

DATE: December 14, 2021

DEPARTMENT OF GENERAL SERVICES  
BUREAU OF CAPITAL PROJECT DESIGN MANAGEMENT  
1800 HERR STREETS  
HARRISBURG, PENNSYLVANIA

**ADDENDUM NO. 7**

on

**PROJECT NO. DGS C-0509-0038 PHASE 001**

**PROJECT TITLE - Norristown State Hospital - Demolition and Remediation**

**PROFESSIONAL:**

SAA Architects  
600 North Hartley St  
York, PA, 17404

**If you submitted a bid through e-Builder prior to this Addendum being issued, your bid has been discarded and you must re-submit your bid(s) through e-Builder prior to the bid opening date and time. Please see Section 4.C. of the Instruction to Bidder**

**GENERAL CHANGES – ALL CONTRACTS**

Item 1 – Bid Documents - Unit Price Schedule (.1) General Construction, Page 6, Buildings 5 and 11: **CHANGE** UNIT OF MEASUREMENT from “Total LF” to “Each.” These lines refer to window units and door units.

Item 2 - Bid Documents - Unit Price Schedule (.1) General Construction, Page 6: **ADD** the line: Building 57, Material - Concrete Caulk, Unit of Measure - LF, Quantity in Lump Sum Bids 1, 2 and 3 - 1,242 LF. Provide Unit Price at end.

Item 3- Bid Questions and Responses: See Attached Document 01-2021-12-14-addnd007-rfi.

**SPECIFICATIONS - ALL CONTRACTS**

Item 1 - **REPLACE** Specification section 263213.13 in its entirety with the section attached as document 03-263213.13 Diesel-Engine-Driven Generator Sets. Further clarifications have been provided.

Item 2 - Specification Section 028400, PCB REMEDIATION AND WASTE MANAGEMENT, paragraph 1.2 C, Table: **ADD** the line: Building 57, Material - Concrete Caulk, Approximate Quantity - 1,242 LF.

**DRAWING CHANGES -ALL CONTRACTS**

N/A

DEPARTMENT OF GENERAL SERVICES  
BUREAU OF PRE-CONSTRUCTION  
1800 HERR STREET  
HARRISBURG, PENNSYLVANIA  
**ADDENDUM NO. 7**

**PROJECT NO. DGS C-0509-0038 PHASE 001  
DEMOLITION OF BUILDINGS/STRUCTURES AND REMEDIATION,  
1001 STERIGERE STREET, NORRISTOWN, MONTGOMERY COUNTY, PA, 19401**

**SAA ARCHITECTS, 600 NORTH HARTLEY STREET, SUITE 500, YORK, PA 17404**

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N/A

## BID QUESTIONS AND RESPONSES

1. Reference drawing EC1.0: Please clarify if the FO cable shown on this drawing is provided by Verizon or by the contractor. **RESPONSE: Fiber Optics cable shown on EC1.0 is provided by Verizon.**
2. Reference drawing EP0.4, drawing note 3: please verify any spoils that are being removed can be disposed of at a standard landfill. **RESPONSE: Each landfill has rules about the types of materials that are acceptable. You will only be able to dispose where acceptable.**
3. Are contractors employees required to be vaccinated to work on this project site? **RESPONSE: See Addendum 006, 2021.12.10.**
4. Will any of the buildings that the Electrical Contractor will be working in be occupied? Will there be restricted access? **RESPONSE: Yes - Building 19 is intersected by a utility tunnel that coincides with the basement. Electrical wires and communications fiber will be reconfigured in this tunnel. Buildings 22 and 29 have steam line terminations at interior junctions. Access will be restricted by the rules for COVID protection listed in Addendum 006.**
5. Please confirm that the Lift station in section 333200 will be provided and installed by GC (.1) Contract, and electrical connection will be installed by EC (.4) Contract. **RESPONSE: (0.1) GC provides foundation, slab, pumping mechanism with all controls and accessories. (0.4) provides power to the equipment.**
6. On drawing AD-101-5 it calls out for 8' chain link fence, and in section 323113 CHAIN LINK FENCES and GATES it calls out for temporary chain link fence in part 1.2 summary. But in Part 2- Product, and Parts 3- Execution its designed for permanent Fencing with post driven, barb wire, and fabric. Please clarify if Chain Link Panels with sandbags/ concrete anchors are acceptable as temporary fencing. **RESPONSE: Sand bags and concrete anchors are acceptable. Section 323113 is applicable to permanent fencing around generator and sewage lift station and not to temporary fencing.**
7. Question for bldg. 57 On Haz mat drawing number HA 113 is shows PCB concrete caulking but it is not listing in the scope of work on page 022900-3 Misc Hazmat abatement. Which is correct? **RESPONSE: The paragraph preceding the table says that the list may not be complete. See the table on HA-100 for quantities of PCB Concrete Caulk. It quantifies the caulk that is not listed on building 57.**
8. Reference Addendum 5, Spec Change Item #3: this states "Replace Specification section 263213.13 in its entirety with the enclosed section 263213.13 Diesel-Engine-Driven Generator Sets. Further clarifications have been provided." There are no revised specs for 263213.13 in Addendum 5. Please provide the revised specs for 263213.13. **RESPONSE: We re-attached the section to this addendum.**

