

White Paper

**National Electrical Code Requirements
for Emergency Power Transfer Switching**

ASCO[®]

An Overview of NEC Article 700, 701, and 702 Provisions that Affect Transfer Switch Selection

The 2017 Edition of the National Electrical Code (NEC) contains provisions that govern the specification and use of standby power systems. Articles 700, 701, and 702 prescribe standards for emergency system wiring and equipment, including automatic transfer switches. Article 708 prescribes standards for standby power systems that must operate to avoid impacts to public welfare or national security. The following table summarizes the scope of each Article.

Article	Focus	Type	Scope					Equipment Affected
			Installation	Operation	Maintenance	Monitoring	Control	
700	Emergency Systems	Permanent	x	x	x			Lighting and controls needed for human safety
701	Legally-Required Systems	Permanent	x	x	x			Systems and equipment needed to aid emergency responders
702	Optional Standby Systems	Temporary & Permanent	x	x				Equipment that does not have a life safety function
708	Systems Required for National or Public Security	Temporary & Permanent	x	x	x	x	x	Equipment or systems that could impact public safety or national security, as indicated by code or a governmental agency

The following narrative identifies content in NEC Articles 700, 701, and 702 that relate to power transfer switching equipment, and compares the scope of the corresponding provisions. Article 708 will be evaluated in a separate report.

NEC Article 700 - Emergency Systems

NEC Article 700 specifies electrical safety requirements for circuits and equipment that must operate to enable the evacuation of buildings where large numbers of people assemble, such as hotels, theaters, areas, and healthcare facilities. Circuits and equipment that provide emergency illumination are covered by Article 700. Examples of other systems to which Article 700 may apply include ventilation systems, fire alarm systems, elevators, fire pumps, and industrial processes where interruption of power could result in a serious safety risk or health hazard. For instance, if power interruption could result in a release of a hazardous material from industrial process machinery, the associated circuits and equipment could be subject to the provisions of Article 700.

General Requirements

Part I of Article 700 specifies general requirements for emergency systems. Within Part I, Article 700.5 specifies that transfer equipment shall be automatic, electrically operated and mechanically held, listed for emergency system use, and shall transfer only emergency loads. In addition, Article 700.4 specifies that emergency systems must “have adequate capacity and rating for all loads to be operated simultaneously;” and that the system must be suitable for the maximum available fault current available at its terminals. An automatic transfer switch (ATS) must be able to withstand the fault current until it is cleared by the overcurrent protection device protecting it. Test methods for evaluating the current that ATSs can withstand and close-on are specified in UL 1008, the safety standard for Transfer Switch Equipment. An appropriately rated, UL 1008-listed ATS will meet the Article 700.4 and 700.5 requirements.

Because emergency power circuits must always be available to serve life-safety equipment, Article 700.5(B) specifies that “Means shall be permitted to bypass and isolate the transfer equipment.” Automatic transfer switches equipped with bypass isolation provide continuous power to loads when the ATS is removed from service for inspection, testing, and maintenance. UL 1008-Listed ATSs with bypass isolation provide reliable service for all of the emergency circuits covered by Article 700.

