



# **Xunlight Photovoltaic Laminates General Instructions**



Contact:  
Jim Young  
Xunlight Corporation  
3145 Nebraska Ave.  
Toledo, Ohio 43607  
Ph +1(419) 469-8690  
Fax +1(419) 469-8601  
[www.xunlight.com](http://www.xunlight.com)



## **Introduction**

Xunlight Corporation is a manufacturer of flexible, lightweight and environmentally safe thin-film silicon solar laminates. Due to the unique composition of our advanced thin-film applications, our laminates can be utilized in a wide variety of ways. The combination of flexible and lightweight allows for the implementation of small- to large-scale energy generation strategies for a variety of applications. Xunlight laminates are designed to be versatile, long-lasting solar laminates suitable for a variety of applications.

## **DISCLAIMER of LIABILITY**

XUNLIGHT does not assume responsibility and expressly disclaims liability for injury, loss, damage, or expense arising out of, or in any way connected with, installation, operation, use, or maintenance by using this manual.

XUNLIGHT assumes no responsibility for any infringement of patents or other rights of third parties, which may result from use of laminates.

No license is granted by implication or under any patent or patent rights. The information in this manual is believed to be reliable, but does not constitute an expressed and/or implied warranty.

XUNLIGHT reserves the right to make changes to the product, specifications, data sheets and this manual without prior notice. For the latest information please visit [www.xunlight.com](http://www.xunlight.com)

## **Safety Warnings**

- Xunlight laminates produce DC electricity when exposed to sunlight or other light sources and can produce an electrical shock or burn. Xunlight laminates continue to produce voltage when attached to a load or combiner box. Even at low light levels, the laminates can produce high voltages. Use insulated tools and gloves when working with Xunlight laminates. Xunlight laminates have no on/off switch, but they can be made to cease functioning by covering them with an opaque material or by placing the laminate on a clean, smooth and flat surface with the working side down so that the cells are not exposed to sunlight. When working on installed laminates, always wear electrical gloves, disconnect all external energy sources and short-circuit the output of the laminates.
- Xunlight Laminates can experience conditions that produce more current and/or voltage than that reported at standard test conditions. Ratings made at standard test conditions are for a fully stabilized product. The initial power production from Xunlight laminates may be as much as 15% above rated outputs during the stabilization period after product installation.
- Reflections from snow, rain clouds or buildings can increase sunlight and therefore raise the current above the rated value. Section 690 of the National Electric Code requires 156 percent for conductor and over current device sizing to account for this variance. Cold temperatures can increase voltage by 0.38 percent per degree C as the temperature drops. The highest acceptable voltage a photovoltaic array can be according to the NEC is 600 Volts. Xunlight laminates should be handled with care. The laminates contain live

electrical components. Do not cut or trim a laminate in any way. Do not drive screws through any part of the laminate. Doing so can cause electric shock, may result in fire and will void the warranty.

- Never artificially concentrate sunlight onto the surface of a Xunlight laminate.
- Care should be taken to avoid stepping on a laminate or placing/dropping tools, or boxes onto the top surface. The Xunlight laminates are slippery, especially when wet. Use extreme caution and proper safety gear when working or near the laminates.
- Damaged Xunlight laminates must be handled with caution and disposed of properly. There are no field serviceable components in a laminate.
- Although the Xunlight laminates can withstand certain types of deformation with no significant loss of performance, care should be taken not to dent the cells and to ensure that the laminate will lie flat when installed. Do not curve to a radius less than that of the shipping drum and not less than 8 inches (200 mm) in any case. Laminates should have a minimum bend radius of 36 inches when installed.
- Do not disconnect a laminate under load. The electrical path should only be disconnected using an approved disconnect device.
- Use caution when cleaning Xunlight laminates, as the combination of water and electricity may present a shock hazard. Generally, a good rain is sufficient to clean laminates installed on membrane roofing. However, in dusty arid locations the laminates can be cleaned with water or mild soap and water. Do not use abrasive soaps or solvents. Do not spray water directly at leading edge of the Xunlight laminates. Avoid cleaning the laminates in the middle of the day.
- Avoid shadows by proper selection of the installation site.
- Depending on the roof type, Xunlight laminates have a Class A fire rating up to and including slopes of 2" per foot. However, this rating is not valid of all types of roofs. Please contact Xunlight with details of your proposed installation.

