

# **SOLAR BRACKET INDUSTRIES PTY Ltd**

## **TILED ROOF MOUNTING BRACKET SPECIFICATIONS**

### **SHEET**



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REVISION SCHEDULE

| Revision Number | Date | Description | Author |
|-----------------|------|-------------|--------|
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|                 |      |             |        |
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|                 |      |             |        |

## 1. SCOPE OF WORK

Design specification for new tiled roof mounting bracket as per SOLAR BRACKET INDUSTRIES PTY Ltd .

Patent and all specification and design requirements is stipulated in the following document.

## 2. SOLAR PANEL MOUNTING BRACKET FORM IN ACCORDANCE WITH SANS 10400

Tile roof mounting bracket **IMAGE 1** consists of 2 components, components is secured to one another with screw as per **IMAGE 3**, the bracket is mounted to timber truss with screws as per **IMAGE 2**, all solar rails is mounted to bracket with screw **IMAGE 3**.

|                                                                                    |                                                                                     |                                                                                     |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |
| <b>IMAGE 1</b><br>TILE MOUNTING BRACKET                                            | <b>IMAGE 2</b><br>GALVANIZED SELF TAPPING SCREW WITH<br>RUBBER WASHER               | <b>IMAGE 3</b><br>8mm Mushroom head square<br>neck                                  |

## 3. SOLAR PANEL TILED ROOF MOUNTING BRACKETS IN COMPLIANCE WITH SANS 10400

| PARAMETER                     | REQUIREMENT                                                                                                                                                                                                                                                                                                                               | REFERENCE         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>Material</b>               | Mounting bracket are manufactured form <b>3CR12 12% chromium utility ferric stainless steel</b> , The material has excellent weather and temperature resistance, refer to data sheet in addendum 1.                                                                                                                                       | SANS 10400 Part B |
| <b>Structural Integrity</b>   | Mounting brackets has a minimum thickness off 3mm, the brackets can support the weight of the solar panels and withstand imposed wind loads, equal and above the industry standards for roof manufactures specifications. <b>(Roofs - Ultimate Super-Imposed Distributed Load of 1,50 kN/m²and Ultimate Uplift Load of 1,60 kN/m².)</b> . | SANS 10400 Part L |
| <b>Anchoring and Fixation</b> | Brackets are anchored to timber trusses with 4x 8mm Top Speed screws as per image 2, centre adjustable screw 8mm Mushroom head square neck as per image 3 to prevent detachment under ultimate wind load conditions. <b>(Roofs - Ultimate Super-Imposed Distributed Load of 1,50 kN/m²and Ultimate Uplift Load of 1,60 kN/m².)</b> .      | SANS 10400 Part B |

| PARAMETER                              | REQUIREMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                 | REFERENCE                   |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Waterproofing</b>                   | Brackets are placed below tiles in such a manner that no sealant is required for brackets, all the tiles must be inspected for damage after installation to ensure the roof retains water waterproofing as per original erection specifications.                                                                                                                                                                                                            | SANS 10400 Part L           |
| <b>Spacing and Clearance</b>           | 1250mm C/C spacing between mounting brackets with a minimum 50mm vertical clearance between solar panels and the mounting surface must be maintained to allow for cooling and to prevent shading. Always consult with a professional engineer or solar installer to determine the appropriate spacing and clearance Ensure that all installations comply with SANS 10400 and other relevant standards to maintain safety and efficiency.                    | SANS 10400 Part XA          |
| <b>Tilt Angle</b>                      | Tiled Mounting bracket allows for horizontal alignment to allow proper fixing of mounting rails.                                                                                                                                                                                                                                                                                                                                                            | SANS 10400 Part XA          |
| <b>Wind Resistance</b>                 | The mounting system must be designed to withstand wind speeds as specified in the local building codes, including any uplift forces. All mounting brackets has a minimum shear resistance of 3Kn. This exceeds the industry standard of Tiled roof component fixing and minimum required shear resistance of timber elements.                                                                                                                               | SANS 10400 Part K           |
| <b>Corrosion Resistance</b>            | <b>3CR12</b> is determined by the chromium content of 12% similar to stainless steel, this <b>3CR12</b> steel may show staining in sever atmospheric conditions, this will not affect the longevity of the bracket. <b>3CR12</b> can be painted if appearance is of concern, especially in coastal areas or other environments with high moisture or salt content.                                                                                          | SANS 10400 Part B           |
| <b>Maintenance Access</b>              | The tile roof mounting bracket design allows for safe and easy access for maintenance and cleaning of the solar panels.                                                                                                                                                                                                                                                                                                                                     | SANS 10400 Part B           |
| <b>Electrical Safety</b>               | Ensure proper grounding of the mounting system to prevent electrical hazards.                                                                                                                                                                                                                                                                                                                                                                               | SANS 10142<br>(Wiring Code) |
| <b>Fire Safety</b>                     | Installations should comply with fire safety regulations, ensuring that the mounting system does not introduce fire hazards.                                                                                                                                                                                                                                                                                                                                | SANS 10400 Part T           |
| <b>Documentation and Certification</b> | All components and installation methods must be documented. If any part of the bracket should be altered it must be certified as compliant with relevant SANS standards.                                                                                                                                                                                                                                                                                    | SANS 10400 Part A           |
| <b>Load Testing</b>                    | Batch testing of Mounting brackets must be done to ensure a manufacturing standard is maintained, load testing to verify their ability to support the designed loads, the following loads are used as standard for static and dynamic loads. MAX STATIC LOAD <b>2.0 kN/m<sup>2</sup>. (PANELS/SNOW)</b><br>DYNAMIC LOAD : 130 km/h (about 36 m/s). This translates to a wind pressure of approximately <b>0.96 kN/m<sup>2</sup> (96 kg/m<sup>2</sup>)</b> . | SANS 10400 Part L           |

