



NEC[®] Requirements for Standby Power Systems



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Emergency & Standby Power Systems

- Alternative power sources are utilized in many electrical systems to supply power when the normal supply is interrupted. When utilization equipment is connected to an alternative power source, does it always constitute an emergency system?



Emergency & Standby Power Systems

- Where alternative power sources are utilized, what are the options for classification of those systems?



NEC Articles on Emergency and Standby Electrical Systems

Article 700 Emergency Systems

Critical



Article 701 Legally Required Standby Systems

Essential



Article 702 Optional Standby Systems

Desirable



NEC Articles on Emergency and Standby Electrical Systems

Article 700 Emergency System

Power Available to Loads in Not More Than 10 Seconds



Article 701 Legally Required Standby Systems

Power Available to Loads in Not More Than 60 Seconds



Article 702 Optional Standby Systems

Power Available to Loads at Discretion of User



NEC Articles on Emergency and Standby Electrical Systems

Article 700 Emergency Systems

Automatic Transfer only Emergency Loads



Article 701 Legally Required Standby Systems

Automatic Transfer of Legally Required and Optional Standby Loads



Article 702 Optional Standby Systems

Automatic or Manual Transfer



Background – 1907

- 1907 NEC, Section 31A requiring emergency lighting for theatres.
 - Two separate and distinct services where practicable, fed from separate street mains.
 - One of the services required to be of sufficient capacity to supply current for all emergency lights
 - If source was isolated plant within theatre building, an auxiliary service from outside source or suitable storage battery with sufficient capacity to supply emergency lights
 - Emergency lights included exit light and all lights in lobbies, stairways, corridors and other portions of theatre to which the public have access which are normally kept lighted during the performance



Why Emergency and Standby Power?

- Traditional view on emergency has been preventing panic in large assembly occupancies and to get people safely out of buildings upon loss of normal power and/or building emergency.
- Optional standby has allowed for creature comfort and business continuity upon loss of normal power
- Recent events have raised concern over reliability, operation, and approach to building emergency and standby systems
 - WTC Bombing
 - September 11, 2001
 - Threat of terrorist attack – infrastructure and biological
 - Katrina-devastation of major US city
 - Economic considerations



Essential Electrical System – Article 517 Health Care Facilities

- A system comprised of alternate sources of power and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.



Essential Electrical System – Article 517 Health Care Facilities

- **Critical Branch.** A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and select power circuits serving areas and functions related to patient care and that is automatically connected to alternate power sources by one or more transfer switches during interruption of normal power source.
- **Life Safety Branch.** A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source.



Essential Electrical System – Article 517 Health Care Facilities

- **Equipment Branch.** A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source and that serves primarily 3-phase power equipment.
- **517.26 Application of Other Articles.** The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.



Emergency & Standby Systems

- Other NFPA Documents
 - NFPA 37 – Stationary Combustion Engines
 - NFPA 99 – Health Care Facilities
 - NFPA 101 – Life Safety Code
 - NFPA 110 – Emergency and Standby Power Systems
 - NFPA 111 – Stored Electrical Energy Emergency and Standby Power Systems
 - NFPA 5000 – Building Construction and Safety Code



Emergency & Standby Systems

- Other NEC Articles:
 - Applicable rules of Chapters 1 through 4
 - 445 – Generators
 - 517 – Health Care Facilities
 - 692 – Fuel Cell
 - 705 – Interconnected Power Production Sources



Emergency & Standby Systems

Article 250

- 250.30 (A) – Grounded Separately Derived Systems
- 250.30 (C) – Outdoor Source
- 250.32 – Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s)
- 250.34 – Portable and Vehicle Mounted Generators
- 250.35 – Permanently Installed Generators



Articles 702, 700 & 701



Chapter 1 – General

Chapter 2 – Wiring Methods and Materials

Chapter 3 – Wiring Methods and Materials

Chapter 4 – Equipment for General Use

Applies generally to all electrical installations

Supplements or modifies Chapters 1 through 4

Chapter 5 – Special Occupancies

Chapter 6 – Special Equipment

Chapter 7 – Special Conditions

Chapter 8 – Communications Systems

Chapter 8 is not subject to the requirements of Chapters 1 through 7 except where specifically referenced in Chapter 8

Chapter 9 – Tables

Applicable as referenced

Annex A through Annex I

Informational only; not mandatory



Why Emergency and Standby Power?

Emergency

- Building exiting
- Panic control
- Building safety systems
(alarm, communications)
- Building mechanical systems
(elevators, ventilation)
- Prevention of catastrophic
industrial process failure

Legally Required Standby

- Building safety systems
- Building mechanical systems
- Lighting for continued
occupancy
- Industrial processes

Optional Standby

- Creature comfort
- Business continuity



System	Equipment Approval	Operation	Maximum Transfer Time	Loads Covered
700 (Permanent source)	Emergency	Automatic	10 seconds	<u>Life safety & critical loads</u> ; means of egress, panic control, ventilation where essential to human life, fire detection & alarm, industrial processes where interruption introduces life safety or health hazards & public safety communications, etc.
701 (Permanent source)	Standby	Automatic	60 seconds	<u>Creates hazards or hampers rescue of fire fighting operations</u> ; heating & refrigeration, communications, ventilation & smoke removal, sewage disposal, lighting systems & industrial processes, etc.
702 (Permanent or portable source)	Intended use	Automatic or manual	N/A	<u>Where safety does not depend on the system</u> ; physical discomfort, serious disruption of industrial equipment, disruption of business, etc.

Optional Standby Systems – 702

- Article 702
 - Applies to system installation and operation
 - Can be permanently installed; or
 - Arranged for portable connection to premises wiring systems





Optional Standby Systems – 702

Those systems intended to supply power to public or private facilities or property where life safety does not depend on the performance of the system. Optional standby systems are intended to supply on-site generated power to selected loads either automatically or manually.



Optional Standby Systems – 702

- Intended to protect public or private facilities or property
- Can be automatic or manual operation
- No specified transfer time
- Where life safety doesn't depend on system performance
- Many standby systems installed today are for business continuity or homeowner convenience



Optional Standby Systems – 702

- Provides an alternate source of power for:
 - Industrial and commercial buildings, farms and residences
 - Heating, refrigeration and data processing loads
 - Industrial processes



Article 702

- Part I – General 702.1 through 702.7
- Part II – Wiring 702.10 through 702.12



Equipment Approval – 110.2

Automatic Transfer Switches for Use in Optional Standby Systems (WPXT)

This Listing covers automatic transfer switches intended for use in Optional Standby Systems in accordance with Article 702 of the National Electric Code. See additional information under “Transfer Switches”, Guide WPTZ. These products have been investigated with overload protection for the control circuits provided within the controller enclosure or by the installer as specified by the wiring diagram.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the introduction of this Directory) together with the word “LISTED,” a control number, and the product name “Automatic Transfer Switch For Use in Optional Standby Systems.” For additional information, see Transfer Switches (WPTZ) and Electrical Equipment for Use in Ordinary Locations (AALZ).

