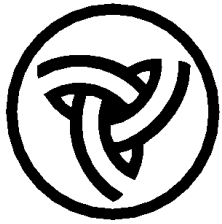


TRANSPORTATION BULLETIN



Illinois Department of Transportation

ADDENDUM NO. 1

Dated: July 27, 2010

For: Transportation Bulletin

Letting Date: July 30, 2010

Volume 13 No. 26r3

Dated: June 25, 2010 Revised: July 20, 2010

Item No. 5A

Replace MIRLs, MITLs, VADIs, Beacon, and Vault;

Additive Alternate No. 1- Installation of a Lighted L-807 Primary Wind
Cone

Carmi Municipal Airport

Carmi, Illinois

White County

IL. Proj. No. CUL-3972

AIP Proj. No. 3-17-0109-B8

Contract No.: CR004

REASON FOR ADDENDUM:

The Special Provision for ITEM 109 - INSTALLATION OF AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT has been revised in the following paragraphs:

- 109-2.18 FAA-APPROVED EQUIPMENT, Paragraph A. Constant Current Regulator for Runway 18/36. Special Provisions section has been revised to clarify types of regulators, manufacturers, or approved equal.

- 109-2.18 FAA-APPROVED EQUIPMENT, Paragraph B. Constant Current Regulator for Taxiway. The Special Provisions section has been revised to clarify types of regulators, manufacturers, or approved equal.
- 109-2.22 OTHER ELECTRICAL EQUIPMENT, Paragraph C. Type S-1 Series Plug Cutout. The Special Provisions section has been revised to note that cutouts shall be certified by the manufacturer as suitable for the respective application. Specific manufacturer models previously listed as not acceptable have been deleted.
- 109-3.19 GROUNDING REQUIREMENTS, Paragraph E. Exothermic weld type connections list three manufacturers or approved equal.

TO ALL PLAN HOLDERS:

Section III - Special Provisions,

Replace Pages 22 through 56 of the Special Provisions with the attached ADDENDUM NO. 1, ITEM 109 INSTALLATION OF AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT (Revised).

**ITEM 109 INSTALLATION OF AIRPORT
TRANSFORMER VAULT AND VAULT EQUIPMENT**
(Revised)

DESCRIPTION

109-1.1. Revise this section to read as follows:

“Item AR109110 “Erect Prefabricated Vault” shall consist of furnishing and installing a pre-fabricated equipment shelter, its concrete piers or concrete slab, and concrete step/pad at entry, as applicable in accordance with this Specification at the location, design, and dimensions shown on the Construction Plans. This item shall include all labor, equipment, materials, coordination, installation, testing, and the furnishing and installation of all incidentals necessary to produce a completed vault building and place it in operating condition.”

109-1.2. Item AR109200 “Install Electrical Equipment” shall consist of furnishing and installing electrical equipment inside the new vault as detailed on the Plans and specified herein. This item shall also include furnishing and installing electric unit heaters, exhaust/ventilation fans, louvers, dampers, and associated controls for the mechanical system. This item shall include all labor, materials, transportation, equipment, wiring, raceways, grounding, warranties, tools, utility coordination, relocations, operational instructions, labeling, testing, and all incidentals required to place the vault and associated equipment into proper working order as a completed unit to the satisfaction of the Owner and Engineer.

Included under this item shall be the following:

- A. Field verification of existing site conditions to determine complexity of the proposed work.
- B. Coordinating all work with the Airport Manager, the designated Airport Maintenance Staff, and the Resident Engineer.
- C. Furnishing and installing all associated electrical equipment, support hardware, raceways, conduits, cable, wiring, grounding, and accessories as detailed on the Plans and specified herein.
- D. Furnishing and installing the heating and ventilation system and associated controls in the new vault.
- E. Furnishing and installing all raceways, conduits, and ducts in, beneath, and adjacent to the vault.
- F. Furnishing and installing all necessary cable and wiring within the vault and to the respective handholes located outside of the vault, as detailed on the Plans and

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specified herein. The galvanized rigid steel conduits from the vault to the respective high-voltage handhole as detailed on the Plans and specified herein, shall also be included under this item. The galvanized rigid steel conduits and schedule 40 PVC conduits from the vault to the respective low voltage handholes as detailed on the Plans and specified herein, shall also be included under this item.

- G. Furnishing and installing new electric service to the vault, as detailed on the Plans and specified herein.
- H. Furnishing and installing new electric feeder to the Terminal Building with associated grounding as detailed on the Plans and specified herein.
- I. Furnishing and installing new electric feeder to the existing gate operator with associated grounding and safety switch at the airfield access gate as detailed on the Plans and specified herein.
- J. Furnishing and installing all necessary conduits, conduit fittings, junction boxes, cable and wiring from the vault to the existing fuel system equipment, as detailed on the Plans and specified herein.
- K. Furnishing and installing a fuel system emergency shutoff station with all necessary support hardware, conduits, junction boxes, cable and wiring from the vault to the fuel system emergency shutoff station, as detailed on the Plans and specified herein.
- L. Furnishing and installing all grounding and surge protection, as detailed on the Plans and specified herein. Ground rods for existing facilities including but not limited to the Terminal Building, Wind-Tee, and gate operator will be included with this item.
- M. Locating, identifying, relocating, and/or replacing all existing airfield lighting cables and existing airfield equipment cables (including existing cables associated with the Automated Weather Observation System and the fuel system equipment), as necessary to disconnect these respective cables from the existing vault and reconnect, replace and/or interface these respective cables to the new vault as applicable. This shall include all splices, cable, interfacing work to handholes (including rerouting cables, duct entrances, sleeves, patching, etc.), splice cans, identification, and labeling cables at each respective handhole and at the respective vault, maintaining separation of low-voltage cables from high-voltage cables, any temporary connections to maintain operation of the respective airfield systems, and any other work required to restore proper operation of the existing airfield systems when reconnected to the new vault. All work shall be coordinated with the Airport Manager and shall be coordinated to minimize down time to the respective airfield systems.
- N. Furnishing shop drawings for new equipment.
- O. Identifying and labeling all control wiring associated with the control circuit upgrades.

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- P. Testing, adjusting, and retesting (where applicable) all new equipment and modifications to existing systems for proper operation.
- Q. Labeling all mechanical and electrical equipment and incidentals necessary to place all of the equipment in operation as a complete unit acceptable to the Owner and Engineer.
- R. Furnishing operation, maintenance, and installation manuals for all new equipment.
- S. Electrical handholes associated with cable relocations and interfacing to duct systems shall be paid for separately under Item AR110610 Electrical Handhole.

109-1.3. Item AR109901 “Remove Electrical Vault” shall consist of removal of existing vault building, foundations, and all equipment located in the existing vault. The existing taxiway constant current regulator shall be relocated to the new vault. The existing step-up transformer for the AWOS shall be relocated to the new vault. All other equipment to be removed shall be turned over to the Owner. In the event that the Owner does not want the respective equipment, the Contractor shall dispose of that respective equipment. Removal of vault equipment shall include the removal of the associated wiring and raceway for the respective equipment that is to be removed. Removal of vault equipment shall include the removal of the existing electric service equipment, conductors and conduit, feeder conductors to the existing vault, feeder conductors to the existing Administration building, and the necessary utility coordination. Removal of vault equipment shall also include backfill, seeding, mulching and grading to restore the respective areas affected by the removal work.

109-1.4. Item AR109924, Replace Electric Services shall consist of removing and replacing the respective service for the “FS” Hangar located adjacent to the Terminal Building. The existing service is located at the vault transclosure and a feeder runs from the vault to the hangar main panel/load center. This item shall include replacing the respective service conductors and conduit from the respective utility transformer to the meter base and new disconnect equipment, and providing a grounding system as detailed on the Plans and specified herein. This item shall include all labor, equipment, wiring, raceways, grounding, materials, tools, utility coordination, labeling, testing and all incidentals required to remove and replace the respective electric service installation to the satisfaction of the serving electric utility, Owner and Engineer.

Included under this Item shall be the following:

- A. Coordinating all work with the Airport Managers, the Airport maintenance staff, and the Resident Engineer.
- B. Coordinating with the serving electric utility the replacement of the existing service with a new service.

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- C. Removing the existing service disconnect, conduit and cable.
- D. Furnishing and installing a new meter base, conduit, and cable as detailed on the Plans and Specified herein.
- E. Furnishing and installing a new ground rod, grounding electrode conductor, and Schedule 40 PVC conduit as detailed on the Plans and Specified herein.

109-1.5 REFERENCES

- A. ANSI C80.1 – Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.4 – Fittings Rigid Metal Conduit and EMT.
- C. ANSI Z535.4-2002 - American National Standard for Product Safety Signs and Labels.
- D. ASTM Specification B3 – Standard Specification for Soft or Annealed Copper Wire.
- E. ASTM Specification B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- F. Federal Specification A-A-59544 Cable and Wire, Electrical (Power, Fixed Installation).
- G. FAA AC No. 150/5340-30D “DESIGN AND INSTALLATION DETAILS FOR AIRPORT VISUAL AIDS”.
- H. FAA AC No. 150/5345-7E, (or latest edition) "SPECIFICATIONS FOR L-824 UNDERGROUND ELECTRICAL CABLE FOR AIRPORT LIGHTING CIRCUITS.
- I. FAA AC No. 150/5345-10F “SPECIFICATION FOR CONSTANT CURRENT REGULATORS AND REGULATOR MONITORS”.
- J. FAA AC No. 150/5345-49C “SPECIFICATION L-854 RADIO CONTROL EQUIPMENT”.
- K. FAA AC No. 150/5345-53 “AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM” (most current issue) and AC150/5345-53C, AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM Appendix 3 Addendum.
- L. NFPA 70 – National Electrical Code (most current issue in force).
- M. UL Standard 6 – Rigid Metal Conduit.

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- N. UL Standard 44 – Thermoset-Insulated Wires and Cables.
- O. UL Standard 83 – Thermoplastic-Insulated Wires and Cables.
- P. UL Standard 467 – Grounding and Bonding Equipment.
- Q. UL Standard 486A-486B Wire Connectors.
- R. UL Standard 514B – Conduit, Tubing and Cable Fittings.

