ADDENDUM 4

APRIL 14, 2025

IFB #AAHC-25-2

RESPONSES TO POST WALK RFI'S

1. Question: Please confirm the finish on all structural steel. Is it exposed galvanized? Painted?

   Answer: Per page 13 of the Structural Repair Spec 2.6 part A, the steel is to be galvanized with galvanized paint at the field welds. You can offer finish paint as an extra alternate.

2. Question: The IFP states in the objective that we are "replacing the solar panels". Please provide electrical drawings for this work.

   Answer: I have attached the requirements for our solar projects, but we typically leave the final design up to the solar contractor to maximize the solar array.

3. Where are the existing solar panels on the roof to be reinstalled? It was mentioned at the walkthrough that they may be relocated to a different roof. Please advise.

   Answer: We want to move the existing panels to the lower roof. Again, we would rely on the solar contractor for final placement to maximize output.

SECTION 26 31 00 - SOLAR PHOTOVOLTAIC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Photovoltaic Panels and Arrays

B. Power Optimizers

C. String Inverters

D. Combiner/Disconnect

E. Photovoltaic Monitoring Equipment and Accessories

F. Photovoltaic Mounting Systems

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in photovoltaic panel or inverter systems with five years documented experience.

B. Installer: Equipment installer shall be NABCEP certified or be certified by photovoltaic inverter and panel manufacturers. Licensed electrical contractors with electrical apprenticeship documentation shall also be acceptable.

C. Operate, commission, and demonstrate seven (7) days of complete photovoltaic system operation prior to turnover to the Owner.

1. Refer to the Part 3 for system commissioning requirements.

1.3 REFERENCES

A. ANSI C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

B. IEEE 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

C. IEEE 929 - Recommended Practices for Utility Interface of Photovoltaic Systems.

D. IEEE 1547 - Standard for Interconnecting Distributed Resources with Electronic Power Systems.

E. IEEE 1547.1 - Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

F. NFPA 70 - National Electrical Code (NEC) Article 690 - Solar Photovoltaic (PV) Systems

G. UL 1703 - Standard for Flat-Plate Photovoltaic Modules and Panels

H. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

I. UL 1998 - Standard for Software in Programmable Components

1.4 SUBMITTALS

A. Submit product data for review and approval by engineer and owner.

B. Photovoltaic Panels: Include unit dimensions, weight, material construction, wattage, voltage, current, open circuit voltage, short circuit current, installation and maintenance information, and manufacturer voltage correction factor in information.

C. Photovoltaic Inverter: Include unit dimensions, weight, installation and maintenance information. Also include the following:

1. Input: DC voltage range, max current input.
2. Output: AC voltage range, total harmonic distortion, power factor, efficiency, maximum current output.
3. General: Power consumption, enclosure type, compliance with references.
4. Environment: Ambient temperature rating, cooling requirements.

D. Array Mounting Frame:

1. Calculations, drawings and installation details shall be designed and sealed by a Professional Engineer licensed in the state where the project is located experienced in solar mounting frame design and installation.
2. Design of support shall be performed for loading indicated in this specification and structural general notes.
3. Coordination drawing drawn to scale and coordinating the photovoltaic array with other systems and equipment in the vicinity for use in the development and layout of the mounting frame.
4. Clear indication of design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
5. Plan drawings and details shall be cross-referenced. Details provided are to clearly indicate attachment to structure, correctly representing the fastening requirements.

E. Roof mounted system certification letter, signed by contractor, that the roof adhesives, fasteners, hardware, and accessories are approved by manufacturers of both the roofing system and the photovoltaic system.

F. Provide list of certified installers with proof of certification.

G. Provide calculation of expected annual total kilowatt hours for proposed equipment and installation.

1.5 SPARE PARTS

A. Provide three (3) additional fuses of each type and size installed.

B. Provide one (1) additional inverter convection cooling fan for each inverter module.

C. Provide two (2) spare photovoltaic panels. Coordinate with owner to for delivery and storage

D. Provide one (1) spare microinverters.

1.6 DELIVERY, STORAGE, HANDLING

A. Store and protect products.

B. Store in warm and dry location or per manufacturer's requirements.

C. Handle per manufacturer's requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data.

B. Include description of operation and servicing procedures, list of major components, recommended remedial and preventative maintenance procedures, and list of spare parts.

1.8 WARRANTY

A. Photovoltaic Panels and Array: Provide 20-year warranty for power production. Equipment shall maintain minimum 80% of the manufacturer-published wattage output rating for 20 years. Provide 5-year workmanship warranty.

