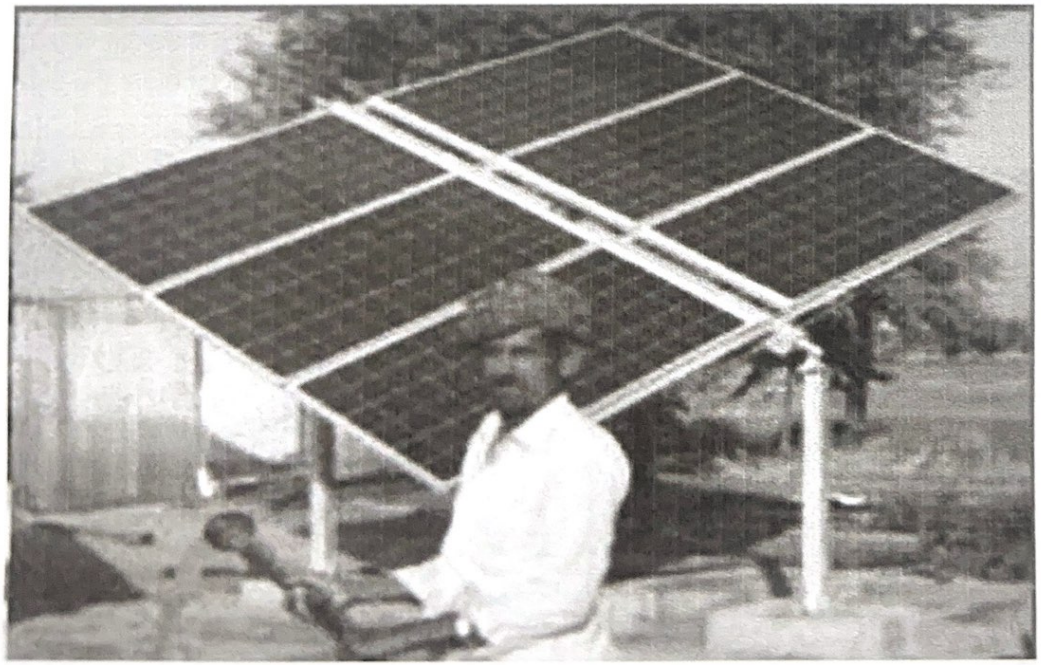
TATA

TATA POWER SOLAR

INSTALLATION AND OPERATION MANUAL OF TPS PHOTOVOLTAIC MODULES

36, 60 & 72 CELLS



Product List: TP and TS series

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1. Introduction

The purpose of this manual is to provide general information regarding the installation and handling of TPS Photovoltaic modules with 36, 60 and 72 cells that serve residential, commercial and industrial segments. For information on mounting other types of TPS modules please contact your installer or visit www.tatapowersolar.com.

In order to ensure the maximum power & system integrity, the installer and operator should read the following instruction carefully before installing, wiring, or using TPS solar module(s). Non compliance may result in damage and/or physical damage.

Disclaimer of Liability:

All TATA Power Solar products are designed and manufactured to comply with relevant international standards (refer to the product label for details). However, as the conditions or methods of installation, operation, use and maintenance are beyond TATA Power Solar's control, then TATA Power Solar does not assume responsibility and expressly disclaims liability for loss, damage or expense arising out of, or in any way connected with, such installation, operation, use or maintenance.

These products have no user serviceable parts, your warranty will be invalidated, in the event of a claim, if there is evidence that the modules have been tampered with. Refer to our Warranty Certificate, separately provided, for full details of our Limited Warranty.

These products are intended to operate under normal sunlight conditions. DO NOT attempt to increase module output by concentrating light on its surface.

2. Module Overview

Tata Power Solar modules consists of series of electrically interconnected crystalline solar cells which are permanently encapsulated/laminated between a tempered glass superstate and EVA/backsheet substrate. These laminates are then fixed inside an aluminium frame to provide rigidity. The following precaution must be taken while installing :

- The module should not be submerged in water
- The frame should not be removed or modified
- The tempered glass are ARC. Any damage or scratches to the glass or ARC coating should be avoided as it can cause loss in power output
- For best performance and to avoid potential issues, keep the front side of the module clean and free of obstructions including covers, tape, adhessives, paint and debris.