109-1.6 SHOP DRAWINGS. The Contractor shall furnish shop drawings for approval before ordering equipment and/or materials. Shop drawings are required for vault equipment and materials to be used on the project. **Shop drawings shall be clear and legible. Copies that are illegible will be rejected.** Contractor shall submit sufficient copies of shop drawings to meet the needs of his personnel, sub-contractor personnel, and equipment suppliers plus 4 copies to be retained by the Project Engineer. Shop Drawings shall clearly indicate proposed items, capacities, characteristics, and details in conformance with the Plans and Specifications. The respective manufacturer shall certify capacities, dimensions, special features, etc. When a submittal is marked “Revise and Resubmit”, “Rejected”, and/or “Not Approved”, do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations, resubmit, and repeat if necessary to obtain a different action mark such as “No Exceptions Taken” or “Furnish as Corrected”. Contractor is responsible for compliance with the specified characteristics. Contractor’s responsibility for error and omissions in submittals is not relieved by the Engineer’s review of submittals. Accompany each submittal with a transmittal letter that includes the date, project title and number, Contractor’s name and address, the number of Shop Drawings, product data and/or samples submitted, notification of any deviations from the Contract, and any other pertinent information. Shop drawings shall include the following information:

- A. Certification of compliance with the Airport Improvement Program Buy American Requirement and the Buy American Act for all materials and equipment.
- B. In order to expedite the shop drawing review, inspection and/or testing of materials and equipment, the Contractor shall furnish complete statements to the Project Engineer as to the origin and manufacturer of all materials and equipment to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials and equipment.
- C. Provide shop drawings for the pre-fabricated vault.
- D. Concrete mix design.
- E. Provide shop drawings for the exhaust fan, intake louver, unit heaters, and light fixtures.

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- F. Submittals for panelboards shall include manufacturer, catalog numbers, panel schedule, voltage and amperage ratings, bus material, integrated short circuit ampere rating, circuit breaker arrangement and sizes and respective enclosure.
- G. Cut sheets with part number and specifications for the transient voltage surge suppressor.
- H. Cut sheets with part number and specifications for the constant current regulators. Include list of spare parts.
- I. Cut sheets with part number and specifications for the S-1 cutouts and enclosure.
- J. Furnish shop drawings for the L-854 radio receiver.
- K. Furnish shop drawings for the radio control interface/relay control interface panel at the Vault. Shop drawings shall include panel layout, terminal block arrangement, and wiring diagram for the panel.
- L. Furnish shop drawings for the lighting contactor control panel for the Airport Nav aids, Entrance Road Lighting, and Vault Exhaust Fan. Shop drawings shall include panel layout, terminal block arrangement, and wiring diagram for the panel.
- M. Furnish shop drawings for the double throw not fusible safety switch to be used with the Runway constant current regulators and other safety switches as detailed on the Plans.
- N. Provide cut sheets for all types of conduit used in the vault (for example galvanized rigid steel conduit and UL listed liquid tight flexible metal conduit). Include certification that steel conduits are made with 100 percent domestic steel.
- O. Provide cut sheets for 6-inch by 6-inch wireway to be used in the vault.
- P. Provide cut sheets for the power and control circuit conductors.
- Q. Provide cut sheets with manufacturer's name, catalog number, dimensions, material and UL listing for each type and size ground rod. Include certification of 100% domestic steel for ground rods. Include cut sheets for exothermic weld connections, ground lugs, and ground wire.
- R. Provide shop drawings for the ground bus bar. Include manufacturer, dimensions, part numbers, and information on standoffs, insulators, splices, bonding jumpers, and mounting hardware.

EQUIPMENT AND MATERIALS

109-2.1 GENERAL. Add the following to this section:

- “C. FAA approval of airport lighting equipment and subsequent inclusion in Advisory Circular 150/5345-1 "Approved Airport Equipment", and/or Advisory Circular 150/5345-53 “Airport Lighting Equipment Certification Program” only means that the test data satisfied the applicable Specification requirements. This does not insure that the approved equipment will satisfactorily operate when connected power-wise and/or control-wise to other approved airport lighting equipment or "off the shelf" equipment not requiring FAA approval.

- D. The Contractor shall ascertain that all lighting system components furnished by him (including FAA-approved equipment) are compatible in all respects with each other and the remainder of the new system. Any non-compatible components furnished by the Contractor shall be replaced by him, at no additional cost to the Airport Sponsor, with a similar unit approved by the Engineer (different model or different manufacturer) that is compatible with the remainder of the airport lighting system.

- E. Except as specified otherwise, all new equipment shall be provided by the Contractor and shall be tested for Specification conformance as part of the Aviation Lighting Equipment Certification Program. Certification of conformance, as tested by the respective testing laboratory, shall be provided by the manufacturer for all items submitted for approval.

109-2.4 BRICK. Delete this section.

109-2.5 RIGID STEEL CONDUIT. Add the following:

“GRSC shall be heavy wall, hot-dipped, galvanized steel pipe bearing the UL label and conforming to UL-6 and ANSI Specification C80.1. Couplings, connectors, and fittings for rigid steel conduit shall be threaded, galvanized steel, or galvanized malleable iron specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4 and UL-514B. Set screw type fittings are not acceptable. Steel used to manufacture conduits shall be 100 percent domestic steel. Contractor shall provide certification that the respective steel conduits used on this project are manufactured from 100 percent domestic steel.”

109-2.6 LIGHTING. Add the following:

“Lighting Fixtures and lamps shall be as designated in "Lighting Fixture Schedule" on the Plans. Provide fixtures complete with all required accessories. Provide conduit and wiring as detailed on the Plans. Fixture wiring shall comply

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with fixture manufacturer's recommendations and the NEC requirements. Mounting Hardware: Provide mounting hardware to supplement building structure for support of fixtures. Supports shall be capable of supporting 300 percent fixture and lamp weight. Emergency lighting system consists of selected fixtures as indicated on Plans. Emergency lighting fluorescent fixtures shall be self-contained, modular, battery-inverter unit factory-mounted within fixture body. Comply with UL 924, and include the following features:

- A. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
- B. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
- C. Charger: Fully automatic, solid-state, constant-current type.
- D. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.”

109-2.7 OUTLETS. Add the following:

- “A. General Purpose Receptacles. General purpose receptacles for all wall-type convenience outlets in non-hazardous areas shall be of the 20-Amp, 125-volt, 3-wire grounding type, NEMA 5-20R, heavy-duty specification-grade **ivory** in color, Arrow Hart Part Number 5362, Bryant Part Number 5362, Hubbell Part Number 5362, Pass & Seymour Part Number 5362, or approved equal. Cover plates for flush-mounted, general purpose receptacles shall be of the stainless steel type as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal.
- B. GFCI Receptacles. Receptacles with ground-fault circuit interrupters shall be provided and installed where noted on the Plans. Ground-fault circuit interrupter receptacles shall be rated 120 VAC, 60 HZ, 20 Amps, specification-grade with NEMA 5-20R receptacle configuration and a trip threshold of 5±1 milliamps. Ground fault circuit interrupter receptacles shall be UL Class “A” ground-fault interrupter receptacle units complying with and tested in accordance with UL Standard No. 943. Ground fault circuit interrupter receptacles shall be Arrow Hart Part Number GF5342, Bryant Part Number GFR53FT, Hubbell Part Number GF5362, Pass & Seymour Part Number 2091-S, or approved equal.
- C. Device Boxes. Device boxes for flush-mounted, non-hazardous receptacles and switches shall be sheet steel construction. Cover plates shall be stainless steel, as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or equal. Surface-mount device boxes shall be of cast aluminum or malleable iron FS design with cover plates of surface-mount FS design, as manufactured by Appleton, Crouse Hinds, or approved

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equal. Weatherproof covers shall be industrial grade, rain-tight NEMA 3R (while outlet is in use, as well as when not in use), UL-listed, FS box-mountable, weatherproof covers, TayMac Corporation Catalog No. 20550, or approved equal.”

109-2.8 SWITCHES. Revise to read as follows:

- “A. Toggle Switches. Single-pole toggle switches shall be 20-Amp, 120/277-volt, specification-grade, as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal. Single-pole, 20-Amp, 120/277-Volt toggle switches shall be Arrow Hart Part Number 1991, Bryant Part Number 4901, Hubbell Part Number 1220, Pass & Seymour Part Number 20AC1, or approved equal.

- B. Device Boxes. Device boxes for flush-mounted, non-hazardous receptacles and switches shall be sheet steel construction. Surface mount device boxes for receptacles and toggle switches shall be die cast construction weatherproof boxes as manufactured by Appleton, Crouse Hinds, Hubbell/RACO/Bell or approved equal. Cover plates shall be stainless steel as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal.”

109-2.13 GROUND BUS. Revise to read as follows:

“Ground bus for the vault interior shall be 1/4 in. thick by 2 in. wide copper bus bar, as manufactured by Harger Lightning Protection Inc., Gus Berthold Electric Company, or approved equivalent. Ground bus shall include standoffs, insulators, splices, bonding jumpers, mounting hardware, etc., as required for the respective application.”

109-2.14 SQUARE DUCT. Revise the last sentence to read:

“Square duct shall be sized, as detailed on the Plans.”

Add the following:

“Wireway shall be installed, as indicated on the Plans, including, but not limited to, straight lengths, elbows, tees, offsets, panel adaptors, closing plates, wire retainers, and supports, as required for a complete installation. Wireways shall be constructed of 16-gauge steel before finishes are applied. All straight lengths of wireway shall have hinged or bolt-on covers. Lengths shall be provided with cover latches, a minimum of every 3 ft, which shall hold the cover securely in-place when closed. Sealing ears shall be provided on both the wireway lengths and connector covers so that the entire run can be sealed.

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Wireways shall be 6 in. by 6 in., as detailed on the Plans. Wireways shall be furnished without knockouts. Connectors shall be slip-in type with self-retained mounting screws. They shall also have the feature to allow “lay-in” of all conductors. Wireways shall be provided with a gray epoxy-painted finish applied over a corrosion-resistant phosphate primer. All wireway lengths and accessories shall be Underwriter’s Laboratories listed and labeled in conformance with UL 870 Standards for Wireways, Auxiliary Gutters, and Associated Fittings and conform to NEMA 1 enclosure rating.”

