

TECHNICAL SPECIFICATION SECTION FOR SEWAGE LIFT STATION

GENERATOR SET/ATS

1. GENERAL

It is the intent of the specification to secure an emergency system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as specified herein.

The equipment supplied and installed shall meet the requirement of the National Electric Code and all applicable local codes and regulations. All equipment shall be new, unused and of current production by a firm that has it's final assembly located in the continental United States. The generating set manufacturer shall have at least twenty-five (25) years experience assembling generating sets. The engine/generator, controls, transfer switch, disconnect shall be complete assembled and wired by the generator manufacture and locally authorized dealer to ensure one-source responsibility for warranty, parts, and service through factory-trained service personnel.

2. SUBMITTAL

Submittal shall include specification sheets showing all standard and optional accessories to be **supplied**, schematic wiring diagrams, dimensional drawings, and interconnection diagrams.

3. RATINGS

The standby generator set shall be rated as standby power (defined as continuous operation for the duration of any power outage). Kilowatt ratings for three-phase voltages are based on a 0.8 power factor, single-phase voltages are based on a 1.0 power factor. Ratings are established on 150 feet altitude and 110° Fahrenheit, as manufactured by Tradewinds Power Corp or purchaser-approved equal. Vibration isolators shall be provided between the engine-generator and the steel sub-base, fuel tank or directly to mounting pad. In all applications in sewage lift stations the generator shall perform and starting both sewage pump motors at the same time.

Refer to Brunswick County or the Engineer for sizing generator applications.

A. **Tradewinds** /Perkins Power. Sure-Gen 910-253-0484

B. Cummins;

C. Caterpillar

4. ENGINE

The prime mover shall be a liquid-cooled #2 diesel-fueled engine of 4-cycle design, equipped with the following:

A. Mechanical or electric fuel transfer pump, primary and secondary fuel filters, water separator, and electric fuel shut-off valve.

B. Electronic governor capable of regulating the no load to full load frequency to a .25% maximum, steady state regulation shall be .25%.

- C. 12-volt positive engagement solenoid shift-starting motor.
- D. 12-volt belt-driven battery charging alternator with solid-state voltage regulation.
- E. Positive displacement full pressure lubrication oil pump, cartridge oil filters, dipstick and oil drain.
- F. Dry replaceable, dual element “heavy duty type” air cleaner.
- G. Unit-mounted radiator, pusher type cooling fan, water pump, thermostat and radiator duct flange (non-enclosed units) shall properly cool the engine and be designed for operation at a minimum ambient temperature of 120° F.

5. ALTERNATOR

The alternator shall be a 4-pole revolving field type with 12 reconnectable leads, self-ventilated and of drip-proof construction. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable volts-per-hertz tracking.

On application of any load up to the full rated load the voltage dip shall not exceed 12.5% and shall recover to stable operation within two seconds. The alternator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system. The alternator shall be capable of accepting the loads and instantaneous voltage dip when loads are started as specified.

The generator shall be directly connected to the flywheel housing and by means of a shaft through a flexible drive plate coupled between the alternator's rotating mass and the engine flywheel for permanent alignment. A ground cable will be installed between the alternator foot and the support crossmember.

6. GENERATOR/CONTROLLER

Generator controller shall be an integral part of the overall weather enclosure and shall have three points of interface so that panel can be removed and replaced quickly as and if required. A separate D/C twist lock receptacle shall be provided for all D/C interfaces to the generator control panel from the generator set. A separate A/C twist lock receptacle shall be provided for all A/C interfaces to the generator control panel from the generator set. A RS 232 connector shall be provided and installed through the control panel box to allow access to the controller without having to remove the controller from the box. This plug-in device will be capable of allowing maintenance personnel to test controller performance without operating the engine. All wire shall be rated for peak A/C voltage and shall be number stamped as indicated in the electrical schematic. The enclosure shall be constructed of .090-gauge aluminum. The microprocessor control board shall be moisture proof and capable of operation from -40° to 85° Celsius.

The digital generating set controller shall be provided utilizing microprocessor-based technology and provide:

- A. CAN Bus option to connect to standard SAE J1939 engine management systems. Error codes will be displayed in numerical and text format.
- B. Comprehensive remote communications via optional RS232 port. Full 2 way communication and panel supports GSM SMS messaging system.

