ADDENDUM NO. 1

FOR

REPLACEMENT OF EXISTING WESTON WASTEWATER PUMPING STATION

FOR

THE HOUSING AUTHORITY OF HAMILTON, ALABAMA

PROJECT NO. 53-09

FEBRUARY 25, 2019

TO: ALL PLAN HOLDERS AND INTERESTED PARTIES

SUBJECT: Plans, Specifications, and Contract Documents are hereby amended, modified, and changed as follows:

I. Reference Part VI – Technical Specifications

A. Add the following attached Division No. 16 – Electrical Specifications at the end of Part VI – Technical Specifications:

Table of Contents

16000	Electrical Work
16231	Generator and Automatic Transfer Switch

II. Electrical Plans

A. Add the attached Electrical Plans, Sheet E1 and E2

THIS ADDENDUM ISSUED THIS 25TH DAY OF FEBURARY 2019.

LADD ENVIRONMENTAL CONSULTANTS, INC

James Payton

James Payton, P.E.

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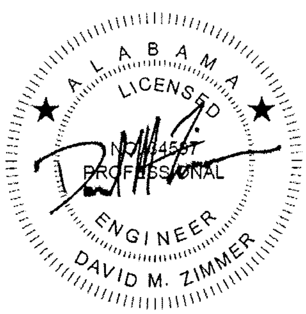
PART VI – TECHNICAL SPECIFICATIONS
(Continued)



2-25-2019

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SECTION 16000
ELECTRICAL WORK

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Work described in this section shall consist of furnishing, installing, and connecting all panels, generators, lift station pumps control panel, motor starters, lighting fixtures, circuit breakers, disconnect switches, and all other equipment shown or otherwise indicated in the Contract Documents.

B. Contractor shall furnish all material and labor to perform the work.

C. See electrical drawings for additional requirements.

1.02 CODES AND STANDARDS

A. Work performed under this section shall conform to the 2017 edition of the National Electrical Code.

B. Equipment and material furnished under this section shall be new, unused, and shall be manufactured to the following standards:

1. I.E.E.E. - Institute of Electrical & Electronic Engineers.
2. A.N.S.I. - American National Standards Institute.
3. U.L. - Underwriters Laboratories, Inc.
4. I.C.E.A. - Insulated Conductor Engineers Association.

1.03 POWER SERVICE

A. The contractor shall provide power to the pump station. The contractor shall coordinate service to the pump station and provide all poles, weather heads, and metering equipment necessary. The contractor is responsible for keeping the existing pump station in service at all times until the new pump station is ready.

B. Contractor shall furnish and install service entrance conduits and cables. The utility rack location shall be coordinated with the owner.

C. Contractor shall furnish and install metering equipment including conduits and cables as required by the power company.

1.04 SHOP DRAWINGS

A. Contractor shall submit six (6) copies of shop drawings for main circuit breakers, pump control panels, autodialer, conduit, light fixtures, and motor starters for conformity with Contract Documents. Catalog cuts shall be submitted for lightning arrestor, wiring devices, lighting fixtures, circuit breakers, conduit and cables.

B.

PART 2 - PRODUCTS

2.01 CONDUITS

A. Rigid conduits shall be hot-dipped galvanized steel.

B. Electrical metallic tubing shall not be used at any location.

C. Liquid-tight flexible conduits shall be used for final connection to motors.

D. Conduits shall be U.L. listed.

E. Schedule 40 PVC conduits shall be provided for underground installation. Provide PVC to steel adapters and rigid galvanized steel elbows where an underground conduit is to be stubbed up. Exposed extension of the conduit shall be rigid galvanized steel.

2.02 CABLES

A. The 600-volt underground service entrance and motor feeder conductors shall be U.L. listed as "THHN/THWN".

B. Conductors shall be copper. Minimum size for power and lighting conductors shall be #12 AWG.

C. Control cables shall be type XHHW, stranded copper, minimum size #14 AWG.

D. Signal cables shall be twisted and shielded, #16 AWG minimum.

E. Cables shall be U.L. listed and shall be manufactured by G.E., General Cable, Rome, Bolden, Collyer, or equal.

2.03 LIGHTNING ARRESTORS

The lightning arrestors shall be suitable for connection to electrical system shown on drawings. The lightning arrestors shall be listed. See drawing for additional information.

2.04 GROUNDING

A. Contractor shall furnish and install grounding system as shown on Drawings. The contractor shall perform a ground test (fall of potential method) and report data to engineer for final approval. Ground test shall be performed on a dry day and 3 days after last rainfall.