109-2.15 GROUND RODS. Revise to read as follows:

“Ground rods shall be 3/4-in. diameter, 10 ft long, UL-listed, copper-clad Ground rods shall have 10 mil. minimum copper coating. Steel used to manufacture ground rods shall be 100 percent domestic steel.”

109-2.16 POTHEADS. Delete this section.

109-2.17 PRE-FABRICATED METAL HOUSING. Delete this section. Replace with the following:

“109-2.17 PRE-FABRICATED EQUIPMENT SHELTER. This item shall consist of a pre-fabricated, pre-engineered equipment enclosure building with concrete floor, steel skid structure, and foundation piers or with concrete slab foundation. This item shall include all labor, equipment, materials, coordination, installation, testing, and the furnishing and installation of all incidentals necessary to accomplish the Scope of Work stated herein and required to produce a completed building and place it in operating condition. Pre-fabricated equipment shelter shall be as described below or an approved equal. The pre-engineered equipment enclosure shall be a light-weight metal or fiberglass building with concrete floor and steel skid structure, nominal 10 ft-6in. wide exterior (Note: interior width shall not be less than 9 ft-6 in., adjust exterior width, as applicable) by nominal 20 ft-0 in. long exterior (Note: interior length shall not be less than 19 ft., adjust exterior length, as applicable) by nominal 8 ft-0 in. high interior (floor to ceiling), as manufactured by VFP, Inc, 176 East Park Drive, Roanoke, Virginia 24019, Phone 1-540-977-0500, Fax: 540-977-5555 with the following features:

- A. Double-door assembly, with two 36 in. wide x 84 in. high doors. Doors shall be furnished with:
 - (2) Stainless steel door strap hinges (per door).
 - Stainless steel classroom-style, key-locked, lever handle.
 - Stainless steel door stop chain (per door).
 - Door sweep with heavy-duty vinyl threshold (per door).

- B. Structural loads as follows:

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- 200 lbs. per sq. ft distributed floor loading.
 - 90 lbs. per sq. ft distributed roof load.
 - 120 mph wind load.
 - Seismic zone 4.
- C. Interior walls and ceiling shall be sheathed with 1/2-in. thick minimum white nupoly board with blocking/studs provided in the walls behind the paneling for secure mounting of equipment, suitable for mounting the respective electrical and mechanical equipment, as specified herein and as detailed on the Plans. Insulation value shall not be less than R-11. Where applicable for support of panelboards, control panels, mechanical equipment, etc. provide additional 4 ft by 8 ft, 3/4-in. thick equipment-mounting boards.
- D. Exterior support hardware for exterior-mounted electrical and/or mechanical equipment, as specified herein and detailed on the Plans.
- E. Floor shall be constructed of 3 in. of concrete, reinforced by the steel foundation skid. The floor shall be finished with 1/8-in. thick, 12 in. by 12 in., light colored, industrial-grade vinyl tile floor covering. Floor shall include a waterproof seal. The floor structure shall be capable of supporting uniform loads of 200 lbs. per sq. ft.
- F. For a lightweight metal building, the exterior walls of the shelter shall be constructed of painted galvaneal steel panels. The exterior roof of the shelter shall be constructed of sealed galvaneal steel panels, with an additional standing seam-painted galvaneal cap. For a fiberglass building, provide granacrylic exterior finish over a seamless fiberglass coating, 1/8-in. thick exterior fiberglass on walls, and 1/4-in. thick on roof.
- G. Building shall rest on an integral steel skid structure designed to support the building during transportation, lifting, and final placement on site. The skid shall incorporate integral lifting points to allow the building to be placed by a crane or other suitable means.
- H. The pre-engineered equipment enclosure shall be delivered to the site and installed onto cast-in-place concrete piers sized and constructed per the respective building manufacturer's recommendations and not less than 5 ft deep by 30 in. diameter. Concrete shall conform to Item 610 Structural Portland Cement Concrete of the Standard Specifications for Construction of Airports. Piers shall extend a minimum of 2 in. above finished grade. Adjust pier elevations as necessary to provide level mounting of the vault building. Provide a minimum of 4 in. of aggregate bedding at the base of each foundation pier. Concrete piers shall include four #5 vertical rebar with #3 lateral ties at 12 in. on center maximum spacing. The building shall be anchored to the piers, in accordance with the building

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manufacturer's instructions, using anchor bolts sized per the respective building manufacturer's recommendations and/or requirements. Following initial installation, the building shall be adjusted, as required, and cleaned in accordance with the manufacturer's instructions.

- I. The pre-engineered equipment enclosure shall be manufactured and installed to accommodate mechanical and electrical systems, equipment, and fixtures specified in other Specification sections.
- J. Building color(s) will be selected by the Owner from the full range of manufacturer's standard colors.
- K. Required submittals shall include: Product data; Shop Drawings showing dimensions, building layout, building construction, connections, materials, structural components, etc.; structural design calculations sealed by a Licensed Structural Engineer or Licensed Professional Engineer (as applicable); details on the doors, louvers, fan and any other equipment furnished with the building, floor loading, roof loading, wind loads, and seismic information, and manufacturer's installation instructions.
- L. The pre-engineered equipment enclosure shall be warranted by the manufacturer to be free of defects in workmanship and materials for a period of **two years** from shipment.
- M. The pre-engineered equipment enclosure shall comply with all applicable codes, ordinances, and other legal requirements of all federal, state and municipal agencies, and authorities having jurisdiction over this project."

109-2.18 FAA-APPROVED EQUIPMENT. Add the following:

"FAA approved equipment shall also comply with the requirements of the Airport Improvement Program Buy American Requirement. FAA approved equipment shall include the following:

- A. Constant Current Regulator for Runway 18/36. Constant current regulator for Runway 18/36 and the associated taxiway shall be a 7.5 KW, L-828 constant current regulator, 240 VAC, single-phase, 60 Hertz input, 6.6-Amps output, with three output brightness steps (4.8, 5.5, and 6.6-Amps). Constant current regulator shall comply with FAA AC 150/5345-10F for Type L-828 regulator. Constant current regulator shall properly operate the respective airfield lighting system it is powering. Constant current regulator shall be dry-type ferro-resonant, dry-type ferromagnetic reactor, or dry-type saturable reactor type regulator. Constant current regulator shall not have solid state controls in the series circuit and shall be designed for no radio communication interference. Solid state electronic designs are not acceptable. **Constant current regulator shall be capable of properly operating a pair of REILS**

with the runway lighting system. Constant current regulator shall include open circuit protection, over current protection, output current ammeter, elapsed time meter (for total time on), output voltmeter, and lightning and transient protection on input and output lines. Constant current regulators shall also include a remote/local control feature with selections for “Remote, Off, 10% Brightness, 30% Brightness, and 100% Brightness”. Control voltage shall be 120 VAC (external). Constant current regulators furnished on this project shall be from the same manufacturer. Constant current regulators shall be manufactured by ADB Siemens, Manairco, Inc. or Flight Light Inc./Hevi-Duty, or approved equal. Include the following spare components:

1. One spare control circuit board for each type in the constant current regulator
2. Primary switch contactor
3. Lightning arresters (input and output)
4. Control circuit fuses or breaker

B. Constant Current Regulator for Taxiway. Constant current regulator for Taxiway and the associated taxiway shall be a 7.5 KW, L-828 constant current regulator, 240 VAC, single-phase, 60 Hertz input, 6.6-Amps output, with three output brightness steps (4.8, 5.5, and 6.6-Amps). Constant current regulator shall comply with FAA AC 150/5345-10F for Type L-828 regulator. Constant current regulator shall properly operate the respective airfield lighting system it is powering. Constant current regulator shall be dry-type ferro-resonant, dry-type ferromagnetic reactor, or dry-type saturable reactor type regulator. Constant current regulator shall not have solid state controls in the series circuit and shall be designed for no radio communication interference. Solid state electronic designs are not acceptable. **Constant current regulator shall be capable of properly operating a pair of REILS with the runway lighting system.** Constant current regulator shall include open circuit protection, over current protection, output current ammeter, elapsed time meter (for total time on), output voltmeter, and lightning and transient protection on input and output lines. Constant current regulators shall also include a remote/local control feature with selections for “Remote, Off, 10% Brightness, 30% Brightness, and 100% Brightness”. Control voltage shall be 120 VAC (external). Constant current regulators furnished on this project shall be from the same manufacturer. Constant current regulators shall be manufactured by ADB Siemens, Manairco, Inc. or Flight Light Inc./Hevi-Duty, or approved equal. Include the following spare components:

1. One spare control circuit board for each type in the constant current regulator
2. Primary switch contactor
3. Lightning arresters (input and output)
4. Control circuit fuses or breaker

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- C. L-854 Radio Controller. L-854 radio controller shall be FAA-approved and comply with FAA AC 150/5345-49 (latest issue), and FCC Rules and Regulations: Part 15. The radio controller shall be a Type I classification (air-to-ground) unit consisting of an AM receiver and Type A decoder mounted in a metal weatherproof enclosure, painted international orange per FAA Standard 595A. Input voltage shall be 120 VAC, 60 Hz. Frequency range shall be 118 to 136 MHz. Unit shall have solid-state circuitry other than the relays. Include a remote antenna with sufficient length of coaxial cable to mount above the vault building roof for proper operation. Frequency shall be 122.8 MHz or as selected by the Airport Manager. Confirm frequency with the Airport Manager, prior to ordering.”

