

## **263100 – PHOTOVOLTAIC ARRAY**

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### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The complete electrical specifications issued for the primary New Academic Building construction project.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. PV laminates (cells laminated into rigid sheets, with connecting cables).
  - 2. PV modules (laminates in mounting frames).
  - 3. Inverters
  - 4. Combiner Boxes
  - 5. PV DC Wiring
  - 6. Racking Systems
  - 7. Metering

#### **1.3 DEFINITIONS**

- A. ETFE: Ethylene tetrafluoroethylene.
- B. FEP: Fluorinated ethylene propylene.
- C. IP Code: Required ingress protection to comply with IEC 60529.
- D. MPPT: Maximum power point tracking.
- E. NOCT: Normal operation cell temperature
- F. PTC: PVUSA Test Condition. Commonly regarded as a "real-world" measure of PV output. See below for definition of "PVUSA."
- G. PV: Photovoltaic.
- H. STC: Standard Test Conditions defined in IEC 61215.

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### **1.4 REFERENCE STANDARDS:**

- A. American National Standards Institute (ANSI):
  - 1. ANSI/UL 1703 Standard for Flat-Plate Photovoltaic Modules and Panels.
- B. International Electrical Commission (IEC):
  - 1. IEC 61215 International Standard (Extended Version) - Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval.
  - 2. IEC 61730-1 International Standard - Photovoltaic (PV) module safety qualification - Part 1 - Requirements for construction
  - 3. IEC 61730-2 International Standard - Photovoltaic (PV) module safety qualification - Part 2 - Requirements for testing.
- C. International Organization for Standardization (ISO):
  - 1. ISO 9001 Quality Management Systems.
  - 2. ISO 14001 Environmental Management Systems.
- D. Underwriters Laboratories, Inc. (UL):
  - 1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.
  - 2. UL 1703 Standard for Flat-Plate Photovoltaic Modules and Panels.
- E. FM Global
  - 1. Approval Standards for Rigid Photovoltaic Panels

### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For PV modules.
  - 1. Include plans, elevations, sections, and mounting details.

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2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly.
4. Include diagrams for power, signal, and control wiring.
5. Include overall submitted array anticipated annual energy production.

### **1.6 INFORMATIONAL SUBMITTALS**

- A. General: Submit listed submittals in accordance with Contract Conditions.
- B. Test and Evaluation Reports:
  1. Certified test reports showing compliance with specified performance characteristics and physical properties.
- C. Manufacturer's Instructions: Submit manufacturer's storage and installation instructions.
- D. Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from a single manufacturer.
- E. Manufacturer(s) Reports: Manufacturer's field reports specified.
- F. Qualification Statements:
  1. Submit letter of verification for Manufacturer's Qualifications.
  2. Submit letter of verification for Installer's Qualifications.

### **1.7 CLOSEOUT SUBMITTALS**

- A. General: Submit listed submittals in accordance with Contract Conditions.
- B. Operation and Maintenance Data:
  1. Submit operation and maintenance data for installed products shall include:
    - a. Manufacturer's instructions detailing maintenance requirements.
- C. Warranty Documentation: Submit warranty documents specified.

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### **1.8 WARRANTY**

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period.
  - 1. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:
    - a. Faulty operation of PV modules.
  - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.
  - 1. Manufacturer's minimum power output warranties include, but are not limited to, the following warranty periods, from date of Substantial Completion:
    - a. Specified minimum power output to 80 percent or more, for a period of 25 years.

### **1.9 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Single Source Responsibility: To ensure quality of appearance and performance, obtain equipment for systems from single photovoltaic system installer or from manufacturers approved by photovoltaic system installer.
  - 2. Manufacturer:
    - a. Having 15 years of experience manufacturing components similar to or exceeding requirements of project.
    - b. Having sufficient capacity to produce and deliver required materials without causing delay in work.
    - c. Capable of providing field service representation during construction.
    - d. Manufacturing facility certified to ISO 9001 and to ISO 14001.
  - 3. Installer:
    - a. Certified in writing by equipment manufacturers as qualified for installation of specified systems, experienced in performing work of

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this section and has specialized in installation of work similar to that required for this project.

