# SECTION 16621
# STANDBY DIESEL GENERATOR

## PART 1- GENERAL

### 1.1 SCOPE

This section defines the requirements for furnishing the following:
One (1) 150 KW/188 kVA, 208/120 Volt Standby Diesel Generator and one (1) 400 ampere, 208/120 volt Automatic Transfer Switch.

### 1.2 REFERENCE STANDARDS

A. The Generator and the Automatic Transfer Switch covered by these specifications shall be designed, tested, rated and assembled in strict accordance with the following Standards:

1. UL 2200 Stationary Engine Generator Assemblies
2. NFPA 110 - Emergency and Standby Power Systems
3. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
4. UL508 Industrial Control Equipment
5. UL 489 Standard for Safety Molded Case Breakers, Molded Case Switches, and Circuit Breaker enclosures
6. UL869A Reference Standard for Service Equipment
7. US EPA Non-road Source Emission Standards, 40 CFR 89, Tier 2
8. UL 1008 - Standard for Transfer Switch Equipment
9. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
10. NFPA 70 - National Electrical Code
11. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
12. UL 508 Industrial Control Equipment
13. UL 1449 3rd edition

### 1.3 DIESEL GENERATOR TESTS

A. The system manufacturer must certify that engine; generator, controls, and breaker have been tested as complete system of representative engineering models (not on equipment sold). The manufacturer shall supply equipment that is a current factory production model.

Prototype testing shall include:

1. Fuel consumption at ¼, ½, ¾, and full load
2. Exhaust emissions
3. Mechanical and exhaust noise
4. Governor speed regulation at ¼, ½, ¾, and full load; and during transients
5. Motor starting kVA
6. Generator temperature rise in accordance with NEMA MG1-22.40
7. Harmonic analysis, voltage waveform deviation and telephone influence factor
8. Generator short circuit capability
9. Cooling system performance
10. Generator revolving field assembly for 2 hours at 2700 rpm (150% over speed) and 70C, and each production unit tested at 2250 rpm (125% over speed) at room temperature.

B. A complete system, 4 hour resistive load bank test at 1.0 pf shall be performed by the supplier after completion of the installation, and shall be included in the pricing.

## 1.4 AUTOMATIC TRANSFER SWITCH TESTS

A. Automatic Transfer Switches shall be completely tested at the factory to ensure proper operation of the components and the correct overall sequence of operations.
B. Automatic Transfer Switch: Factory tests shall ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification.
C. At the end of completion of all the tests, provide a certificate of compliance showing that the ATS does indeed meet the specification requirements.

## 1.5 REQUIREMENTS, CODES AND REGULATIONS

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has a minimum of 10 years of experience building this type of equipment.

## 1. 6 SUBMITTALS

Items to be included in the Bid Package: Items 1-5 listed below.
Items due at equipment delivery: Items 1-18 listed below.

A. Engine-generator and transfer switch submittals shall include the following information:

1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
2. Manufacturer's catalog cut sheets of all auxiliary components such as isolators, battery charger, silencer, exhaust flex, main circuit breaker, etc.
3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
4. Weights of all equipment with indicated pick up locations.

5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
6. Interconnect wiring diagram of complete emergency system, including generator, automatic transfer switch, breaker, day tank, remote pumps, battery charger, remote alarm indications.
7. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactances and time constants.
10. Generator current decrement curve.
11. Generator motor starting capability.
12. Generator thermal damage curve.
13. Jacket water heater connection diagram.
14. Control panel schematics.
15. Automatic load transfer switch (s).
16. Oil sampling analysis, laboratory location, and information.
17. Manufacturer's and dealer's written warranty.
18. Emissions data

## 1.7 ACCEPTABLE MANUFACTURERS

A. Diesel Generator

1. Caterpillar
2. Cummins/Onan
3. Kohler
4. Generac

B. Automatic Transfer Switch

1. ASCO
2. ZENITH
3. RUSSELECTRIC

## 1.8 AUTHORIZED DISTRIBUTOR

The system consisting of the Diesel Generator and the automatic switches shall be supplied by one (1) equipment supplier who shall be an authorized distributor for both products.

The authorized distributor shall have factory trained personnel on both the generator and the Automatic Transfer Switch, who can be on call 24 hours a day, 365 days a year.

## 1.9 WARRANTY

A. Five Year Warranty

The manufacturer's standard warranty shall in no event be for a period of less than five (5) years from date of initial start-up and acceptance of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. The warranty shall be appropriate with the standby generator application. Warranty initiation shall begin on the date the equipment has been installed and accepted.

1.10 PARTS AND SERVICE QUALIFICATIONS

A. Service Facility:

The supplier shall have service facilities which maintain 24-hour parts and service capability and shall stock parts as needed to support the generator set and automatic transfer switch package for this specific project.

