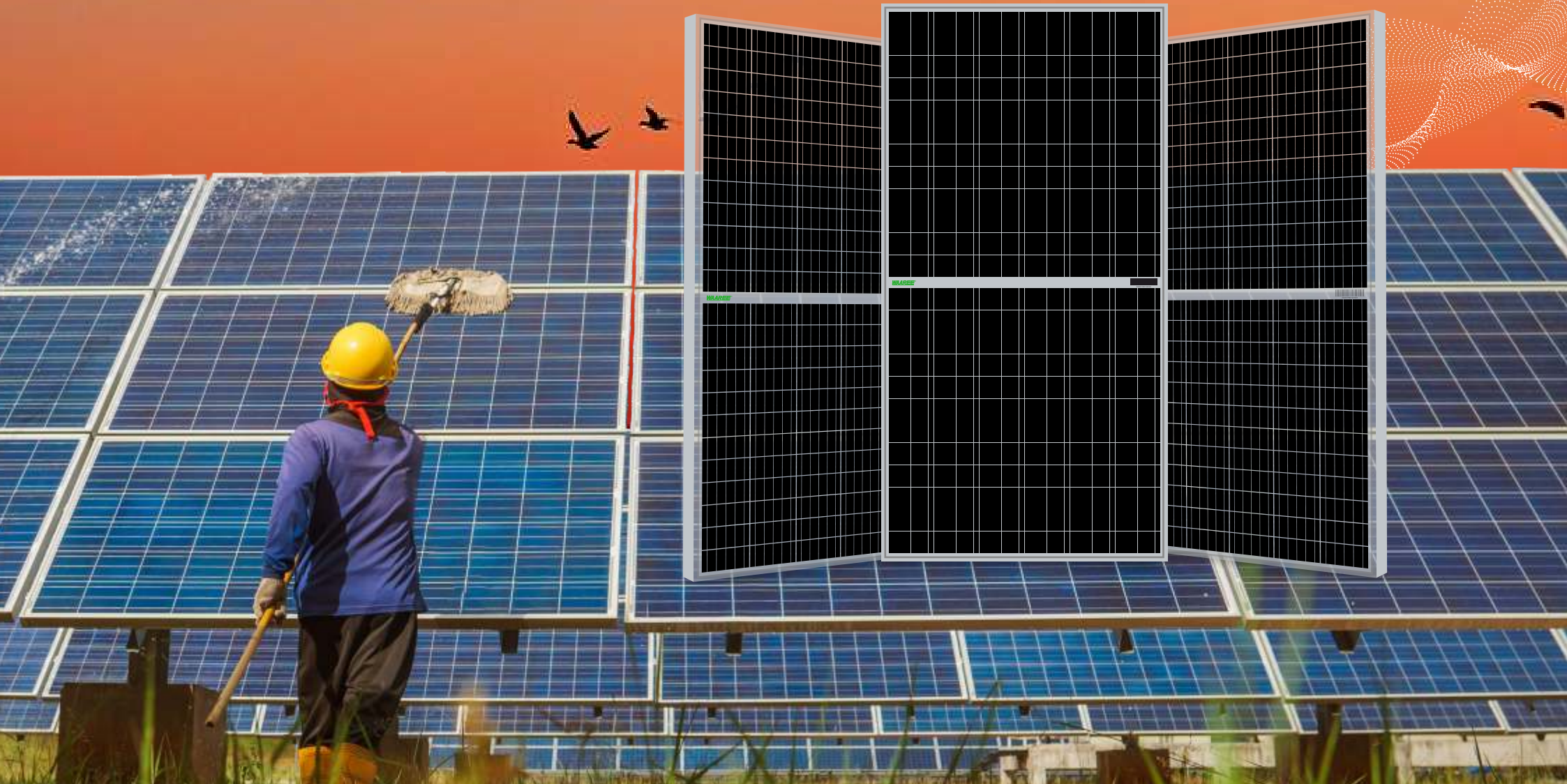


CLEANING MANUAL

SOLAR MODULES

WAAREE[®]
One with the Sun



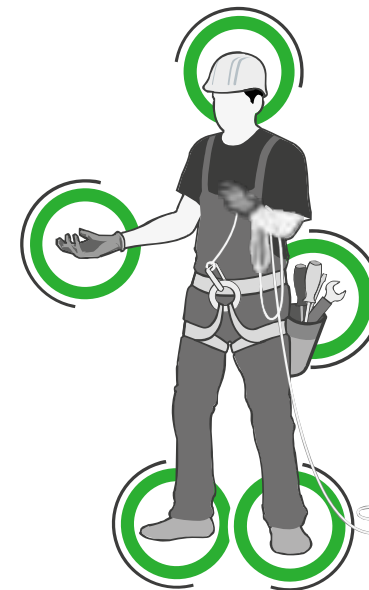
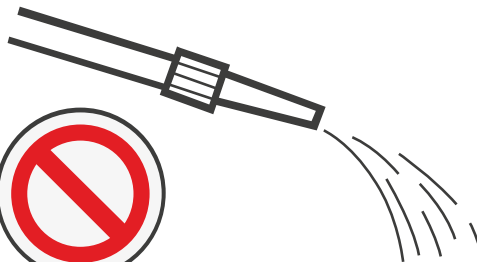
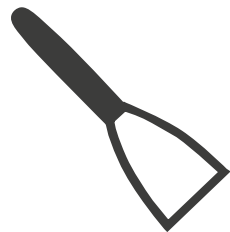
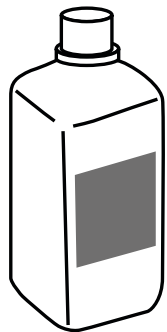
1. INTRODUCTION

This document contains information of cleaning of solar modules in general. Specific cleaning procedures will be based on site condition, quality of water and cleaning mechanism used. It is important to read this manual and understand the instructions carefully. WAAREE module have been designed for easy installation and minimal maintenance, however, dust, pollen, leaves and other contaminants often find their way onto the panel and soil the surface.

With the passage of time, dirt and dust may accumulate on the glass surface of the module, reducing the power output of the module and in the longer run affect the module reliability. WAAREE recommends regular cleaning of modules to ensure maximum power output.

2. GENERAL GUIDELINES & RULES

- ◆ Wear Proper PPE as Per Requirement.
- ◆ Damaged panels can present a lethal shock hazard due to leakage currents. The risk of shock is higher when panels are wet. Before cleaning, thoroughly inspect panels for cracks, damage, and loose connections.
- ◆ No aggressive and abrasive cleansers or chemicals should ever be used on the ARC coated front and/or back glass/rear side transparent backsheet. No alkali-based chemicals should be used, including ammonia based solutions.
- ◆ Acceptable Module cleaning methods are to spray the Modules with low-pressure water closely matched in temperature to the Module or to use a dry cleaning technique. Do not apply water that is more than 20°C warmer or colder than Module surface temperature.
- ◆ Don't stand on the panels for cleaning.
- ◆ When using water, RO water provides the best results. In absence of RO water, tap water with low mineral Content (<75mg/L) to be used. Do not use solutions containing hydrochloric acid, D-Limonene, ammonia or sodium hydroxide.
- ◆ If needed, a mild, non-abrasive, non-caustic detergent with tap water (<500 mg/l) and detergent solution mix between 6.5 < pH < 8.5 at 25°C may be used.