- b. Must have NABCEP certification (North American Board of Certified Energy Practitioners).
- c. Install must provide proof of a minimum of (5) prior completed installations of PV Array size 100 KW or larger) using the manufacturer's product.
- d. Have proper licensing and be able to provide contractor's license number from Authority Having Jurisdiction where project is located.
- e. Must be an approved vendor by NJ DPMC

### **4. Regulatory Requirements:**

- a. Provide system meeting requirements of National Electric Code (NEC), edition adopted by local jurisdiction, containing information on photovoltaic systems such as grounding, conductor, over-current protection, disconnect, and labeling requirements.
- b. Provide Photovoltaic modules compliant with requirements of UL-1703 – Standard for Flat Plate Photovoltaic Modules and Panels.
- c. Provide system meeting requirements of federal, state, and local building codes.

## **1.10 DELIVERY, STORAGE & HANDLING**

### **A. Delivery and Acceptance Requirements:**

- 1. Deliver material in accordance with in accordance with manufacturer's written instructions.
- 2. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

### **B. Storage and Handling Requirements:**

- 1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

### **C. Packaging Waste Management:**

- 1. Separate waste materials for reuse and/or recycling.
- 2. Remove packaging materials from site and dispose of at appropriate recycling facilities including pallets.
- 3. Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material for recycling.
- 4. Fold metal and plastic banding. Flatten and place in designated area for recycling.

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### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURER**

- A. Manufacturers listed in the products section below are the basis of design manufacturer. Alternate manufacturers are acceptable, however submittal documentation must demonstrate that alternate products meet keep design requirements. Key design requirements include the following:
1. Energy Production – submitted array shall meet the same anticipated energy generation either same module efficiency and performance on a w/sf basis or overall anticipated annual energy generation.
  2. Inverter Quantity and Size – inverters shall be small scale inverters per the owner's direction. One central inverter or microinverters on each panel shall not be accepted.
  3. AC wiring – conduits and wires shall be able to fit in the design designated locations for runs from the roof to the main panelboard.
  4. Structural Weight – for combined solar panel and racking assembly shall not exceed 7.75 psf for the ballasted system on the lower roofs and 350 lbs upward and 275 lbs downward for the connection points for the fixed, structurally attached rail racking system on the upper roof.

#### **2.2 OTHER REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Seismic Qualification Certificates: For panels, racking systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

#### **2.3 PV SYSTEMS DESCRIPTION**

- A. Interactive PV System: Collectors connected in parallel to the electrical utility; and capable of providing power for Project and supplying power to a distributed network.

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1. A 356-module array to generate a total nominal rated output of 113.9kW. Design calculations predict an annual energy generation total of 124,860 kWh.
2. System Components:
  - a. Photovoltaic modules.
  - b. Grid-tied inverter.
  - c. Combiner Box
  - d. DC wiring
  - e. Racking System.
  - f. Utility and PV meter.

### **2.4 PHOTOVOLTAIC MODULES**

- A. Basis of Design Manufacturer: Motech Industries, or approved equal
  1. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.
  2. Any alternate manufacturers submitted shall meet the minimum performance requirements of 15.36 peak watts per square foot of panel or greater.
- B. Basis of Design Model Number: XS72 C3-320: 320 watt module with a high-strength aluminum frame, white backsheet,
  1. Module Dimensions: 77.01"l, 38.9"w, 1.77"d.
  2. Maximum Power (Pmax):
    - a. STC 1000W per m<sup>2</sup>: 320W.
  3. Voltage at Pmax (Vmpp):
    - a. STC 1000W per m<sup>2</sup>: 35.91V.
  4. Current at Pmax (Impp):
    - a. STC 1000W per m<sup>2</sup>: 8.91A.
  5. Short Circuit Current (Isc):
    - a. STC 1000W per m<sup>2</sup>: 9.28A.
  6. Open Circuit Voltage (Voc):
    - a. STC 1000W per m<sup>2</sup>: 45.31V.
  7. Module Efficiency: 16.54 percent.

