

Unloading Handling & Storage Manual

Table of Contents

1. Introduction.....	2
Purpose and Importance of the Manual.....	2
Applicable Product series:.....	2
2. Unloading of Solar Modules.....	3
Important and Mandatory Checkpoints at time of Delivery:	3
1.Unloading with a forklift	4
2.Unloading with a Crane.....	6
3. Unpacking of Solar Modules	7
3.1 Markers on outer packaging	7
3.2 Packaging Parts List.....	8
3.3 Unpacking Instruction to Solar Modules Pallet:.....	9
4. Storage Recommendations for Solar Panels	11

1. Introduction

This manual provides comprehensive guidelines for the safe and efficient Unloading and storage of solar photovoltaic (PV) modules manufactured and supplied by JAKSON Engineers Limited. Adherence to these procedures is essential to maintain product integrity, ensure personnel safety, and comply with relevant standards.

Purpose and Importance of the Manual

The primary objectives of this manual are:

- **Ensuring Safety:** To protect all personnel involved in the handling of PV modules by outlining proper procedures and safety measures.
- **Maintaining Product Integrity:** To prevent damage to PV modules during loading, unloading, and transportation, ensuring optimal performance and longevity.
- **Operational Efficiency:** To streamline the unloading processes, reducing time and resource consumption while maintaining high safety and quality standards.

Applicable Product series:



HELIA: Monoperc Monofacial series



HELIA PLUS: Monoperc Bifacial series



HELIA NXT: TOPCon Bifacial series with M10/M10R cells



HELIA NXTR: TOPCon Bifacial series with G12R cells

2. Unloading of Solar Modules

At receipt of PV modules, verify the product details as per your order. Packing list pasted outside the box/pallet contains all details including the serial no of modules. Before unloading, check for any physical damage during transit.



Fig.1 Before unloading, check all Pallets and Packing are good condition with no physical damage

Important and Mandatory Checkpoints at time of Delivery:

On receipt of material ,Purchaser must check that consignment is received in safe condition and there is no physical impact/ damage observed before unloading.

- a) **If Physical Damage observed at time of delivery** - In the event if any pallets are found tilted/damaged on receipt , mention same on LR while taking delivery of consignment. Take photographs of damaged material from all angles along with short video and share with seller immediately with all supporting evidence like damage Pictures, serial numbers, LR copy with Purchasers comments, along with Invoice copy for raising transit insurance claim. (applicable in case insurance is in supplier scope)

Thereafter within maximum of 15 days of delivery, purchaser should share details of modules actually found damaged after opening of pallets with photographs and serial numbers for further action.

Post submission of details, purchaser should keep the damaged modules in as it is condition and assist Insurance surveyor appointed by seller for quantification of loss.

- b) **If there is no physical damage at time of delivery** – In case purchaser is unable to check and verify for any transit damage inside pallet, Purchaser should mention on LR (Lorry Receipt) that material has been received subject to physical verification. Same must be physically checked and verified within 7-10 days of material receipt at site for any transit damage. Follow procedure as mentioned in earlier clause informing seller representative with all required details.
- c) Any damage which happen due to shifting of modules from first point to delivery during subsequent handling or transportation to site is not covered in transit insurance.

1. Unloading with a forklift

1. It is advisable to unload the packing box exclusively using a forklift.
2. Ensure that the forklift is in good working condition and operated by trained person.
3. Always transport full bulk pack solutions with a forklift, entering from the short side. When loading and unloading, select the forklift based on the size and weight of the goods. If the fork length is less than three-quarters of the size of the goods, attach extension sleeves to the forks before lifting to prevent the packing container from tipping during movement.
4. Avoid contact or collisions between sharp objects (such as forklift pallet forks) and the module box to prevent damage to the internal modules. The forklift's load capacity should be suitable to safely carry the weight of the pallet/pallets. (recommended min 3 tons load bearing capacity for up to 2 Pallets)
5. If the modules need to be temporarily stored after unloading, ensure there is sufficient space between each pallet to avoid scratching the cartons or pallets during subsequent transfers.
6. At the project site, operate the forklift at a controlled speed of no more than 5 km/h in straight lines and no more than 3 km/h while turning.
7. Please drive slowly and avoid allowing the forks to strike the cartons or pallets. It is recommended to operate the forklift from the short side of the pallet and avoid contact with the glass side. If it is necessary to work on the glass side, please place protective buffer material in advance to prevent damage to the internal modules from external forces.