2.05 MAIN CIRCUIT BREAKER

A. The main circuit breaker shall be in NEMA-4X Stainless Steel enclosure with external operating handle with provision to padlock in both "on" and "off" positions, and shall have a minimum interrupting capacity of 35,000 A. RMS symmetrical. The main circuit breakers shall be U.L. listed for service entrance. The main breaker shall be by Square D, Cutler Hammer, or GE.

PART 3 - EXECUTION

3.01 PERMITS AND INSPECTION

A. The Contractor shall obtain all necessary permits to perform the work and arrange for inspection by authorities having jurisdiction. Contractor shall pay all necessary fees.

3.02 GUARANTEES AND TESTS

A. Work shall be guaranteed for 12 months after date of acceptance. Work shall be free from improper grounds and short circuits. All control systems shall be checked for proper operation.

3.04 COORDINATION

A. Work under this Section shall be coordinated with that of other trades. Outlets, switches, fixtures, etc., shall be relocated to avoid interference with other work at no additional cost to Owner.

END OF SECTION

SECTION 16231
GENERATOR AND AUTOMATIC TRANSFER SWITCH

1) **Submittal**

a) The submittal shall include test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

b) The NATURAL GAS generator set including generator and automatic transfer switch shall be by Kohler, Caterpillar or Cummins.

c) See drawings for Generator and ATS voltage and amp ratings.

d) Generator Vendor shall submit generator sizing calculations and a Letter of Guarantee stating that the submitted generator has been properly sized.

2) **Testing**

a) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

i) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.

(1) Maximum power (kW).

(2) Maximum motor starting (kVA) at 30% instantaneous voltage dip.

(3) Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-22.40 and 16.40.

(4) Governor speed regulation under steady-state and transient conditions.

(5) Voltage regulation and generator transient response.

(6) Fuel consumption at 1/4, 1/2, 3/4, and full load.

(7) Harmonic analysis, voltage waveform deviation, and telephone influence factor.

(8) Three-phase short circuit tests.

(9) Alternator cooling air flow.

(10) Torsional analysis to verify that the generator set is free of harmful torsional stresses.

(11) Endurance testing.

b) **Production Tests**

i) Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

ii) Single-step load pickup.

iii) Transient and steady—state governing.

iv) Safety shutdown device testing.

v) Voltage regulation.

vi) Rated Power @ 0.8 PF

vii) Maximum Power.

viii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

c) **Site Tests**

i) Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

ii) Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

iii) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.

iv) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.

v) Automatic start-up by means of simulated power outage to test remote- automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate kW rating.

3) **Warranty & Maintenance**

a) The generator set shall be guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty for one year from date of start-up. Optional warranties shall be available upon request.

b) The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

4) **Equipment**

a) Refer to the electrical drawings for generator size and operating voltage. The generator set shall be sized while operating in an ambient condition of 85°F (67.2°C) and 900 feet above sea level. The generator set shall be capable of starting motor loads, with a maximum voltage dip of 25% and shall be capable of starting and running the loads as indicated on the drawings.

5) **Engine**

a) The engine shall be equipped with the following:

i) An isochronous governor capable of +.25% steady-state frequency regulation.

ii) 24 Volt positive engagement solenoid shift-starting motor.

iii) 40-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.

iv) Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

v) Dry-type replaceable air cleaner elements for normal applications.

b) The turbocharged engine shall be fueled with NATURAL GAS and be supplied with a unit-mounted electric solenoid fuel shut-off valve.

c) The engine shall have a minimum of 3 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H20 static pressure on the fan in an ambient temperature up to 122F/50C.

6) **Generator**

a) The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be

isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.

b) The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2.

c) The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

d) The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

7) **Controller**

a) Standards

i)Control must meet NFPA-110 Level 1 requirements (1996 version) and must have an integral alarm horn as required by NFPA.

ii) NFPA-99 and NEC must also be accommodated.

iii) The generator set control must be listed under UL 508.

b) Applicability

i)For standardization purposes, the control functionality described herein must be available on generator sets 15 kW and larger.

ii) The control must be usable on 12- or 24-volt starting systems.

iii) Environment
(1) -40°C to +70°C operating temperature range
(2) 5-95% humidity, non condensing

iv) It shall be possible to mount the control on the generator set or remotely within 40 feet of the generator set.

