

Sunman Energy
Level 9, 153 Walker Street
North Sydney NSW 2060

16 Feb 2023
Gamcorp Reference: 12270

eArc Solar Panels to Be Installed On Top of Building Roofs

Gamcorp have been engaged by Sunman to issue a White Paper which explores the advantages of the eArc Module compared to the conventional glass panels. Due to the new wind codes (AS/NZS 1170.2-2021) impact on the commercial solar industry, innovative products and solutions will need to be adopted to ensure maximum utilisation of a roof area. Many projects that were considered not suitable for traditional systems have taken advantage of the innovative elements of Sunman's eArc MonoCrystalline Module system and examples of these advantages are elaborated below:

Information provided by Sunman Energy:

1. Solar PV panel specifications: eArc MonoCrystalline Module
2. Structural Silicon to be used to glue the panels to the roof sheet.

Gamcorp Review & Technical Comments:

Based on the specifications provided, the installed weight of PV panels is 3.5kgs/m², which equals 0.035kPa.

- **Gravity Load (Dead-Loads):** For existing buildings, based on the assumption that the building roof has been designed complying with the Australian Building Regulations, the roof structure has been designed for a Live Load of 0.25kPa. After Solar installation, it can be reasonably assumed that this live load of 0.25kPa can be reduced to 0.215kPa for the area occupied by the solar panels.
- **Wind Load (Uplift/Downward):** Since the panel is 2mm thick only, and they are flush-installed onto the roof surface. The roof profile before eArc solar panel installation and after eArc solar panel installation can be treated to be the same such that the wind applied on the roof before eArc solar panel installation and after eArc solar panel installation remains unchanged.

Gamcorp has seen some advantages when installing eArc solar panels vs traditional glass panels on top of the existing building roof, such as:

- **Large Spans between Rafters:**
The installation of traditional glass panels for roofing may result in an increase in the deflection of the structure due to the wide spacing between the rafters and the added weight of the panels. This can cause issues with serviceability due to excessive deflection. As an alternative solution, the use of lightweight solar panels, such as eArc panels, is recommended to mitigate these issues. This is particularly relevant when the roof structure consists of a single span direct roof structure (purlin/batten), as deflection is more likely to be a concern in such scenarios. The implementation of eArc panels offers a more favorable outcome in these circumstances.
- **High Wind Pressure Zones:**
In regions that experience high wind pressure, such as corner and edge zones, the installation of traditional glass panels will necessitate the use of additional rails to ensure secure placement on the roof. The fixing requirements for traditional panels are limited by the array frame and the direct support provided by purlins, whereas adhesive bonding allows for a greater number of fixings across the entire undersurface of the panel, which is significantly higher than the fixing capacity of rail/clamp connection systems.
- **Flexible Panels:**
Since eAc panel is semi flexible, for some unique roof profiles, or at some awkward locations on the roof, it can normally provide better solutions than the traditional glass panels, which are rigid. This is especially true with insulated curved roof sheeting where the curvature of the panel can match the low curvature of the roof sheeting itself.

Advantages for New Building Design:

In the context of new building design to allow for solar panel installations, the use of the light-weight eArc panels is even much better than the use of the traditional glass panels, which is supported by the following:

- **Purlin Design Reduction:**
The dead load to be resisted by the direct support roof structure will be much less. For example, for a typical warehouse building, dead load of the roof to be considered is normally in the order of 0.11kPa (0.05kPa from the metal roof sheet, 0.05kPa from the roof steel purlins, and 0.01kPa from the safety mesh and some light lighting). If the building needs to allow for installation of solar panels, for traditional glass panels, the additional weight will be 0.15kPa, which is 136% of the roof dead load itself. While light-weight eArc panels are used, the additional weight is 0.035kPa, which is only 31% of the roof dead load itself.
- **Rafter Spacing Reductions:**
This leads to an economical design of the primary building structure as well, such as rafters and columns. For example, for a typical rafter spacing of 9.0m, the additional dead load to the rafter from installing traditional glass panels is 1.35kN/m, which is 135kg/m; While the additional dead load to the rafter from installing the light-weight eArc panels is 0.315kN/m, which is only 31.5kg/m;
- **Concrete Design Efficiencies:**
Finally it leads to an economical design of the foundation due to less weight which needs to be resisted by the footing. For example, if the rafter spans 30m with a spacing of 9.0m, the difference of the load to the foundation between installing the traditional glass panels and the light-weight eArc panels will be 15.5kN. If the soil allowable bearing pressure is 150kPa, for this additional 15.5kN dead load, an additional area of 320mm by 320mm concrete is required to be added to the pad footing design.

Advantages for Builders and Building Designers:

The physical amount of saving is dependent on the size and use of the building but these parameters should be clear for a building designer to modify their next project and review the advantages with their builder.

- Advantages for Structural Designers:
 - Reduced purlin size, increased spacing and span
 - Increased flexibility in rafter spacing and portal frame size, including bolt connections
 - Lower concrete requirements, reducing pressure on foundation footings
- Advantages for Builders:
 - Decreased steel tonnage for roof structure
 - Reduced labor time due to lighter purlins and wider spacing
 - Decreased concrete volume and labor costs, reduced carbon emissions to meet energy rating requirements
- Advantages for Building Designers:
 - Reduced steel and concrete has significant benefits to reducing your Carbon emissions while still being able to completely utilise the roof area for Solar Installation.

From the above discussions, it can be seen that from both existing structure and new building design perspective, installation of the light-weight eArc panels has many more benefits than the installation of the traditional glass panels.

Case Study Report:

Five cases have also been studied to support our above findings. For detailed information of the report of the five cases study, please refer to Gamcorp report 12270 - Structural Assessment Documentation.

Lastly we would like to highlight that installation of ligh-weight eArc panels need to be site-specific designed/assessed to ensure the panels can be safely secured on the roof. For existing structures, the roof structure will also need to be assessed to ensure it can withstand the wind load required by the latest AS/NZS1170.2-2021.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



Jianzeng Geng
Technical Director
FIEAust CPEng NER 3108316
NT Registration: 239858ES
QLD Registration: 18455
VIC Registration: EC 39483
TAS Registration: CC7263