FIXGRID LIGHTNING PROTECTION AND EQUIPOTENTIAL BONDING

The present concept contains instructions for the electrical layout of PV installations on the FixGrid mounting system with regard to equipotential bonding and lightning protection. All instructions referenced herein are to be considered as non-binding recommendations only. In each case, the installation company carrying out the work or, if applicable, a lightning protection planning office is responsible for standard-compliant electrical system design. In particular, the lightning protection class must be considered, specified, and documented separately, depending on the application.

In the case of flat roof systems, there is always some risk of thermally induced migration processes depending on a wide variety of factors, such as the condition of the roof substructure, the insulating structure, the roofing membrane, and, in particular, the roof pitch. To prevent such migration processes, the module blocks must in some cases be positionally secured. Furthermore, it has proved effective to configure the interconnected module blocks so that they do not exceed approx. 10 m x 10 m. Even within these blocks, aluminium supports resting directly on the roof are generally only used for short sections. These separations generate some additional cost for the electrical system connections in terms of equipotential bonding and/or lightning protection which, in the case of the FixGrid system, has as far as possible been compensated for by a number of components specially standardised for this application. An evaluation of the components used in the FixGrid system and system connections for lightning protection carrying capacity enables the very simple, low-cost implementation of a complete, standard-compliant, external lightning protection system for the PV installation and, if necessary, partially for the building below.

The following stages of integration into existing protection concepts should be considered:

1. EQUIPOTENTIAL BONDING

In general, it is recommended that PV installation components be included in on-site equipotential bonding pursuant to country-specific requirements. This requires an electrical conductive connection between all accessible components of the load-bearing system. Whether and where an equipotential bonding is necessary is ultimately decided upon by the system installer; the standards only provide a recommendation in this regard. Depending on the module manufacturer’s specifications, the module frames should, if necessary, also be included in the equipotential bonding. Schletter module clamps are basically designed as grounding module clamps. All module clamps are equipped with a stainless-steel mandrel, which pierces the anodization during assembly and thus establishes a conductive connection.

If equipotential bonding is required, the connections must be made using at least 6 mm² copper (or equivalent).
Components suitable for equipotential bonding design

**EARTHING CLAMPS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>135003-002</td>
<td>Earthing clamps for 8 mm lightning protection wire or copper wire</td>
</tr>
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**PUNCHED MOUNTING TAPE AND ACCESSORIES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>119015-002</td>
<td>Punched mounting tape 6 - 50 m</td>
</tr>
<tr>
<td>943308-120</td>
<td>VA allen screw with M8x20 bottom gear teeth</td>
</tr>
<tr>
<td>943922-008</td>
<td>Washer large VA M8</td>
</tr>
<tr>
<td>943914-008</td>
<td>Square nut M8, V4A</td>
</tr>
<tr>
<td>129010-008</td>
<td>Click-in component for M8 nut</td>
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If necessary, centre clamps in the “earthing module clamps” design (ordered separately).
It should be noted that grounding strap 6 must be drilled out for this application. As an alternative, the stronger grounding strap 16 with an 8.5 hole diameter can be selected.

2. STANDARD-COMPLIANT LIGHTNING PROTECTION OF A PV INSTALLATION WHILE MAINTAINING SEPARATION DISTANCES

In the case of external lightning protection for a flat roof PV installation, it is essential that the PV installation structures do not impair its effect. Furthermore, it is recommended that the PV installation be designed in such a way that it can be subsequently included in the safe area of the building lightning protection system. In accordance with VDE 0185-305-3 addendum 5, the specified separation distance between the PV system and the lightning protection system must be observed. Partition distances must not fall short at any point, unless specially insulated cable runs are used at proximity points. In this case, any potentially necessary equipotential bonding of the PV installation must be routed separately from the lightning protection system. The lightning protection system meshes must not exceed a maximum distance (e.g. 15 m x 15 m for lightning protection class 3).

Figure 3: Example of a lightning protection design compliant with separation distances
3. STANDARD-COMPLIANT LIGHTNING PROTECTION OF A PV INSTALLATION WITHOUT MAINTAINING SEPARATION DISTANCES

As can be seen in Figure 3, in the case of the strictly adherent implementation of a lightning protection system, a large proportion of the roof surface cannot be used due to compliance with separation distances. The separate routing of an equipotential bonding system is also geometrically difficult in many places. Furthermore, there are also cases in which separation distances are more or less impossible, such as sheet metal roofing or metal constructions. Here, relevant standards stipulate that the PV installation must be connected to the lightning protection system. Therefore, no separation distances have to be considered; the internal connections of the load-bearing system even have to be connected to the lightning protection system components with low impedance at as many points as possible. In this case, the equipotential bonding of the PV installation can no longer be separated from the lightning protection equipotential bonding and, for this reason, must be designed with lightning current carrying capacity at all connections and with cross-sections of at least 16 mm² copper or equivalent.