3. Storage, Unpacking and Handling

Below mentioned guidelines should be carefully followed for storing, unpacking and handling of modules

Packaged module must be stored in dry and ventilated area with the cover on the top of the box. It should not be exposed to rain, snow hail or other destructive environmental condition.

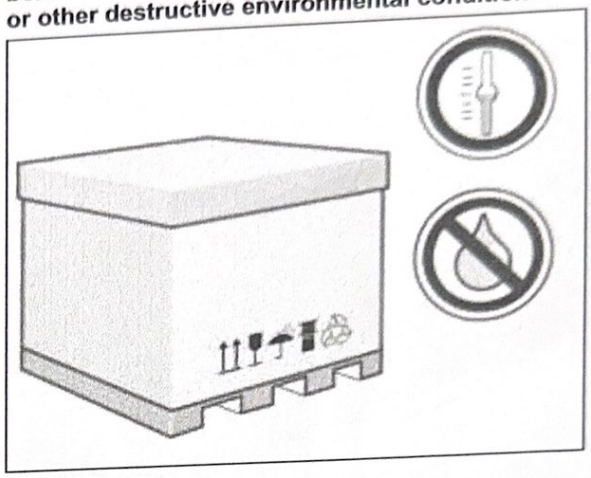

Fig. 1 Module should be kept in dry and ventiallated area

Once the modules are opened, it should be kept in a dry and ventillated area. It shouild not be stacked one over the other

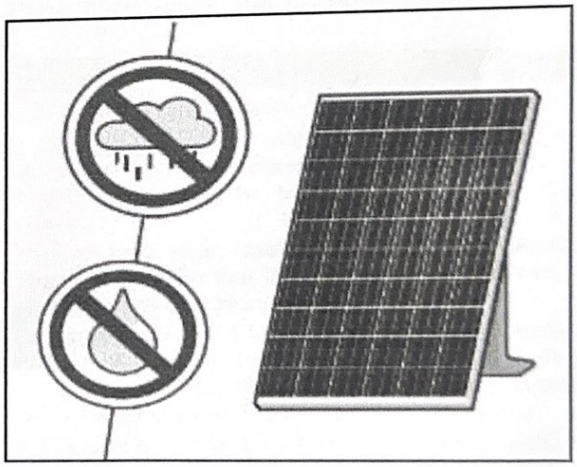

Fig.2 Unpacked modules should not be exposed to rain, snow or other harsh enviromental condition

Lift packaged modules by grasping both side of the package.

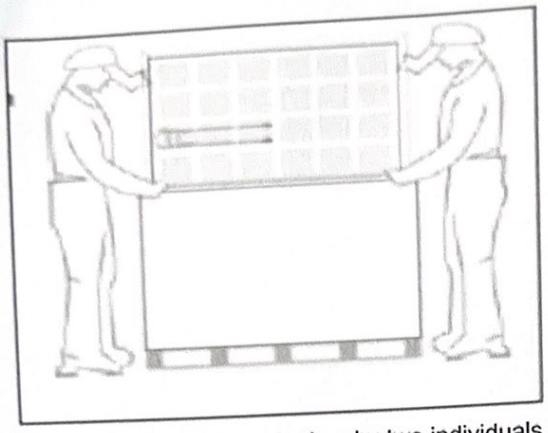

Fig. 3 Module lifted from the box by two individuals

Do not carry or hold a module by it's wire or junction box. It should always be carried by it's frame