- C. Engine instruments: Oil pressure, water temperature, actual engine hours run, charging voltage, battery volts and engine rpm.
- D. Generator Instruments: Volts, Hz, Amps, kW, kVA, Power factor
- E. 16 bit micro processor control
- F. Optional RS 485 'Modbus' output.
- G. LCD 4 line text based backlit display
- H. PC configuration and status monitoring using 5xxx PC software
- I. PIN number front panel programming protection for selected trip points and timers to allow in field adjustments
- J. Built in exerciser times
- K. Sleep mode to conserve battery life
- L. Automatic and manual operation modes
- M. Six configurable auxiliary inputs for connection to external fault detection equipment-expandable to 14 auxiliary inputs along with three configurable outputs
- N. Integral load switch control capability
- O. Able to survive 0V for 50mS without internal batteries
- P. Ability to be configured for use with a 16 light remote annunciator. Range is 1000 meters over standard wires (NFPA 110)
- Q. Optional 8 light remote annunciator and 8 dry relay contacts-Fully programmable.
- R. Ability to communicate with Thompson Technologies automatic switch
- S. Enclosure protection IP55 with gasket
- T. Multiple display languages
- U. Auto scroll display
- V. Integral load switch capability
- W. Pre-alarms and shutdowns for generator voltage, frequency and amps.
- X. Adjustable high current shutdown alarm-IDMT curves.
- Y. 4 configurable LED's on front panel-Warnings, shutdowns or Status indicators
- Z. Event log

- AA. Fuel level input with transfer pump control
- BB. Multiple wiring topologies supported-Front panel configurable
- CC. UL, CE and CUL approved
- DD. Generator available LED
- EE. Close generator output LED

7. ACCESSORIES

The following accessories, as required, shall be installed, and completely wired to ensure that no site installation is required.

- A. Battery racks. Battery cables. 12-volt or 24-volt battery(s) capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit ~ SAE Standard 1-537 for each particular kW rating. The battery rack shall be welded to the sub-base or fuel tank and shall have two hold down bolts with one cross over strap.
- B. Oil and water drain lines shall be installed and extended to the outside of the weather protective enclosure through bulkhead fittings. Each drain line shall include but not be limited to a brass ball valve and flexible lines. The ball valves shall be located on the interior of the package.
- C. Engine exhaust silencer shall be coated to be temperature and rust resistant and rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment. Silencer is mounted within the structure of the weather protective enclosure. The silencer is connected to the engine by a stainless steel flexible pipe.
- D. The block heater shall be sized properly to carry the correct wattage and voltage for the engine chosen by the generator supplier. This block heater shall also be thermostatically controlled to maintain engine coolant at 90° F (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 regulations. If the line voltages do not match the required voltages, the manufacturer shall furnish and install the necessary transformer in the transfer switch compartment to convert the primary power source voltage to the voltage and current level required.
- E. Automatic float and equalize battery charger with constant voltage constant from no load to full load. Current limited during engine cranking and short circuit conditions. Temperature compensated for ambient *from* -40 degrees C to +60 degree C, voltmeter and ammeter fused, reverse polarity and transient protected. Optional alarm circuit board to meet the requirements of NFPA-110 for low battery voltage, high battery voltage and battery charger malfunction.
- F. A duplex receptacle, GFCI type, is made available to route power from the normal source to the float charger and block heater. The float charger and block heater are connected to the float charger.
- G. Remote-stop button.
- H. Weather-protective enclosure constructed of marine grade aluminum white powder coat paint finish. The enclosure shall have removable and hinged side panels to allow inspection and maintenance. This enclosure shall be constructed from minimum-.090-gauge aluminum for units up to and including 35kW. Enclosures housing gensets larger than 35kW are constructed of 1/8" thick marine grade aluminum. All enclosures shall have stainless hardware throughout. The enclosure shall have a removable panel at the radiator end to allow access to the interior mounted exhaust silencer and for cleaning of the radiator cooling fins. The sound level of the enclosure without additional material added shall not exceed 78 dBA at a distance of 7 meters.

- I. Sound attenuation material added to the enclosure will be constructed of 1-inch adhesive backed foam.
- J. The generator set will be fitted with a mainline circuit breaker(s), unless otherwise specified, sized a minimum of 15% above the rated amperage. This breaker will be mounted on the side of the alternator conduit box with rubber anti-vibration mounts.
- K. Double wall steel sub-base mounted fuel tank shall be provided adhering to UL code 142 requirements. A fuel level gauge, 4-20mA analog level transmitter and low-level alarm contact shall be provided to annunciate the fuel level on the generator control panel. In addition, there shall be a leak detection switch located in the outer tank to indicate any occurrence on the generator control panel. The fuel tank shall have a lifting eye on each corner constructed of 3/8 structural steel plate. 36 hour run time tank. The tank will be fitted with a fuel drain fitting to remove the diesel fuel from the tank. The fuel tank shall be provided with a lockable fuel fill cap, suction and return pipes. Consideration shall be given in the upper plate design to ensure free and easy access to the hardware that holds the vibration mounts to the top of the fuel tank. At the rear of the tank there shall be an area to allow electrical stub up.
- L. Genset is fitted with a fuel/water separator.