Nonautomatic Transfer Switches (WPYV)

This listing covers nonautomatic transfer switches intended to transfer a common load from a normal supply to an alternate supply of an equipment system in accordance with Sections 517-34 and 517-43 or an optional stand-by system in accordance with Article 702 of the National Electrical Code. See additional information under “Transfer Switches”, Guide WPTZ.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word “LISTED,” a control number, and the product name “Non-Automatic Transfer Switch”.



Capacity and Rating – 702.4

- Optional Standby Systems
 - Capacity for all loads being operated simultaneously
 - Suitable for the maximum fault current
 - User can select connected loads (during time of operation)



Capacity and Rating – 702.4

- **(B) System Capacity.** The calculations of load on the standby source shall be made in accordance with Article 220 or by another approved method.
- **(1) Manual Transfer Equipment.** Where manual transfer equipment is used, an optional standby system shall have adequate capacity and rating for the supply of all equipment intended to be operated at one time. The user of the optional standby system shall be permitted to select the load connected to the system.



Capacity and Rating – 702.4

- **(2) Automatic Transfer Equipment.** Where automatic transfer equipment is used, an optional standby system shall comply with (2)(a) or (2)(b).
- *(a) Full Load.* The standby source shall be capable of supplying the full load that is transferred by the automatic transfer equipment.
- *(b) Load Management.* Where a system is employed that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the load management system.



Transfer Equipment – 702.5


- Optional standby transfer switches:
 - Must be suitable for the intended use; and
 - Designed and installed to prevent inadvertent connection
 - Required for all standby systems for which an electric-utility supply is either the normal or standby source.

Can the transfer switch be installed ahead of the service disconnecting means? See 230.82





UTILITY

- Interlocked Circuit Breakers:
1. Turn **UTILITY** circuit breaker **-OFF**
 2. Turn **OFF** all branch circuit breakers
 3. Slide this interlock plate up 
 4. Turn **STANDBY** circuit breaker **"ON"**
 5. Turn **"ON"** branch circuit breakers supplying essential circuits
- Reverse procedure to return to **UTILITY** circuit breaker. 40273-807-01

STANDBY

Generator

Optional Standby Systems

- Temporary connections permitted for portable generators
 - ✓ Industrial installations with written safety procedures
 - ✓ Qualified persons service the installation
 - ✓ Normal supply is physically isolated by a lockable disconnecting means; or,
 - ✓ Normal supply conductors are disconnected



Outdoor Generator Sets – 702.12

- Where equipped with a readily accessible disconnecting means that is within sight of the building or structure, an additional disconnecting means at the building or structure is not required.





IMPORTANT: If this product is not used with an approved transfer switch, it is **not allowed** by the NEC to supply power from a portable generator to a premises wiring system because of serious safety concerns.



 **GENERAL DUTY SAFETY SWITCH**
INTERRUPTOR DE SEGURIDAD DE SERVICIO GENERAL
30 A
240 Vac / V-

 **⚠ DANGER / PELIGRO**
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH
PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open. Keep door latched.
- Turn off switch before removing or installing fuses or making load side connections.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.
- Do not use renewable link fuses in fused switches. Failure to follow these instructions will result in death or serious injury.

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía (consulte la norma NFPA 70E).
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Nunca haga funcionar el interruptor con la puerta abierta cuando esté energizado. Mantenga la puerta asegurada.
- Desenergice el interruptor antes de extraer o instalar fusibles o de hacer conexiones en el lado de carga.
- Siempre utilice un dispositivo de tensión nominal adecuado en los clips para fusibles de los lados de carga y línea para confirmar la desenergización del interruptor.
- Desenergice el interruptor antes de realizar cualquier otro trabajo en el interruptor.
- No utilice fusibles de cinta renovables en los interruptores de fusible. El incumplimiento de estas precauciones podrá causar la muerte o lesiones serias.

To lock out switch, place padlock hasp through hole in lockplate and hole in handle. 40275-956-01

Para bloquear el interruptor, pase la alidaba del candado por el agujero en la placa de inmovilización y el agujero en la palanca.

Optional Standby Systems

- Signals
 - Where practicable, provide audible and visual signal devices to:
 - Indicate derangement of the optional standby source
 - Indicate the optional source is carrying the load
 - Not required for portable sources