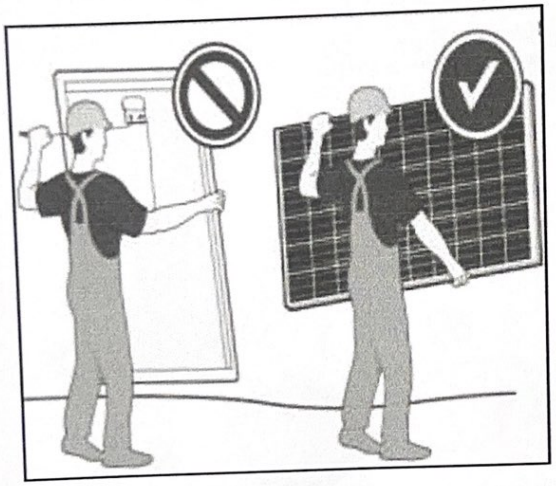

Fig. 5 Modules should always be carried by it's frame

Do not place modules on top of one another. It should be covered with corner cap and kept over one another

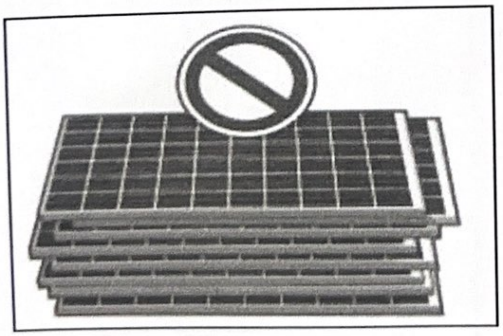

Fig. 7 Modules shouldn't be stack one over the other

Do not place any load, step or sit on the glass surface of the solar module

Do not handle module with bare hand and avoid scratches, handling marks or damage especially to the front glass of the module, backsheet, or electrical components

Do not mark modules with sharp instruments, specially the glass surface and backsheet should have any scratches as this may lead to power loss

Do not leave the module unsupported and unsecured

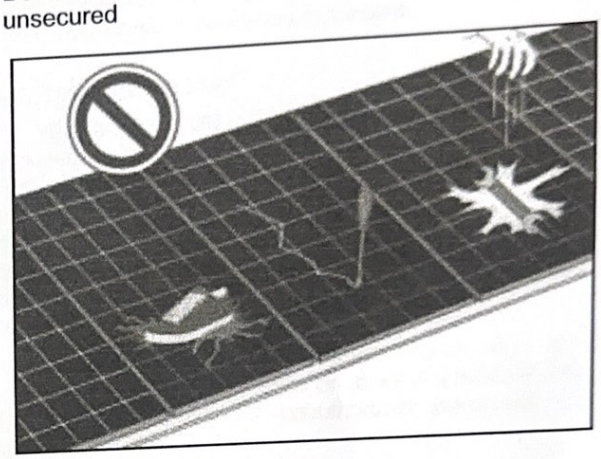

Fig. 6 Falling of sharp objects, stepping over the Module should be avoided

Do not modify the frames anyway or care must be taken that it should have any scratches

4. Safety

4.1. General Information

These products are intended to operate under normal sunlight conditions, DO NOT attempt to increase module output by concentrating light on its surface.

Prior to installation, seek guidance from a certified engineer to verify that the mounting arrangement is proper for the conditions of the location.

Furthermore, if the PV modules are to be installed on a roof, ensure that a full structural evaluation covering the effects of module and mounting system on the roof is carried out by a competent person.

- The system has to be in compliance with all applicable building and electrical codes or regulations.
- PV systems have the ability to form high temperature arcs if the module, cabling or electrical devices are damaged.

To minimize fire hazards:

- For rooftop installations, mount the modules over a fire resistant roof covering rated for the application.
- For ground mounted installation the design should take into account the growth of vegetation in order to minimize consequent fire risks

- System should be designed to allow all means of electrical disconnection to be readily accessible to fire fighters and responders to safety incidents.
- These modules have not been certified for building integration (directly into the roof or wall), marine or vehicle applications.

These applications may have additional requirements for which our products have not been certified.

4. 2. Handling Safety

Before performing any operation involving the module or system electrical connections, perform a risk assessment paying particular attention to the environmental conditions and personal protection equipment required.

a) Use appropriate protective safety equipment as recommended by local safety codes and practices (e.g. hard hat, scaffolding, steel toe capped shoes, gloves and restraining harness) and exercise caution, particularly when installing modules at height.

