16620  EMERGENCY POWER SYSTEMS

PART 1:  GENERAL

1.01  SUMMARY

A.  This Section provides the University guidelines for the installation of Emergency Power Systems.

B.  This standard is developed primarily to address the design and installation of an engine-driven generator to support facility emergency and standby loads.


1.02  SYSTEM DESIGN CONSIDERATIONS

A.  Typically an engine driven generator with automatic transfer switching shall provide backup power for the facility emergency systems.

B.  Building life safety systems shall be connected to the generator system in accordance with all applicable codes. These include, but are not limited to:

   1.  Fire alarm and detection system
   2.  Security and card access systems
   3.  Facility exit and egress lighting.
   4.  Fire Pump and jockey pump
   5.  Smoke purge fans
   6.  Laboratory fume hoods / fans
   7.  Elevators (when used as means of egress)

C.  Critical mechanical equipment shall be considered for connection to the generator system to avoid building freeze-up or flooding. This includes but is not limited to:

   1.  Heating system pumps
   2.  Condensate return pumps
   3.  Sewage ejector pumps
   4.  Building Automation System (BAS)
   5.  BAS control air compressors

D.  Consideration shall also be given to other Owner equipment loads such as:

   1.  Incubators
   2.  Refrigerators and coolers
   3.  Ultra-low laboratory equipment
E. If one generator is used to supply both emergency and non-emergency (legally required or optional standby) loads, dedicated transfer switches for each type of load will be required per Code.

F. For small buildings or facilities (those with minimal emergency loads), a life cycle cost analysis (including maintenance costs) should be performed to determine if battery pack sources or a generator set source would be the most cost effective source for emergency systems.

1.03 SYSTEM DESIGN PLANNING

A. For major EPSS renovations (such as EPSS revisions or replacement) and new system designs, consultant shall engage Cornell University’s Facilities Engineering (CU FE) via the Cornell Project Manager to determine the overall scope of the work before commencing design.

B. Coordinate the following system design elements with the Project Manager and representatives from CU FE in a basis of design document:

1. List applicable Codes and Standards with Editions used in the system design, including applicable versions of the Building Code of New York State, NFPA 72, NFPA 70, and the Elevator Code. Identify building occupancy type.

2. Develop and identify overall design considerations:
   a. EPS Indoor or outdoor location;
   b. EPS Sound attenuation level;
   c. EPS Type of fuel supply;
   d. ATS type (i.e. open transition, closed transition, bypass/isolation)
   e. Types of loads to be connected to the Emergency Power Supply;
   f. EPS Monitoring and connection to supervising station, i.e. Digitize.

3. Location of EPS, ATS, branch circuit panels, and remote annunciator.
4. Routing of generator exhaust piping.
5. Special systems considerations (i.e. fire pumps, elevators, atrium smoke purge).

C. Consultant shall maintain an up-to-date list of each load considered and categorize by load type (Emergency, Legally Required or Optional Standby) connected within the facility. Consultant shall coordinate the final generator sizing with the project manager and CU FE using manufacturer software sizing program. Provide the final data to Project Manager prior to the completion of the construction documents.
1.04 SUBMITTALS

A. To ensure compliance with the intent of this standard, all new EPSS final designs and associated contract submittals shall be reviewed by CU FE.

B. One (1) copy of new EPS submittal shall be sent to the CU FE Electrical Section for review and comment prior to releasing final approved submittals to the contractor. Submittals shall contain the following information:

C. Product information for all installed components, such as the EPS, ATS size and type; fuel storage tank(s), outdoor enclosure, exhaust silencer, annunciator.

D. System labeling materials and methods as described in this section.

E. Refer to CU Design and Construction Standard 16010 for additional submittal requirements.

1.05 AS-BUILT INFORMATION

A. At completion of the project, Engineer of Record shall provide a complete set of EPSS “As-Built” information that includes the following information prior to the closeout of the project:

1. EPS and EPS Annunciator(s) locations
2. Emergency Power Panel locations
3. Special systems interface locations
4. Complete EPSS diagram that depicts wiring between EPS and all EPSS components. Such detail shall include all major equipment and their locations (approved room number designation), power wiring connections, and interconnections to other special systems as designed per this standard.
5. Completed Commissioning documentation (Startup List)
6. Approved Routine EPSS Testing Job Plan

PART 2: PRODUCTS

2.01 EMERGENCY POWER SUPPLY (EPS)

A. System Installation Considerations

1. An engine-driven generator shall be located in a room or enclosure designed for the purpose. Assembly shall meet all requirements of UL and generator emissions must meet EPA certifications.
2. The EPS shall be separated from other areas as required by Code for the isolation of hazards.
3. The EPS should be installed as close as practicable to the normal (utility) electric service to reduce the amount of cabling required to transfer switch(es).