c) Hardware Requirements

i)The control shall have an industrial type run-off/reset-auto three-position selector switch.

ii) A controller mounted emergency stop push button must be supplied.

iii) It shall be possible to adjust alternator output voltage at the control.

iv) Five indicating lights:
(1) system ready - green

(2) not in auto - yellow
(3) programming mode - yellow
(4) system warning - yellow
(5) system shutdown - red

v) Lighted display with two lines of 20 alphanumeric characters for messages.

vi) Sixteen position snap action sealed keypad for menu selection and data entry.

vii) For ease of use, an operating guide must be on the controller face plate.

d) Control Function Requirements

i)Field programmable time delay for engine start. Adjustment range, 0-5 minutes in 1 second increments.

ii) Field programmable time delay engine cooldown. Adjustment range, 0-10 minutes in 1 second increments.

iii) Real time clock and calendar for time stamping of events.

iv) Output with adjustable timer for starting aid. Adjustment range, 0-10 seconds.

v) Output for shedding of loads if the generator reaches 100% of its kW rating or the generator output frequency falls below 59 Hz (60 Hz system) or 49 Hz (50 Hz system).

vi) Programmable cyclic cranking that allows up to six crank cycles and up to 45 seconds of crank time.

vii) The capability to reduce controller current battery draw, for applications where no continuous battery charging is present, must be provided.

e) Generator System Monitoring Requirements

i)All monitored functions must be viewable on the digital display.

ii) The following generator functions must be monitored:
(1) all output voltages—single phase, three phase, line to line, and line to neutral
(2) all single phase and three phase currents
(3) output frequency
(4) system power factor
(5) total instantaneous kilowatt loading
(6) a display of percent generator duty level—actual kW loading divided by the kW rating

iii) Engine parameters listed below shall be monitored:
(1) coolant temperature both in English and metric units
(2) oil pressure in English and metric units
(3) battery voltage
(4) rpm

iv) Operational records since system start up must be stored in the controller.

(1) run time loaded
(2) run time unloaded
(3) number of starts
(4) number of days of operation
(5) system start date
(6) last run data including date, duration, and whether loaded or unloaded
(7) kilowatt hours

v) The following operational records must also be available in a resetable form for maintenance purposes:
(1) run time loaded
(2) run time unloaded
(3) kW hours
(4) days of operation
(5) number of starts
(6) start date after reset

vi) The controller must store the last four generator system fault shutdowns with date of shutdown and reason for shutdown.

vii) For maintenance and service purposes, the following information must be stored in the control and displayed on demand:
(1) manufacturer's model and serial number
(2) battery voltage
(3) kilowatt rating
(4) system voltage
(5) system frequency
(6) number of phases

f) The control must be capable of detecting the following conditions, indicate if the condition will shutdown the generator or provide a warning, and annunciate the situation, using words and phrases, on the digital display.

i)Will cause a system shutdown:
(1) air damper tripped (if used)
(2) customer auxiliary input on (any of the four inputs available)
(3) emergency stop
(4) high coolant temperature
(5) high oil temperature
(6) controller internal fault
(7) locked rotor
(8) low coolant level
(9) low oil pressure
(10) NFPA common alarm
(11) overcrank
(12) overspeed with user adjustable level
(a) range 65-70 Hz on 60 Hz systems and 55-70 Hz on 50 Hz systems
(13) output overvoltage with user adjustable level
(a) range 105% to 135%
(14) underfrequency with user adjustable level
(a) range 80% to 90%

(15) undervoltage with user adjustable level
(a) range 70% to 95%

ii) Will cause a warning but leave the generator running:
(1) battery charger failure
(2) coolant temperature gauge signal loss
(3) customer auxiliary input on (any of the four inputs available)
(4) power system supplying load
(5) ground fault detected—detection by others
(6) high battery voltage—Level must be user adjustable.
(a) Range 14.5 to 16.5 volts for 12-volt systems
(b) and 29-33 volts for 24-volt systems.
(7) high coolant temperature
(8) load shed
(9) low output voltage
(10) low battery voltage—Level must be user adjustable.
(a) Range 10-12.5 volts for 12 volt systems
(b) and 20-25 volts for 24 volt systems.
(11) low coolant temperature
(12) low fuel level or pressure
(13) low oil pressure
(14) NFPA common alarms
(15) overcurrent
(16) oil pressure gauge signal loss
(17) speed sensor fault
(18) weak battery

g) System Programming

i)It must be possible to disable programming so the system can only be monitored.

