



ALMIPL SOLAR

Powering The New Age (Energy)

INSTALLATION AND MOUNTING

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Solar Energy**

Installation and Mounting System

Pre-Assembly

- **Engineering** the PV system.
- **Procuring** the Components according to the requirement.
- Gathering all the required tools, Fixtures for assembly.
- **Constructing**

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Installation Considerations

- Load of the system.
- Strength of the fixtures, rackings etc.
- Environmental considerations (like wind, snow, storms, seismic etc..)
- Blowing Wind and accumulated snow can add to the load of installed system.
- E.g., Module dead loads 3-5 lbs/ft²
 - Wind uplift can be up to 50 lbs/ft²
- Simplified array access for maintenance.
- Module wiring may be concealed to maintain the aesthetics of the shading structure.

Flush to Roof Racking Systems



Mounting System Types

- Flush to Roof Racking System.
- Tilt up Racking System.
- Ballast Racking System.
- Top of the Pole Racking System.

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Tilt Up Racking System

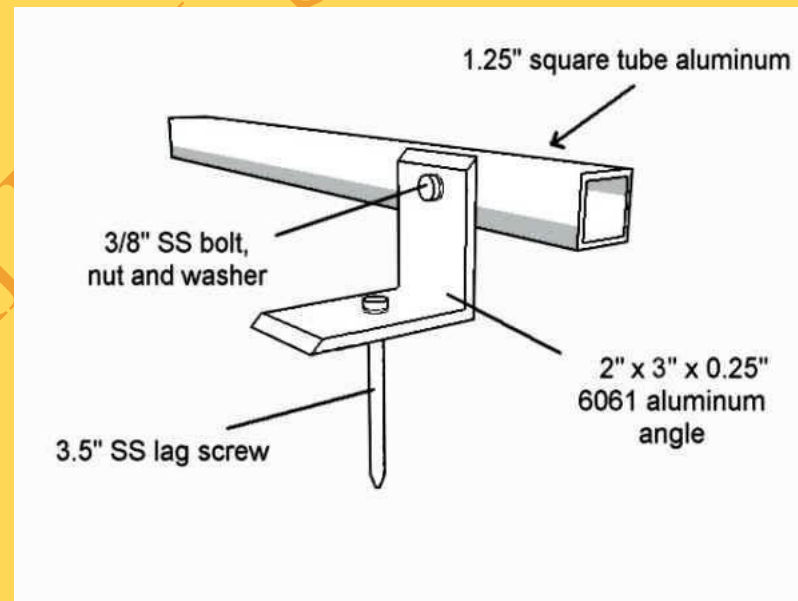


Ballast Racking Systems

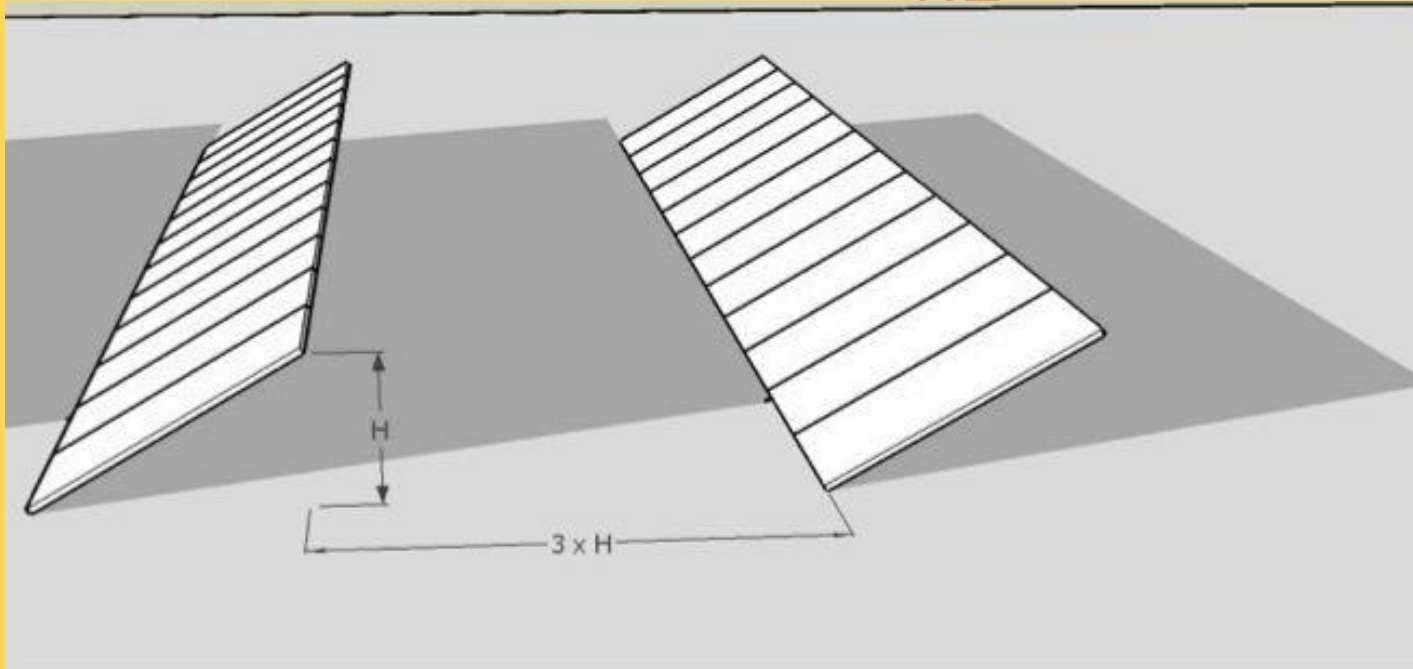


Mounting Considerations

- Selecting a suitable Mounting system.
- Assessing the load and retaining strength of the Mounting.
- Flexibility and strength of tilt adjusting provision.



Row Spacing

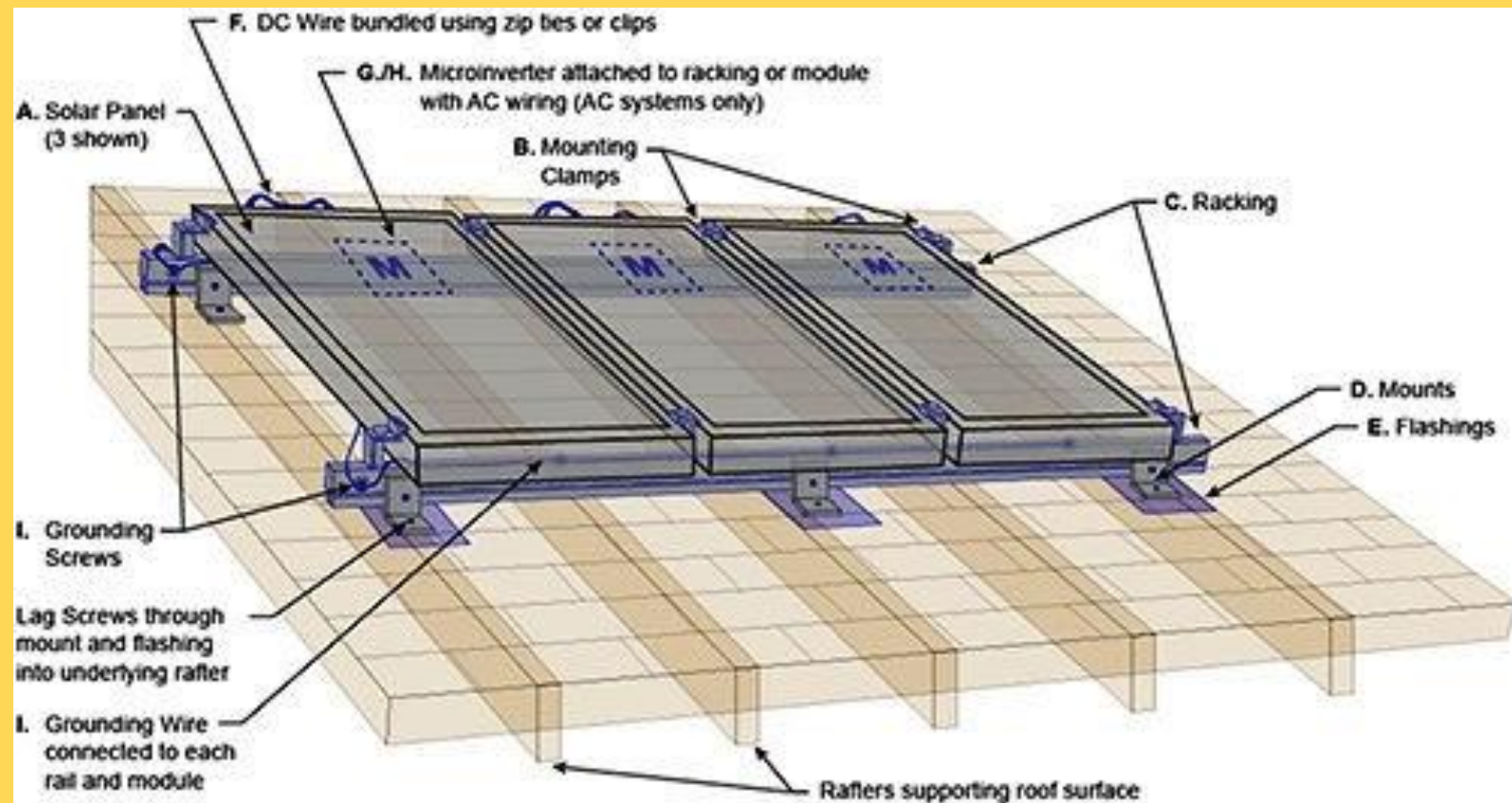


Row Spacing

- Row spacing and sun angle
 - Rule of thumb 3.5 times the height for row spacing
 - Altitude angle for given times and using trigonometry.

