

Structural Assessment – Sunpark Greenhouse System

1. Introduction

This document presents the structural assessment of the **Sunspan System**, in which photovoltaic panels are applied as a fully integrated roofing solution on pitched roofs.

The assessment is based on:

- structural calculations performed by Alcomtek
- project-specific assumptions
- product specifications of photovoltaic panels

The purpose of this document is to demonstrate the structural suitability of the system within defined boundary conditions.

2. System Description

The Sunspan System consists of aluminium glazing bars mounted directly onto the purlins. The photovoltaic panels act as the weatherproof roof covering.

Load transfer is as follows:

- wind and snow loads → photovoltaic panels
- photovoltaic panels → aluminium bars
- aluminium bars → purlins

The design is governed by:

- the strength and stiffness of the aluminium profiles
- and the allowable load capacity of the photovoltaic panels

In practice, the photovoltaic panels are typically the governing factor.

3. Standards and Assumptions

The assessment is based on:

- EN 1990 – Basis of structural design
- EN 1991-1-4 – Wind actions
- Dutch National Annex

Assumptions:

- Consequence class: **CC2**
- Terrain category: **open terrain (unobstructed)**
- Excluding: **coastal areas**
- Roof pitch: **10°**



4. Loads

The load assumptions are based on structural calculations in accordance with EN 1991-1-4 and the Dutch National Annex.

The applied loads depend on:

- building height
- wind direction
- roof zones (zones F to J)

4.1 Wind Load – Portrait Orientation (reference: 10 m height)

Peak velocity pressure:

$$q_p = 1.02 \text{ kN/m}^2$$

Wind direction 0° (X):

Zone Wind suction

F	-1.33 kN/m ²
G	-1.02 kN/m ²
H	-0.46 kN/m ²
I	-0.51 kN/m ²
J	-0.82 kN/m ²

Wind direction 90° (Y):

Zone Wind suction

F	-1.48 kN/m ²
G	-1.33 kN/m ²
H	-0.66 kN/m ²
I	-0.56 kN/m ²

Governing zone: **Zone F ≈ -1.48 kN/m²**

4.2 Wind Load – Landscape Orientation (reference: 30 m height)

Peak velocity pressure:

$$q_p = 1.43 \text{ kN/m}^2$$

Wind direction 0° (X):

Zone Wind suction

F	-1.86 kN/m ²
G	-1.43 kN/m ²
H	-0.64 kN/m ²
I	-0.72 kN/m ²
J	-1.14 kN/m ²



Wind direction 90° (Y):

Zone Wind suction

F	-2.07 kN/m ²
G	-1.86 kN/m ²
H	-0.93 kN/m ²
I	-0.79 kN/m ²

Governing zone: **Zone F ≈ -2.07 kN/m²**

4.3 Snow Load

The characteristic snow load is taken as:

$$q_{snow} = 0.70 \text{ kN/m}^2$$

This load is included in the load combinations but is not governing compared to wind suction.

5. Landscape Orientation

Conclusion based on Alcomtek calculations

The selected profiles in the Sunspan landscape configuration are capable of resisting the assumed extreme loads without any issues throughout the Netherlands, under the following conditions:

- Building height ≤ **10 m**
- Roof pitch ≥ **10°**
- Purlin spacing ≤ **1.85 m**
- Applicable in all Dutch wind regions
(*open terrain, excluding coastal areas*)

Additional condition – photovoltaic panels

- Panel mounted on the **short side**
- Allowable wind load:

$$\leq 1.5 \text{ kN/m}^2$$

Assessment

The calculated wind suction (up to **2.07 kN/m²**) exceeds this limit. Therefore, the photovoltaic panel is governing.

Mandatory verification

For landscape installation: The installer must verify with the panel manufacturer that the panel is suitable for this load when mounted on the short side.

If this cannot be confirmed: **portrait orientation must be applied**



6. Portrait Orientation

Conclusion based on Alcomtek calculations

The selected profiles in the Sunspan portrait configuration are capable of resisting the assumed extreme loads without any issues throughout the Netherlands, under the following conditions:

- Building height ≤ 30 m
- Roof pitch $\geq 10^\circ$
- Purlin spacing ≤ 1.55 m
- Applicable in all Dutch wind regions
(*open terrain, excluding coastal areas*)

Additional condition – photovoltaic panels

- Panel mounted on the **long side**
- Allowable wind load:

$$\leq 2.4 \text{ kN/m}^2$$

Assessment

The governing wind suction ($\approx 1.48 \text{ kN/m}^2$) remains within this limit. Therefore, the system is directly applicable within these conditions.

7. Profile Verification

The aluminium profiles have been verified for:

- Allowable stress:

$$\sigma_{allow} = 195 \text{ MPa}$$

- Deflection:

$$w_{max} = L/100$$

Result:

- Profiles comply in all configurations
 - Not governing for the design
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8. Summary

	Orientation	Max. height	Purlin spacing	Wind suction	Allowable	Governing
Landscape	10 m	≤ 1.85 m	up to 2.07 kN/m ²	1.5 kN/m ²	Panel	
Portrait	30 m	≤ 1.55 m	up to 1.48 kN/m ²	2.4 kN/m ²	System OK	



9. Conclusion

The Sunspan System complies with the Eurocodes within the boundary conditions defined by the Alcomtek calculations.

- The aluminium profiles provide sufficient strength and stiffness
- Load transfer is structurally sound
- Applicability is primarily governed by the photovoltaic panels

In **landscape orientation**, the photovoltaic panel is governing and requires verification. In **portrait orientation**, the system complies within standard panel specifications.

10. Disclaimer

This assessment is based on:

- Dutch wind conditions
- standard assumptions
- Alcomtek structural calculations

It should be noted that:

Wind Region I according to the Dutch National Annex represents a relatively conservative wind loading scenario compared to many other countries.

However:

For projects outside the Netherlands, or with project-specific conditions, the final structural design must always be verified and approved by a **locally certified structural engineer**, in accordance with national regulations.