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8. Module Weight: 49.4 lbs
9. Tolerance: 0 to plus 3 percent.
10. NOCT: 45.8 degrees C plus or minus 2 degrees C.
11. Maximum Series Fuse Rating: 15A.
12. Application Class, IEC 61730: Class A.
13. Maximum System Voltage:

- a. NEC Rating: 600V.
- b. IEC Rating: 1000V.

C. Description:

1. Compatibility:
  - a. Ensure components and materials are compatible with specified accessories and adjacent materials.
2. Material Composition Large Panels: 72-cell monocrystalline photovoltaic modules incorporating low-iron tempered glass with anti-reflective coated (ARC) glass minimal .125" thick, an aluminum frame, bypass diodes, universal PV wire output cables and MC4 connectors.

D. Performance/Design Criteria:

1. Certified according IEC 61215 (Design qualification and type approval.)
2. Certified according to the IEC 61730-1.
3. Certified according to the IEC 61730-2.
4. Complies with UL 790, Class C.
5. Listed to ANSI/UL 1703.
6. Complies with ULC/ORD-C1703.
7. Loading:
  - a. Frames capable of withstanding loads of not less than 50 psf (2400Pa) in a variety of mounting methods.
  - b. Frames capable of meeting IEC extended snow load requirements of not less than 112 psf (5400 Pa) when using traditional mounting at the bolt holes.
  - c. Panels rated to withstand wind speeds of 115 mph per local design wind load requirements.
  - d. Panels rated to withstand hail impact of up to 1" at 50 miles per hour.



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### **2.5 GRID-TIED INVERTER**

#### **A. Basis of Design Manufacturer: SMA America**

1. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.

#### **B. Basis of Design Inverter Type 1: SMA Sunny Power Tri-Phase 15000TL-US**

1. Substitution Limitations:
  - a. Substitutions: Substitutions shall be permitted for products that are of a similar inverter type/size. It shall be the contractor and substituted manufacturer's responsibility to prove equal performance. Any re-stringing of the PV modules shall be the contractors responsibility and shall be submitted for review and approval.
2. Inverter shall be UL1741 listed and compliant with IEEE-1547 per PSE&G requirements.
3. Control Type: Maximum power point tracker control.
4. Inverter Type: Transformerless.
5. Inverter Electrical Characteristics: 15kW-15.3kW Inverter
6. Inverter Input Characteristics:
  - a. Maximum Voc: 1000 V dc.
  - b. MPPT Voltage Range: 300V-800V dc.
  - c. Minimum DC Voltage: 150V
  - d. Starting Voltage: 188V
  - e. Maximum Input Current: 66 A.
  - f. MPPT Input Current: 33 A.
  - g. Number of MPPT Inputs: 2
  - h. Total Number of Inputs: 2
7. Inverter Output Characteristics:
  - a. Nominal Output Voltage: 480/277 V ac three phase.
  - b. Maximum Output Current: 18 A.
  - c. Rated AC frequency: 60 Hz.
  - d. Power Factor at Rated Power: 1
  - e. Peak Efficiency: 98.2 percent.
  - f. CEC Weighted Efficiency: 97.5 percent.
  - g. Outdoor enclosure: NEMA 3R.
8. Operating Conditions:
  - a. Operating Ambient Temperatures: Minus 25 deg C to plus 60 deg C.