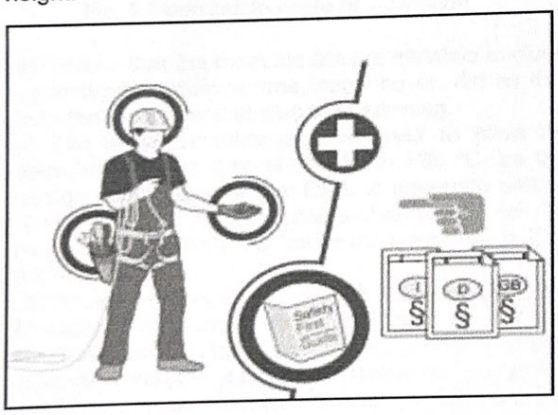

Fig. 8 Installer wearing proper dress code

b) PV modules are heavy and should always be handled by two people, preferably supporting the

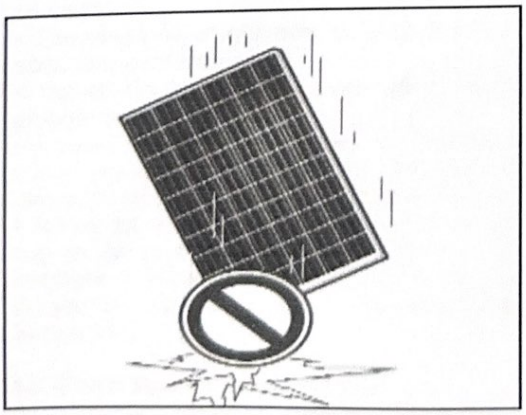

Fig. 9 Module should not be dropped

module by its long sides; furthermore, they contain glass, which can be easily broken if mistreated. **DO NOT** walk on, bend or drop the PV module similarly **DO NOT** place heavy loads or drop objects on the module and **ALWAYS** keep sharp objects away from the module front and back surface.

DO NOT install the module if the back sheet or glass is damaged because there is an electrical and fire risk.

c) Modules can get very high temperatures when they are in operation and especially if they are partially shaded, be careful not to touch them without proper personal protection equipment.

4.3. Electrical Safety

PV modules generate DC electricity whenever they are exposed to light and potentially lethal voltages can be present when more than two modules are connected in series. The installation and wiring of the PV modules should always be performed by an electrical installer who is qualified in accordance with ALL local standards and codes. When working with PV modules, the following precautions shall be taken;

a) Ensure that appropriate barriers (fences etc.) are installed to prevent interference or accidental contact with live circuit elements by unauthorized personnel or animals.

b) Disconnect the electrical circuit (inverter or DC load switch) before disconnecting module cables.

DO NOT

a) Scratch or mishandle the product,

b) Damage, pull, bend or place heavy loads on the cables.

c) Connect modules together when the terminals are wet.

d) Attempt any installation in adverse weather conditions (high winds, rain or when ice or snow is present).

4.4. Fire Rating

Modules conforming to UL1703 have been certified to comply with UL790 Class C fire rating.

For rooftop installations, the fire rating of a roof covering below the modules must be the same or better than the module rating

5. Mechnaical Installation

5.1 Planning and Design

- Before installation, check to ensure all sub-structure will accommodate expected system loads.
- For rooftop installations, mount the modules over a fire resistant roof covering rated for the application
- Mechanical structures should not contact the module backsheet under any load conditions. Also, ensure that the other component system do not exert mechanical and electrical influences on the modules.
- Consider the following factors during system design, which will influence performance:

a) TPS solar modules produce the most power when they are pointed directly at the sun, and should be tilted for optimum system performance. Find out the optimum orientation and tilt of the PV modules for your region to achieve the maximum yield. Generally, the permissible angle of inclination of the solar module is beween $3° \leq \Theta \leq 80°$.

