

## Structural Assessment – Kyroof Fixing System

### 1. Introduction

This document provides the structural assessment of the Kyroof fixing system, in which photovoltaic panels are mounted onto an OSB roof deck using mechanical brackets. The OSB boards are fixed to timber battens, which form part of the supporting roof structure.

The assessment is based on:

- **Eurocode 5 (EN 1995-1-1)** – Timber structures
- **Eurocode 1 (EN 1991-1-4)** – Wind actions
- ETA data of the applied fasteners

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### 2. System build-up

The load transfer is as follows:

**Solar panel → brackets → OSB board → screws → battens / rafters**

Two connections are considered:

1. OSB board → timber substructure
2. Bracket → OSB board

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### 3. Fixing of OSB boards to timber battens

#### Assumptions

- Screw: full-thread 5×60 mm stainless steel
- Timber class (conservative): **C18**
- Characteristic density:

$$\rho_k = 320 \text{ kg/m}^3$$

- Effective penetration depth:

$$l_{ef} = 25 \text{ mm}$$

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#### Withdrawal parameter (Eurocode 5)

$$f_{ax,k} = 0.082 \cdot \rho_k = 0.082 \cdot 320 = 26.2 \text{ N/mm}^2$$



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### Characteristic withdrawal resistance

$$F_{ax,Rk} = f_{ax,k} \cdot d \cdot l_{ef}$$
$$F_{ax,Rk} = 26.2 \cdot 5 \cdot 25 = 3275 \text{ N}$$

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### Design value

$$F_{ax,d} = \frac{3275}{1.3} \approx 2520 \text{ N}$$

Design value  $\approx$  2.5 kN per screw

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## 4. Fixing of brackets to OSB

### Assumptions

- OSB3 board, thickness: 18 mm
- Density:

$$\rho_k \geq 600 \text{ kg/m}^3$$

- Screw diameter: 5 mm
- Effective penetration depth:

$$l_{ef} = 18 \text{ mm}$$

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### ETA-based withdrawal values

According to supplier data:

$$f_{ax,k} = 30\text{--}45 \text{ N/mm}^2$$

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### Characteristic resistance

$$F_{ax,Rk} = f_{ax,k} \cdot d \cdot l_{ef}$$

Lower bound:

$$30 \cdot 5 \cdot 18 = 2700 \text{ N}$$

Upper bound:

$$45 \cdot 5 \cdot 18 = 4050 \text{ N}$$

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### Design value

$$F_{ax,d} = 2.1\text{--}3.1 \text{ kN per screw}$$

Conservatively adopted:  $\approx$  2.0 kN per screw



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## 5. Fixing of solar panels

### Assumptions

- Panel area:

$$A \approx 2.05 \text{ m}^2$$

- Number of fixings: 4 per panel
- Design value per screw:

$$F_{ax,d} = 2.1 \text{ kN}$$

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### Total resistance per panel

$$F_{tot} = 4 \cdot 2.1 = 8.4 \text{ kN}$$

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### Equivalent load per m<sup>2</sup>

$$q = \frac{8.4}{2.05} \approx 4.1 \text{ kN/m}^2$$

≈ 4100 N/m<sup>2</sup> uplift capacity

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## 6. Wind load (Eurocode 1)

### Reference scenario (conservative)

The system has been assessed using Dutch wind regions as a reference:

- Wind region: I
- Terrain category: open terrain
- Built height: 20 m
- Peak velocity pressure:

$$q_p = 1.27 \text{ kN/m}^2$$

- External pressure coefficient (worst-case local zone):

$$C_{pe} = -2.9$$

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### Resulting uplift load

$$q = q_p \cdot C_{pe}$$
$$q \approx 3.7 \text{ kN/m}^2$$

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## 7. Comparison: resistance vs load

Component	Capacity
OSB-to-structure fixing	~ 3.7 kN/m <sup>2</sup>
Panel fixing	~ 4.1 kN/m <sup>2</sup>
Wind load (reference case)	~ 3.7 kN/m <sup>2</sup>

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## 8. Conclusion

- The Kyroof fixing system is structurally adequate for the considered reference scenario.
- Both the OSB-to-structure connection and the bracket-to-OSB connection provide sufficient resistance.
- The calculated capacity is in line with a conservative wind load scenario.

In practice:

- Not all extreme conditions occur simultaneously
  - Load distribution over multiple fixings provides additional robustness
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## 9. Important considerations

- Load distribution depends on system stiffness and detailing
  - Edge distances and fixing patterns must be respected
  - Local peak loads (edge and corner zones) may govern the design
  - National regulations and local wind conditions must always be applied
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## 10. Disclaimer and recommendation

This assessment is based on **Dutch reference conditions**.

For projects:

- outside the Netherlands
- in higher wind or snow regions
- or with project-specific configurations

the final structural design must always be:

**verified and approved by a locally certified structural engineer,**  
in accordance with applicable national regulations.