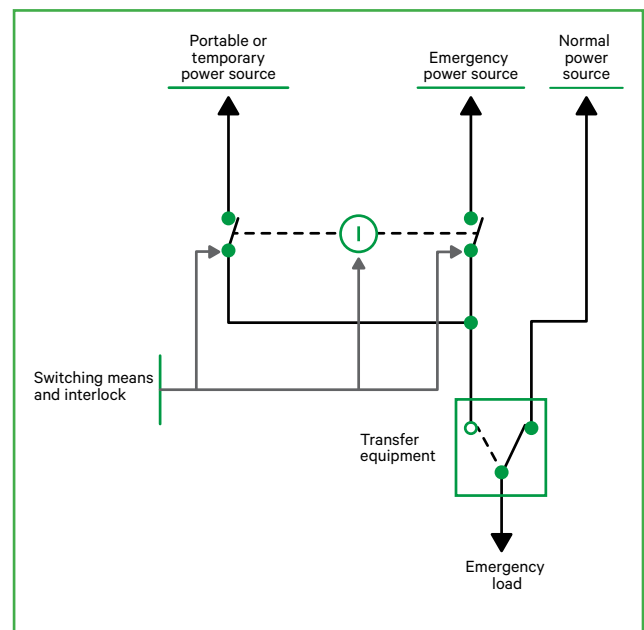
Article 700.3 requires testing of installed systems to verify proper function when a facility is commissioned, then periodically thereafter. It also specifies that a means must be provided to test the system under maximum anticipated load, and stipulates record-keeping requirements for all maintenance and testing activities. Article 700.3(C) requires that emergency system equipment, which includes transfer switches, be maintained in accordance with manufacturer instructions and industry standards. For additional information regarding the components of an effective transfer switch maintenance program, read the ASCO white paper entitled, “[Maintaining Automatic Transfer Switches for Reliability and Longevity](#).” For information regarding the selection of qualified service providers, review the ASCO white paper entitled, “[Identifying Qualified Service Providers to Optimize Power Reliability](#).”

Within Article 700.3, item (F) represents a significant addition to the code. This provision requires that emergency systems that rely on a single source of alternate power be fitted with a permanent switching means for connecting a portable or temporary power source. This will ensure that a standby power source is available when a facility’s permanent standby power source is removed from service for maintenance or repair. The informational note accompanying Article 700.3(F) states there are many possible methods to achieve its requirements. Figure 700.3(F), shown below, accompanies the article to demonstrate one example of how to comply with this new requirement. An excellent method of meeting this requirement would utilize a UL 1008-Listed, manual transfer switch.

Interestingly, Article 400.3(F) also specified that the means for connecting temporary or portable equipment can also be used to connect a load bank. ASCO’s white paper entitled “[Load Banks for Power System Testing](#)” explains how load banks may be used with emergency power systems.

Article 700.4(B) allows the alternate power source to be utilized for emergency, legally required standby, and optional standby systems where the source has adequate capacity to or where selective load pickup and shedding is provided. The article requires that emergency circuits be assigned the highest priority, with second priority assigned to legally required standby circuits defined in Article 701, and third priority assigned to optional standby circuits, defined by Article 702. Selective load pickup and shedding capabilities can be obtained with state-of-the-art ATS equipment.

1 National Fire Protection Agency, NFPA 70: National Electrical Code®. 2017 Edition. Quincy, MA: National Fire Protection Agency, 2016, p. 70–581.



For emergency power systems with a single alternate power source, NEC Article 700.3(F) requires a means of connecting temporary or portable power.¹

Circuit Wiring

Part II of Article 700 pertains to emergency system circuit wiring and does not specify requirements that affect the selection of transfer switches.

Sources of Power

In Part III – Sources of Power, Article 700.12, General Requirements specifies that alternate power must be available within the time required for the application but not to exceed 10 seconds. To meet the requirements of Article 700.12, engine start and transfer switching must occur no longer than 10 seconds after the failure of the normal supply. Article 700.12(B)(5) allows for the use of an auxiliary power source to provide power to the emergency system within 10 seconds if the generating system requires more time to develop power. An uninterruptible power supply may meet this provision.

Emergency System Circuits for Lighting and Power

Part IV of Article 700 addresses emergency system circuits for lighting and power with consideration given for transferring emergency lighting and equipment loads.

