Applies to the below PV Module

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Type</th>
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<tbody>
<tr>
<td>ASP-7-AAA</td>
<td>ASM-6-PERC-AAA</td>
</tr>
<tr>
<td>ASP-6-AAA</td>
<td>ASM-6-B-PERC-AAA</td>
</tr>
<tr>
<td>ASP-6-AB-AAA</td>
<td>ASM-6-AB-PERC-AAA</td>
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<td>ASP-6-AB-AAA</td>
<td>ASP-14-AAA</td>
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<td>ASM-7-PERC-AAA</td>
<td>ASM-14-PERC-AAA</td>
</tr>
</tbody>
</table>

MUNDRA SOLAR PV LIMITED

Adani House,
Near Mitakhali Circle,
Navrangpura, Ahmedabad – 380009,
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Tel: +91 79 2656 5555 Fax: +91 79 2555 55.
1. DISCLAIMER OF LIABILITY

• This Installation Manual is applicable for Mundra Solar PV Ltd.’s (MSPVL) PV Modules. MSPVL is referred as Adani / Adani Solar in the Installation Manual as MSPVL is part of Adani Group.
• This manual is for authorized & trained users only. ADANI is not responsible for any type of mishandling or failure to follow instruction manual. Any type of Loss, Damage, Hazard, Injury or Expense because of improper installation, Handling, Usage & Maintenance is not in scope of ADANI.
• Adani Solar assumes no responsibility for the infringement of intellectual property rights or other rights of third parties that may result from use of the module. No license is granted in this regard, either expressly or implicitly, or under any patent rights.
• Information contains in this instruction manual is based on ADANI Information and expertise. This manual and specification can be changed by the company without giving any prior notification. Adani has rights to amend this document any time without prior notification.
• The Installation manual is applicable for both 1500V & 1000V series modules. It is recommended to check & get a confirmation from the manufacturer on the rated system voltage of the product before using the panels.

2. SAFETY MEASURES

2.1 Fire Safety

Consult your local authorities for guidance and requirements for installation or building fire safety.

• The top structure and installation may affect the building fire safety; improper installation may lead to fire hazards. As required by the local authorities, use such devices as ground fault cut-outs and fuses.
• Please do not operate the panel in the environment vulnerable to combustible gases or near any equipment.
• MSPVL PV Modules (for modules under UL spec) have a Type 1 fire resistance rating in accordance with UL 1703 certification. The fire rating of this PV module is valid only when mounted in the manner specified in the mechanical mounting instructions. When PV modules are mounted on rooftops, the roof must have a fire resistant covering suitable for this application. PV modules are electrical generating devices that may affect the fire safety of a building.
• In the event of a fire, PV modules may continue to produce a dangerous voltage, even if they have been disconnected from the inverter, have been partly or entirely destroyed, or the system wiring has been compromised or destroyed. In the event of a fire, inform the fire crew about the particular hazards from the PV system, and stay away from all elements of the PV system during and after a fire until the necessary steps have been taken to make the PV system safe.

• On direct exposure to sun light PV module produces electricity, which can result in electric shock or while working with module exposed under direct sunlight, it is advised to use installation tools and for precaution, wear hand gloves to protect from electrical hazards. Also is advised to keep away from any metallic contact touching the human body.
• Standing on module is strictly prohibited as it can impact the module’s performance and is not applicable to warranty claims if it is discovered that people have stood on PV modules, no one should stand on the module rare and front surface. Uneven pressure develop during standing on it can damage solar cell.
• Module front surface is made of tempered glass and has an ARC coating, so it needs special care in handling. If glass breaks due to any reason, it is advised to keep human contact away. At ambient wet condition any human contact with the broken glass surface may lead to electrical shocks. Once module glass breaks it has to be scraped or disposed after removing it from String after String is disconnected from the load.
• Any loose connection in connectors of PV module can cause electrical arcing and can lead to fire hazard. It is recommended to not keep any gap in connectors. Also ensure all the connectors should be corrosion free and protected against corrosion and soiling. It is strictly prohibited to remove or cut any connector of PV Module for installation easiness by the installer / customer and the module is deemed out of warranty.
• Do not install or handle any PV Modules in unfavourable environmental condition like high flow winds and wet snowy roof surfaces for personal safety. Modules should always be dry while installing.
• Please Ensure the polarity of the modules or strings is not reversed in relation to the other.
• Any artificial sunlight focusing on PV module is not recommended as it can reduce its performance and life cycle.
• Adani PV modules are certified to operate in Class A condition installed below a specified voltage level (1500V / 1000V dc). Consider this voltage range while designing the power plant. This value should be taken into consideration when designing the power plant, as per the temperature ranges present at the site. The mixing of power classes in one string is not allowed and can be harmful. Damage to modules due to such mixing can lead to the invalidity of product warranties.
• At different environmental conditions, PV module can produce high current and voltage than the measured in STC condition. Snow and water causes reflection which can increase the sunlight intensity which can increase the flow of current and Power output. The Isc value should be multiplied by 1.25 when determining the conductor current ratings, fuse sizes, and the size of controls connected to SPV output. Refer to Section 690.8 of the National Electric Code (for modules under UL spec) to check when an additional multiplying factor of 1.25 may be applicable.
• The product warranty is null and invalid in the event of a fire, as per the mixing of power classes in one string is not allowed and can be harmful. Damage to modules due to such mixing can lead to the invalidity of product warranties.
3. PV MODULE UNPACKING AND STORAGE