9. Reference Drawings EP0.0-EP0.4, addendum #5 response to question #42 indicates that all existing electrical ductbanks are to be abandoned in place after the wiring is removed. Please verify that the intent is to remove the entire manhole and all accessories, referenced by demo note E1 on these drawings, but the existing electrical ductbanks that connect to them are just abandoned in place. **RESPONSE: Confirmed.**
10. We are getting question about unit Price Schedule from our subcontractors? The Unit Price Schedule Page 6 shows for PCB Window Caulk/Glazing and PCB Door Caulk unit of measurement state "Total LF". Should this unite be "EA" otherwise the cost 229 LF PCB Window Caulk/Glazing would not cover the cost the entire 229 Windows. Please advise? **RESPONSE: Yes - and 'EA' refers to a single window or door.**
11. When is the proposal due? All indications in the spec say the proposal deadline is 12/2/21 however the timer on e-builder says that the proposals are not due until 12/13/21. Please change the due date officially through an addendum, or correct the info on e-builder. **RESPONSE: Changed by addendum 006 to Friday, December 17.**
12. Can the Department provide the PCB analytical results for the caulk and oil materials, this information is needed to determine disposal costs. **RESPONSE: Analytical results are not available.**
13. Attention is directed to the fact that the drawings and overall system design are based on a particular piece of equipment from a particular manufacturer. These specifications are intended to provide guidelines for standard equipment of a recognized manufacturer who already meets all the requirements of this specification." Please Identify particular piece of equipment and the particular manufacturer. **RESPONSE: Provide a Simplex Brand 4100 ES Fire Alarm Network FACU in accordance with the Construction Drawings and Specifications.**
14. are there any boring testing logs are available for this site? **RESPONSE: There are none.**
15. ITEM 21: IS THE ENTIRE 45000 LF OF PIPE WRAP EXPOSED OR WILL IT REQUIRE SOME SELECTIVE DEMO TO ACCESS IN ORDER TO REMOVE?? **RESPONSE: No selective demolition.**
16. Do unit prices for environmental need to be supplied with the proposal? **RESPONSE: Yes.**
17. We do not see place for acknowledgement of addendum, where is this to be done if at all? **RESPONSE: Please acknowledge each addendum in your submittal. If not found in the eBuilder instructions, send to TDOLAN@pa.gov.**

SECTION 263600TRANSFER SWITCHESPART 1 - GENERAL

## 1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 - General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

## 1.2 SUMMARY

## A. Section Includes:

1. 400 Amp Automatic Transfer Switch
2. 100 Amp Automatic Transfer Switch

## 1.3 ACTION SUBMITTALS

## A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

## B. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Include material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

## 1.4 INFORMATIONAL SUBMITTALS

## A. Qualification Data: For manufacturer-authorized service representative.

## B. Seismic Qualification Data: Certificates, for transfer switches, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Features and operating sequences, both automatic and manual.
  - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

#### 1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Member company of NETA.
  - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

#### 1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Department or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Department no fewer than 5 working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Department's written permission.

#### 1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Caterpillar, Inc.; Electric Power Division.
  - 2. Cummins Power Generation.
  - 3. Generac.
  - 4. Kohler Power Systems.
  - 5. Or approved equal.
- B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
  - 2. Short-time withstand capability for three cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Neutral Terminal: Solid and fully rated unless otherwise indicated.

- L. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- M. Battery Charger: For generator starting batteries.
  - 1. Float type, rated 10 A.
  - 2. Ammeter to display charging current.
  - 3. Fused ac inputs and dc outputs.
- N. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- O. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed tape or shrinkable sleeve markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
  - 4. Accessible via front access.
- P. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.3 400 AMP AUTOMATIC TRANSFER SWITCH

- A. Equipment
  - 1. Furnish and install an automatic transfer switches system(s) with 3-Pole / 4-Wire, Solid Neutral, 400 Amps, 208V/60Hz. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.
- B. Manufacturer
  - 1. Automatic transfer switches shall be similar to Kohler Service Entrance Rated - Programmed Transition (KEP)/KEP-DCTA-0400#NN.
- C. Enclosure
  - 1. The ATS shall be furnished in a NEMA 1 enclosure.
  - 2. All standard door mounted switches and indicating LEDs shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall be capable of having a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.