**3.1 Compliance Verification:** Installers should ensure compliance with the latest edition of SANS 10400 and other relevant standards.

**3.2 Local Regulations:** Consider any additional local regulations or requirements that may apply.

#### 4. QUALITY CONTROL AND MANUFACTURING PROCESS

- **Manufacturing Quality Control:** Implement a quality control process during manufacturing to ensure each mounting bracket meets the design specifications and standards.
- **Inspection and Testing:** Regularly inspect and test the brackets during production to maintain consistent quality.

#### 5. DOCUMENTATION AND RECORD KEEPING

- **Technical Documentation:** Comprehensive technical documentation that includes design calculations, material specifications, load test results.
- **Compliance Certificate:** Obtain a compliance certificate from a recognized authority or certification body that verifies the mounting bracket meets all relevant parts of SANS 10400.

#### 6. DESIGN CALCULATIONS TABLES

##### 6.1 Nodal point displacement at SLS

| NODAL POINT DISPLACEMENTS at SLS |           |    |    |    |        |        |        |
|----------------------------------|-----------|----|----|----|--------|--------|--------|
| Node                             | Load Case | X  | Y  | Z  | X-rot. | Y-rot. | Z-rot. |
|                                  |           | mm | mm | mm | rad    | rad    | rad    |
| 1                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 2                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 3                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 4                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 5                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 6                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 7                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | DYNA      | 0  | 0  | 0  | 0      | 0      | 0      |
|                                  | C         | 0  | 0  | 0  | 0      | 0      | 0      |
| 8                                | STATIC    | 0  | 0  | 0  | 0      | 0      | 0      |

|    |        |      |   |   |        |   |        |
|----|--------|------|---|---|--------|---|--------|
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 9  | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 10 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 11 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 12 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 13 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 14 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 15 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 16 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 17 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 18 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 19 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 20 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 21 | STATIC | 0    | 0 | 0 | 0      | 0 | 0      |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0    | 0 | 0 | 0      | 0 | 0      |
| 22 | STATIC | 0,04 | 0 | 0 | 0      | 0 | -0,007 |
|    | DYNA   | 0    | 0 | 0 | 0      | 0 | 0      |
|    | C      | 0,04 | 0 | 0 | 0      | 0 | -0,007 |
| 23 | STATIC | 0,14 | 0 | 0 | 0      | 0 | -0,014 |
|    | DYNA   | 0    | 0 | 0 | 0,0001 | 0 | 0      |

