

order of priority until all emergency loads are connected to the bus.

- (3) The system shall be designed so that, upon failure of one or more engine generator sets, the load is automatically reduced, starting with the load of least priority and proceeding in ascending priority, so that the last load affected is the highest-priority load.

6.4 Bypass-Isolation Switches.

6.4.1 Bypassing and Isolating Transfer Switches. Bypass-isolation switches shall be permitted for bypassing and isolating the transfer switch and shall be installed in accordance with 6.4.2, 6.4.3, and 6.4.4.

6.4.2 Bypass-Isolation Switch Rating. The bypass-isolation switch shall have a continuous current rating and a current rating compatible with that of the associated transfer switch.

6.4.3* Bypass-Isolation Switch Classification. Each bypass-isolation switch shall be listed for emergency electrical service as a completely factory-assembled and factory-tested apparatus.

6.4.4* Operation. With the transfer switch isolated or disconnected, the bypass-isolation switch shall be designed so it can function as an independent nonautomatic transfer switch and allow the load to be connected to either power source.

6.4.5 Reconnection of Transfer Switch. Reconnection of the transfer switch shall be possible without a load interruption greater than the maximum time, in seconds, specified by the type of system.

6.5 Protection.

6.5.1* General. The overcurrent protective devices in the EPSS shall be coordinated to optimize selective tripping of the circuit overcurrent protective devices when a short circuit occurs.

6.5.2 Short Circuit Current. The maximum available short circuit current from both the utility source and the emergency energy source shall be evaluated for the ability to satisfy this coordination capability.

6.5.3* Overcurrent Protective Device Rating. The overcurrent protective device shall have an interrupting rating equal to or greater than the maximum available short circuit current at its location.

7.1.3 The EPSS equipment shall be installed as required to meet the user's needs and to be in accordance with all of the following:

- (1) This standard
- (2) The manufacturer's specifications
- (3) The authority having jurisdiction

7.1.4 EPSS equipment installed for the various levels of service defined in this standard shall be designed and assembled for such service.

7.1.5 When the normal power source is not available, the EPS shall be permitted to serve optional loads other than system loads, provided that the EPS has adequate capacity or automatic selective load pickup and load shedding are provided as needed to ensure adequate power to (1) the Level 1 loads, (2) the Level 2 loads, and (3) the optional loads, in that order of priority. When normal power is available, the EPS shall be permitted to be used for other purposes such as peak load shaving, internal voltage control, load relief for the utility providing normal power, or cogeneration.

7.2 Location.

7.2.1 Indoor EPS Installations. The EPS shall be installed in a separate room for Level 1 installations.

7.2.1.1 The EPS room shall be separated from the rest of the building by construction with a 2-hour fire resistance rating.

7.2.1.2 EPSS equipment shall be permitted to be installed in the EPS room.

7.2.1.3 No other equipment, including architectural appurtenances, except those that serve this space, shall be permitted in the EPS room.

7.2.2 Outdoor EPS Installations.

7.2.2.1 The EPS shall be installed in a suitable enclosure located outside the building and capable of resisting the entrance of snow or rain at a maximum wind velocity as required by local building codes.

7.2.2.2 EPSS equipment shall be permitted to be installed in the EPS enclosure.

7.2.2.3 No other equipment, including architectural appurtenances, except those that serve this space, shall be permitted in

6.4.3* Bypass-Isolation Switch Classification. Each bypass-isolation switch shall be listed for emergency electrical service as a completely factory-assembled and factory-tested apparatus.

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6.5.3* Overcurrent Protective Device Rating. The overcurrent protective device shall have an interrupting rating equal to or greater than the maximum available short circuit current at its location.

6.5.4 Accessibility. Overcurrent devices in EPSS circuits shall be accessible to authorized persons only.

Chapter 7 Installation and Environmental Considerations

7.1 General.

7.1.1* This chapter shall establish minimum requirements and considerations relative to the installation and environmental conditions that have an effect on the performance of the EPSS equipment such as the following:

- (1) Geographic location
- (2) Building type
- (3) Classification of occupancy
- (4) Hazard of contents

7.1.2* Minimizing the probability of equipment or cable failure within the EPSS shall be a design consideration to reduce the disruption of loads served by the EPSS.

permitted to be used for other purposes such as peak load shaving, internal voltage control, load relief for the utility providing normal power, or cogeneration.

7.2 Location.

7.2.1 Indoor EPS Installations. The EPS shall be installed in a separate room for Level 1 installations.

7.2.1.1 The EPS room shall be separated from the rest of the building by construction with a 2-hour fire resistance rating.

7.2.1.2 EPSS equipment shall be permitted to be installed in the EPS room.

7.2.1.3 No other equipment, including architectural appurtenances, except those that serve this space, shall be permitted in the EPS room.

7.2.2 Outdoor EPS Installations.

7.2.2.1 The EPS shall be installed in a suitable enclosure located outside the building and capable of resisting the entrance of snow or rain at a maximum wind velocity as required by local building codes.

7.2.2.2 EPSS equipment shall be permitted to be installed in the EPS enclosure.

7.2.2.3 No other equipment, including architectural appurtenances, except those that serve this space, shall be permitted in the EPS enclosure.

7.2.3* Level 1 EPSS equipment shall not be installed in the same room with the normal service equipment, where the service equipment is rated over 150 volts to ground and equal to or greater than 1000 amperes.

7.2.4* The rooms, enclosures, or separate buildings housing Level 1 or Level 2 EPSS equipment shall be designed and located to minimize damage from flooding, including that caused by the following:

- (1) Flooding resulting from fire fighting
- (2) Sewer water backup
- (3) Other disasters or occurrences

7.2.5* Minimizing the possibility of damage resulting from interruptions of the emergency source shall be a design consideration for EPSS equipment.

7.2.6 The EPS equipment shall be installed in a location that permits ready accessibility and a minimum of 0.9 m (36 in.)

from the skid rails' outermost point in the direction of access for inspection, repair, maintenance, cleaning, or replacement. This requirement shall not apply to units in outdoor housings.

7.2.7 Design considerations shall minimize the effect of the failure of one energy converter on the continued operation of other units.

7.3 Lighting.

7.3.1 The Level 1 or Level 2 EPS equipment location(s) shall be provided with battery-powered emergency lighting. This requirement shall not apply to units located outdoors in enclosures that do not include walk-in access.

7.3.2 The emergency lighting charging system and the normal service room lighting shall be supplied from the load side of the transfer switch.

7.3.3* The minimum average horizontal illumination provided by normal lighting sources in the separate building or room housing the EPS equipment for Level 1 shall be 32.3 lux (3.0 ft-candles) measured at the floor level, unless otherwise specified by a requirement recognized by the authority having jurisdiction.

7.4 Mounting.

7.4.1 Rotating energy converters shall be installed on solid foundations to prohibit sagging of fuel, exhaust, or lubricating-oil piping and damage to parts resulting in leakage at joints.

7.4.1.1 Such foundations or structural bases shall raise the engine at least 150 mm (6 in.) above the floor or grade level and be of sufficient elevation to facilitate lubricating-oil drainage and ease of maintenance.

7.4.2 Foundations shall be of the size (mass) and type recommended by the energy converter manufacturer.

7.4.3 Where required to prevent transmission of vibration during operation, the foundation shall be isolated from the surrounding floor or other foundations, or both, in accordance with the manufacturer's recommendations and accepted structural engineering practices.

7.7.2 Air shall be supplied to the EPS equipment for combustion.

7.7.2.1* For EPS supplying Level 1 EPSS, ventilation air shall be supplied directly from a source outside the building by an exterior wall opening or from a source outside the building by a 2-hour fire-rated air transfer system.

7.7.2.2 For EPS supplying Level 1 EPSS, discharge air shall be directed outside the building by an exterior wall opening or to an exterior opening by a 2-hour fire-rated air transfer system.

7.7.2.3 Fire dampers, shutters, or other self-closing devices shall not be permitted in ventilation openings or ductwork for supply or return/discharge air to EPS equipment for Level 1 EPSS.

7.7.3 Ventilation air supply shall be from outdoors or from a source outside the building by an exterior wall opening or from a source outside the building by a 2-hour fire-rated air transfer system.

7.7.4 Ventilation air shall be provided to supply and discharge cooling air for radiator cooling of the EPS when running at rated load.

7.7.4.1 Ventilation air supply and discharge for radiator-cooled EPS shall have a maximum static restriction of 125 Pa (0.5 in. of water column) in the discharge duct at the radiator outlet.

7.7.4.2 Radiator air discharge shall be ducted outdoors or to an exterior opening by a 2-hour rated air transfer system.

7.7.5 Motor-operated dampers, when used, shall be spring operated to open and motor closed. Fire dampers, shutters, or other self-closing devices shall not be permitted in ventilation openings or ductwork for supply or return/discharge air to EPS equipment for Level 1 EPSS.

7.7.6 Units housed outdoors shall be heated as specified in 5.3.5.

7.7.7 Design of the heating, cooling, and ventilation system for the EPS equipment room shall include provision for factors including, but not limited to, the following:

by normal lighting sources in the separate building or room housing the EPS equipment for Level 1 shall be 32.3 lux (3.0 foot-candles) measured at the floor level, unless otherwise specified by a requirement recognized by the authority having jurisdiction.

7.4 Mounting.

7.4.1 Rotating energy converters shall be installed on solid foundations to prohibit sagging of fuel, exhaust, or lubricating-oil piping and damage to parts resulting in leakage at joints.

