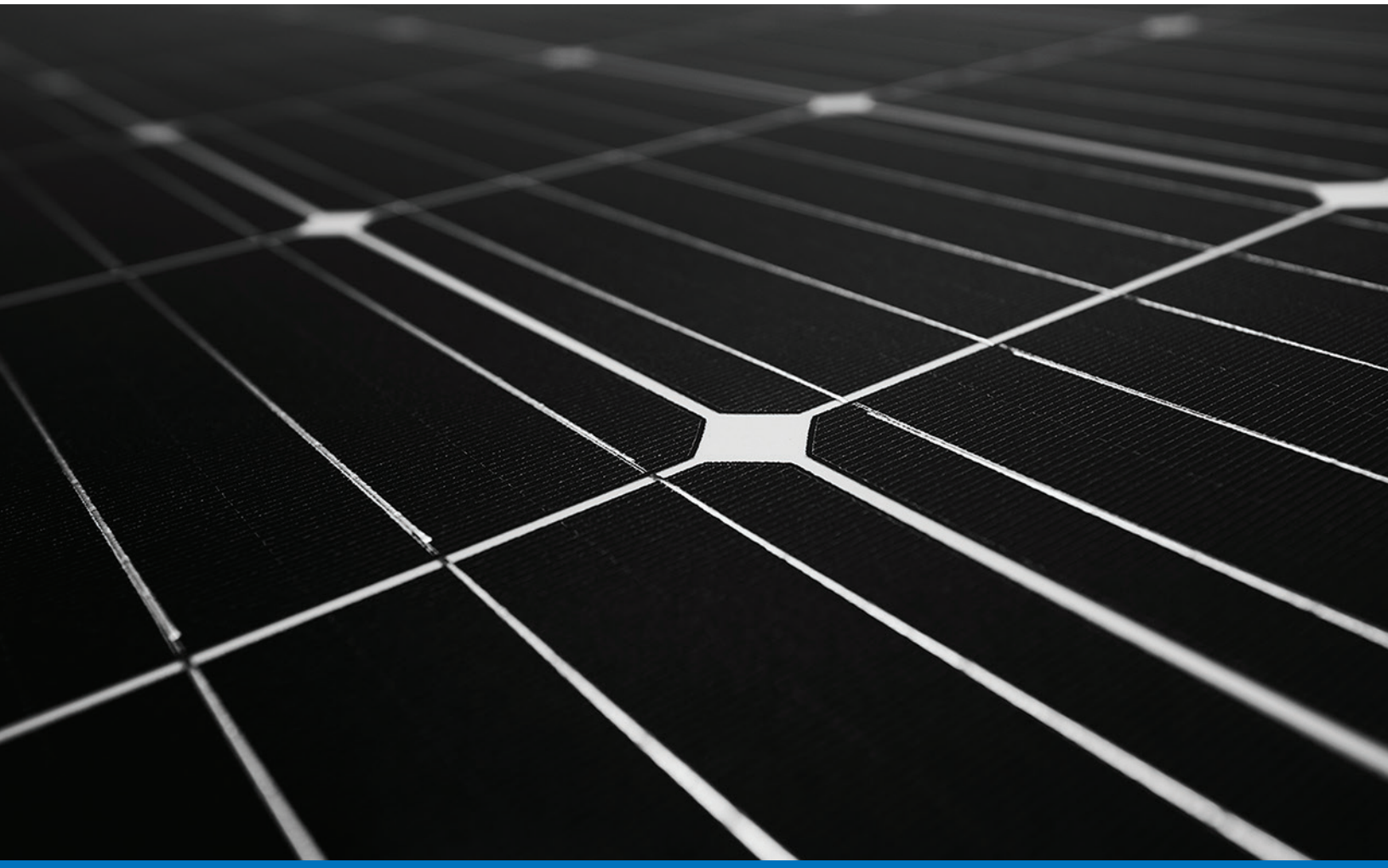
SILFAB SOLAR®



SILFAB SOLAR INC.
SAFETY & INSTALLATION MANUAL

PHOTOVOLTAIC MODULES
SIL N SERIES, SIL M SERIES, SIL B SERIES, and SIL H SERIES

Document Number: MAN-SFO-16 | SAFETY AND INSTALLATION MANUAL FOR PHOTOVOLTAIC MODULES

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1. SAFETY NOTICE

This Safety and Installation Manual provides important safety information relating to the installation, maintenance and handling of Silfab SIL series modules modules. Professional installers, operation & maintenance technicians, and system users/owners should read this manual carefully and strictly follow the instructions. Failure to follow these instructions may result in death, injury or property damage, and possible void of warranty.

Please keep this manual for future reference.

We recommend checking www.silfabsolar.com regularly for the most updated version.

Warning: All instructions should be read and understood before attempting to install, wire, operate and/or maintain the module. Module interconnects pass direct current (DC) when exposed to sunlight or other light sources. Contact with electrically active parts of the module, such as terminals, can result in injury or death, whether the module is connected or disconnected.

Avertissement: Toutes les instructions devront être lues et comprises avant de procéder à l'installation, le câblage, l'exploitation et/ou l'entretien des panneau solaire. Les interconnexions des panneau solaire conduisent du courant continu (CC) lorsque le panneau est exposé à la lumière du soleil ou à d'autres sources lumineuses. Tout contact avec des éléments sous tension du panneau tels que ses bornes de sortie peut entraîner des blessures ou la mort, que le panneau soit connecté ou non.

2. INSTALLATION MANUAL DISCLAIMER

The information contained in this manual is subject to change by Silfab Solar Inc. without prior notice. Silfab Solar Inc. gives no guarantee of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein. This Manual (or document) is written in English with Spanish (or other language) translation for reference only. In case there are inconsistencies or conflicts between the English version and the Spanish version (or other language version) of this Manual (or document), the English version shall overcome and take control in all respects.

3. GENERAL INFORMATION

Silfab Solar modules convert the energy of light directly into continuous/direct current (DC) by the photovoltaic effect.

SIL series consisted of different modules in the sense of cell number, contact technology, and module size. SIL-XXX NL, SIL-XXX ML, SIL-XXX BL, and SIL-XXX HL are 1700 x 1000 mm modules. SIL-XXX NT and SIL-XXX MT are 1992 x 994 mm modules. SIL-XXX NU, SIL-XXX HU, and SIL-XXX OP are 2026 x 1006 mm modules. XXX indicates the power output in terms of watts.

3.1 Model Naming Overview:

SIL-XXX M(X)/N(X)/B(X)/X(X)/H(X) Where:
SIL – Silfab brand
XXX - indicates the power bin in watts
M/N/B/X/H is used to indicate technology, e.g. M = mono M2. N = mono M3. B = back-contact. X = bifacial. H = mono half-cell. (X) to indicate size. L=1700x1000mm, A=1650x990mm, T=1992x994mm, G=1970 x 990mm, U=2026x1006mm.

3.2 Electrical Specifications

The performance and all photovoltaic parameters of the modules are measured under two different conditions: (1) Standard Test Conditions (STC) and (2) Normal Operating Cell Temperature (NOCT). Detailed electrical characteristics for all PV modules are presented in our products' DATASHEET and www.silfabsolar.com.

3.3 Disclaimer of Liability

Since the methods of system design, installation techniques, handling and use of this product are beyond company control; Silfab Solar Inc. does not assume responsibility and expressly disclaims liability, for loss, damage or expense resulting from improper installation, handling or use.

4. PRODUCT CERTIFICATION

All Silfab products have certified by UL 1703 and ULC ORD C1703 for PV Modules. A list of products including SIL-XXX NL, SIL-XXX BL, SIL-XXX HL, SIL-XXX NT, SIL-XXX HU and SIL-XXX NU have UL 61215-1/-1-1/-2, UL 61730-1/-2 certifications.

These UL and IEC to be freestanding. To satisfy the listing for this product the modules must be mounted with a rack or standoff structure. The UL and IEC listing does not include integration into a building surface because additional requirements may apply. The module is considered to be in compliance with UL 1703 and/or IEC 61215/61730 only when the module is mounted in the manner specified by the mounting instructions contained in this document.

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5. LIMITED WARRANTY

Please refer to Silfab General Terms and Conditions of Sale for details of the modules' limited warranty. Failure to comply with this Safety and Installation Manual would void Silfab Warranty for the PV modules as stated in the General Terms and Conditions of Sale.

6. MODULE SPECIFICATION

Please refer to the appropriate datasheets for electrical performance data and mechanical installation information.

7. SAFETY PRECAUTIONS

Installation should be performed only by authorized personnel.

All installations must comply with the applicable geographic electrical standards. I.e. International, National, Regional and local electrical standards etc.

Within the modules there are no user serviceable parts. Do not attempt to repair any part of the modules. Do not use or install broken modules

In order to reduce the risk of electric shock, prior to installing the modules, remove metallic jewelry and use insulated tools during installation.

Modules produce voltage even when not connected to an electrical circuit or load and have no on/off switch. Modules can be rendered inoperative only by removing them from sunlight, or by fully covering their front surface with cloth, cardboard, or other completely opaque non-marking material, or by working with them face down on a smooth, flat surface.

• Do not expose the modules to artificially concentrated sunlight.

• Do not stand on, drop, scratch, or allow objects to fall on the modules.

• Do not lift the modules by the junction box or junction box cables.

• Do not install or handle the modules when they are wet or during periods of high winds. Modules in Silfab packaging should not be kept outdoors for a period exceeding 60 days.

• Ensure that junction box cables are provided with strain relief to avoid damage to the junction box, maintaining a minimum bending radius of 50 mm at all locations along the cable.

• Do not leave cable connectors exposed in adverse climatic conditions. Water and dust deposits inside the cable connectors can cause long term damage.

A module with broken glass, torn or cut backsheet, damaged junction box, connectors or cables present electrical safety hazards and must be removed from service.

The total voltage of modules connected in series corresponds to the sum of the voltages of the single modules; whereas connecting the modules in parallel results in adding up the currents. Consequently, strings of inter-connected modules can produce high voltages and high currents and constitute an increased risk of electric shock and may cause injury or death.

For installation, maintenance, or before making any electrical connection or disconnection, ensure all modules in the PV array are exposed to a light intensity that is less than 400W/m^2 as measured by an accurate solarmeter/ pyranometer.

Methods to reduce solar irradiance when making electrical connections or disconnections include:

• Covering the modules with an opaque cloth or other material in order to shield them from exposure.

• Making the connections during hours of low intensity of solar irradiance (such as early morning or late afternoon).

8. INSTALLATION

8.1 Module Mounting Overview

The fire rating of Silfab modules is valid only when mounted in the manner specified in the mechanical mounting instructions.

When installing Silfab modules, local building code requirements and regulations must be adhered to at all times. In case of roof mounting, the appropriate system fire class rating of PV module with Mounting system in combination with roof covering and slope applications should be considered. Silfab modules are fire rating Type 1 or Type 2 in accordance with UL 1703 standard. For more information about the specific product, please check DATASHEET or www.silfabsolar.com.

Sufficient ventilation of the module backside is required to maintain the Type 1 or 2 fire rating, and therefore the mounting configuration (e.g. sufficient clearance) should be adapted accordingly. The recommended clearance distance is a minimum 10 cm (3 15/16").

To maximize the rate of energy conversion, modules have to be installed in the best orientation and tilt according to your

region. To prevent solar module hot spots and/or reduction in power, find a location that has the lowest shading.

Avoid low tilt angles to prevent the accumulation of dirt/debris along the module edge.

Modules must be spaced a minimum 10 mm (3/8") a part on all sides to provide space for thermal expansion and to provide ventilation.

Do not drill any additional holes into the module frames and do not cover the drainage holes.

Do not mount Silfab modules in a position where the junction boxes are "upside down" (leads facing upwards).

8.2 Module Mounting Method using mounting holes

Each module must be securely fastened at a minimum of 4 points.

Only use the 4 pre-drilled mounting holes (slots, see Figures 3 and 5) on the PV module frame to bolt the module with M6 (1/4") stainless steel screws and nuts to the mounting framework.

The distance of the mounting holes has been designed in order to result in a uniform wind and snow load without damaging the module.

⊘ Do not drill additional holes in the module frame; doing so will void the Warranty.

8.3 Mounting using clamping method

Silfab recommends the use of clamps with a design as shown in Fig. 4a (or equivalent). The use of improper clamps will void the Warranty.

• These modules can be installed in either Portrait (vertical) or Landscape (horizontal) configuration. Refer to Fig. 4 b, c, and d for an example of attaching the modules to a support structure using mounting clamps. Use stainless steel hardware.

• These modules can be mounted on continuous base structures (inclined or horizontal) such as rails or similar.

• Both base structures must be mounted at the same distance from the symmetrical axis (portrait or landscape) of the module (Fig. 5).

• Placing the supporting elements as per Fig. 5 is necessary in order to maintain a correct load distribution and achieve the design and test load rating based on the UL1703.

• When clamping the modules on a support structure, the following rules have to be applied in order to maintain the resistance against static loads as certified:

If the bars or rails run parallel to the module's short frame edge, they must be placed nearby the mounting holes in order to achieve a design load of 75 lb/ft^2 (3600Pa) downward applied force or a test load of 113 lb/ft^2 (5400Pa) downward applied force per UL 1703 for all Silfab products. For upward applied loads, as long as the same mounting zones are utilized, a maximum certified design load of 56 lb/ft^2 (2667Pa) and maximum test load of 84 lb/ft^2 (4000Pa) is allowable. This load rating only applies to the following Silfab product lines: (SIL-XXX ML/NL/BL/HL/XA/NX).

With regards to Silfab's larger product family (e.g. SIL-XXX NT/MT/NU/HU), the maximum allowable upward applied design load is 33 lb/ft^2 (1600Pa) which corresponds to a test load of 50 lb/ft^2 (2400Pa) per UL 1703 requirements. Please refer to Fig. 5a-d for the mounting zone tolerances highlighted in blue.

If the bars or rails run parallel to the module's long frame edge, they have to be placed within the spacing of 500-750 mm (19 11/16 – 29 1/2") in order to achieve the UL1703 design load rating (upward or downward) of 33 lb/ft^2 (1600 Pa) or a test load rating of 50 lb/ft^2 (2400 Pa) for the product lines based on 60-cell format: SIL-XXX ML/NL/BL/XA/HL. Please see the orange mounting zone sections in Fig. 5a.

Silfab recommends the use of CAMO clamp with a design as shown in Fig. 4 e. The following conditions have to be applied in order to receive coverage under Silfab's Warranty:

• CAMO clamp is allowable only The following Silfab product lines: (SIL-XXX ML/NL/BL/XA/HL/NX).

• If bars or rails run parallel to the module's short frame edge, they must be placed outside of the mounting holes (±15 mm of the mounting hole's edge). Supporting bars or rails must be placed within the spacing of 900mm (±25) for SIL-XXX ML/NL/BL/HL modules, 1000mm(±25) for 1035 (±25) for SIL-XXX NX modules.

• When utilizing the above mounting rules, a maximum downward design load of 75 lb/ft^2 (3600Pa) or a test load of 113 lb/ft^2 (5400Pa) is certified. For upward applied loads, a maximum certified design load of 33 lb/ft2 (1600Pa) or maximum test load of 50 lb/ft^2 (2400Pa) is allowable, per UL 1703 requirements.

• If the bars or rails run parallel to the module's long frame edge, they must be placed within the spacing of 550 - 650 mm and centered, for the product lines based

on a 66-cell format: SIL-XXX NX. Please see the orange mounting zone sections in Fig. 5d.

• When utilizing the above mounting rules, a maximum downward design load of 33 lb/ft^2 (1600 Pa) or a test load of 50 lb/ft^2 (2400 Pa) is certified. For upward applied loads, a maximum certified design load of 31 lb/ft^2 (1470 Pa) or maximum test load of 46 lb/ft^2 (2200 Pa) is allowable, per UL 1703 requirements.

RECOMMENDED

A photovoltaic system composed of Silfab modules mounted on a UL2703 certified mounting system should be evaluated in combination with roof coverings in accordance with UL 1703 standard meet the requirements to achieve the specified System Fire Type designation for a non-BIPIV module or panel.

For instance, if a listed mounting system with Class A System rating is installed with type 1 modules, the photovoltaic system is suitable to maintain the System Class A Fire Rating.

Any mounting system limitations on inclination or accessories required to maintain a specified System Fire Class Rating should be clearly specified in the installation instruction and UL2703 certification of the mounting system supplier.

Recommended clearance distance of 115mm (4.5inch) (recommended) between module frame and the surface of the wall or roof. Other mounting techniques may affect the UL Listing or the fire class ratings.

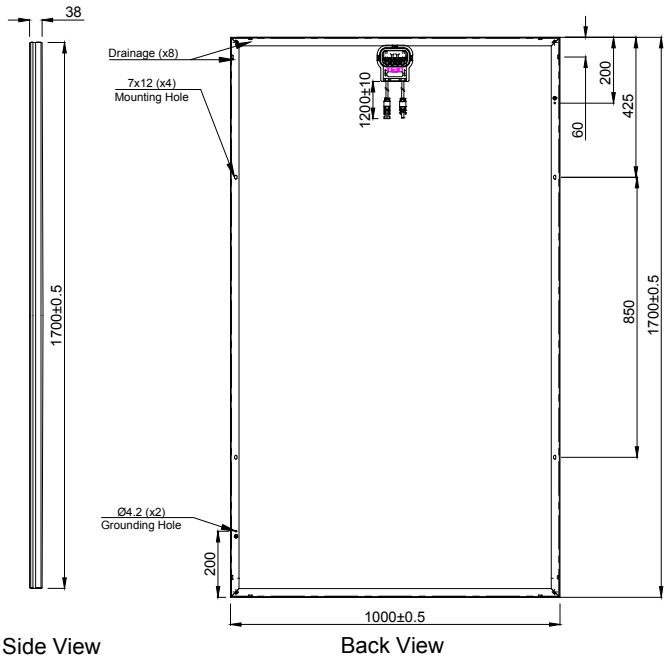


Fig. 3a: Mechanical drawing of the SIL NL, SIL ML, and SIL HL modules showing the mounting holes, the drainage holes, and the ground connection holes.

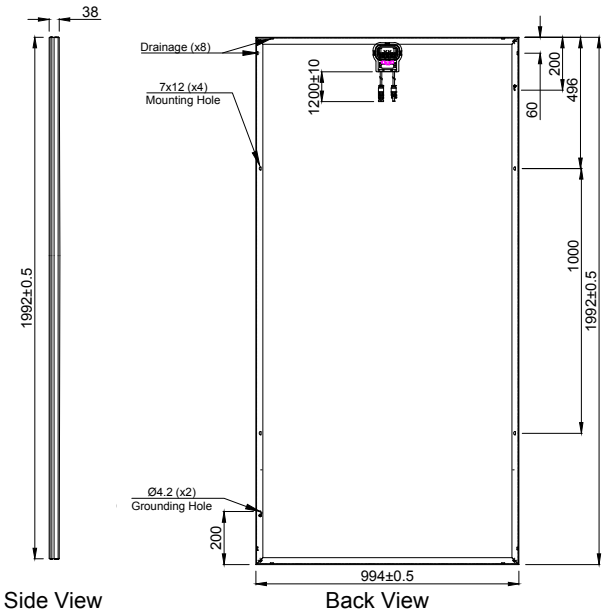


Fig. 3b: Mechanical drawing of the SIL NT and SIL MT modules showing the mounting holes, the drainage holes, and the ground connection holes.