|    |        |       |       |   |        |   |         |
|----|--------|-------|-------|---|--------|---|---------|
|    | C      | 0,14  | 0     | 0 | 0,0001 | 0 | -0,014  |
| 24 | STATIC | 0,32  | 0     | 0 | 0      | 0 | -0,021  |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,32  | 0     | 0 | 0,0001 | 0 | -0,021  |
| 25 | STATIC | 0,56  | 0     | 0 | 0      | 0 | -0,028  |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | 0     | 0 | 0,0001 | 0 | -0,028  |
| 26 | STATIC | 0,56  | -0,32 | 0 | 0      | 0 | -0,0345 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -0,32 | 0 | 0,0001 | 0 | -0,0345 |
| 27 | STATIC | 0,56  | -0,69 | 0 | 0      | 0 | -0,04   |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -0,69 | 0 | 0,0001 | 0 | -0,04   |
| 28 | STATIC | 0,56  | -1,11 | 0 | 0      | 0 | -0,0445 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -1,11 | 0 | 0,0001 | 0 | -0,0445 |
| 29 | STATIC | 0,56  | -1,58 | 0 | 0      | 0 | -0,048  |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -1,58 | 0 | 0,0001 | 0 | -0,048  |
| 30 | STATIC | 0,56  | -2,07 | 0 | 0      | 0 | -0,0505 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -2,07 | 0 | 0,0001 | 0 | -0,0505 |
| 31 | STATIC | 0,56  | -2,58 | 0 | 0      | 0 | -0,052  |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -2,58 | 0 | 0,0001 | 0 | -0,052  |
| 32 | STATIC | 0,56  | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,56  | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 33 | STATIC | 0,04  | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | 0,04  | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 34 | STATIC | -0,49 | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | -0,49 | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 35 | STATIC | -1,02 | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | -1,02 | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 36 | STATIC | -1,54 | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | -1,54 | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 37 | STATIC | -2,07 | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | -2,07 | -3,11 | 0 | 0,0001 | 0 | -0,0525 |
| 38 | STATIC | -2,59 | -3,11 | 0 | 0      | 0 | -0,0525 |
|    | DYNA   | 0     | 0     | 0 | 0,0001 | 0 | 0       |
|    | C      | -2,59 | -3,11 | 0 | 0,0001 | 0 | -0,0525 |

## 6.2 Beam element end forces in local element axes at ULS

| BEAM ELEMENT END FORCES IN LOCAL ELEMENT AXES at ULS |           |            |           |           |         |     |     |    |
|------------------------------------------------------|-----------|------------|-----------|-----------|---------|-----|-----|----|
| Element                                              | Load Case | Axial Load | Y - Shear | X - Shear | Torsion | Myy | Mxx | GN |
|                                                      |           | kN         | kN        | kN        | kNm     | kNm | kNm |    |
| 1-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 2                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 2-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 3                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 3-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 4                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 4-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 5                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 5-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 6                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 6-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 7                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | C         | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 7-                                                   | STATIC    | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
| 8                                                    |           | 0          | 0         | 0         | 0       | 0   | 0   | 0  |
|                                                      | DYNA      | 0          | 0         | 0         | 0       | 0   | 0   | 0  |



|     |        |   |   |   |   |   |   |   |
|-----|--------|---|---|---|---|---|---|---|
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8-  | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9   |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9-  | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10- | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11- | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12- | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13- | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14- | STATIC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15  |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|     |        |      |   |       |   |      |      |   |
|-----|--------|------|---|-------|---|------|------|---|
| 15- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 16  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 16- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 17  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 17- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 18  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 18- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 19  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 19- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 20  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 20- | STATIC | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 21  |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | DYNA   | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | 0 | 0     | 0 | 0    | 0    | 0 |
| 21- | STATIC | 2    | 0 | 0     | 0 | 0    | 0,14 | 0 |
| 22  |        | -2   | 0 | 0     | 0 | 0    | 0,14 | 0 |
|     | DYNA   | 0    | 0 | -0,96 | 0 | 0,04 | 0    | 0 |
|     |        | 0    | 0 | 0,96  | 0 | 0,03 | 0    | 0 |
|     | C      | 2,4  | 0 | -1,34 | 0 | 0,05 | 0,17 | 0 |
|     |        | -2,4 | 0 | 1,34  | 0 | 0,04 | 0,17 | 0 |
| 22- | STATIC | 2    | 0 | 0     | 0 | 0    | 0,14 | 0 |

