

Emergency Power Supply Systems (EPSS) Guaranteeing Reliability and Compliance

- Reliability
- JCAHO and EPA Standard Changes
- New Products
- New Ideas
- Often Found Non Compliant Items
- Safety

Bill Dance - UT Guy

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Reliability Requirements

First, you must have bullet proof components----every thing else depends on it.

Secondly, you must have the budget and a plan to maintain the components.

Thirdly, you must be allowed to perform maintenance and testing according to the manufacturer's standards and all AHJ standards/rules.

Fourth, must use technicians that are trained on your components.

Fifth, you must carefully document all maintenance and testing reports.

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Fuel Testing

NFPA 110, 8.3.8 A fuel quality test shall be performed at least annually using tests approved by ASTM standards

- Lab Tests
- Tank/Fuel Cleaning
- Filtration
- Additives

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JCAHO Sentinel Event Alert #37

Critical Issues

- Air Conditioning – Adding chiller loads to EPSS
- Elevators – Adding additional cars to EPSS
- Fuel Supplies – Tracking expiration dates

Critical Actions

- Risk Analysis
- Evaluation of EPSS – Present and Planned
- Education of Technicians
- Evaluating and Possibly Modifying Emergency Protocols...including EPSS PM programs

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Fuel Cells

At present they cannot be used as “stand-by systems” because of the ramp-up time required.

However, they should be considered in an overall design plan as a source of “normal power”, and when “paralleled” with battery powered UPS

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How reliable must emergency power be?

By its pure definition emergency power must be more reliable than the utility.

Onsite "emergency power systems" should be relabeled as onsite "electrical utilities" and designed, installed, and treated with the same maintenance and testing protocols -according to manufacturer's manuals.

Can you “defend in place”?

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Who is working on your set?

NFPA 110, 8.4.8 - The routine maintenance and operational testing program shall be overseen by a properly instructed individual.

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EPSS Services

- Evaluations
- Risk Assessments
- Education
- Commissioning (Planning, Design, Product Selection, Acceptance Testing and Training)

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Business cards

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Prevailing Winds

NFPA 110, 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.

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EPA Final Rule on Running Generators During Maintenance, Testing & Peak Shaving

- Maximum 100 hours per year for post July 11, 2005 new sets, reconstructed or modified sets
- Exceptions can be granted
- Federal, State or local safety standards
- Non-resettable meter
- Acceptance testing

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Condensate Drain

NFPA 110, 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.

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Automatic vs. Written Reports

NFPA 110, 8.3.4 - A permanent record of the EPSS inspections, tests, exercising, operation, and repairs shall be maintained and readily available.

[The word "written" was replaced with "permanent" to pave the way for computerized reporting.]

Trunk Monkey

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Monitoring

"Most systems tell you what happened. A good one will tell what's about to happen"

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Battery Heaters and Room Temp

NFPA 110, 5.3.1 -The EPS shall be heated as necessary to maintain the water jacket and battery temperature determined by the EPS manufacturer for cold start and load acceptance for the type of EPSS.

NFPA 110, 7.7.7 - Units housed outdoors shall be heated as specified in 5.3.3.

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By-Pass Valve Needed

NFPA 110, 5.6.3.2.1 - Solenoid valves shall have a manual (non-electric) operation, or a manual bypass valve shall be provided.

5.6.3.2.1.1 The manual bypass valve shall be visible and accessible and its purpose identified.

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Indicating Valve Needed

NFPA 110, 7.9.11 All manual fuel system valves shall be of the indicating type.

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Monthly (20-40 Day) Testing

NFPA 110, 8.4.2 - Diesel generator sets in service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:

1. Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer.
2. Under operating temperature conditions and at not less than 30 percent of the EPS nameplate kW rating.
3. If the engine cannot be loaded as required in (2), the engine shall be operated until the water temperature and the oil pressure have stabilized and then the test shall be terminated before the 30 minute time period expires.

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Annual Penalty

NFPA 110, 8.4.2.3 - Diesel-powered EPS installations that do not meet the requirements of 8.4.2 shall be exercised monthly with the available EPSS load and exercised annually with supplemental loads at 25 percent of nameplate rating for 30 minutes, followed by 50 percent of nameplate rating for 30 minutes, followed by 75 percent of nameplate rating for 60 minutes, for a total of 2 continuous hours.

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Why have a connection box for load bank and a portable generator?

SEA #37 "Assess the need for additional redundancy through portable, truck-mounted generators and develop procedures to isolate generators from problem areas and to tie in supplemental equipment not normally fed by emergency power. Also, consider designing in emergency connection panels. These might, for example, be used to hook up a truck-mounted unit during construction or renovation."

NFPA 110, 8.1.2 Consideration shall be given to temporarily providing a portable or alternate source whenever the emergency generator is out of service.

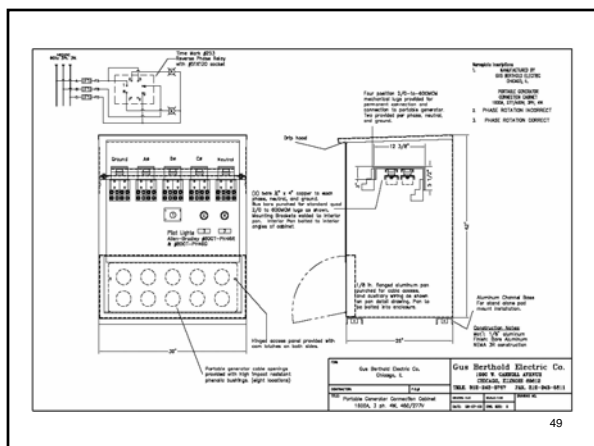
NFPA 110, 8.4.2.2 Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.