Fig.2a A forklift



Fig.2b Please drive slowly and avoid allowing the forks to strike the cartons or pallets

Unloading Platform requirements and Precautions:

Unloading Tools: Forklift/Unloading platform/Unloading pad tooling If the container is unloaded on the unloading platform, it is required to be used with the unloading platform or tooling.

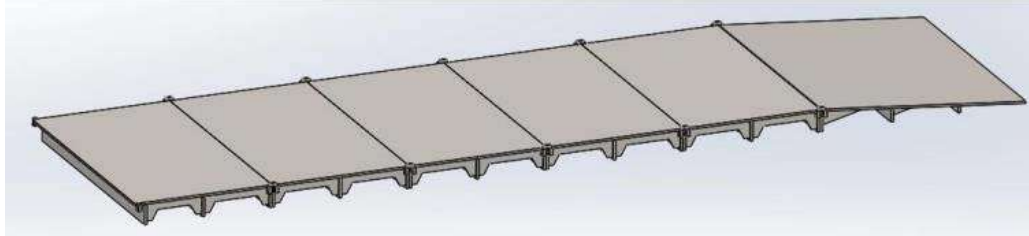


Fig.3

The unloading platform or tooling must be used when unloading from the container onto the platform. Ensure the height of the unloading platform and tooling aligns with the container's bottom plate, maintaining a height tolerance within ± 10 mm.

1. The unloading platform should be made from sturdy, durable materials capable of supporting the weight of the solar panels, forklifts, or other unloading equipment without risk of collapse. Concrete or steel platforms are ideal for heavy-duty use.
2. The platform must be level to ensure the load remains stable when lifted. Uneven surfaces increase the risk of tipping or dropping the load during unloading.
3. The platform should have a non-slip surface (e.g., textured steel or rubber mats) to prevent accidents caused by slipping or instability during the unloading process.
4. The platform should be large enough to accommodate the entire load of solar panels being unloaded, including enough space to maneuver forklifts and other equipment safely. A clear area for storage or immediate transport of panels should also be considered.
5. The platform should be of an appropriate height to facilitate easy loading and unloading with forklifts or other handling equipment.
6. Ensure that the platform is designed to drain water effectively, especially if it is used in outdoor conditions.
7. Ensure the unloading area is well-lit. Poor lighting can lead to mishandling and accidents.

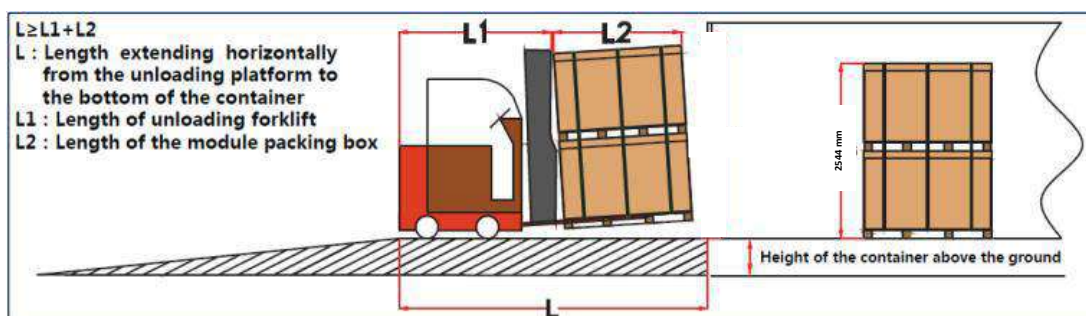


Fig. 4

During container unloading with a fuel forklift, adjust the fork height to align with the pallet's short side. Insert the forks completely under the pallet, ensuring the modules are lifted at an appropriate height with a tilt angle of less than 2° . Minimize the distance between the modules and the ground when moving the forklift out of the container door. Ensure the fork height from the ground and the clearance between the goods and the container's top do not exceed 80 mm. The forklift arm must have sufficient length to lift the modules securely from the pallet's short side, with the fork height not exceeding 40 mm from the ground. If unloading from the pallet's long side, use a fuel oil forklift and proceed slowly to ensure safe handling.