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Mounting

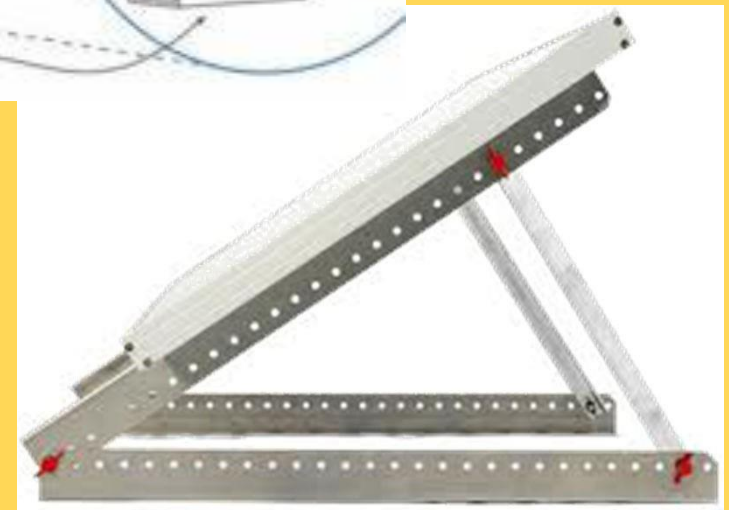
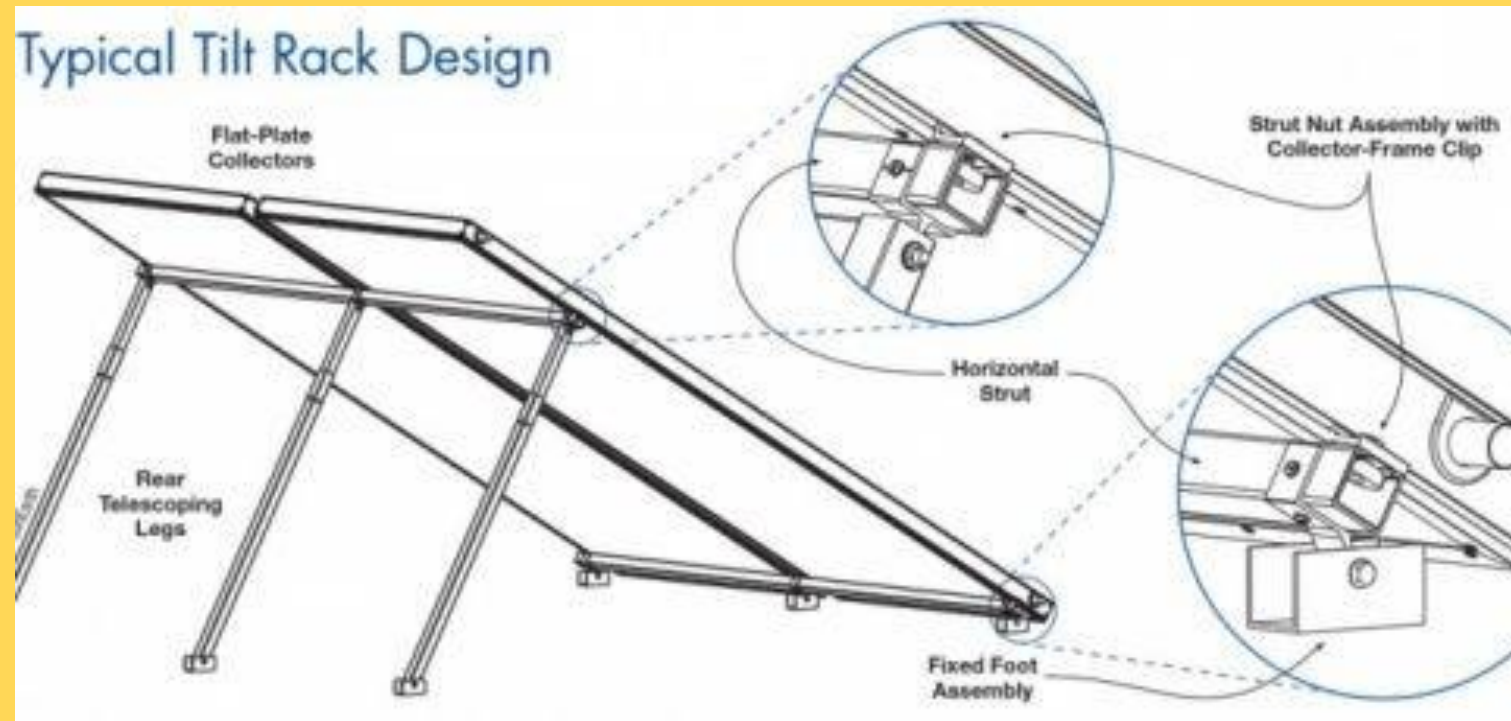


Module Location and Orientation

- We need different kinds of mountings for different locations.
- Possible Locations:
 - Slant Roof,
 - Direction of Slant Roof
 - Flat RCC Roof,
 - Open ground,
 - Vertical wall.
 - Vehicle top.



Tilt-Up Racking System Arrangement



- Build a simple, adjustable support from steel U/L-channel struts for either solar panels or the solar hot water collector below.

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Top of Pole Racking System



Ranking Components

- Module Dimensions
- Racks
- Struts
- Angles
- Clamps
- Channels
- Aluminum/GI Rails

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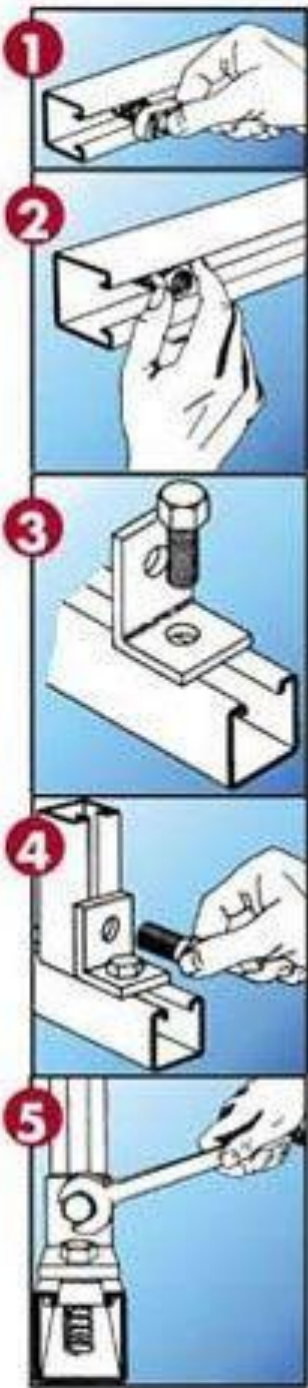
Tool List