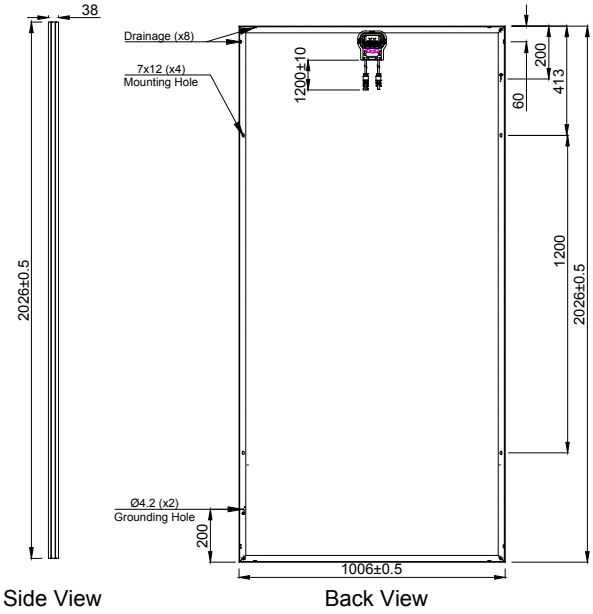


Fig. 3c: Mechanical drawing of the SIL NU and SIL HU modules showing the mounting holes, the drainage holes, and the ground connection holes.

Fig. 3d: Mechanical drawing of the SIL NX module showing the mounting holes, the drainage holes, and the ground connection holes.

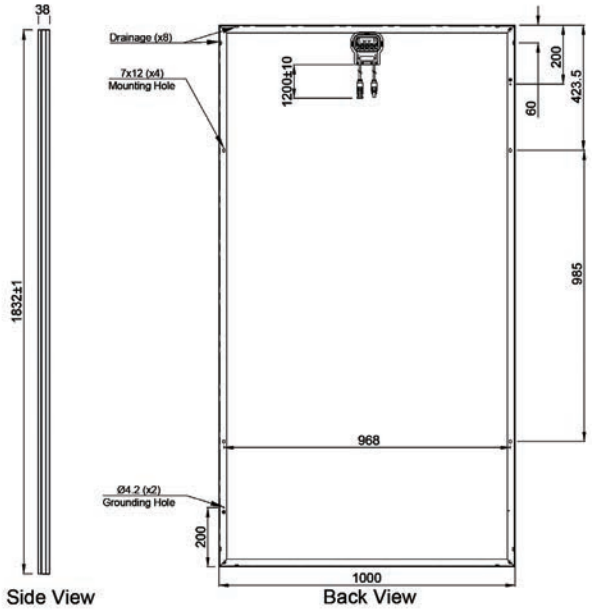


Fig. 4a: cross section of a mounting clamp to be used for attaching the modules to support structure (minimum length is 40 mm).

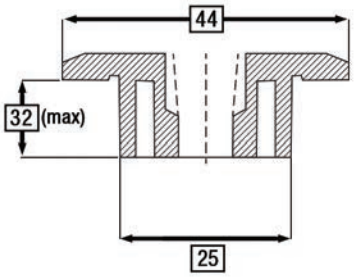


Fig. 4b: modules attached to supporting structure (rail, item 01) using a clamp (item 02) fixed with a bolt (item 03) and nut (item 04) – view between two modules.

1 Rail 2 Clamp 3 Bolt 4 Nut

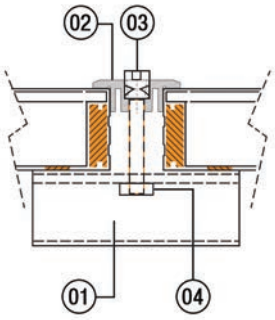


Fig. 4c: modules attached to supporting structure – side view

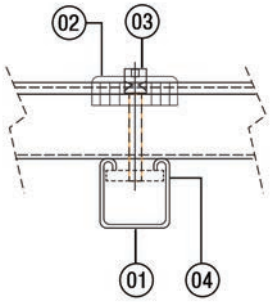


Fig. 4d: end of module row with additional spacer (item 05: 50mm x 30mm x 24mm)

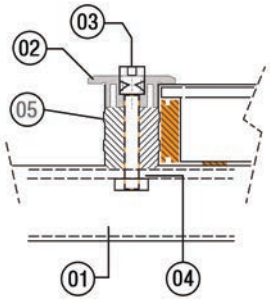
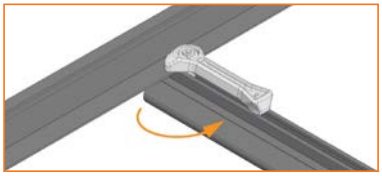
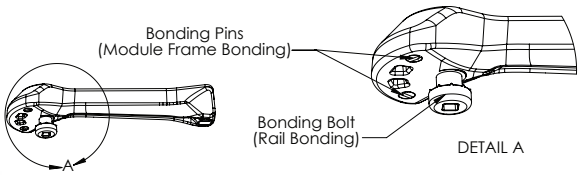
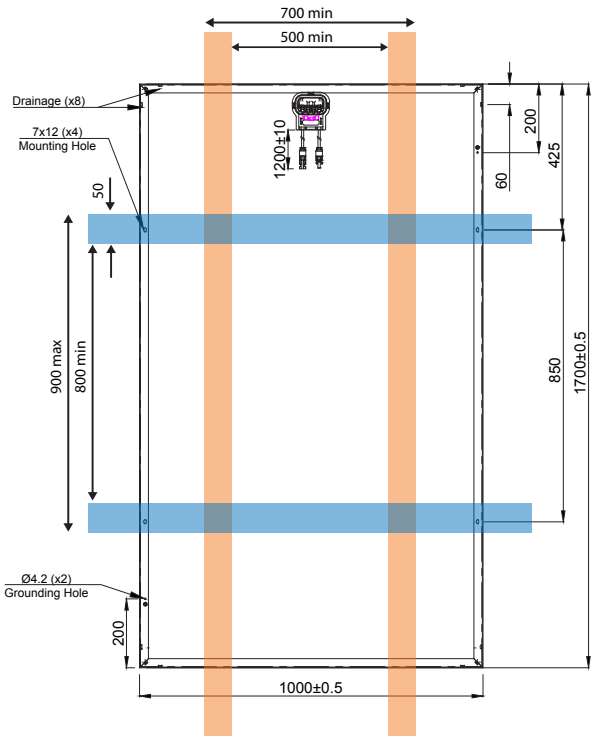


Fig. 4e: CAMO hidden end clamp. Clamp slide into rail channel and the bonding pins contacts the module flange edge.







