Performance

- Electrical performance for SolarWorld’s Sunmodules (235W, 240W, 245W, 250W, 255W, 260W, 265W, 270W) is shown in the following tables.
- Visit SolarWorld’s website to access Sunmodules’ data sheets and Sunmodule User Instruction.

<http://www.solarworld-usa.com/system-designers/data-sheets.aspx>

Module Output	235 W			240 W		
	mono	poly	mono black	mono	Poly	mono black
Max power (Pmax) (Wp)						
STC*	235	235	235	240	240	240
NOCT*	170.9	170.4	170.9	175.4	174.2	175.4
Voltage at Pmax (Vmpp) (V)						
STC	30.3	30	30.3	30.6	30.2	30.6
NOCT	27.5	27.1	27.5	27.9	27.4	27.9
Current at Pmax (Impp) (A)						
STC	7.77	7.85	7.77	7.87	7.96	7.87
NOCT	6.22	6.28	6.22	6.3	6.37	6.3
Short circuit current (Isc) (A)						
STC	8.19	8.35	8.19	8.22	8.44	8.22
NOCT	6.6	6.73	6.6	6.63	6.8	6.63
Open Circuit Voltage (Voc) (V)						
STC	37.5	37	37.5	37.6	37.2	37.6
NOCT	34	33.5	34	34.2	33.7	34.2
Module efficiency	14.02%	14.02%	14%	14.31%	14.31%	14.31%
Tolerance (Wp)	`+5	`+5	`+/- 3%	`+5	`+5	`+5
Nominal Voltage (Wp)	235	235	235	240	240	240

*STC: 1000W/m2, 25°C, AM 1.5

*NOCT: 800W/m2, 20°C, AM 1.5

Module Output	245 W			250 W		255 W	260 W
	Module type	mono	poly	mono black	mono	mono black	mono
Max power (Pmax) (Wp)							
STC*	245	245	245	250	250	255	260
NOCT*	179.1	176.4	179.1	183.3	183.3	184.1	187.6
Voltage at Pmax (Vmpp) (V)							
STC	30.8	30.8	30.8	31.1	31.1	31.4	31.6
NOCT	28.1	27.7	28.1	28.5	28.5	28.3	28.5
Current at Pmax (Impp) (A)							
STC	7.96	7.96	7.96	8.05	8.05	8.15	8.24
NOCT	6.37	6.37	6.37	6.44	6.44	6.52	6.59
Short circuit current (Isc) (A)							
STC	8.25	8.49	8.25	8.28	8.28	8.66	8.73
NOCT	6.65	6.84	6.65	6.68	6.68	6.99	7.05
Open Circuit Voltage (Voc) (V)							
STC	37.7	37.5	37.7	37.8	37.8	37.8	37.9
NOCT	34.4	33.7	34.4	34.6	34.6	34	34.1
Module efficiency	14.61%	14.61%	14.61%	14.91%	14.91%	15.21%	15.51%
Tolerance (Wp)	`+5	`+5	`+5	`+5	`+5	`+5	`+5
Nominal Voltage (Wp)	245	245	245	250	250	255	260

*STC: 1000W/m2, 25°C, AM 1.5

*NOCT: 800W/m2, 20°C, AM 1.5

Module Output	265 W	270 W
Module type	mono	mono
Max power (Pmax) (Wp)		
STC*	265	270
NOCT*	187.6	194.9
Voltage at Pmax (Vmpp) (V)		
STC	31.9	32.1
NOCT	28.7	28.9
Current at Pmax (Impp) (A)		
STC	8.33	8.42
NOCT	6.66	6.74
Short circuit current (Isc) (A)		
STC	8.82	8.9
NOCT	7.12	7.19
Open Circuit Voltage (Voc) (V)		
STC	38.1	38.3
NOCT	31.9	34.5
Module efficiency	15.81%	16.10%
Tolerance (Wp)	`+5	`+5
Nominal Voltage (Wp)	265	270

*STC: 1000W/m2, 25°C, AM 1.5

*NOCT: 800W/m2, 20°C, AM 1.5

PART 3 EXECUTIONS

3.1 EXAMINATION

- A. Inspect installation region to validate the project can be completed in agreement with the drawings and structural calculations with no interruption from other equipment or trades.
- B. Do not start installation till drawings and calculations have been accurately prepared.
- C. If planning is the duty of alternative installer, notify Architect of unacceptable planning before proceeding.

3.2 PREPARATION

- A. Clean all surfaces including modules thoroughly preceding installation.
- B. Arrange surfaces in accordance to manufacturer recommendation for project conditions.
- C. Insure mounting rails or other type systems are properly secured and able to properly support the modules.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Make sure that the module meets the technical requirements of the overall system.
- C. Other system components shall not exert any adverse mechanical or electrical influences on the module.
- D. To avoid performance losses, all modules connected in series should be arranged with the same orientation and tilt angle.
- E. Try to reduce possibility of corrosive or electrolytic action between metals.
- F. Implement care while installing components so as not to damage finish surfaces.
- G. Touch up as required to repair damaged finishes.
- H. Remove all protective masking from material immediately after installation.

3.4 PROTECTION

- A. Protect installed products until execution of project.
- B. Touch-up, repair or replace damaged products before completion.
- C. Regular inspection of the system to ensure:
 - 1. All fixtures are securely tightened and corrosion free.
 - 2. Wiring is securely connected, properly arranged and free of corrosion.
 - 3. Cables are free of damage.