7.4.1.1 Such foundations or structural bases shall raise the engine at least 150 mm (6 in.) above the floor or grade level and be of sufficient elevation to facilitate lubricating-oil drainage and ease of maintenance.

7.4.2 Foundations shall be of the size (mass) and type recommended by the energy converter manufacturer.

7.4.3 Where required to prevent transmission of vibration during operation, the foundation shall be isolated from the surrounding floor or other foundations, or both, in accordance with the manufacturer's recommendations and accepted structural engineering practices.

7.4.4 The EPS shall be mounted on a fabricated metal skid base of the type that shall resist damage during shipping and handling. After installation, the base shall maintain alignment of the unit during operation.

7.5* Vibration. Vibration isolators, as recommended by the manufacturer of the EPS, shall be installed either between the rotating equipment and its skid base or between the skid base and the foundation or inertia base.

7.6* Noise. Design shall include consideration of noise control regulations.

7.7 Heating, Cooling, and Ventilating.

7.7.1* With the EPS running at rated load, ventilation airflow shall be provided to limit the maximum air temperature in the EPS room or the enclosure housing the unit to the maximum ambient air temperature required by the EPS manufacturer.

7.7.1.1 Consideration shall be given to all the heat emitted to the EPS equipment room by the energy converter, uninsulated or insulated exhaust pipes, and other heat-producing equipment.

transfer system.

7.7.4 Ventilation air shall be provided to supply and discharge cooling air for radiator cooling of the EPS when running at rated load.

7.7.4.1 Ventilation air supply and discharge for radiator-cooled EPS shall have a maximum static restriction of 125 Pa (0.5 in. of water column) in the discharge duct at the radiator outlet.

7.7.4.2 Radiator air discharge shall be ducted outdoors or to an exterior opening by a 2-hour rated air transfer system.

7.7.5 Motor-operated dampers, when used, shall be spring operated to open and motor closed. Fire dampers, shutters, or other self-closing devices shall not be permitted in ventilation openings or ductwork for supply or return/discharge air to EPS equipment for Level 1 EPSS.

7.7.6 Units housed outdoors shall be heated as specified in 5.3.5.

7.7.7 Design of the heating, cooling, and ventilation system for the EPS equipment room shall include provision for factors including, but not limited to, the following:

- (1) Heat
- (2) Cold
- (3) Dust
- (4) Humidity
- (5) Snow and ice accumulations around housings
- (6) Louvers
- (7) Remote radiator fans
- (8) Prevailing winds blowing against radiator fan discharge air

7.8 Installed EPS Cooling System.

7.8.1 Makeup water hose bibs and floor drains, where required by other codes and standards, shall be installed in EPS equipment rooms.

7.8.2 Where duct connections are used between the prime mover radiator and air-out louvers, the ducts shall be connected to the prime movers by means of flexible sections.

7.9 Fuel System.

7.9.1 Fuel tanks shall be sized to accommodate the specific EPS class.

7.9.1.1* All fuel tanks and systems shall be installed and maintained in accordance with NFPA 30, *Flammable and Combustible Liquids Code*; NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*; NFPA 54, *National Fuel Gas Code*; and NFPA 58, *Liquefied Petroleum Gas Code*.

7.9.1.2* Fuel system design shall provide for a supply of clean fuel to the prime mover.

7.9.1.3 Tanks shall be sized so that the fuel is consumed within the storage life, or provisions shall be made to remediate fuel that is stale or contaminated or to replace stale or contaminated fuel with clean fuel.

7.9.2 Fuel tanks shall be close enough to the prime mover for the fuel lift (suction head) of the prime mover fuel pump to meet the fuel system requirements, or a fuel transfer pump and day tank shall be provided.

7.9.2.1 If the engine manufacturer's fuel pump static head pressure limits are exceeded when the level of fuel in the tank is at a maximum, a day tank shall be utilized.

7.9.3 Fuel piping shall be of compatible metal to minimize electrolysis and shall be properly sized, with vent and fill pipes located to prevent entry of groundwater or rain into the tank.

7.9.3.1* Galvanized fuel lines shall not be used.

7.9.3.2 Approved flexible fuel lines shall be used between the prime mover and the fuel piping.

7.9.4 Day tanks on diesel systems shall be installed below the engine fuel return elevation.

7.9.4.1 The return line to the day tank shall be below the fuel return elevation.

7.9.4.2 Gravity fuel oil return lines between the day tank and the main supply tank shall be sized to handle the potential fuel flow and shall be free of traps so that fuel can flow freely to the main tank.

7.9.5 Integral tanks of the following capacities shall be permitted inside or on roofs of structures, or as approved by the

- (5) Regulator vent piping
- (6) Flexible fuel line section
- (7) Fuel line filters
- (8) Fuel vaporizers (LP-Gas)
- (9) Ambient temperature effect of fuel tank vaporization rates of LP-Gas where applicable

7.9.10 The fuel storage and supply lines for an EPSS shall be in accordance with this standard or with the specific authority having jurisdiction, or both.