109-2.22 OTHER ELECTRICAL EQUIPMENT. Add the following:

“Switches, cutouts, relays, lighting contactors, terminal blocks, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications shall conform to the applicable rulings and standards of the institute of Electrical and Electronic Engineers or the National Electrical Manufacturer’s Association. When specified, test reports from a testing laboratory indicating that the equipment meets the specifications shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the Plans or in the proposal. Contractor shall confirm quantity for all electrical equipment with the Plans. Equipment and Materials shall be manufactured in the United States to comply with the Airport Improvement Program Buy American Requirements and the Buy American Act. Proposed electrical equipment for the vault shall be as follows:

- A. Radio Control Relay Interface Panel. A relay interface panel shall be provided for the constant current regulators to interface the L-854 radio controller to each respective constant current regulator and each respective navaid lighting contactor. Relay interface panel shall be as detailed on the Plans. Relay interface panel shall be manufactured by an FAA approved L-821 control panel manufacturer or a UL 508 industrial control panel builder and shall be manufactured in the United States to comply with the Airport Improvement Program Buy American Requirements and the Buy American Act.
- B. Lighting Contactor Panel for Airport NAVAIDS. The lighting contactor panel for use with the airfield Navaids (including the Airport Rotating Beacon, Wind Tee, Wind Cone, Runway 18-36 PAPI units, Airport Entrance Road Lighting, and Vault Exhaust Fan) and shall be as detailed on the Plans. The lighting contactor panel shall be manufactured by an FAA approved L-821 control panel manufacturer or a UL 508 industrial

control panel builder and shall be manufactured in the United States to comply with the Airport Improvement Program Buy American Requirements and the Buy American Act.

- C. Type S-1 Series Plug Cutouts. Provide series plug cutouts for each constant current regulator as detailed on the Plans. Series plug cutouts shall be Type S-1, rated 5KV, 20-Amp, and shall comply with FAA AC 150/5340-4C. Cutouts shall be certified by the manufacturer as suitable for the respective application. Cutouts for the runway series circuit will be wired for manual transfer operation (one series circuit loop with the capability of being powered from either of two constant current regulator power sources). Series plug cutouts shall be Crouse-Hinds, Type S-1, Model 2, Catalog Number 30775, or an approved equal. Series cutouts where the manufacturer has noted their cutouts are not recommended to operate with the handle pulled/removed are not acceptable. Other cutouts, that do not function the same as the Crouse-Hinds, Type S-1, Model 2, Catalog Number 30775 units, are not acceptable. Install the series plug cutouts in a NEMA 1 or NEMA 12 painted steel enclosure adequately sized to house the cutout(s), with a hinged cover and back panel to mount the cutouts. All enclosures shall be pad lockable.
- D. Circuit Breaker Panelboards. Circuit breaker panelboard shall be rated 120/240 VAC, 1 phase, 3-wire and shall have copper bus structure braced for 10,000 RMS Amperes fault current minimum at 120/240 VAC. All copper parts shall be plated to prevent corrosion. Panelboards shall bear the UL label. Panelboards for service entrance applications shall be UL-listed suitable for service entrance. All panelboards shall be dead-front safety-type, equipped with thermal magnetic-molded case breakers and solid neutral bus. Bus bar connections to the branch circuit breakers shall be the "Distributed Phase" or "Phase Sequence" type. Bussing shall be such that adjacent single-pole breakers will be on different phases or polarities, and that two pole breakers can be installed at any location. Panelboard numbering shall be such that starting at the top, odd numbers shall be used in sequence down the left hand side, and even numbers shall be used in sequence down the right hand side. Cabinets shall be fabricated of code-gauge, galvanized steel with gutters per the NEC. Fronts shall have doors with matching one-piece trim, be code-gauge, and be finished with rust-inhibiting primer and baked enamel. Fronts shall have adjustable indicating trim clamps completely concealed when door is closed. Provide a circuit directory frame and card with a clear plastic covering on the inside of the doors. Fronts shall have flush locks, and be furnished with two keys per lock. Provide circuit breakers, quick-make, quick-break, thermal-magnetic, trip indicating, and common trip on all multi-pole breakers. Handles shall have "ON", "OFF" and "TRIPPED" positions. Circuit breakers shall be UL-listed in accordance with UL Standard 489. Breakers shall have bolt-on connections to the bus.

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Amperage trip ratings, voltage ratings, interrupting current ratings, and number of poles shall be as shown on the panelboard schedules. Contractor shall confirm and adjust circuit breaker sizes, as required for the respective equipment or device being fed, in accordance with the respective equipment manufacturer's recommendation and the NEC. Panelboards shall be furnished with copper-ground bus and separate insulated neutral bus.

- E. Transient Voltage Surge Suppressor (TVSS) for Vault Service Panelboard. AC power surge arrester/TVSS shall be UL-listed per UL 1449, Second Edition, and shall conform to the applicable requirements of FAA-STD-019d dated August 9, 2002, "LIGHTNING AND SURGE PROTECTION, GROUNDING, BONDING, AND SHIELDING REQUIREMENTS FOR FACILITIES AND ELECTRONIC EQUIPMENT". AC power surge arrester/TVSS for the main distribution panel shall be suitable for a 120/240 VAC, 1-phase, 3-wire, plus ground system with a surge current rating of 240,000-Amps, 8 x 20 microsecond wave per mode (L-L, L-N, L-G, N-G), and status indication lights in a NEMA 12-rated enclosure, Lightning Protection Corporation Model LPC 2020-8U-G, or approved equal. Include six spare indicator lamps with each AC power surge arrester/TVSS.
- F. Fractional Horsepower Manual Motor Starters. Fractional horsepower manual motor starters shall be toggle-operated type with thermal overload protection in each phase conductor sized for the respective motor. Fractional horsepower manual motor starters shall be installed in NEMA 1 surface enclosures where located indoors in a dry, non-corrosive, non-hazardous location. Fractional horsepower manual motor starters shall be installed in NEMA 4/4X enclosures where located outdoors or in wet locations. Starters shall include handle guard/lock off feature to permit pad locking the device in the off position. Acceptable Fractional horsepower manual motor starter products are General Electric - CR101, Square D - Class 2510, Cutler-Hammer – MS, or approved equal.
- G. Photocells. Photocells for use with the airfield lighting controls shall be rated 2000-Watts at 120 VAC, with off delay, -40°C to 60°C operating temperature range, Tork Model No. 2101, or approved equal. Contractor shall confirm the selected photocell is suitable for the respective application.
- H. Double Throw Not Fusible Safety Switch. Double throw not fusible safety switch for use as a manual transfer switch shall be UL listed, heavy duty, 100 Amp, 240 VAC, 2-pole with equipment ground kit in a NEMA 1 enclosure, Cutler-Hammer Catalog Number DT223UGK with ground kit or approved equal. Switch must be suitable to connect a single power source to either of two different loads. The switch will be used to connect

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power to either of two different constant current regulators. Switches that void the UL listing for this application are not acceptable.

- I. Safety Switches: Furnish and install safety switches as detailed on the Plans and specified herein. Safety switches shall be heavy duty, UL-listed, with amperage, voltage, number of poles, and type (fusible or not fusible), and accessories as detailed on the Plans. Safety switches shall be pad lockable in the off position. Include ground lugs or grounding kits with all safety switches. Safety switches located outdoors, or in damp areas shall be in NEMA 3R and 12 or NEMA 4X enclosures without knockouts. Safety switches located in hazardous classified areas shall be UL-listed or FM approved as suitable for the respective location. Safety switches shall be as manufactured by Square D, or approved equivalent.
- J. Junction and Pull Boxes. Junction and pull boxes shall be sized, as required for conductors and splices and per 2008 NEC Article 314. Boxes shall be UL-listed. Special boxes made to suit conditions shall be used to accommodate the respective application, or where required by the NEC, even though they might not be indicated on the Drawings. Surface-mounted exterior junction and pull boxes located in non-hazardous, non-classified areas shall be NEMA 4X stainless steel or aluminum, Crouse-Hinds, Killark, Hoffman, Hennessy, or approved equal. All junction and pull boxes installed in classified hazardous areas (Class 1, Division 1 or 2, Group D) shall be NEMA 7 and NEMA 4 and shall comply with applicable provisions of the NEC, including, but not limited to, Articles 500 and 501.
- K. Schedule 40 PVC Conduit. Schedule 40 PVC conduit shall comply with Item 110 and the following: Conduit shall be Schedule 40 PVC, 90°C, UL-rated, or approved equal. Material shall comply with NEMA Specification TC-2 (Conduit), (Fittings UL-514), and UL-651 (Standard for Rigid Non-metallic Conduit). The conduit and fittings shall carry a UL label (on each 10 ft length of conduit and stamped or molded on every fitting). Conduit and fittings shall be identified for type and manufacturer and shall be traceable to location of plant and date manufactured. The markings shall be legible and permanent. The conduit shall be made from polyvinyl chloride C-300 compound that includes inert modifiers to improve weatherability and heat distortion. Clean, reworked material generated by the manufacturer's own conduit production may be used by the same manufacturer, provided the end products meet the requirements of this Specification. The conduit and fittings shall be homogenous plastic material free from visible cracks, holes, or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks, or other imperfections which could mar conductors or cables. Conduit fittings and cement shall be produced by the same manufacturer to assure system integrity.

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- L. Liquid-Tight Flexible Metal Conduit. Liquid-tight, flexible metal conduit shall consist of polyvinyl jacket over flexible hot dip galvanized steel tubing. The flexible conduit shall be completely sealed from liquids, dust, dirt, and fumes and be resistant to oil, gasoline, grease, and abrasion. Jacket shall also be sunlight-resistant. Liquid-tight flexible metal conduit shall be UL-listed, suitable for use as a grounding conductor, and comply with Article 350 of the NEC. **Liquid-tight flexible metal conduit and associated fittings shall be UL-listed to meet the requirements of NEC 350.6.** Liquid-tight flexible metal conduit shall be Anaconda Sealtite Type UA as manufactured by Anamet Electrical Inc., 1000 Broadway Avenue East, Mattoon, Illinois 61938-0039, (Phone: 217-234-8844), Liqueatite Type LA as manufactured by Electri-Flex Company, 222 W. Central Ave., Roselle, Illinois 60172, (Phone: 630-529-2920 or 1-800-323-6174), or approved equal. Do not install liquid-tight, flexible metal conduit that is not UL listed. Confirm liquid-tight, flexible metal conduit bears the UL label prior to installation.”

109-2.20 WIRE. Add the following to Section A. Control Circuits:

“THWN Wire. Cable shall comply with Underwriters’ Laboratories Standard UL-83 and Federal Specification A-A-59544. Conductor shall be soft-annealed, uncoated copper and shall comply with ASTM B3 and B8. Insulation shall be rated for 600-Volt. Insulation shall be polyvinyl-chloride conforming to Underwriters’ Laboratories requirements for Type THW. The outer covering shall be nylon-conforming to Underwriters’ Laboratories for type THHN or THWN. Cable shall be UL-listed and marked THWN. Power and control wiring shall be Encore, Superior Essex, Southwire Company Type THWN, or approved equal.”

