1 Kit presentation

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1. Kit presentation

1.1 GSE In-Roof System™

GSE In-Roof System™ enables modules installation on every type of roof covering (curved tiles, interlocking, flat tiles, slates), as well as on new buildings like retrofit buildings.

The mounting system may be installed in a portrait or landscape orientation, with a specific frame for each format, suitable for small installations (less than 3 kWp) and large roofs (ie dedicated manual).

GSE In-Roof System™ must be installed on the wooden substructure of the buildings and mounted on specific battens, adapted to climatic conditions. It can be mounted on slopes between 12° and 50°.

GSE In-Roof System™ is guaranteed for 10 years by the manufacturer. The system doesn’t require much maintenance, except regular cleaning of the PV panels to guarantee an optimum production.

Complementary manuals available:

- GSE Intégration In-Roof System v. TS-1
- GSE Intégration In-Roof System v. A-1
- GSE Intégration In-Roof System Industrial roofs
- GSE Intégration In-Roof System Roof window
1. Kit presentation

1.2 Contents of the kit

◆ MOUNTING FRAME

- GSE Portrait Frame
- GSE Landscape Frame

◆ MOUNTING CLAMPS

- Wood self-drilling screw 6,5 x 60
- EPDM Foam
- End clamp
- Middle clamp
- Edge wedges (L/R)

◆ FLASHINGS

- Flashing hook
- Lateral flashing

◆ WATERPROOFING

- Flexalu TM or eq.
- Sheet of zinc
- Lead tape
- Precompressed seal
- HPV roof undertalment

OPTION 1

- Top flashing
- Attach angle
- Aluminium pop rivet
- Top flashing junction
- Corner flashing

OPTION 2

- Sheet of zinc
1. Kit presentation

1.3 GSE PORTRAIT Frame

Upper stop of the module

Overlapping graduation

Water drainage guide

PV panel supports

Frame fixation (no pre-drilling)

Frame fixation (10 mm pre-drilling)

Clamps fixation (6 clamps) (10 mm pre-drilling)

Clamps fixation (4 clamps) (10 mm pre-drilling)

Portrait frame references – Module sizes

<table>
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<tr>
<th>Réf.</th>
<th>Version 2012</th>
<th>Module tolerances</th>
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1. Kit Presentation

1.4 GSE LANDSCAPE Frame

- Frame fixation (no pre-drilling)
- Frame fixation (10 mm pre-drilling)
- Clamps fixation (6 clamps) (10 mm pre-drilling)
- Clamps fixation (4 clamps) (10 mm pre-drilling)

Landscape frame references – Module sizes

<table>
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<tr>
<th>Module tolerances</th>
<th>Height</th>
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<tr>
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</tbody>
</table>

Overlapping area graduation

- Height tolerance
- Width tolerance
1. Kit Presentation

1.5 Tools required

◆ CHALK LINE
◆ HAMMER
◆ SCREWDRIVER
◆ AVIATION SNIP
◆ DRILL BITS
  • WOOD / METAL DRILL BIT Ø 10mm
  • HEX BIT Ø 8mm
◆ RIVET GUN
◆ MEASURING TAPE
◆ WHITE MARKER
◆ PENCIL

◆ INSTALLATION VIDEO GUIDES

PLEASE FIND ALL OUR INSTALLATION VIDEO GUIDES ON YOUTUBE:

GSE IN-ROOF SYSTEM
GSE AIR’SYSTEM
2. Building site preparation

The installer must proceed to a measurement work beforehand, in order to guarantee the durability and performance of the PV array installed. Climatic conditions of the project (ie. wind and snow\(^1\)) and PV array layout should be considered according to current regulations (Eurocodes and BS 5534).

This data will help **check if the system is suitable for the project conditions**. The thickness of the support battens must be adapted to the roof battens to ensure the junction with the roof covering is watertight.

