

**SITE PLAN GENERAL NOTES**

- A. VERIFY THE EXACT LOCATION OF ALL UNDERGROUND UTILITIES BEFORE DIGGING, EXCAVATING, OR DIRECTIONAL BORING. REPAIR EXISTING UTILITIES DAMAGED DURING CONSTRUCTION.
- B. ALL UNDERGROUND CONDUIT SHALL BE 1" MINIMUM AND INSTALLED 24" BELOW FINISHED GRADE UNLESS NOTED OTHERWISE, WITH RED WARNING TAPE AT 12".
- C. SCALE IS APPROXIMATELY 1" = 20'-0". UNIT MEASURES ARE TAKEN FROM INTERNET AERIAL VIEWS. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS AND ACTUAL LENGTHS.

**PHOTOVOLTAIC SYSTEM GENERAL NOTES**

- A. COORDINATE WITH THE LOCAL UTILITY COMPANY ON ALL INTERCONNECTION REQUIREMENTS. THE CONTRACTOR SHALL COMPLETE, AND SUBMIT ALL FORMS AND PROCEDURES AS REQUIRED FOR INTERCONNECTION.
- B. THE PHOTOVOLTAIC SYSTEM SHALL COMPLY WITH RAPID SHUTDOWN REQUIREMENTS OUTLINED IN NEC 690.12.
- C. PROVIDE ALL IDENTIFICATION AND MARKING REQUIREMENTS FOR ALL WIRING AND DEVICES ASSOCIATED WITH THE PHOTOVOLTAIC SYSTEM AS OUTLINED IN NEC 690 PART IV.
- D. PROVIDE ALL MARKINGS, IDENTIFICATION, PLAQUES, ETC. FOR PHOTOVOLTAIC SYSTEMS AS OUTLINED IN NEC 690 PART IV.

**SHEET NOTES**

- 1. PROVIDE A 63kWdc / 60kWac PHOTOVOLTAIC SYSTEM. A PORTION OF THE SYSTEM SHALL BE MOUNTED TO THE ROOF OF THE EXISTING HORSE STABLE STRUCTURE AND THE OTHER PORTION SHALL BE MOUNTED TO A NEW HORSE STABLE STRUCTURE. NEW STRUCTURE IS DESIGNED BY OTHERS, COORDINATE WITH OWNER.
- 2. ROOF-MOUNTED SOLAR MODULE. (TYPICAL).
- 3. SOLAR INVERTER AND SOLAR DISCONNECT MOUNTED ON UNISTRUT RACKING SYSTEM. SEE POWER RISER DIAGRAM AND ASSOCIATED DETAIL FOR FURTHER REQUIREMENTS.
- 4. PROVIDE VEHICLE PROTECTIVE BOLLARDS IN FRONT OF EQUIPMENT. SEE ASSOCIATED DETAIL. (TYPICAL).
- 5. INSTALL FEEDER FOR PHOTOVOLTAIC SYSTEM A MINIMUM OF 36" BELOW FINISHED GRADE, WITH DETECTABLE RED WARNING TAPE AT 12".
- 6. INSTALL NEW SERVICE DISCONNECT FOR PHOTOVOLTAIC SYSTEM ADJACENT TO EXISTING BUILDING'S SERVICE DISCONNECTS. SEE POWER RISER DIAGRAM FOR FURTHER REQUIREMENTS.



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ETI Project No: 2024-043

**PHOTOVOLTAIC SYSTEM**

for  
MORGAN COUNTY FAIRGROUNDS

PROJECT #: \_\_\_\_\_  
DATE: 10/03/24  
DRAWN: TMR  
REVISIONS

DATE	DESCRIPTION

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ASSOCIATES, Inc.