B. Service Personnel

The supplier shall maintain qualified factory trained service personnel capable of responding to an emergency call within 4 hours of notification (24 X 7 X 365).

# PART 2. PRODUCTS:

2.1 DIESEL GENERATOR

A. General

The diesel generator shall be rated as follows:

150 kW/188 kVA, 208/120 volts, 3 phase 4 wire, standby duty.

B. Material and Parts

C. All materials and parts comprising the unit shall be new and unused Diesel Engine

1. Engine Requirements

The engine shall be a compression ignition model for diesel fuel and that has been manufactured and successfully operated in similar service for a period sufficient to thoroughly establish its reliability. The engine shall be water cooled inlet or vee type, 4 cycle, compression diesel. It shall meet specifications when operating on number 2 fuel domestic burner oil. The engine shall be equipped with fuel, lube oil, intake filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter and gear driven water pump. The engine speed shall not exceed 1800 rpm at normal full load

operation when equipped with all necessary operating accessories such as air cleaners, oil pump, water pump, generator, etc. The engine ratings shall not exceed the standby power service rating published by the manufacturer. The ratings shall meet the following parameters. Engines with ratings not based on these parameters shall be de-rated in accordance with the manufacturer's published de-rating factors.

| | |
|---|---|
| Use: | Standby |
| Altitude: | 190 feet above sea level |
| Ambient Temperature: | 110 degrees F @ the radiator core. |

2. Governor

The governor shall be electronically controlled. It shall maintain isochronous frequency regulation from no load to full rated load. The steady state operating band shall be within 0.25 %.

3. Block Design

The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.

4. Lubrication System

The engine shall utilize a gear-type, positive displacement, full pressure lubricating oil pump and water-cooled lube oil cooler. Pistons shall be spray-cooled. Provide oil filters, oil pressure gauge, dipstick and oil drain.

5. Fuel System

Fuel filter and serviceable fuel system components shall be located to prevent fuel from spilling onto the generator set batteries.

D. Generator

1. Generator Specifications

The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling.

2. Insulation

The insulation material shall meet NEMA standards for Class H insulation and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 ºC rise by resistance over 40 C ambient). The excitation system shall be of brushless construction.

3. Exciter and Load Recovery

The voltage regulation from no load to rated load shall be within a 2% band of rated voltage. Steady state voltage modulation shall not exceed one cycle per second.

4. For any addition of load up to and including 90% of rated load, the voltage shall recover to and remain within the steady band in not more than 1.5 seconds. The voltage dip shall not exceed 20% of the rated voltage at any time.

5. The frequency regulation from no load to rated load shall conform with the engine governor performance. For any addition of load up to 90% of rated load, the frequency shall recover to the steady state frequency within 5 seconds.

6. The generator, by inherent design, shall be capable of sustaining a minimum of 250% of rated current for a minimum of 10 seconds under a three phase symmetrical short circuit fault. A resettable 3 phase line current sensing circuit breaker with inverse time verses current response, set to open after a 10 second fault condition, shall be furnished. Each Generator Shall be two thirds pitch.

E. Voltage Regulator

The voltage regulator shall be of the solid state design and provide volts per hertz operation. It shall be mounted on top or side of the generator and enclosed in a NEMA rated enclosure. A built in voltage adjusting rheostat shall provide 10% voltage adjustment. Provide an isolation transformer in the voltage regulator circuit.

F. Generator Circuit Breaker

One (1) 400 ampere, 14 kAIC rated, 208 Volts**,** generator mounted circuit breaker, molded case or insulated case construction, 3 pole, NEMA 1P22. The breaker shall be listed and labeled by an independent testing agency approved by the State of North Carolina and utilize a thermal magnetic trip unit and 24 VDC shunt trip. The breaker shunt trip device shall be connected to the engine/generator safety shutdowns. The breaker shall be housed in an extension terminal box mounted on the side of the generator. Mechanical type lugs shall accommodate termination of 1 (one) 500 MCM conductors per phase.

G. Control Panel

1. Generator Mounted Control Panel

Provide a generator mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation; adjustable cycle cranking, AC metering (0.5% true rms accuracy) with phase selector switch, digital engine monitoring, shutdown sensors and alarms with horn and reset, adjustable cool down timer and emergency stop push-button. Panel shall also include generator temperature monitoring and protection and discrete I/O modules. The signal to the remote annunciator shall be over a twisted shielded pair of wires. Panel shall incorporate self-diagnostics capabilities and fault logging.
Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged lid.

2. Control Panel Display Readouts

Provide the following digital readouts and, in addition, comply with NFPA 110, Level I.

