

NFPA 110 Pertaining to Generator Set Systems Level 1 and 2

1.0 Introduction

The National Fire Protection Association (NFPA) maintains several standards covering standby generators and automatic transfer switches (ATS).

This info sheet outlines the differences between NFPA levels 1 and 2 and the topics it addresses. (see Table Below)

“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 Table 5.6.5.2 Safety Indications and Shutdowns for Level 1 and Level 2 (2013)

Item	Indicator Function (at Battery Voltage) <i>See notes over</i>	Level 1			Level 2		
		CV	S	RA	CV	S	RA
a	Over crank	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	X	X	X	X	X	O
f	Overspeed	X	X	X	X	X	O
g	Low fuel main tank	X	NA	X	O	NA	O
h	Low coolant level	X	O	X	X	O	X
i	EPS supplying load	X	NA	NA	O	NA	NA
j	Control switch not in automatic position	X	NA	X	X	NA	X
k	High battery voltage	X	NA	NA	O	NA	NA
l	Low cranking voltage	X	NA	X	O	NA	O
m	Low voltage in battery	X	NA	NA	O	NA	NA
n	Battery charger ac failure	X	NA	NA	O	NA	NA
o	Lamp test	X	NA	NA	X	NA	NA
p	Contacts for local and remote common alarm	X	NA	X	X	NA	X
q	Audible alarm silencing switch	NA	NA	X	NA	NA	O
r	Low starting air pressure	X	NA	NA	O	NA	NA
s	Low starting hydraulic pressure	X	NA	NA	O	NA	NA
t	Air shutdown damper when used	X	X	X	X	X	O
u	Remote emergency stop	NA	X	NA	NA	X	NA

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

Notes referring to chart on page one	
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 (r) or (s) shall apply only where used as a starting method.
4	Item (i): 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 5.6.5.2 (4).
7	Item (g) 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.

2.0 NFPA 110 Categories

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. The class defines the minimum time, in hours, for which the EPSS is designed to operate at its rated load without being refuelled or recharged. (See table 2 below)

Type. The type defines the maximum time, in seconds, that the EPSS will permit the load terminals of the transfer switch to be without acceptable electrical power. (See table 3 below)

Level. This standard recognizes two levels of equipment installation, performance, and maintenance.

- Level 1 systems shall be installed where failure of the equipment to perform could result in loss of human life or serious injury
- Level 2 systems shall be installed where failure of the EPSS to perform is less critical to human life and safety

Class	Minimum Time
Class 0.083	0.0830hr (5 min)
Class 0.25	0.25 hr (15 min)
Class 2	2 hr
Class 6	6 hr
Class 48	48 hr
Class X	Other time, in hours, as required by the application, code, or user

Class	Minimum Time
Type U	Basically uninterruptible (UPS systems)
Type 10	10 sec
Type 60	60 sec
Type 120	120 sec
Type M	Manual stationary or nonautomatic - no time limit

3.0 Site Testing of Generator Sets to NFPA 110:

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 load to be applied for 2-hour full load test, with building load permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide load equal to 100% of nameplate kW rating of EPS, less applicable derating factors for site conditions.

4.0 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 - not less than 30% of nameplate rating. If this not met, the set shall be exercised monthly with available EPSS load and annually, with supplemental loads at not less than 50% of EPS nameplate rating for 30 continuous minutes and not less than 75% for 1 hour continuous, for total of not less than 1.5 hours. 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.

A Level 1 EPSS should be tested at least once with minimum of 30% rating for 4 hours, 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

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5.0 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 assignation 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