### 2.1 Climatic Conditions

#### Climatic load according to Eurocode 1 and BS 5534:

<table>
<thead>
<tr>
<th>Geographical wind zone</th>
<th>Wind speed (m/s)</th>
<th>Design Wind Pressure (kN/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>0,820</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>0,975</td>
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<tr>
<td>3</td>
<td>26</td>
<td>1,150</td>
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<tr>
<td>4</td>
<td>28</td>
<td>1,330</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>1,600</td>
</tr>
</tbody>
</table>

**Maximum design wind uplift resistance: 1,88 kN/m\(^2\)**

(According to MCS 012 BBA 0156 certificate)

### 2.2 Location on the roof

The location of the PV array has an influence on the wind load value whether it is in the center, on the edge or in the corner of the roof. The worst case should be taken into account.

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\(^1\) The seismic resistance of the GSE In-Roof System is validated on the whole European territory. This criterion is not to be taken into account.
2.3 Determine wind pressure of the project

To calculate the wind load on the PV array, you need to priorly know the following parameters:

- Location of the project
- Altitude
- Type of terrain
- Distance from the shoreline
- Ridge height
- Roof pitch
- Roof zone (Center, Edge, Corner)

Ideally, climatic load (and especially wind load) should be calculated for each project, but you can refer to the tables below, if all conditions matches with those of the project.

Fixed conditions:

- Terrain category: **Country terrain** (including Town Terrain)
- Distance from the shoreline: **10 km**
- Battens dimension: **25 x 50mm**

### 1st case: Roof pitch ≥ 25°

<table>
<thead>
<tr>
<th>Ridge Height</th>
<th>Location on the Roof</th>
<th>Zone 1 (Alt ≤ 250m)</th>
<th>Zone 2 (Alt ≤ 200m)</th>
<th>Zone 3 (Alt ≤ 150m)</th>
<th>Zone 4 (Alt ≤ 100m)</th>
<th>Zone 5 (Alt ≤ 50m)</th>
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</thead>
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<tr>
<td>6 m</td>
<td>Center</td>
<td>1.26 kN</td>
<td>1.38 kN</td>
<td>1.44 kN</td>
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<td></td>
<td>Edges</td>
<td>1.46 kN</td>
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<td>1.67 kN</td>
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<td></td>
<td>Corners</td>
<td>1.56 kN</td>
<td>1.72 kN</td>
<td>1.78 kN</td>
<td>1.96 kN</td>
<td>2.05 kN</td>
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<tr>
<td>8 m</td>
<td>Center</td>
<td>1.37 kN</td>
<td>1.51 kN</td>
<td>1.57 kN</td>
<td>1.72 kN</td>
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<td>2.09 kN</td>
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<td>Corners</td>
<td>1.71 kN</td>
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<td>10 m</td>
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<td>1.43 kN</td>
<td>1.57 kN</td>
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<td>2.23 kN</td>
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### 2nd case: Roof pitch ≥ 35°

<table>
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<tr>
<th>Ridge Height</th>
<th>Location on the Roof</th>
<th>Zone 1 (Alt ≤ 250m)</th>
<th>Zone 2 (Alt ≤ 200m)</th>
<th>Zone 3 (Alt ≤ 150m)</th>
<th>Zone 4 (Alt ≤ 100m)</th>
<th>Zone 5 (Alt ≤ 50m)</th>
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<td>1.09 kN</td>
<td>1.19 kN</td>
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<td>1.36 kN</td>
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<tr>
<td>8 m</td>
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<td>Corners</td>
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<td>1.78 kN</td>
<td>1.92 kN</td>
<td>2.04 kN</td>
<td>2.13 kN</td>
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</tbody>
</table>
3. Installation

### 3.1 Preparation of the roof covering

#### 3.1.1 Calculation of the PV array dimensions

INFO: Download our layout calculator on the « Download & Media » section of our website www.gseintegration.com to determine the dimensions of your PV array.