Delete paragraphs 1, 2, and 3 under Section B. Power Circuits.

Add the following:

“Power Cable (600-Volt and Below). All power wiring, 600-Volt and below, shall be the type, size, and number of conductors as noted on the Plans.

THWN Wire. Cable shall comply with Underwriters’ Laboratories Standard UL-83 and Federal Specification A-A-59544. Conductor shall be soft-annealed, uncoated copper and shall comply with ASTM B3 and B8. Insulation shall be rated for 600-Volt. Insulation shall be polyvinyl-chloride conforming to Underwriters’ Laboratories requirements for Type THW. The outer covering shall be nylon-conforming to Underwriters’ Laboratories for type THHN or THWN. Cable shall be UL-listed and marked THWN-2. Power and control wiring shall be Encore, Superior Essex, Southwire Company Type THWN-2, or approved equal. **Note where THWN wiring is referenced on the Plans, it shall be THWN-2.**

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XHHW Wire. Cable shall be UL-listed as Type XHHW-2 per UL Standard 44. Cable shall also conform to ICEA S-95-658/NEMA WC70 and Federal Specification A-A-59544. Conductors shall be Class B stranded, annealed, uncoated copper per UL Standard 44. Insulation shall be rated for 600-Volt. Insulation shall be cross-linked polyethylene complying with the physical and electrical requirements of UL Standard 44 for Type XHHW-2. XHHW wire may be used in place of THWN wire for all applications and shall be Southwire Type XHHW-2, or approved equal.

XLP-USE Wire. Cable shall comply with UL Standard 44, UL Standard 854, and Federal Specification A-A-59544. Conductor shall be concentric-strand, soft copper, conforming to ASTM B8 and Underwriters' Laboratories Standard UL44 for Rubber-Insulated Wires. Insulation shall be rated for 600-Volts. Insulation shall be cross-linked polyethylene conforming to Underwriter's Laboratories Requirements for Type USE-2 insulation. Cable shall be UL-listed and marked USE-2. Cable shall be Service Wire Company Type USE-2, or approved equal.

Series Circuit 5000-Volt Cable. Cable for use with series circuit airfield lighting shall be FAA-L-824, Type C cable complying with Item 108. L-824 cable shall be FAA approved and listed in the current AC150/5345-53C, AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM Appendix 3 Addendum. Circuits for use with constant current regulator outputs (runway or taxiway lighting circuits) shall use 5000-Volt rated cable.

Grounding electrode conductors and/or bonding jumpers shall be the size and type, as detailed on the Plans. Ground wire for bonding constant current regulator housings, cutout enclosures, and other vault equipment frames to the vault ground bus shall be #6 AWG stranded copper.”

109-2.21 FLOOR DRAINS. Delete this section.

109-2.22 MECHANICAL EQUIPMENT.

“Ventilation System. Ventilation system shall be as detailed on the Plans. Input power for fan and damper motors shall be 120 VAC.

Electric Wall Heaters. Provide fan forced electric wall heaters in the capacity required for maintaining space temperature at 72°F in the winter. Each wall heater shall include the following features: Heating element shall be of the non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which plate fins are copper brazed. Heater shall include a 5-year warranty. Heating capacity shall be as shown on the Plans. The fan shall be 5-bladed aluminum. The fan motor shall be totally enclosed. Fan delay switch shall be bi-metallic, snap action-type. Fan shall be activated after heating element reaches operating temperature. Integral thermostat shall be bi-metallic, snap action-type

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with enclosed contacts. Thermal cutout shall be built in the system to automatically shut off the heat in the event of overheating and reactivate the heater when temperature returns to normal. Provide white louvered steel front cover. Provide surface-mounting box for surface installation, painted to match front cover. All sheet metal parts shall be phosphatized, and final finished in baked enamel paint. Input voltage shall be 240 VAC, 1 phase, 60 Hz.”

CONSTRUCTION METHODS

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-3.1 GENERAL. Add the following:

“The Contractor shall coordinate the installation of mechanical and electrical equipment with the building manufacturer and the foundation and floor.”

109-3.2 FOUNDATION AND WALLS. Revise this section as follows:

“Foundations shall be constructed as specified in 109-2.17 PRE-FABRICATED EQUIPMENT SHELTER.”

109-3.3 ROOF. Delete this Section.

109-3.4 FLOOR. Revise this section as follows:

“The building floor shall be constructed as specified in 109-2.17 PRE-FABRICATED EQUIPMENT SHELTER.”

109-3.5 FLOOR DRAIN. Delete this section.

109-3.7 DOORS. Revise this section as follows:

“Doors shall be as specified in 109-2.17 PRE-FABRICATED EQUIPMENT SHELTER.”

109-3.8 PAINTING. Delete this section.

109-3.9 LIGHTS AND SWITCHES. Add the following:

“Furnish and install receptacles, toggle switches, and control stations, as detailed on the Plans. Receptacles, toggle switches, and control stations shall be located at 4 ft–0 in. above finished floor elevation or finished grade at all structures. Adjust locations and/or mounting heights, where necessary, to avoid interferences. All receptacles shall be grounded with an equipment ground wire connected to the grounding terminal or screw on the receptacle. All toggle switches shall be grounded with an equipment ground wire connected to the grounding terminal or

screw on the switch. Test all GFCI receptacles and receptacles protected by GFCI's for proper operation. Verify all receptacles and switches are wired for the correct voltage.”

**INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED
METAL HOUSING**

109-3.10 GENERAL. Add the following to this section:

“The Contractor shall furnish and install all materials necessary for complete and operational installation of the vault equipment, as specified herein and as shown on the Plans. The complete installation and wiring shall be done in a neat, workmanlike manner. All electrical work shall comply with the requirements of the NFPA 70 – National Electrical Code (NEC) most current issue in force, and all other applicable local codes, laws, ordinances, and requirements in force. Electrical equipment shall be installed in conformance with the respective manufacturer’s directions and recommendations for the respective application. Any installations which void the UL listing, ETL listing (or other third party listing), and/or the manufacturer’s warranty of a device will not be permitted.

- A. Contractor shall keep a copy of the latest NEC in force on site at all times during construction for use as a reference.
- B. Contractor shall keep a copy of the Plans, Special Provision Specifications including any addenda, and copies of any change orders on site at all times during construction.
- C. Contractor shall coordinate work and any power outages with the Airport Manager and the Resident Engineer. Any shutdown of existing systems shall be scheduled with and approved by the Airport Manager prior to shutdown. Once shut down, the circuits shall be labeled as such to prevent accidental energizing of the respective circuits. All personnel shall follow U.S. Department of Labor Occupational Safety & Health Administration (OSHA) 29 CFR Part 1910 Occupational Safety and Health Standards for electrical safety and lockout/tagout procedures including, but not limited to, 29 CFR section 1910.147 The Control of Hazardous Energy (lockout/tagout).
- D. All electrical equipment installed by the Contractor shall be properly labeled, and all cables must be tagged.
- E. All changes to the airfield lighting system control wiring will be documented by the Contractor and provided to the Resident Engineer.
- F. Locate Existing Underground Utilities and Cables. The location, size, and type of material of existing underground and/or aboveground utilities

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indicated on the Plans are not represented as being accurate, sufficient, or complete. Neither the Owner nor the Engineer assumes any responsibility whatever in respect to the accuracy, completeness, or sufficiency of the information. There is no guarantee, either expressed or implied, that the locations, size, and type of material of existing underground utilities indicated are representative of those to be encountered in the construction. It shall be the Contractor's responsibility to determine the actual location of all such facilities, including service connections to underground utilities. Prior to construction, the Contractor shall notify the utility companies of his operational plans, and shall obtain, from the respective utility companies, detailed information and assistance relative to the location of their facilities and the working schedule of the companies for removal or adjustment, where required. In the event an unexpected utility interference is encountered during construction, the Contractor shall immediately notify the utility company of jurisdiction. The Owner's Representative and/or the Resident Engineer shall also be immediately notified. Any damage to such mains and services shall be restored to service at once and paid for by the Contractor at no additional cost to the Contract. All utility cables and lines shall be located by the respective utility. **Contact JULIE (Joint Utility Location Information for Excavators) for utility information, phone: 1-800-892-0123.** Contact the FAA (Federal Aviation Administration) for assistance in locating FAA cables and utilities. Location of FAA power, control, and communication cables shall be coordinated with and/or located by the FAA. Also contact Airport Director/Manager and Airport Personnel for assistance in locating underground Airport cables and/or utilities. Also coordinate work with all aboveground utilities."

109-3.11 POWER SUPPLY EQUIPMENT. Add the following to this section:

"Electric Service Entrance for New Airport Vault. Contractor shall furnish and install electric service entrance for the new airport vault, as detailed on the Plans and specified herein. As part of the service entrance work, the Contractor shall coordinate with the serving utility, **(Wayne-White Counties Electric Cooperative, P. O. Drawer E, 1501 West Main, Fairfield, Illinois 62837, Attn Mr. Richard Attebery, Staking Engineer, Phone 618-842-2196 and/or Mr. Chris Hopfinger, Systems Engineer, Phone: 618-842-2196)** the installation of a 120/240 VAC, single-phase, 3-wire service sufficient to handle a 400-Amp service for the new airport vault and associated equipment. **The respective Airport Authority/IDOT Division of Aeronautics shall pay for all associated electric utility company charges required to provide electric service to the new vault. The Contractor is not responsible for electric utility company charges associated with the proposed electric service to the new vault.** The Contractor shall coordinate the new electric service with the serving electric utility company and the Airport Manager. The service entrance shall include, but not be limited to, all service entrance equipment, labor, and materials, as detailed

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on the Plans and specified herein, in order to provide a complete and operational electrical system.

A. Electric Utility Company: Major work items to be performed by the serving electric utility company will be as follows:

1. The furnishing of power for a 120/240 VAC, single-phase, 3-wire secondary service sufficient to handle the loads for a 400-Amp service.
2. Furnishing and installing the meter.
3. Furnishing and installing service conductors and conduit from the respective utility transformer to the meter base.
4. The serving electric utility company will retain the right to review and approve Drawings prior to installation.