4. EPS control panel, including metering/display and emergency stop switch shall be located to allow for ease of access and viewing of EPS conditions. Note that some installations may require the remote location of the control panel as the panel is usually located on top of the generator housing end of the EPS, and where the EPS has a subbase tank and/or located outdoors the control panel could be over 8’0” AFG.

5. If locating the ATS in the same room as the EPS, locate the ATS(s) closest to the egress door; do not locate ATS in an area that requires personnel to travel around or over the generator set for access.

6. Allow a minimum of three feet around the sides and generator end of the EPS for service and to ensure free flow of generator cooling air.

7. An adequate supply of combustion air and cooling air shall be provided for the emergency generator room. Manufacturer’s recommendations for air supply and exhaust shall be determined and facilities designed according to these recommendations.

8. Supply air shall be taken from outdoors or from indoor areas having normal ambient temperatures.

9. If necessary, provide a heat source such as a unit heater to keep room at an acceptable ambient room temperature.

10. Provide motorized dampers on all ducts/openings, interlocked to operate (open) on generator run. Provide fire ratings on all assemblies as required by Code.

11. EPS shall be supplied with accessible coolant and oil drains with valving. Locate to allow for ease of maintenance.

2.02 FUEL SUPPLY

A. General

1. Priority for selection of the EPS fuel supply type shall be given for the EPSS to meet Code required transfer times (i.e. to power egress lighting will need to meet 10 second start and transfer time, NFPA 110 Type I).

2. Fuel capacity for EPS Class (run time) shall be adequate for a minimum of (4) hours at EPS full load unless otherwise dictated by Code.

3. Larger fuel capacities shall be discussed with CU FE and the Project Manager, but are generally no longer than (8) hours due to long term fuel storage quality concerns. In addition, the University has the ability to bring the cogeneration facility on-line for large scale needs within (4) hours in the event of a utility outage for central campus.

4. Fuel supply installations shall meet all applicable Codes and Standards.
B. Diesel Fuel

1. The main campus fuel supply Ultra-Low Sulfur Diesel (ULSD) tank for all campus generators is located at Palm Road. ULSD fuel information can be obtained from the Project Manager.

2. Storage tanks for individual EPS shall be sub base type or remotely located within a facility. All tanks shall be UL Listed and dual-wall type unless otherwise coordinated with the Project Manager and CU FE.

3. Tanks shall be installed to allow for access and visual inspections.

4. Fill ports shall be equipped with a mechanical whistler audible alarm. Automated solenoid valves interlocked with the fuel system to prevent overfill of the remote internal building tank is discouraged.

5. Consultant shall design diesel type EPSS so that it will run / operate with at least a 30% loading; supplemental electric resistance load banks should be designed to provide and to maintain a 30% minimum load during a monthly test. This is to prevent annual load banking of the unit under the requirements of NFPA 110 where diesel EPS do not meet minimum loading.

C. Natural Gas

1. Note that natural gas fuel supply is not readily available on central campus.

2. Natural gas service shall be obtained downstream from the facility main building pressure regulator and meter.

3. No natural gas piping shall be installed underground/below grade.

4. Provide electronic interlocks / valving to ensure gas supply to unit is shut off when generator is not running.

D. Other Fuel Supply Types

1. Other fuel types may be considered based upon EPS location, site conditions and access / availability of fuel resources. Coordinate with CU FE and Project Manager.

2.03 ENCLOSEMENT

A. Consideration and approval of outdoor EPS unit locations shall be reviewed and coordinated with the Cornell University Architect. This could require consultant to schedule a site visit and walk through and/or photo renderings of the proposed equipment.