D. Controls

1. A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and control through the communications interface port or USB. The following parameters shall only be adjustable via a password protected programming on the controller:
  - a. Nominal line voltage and frequency
  - b. Single or three phase sensing
  - c. Operating parameter protection
  - d. Transfer operating mode configuration (Standard transition, Programmed transition, or Closed transition)

E. Voltage and Frequency

1. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

a. Parameter	Dropout/Trip	Pickup/Reset
b. Under voltage	75 to 98%	85 to 100%
c. Over voltage	106 to 135%	95 to 100% of trip
d. Under frequency	95 to 99%	80 to 95%
e. Over frequency	01 to 115%	105 to 120%
f. Voltage unbalance	5 to 20%	3 to 18%
2. Repetitive accuracy of all settings shall be within  $\pm 0.5\%$  over an operating temperature range of  $-20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .
3. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.
4. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.
5. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
6. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
7. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

2.4 100 AMP AUTOMATIC TRANSFER SWITCH

A. Equipment

1. Furnish and install an automatic transfer switches system(s) with 3-Pole / 4-Wire, Solid Neutral, 100 Amps, 208V/60Hz. Each automatic transfer shall consist of an inherently

double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

B. Manufacturer

1. Automatic transfer switches shall be similar to Kohler Service Entrance Rated - Programmed Transition (KEP)/KEP-DCTA-0100#MM.

C. Enclosure

1. The ATS shall be furnished in a NEMA 1 enclosure.
2. All standard door mounted switches and indicating LEDs shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall be capable of having a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

D. Controls

1. A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and control through the communications interface port or USB. The following parameters shall only be adjustable via a password protected programming on the controller:
  - a. Nominal line voltage and frequency
  - b. Single or three phase sensing
  - c. Operating parameter protection
  - d. Transfer operating mode configuration (Standard transition, Programmed transition, or Closed transition)

E. Voltage and Frequency

1. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

a.	Parameter	Dropout/Trip	Pickup/Reset
b.	Under voltage	75 to 98%	85 to 100%
c.	Over voltage	106 to 135%	95 to 100% of trip
d.	Under frequency	95 to 99%	80 to 95%
e.	Over frequency	01 to 115%	105 to 120%
f.	Voltage unbalance	5 to 20%	3 to 18%

2. Repetitive accuracy of all settings shall be within  $\pm 0.5\%$  over an operating temperature range of  $-20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .
3. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.
4. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.

5. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
6. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
7. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

## 2.5 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
  1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
    - a. Overvoltage.
    - b. Undervoltage.
    - c. Loss of supply voltage.
    - d. Reduction of supply voltage.
    - e. Alternative supply voltage or frequency is at minimum acceptable values.
    - f. Temperature rise.
    - g. Dielectric voltage-withstand; before and after short-circuit test.
    - h. Overload.
    - i. Contact opening.
    - j. Endurance.
    - k. Short circuit.
    - l. Short-time current capability.
    - m. Receptacle withstand capability.
    - n. Insulating base and supports damage.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Annunciator and Control Panel Mounting: Surface mounted unless otherwise indicated.
- B. Identify components according to Section 260553 "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

- D. Comply with NECA 1.

### 3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, motor controls, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Department if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Connect twisted pair cable according to Section 260523 "Control-Voltage Electrical Power Cables."
- G. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- H. Brace and support equipment according to Section 260548.16 "Seismic Controls for Electrical Systems."
- I. Final connections to equipment shall be made with liquid tight, flexible metallic conduit no more than 18 inches in length.

### 3.3 FIELD QUALITY CONTROL

- A. Administrant for Tests and Inspections:
  - 1. Department will engage qualified testing agency to administer and perform tests and inspections.
  - 2. Engage qualified testing agency to administer and perform tests and inspections.
  - 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
  - 4. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- B. Tests and Inspections:
  - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
  - 2. Visual and Mechanical Inspection:

- a. Compare equipment nameplate data with Drawings and Specifications.
  - b. Inspect physical and mechanical condition.
  - c. Inspect anchorage, alignment, grounding, and required clearances.
  - d. Verify that the unit is clean.
  - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
  - f. Verify that manual transfer warnings are attached and visible.
  - g. Verify tightness of all control connections.
  - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
    - 1) Use of low-resistance ohmmeter.
    - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
  - i. Perform manual transfer operation.
  - j. Verify positive mechanical interlocking between normal and alternate sources.
  - k. Perform visual and mechanical inspection of surge arresters.
  - l. Inspect control power transformers.
    - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
    - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
    - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
3. Electrical Tests:
- a. Perform insulation-resistance tests on all control wiring with respect to ground.
  - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
  - c. Verify settings and operation of control devices.
  - d. Calibrate and set all relays and timers.
  - e. Verify phase rotation, phasing, and synchronized operation.
  - f. Perform automatic transfer tests.
  - g. Verify correct operation and timing of the following functions:
    - 1) Normal source voltage-sensing and frequency-sensing relays.
    - 2) Engine start sequence.
    - 3) Time delay on transfer.
    - 4) Alternative source voltage-sensing and frequency-sensing relays.
    - 5) Automatic transfer operation.
    - 6) Interlocks and limit switch function.
    - 7) Time delay and retransfer on normal power restoration.
    - 8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
- a. Check for electrical continuity of circuits and for short circuits.

- b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
  - c. Verify that manual transfer warnings are properly placed.
  - d. Perform manual transfer operation.
5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
- a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
  - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
  - c. Verify time-delay settings.
  - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
  - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
  - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
  - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
- a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Transfer switches will be considered defective if they do not pass tests and inspections.
- F. Remove and replace malfunctioning units and retest as specified above.
- G. Prepare test and inspection reports.
- H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
- 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  - 3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Department's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION