INSTALLATION MANUAL

BIPVco FLEXTRON modules

PLEASE READ THIS MANUAL CAREFULLY BEFORE INSTALLING OR USING THE MODULES. PLEASE PASS ALONG THE ATTACHED USER MANUAL TO YOUR CUSTOMER.

1.0 INTRODUCTION

The BIPVco FLEXTRON photovoltaic module is a building applied (BAPV) design. The FLEXTRON modules are intended to be adhered to approved roof elements under controlled conditions. This Installation Manual contains essential information for the electrical and mechanical installation that you must know before installing the modules. It also contains general safety information you need to be familiar with before installing any solar photovoltaic (PV) system.

1.1 General Warning

- Before you attempt to install, wire, operate and maintain a FLEXTRON module, please make sure that you completely understand the information described in this installation manual.
- PV modules produce electricity whenever exposed to sunlight or other light sources, always treat as live.
- Potentially lethal DC voltages can be generated whenever PV Modules are exposed to a light source, therefore, avoid contact with electrically active parts and be sure to isolate live circuits before attempting to make or break any connections.
- When the modules are connected in series, voltage is cumulative. When the modules are connected in parallel, current is cumulative. As a result, a large-scale PV system can produce a high voltage and current which could present an increased hazard and may cause serious injury or death.
- In case of snow build-up, snow may slide more easily on the smooth surface of the module than other parts of the roof. Snow may suddenly slide off the roof and hit nearby objects/areas. Take preventive measures (e.g. snow stopper) when there is possible risk such case would cause an injury or a damage.

1.2 General Safety

- Before installing a PV module, contact appropriate authorities to determine permit, installation and inspection requirements that should be followed. Always install PV modules in accordance with applicable rules and regulations (e.g. IEC 62548:2016)
- Roof structures containing with integrated PV modules such as FLEXTRON should only be installed by personnel approved by the roof system manufacturer. Electrical connections should only be made by electricians qualified to locally applicable codes. Only such authorised installers or service personnel should have access to the PV module installation site.
- No matter where the PV modules are installed, either roof mounted construction or any other type of structures above the ground, appropriate safety practices (e.g. scaffolding) should be followed and required safety equipment should be used in order to avoid possible safety hazards. Note that the installation of some PV modules on roofs may require the addition of fireproofing, depending on local building/fire codes.
- Do not shade portions of the PV module surface from the sunlight for a long time. A shaded cell may become hot and will cause a drop in generated power and could cause an operation failure of the PV modules.
- Turn off inverters and circuit breakers immediately, should a problem occur.
- A defective PV module may generate power even if it is removed from the system. It may be dangerous to handle the module while exposed to sunlight as high voltages may be present. Place any defective PV module in a carton so all the cells are completely shaded.
- In case of series connection, the maximum open circuit voltage must not be greater than the specified maximum system voltage.

1.3 Handling Safety

- Keep the FLEXTRON module packed in the carton until installation.
- Static may be present in the in the FLEXTRON module, e.g. after friction of the modules over the surfaces (electrostatic loading). This can discharge through the edge on the module, to avoid discomfort always handle modules with polymeric gloves (e.g. nitrile or nitrile coated knitted gloves).
- Do NOT place FLEXTRON modules directly on top of each other.
- The front surface of the FLEXTRON module is susceptible to scratching, avoid scraping with sharp edges.
- Do NOT stand or step on the PV module.
- Do NOT place or allow hard objects to fall onto FLEXTRON modules
- Do NOT cause the FLEXTRON module or twist excessively. A bending radius of less the 225mm can damage the module.
- Do NOT scratch or hit at the back sheet.

1.4 Installation Safety

- Always wear appropriate construction site safety equipment e.g. protective head gear, gloves and safety shoes.
- FLEXTRON modules can be mounted on rigid roofing elements such as raised seam steal sheets (e.g. TATA Urban). To avoid injury, due to sharp edges when handling, the roofing system manufacturer's safety instructions should be closely followed. Recommended personal protective equipment (PPE) as specified by the roofing system manufacturers installation instructions should be worn at all times.
- Do NOT touch the junction box and the end of output cables, the cable ends (connectors), with bare hands during installation or under sunlight, regardless of whether the module is connected to or disconnected from the system. If necessary cover the module with an opaque material to isolate the module from incident light and handle the wires with rubber-gloved hands to avoid electric shock.
- Do NOT install or handle modules when they are wet or during periods of high wind.
- Always use insulated tools.
- When installing PV modules at height, do not drop any object (e.g., PV module or tools).
- Make sure plug-in connectors are correctly mated.
- Do NOT unplug connectors if the system circuit is connected to a load.
- Do NOT work alone (always work as a team of two or more people).
- Wear a safety belt when working at height.
- Do NOT wear metallic jewellery which can cause electric shock during installation.
- Do NOT damage the surrounding PV modules or mounting structure when replacing a PV module.
- Cables should be located so that they will not be exposed to direct sunlight after installation to prevent degradation of cables.
- Do NOT use modules near equipment or in a location where flammable gases may be generated or collected.
- The voltage is proportional to the number of modules in series. In case of parallel connection, please be sure to take proper measures (e.g. fuse for protection of module and cable from over current, and/or blocking diode for prevention of unbalanced strings voltage) to block the reverse current flow.
- Under normal conditions, a photovoltaic 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 this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output." The module electrical rating are measured under Standard Test Conditions, which are 1000W/m^2, irradiance with AM 1.5
- Concentrated sunlight or artificial light must not be directed onto the FLEXTRON module.

1.5 Disclaimer of liability

This document does not constitute a guarantee, expressed or implied. BIPVco does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with installation, operation, use or maintenance of the PV modules. No responsibility is assumed by BIPVco for any infringement of patents or other rights of third parties that may result from use of PV module. BIPVco reserves the right to make changes to the product, specifications or installation manual without prior notice. All the information described in this manual is the intellectual property of BIPVco.

2.0 ATTACHMENT INSTRUCTIONS

The FLEXTRON module is a building applied (BAPV) design. The modules intended to be adhered to BIPVco approved* roof surfaces under controlled conditions using the SikaLastomer®-68 or SikaLastomer®-18 ethylene propylene copolymer adhesive tape. FLEXTRON modules are designed to be adhered to either primary roof elements (e.g. metal or membrane roof coverings) or a secondary roof element (i.e. a carrier fitted over the primary roof). The attachment guidelines below are provided as an outline only and are meant for bonding to approved, clean, dry and un-weathered roof elements.

*BIPVco has approved the following roof surfaces as suitable substrates for adhering FLEXTRON photovoltaic modules.

Material	Brand	Manufacturer
Steel with painted Galvalloy® polyurethane coating.	Colorcoat Prisma®	TATA Steel UK Ltd.
TPO (Thermoplastic Polyolefin)	Rubberfuse Sintofoil RG (2.0mm)	Imper Italia S.P.A.
Aluminium (PVDF)	Kalzip	Kalzip GmbH

IMPORTANT: Consult with your BIPVco local agent for prior approval before adhering FLEXTRON modules to any surface not listed above. Utilising substrates that are not on the approved list or reapplying FLEXTRON modules that were previously bonded to a roof membrane will void the warranty of the modules.

IMPORTANT: It is the responsibility of the roof specifier to ensure that the roof design is fit for purpose and complies with all relevant building codes in force in the jurisdiction where the roof is being installed. It is the responsibility of the contractor to ensure that the roof system manufacture's installation instructions are closely followed. BIPVco take no responsibility for the design or installation of the roof structure.

- The FLEXTRON module must be bonded to the roof element in a controlled factory environment using the approved attachment methods. Failure to follow the approved methods will invalidate the manufactures warranty.
- The FLEXTRON module can be installed on site under controlled conditions but only by an approved BIPVco installer.
- Metal roof elements must be flat and smooth. Do not bond PV modules directly to corrugate or R-panel metal roof systems.