### **Codes and Regulations**

In the U.S., all installations should conform to the National Electric Code (NEC), including article 690 on Solar Photovoltaic Systems and all other appropriate articles and sections. The mechanical and electrical installation of Xunlight laminates in Canada should be performed in accordance CSA C22.1 and with all applicable codes, including electrical codes, building codes, and electrical utility interconnect requirements. Such requirements may vary with mounting locations and roofing technology. Requirements may also vary with system voltages and array complexities. Local authorities should be contacted for governing regulations. Mechanical installation should be completed by licensed roofing contractors and electrical connections should be completed by licensed electrical contractors or certified NABCEP installers.

## Product Specifications

The maximum system voltage for a Xunlight laminate is 600 Vdc in the US and Canada (1000V in Europe). Xunlight laminates must not be connected directly in parallel without use of a string fuse.

Xunlight laminates have no external metal parts that require grounding. If a metal structure, wire-way, or combiner box is included in the photovoltaic -system, grounding of that component should be in conformance with local and national codes.

The electrical characteristics in Table 1 are within  $\pm 10$  percent of the indicated values of  $I_{SC}$ ,  $V_{OC}$ , and  $P_{MAX}$  under standard test conditions (irradiance of  $100 \text{ mW/cm}^2$ , AM 1.5 spectrum, and a cell temperature of  $25^\circ\text{C}$  ( $77^\circ\text{F}$ )). Note that during the first few weeks of operation, the power may be higher than the rated values by 15%, voltages may be higher by 10% and currents may be higher by 5%. Typical power degradation of Xunlight laminates after light soaking in accordance with the IEC61646 method is 10-12%.

Under normal conditions, a photovoltaic laminate is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of  $I_{SC}$  and  $V_{OC}$  marked on this laminate should be multiplied by a factor of 1.3 when determining component voltage ratings, conductor ampacities, and size of controls connected to the PV output. The fuse rating for the Xunlight laminates is 10 amperes (8 amperes in Europe). Only DC-rated fuses of the appropriate type and voltage rating shall be used.

Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable.

The Xunlight family of photovoltaic laminates consists of three different series of laminates. The XR series, the XRS series, and the XRU series. The product data sheets (below) lists the ratings and sizes of the available laminates in each series. Please visit [Xunlight.com](http://Xunlight.com) for the latest updates to the data sheets. The electrical connection to the laminate is factory installed and is terminated with Tyco SOLARLOK connectors. Each solar cell in a laminate has two bypass diodes for minimize loss of performance under partial illumination. The laminates weigh approximately  $0.5 \text{ lb/ft}^2$  and are rated to withstand a uniform  $30 \text{ lb/ft}^2$  load if installed according to instruction



# XR Solar Laminate Series

**Models: XR12  
XR36**

Basic Characteristics at STC		XR12	XR36
Power (±5%)	Pm (W)	97	291
Open Circuit Voltage	Voc (V)	26.50	79.50
Short Circuit Current	Isc (A)	6.35	6.35
Voltage at Max Power	Vm (V)	19.40	58.20
Current at Max Power	Im (A)	5.00	5.00
Length (±3 mm/0.12 in)	L (mm/in)	1801/70.91	5182/204.03
Width (±3 mm/0.12 in)	W (mm/in)	911/35.88	911/35.88
Weight	M (kg/lbs)	4/9	12/26
Thickness	T (mm/in)	1.5/0.06	1.5/0.06