B. Review enclosure paint finish with University Architect. Note that a non-standard manufacturer finish may be required to enhance aesthetics, and could result in additional lead time on the equipment.
C. Outdoor enclosures shall be sound attenuated; coordinate specific dB(A) limits with CU FE during design. Provide hoods as required to meet required sound levels.

D. Generator exhaust piping and muffler shall be installed and contained within the enclosure. The exhaust outlet only shall be extended through the enclosure.

E. General “skin-tight” enclosure is standard. Review walk-in type with CU FE if additional electrical equipment is necessary to support the EPSS prime mover.

F. Review installations of maintenance GFCI convenience receptacle(s) and/or interior enclosure lighting inside enclosures with Project Manager.

2.04 GENERATOR EXHAUST

A. Generator exhaust piping shall be installed to minimize the possibility exposing the public to noxious gases. It is preferred to have a vertical discharge to allow for the gas plume to rise quickly. Maintain safe distances from building air intakes, keep away from loading docks.

B. Avoid rain caps or other devices that limit plume rise on exhaust stacks. Although widely used, conical rain caps are not necessarily effective at preventing rain from infiltrating the exhaust system because rain does not typically fall straight down. Alternate design options are presented in the ASHRAE Handbook–HVAC Applications.

C. Where generator engine sets are installed indoors, it is preferred to route the exhaust piping within the building until the outlet exits to the exterior wall or roof. Provide all necessary insulation and fire ratings to accommodate the installation.

D. Provide air modeling dispersion analysis of the generator exhaust system to ensure acceptable levels are maintained. Coordinate the design criteria with the Project Manager and CU FE.

E. Supplemental means shall be considered to reduce emissions through the installation of catalytic converters if the dispersion analysis cannot meet design criteria.

2.05 BATTERIES/CHARGING SYSTEM

A. Type – NiCad or sealed lead acid type. Consultant shall review total ownership costs (including disposal and/or recycling fees) and provide recommendation to CU FE prior to final equipment selection.

B. Battery charger output shall be monitored, alarm condition shall be sent to Cornell EMCS.
2.06 REMOTE ANNUNCIATOR PANEL

A. Remote annunciator panel operation and features shall be similar to the main control panel operation and features.

B. Conform with NFPA 110 for required alarm and pre-alarm conditions.

C. Remote annunciator panel enclosures shall be similar to the main control panel enclosures, panel covers, and trim rings. (Note: Keyed locks for remote annunciator panels shall be keyed the same as the main control panel.) However, this panel shall be flush-mounted unless approved for surface-mounting by the Architect of Record.

D. Coordinate the mounting of the remote annunciator with building support staff. Locate in an area that can observe and report conditions, such as adjacent to the fire alarm annunciator or control panel.

2.07 TRANSFER SWITCH(ES)

A. General

1. All transfer switches shall be automatic unless otherwise coordinated. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a nonfused mechanism, momentarily energized.

2. The switch shall be positive double throw operation. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

B. Types

1. Transferring circuits with neutral conductors shall have a switched neutral pole (or overlapping neutral") whenever a "separately derived service" (as defined in the NEC) is involved. Provide switched neutral type ATS for all 480Y/277V systems, review applicability for 208Y/120V systems and provide information to CU FE.

2. Open Transition – general use and preferred in most installations.

3. Closed Transition – consider where routine testing would be disruptive to facility research and/or occupants. Coordinate the installation of this type of equipment with CU FE; a central record of this type of ATS is managed. Installation of this type of ATS requires that a shunt trip be installed on the EPS output breaker to prevent the continued supply of power from the generator if the two sources are paralleled for longer than 50 milliseconds.

2.08 SYSTEM IDENTIFICATION/LABELING

A. Provide lettered plates for the following equipment, components, and accessories. The plate shall contain the equipment identification (custom panel number, area served), as well as power circuit source and breaker number.

1. Power Panels served by EPS
2. Normal (utility) circuit breakers serving automatic transfer switches
3. Automatic Transfer Switches
4. Remote annunciators

B. Label shall be red plastic, lamicoid engraved plated or approved equal. (Note: ALL Lettered plates shall be reviewed and approved by Cornell University’s Project manager prior to installation.)