702.7



Optional Standby Systems

- Circuit wiring:
 - Permitted with other general wiring



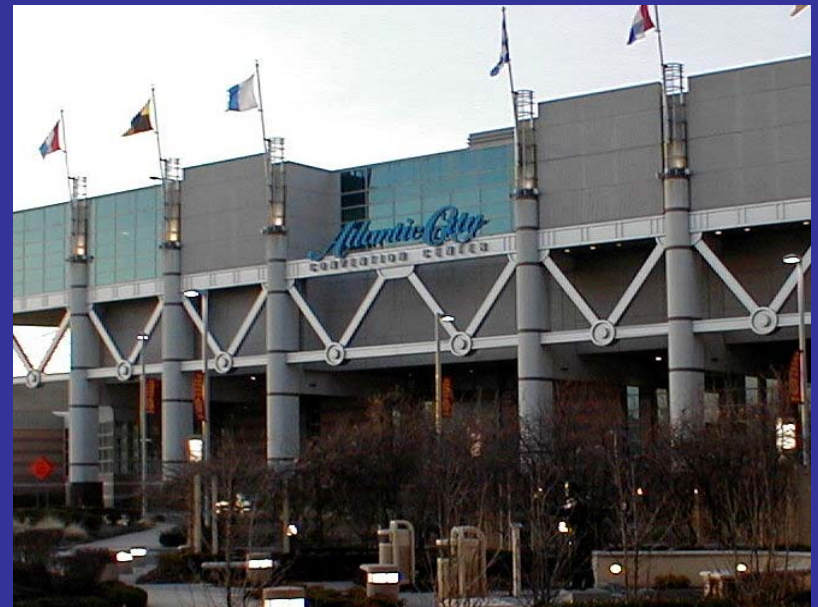
702.9



Emergency Systems – 700.2

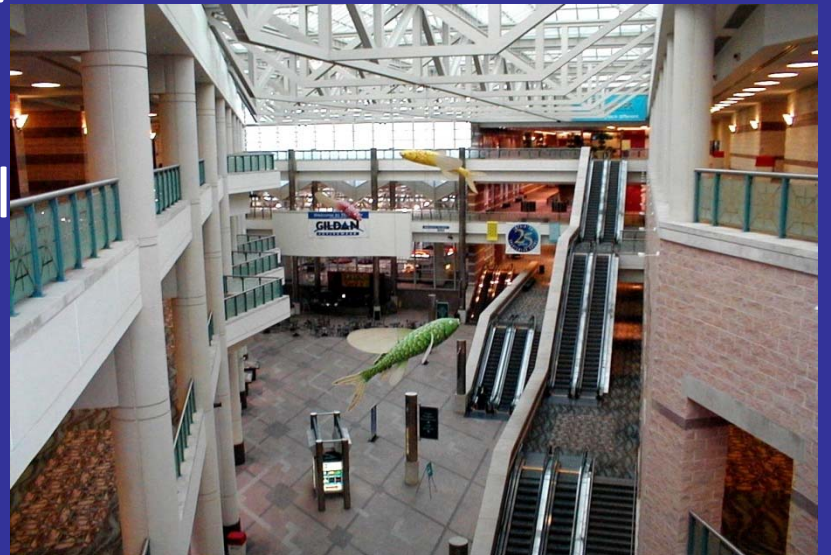
Emergency System.

- Systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction.
- Intended to automatically supply illumination, power, or both, to designated areas and equipment in the event of failure of the normal supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential for safety to human life.



Emergency Systems – 700

- Provide illumination for building exiting and panic control
- Occupancies types requiring emergency illumination include but are not limited to:
 - Assembly
 - Detention and Correctional
 - Educational
 - Health Care
 - Mercantile



Emergency Systems – 700

- May also be required to provide power for:
 - Ventilation systems for maintaining human life
 - Fire detection and alarm systems
 - Elevators
 - Fire pumps (not mandated by Article 695)
 - Public safety communications systems
 - Industrial processes (non-orderly shutdown concern)



What Requires Article 700 Systems?

2702.3 Maintenance.

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SECTION 2702.2 EMERGENCY AND STANDBY POWER SYSTEMS [F]

2702.1 Installation. Emergency and standby power systems required by this code or the *Fire Code of New York State* shall be installed in accordance with this code, NFPA 110 and 111. [F]

2702.1.1 Stationary generators. Emergency and standby power generators shall be listed in accordance with UL 2200. [F]

2702.2 Where required. Emergency and standby power systems shall be provided where required by [Sections 2702.2.1](#) through [2702.2.20](#). [F]

2702.2.1 Group A occupancies. Emergency power shall be provided for voice communication systems in Group A occupancies in accordance with [Section 907.2.1.2](#). [F]

2702.2.2 Smoke control systems. Standby power shall be provided for smoke control systems in accordance with [Section 909.11](#). [F]

2702.2.3 Exit signs. Emergency power shall be provided for exit signs in accordance with [Section 1011.5.3](#). [F]

2702.2.4 Means of egress illumination. Emergency power shall be provided for means of egress illumination in accordance with [Section 1006.3](#). [F]

2702.2.5 Accessible means of egress elevators. Standby power shall be provided for elevators that are part of an accessible means of egress in accordance with [Section 1007.4](#). [F]

2702.2.6 Accessible means of egress platform lifts. Standby power in accordance with this section or ASME A18.1 shall be provided for platform lifts that are part of an accessible means of egress in accordance with [Section 1007.5](#). [F]

2702.2.7 Horizontal sliding doors. Standby power shall be provided for horizontal sliding doors in accordance with [Section 1008.1.3.3](#). [F]

2702.2.8 Semiconductor fabrication facilities. Emergency power shall be provided for semiconductor fabrication facilities in accordance with [Section 415.8.10](#). [F]

2702.2.9 Membrane structures. Standby power shall be provided for auxiliary inflation systems in accordance with [Section 3102.8.2](#). Emergency power shall be provided for exit signs in temporary tents and membrane structures in accordance with the *Fire Code of New York State*. [F]

2702.2.10 Hazardous materials. Emergency or standby power shall be provided in occupancies with hazardous materials in accordance with [Section 414.5.4](#). [F]

2702.2.11 Highly toxic and toxic materials. Emergency power shall be provided for occupancies with highly toxic or toxic materials in accordance with the *Fire Code of New York State*. [F]

2702.2.12 Organic peroxides. Standby power shall be provided for occupancies with silane gas in accordance with the *Fire Code of New York State*. [F]

2702.2.13 Pyrophoric materials. Emergency power shall be provided for occupancies with silane gas in accordance with the *Fire Code of New York State*. [F]

2702.2.14 Covered mall buildings. Standby power shall be provided for voice/alarm communication systems in covered mall buildings in accordance with [Section 402.13](#). [F]

2702.2.15 High-rise buildings. Emergency and standby power shall be provided in high-rise buildings in accordance with [Sections 403.10](#) and [403.11](#). [F]

2702.2.16 Underground buildings. Emergency and standby power shall be provided in underground buildings in accordance with [Sections 405.9](#) and [405.10](#). [F]

2702.2.17 Group I-3 occupancies. Emergency power shall be provided for doors in Group I-3 occupancies in accordance with [Section 408.4.2](#). [F]

2702.2.18 Airport traffic control towers. Standby power shall be provided in airport traffic control towers in accordance with [Section 412.1.5](#). [F]

2702.2.19 Elevators. Standby power for elevators shall be provided as set forth in [Section 3003.1](#). [F]

javascript:Next('/st_ny_st_b200v10_27_sec001_par001.htm'); y power shall be provided for smokeproof enclosures as required by [Section 909.20](#). [F]



NFPA 110 – Standard for Emergency and Standby Power Systems

- Covers from the EPS (source) to the line terminals of the transfer equipment
- EPSS is identified by:
 - Level
 - Class
 - Type
- **NFPA 20 - 9.6.2.1** On-site standby generator systems shall comply with Section 9.4 and shall meet the requirements of Level 1, Type 10, Class X systems of NFPA 110, *Standard for Emergency and Standby Power Systems*.



