

PV Modules Cleaning Work Instruction

Abstract:

This manual is a detailed description of cleaning method for all LONGi PV panels product. This manual could be regarded as supplementary services of Installation Manual for LONGi PV Solar Modules.

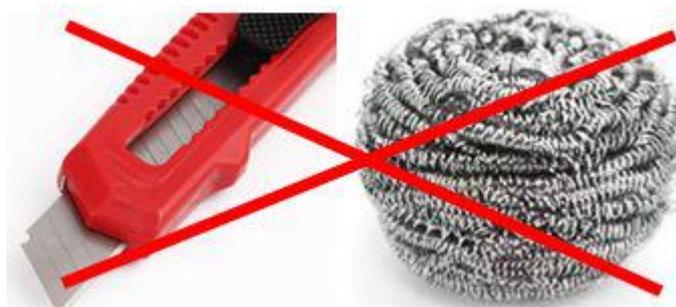
Dirt and dust accumulate on the glass surface of modules as time passes, which result in reducing the output power. In order to have the maximum output power, LONGi recommends a periodic cleaning of modules, especially in the areas with a low amount of precipitation.

The clearing work must be done before cutting off the power of the module and wait until the module cooling down. The entire operation steps must be done under requisite electrical protection measures. Make sure reconnect the modules after they dry out.

1. Detailed Description

1.1 **Do not** touch modules with bare hands. Wearing cleaning gloves during cleaning to avoid fingerprints and other grime left on the glass.

1.2 **Do not** use knives, blades, steel wool and other abrasive materials to clean the glass.



1.3 Various types of soft foams, non-woven fabrics, brooms, soft sponges and soft brushes are permitted.



As shown in figure above, the blue face of a sponge can only be used to clean the aluminum frame of the modules. It cannot use to clean the glass side as it will scratch up the glass which resulted in reducing the output power.

1.4 The nylon brushes which have the wire diameters from 0.06-0.1 mm are recommended to use.

1.5 Glass cleaner, alcohol and methyl alcohol are only allowed to use in case of the water cannot clean properly.

1.6 **Do not** use abrasives, abrasive cleaners, scrubbers, polishers, sodium hydroxide, benzene, nitrite diluents, acids or alkalis products.

1.7 During cleaning, the hydraulic pressure must below 3000 Pa to avoid the micro-crack of the front side of a module. For bifacial modules, the hydraulic pressure must below 1500 Pa to clean the back side of the modules. It is not recommend cleaning the back side of conventional modules.

Water with a high mineral is not recommended as the dried minerals will be deposited on glass. Normally, municipal water meets the two requirements. If low mineral water is not available in some regions, it is suggested that to add the sodium chloride $\leq 2\%$ in water to avoid depositing the dried minerals on glass.

1.8 The difference between water temperature and modules temperature should be controlled at a certain range from $-5\text{ }^{\circ}\text{C}$ to $10\text{ }^{\circ}\text{C}$. Also, the pH value of water has to be around 6-8.

1.9 **Do not** use steam or corrosive chemicals to speed up the cleaning process.

1.10 **Do not** clean the module when the cable and glass are broken, which may trigger a risk of electric shock.

1.11 **Do not** stand on the module while cleaning.



2. Suggestion for cleaning

2.1 Cleaning time

Mornings, evenings, nights and rainy days with low irradiation are a good time for cleaning. It is suggested that to clean the modules while the inverter being off.

Avoid shading while cleaning; shading causes Hot Spot effect which may result in reducing output power even fire.

It has to be aware that there may be sunlight penetrating the thin rain layer and the power station may produce a small amount of electricity, which needs to be paid attention to be safety.

2.2 Cleaning Period and Region

The large-scale PV station contains a huge number of modules, it is necessary to plan the cleaning period and divide the area into subdivisions according to

the specific circumstances.

In the pluvial region , it is recommended to clean in 40-50 days, and in dry regions with less rain, it is recommended to clean in 20-30 days.(It is recommended that the customer evaluates the cleaning frequency according to the actual situation of the region)

The cleaning work in each subdivision should be carried out based on the electrical structure of PV station layout .

3. Cleaning Process

A Normal cleaning work including three steps: sweeping, scraping and washing.

3.1 Step 1: Sweeping

The sweeping process should be taken by dried duster or towels. First, remove the dirt and leaves on the module surface. If there are no other deposits, modules can be cleaned only at this step.

3.2 Step 2: Scraping

Sticky stuff such as dirt, bird droppings, leaves, etc., should be scraped off with non-woven fabric or brush, and High-hardness tools are forbidden to use.

3.3 Step 3: Washing

For the colour substances such as bird dropping, plant juice, etc. on the glass surface or dirt that hardly dust off, then water-cleaning should be used. The colored substances are generally removed by spraying clean water on the region with pollutants, then scraping with a brush.

Oil substances may be removed by cleaning water mixed with alcohol and

scraping it off with a brush.

If necessary, the module may be cleaned with glass-cleaning detergent, together with non-woven fabric or glass scrubbers.

Frameless bifacial modules cleaning process are same as the conventional PV modules; however, as the module without the frames, it is necessary to fully consider the deformation caused by the applied stress. Avoid using larger force, and prevent the module being damaged or safety accident.

As the back side of bifacial modules can also generate power, hence, it is necessary to clean the back side (Longi does not advise customers to wash the junction box directly).

3.4 Snow Removing

LONGi modules are designed to be able to withstand high snow pressure. In order to increase the output power, use a brush to gently remove the snow is necessary. However, do not try to remove the frozen ice on the module surface.

It is allowed to clean the module by cleaning equipment or robots, which meet the requirement of this manual and the requirement of equipment companies.

4. Safety Instruction

4.1 Avoid Leakage

Photovoltaic power stations have a large number of electrical components, which have a high voltage potential (~hundreds of volts). Although the washing process carries out under low sun irradiation (irradiation ≤ 200 W/m²), the modules still contain high voltage. Any devices connected to wire may have electric leakage. Hence, before washing the module, it is better to first check

the abnormal record of electricity and analyse the risk of electric leakage. In addition, it is necessary to use a voltage tester screwdriver to check frames, holders and glass surfaces to eliminate the risk of electricity risk and hence ensure the human safety.

4.2 Injury

The aluminum frame of the module or the corner of the glass can form sharp corners. Therefore, it is necessary to wear appropriate protective clothing and safety helmet to avoid the injury. Do not wear clothing or use the tools with Hooks, laces or threads.

4.3 Avoid Scratch

Hard or sharp tools are not allowed when washing modules for such tools could cause scuffing problem or even crack of tempered glass.