B. Contractor: Major work items to be performed by the Contractor shall be as follows: all work, labor, equipment, and materials shall be as detailed on the Plans specified herein and per the serving electric utility's requirements, where applicable.

1. Furnishing and installing service entrance equipment support hardware as detailed on the Plans.
2. Installing a Class 320 Amp meter base per the serving electric utility company requirements. Contact the serving electric utility company for meter base requirements.
3. Furnishing and installing service entrance cables and conduit from the meter base to the service disconnect.
4. Furnishing and installing ground conductors, ground rods, and grounding electrode conductor conduit.
5. Coordinating work with the Airport Managers.
6. Coordinating work and verifying all requirements with serving electric utility.
7. Additional work as required by the serving electric utility and as required to provide a complete and operational electric service entrance system.

Electric Service Entrance for Existing FS Hangar/Sky Diving Hangar. Contractor shall furnish and install electric service entrance for the existing FS Hangar/Sky Diving Hangar, as detailed on the Plans and specified herein. As part of the service entrance work, the Contractor shall coordinate with the serving utility, **(Wayne-White Counties Electric Cooperative, P. O. Drawer E, 1501 West Main, Fairfield, Illinois 62837, Attn Mr. Richard Attebery, Staking Engineer, Phone 618-842-2196 and/or Mr. Chris Hopfinger, Systems Engineer, Phone: 618-842-2196)** the installation of a 120/240 VAC, single-phase, 3-wire service sufficient to handle a 100-Amp service for the existing FS Hangar/Sky Diving Hangar. **The respective Airport Authority/IDOT Division of Aeronautics**

shall pay for all associated electric utility company charges required to provide electric service to the existing FS Hangar/Sky Diving Hangar. The Contractor is not responsible for electric utility company charges associated with the proposed electric service to the existing FS Hangar/Sky Diving Hangar. The Contractor shall coordinate the new electric service with the serving electric utility company and the Airport Managers. The service entrance shall include, but not be limited to, all service entrance equipment, labor, and materials, as detailed on the Plans and specified herein, in order to provide a complete and operational electrical system.

- A. Electric Utility Company: Major work items to be performed by the serving electric utility company will be as follows:
1. The furnishing of power for a 120/240 VAC, single-phase, 3-wire secondary service sufficient to handle the loads for a 100-Amp service.
 2. Furnishing and installing the meter.
 3. Furnishing and installing service conductors and conduit from the utility transformer to the meter base.
 4. The serving electric utility company will retain the right to review and approve Drawings prior to installation.
- B. Contractor: Major work items to be performed by the Contractor shall be as follows: all work, labor, equipment, and materials shall be as detailed on the Plans specified herein and per the serving electric utility's requirements, where applicable.
1. Furnishing and installing service entrance equipment support hardware as detailed on the Plans.
 2. Installing a Class 200 Amp meter base per the Serving electric utility company requirements. Contact the serving electric utility company for meter base requirements.
 3. Furnishing and installing service entrance cables and conduit from the meter base to the service disconnect.
 4. Furnishing and installing ground conductors, ground rod, and grounding electrode conductor conduit.
 5. Coordinating work with the Airport Managers.
 6. Coordinating work and verifying all requirements with serving electric utility.
 7. Additional work as required by the serving electric utility and as required to provide a complete and operational electric service entrance system.

Constant Current Regulators. Install constant current regulators in conformance with the manufacturer's recommendations, as detailed on the Plans and as specified herein. Maintain working clearances in front of constant current regulators per the requirements of NEC 110.26 and 110.34. Maintain clearance

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around constant current regulators for air flow and cooling per the respective manufacturer's recommendations. Confirm circuit breaker sizes for constant current regulators are sized in conformance with the respective manufacturer's recommendations and/or requirements and NEC. Where necessary to accommodate the respective constant current regulator input amperage requirements, circuit breakers, conductors, and conduits shall be adjusted (increased in size) to meet the manufacturer's recommendations and/or requirements and the NEC. Conduit connections to constant current regulators shall be with UL-listed, liquid-tight, flexible metal conduit. Include an external bonding jumper or internal equipment ground wire with each piece of liquid-tight, flexible metal conduit that is connected to a constant current regulator to comply with NEC 350.60. High-voltage wiring shall enter each respective regulator at the high-voltage/series circuit output section of the regulator. 240 VAC input power wiring shall enter each respective regulator at the low-voltage/input power section of the regulator. Furnish and install control wiring, as detailed on the Plans. Control wiring shall enter each respective regulator at the control section of the regulator. Bond each constant current regulator enclosure frame, to the vault ground bus with a #6 AWG (minimum), bare-stranded, copper-bonding jumper."

109-3.12 SWITCHGEAR AND PANELS. Add the following to this section:

- A. Installation of Control Panels. Install control panels, as detailed on the Plans and in conformance with the respective panel manufacturer's requirements and/or recommendations.
- B. Installation of S-1-Type Cutouts. Install plug cutouts in conformance with the manufacturer's recommendations, as detailed on the Plans and as specified herein. Provide NEMA 1 or NEMA 12 painted steel enclosures adequately sized for the cutouts and cables with hinged cover and back panel to mount the plug cutouts.
- C. Installation of Panelboards. Panelboards shall be thoroughly inspected for physical damage, proper alignment, anchorage, and grounding. The exterior finish shall be inspected for blemishes, nicks, and bare spots and touched up, as required, using matching touch-up paint. Inspections shall be made for proper installation and tightness of connections for circuit breakers. Install panelboards, as shown on the Plans and in accordance with NEMA PB1.1. Maximum distance from floor to highest breaker shall not exceed 6 ft-6 in. Install panelboards plumb. Install circuit breakers in panelboards in conformance with the respective manufacturer's directions. Connect only one wire/cable to each breaker terminal. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard to identify the respective device fed by each circuit breaker. Revise directory to reflect circuiting changes, as required. Provide legend plates for all panelboards to identify the panelboard designation, the power source, and the voltage system. Legend plates shall be weatherproof and

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abrasion-resistant, phenolic material. Lettering shall be black on white background. Panelboards shall be thoroughly tested after installation and connection to respective loads.

- D. Surge Arrester Installation. Install Surge Protector Devices (SPD)/TVSS devices in conformance with of FAA-STD-019d, dated August 9, 2002, "LIGHTNING AND SURGE PROTECTION, GROUNDING, BONDING AND SHIELDING REQUIREMENTS FOR FACILITIES AND ELECTRONIC EQUIPMENT" and the respective manufacturer's directions and recommendations. Contractor shall confirm all connections to the surge arrester (phases, neutral, and ground) are completed and secure. Connection leads to the surge arrester shall be sized per the respective manufacturer's recommendation and as detailed herein, and shall be maintained as short as possible, maximum 2 ft in length, and laced together for mutual coupling. The conduit or conduit nipple connecting the SPD/TVSS device enclosure to the panel enclosure shall be sealed with duct seal or other nonflammable medium to prevent soot from entering the enclosure in the event of a SPD/TVSS device failure.
- E. Installation of Safety Switches. Safety switches shall be provided with appropriate mounting hardware and strut support. Strut support shall be hot-dipped, galvanized steel strut support, Unistrut P-1000 HG, or approved equal. Provide zinc rich paint applied to field cuts of strut support to minimize the potential for corrosion per the respective strut support manufacturer's recommendation. All hardware shall be corrosion-resistant. Mount safety switches securely in accordance with the manufacturer's recommendations/instructions and as required for the respective application. Inspect all safety switches for proper operation, tight and secure connections, and correctness. All safety switch enclosures shall be bonded to ground with a ground lug or bar and ground wire. Field cut holes in safety switch enclosures to accommodate conduit entrances. Where safety switch enclosures are provided with concentric knockouts, and the respective conduit does not use the largest knockout, install a grounding bushing with ground wire connections between the bushing and the ground bus. Where safety switches enclosures are used for service entrance applications provide a grounding bushing with ground wire connections between the bushing and the ground bus at each metal conduit entry. Do not use safety switch enclosures for a splice box or for a pull box. Do not route control wires or other circuit wiring through a safety switch enclosure. Where splices are required or other control circuit wires are installed in the respective conduit to a safety switch, provide a separate junction box to accommodate the splices and/or other circuit conductors. Provide weatherproof, abrasion-resistant, engraved legend plates for each safety switch noting the device served, the power source, and the voltage system."

109-3.13 DUCT AND CONDUIT. Add the following to this section:

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“A. Conduit shall be installed in accordance with the following:

1. All service, feeder, branch circuit, and control circuit conduits associated with the new vault shall be galvanized rigid steel conduit as detailed on the Plans.
2. All conduits associated with the fuel system shall be galvanized rigid steel conduit.
3. Schedule 40 PVC conduits shall be used for individual grounding electrode conductors and/or bonding jumpers.
4. Liquid-tight, flexible metal conduit shall be used as specified herein.

B. Conduit Runs:

1. All conduit shall be sized, as indicated on the Drawings, or if conduit sizes not shown shall be in accordance with the NEC. All conduit systems shall be mechanically and electrically continuous from source of current to all outlets and grounded in accordance with the NEC.
2. Run all exposed conduit parallel to building walls using right angle bends. Exposed diagonal runs of conduit will not be permitted. Do not install conduit on roof surfaces unless specifically indicated on the Drawings.
3. Ream conduit after threads are cut. Cut ends square and butt solidly into couplings.
4. Prevent the accumulation of water, foreign matter, or concrete in the conduits during the execution of the work. Temporarily plug conduit, blowout, and swab before wires are pulled.
5. Fasten conduits to all sheet metal boxes and cabinets with two locknuts in accord with the NEC where insulated bushings are used and where bushings cannot be brought into firm contact with the metal enclosures; otherwise, use at least a single locknut and bushing.
6. Seal each underground joint and make water-tight.
7. Where building construction or other conditions make it impossible to use standard threaded couplings, install water-tight, threaded unions.
8. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with conduit

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bending machine to avoid changing the internal diameter of the conduit and not damage its protective coating either inside or outside. Individual bends shall not exceed 90 degrees, and not more than 270 degrees total bends will be allowed in any one conduit run. Where more bends are necessary, and conduit runs exceed 150 lin. ft, install a suitable pull box or junction box.