Vertical Mounting Zone

Horizontal Mounting Zone

ATTENTION:

In the case of installation with modules in the portrait configuration, install the modules with the junction boxes at the top in their "upright" position. This will reduce the risk of moisture ingress into the junction box.

Fig. 5a: allowed positions for fixing SIL-XXX ML/NL/BL/HL modules using mounting clamps. Mounting must stay WITHIN the coloured areas.

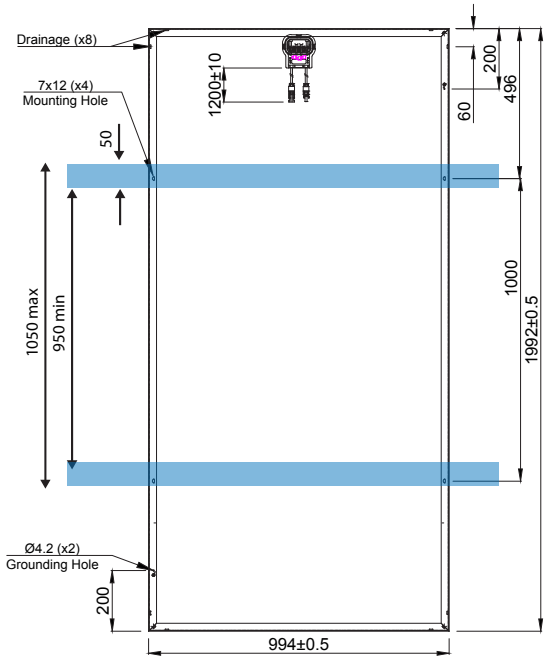


Fig. 5b: Allowed positions for fixing SIL NT and SIL MT module using mounting clamps. Mounting must stay WITHIN the coloured areas.

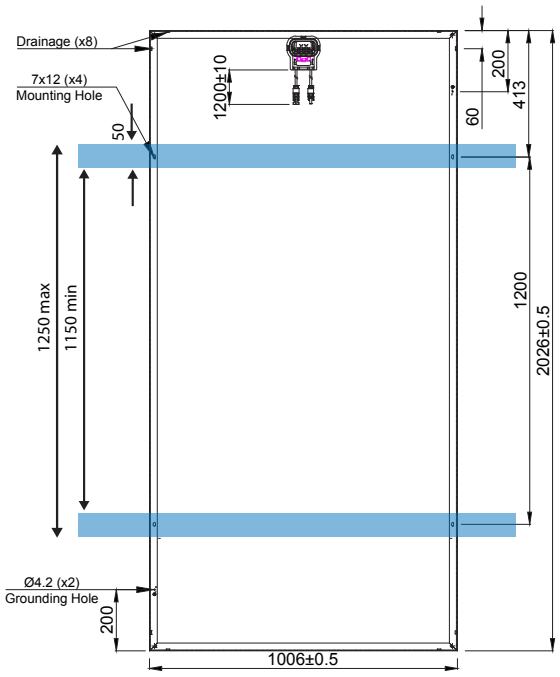


Fig. 5c: Allowed positions for fixing SIL NU, SIL HU, and SIL OP module using mounting clamps. Mounting must stay WITHIN the coloured areas.

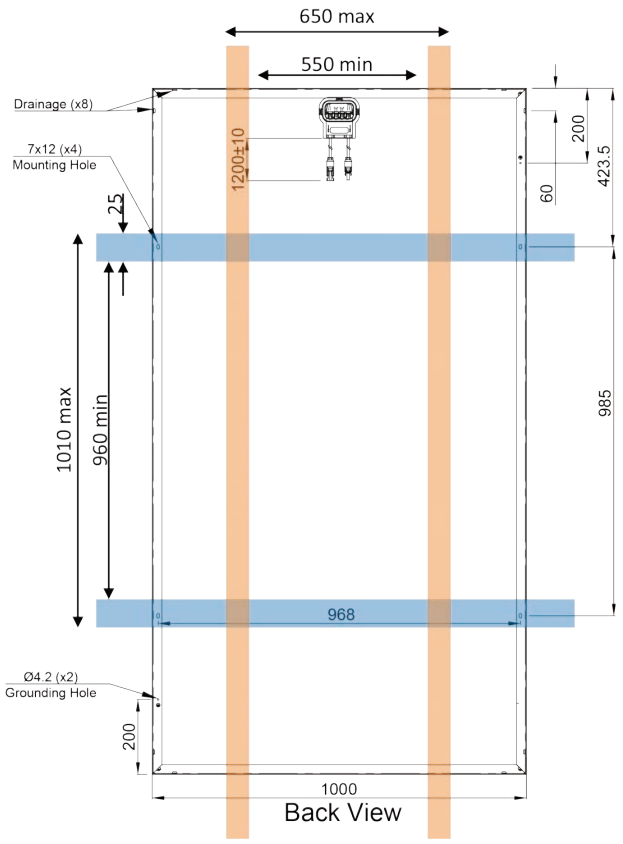


Fig. 5d: Allowed positions for fixing SIL NX module using mounting clamps. Mounting must stay WITHIN the coloured areas.

9. HANDLING OF MODULES

The Silfab modules are robust, but cells may be subject to damage if the modules are improperly handled or installed.

Wear protective gloves when handling and installing the modules to protect against cuts and burns.

Handle the module in a way that avoids breakage or scratching of the glass or backsheet and mechanical damage to any other part of the module.

Do not carry the module by its cables. Electric shock or damage to the module may result.

Do not drop sharp or heavy objects on either surfaces of the module.

Do not subject the modules to any impact, and do not flex them mechanically.

In the event of any damage to either the front or the back of the module, dangerous electrical hazards may exist, especially if the module is connected in series to a string. Replace the module immediately and take extreme caution when handling.

Do not step or stand on the PV Module.

9.1 Electrical Connection

Do not connect or disconnect modules under load! Danger! Risk of serious injury or death from electric shock or electric arc flash!

Only connect modules with the same rated current in series and modules with the same rated voltage in parallel.