- ◆ The back surface of traditional module does not normally need cleaning. However if needed, dry cleaning with soft brush is suggested. If utilizing a bifacial module, it is recommended that a method similar to cleaning of front side be utilized to ensure effective power generation from both the sides of module. Further avoid using any sharp objects that may damage and/or penetrate the substrate.



DO NOT USE HARMFUL CHEMICALS

- ◆ In general dry cleaning is less effective than wet cleaning, but In case of non-availability of water (in dry areas) where dry cleaning only can be done use soft micro fiber cloths, various types of soft foams, nonwoven fabrics, brooms, soft sponge and soft brushes are permitted.
- ◆ If the panels require more cleaning effort to remove stubborn marks, use a soft sponge, microfiber cloth or non-abrasive brush and lightly wipe over the affected area. This may be mounted on an extension pole for an extended reach. Treatment in this manner should remove any loose soiling from the panel glass. Do not use knives, blades, steel wool or other abrasive materials to clean the glass.
- ◆ Never spray the water on broken module, it will give electric shock.
- ◆ Keep hand and Body clear when operating module cleaning Machine, Always Maintain a safe distance from Moving parts.
- ◆ Wear rubber sole shoes with good grip to prevent slip and falls.
- ◆ When working at heights, use fall safe and personal protection measures throughout the cleaning process.
- ◆ If cleaning solar modules from the ground is not possible, do not attempt to access your rooftop or ground mounted panel unless you have the appropriate safety equipment and training.
- ◆ Spraying cleaning water on junction box, cable tray, combiner box etc. is strictly prohibited.
- ◆ Never at any point stand on, walk on, lean on or apply pressure to the panels as this can cause both visible and non-visible damage to the panel.
- ◆ The use of pressure or steam cleaners and high pressure hoses, knives, blades and metallic sponges is not permitted.