FixGrid meets the necessary requirements for this type of lightning protection integration. The system internal connections have been specially tested for this application and suitable connection components are available accordingly:

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<tr>
<td>119015-003</td>
<td>Punched mounting tape 16 - 50 m</td>
</tr>
<tr>
<td>943308-120</td>
<td>VA allen screw with M8x20 bottom gear teeth</td>
</tr>
<tr>
<td>943922-008</td>
<td>Washer large VA M8</td>
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The grounding strap 16 (product no. 119015-003) has been specially designed to create simple, low installation cost lightning current carrying capacity connections in the FixGrid system and other systems as well. In loosely coupled flat roof systems, the strap should always be laid in such a way that there is only a mechanically loose coupling between the base support sections (form appropriate relief loops for short sections).

![Figure 4](image-url)  
Figure 4: Lightning protection equipotential bonding with FixGrid without maintaining separation distances (The connections shown are a recommendation only)

![Figure 5](image-url)  
Figure 5: Lightning equipotential bonding with FixGrid100 without maintaining separation distances (The connections shown are only a recommendation. Depending on the calculation of the division of the partial lightning currents, connections may be omitted under certain circumstances)

**Instructions for DC cabling and wiring:**

If separation distances are not maintained and the load-bearing system is instead permanently connected to the lightning protection system, partial lightning currents are to be expected throughout all electrical wiring of the PV installation. Therefore, type 1 lightning current arresters must usually be used for the wiring of the DC lines in this case. Detailed requirements with respect to lightning current carrying capacity and layout of arresters are set out in the relevant standards. The overall wiring concept should always be coordinated with the lightning protection planning office.

**4. REPLACING EXTERNAL LIGHTNING PROTECTION SYSTEM COMPONENTS**

In some installation settings, an extensive and suitably meshed lightning protection system is already present on flat roofs. Even if in such cases only the galvanic connection of the supporting frame to the lightning protection system is possible, installation issues may nevertheless arise due to overlaps. To remedy this, the available arrester unit of the external lightning protection system can, if necessary, be removed from the roof and either wholly or partially replace with FixGrid. Care should be taken to ensure a connection with suitable lightning current carrying clamps and compliance with the original maximum mesh size of the arrester. Lightning spikes should be positioned so that the modules are protected against a direct lightning strike.

Since the geometric design of the FixGrid usually ensures that the blocks are no larger than 10 m x 10 m, the condition concerning the maximum mesh spacing can usually be well observed.
5. FIXGRID AS INTERCEPTION UNIT OF AN EXTERNAL LIGHTNING PROTECTION SYSTEM

In case of non-compliance with the separation distance, the verified lightning current carrying capacity of the FixGrid system also makes it possible to use the system itself as part of the interception unit, provided the internal system connections have been supplemented accordingly.

Components suitable for the interception system design

**LIGHTNING SPIKE**

| 129079-000 | FixGrid lightning protection with lightning spike |

Planning notes

- **FixGridProtect lightning interception spike sets**
  Lightning protection interception spikes for FixGridProtect are defined in length so that, with a maximum module block size of 6 m x 6 m (traverse 8.5 m) and in compliance with a maximum block distance of 0.5 m, geometric verification complies with the known lightning sphere method ($r = 45$ m). It should be noted that either a (usually negligibly low) yield reduction should be tolerated due to the umbra of the interception spikes, or the modules may have to be arranged differently. The clamps used to mechanical mount the interception spikes were also checked for lightning current carrying capacity as part of the certification process. When mounting it should be ensured that a distance of >20 mm is maintained between the interception spike and module frame.

- **If necessary, additional interception rods at the edges**
  Use the lightning sphere method to check whether additional interception rods are required at the margins of the PV installation or building to completely include the installation itself or the building within the protective scope.
- **Adjacent blocks**
  If the module blocks are directly adjacent to each other, the interception spikes of the directly adjacent module block can be omitted as long as the maximum allowable distance has not been exceeded in accordance with the lightning sphere method.

- **Arrester systems and earthing systems**
  The individual subfields of the FixGrid PV assembly system should be connected with each other in such a way that a standard mesh is formed on the roof. If necessary, further additional lightning rods should be connected to this mesh. For partial lightning currents, down conductors should be installed on the building at suitable distances and connected to a earthing system dimensioned according to standards.

- **Appropriate wiring for DC cables**
  The notes under section 3 must be observed.

- **Verification and certification**
  The suitability of the system for integration into a lightning protection system has been proven in a standardised test of the lightning current carrying capacity of all connections. The tests were carried out after the specified pre-aging of all components with salt spray tests.

![Figure 7: Example arrangement for the interception spikes on the module blocks (FixGrid and FixGrid100)](image-url)
SUMMARY

FixGrid offers a full range of options for connecting to an existing lightning protection system. The suitability for this has been proven by standardised tests in a certified lightning protection laboratory. It is also possible to use FixGrid as an interception unit for an external lightning protection system if it is not possible to maintain the separation distance according to the standard.

A specialist company or lightning protection office must always be involved for the dimensioning and system design, as concepts for wiring through components of the internal lightning protection system as well as an individual risk concept and a zone analysis in particular must also be created and documented. Also, the lightning protection system may only be constructed by a competent lightning protection contractor who assumes responsibility for its proper function.

As the manufacturer of FixGrid, we have created all the prerequisites for cost-effective integration into external lightning protection system. However, we request that you refrain from detailed enquiries about the lightning protection system itself within the scope of the mechanical system design as we are unable to advise on this. Instead, this documentation should be made available to the responsible lightning protection system planner as well as to the lightning protection contractor.

More information at: www.schletter-group.com