SECTION 263200 - STANDBY/EMERGENCY POWER SYSTEM

1.0 Design Professional is responsible for designing a system that is in accordance with applicable portions of the NFPA Codes, IEEE Standards, EPA Emission Standards and NEMA Standards. All products shall be UL listed for the application. The system design shall be in accordance with NFPA 70 (NEC) and NFPA 110.

2.0 Design Professional is responsible for assessing determining the needs system capacity and configuration as necessary to comply with code minimum code requirements plus in addition to ascertaining the University's building program requirements for additional non-mandatory loads that should be placed on the standby/emergency system.

3.0 Sizing of the standby/emergency system shall be in accordance with code and manufacturer's recommendations. In addition to meeting the minimum system capacity requirements, the systems shall include capacity for future planned additions plus thirty (30) percent spare capacity. Generator set capacity shall be based on the following environmental criteria:

A. Ambient temperature: 5 to 40 deg. C

B. Relative humidity: 0 to 95 percent

C. Altitude: Sea level to 100 feet

4.0 The standby/emergency system shall be designed to accommodate the types of loads placed on the system (i.e., motors, UPS, HID lighting, etc.), and full consideration must be given to the manner in which loads are controlled and emergency system power is distributed. The Design Professional shall calculate the generator size using manufacturer's generator sizing program.

5.0 When directed by the University Engineering Department, the design shall include provisions for temporary connection of a trailer-mounted portable generator.

6.0 As a minimum, optional standby loads shall include storm water sump pumps, sewage ejector pumps, and the building automation and security systems shall be connected to the generator supply in addition to emergency life safety, critical (for hospital occupancies) and legally required building loads. A duplex receptacle color-coded red and connected to the generator supply shall be provided in the electrical service entrance room, the main telephone room, the generator and ATS rooms, and the elevator machine room – receptacles to be powered from the optional standby branch.

7.0 Steady state voltage variation at the generator set load terminals shall not exceed 5% of rated output from no load to full load. There shall be no measurable steady state or transient frequency variations when the generator set is operating at any constant load within its rated capability. No-load harmonic voltage distortion shall not exceed 5% THD and 3% for any single harmonic order.

8.0 A dynamic load analysis shall be performed to verify that the effects of block loading (from ATS transfers, motor starting, etc) do not result in the transient voltage drop at the generator terminals exceeding 20%, for normal loads, 10% for sensitive loads, frequency variation is maintained at 5% or less, or other criteria as dictated by load equipment requirements. Oversized alternators shall be specified where required to provide sufficient S-kVA to meet motor starting requirements, and/or when required to serve loads with high harmonic distortion content.

9.0 Design Professional is responsible for verifying that an oversized generator does not create maintenance problems with regard to load testing. If the initial loading of the engine generator will lead to

wet-stacking or other issues related to low load conditions, a resistive load bank should be considered.

10.0 The source of standby/emergency power shall be engine-driven generators. Fuel shall be diesel oil or natural gas. Generators Engines shall have critical grade silencers. Engine exhaust shall be piped to a location that eliminates the possibility of exhaust gas entrainment in HVAC air intakes, for all new and existing buildings in the vicinity of the generator location. In areas of dense building populations, areas surrounded by high or medium rise buildings, etc., a wind-wake analysis is mandatory. All generators must meet EPA, DEP and Philadelphia AMS exhaust emission requirements.

11.0 Generator set alternator shall be synchronous type, permanent magnet generator (PMG) exciter, 2/3 pitch starter winding with NEMA MG1-1.65 Class H insulation and 80°C temperature rise and LSI electronic trip main-line circuit breaker(s). Ground fault pick-up shall alarm only when code requirements mandate this.

12.0 Generator sets shall include microprocessor based digital control and monitoring systems that manage all engine parameters, engine starting, governor functions, voltage regulator functions, and overcurrent protection. Panel shall include Hand-Off-Auto generator set control switch function. Generator set control panel shall provide digital display of all parameters, alarms and faults as required by NFPA 110, and shall maintain an event log. Provide Modbus TCP/IP port for remote monitoring (by SCADA or similar system) of all generator parameters and conditions. Include manufacturer's technical services to assist with integration between generator and remote monitoring/SCADA system. Provide a minimum of two each, dry contacts for generator common trouble/fault alarm, generator running, and fuel tank high and low level – for wiring to BAS and fire alarm systems. Provide generator Fault and Alarm status to the SCADA system – consult with the University Engineering Department for specific guidance on the SCADA interface method to be used.

13.0 Generator governor shall be adjustable isochronous type with speed sensing.

14.0 Engine starting/charging system shall include redundant battery chargers, batteries, and best source selective switch to power the engine cranking motor. Battery capacity shall be adequate for a minimum number of cranking cycles as required by NFPA 110, at the project conditions defined in Division 1 of the project specifications. Engine-driven alternator shall maintain battery charge while the engine is running. Provide UL 1236 compliant automatic float/equalize battery charger to maintain battery charges during engine-off times. Battery charger shall be equipped with alarm contacts for charger and battery status, to be monitored by the generator set control panel.

15.0 Diesel fuel oil shall, in all cases, be stored in tanks that are equipped with secondary containment provisions meeting all EPA SPCC requirements, including monitoring of interstitial containment spaces for leakage. In general, generator set subbase tanks are to be used, and shall be labeled with rated fuel capacity, and projected engine run time at full generator set load. When permitted by the University Engineering Department, remote bulk storage and transfer pumping systems may be used. Fuel transfer systems shall include all day tanks, piping, level controls, control panels, pumps, motor starters, etc. Transfer pumping systems must be powered from a life safety branch associated with the generator(s) they serve. Overflow lines from day tanks must be piped back to the associated bulk storage tank. Day tank vents shall be piped to a high enough elevation so as to prevent fuel overflow from spilling out of the vent line.

