# SECTION 26 32 00

# EMERGENCY AND STANDBY POWER SYSTEMS

This section addresses emergency and standby generators, transfer switches and the emergency and standby electrical systems, emergency lighting, lighting inverters, emergency battery units.

## PART 1 - DESIGN DIRECTIVES

### 1.1 EMERGENCY AND STANDBY SYSTEMS AT DARTMOUTH CAMPUS FACILITIES

A. Dartmouth College buildings' emergency and standby power is typically provided by diesel or LP gas fueled generators. Large buildings typically have a generator installed within the building. Smaller buildings may be provided with generator power from a district generator, which may be located in an adjacent or nearby building.

B. Location of generators shall consider ease/difficulty of maintenance, exhaust location relative to air intakes and open windows, complexity of fuel transfer systems, campus aesthetics, carbon monoxide presence in sleeping facilities, operating noise, and other considerations. For these reasons, preferred locations are at ground or lower levels of buildings, non-residential buildings, and interior locations.

C. Lighting inverter systems for emergency lighting may be allowed on a temporary basis.

D. Other sources of emergency and standby power may be considered.

E. Where a district generator serves the emergency and standby systems at other building(s), a single emergency feeder shall be provided to each other building. A standby feeder shall be spliced from the emergency feeder at each other building.

F. Emergency feeders - Preference for very limited use of MI cable. Emergency system feeders should be located in sprinkler protected areas or encased in concrete. Risers should be in stacked sprinklered electric rooms.

G. NH DES/Title IV Emissions permitting – Coordinate permitting requirements with Dartmouth FO&M.

### 1.2 DESIGN REQUIREMENTS

A. At the schematic phase of the project, the design engineer shall provide a list of loads proposed to be served by emergency power, required standby power and/or optional standby power. Load characteristics and calculated total demand load on each branch shall be provided. This load summary shall be reviewed with Dartmouth College at each subsequent phase of the project design.

B. The construction drawings shall include complete panelboard schedules including per phase load information with connected and demand load totals.

## 1.3 DESIGN CRITERIA

A. EMERGENCY AND STANDBY SYSTEMS

1. Both systems shall be metered. Metering may be accomplished by providing a meter on load side of ATS, on feeder to ATS (acceptable for small/minor buildings), or via the ATS ethernet connection if configured to the campus power monitoring system.

B. GENERATORS AND ACCESSORIES

1. Generators shall be designed as separately derived sources. Exceptions shall be discussed with FOM-Engineering at schematic phase of project.
2. Water jacket and battery heaters
   a. Shall be connected to a normal power source.
   b. Shall be thermostatically controlled with an adjustable set point.
   c. A manual disconnect shall be installed adjacent to the heater.
   d. Isolation valves shall be provided for block heaters to allow replacement without draining the system.
3. Engine crankcase vents shall be piped to the exterior or means shall be provided to recycle crankcase vapors without the use of replaceable filters.
4. Generator Alarms shall be monitored by the Fire Alarm System. Alarm points monitored shall be:
   a. Generator Running
   b. Generator Fault/Alarm
   c. Generator Switch Not-In-Auto
5. Generator s shall be monitored by the building BMS system. Points monitored shall be:
   a. Generator Running
   b. Generator Fault/Alarm
   c. Generator Switch Not-In-Auto
   d. Other points as defined by Dartmouth FOM-Director of Operations
6. Exhaust muffler – Critical silencer shall be specified for all installations.
7. Exhaust pipes for generators and engines shall be located away from fresh air intakes and not be oriented towards sensitive populations.
8. Generator remote annunciator panel shall be located at the building entrance near the fire alarm system annunciator panel or as alternately defined by FOM-Engineering.
9. Generator installations shall include the following options:
   a. Heavy Duty Air Cleaner
   b. Battery Charger
   c. Battery Heater (exterior applications only)
   d. Water Jacket Heater
   e. Common Failure Relay

f. Run Relay
g. Engine Mounted Fuel Pressure Gauge
h. Isochronous Governor
i. 1% Voltage Regulation
j. kW meter
k. Amp Meter
l. Electronic Frequency Meter
m. Over and Under Frequency Protection
n. Volt Meter
o. Oil Drain Extension
p. Fuel Line Water Separator
q. Critical Silencer
r. NFPA 110 Control Panel
s. Hour Meter
t. Alarm Contacts for Fire Alarm Monitoring
u. Alarm Contacts (open communications protocol such as Lon Works, Modbus, or BACnet)
v. External Voltage Control
w. External Speed Control
x. Cyclic Cranking