Megger L. T. (1000 V)	02 Nos.
Earth Tester (0 – 20 ohm)	02 Nos.
DC Clamp Meter	04 Nos.
Crimping Machine Hydraulic	03 Nos.
Crimping Machine Manual	05 Nos.
MC4 Crimping Tool	16 Nos.
Hammer Drill Machine	10 Nos.
Drill Machine	12 Nos.
Hand Grinder	06 Nos.
Bench Drill Machine	04 Nos.
Welding Machine	05 Nos.
MS Conduit Offset Machine	03 Nos.
Bench Vice	03 Nos.
Pipe Vice	05 Nos.
Vehicle	05 Nos.
Battery Operated Richet	04 Nos.

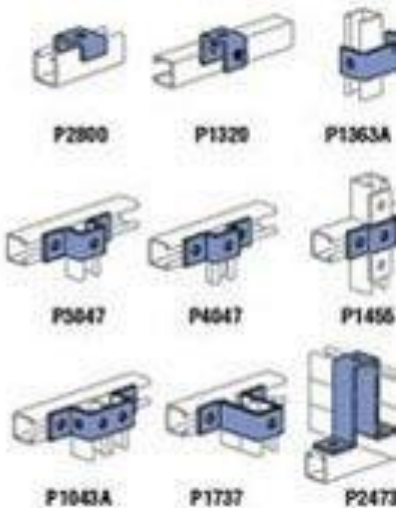
Tools and Materials

- Tape measure
- Drill/driver with bits
- Caulk gun
- Wiring tools
- Metal-cutting saw
- Socket wrench
- Photovoltaic panel (50 to 80 watts)
- Charge controller
- Catastrophe fuse
- Battery sized for 3-day autonomy
- Battery case
- Battery cables
- 12-volt LED lights including motion- sensor light
- Additional 12-volt light fixtures as desired
- 20 ft. Unistrut 1-7/8"-thick U-channel (see Resources, page 152)
- 45° Unistrut connectors
- 90° Unistrut angle brackets
- Unistrut hold-down clamps
- 3/8" spring nuts
- 3/8"-dia. × 1"-long hex-head bolts with washers
- Green ground screws
- DC-rated disconnect or double throw snap switch
- 6" length of 1/2"-dia. liquid-tight flexible metallic conduit
- Lay-in grounding lugs
- Insulated terminal bars to accept one 2-gauge wire and four 12-gauge wires
- Cord cap connectors for 1/2"-dia. cable
- 1/2" ground rod and clamp
- Copper wire (6- and 12-gauge)

- Square boxes with covers
- 1/2" flexible metallic conduit or Greenfield
- 1/2" Greenfield connectors
- 1-1/16" junction boxes with covers
- PVC 6 × 6" junction box with cover
- 1-4/2 UF wire
- 1/4 × 20 nuts and bolts with lock washers
- Cable Tray
- Roof flashing boot
- Roof cement
- Silicone caulk
- Eye protection



"U" Shape Fittings



Wing Shape Fittings



Post Bases



CEE

SIZES: 4" x 2 1/8" to 12" x 3 1/2"

GAUGES: 12 ga. - 16 ga.

FINISHES: Red oxide or galvanized



EAVE STRUT

SIZES: 8 1/8" x 5" x 2 3/4" or 8" x 5" x 5"

GAUGES: 12 ga. or 14 ga.

FINISHES: Red oxide or galvanized

* Available as low eave or high eave and as single slope or double slope



ANGLE

SIZES: 2" x 2", 2" x 4" or 3" x 3"

GAUGES: 14 ga. or 16 ga.

FINISHES: Red oxide or galvanized

* 16 ga. is available in custom dimensions



1/2" SUB-GIRT

SIZE: 1/2" deep x 2 3/4" wide

GAUGES/FINISHES: 16 ga. red oxide or 18 ga. galvanized





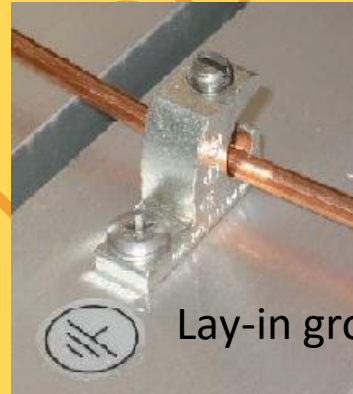
Caulk gun



Slotted Angle Struts



Catastrophe Fuse



Lay-in grounding lugs



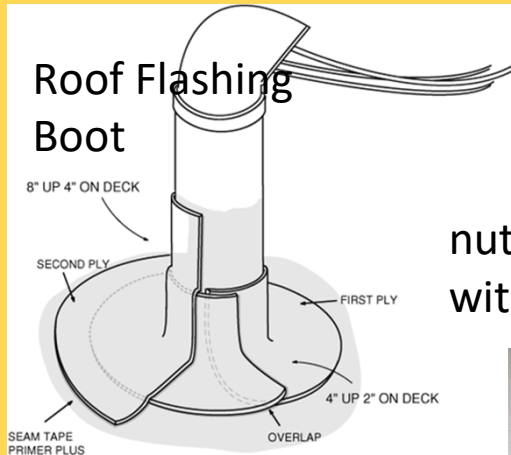
Catastrophe Fuse



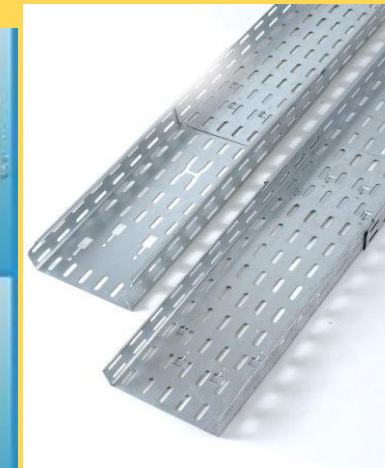
Battery Terminals



Green Ground Screw



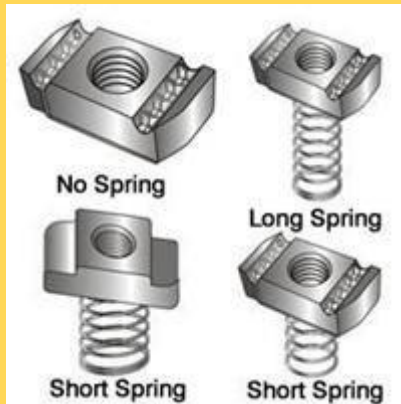
nuts and bolts with lock washers



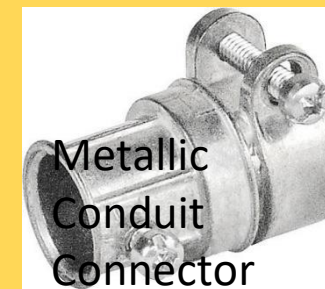
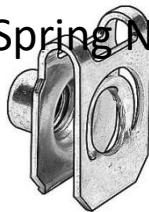
CableTray

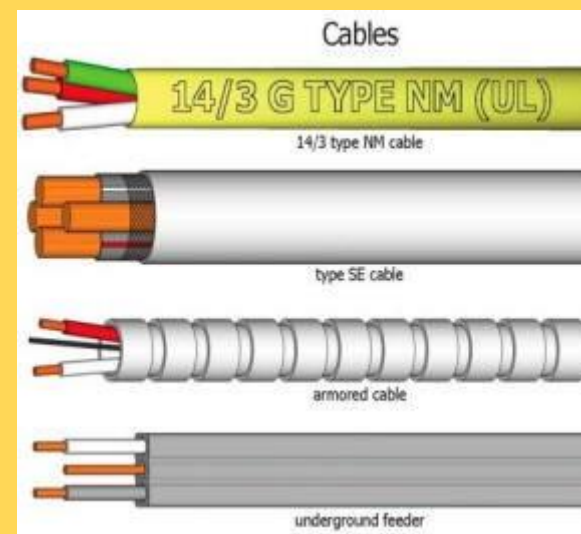
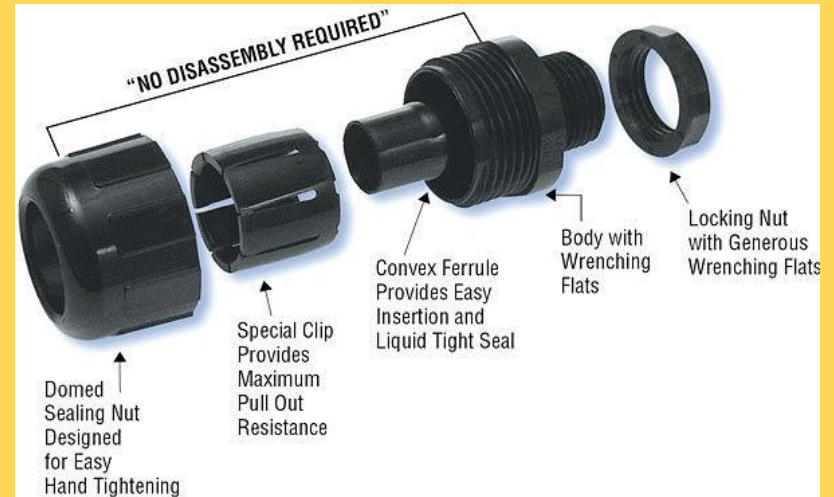


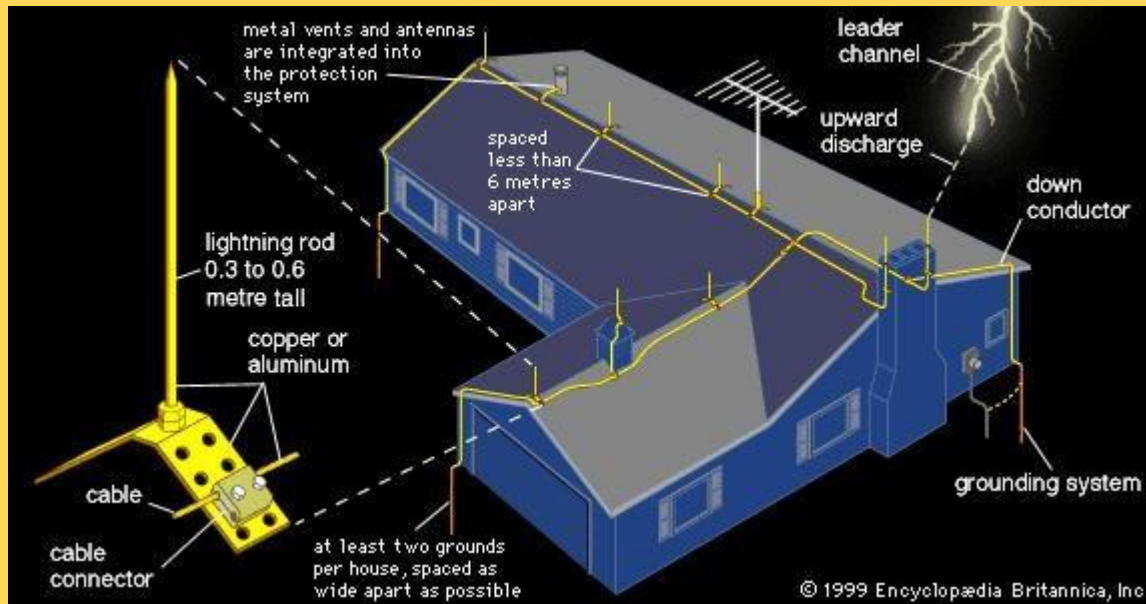
6x6 Junction box



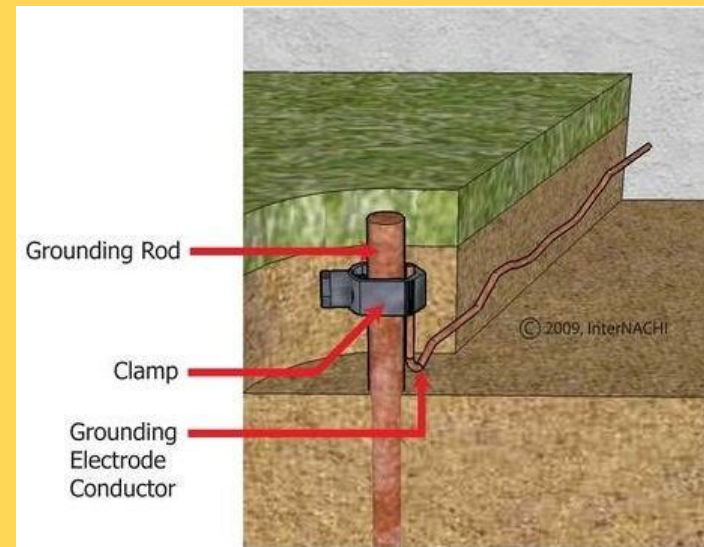
Spring Nuts





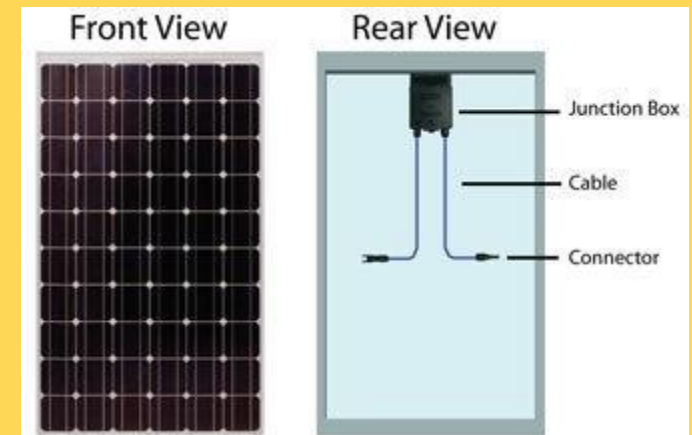


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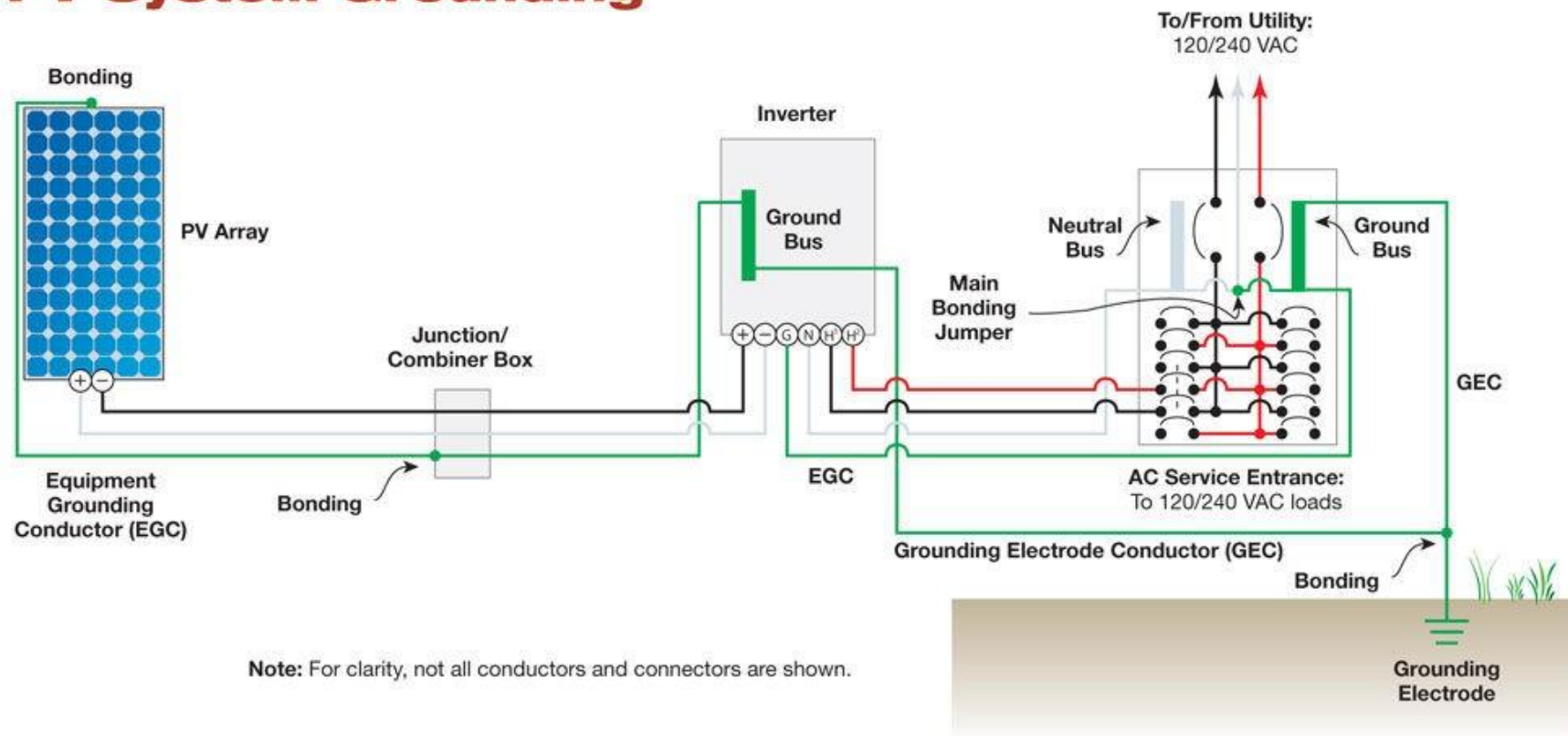