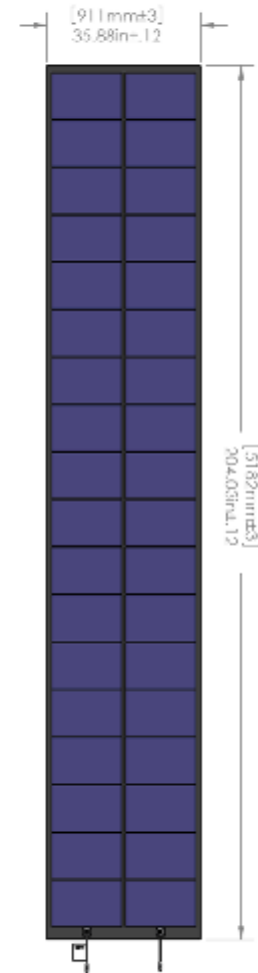
Characteristics for System Design *	
Max System Voltage	600 V (US/Canada), 1000 V (Europe)
Series Fuse	10 A (UL 1703/US NEC), 8 A (Europe/IEC)
Temp Coefficient of Power	- 0.243 %/°C
Temp Coefficient of Voc	- 0.394 %/°C
Temp Coefficient of Isc	+0.136 %/°C
NOCT	51.5 °C
Classification	IEC Application Class A/Safety Class II
UL 1703 Fire Rating	Class A

\* See manual or contact Xunlight for details.

Certifications
Certified to the following standards: IEC 61646, EN 61730 and UL 1703.

Warranty
25 year limited power output warranty (80% of minimum power at 25 years)
5 year limited product warranty

All specifications subject to change without notice. Latest datasheets available at [www.xunlight.com](http://www.xunlight.com).



**XR36**  
See table for other models



# XRS Solar Laminate Series

Models: **XRS10**  
**XRS19**

Basic Characteristics at STC		XRS10	XRS19
Power (±5%)	Pm (W)	81	154
Open Circuit Voltage	Voc (V)	22.1	42.0
Short Circuit Current	Isc (A)	6.35	6.35
Voltage at Max Power	Vm (V)	16.2	30.7
Current at Max Power	Im (A)	5.00	5.00
Length (±3 mm/0.12 in)	L (mm/in)	2944/115.9	5480/215.8
Width (±3 mm/0.12 in)	W (mm/in)	454/17.9	454/17.9
Weight	M (kg/lbs)	3.3/7.2	6.3/13.8
Thickness	T (mm/in)	1.5/0.06	1.5/0.06

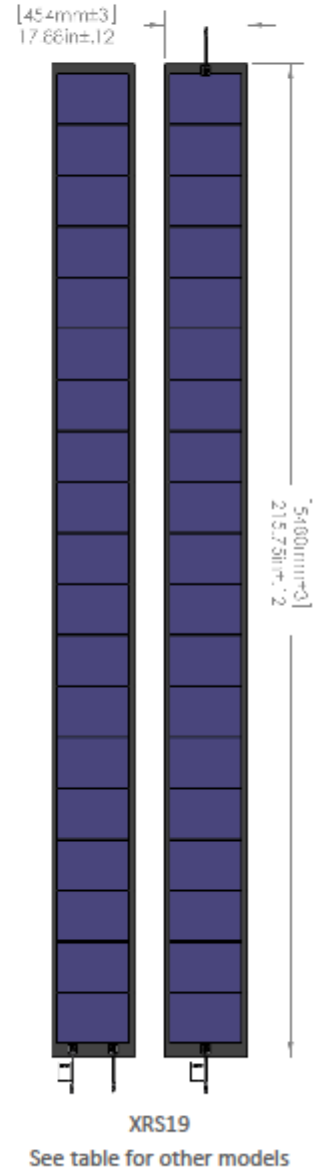
Characteristics for System Design *	
Max System Voltage	600 V (US/Canada), 1000 V (Europe)
Series Fuse	10 A (UL 1703/US NEC), 8 A (Europe/IEC)
Temp Coefficient of Power	- 0.243 %/°C
Temp Coefficient of Voc	- 0.304 %/°C
Temp Coefficient of Isc	+0.136 %/°C
NOCT	51.5 °C
Classification	IEC Application Class A/Safety Class II
UL 1703 Fire Rating	Class A

\* See manual or contact Xunlight for details.

