ABOVE GRADE DIESEL POWER-PACS

Technical Specifications

PART 1 - GENERAL

1.1 SUMMARY

A. The contractor shall furnish and install, as shown on the plans, one (1) pre-fabricated, skid mounted, weatherproof, standby power system. The standby power system shall monitor incoming electrical utility and shall provide its own standby power to the related equipment in the event of power loss, phase loss, etc. The standby power system and appurtenances shall be maintained in an enclosed fiberglass structure designed to provide resistance to rusting, operational reliability through environmental control, and provide ease of access to housed components. It is the supplier's responsibility to include all necessary appurtenances to provide for a complete, automatic, and smooth operating system.

1.2 SYSTEM DESCRIPTION

A. The principal items of equipment shall include, but not be limited to, the following:

1. Engine generator set
2. Engine control
3. Generator control
4. Automatic transfer switch
5. One-piece seamless fiberglass walk-in enclosure
6. Fabricated steel base structure
7. Intake and exhaust louvers and ductwork
8. Environmental accessories

1.3 SUBMITTALS

A. Include data on features, components, ratings, and performance.

B. Wiring Diagrams for system. Show power and control connections.

C. Installation Diagrams for system. Show a complete list of all installation parts required by the installing contractor.

D. Detailed operating instructions. Describe operation under both normal and abnormal conditions.

1.4 QUALITY ASSURANCE

A. Single source Responsibility. Obtain system components from a single manufacturer with responsibility for the entire system. Unit shall be a representative product built from components that have proven compatibility and reliability and are coordinated to operate as a unit. Manufacturer will maintain stock on goods consumed during normal use of the product.

B. All equipment specified above shall be supplied by the Power Pac manufacturer; providing a single source service and warranty facility.

C. The equipment specified has been deemed most suitable for the application. The contractor is required to base their submitted bid on the specified equipment and not to exceed budget price which has been furnished by the supplier to protect the owner.

D. Alternative manufacturers will be considered only if one or more bidding contractor(s) presubmit all materials required to review the alternative design, two (1) weeks prior to the bid date. A minimum of six (4) complete equipment submittals

shall be provided for review and approval. Costs associated with the review of alternative equipment shall be the responsibility of the submitting contractor.

E. Any acceptable alternates will be identified by addendum. Price deducts for acceptance of alternative equipment from specified equipment will be passed to the owner and thus identified on bid form.

F. The determination of the specified equipment is based upon review of system components and presently operating systems. The design is based on equipment which has been in operation for 20 years where the generator and automatic transfer switch show no signs of rusting, deterioration, or have required major service. Alternate systems which can exhibit similar service on outdoor installations showing 20 years of continuous service without deterioration may be considered after the bid. Where alternate systems are to be submitted for consideration the contractor shall furnish the specified manufacturers proposal and the alternate suppliers proposal. Any difference in price shall be offered as a change order reduction to the contract bid price. Alternate systems will not be considered without a full credit to the owner.If an alternate is to be proposed, the contractor shall furnish a complete change order proposal to the owner within ten days of the contract award. The proposal must include the following data for evaluation.

1. A complete specification for the proposed standby power system.
2. A statement of full conformance to the bid specification signed by an officer of the manufacturer. All deviations must be clearly identified in the statement of conformance.
3. A general arrangement drawing showing overall dimensions, equipment layout and service couplings.
4. Complete submittal data for all major components (standby power generator, automatic transfer switch, fiberglass housing, steel base structure, louvers, and environmental components, etc).
5. An electrical schematic showing power wiring.
6. Installation list of 20 locations including contact names and phone numbers of customers having in service the proposed design with fiberglass enclosure for a minimum of 5 years. List shall include five references with at least 20 years of continuous service to verify equipment longevity and reliability.
7. Field verification of sound requirements shall consist of sound readings taken in the dB(A) scale at eight (8) equally spaced points around the unit at a 23 ft. radius. Readings are to be taken while the unit is in its normal operating position under full load conditions. Points are to be averaged for comparison to the published manufacturer’s sound data and must show a minimum 10% reduction beyond the manufacturer's enclosure. Failure to meet the specified sound reduction levels will be grounds for rejection of the equipment.

G. It is the sole discretion of the owner/engineer to determine if the data submitted shows the standby power system to be equal to the system specified. The contractor shall pay the owner and engineer for any and all review costs for review of any alternate which is not accepted as an equal to the specified system.