7.9.11 All manual fuel system valves shall be of the indicating type.

7.9.12 Listed generator subbase secondary containment fuel tanks of 2498 L (660 gal) capacity and below shall be permitted to be installed outdoors or indoors without diking or remote impounding.

7.9.12.1 A minimum clearance of 0.9 m (36 in.) shall be maintained on all sides.

7.9.13 Automatically actuated valves shall not be permitted in the fuel oil supply or fuel oil return lines.

7.10 Exhaust System.

7.10.1 The exhaust system equipment and installation, including piping, muffler, and related accessories, shall be in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and other applicable standards.

7.10.2 Exhaust system installation shall be gastight to prevent exhaust gas fumes from entering inhabited rooms or buildings and terminate in such a manner that toxic fumes cannot reenter a building or structure, particularly through windows, air ventilation inlets, or the engine air-intake system.

7.10.3* Exhaust piping shall be connected to the prime mover by means of a flexible connector and shall be independently supported thereafter so that no damaging weight or stress is applied to the engine exhaust manifold or turbocharger.

7.10.3.1 A condensate trap and drain valve shall be provided at the low point(s) of the piping unless the piping is self-draining.

7.9.2.1 If the engine manufacturer's fuel pump static head pressure limits are exceeded when the level of fuel in the tank is at a maximum, a day tank shall be utilized.

7.9.3 Fuel piping shall be of compatible metal to minimize electrolysis and shall be properly sized, with vent and fill pipes located to prevent entry of groundwater or rain into the tank.

7.9.3.1* Galvanized fuel lines shall not be used.

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7.9.4 Day tanks on diesel systems shall be installed below the engine fuel return elevation.

7.9.4.1 The return line to the day tank shall be below the fuel return elevation.

7.9.4.2 Gravity fuel oil return lines between the day tank and the main supply tank shall be sized to handle the potential fuel flow and shall be free of traps so that fuel can flow freely to the main tank.

7.9.5 Integral tanks of the following capacities shall be permitted inside or on roofs of structures, or as approved by the authority having jurisdiction:

- (1) Maximum of 2498 L (660 gal) diesel fuel
- (2) Maximum of 95 L (25 gal) gasoline fuel

7.9.6* The fuel supply for gas-fueled and liquid-fueled prime movers shall be installed in accordance with applicable standards.

7.9.7* Where the gas supply is connected to the building gas supply system, it shall be connected on the supply side of the main gas shutoff valve and marked as supplying an emergency generator.

7.9.8 The building's main gas shutoff valve shall be marked or tagged to indicate the existence of the separate EPS shutoff valve.

7.9.9 The fuel supply for gas-fueled and liquid-fueled prime movers shall be designed to meet the demands of the prime mover for all of the following factors:

- (1) Sizing of fuel lines
- (2) Valves, including manual shutoff
- (3) Battery-powered fuel solenoids
- (4) Gas regulators

7.9.12.1 A minimum clearance of 0.9 m (36 in.) shall be maintained on all sides.

7.9.13 Automatically actuated valves shall not be permitted in the fuel oil supply or fuel oil return lines.

7.10 Exhaust System.

7.10.1 The exhaust system equipment and installation, including piping, muffler, and related accessories, shall be in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and other applicable standards.

7.10.2 Exhaust system installation shall be gastight to prevent exhaust gas fumes from entering inhabited rooms or buildings and terminate in such a manner that toxic fumes cannot re-enter a building or structure, particularly through windows, air ventilation inlets, or the engine air-intake system.

7.10.3* Exhaust piping shall be connected to the prime mover by means of a flexible connector and shall be independently supported thereafter so that no damaging weight or stress is applied to the engine exhaust manifold or turbocharger.

7.10.3.1 A condensate trap and drain valve shall be provided at the low point(s) of the piping unless the piping is self-draining.

7.10.3.2 Design consideration shall be given to thermal expansion and the resultant movement of the piping.

7.10.3.3 For reciprocating engines, mufflers shall be placed as close as practicable to the engine, in a horizontal position if possible.

7.10.3.4 An approved thimble(s) shall be used where exhaust piping passes through combustible walls or partitions.

7.10.3.5 For reciprocating engines, the piping shall terminate in any of the following:

- (1) Rain cap
- (2) Tee
- (3) Ell, pointing downwind from the prevailing wind
- (4) Vertically upward-oriented stack with suitable provisions for trapping and draining rain and snow water

7.10.3.6 Design consideration shall be given to the potential heat effect due to proximity to all of the following:

- (1) Conduit runs
- (2) Fuel piping
- (3) Lighting fixtures