Certifications	
Standard XRS-19 available certified to IEC 61646, EN 61730 and UL 1703.	
Certifications expected for other models September 2011.	

Warranty	
25 year limited power output warranty (80% of minimum power at 25 years)	
5 year limited product warranty	

All specifications subject to change without notice. Latest datasheets available at [www.xunlight.com](http://www.xunlight.com).





# Product Data Sheet

## XRU Solar Laminate Series

Models: **XRU10**  
**XRU19**

Basic Characteristics at STC		XRU10	XRU19
Power (±5%)	Pm (W)	71	134
Open Circuit Voltage	Voc (V)	22.5	42.0
Short Circuit Current	Isc (A)	5.4	5.4
Voltage at Max Power	Vm (V)	16.7	31.7
Current at Max Power	Im (A)	4.24	4.24
Length (±3 mm/0.12 in)	L (mm/in)	2944/115.9	5480/215.8
Width (±3 mm/0.12 in)	W (mm/in)	391/15.4	391/15.4
Weight	M (kg/lbs)	2.8/6.2	5.3/11.7
Thickness	T (mm/in)	1.5/0.06	1.5/0.06

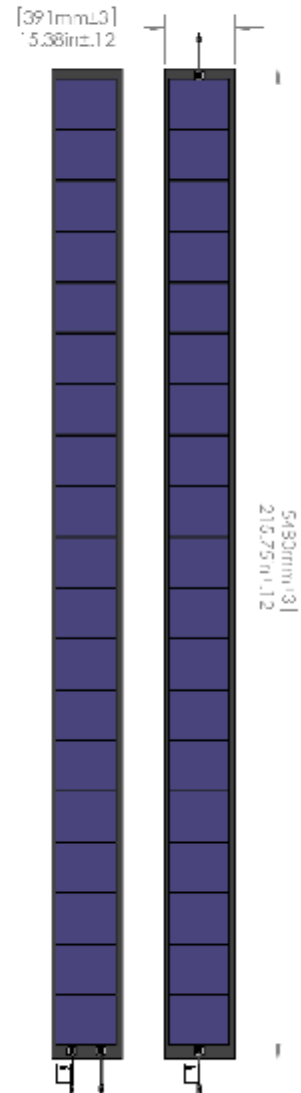
Characteristics for System Design *	
Max System Voltage	600 V (US/Canada), 1000 V (Europe)
Series Fuse	10 A (UL 1703/US NEC), 8 A (Europe/IEC)
Temp Coefficient of Power	- 0.243 %/°C
Temp Coefficient of Voc	- 0.394 %/°C
Temp Coefficient of Isc	+0.136 %/°C
NOCT	51.5 °C
Classification	IEC Application Class A/Safety Class II
UL 1703 Fire Rating	Pending

\* See manual or contact Xunlight for details.

Certifications	
Available certified to IEC 61646, EN 61730 (UL 1703 expected September 2011).	
Certifications for option with J-Box at same end expected September 2011.	

Warranty	
25 year limited power output warranty (80% of minimum power at 25 years)	
5 year limited product warranty	

All specifications subject to change without notice. Latest datasheets available at [www.xunlight.com](http://www.xunlight.com).




XRU19

See table for other models

Before starting any installation, review the label supplied on each laminate for electrical specifications, system design specifications and warnings or cautions. Figure 2 shows an example label and the information it contains.