NFPA 110 – Standard for Emergency and Standby Power Systems

- Covers from the EPS (source) to the line terminals of the transfer equipment
- Two “levels” of EPSSs
 - Level 1 systems shall be installed where failure of the equipment to perform could result in loss of human life or serious injuries. Level 1 = Article 700 in the NEC.
 - Level 2 systems shall be installed where failure of the EPSS to perform is less critical to human life and safety. Level 2 = Article 701 in the NEC.
 - NFPA 110 is not required to be applied to Article 702 Optional Standby Systems.



NFPA 110 – Standard for Emergency and Standby Power Systems

- **Other EPSS System Designations:**
 - **Class.** The class defines the minimum time, in hours, for which the EPSS is designed to operate at its rated load without being refueled or recharged.

Table 4.1(a) Classification of EPSSs

Class	Minimum Time
Class 0.083	0.083 hr (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



NFPA 110 – Standard for Emergency and Standby Power Systems

- **Other EPSS System Designations:**
 - **4.3 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. Table 4.1(b) provides the types defined by this standard.

Table 4.1(b) Types of EPSSs

Designation	Power Restoration
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



What Requires Article 700 Systems?

Requirements comes from other codes.

NFPA 101, Life Safety Code
Chapter 7 – Means of Egress

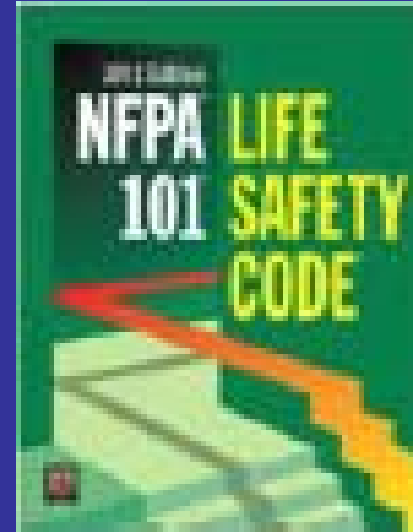
7.9 Emergency Lighting.

7.9.1.1* Emergency lighting facilities for means of egress shall be provided in accordance with Section 7.9 for the following:

(1) Buildings or structures where required in Chapter 11 through Chapter 42

7.9.2.2 New emergency power systems for emergency lighting shall be at least Type 10, Class 1.5, Level 1 in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

Performance requirements for emergency lighting specified in NFPA 101 or applicable building code.



What Requires Article 700 Systems?

- Chapter 38 – New Business Occupancies

38.2.9 Emergency Lighting.

38.2.9.1 Emergency lighting shall be provided in accordance with Section 7.9 in any building where any one of the following conditions exists:

- (1) The building is two or more stories in height above the level of exit discharge.
- (2) The occupancy is subject to 50 or more occupants above or below the level of exit discharge.
- (3) The occupancy is subject to 300 or more total occupants.



What Requires Article 700 Systems?



Designation: E2668 – 10

Standard Guide for Emergency Operations Center (EOC) Development¹

1. Scope

1.1 This guide provides general guidelines for the development of an emergency operations center (EOC).

1.2 An EOC may be developed by either the public or private sector in response to the demonstrated or predicted need for a designated facility at which those involved in emergency/disaster management and the coordination of response and recovery efforts work.

1.3 This guide may also serve as a foundation for larger facilities such as a regional operations center (ROC) or state operations center (SOC) with a broader area of responsibility and more extensive needs to communicate and coordinate with others.



Equipment Approval – 110.2

- Emergency Systems
 - Approved for use on emergency systems
 - AHJ's typically rely on listing or identification
 - Product standards include:
 - UL 924 – Emergency Lighting and Power Equipment
 - UL 1008 – Transfer Switch Equipment
 - UL 2200 - Stationary Engine Generator Assemblies



UL 2200

1 Scope

1.1 These requirements cover stationary engine generator assemblies rated 600 volts or less that are intended for installation and use in ordinary locations in accordance with the National Electrical Code NFPA-70; the Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA-37, the Standard for Health Care Facilities, NFPA-99, and the Standard for Emergency and Standby Power Systems, NFPA-110.



Tests and Maintenance – 700.4

- AHJ to conduct or witness acceptance test and periodic testing thereafter
- Scheduled periodic testing acceptable to AHJ
- Battery maintenance
- Written record to be kept
- Load testing under maximum anticipated load
- Chapter 8 in NFPA 110 provides testing requirements for emergency power supply systems



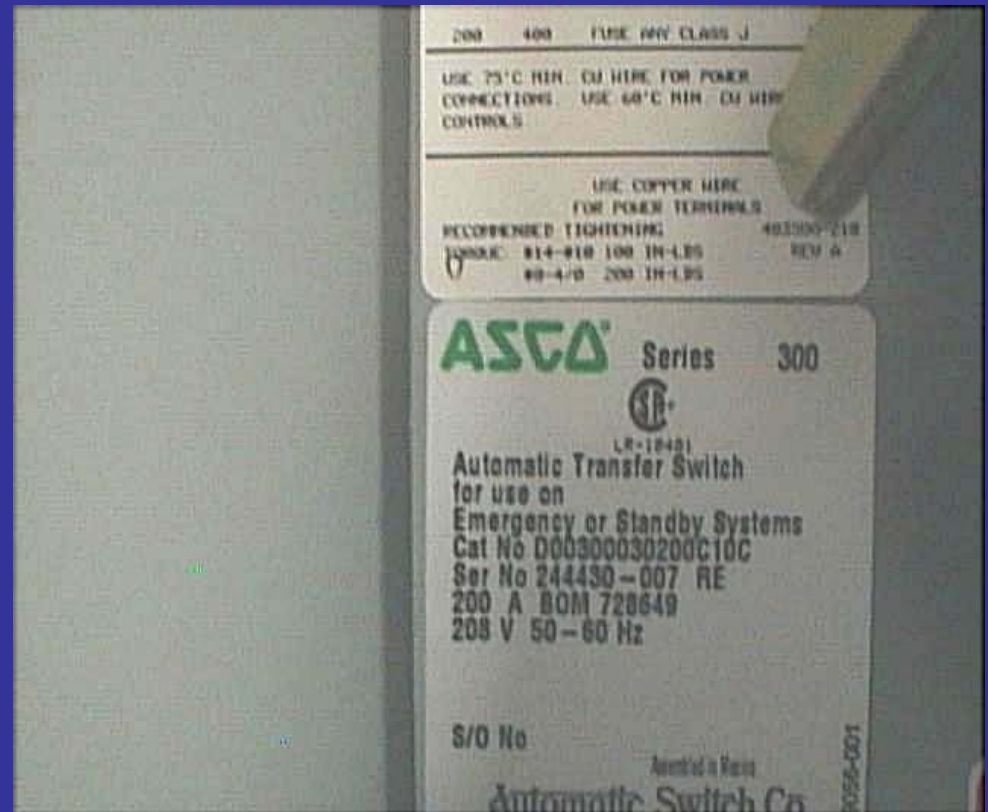
System Capacity – 700.4(A)

