

INSTALLATION MANUAL FOR INVITAIC BIPV MODULES

Photovoltaic curtain wall

INVITAIC
Invisible Photovoltaic



INTRODUCTION

This manual provides important safety instructions for the INVITAIC BIPV module (Photovoltaic curtain wall) and should be read and understood in its entirety prior to handling and installation.

Solar photovoltaic curtain wall integrates photovoltaic power generation technology and curtain wall technology, making full use of the surface and space of the buildings, converting the solar energy that the traditional curtain wall tries to shield outside the building into beneficial electric energy for people, the biggest feature is that it has the functions of ventilation, environmental protection and energy saving, saving the consumption of precious fossil energy on the earth and reducing the pollution to the environment. At the same time, it provides a new aesthetic decorative effect for modern architecture.

Photovoltaic curtain wall is a high-tech building shell that can meet all the requirements of bad weather, and of course can meet the physical requirements of the building, such as flame retardant, heat insulation and noise reduction.

After the photovoltaic curtain wall is installed with photoelectric templates, traditional building materials are saved, such as photoelectric templates can replace polished natural building materials. Photovoltaic curtain walls also greatly reduce the burden on the environment, as it protects natural resources from loss. In particular, solar cell power generation will not emit carbon dioxide or produce gases harmful to the greenhouse effect, and no noise, is a net energy, and the environment has a good compatibility.

The biggest advantage of photovoltaic curtain wall is that it does not require fuel, does not produce waste gas, no waste heat, no waste slag, no noise pollution, and can be used to generate electricity. Because it can generate electricity, it can pay less electricity, and it can sell excess electricity to the power bureau. It can be seen that the photovoltaic curtain wall itself is a high-tech new product that can produce economic benefits and green environment.

Application scope

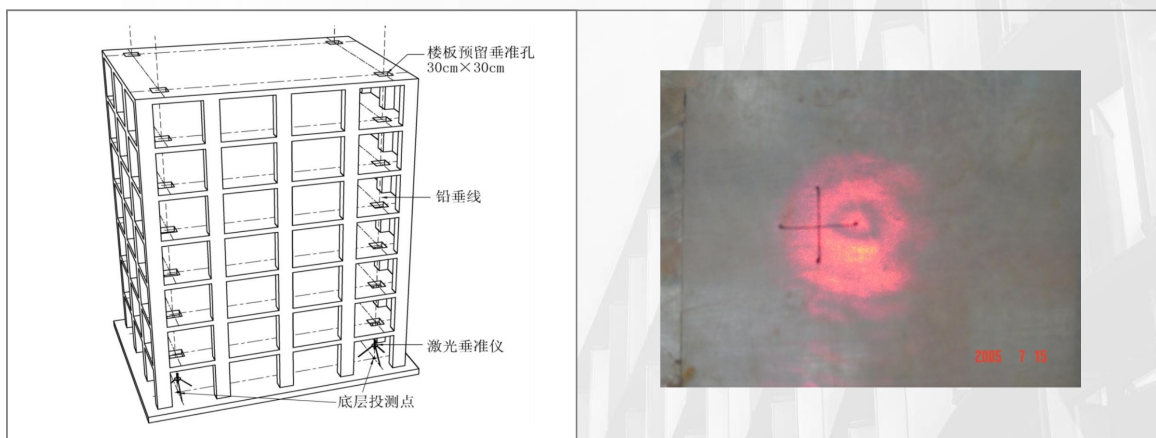
This installation manual is applicable to the installation processing of photovoltaic power generation glass curtain wall.

PHOTOVOLTAIC CURTAIN WALL INSTALLATION AND CONSTRUCTION POINTS

Construction process

1. General provisions

- 1) The main works of the steel structure, reinforced concrete structure and brick-concrete structure of the installation curtain wall should meet the requirements of the relevant building structure construction and acceptance codes; In particular, the verticality of the main structure and the flatness of the outer surface and the dimensional deviation of the structure must meet the requirements, otherwise appropriate treatment measures should be taken before the installation and construction of the curtain wall.



- 2) The material variety, specifications, color and performance of curtain wall components and accessories shall meet the design and quality requirements. When the glass curtain wall is installed, the components, accessories, glass, sealing materials and gaskets should be inspected and accepted according to the quality requirements, and unqualified and expired materials cannot be used.

- 3) Reasonable arrangement of curtain wall installation and construction sequence, and take reliable safety protection measures. The curtain wall construction environment and the construction sequence of the sub-projects should be carefully studied, and the sub-projects that will cause serious interference or pollution to the curtain wall installation should be arranged before the curtain wall installation, otherwise reliable protection measures should be taken before the curtain wall installation and construction.

2. Installation preparation

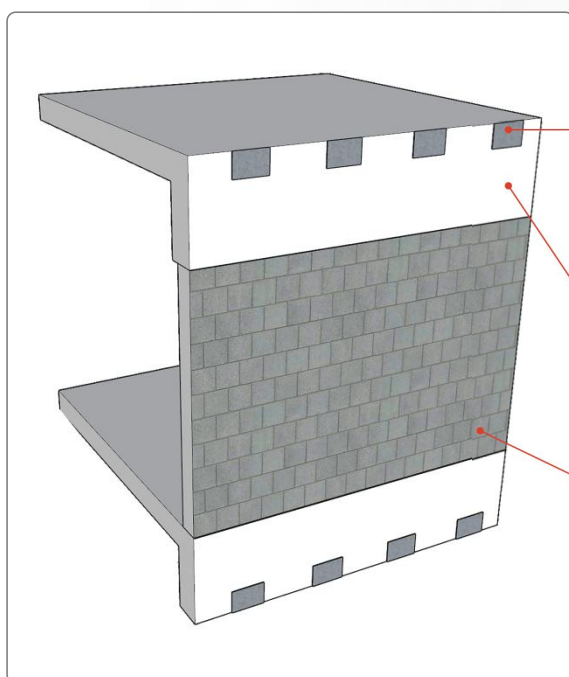
- 1) Conduct comprehensive technical and quality disclosure and safety specification education for site managers and installers, prepare fire prevention and safety equipment and facilities.
- 2) The components should be protected from collision and damage during handling and hoisting; The components should be placed in a ventilated, dry place that is not in contact with acid and alkali substances, and should be strictly prevented from rainwater infiltration.
- 3) The components shall be stacked on special shelves or cushion wood according to varieties, specifications, types and numbers; Glass components should be placed slightly inclined and upright, and protective measures should be taken when stacked outdoors (as shown below).



- 4) The components should be inspected and corrected before installation. The components should meet the requirements of design drawings and related quality standards, there should be no deformation, damage and pollution, unqualified components should not be installed on the wall. The components of glass curtain wall may artificially cause deformation, damage in the transportation, stacking, lifting process, so before installation must be tested in advance of the components, found unqualified should be replaced in time. For easily damaged and easily lost components, such as accessories, glass, sealing materials, rubber pads, etc., a certain

number of replacement should be reserved.

- 5) Auxiliary processing of components in the field, such as drilling, tapping, field modification of component deviations, etc., the processing position, accuracy and size should meet the design requirements.
- 6) The embedded parts connected with the glass curtain wall and the main structure shall be buried according to the design requirements during the construction of the main structure. Before placing the embedded parts, the accurate position of the embedded parts should be checked according to the curtain wall installation baseline; The embedded parts shall be firmly fixed in the predetermined position, and the anchor steel bar and the main steel bar of the main component shall be tied firmly with iron wire or spot-welded to prevent the position of the embedded parts from changing during the pouring of concrete; During construction, the concrete around the anchor bars of embedded parts must be compact and vibrating; After the concrete mold is removed, the mortar on the surface of the embedded steel plate should be removed in time.



Schematic diagram of buried parts

Structural beam schematic diagram

Maintenance structure diagram

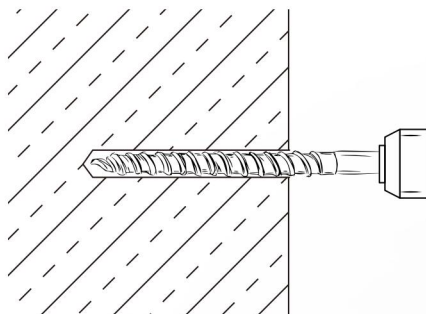
3. Measurement

- 1) According to the elevation points, entry and exit position lines and axis positions given by the curtain wall drawings and civil construction units, the reference lines such as the plane, column, division and Angle of the curtain wall are determined on the main body with heavy hammers, steel wires, levels and other measuring tools, and the theodolite is used to adjust and retest.

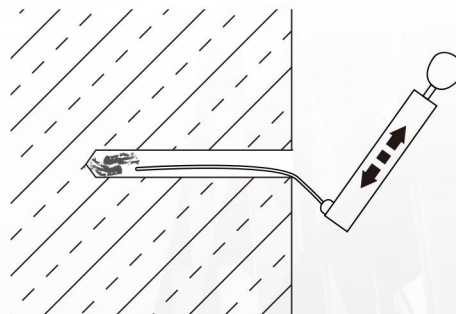


- 2) The measurement of the grid axis of the curtain wall should be compatible with the measurement of the main structure, and the horizontal elevations should be carried out layer by layer from the ground to avoid the accumulation of errors. If the error is greater than the allowable deviation value, the axis of the curtain wall should be properly adjusted after the consent of the designer and the supervisor, so that it can meet the structural requirements of the curtain wall.
- 3) The measurement of high-rise buildings should be carried out when the wind is not more than three degrees, and the measurement should be carried out at a fixed time every day.
- 4) The quality inspection personnel shall inspect the measurement situation in time and record.
- 5) During the measurement, the deviation of the embedded parts should be inspected, and the deviation value of the upper, lower, left and right should not exceed $\pm 45\text{mm}$. The abnormal embedded parts must be properly treated before installation and construction, and the treatment opinions should be reported to the supervisor, the owner and the relevant departments of the company.