B. Photovoltaic Inverter: Provide **20** year warranty of equipment and installation.

C. Include coverage for travel, parts, and service.

1.9 PRE-INSTALLATION CONFERENCE

A. Roof Mounted System: Conduct a pre-installation conference prior to commencing roof mounted system work. Minimum participants to include general contractor, roofing contractor, electrical contractor, and photovoltaic system installer. Minimum agenda items shall include:

1. Installation schedule.
2. Protocols to protect roof system and roof warranty.
3. Adhesive, fastener, accessories, and hardware approved to maintain roof system and photovoltaic system warranties.

4. Adhesive, fastener, accessories and hardware required to support photovoltaics systems on surfaces installed by others.

1.10 SYSTEM DESCRIPTION

A. Complete photovoltaic system rated 400 volt DC at STC including photovoltaic panels, inverter system, combiner/disconnects, metering, and reporting equipment. Systems shall be configured to produce 240/120 single phase 3 wire 60 Hz power. Refer to drawings for expected solar

B. The photovoltaic system shall include a metering system for total system power production and a reporting system to monitor individual components.

C. The photovoltaic system and inverter shall be configured as a grid inter-tie solar photovoltaic system. The individual inverters shall automatically de-energize their output to the building electrical system and disconnect from the photovoltaic panels upon loss of the utility electrical service. The photovoltaic inverter system shall remain disconnected until the electrical utility voltage has been restored.

D. Equipment shall be identified for use in solar photovoltaic systems.

E. Equipment, including wiring, fuses, circuit breakers, etc., used in any DC portion of the photovoltaic power system shall be listed for use 400 volt DC circuits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. VSun

B. Kyocera series

C. Mission Solar series

D. Or pre-approved equals

2.2 PHOTOVOLTAIC PANELS AND ARRAYS

A. Equipment Ratings: Submit product data for review and approval by engineer and owner including the following equipment ratings:

1. Maximum Rated Power (STC) Pmax (watts)
2. Operating Power Point Voltage Vmp (VDC)
3. Maximum Power Point Current Impp (A)
4. Maximum Open Circuit Voltage Voc (VDC)
5. Maximum Short Circuit Current Isc (A)
6. Nominal Operating Cell Temperature Conditions (NOCT) Pmax (watts)

B. Operating Environment Conditions:

1. Operating Temperature: -40 to 90°C
2. Wet location listed

C. Cell Material: Silicon-based solar cell construction with UV stabilized polymer. Provide with bypass diode technology for partial shading operation.

D. Panel Construction: Anodized aluminum frame with ground point and tempered glass cover.

E. Dimensions: Submit product data for review and approval by engineer and owner including panel dimensions (width depth, length) and maximum panel weight.

F. Panel Connections and Terminations:

1. Provide manufacturer's wiring and quick-connect terminations for series creation of module-strings installation of panels.
2. Provide manufacturer wiring to combiner boxes for parallel grouping of module-strings.
3. All exterior wire and terminations shall be listed sunlight resistant.

2.3 POWER OPTIMIZERS

A. Provide power optimizer modules mounted to back of panels to track MPPT and minimize losses from shading and uneven string lengths.

B. Minimum Efficiency: 98%

C. Maximum System Voltage: 1000 VDC

D. Operating Temperatures: -40 to 85°C

E. Protection Rating: IP68 / NEMA 6P

F. Power optimizer must have been tested with submitted photovoltaic panel.

2.4 COMBINER/DISCONNECT

A. Combination of combiner box and solar array disconnect in a single enclosure.

B. Load break switch rated 1000 VDC maximum with lockout provisions.

C. Fuse holders rated 30 amp maximum. Terminal blocks for each PV string.

D. Provide fused surge protective device (SPD) with visual status indicator series or approved equal.

E. Enclosure: NEMA 4X.

2.5 PHOTOVOLTAIC GRID TIE STRING INVERTERS

A. Inverter Manufacturers: Manufacturer and model must have been tested and be compatible with photovoltaic panel model. Model capacities may change number of inverters required and shall be agreed to during submittals.

1. Solar Edge
2. Or pre-approved equals

B. Equipment Ratings:

1. AC Output Power Rating for Inverter: See Site Estimates watt
2. Output Voltage:240V 1 phase
3. Power Factor: 1.0
4. Minimum CEC Efficiency: 97.5%
5. MPPT Operating Voltage Range: 150 to 600 VDC
6. Minimum number of MPPT tracker inputs: 2
7. Total Harmonic Distortion: Less than 5%
8. DC Voltage Ripple: Less than 5%
9. Enclosure: NEMA 3R

C. Operating Environment Condition:

1. Maximum ambient temperature: 113°F
2. Wet location listed

D. Inverter Technology: Transformerless Full DC/AC rectification, real sine-wave output with high frequency pulse width modulation PWM.