6. AUTOMATIC TRANSFER SWITCH

SCOPE

AUTOMATIC TRANSFER SWITCH

This Specification covers the supply of a complete operational automatic transfer switch rated ____Amps, ____Volts, ____Phase, and ____Hz, _ Pole, for installation by others. Three phase systems must be multi-voltage capable.

List of Accepted Transfer Switch Manufacturers:

A. Thompson Technology. Sure-Gen, Inc. 910-253-0484

B. Enercon

C. Russell Electric

GENERAL REQUIREMENTS

GENERAL

The unit shall be manufactured in accordance with this specification and applicable UL, CSA, IEC, NEMA, and ANSI standards.

The unit shall be manufactured in a facility, which is registered to an ISO 9001:2000 quality system.

Supplier shall be responsible for ensuring the compatibility of all components of the unit.

The unit shall be free of defects in material and workmanship.

RELATED INDUSTRY STANDARDS

UL 1008

**Automatic Transfer Switches for Use in
Emergency Systems**

ENGINEERING SUBMITTALS

The following documentation shall be made available for submission to the project engineer for review/approval purposes on the automatic transfer switch:

- Physical Layout Drawing
-Outline dimensions, cable entry/exit locations, interior/exterior component layouts, connection data.
- Electrical Schematic
-Internal wiring, customer connection terminals, optional components, controller settings.
- Product Data Sheets
-Equipment Ratings.

RATINGS & CONSTRUCTION

AUTOMATIC TRANSFER SWITCH

**Rating of the automatic transfer switch shall be _____AMP,
_____VAC, ___Hz, ___ PHASE, ___WIRE.**

The transfer switch shall comprise of ___ switching poles plus a solid neutral.

Fault withstand current rating of the complete assembly shall be _____Kamps RMS. The interrupting and closing rating shall be equal to or exceed the required withstand rating. This rating shall be obtained with standard upstream over current protection devices.

The automatic transfer switch must be listed or certified to the following safety standards:

UL 1008 Automatic Transfer Switches For Use in
Emergency Systems

The completed assembly shall be mounted in a NEMA 3R enclosure suitable for outdoor application.

All materials and parts used in the unit shall be new, of current manufacture, of best industrial grade, and free from defects and imperfections.

The transfer switch mechanism shall provide a simple means of manual operation using only components, which are permanently affixed, in the operating position. Transfer switch must be capable of being switched under load in a manual configuration.

The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load.

All internal control devices used in the automatic transfer switch shall be cable of being de-energised and isolated from the system by use of an accessible isolation plug for servicing procedures as required.

The automatic transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable.

All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

FUNCTIONAL REQUIREMENTS

GENERAL DESCRIPTION

The automatic transfer switch shall automatically transfer the load to the generator supply in the event of a utility supply failure and return the load to the utility supply upon restoration. The automatic transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator supplies from being interconnected.

“AUTOMATIC SEQUENCE OF OPERATION

Note: For specific device settings refer to *Section 4.3 “STANDARD “CONTROL FEATURES.”*

When the voltage on any phase of the utility supply is below preset levels of rated voltage for a preset time delay, a contact shall close to initiate starting of the generator set.

The load shall transfer to the generator supply when the generator voltage and frequency have reached acceptable preset levels and the warm-up time delay has expired.

When the utility supply is restored to above preset levels of rated voltage on all phases, load transfer from generator to utility supply shall be initiated following expiry of the utility return timer.

Once the transfer mechanism operates and opens the generator power switching device, the transfer mechanism shall stop in the neutral position (i.e. with both power switching devices open) for the duration of the neutral delay timer setting to allow load voltage to decay prior to re-connecting the utility supply.

The load shall be re-connected to the utility supply once the neutral delay timer expires and the transfer mechanism continues operation and closes the utility power switching device.

The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail prior to expiry of the utility transfer delay.

The generator set shall continue to operate following a load transfer for a cooldown delay period, and then a contact shall open to stop the generator set.

An “on load” test mode may be initiated which shall cause a simulated utility failure condition and transfer the load to the generator set. The transfer sequence shall be the same as for a utility power failure except a neutral delay sequence shall occur when transferring from utility to a generator source.

The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail during an “on load” test mode.

STANDARD CONTROL FEATURES

The transfer switch shall be rated for use on multiple system voltages. The transfer switch shall be field configurable to operate on the following nominal system voltages; 208V, 240V, 380V, 480V, 600V. Field selectable single or three phase.

Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.

A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.

The transfer switch controller shall be microprocessor based and shall contain all voltage, frequency sensing and timing functions.

Three phase under voltage sensing shall be provided for the utility supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 1 second.

Three phase under voltage sensing shall be provided for the generator supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 5 seconds.

Under frequency sensing shall be provided for the generator supply to permit load transfer to the generator supply if within nominal limits. The frequency sensing function shall contain a user adjustable setpoint with a range of 70-90%. The factory setting shall be set at 90% of nominal frequency.