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- b. Relative Humidity: 0 to 95 percent, noncondensing.
    - c. Mounting Angle Range: 15 to 90 degrees.
    - d. Noise emission: 51 dB(A)
    - e. Maximum night time losses: 1 W
  - 9. Inverters shall have the following:
    - a. Overcurrent protection on both the input and output.
    - b. All fuses, disconnects, and circuit breakers shall be dc rated on the input side.
    - c. Digital display.
    - d. Surge overload protection.
    - e. Network capability.
  - 10. Physical Characteristics:
    - a. Inverter Dimensions: 26.2" x 25.6" x 10.4" (LxWxH).
    - b. Inverter Weight: 121 lb
  - 11. Warranty:
    - a. Provide manufactures warranty for a minimum of 10 years.
- C. Basis of Design Inverter Type 1: SMA Sunny Power Tri-Phase 20000TL-US
- 1. Substitution Limitations:
    - a. Substitutions: Substitutions shall be permitted for products that are of a similar inverter type/size. It shall be the contractor and substituted manufacturer's responsibility to prove equal performance. Any re-stringing of the PV modules shall be the contractors responsibility and shall be submitted for review and approval.
  - 2. Inverter shall be UL1741 listed and compliant with IEEE-1547 per PSE&G requirements.
  - 3. Control Type: Maximum power point tracker control.
  - 4. Inverter Type: Transformerless.
  - 5. Inverter Electrical Characteristics: 20kW-20.4kW Inverter
  - 6. Inverter Input Characteristics:
    - a. Maximum Voc: 1000 V dc.
    - b. MPPT Voltage Range: 300V-800V dc.
    - c. Minimum DC Voltage: 150V
    - d. Starting Voltage: 188V
    - e. Maximum Input Current: 66 A.
    - f. MPPT Input Current: 33 A.

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- g. Number of MPPT Inputs: 2
    - h. Total Number of Inputs: 2
  - 7. Inverter Output Characteristics:
    - a. Nominal Output Voltage: 480/277 V ac three phase.
    - b. Maximum Output Current: 24 A.
    - c. Rated AC frequency: 60 Hz.
    - d. Power Factor at Rated Power: 1
    - e. Peak Efficiency: 98.5 percent.
    - f. CEC Weighted Efficiency: 97.5 percent.
    - g. Outdoor enclosure: NEMA 3R.
  - 8. Operating Conditions:
    - a. Operating Ambient Temperatures: Minus 25 deg C to plus 60 deg C.
    - b. Relative Humidity: 0 to 95 percent, noncondensing.
    - c. Mounting Angle Range: 15 to 90 degrees.
    - d. Noise emission: 51 dB(A)
    - e. Maximum night time losses: 1 W
  - 9. Inverters shall have the following:
    - a. Overcurrent protection on both the input and output.
    - b. All fuses, disconnects, and circuit breakers shall be dc rated on the input side.
    - c. Digital display.
    - d. Surge overload protection.
    - e. Network capability.
  - 10. Physical Characteristics:
    - a. Inverter Dimensions: 26.2" x 25.6" x 10.4" (LxWxH).
    - b. Inverter Weight: 121 lb
  - 11. Warranty:
    - a. Provide manufactures warranty for a minimum of 10 years.
- D. Basis of Design Inverter Type 1: SMA Sunny Power Tri-Phase 24000TL-US
- 1. Substitution Limitations:
    - a. Substitutions: Substitutions shall be permitted for products that are of a similar inverter type/size. It shall be the contractor and substituted manufacturer's responsibility to prove equal performance. Any re-

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stringing of the PV modules shall be the contractors responsibility and shall be submitted for review and approval.

2. Inverter shall be UL1741 listed and compliant with IEEE-1547 per PSE&G requirements.
3. Control Type: Maximum power point tracker control.
4. Inverter Type: Transformerless.
5. Inverter Electrical Characteristics: 24kW-24.5kW Inverter
6. Inverter Input Characteristics:
  - a. Maximum Voc: 1000 V dc.
  - b. MPPT Voltage Range: 300V-800V dc.
  - c. Minimum DC Voltage: 150V
  - d. Starting Voltage: 188V
  - e. Maximum Input Current: 66 A.
  - f. MPPT Input Current: 33 A.
  - g. Number of MPPT Inputs: 2
  - h. Total Number of Inputs: 2
7. Inverter Output Characteristics:
  - a. Nominal Output Voltage: 480/277 V ac three phase.
  - b. Maximum Output Current: 29 A.
  - c. Rated AC frequency: 60 Hz.
  - d. Power Factor at Rated Power: 1
  - e. Peak Efficiency: 98.5 percent.
  - f. CEC Weighted Efficiency: 98.0 percent.
  - g. Outdoor enclosure: NEMA 3R.
8. Operating Conditions:
  - a. Operating Ambient Temperatures: Minus 25 deg C to plus 60 deg C.
  - b. Relative Humidity: 0 to 95 percent, noncondensing.
  - c. Mounting Angle Range: 15 to 90 degrees.
  - d. Noise emission: 51 dB(A)
  - e. Maximum night time losses: 1 W
9. Inverters shall have the following:
  - a. Overcurrent protection on both the input and output.
  - b. All fuses, disconnects, and circuit breakers shall be dc rated on the input side.
  - c. Digital display.
  - d. Surge overload protection.
  - e. Network capability.