High hazardous voltage (several hundreds of volts) may occur during installation. Consequently, installation and maintenance of the modules, as well as the connection to the main power supply, may only be performed by authorized and qualified persons.

Under normal conditions, a PV module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on the module should be multiplied by an appropriate safety factor to be determined by the design engineer based on local electrical code requirements. As a worst case, use a safety factor of 1.25 for voltage and cable ampacities and a safety factor of 1.56 for fuse sizing.

For SIL-XXX ML/NL/BL/HL and SIL-XXX NT/MT, SIL-XXX NX the maximum system voltage rating is 1000V for TUV/IEC and 1000V for UL. For SIL-XXX NU, SIL-XXX HU, and SIL-XXX OP, the maximum system voltage rating is 1500V.

The maximum series fuse rating is 20A.

The bypass diodes are not over-current protection devices. In the event of known or suspected diode failure, installers or maintenance providers should contact Silfab. Never attempt to open the junction box!

To obtain the desired system voltage, modules are wired in series connection. The recommended maximum series configuration must NOT exceed the certified maximum system voltage stated in the module spec sheets calculated in the worst case Voc conditions to be determined by the engineer of record (EOR).

*Refer to the appropriate local geographic electrical codes and regulations for the correct Voc correction factor according to the respective temperatures. If this information is not available, a 1.25 multiplying factor can be used as default value for correction of Voc.

For connection of the modules use only appropriate cables with a minimum conduct cross-section of 4 mm^2 that is compliant to the relevant jurisdiction code.

Verify the junction box lid is firmly closed before installing the module.

Do not repair or reconnect junction box cable. It may occur spark or electric shock.

Do not bend junction box cable. Under stress, it can damage the module. Cable bending radius should be at least more than 4 times the cable diameter.

Before connection of the system to the grid, the PV system must be approved for correct installation, by all appropriate authorities.

Lightning protection is recommended for PV systems that are to be installed in locations with high probability of lightning strikes.

⚠ The design of the PV system should be done by a qualified person familiar with PV system design. Silfab does not assume any responsibility for how the modules are installed or how the system is designed.

For all solar systems, the connectors MUST be UL rated for interminability and fully inter-matable with Silfab modules' connectors. Otherwise, Silfab will void the warranty and will not be responsible for any resulting safety issue.

⚠ Silfab solar modules are equipped with factory-assembled Junction box with 12AWG/4mm^2 cables, and insulated for 90°C maximum, with either GZX PV-GZX0601-1-F, PV-GZX0601-1-M or MC4 connectors. Any attempt to repair/modify the junction box, cable, or connector will void the Silfab Solar warranty.

9.2 Functioning Grounding

For installations located in tropical regions (between 23.5o N and 23.5o S), functional grounding at the negative pole of the DC side of the system must be implemented.

- Ensure the difference in potential between the negative pole of the DC array and the negative end of the DC side of the inverter input terminals is 0V.
- Follow the directions of the inverter manufacturer and prevailing local regulations.
- Only use inverters which include licensed grounding kits.
- Functional grounding is required to be implemented in installation sites with increased salt content in the air. (e.g. close the sea, defined as less than 500m from a coastline).

9.3 Protective Grounding

In order to prevent electrical shock or fire, the frame of the module as well as any non-current carrying metal parts of the system must be electrically grounded. While this section provides some information about grounding Silfab's frames and modules, reference should be made to local statutes and regulations for specific requirements on grounding. As an additional resource, reference the U.S. National Electrical Code addresses equipment grounding/bonding requirements in Article 250. You may also reference Canadian Electrical Code requirements located in CSA C22.1.

Proper grounding is achieved by bonding all exposed non-current carrying conductive parts to the appropriately sized equipment grounding conductor (EGC) or racking/rail system that has been tested and verified to be used as a means of integrated grounding.

Silfab's frames are protected from corrosion via an anodized coating. This coating must be penetrated in order to ensure proper bonding for equipment grounding requirements. The different methods outlined below are suggested methods to establish an appropriate bond between the frame and the EGC or racking system. The installer must ensure that the ground path of the EGC or racking system follows proper grounding requirements.

Option A: Use of a grounding lug

A UL listed grounding lug can be bonded to the grounding hole located on the bottom flange of Silfab's module frame. The holes are marked with an electrical ground symbol.

To install the grounding lug, follow the specified instructions of the manufacturer. The grounding lug should be made of stainless steel or tin plated metals such as aluminum to avoid corrosion. The grounding lug should be attached to the frame grounding hole using stainless steel hardware (screw, toothed lock washer or KEPS nut). A lock washer or other locking mechanism is required to maintain tension between the bolt and assembly; Silfab recommends a torque value of 25inch-lbs. The conductor must be attached to the ground lug using the lug's set screw. Refer to NEC Article 690. Care should be taken to avoid the use of grounding hardware of dissimilar metals which may lead to corrosion. Ensure that the grounding area for the connection is clean and free from oxides and/or any debris that could impede the pathway for the electrical ground. Always follow safety procedures when installing any grounding/mounting system.

Option B: Integrated grounding methods

A Silfab module can be bonded with a racking/rail system using a UL1703 or UL2703 certified integrated grounding method. The racking/rail system will then have to be electrically grounded in such a way that the overall system is properly grounded per local requirements and regulations such as what is defined in NEC article 250 or Canadian CSA C22.1.

One example of an integrated grounding method is the use of a washer recognized as meeting UL2703 requirements between the module and the racking/

rail system, and is listed on UL's product database. An example of a UL2703 recognized integrated grounding method is a WEEB washer which Silfab has found to be generally compatible with Silfab modules, however each combination of module/racking system requires a specific WEEB washer size. It is the responsibility of the installer to ensure that that the specific size requirement has been met and is used appropriately per the manufacturer's installation manual. Note, WEEB washers are intended for single-use only; they must not be reused after removal or loosening. Refer to Wiley's installation instructions for the specific use of WEEB washers.

Other grounding methods may be used in conjunction with a module mounting system tested to UL2703. For these installations, the Silfab module and frame style must be tested and part of the instructions for the listed mounting product. The Silfab module must be installed in accordance with these instructions as well as the mounting system's listed instructions.

As a final reminder, both Option A and Option B must be grounded as per NEC Article 250 or CSA C22.1, whichever may apply to your local jurisdictional and code requirements.