An engine start contact shall be provided which shall close to initiate starting of the engine. The engine start contact shall be rated 5A, 120/240VAC, 5A, 28Vdc resistive.

The following time delay functions shall be provided:

Engine Start- A time delay on engine start shall be provided to delay the engine start signal after failure of the utility source. The time delay shall be user adjustable 0 - 60 seconds, factory set at 3 seconds.

Engine Warm-up- A time delay for engine warm-up shall be provided which permits transfer to the generator supply after generator voltage and frequency exceed acceptable limits. The time delay shall be user adjustable 0 - 60 seconds, factory set at 2 seconds.

Utility Return- A time delay for return to utility shall be provided which permits transfer to the utility supply only after stable voltage conditions exist for the specified time period. The time delay shall be user adjustable 0 - 30 minutes, factory set at 2 minutes.

Engine Cooldown- A time delay for engine cooldown shall be provided which delays the engine stop signal after load has retransferred to the utility source until the time delay period expires. The time delay shall be user adjustable 0 - 30 minutes, factory set at 2 minutes.

Neutral Delay- A time delay for neutral position shall be provided to minimize the effect of out-of-phase transfer due to connected motor load. The time delay shall be user adjustable 0 - 60 seconds, factory set at 3 seconds.

Provision for local and remote operator-initiated system test modes shall be provided. Test modes shall allow “on load” testing of the generator set.

An automatic plant exercise time function shall be provided for generator testing. A fixed timer shall provide a 7 day off mode and a 20 minute run period. The exercise mode shall be enabled by a door mounted push-button.

Control logic shall be provided for immediate transfer to the utility supply (if within acceptable limits) should the generator set fail during any activated test mode.

Control logic shall be provided for sensing a Transfer Switch Failure condition, and if the alarm condition is activated, the transfer controller shall automatically force a transfer to the alternate source if available.

Pilot lights shall be provided to indicate load on utility status (green) and load on generator status (red). Pilot lights to be long life LED type.

Pilot lights shall be provided to indicate utility source available status (green) and generator source available status (green). Pilot lights to be long life LED type.

Pilot light shall be provided to indicate energized load voltage status of the transfer switch. Pilot light to be long life LED type.

The transfer switch controller shall provide a lamp test function to test all LED lights.

The transfer controller shall provide a user initiated timer bypass feature to allow temporary bypassing of any active timer to reduce unnecessary delays in testing or trouble shooting procedures.

Utility Supply Auxiliary Contact (AUX-U)

An auxiliary contact (qty 1) shall be provided which operates when the utility source is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

Generator Supply Auxiliary Contact (AUX-G)

An auxiliary contact (qty 1) shall be provided which operates when the generator is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

OPTIONAL CONTROL FEATURES

4.3.1.0 FTS4 -Four function Test Switch (Auto, Off, Engine Start Test).

7. PLANT TESTING:

Each generator set shall be tested under varying loads with guards and exhaust system in place. Test shall include:

- A. Load steps of 25, 50, 75 and 100%.
- B. Block load from no load to 75% and 100%
- C. Transient and steady state governing.
- D. Safety shutdown device testing.
- E. Voltage regulation.
- F. Arrangements to witness performance tests or a certified test record shall be available at the request of the purchaser.

8. EXECUTION

The Owner in accordance with the manufacturer's recommendations and all applicable codes shall install the equipment.

Site tests: An installation check. The manufacturer's local representative shall perform start-up and load test. The time and date of the site tests shall be coordinate with the Owner. The tests shall include:

- A. Fuel, lubricating oil and engine coolant shall be checked for conformity to the engine manufacturer's recommendations under the present and anticipated environmental conditions.
- B. Accessories that normally function while the set is in standby mode shall be checked prior to cranking the engine. This shall include: engine heaters. Solid-state battery charger, generator strip heaters, remote annunciator, etc.
- C. Start-up under test mode to check for exhaust leak and cooling airflow. Test for movement during starting and stopping, vibration during running normal and emergency along with line-to-line voltage and phase rotation while running a known test load.
- D. 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 systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage and frequency shall be monitored throughout the test.

9. SUBMITTAL AND WARRANTY

- A. Submittal shall include specification sheets showing all standard and optional accessories to be supplied; foundation plan; schematic wiring diagrams; dimension drawings; and interconnection diagrams identifying by terminal number of each required interconnection between the generator set the transfer switch, and the remote annunciator panel and the load. Equipment shall not be released for manufacture until submittal materials are approved.

- B. The manufacturer shall warrant the generating set against all manufacturing defects for a period of three-years or 1,500 hours (maximum of 500 hours per year), whichever occurs first, from the date of system start-up. The warranty period shall commence from the date of system start-up but no later than six months from the date of shipment from the manufacture.