C. Standard naming of ATS:

1. NEC defined Article 700 load– “ATS-EM_” (sequential number as suffix if more than one ATS installed)
2. NEC defined Article 701 load– “ATS-LR_” (sequential number as suffix if more than one ATS installed)
3. NEC defined Article 702 load– “ATS-OS_” (sequential number as suffix if more than one ATS installed)

2.09 ACCEPTABLE MANUFACTURERS

A. The equipment, components, and accessories shall be as specified by Cornell University’s Facilities Engineering Electrical Section. Requests for authorization to substitute, vary, or change the specified equipment, components, or accessories of the approved manufacturer may be submitted, in compliance with Cornell University’s Design and Construction Standards (see Section 01001 - General Requirements), to FE Electrical Section prior to the Contractor’s submission of the invitation-for-bid proposal.

B. Acceptable EPS manufacturers:
   1. Caterpillar
   2. Cummins
   3. Kohler
   4. No other manufacturers will be considered.

C. Acceptable Automatic transfer switch (ATS) manufacturers are:
   1. Russelectric (preferred)
   2. Zenith
   3. ASCO
   4. As supplied by the EPS manufacturer.
PART 3: EXECUTION

3.01 SYSTEM COMMISSIONING

A. EPSS Startup list to be provided to CU FE for review and approval prior to startup. See Section 3.03.

B. Acceptance testing:

1. Provide minimum (5) working days prior notice to Project Manager.
2. Complete and submit EPSS Startup Checklist to Project Manager.
3. Contractor to provide portable load bank sized for output of generator set.
4. Contractor shall supply adequate fuel for testing and shall fill tank to capacity upon completion of all acceptance testing.
5. Building load shall not be used for ANY load testing.

C. Owner Training

1. Provide access by Cornell maintenance personnel for alarm and fault conditions. Train Owner personnel on EPS operation and troubleshooting of the EPS control panel.
2. Provide (4) hour training of the EPSS, including execution of the EPSS monthly testing job plan.
3. Provide contact information to the Owner for EPS control system software upgrade/purchase.

3.02 ROUTINE EPSS TESTING PROGRAM

A. The University has implemented a campus-wide EPSS program which includes the scheduling and testing of the EPSS as required by the BCNYS and NFPA 110.

B. The routine exercising and operation of the equipment is administered through the campus asset management system, and consists of a custom job plan for each EPSS.

C. Consultant shall be responsible to coordinate the development, initial execution and the delivery of the accepted monthly test routine to the Project Manager.

D. Completed job plan shall be submitted to CU FE for review and approval, upon which time it shall be entered into the asset management system for implementation by the Cornell Shops.
3.03 EPSS START-UP

A. General

1. EPSS start up shall conform with the requirements of the most current adopted version of NFPA 110. This shall include, but not be limited to a load test and cold-start test.
2. Verification of all alarm and trouble conditions shall be verified and recorded.
3. Load bank equipment, connections, fuel and all associated labor costs for the EPSS startup shall be provided by the installing contractor.

B. Function Test

1. EPSS shall be function tested before final acceptance by the Owner. This may be performed as a black start (utility power shall be disconnected from the building and the EPSS permitted to start the facility standby loads).
2. Any and all interlocks, load shed and other schemes shall be tested to ensure proper operation.
3. Load on the EPSS and on each ATS shall be recorded.
4. ATS transfer times shall be recorded.

C. Closeout Documents

1. Provide copies of all test information to Project Manager, including:
   a. EPSS startup, alarm and trouble condition verification
   b. Generator Data (See 3.04D)
   c. ATS Data (See 3.04E)
   d. Function Test Data
      i. Interlocks
      ii. Load Shed
      iii. Other load management schemes
   e. EPSS running load (metered kW)
   f. ATS load(s) (metered amperes)
   g. ATS transfer time(s)

2. Provide small scale drawings (letter or 11”x17” size) that depicts the “As-Built” location of:
   a. EPS
   b. ATS(s)
   c. All utility supply circuit breakers serving ATS
   d. All standby power panels
D.  GENERATOR DATA

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<tr>
<td>Diesel Tank Size (gallons)</td>
<td>Location (Room)</td>
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<tr>
<td>Run Time at Full Load (hrs)</td>
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E.  ATS DATA (Provide for each ATS installed)

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<tbody>
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END OF SECTION