- Capacity for all loads being operated simultaneously
- Suitable for the maximum fault current at its terminals
- With proper load shedding (where necessary) the alternate source supplies:
 - (1) Emergency systems
 - (2) Legally Required Standby Systems
 - (3) Optional Standby Systems
- Portable supply sources shall be available out of service for major maintenance or repair



Transfer Equipment – 700.5 (A)

- Must be automatic
- Identified for emergency use
- Approved by the AHJ
- Designed and installed to prevent inadvertent
- Parallel operation in accordance with Article 705



Parallel Operation – Multiple Generators with Electric Utility Supply

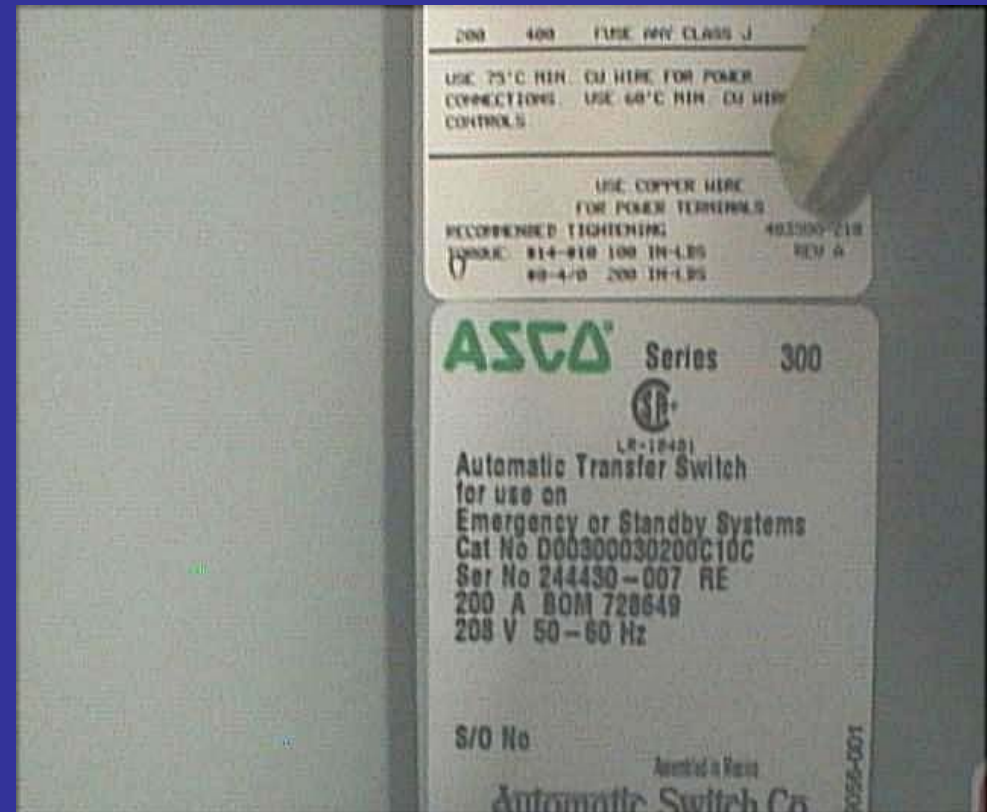


Transfer Equipment – 700.5 (C)

Automatic Transfer Switches.

Automatic transfer switches shall be electrically operated and mechanically held.

Automatic transfer switches, rated 1000 VAC and below, be listed for emergency system use.



Transfer Equipment – 700.5(A) & UL 1008

Automatic Transfer Switches for Use in Emergency Systems (WPWR)

This listing covers automatic transfer switches intended for use in Emergency Systems as contemplated by Articles 517 and 700 of the National Electrical Code. These transfer switches are also suitable for use in Standby Systems in accordance with Articles 701 and 702 of the National Electrical Code. See additional information under “Transfer Switches”, Guide WPTZ.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word “LISTED,” a control number, and the product name “Automatic Transfer Switch For Emergency Systems”.



Identification Signs – 700.7(A), 701.7(A), 702.7(A)

(A) Emergency Sources

- Provided at the service equipment
- Indicates type and of alternate
- Not required for unit equipment



Identification Signs – 700.7(B), 701.7(B), 702.7(B)

- Emergency, Legally Required and Optional Standby Systems
- Located at normal power source equipment
- Applies to alternate power systems that are not separately derived
- Warns of hazard associated with removing bonding jumper while alternate source is energized



Circuit Wiring – 700.10(A)

- Emergency system wiring
- All boxes and enclosures identified
 - Includes transfer switches, generators and power panels
 - Must be permanently marked
 - Readily identifiable as components of emergency system



Surge Protection – 700.8

- Listed surge protection device required to be installed in or on all emergency system switchboards and panelboards.



Photo: IAEI Archives



Circuit Wiring – 700.10(B)

- Emergency system wiring
 - Circuits from same emergency source permitted in same raceways, cables, boxes and cabinets
 - Emergency wiring must be entirely independent of all other wiring from:
 - The source to the loads; or,
 - The source distribution to the loads
 - Permitted to share common enclosures in
 - Transfer equipment
 - Exit or emergency luminaires
 - Junction boxes attached to exit or emergency luminaires
 - Junction boxes attached to unit equipment



Wiring Design and Location – 700.10(C)

- Emergency system wiring performance requirement
 - Designed and located to minimize hazards due to:
 - Flooding
 - Fire
 - Icing
 - Vandalism
 - Other adverse conditions



Fire Protection – 700.10(D)(1)

- Required for feeder circuit wiring:
 - Buildings above 75 feet of any occupancy type, or
 - Assembly occupancies for 1000 or more persons
- Feeder circuit protection by:
 - Spaces or areas fully protected by automatic fire suppression system
 - Listed electrical circuit protective system w/minimum 2-hour fire rating
 - Listed thermal barrier system for electrical system components w/mimimum 2-hour fire rating
 - Listed fire rated assembly with minimum 2-hour fire-rating/Dedicated to emergency wiring
 - Encased in not less than 2 inches of concrete