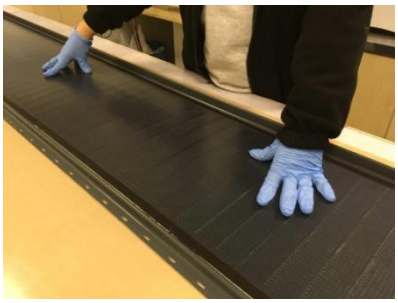
- The ambient temperature at the time of installation should be between 15°C - 35°C. If the temperature is higher than 35°C the polymer film release liner may be difficult to remove from the self-adhesive. If the temperature is lower than 15°C, the self-adhesive may not adhere properly to the roof surface.
- Roof materials and components should be stored in the manufacturer's original, unopened, undamaged packaging with identification labels intact.
- Remove any factory applied protective polymer film from metal roof elements before cleaning.
- The contractor should refer to the roof panel plan for exact PV module placement on each roof element to align the PV module correctly in relation to the ridge cap, ridge trim, middle roof seams and fasteners.
- In order to achieve the required adhesion, clean the roof element surface according to the roof system manufacturer's guidelines.

2.1 Bonding of FLEXTRON modules to an approved roof element.

- The roof element should be cleaned with Sika® Aktivator 205 (or equivalent cleaning agent) no more than 30 minutes prior to bonding of the FLEXTRON module.

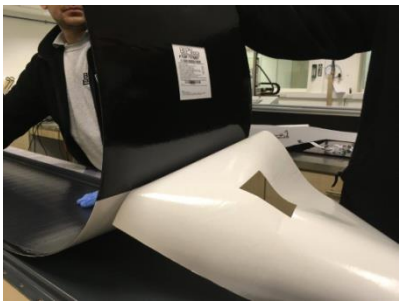
- Use a clean lint-free cloth or disposable lint free wipe for cleaning and allow to dry completely.

- Refer to the roof plan for the precise location of the FLEXTRON module on the roof element.

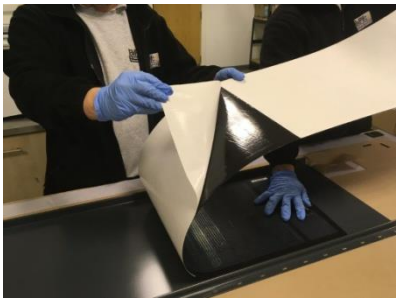


- Locate and mark the roof element for exact module placement.

- Starting from the junction box end, peel the release paper to expose the Sika® adhesive



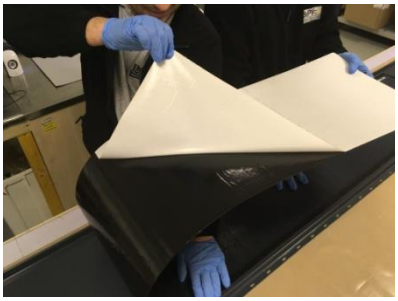
- Press the top surface of the FLEXTRON module to the roof element surface to ensure a good adhesive bond.



- Take care to maintain module's alignment.

- Note: Once more than 100-150mm of the module is bonded to the surface do not attempt to remove.

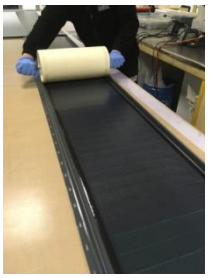
- One worker should carefully peel back the remainder of the release paper from the FLEXTRON module.



- A second worker should gently press down the exposed adhesive surface onto roof element surface taking care to maintain alignment.

- Pressure should be applied in a continuous motion across the FLEXTRON module surface width to ensure full surface contact to roof surface taking care to avoid creating voids and air bubbles under the module especially along the module perimeter.

- Once the FLEXTRON module is bonded to the metal panel roof surface, roll the module with a maximum pressure of approximately 75 kg per linear meter to ensure full contact with the roof surface, paying careful attention to module perimeter edge.



3.0 SITE SELECTION

- Do not install the FLEXTRON modules so that the building or other structure, or other systems or components, exert damaging mechanical or electrical influences on the PV modules.
- FLEXTRON modules can be mounted in landscape or portrait orientation
- Do not install where modules are likely to be shaded. FLEXTRON modules protect themselves from shade-producing hot spots that may damage other modules, but the electrical performance of any PV module can be reduced due to shading obstructions.
- Care should be taken avoid full or partial shading from sources such as rooftop equipment, structural elements of a building and nearby trees, poles, power lines or other nearby buildings to minimize the impact on the power production of the BIPVco FLEXTRON solar array.
- If FLEXTRON modules on the same installation are mounted at different angles or orientations then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPT if the inverter has more than one MPPT). Refer to the inverter manufacturer's installation instructions for further information.
- Do not install FLEXTRON modules in areas prone to water collection or where they will be continually exposed to water (e.g. under sprinklers or fountains).
- Roofs should have a minimum slope of 3 degrees for positive drainage. The roof should have verifiable positive drainage as per regional guidelines. Refer to the roof system manufacturer for additional requirements.
- PV module installation should not exceed roof system fire rating slope limitations. FLEXTRON modules can be installed on roof slopes with a maximum slope of 45 degrees to the horizontal.
- The FLEXTRON modules have a projected power production service life of +25 years. Roof systems should have a similar projected remaining service life.
- In case the PV modules are used in areas such as: heavy snow areas, extremely cold areas, strong wind areas, installations over water or areas where installations are prone to salt water damage, consult with your BIPVco local agent first to determine an appropriate installation method, or to determine whether the installation is suitable.

4.0 SITE INSTALLATION

- The contractor shall install the roof element with FLEXTRON modules attached in accordance with roof system manufacturer's written installation specifications.
- The contractor, before installing modules should contact the appropriate local authority and obtain any required building permits and to determine installation and inspection requirements that apply to the installation site. This includes any local jurisdiction requirements relative to applicable codes.
- BIPVco recommends a structural engineer should be used to determine project requirements for attachment methods based on the expected wind loads and local building codes.
- The contractor shall determine if the construction or structure (roof, facade, support, etc.) where the PV modules are being installed has enough strength for the installation.
- To maintain the fire rating of the modules do not install within 150 mm of the edge of the roof.
- The fire rating of the FLEXTRON modules is valid only when mounted in the manner specified in the mounting instructions.
- When installed on a roof where local code requirements dictate a minimum fire rating, the roof shall meet the minimum requirements before installation of the PV module to ensure the safety of the building envelope.

5.0 ELECTRICAL INSTALATION INSTRUCTIONS

5.1 Module identification

BIPVco modules are identified by the following numbering system. E.g. the module below is a FLEXTRON module with a black backsheet, rear mounted junction box and a power of 115 W

Type	Width	Length	J Box		Power			Colour	Version
Flextron **M**etektron **P**owerPly	Number of cells wide: **1** - **3**	Meters approx. **1**, **3** or **5**	**F**ront **R**ear		110 - 260W; 5W increments 260 - 380W; 10W increments			Solid colours **B**lack **W**hite	Version number
F	**1**	**3**	**R**	**-**	**1**	**1**	**5**	**B**	**1**

5.2 Electrical Characteristics

The modules covered by this installation manual are listed below:

56 Cell FLEXTRON modules with front or rear mounted junction boxes:						
		F13F - 110 xx **F13R - 110 xx**	**F13F - 115 xx** **F13R - 115 xx**	**F13F - 120 xx** **F13R - 120 xx**	**F13F - 125 xx** **F13R - 125 xx**	**F13F - 130 xx** **F13R - 130 xx**
Nominal Power (± 3%)	Pmpp (W)	110	115	120	125	130
Open circuit Voltage	Voc (V)	37.8	38.1	38.7	39.3	39.4
Maximum Power Voltage	Vmpp (V)	30.4	31.0	31.5	32.0	32.6
Short Circuit Current	Isc (A)	4.10	4.10	4.10	4.10	4.10
Maximum Power Current	Impp (A)	3.61	3.71	3.81	3.91	3.99
Maximum system voltage	(V)	1000				
Maximum Series Fuse Rating	(A)	10				

112 Cell FLEXTRON modules with front or rear mounted junction boxes:						
		F15F - 220 xx **F15R -220 xx**	**F15F -230 xx** **F15R -230 xx**	**F15F - 240 xx** **F15R - 240 xx**	**F15F-250 xx** **F15R-250 xx**	**F15F-260 xx** **F15R-260 xx**
Nominal Power (± 3%)	Pmpp (W)	220	230	240	250	260
Open circuit Voltage	Voc (V)	75.6	76.3	77.4	78.5	78.8
Maximum Power Voltage	Vmpp (V)	60.9	61.9	63.0	64.1	65.2
Short Circuit Current	Isc (A)	4.10	4.10	4.10	4.10	4.10
Maximum Power Current	Impp (A)	3.61	3.71	3.81	3.91	3.99
Maximum system voltage	(V)	1000				
Maximum Series Fuse Rating	(A)	10				

168 Cell FLEXTRON modules with front or rear mounted junction boxes:						
		F33F - 330 xx **F33R - 330 xx**	**F33F - 340 xx** **F33R - 340 xx**	**F33F - 350 xx** **F33R - 350 xx**	**F13F - 360 xx** **F13R - 360 xx**	**F33F - 370 xx** **F33R - 370 xx**
Nominal Power (± 3%)	Pmpp (W)	330	340	350	360	370
Open circuit Voltage	Voc (V)	113.4	114.1	115.0	116.2	117.2
Maximum Power Voltage	Vmpp (V)	91.3	92.4	93.4	94.5	95.6
Short Circuit Current	Isc (A)	4.10	4.10	4.10	4.10	4.10
Maximum Power Current	Impp (A)	3.61	3.68	3.74	3.81	3.88
Maximum system voltage	(V)	1000				
Maximum Series Fuse Rating	(A)	10				

Standard test conditions (STC): 1000W/m^2, 25°C, AM 1.5 Spectrum.

5.3 Application Class

- The FLEXTRON module is rated as “Application class A” according to IEC 61730:2004. Modules qualified as Application Class A are considered to meet the requirements for safety class II.
- FLEXTRON modules may be connected in systems operating at up to 1000V where general contact or access is anticipated.

5.4 Wiring

- All connections should be performed, by qualified installers, in accordance with the local codes and regulations. (e.g. IEC 62548:2016)
- Modules can be connected in series to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry.

- FLEXTRON modules can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection.
- FLEXTRON modules are provided with junction boxes with Multi-Contact® MC4 male and female cable couplers. Mated connectors must be of the same type and from the same manufacturer.
- For field connections, use at least 4 mm^2 copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV wire.
- The maximum voltage of the system must be less than the maximum certified system voltage and the maximum input voltage of the inverter and of the other electrical devices installed in the system.
- It is recommended that all cables are run in appropriate conduits and sited away from areas prone to water collection.

5.5 System configuration

- FLEXTRON modules can be connected in either a series or parallel configurations.
- FLEXTRON modules must not be connected is series so as to give and output voltage higher than they certified system voltage of 1000V
- The maximum number of modules in series can be calculated by dividing 1000V by (Voc x 1.25) value of the module. The variation of Voc under different temperatures should be taken take into consideration when making this calculation (i.e. the Voc of the modules will be higher when the temperature drops).
- Strings of series connected FLEXTRON modules can be connected in parallel. Each string should have similar voltage to avoid reverse currents.
- No more than 2 (TWO) strings of FLEXTRON modules can be connected in parallel.
- When connected in parallel reverse current protection (e.g. blocking diodes) should be installed in accordance with IEC 62548:2016.

5.6 Fusing

- When fuses are fitted they should be rated for the maximum DC voltage and connected in each pole of the array.
- The maximum rating of a fuse connected in series with an array string is typically 10A but the actual module specific rating can be found on the product label and in the product datasheet.

5.7 Grounding / Earthing

- Flextron modules do not have a metallic frame and therefore do not require grounding. If the FLEXTRON modules are applied to a metallic roof element, grounding maybe required to comply with locally applicable wiring regulations.

6.0 MAINTAINENCE

- The modules are designed for long life and require very little maintenance. If the angle of the PV module is 5 degrees or more, normal rainfall is sufficient to keep the module glass surface clean under most weather conditions. If dirt/sand build-up becomes excessive, clean the top surface only with a soft cloth using water. Do not use a jet wash or a high powered water hose.
- Do not clean the module surface with aggressive chemicals.
- In order to ensure the correct operation of the system, the condition of the connectors and wiring should be inspected periodically.
- FLEXTRON modules do not contain any user serviceable parts. If malfunction is suspected contact your installer or BIPVco local agent immediately.