- After receiving the PV Modules, Customers are requested to match the product specification as it had been ordered. All the module serial number and other details are present on the box of the PV modules.
- Do not stack packing boxes (pallets) more than 2 boxes high. If pallets are temporarily stored outside, an external protective cover should be placed over them and the stack height should not be more than 1 pallet high.
- During unpacking there should be two people to unpack from vertical side as shown in figure below. Also keep attention during unpacking that one module should not fall on another module inside the box.
- Improper handling of PV module may cause scratches and damage to module. It is not recommended to apply adhesive or paints on the surface and frame of the module.
- Do not short the –Ve & +Ve terminal of the Junction box of the PV module. Do not use any knife as it can damage the PV module. It is not recommended to place modules directly on another module.

3.1 Module Identification

Every module has a unique serial number, which is laminated behind the glass. Please do not tamper with the serial number of the module and always record all serial numbers in an installation for your future records.

3.2 Module Storing

- After receiving the PV Module, it should be stored in a dry room temperature. Do not exceed the temperature limit. Do not store inside the box. It should be placed on the ground or on the rack. Modules should be stored inside the box if the room temperature exceeds the limit.
- If the modules are stored outside the box, it should be protected from direct sunlight and rain. It should be placed on the ground or on the rack.
- If the modules are stored on the rack, it should be placed on the top of the rack.
- If the modules are stored inside the box, it should be placed on the bottom of the rack.

3.3 Distribution of Modules

- During distribution, modules should be handled carefully. Modules should not be dropped or subjected to any physical damage. Modules should be transported in original packing material.
- Modules should be transported in a manner that ensures that they are not subjected to any physical damage. Modules should be transported in original packing material.

3.4 Stacking of Modules

- Modules should not be stacked more than 1 pallet high. Modules should be stacked only on the ground or on the rack. Modules should not be stacked on the rack.
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3.5 Handling of Modules

- Modules should be handled carefully. Modules should not be dropped or subjected to any physical damage. Modules should be transported in original packing material.
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3.6 Protection of Modules

- Modules should be protected from direct sunlight and rain. Modules should be placed on the ground or on the rack.
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4. ENVIRONMENTAL CONSIDERATIONS

4.1 Climate Conditions

All Adani Solar modules are tested for IEC 61724, IEC 61730-1 & II, UL 1703, IEC 6701, IEC 62716, IEC 62804. The modules are qualified for application Class A. Modules qualified for safety through IEC 61730 within this application class is considered to meet the requirements of Safety Class II. ADANI PV modules meet the requirement of European standards as they are also qualified for application Class A.

Environmental Condition

Ambient temperature: -40°C to +55°C.
Operating temperature: -40°C to +85°C.
Storage temperature: -20°C to +50°C.
Humidity: ≤85 RH%.

4.2 Mechanical Load Pressure

Design Load: 800Pa and 1800 Pa
Safety Factor: 3
Mechanical Load Pressure: 54000 Pa (112.8 lb/ft2) from front and 2400 Pa from the rear (50.12lb/ft2).

Stability of structure

Structure matching the mounting hole pitch of different types of modules is used to survive the load required and fatigue of the outdoor application. The structure should be coated to survive in external environment till lifecycle of PV module of 25 Years. Please consult the Mundra Solar technical support department for more information on the use of modules in special climates, such as an altitude greater than 2000 m.

4.3 Important instruction for Mounting

- Always avoid loop formation during designing, to minimize the risk during indirect light striking.
- Confirm mounting system must withstand the Loads of wind & snow should not cross the maximum rated load bearing capacity of PV module that is 2400 Pa for wind and 5400 Pa for snow. Adani advises the customer to choose the modules carefully considering the environmental conditions.
- Modules are evaluated by third party lab for max. positive loading of 5400 Pa.
- Module installation in projects must face north while being installed in the northern hemisphere and the modules should be south facing while being installed in the southern hemisphere. Electricity generation reduces when the module installed at site facing west or east. Failure to follow this instruction will lead to lesser power generation.
- When the modules are connected in series, the angle at which it is installed should be the same for all the modules. If modules in series connected system are installed at different angles, the radiation of sun becomes uneven which will result in different fluctuating current across the string and will lead to loss in Power Output.
- PV module facing directly to sun produces more power. When solar modules are installed on permanent structure it is recommended to tilt the PV modules for optimum performance during winter season. Measurement of tilt angle done between the solar module and the ground. Recommended Tilt Angle for a fixed system is listed below.
- PV modules should not be installed under shade or shadow under any conditions as it may lead to current mismatch across the solar cells leading to damage of the solar module. Shadow on the solar module is only acceptable if the irradiation is less than 200 W/m².
- Never disconnect module cables when it is connected with load.

- The mechanical load bearing capacity depends upon the installer’s mounting methods and failure to follow the instructions in this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that the installation methods used meet these requirements as well as any local codes and regulations.
- In installations not under the requirements of the IEC, 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 capacities. Installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part I,overcurrent device ratings, and size of controls connected to the PV output of the modules are being used in canada.
- MSPVL sending modules always in packed condition. The qty. details is always indicating outside box on sticker. If customer received any loose module/open box condition at the time of receipt of consignment, Receiver is advised to hold unloading and inform MSPVL. Logistics team on mobile no-91 9099003379 and start unloading as per his advice.
- Customer need to compare receipt no of Pallets qty against mentioned qty on transporter’s LR / MSPVL packing list at the time of receiving of consignment. For any difference in QTY of no of pallets, recipient is advised to mentioned discrepancy clearly on LR and obtain signature of vehicle driver and also obtain driving license copy of driver.
- For any, physically damage of pallets on vehicle & customers are requested to intimate us along with support photographs of damaged pallets-on vehicle for Insurance claim purpose on same day of receipt of container and same need to inform MSPVL. Logistics team on mobile no-91 9099003379 and start unloading as per his advice.
- It is necessary to mentioned discrepancy remark clearly on transporter’s LR duly signed and stamped. It is also necessary to obtain signature of driver on LR / POD. The discrepancy remarks should be agreed by Vehicle driver.
- All LR (POD) shall be stamped and sealed duly signature by customer mentioning number of pallets received.
- For the detail Procedure for transit damage insurance claim please refer to document no. GPSVL/UN/UNQ/K0079.
PV modules should be installed in a place where no shading occurs throughout the year. Shading can be minimized by ensuring that the distance between an obstruction and the solar array is more than three times the height of the obstruction.

PV module can be installed in portrait or landscape orientation, impact of dirt shading can be minimized by orienting the PV modules in portrait. The module facing should be south in northern hemisphere and north in southern hemisphere.

Sufficient row to row gap has to be chosen and PV modules should be spaced between two rows appropriately such that no shadows appear on the PV module at any part of the day during 365 days due to inter row spacing.

For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, this could have a direct impact on the power output.

To maintain the fire class rating any slope of 1: 2.4 is required.

Do not use mounting methods where drainage holes are blocked.

At any condition PV module should not be installed by immersing the module under water.

PV module should not be installed on moving objects like vehicle or vessel.

ADANI solar module is fire rated with Type 1 for Class C.

### 3.1 Module Identification

PV modules can be installed or fixed by Bolts method or by clamp method. For bolts type fixing corrosion resistive M8 bolts to be used. Mounting methods should ensure following things:

- Minimum clearance required between module frame and surface of the roof or wall is 200 mm.
- Minimum distance between each Solar PV Module should be 10.50 mm.
- Drainage holes should be kept open and no blockage is allowed in the drainage hole.