A. Engine oil pressure
B. Coolant temperature
C. Engine RPM
D. System DC Volts
E. Engine running hours
F. Generator AC volts
G. Generator AC amps
H. Generator frequency
I. Low fuel

H. Remote Annunciator

Provide a remote annunciator for the generator to meet the requirements of NFPA 110, Level 1. The annunciator shall provide remote annunciation of all points stated above. Additionally, the remote annunciator shall have the capability to display the Generator Start signal. The annunciator shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn. The annunciator shall not exceed 4" in thickness.

I. TVSS (Transient Voltage Surge Suppression)

Provide and install TVSS as described below, on the 208 volt output from the generator, 120 VAC input to the generator and the 24 V DC output to the remote annunciator. All TVSS devices shall meet UL 1449, 3rd edition.

1. 208 volt output from the generator. Frequency range: 47-63 Hz, Response time less than 1 nano second , with Sine wave tracking and EMI/RFI Noise filter, in NEMA 4X surface mount box, with LED indicator lights and LCD readout with touch pad interface, Surge counter , dry contacts, and audible alarms.
2. 120 VAC input to the generator. 120 V AC application with surge protection levels of 330 Volts, surge current rating of 700A, a response time of less than 5 nano seconds, with illuminated status indicators.
3. The DC output to the remote annunciator, Din rail mounted, 24 V Dc operation, 60 V peak @ 1200 A, less than 5 nano second response time.

J. Cooling System

1. Radiator

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F ambient air entering the enclosure without de-rating the unit and 50/50 anti-freeze mixture. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

K. Fuel System

1. Fuel Filter
Properly sized fuel filters shall be provided by the engine manufacturer

2. Fuel Line Rating
Flexible fuel lines shall be rated 300 degrees F and 100 PSI.

3. Sub-Base Fuel Tank
A UL 142 listed, dual walled, painted steel sub-base tank with capacity, to supply fuel to the engine for a minimum of 24 hours operation at 100% of rated load, shall be furnished**.**

L. Exhaust System

1. (OUTSIDE BUILDING) - Provide a critical grade silencer to reduce engine exhaust noise to a maximum dBA level of 85 @ a distance of 10 feet. The silencer, with piping, shall be securely mounted within the interior of the weather proof enclosure with proper insulation. The exhaust silencer outlet shall be terminated with an exhaust elbow and rain cap on the exterior of the enclosure.

M. Starting System

1. Starting Motor

A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

2. Jacket Water Heater

Provide a unit mounted thermal circulation type water heater. The heater Watt rating shall be sized by the manufacturer to maintain jacket water temperature at 120 degrees F, and shall be a (120) volt, single phase, 60 hertz.

3. Batteries

A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. Necessary cables and clamps shall be provided.

4. Battery Trays

A battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall treated to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over battery electrolyte shall be contained within the tray to prevent a spill to ground.

5. Battery Charger

A current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts

per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. Ac input voltage shall be 120 volts, single phase. Charger shall have LED annunciation for low DC volts, rectifier failure, loss of AC power, high DC volts. Amperage output shall be no less than ten (10) amperes.

N. Weather Protective Enclosure

Steel weather protective enclosure shall be a minimum of 14-gauge sheet metal, and shall have a minimum ambient capability of 43 C (110 F). Shall have removable, hinged doors and removable end panels to allow easy routine maintenance. All hinges and latches shall be rust resistant and doors shall be equipped with rubber seals. A lockable service access cover shall be provided for easy access to the radiator fill cap. The roof shall be pitched to prevent moisture accumulation. The enclosure shall be painted utilizing electrostatically applied powder baked paint.

O. Access platform and steps

Provide access platform and steps to access the generator breaker and control panel, if they are higher than 6'-0" above ground.

## 2.2 AUTOMATIC TRANSFER SWITCH (ATS):

A. General

1. Provide one (1) Open Transition Automatic transfer switch for the generator. The ATS shall be rated 400 amperes, 208/120 Volts designed as Optional Standby Automatic Transfer Switch and shall meet NEC article 702.
2. The ATS shall be 4-pole. The automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation and a utility main circuit breaker. The transfer switch and controller shall be the products of the same manufacturer.
3. ATS shall be rated to close on and withstand minimum of 1,000 AIC.
4. The ATS shall be labeled in accordance with UL 1008's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.
5. Transfer Switches using interlocked molded case circuit breakers are not acceptable.

B. Mechanically Held Transfer Switch

1. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
3. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

C. Microprocessor Controller

1. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
2. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to □□1% of nominal voltage. Frequency sensing shall be accurate to □□0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
4. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
5. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as covered in IEEE standards.

D. Enclosure

1. The ATS shall be provided in a NEMA 3R enclosure, suitable for outdoor installation.
2. The ATS shall be in a NEMA 3R enclosure suitable for mounting directly on to a concrete pad. Vendor shall make provisions for direct conduit entry in to the ATS
3. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.