9. Provide empty conduits installed with a pull wire. Pull wire shall be No. 14 AWG, zinc-coated steel or of plastic having not less than 200 lb. tensile strength. Leave not less than 12 in. of slack at each end of the pull wire.
10. Use liquid-tight, flexible metal conduit for final connection to motors, constant current regulators, transformers, portable equipment, and for equipment subject to vibration and noise transmission. For each conduit size up to 1-in. trade size, flexible conduit shall be minimum length of 12 in. and a maximum length of 36 in. and for conduit sizes above 1-in. trade size, flexible conduit shall be minimum length of 20 in. and maximum length of 48 in. Liquid-tight flexible metal conduit and associated fitting shall be UL listed to meet the requirements of NEC 350.6. Liquid-tight flexible metal conduit that is used for flexibility (including connections to motors, constant current regulators, and transformers) shall require an external bonding jumper or internal equipment grounding conductor per NEC 350.60. Do not install liquid-tight flexible metal conduit that is not UL listed.
11. Provide duct seal at conduit terminations inside enclosures where the respective conduit is from below grade.

C. Raceway Support and Hangers:

1. Securely fasten raceways in-place and support from ceiling or walls at spacing not exceeding:

<u>Material</u>	<u>Maximum Spacing of Supports</u>
a. 1/2-in. through 1-in. trade size conduit	6 ft
b. 1 1/4-in. through 1 1/2-in. trade size conduit	8 ft
c. 2-in. to 4-in. trade size conduit	10 ft
d. Liquid-tight, flexible metal conduit	4 1/2 ft
e. Metal wireway	10 ft

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2. Support rigid conduits within 3 ft of every outlet box, junction box, pull box, cabinet, or termination. Support flexible conduit within 12 in. on each side of every outlet box or fitting.
3. Support conduits by pipe straps, wall brackets, hangers, or ceiling trapeze. The use of perforated iron or wire for supporting conduits is prohibited. Fasten with wood screws or screw nails to wood; by toggle bolts on hollow masonry units, by concrete inserts, or expansion bolts on concrete or spring-tension or threaded C-clamps for rigid steel conduits on steel. Do not weld conduits or pipe straps to steel structures unless specifically indicated.
4. The load applied to fasteners shall not exceed one-third the proof test load of the fasteners.
5. Fasteners attached to concrete shall be vibration and shock-resistant.
6. All screws, bolts, washers, and miscellaneous hardware used for conduit supports shall be fabricated from rust-resisting metal. Trapeze hangers shall have hanger assemblies protected with galvanized finish.”

D. Hazardous Locations

1. Electrical equipment installed at the fuel tank and dispenser site in classified hazardous locations (Class I, Division 1 or 2, Group D) shall be approved and listed suitable for the respective hazardous environment and shall conform to the applicable sections of the NEC, most current issue in force, including but not limited to Articles 500, 501, 504, 514, and 515.
2. Perform all work in classified hazardous locations as defined by the NEC in strict accordance with the NEC for the particular "Class", "Division", and "Group" of hazardous locations involved or indicated on the Drawings. Provide conduit and cable seals in accordance with the NEC.
3. All conduits installed in classified hazardous locations (including Class I, Division 1 or 2, Group D) shall be suitable for the respective location. All boxes and fittings installed in Class I, Division 1 locations shall be approved (FM Approved or UL-listed) suitable for Class I, Division 1 locations. All boxes and fittings installed in Class I, Division 2 locations shall conform to the requirements of NEC 501.10 (B)(4).

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4. Per Article 501.15 (C) (6) of the 2008 NEC and UL Standard 886, the cross sectional area for conductors installed in a conduit seal off fitting shall not exceed 25 percent, unless the conduit seal off fitting has been specifically approved for a higher percentage of fill.
5. Install explosion-proof conduit sealing fittings in conformance with the respective manufacturer's instructions. Contact the respective seal off manufacturer if assistance is required for direction of installing packing fiber to form a dam and pouring the sealing compound.
6. Explosion-proof flexible conduit shall be provided as a connection between each motor junction box (or any other piece of equipment subject to movement or vibration) and the rigid conduit system where installed in a classified hazardous location. For Class I, Division 2 hazardous locations, liquid-tight, flexible metal conduit may be used where it is listed as approved for use in a Class I, Division 2 hazardous location.
7. EMT is not suitable for use in classified hazardous locations and, therefore, shall not be installed in classified hazardous locations.

109-3.15 WIRING AND CONNECTIONS. Add the following to this section.

“Low-voltage wiring shall maintain separation from high-voltage wiring. Low-voltage and high-voltage wiring shall not be installed in the same raceway. Low-voltage and high-voltage wiring shall not be installed in the same handhole or junction box.”

109-3.16 MARKING AND LABELING. Add the following to this section:

- “C. Legend plates shall be provided for all equipment. Legend plates shall be provided to identify the equipment controlled, the power source, and the function of each device. Legend plates shall be weatherproof and abrasion-resistant phenolic/plastic engraved material and fastened with contact type permanent adhesive, screws, or rivets. Installation shall not break, crack, or deform the legend plate. Lettering shall be ¼ in. high, black on a white background, unless noted otherwise.
- D. All mechanical equipment shall be labeled to identify the respective equipment designation.

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- E. Each panelboard shall be furnished with a phenolic engraved legend plate that identifies the panel designation, the power source, and the respective voltage, phase, and wire.
- F. Each constant current regulator shall be furnished with a phenolic-engraved legend plate that identifies the regulator number designation, the runway or taxiway served, and the power source and circuit number.
- G. Each plug cutout cabinet shall be furnished with a phenolic-engraved legend plate that identifies the respective circuit or regulator and the voltage system (5000-Volts).
- H. Each individual circuit breaker, control panel, terminal panel, safety switch, etc. shall be furnished with a phenolic-engraved legend plate that identifies the respective device, the power source, and the respective voltage, phase, and wire. Furnish additional phenolic-engraved legend plates as detailed on the Plans and/or where required by code.
- I. Provide legend plates to identify the vault ground bus in each room of the vault. Lettering shall be 1/2 in. high, white on a green background. Legend plate shall be labeled "VAULT GROUND BUS".
- J. At electrical handholes, identify each cable originating in the vault with respect to the system or device served.
- K. Color code phase and neutral conductor insulation for No. 6 AWG or smaller. Provide colored marking tape for phase and neutral conductors for No. 4 AWG and larger. Insulated ground conductors shall have green colored insulation for all conductor AWG and/or KCMIL. Standard colors for power wiring and branch circuits shall be as follows:

120/240 VAC, 1 PHASE, 3 Wire

Phase A	Black
Phase B	Red
Neutral	White
Ground	Green

- L. Furnish and install weatherproof warning label for each meter socket, enclosed circuit breaker, disconnect switch, switchboard, cutout, panelboard, load center, motor control center, and control panel to warn persons of potential electric arc flash hazards, per the requirements of NEC 110.16 "Flash Protection". Labels shall also conform to ANSI Z535.4-2002 "American National Standard for Product Safety Signs and Labels". NEC 110.16 requires that switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while

energized shall be field marked to warn qualified persons of potential arc flash hazards. The markings shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. This new requirement is intended to help reduce the occurrence of serious injury or death due to arcing faults to those working on or near energized electrical equipment. The warning labels are to indicate to a qualified worker who intends to open the equipment for analysis of work that a serious hazard exists and that the worker should follow appropriate work practices and wear appropriate personal protective equipment (PPE) for the specific hazard. Labels shall be as detailed on the Plans or shall include at least the following information: “Warning - Potential Arc-Flash Hazards exist while working on this energized equipment. Appropriate PPE Required.”

109-3.18 ELECTRICAL TESTING. The installation shall be tested in operation and as a completed unit prior to acceptance. Contractor shall furnish all equipment, meters, instruments, cable connections, tools, manpower, and labor to perform the respective tests. Test all new equipment and all existing equipment where modifications take place and confirm proper operation. Coordinate tests with the respective airport personnel and the Resident Engineer. Tests shall include resistance, voltage, and current reading, as applicable for the respective equipment. When tests disclose any unsatisfactory workmanship or equipment furnished under this contract, correct defects and retest. Repeat tests until satisfactory results are obtained. When any wiring or equipment is damaged by tests, the wiring or equipment shall be repaired or replaced at no additional cost to the contract. Test repaired or replaced items to ensure satisfactory operation. Submit three copies of all test reports to the Engineer. All test reports shall be assembled and bound in a folder or binder. Each test report shall include the following information:

- Project number,
- Project title and location,
- Device or system tested,
- Test performed,
- Date performed,
- Test equipment used,
- Respective Contractor’s name, address, and telephone number,
- Testing firm’s name, address, and telephone number if other than the Contractor,
- Names of individuals performing tests,
- Names of individuals observing tests,
- Statement verifying each test,
- Nameplate data from respective equipment tested,
- Test results, and
- Retest results after correction of defective components or systems (where applicable).