The dimensions of the PV array can be calculated using the GSE frame reference (see sections 1.3 and 1.4 to determine the GSE frame compatible with the module):

**Array height (mm) =**

\[ ((\text{Height Ref.} +0 \text{ to } 35+10) \times \text{Nb. lines}) + 160 + 150 + 50 + 100^2 \]

\[ \text{A + B + C + D + E} \]

**Array width (mm) =**

\[ ((\text{Width Ref.} + 36.5) \times \text{Nb. columns}) + (2 \times 165) \]

\[ \text{F + 2 x G} \]

* If integrated in the roof center, add a board to equalise with the tile curve height (ie. 3.3)

#### 3.1.2 Roof cover installation

Remove the roofing elements following the PV array dimensions (calculated beforehand), and by removing 1 or 2 extra tile lines (slate or flat tile) on the lateral sides and top of the array.

<table>
<thead>
<tr>
<th>GSE PORTRAIT FRAMES</th>
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<tr>
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<table>
<thead>
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<th>GSE LANDSCAPE FRAMES</th>
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</thead>
<tbody>
<tr>
<td>Height Ref.</td>
</tr>
<tr>
<td>Width Ref.</td>
</tr>
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</table>

* Landscape frames 1686_1016 and 1700_1016 have a reference height of 992.
3. Installation

3.2 Fixation of the support battens

ATTENTION: PRIOR TO STARTING ANY WORK, THE INSTALLER MUST ENSURE THAT THE FRAMEWORK IS FLAT AND THERE MUST BE A ROOF UNDERLAY ACCORDING TO THE BUILDING STANDARD BS 5534.

1. Determine beforehand the number of fixing clamps and the adapted batten section (see section 2).
2. Dispose the wooden battens to the following locations:
   - Fixing points of the clamps
   - Fixing points of the frames
   - Junction between the frame rows
   - Support of the sealing strip
   - Mounting hooks of top flashings

ATTENTION: THE POSITION OF THE FIXING CLAMPS AND THEIR SUPPORT BATTENS MUST COMPLY WITH MODULE MANUFACTURER REQUIREMENTS.

3 Since these elements play no role in the mechanical system strength, the width of the timber could be different from that calculated for the fixing clamps. Only the thickness should be identical.
3. Installation

All of our battening plans in PORTRAIT and LANDSCAPE configuration are available on our site www.gseintegration.com

Example of battening plans for PORTRAIT frames with a reference height of 1640 mm and 4 fixing clamps:

Example of battening plans for LANDSCAPE frames with a reference height of 992 mm and 4 fixing clamps:
3.3 Sealing strip installation

The sealing strip is laid out to link up with the bottom part of the roofing (PV array in the middle of the roofing).

A batten is placed to fit with the thickness of the roof tile and to provide a flat base for the sealing strip.

When installing the sealing strip on tiles with relief, make sure to press it down well so that it follows the roof tile’s shape correctly. Make a 20-mm fold on the top part and sides to prevent water upwelling.

ATTENTION:
ALWAYS MAINTAIN A MINIMUM SLOPE OF 3°
3. Installation

When installing all the way to the eaves, the sealing strip is laid out in a way as to connect directly to the gutter.

At any rate, the length and the width of the strip should be enough so that the following overlap dimensions are adhered to:

3.4 GSE Frames installation

Draw a chalk line along the bottom of the first row, in the middle of the reference lath.
3. Installation

Interlock the plastic frames from the right to the left side (left to right is also possible - check that the interlocking is well done)

Attach the panels only by the reference points.

**ATTENTION:** WHEN INSTALLING THE SUBSEQUENT ROWS, ADJUST HOW ONE ROW COVERS THE OTHER USING THE SCALE BASED ON THE LENGTH OF THE MODULE (CF DEVICE).
3.5 Lateral flashings installation

**ATTENTION:**
BEFORE INSTALLING THE LATERAL FLASHINGS, MAKE SURE TO PLACE THE WEDGES AT THE ARRAY ENDS, UNDER THE CORRUGATIONS, WHERE THE END CLAMPS ARE LOCATED.