Fire Protection – 700.10(D)(2)

- Required for Feeder Equipment:
 - Buildings above 75 feet of any occupancy type, or
 - Assembly occupancies for 1000 or more persons
- Feeder equipment (including transfer switches, transformers, panelboards) located in spaces protected by:
 - Approved fire suppression system
 - Spaces with 2-hour fire resistance rating



Fire Protection – 700.10(D)(3)

- Required for emergency generator control wiring:
 - Buildings above 75 feet of any occupancy type, or
 - Assembly occupancies for 1000 or more persons
- Generator Control Wiring Between Transfer Equipment and Emergency Generator
 - Keep entirely independent of all other wiring and be protected using one of more of the methods specified in 700.10(D)(1)



Power Sources – 700.12

- Intended to automatically supply (within 10 seconds):
 - Emergency lighting or power
 - Or both
- Failure of normal supply to, or within, buildings
- Consideration given to:
 - Occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building.



Power Sources – 700.12

- Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism.
- NFPA 110 recommends:
 - For natural conditions, emergency power supply system (EPSS) design should consider the “100-year storm” flooding level or the flooding level predicted by the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) models for a Class 4 hurricane.



Power Sources – 700.12

- Sources within assembly occupancies for greater than 1000 persons or in buildings above 75 ft in height with any of the following occupancy classes — assembly, educational, residential, detention and correctional, business, and mercantile — shall be installed either:
 - In spaces fully protected by approved automatic fire suppression systems, or
 - In spaces with a 1-hour fire rating
 - NFPA 110 requires 2-hour fire rating for Level 1 systems



Power Sources – 700.12(A)-(F)

- Emergency Systems
 - Storage batteries
 - Generator sets
 - Uninterruptible power supplies
 - Separate service (acceptable to AHJ)
 - Fuel Cells
 - Unit Equipment



Power Sources – 700.12

- Storage Batteries
 - Load rating for 1.5 hours without falling below 87.5% normal voltage
 - Automatic battery charger required
- Generator Sets
 - On premise fuel supply for not less than 2-hour full-demand operation
 - Not permitted to be supplied by public gas utility or rely on municipal water utility (cooling)
 - Automatic transfer between multiple fuel sources
 - All necessary auxiliary equipment to be supplied from emergency power (fuel pumps, dampers for ventilation)



Outdoor Generator Sets – 700.12(B)(6), 701.12(B)(5), 702.12

- Article 225
 - Disconnecting means for conductors supplying or passing through: 225.30
 - Location: 225.32
 - Suitable for use as service equipment: 225.36 (not SUSE per 2014 NEC)
 - 445.18:
 - Generator driving means can be readily shut down , is rendered incapable of restarting and is lockable in the off position.
 - Generator is not arranged to operate in parallel



Outdoor Generator Sets – 700.12(B)(6), 701.12(B)(5), 702.12

- Outdoor housed generator sets
 - Equipped with a readily accessible disconnect
 - Located “within sight from”
 - Additional disconnecting means not required



Separate Service – 700.12(D)

- Shall be acceptable to the authority having jurisdiction as suitable for use as an emergency source of power
- Separate service drop or service lateral
- Service conductors sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply



Unit Equipment – 700.12(F), 701.12(G)

- Unit Equipment
 - 87-1/2% of total lamp load for <1-1/2 hrs
 - Flexible cord and plug connections permitted
 - Remote luminaires
 - Must meet 700.10
 - Must use Chapter 3 wiring methods



Unit Equipment – 700.12(F), 701.11(G)

- Unit Equipment
 - Supply branch circuit requirements
 - Same as normal lighting circuit; and,
 - Connected ahead of local switches
 - Exception for separate and uninterrupted areas
 - Must be clearly identified at the distribution panel
 - Supply circuit is not an “emergency circuit” but is permitted to be connected to an emergency system.



Loads on Emergency Branch Circuits – 700.15

- Emergency circuits for lighting & power
 - Only appliances and lamps that have been specified for emergency use are permitted to be supplied by emergency branch circuits
 - Specified items must meet AHJ's approval



Emergency Illumination – 700.16

- Emergency illumination:
 - Required means of egress lighting
 - Illuminated exit signs
 - Other lights to provide required illumination
 - Designed and installed so failure of a single element (burning out of a lamp) does not result in total darkness
 - High intensity discharge lighting considerations (restrike time)
 - Emergency illumination required in the area of indoor service or building feeder disconnecting means



NFPA 101 – 7.9.2.2

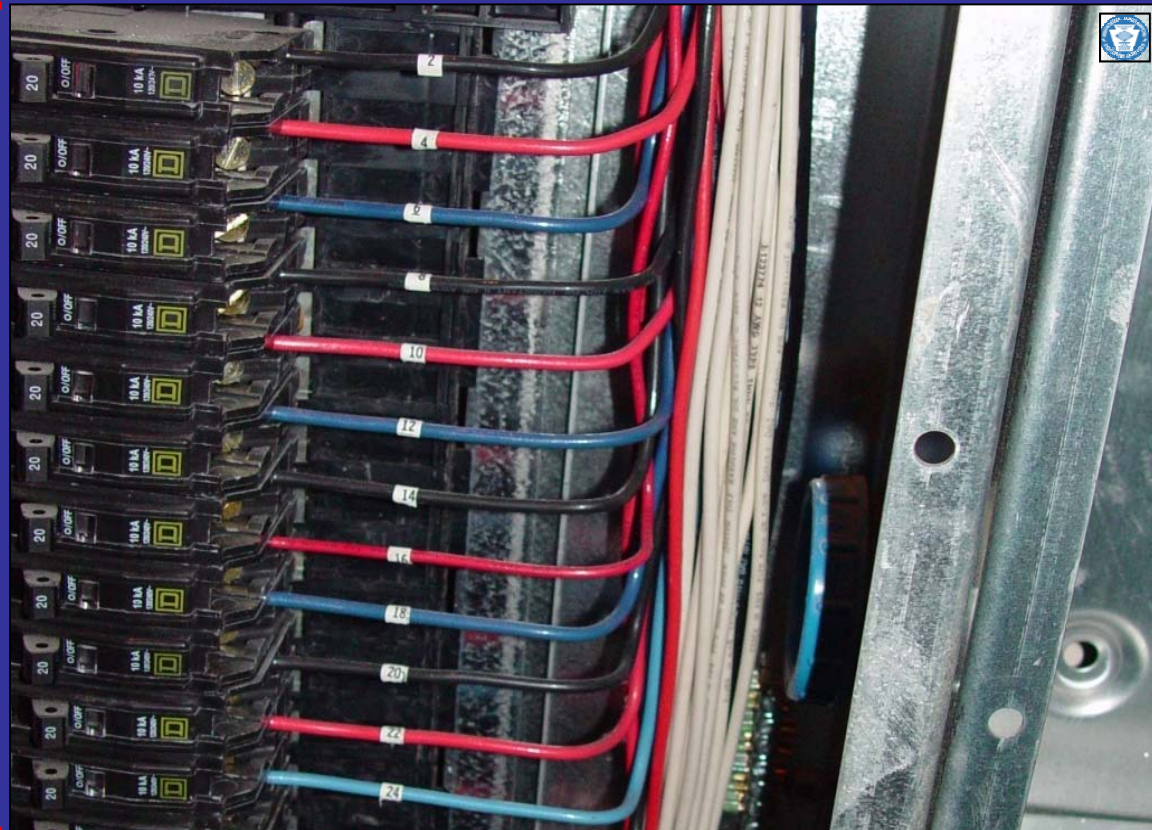
- The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting due to any of the following:
 - (1) Failure of a public utility or other outside electrical power supply
 - (2) Opening of a circuit breaker or fuse
 - (3) Manual act(s), including accidental opening of a switch controlling normal lighting facilities