C. FUEL TANK

1. Above ground storage tanks are recommended by Dartmouth Environmental Health and Safety. Regulations are less restrictive and cost and impact is less for potential spill clean-up.
2. The capacity of the emergency generator fuel supply shall provide a minimum of 24 hours of run time under full load (48 hours under 50% load).
3. Fuel Tanks:
   a. Devices containing 55-gallons or more of oil, gas, or another hydraulic fluid shall have secondary containment.

      1) Containment shall be capable of encompassing 110% of tank capacity.

4. Fuel Tanks shall have sensors to detect and alarm for - overfill protection.
5. Fuel Tanks shall have audible whistle for overfill protection. The whistle shall be located to be audible at the fuel service fill location.
6. Fuel tanks for oil, gas, or another hydraulic fluid shall not be located near floor drains or storm drains.
7. Spill kits shall be provided and shall be located nearby oil containing devices.
8. Oil, gasoline, and hydraulic oil storage tanks will require additional NFPA labeling, and No Smoking signage.
9. Oil, gasoline, and hydraulic oil storage tanks (either above ground or below ground) should be reported to EHS for tracking if they are being installed, removed, or modified.
10. Oil removed from tanks for disposal/recycling should be moved in an approved container for transportation to a hazardous waste accumulation area for disposal by EHS through an approved vendor.

11. Emergency generators and their exhaust pipes should not be located near flammable materials. (There is probably a better way to word this, but Harvard recently had two fires due to load testing of emergency generators.)

D. FUEL LINES

1. Fuel lines should be double walled.
2. For generator fuel system specifications, refer to Dartmouth College Standard Specification Division 15.

E. LOAD BANK

1. The radiator or duct mounted resistive load bank shall be sized and connected to present a minimum 40% load to the generator during the weekly automatic exercise test.
2. The load bank shall have automatic controls energizing the load bank during exercising, dropping out if the load exceeds the generator capacity, and not energizing under an actual outage.
3. Load bank control wires are required to each automatic transfer switch for load bank to drop out in the event of loss of normal power.
4. The generator distribution equipment or the GMS and Docking Station shall have means to connect a temporary loadbank, if the permanent loadbank does not provide 100% load.

F. GENERATOR MAINTENANCE SWITCH and DOCKING STATION (as required by NEC 700.3 (F))

1. GMS shall be designed to provide back-up to both emergency and standby systems from a mobile (rollup) generator.
2. GMS shall be monitored by the fire alarm system, via a monitoring module. Text shall read (when activated), "(Building/Location/Generator ID) - Generator Maintenance Switch - Not in Normal."
3. GMS Docking Station (mobile generator connection box) shall have rotation of system labelled.
4. GMS Docking Station (mobile generator connection box) location shall have a ground rod provided in its vicinity for connection of the mobile generator.
5. Docking station shall include the capability of connecting a load bank to the generator for testing purposes.
6. Docking Station shall have 400A male Cam-type receptacles.

G. AUTOMATIC TRANSFER SWITCH (ATS)

1. Transfer switches shall be 4-pole. (Exceptions - where the generator is not a separately derived source)
2. Remote annunciators are not required for ATS's.
3. ATS shall be specified with capability for remote ethernet access.
   a. Russelectric – the controller shall be the RPTCS-05 model shall be specified.
   b. ASCO – the controller accessory (ethernet gateway) 72EE2 shall be specified.