ii) It shall be possible to program the control with the controller keypad or using an IBM compatible personal computer.

iii) Programming access must be password protected.

iv) The following must be programmable from the controller keypad:
(1) Time delay settings:
(a) generator run time (0 to 72 hours)
(b) enable times for auxiliary inputs
(c) engine start
(d) engine cooldown
(e) overvoltage and undervoltage delays
(f) starting aid
(g) crank on and crank pause time
(2) Trip point settings:
(a) high battery voltage
(b) low battery voltage
(c) overspeed
(d) underfrequency
(e) overvoltage

(f) undervoltage

h) Inputs and Outputs

i)Inputs

(1) There shall be four dry contact inputs that can be user configured to shutdown the generator or provide a warning.

(2) It shall be possible to define each user configured input using words or phases that will be viewable on the digital display.

(3) Additional standard inputs required:

(a) Input for an external ground fault detector. Digital display must show "ground fault" upon detection of a ground fault.

(b) Reset of system faults.

(c) Remote two wire start.

(d) Remote emergency stop.

ii) Outputs

(1) All NFPA 110 Level 1 outputs must be available.

(2) There shall be ten outputs available for interfacing to other equipment:

(a) Any of these outputs shall be able to be user configured from a list of over 25 functions and faults.

(b) These outputs shall be dry contacts.

(3) "Generator Running" and "Generator Common Fault" dry contacts rated for 5 Amp, 120VAC shall be provided for remote indication..

i) Communications

i)The controller must have the optional capability to communicate to a personal computer (IBM or compatible).

ii) It shall be possible to add this capability in the field using plug connected modules.

iii) Both RS-232 and RS-485 communication formats must be supported.

iv) A variety of connections shall be available based on requirements:

(1) A single connection to a PC. A cable length of up to 4000 feet must be supported.

(2) A single connection from a device to a PC over phone lines.

v) When equipped with communications modules, transfer switches along with the generator controller must be able to be connected to the same communication network with no additional interfaces being required.

vi) Cabling is to be device-to-device in a daisy chain fashion with no limitation on device locations within the network.

vii) The network must be self-powered. No power wiring between devices is allowed.

8) **Accessories**

a) Line circuit breaker shall be sized as shown on the drawings. Breaker shall be UL molded case type, generator mounted and rated for service entrance.

b) Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.

c) Generator housing shall be weather and sound attenuated (75db at 23 feet). Housing shall be constructed of rugged aluminum, cleaned, phosphated, and electrocoat painted inside and out with rust inhibiting primer and exterior coat of the manufacturer's standard color. Side panels will be lockable and easily removed for servicing.

d) Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.

e) 12-volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.

f) 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.

g) The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).

h) Two flexible fuel lines rated 300°F and 100 psi ending in pipe thread.

1) **Compliance With Codes and Standards**

a) The ATS shall conform to the requirements of:

i) UL 1008--Standard for Automatic Transfer Switches

ii) NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700

iii) NFPA 99--Essential Electrical Systems for Health Care Facilities

iv) NFPA 110--Standard for Emergency and Standby Power Systems

v) IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book)

vi) IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)

vii) NEMA Standard ICS 2-447 Automatic Transfer Switches.

9) **Automatic Transfer Switch**

a) Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.

b) The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated 400 amperes and below shall be suitable for 100% tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.

c) The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.

10) **Mechanical Requirements**

a) All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.

b) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

c) The contact transfer time shall not exceed one-sixth of a second.

d) All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.

e) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

f) The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

11) **Equipment**

a) Refer to the drawings for transfer switch ratings.

b) The ATS shall be furnished in a NEMA 4X stainless steel enclosure.

c) The switch shall be a 600 volt class.

d) The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps

e) The withstand and closing ratings with any overcurrent protective device shall be 35,000 Amps

12) **Transfer Switch Control System**

a) The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.

i) The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

b) The control module shall include programming keypad, alphanumeric display for monitoring settings and diagnostic values, key-lockable program selector switch, light-emitting diode status indication, and user instructions. These features shall be user accessible when the enclosure door is closed.