PV modules are not to be subjected to wind or snow loads exceeding the maximum permissible loads and should not be subjected to excessive forces due to the thermal expansion of support structures, careful consideration has to be shown during system design and installation such that thermal expansion of support structures do not cause any breakage of PV modules which will not be part of Adani Solar’s Warranty Document. When modules are ground mounted, select the height of the mounting system in such a way as to prevent the lowest edge of the module from being covered by snow for a long time in winter in areas that experience severe snow fall. If snow settles on the PV modules, the regular clearing of snow and other foreign particles and dust and dirt is highly recommended to ensure the long-term reliability of the PV modules. Failure to comply may result in damage to the module and lead to deformation or drop in power output which will not be covered under warranty.

* “The module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by the mounting instructions below.”

* “Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 1703 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field Inspection certifying that the installed module complies with the requirements of UL 1703”.

### A. Bolt Type Fixing

Every module frame contains 8 mounting holes of 9 mm X 14mm. It is recommended from ADANI to use corrosion resistance stainless steel fixing. The module fixed with the support of M8 bolt, washer and nut. For reference please see the below image. The assembly of M8 bolt, nut, washer and the PV module should be tightened to a minimum torque of 16-25 Nm.

Mechanical Drawings of PV Module “ASM-7-PERC-AAA & ASP-7-AAA”.

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Fig 2: 72 Cell Module Drawing of ASM-7-PERC-AAA & ASP-7-AAA
B. Clamp Type Fixing

ADANI Solar has done number of tests on clamps and on the basis of that test results, it is recommended to use clamps with EPDM or with insulating type washer only.

- Total 4 numbers of clamps are required to fix the PV module on structure or mounting rail.
- To avoid any kind of breakage of glass, clamps should not touch the glass and the shadow of clamp should not come on the module front surface.
- No modification or changes in the structure of module frame is permissible.

When modules fixed with clamp type fixing method, 4 clamps are required to fix the module, 2 clamps on each long side frame and 2 clamps on each short type frame side. ADANI solar modules are certified for bearing 2400 Pa wind load and 5400 Pa snow load on the front side of the PV module. To bear this load more number of clamps can be used to fix the module.
• Figures to represent mounting methods and applies to all 144, 72, & 60 Cell PV Modules.

Different Mounting Configurations can be tried as per Installer’s calculations, but however failure to comply with the above suggestions may result in a lowering of load handling capabilities and may lead to failure of any overload situation which may not be covered under product warranty.
Dimensions depending on Module type in (mm)

<table>
<thead>
<tr>
<th>Model Name</th>
<th>ASP-7-AAA; ASM-7-PERC-AAA</th>
<th>ASP-6-AAA; ASM-6-PERC-AAA; ASM-6-B-PERC-AAA; ASM-6-AB-PERC-AAA</th>
<th>ASP-14-AAA ASM-14-PERC-AAA</th>
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<tr>
<td>Length</td>
<td>1998</td>
<td>1660</td>
<td>1996</td>
</tr>
<tr>
<td>Breadth wise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mounting hole</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>pitch</td>
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<td>947</td>
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<td>202</td>
<td>198.4</td>
<td>198.4</td>
</tr>
<tr>
<td>A</td>
<td>499.5</td>
<td>415</td>
<td>499</td>
</tr>
<tr>
<td>B</td>
<td>249.75</td>
<td>207.5</td>
<td>249.5</td>
</tr>
<tr>
<td>C</td>
<td>241.25</td>
<td>236.75</td>
<td>236.75</td>
</tr>
</tbody>
</table>

For more specification please refer product datasheet.
6.2 PV Module Grounding

- As per National Electrical code (NEC Guidelines) all the PV Module (modules under UL spec) frames and mounting structures must be properly grounded for safety of people on the site. The module frame must be properly grounded (refer to NEC clause 250).
- Appropriate grounding is done by bonding the module frames and all the metallic structure together with the help of a grounding conductor made of copper, copper alloy or other material as per the electrical conductor prospective of respective national standards. The grounding connector should be connected to earth with the help of earth ground electrode.
- In case of metallic support, the surface of the frame must be electroplated.
- First, carefully strip 16mm of the insulating jacket from the end of grounding wire to avoid nicking or cutting conductors, insert the wire into the slot of the lug (see picture), and screw down the slotted screw.
- To fulfill the grounding & bonding requirements, please refer to the regional and national safety and electrical standards. Always use recommended type of connectors or similar for grounding.
- If grounding is required, the grounding wire must be properly fastened to the module frame to ensure.
- Screw must be tightening with torque of 2.3 to 2.8 Nm [20 and 25 in.- lbs.]. The head of the screw must be flushed with the base and base must be flush with the frame.

For grounding hole location and its size please refer to the product catalogue.

- Appropriate grounding is done by bonding the module frames and all the metallic structure together with the help of a grounding conductor made of copper, copper alloy or other material as per the electrical conductor perspective of National Electrical Codes. The grounding connector should be connected to earth with the help of earth ground electrode.
- ADANI solar modules can be installed by using any third party listed grounding devices to connecting grounding terminals. As per instruction manual of grounding device manufacturer, the grounding device should be installed. It is recommended to ground every module at the provided grounding holes (4 mm or 5/32 inch diameter marked with ground symbol).
- For grounding hole location and its size please refer to the product catalogue.
- Adani recommends following grounding procedures for the proper groundings.

Fig: Grounding assembly of PV module
A module with exposed conductive parts is considered to be in compliance with UL 1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.

Procedure 1: Grounding by bolts: 2058729-1

1) Wire bolt and slot  2) Mounting wash hex nut  3) Aluminium frame  
4) 4 to 16mm2 cable  5) HEX nut

- Tyco made grounding hardware comes with grounding bolt, mounting and grounding hex nut inside the package.
- Electrical contact developed by penetration of anodized coating of the aluminium frame and tightening the mounting.
- Grounding wire dimension should be considered of 6 to 12 AWG solid bar copper installed under the wire binding bolt.
- Tightening of wire binding bolt must be done at proper torque level 45 in lb.

Procedure 2: Grounding by bolts: # 2058729-1

1) Wire slot (available for 4-6 mm2 cable)  2) Slider  3) Bolt  4) Base  5) Nut

- Tyco made grounding hardware comes with grounding bolt, mounting and grounding hex nut inside the package.
- Electrical contact developed by penetration of anodized coating of the aluminium frame and tightening the mounting hex nut by applying proper torque of 25 in lb. Hex nut comes with a star washer.
- Grounding wire dimension should be considered of 6 to 12 AWG solid bar copper installed under the wire binding bolt.
- Tightening of wire binding bolt must be done at proper torque level 45 in lb.
- Tyco grounding bolt is only recommended to use with 6 to 12 AWG solid copper wire.

Procedure 3: ERICO grounding bolt EL6CS14-6


It is recommended that lug should be installed on a surface that is larger than the bottom surface of the lug.

- Lug should be fixed on the grounding hole present on the PV module.
- To secure grounding bolt to the module frame machine bolt A should be torqued to 35 in lb.
- Grounding bolt can be used with only 6-12 AWG bare copper wire.
- Machine bolt must be torqued up to 35 in lb for the proper wire binding.
- “Where common grounding hardware (nuts, bolts, star washers, split-ring lock washers, flat washers and the like) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.”
- “Common hardware items such as nuts, bolts, star washers, lock washers and the like have not been evaluated for electrical conductivity or for use as grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity. Such devices, where supplied with the module and evaluated through the requirements in UL 1703, may be used for grounding connections in accordance with the instructions provided with the module.”
• All wiring should be performed by well-trained installers as per the local codes and regulations.

• It is recommended to connect only such number of modules in series such that the system voltage should not exceed the rated value at any time of the year. The EPC to choose the appropriate design based on the inverter MPPT ratings and operating voltage conditions and the environmental conditions considering the lowest temperature at the site.

• To increase the operating voltage, PV module have to connect in series and for connecting modules in series, positive connector of one module is connected to the negative terminal of another module. During series connections, please ensure the sound of click should come. Click sound shows the proper connectivity between the two terminals. Adani recommends a maximum of 2 strings to be connected in parallel with appropriate string fuse for circuit protection.

• If any module/array/string is connected in reverse polarity, in that case product can be damaged permanently and repair is not possible and Warranty will not rendered to those modules. Before making parallel connection always verify voltage level and polarity of the string. If during measurement any reverse polarity or a voltage difference of 10 V found between the strings then check the strings circuit or string configuration before making connection. All the wiring should be performed by well trained and qualified technicians only.