Manufacturer/Fabricant	: Xunlight Corporation
Model/Modèle	: XR36-291
Date of Manufacture/de fabrication (mm/dd/yyyy)	: 00/00/0000
Serial Number/Numéro de série	: EXAMPL
Maximum Power/Puissance maximale (Pmax)	: 291 W
Open Circuit Voltage/Tension en circuit ouvert (Voc)	: 79.50 V
Short-circuit Current/Courant de court-circuit (Isc)	: 6.35 A
Voltage at maximum power/Tension nominale (Vmp)	: 58.2 V
Current at maximum power/Courant nominal (Imp)	: 5.00 A
Maximum system voltage/Tension maximale du système	: 600 V
Series Fuse/Fusible de séries	: 10 A
Diode	: 12 A
Fire Rating/Classement de résistance au feu	: Class/Classe A


All values at standard test conditions (AM1.5, 1000 W/m<sup>2</sup>, 25°C) in accordance with IEC-61646 after light soaking/Toutes les valeurs sont fournies sous conditions de test standard (CTS - AM 1,5; 1000 W/m<sup>2</sup>, 25°C) après ensoleillement selon CEI-61646. See manual for details/Voir le manuel pour plus de détails.




EXAMPL

---

Field wiring/Câblage minimal 14AWG, -40°C to 90°C Cu only/Cu uniquement.  
 See manual for wiring instructions/Voir le Manuel d'installation pour les instructions de câblage.  
 Maximum mechanical load 30 lb/sq. ft. (not rated for structural loads)/Puissance mécanique 30 lb/pied carré (non conçu pour charges structurales).  
 Panels do not contain any user serviceable parts. Panels must be maintained by qualified personnel only/Attention : Le produit ne contient aucune pièce réparable par l'utilisateur. Les panneaux sont entretenus et réparés uniquement par un personnel qualifié.  
 Warning: Risk of electric shock. Panels produce electricity when exposed to light/Avertissement : Risque de choc électrique/ Les panneaux produisent de l'électricité à partir du rayonnement solaire.



**Xunlight**  
CORPORATION  
Flexible • Lightweight • Powerful



**Intertek**  
4000344  
Conforms to UL Std 1703  
Certified to UL/ORD Std C1703

3145 Nebraska Avenue, Toledo, OH 43606, USA. Patents pending/Brevets en instance.  
 Made in USA/Fabriqué aux É.-U.

**Do not disconnect under load.  
 Ne pas débrancher lorsque chargée.**

Figure 2. Example of Laminate Label

## **Installation Considerations**

Specific instructions for various types of installations are available from Xunlight as attachments to this document. Further, a system installation will typically include wire-ways, conduits, combiner boxes, over current protection devices, and inverters. The specification and installation of these system components are not covered in this document or in the attachments. A qualified professional, NABCEP certified installer, or licensed electrician should design and install Xunlight XR-Series laminate systems in accordance with all national and local codes and regulations. Do not design or install a system that exceeds the fuse, voltage, or current ratings on the label of a Xunlight laminate.

### **Rooftop installation methods**

A minimum slope of 0.25" per foot is recommended for all installations to permit water runoff. Fire rating restrictions apply for roof slopes greater than 2" per foot. Contact Xunlight if planning such installations.

### **Standing Seam Metal Roofs**

There are several different ways to attach the Xunlight laminates to standing seam metal roofs. For metal roofs having flats between the structural ribs less than 16 inches (405mm) there is a plate mounting option where the laminate is adhered to a metal roofing material and fastened over top of the structural ribs. This installation method can be used for all of the Xunlight laminates. Below is an example of this installation method, XR series laminates are installed on a trapezoidal steel roof