E. Controller Display and Keypad

A four line, 20 character LCD display and 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 limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency
2. Single or three phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration

F. Voltage, Frequency and Phase Rotation Sensing

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

| Parameter | Sources | Dropout / Trip | Pickup / Reset |
|---|---|---|---|
| Undervoltage | N&E,3□ | 70 to 98% | 85 to 100% |
| Overvoltage | N&E,3□ | 102 to 115% | 2% below trip |
| Underfrequency | N&E | 85 to 98% | 90 to 100% |
| Overfrequency | N&E | 102 to 110% | 2% below trip |
| Voltage unbalance | N&E | 5 to 20% | 1% below dropout |

2. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20□C to 60□C.
3. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

4. The controller shall be capable (when activated by the keypad or through the serial port) 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 CBA).
5. Source status screens shall be provided for both normal & emergency to pro-vide digital readout of voltage on all 3 phases, frequency, and phase rotation.

G. Time Delays

1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
3. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

    **a.** Prior to transfer only.
    **b.** Prior to and after transfer.
    **c.** Normal to emergency only.
    **d.** Emergency to normal only.
    **e.** Normal to emergency and emergency to normal.
    **f.** All transfer conditions or only when both sources are available.

6. The controller shall have the capability of including a module for future optional Closed Transition and Delayed Transition operations.

7. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
8. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

H. TVSS ( Transient Voltage Surge Suppressor)

Provide and install TVSS as described below, on the 208 volt input to and output from the generator. TVSS shall meet UL 1449, 3rd edition.

1. Frequency range: 47-63 Hz, Response time less than 1 nano second , with Sine wave tracking and EMI/RFI Noise filter, in NEMA 4X surface mount box, with LED indicator lights and LCD readout with touch pad interface, Surge counter , dry contacts, and audible alarms.

I. Additional Features

1. A three position momentary-type test switch shall be provided for the ***test / automatic / reset*** modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
2. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
3. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
4. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
5. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

**The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:**

6. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
7. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to

normal. Both of these inhibit signals can be activated through the keypad or serial port.

8. An in-phase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer.

9. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.

10. **Engine Exerciser -** The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

    **a.** Enable or disable the routine.
    **b.** Enable or disable transfer of the load during routine.
    **c**. Set the start time, time of day, day of week, week of month ($1^{st}$, $2^{nd}$, $3^{rd}$, $4^{th}$, alternate or every)
    **d**. Set the duration of the run.

    At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

11. **System Status -** The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

    ***Normal Failed***
    ***Load on Normal***
    ***TD Normal to Emerg***
    ***2min15s***

    Controllers that require multiple screens to determine system status display “coded” system status messages, which must be explained by references in the operator’s manual, are not permissible.

12. **Self-Diagnostics** - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

13. **Communications Interface –** The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of parameters.

14. **Data Logging** – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss.

    The following events shall be time and date stamped and maintained

    **a.** Event Logging

    1. Data and time and reason for transfer normal to emergency.
    2. Data and time and reason for transfer emergency to normal.
    3. Data and time and reason for engine start.
    4. Data and time engine stopped.
    5. Data and time emergency source available.
    6. Data and time emergency source not available.

    **b.** Statistical Data

    1. Total number of transfers.
    2. Total number of transfers due to source failure.
    3. Total number of days controller is energized.
    4. Total number of hours both normal and emergency sources are available.

15. **Communications Module** - A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices.

# PART 3. EXECUTION

A. Installation: The generator and the Automatic transfer switch will be installed not by the supplier. For installation instructions, refer to the project drawings.

B. Commissioning:

The supplier shall provide start-up and testing for the Generator and the Automatic Transfer Switches. The supplier shall coordinate all start-up and testing activities with the Engineer and Owner.

C. After installation is complete, the Vendor shall provide a minimum of two full days of onsite assistance for installation, startup and testing.

1. Verify that the equipment is installed properly.
2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.
3. Test all alarms and safety shutdown devices for proper operation and annunciation.
4. Check all fluid levels.
5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
7. Connect the generator to building load and transfer switch, operating the switch, and verifying that the generator will start and run all designated loads in the plant.
8. Perform a 4-hour load bank test at 1.0 power factor at full nameplate load using a resistive load bank and cables supplied by the local generator dealer. Observe and record the following data at 15-minute intervals:

    A. Service meter hours
    B. Volts AC - All phases
    C. Amps AC - All phases
    D. Frequency
    E. Power factor or Vars
    F. Jacket water temperature
    G. Oil Pressure
    H. Fuel pressure
    I. Ambient temperature

9. Check the Automatic transfer switch for proper wiring

10. Verify phase rotation between the Generator, Utility and the Automatic Transfer Switch wiring.

D. Operation and Maintenance Manuals

Provide three (3) sets of operation and maintenance manuals covering the generator, Automatic Transfer Switches and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

E. Training

Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.