Multiwire Branch Circuits – 700.19

- Multiwire branch circuits prohibited from supplying emergency lighting and power circuits

All two-wire
branch circuits for
emergency lighting



Switch Requirements and Locations – 700.20 & 700.21

- Lighting circuit switch requirements
 - Arranged for authorized control of lighting
 - Manual switches convenient to those authorized
 - Specific locations
 - 3 way and 4 way switches not permitted



Overcurrent Protection – 700.25 & 700.26

- 700.25 Branch-circuit overcurrent protection
 - Accessible to authorized persons only
- 700.26 Ground fault protection of equipment
 - Not required to have automatic disconnecting means
 - Ground fault indication required per 700.7(D)



Selective Coordination – 700.27

- Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.
- Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings.



Legally Required Standby Systems – 701

- Must be required and classed as legally required standby by:
 - Federal, state, municipal or other codes
 - Any governmental agency having jurisdiction
- Automatically supplies loads other than emergency



Legally Required Standby Systems – 701

- Those systems required and so classed as legally required standby by municipal, state, federal, or other codes or by any governmental agency having jurisdiction. These systems are intended to automatically supply power to selected loads (other than those classed as emergency systems) in the event of failure of the normal source.



Legally Required Standby Systems – 701

- Typically installed for serving non-emergency but essential loads such as:
 - Heating and refrigeration systems
 - Communications, ventilation and smoke removal systems
 - Sewage disposal
 - Lighting
 - Industrial processes

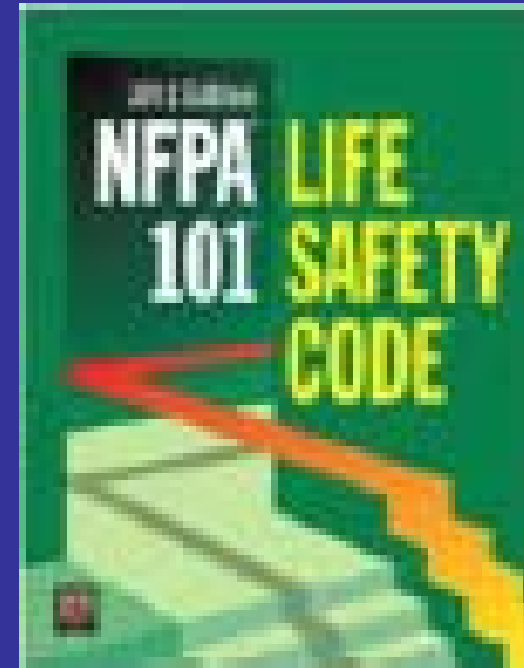


What Triggers Article 701 Systems?

- Requirements comes from other codes.

NFPA 101, Life Safety Code
Chapter 11 Special Structures
and High Rise Buildings

11.8.4.2 (A)* Class I, Type 60,
standby power in accordance with
Article 701 of NFPA 70, National
Electrical Code®, and NFPA 110,
Standard for Emergency and Standby
Power Systems, shall be provided.



Article 701

- Part I – General 701.1 through 701.7
- Part II – Circuit Wiring 701.10
- Part III – Sources of Power 701.12
- Part IV – Overcurrent Protection 701.25 through 701.27



Tests and Maintenance for Legally Required Standby Systems – 701.3

- AHJ to conduct or witness acceptance test
- Scheduled periodic testing acceptable to AHJ
- Battery maintenance
- Written record to be kept
- Load testing required
- Chapter 8 in NFPA 110 provides testing requirements for standby power supply systems



Capacity and Rating – 701.4

- Legally Required Standby Systems
 - For all loads being operated simultaneously
 - Suitable for the maximum fault current
 - With proper load shedding (where necessary) the alternate source supplies:
 - (1) Legally Required Standby Systems
 - (2) Optional Standby Systems



Transfer Equipment – 701.5(A)

- Must be automatic
- Identified for standby use
- Approved by the AHJ
- Designed and installed to inadvertent

Automatic Transfer Switches for Use in Emergency Systems (WPWR)

This listing covers automatic transfer switches intended for use in Emergency Systems as contemplated by Articles 517 and 700 of the National Electrical Code. These transfer switches are also suitable for use in Standby Systems in accordance with Articles 701 and 702 of the National Electrical Code. See additional information under “Transfer Switches”, Guide WPTZ.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word “LISTED,” a control number, and the product name “Automatic Transfer Switch For Emergency Systems”.



