



## Classroom Material/Equipment Requirements Photovoltaics – Level 1 ETA® International

Some of these tools are time savers, but not required. (Oscillating tool instead of sandpaper for example – you must have one or the other as a minimum). Appropriate tools for your geographic location may be substituted in your course approval listing rather than the described North American SUGGESTED listing.

### Classroom suggested items:

1. Manual/Workbook (approved by ETA® Course Approval)
2. Support and resource materials (videos, catalogs, spec sheets, additional books)
3. Slide or video presentation(s)
4. Calculators
5. Internet access
6. Copy of the NEC® Handbook (recommended)
7. White board/poster board with markers

### Consumables:

- 1 AWG wire and stranded wire (e.g. #10 bare, black, white) as needed
- 2 Wire connectors and grounding connectors (including screws, nuts/bolts)
- 3 12-volt switch(es)
- 4 12-volt fuse(s)
- 5 12-volt disconnect(s) (DC)
- 6 Half (½”) inch EMT conduit
- 7 Half (½”) conduit connectors
- 8 Clear all-weather sealant

### PV Equipment and Installation Materials:

- 1 Solar panels (minimum of 3)
- 2 Commercial racking to mount panels
- 3 12-volt deep cycle batteries (minimum of 4)
- 4 Combiner box (with breakers) or NEMA 3R rated junction box
- 5 AC disconnect
- 6 DC disconnect
- 7 Service panel box
- 8 Inverter
- 9 Two copper grounding electrodes
- 10 Micro-inverters (optional)
- 11 Power Optimizer (optional)
- 12 Charge Controller (optional)

(over)

**Tools (insulated tools are best) and installation items:**

- 1 Volt-Ohm meter(s) / multimeter
- 2 Kill-A-Watt meter
- 3 Pyranometer (solar energy meter)
- 4 Solar Pathfinder (or equivalent)
- 5 Infrared thermometer
- 6 Load element (e.g. light bulb, LED, small motor—visually verify system connections)
- 7 Wire strippers, crimpers, cutters
- 8 Screw drivers: Philips and flat-head, different lengths
- 9 Variable speed drill(s) with various drill bits and driver bits
- 10 Socket set(s)
- 11 Pliers: standard, needle-nose, locking, pipe
- 12 Assorted open end wrenches and pipe wrench
- 13 Hammers: claw or framing, ball peen, rubber mallet
- 14 Cutting tools: hack-saw or reciprocating saw,
- 15 Sanding tools: oscillating or sander tools, sandpaper, files
- 16 Fiberglass ladder (appropriately rated for weight)
- 17 Personal climbing harness / lanyard
- 18 Compass (or smart phone with compass app)
- 19 Half (1/2") inch one-shot EMT conduit bender
- 20 Hard hat
- 21 Safety gloves
- 22 Safety goggles
- 23 Fish tape
- 24 Stud finder with electrical wiring/cable and pipe alerts
- 25 Permanent marking pens
- 26 Measuring tape or Surveyors tape (30-100 feet/meters)
- 27 Metal ruler (foot, yard or meter)
- 28 Small level