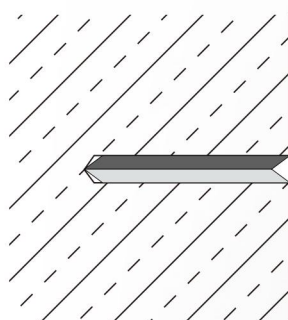
4. Deviation treatment of embedded parts



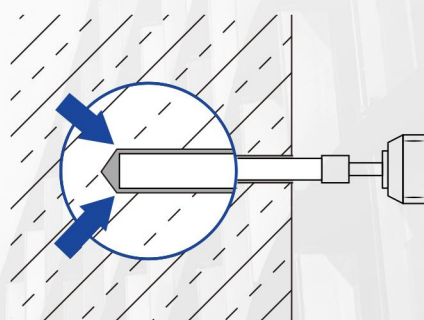
- ① Drill holes using electric hammer or diamond drilling machine.



- ② Use a blowing pump or compressed air to blow out dust and stagnant water. The holes must be free of ice or oil/grease.



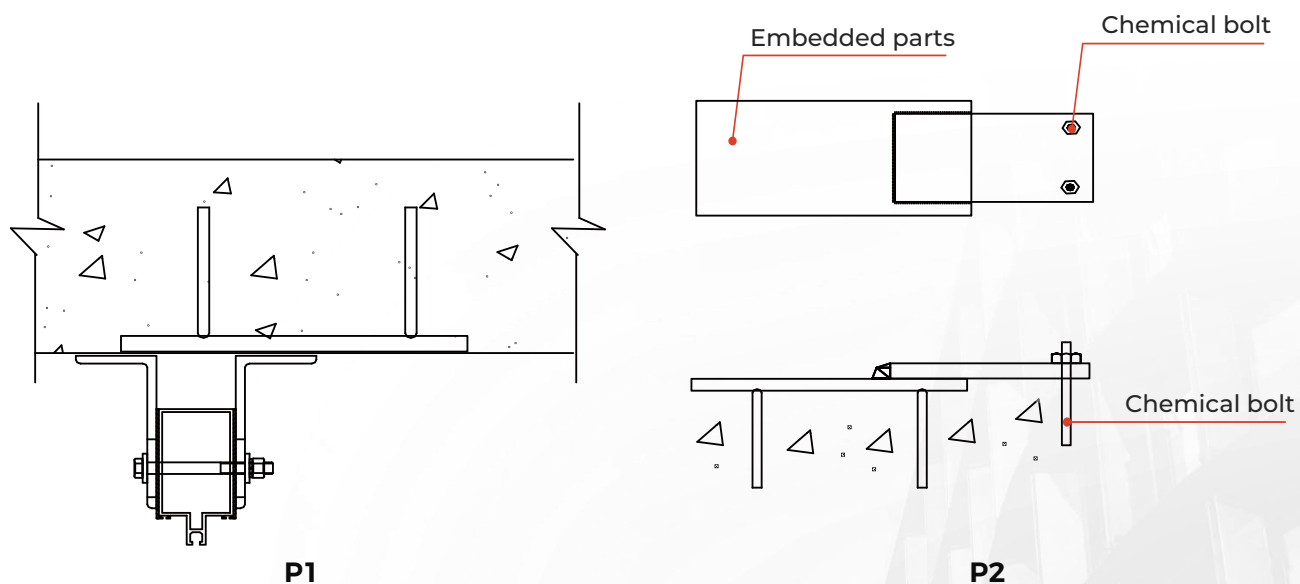
- ③ Place the pack completely into the hole. Note: The medicament pack must be complete and cannot be cut.



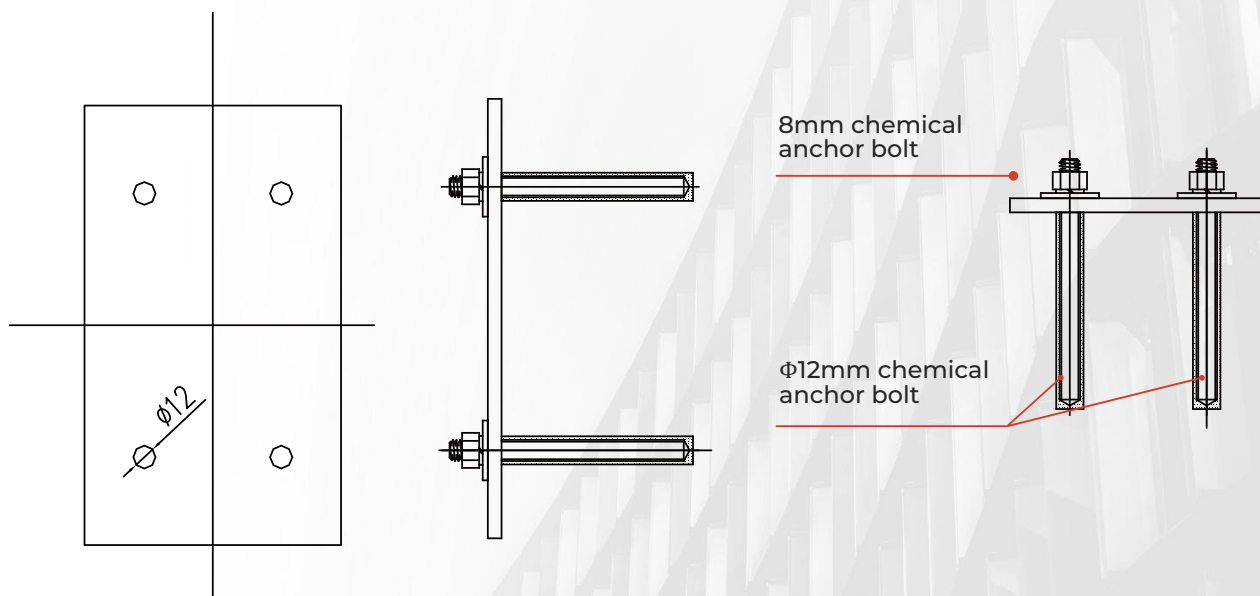
- ④ Use an electric clock drill with clock function to slowly screw into the screw until the screw touches the bottom of the hole and a little medicine is filled out.

Deviation treatment of embedded parts

- 1) When the deviation of the embedded part is 45~150mm, the steel plate of the same thickness and the same material as the embedded part is allowed to be added. And to be ensured that one end of the steel plate is welded with the embedded part, the weld height needs $\geq 7\text{mm}$, and the weld is continuous corner welding; The other end of the steel pipe is fixed with two M12 $\times$ 110 building anchors. After construction, the construction anchors shall be subjected to mechanical tests, and the test results shall meet the design requirements.

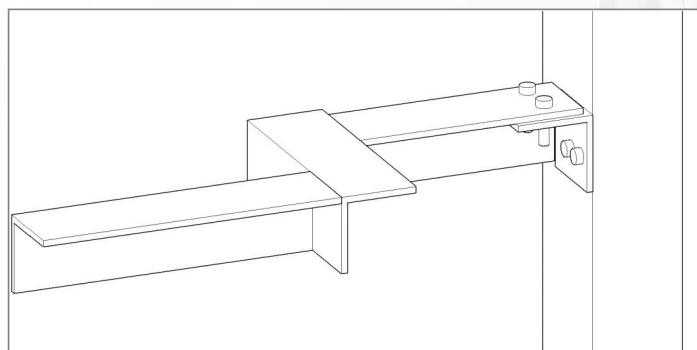


- 2) The deviation of the embedded parts exceeds 300mm or cannot be handled on site due to the other reasons, the design department, the owner and the other relevant parties shall jointly negotiate to put forward the feasibility treatment plan and sign the approval, the construction department shall construct according to this plan.



- 3) When the surface of the embedded part is tilted in the vertical direction with a large error, the steel plate of appropriate thickness should be used to pad and weld firmly. It is forbidden to use irregular metal parts such as steel bars for pad welding or lap welding.

- 4) When the horizontal inclination error of the surface of the embedded part is large, which affects the normal installation, the method (1) above can be used to correct . the size of the steel plate and the number and position of the building anchor can be determined by design according to the actual situation on the site.
- 5) The anti-corrosion measures of the embedded parts must be implemented in accordance with the corresponding standards, and must be polished by hand to make the metal luster exposed before spraying anti-embroidery paint; If there are special requirements, they must be handled according to special requirements.
- 6) When the length of the support is not enough due to the inward migration of the floor, it can not be installed normally, the solution can be lengthened by lengthening the support.



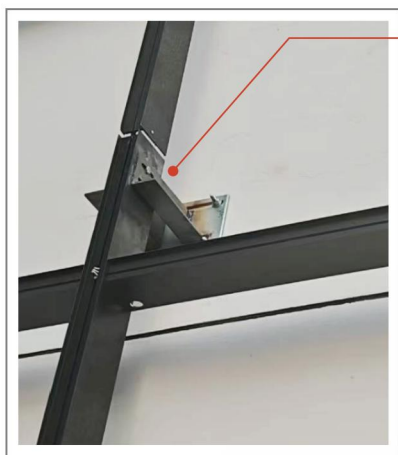
Curtain wall extension support

- ➔ When the extension range is $< 100\text{mm}$, the Angle steel can be used to make the support, so that the end is welded with the surface of the embedded part, the weld height is $\geq 7\text{mm}$, and the weld is continuous peripheral welding.
- ➔ When the extension amplitude is $\geq 100\text{mm}$, the triangle support should be welded at the lower part of the support while the Angle steel is used as the support; The supporting material can be made of Angle steel not less than $< 50 \times 50 \times 5\text{mm}$, one end is welded with the support, the weld length is $\geq 80\text{mm}$, the weld height is $\geq 5\text{mm}$; The other end is connected with the main structure by building anchors, and the position of the strengthened support is firm and does not hinder the normal installation.

5. Column installation

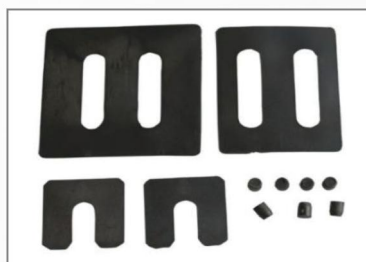


- 1) The column is generally based on construction and transportation conditions, can be a floor height for a whole, the length can reach 7.5M, and the joint should have a certain gap. The connection mode adopts sleeve connection, which can adapt and eliminate the influence of building deflection deformation and temperature deformation; The connection between the connector and the embedded part can be connected by an interspaced articulated and rigid structure, the articulated joint only resists the horizontal force, and the rigid joint can resist the horizontal force, but also bear the vertical force and be transmitted to the main structure.
- 2) Before installing the column, carefully check whether the column specifications, dimensions, quantities, numbers and other information are consistent with the construction drawings. Construction personnel must be trained on altitude work and obtain work permits before entering the construction site. During the construction, the relevant national labor and health regulations and the relevant provisions of the current industry standard JGJ80 "Technical Code for Safety Operation of construction Heights" shall be strictly implemented. In particular, it should be noted that it is not allowed to work at altitude when the wind exceeds level 5.
- 3) The column is connected with the connector first, and then the connector is connected with the main embedded part, the final adjustment and fixing is necessary; The deviation of column installation elevation should not be greater than 3mm, the deviation of axis front and rear should not be greater than 2mm, and the deviation of left and right should not be greater than 3mm; At the same time, it should be noted that errors should not accumulate, and the positive tolerances should be maintained for the window opening position.

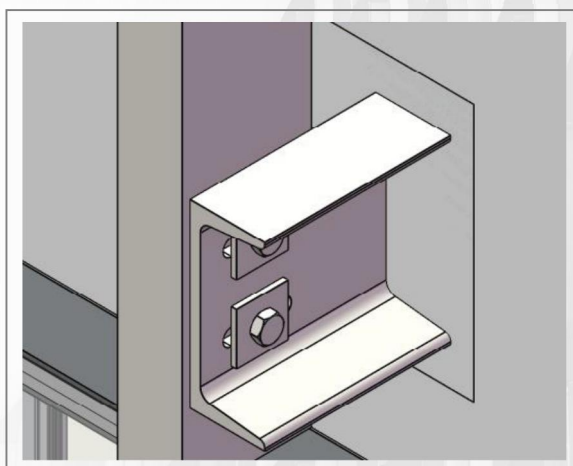


Schematic diagram of
columns and connections

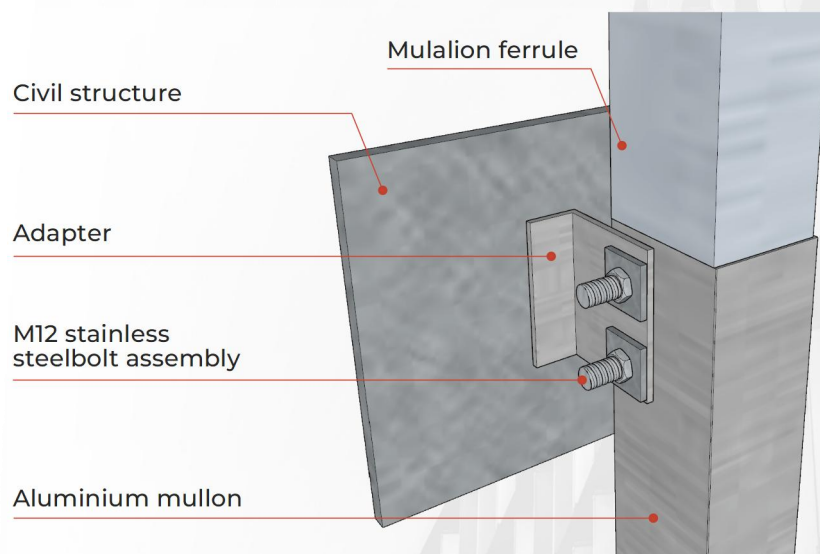
- 4) The maximum elevation deviation of the columns on the same floor should not be greater than 5mm, and the distance deviation of the adjacent columns should not be greater than 2mm.
- 5) The anti-corrosion isolation gasket as right picture must be added between the contact surface of the column and the connecting piece (as shown below).



- 6) After the column is initially positioned according to the deviation requirements, it should be self-checked, and the unqualified ones should be adjusted and corrected. After qualified, the connector (support) will be formally welded firmly, and the welded connector and the embedded part must take reliable anti-corrosion measures.

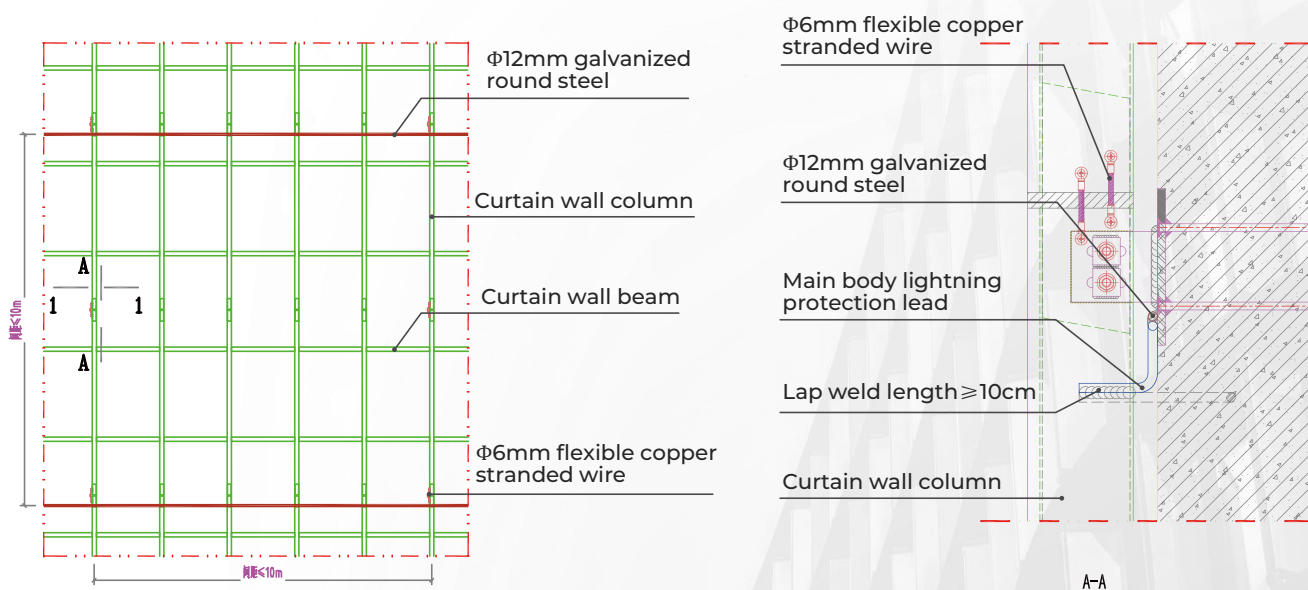


- 7) The glass curtain wall column should be fastened in time after installation and adjustment; Temporary bolts for the installation of the glass curtain wall should be removed in time after the installation, positioning, adjustment and fastening of the components.
- 8) Welders are special types of work, need to go through professional safety technology learning and training, after passing the examination and obtaining the special type of operation certificate, can work independently.
- 9) The welding site must take fire and explosion-proof safety measures before operation; Fire bucket should be set under the weldments, and the operator must wear protective glasses and face mask when operating; The grounding neutral wire of the welding machine and the welding working return wire must comply with the relevant safety regulations.
- 10) After the columns are securely installed, remove the standard blocks used to locate the expansion joints between the upper and lower columns, and apply sealant to the expansion joints.



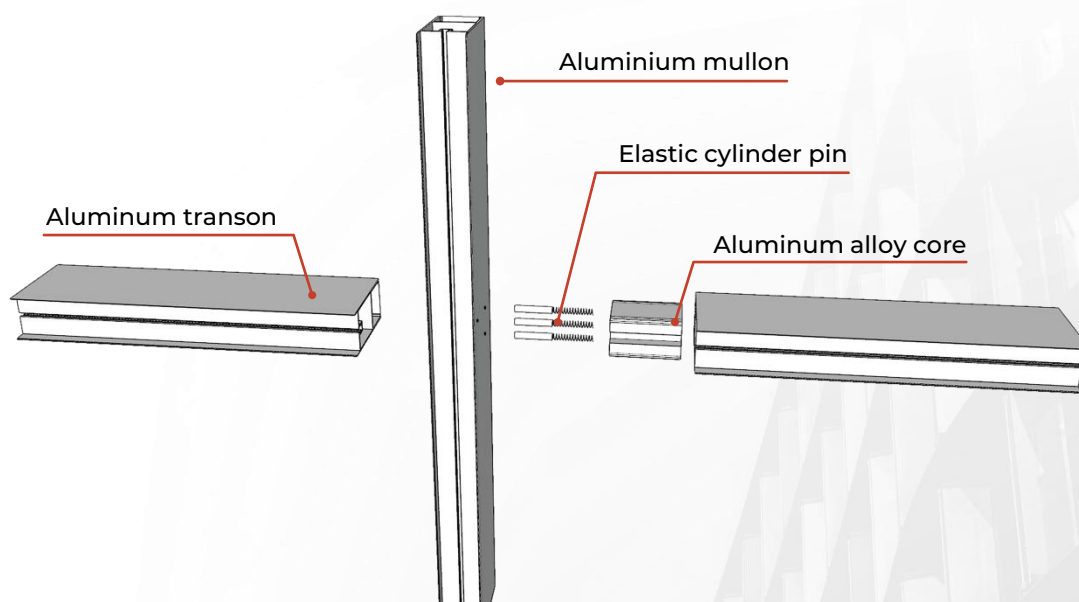
6. Lightning protection

- 1) The column is generally based on construction and transportation conditions, can be a floor height for a whole, the length can reach 7.5M, and the joint should have a certain gap. The connection mode adopts sleeve connection, which can adapt and eliminate the influence of building deflection deformation and temperature deformation; The connection between the connector and the embedded part can be connected by an interspaced articulated and rigid structure, the articulated joint only resists the horizontal force, and the rigid joint can resist the horizontal force, but also bear the vertical force and be transmitted to the main structure.

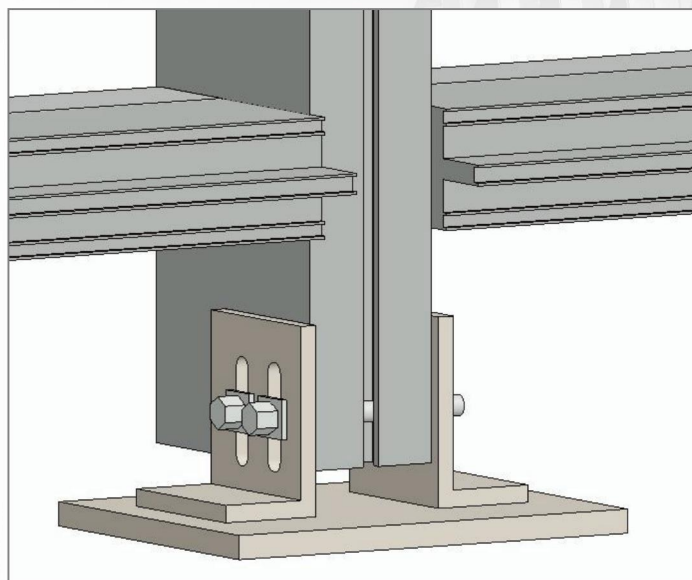


- 2) Lap welding of round steel or flat steel with embedded parts and pressure balancing ring, the weld length is not less than 75mm. An aluminum strip with the width of not less than 24mm and the thickness of not less than 2mm should be used to connect each column and support located in the equalizing layer, and ensure that its on-resistance is less than 10Ω .
- 3) Necessary resistance tests must be performed on the connected on-off parts of each equalizing layer, and the grounding resistance value should be less than 10Ω . The connection between the lightning protection system of the curtain wall and the lightning protection system of the main body should also be checked for resistance, and the grounding resistance value is less than 10Ω .
- 4) All lightning protection materials should be hot-dip galvanized; After the installation of the lightning protection system, it shall be submitted for acceptance in time, and the inspection results shall be recorded in time.

7. Beam mounting

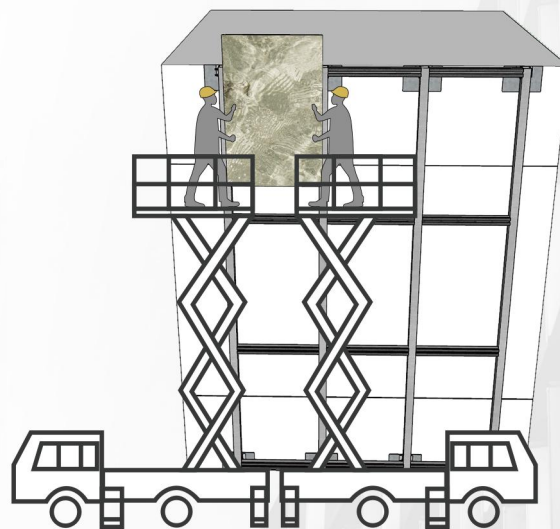


- 1) The beam segment is embedded in the column, and the elastic rubber pad should be added to the connection between the two ends and the column to adapt to and eliminate the requirements of transverse temperature deformation.(See below bottom beam and column installation diagram)



- 2) The installation of beams must be carried out after the installation of civil mud and columns, from the top to the bottom of the building, and from the bottom to the same floor; When the height of each layer is installed, it should be checked, adjusted, corrected and fixed to meet the quality requirements.
- 3) The beam should be firmly installed according to the design requirements, and the joint between the beam and the column should be made of sealant with the color similar to the column and the beam.
- 4) When installing the beam, it should be noted that if there is a drainage system, condensate drainage pipe and accessories in the design, the reserved hole of the beam should be tightly connected, and the connection with the water outlet hole of the lining plate should be equipped with a rubber seal. Other ventilation reserve holes and rainwater drainage outlets should be constructed according to the design and should not be omitted.

8. PV panel installation

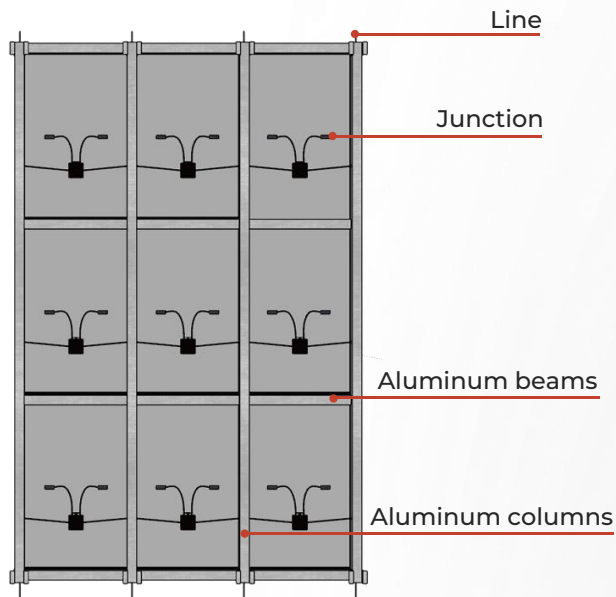


- 1) The variety, specifications and color of the glass should be consistent with the design requirements, the color of the entire curtain wall glass should be maintained evenly, and the coating surface of the glass should be oriented toward the room.
- 2) The frame should be protected during installation to avoid collision, damage or falling.

- 3) The press block used to fix the assembly frame is strictly prohibited to install less or no installation, and ensure that the screws are tightened.
- 4) The partition glass joint should be vertical and horizontal, and the seam width should be uniform; After the preliminary positioning of each glass frame, it should be coordinated with the adjacent glass frame to ensure that the joint meets the requirements.

9. Electric line connection

Connect each photovoltaic module line according to the drawing, double check and then seal it.



Certified Connectors Information		
No.	Manufacturer	Type /model
Connector 1	Suzhou Xtong Photovoltaic Technologies Co.,Ltd.	PV-XT101.1
Connector 2	Stäubli Electrical Connectors	PV-KST4-EVO 2/xy_UR (male); PV-KBT4-EVO 2/xy_UR(female)
Connector 3	Trina Solar Co., Ltd.	TS4; TS4-36; TS4-cd (c=1;d=1 or 2)
Connector 4	Suzhou Xtong Photovoltaic Technologies Co.,Ltd.	PV-XT101.2
Connector 5	Suzhou Xtong Photovoltaic Technologies Co.,Ltd.	XT2

10. Sealing

- 1) After the glass or glass components are installed, they must be sealed in time with weatherproof sealant to ensure the air tightness and water tightness of the glass curtain wall.
- 2) The construction area should be cleaned before the construction of weather-resistant silicone sealant, and there should be no water, oil stains, rust, cement mortar, dust and other debris in the joint; Toluene or methyl diethyl ketone can be used as a cleaning agent.

- 3) Weather-resistant silicone sealant should form two sides of the relative bond in the seam, and should not be bonded on three sides, and the bottom of the deeper sealing notch should be filled with polyethylene foam material.
- 4) In order to protect the glass and aluminum frame from contamination, the base tape should be affixed to the parts that may cause contamination, and the base paper tape should be removed immediately after filling and scraping.

11. Protection and cleaning

- 1) The photovoltaic curtain wall in construction should be protected by appropriate measures to prevent collision, deformation, discoloration, pollution and drainage pipe blockage.
- 2) Adhesives that affect surface decoration such as curtain wall and curtain wall components during construction should be removed in time.
- 3) After the installation of the glass curtain wall project, a cleaning plan (cleaning tools, hanging baskets, cleaning methods, time, procedures, etc.) should be developed to prevent surface pollution and anomalies of the curtain wall.
- 4) After the curtain wall is installed, the surface of the curtain wall and exposed components should be cleaned from top to bottom using neutral cleaners. The neutral cleaning agent for cleaning glass and aluminum alloy should be carried out the corrosion resistance test before cleaning to prove that it can be used after no corrosion effect on aluminum alloy and glass. Cleaning agents have glass cleaning agents and aluminum alloy cleaning ingredients can not be misused, will affect each other. After cleaning with detergent, it should be rinsed with clean water in time.

12. Final quality inspection

- 1) After the curtain wall is installed, the quality inspector should conduct a final inspection. And urge the relevant personnel to rectify the unqualified items in time, and the second inspection required after the rectification is completed.
- 2) The general inspection of the curtain wall should be recorded in time at the same time, all inspection records, evaluation forms and other information should be archived and stored.

13. Maintenance

In addition to strictly following the above requirements for installation and construction, the maintenance process should also implement the following requirements.

- 1) When replacing the hidden frame curtain wall glass, it is necessary to install a pressing block around the glass, requiring each frame to install three pieces, and add a cushion block at the bottom; Elastic material should be added between the pressing block and the glass, and the pressing block and pad block should be removed in time after the structural glue is dried, and the sealant should be added.
- 2) When replacing the glass on the higher floor, a reliable fixed hanging basket or cleaning machine should be used, and there must be a manager at the scene. When working at height, more than two people must operate, and set protective facilities to prevent glass and tools from falling.
- 3) Do not replace the glass on the higher floor in severe weather such as wind above level 4 and the heavy rain, and do not repair the curtain wall surface and external components.
- 4) The replacement of glass, aluminum profiles and other components should be consistent or similar to the previous, and the function and performance after repair should not be lower than the original state.



Meaning of crossed - out wheeled dustbin:

- Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.
- Contact your local government for information regarding the collection systems available.
- If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.
- When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.

Disclaimer of Liability

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of BIPV product are beyond INVITAIC's control, INVITAIC does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance. No responsibility is assumed by INVITAIC for any infringement of patents or other rights of third parties, which may result from use of the BIPV product. NO license is granted by implication or otherwise under any patent or patent rights. The information in this manual is based on INVITAIC's knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions do not constitute a warranty, express or implied. INVITAIC reserves the right to change the manual, the PV product, the specifications, or product information sheets without prior notice.