c) The control module shall be capable of storing the following records in memory for access either locally (at the control module) or remotely (at a computer):

i) Number of hours transfer switch is in the emergency position (total and since record reset)

ii) Number of hours the emergency is available (total and since record reset)

iii) Total days that control has been energized (total and since record reset)

iv) Total transfers in either direction (total and since record reset)

v) Date of record reset

vi) Date of last exercise period

vii) Date, time, and description of the last four source failures

viii) Elapsed time during the most recent source outage

13) **Operation**

a) Source Voltages

i) The voltage of each phase of the normal source and a single phase of the emergency source shall be monitored with pickup adjustable from 75% to 100% and dropout adjustable from 70% to 95% of nominal. Adjustment must be digital.

ii) An automatic minimum differential of 2% shall be maintained between pickup and dropout settings.

iii) Repetitive accuracy of the setting shall be ±2% or better over an operating temperature range of -20°F to 150°F (-29°C to 65.5°C).

iv) The settings shall be fully field-adjustable by keypad or keyboard (local or remote) in increments of 1 Volt without opening the enclosure door and without the use of special tools or separate meters.

v) Factory settings shall be pickup at 90% and dropout at 85%.

vi) A light-emitting diode shall indicate that normal and/or emergency voltage is within the set point parameter. The indication shall be viewable when the enclosure door is closed.

b) Time Delays

i) The control module shall include four time delays that are fully field-adjustable by keypad or keyboard in increments of 1 second over the entire range.

ii) Adjustments and viewing of the time delay values shall be accessible when the enclosure door is closed.

iii) Light emitting diodes shall indicate when the timing feature is running and when the time delay has ended.

iv) Required Time Delays

(1) Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 5 seconds.

(2) Time delay for transfer to emergency: Range 0-5 minutes. Factory set at 5 seconds.

(3) Time delay for transfer back to normal: Range 0-30 minutes. Factory set at 5 seconds.

(4) Time delay for engine cooldown: Range 0-30 minutes. Factory set at 5 seconds.

v) Input values outside the allowable parameters shall cause a "range error" message to be displayed.

c) The user shall have the ability to manually program an engine start and run for a period of up to 72 hours in the loaded or unloaded mode of operation. The time delay transfer to emergency and/or normal may be bypassed during the run period. A numeric indication shall be displayed of the run time remaining in hours and minutes. The run period may be stopped at any time with a single keystroke. After the run period has stopped, the engine shall run unloaded for the cooldown time.

d) User terminals shall be available to connect a normally closed contact that, when opened, signals the control module to start and transfer load to the engine-generator. Closing these contacts shall initiate a retransfer and engine cooldown sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.

e) The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field by installing an insulated program jumper provided by the vendor as standard.

i) Anti-single phasing protection shall detect regenerative voltage as a failed source condition.

ii) In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal.

iii) Manual operation override shall function to bypass any manual switch accessories if the source to which the transfer switch is positioned fails. This program jumper shall be factory installed.

iv) Plant Exerciser: Programmable seven-day, fourteen-day or calendar exerciser. Each exerciser mode shall be capable of performing up to two exercise runs in up to five exercise event periods. The exerciser period shall be programmed with the enclosure door closed. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated.

v) All phases of normal and all or single phases of emergency shall be monitored for overvoltage and single phase of normal and emergency for over- and under-frequency. The values shall be programmed with the enclosure door closed.

vi) Extended Time Delay: Allows the time delay settings to be extended to 99 minutes.

f) Status Indicators

i) Light-emitting diodes shall indicate the status of the following:

ii) Contactor Position

iii) System Status

(1) Transfer Switch Position Sensing Fault
(2) Transfer Switch Fail to Transfer
Internal Control Module Fault
Manual Transfer Operation
(3) External Fault Condition (two inputs)
Not In Automatic
(4) Programming Switch Not In Off

(5) The system status messages shall also be shown on the alphanumeric display.

iv) Accessory Active

Plant Exerciser
In-Phase Monitor
Load Shed
Area Protection

v) A lamp test push button shall light all light-emitting diodes.

g) The control module shall have a three-position, key-operated, programming control switch. The key shall be removable in any position. The positions shall be:

i) Off--Allows all enabled accessories to be monitored only. Settings cannot be changed while in this position.

ii) Local--Allows all enabled accessory settings to be changed by local keypad entry.

iii) Remote--Allows all enabled accessories to be altered via the remote communications port.

h) A momentary-type test switch shall be provided to simulate a normal source failure.

i) The transfer switch shall be able to control up to 12 isolated form C auxiliary contacts for indication of switch position and source availability.

j) A set of gold-flashed contacts rated 10 amps, 28VDC shall be provided for a low-voltage engine start signal when the normal source fails.

END SECTION