Junction Box

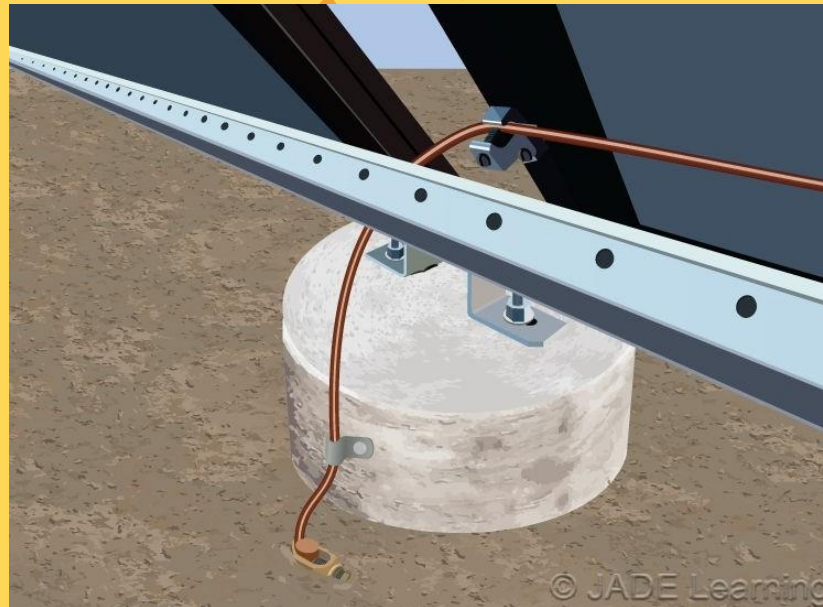
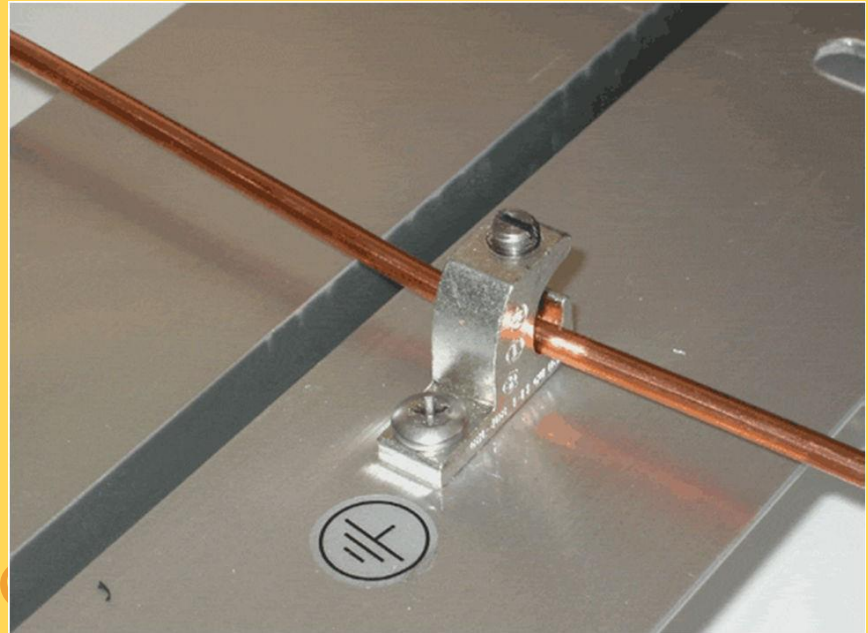
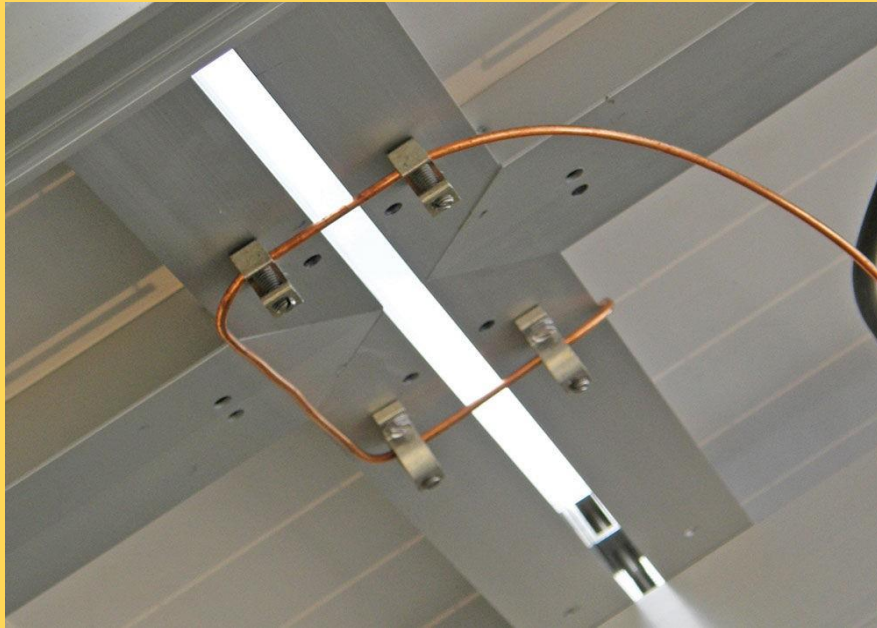
- Junction Box facilitates the connection of terminals to a solar PV Module reliably.



