

## Your Reliable Guide for Power Solutions

# NFPA 110 Pertaining to Generator Systems Level 1 and 2

Information Sheet # 15

The National Fire Protection Association (NFPA) maintains several standards covering standby generators and automatic transfer switches (ATS). This information sheet is an overview of the topics covered in NFPA 110 levels 1 and 2.

**“System designers must review the complete NFPA 110 document to determine exact NFPA 110 requirements.”**

The NFPA standard for generator set systems most frequently encountered by the designer is NFPA 110 – **Standard for Emergency Power Supply Systems (EPSS)**. By definition, this consists of an engine-driven generator set connected to a system of conductors, disconnecting and over-current protection devices, transfer switches, supervisory and support devices (including fuel storage); up to and including the load terminals of the transfer equipment.

Local authorities, such as building inspectors or fire marshals, should always be consulted to determine if NFPA 110 compliance is required for a standby generator set application.

### **NFPA 110 details three categories in classifying an emergency power supply system:**

The categories defined are Class, Type and Level. All need to be defined in any project specification to ensure that the proper configuration is quoted and supplied.

**Class.** This defines the minimum number of hours the generator set can operate at its rated load without refueling. Most commonly specified are: Class 48 (minimum of 48 hours) and sometimes Class 72 (minimum of 72 hours).

*Note! Level 1 installations in high seismic risk areas (Zones 3 and 4) require a minimum of a 96 hour on-site fuel supply (i.e. Class 96). This fuel supply cannot be shared with any other purpose.*

**Buildings Included in Zones 3 and 4 Defined as Essential Facilities.** (See chart two detailing sample building and structures seismic use group III (IBC-2000) and use group IV (IBC-2003/2006) building codes, designate as essential facilities.)

**Type.** This defines the maximum time, in seconds, from a utility outage until the standby generator is supplying power that the load terminals of the ATS can be without acceptable electrical power. For example Type 10 means that the standby system must provide power within 10 seconds.

**Level.** Level 1 is most stringent and imposed when failure of the standby system could result in loss of human life or serious injury. Level 2 is used when failure is less critical to human life and safety. Level 1 requires that additional generator features be included. (See the chart one over for details of Level One and Level Two)

### **Site Testing and Maintenance of Generator Sets to NFPA 110:**

**Testing.** NFPA 110 stipulates several different site tests which should be referred to in order to ensure compliance. Tests can be made at unity power factor, if the 0.8 power factor rated load testing of the complete unit was carried out by the manufacturer before shipment from the factory.

NFPA stipulates exhaust-stack temperatures to prevent wet stacking (*a field term indicating the presence of unburned fuel or carbon in the exhaust system*) based on the generator size. These can be given to technicians by the manufacturer of the generator set. If no more than 60% of generator rated output is available in building load, a resistive load bank must be used to test the generator at its full output capacity.

**Maintenance and Operational Testing/Inspection.** All EPSS with ancillary equipment, including transfer switches, must be inspected weekly and exercised under load at least monthly, for a minimum of 30 minutes, preferably with load. NFPA 110 also requires circuit breakers be exercised annually with EPS in “off” position. Breakers rated in excess of 600 volts should be exercised every six months and tested every two years under simulated overload conditions. This will require careful planning and diligent coordination. It is vital that all management and staff are aware when scheduled maintenance is arranged to be carried out. *A Level 1 EPSS must be tested for at least four hours, at least once every 36 months.* ATS’s are subject to an annual maintenance program, including one major maintenance and three quarterly inspections. All data and readings should be recorded in the on-site maintenance log, for future inspection and reference.

### **For more information about NFPA 110**

NFPA Headquarters, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 0269-9101 • NFPA website: [www.nfpa.com](http://www.nfpa.com)

To fulfill our commitment to be the leading supplier in the power generation industry, the Kraft Power Corporation team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

The installation information provided in this information sheet is informational in nature only, and should not be considered the advice of a properly licensed and qualified electrician or used in place of a detailed review of the applicable National Electric Codes and local codes. Specific questions about how this information may affect any particular situation should be addressed to a licensed and qualified electrician.