16.0 The minimum requirement for day tank or sub-base tank fuel capacity shall be the capacity required to provide three hours of run time at projected generator load, plus additional run time as required by building program requirements and/or as directed by the University Engineering Department.

17.0 Fuel storage and the fuel oil storage tank filling station shall have spill containment and shall be provided with a spill absorption kit. The location of the fuel filling station shall be coordinated through the University Engineering Department, in order to properly consider access required by fuel delivery contractor trucks. When required (such as cases where generator fuel tanks are located on upper building floors), fill stations shall include fuel transfer pumping systems.

18.0 Natural gas fuel supply systems shall include all required booster pumps, PRV's, shut off valves, piping. The design professional shall be responsible for verifying that the natural gas supply infrastructure serving the building in which the generator set is located can support the gas flow and pressure requirements of the generator set. Refer to plumbing design standards, Section 220000 – Plumbing Systems, paragraph 14.0 for additional requirements.

19.0 The generator shall be located indoors, unless specific permission is obtained from the University Engineering Department, the University Architect, and the University EHRS Department for locating the generator in an outdoor enclosure. Generator rooms shall be dedicated for the generator and shall meet the location requirements outlined in NFPA 110. Designs for installations in existing buildings shall address rigging requirements for getting existing generators out of the building and new generators into the building.

20.0 Generator and ATS rooms shall be provided with self-contained battery pack lighting units.

21.0 Generator sets shall include a skid mounted glycol based engine cooling radiator system. The radiator cooling air discharge for the generator set shall be ducted to building exterior walls. Intake and discharge cooling air shall pass through building openings equipped with motorized (powered closed, spring open) louvers that minimize the amount of air infiltration during engine-off times. A dedicated generator-running dry contact shall supervise louver operation. Remote radiator systems are permitted only when specifically allowed by the University Engineering Department. In such cases, where the static pressure head requires it, provide a secondary cooling loop, with heat exchanger and generator powered duplex secondary cooling loop pumping system.

22.0 Outdoor generator enclosures shall be walk-in type and shall be provide a minimum of 25 dB of sound attenuation at 10 feet.

23.0 Generator sets (including those installed indoors) shall be equipped with engine block coolant heaters, and space heaters for the generator/alternator, main circuit breaker, and control panel. The generator controls shall be arranged to automatically shut off power to the block heaters and space heaters, when the generator set is running.

24.0 The engine and generator subassembly, and all other vibration producing generator set components, shall be supported on a manufacturer-supplied steel skid, using suitable restrained spring isolators and elastomeric isolator pads. Perform a structural vibration analysis for buildings that contain vibration-sensitive occupancies or equipment. Where required to meet the requirements of sensitive occupancies, provide additional isolators and inertia bases, as required to meet the vibration criteria. Generators located in other than basement elevations shall be installed with additional restrained spring isolators between the skid and the building structure. Vibration analysis shall be performed for sensitive occupancies, as determined by the University Engineering Department.

25.0 Provide one or more UL 1008 listed automatic transfer switches (ATS) for the emergency life safety, legally required, standby and optional standby loads, in accordance with NEC articles 700, 701 and 702. Patient care facilities will also require a critical branch in accordance with NEC article 517.

26.0 ATS's shall be of the contactor-based design, mechanically-held, electrically operated. All ATS's shall include bypass-isolation features (to allow servicing of the ATS), microprocessor-based controller, in-phase monitor, and a power monitoring device that provides front of panel display of ATS

amperes (Ia, Ib, Ic, I avg) and voltage (Vab, Vbc, Vca, Van, Vbn, Vcn, Vavg), real, reactive and apparent power, real and reactive energy, power factor. The front panel display shall also show retransfer countdown elapsed time.

27.0 ATS fault current withstand ratings shall be adequate for the available fault current, and shall be coordinated with the manufacturer and type of circuit breakers that are protecting the ATS. ATS may be protected by current-limiting fuses only with specific approval of the University Engineering Department.

28.0 Specifications shall include requirements for the generator set manufacturer's on-site technical services to supervise initial generator set preparation and start-up/test run. The technical representative shall be a manufacturer factory trained and certified generator set technician. Provide test report documenting that the installation meets all of the manufacturer's warranty requirements, documents the date the warranty takes effect, and documents all NETA testing requirements for generator sets and ATS's.

29.0 The initial field testing of the generator shall include a 100% full load test for a minimum 4-hour period with temporary resistive load bank and installation acceptance tests as required by NFPA 110 including cold start and load acceptance tests. Provisions for periodic maintenance testing of the generator under building load (minimum 30% of nameplate rating) shall be included in the design. Include provisions for temporary connection of a portable load bank, when dictated by project conditions, or as directed by the University Engineering Department.

30.0 Project specifications shall include requirements for provision of 12 months of maintenance service by the manufacturer's service organization, beginning at Substantial Completion of the project. The manufacturer's warranty shall cover the equipment – materials and workmanship, for 5 years from the date of Substantial Completion.

31.0 Project specifications shall require that the Construction Manager, Contractor, or other entity responsible for installation of the generator set be required to obtain the necessary air quality permits. All air quality permit applications shall be reviewed by the University EHRS Department prior to submittal to the approving agency.

32.0 Generator sets shall be supplied by one of the following manufacturers:

A. Cummins/Onan

B. Caterpillar

Other manufacturers may be considered, only with specific approval from the University Engineering Department.

33.0 ATS's shall be supplied by one of the following manufacturers:

A. ASCO (7000 Series)

B. Russelectric (RTS-03)

Other manufacturers will be accepted only with specific approval from the University Engineering Department.