E. Internal Protection: Inverter shall measure utility voltage, current, and impedance. Loss of utility power shall cause inverter to shut down and disconnect its output to the AC bus and input from the DC bus. Inverter shall automatically reconnect to AC output bus and DC input bus upon return of utility source.

F. The inverter shall be constructed to not allow backfeeding from the electrical utility to the photovoltaic panels or DC input bus.

G. The inverter shall be cooled via a forced air cooling fan.

H. Inverters shall be provided with Ethernet connection for metering and recording system outputs.

2.6 METERING AND REPORT

A. Personal Computer Software: Provide manufacturer's software for metering and reporting on personal computer. The Electrical Contractor shall install and provide provision for custom initialization of the photovoltaic system software package.

B. Displayed and Recorded Data:

1. The following data shall be provided for each photovoltaic inverter and updated every 10 seconds.

    a. Power
    b. kWh today
    c. Total kWh
    d. Date
    e. Time

2. The following data shall be provided for the entire photovoltaic system:

    a. Power
    b. kWh today
    c. Total kWh
    d. Date
    e. Time
    f. kWh to utility today
    g. Total kWh to utility

3. The above information shall be recorded, logged, and compiled by the personal computer software for production and performance evaluation purposes.
4. Provide data reporting and recording of all manufacturers' standard reporting functions and data acquisition reporting.
5. Central inverter communications and monitoring for performance, trouble, and diagnostics. Input and output voltages, amperages, and power and fault alarms shall communicate to the gateway and designated users.

2.7 ARRAY MOUNTING

A. Basis of design is given so integrator can provide design and installation of an equivalent system that is compatible with the provided modules and structure. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. UNIRAC Large Array (U-LA) (Basis of Design)
2. DPW Direct Power and Water
3. PROSOLAR

B. Mounting system requirements Roof mounting system:

1. 35-degree tilt angle.
2. Wind load requirements: 120 mph and class for the application.
3. 30 pounds per square foot snow load.
4. Total System Weight: 5 lbs/sf
5. Provides four mounting supports for each panel in accordance with manufacturer's requirements.
6. Coordinate final dimensions with architectural drawings and existing conditions.
7. Provisions for mounting microinverters or power optimizers.
8. Structural aluminum members to be mill finish. All brackets and connections to be stainless steel.
9. Connect mounting system to electrode grounding system.

C. Provide complete solar array mounting system including rails, splices, fasteners, legs, clamps, standoffs, feet, and anchors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Photovoltaic cabling shall be installed in raceways separate from other building system cabling. Photovoltaic cabling shall be installed in conduit when located interior to the building.

B. The photovoltaic panels and arrays shall be configured in an open circuit, short circuit, or provided with an opaque covering to disable the array from producing electrical power during installation. Refer to the manufacturer's information for additional disabling requirements during installation.

C. Install fuses in all fuse holders and disconnects. Provide a label on the inside of each disconnect identifying the size, type, and model of each fuse installed.

D. Provide provisions to seal all exterior penetrations. All photovoltaic system roof penetrations shall be sealed by the roofing contractor at the expense of the photovoltaic system contractor.

E. DC Arc-Fault Circuit Protection: Provide PVAFCI arc-fault circuit interruption protection for DC branch circuits.

F. DC Shock Hazard Protection: Provide PVHCS hazard control system to limit electric shock potential to 80 volts or less post rapid shutdown initiation or per code.

G. Roof Mounted Systems:

1. Provide photograph and report documentation of the roof system condition prior to installing any roof mounted photovoltaic systems. Provide a copy of the report to the general contractor and roofing contractor.
2. Provide protective roof mats during the fabrication and installation of roof mounted photovoltaic systems to protect the roofing system.
3. Provide provisions for roofing contractor to seal roof penetrations, provide roof protection at ballasted rack and raceway supports, and other points of interface between the roof and photovoltaic system at the expense of the photovoltaic installer.
4. Provide provisions for the roofing contractor to repair any penetrations, wear, or general damage caused by installation of the photovoltaic system at the expense of the photovoltaic system installer.

H. Wire and Cable Schedule:

1. DC Distribution System:

a. Exterior: Photovoltaic panel manufacturer-supplied cabling with quick connects.
b. Interior: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.

c. Underground or Wet Locations: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.
d. Conductors shall be color coded as follows:

1) PV-: Black
2) PV+: Red
3) Ground Bond: Green

2. Use no wire smaller than 10 AWG for DC wiring of the photovoltaic system.
3. Use 8 AWG for DC wiring of photovoltaic systems with distances between the photovoltaic panel and photovoltaic inverter greater than 100 feet.