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Load Bank, or Rental EPS, Connection Cabinet



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Non-Essential Loads

NFPA 99, 4.4.1.1.7.3 - Optional loads shall be permitted to be served by the essential electrical system generating equipment. Optional loads shall be served by their own transfer means, such that these loads shall not be transferred onto the generating equipment if the transfer will overload the generating equipment and shall be shed upon a generating equipment overload. Use of the generating equipment to serve optional loads shall not constitute "other purposes" as described in 4.4.1.1.7.1 and therefore shall not require multiple generator sets.

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Non-Essential Loads

NFPA 110, 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. NFPA 99 and 110 cites

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Digital Paralleled Systems (2x600) kW Vs. Single 1200 kW

Digital Paralleled Systems Benefits

- Allows "Critical" Load to Have Redundant Back-up
- Both Units Can Back-up Entire Facility
 - Life Safety/Critical
 - Equipment
- Protects Patients/Customers Critical Loads During Servicing
- Lower costs Through Traditional Analog Paralleling Systems
- Ability to Add Systems As Your Needs Increase
- Utility Rate Program Opportunities
 - Curtailment Rates
 - Interruptible Rates

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- Addition of air conditioning – Risk Assessment.
- Addition of more elevators – Risk Assessment

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36 Month Testing

- NFPA 110, 8.4.9 - Level 1 EPSS shall be tested for the duration of its assigned class (*see Section 4.2*), [or] for at least 4 hours, at least once within every 36 months. [A formal interpretation is forthcoming from the NFPA.]
- NFPA 110, 8.4.9.1 - The load shall be the EPSS system load running at the time of the test (*the JCAHO has now mandated the load be at least 30% of nameplate*). The test shall be initiated by opening all switches or breakers supplying normal power to the EPSS.
- NFPA 110, 8.4.9.2 - A power interruption to non-EPSS loads shall not be required.

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Parallel Sets

Q. We have 4 generators paralleled to one bus. "Do you need to test each generator's ability to close to the bus in <10 seconds each month, or just the ability of the 'first generator to close to the bus', and then to the Emergency System (Life Safety and Critical Branch) in <10 seconds each month?"

As you know in most paralleled systems there may be a different set each month that closes to the bus first....depending on a lot of mechanical and electrical factors.

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Parallel Sets

A. My answer would be that as long as the "load side of the LS and CB ATs" had power in <10 seconds, the EPSS is in compliance. If this wasn't the case then there would have to be 4 different tests each month with 3 sets manually switched to the OFF position to ensure an accurate test.

I don't think it would be a bad idea to 'occasionally' knock off 3 at a time, but only under extremely controlled conditions, and when Equipment Branches wouldn't be in need of quick restoration in case of a normal power outage during a test.

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Test Switch or Breaker

NFPA 110, 8.4.3 - The EPS test can be initiated by simulating a power outage using the test switch(es) on the ATs or by opening a normal breaker. Opening a normal breaker shall not be required.

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ATS and Switchgear PMs

NFPA 110, 8.3.5 - Transfer switches shall be subjected to a maintenance and testing program that includes all of the following operations:

- (1) Checking of connections
- (2) Inspection or testing for evidence of overheating and excessive contact erosion
- (3) Removal of dust and dirt
- (4) Replacement of contacts when required

NFPA 110, 8.3.6 - Paralleling gear shall be subject to inspection, testing, and maintenance program that includes all of the following operations: (same as above)

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The Benefits of Bi-Fuel™

- Simultaneous Combustion of Diesel and Natural Gas
- Extended Run Times
- Minimize On-Site Fuel Storage
- Full Diesel Operations
- Capital Savings Over Spark-Ignited Engine
- NFPA Compliant

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Generator Lockouts

29 CFR 1910.147(c)(2)(iii) - After January 2, 1990, whenever replacement or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment shall be designed to accept a lockout device. [Dewalt](#)

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Emergency Stop

NFPA 110, 5.6.5.6 - All installations shall have a remote manual stop station of a type to prevent inadvertent or unintentional operation located outside the room housing the prime mover, where so installed, or elsewhere on the premises where the prime mover is located outside the building.

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“Maintenance Free” Batteries

NFPA 110, 8.3.7.1 - Maintenance of lead-acid batteries shall include the monthly testing and recording of electrolyte specific gravity. Battery conductance testing shall be permitted in lieu of the testing of specific gravity when applicable or warranted.

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Safety – Eye Protection

NFPA 70E, 240.2 – Battery and Battery Rooms. Eye and Body Wash Apparatus. Eye and body wash apparatus shall be maintained in operable condition.

1910.133(a)(1) - The employer shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

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Safety – Eye Protection

NFPA 70E, 320.8 – Personnel Protective Equipment. The following protective equipment shall be available to employees performing battery maintenance:

- (1) Goggle and face shields
- (2) Chemical-resistant gloves
- (3) Protective aprons
- (4) Protective overshoes
- (5) Portable or stationary water facilities rinsing eyes and skin in case of electrolyte spillage.

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Safety – Eye Protection

29 CFR 1910.151(c) - Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

Pinky the Cat

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Automatic Restoration

NFPA 110, 8.4.2.2 Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.

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