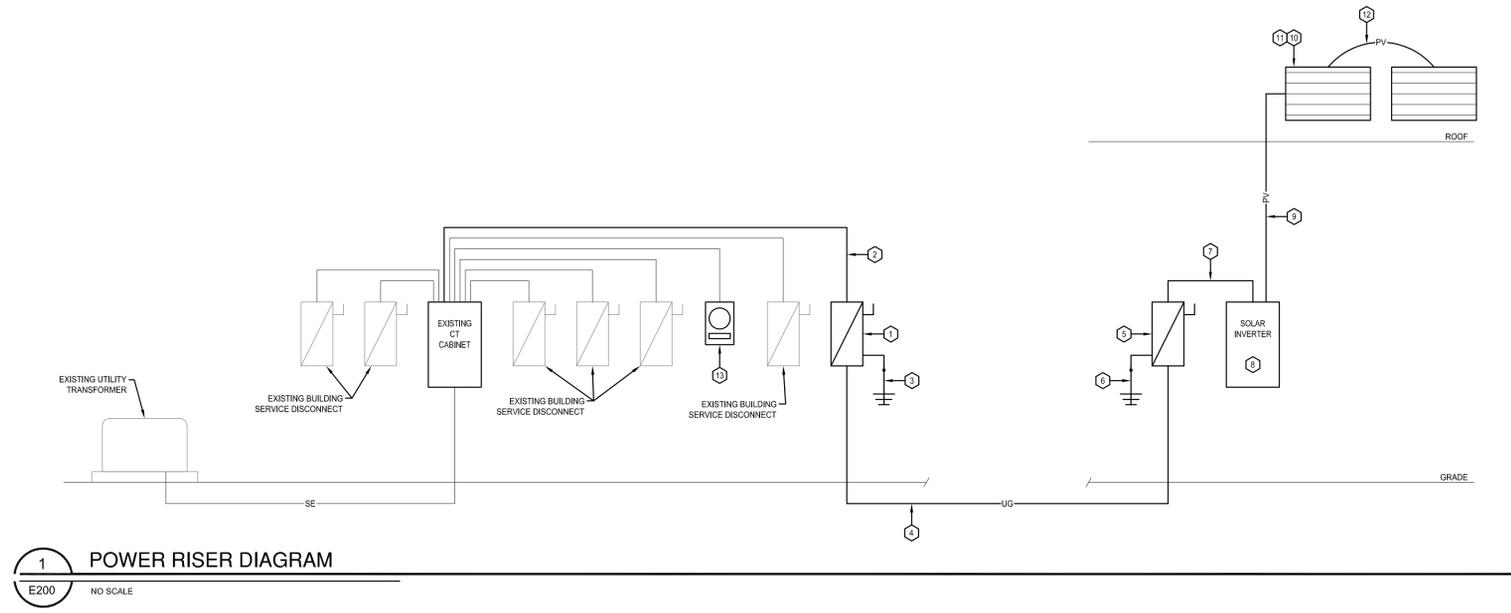


SHEET  
**E100**

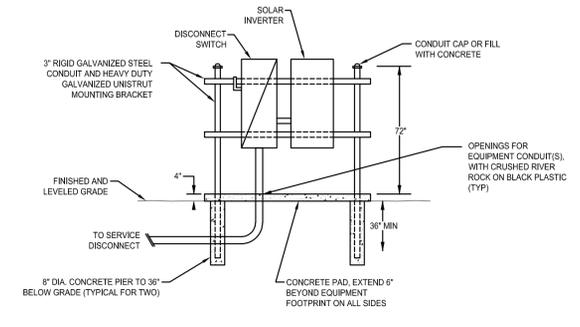


**1** ELECTRICAL PLAN - PHOTOVOLTAIC SYSTEM  
E100 SCALE: (SEE SITE PLAN GENERAL NOTE C)

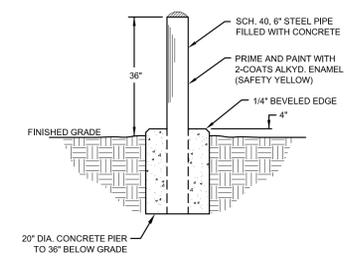




**1 POWER RISER DIAGRAM**  
E200 NO SCALE



**2 EQUIPMENT MOUNTING DETAIL**  
E200 NO SCALE



**3 PROTECTIVE BOLLARD DETAIL**  
E200 NO SCALE

**PHOTOVOLTAIC SYSTEM GENERAL NOTES**

- A. COORDINATE WITH THE LOCAL UTILITY COMPANY ON ALL INTERCONNECTION REQUIREMENTS. THE CONTRACTOR SHALL COMPLETE AND SUBMIT ALL FORMS AND PROCEDURES AS REQUIRED FOR INTERCONNECTION.
- B. THE PHOTOVOLTAIC SYSTEM SHALL COMPLY WITH RAPID SHUTDOWN REQUIREMENTS OUTLINED IN NEC 690.12.
- C. PROVIDE ALL IDENTIFICATION AND MARKING REQUIREMENTS FOR ALL WIRING AND DEVICES ASSOCIATED WITH THE PHOTOVOLTAIC SYSTEM AS OUTLINED IN NEC 690 PART IV.
- D. PROVIDE ALL MARKINGS, IDENTIFICATION, PLAQUES, ETC. FOR PHOTOVOLTAIC SYSTEMS AS OUTLINED IN NEC 690 PART IV.

**SHEET NOTES**

- 1. PROVIDE A SERVICE-ENTRANCE RATED, 600V, 200-AMP, FUSIBLE, NEMA 3R DISCONNECT SWITCH, FUSE AT 125-AMPS. LABEL PER NEC 690 REQUIREMENTS.
- 2. PROVIDE 4 - #1 AWG IN A 1.5" RIGID-STEEL CONDUIT, PROVIDE BONDING GROUND CONDUCTOR FROM CT CABINET TO DISCONNECT PER NEC REQUIREMENTS.
- 3. BOND NEW PV SERVICE DISCONNECT TO EXISTING BUILDING / SERVICE GROUNDING SYSTEM PER NEC REQUIREMENTS. FIELD VERIFY EXISTING CONDITIONS.
- 4. PROVIDE 4 - 1/0 AWG, #4 GND IN A 2" CONDUIT, WHERE CONDUIT IS EXPOSED, IT SHALL BE RIGID-STEEL TYPE.
- 5. PROVIDE A 600V, 200-AMP, FUSIBLE, NEMA 3R DISCONNECT SWITCH, FUSE AT 125-AMPS. LABEL PER NEC 690 REQUIREMENTS. DO NOT BOND NEUTRAL AND GROUND BUS.
- 6. GROUND AND BOND ELECTRICAL SYSTEM IN ACCORDANCE WITH THE NEC. PROVIDE (3) 5/8" x 10'-0" COPPER GROUND RODS SPACED EQUILATERALLY ON 10'-0" CENTERS, BOND TO STEEL STRUCTURE WITH A MINIMUM OF #6 AWG.
- 7. PROVIDE 4 - #1 AWG, #6 GND IN A 1.5" CONDUIT, CONDUIT SHALL BE RIGID-STEEL TYPE.
- 8. PROVIDE A 60KWac, 480V, 3-PHASE SOLAR INVERTER, YASKAWA MODEL PVI 60TL-480 OR EQUAL.
- 9. PROVIDE PHOTOVOLTAIC WIRING AS REQUIRED FROM PHOTOVOLTAIC SYSTEM TO SOLAR INVERTER, QUANTITY AND SIZE AS REQUIRED FOR A COMPLETE AND OPERABLE SYSTEM. WIRING SHALL BE INSTALLED IN RIGID-STEEL CONDUIT. (TYPICAL).
- 10. PROVIDE SOLAR MODULES, QUANTITY AS REQUIRED FOR PHOTOVOLTAIC SYSTEM SIZE SPECIFIED. CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL SOLAR MODULE LAYOUT, QUANTITY, STRINGING, ETC. FOR A COMPLETE AND OPERABLE SYSTEM. BASIS OF DESIGN IS JINKO SOLAR US EAGLE G5 SERIES 525-WATT SOLAR MODULE.
- 11. PROVIDE SOLAR MODULE RACKING SYSTEM, SECURE TO ROOF AND INSTALL SOLAR MODULE PER MANUFACTURER'S INSTRUCTIONS. RACKING SYSTEM BY UNIRAC OR EQUAL.
- 12. PROVIDE PHOTOVOLTAIC WIRING BETWEEN SOLAR MODULES AS REQUIRED, SIZED AS REQUIRED, WHERE INSTALLED OUTSIDE OF THE ARRAY, WIRING SHALL BE INSTALLED IN RIGID-STEEL CONDUIT, WHERE INSTALLED INSIDE ARRAY AND ALLOWABLE BY THE NEC, WIRING CAN BE INSTALLED FREE-AIR, WHERE PLASTIC TIES ARE USED TO SECURE WIRING, PLASTIC TIES SHALL BE UV / OUTDOOR RATED. (TYPICAL).
- 13. UPGRADE METERING SERVICES PER LOCAL UTILITY COMPANY'S REQUIREMENTS, COORDINATE WITH UTILITY COMPANY.



**PHOTOVOLTAIC SYSTEM**  
for  
MORGAN COUNTY FAIRGROUNDS

PROJECT #:  
DATE: 10/03/24  
DRAWN: TMR

DATE	DESCRIPTION

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**DIVISION 26 - ELECTRICAL**  
**SECTION 260101 - COMMON ELECTRICAL WORK**

**PART 1 GENERAL**

**1.1 SCOPE**

- A. This Section shall apply to all Contractors and Subcontractors that are responsible for Division 26, 27, and 28.
- B. The work covered by this Section of the Specifications consists of furnishing all labor and materials (unless otherwise specified) and in performing all operations necessary for the installation of the complete electronic and electrical system as required by terms and conditions of the Contract. The work shall also include the completion of such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical and electronic systems described on the drawings or required by these Specifications.
- C. The work in this Contract involves the installation of new work as well as work on the Site and may include demolition and renovation work. It shall be the Contractor's responsibility to visit the site so that he may ascertain all existing conditions which may affect the work under his Contract. No additional compensation will be granted for additional work required by this Contractor for his failure to visit the jobsite and determine existing conditions. This Contractor shall provide all labor and materials required to complete the work described in the Plans and Specifications and as may be required for a ready to operate installation.
- D. Generally the removal and repairing of existing floors, walls, ceilings, etc., in the remediated areas where required for the installation of conduit, lights, panels, etc., shall be provided by the General Contractor under the direction of the Contractor. Holes required through floors, walls and roof of the building shall be provided by this Contractor. If specifically shown to be done by this Contractor, this Contractor shall include in his Contract price the removal and replacement of general construction materials as required.

**1.2 DRAWINGS**

- A. The drawings which constitute a part of this Contract indicate the general arrangement of circuits and outlets, locations of switches, panels, and other work. The Drawings and Specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both. Data presented on these drawings are as accurate as planning can determine, but accuracy is not guaranteed and field verification of all dimensions, locations, levels, etc., to suit field conditions is required. Review all Design Team Structural, and Mechanical Plans and adjust all work to conform to all conditions shown therein. The Design Team/Drawings shall take precedence over all other drawings as to dimensions.

**1.3 CONFLICTS**

- A. Any conflict noted in (1) the Drawings, (2) Specifications, or (3) Drawings and Specifications; or (4) between Plans and Codes or Ordinances or (5) between the Plans or Specifications and Manufacturer's installation recommendations shall be immediately brought to the attention of the Design Team for clarification. If conflicts are discovered prior to bidding and there is not sufficient time to obtain a clarification from the Design Team prior to bidding, the Contractor shall bid the larger quantity or better quality of work. All conflicts shall be brought to the attention of the Design Team when discovered and before installation.
- B. Contractor shall be responsible to field measure and confirm mounting heights and locations of electrical equipment with respect to counters, radiation, etc. Do not scale distances off the Electrical Plans. Use actual building dimensions from the Design Team/Drawings.

**1.4 WORK IN EXISTING BUILDINGS**

- A. All work in existing buildings, indicated on the drawings or specified herein, shall be executed with a minimum amount of interference with the normal activities of the occupants of the building. No services or utilities shall be interrupted without previous scheduling time of the same with the Owner and receipt of his approval. Changing of the electrical system, telephone system, and other major events shall be arranged and be agreeable with the Owner in advance and time of downtime. All work shall be scheduled in advance with the Owner and shall not proceed without the Owner's written approval.
- B. The Owner shall be notified before starting to weld or cut. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc. Welding or cutting with an open flame or arc must be stopped in a timely fashion before leaving premises.
- C. Noisy operations such as those involving use of air hammer, etc., in demolition, or cutting of openings shall be scheduled with the Owner.
- D. Typically, the Owner will continue to occupy the building and carry on normal activity. Each Contractor shall protect the occupied areas from dust, smoke, etc., by a method approved by the Owner/Design Team.

**1.5 EXAMINATION OF SITE**

- A. Prior to submitting a bid, this Contractor shall visit the site of the job and ascertain all conditions affecting the proposed electrical installation and make provisions as to the cost thereof. No additional compensation will be granted for additional work required by this Contractor for failure to visit jobsite and determine existing conditions. The Contractor shall verify location and size of existing systems that are to be connected to, routed around, or extended from.
- B. The Contractor shall verify with the City and Utility Companies, and Owner, etc., the location of any existing overhead or buried utilities on or near the site. The Contractor shall verify requirements for connecting into existing utilities with the City and Utility Company, and Owner and connect into as required. Failure to determine existing conditions or the nature of new connections will not be considered a basis for the granting of additional compensation.

**1.6 PRIOR APPROVAL**

- A. The Contractor's attention is directed to the requirement of "prior approval" for materials to be supplied in this project if they are not specifically designated as a specified manufacturer or approved equal.
- B. Prior approval requires that literature be submitted to the Design Team a minimum of ten (10) days prior to the bidding date, and that the literature be submitted to the Engineer to give approval. This approval is a tentative approval and does not imply anything but approval to bid.

**1.7 SHOP DRAWINGS**

- A. The Contractor shall submit five (5) copies of Shop Drawings and Product Data to the Design Team/Engineer for approval or submit digital information on Submittal Exchange or other approved digital documentation system. Submittals shall be in accordance with the requirements of the Plans and Specifications and requirements of the Contract. Shop Drawings shall be submitted for the following items:
  1. Enclosed Switches
  2. Photovoltaic System

**1.8 USE OF OTHER THAN SPECIFIED EQUIPMENT**

- A. All equipment shown on the drawing shall be specified equipment. If the Contractor uses different approved equipment than what was specified, all additional work or components required to make an operable system shall be made without additional cost to the Owner. The Contractor shall be held responsible for selecting different approved equipment so that equipment will fit in the available space provided for the specified equipment.

**1.9 PERMITS AND LICENSES**

- A. Obtain and pay all permits and licenses required and furnish the Design Team for the Owner a certificate of final inspection and approval from the Local Authority having jurisdiction over this electrical installation.

**1.10 WARRANTY**

- A. The entire electrical system installed under this Contract shall be left in proper working order. Replace, without additional cost (except materials not furnished by the Electrical Contractor) which develops defects from ordinary wear and tear within one (1) year from the date of acceptance, or provide extended warranty, as specified. All new material and equipment shall be warranted against defects in composition. Lamps shall be warranted for their published life. Warranty certificates shall be furnished on special equipment.

**1.11 PROGRESS OF WORK AND DOWNTIME**

- A. Order the progress of the electrical work so as to conform to the progress of the work as scheduled in the Specifications and complete the entire installation as soon as the condition of the building will permit. Any cost resulting from defective or delayed work performed under this Section shall be borne by this Contractor.
- B. As much of this building may be occupied when construction is ongoing it will be of prime importance to coordinate downtime of electrical systems with the Owner. Changing of the electrical entrance and other major events shall be arranged and be agreeable with the Owner in length and time of downtime.