1.5 WARRANTY

1. The manufacturer shall warrant for one year from date of start-up, not to exceed eighteen months from date of shipment, that the structure and all equipment will be free from defects in design, material and workmanship.
2. The generator and transfer switch shall be provided with a prorated, five (5) years or fifteen hundred (1500) hours warranty, whichever occurs first from the date of system start-up. Coverage includes replacement parts for the entire coverage period. Labor to replace these parts is also included for the first two (2) years.

3. Goods consumed in normal operation of the equipment are not required to be warranted.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

A. These specifications are based on the certain products deemed most suitable for the application involved. The complete Power Pac system shall be as manufactured by Precision Systems of Calumet City, IL or engineer approved equal.

2.2 EMERGENCY GENERATOR

A. GENERATOR OPERATING CONDITIONS

1. Engine generator set shall be capable of continuous standby rating at 0.8PF at the conditions and minimum capabilities listed in Table 1. The unit shall be capable of the KW and KVA for motor starting at a maximum sustained voltage dip of 10% listed in Table 1.

2. The standby generator shall be equal or superior to the manufacturer and model specified in Table 2.

B. ENGINE GENERATOR AND ENGINE EQUIPMENT

1. Performance

a. Generator shall meet or exceed the performance characteristics outlined in Table 2.

b. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

c. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

d. The engine-generator set shall pick up a single step load of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

e. Motor starting capability shall be within the minimums listed in Table 2. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified KVA load at near zero power factor applied to the generator set.

2. The AC generator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

3. Construction

a. Generator shall meet or exceed the design characteristics outlined in Table 2.

b. The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

c. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

d. The engine shall be a 4-cycle, inner cooled, turbocharged or naturally aspirated, as required by engine manufacturer. Engine shall be certified as capable of developing the minimum horsepower output rating listed in Table 2 at 1800 RPM.

e. Maximum fuel rating and fuel consumption at full load shall be as listed in Table 2.

f. Engine equipment shall include the following:

1. Electric starter as required by the manufacturer.
2. Fuel filter with replaceable element.
3. Replaceable dry element air cleaner.
4. Positive displacement mechanical full pressure, lubrication oil pump with full flow lubrication oil filters.
5. Engine speed shall be governed by governor system specified in Table 2 which will automatically control frequency to a maximum rating less than that specified in Table 2 from full load to no load.

4. Engine protective devices to indicate alarm and engine shutdown for the following:

a. Low coolant temperature alarm.
b. Low coolant level shutdown.
c. Low lubrication oil pressure alarm and shutdown.
d. High coolant temperature alarm and shutdown.
e. Over speed shutdown.
f. Over crank lockout.

5. Engine mounted thermostatically controlled water jacket heaters shall be rated for 120 volts, single phase, 60 hertz at the wattage shown in Table 2.

6. Battery charging alternator with solid state regulator.

7. Engine shall be cooled by engine mounted radiator system including belt driven pusher fan, coolant pump, and thermostat temperature control. The radiator shall be provided with a duct adaptor flange.

8. The engine exhaust muffler shall be of a spiral type and shall be rated for residential silencing. The muffler shall be mounted so that its weight is not supported by the engine and shall utilize flexible stainless steel exhaust connectors. The exhaust piping shall be routed through the side wall of the steel base and be terminated outside the enclosure. Piping outside the enclosure shall be insulated with a minimum 2" thick calcium silicate thermal insulation with aluminum shroud.

9. Provide connections for connecting fuel system to the engine in compliance with applicable codes and regulations.

C. AC GENERATOR

1. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for insulation system noted in Table 2. Actual temperature rise measured by resistance method at full load shall not exceed temperature listed in Table 2.

2. The generator shall be capable of delivering rated output KVA at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

3. A permanent magnet generator (PMG) or shunt exciter shall be included to provide a reliable source of excitation power for optimum motor starting. Exciter

type to be determined by the generator manufacturer.

D. GENERATOR SET MICROPROCESSOR CONTROL

1. Control Switches

   a. A mode select switch shall be provided and shall initiate the following control modes. When in the Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

   b. A red 'Mushroom-head' push button emergency stop switch shall be supplied. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

   c. A reset switch shall be provided. The switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

   d. The control panel shall be supplied with a panel lamp switch that will light the entire panel with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time. Pressing and holding this button will test all front panel LED's and meters. The meters will light one bar at a time.