I. Provide provisions for programming and initializing the system metering and reporting software per the Owner's requirements. The Contractor shall organize a meeting with the Owner to finalize the programming and user interfaces of the program software.

J. Install equipment per the manufacturer's recommendations.

3.2 LABELING

A. Label all photovoltaic system equipment as required by code.

B. Label ground fault indicators:

1. "IN THE EVENT OF A GROUND FAULT INDICATION - THE NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNDERGROUNDED"

C. Label all AC-alternating current and DC-direct current disconnects of the photovoltaic power system.

1. "---PHOTOVOLTAIC SYSTEM DISCONNECT---WARNING. ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION"

D. The AC disconnecting means for each photovoltaic inverter shall be labeled with the following:

1. Operating Current:

2. Operating Voltage:
3. Maximum System Voltage:

E. Label DC raceways, cabling, junction boxes, and conduit bodies with adhesive markings and labels suitable for the environment:

1. Color: White capital letters on red background.
2. Label Text: PHOTOVOLTAIC POWER SOURCE.
3. Label intervals: Maximum 10 intervals or as required by code to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned.

F. Label DC system disconnect and power conversion equipment with the following:

1. Equipment type and contract documents designation of equipment.
2. Name of upstream equipment and location of the upstream equipment if it is not located within sight.
3. Nominal equipment voltage and rating.
4. Max DC Voltage.
5. Available fault current (from batteries if applicable).
6. Date of fault current study; refer to one-line diagram.

G. Label each electrical service location with rapid shutdown feature:

1. Label text: "SOLAR PV SYSTEM WITH RAPID SHUTDOWN. TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY."

H. Short Circuit Current: The interactive system point of interconnection shall be labeled at the disconnecting means with the following:

1. Maximum AC Output Operating Current:
2. Operating AC Voltage:

I. The building service entrance disconnect shall be clearly labeled to identify there is a photovoltaic system interconnection. The location of the interactive system disconnect shall be identified with a plaque reading: "WARNING - PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED AT <**Insert**>."

J. Conductor Identification:

1. PV System DC circuit conductors shall be identified at all termination connections.
2. Identification shall include color coded shrink tube tagging, conductor colored insulation, or marking tape. Include +, POSITIVE, or POS identification style labeling in addition to color identification.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Check for damage and tight connections prior to allowing the photovoltaic panels to begin power generation.

C. Check for damage and proper operation of the photovoltaic inverters.

D. Verify operation of the metering and reporting system components. Adjust and update the graphical user interface for project specific conditions.

3.4 SYSTEM COMMISSIONING

A. Provide system commissioning report.

B. Notify Architect/Engineer seven days prior to beginning final witness testing of the photovoltaic system.

1. The Electrical Contractor shall fully test the complete photovoltaic system prior to notifying the Architect/Engineer for final witness testing.

C. Test, measure, and record the following system values:

1. Date:
2. Time of test:
3. Testers:
4. Sun overcast conditions (full sun) (scattered clouds) (full cloud coverage).
5. Inverter:

    a. DC input current:
    b. DC input voltage:
    c. AC output current:
    d. AC output voltage:
    e. Output power:

D. Performance Test of Interactive Inverter System:

1. Verify proper operation of the photovoltaic system. Verify the photovoltaic system is producing power and delivering it to the building electrical distribution system.
2. Simulate power outage of electrical utility by switching the main electrical service disconnect from "closed" to "open".
3. Verify that each individual photovoltaic inverter has stopped producing electrical energy and has disconnected itself from the photovoltaic panels and building electrical distribution system.
4. Simulate return of utility electrical power by switching the main electrical service disconnect from "open' to "closed".

5. Verify each photovoltaic inverter has reconnected to the photovoltaic panels and building electrical distribution system. Verify power delivery from the photovoltaic inverters to the building electrical distribution system.
6. Document any test failure, including reason for failure and corrective actions. Retest the photovoltaic system to complete satisfactory operation.

3.5 OWNER TRAINING

A. Provide Owner training.

B. Provide complete overview of the photovoltaic system to the Owner including:

1. System overview
2. System operation
3. Manufacturer maintenance instructions
4. System component locations
5. Operation of the metering and reporting components and software

C. Minimum Training Time:

1. Eight hours includes:

a. Four hours system components.
b. Four hours computer software operation.

END OF SECTION 26 31 00