**TIP:**
Mark their position on the inner surface of the panel to identify them after positioning the lateral flashings.

- Place the lateral flashings of the low end of the first row of panels, up to 120 mm of the upper edge of the last row. The overlap between two parts of the lateral flashing will be at least 150 mm. Each will be held in place by at least 2 attachment hooks.
• Carry out the pre-drilling using a 10 mm wooden drill bit on the 4 remaining attachment points of the GSE frame.

Tip: It is possible to pre-drill the expanding points of the frame before mounting on the roof. The frames are drilled individually (do not drill several frames at the same time).

• Screw the 4 attachment points of the frame.

• Then, pre-drill the fixing points of the clamps.

• For end clamps, pre-drill through the flashing, the frame’s corrugation and the wedges.

Reminder:
It is possible to pre-drill the expanding points of the frame before mounting on the roof. The frames are drilled individually (do not drill several frames at the same time).

ATTENTION:
Never drill the outflow zones.

Please refer to the plans page 6 & 7 for the location of the fixing points.
3. Installation

### 3.6 PV modules installation

#### 3.6.1 Cabling preparation

Example of wiring diagram with installation of micro-inverters:

Position the module in such a way that the cables of the junction box pass through the designated space.

TIP:
Some module manufacturers allow portrait orientation setting with the junction box going downwards. Please refer to the manufacturer’s guidances.
When using micro-inverters, attach them to a lath at the level of the GSE frame’s central hole.

**Attention:** Please refer to the inverter’s manual to be sure that the installation comply why the manufacturer recommendations.

**Authenticated compatibility for:**

- Enphase
- SolarEdge
- Tyco Electronics
- APsystems

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**Passage of grounding cables:**

**Attention:** When setting up the cables, make sure you do not create any induction loop, in accordance with regulation.

Grounding of the frame of the modules and of the micro-inverter (please refer to the implementation requirements of manufacturers):

**Attention:** Make sure that all cable passages are kept on the frame using cable clamps.
3. Installation

3.6.2 Fixation of the PV module

Position the modules in such a way that they’re resting on the support pads (yellow) and abut against the upper pads (orange arrows).

**ATTENTION:**
CHECK THAT THE MODULES ARE WELL CENTERED IN RELATION TO THE FRAME SO THAT THE GRIP OF THE CLAMPS IS THE SAME ON BOTH SIDES. THE MODULE FRAME MUST ABUT AGAINST THE UPPER PADS OF THE PANEL TO PREVENT SHIFTING.
Stick the EPDM foam under the clamps and pre-drill them, by screwing and unscrewing to remove material.

**ATTENTION:**
CHECK THAT BENEATH THE CLAMP IS DRY AND HAS NO DIRT TO ENSURE OPTIMAL BONDING OF THE FOAM.

Attach the modules by screwing the fixing clamps at the designated positions.
ATTENTION:
THE TOP FLASHING PIECE IS DESIGNED WITH A SLOPE OF 14° TO ALLOW WATER FLOW ABOVE THE UPPER ROW OF MODULES. IT IS THEREFORE, ESSENTIAL FOR THE INSTALLER TO ENSURE THAT THE ROOF SLOPE IS SUFFICIENT TO PREVENT WATER STAGNATION ACCORDING TO THE REGULATION.

IN BORDERLINE CASES, WE RECOMMEND THAT YOU EITHER USE A THICKER SUPPORT LATH TO DECREASE THE COUNTER-SLOPE OR TO REPLACE THE TOP FLASHINGS WITH A FLEXIBLE FLASHING STRIP (SEE BELOW).

Join the top flashings and the attach angle using pop rivets, taking care that you adjust the module frame thickness.
Position the assembly so that the module frame thickness fits between the attach angle and the top flashing.

Make cuts on the attach angle at the position of the GSE panel corrugations

Place the top junction flashing, having applied beforehand two PU glue joints on the covered top flashing area. The connecting piece must overlap with the top flashing with at least 100 mm. The gap between the top flashings should not exceed 160 mm.

