

PART 1: GENERAL

1.01 Engine Generators

This section of the standard includes design requirements for a packaged electric generator set to provide emergency and stand-by power.

1.02 Enclosed Transfer Switches

This section includes automatic transfer switches and bypass/isolation switches for systems rated 600 volts and less. The transfer switches shall be the means of automatically switching the Emergency Electrical System loads between normal and emergency power. Transfer switch must be able to be automatically exercised under load on a weekly basis for at least 15 minutes. This applies in the instances where an emergency generator is a part of the project scope.

1.03 Emergency System

1. The emergency system shall consist of an emergency panel fed from an automatic transfer switch which shall have a normal feeder from the new facility and an emergency feeder from the University's existing 480 volt, 4 wire grounded wye emergency system. This system shall be provided even if no emergency power source is currently available.
2. Emergency power shall be provided for the following: All stairwell lighting Fixtures in corridors and public areas that are considered "night lighting", Elevator lighting, Egress lighting, Fire Alarm System Communication system, Sump pumps, Stairwell pressurization fans and all systems for Life Safety Systems, such as UPS Backups located in MDF & IDF rooms.
3. Emergency power shall be provided for one elevator motor in each bank of elevators in high rise buildings as defined by the National Fire Codes. A keyed selector switch shall be located on the ground floor allowing rescue personnel to select any elevator in the bank.
4. If due to size and location, emergency power is not available from the University's emergency power system or by generator set, provide individual equipment, i.e. light fixtures with individually mounted battery packs.
5. Fire pumps shall be connected to the emergency system per applicable codes.
6. Generator shall and or enclosure shall be manufactured to provide sound attenuation to 85 dB at 10 Ft.
7. Where diesel generators are used PSP shall provide a design where by refueling can be accomplished at street level.

PART 2: PRODUCTS

2.01 Engine Generators

- A. The generator set shall be a natural gas, four-stroke engine, and rated for emergency service at 480Y/277 Volts, grounded-wye, 60 Hz. Diesel generators are acceptable where natural gas is not available. Fuel supply must be capable of supporting operation for a minimum 72 hours without a refuel.
- B. The engine should be capable of developing adequate brake horsepower operating on 900 BTU gas, at a potential delivery rate of 6628 CFH, to drive a generator delivering the rated kW plus 5% on an emergency basis for ambient conditions of 110 degrees F and 1,200 feet above sea level for the duration of utility interruptions.
- C. The natural gas fired engine-generator set shall be rated not less than specified kW/kVA at 0.8 power factor on an emergency basis. The AC synchronous generator shall be rated 60 Hz, 4 pole, revolving field, 1800 RPM for use with a 208Y/120 or 480Y/277 VAC, 3 phase, 4 wire electrical system. The alternator shall be oversized and rated for at least 125% of the specified kW/kVA at 80 degree rise for non-linear load considerations.
- D. The engine-generator set shall be capable of picking up a minimum of 100% nameplate and connected kW and power factor, less applicable de-rating factors, in one step with the unit at operating temperature.
- E. The engine-generator set shall have a motor starting or surge KVA capability of three times the rated KVA based upon a recovered sustained RMS voltage drop of no more than 10% of no load voltage with the specified load kVA at or near zero power factor. Maximum instantaneous voltage dip shall not exceed 30% at this load and power factor level. If associated with serving a fire pump, the maximum dip shall not exceed 15%.
- F. The generator set shall be connected to the power system through an automatic transfer switch and shall be considered a separately derived power source for grounding purposes.
- G. Acceptable manufacturers:
 - 1. Kohler Power Generation
 - 2. Owner approved equivalent
- H. Sequence of Operation
 - 1. When normal utility power is available, the Emergency Power System shall receive power from the normal power distribution system and transmit normal utility power over the Emergency Power System.

2. Upon failure of the normal utility source, the engine shall start automatically and the automatic transfer switch shall switch the supply and local engine generator set power to the Emergency Power System within 5 seconds from loss of normal power.
3. Upon restoration of normal utility power, the controls shall automatically reverse the shutdown procedures with time-delay-on-retransfer and time-delay-on-engine-shutdown.