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10. Physical Characteristics:

- a. Inverter Dimensions: 26.2" x 25.6" x 10.4" (LxWxH).
- b. Inverter Weight: 121 lb

11. Warranty:

- a. Provide manufactures warranty for a minimum of 10 years.

### **2.6 COMBINER BOX**

A. Basis of Design: SMA America – SBCB-6

1. Combiner Box shall be UL1741 listed.

2. Combiner Box Electrical Characteristics:

- a. Maximum Voltage: 600 V dc.
- b. Maximum Input Fuse Rating: 15 A.
- c. Input Wire Size: 10 to 6 AWG
- d. Total Number of Inputs: 6
- e. Maximum Output Current: 90 A.
- f. Maximum Continuous Output Current: 72 A.
- g. Output Wire Size: 6 AWG to 350 kcmil
- h. Power Supply: 24 V dc.
- i. Outdoor enclosure: NEMA 3R/4
- j. PV Array Configuration Options: Positive or Negative Grounded.

3. Combiner Boxes shall have the following:

- a. Overcurrent protection the input.
- b. DC rated fuses.
- c. Lockable door.
- d. Field mountable in the horizontal or vertical position

4. Characteristics:

- a. Combiner Box Dimensions: 10" x 8" x 6" (LxWxH).
- b. Combiner Box Weight: 11 lbs.

5. Warranty:

- a. Provide manufactures warranty for a minimum of 5 years.

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### **2.7 PHOTOVOLTAIC SYSTEM DC WIRING**

- A. Manufacturers: Southwire, AWC Wire, USA Wire & Cable, Inc.
- B. Characteristics:
  - 1. UL Type PV (overall) UL 4703
  - 2. USE-2 Rated (14 AWG & Larger 600V)
  - 3. UL Type RHW-2 (90°C wet, 10 AWG & Larger Per UL)
  - 4. RoHS Compliant
  - 5. Flame Resistance: VW-1
  - 6. Maximum Operating Voltage: 600 or 1000 VRMS (UL PV), 10000 VRMS (CSA RW90)
  - 7. Temperature Range: -40°C to 90°C
  - 8. Min. Bend Radius: 8x Diameter

### **2.8 RACKING SYSTEM**

- A. Basis of Design Manufacturers: Unirac and SMA America
  - 1. Substitution Limitations: Any substitution shall be coordinated with the structural capacity of the building. Basis of design system is based on the following parameters:
    - a. Ballasted Racking System: Combined solar panel and racking assembly shall not exceed 7.75 psf
    - b. Fixed Mount Rail System: 350 lbs upward and 275 lbs downward for the structure connection points. Connection point spacing shall be at 96" to match building structural framing spacing.
- B. Racking Systems shall be type as specified on drawings.
- C. Roof Mount Ballasted: Unirac Roofmount
  - 1. Extruded aluminum, two rails, tilt legs, and roof standoffs.
  - 2. Roof Surface protection provided.
  - 3. Ballast trays incorporated into racking framing.
  - 4. Roof Mounting:
    - a. No roof penetrations.
    - b. Self-ballasting.
    - c. Wind-tunnel tested to 115-mph wind.
    - d. Anticipated Max Ground Snow Load: 30 psf
    - e. Ballast Block Weight: 32 lbs
    - f. Maximum Roof Loading: 7.55 psf