2. Alarm Lamps and Status Display

   a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
      1. Running
      2. Remote Start
      3. Not In Auto
      4. Shutdown
      5. Warning

   b. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown). The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

   c. The control shall include a flashing red lamp to indicate that the Off/Manual/Auto switch is not in the Auto position.

   d. The generator shall be provided with a user configurable status display screen. This alphanumeric two (2) line twenty (20) character per line display shall display information on and allow user control of the generator via various menus. It shall be controlled by four momentary buttons adjacent to the display. Basic menu descriptions are:

      1. The Engine Menu shall display real time information on the current state of the generators engine. Information available for display will include:
         i. Engine coolant temperature
         ii. Engine oil pressure
         iii. Engine oil temperature
         iv. Engine speed

v. Battery voltage
vi. Governor duty cycle

2. The Alternator Menu shall display real time information on the current state of the generators alternator. Information available for display will include:
    i. Line-to-line voltage
    ii. Line-to-neutral voltage
    iii. Amperage for all phases
    iv. Total power output
    v. Power output per line

3. The Adjust Menu will allow user control of the generator. If parameters are adjusted beyond preset factory limitations, their entry will not be accepted. User adjustments include:
    i. Output voltage
    ii. Output frequency
    iii. Engine start delay
    iv. Engine stop delay

4. The Faults Menu shall display current and up to twenty (20) historical faults for the engine and alternator. The display will indicate if the fault is active, a fault code, the total engine operation time when the fault occurred, whether the fault was/is a Warning or Shutdown fault, and a brief description of the fault. A partial list of the faults that can be monitored/recorded are:
    i. Pre-low oil pressure (warning)
    ii. Low oil pressure (shutdown)
    iii. Oil pressure sender failure (warning)
    iv. Low coolant temperature (warning)
    v. Pre-high coolant temperature (warning)
    vi. High coolant temperature (shutdown)
    vii. Engine temperature sender failure (warning)
    viii. Low coolant level (warning or shutdown--selectable)
    ix. Fail to crank (shutdown)
    x. Over speed (shutdown)
    xi. Low battery voltage (warning)
    xii. High battery voltage (warning)
    xiii. Weak battery (warning)
    xiv. High AC voltage (shutdown)
    xv. Low AC voltage (shutdown)
    xvi. Under frequency (shutdown)
    xvii. Over current (warning)
    xviii. Over current (shutdown)
    xix. Short circuit (shutdown)
    xx. Over load (warning)
    xxi. Emergency stop (shutdown)

3. Engine Control Functions

    a. The control system provided shall include a cycle cranking system for three (3) start cycles which consist of fifteen (15) seconds of cranking followed by fifteen (15) seconds of rest per cycle.

    b. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

c. The control system shall be capable of discriminating between failed sender or wiring components, and an actual failure condition for engine speed, oil pressure, and engine temperature. Failure of the sending units or wiring will result in warning alarms.

4. Alternator Control Functions

a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided.

b. If load current exceeds 110% of rated current of the generator set on any phase for more than 60 seconds, controls shall shut down and lock out the generator set. The purpose of this control is to prevent thermal damage to the alternator. The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

c. If any phase of the output current achieve short circuit conditions, controls shall shut down and lock out the generator set. The purpose of this control is to prevent thermal damage to the alternator. The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

d. If total load on the generator exceeds the nameplate KW rating of the generator set for more than 5 seconds, load shed controls shall operate a set of dry contacts to shed generator load. The purpose of this control is to prevent thermal damage to the alternator.

e. If AC over voltage exceeds 110% of the rated voltage of the generator set for more than 10 seconds, controls shall shut down and lock out the generator set. Controls shall shut down and lock out the generator set instantaneously if voltage exceeds 130% of rated output. Controls shall also shut down and lock out the generator if under voltage occurs for more than 10 seconds at an output level of less than 85% of rated output. Controls shall respond to only true RMS voltage conditions.

5. Other Control Functions

a. A warning indicator shall be given if the DC control or battery voltage is less than 75% or greater than 115% of normal operating voltage. During engine cranking (starter engaged), the low voltage limit shall be disabled. DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

E. OTHER EQUIPMENT TO BE PROVIDED WITH GENERATOR SET

1. The generator set shall be provided with a mounted main line circuit breaker sized to carry the rated output current of the generator set.