I. Remote Alarm Annunciator:

1. Provide a remote alarm annunciator with visual indication and dry type Form C contacts to indicate and provide remote status indication of the generator.

J. Batteries: Batteries shall be 12-volt heavy-duty gel cell type.

K. Battery Charger: Shall have 120V input and be capable of restoring a pair of fully discharged batteries to a fully charged condition in 12 hours.

L. Jacket Water Heater: Provide a separate 120 or 208 Volt circuit from normal power for the engine jacket water heater and controls.

M. Generator Heater: Provide a separate 120 or 208 Volt circuit from normal power for the generator heater and controls.

2.02 Enclosed Transfer Switches

- A. The switch shall be rated at 208Y/120 or 480Y/277 VAC, 60 Hertz 4 wire operation. The transfer switch shall be contactor type. Molded case circuit breakers functioning as transfer switches shall not be allowed. The switch shall be enclosed in a NEMA 1 steel cabinet. The front door shall be key lockable. All components shall be front accessible.
- B. The automatic transfer switch shall be designed such that a maintained neutral position in which the load is not connected to either source. The switch mechanism shall be designed to permit use of all three positions during programmed transitions on both transfer and retransfer.
- C. The switch shall be designed with generator start controls.
- D. The design shall require that the transfer switch have an isolation-bypass feature. This feature allows the removal of the transfer switch mechanism for repair without interruption to the load.

PART 3: EXECUTION

3.01 Engine Generators

- A. Site plan drawing shall indicate location of generator with pad drawn to scale.
- B. Site plan shall also clearly indicate conduits from generator to automatic transfer switch. Layout shall also include the required conduits necessary for controls and accessories.
- C. Building floor plans shall indicate location of remote annunciator panel and required conduit and circuit connectivity.

- D. One-line diagram shall indicate generator size, automatic transfer switch in normal position, feeder sizes and generator main breaker size.
- E. Professional Service Provider (PSP) shall provide pad construction details. PSP is responsible for coordination with Civil/Structural Engineer.

3.02 Enclosed Transfer Switches

- A. Normal and emergency circuits feeding into the switch shall be protected by molded case circuit breakers.
- B. The continuous duty ampere rating shall be for the complete downstream load.
- C. Drawings shall indicate location, drawn to scale in the electrical rooms. An alphanumeric designator consistent with the standards of The University shall be applied to the room layout and the single line diagram. The single-line diagram shall show the continuous duty rating, both sources of power with appropriate feeders and the switch shown in the normal operating position.
- D. The PSP shall coordinate with The University on precise sequence of operation, but the minimum baseline requirement shall adhere to the following:
 - 1. Under voltage Sensing : All phases of normal and emergency power shall be monitored with solid state under voltage sensors. When normal load voltage drops to 85% of normal, transfer switch shall initiate emergency generator and transfer when emergency source is at minimum of 90% voltage and proper frequency.
 - 2. Overvoltage Sensing: All phases of normal and emergency power shall be monitored with solid state adjustable overvoltage sensors. These sensors shall be adjustable for pick-up settings from a minimum of 100% to a maximum of 130% (+/- 5%), with a dropout of 5% (+/- 1%) of nominal voltage above the pick-up setting. An adjustable time delay of 0.5 – 2.2 seconds shall be provided.
 - 3. Frequency Sensing: Solid state and adjustable for pickup of +/- 4% to +/-20% of nominal frequency. Dropout shall be +/- 5% of nominal wider than the pick- pick-up frequency bandwidth. The time delay shall be adjustable from 0.1 15 seconds.
 - 4. Retransfer: Retransfer to normal power shall occur when normal source has stabilized to 95% voltage for minimum of 15 minutes. Control shall be adjustable from 0 – 30 minutes. Appropriate controls for cooling down generator shall be provided prior to stopping (factory set at 30 minutes.)

END OF STANDARD