**1.12 COORDINATION**

- A. The Contractor shall confirm dimensions noted and locations of General and Mechanical Contractor's equipment as well as equipment to be furnished by the Owner. Verify all equipment and motor sizes, voltage and connection requirements for equipment furnished by others and wired under this Contract, verify roughing-in, and provide proper branch circuits and connections as recommended by equipment manufacturers. Coordinate with the other contractors to avoid interference with ductwork, structural members, girdes, cabinetwork, etc. Motors shall not be connected to utility verification has been made that motor running protection exists.
- B. Where the drawings indicate fixtures and equipment which are to be furnished by others (or Owner) and which require connections to the electrical systems, the Electrical Contractor shall furnish and install all rough-in of conduit, boxes, conductors, disconnect switches, plugs with pigtail, receptacles etc., which are required for the final connections. Rough-in dimensions and required connections shall be determined from the equipment itself or from the equipment manufacturer's shop drawings. Final connections to the equipment shall be made by this Contractor.

**1.13 CUTTING AND PATCHING**

- A. Each Contractor shall be responsible for all cutting and patching required for his work. Carefully lay out all work in advance and where cutting, channeling, chasing, or drilling of building surfaces is necessary for the proper installation of electrical equipment, carefully perform this work in a manner approved by the Design Team. Patching shall be done in a neat workmanlike manner by craftsmen skilled in the trade involved and shall be prepared to receive paint. Damaged surfaces shall be repaired at no cost to the Owner. Concrete walls shall be cut only with rotary type drilling tools. Openings through floors and walls may be drilled up to 1" diameter. Electrical equipment and conduit shall not be cut with torches, and shall be joined only by bolting (i.e., do not weld wireways to panels, etc.).

**1.14 INDUSTRY STANDARDS AND CODES**

- A. The complete installation shall comply with the applicable Local and State wiring ordinances, with the regulations of the latest edition of the National Electrical Code of the National Fire Protection Association (supplements and official interpretations included) and with the requirements of the Power, Television and Telephone Companies furnishing service to this installation. The drawings and specifications take precedence when they are more stringent than codes, ordinances, or statutes in effect, and vice versa.
- B. All work shall be in accordance with State and Local Codes and requirements of Local Utilities. Where the applicable Building Codes and the drawings or specifications do not agree, the code shall take precedence, but only in cases where what is shown on the drawings or required by the specifications violates the code. Where there is a Code or Utility Company requirement and drawing or specification discrepancy the Code shall have precedence only when it is more stringent than the item specified or shown on the drawings. Items that are allowable by the Local Building Codes, which are less stringent than that required by the specifications or the drawings the less stringent work, shall not be substituted.

**1.15 RESPONSIBILITY OF THE CONTRACTOR**

- A. The Contractor and his journeyman shall have Electrical Licenses, as required by the City and State in which work is being performed, and shall provide journeymen to his superintendents and/or foremen on the project. All workmen shall be skilled in their trade or working under someone who is skilled in the trade and responsible for the work involved.

- B. The Contractor shall be totally responsible for his portion of the work from the date of his Contract until final acceptance of the building by the Owner and must repair all damage sustained without cost to the Owner regardless of cause. The Contractor shall use proper care and diligence in bracing and securing all parts of the work against the elements and shall, in all cases, judge as to the amount of protection required. Proper storage of materials shall be maintained at all times.

**1.16 TEMPORARY POWER AND LIGHTING**

- A. The Electrical Contractor shall provide electrical wiring and light fixtures for temporary power, heating, and lighting in construction areas.

**1.17 FIRE AND SMOKE STOPPAGE**

- A. It shall be the responsibility of this Contractor to maintain fire and smoke integrity of all walls, ceilings, floors etc., through which his work passes through or into. Fire and smoke barriers shall be provided, and around as required by Codes.
- B. Where holes are required to be patched, or conduit, piping, ducts, etc., are required to be patched around, it shall be filled with a material that is UL Classified Standard 1479 for this use and Factory Mutual System approved.

**1.18 ACCESS TO EQUIPMENT**

- A. All control devices, specialties, pull boxes, disconnect switches, and similar equipment shall be so located as to provide for easy access for operation, repair and maintenance. Access shall conform to Local Electric Codes. Access doors shall be provided if devices are concealed.

**1.19 TESTS**

- A. At the completion of his work, the Contractor shall perform the following tests in the presence of the Design Team:
  1. Test for short circuits and grounds.
  2. Test to prove correct operation of all equipment, including lighting control systems.
  3. Check for balance of load on phases, and connect load to balance as closely as possible. Should the Power Company disclose any unfavorable conditions or reactions on the service, the Contractor shall make changes as may be suggested to properly balance the load.

**1.20 CLEAN-UP**

- A. The Contractor shall remove all rubbish and debris resulting from his work daily and shall leave equipment that he installed clean and ready for operation.

**1.21 QUALITY ASSURANCE**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as recommended by the manufacturer(s) and as required for a complete and operating system(s).
- C. Install products in accordance with manufacturer's instructions.
- D. Perform work in accordance with NECA 1 (general workmanship).
- E. Clean exposed surfaces to remove dirt, paint, or other foreign materials. Restore factory finishes, where applicable.
- F. Correct wiring deficiencies and replace damaged or defective items as a result of demolition or new work.
- G. Comply with requirements of NFPA 70.
- H. Provide Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- I. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2.
- J. Handle products carefully to avoid damage to finish.
- K. Install devices and equipment plumb and level.

**1.22 RECORD DRAWINGS**

- A. Maintain a clean, undamaged set of whiteprints of Contract Drawings. Mark the set to show the actual installation where the installation varies from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately, where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date:
  1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
  2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  3. Note related Change Order numbers where applicable.
  4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dated and other identification on the cover of each set.
  5. Turn Record Drawings over to the Owner with the Operation and Maintenance Manuals.

**END OF SECTION 260101**

**SECTION 260519 - CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

**PART 2 PRODUCTS**

- 1.2 CONDUCTOR AND CABLE APPLICATIONS**
    - A. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
    - B. Nonmetallic-sheathed cable is not permitted.
    - C. Underground feeder and branch-circuit cable is not permitted.
    - D. Service entrance cable is not permitted.
    - E. Armored cable is not permitted.
    - F. Metal-clad cable is not permitted.
  - 2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS**
    - A. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
    - B. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
    - C. Conductor Material:
      1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
    - D. Minimum Conductor Size:
      1. Branch Circuits: 12 AWG.
      - a. Exceptions:
        - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
        - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
        - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
      2. Control Circuits: 14 AWG.
    - E. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
    - F. Conductor Color Coding:
      1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
      2. Color Coding Method: Integrally colored insulation.
        - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
      3. Color Code:
        - a. 480Y/277 V, 3 Phase, 4 Wire System:
          - 1) Phase A: Brown.
          - 2) Phase B: Orange.
          - 3) Phase C: Yellow.
          - 4) Neutral/Ground: Gray.
        - b. Equipment Ground, All Systems: Green.
        - c. Trailers for 3-Way and 4-Way Switching: Purple.
- 2.3 SINGLE CONDUCTOR BUILDING WIRE**
  - A. Conductor Stranding:
    1. Feeders and Branch Circuits:
      - a. Size 10 AWG and Smaller: Solid.
      - b. Size 8 AWG and Larger: Stranded.
    2. Control Circuits: Stranded.
  - B. Insulation Voltage Rating: 600 V.
  - C. Insulation:
    1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      - a. Size 4 AWG and Larger: Type XHHW-2.
      - b. Installed Underground: Type XHHW-2.

**2.4 PHOTOVOLTAIC WIRE**

- A. Description: Sunlight-resistant, single-conductor, insulated photovoltaic wire listed and labeled as complying with UL 4703, specifically designed for interconnection wiring of photovoltaic power systems in accordance with NFPA 70.
- B. Conductor Stranding: Stranded.
- C. Insulation Voltage Rating: As required for photovoltaic power system voltage.

**2.5 WIRING CONNECTORS**

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 489A-489B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
  1. Copper Conductors Size 8 AWG and Smaller: Use twist-on-insulated spring connectors.
  2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
  1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

- 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
- 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- 4. Conductors for Control Circuits: Use crimped terminals for all connections.

**D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.**

- E. Do not use push-in wire connectors as a substitute for twist-on-insulated spring connectors.
- F. Twist-on-Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or self-screw type.
- H. Compression Connectors: Provide counterflange type or hex type crimp configuration.
- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to the nylon-insulated.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Circuited Requirements:
  1. Unless dimensioned, circuit routing indicated is diagrammatic.
  2. When circuit destination is indicated without specific routing, determine exact routing required.
  3. Circuited Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.
  4. Conduits and Raceways: Unless otherwise indicated, use minimum size of metal conduit or rigid PVC conduit for three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/ground conductor for each individual branch circuit.
- B. Installation in Raceway:
  1. Pull all conductors and cables together into raceway at same time.
  2. Do not damage conductors or cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  3. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- C. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- D. Terminate cables using suitable fittings.
- E. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unsplined conductors.
- F. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding," apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- H. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

**END OF SECTION 260519**

**SECTION 260526 - GROUNDING AND BONDING**

**PART 1 GENERAL - NOT USED**

**PART 2 PRODUCTS**

**2.1 GROUNDING AND BONDING REQUIREMENTS**

- A. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
  - B. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - C. Grounding Electrode System:
    1. Provide conductor to required and supplemental grounding electrodes indicated to form grounding electrode system.
      - a. Provide continuous grounding electrode conductors without splice or joint.
      - b. Install grounding electrode in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
    - D. Service-Supplied System Grounding:
      1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
      2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus. Where metal raceways are used, make connection at neutral (grounded) conductors and ground on load side of service disconnect.
      3. All metallic meter enclosures, CT Cabinets, and metallic conduit shall be bonded to the system per the NEC, see Article 250.
    - E. Separately Derived System Grounding:
      1. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source disconnect enclosure.
      2. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
      3. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
      4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
      5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
    - F. Bonding and Equipment Grounding:
      1. Provide bonding for equipment grounding conductors, equipment ground buses, metallic equipment enclosures, CT cabinets, meter sockets, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
      2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

**2.2 GROUNDING AND BONDING COMPONENTS**

- A. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
  1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
  2. Connectors for Grounding and Bonding:
    1. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    2. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Make grounding and bonding connections using specified connectors.
  1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  3. Exothermic Welds: Make connections using molten and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