2. The generator shall be provided with a mounted battery charger providing a minimum of 6A output.

3. The generator shall be provided with a 120VAC thermostatically-controlled block heater.

2.3 AUTOMATIC TRANSFER SWITCH

A. ATS GENERAL

1. The complete microprocessor controlled automatic transfer switch shall be designed and manufactured by the manufacturer of the engine generator set. It shall be UL 1008 listed and be approved by the Canadian Standards Association. The manufacturer shall furnish schematic and wiring diagrams for the automatic transfer switch and a typical interconnection wiring diagram for the entire standby

system. Test reports certified by the manufacturer shall be provided to the engineer for the entire engine/generator/transfer switch system.

B. ATS RATINGS

1. The transfer switch shall be rated 225 amps and 600 Volts AC minimum. The transfer switch shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 90% (non- condensing), and altitudes up to 10,000 feet.

C. ATS CONSTRUCTION

1. The transfer switch shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.
6. Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Equipment using add-on accessory overlapping contacts are not acceptable.
7. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

D. ATS CONNECTIONS

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

E. ATS OPERATOR CONTROLS

1. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of the enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities:
    a. High intensity LED lamps to indicate the source that the load is connected to

(source 1 or source 2), and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b. “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and re-transfer and immediately proceed with its next logical operation.

c. “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

d. “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

F. ATS INTERNAL CONTROLS

1. The transfer switch internal control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

   a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 90 to 95% of the normal voltage level and dropout in a range of 70 to 90% of normal voltage level).

   b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 90 to 95% of the normal voltage level and dropout in a range of 70 to 90% of normal voltage level).

3. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

4. The transfer switch shall incorporate adjustable time delays for generator start (adjustable in a range from 0-10 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown)(adjustable in a range from 0-30 minutes).

5. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the following voltage and RFI/EMI standards.

6. The transfer switch shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 2 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs.

G. ATS CONTROL INTERFACE

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

2. Provide one set of form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250VAC.

3. The transfer switch shall provide relay contacts to indicate the following

conditions: load connected to source 1 and load connected to source 2.

H. ATS ENCLOSURE

1. Enclosures shall be UL listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking.
2. Transfer switches shall be mounted in an enclosure of the types as designated on the drawings. Separate enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

I. ATS OPEN TRANSITION OPERATION

1. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.
2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:
    a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
    b. The transfer switch shall issue a compatible start command to the generator set.
    c. When the control system senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
    d. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the loads to the normal service.
    e. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
    f. The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.
3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:
    a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
    b. The transfer switch shall issue a compatible start command to the generator

set.

c. When the control system senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

d. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

J. OTHER ATS REQUIREMENTS

1. The transfer switch supplier shall perform a complete operational test on the transfer switch prior to shipping form the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

2. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

3. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

4. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

5. The transfer switch shall be equal or superior to Model OTEC as manufactured by Cummins.

2.4 STRUCTURAL ASSEMBLY

A. ENCLOSURE GENERAL

1. The generator and automatic transfer switch and other associated equipment are to be supplied as a complete assembly mounted on a single common base and enclosed within the fiberglass structure. All necessary wiring between the ATS, environmental panel, and generator are to be completed prior to shipment. Alternatives requiring field assembly or that have not been tested as a complete unit shall not qualify as equal product and shall not be accepted.

B. FIBERGLASS ENCLOSURE

1. Fiberglass enclosure shall be of the Walk-In design with single door entryway. No major conduits shall be attached to the enclosure. The enclosure shall be large enough to accommodate inside storage of all specified equipment, including generator, transfer switch, and convenience accessories.

2. The fiberglass enclosure shall have a gel coating of suitable thickness and density formulated to provide durability, abrasion resistance, color fastness, gloss retention, and shall be impervious to sewage, grease, oil, gasoline and other common chemicals. Walls and ceiling shall be solid fiberglass, minimum 3/16th inch thick construction utilizing chopped strand with 18 oz. woven roving backed with polyester bonder per ASTM D-579 at the major stress points. Exterior fiberglass finish shall be smooth automotive type finish. Rough finish enclosures that allow for the collection of environmental elements that lead to the failure of the fiberglass, shall not be considered equal and shall not be accepted.

3. In order to prevent leakage, the housing will be a single piece design enclosure. Multi-piece or seamed designs utilizing mechanically connected or caulked

sections with different coefficients of thermal expansion, will not be accepted. The complete enclosure shall be designed to withstand a wind load of 90 miles per hour. The roof shall be capable of withstanding a loading of 30 pounds per square foot minimum.