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- g. Service Life: 25 years.
      - h. Freestanding system.
  - D. Roof Mount – Fixed Racking : Unirac Solarmount
    - 1. Flush mount on flat roof.
    - 2. Framing:
      - a. Material: Extruded aluminum.
      - b. Span Distance between connection points: 96 in.
      - c. Maximum Cantilever Length: 32 in.
      - d. Raceway Cover Plates: Aluminum.
      - e. Wind-tunnel tested to 115-mph wind.
      - f. Anticipated Max Ground Snow Load: 30 psf
      - g. Maximum Connection Point Loads: 350 lbs upward and 275 lbs downward
      - h. Service Life: 25 years.
  - E. Roof Mount – Inverter Racking System: SMA America Ready-Rack
    - 1. Description: Racking assembly for mounting SMA inverters.
    - 2. Physical Characteristics:
      - a. Dimensions: 60" x 26.5" 31" (LxWxH)
      - b. Installed Weight (Including inverter weight): 220 lbs
      - c. Components: Able to hold inverter, AC disconnects, Combiner box.
    - 3. Electrical Characteristics:
      - a. AC Disconnect: 40 A.
    - 4. Standards Compliance: UL Compliant
    - 5. Warranty: Provide manufactures warranty for a minimum of 5 years
- 2.9 PV ARRAY METERING
- A. Manufacturers:
    - 1. E-MON L.P.
    - 2. Cutler Hammer
    - 3. Siemens.
    - 4. Square D; Schneider Electric.
  - B. Kilowatt-Hour/Demand Meter: Electronic three-phase meters, measuring electricity use and demand.

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1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: Digital liquid crystal, indicating accumulative kilowatt hours, current time and date, current demand, historic peak demand, and time and date of historic peak demand.
3. Demand Signal Communication Interface: Match signal to connect to building automation system input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.
4. Programmable Contact Module: Unit shall have push-button switches and a display for setting the demand level at which an integral set of Form C contacts shall be operated to initiate indicated action.
5. Enclosure: NEMA 250, Type 1 minimum, with hasp for padlocking or sealing.
6. Identification: Comply with Division 26 Section "Identification for Electrical Systems."
7. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
8. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for ratings of circuits indicated for this application.
  - a. Type: split core.
9. Meter Accuracy: Nationally recognized testing laboratory certified to comply with ANSI C12.1.
10. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.

### **2.10 BUILDING MANAGEMENT SYSTEM INTEGRATION AND ENERGY DISPLAY**

#### **A. BMS System Integration**

1. PV array metering shall be connected to the building BMS system for monitoring of energy generation.
  - a. Building BMS Controls Manufacturer: Automated Logic
2. Installer shall coordinate with controls vendor for coordination between meter and BMS. Any control wiring required for connection to the BMS shall be by installer.

#### **B. Solar Energy Web Based display for Campus View**

1. Basis of Design Manufacturer: SMA America
  - a. Remote Monitoring and diagnostics Device: Sunny Webbox
  - b. Diagnostics software and web interface : Sunny Portal



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2. Web Based interface for campus community shall be provided as part of this project.
3. Interface shall be provided as a complete system and shall be compatible with installed system components
4. Interface shall be accessible for viewing via a website based interface.
5. Contract for web-interface shall include a minimum of 2 years technical support.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Do not begin installation until mounting surfaces have been properly prepared.
- C. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.
- E. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Coordinate layout and installation of PV panels with roof, roof equipment, structural assembly and other construction.
- C. Support PV panel assemblies independent of supports for other elements such as roof and support assemblies, enclosures, vents, pipes, and conduits. Support assembly to prevent twisting from eccentric loading.
- D. Install PV inverters and combiner boxes in locations indicated on Drawings.

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- E. Install weatherseal fittings and flanges where PV panel assemblies penetrate exterior elements such as walls or roofs. Seal around openings to make weathertight. See Section 079200 "Joint Sealants" for materials and application.
- F. Wiring Method: Install cables in raceways.
- G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### **3.3 CONNECTIONS**

- A. Coordinate PV panel cabling to equipment enclosures to ensure proper connections.
- B. Coordinate installation of utility-interactive meter with utility.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

END OF SECTION 263100