Circuit Wiring – 701.10, 702.10

- Legally required and optional standby system wiring:
 - Permitted within same raceways and enclosures with each other and with other general wiring



Power Sources –701.12(A)-(G)

- Legally Required Standby Systems
 - Storage batteries
 - Generator sets
 - Uninterruptible power supplies
 - Separate service (acceptable to AHJ)
 - Connection ahead of the service disconnect
 - Fuel Cells
 - Unit Equipment

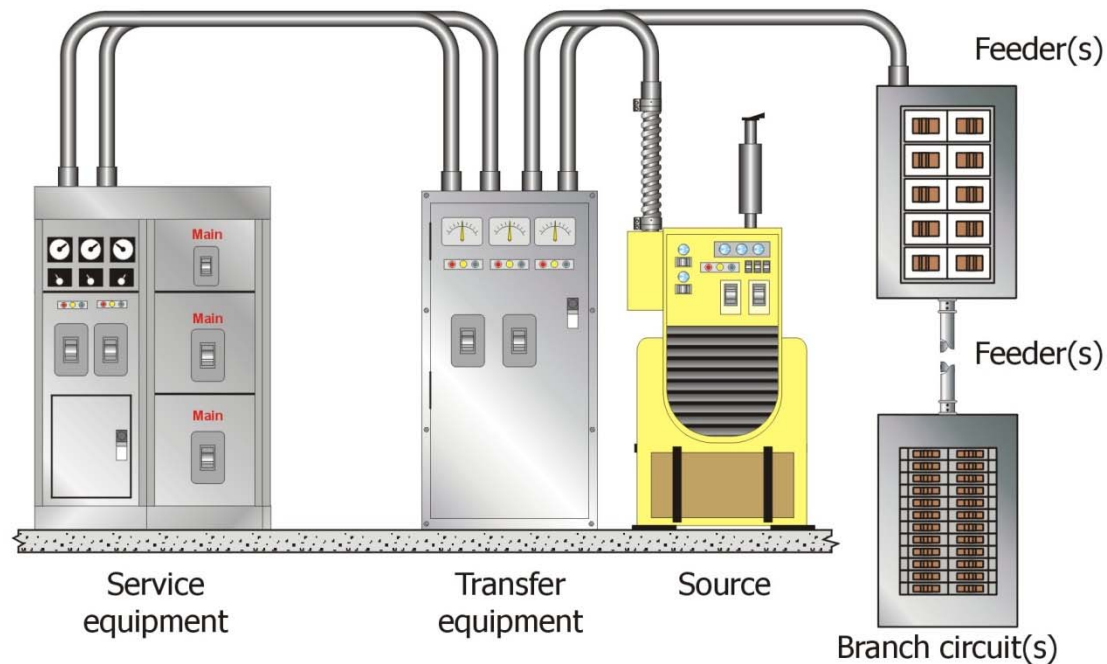


Selective Coordination – 701.27

- Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

701.18 Selective Coordination

All overcurrent devices in legally required standby systems are required to be selectively coordinated to ensure proper isolation and localization of fault by the overcurrent device(s) closest to the fault.



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Article 708 – Critical Operation Power Systems

- First included in the 2008 NEC
- Developed in response to call from federal government to have requirements for buildings and systems that are more resilient to terrorist threat and natural disasters
- Emergency system “on steroids”
- Approaches emergency power similarly to health care – “defend in place”
- Provides specific requirements for “hardened” wiring systems



Article 708 – Critical Operation Power Systems

- **Critical Operations Power Systems (COPS).** Power systems for facilities or parts of facilities that require continuous operation for the reasons of public safety, emergency management, national security, or business continuity.
- Critical operations power systems are those systems so classed by municipal, state, federal, or other codes by any governmental agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system. These systems include but are not limited to power systems, HVAC, fire alarm, security, communications, and signaling for designated critical operations areas.



Article 708 – Critical Operation Power Systems

(C) COPS Feeder Wiring Requirements. COPS feeders shall comply with 708.10(C)(1) through (C)(3).

(1) Protection Against Physical Damage. The wiring of the COPS system shall be protected against physical damage. Wiring methods shall be permitted to be installed in accordance with the following:

(1) Rigid metal conduit, intermediate metal conduit, or Type MI cable.

(2) Where encased in not less than 50 mm (2 in.) of concrete, any of the following wiring methods shall be permitted:

- a. Schedule 40 or Schedule 80 rigid polyvinyl chloride conduit (Type PVC)
- b. Reinforced thermosetting resin conduit (Type RTRC)
- c. Electrical metallic tubing (Type EMT)
- d. Flexible nonmetallic or jacketed metallic raceways
- e. Jacketed metallic cable assemblies listed for installation in concrete



Emergency & Standby Power Systems

- When alternative power systems are used and classification of the system involves a variety of options, is the correct classification based on the power source, utilization equipment supplied, use of that utilization equipment, building occupancy type, or other criteria?



What is this System?

A house includes a normal electrical system with a generator that can supply the entire load. Is the alternative power system essential, emergency, legally required standby, optional standby, and/or COPS systems?







What is this System?

A house includes a normal electrical system with a generator that cannot supply the entire load. Transfer switch includes load shed capability. Is the alternative power system essential, emergency, legally required standby, optional standby, and/or COPS systems?







20kW

GENERAC
Guardian Series



WARNING: SHOCK HAZARD
DO NOT OPEN THIS PANEL UNLESS YOU ARE A QUALIFIED ELECTRICIAN.
... (rest of the text is too small to transcribe accurately) ...

UTILITY SERVICE DISCONNECT

ON OFF
200A

WARNING: SHOCK HAZARD
DO NOT OPEN THIS PANEL UNLESS YOU ARE A QUALIFIED ELECTRICIAN.
... (rest of the text is too small to transcribe accurately) ...

WARNING: SHOCK HAZARD
DO NOT OPEN THIS PANEL UNLESS YOU ARE A QUALIFIED ELECTRICIAN.
... (rest of the text is too small to transcribe accurately) ...

WARNING: SHOCK HAZARD
DO NOT OPEN THIS PANEL UNLESS YOU ARE A QUALIFIED ELECTRICIAN.
... (rest of the text is too small to transcribe accurately) ...

120V 15A
120V 15A

What is this System?

An office building includes multiple county and state administrative offices, some IT facilities, a small assembly meeting room, and the 911 Center. Building includes a normal electrical system, unit equipment for egress and exit lighting, multiple levels of UPS power, and a generator. Are the alternative power systems essential, emergency, legally required standby, optional standby, and/or COPS systems?







EXIT



What is this System?

A building includes a major business data center. Building includes redundant normal electrical systems, redundant and multiple levels of UPS power, and redundant generators. Are the alternative power systems essential, emergency, legally required standby, optional standby, and/or COPS systems?



What is this System?

A grocery store includes a normal electrical system with multiple levels of UPS power, and a generator supplying egress and exit lighting, the fire alarm control panel, cash registers, and refrigeration equipment. Are the alternative power systems essential, emergency, legally required standby, optional standby, and/or COPS systems?



Questions?