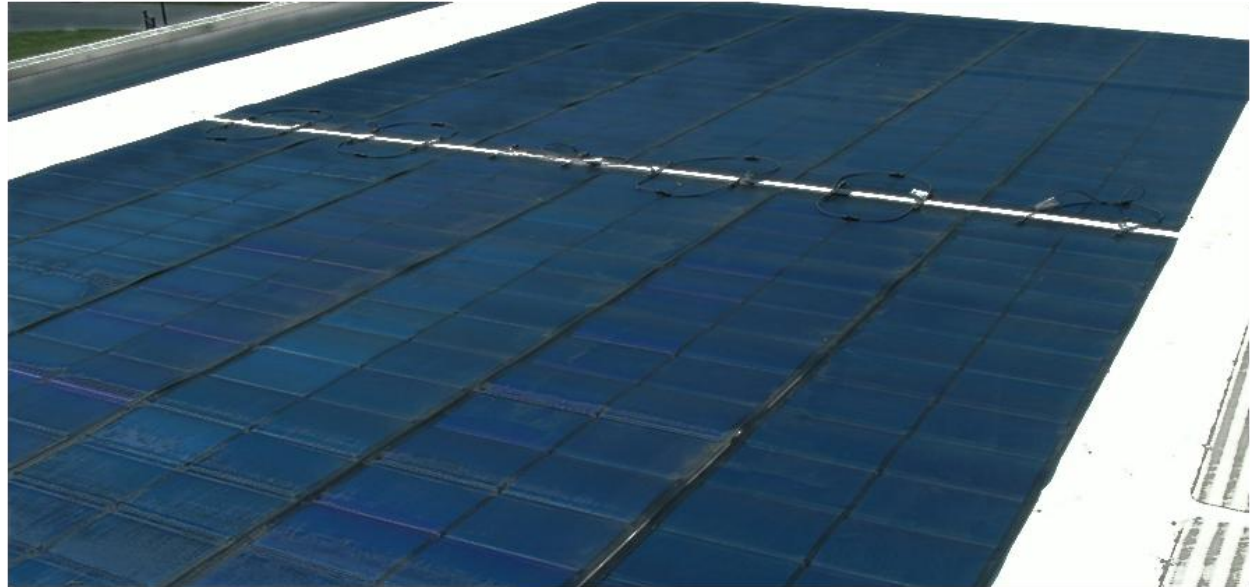


For standing seam metal roofs having structural ribs with a flat area over 16 inches (405mm) but less than 18.75 inches (476mm) the XRU series of laminates are ideally suited. For standing seam metal roofs having structural ribs with a flat area over 18.75 inches (476mm) the XRS series of laminates are recommended. The XRU and XRS laminates are adhered directly to the flat of the roof using standard roofing tapes. Below illustrates this type of installation, XRS laminates are directly adhered to a metal standing seam roof.



**EPDM or TPO Membrane Roofs**

For single ply membrane roofs using EPDM or TPO, the XR family of laminates can be directly adhered to the surface using standard roofing tapes. Below illustrates XR36 laminates installed on one such roof.



## Tilted Mounting Structure

For flat roofs that experience excessive snow coverage the tilted mounting structure is ideal. The structure offers several advantages on the not so ideal roof tops. The raised profile keeps the laminates out of the pooled water or ice caused by snow and allows snow to melt and runoff of the laminates quickly. The additional benefit is that it adds a 10° tilt angle which improves the power output of the system. XR series laminates are direct adhered to the mounting structure using common roofing tapes and the assembly can be ballasted to the roof. In the case of EPDM or TPO roofs the mounting structure can be directly adhered to the roof using standard roofing tapes with no penetrations in the roofing membrane required.



## Miscellaneous Installation and Uses

### Land Fill and Ground Cover applications

Due to the laminate's flexibility and lightweigh the XR family of laminates are ideal for direct adhering to landfill and other ground covers where rigid panels are not suitable. Illustrated below is one such installation.



### Tilted Ground Mounting

The tilted mounting structure is also well suited for ground mounting as well as a roof mounted systems. The system can be anchored to the ground using many common ground anchoring methods or be ballasted. Due to the fact that a foundation is not required for mounting the laminates, sections or the entire solar array can be moved if required in the future. Below is an illustration showing an array mounted on grassy soil, though another popular application is an unused parking lots.



## Facade mounting

The XR family of laminates can be mounted on the facade of buildings or other structures. In the picture below, Xunlight laminates are facade mounted on the world's first totally solar powered sign in Times Square.



## Unique applications

If you have a unique application, please contact Xunlight via [www.Xunlight.com](http://www.Xunlight.com) or call 419-469-8622. Our experienced applications group can go to work for you and provide a solution for your solar power needs.