

ADDENDUM NUMBER FOUR (4)

Date: January 13, 2021

Project Name: Fire Station #20
4445 Medgar Evers
Jackson, Mississippi

CCD Project No. Canizaro Cawthon Davis - 16004
City of Jackson - 15B7003.401

Copies To: All bid document holders of record
Owner
Civil Tech, Inc
Spencer Engineers, Inc.
Innovative Engineering Services, LLC
City Building Department

A Professional Association
Gregory D Cawthon AIA
T Steven Davis AIA

The following changes, additions, deletions, clarifications and/or substitutions to the project manual dated November 17, 2020, and Drawings dated January 15, 2018 (Revised November 17, 2020) are hereby made part of the Contract Documents. Receipt of this addendum shall be acknowledged by inserting its number and date in the Bid Proposal Form where indicated.

REFER TO ADDENDA

3.1 Change Date on Addenda 3 to January 12, 2021.

REFER TO THE SPECIFICATIONS

3.2 Replace the following specification sections with attached revised specification sections.

1. Replace Section 16231 - Engine Generators with Section 16231R – Engine Generators (Revised)
2. Replace Section 16415 - Transfer Switches with Section 16415R – Transfer Switches (Revised)

REFER TO DRAWINGS

- 3.3 Drawing C-1.0 Clarification. All pavement edge curbs are Curb and Gutter as noted on the drawings and as detailed. See detail 8/C4.0.
- 3.4 Drawing C-4.0, Detail 8. The dowels and joint between concrete paving and concrete curb and gutter is not required. Clarification: Concrete curbs at asphalt paving shall be curb and gutter similar to this detail.
- 3.5 Drawing C-6.0, Detail 2 – Concrete Paving Details. Delete this detail. There is no Dumpster Approach Slab.

END OF ADDENDUM NUMBER THREE (4)

SECTION 16231R

ENGINE GENERATORS (Revised)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes trailer mounted, portable, packaged engine-generator sets for emergency power supply with the following features:
 - 1. Natural gas engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted control and monitoring.
 - 4. Outdoor enclosure.
- B. See Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 SUBMITTALS

- A. Product Data: For each type of packaged engine generator and accessory indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Source quality-control test reports.
- D. Field quality-control test reports.
- E. Operation and maintenance data.
- F. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASME B15.1.
- D. Comply with NFPA 37.
- E. Comply with NFPA 70.
- F. Comply with NFPA 99.

- G. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- H. Comply with UL 2200.
- I. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- J. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.4 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet (300 m).

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary 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 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - 2. Output Connections: Three-phase, four wire.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.2 ENGINE

A. Fuel:

1. Natural gas.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Natural Gas:
 - a. Carburetor.
 - b. Secondary Gas Regulators: .
 - c. Fuel-Shutoff Solenoid Valves: .
 - d. Flexible Fuel Connectors: .

- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. Governor: Adjustable isochronous, with speed sensing.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- I. Muffler/Silencer: Industrial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1. Minimum sound attenuation of 12 dB at 500 Hz.
 - 2. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge after installation is complete shall be 75 dBA or less.
- J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 12-V electric, with negative ground.
 - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: 15 seconds.
 - 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
 - 5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 - a. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.

2.3 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:
 - 1. AC voltmeter.
 - 2. AC ammeter.
 - 3. AC frequency meter.
 - 4. DC voltmeter (alternator battery charging).
 - 5. Engine-coolant temperature gage.
 - 6. Engine lubricating-oil pressure gage.
 - 7. Running-time meter.
 - 8. Ammeter-voltmeter, phase-selector switch(es).
 - 9. Generator-voltage adjusting rheostat.
 - 10. Generator overload.
- E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.4 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
 - 5. Circuit breaker must be service entrance rated.

2.5 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 20 percent, maximum.

2.6 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
- C. Lights with Switch: Vaporproof-type fixtures within or outside of housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - 1. AC lighting system and connection point for operation when remote source is available.
 - 2. DC lighting system for operation when remote source and generator are both unavailable.
- D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.7 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.9 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
 - 2. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with elastomeric isolator.
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."
 - 1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."

- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- F. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.
- G. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- H. Connect engine exhaust pipe to engine with flexible connector.
- I. Connect fuel piping to engines with a gate valve and union and flexible connector.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- L. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 7. Exhaust Emissions Test: Comply with applicable government test criteria.
 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at a location 23 feet away, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 16415 R

TRANSFER SWITCHES (Revised)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes automatic transfer switches rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned 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.
- D. Field quality-control test reports.
- E. Operation and maintenance data.
- F. Provide (5) five year warranty for ATS

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 70.
- D. Comply with NFPA 99.

- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Service Entrance Rated: ATS shall be service entrance rated or a disconnect may be provided between the utility and ATS.
- B. 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.
- C. Tested Fault-Current Closing and Withstand 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.
- D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- H. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

- J. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- K. Enclosures: General-purpose NEMA 250, Type 3, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.
- F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
- G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.
- H. Automatic Transfer-Switch Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.3 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.
- B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. 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, 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 of 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. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - f. 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. Remove and replace malfunctioning units and retest as specified above.
- F. 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. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. 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.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION