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SOLAR ENERGY ELECTRICAL POWER GENERATION EQUIPMENT

1. GENERAL

A. Related sections:

- i. 00 00 03 – Modifications to General Requirements of BOR Contracts
- ii. 00 00 11 – Aesthetic Authority
- iii. 01 33 00 – Submittals
- iv. 01 41 26.04 – Fire Marshal Construction Inspection Requirements
- v. 01 77 00 – Project Closeout
- vi. 01 81 00 – Facility Performance Requirements
- vii. 01 91 13 – General Commissioning Requirements
- viii. 02 01 00 – Maintenance of Existing Conditions
- ix. 02 22 00 – Existing Conditions Assessment
- x. 07 00 00 – General Thermal and Moisture Protection Requirements – Roof Drains & Roofs
- xi. 26 00 00 – General Electrical Requirements
- xii. 26 05 19 – Low-Voltage Electrical Power Conductors & Cables
- xiii. 26 05 26 – Grounding & Bonding for Electrical Systems
- xiv. 26 05 33.13 – Conduit for Electrical Systems
- xv. 26 05 43 – Underground Ducts & Raceways for Electrical Systems
- xvi. 26 24 13 – Switchgears and Switchboards
- xvii. 26 41 00 – Facility Lightning Protection

B. Related documents

- i. NEC Article 250, Grounding and Bonding
- ii. NEC Article 480, Storage Batteries
- iii. NEC Article 690, Solar Photovoltaic (PV) Systems
- iv. NEC Article 705, Interconnected Electric Power Production Sources
- v. NEC Article 706, Energy Storage Systems
- vi. IFC Section 1204, Solar Photovoltaic Power Systems
- vii. UL 1703, Standard for Flat-Plate Photovoltaic Modules and Panels
- viii. General Services Administration PBS-P100 Chapter 6.5.14, Solar Photovoltaic Systems
- ix. IBC Chapter 15, Roof Assemblies and Rooftop Structures
- x. ASCE 7-16 Sections 29.4.3 and 29.4.4, Wind Loads on Rooftop Solar Panels
- xi. National Roofing Contractors Association, Handbook of Accepted Roofing Knowledge
- xii. Southern Company, Operation of Distributed Energy Resources (DER) in Parallel with the Distribution System Policy

C. Applicability

- i. This section applies to Solar Energy Electrical Power Generation Systems with inverter generating capacity less than 5 megawatts.

D. Definitions

- i. Solar Energy Electrical Power Generation System (shortened to Solar Photovoltaic Energy System, or System, for brevity in this section): Solar photovoltaic modules, support structures, controls, energy storage devices, and



other materials, hardware or equipment necessary to the process by which solar radiation is collected, converted into electricity, stored, protected from unnecessary dissipation, and distributed.

E. Quality Assurance

- i. All work on or near existing UGA facilities shall comply with:
 - a. Section 02 01 00 – Maintenance of Existing Conditions, and
 - b. Section 02 22 00 – Existing Conditions Assessment.
- ii. Solar Photovoltaic Energy System Installer(s) shall be qualified as follows:
 - a. Licensed by the state of Georgia per section 00 00 03 – Modifications to General Requirements of BOR Contracts,
 - b. Certified PV Installation Professional (PVIP) by the North American Board of Certified Energy Professionals (NABCEP), and
 - c. Have successfully installed at least four projects within the past five years that, in aggregate, equal or exceed the size of the proposed project. References shall be provided for each of the referenced qualified projects.
- iii. Structural Integrity
 - a. For rooftop installations on existing facilities, a current Georgia licensed structural engineer shall provide adequate review and structural analysis of the existing structure that will support the proposed System.
 - b. Designs for system supports, racking, and foundations (where applicable) shall be prepared under the seal of a current Georgia licensed structural engineer.
- iv. Roof Envelope Integrity
 - a. For rooftop installations on existing facilities, verify project suitability with UGA FMD and the warrantor of the existing roofing system. Notify warrantor prior to beginning work and on completion of work, and obtain documentation verifying that the existing roofing system has been inspected and the warranty remains in effect. Submit documentation at project closeout.
 - b. Any damage done to the roof during installation shall be covered by the Solar Photovoltaic Energy System Installer's workmanship warranty.
 - c. Roof mounted equipment shall meet standard of care of roof design and installation, and an exterior envelope consultant shall be engaged as needed. Equipment shall be installed in a manner as to comply with, and not void, the roofing manufacturer's warranty requirements.
 - d. Equipment and mounts shall be installed in a manner that allows for future roof inspection and repair.
- v. Electrical Integrity
 - a. For connection to existing facilities, a licensed Professional Electrical Engineer shall provide adequate review and analysis of the existing electrical service equipment and service spaces for suitability to connect the proposed System.



- vi. Batteries
 - a. If a Solar Photovoltaic Energy System is to include battery storage, batteries shall be installed, enclosed, and ventilated in compliance with applicable codes.
- F. Utility Connection
 - i. Notify FMD Office of Utility and Energy Management prior to contacting the utility.
 - ii. Contractor shall coordinate with the serving electric utility to establish an interconnection agreement.
 - iii. Utility connections shall comply with Southern Company's Operation of Distributed Energy Resources (DER) in Parallel with the Distribution System Policy.
- G. Submittals
 - i. Comply with the following sections:
 - a. 00 00 03 – Modifications to General Requirements of BOR Contracts
 - b. 01 33 00 – Submittals
 - c. 01 77 00 – Project Closeout
 - ii. Estimated Energy Output
 - a. Submit a summary report of calculated monthly and annual energy output for the proposed System, including a description of calculation methods.
 - b. Submit an Excel spreadsheet with calculated 12-month hourly energy output for the proposed System.

2. PRODUCTS

- A. General
 - i. Provide materials to fabricate a functioning Solar Photovoltaic Energy System in accordance with ASTM, IEEE, IFC, NEC, NEMA, NFPA, UL, and as specified in this section.
- B. DC-AC Inverter
 - i. Shall carry, at minimum, a 10 year manufacturer's warranty against defects in materials and workmanship.
 - ii. Shall include maximum power point tracking (MPPT) features.
 - iii. Shall include anti-islanding protection if paralleling arrangement is required.
- C. Solar Photovoltaic (PV) Modules
 - i. Shall be UL listed.
 - ii. Shall carry, at minimum, a 10 year manufacturer's warranty against defects in materials and workmanship.
 - iii. Shall carry, at minimum, a 25 year manufacturer's power output warranty, with the first 10 years at 90% minimum rated power output and the balance of the 25 years at 80% minimum rated power output.
- D. Instrumentation
 - i. Meters
 - a. For a System that is connected to a building, the System shall be furnished with a meter that communicates to the building automation system per Section 26 24 13 – Switchgears and Switchboards.



- b. For a System that is connected directly to the serving utility, the meter provided by the utility satisfies the requirements of this section.

3. EXECUTION

A. Installation

- i. Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions.

B. Grounding

- i. System support and racking shall be grounded in compliance with applicable codes and according to manufacturer instructions.

C. Marking

- i. All Solar Photovoltaic Energy System direct-current (DC) conduit, enclosures, raceways, cable assemblies, junction boxes, combiner boxes, and disconnects shall be marked in accordance with applicable codes.
- ii. For a roof-mounted System, signage is required on all stairway doors providing access to the roof where it is installed. Each stairway door providing access to the roof shall have a sign affixed to the interior side of the stairway door. The signage shall contain the text "CAUTION PHOTOVOLTAIC SYSTEM INSTALLED ON ROOF." The sign shall consist of letters at least 2 inches high on a contrasting background. (For reference, see PBS-P100 6.5.14.3.)
- iii. The entrance to the mechanical/electrical room containing the Solar Photovoltaic Energy System disconnecting means shall be marked "PV SYSTEM DISCONNECT INSIDE."

D. Location of DC Conductors

- i. Conduit, wiring systems, and raceways for Solar Photovoltaic Energy System circuits shall be located in accordance with applicable codes.

E. Roof Access and Pathway Requirements

- i. The Solar Photovoltaic Energy System, including supports and power conductors, shall incorporate clearances in accordance with applicable codes.

F. Commissioning

- i. The System shall be commissioned in accordance with section 01 91 13 – General Commissioning Requirements.
- ii. A PV Commissioning & Maintenance Specialist (PVCMS) certified by the North American Board of Certified Energy Professionals (NABCEP) is required for all projects with a Solar Photovoltaic Energy System.
 - a. In cases where the System is part of a construction project with commissioning, the PVCMS scope shall be included within the broader commissioning contract.
- iii. Inspection and operational testing shall be performed in accordance with manufacturer's recommendations.



- iv. Prior to initial operation, inspect the Solar Photovoltaic Energy System for conformance to drawings, specifications, and applicable codes. In addition, include the following:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify required area clearances.
 - d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or perform thermographic survey after energization.
 - e. Verify the correct operation of all sensing devices, alarms, and indicating devices.
 - f. Verify that all cable entries from top of junction boxes are sealed per junction box rating.
 - v. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the solar photovoltaic electrical power generation system is in good operating condition and properly performing the intended function.
- G. Utility Connection
- i. Connect the Solar Photovoltaic Energy System to the serving electric utility grid only after receiving written approval from the FMD Office of Utility and Energy Management and the utility company.
 - ii. Only qualified personnel shall connect the System to the serving electric utility grid.