• It is highly recommended and advised for the EPC to use Blocking diodes of appropriate specifications in String Combiner boxes to prevent any reverse current arising out of parallel strings due to voltage mismatch across Strings in Grid Scale utility power plants or from Storage devices if used with Storage solutions.

• ADANI Solar modules contains copper cables with 4mm² cross-sectional area with voltage rating 1000V/1500V (IEC&UL) for maximum system voltage, 90° C and are also UV Resistant. Do not expose cable in water logged place. When additional connectors and cables are used then check that connectors should be compatible with MC4 and cables are 12AWG.

• Maximum system voltage should be less than the rated system voltage or the maximum input voltage of the inverter. Voc α (1/T) so the open Circuit Voltage require to calculated at the lowest Ambient temperature for the location Power generation unit.

For this below formula can be used:

System voltage =

\[ X \times \text{Voc} \times [1 + ((\text{Ta-Voc} \%) \times (25 - \text{Tmin}))] \]

Where;

\[ X \] - No. modules which are connected in series.

\[ \text{Voc} \] - Open circuit voltage of each module (Refer to the Data Sheet)

\[ \text{Ta-Voc} \] - Thermal coefficient of open circuit voltage for the module in Percentage

\[ \text{Tmin} \] - Minimum ambient temperature of the location of the plant

• Outer cable diameter maximum is 7 mm and minimum is 5 mm.

• In field application it is recommended to use 4 mm² cables insulated for minimum of 90°C and designated as PV wire.

• Bending radius of junction box cable is minimum 42 mm.
6.4 Connectors

- Protect unplugged connectors against moisture, dust and any environmental pollution. Only clean and dry plugged connectors fulfill their ingress protection (IP) class. Ensure that connector caps are hand tight before connecting the modules. Do not attempt making an electrical connection with wet, soiled, or otherwise faulty connectors. Avoid sunlight exposure and water immersion of the connectors. Avoid connectors resting on the ground or roof surface.

- Faulty connections can result in arcs and electrical shock. Check that all electrical connections are securely fastened. Make sure that all locking connectors are fully engaged and locked.

- The junction boxes used with MSPVL PV modules contain bypass diodes wired in parallel with the PV cell strings. In the case of partial shading, the diodes bypass the current generated by the non-shaded cells, thereby limiting module heating and performance losses. Bypass diodes are not overcurrent protection devices.

* Modules equipped with PV wiring connectors that comply with the Standard for Connectors for Use in Photovoltaic Systems, UL 6703, shall have the specific allowable mating connector manufacturer(s) and model number(s) listed, as well as contact information and/or website of the PV connector manufacturer. If a specific module product is available with multiple PV wiring connectors from various manufacturers, then the following shall be included:

1) Means to identify each distinct PV connector manufacturer's product - such as a picture or illustration, unique physical features, markings, company logos, etc.

2) Allowable mating connector manufacturer and model number(s) listed for each distinct cable connector manufacturer's product(s), as well as contact information and/or website of the PV connector manufacturer.

6.5 Bypass Diodes

- Bypass diodes divert current from the cell strings in the event of partial shading.

- Diode replacement of potting type Junction is not possible in case of any type of failure. If any bypass diode stops working then the only way to correct the problem is to replace the complete Junction box with new one. To replace Junction Box MSPVL recommends contacting the supplier.

6.6 Cables and Wiring

- Adani PV modules are provided with two (2) stranded, sunlight resistant output cables that are terminated with PV connectors (MC4 & Amphenol compatible) ready for most installations. The positive (+) terminal has a female connector while the negative (-) terminal has a male connector. The module wiring is intended for series connections (i.e. female (+) to male (-) interconnections), but can also be used to connect suitable third-party electrical devices that may have alternative wiring configurations so long as the manufacturer’s instructions are followed.

- Use field wiring with suitable cross-sectional areas that are approved for use at the maximum short-circuit current of the PV module. Adani recommends installers to use only sunlight resistant cables qualified for direct current (DC) wiring in PV systems. The minimum wire size should be 12 AWG. The temperature range of the cables is -40°C to +90°C.

- Cables should be fixed to the mounting structure in such a way that mechanical damage to the cable and/or the module is avoided. Maintain a minimum cable bending radius greater or equal than five times the cable diameter. Route the cable in a way that the tensile stress on the conductor or connections is prevented. For fixing, use appropriate means, such as sunlight resistant cable ties and/or wire management clips specifically designed to attach to the PV module frame. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.
## 7. ELECTRICAL & MECHANICAL PARAMETERS

<table>
<thead>
<tr>
<th>Type name or model number</th>
<th>ASP-7-AAA</th>
<th>ASP-6-AAA</th>
<th>ASP-6-AB-AAA</th>
<th>ASM-7-PERC-AAA</th>
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</thead>
<tbody>
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<td><strong>Rated maximum power range [W]</strong></td>
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<td>265-270</td>
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<td>Monocrystalline</td>
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<td>60</td>
<td>72</td>
<td></td>
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<td>8.10-9.60</td>
<td>8.10-9.50</td>
<td>8.7-10.37</td>
<td></td>
</tr>
<tr>
<td><strong>Rated open circuit voltage range [V]</strong></td>
<td>43.3-46.7</td>
<td>36-38.4</td>
<td>43-48.69</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum system Voltage [VDC]</strong></td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td><strong>Over-current protection rating [A]</strong></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions (l × w × h) [mm]</strong></td>
<td>1998x1010x35/40</td>
<td>1660x992x35/40</td>
<td>1998x1010x35/40</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Series Fuse, (A)</strong></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><strong>Fire Class Rating</strong></td>
<td>Class C, Type 1</td>
<td>Class C, Type 1</td>
<td>Class C, Type 1</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>23.5 Kg (35 mm frame variant)</td>
<td>17.5 Kg (35 mm frame variant)</td>
<td>23.5 Kg (35 mm frame variant)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28Kg(40 mm frame variant)</td>
<td>18.8 Kg (40 mm frame variant)</td>
<td>28 Kg(40 mm frame variant)</td>
<td></td>
</tr>
</tbody>
</table>

All electrical data mentioned above shall be shown as relative to standard test conditions (1000 W/m², 25 °C, AM 1.5 according to IEC TS 61836).
The products can be used in Grid Connected Utility & standalone system in houses, rooftop, PV stations, Communication stations, Petrol, Ocean, metrological, traffic and solar building etc. The maximum power of ASP-7-AAA Multi Crystalline Silicon 72 series modules is in range of 300 Wp to 335 Wp with tolerance of ±3%. So the EPC / Customer is advised not to mismatch any modules & strings with different currents and different voltages which can lead to adverse effects of performance generation of the entire PV Power Plant.

• A solar array generates DC electricity when sunlight falls on the modules and the inverter is in active mode. Once the minimum voltage and current requirements are met, this is converted into AC power accordingly.

• Adani’s ASP & ASM series modules are made with 144, 66, 72 or 60 crystalline silicon cells of high efficiency. Cell circuit is laminated with the help of encapsulant sheet and front surface is of tempered glass with plastic polymer sheet on its back side to provide electrical insulation and environmental protection. Then the laminates are inserted into anodized aluminum frame. IP67 rating terminal box made of plastic material which is resistant to high temperature contains connection terminals and bypass diodes. In aluminium frames there is number of holes to attach the modules with structure in field.

8. ELECTRICAL CONFIGURATION

Caution

The modules are rated to operate at potentially dangerous voltage level of just under a specified system voltage; coming in contact of this high voltage may cause electrical hazards, Arcing and Fire hazards. It is recommend that all the solar Module, Module array and the DC combiner box should be handled by only trained person. Adani is not responsible for any hazards on the site and to the trained manpower in event of any safety hazard or causality.

Electrical hazard

While disconnecting the array from the circuit, use rated isolator or DC switch. DC power after disconnection may be active for some time and hence it is recommended only trained person should operate or handle upon Panels, string Combiner Box etc. ADANI solar is not responsible for any type of accident occurring in Power plant using ADANI panels.

• There is always a risk of Lightening to PV Power plants and PV modules and Adani Solar requests the EPC Installer and the customer to analyse the risk of lightening as per IEC 62305-2 and install Lightening arrestors and SPD’s such that no part of PV system and PV Module is affected by Lightening or any other high voltage surges. To ensure effective protection for entire power plant along with PV modules, a lightening protection system with optimally coordinated elements with air-termination system, earth-termination system, lightning equipotential bonding, surge protective devices for any DC input/output devices as per IEC 61643-11. Consistent lightning and surge protection for all systems allows to considerably increasing the performance ratio of Solar PV power.

8.1. FUSE RATING

Connect Fuse in non-grounded pole of solar array. Maximum fuse rating connected in series is 15 A. Actual fuse rating is mentioned in PV module specification sheet and on the PV Module’s back label. Fuse rating value also indicates the maximum current reverse current that can flow from the module. It is recommended to use 15 A fuses per string.

8.2 Selection of Inverter and compatibility

Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. When installed as per the IEC standards and regulations, Adani Solar modules do not normally need to be electrically connected to earth and can operate with either galvanically isolated (with transformer) or transformerless inverters. If galvanically isolated inverters with transformers are used, the negative pole of the array must be connected to earth. If a transformer less inverter is used, the installer should ensure that the right active negative earthing / grounding or PID Controller kit is installed by consulting with the inverter supplier and taking approval from the inverter supplier. Both methods are required in order to prevent the modules from potential induced degradation in the field.
9. PV MODULE MAINTENANCE AND CARE

For better performance and reliability of the system, a minimum of maintenance is required in well-designed PV plants.

- It is recommended to do yearly plant maintenance by trained professionals. Complete everyday tracking of PV Module’s performance through SCADA or through string performance should be noted and tracked and analysed and if any discrepancy from normal behaviour, it should be immediately notified to Adani Solar.
- Check the mounting structure status and ensure any/all the modules should be tightly fitted on the structure and should be as per the mounting instruction provided above.
- Check for any shading on PV module, area of module on which light is falling should not be shaded by any trees, objects and leaves. All these obstructing objects should be removed immediately. Early morning / Late Evening shadowing where irradiance is lesser than 200 W/m² is acceptable.
- Ensure all cable assemblies are tightly fitted and no part of the cable is immersed or exposed to water logging.
- Check all the strings fuses of each non-earthed pole are working properly and in operation.
- To clean the module always use soft module cleaning kit or do cleaning with soft cloth and slight detergent as an alternate solution. Cleaning can be performed by Wet Cleaning, Soft Cleaning, Compressed Air cleaning, rotating brush, Dry Brush cleaning. Cleaning should be performed in a way that no stress on PV modules is caused and no cracks on solar cells to be caused out of cleaning. Water used for cleaning should be of same temperature as of module, and water should be regularly checked for TDS, it is immediately recommended to install RO at the site if the TDS of the water is deviating from appropriate standards and acceptable limit of less than 500mg/l. Water used for cleaning should be of the same temperature as of the module and if not used, temperature difference can create thermal shocks by which PV module can be damaged and will not be a part of the Warranty. During cleaning, always ensure at all condition module should not be damaged from micro crack and other type of defects. Climbing of personal on the PV modules is strictly prohibited as it can cause irreversible damage to the solar cells of the PV modules. The PV Modules are advised to be cleaned regularly ensuring dust/dirt free and devoid of any bird droppings. Failing to clean the same can cause damage to the solar cells of the PV modules.
- For maximum power output and generation and best reliability, it is recommended to keep modules clean and tidy.
- The rare surface of the module does not require cleaning unless any objects or dirt stuck on the backsheet. Avoid cleaning by sharp edges objects which can damage the material of backsheet and can cause a cut and impact the performance of the PV module and the plant due to cascading effect.

Product should be recycled in useful renewable method after end of its life cycle. Please contact Adani Solar after the end of product life cycle for recycling procedure.

11. WARNING

While performing any type of electrical maintenance, all the system should be isolated / shutdown and maintenance should be performed by well trained professionals only. Any failure to follow instruction may results in lethal electric shocks, burns, other injuries and some time may death also. ADANI solar is not responsible for any type of accident occurring in Power plant using ADANI panels.

The documentation includes a statement advising that external or otherwise artificially concentrated sunlight shall not be directed onto the front or back face of the PV module (if not qualified for).

12. Contact Details

PV modules do not contain any serviceable parts. If customer has any doubts that installation is not working properly, please contact your installer / EPC / O&M. Immediately and immediately please leave a note to the Adani’s Customer Service Team.

1. Contact ADANI Solar sales and service team at cs@adani.com
2. Email customer feedback at cs@adani.com