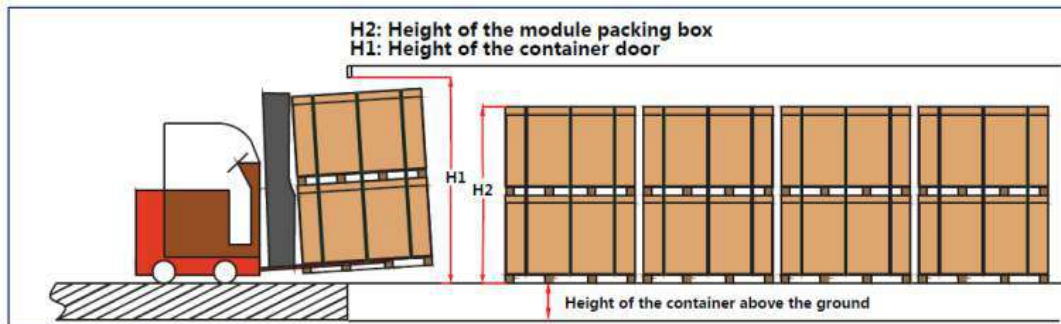


Fig. 5

2. Unloading with a Crane

- Unloading with a crane should be avoided and only used where forklift is not feasible.** If a crane is necessary, ensure specialized tools are selected based on the module's weight and size.
- Use a long nylon sling for crane hoisting; wire ropes are not permitted. . Use $\geq 8m$ and $\leq 11m$ belts for unloading the Solar PV Modules Pallet.
- Ensure the sling's length is evenly distributed on both sides to prevent tilting or excessive tension that could damage the modules.
- Keep the box balanced during lifting to avoid tilting and ensure safe handling.
- Support the box during lifting using wooden planks, boards, or similar fixtures to reduce pressure on contact points/modules.
- Always place packing boxes/pallet on flat, even ground after unloading.
- Arrange modules neatly with a spacing of at least 25 cm between boxes/pallets.
- Do not stack packing boxes or pallets higher than two.
- Document the unloading process with photos and videos for warranty registration.
- Do not lift more than one pallet at a time and avoid unloading in adverse weather conditions such as high winds/ storms/ heavy rain, or snow.

3. Unpacking of Solar Modules

1. Before unpacking, verify the product type, power bins, serial numbers, and instructions provided on the packaging box. Avoid using unauthorized unpacking methods.
2. Ensure the packaging box is intact before unpacking. Use a utility knife to carefully remove the packing belt and wrapping film. Avoid forceful removal to prevent scratching the modules.
3. Follow the recommended unpacking procedures, involving at least two trained people for the task. Always wear appropriate PPE, such as insulating gloves, safety boots, hard helmets etc.

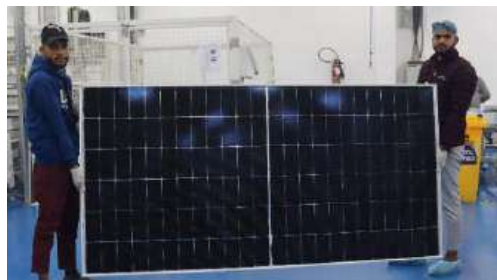


Fig.6

4. When stacking modules, ensure the glass side of the bottom module faces up, the middle modules face down, and the top module faces up. Limit stacks to a maximum of 16 modules, keeping the frames properly aligned.
5. Avoid carrying or unpacking modules in windy conditions. Secure unpacked modules appropriately and refrain from unpacking outdoors in rain or snow.
6. Do not carry modules alone (one person) to prevent accidental slips that could cause scratches, cracks, deformation or injury.
7. Avoid lifting modules by their cables or junction box.
8. Keep the stand supporter stable during unpacking to prevent tilting. Do not lean modules against unstable objects like poles or mounting columns. Refrain from directly supporting the back of modules with materials like wooden strips.