|     |        |      |      |       |   |      |      |   |
|-----|--------|------|------|-------|---|------|------|---|
| 23  |        | -2   | 0    | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | -0,96 | 0 | 0,03 | 0    | 0 |
|     |        | 0    | 0    | 0,96  | 0 | -    | 0    | 0 |
|     | C      | 2,4  | 0    | -1,34 | 0 | 0,04 | 0,17 | 0 |
|     |        | -2,4 | 0    | 1,34  | 0 | -    | -    | 0 |
| 23- | STATIC | 2    | 0    | 0     | 0 | 0,03 | 0,17 | 0 |
| 24  |        | -2   | 0    | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | -0,96 | 0 | 0,02 | 0    | 0 |
|     |        | 0    | 0    | 0,96  | 0 | -    | 0    | 0 |
|     | C      | 2,4  | 0    | -1,34 | 0 | 0,01 | 0,17 | 0 |
|     |        | -2,4 | 0    | 1,34  | 0 | 0,03 | -    | 0 |
| 24- | STATIC | 2    | 0    | 0     | 0 | 0,01 | 0,17 | 0 |
| 25  |        | -2   | 0    | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | -0,96 | 0 | 0,14 | 0    | 0 |
|     |        | 0    | 0    | 0,96  | 0 | 0    | 0    | 0 |
|     | C      | 2,4  | 0    | -1,34 | 0 | 0,01 | 0,17 | 0 |
|     |        | -2,4 | 0    | 1,34  | 0 | -    | -    | 0 |
| 25- | STATIC | 0    | 2    | 0     | 0 | 0    | 0,17 | 0 |
| 26  |        | 0    | -2   | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | 0     | 0 | 0,12 | 0    | 0 |
|     |        | 0    | 0    | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 2,4  | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | -2,4 | 0     | 0 | 0,17 | -    | 0 |
| 26- | STATIC | 0    | 2    | 0     | 0 | 0    | 0,14 | 0 |
| 27  |        | 0    | -2   | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | 0     | 0 | 0,1  | 0    | 0 |
|     |        | 0    | 0    | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 2,4  | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | -2,4 | 0     | 0 | 0,14 | -    | 0 |
| 27- | STATIC | 0    | 2    | 0     | 0 | 0    | 0,12 | 0 |
| 28  |        | 0    | -2   | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | 0     | 0 | 0,08 | 0    | 0 |
|     |        | 0    | 0    | 0     | 0 | 0    | 0    | 0 |
|     | C      | 0    | 2,4  | 0     | 0 | 0    | 0    | 0 |
|     |        | 0    | -2,4 | 0     | 0 | 0,12 | -    | 0 |
| 28- | STATIC | 0    | 2    | 0     | 0 | -0,1 | 0,08 | 0 |
| 29  |        | 0    | -2   | 0     | 0 | 0    | -    | 0 |
|     | DYNA   | 0    | 0    | 0     | 0 | 0,06 | 0    | 0 |
|     |        | 0    | 0    | 0     | 0 | 0    | 0    | 0 |

|     |        |      |      |   |   |   |      |   |
|-----|--------|------|------|---|---|---|------|---|
|     | C      | 0    | 2,4  | 0 | 0 | 0 | 0,1  | 0 |
|     |        | 0    | -2,4 | 0 | 0 | 0 | -    | 0 |
| 29- | STATIC | 0    | 2    | 0 | 0 | 0 | 0,06 | 0 |
| 30  |        | 0    | -2   | 0 | 0 | 0 | -    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0,04 | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | 0    | 2,4  | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | -2,4 | 0 | 0 | 0 | 0,07 | 0 |
| 30- | STATIC | 0    | 2    | 0 | 0 | 0 | -    | 0 |
| 31  |        | 0    | -2   | 0 | 0 | 0 | 0,05 | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | -    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0,02 | 0 |
|     | C      | 0    | 2,4  | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | -2,4 | 0 | 0 | 0 | 0    | 0 |
| 31- | STATIC | 0    | 2    | 0 | 0 | 0 | 0    | 0 |
| 32  |        | 0    | -2   | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | 0    | 2,4  | 0 | 0 | 0 | 0,05 | 0 |
|     |        | 0    | -2,4 | 0 | 0 | 0 | -    | 0 |
| 31- | STATIC | 0    | 2    | 0 | 0 | 0 | 0,02 | 0 |
| 32  |        | 0    | -2   | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | 0    | 2,4  | 0 | 0 | 0 | 0,02 | 0 |
|     |        | 0    | -2,4 | 0 | 0 | 0 | 0    | 0 |
| 32- | STATIC | -2   | 0    | 0 | 0 | 0 | 0    | 0 |
| 33  |        | 2    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | -2,4 | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 2,4  | 0    | 0 | 0 | 0 | 0    | 0 |
| 33- | STATIC | -2   | 0    | 0 | 0 | 0 | 0    | 0 |
| 34  |        | 2    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | -2,4 | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 2,4  | 0    | 0 | 0 | 0 | 0    | 0 |
| 34- | STATIC | -2   | 0    | 0 | 0 | 0 | 0    | 0 |
| 35  |        | 2    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | -2,4 | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 2,4  | 0    | 0 | 0 | 0 | 0    | 0 |
| 35- | STATIC | -2   | 0    | 0 | 0 | 0 | 0    | 0 |
| 36  |        | 2    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | DYNA   | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     |        | 0    | 0    | 0 | 0 | 0 | 0    | 0 |
|     | C      | -2,4 | 0    | 0 | 0 | 0 | 0    | 0 |