4. The exterior color shall be white for thermal reflection and attractiveness. A minimum 1 in. (R7) thick, 2 lb. density, polyisocyanurate board shall be applied to the interior of the housing and be coated with an exterior white gel coating as specified above.
5. Door will be white fiberglass construction with aluminum channel frame. Minimum dimensions shall be 36 in. wide by 80 in. high. It shall be mounted in the location shown on the contract drawings.

C. STEEL BASE ASSEMBLY

1. The steel base shall be designed to mount and support the components defined in this section. The base will be of sufficient size to allow access for maintenance to these mounted items. The base shall be designed with adequate lifting points for installation as well as anchoring points as detailed on the contract drawings.
2. The steel base shall be designed for the mounting of the fiberglass enclosure. The enclosure shall be secured to the steel base assembly utilizing stainless steel fasteners and a closed cell neoprene gasket. Design shall be such as to preclude the possibility of moisture entering the housing at the union of the fiberglass and steel.
3. The base assembly shall be shot blasted to a commercial finish per SSPC-SP6. The base shall receive a minimum 10 mils DFT epoxy paint of Sherwin Williams Macropoxy 646. The floor area of the base will receive a non-skid drainage mat system.

D. FUEL SYSTEM

1. A U. L. designed double walled fuel tank shall be provided within the station. The fuel tank shall be double walled steel construction and shall have a minimum 24 hour generator run capacity. A mechanical fuel level gauge shall be mounted within the tank. A low level switch shall provide indication that a low fuel level condition exists.
2. The fuel tank shall have a containment area within the structure for collection of leaked fuel. The containment area shall be monitored with a float switch to detect the presence of liquid. The float switch shall provide indication that a fuel leak has been detected.
3. A fuel fill port and fuel vent shall be provided on the exterior of the enclosure to facilitate refilling of the tank. The fill port shall incorporate an overflow containment system to prevent fuel spillage. The overflow shall allow for the automatic return of fuel to fuel tank. The fuel port shall be supplied with a stainless steel padlockable hasp to deter vandalism.

E. INTAKE AND EXHAUST LOUVERS

1. The system shall include a complete intake and ducted exhaust louver system designed to provide an adequate amount of air for both cooling and combustion. The system shall consist of intake and exhaust louvers, motorized operators, and radiator duct discharge assembly.
2. The louvers shall be certified AMCA Standard 500 at a maximum of 0.35" WG while the engine generator set is operating at full load. Louvers shall be 6", multi-blade, minimum 13 gauge extruded aluminum, 6063-T5 alloy, with 5/8th inch aluminum mesh removable bird screen. The louvers shall be the powered type

with fixed and adjustable blades motorized to the closed position with spring return. The adjustable louver blades shall be furnished with a closed cell gasket to insure minimum air infiltration while closed. The gasket shall be replaceable.

3. The motorized actuator shall be UL labeled. They shall be of the two position design and shall close louver when power is applied. The actuator shall be rated for 120 volt, single phase, 60 hertz and shall provide a minimum torque rating of 60 lb.-in. Relay logic within environmental panel shall control acuation of the louvers. Louvers shall remain open for a user adjustable period of time after generator operation to allow for cooling within the enclosure.

F. DUCT ASSEMBLY

1. Duct assembly shall be provided between the engine radiator and the exhaust louver. The duct assembly shall be designed to provide a minimum amount of restrictions and a smooth air flow from the radiator to the exhaust louver.

G. ELECTRICAL ASSEMBLY

1. All conduit and wiring shall be installed in accordance with the latest edition of the National Electric Code.
2. All conduits within the base assembly shall be supplied by the manufacturer. Internal conduits shall be thin wall metallic tubing with set screw or compression type connections. Where flexibility is required flexible metallic conduit shall be used.
3. Conduit connections for electrical service lines shall be provided on the exterior portion of the base as shown on the contract drawings. All couplings for field connection of conduits shall be of heavy wall steel construction and shall be continuously welded around their circumference. External conduits shall be rigid galvanized steel with threaded connections.
4. The service pole and metering shall be provided by the installing contractor. A U.L. rated main disconnect switch, conduit and wiring between the power company termination and the standby power system shall be furnished and installed by the installing contractor.
5. A load center for the convenience accessories shall be provided.