3.1 Markers on outer packaging



Fig.7



Fig.8

3.2 Packaging Parts List



PALLET



CORNER PROTECTOR



Corrugated Cardboard



Straps



Stretch foil



Edge Protector

Fig.9

3.3 Unpackaging Instruction to Solar Modules Pallet:

Required equipment: Scissors, working gloves

Personnel: At least 3

1. Check the pallet list for all module information.
2. Cut the green straps. Use suitable cutting devices (eg scissors)
3. Remove the shrink wrap.
4. Lift the cardboard frame from side and top.
5. After removing the strap, please take the PV modules out of the cardboard box. First start with the modules that have edge protector.
6. Place the module in a safe place with cardboard underlayment to avoid damage.
7. Modules should be taken out one by one from one end by two people, with a third person providing support from the other side of the pallet if an anti-falling shelf is not available.
8. Repeat the process for all modules until they're all out of the box.
Always use the short sides when lifting and transporting modules. Be careful to never stand in a potentially dangerous posture while handling or transporting the modules. Mechanical equipment should always be used when transporting multiple modules.
9. The unpacked PV modules should be placed flat on the pallet. The stacked quantity should not be more than 16 pieces. Be sure to place the first module with the front side up and the others with the front side facing down.

Table -1(Unpackaging Instruction to Solar Modules Pallet)


Step 1: Check the pallet list for all module information.



Step 2: Cut the green straps. Use suitable cutting devices (eg scissors). Remove the shrink wrap.



Step 3: Remove the cardboard frame from sides.



Step 4: Cut the green straps. Use suitable cutting devices (eg scissors). An anti-falling shelf should be used or somebody should hold/support the modules from one of the longer edges to avoid any tilting or falling of modules.



Step 5: Modules should be taken out one by one from one end by two people, with a third person providing support from the other side of the pallet if an anti-falling shelf is not available.



Step 6: Repeat the process for all modules until they're all out of the box. An anti-falling shelf can be used for providing support to the modules.

4. Storage Recommendations for Solar Panels

1. Store modules in a dry, ventilated environment on flat, hard ground.
2. Maintain a relative humidity below 85% and a temperature range of -40°C to 50°C.
3. Panels should be kept out of direct sunlight during storage.
4. Keep modules in their original waterproof and dustproof packaging.
5. **Avoid stacking pallets more than two ; if outdoors, it is recommended to stack only one pallet with protective covers.**
6. Maintain a spacing of at least 25 cm between boxes and ensure neat arrangements.
7. Do not store modules near corrosive chemicals or flammable gases. Make sure the storage area is equipped with appropriate fire suppression equipment, such as extinguishers, and that personnel are trained in emergency response procedures
8. Regularly inspect warehouse shelves for sufficient carrying capacity and stability.
9. Protect storage areas from rain and implement drainage to prevent water accumulation.
10. Access to the module storage area should be restricted to authorized personnel only.
11. For long-term storage, it is advisable to keep the modules in a standard warehouse with regular inspections. Ensure personal safety when reinforcing packaging if any irregularities are detected. The warehouse shelves should have adequate load-bearing capacity and storage space, with routine checks to guarantee safe storage.
12. If you must store the modules at the project site, avoid soft or unstable ground. Opt for a solid surface or elevated ground with a flat area to prevent package collapse or tilting during long-term storage. In rainy conditions, fully cover the modules and pallets with protective rain gear, and implement moisture-proof measures for pallets and cartons to guard against collapse and moisture infiltration.
13. When conditions are sunny or windy, remove the rain cover promptly to allow packages to dry and prevent damage caused by water accumulation. Ensure that pallets do not remain submerged in rainwater to avoid mold and decay. Implement drainage measures to prevent water buildup on the ground after rain, which could lead to softening or sinking of the surface.

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