4. Data Jack, IP Address (on Dartmouth Energy VLAN) and jumper cable shall be provided for each ATS. Refer to Division 27 for related requirements.
5. 3 cycle
6. Open transition for non-critical loads.
7. Closed transition with bypass isolation for highly critical loads such as data centers.
8. Emergency ATS – single operator. Must be coordinated with existing generator voltage/frequency regulation. Dual operator unit may be required for older generators.
9. Standby ATS – dual operator with capability for delayed transfer and controlled to off transfer (as in load shed mode).
10. ATS Controls wires:
    a. Control wires shall be brought to the generator control panel from each automatic transfer switch.
    b. Control wires shall include wires for load shed control.
    c. Control wires - Minimum six wires plus ground.

H. EMERGENCY SHUT-OFF FOR GENERATOR

1. In compliance with NEC 445.18 – Dartmouth College generators over 15 kW shall have an emergency stop button located at all of the following locations of the building where the generator is located:
    a. Exterior to the entry door to the generator room or enclosure.
    b. In the main electric room, within sight of the building's main electrical disconnect.
    c. At the fire alarm panel location.

2. The emergency stop button shall be located in a locked box if in a publicly accessible location.

I. RACEWAYS, CONDUITS, DISTRIBUTION, DISCONNECTS, SIGNAGE

1. Emergency system feeders should be located in sprinkler protected areas or encased in concrete. Risers should be in stacked sprinklered electric rooms. Use of MI cable for feeders shall be avoided.
2. Underground Emergency system feeders shall be encased in concrete.
3. Disconnecting means shall be provided inside the building served, nearest the point of entrance (Per NEC 225.32). Note that Exception No. 1 shall not be accepted for Dartmouth College buildings.
    a. The location of the disconnect shall be in a location accessible to authorized persons (ie., Dartmouth College FOM staff only).
    b. A single disconnect from an emergency/stand-by power source (generator) shall be permitted to have one disconnect at the building. (Per NEC 700.10(B)(5)d.)
    c. Disconnects for the emergency and standby systems in the building served shall be in separate enclosures, or separate vertical busses of a switchgear. (Per NEC 700.10(B))
    d. Where emergency and standby disconnects are fed from a single feeder, the feeder overcurrent protection shall be coordinated per NEC 700.10(B)(5)b.(ii).

e. With coordination with and permission of the AHJ, these disconnects may be eliminated in lieu of use of the emergency stop button.

4. A permanent plaque or directory shall be installed at the building main electrical disconnect and at each feeder and/or source disconnects. The plaque or directory shall denote all locations of disconnects of sources, feeders and/or branch circuits supplying or passing through the building. The plaque or directory shall identify – the location of all other disconnects, the source of power and the source location, and the equipment served. (Per NEC 225.37) . Include all portable means of power supply to building.

J. EMERGENCY AND STANDY-BY LOADS

1. Dartmouth College and Town of Hanover approved (required) assignment of typical emergency, required standby, optional standby loads.
   a. Emergency Loads (Code Article 700)
      1) Interior Egress lighting
      2) Multi-user bathrooms in residence halls, Restrooms in public buildings
      3) Exterior Egress Lighting
      4) Main Electric Rooms Lighting
      5) Large Mechanical, other Maintenance Rms Lighting (Clarification: Where these areas are large enough so that the egress is defined, egress lighting shall be on the emergency branch.)
      6) Generator Rooms Lighting
      7) Fire Pump
      8) Fire Alarm System (though also allowed to be on required standby system)
      9) Fire alarm reporting/network equipment. (though also allowed to be on required standby system)
      10) Emergency Generator operations equipment
         a) Fuel pumps,
         b) Air supply and exhaust dampers

   b. Required Standby Loads (Code Article 701)
      1) Systems Providing 911 or other Emergency Communications (Voice over IP (VoIP) equipment, Code Blue Phones, Elevator phones)
      2) Systems Providing Notification to Campus S&S (Radio systems, Emergency communications system
      3) Elevator - Where Required by IBC
      4) Smoke Evacuation Systems - Smoke Control System per IBC Section 909 (2006 Ed.),
      5) Duct & Air Transfer Protection per IBC Section 716 (2006 Ed.), including smoke dampers and exhaust fans per IBC Section 716.5.3
      6) Hazardous Fume Hood Exhaust

   c. Optional Standby Loads (Code Article 702)
      1) Elevator - When desired on project and not required by Codes.
      2) Sewage Ejection Pumps

3) Kitchen Hood exhaust
4) Access Control System
5) Security System
6) Automatic Door Operators (for ADA)
7) Heating hot water circulating pumps
8) Select telecommunications equipment not providing 911 or other emergency communication services.
9) Other loads as determined for project

K. EMERGENCY LIGHTING

1. Circuiting requirements - Hallways and stairways shall have lighting connected to operate from circuits supplied by the emergency source transfer switch and from circuits supplied by the normal source (as required by NFPA).
2. Battery unit Light are required in main substation rooms as well as emergency (ESL rooms)
3. Lighting Inverters – not a preferred source of emergency lighting power.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE EQUIPMENT MANUFACTURERS:

A. Generators

1. Cummins/Onan
2. Kohler
3. Caterpillar (excluding generator sets utilizing the Cat 3208 engine).

B. Automatic Transfer Switches

1. Russelectric RTS-03 with RCPTS-05 controller (full metering, bacnet and IP)
2. ASCO with similar controller.
3. Provide data drop and integration of metering into campus EMS system(s).

C. Generator Maintenance switch - Manual transfer switch or mechanically interlocked circuit breaker type

1. Mechanically interlocked circuit breaker type
   a. ESL
   b. Approved equal

2. Manual Transfer switch
   a. Any

D. Fuel Tank Gauge

1. Skid mounted fuel oil tanks shall be equipped with a float type gauge accurate to 2% of the tank volume.

E. Load Bank

1. Acceptable duct or radiator mounted resistive load bank shall be manufactured by Simplex or Avtron or approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Generator

1. The generator set shall be installed on a housekeeping pad that is a minimum of four inches high and larger in length and width by eight inches over the dimensions of the generator base. The generator base shall be securely fastened to the housekeeping pad.
2. Generators and their exhaust pipes shall not be located near flammable materials.
3. Exhaust pipes for generators and engines shall be located away from fresh air intakes and not be oriented towards sensitive populations.

B. Fuel Tanks and Containment Devices

1. Devices containing 55-gallons or more of oil, gas, or another hydraulic fluid shall have secondary containment capable of 110% of the volume of the largest storage device.
2. Devices containing 55-gallons or more of oil, gas, or another hydraulic fluid shall not be located near floor drains or storm drains.
3. Spill kits shall be accessible and located nearby oil containing devices.
4. Provide NFPA labelling for Oil, gasoline, and hydraulic oil storage tanks.

### 3.2 FUEL AND HAZARDOUS LIQUIDS HANDLING AND REPORTING

A. Oil removed from tanks for disposal/recycling should be moved in an approved container for transportation to a hazardous waste accumulation area for disposal by Dartmouth College Environmental Health & Safety through an approved vendor.

B. Devices containing 55-gallons or more of oil, gas, or another hydraulic fluid shall be reported to Dartmouth College Environmental Health & Safety if they are being installed, removed, or modified.

C. Oil, gasoline, and hydraulic oil storage tanks (either above ground or below ground) shall be reported to Dartmouth College Environmental Health & Safety for tracking if they are being installed, removed, or modified.

### 3.3 IDENTIFICATION, LABELLING

A. Fuel Tanks - Provide NFPA labelling for Oil, gasoline, and hydraulic oil storage tanks.

B. Generator Maintenance Switch –

C. ATS – Shall include “Fed from” information.

D. Generator -

## 3.4 START-UP, ACCEPTANCE TESTING AND COMMISSIONING

A. Start-up service shall include a 4-hour load bank test, one hour at full load.

## 3.5 RECORDS/DOCUMENTATION

A. Operations and Maintenance

1. Two sets of operation and service documentation shall be provided and include all manufacturers' service and repair publications and shall include set up procedures for all unit and system components. Standard owner's manuals shall be supplemented with detailed service information to meet this requirement.

B. Emissions data sheets shall be submitted to:

1. Director of FOM Engineering and Utilities, Dartmouth College
2. Environmental Health & Safety, Dartmouth College

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