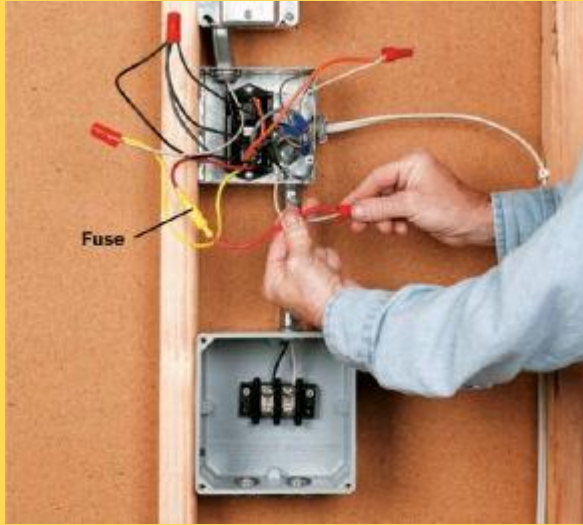
Grounding

PV System Grounding





Assembling



PV-System and kW-Scale PV Installation

Hands-on: kW-Scale PV Plant Installation



Typical Design Errors

- Shading
- Voltage window
- Wiring Losses
- Wiring errors-reverse polarity

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Health and Safety Considerations

- Health and Safety aspects should comply with the high standards.
- Typically OSHA recommendations.
- **OSHA:Occupational Safety and Health Act/Administration.**
- OSHA standards cover many electrical hazards in many different industries.
- OSHA's general industry electrical safety standards are published in Title 29 Code of Federal Regulations (CFR), USA
- The exploit of personal protective equipment (PPE) procedures for securely disconnecting live paths, and appropriate examination and in conformity with the entire solar power installations specific system signage and warnings.

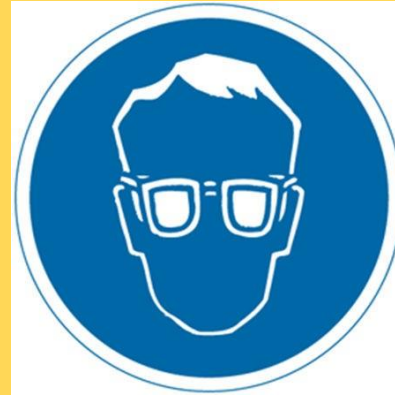
OSHA Description of Adverse Effects of Electricity

Effects of Electric Current in the Human Body

Current	Reaction
Below 1 milliampere	Generally not perceptible
1 milliampere	Faint tingle
5 milliamperes	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries.
6–25 milliamperes (women)	Painful shock, loss of muscular control*
9–30 milliamperes (men)	The freezing current or "let-go" range.* Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
50–150 milliamperes	Extreme pain, respiratory arrest, severe muscular contractions. Death is possible.
1,000–4,300 milliamperes	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely.
10,000 milliamperes	Cardiac arrest, severe burns; death probable

* If the extensor muscles are excited by the shock, the person may be thrown away from the power source.

Safety Symbols

A large yellow rectangular sign with a black border. On the left side, there is a black triangular warning symbol showing two hands being touched, with a spark between them. To the right of the symbol, the text reads:

ATTENTION
OBSERVE PRECAUTIONS
FOR HANDLING

ELECTROSTATIC
SENSITIVE
DEVICES