9.4 Silfab Module Installation in Marine Applications

This section provides guidance of safe handling and installation of Silfab PV modules less than 500 meters to any salt water coastal waterway regarded as "near-coastal". Improper care and negligence to properly protect PV system as recommended may potentially induce salt-mist corrosion and accelerate electrical insulation losses and galvanic corrosion. Silfab reserves the right to review any potential warranty claims in "near-coastal" environments against a customer's strict adherence to the best practices and recommendations provided in this section. Any non-conformances found will potentially disqualify the product from being covered under Silfab's Limited Product and Linear Performance Warranty. For further inquiries please contact Silfab's Customer Service.

Mechanical Installation

• Do not scratch or break the corrosion-resistant coating (e.g. anodization layer) on PV Modules and mounting system, unless it is part of the electrical equipment grounding system (grounding lugs, integrated grounding hardware compliant to UL2703).

• Use corrosion-resistant material (e.g. stainless steel SUS 316) for components (e.g. nuts, bolts, gaskets, etc.) to install your PV system.

• For safe mounting installation, use insulation gaskets between mounting hardware attached to the PV module frame between PV module frame and rail, unless the mounting hardware is part of the electrical equipment grounding system using integrated mounting/grounding hardware that is compliant with UL2703.

• Recommendation for gasket insulation are mica lamination, or silicone, or fluoride made insulating material.

Grounding

• Silfab recommends to protect any exposed grounding points (such as a grounding block) of the PV system with a corrosion-resistant coating, for example (a) Butyl Plaster to completely cover an exposed grounding block or (b) spray fluorocarbon varnish of 40 um thick onto exposed ground blocks thoroughly to form an anti-corrosion protective film.

Remember to clean the exposed grounding block and surrounding area and make sure the surface is dry. Any exposed components must be fully covered from exposure to salt.

To ensure optimum module performance, Silfab recommends maintenance service every three months with the following measures:

• Check the module frame, mounting system, grounding block and junction areas for potential signs of corrosion.

• Clean the module frame, mounting system, grounding block and junction areas from accumulation of dust and/or salt with soft foam materials, non-woven fabrics, whisks, soft sponges, soft brushes and hair brushes may be used.

• Upon possible finding of corrosion due to salt, re-apply Butyl Plaster or fluorocarbon varnish to cover rusty area thoroughly.

Important note: Disclaimer of liability

Silfab PV Modules have successfully passed IEC 61701:2011 – Level 5 Salt Mist Corrosion Test. However, full protection against salt exposure is largely dependent on multiple components of the PV system beyond Silfab's control. As such, Silfab can strongly recommends to adhere to the installation procedure. If negligence is found, Silfab cannot hold responsibility and disclaim liability for any loss, damage, or expense arising out from "near-coastal" installation.

10. MAINTENANCE

Cleaning method of ARC-Glass of Silfab PV Module

Silfab uses anti-reflective coated glasses for maximum performance. It is recommended to regularly clean the modules to ensure maximum power output.

Module cleaning should be done in the early morning, in the evening, at night or on rainy days when solar irradiance is low.

Detailed description:

• Do not touch the glass with bare fingers or hands. Wear clean gloves to prevent fingerprints and other dirt from staying on the glass.

• Do not use metal tools, such as blades, knives, steel wood and other abrasive materials. Cleaning the glass with hard surface will scratch the ARC-glass.

• Do not use high pressure washers, abrasive brushes, powders, cleaners, polishers, sodium hydroxide, benzene, nitro-thinners, acid or alkali and other chemical substances. Doing so may damage the anti-reflective coating that is present on the glass of the modules and void warranty.

• All types of commercial glass cleaners, or alcohol/ethanol/methanol can be used.

ROUTINE STEPS OF CLEANING:

1. Whisking: Debris such as dust and leaves on module surface should be removed with dry cloth.
2. Scraping: hard foreign matters such as dirt, bird droppings, plant branches, etc., should be scraped off with non-woven fabric or hair brush.
3. Washing: Colored substances, such as bird dropping, plant juices, etc., on module surface can be removed by cleaning by spraying water onto the dirty region and scraping with hair brush or non-woven fabric. The pressure of the cleaning water should be less than 690Kpa (100 PSI).
4. Cleaning of snow: Silfab modules can withstand heavy snow pressure up to 5400 Pascal. Do not try to remove frozen snow or ice from the module. Use a hair brush to gently remove the snow.

11. DIAGNOSTICS & TROUBLESHOOTING

The strict quality controls in Silfab Solar's manufacturing facility ensures all of our modules are sold free of significant defects, breakages and/or other problems. However, in its operation some problems may arise that can alter the correct operation of the modules.

In the event of accelerated deterioration of the module, Silfab Solar should be notified immediately to make the necessary replacement under the Silfab Limited warranty.

Please refer to the Silfab RMA Procedure for details on how to obtain repair or replacement service, credit or refund (as applicable) under the modules' limited warranty.

12. MODULE IDENTIFICATION

Each module is equipped with three identical serial numbers that acts as a unique identifier. They are located:

• inside the laminate under the front glass
• module frame
• on the pallet list

Moreover, each module has a specific label that is attached on the rear side. This label specifies the product information including type, power and electrical parameters. Product label has a QR-CODE to download more information.

13. PACKAGING, HANDLING & STORAGE

13.1 Silfab's Packaging

These modules are arranged in horizontal or vertical positions as shown in Fig. 7 and 8. Transport the module in its original packaging until installation to avoid water infiltration and do not place any heavy or sharp object on the top or sides of the pallet, as it could damage the modules.

Silfab Packaging Details

	SIL-XXX ML/NL/BL/HL	SIL-XXX NT/MT	SIL-XXX NX	SIL-XXX NU/HU/OP
Number of modules stacked	26	27	26	27
Modules Siding	Horizontal	Vertical	Horizontal	Vertical
Package size (L x W x H)	175 x 105.5 x 126	203 x 113 x 117	188 x 105.5 x 126	206.5 x 113 x 118.2
Package weight	525 kg	620 kg	570 kg	660 kg
Pallet	Wooden Pallet IPPC compliant	Wooden Pallet IPPC compliant	Wooden Pallet IPPC compliant	Wooden Pallet IPPC compliant
Packaging	Stretch Wrap Film Containment Straps	Cardboard Box Containment Straps	Stretch Wrap Film Containment Straps	Cardboard Box Containment Straps
Module protective corner angles	Plastic	Cardboard	Plastic	Cardboard

Fig. 7 Horizontal packaging of photovoltaic modules.

Fig. 8 Vertical packaging of photovoltaic modules.