In the same way, place the corner flashings, having applied beforehand a PU glue joint on the overlapping zone of the top flashing. (Overlapping at least 100mm)
3. Installation

Fix all flashings to the battens using flashing hooks (at least 2 per piece).

Place the precompressed seal on the flashings around the area on the lateral and upper parts.

The seal must reach the bottom of the flexible flashing strip to prevent any potential infiltration of water or solid particles.
OPTION: REPLACING TOP FLASHINGS WITH A FLEXIBLE STRIP

It is possible to install a flexible flashing strip or equivalent to make the connection with the upper roofing elements. Shape a 2-cm fold in the upper and lateral parts of the strip to prevent any water upwelling.

3.8 Specific case : PV array with inner/outer angles

In the case of non-rectangular PV array, inner and outer angles must be connected to the roofing using a flexible flashing strip compliant with the building/roofing regulation.

3. Installation

### 3.8.1 Inner Angle (L-Shaped)

Place the flashing strip by covering the lower-row frames up to the corrugation of the adjacent frame, then cover the strip with the lateral flashing.

![Installation of the flexible strip](Image1)

![Installation of lateral flashing](Image2)

### 3.8.2 Outer Angle (T-Shaped)

Place the lateral flashing on the lower-row panel. Reposition the adjacent tiles to cover the lateral flashing, then place the flashing strip so that it overlaps with the last row of tiles, ensuring that there is a 2-cm fold in the upper section.

![Installation of the flexible strip](Image3)

Then, position the GSE panel so that it’s overlapping with the flashing strip.

**ATTENTION:**

FOR THE OVERLAP, FOLLOW ROOFING REGULATION AS WELL AS THE REQUIREMENTS IN SECTIONS 3.3 AND 3.7 OF THIS DOCUMENT.
3.9 Connection to the roof covering

Reposition the lateral and upper sections of the roofing elements to make a continuous and watertight connection with the roof.

It may be necessary to cut the tiles to ensure a compliant overlap between the elements, according to roofing regulation. These elements must be attached mechanically, as described in the roofing regulation.

TIP: YOU CAN USE DOUBLE TILES OR HALF TILES FOR THE LATERAL CONNECTION.

The roof tiles must rest on the flashings with enough overlap to meet the requirements of the roofing regulation.
4. Maintenance and servicing

4.1 Verification

It is important to check once a year whether leaves and/or other elements have gone under the photovoltaic system or between the panels. You can use compressed air to remove elements that have gone under the photovoltaic system. Do not use solvents to clean the polypropylene supports.

![Warning symbol]

We recommend a maintenance contract that includes one annual visit to check: production, electrical part, panels, panel supports, attachments, precompressed joints, sealing strip.

4.2 Module replacement

Disconnect the PV array from the AC box and proceed as follows:

1. Unscrew the fixing clamp, remove the module and remove the edge wedges.

2. Screw one GSE screw at the location of old hole, having placed beforehand a new polypropylene edge wedges under the corrugation if it is located on an array edge.

3. Make a new 10 mm hole, 25 mm above the old position.

4. Place the module and attach the new assemblies (fixing clamp + EPDM foam + GSE screw).
5. Assistance and contact

5.1 Training session

GSE Integration team offers technical training on the product which can include practice on demonstration models upon your request, provided that there are enough participants.

For information, please contact your sales manager or your distributor.

5.2 Technical Assistance

TECHNICAL SUPPORT IS AVAILABLE TO YOU FROM MONDAY TO FRIDAY FROM 9:30 A.M. TO 6:00 P.M. (GMT+01:00)

6. Certifications and warranties

6.1 Technical assessments

- ETN n°010T170F
- Avis Technique n°21-16/57
- MCS 012 – BBA 0156

6.2 Fire Test

- BRoof T1
- BRoof T3
- BRoof T4
GSE IN-ROOF SYSTEM is a patented development project of GROUPE SOLUTION ÉNERGIE

GSE Integration

Your distributor:

www.gseintegration.com