3. CLEANING FREQUENCY AND TIME

- ◆ Based on power output from modules, site environment condition & season the frequency of cleaning should be fixed.
- ◆ Module cleaning should be done early in the morning and after sunset in the evening to prevent thermal stress and cracks on the module. This would further also ensure that the reliability of the module is not compromised in the longer run.
- ◆ Early morning can be a particularly good time for cleaning as dew that has settled on the panels overnight will likely have softened grime. That means you'll need to use less water and less energy to clean your solar panels.
- ◆ Cleaning process must be carried out only when the module in open circuit mode or when the inverter is not operational.



4. ROUTINE STEP OF CLEANING

Whisking

Deposits such as dry floating dust and leaves on the module surface should be whisked off with a dry & soft duster or cloth. If there are no other deposits on the module surface then the module has been cleaned in this step

Scraping

If there is hard foreign matter such as dirt, bird droppings, plant branches, leaves, etc., closely attached to the module, it should be scraped with non-woven fabric or hair brush. Never scratch the module with a high hardness object

Washing & Rinsing

If there are colored substances such as bird droppings, plant juices, etc., on the module surface or dust that cannot be whisked off due to high indoor humidity, the colored substances need to be removed by cleaning. The colored substances are generally removed with clean water by spraying it onto the region with pollutants and scraping with a hair brush.

Wipe the module surface from the top downwards to remove any residual water from the panel glass. A wiper or rubber squeegee can be used for this. However pay attention that any leftover grains of dirt or sand don't scratch the surface of the panel.

Oily substances if any, may be removed by coating water blended with alcohol onto the colored region and scraping with a hair brush after the solution penetrates through the pollutants.

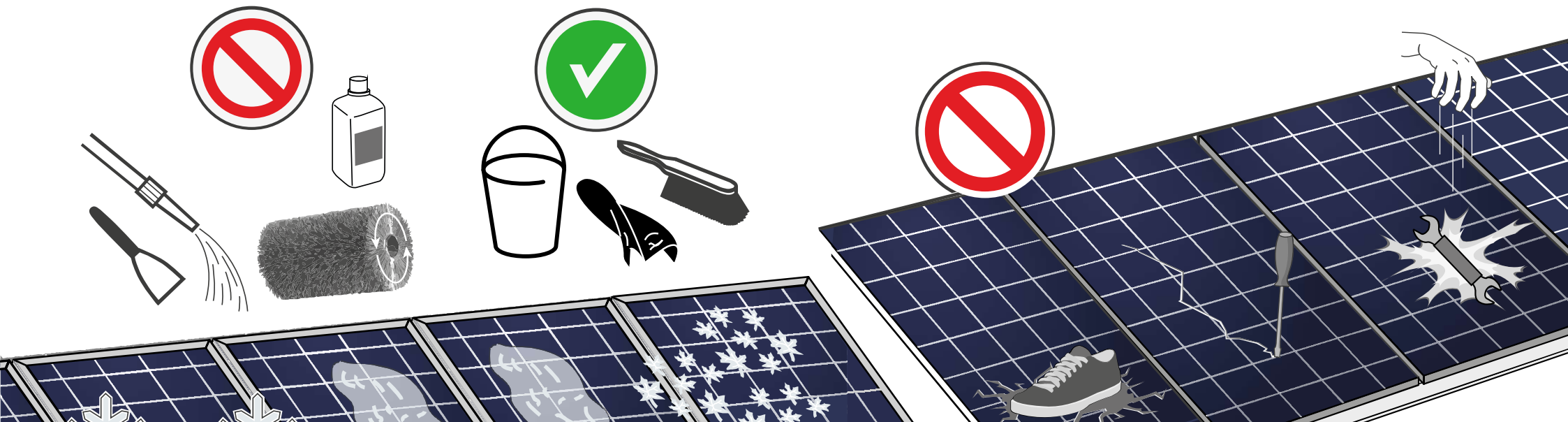


5. CLEANING OF SNOW

WAAREE modules are designed to be able to withstand high snow pressure. However, if you need to clear snow to improve the power output, use a brush to gently remove the snow. Further gas can be used to blow the snow too. Never try to remove frozen snow or ice on the modules as it may cause crack in the module.

6. DO & DON'TS

- ◆ Do ensure proper handling of module
- ◆ Do not use high pressure water jet for cleaning
- ◆ Do not use cold water when the module glass temperature is high. Difference in glass surface Temperature and the water temperature can result in fracturing or breaking of the glass.
- ◆ Do not use hot water to clean cold panel. Difference in glass surface temperature and the Water temperature can result in fracturing or breaking of the glass.
- ◆ Do not clean with bare hands. Use appropriate PPE.
- ◆ Do not use harmful chemicals for solar panel cleaning.
- ◆ Don't use tools like Knife, Blade, Wire brush etc. for cleaning.
- ◆ Don't stand on the panels for cleaning.
- ◆ Do not wear metal accessories such as jewellery, watches etc. while cleaning the modules



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