Fig. 9 Protective Corner

13.2 Correct Handling of Module Packaging

Each package has been designed for safe shipment and storage of modules. The following symbols apply to the packing, with the following meanings:

AVOID EXPOSING TO RAIN OR SNOW. DO NOT LEAVE EXPOSED TO FLOODING: The plastic wrap and/or cardboard is intended to prevent temporary contact with dirt, water or other materials but will not protect the modules from damage resulting from excessive rain, snow and flooding. Modules should be stored in a sheltered dry location whenever possible. Modules are not to be stored outside for a period exceeding 60 days.

KEEP PACKAGING UPRIGHT: The packaging is only designed to be handled and stored with the modules sitting on the pallet as per Fig. 7. Not following these indicated directions may create forms of mechanical stress on the modules that could cause damage or breakage.

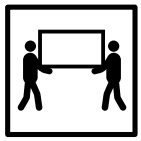
RECYCLE WHERE POSSIBLE: Both modules and packaging contain recyclable materials. Use caution when dealing with damaged modules.

FRAGILE: Any direct impact to the glass or on the corners of the modules should be avoided. Avoid flexing the laminates or applying non-distributed loads and stresses. Avoid scratching the surface of the exterior glass or backsheet. Do not apply any forces to the backsheets. Do not drop the modules or pallets from any height.

HANDLE WITH CARE: during the operation of shipping and storage of the modules use maximum care to ensure the full integrity of the modules. Hidden cell damage can result if care is not taken.

DO NOT STEP ON MODULE.

DO NOT STACK MORE THAN TWO PALLETS HIGH. (as shown if Fig.7b)



SAFETY FIRST.

13.3 How to Handle the Pallet

During the handling of the pallet make sure to pay the utmost attention. The packaging must be raised/moved exclusively with fork-lift trucks or hand pallet trucks fitted with forks of length appropriate to its size and weight. The pallet which supports the packaging is a "4 ways" type (able to be lifted from any of the short or long sides). For the safe handling of the pallet the forks length should be:

• A minimum of 1800 mm for lifting from the shorter side

• Able to support the total weight of the packaging (>1000 kg)

Fig. 10 How to handle the packaging - When using a fork-lift, please ensure the forks go all the way through pallet. The fork length should be a minimum of 1800 mm

⚠ Verify that the package is positioned on a surface that is either flat or not excessively deformed to a point that would impart an inclination to the pallets which could damage the PV modules.

⚠ Do not aggressively lift pallets as module damage may occur.

13.4 Unpacking Modules

Observe the following procedures for the unpacking of modules:

• Place the packaging on a stable and flat surface

• Using a knife carefully cut the straps and plastic wrap then remove them.

• Remove the upper cover

• Recover the flash list (for record keeping)

• Remove the PV modules and their protective corners without damaging them

• Collect and store the protective and the wooden pallets

ⓘ Note: Once you have removed the strapping the pallet must no longer be moved as the load will not be secure.

If movement of the pallet is required be sure to re-strap the pallet as per the original packaging strap locations.

13.5 Pallet Sheet

Each package has a sheet ("pallet sheet") placed in a visible position and containing some pertinent information such as: serial number of each module, part number of each module and pallet number. All Numbers are readable with a standard bar code reader. See Fig.7.

13.6 Recycling Packaging Materials

Silfab undertakes efforts to treat every aspect of production to minimize the environmental impact. The packaging is made with materials that for the most part are reusable.

In particular, the wooden pallets (Fig.11) and protective corners (Fig.12) should be retained. Arrangements for recovery will be made on a case by case basis.

Fig.11

Fig.12

Fig. 11 & 12: How to package the pallets and plastic corners, respectively, after unloading, ready to deliver back to Silfab for reuse.

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14. REVISION LOG

Revision Level	Section(s) affected	Brief description of changes	Date
MAN-SLA-01 and MAN-SLG-01	ALL	Initial release	14/11/2011
MAN-SFO-02	MULTIPLE	Consolidated SLA & SLG manuals into SFO; added safety note; added more info on shading, diode failure, grounding, load ratings, environmental considerations, cleaning, transport, handling, etc.	04/22/2013
MAN-SFO-03	MULTIPLE	Added SSA/SSG models; clarified/revised information in multiple sections. A full re-read is recommended.	02/17/2015
MAN-SFO-4	ENTIRE DOCUMENT	Removed Poly modules; Added Bifacial modules; Added Identification locators; Added Diagnostics and Troubleshooting; clarified/revised information in multiple sections. A full re-read is recommended.	05/10/2017
MAN-SFO-5	MULTIPLE	Reviewed and implemented changes each section.	17/11/2017
MAN-SFO-6	SECTION 9 - handling of module	Addition of Marine Application.	01/12/2017
MAN-SFO-7	MULTIPLE	Additional grounding instruction & connector information	26/04/2018
MAN-SFO-8	MULTIPLE	Wind load & marine coastal installation	26/04/2018
MAN-SFO-9	MULTIPLE	Wind load & marine coastal salt mist building allowance	10/04/2019
MAN-SFO-10	MULTIPLE	9.2, 9.3, 9.5, Table of Contents	11/09/2019
MAN-SFO-11	MULTIPLE	Update to nomenclature	11/11/2019
MAN-SFO-11	MULTIPLE	Update to drawing Fig. b/Update 8.3 Mounting text	10/01/2020
MAN-SFO-11	TEXT CHANGE	P. 3, 8.3	14/02/2020
MAN-SFO-11	TEXT CHANGE	Pp. 3, 4, 5, 6, 12, 13	03/04/2020
MAN-SFO-12	TEXT CHANGE	P. 13, Includes previous changes	03/25/2020
MAN-SFO-13	MULTIPLE	Pp. 3,5, Section 8.3, text revision, addition of figure 4e	04/02/2020
MAN-SFO-14	TEXT CHANGE	Page 1, Section 4	07/17/2020
MAN-SFO-15	MULTIPLE	Text/Drawing changes, addition of SIL NX specs	01/28/2021
MAN-SFO-15	MULTIPLE	Logo Change, add Burlington Address, Font Changes	05/27/2021
MAN-SFO-15	MULTIPLE	Removed SIL-XXX-BK, Change to NX Mounting Drawing	10/27/2021
MAN-SFO-15	SECTION 8.3, p3	Revision to clamping method	10/27/2021
MAN-SFO-15	BACK COVER	Address update	11/15/2021
MAN-SFO-15	COVER/BACK COVER	Logo updated to registered trademark	07/01/2022
MAN-SFO-16	MULTIPLE	Removal of XL references / Updated Addresses	01/24/2025

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