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109-3.19 GROUNDING REQUIREMENTS. Grounding shall conform to the following as applicable: The Contractor shall furnish and install all grounding shown on the Plans and/or as may be necessary or required to make a complete grounding system, as required by the latest NEC (NFPA 70) in force. The reliability of the grounding system is dependent on careful, proper installation, and choice of materials. Improper preparation of surfaces to be joined to make an electrical path, loose joints, or corrosion can introduce impedance that will seriously impair the ability of the ground path to protect personnel and equipment and to absorb transients that can cause noise in communications circuits. The following functions are particularly important to ensure a reliable ground system:

- A. All products associated with the grounding system shall be UL-listed and labeled.
- B. All bolted or mechanical connections shall be coated with a corrosion preventative compound before joining, Sanchem Inc. "NO-OX-ID "A-Special" compound, Burndy Penetrox E, or equal
- C. Metallic surfaces to be joined shall be prepared by the removal of all non-conductive material, per 2008 NEC Article 250-12. All copper bus bars must be cleaned prior to making connections to remove surface oxidation.
- D. Metallic raceway fittings shall be made up tight to provide a permanent low impedance path for all circuits. Metal conduit terminations in enclosures shall be bonded to the enclosure with UL-listed fittings suitable for grounding. Provide grounding bushings with bonding jumpers for all metal conduits entering service equipment (meter base, CT cabinet, main service breaker enclosure, etc.), generator breaker enclosures, and automatic transfer switch enclosures. Provide grounding bushings with bonding jumpers for all metal conduits entering an enclosure through concentric or eccentric knockouts that are punched or otherwise formed so as to impair the electrical connection to ground. Standard locknuts or bushings shall not be the sole means for bonding where a conduit enters an enclosure through a concentric or eccentric knockout.
- E. Furnish and install ground rods at all locations where shown on the Plans or specified herein. Ground rods shall be 3/4-in. diameter, 10 ft long, UL-listed, copper-clad. Ground rods shall have 10 mil. minimum copper coating. Top of ground rods shall be a minimum of 30 in. below finish grade unless otherwise noted on the Plans. Ground rods shall be spaced, as detailed on the Plans, and in no case spaced less than one-rod length apart. All connections to ground rods and/or ground rings shall be made with exothermic weld type connectors, Cadweld by Erico Products, Inc., Solon, Ohio, (Phone 1-800-248-9353), Thermoweld by Continental Industries, Inc., Tulsa, Oklahoma (Phone 918-663-1440) or Ultraweld by Harger, Grayslake, Illinois (Phone 1-800-842-7437), or approved equal. Exothermic weld connections shall be installed in conformance with the respective manufacturer's directions using molds as required for each respective application. Bolted connections will not be permitted at ground rods or at buried grounding electrode conductors. Grounding electrode conductors shall be bare copper (stranded or solid) sized, as detailed on the Plans. In addition to the grounding work described herein and shown on the Plans, the Contractor shall test

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the made electrode ground system with an instrument specifically designed for testing ground systems. If ground resistance exceeds **25 Ohms**, contact the Resident Engineer for further direction. Copies of ground system test results shall be furnished to the Resident Engineer, upon request, for review and record purposes.

- F. All connections, located above grade, between the different types of grounding conductors shall be made using UL-listed, double-compression, crimp-type connectors or UL-listed, bolted ground connectors. For ground connections to enclosures, cases, and frames of electrical equipment not supplied with ground lugs, the Contractor shall drill required holes for mounting a bolted, ground connector. All bolted, ground connectors shall be Burndy, Thomas and Betts, or equal. Tighten connections to comply with tightening torques in UL Standard 486A to assure permanent and effective grounding.
- G. All metal equipment enclosures, conduits, cabinets, boxes, receptacles, etc. shall be bonded to the respective grounding system. Provide grounding bushings at all conduits entering service entrance equipment (meter bases, service disconnects, service panelboards, etc.) and distribution panels or load centers and ground wire from bushing to ground bus in the respective service entrance equipment or distribution panel.
- H. Each feeder circuit and/or branch circuit shall include an equipment ground wire. Metal raceway or conduit shall not meet this requirement. The equipment ground wire from equipment shall not be smaller than allowed by 2008 NEC Table 250-122 "Minimum Size Conductors or Grounding Raceway and Equipment." When conductors are adjusted in size to compensate for voltage drop, equipment-grounding conductors shall be adjusted proportionately according to circular mil area. All equipment ground wires shall be copper, either bare or insulated green in color. Where the equipment grounding conductors are insulated, they shall be identified by the color green, and shall be the same insulation type as the phase conductors.
- I. All utility transformer bank grounds shall be installed in accordance with the serving utility company's recommendation and in accordance with the NEC.
- J. Bond the main electrical service neutral to ground at the main service disconnect. Bond the service neutral to ground at one location only per the NEC. A grounding connection shall not be made to any neutral circuit conductor on the load side of the service disconnecting means, except as permitted by 2008 NEC 250-24.
- K. The secondary neutral of all transformers (separately derived system transformers) shall be grounded in accordance with the NEC. The respective grounding electrode conductor shall be connected to the neutral point of the transformer between the transformer and the output disconnecting means. Size of the grounding electrode conductor shall be in accordance with 2008 NEC Article 250-66 and Table 250-66 unless shown larger on the Drawings. A bond shall be provided between the neutral and transformer case, or other metal that is part of the AC equipment grounding

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system, so as to complete a circuit for fault current to the transformer winding from the AC equipment grounding system. Size of the neutral bonding conductor shall be in accordance with 2008 NEC Article 250-102.

- L. All exterior metal conduit, where not electrically continuous because of manholes, handholes, non-metallic junction boxes, etc., shall be bonded to all other metal conduit in the respective duct run, and at each end, with a copper-bonding jumper sized in conformance with 2008 NEC 250-102. Where metal conduits terminate in an enclosure (such as a motor control center, switchboard, etc) where there is not electrical continuity with the conduit and the respective enclosure, provide a bonding jumper from the respective enclosure ground bus to the conduit sized per 2008 NEC 250-102.
- M. Install grounding electrode conductors and/or individual ground conductors in Schedule 40 or Schedule 80 PVC conduit. Where grounding electrode conductors or individual ground conductors are run in PVC conduit, do not completely encircle conduit with ferrous and/or magnetic materials. Use non-metallic, reinforced fiberglass strut support. Where metal conduit clamps are installed, use nylon bolts, nuts, washers, and spacers to interrupt a complete metallic path from encircling the conduit.
- N. Furnish and install #1/0 AWG bonding jumpers between the respective building steel skids and the vault ground ring for pre-engineered equipment enclosure building with concrete floor and steel skid structure. Connections to the ground ring and to the steel skids shall be exothermic weld-type connections. Provide one connection to each skid member associated with the respective building.

109-3.20 RESTORATION. Any and all trenches and disturbed areas will be backfilled and restored to a smooth grade and seeded to the satisfaction of the Engineer. All trench settlement or disturbed areas shall be corrected for a period of one year. Restoration, grading, and seeding of areas disturbed during the installation of the proposed vault work and/or vault removal work will be incidental to the respective 109 Pay Item.

METHOD OF MEASUREMENT

109-4.1. Delete this section.

109-4.2. Revise this section to read as follows:

“The quantity of prefabricated equipment shelters to be paid for under Item AR109110 Erect Prefabricated Vault shall consist of the number of shelters constructed in place and accepted as a complete unit.”

109-4.3. Add the following to this section:

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“The quantity of vault equipment to be paid for under Item AR109200 Install Electrical Equipment shall consist of furnishing and installing all mechanical and electrical equipment at the vault, as detailed on the Plans and specified herein. This item shall include all labor, equipment, surge protection, grounding, materials, tools, operational instructions, coordination, and testing required to place the vault and associated electrical equipment into proper working order. Cables, conduits, equipment, support hardware, and grounding associated with the new electric service to the vault shall be considered incidental to this item, and no additional compensation will be allowed. Cables inside or at the Airport Electrical Vault Building shall be considered incidental to this item, and no additional compensation will be allowed. Conduit entries, elbows, and fittings located at, adjacent to, or beneath the vault shall be considered incidental to this item, and no additional compensation will be allowed. Relocation of the existing constant current regulator from the existing vault to the new vault shall be considered incidental to this item, and no additional compensation will be allowed.

- A. Conduits and ducts between the vault and high voltage handhole located in the area around the vault will be considered incidental to this item, and no additional compensation will be allowed.
- B. Conduits and ducts between the vault and low voltage handholes located in the area around the vault will be considered incidental to this item, and no additional compensation will be allowed.
- C. Furnishing and installing new electric feeder to the Terminal Building will be considered incidental to this item, and no additional compensation will be allowed.
- D. Furnishing and installing new electric feeder to the existing gate operator at the airfield access gate will be considered incidental to this item, and no additional compensation will be allowed.
- E. Cables for the Automated Weather Observation System from the vault to the designated splice point (where existing cables are intercepted and spliced to new cables) will be considered incidental to this item, and no additional compensation will be allowed.
- F. Cables, conduits, junction boxes, fittings, and associated hardware for the fuel system from the vault to the designated splice point (where existing cables are intercepted and spliced to new cables) will be considered incidental to this item, and no additional compensation will be allowed.
- G. Fuel system emergency shutoff station, and associated cables, conduits, junction boxes, fittings, and support hardware will be considered incidental to this item, and no additional compensation will be allowed.

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- H. Furnishing and installing the radio receiver antenna cable and conduit from the vault to the antenna to be located on the existing tower will be considered incidental to this item, and no additional compensation will be allowed.
- I. 4” directional bore duct will be paid for separately under Item 110.
- J. Electrical Handholes will be paid for separately under item AR110610 Electrical Handhole – per each.

109-4.4. The quantity of Remove Electrical Vault to be paid for under Item AR109901 “Remove Electrical Vault” shall consist of removal of existing vault transclosure, foundation, and all equipment and associated wire and raceway located in the existing vault as detailed on the Plans and specified herein. Removal of vault equipment shall include the removal of the existing electric service equipment, conductors and conduit, feeder conductors to the existing vault building, feeder conductors to the existing Terminal building, Feeder conductor to the existing FS Hangar, and the necessary utility coordination. This item shall include all labor, equipment, tools, excavating, disposal, utility coordination, and incidentals required to complete this item of work. Removal of vault equipment shall also include backfill, furnishing earth material, seeding, mulching and grading to restore the respective areas affected by the removal work.

109-4.5. The quantity of the electric service replacement for the FS Hangar located adjacent to the Terminal Building to be paid for under Item AR109924, Replace Electric Services shall consist of removing the existing service and feeder and furnishing and installing a new service from the respective utility transformer to the FS Hangar main Panel/load center. This item shall include replacing the respective service conductors and conduit from the utility transformer to the respective meter base and service disconnect equipment, and furnishing and installing a grounding system as detailed on the Plans and specified herein. This item shall include all labor, equipment, wiring, raceways, grounding, materials, tools, utility coordination, labeling, testing and all incidentals required to remove and replace the respective electric service installation to the satisfaction of the serving electric utility, Owner and Engineer.

BASIS OF PAYMENT

Payment will be made under:

- Item AR109110 Erect Prefabricated Vault - per lump sum
- Item AR109200 Install Electrical Equipment - per lump sum
- Item AR109901 Remove Electrical Vault - per lump sum
- Item AR109924 Replace Electric Services- per lump sum