**Chart One- NFPA 110 Table 5.6.5.5 Safety Indications and Shutdowns for Level 1 and Level 2 (2005 Edition)**

Item	Indicator Function (at Battery Voltage)	Level 1			Level 2		
		CV	S	RA	CV	S	RA
a	Overcrank	X	X	X	X	X	O
b	Low water temperature	X	NA	X	X	NA	O
c	High engine temperature pre-alarm	X	NA	X	O	NA	NA
d	High engine temperature	X	X	X	X	X	O
e	Low lube oil pressure pre-alarm	X	NA	X	O	NA	NA
f	Low lube oil pressure	X	X	X	X	X	O
g	Overspeed	X	X	X	X	X	O
h	Low fuel main tank	X	NA	X	O	NA	O
i	Low coolant level	X	O	X	X	O	X
j	EPS supplying load	X	NA	NA	O	NA	NA
k	Control switch not in automatic position	X	NA	X	O	NA	NA
l	High battery voltage	X	NA	NA	O	NA	NA
m	Low cranking voltage	X	NA	X	O	NA	O
n	Low voltage in battery	X	NA	NA	O	NA	NA
o	Battery charger ac failure	X	NA	NA	O	NA	NA
p	Lamp test	X	NA	NA	X	NA	NA
q	Contacts for local and remote common alarm	X	NA	X	X	NA	X
r	Audible alarm silencing switch	NA	NA	X	NA	NA	O
s	Low starting air pressure	X	NA	NA	O	NA	NA
t	Low starting hydraulic pressure	X	NA	NA	O	NA	NA
u	Air shutdown damper when used	X	X	X	X	X	O
v	Remote emergency stop	NA	X	NA	NA	X	NA

Notes & Legend: CV = Control panel-mounted visual. S = Shutdown of EPS indication. RA = Remote audible. X = Required. O = Optional. NA = Not applicable

1	Item (p) shall be provided, but a separate remote audible signal shall not be required when the regular work site in 5.6.6 is staffed 24 hours a day.
2	Item (b) is not required for combustion turbines.
3	Item (s) or (t) shall apply only where used as a starting method.
4	Item (j): EPS ac ammeter shall be permitted for this function.
5	All required CV functions shall be visually annunciated by a remote, common visual indicator.
6	All required functions indicated in the RA column shall be annunciated by a remote, common audible alarm as required in 5.6.5.5 (4).
7	Item (h) on gaseous systems shall require a low gas pressure alarm.
8	Item (b) shall be set at 11°C (20°F) below the regulated temperature determined by the EPS manufacturer as required in 5.3.1.

**Chart Two - Sample building and structures seismic use group III and IV building codes, designate as essential facilities:**

Hospital and other healthcare facilities with surgery and emergency treatment	Power stations and other public utility facilities required for category III/IV structures
Fire, rescue and police stations and emergency vehicle garages	Structures containing max. allowable highly toxic materials per section 307 table 307.7 (2)
Designated earthquake, hurricane or other emergency shelters	Buildings and other structures having critical national defense functions
911, communication, data, switching, operation centers	Water treatment facilities required to maintain water pressure for fire suppression

**Note regarding - Joint Commission of Accreditation for Hospital Organizations (JCAHO)**

We feel it of interest to note that many hospitals are now being accredited by the Joint Commission. This organization addresses emergency management of hospitals (such as occurs with loss of utility power, water, etc). They provide standards covering: provisioning of care, treatment and services, patients rights and responsibilities in hospitals, and this includes a reliable EPSS in most cases. There has to be a written emergency plan in place with clearly defined responsibilities and assignment of adequate staff, including multiple back-up personnel. All such persons must be trained and their attendance should be taken into account by the EPSS supplier when arranging such courses. The EPSS maintenance requirements must conform to NFPA 110 for testing purposes, but in addition, calls for monthly testing of generator and automatic transfer switches. *(More details can be found on JCAHO web site: www.jointcommission.org)*

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