H. ENVIRONMENTAL SYSTEMS

1. Minimum of Two (2) 48”, 15 watt, high output LED wet location light fixtures shall be mounted in the ceiling of the housing. Lighting control shall operate when the entry hatch is open and shall have a manual override.
2. A ventilation blower shall be wall mounted inside the housing and ducted to the outside atmosphere. The blower shall be capable of one air change every 10 minutes. An adjustable percentage timer shall control the ventilation blower.
3. A 30 pint per day dehumidifier shall be installed in the enclosure and its discharge shall be piped to the sump pump for continuous drainage. The dehumidifier shall be automatically controlled through and integral, adjustable, humidistat.
4. The enclosure shall be provided with a single electric forced air heater. The heater shall be 240V, rated for 5,000 watts. The heater shall be thermostatically controlled. The heater shall also be locked out when the generator is running.
5. An environmental control panel with thermal magnetic circuit breakers for branch disconnect service and short circuit protection shall be provided to protect and operate the electrical environmental systems within this section. Individual breakers within
6. Red indicator lights labeled “Low Fuel" and "Tank Failure” shall be provided in the

door of the enclosure for local alarm indication.

7. The enclosure interior shall be affixed with one (1) 120V, battery backed emergency LED light to activate when utility or generator power is not present. Path of egress for illumination is 18' wide by 6' deep.
8. A smoke and carbon monoxide detector shall be provided. Unit shall be 120VAC rated with battery backup. An isolated relay shall be provided each for smoke and for carbon monoxide to provide a Form A contact local strobe light an SCADA integration.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUALS

1. Provide two (2) complete sets of operation and manuals covering all equipment within this specification. Manuals will be provided in a three ring binder that will be clearly labeled for the specific job. Contact information for the manufacturer and the local representative will be provided within the manual.

3.2 START-UP AND TESTING

A. FACTORY TESTING

1. A complete test including all generator, transfer switch and environmental functions will be performed after assembly and before system is shipped to the jobsite. The test shall include simulated power outage and operation test of all components as a completed system related to generator and transfer switch. Factory test of components prior to final assembly shall not be an acceptable alternate to the complete system check. A copy of this report will be available upon request prior to start-up.

B. START-UP

1. The manufacturer shall provide the services of an authorized factory representative to inspect the installation, make any necessary adjustments, and place the equipment into operation. The manufacturer’s representative shall instruct the operating personnel in the operation and maintenance of the equipment. The manufacturer’s representative shall note any deficiencies on the startup report and inform the appropriate party at the time of start up to remedy the deficiency or make the necessary repairs or adjustments as needed. The manufacturer shall provide one day(s) service to perform the above tasks. At the job site during start-up, a start-up report shall be prepared by the technician and will be available in typewritten form to the customer upon request.

125HP Pump Station

TABLE 1

Engine Generator Operating Parameters

Phase	3
Wire	4
Voltage(V)	480/277
Hertz (Hz)	60
Rating (KW)	166
Rating (KVA)	207
Starting Rating (KW)	202
Starting Rating (KVA)	920

TABLE 2

Generator Characteristics

Cylinder Quantity	6
Engine Displacement (in3)	408
Horsepower Output (HP)	324
Fuel Type	Diesel
Max. Fuel Consumption (GPH)	13.3
Governor Type	Isochronous
Frequency Control	1%
Engine Heater (Watts)	1500
AC Generator Insulation Class	H
AC Generator Temp Rise (C)	125

Manufacturer

Brand Name	Cummins
Model	C175D6D
Model	OTEC 225A ATS

100HP Pump Station

TABLE 1

Engine Generator Operating Parameters

Phase	3
Wire	4
Voltage(V)	480/277
Hertz (Hz)	60
Rating (KW)	150
Rating (KVA)	188
Starting Rating (KW)	212
Starting Rating (KVA)	920

TABLE 2

Generator Characteristics

Cylinder Quantity	6
Engine Displacement (in3)	408
Horsepower Output (HP)	324
Fuel Type	Diesel
Max. Fuel Consumption (GPH)	11.7
Governor Type	Isochronous
Frequency Control	1%
Engine Heater (Watts)	1500
AC Generator Insulation Class	H
AC Generator Temp Rise (C)	125

Manufacturer

Brand Name	Cummins
Model	C150D6D
Model….	OTEC 225A ATS