Solar photovoltaic ("PV") projects participating in the Solarize Massachusetts and Mass Solar Connect Program, as applicable must maintain compliance with the Minimum Technical Requirements set forth in this document. These requirements are not intended to be all-encompassing, nor is this attachment intended to be a substitute for engineering specifications or for safety requirements. Site-specific conditions and/or local regulations may require additional requirements not contained in this attachment. MassCEC reserves the right to exclude Installers from future program participation if it is determined by MassCEC that any associated PV project does not satisfy the Minimum Technical Requirements.

### Eligible and Related Equipment

All installations must use PV technology, which is defined as cells or solar photovoltaic arrays that directly convert energy from the sun into electricity. Building integrated installations are eligible assuming all other requirements are met.

### Installation Requirements

The PV project electrical work must be performed by a Massachusetts licensed electrician. For more information on this requirement please see: http://www.mass.gov/ocabr/licensee/dpl-boards/el/regulations/board-policies/guidance-memo-pv-installation.html

The PV project must be installed according to the manufacturer's instructions and in compliance with all applicable codes, standards, interconnection and permitting requirements including:

- Local, state, and/or federal building and electrical laws, codes and practices.
- The provisions of the most current edition of the Massachusetts Electric Code ("MEC") as specified by state code. In all cases where manufacturer instructions, third-party guides/handbooks, or other materials contradict the most current edition of any local, state, or federal code, the applicable code shall take precedence over such materials.
- Interconnection Agreement - A separate application must be submitted to the electric utility to start the formal interconnection process, and sufficient lead time should be allowed as part of the installation, based on timeframes listed in the Interconnection Tariff. All PV projects must have an appropriate electric utility interconnection agreement in place, and have authorization to interconnect from the utility at the time of interconnection to the utility grid.
- All pertinent permits and inspections must be obtained and copies kept on file as may be required by local codes and/or state law.

Additional general installation practices to be followed include:

- All installations must follow the most current edition of the MEC with the following changes as noted below.
- PV projects designed to be installed on pitched (greater than 5°), non-flat roofs, are required to have a tilt and azimuth that is the same as the roof pitch and azimuth, in order to be eligible for the Program.
- Installations of ground- and pole-mounted arrays must have a disconnect switch as described in Article 690.17, located at the array to isolate all DC current carrying conductors. For installations on buildings, refer to Article 690.12.
- PV systems shall not be connected directly to the output of a standby generator, unless the generator is designed to be operated in parallel with a PV system.
- Areas where wiring passes through ceilings, walls, or other areas of the building must be properly restored, booted, and sealed.
- Thermal insulation in areas where wiring is installed must be returned to “as found or better” condition.

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1 Massachusetts Building Code (780 CMR) and Electrical Code (527 CMR) are available from the Executive Office of Public Safety and the Board of Fire Prevention Regulations, respectively.
• All installed electrical components must be listed by a nationally recognized testing laboratory such as Underwriters Laboratory ("UL"), and/or be compliant with Institute of Electrical and Electronics Engineers ("IEEE") standards, or the American National Standards Institute ("ANSI"), or other nationally recognized testing laboratory standards (e.g., UL, CSA, ETL, TUV, etc.), unless otherwise noted in this document, and installed in a manner consistent with the relevant listing and labeling.

• An owner’s manual of operating and maintenance instructions must be provided to the PV project owner and preferably also posted on or near the PV project. The owner’s manual should include manufacturer’s specifications, serial numbers, warranty policies, etc.

• Owners must be provided with, at minimum, a basic training orientation that includes maintenance instructions, troubleshooting, meter reading, and electric production reporting instructions. Owners should also be informed of any opportunities to sell Solar Renewable Energy Certificates ("SREC’s"). For more information, see the Energy Production Reporting Requirements section later in this document.

**Best Practices and Common Installation Violations**

• All work must be completed in a neat and professional manner, as required by Article 110.12.

• Twist-on wire connectors (wire nuts) shall not be used in any outdoor enclosure unless listed to UL 486D for use in damp/wet locations. Proof of listing will be required during inspection if applicable. (See Article 110.28 for more information)

• Warning labels, as specified in the MEC must be posted on disconnects, panel enclosures, DC raceways, and accessible junction boxes. The labels shall be suitable for the environment in which they are installed, as required by Article 110.21(B).

• Article 300.7(A) requires raceways passing from the interior to the exterior of a building be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway.

• Terminal ratings and conductor size/limitations must be followed per Article 110.3(B). Common violations include multiple conductors under a terminal listed for a single conductor, or conductors undersized for the terminals, such as inside a meter enclosure.

• MassCEC recommends that photos be taken of the following system components for all rooftop solar arrays: module frame grounding method, array grounding method, array wire management, interior of any rooftop enclosures, and exterior of any rooftop enclosures. These photos shall be kept on record with the primary installer and made available to MassCEC upon request.

• MassCEC recommends, but does not require, that all PV projects installed under the Solarize Mass and Mass Solar Connect programs include appropriate surge arresters or other means to protect PV project components from lightning and other surge events. However, it is the responsibility of the installer to ensure that the installation meets any local, state or federal building and electrical laws that address lightning and surge protection.

**PV Project and Equipment Warranty Requirements**

• **Installer Warranty.** All PV projects must have a minimum 5 year labor warranty provided by the installer to protect the system owner against defective workmanship, PV project or component breakdown (exceptions noted below), or degradation in electrical output of more than fifteen percent from their originally rated electrical output during the warranty period. The warranty must cover the PV project, including PV modules (panels) and inverters, and provide for no-cost repair or replacement of the PV project or system components, including any associated labor during the warranty period.

• **Manufacturer Warranty.** All major equipment must meet the following minimum manufacturer warranties:
  • **Photovoltaic Module:** Minimum of one year product warranty from date of sale to first System Owner for product workmanship and materials, plus a minimum performance warranty of 20 years within which time the module will produce, under standard test conditions, a minimum of 80% of the product’s minimum rated power at time of sale;
  • **Inverters:** Minimum of 10 years product warranty from date of sale to first System Owner for product workmanship
and materials;
- Revenue grade production meters: 2 year product warranty
- Mounting equipment: 5 year product warranty.
- **Exception:**
  - Aforementioned warranty requirements do not apply to the components of a Data Acquisition System (“DAS”) with exception of the revenue grade meter. However, equivalent warranties, if available, or equivalent service contracts are recommended for such equipment.

### Additional Solar PV Equipment Requirements

The equipment and components that comprise the PV project must have the following characteristics:
- All electrical equipment must be new, with the exception of remanufactured revenue grade meters for application to PV systems of 10 kW capacity or less.
- UL listed and compliant with IEEE standards, or other nationally recognized testing laboratory standards (e.g., UL, CSA, ETL, TUV, etc).
  - All photovoltaic modules must be certified by a nationally recognized testing laboratory as meeting the requirements of the UL Standard 1703.
  - Inverters must be certified as meeting the requirements of IEEE 1547 and UL Standard 1741.
- All modules, inverters, and production meters must be on the California Energy Commission’s list of eligible renewable energy equipment: [http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php](http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php).
  - Note: Unlisted equipment must meet the above mentioned requirements and be added to the California Energy Commissions list of eligible renewable energy equipment to be eligible in the program.
- **Exceptions:**
  - A DAS does not need to be UL listed.
  - Reconditioned meters recertified to meet accuracy standards.

### Electricity Production Meter Requirements

All PV projects must have a dedicated production meter that:
- Is readily accessible and easily understood by the System Owner;
- Records the PV project’s AC output as measured on the AC side of the PV project’s inverter; in the case of DC-only PV projects the meter should record the PV project output provided to the facility load; if a storage device is integral to the PV project, the meter should record the output from the storage device;
- Shall be separate from the utility billing meter and shall not interfere with utility billing or net-metering;
- Must be a standard utility “revenue quality” meter that conforms to applicable ANSI C-12 standards and shall be installed on the AC output side of the PV projects inverter; and
- Shall be available for periodic testing and/or re-calibration, if necessary.
- Must meet the accuracy and other requirements specified in the most recent version of the SREC II – Production Metering Requirements, and any other relevant requirements put forth by MassCEC for SREC reporting.
- If a PV system requires two revenue grade meters to establish the amount of AC energy generated, such as in the case of some systems incorporating energy storage, then two revenue grade meters shall be installed. Installer must provide training to the person(s) who will be reporting to the MassCEC PTS on how to derive the appropriate energy generation value from readings on the two meters.