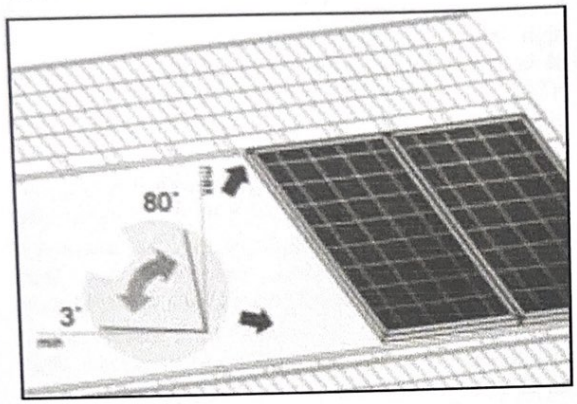

Fig. 9 Permissible angle of inclination

b) Ensure that the modules are not installed in close proximity to buildings, tree, snow cover, dirt as this may lead to power loss due to shadowing.

c) The solar modules are designed to have an operating temperature of -40 °C to +85 °C, so the design should ensure that there is adequate airflow across the module. Also, wind and snow load can be maximum upto 5400 Pa (as tested according to IEC 61215)

d) Allow a minimum spacing of 6.5 mm between modules for thermal expansion and of 10 cm between module frame and the mounting structure to ensure that the junction box does not touch the structure and air circulate across the back of the module

5.2 Mounting Frame Requirements:

- All the necessary structural requirements should be meet
- The structure should able to withstand the local snow and wind load
- The structure should be properly fastened to the ground, roof or the facade
- Ensures sufficient air circulation to the module.
- The electrochemical voltage potential among different metals should be low to prevent corrosion.
- Allows for stress-free expansion and contraction due to temperature fluctuations. Ensure that no mechanical stresses are generated on the module. Ensure that the clamps and the mounting frame are compatible.

5.3 Clamp System Requirements

Use customary clamps that satisfy

- Clamp width: ≥40 mm.
- Clamp height compliant with a 50 mm frame height.
- Clamp depth: 7–12 mm.
- Clamping surface area (depth x width): ≥400 mm².
- Clamps that satisfy the structural requirements of the installation site.
- Long-term stable clamps that securely affix the module to the mounting frame.

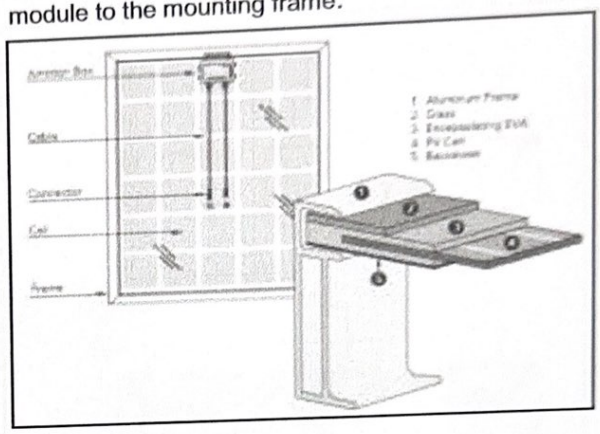

Fig. 10 Module components and cross section of the laminated system

5.4 Module Orientation Requirements

- Both the vertical or horizontal installation is permitted.
- Installation with a junction box at the bottom is permitted for modules with junction boxes classified as IP65 or IP68. Ensure that no water accumulation occurs and the drainage holes in the frame are not covered. There should be no sealing.
- A module with 1,210 mm-long cable can be wired as a "2nd next neighbor"

1. "2nd next neighbor" - Wiring without a return cable.
2. Standard wiring with a return cable

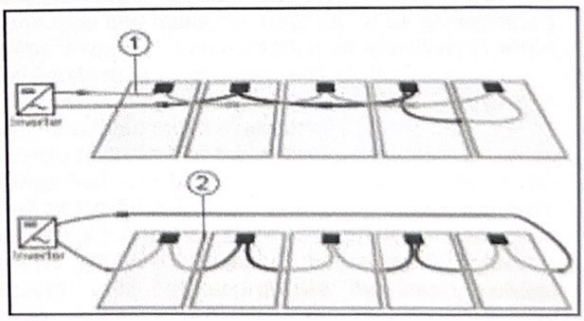

Fig. 10 Shows wiring of cable for adjacent module

These modules are suitable for mounting using either

- A minimum of 4 front mounted module clamps fixed in the locations shown in Figure 11 or