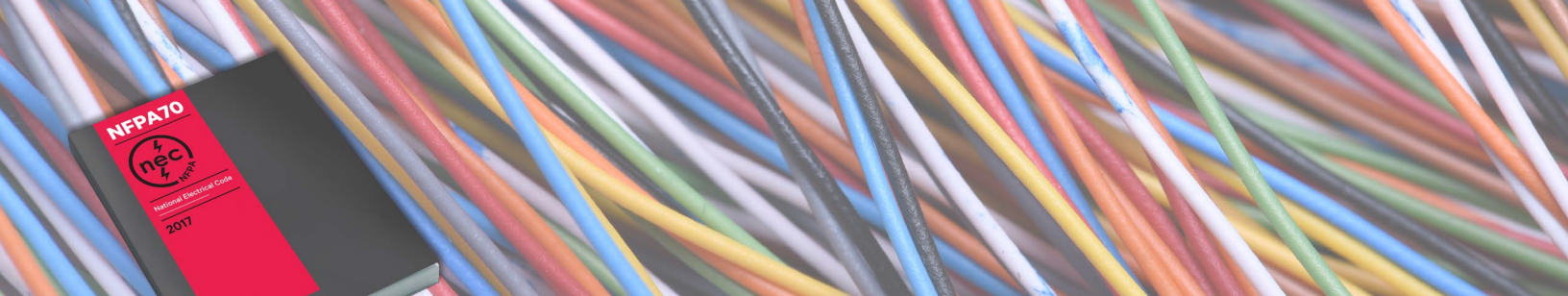
Emergency Lighting Circuits

Part V addresses controls for emergency lighting circuits with consideration for using listed branch circuit emergency lighting transfer switches.

Overcurrent Protection

In Part VI, Article 700.32 specifies that emergency system overcurrent devices “... shall be selectively coordinated with all supply-side overcurrent devices.” Selective coordination refers to the process of ensuring that upstream breakers and fuses do not trip before downstream breakers and fuses, thereby preventing inadvertent removal of power from equipment that would otherwise have been unaffected by a fault. The article further requires that “Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems”. Selective coordination specifications are typically developed following a study of the facility conducted for this purpose. Manufacturers offer ATSS that can withstand fault currents ranging up to 0.5 seconds to help satisfy selective coordination requirements.





NEC Article 701 – Legally Required Standby Systems

NEC Article 701 specifies electrical safety requirements for legally required standby systems circuits and equipment that must operate when the normal supply or system is interrupted. While Article 700 addresses equipment and systems that are needed to provide required illumination for building egress or power for equipment essential for safety of life, Article 701 specifies the requirements to provide power to aid support personnel responding to emergencies or supporting recovery from emergency events. For example, while emergency circuits under Article 700 will power lighting required to exit a building, legally-required circuits may power lighting that enables responders to view controls for critical building equipment, such as controls for valves, transfer switches, power distribution panels, and other electrical or safety equipment.

General Requirements

The majority of the previously described Article 700 provisions are also stipulated in Article 701. Article 701.4 permits that the alternate power source for the legally required standby system can supply both legally required and optional standby loads if (1) the alternate source has adequate capacity for all of the connected loads, or (2) the application of selective load pickup and shedding will ensure adequate power to legally required standby circuits.

Sources of Power

In Part III, the ATS-related provisions for sources of power are similar to those in Article 700. The primary variance is found in Article 701.12, which requires that alternate sources of power for legally-required systems come online within 60 seconds.

NEC Article 702 - Optional Standby Systems

NEC Article 702 specifies requirements for the “installation and operation of optional standby systems, both those that are permanently installed in their entirety and those arranged for connection to a portable supply where life safety does not depend on the performance of the system.” [702.1, 702.2] Examples of systems covered by Article 702 include those in (1) residences provided to avoid inconvenience or discomfort; (2) business facilities installed to avoid interruption in the operation of revenue-generating equipment, and (3) warehouses where loss of refrigeration would result in product spoilage and business losses.

It is important to understand that Article 702 does not specify a maximum time in which power must become available. In addition, because applicable systems do not support life-safety equipment, Article 702 provides for greater latitude in the design of optional standby systems. Article 702 provisions that could affect the selection of a power transfer switch are summarized as follows.

In Part I, Article 702.4 allows for use of a manual or automatic switch to transfer loads between the normal and emergency power sources. Any manual transfer switch must have adequate capacity and rating to supply all load equipment intended to be operated at one time [702(b)(1)]. If an ATS is used, it shall have a capacity to carry the full equipment load, or to carry the maximum load that will be applied using a load management system. Without further description, Article 702.5 stipulates that the “Transfer equipment shall be suitable for the intended use...”

Summary

Power transfer switching requirements for emergency systems, legally required systems, and optional standby systems are specified in NEC Articles 700, 701, and 702, respectively. Requirements for critical power operating systems in Article 708 will be reviewed in a separate document.

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