**END OF SECTION 260526**

**SECTION 260529 - HANGERS AND SUPPORTS**

**PART 1 GENERAL - NOT USED**

**PART 2 PRODUCTS**

**2.1 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  2. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.25. Include consideration for vibration, equipment operation, and shock loads where applicable.
  3. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or stainless steel unless otherwise indicated.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  1. Conduit Straps: One-hole or two-hole type, steel.
  2. Conduit Clamps: Make connections using manufacturer's recommended methods.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  1. Channel Material:
    - a. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
  1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  2. Concrete: Use precast concrete inserts, expansion anchors, or screw anchors.
  3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  4. Hollow Masonry: Use toggle bolts.
  5. Hollow Stud Walls: Use toggle bolts.
  6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  7. Sheet Metal: Use sheet metal screws.
  8. Wood: Use wood screws.
  9. Plastic and lead anchors are not permitted.
  10. Power-actuated fasteners are not permitted.
  11. Hammer-driven anchors and fasteners are not permitted.
  12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- B. Equipment Support and Attachment:
  1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  3. Conduits and Raceways: Unless otherwise indicated, support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete base which constructed in accordance with Section 051000. Provide independent support for equipment as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
  5. Securely fasten floor-mounted equipment. Do not install equipment which it relies on its own weight for support.

**END OF SECTION 260529**

**SECTION 260533 - CONDUIT**

**PART 1 GENERAL**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
  3. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
- PART 2 PRODUCTS**
  - 2.1 CONDUIT APPLICATIONS**
    - A. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
    - B. Underground:
      1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
      2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or high-density polyethylene (HDPE) conduit.
      3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit below grade where emerging from underground.
      4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows or PVC-coated galvanized steel rigid metal conduit elbows for bends.
      5. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
      - C. Embedded Within Concrete:
        1. Under Slab on Grade: Not permitted.
      - D. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
      - E. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
      - F. Flexible Connectors to Vibrating Equipment:
        1. Damp, Wet, or Corrosive Locations: Use liquid-tight flexible metal conduit.
        2. Maximum Length: 6 feet unless otherwise indicated.
  - 2.2 CONDUIT - GENERAL REQUIREMENTS**
    - A. Provide conduit, fittings, supports, and accessories required for complete raceway system.
    - B. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
    - 2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**
      - A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
      - B. Fittings:
        1. Material: Use steel.
          - a. Do not use die cast zinc fittings.
        2. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
      - 2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)**
        - A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
        - B. Fittings:
          1. Material: Use steel.
            - a. Do not use die cast zinc fittings.
          2. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
      - 2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)**
        - A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
        - B. Fittings:
          1. Material: Use steel.
            - a. Do not use die cast zinc fittings.
      - 2.6 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)**
        - A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 137.
        - B. Fittings:
          1. Material: Use steel.
            - a. Do not use die cast zinc fittings.
          2. Connectors and Couplings: Use compression/gland or self-screw type.
            - a. Do not use identifier type connectors and couplings.

**3.1 INSTALLATION**

- A. Conduit Routing:
  1. Unless dimensioned, conduit routing indicated is diagrammatic.
  2. Concealed conduits unless specifically indicated to be exposed shall be installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
- B. Conduit Support:
  1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  - 4.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
- B. Format for Equipment Identification
1. Minimum Size: 1 inch by 2.5 inches.
  2. Text: All capitalized unless otherwise indicated.
  3. Minimum Text Height:
    - a. Equipment Designation: 1/2 inch.
    - b. Other Information: 1/4 inch.
  4. Color:
    - a. Normal Power System: White text on black background.
    - b. Emergency Power System: White text on red background.
- 2.3 UNDERGROUND WARNING TAPE
- A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated, 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection, with legend rotatin type of service, continuously repeated over full length of tape.
- B. Color:
1. Tape for Buried Power Lines: Black text on red background.

**PART 3 EXECUTION**

- 3.1 INSTALLATION
- A. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance.
  - B. Install underground warning tape above buried lines with one tape per trench at \_\_\_\_ inch(es) below finished grade.

END OF SECTION 260583

**SECTION 260583 - WIRING CONNECTIONS**

**PART 1 GENERAL - NOT USED**

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.1 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- E. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- F. Install terminal block jumpers to complete equipment wiring requirements.
- G. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 260583

**SECTION 262813 - FUSES**

**PART 1 GENERAL - NOT USED**

**PART 2 PRODUCTS**

**2.1 APPLICATIONS**

- A. Feeders:
  1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. General Purpose Branch Circuits: Class RK1, time-delay.
- C. Individual Motor Branch Circuits: Class RK1, time-delay.
- D. Primary Protection for Control Transformers: Class CC, time-delay.