|     |        |      |   |   |   |   |   |   |
|-----|--------|------|---|---|---|---|---|---|
|     |        | 2,4  | 0 | 0 | 0 | 0 | 0 | 0 |
| 36- | STATIC | -2   | 0 | 0 | 0 | 0 | 0 | 0 |
| 37  |        | 2    | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0    | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0    | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | -2,4 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 2,4  | 0 | 0 | 0 | 0 | 0 | 0 |
| 37- | STATIC | -2   | 0 | 0 | 0 | 0 | 0 | 0 |
| 38  |        | 2    | 0 | 0 | 0 | 0 | 0 | 0 |
|     | DYNA   | 0    | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 0    | 0 | 0 | 0 | 0 | 0 | 0 |
|     | C      | -2,4 | 0 | 0 | 0 | 0 | 0 | 0 |
|     |        | 2,4  | 0 | 0 | 0 | 0 | 0 | 0 |

### 6.3 Reactions at ULS

| REACTIONS AT ULS |           |    |      |       |       |       |       |
|------------------|-----------|----|------|-------|-------|-------|-------|
| Node             | Load Case | X  | Y    | Z     | X-mom | Y-mom | Z-mom |
|                  |           | kN | kN   | kN    | kNm   | kNm   | kNm   |
|                  |           |    |      |       |       |       |       |
| 1                | STATIC    | 0  | 0    | 0     | 0     | 0     | 0     |
|                  | DYNA      | 0  | 0    | 0     | 0     | 0     | 0     |
|                  | C         | 0  | 0    | 0     | 0     | 0     | 0     |
| 6                | STATIC    | 0  | 0    | 0     | 0     | 0     | 0     |
|                  | DYNA      | 0  | 0    | 0     | 0     | 0     | 0     |
|                  | C         | 0  | 0    | 0     | 0     | 0     | 0     |
| 21               | STATIC    | 0  | 2    | 0     | 0     | 0     | 0,14  |
|                  | DYNA      | 0  | 0    | -0,96 | -0,04 | 0     | 0     |
|                  | C         | 0  | 2,41 | -1,34 | -0,05 | 0     | 0,17  |

### 6.4 Reactions at SLS (Combinations only)

| REACTIONS AT SLS (Combinations only) |           |    |    |       |       |       |       |
|--------------------------------------|-----------|----|----|-------|-------|-------|-------|
| Node                                 | Load Case | X  | Y  | Z     | X-mom | Y-mom | Z-mom |
|                                      |           | kN | kN | kN    | kNm   | kNm   | kNm   |
|                                      |           |    |    |       |       |       |       |
| 1                                    | C         | 0  | 0  | 0     | 0     | 0     | 0     |
| 6                                    | C         | 0  | 0  | 0     | 0     | 0     | 0     |
| 21                                   | C         | 0  | 2  | -0,96 | -0,04 | 0     | 0,14  |

## 7. CONCLUSION

### **TILED ROOF MOUNTING BRACKET CERTIFICATION.**

Herewith certification that the tiled solar mounting bracket has met all design requirements in accordance with the required SANS specifications and is deemed safe for the intended use.

We trust that you will find the information in the report in order and feel free to contact us for any further information that may be required.

Mr L.B.F Ambrose ECSA Registration NO 201370161 will be the responsible engineer.

Yours Sincerely.

**For: FLAGG CONSULTING ENGINEERS (PTY) Ltd**

**LLOYD AMBROSE**

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