**2.2 FUSES**

- A. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- B. Voltage Rating: Suitable for circuit voltage.
- C. Provide the following accessories where indicated or where required to complete installation:
  1. Fuseholders: Compatible with indicated fuses.
  2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

**SECTION 262817 - ENCLOSED SWITCHES**

**PART 1 GENERAL - NOT USED**

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. ABB/GE
- B. Eaton Corporation
- C. Schneider Electric, Square D Products
- D. Siemens Industry, Inc

**2.2 ENCLOSED SAFETY SWITCHES**

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty, ratings, configurations, and features as indicated on the drawings.
- B. Horsepower Rating: Suitable for connected load.
- C. Voltage Rating: Suitable for circuit voltage.
- D. Provide with switch blade contact position that is visible when the cover is open.
- E. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
- F. Heavy Duty Switches:
  1. Comply with NEMA KS 1.
  2. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Copper suitable for terminating copper conductors only.
  3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- G. Provide the following features and accessories where indicated or where required to complete installation:
  1. Hubs: As required for environment type; sized to accept conduits to be installed.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

END OF SECTION 262817

**SECTION 263100 - PHOTOVOLTAIC COLLECTORS**

**PART 1 GENERAL**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  1. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  2. Roof-Mounted Arrays: Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.
- C. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.
- D. Utility Interconnection:
  1. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
  2. Coordinate with Utility Company to provide utility metering suitable for system requirements.
  3. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

**1.2 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, details, and description of operation.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- D. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.
- E. Design Data:
  1. Include structural calculations, certified by structural engineer, for equipment and mounting system upon request.
  2. Include electrical calculations for array and associated equipment \_\_\_\_\_.
- F. Installer's Qualification Statement.

- G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

**1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with Utility Company requirements for interconnection.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.
  1. Licensed in the State in which the Project is located to install photovoltaic systems.
  2. Supervisor: North American Board of Certified Energy Practitioners (NABCEP) certified PV Installer or three years experience supervising the installation of photovoltaic systems.
  3. Installer Personnel: At least 2 years of experience installing photovoltaic systems.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**1.4 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Photovoltaic Modules:
  1. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
  2. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.
- C. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- D. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Photovoltaic Modules: Jinko Solar US Eagle G5 Series 525-Watt or Equal.
- B. Photovoltaic Module Mounting System: Unirac or Equal.
- C. Photovoltaic Inverters: Yaskawa Solectria Solar or Equal.
- D. Source Limitations: For each type of component, furnish products produced by a single manufacturer and obtained from a single supplier.

**2.2 PHOTOVOLTAIC SYSTEM REQUIREMENTS**

- A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.
- B. System Description:
  1. Photovoltaic array is roof-mounted in location indicated on the drawings.
  2. Orientation of array is as indicated on the drawings.
  3. System includes interconnection with utility grid (grid-tied system).
  4. Owner intends to secure funds from available federal, state, and utility company rebate and incentive programs.
- C. Capacity:
  1. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.
- D. Size:
  1. Array: Designed to fit within the area designated on the drawings.
  2. Individual Modules: Size is not critical.
- E. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.
- F. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.
- G. Provide photovoltaic system and associated components that qualify for available federal, state, and utility company rebate and incentive programs.
- H. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.
  1. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.
- J. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.
- K. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- L. Arrange array to minimize shading during peak production periods.

**2.3 PHOTOVOLTAIC MODULES**

- A. Acceptable Module Types: Either crystalline silicon or thin film modules complying with specified requirements will be considered for this project.
- B. General Requirements:
  1. Photovoltaic Modules: Factory assembled, consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.
  2. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
  3. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
  4. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

**2.4 BALANCE OF SYSTEM COMPONENTS**

- A. Photovoltaic Module Mounting System:
  1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
  2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.
  3. Roof-Mounted Arrays:
    - a. Provide system compatible with the roof at the installed location.
- B. Photovoltaic Inverters:
  1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
  2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
    - a. Maximum power point tracking (MPPT).
    - b. LCD display.
    - c. Integral AC disconnect.
    - d. Integral DC disconnect.
  3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Provide required support and attachment in accordance with Section 260529.
- C. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.
- D. Circulating Requirements. In Addition to Requirements of Section 260519:
  1. Wiring Methods:
    - a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.
    - b. Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable (not routed inside building) for wiring between string(s) and combiner box(es).
    - c. Unless otherwise indicated, use type THHN/THWN-2 single-conductor building wire in suitable raceway for wiring between combiner box(es) and point of interconnection.
    - d. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.
    - e. Install cables in suitable raceway where readily accessible or where required by authority having jurisdiction.
  2. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.
- E. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:
  1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.
- F. Identification Requirements, in Addition to Those Specified in Section 260533:
  1. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.
  2. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".
  3. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
  4. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
  5. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
  6. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard"; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
  7. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.

8. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

**3.2 SYSTEM STARTUP**

- A. Obtain Owner's approval prior to performing system startup.
- B. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.
- C. Prepare and start system in accordance with manufacturer's instructions.

**3.3 CLOSEOUT ACTIVITIES**

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.
  1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  2. Provide minimum of four hours of training.
  3. Location: At project site.

END OF SECTION 263100



**PHOTOVOLTAIC SYSTEM**

for  
**MORGAN COUNTY FAIRGROUNDS**

PROJECT #:

DATE: 10/03/24

DRAWN: TMR

REVISIONS

DATE	DESCRIPTION

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JOSEPH R. HEWGLEY &  
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SHEET  
**E301**