ARTICLE
702 Optional Standby Systems

Part I. General

702.1 Scope. This article applies to the installation and operation of optional standby systems.

The systems covered by this article consist of those that are permanently installed in their entirety, including prime movers, and those that are arranged for a connection to a premises wiring system from a portable alternate power supply.

Informational Note: Optional standby systems are typically installed to provide an alternate source of electric power for such facilities as industrial and commercial buildings, farms, and residences and to serve loads such as heating and refrigeration systems, data processing and communications systems, and industrial processes that, when stopped during any power outage, could cause discomfort, serious interruption of the process, damage to the product or process, or the like.

Article 702 applies not only to permanently installed generators and prime movers but also to portable alternate power supplies that can be connected to an optional standby system. For example, upon failure of an optional standby generator at a frozen food processing plant, a vehicle-mounted generator can be brought in and connected to the plant's optional standby system, which has the capability for such a connection. See Exhibit 702.1.

Generators used in residential-type occupancies are installed as optional standby systems because there is no code or AHJ mandate to provide an alternate source of power. Some of the largest and most sophisticated standby systems installed are optional standby systems that are installed to support uninterrupted operation of data systems associated with businesses such as financial institutions, mercantile operations, and Internet service providers.

See also

Article 700 for emergency systems

Article 701 for legally required standby systems

•N **702.2 Reconditioned Equipment.** Reconditioned transfer switches shall not be permitted.

702.4 Capacity and Rating.

(A) System Capacity.

(1) Manual and Nonautomatic Load Connection. If the connection of load is manual or nonautomatic, 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.

Informational Note: Manual and nonautomatic transfer equipment require human intervention.

EXHIBIT 702.1 A trailer- (vehicle-) mounted portable generator. *(Courtesy of the International Association of Electrical Inspectors)*

The use of manual transfer equipment requires the user to manually switch to the standby source. The user can then select the necessary loads. The standby source must have adequate capacity to supply the user-selected loads that are intended to be operated at the same time.

Δ **(2) Automatic Load Connection.** If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) or (A)(2)(b) in accordance with Parts I through IV of Article 220 or by another approved method.

For standby systems employing automatic transfer switches (ATS), the source must have the capacity to supply all the loads connected to it, unless an automatic load management system (sometimes referred to as load shedding) is used to ensure that the transferred load does not overload the source.

(a) *Full Load.* The standby source shall be capable of supplying the full load that is automatically connected.

(b) *Energy Management System (EMS).* Where a system is employed in accordance with 750.30 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 EMS.

•**702.5 Interconnection or Transfer Equipment.**

(A) General. Interconnection or transfer equipment shall be required for all standby systems subject to the requirements of this article. Equipment shall be suitable for the intended use and shall be listed, designed, and installed so as to prevent the inadvertent interconnection of all sources of supply in any operation of the equipment.

Traditional automatic transfer switches (ATS) are not designed to permit parallel operation of generation equipment and the normal source and need not comply with Article 705. However, certain ATS configurations are intentionally designed to briefly

allow (for a few cycles) parallel operation of the generation equipment with the normal source upon load transfer from generator to normal source. This load transfer can occur with minimal disturbance or effect on the load. Transfer switches that employ this type of paralleling must comply with Article 705.

Exception: Temporary connection of a portable generator without transfer equipment shall be permitted where conditions of maintenance and supervision ensure that only qualified persons service the installation and where the normal supply is physically isolated by a lockable disconnecting means or by disconnection of the normal supply conductors.

The exception provides requirements for the connection of loads to a generator without the use of a transfer switch. Supervision by qualified personnel is critical to ensuring that power produced by the generator is not fed back onto the utility distribution lines through the loads, potentially creating a dangerous electrical shock hazard to line workers.

Δ **(B) Meter-Mounted Transfer Switches.** Transfer switches installed between the utility meter and the meter enclosure shall be listed meter-mounted transfer switches and shall be approved.

Informational Note No. 1: See UL 1008M, *Transfer Switch Equipment, Meter Mounted*, for more information.

Informational Note No. 2: Manual and nonautomatic transfer equipment use human intervention.

Because most meters and their associated enclosures are under the control of the serving electric utility, their approval is necessary in order to install a meter-mounted transfer switch. In addition to this requirement in Article 702, the permission to install a meter-mounted transfer switch, such as the type shown in Exhibit 702.2, ahead of service equipment is specified in 230.82(11). The meter-mounted transfer switch is required to be marked indicating that it is not service equipment. However, the fact that it is not service equipment does not preclude making a grounding electrode conductor connection to the grounded (neutral) service conductor in the meter enclosure as long as it is accessible, as required by 250.68(A). Additionally, the meter-mounted transfer switch is not suitable for use as the emergency disconnect required by 230.85 for one- and two-family dwellings.

EXHIBIT 702.2 A meter-mounted transfer switch suitable for use in optional standby systems. *(Courtesy of Global Power Products, Inc.)*

(C) Documentation. In other than dwelling units, the short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Product standards require transfer equipment to be marked with the short-circuit withstand/closing or short-time current rating (short-circuit current rating). Typically, a transfer switch is marked by the manufacturer with several options, resulting in many short-circuit current rating values. Those values can vary based upon the overcurrent protective device (OCPD) type, ampere rating, and setting. For a specific installation, the short-circuit current rating of the transfer switch is based on the overcurrent protection provided. The field marking required by this section documents the specifics of the protection scheme and verifies compliance with 110.3(B) and 110.10.

(D) Parallel Installation. Systems installed to permit operation in parallel with the normal source shall also meet Part I or Part II of Article 705.

702.6 Signals. Audible and visual signal devices shall be provided, where practicable, for the following purposes specified in 702.6(A) and (B).

(A) Malfunction. To indicate malfunction of the optional standby source.

(B) Carrying Load. To indicate that the optional standby source is carrying load.

Exception: Signals shall not be required for portable standby power sources.

702.7 Signs.

Δ **(A) Standby.** A sign shall be placed at the service equipment for other than one- and two-family dwellings that indicates the type and location of each on-site optional standby power source. For one- and two-family dwelling units, a sign shall be placed at the disconnecting means required in 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect or means to shut down the prime mover as required in 445.19(C).

Δ **(B) Grounding.** Where removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power

source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating:

WARNING:
SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THIS EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED.

The warning sign(s) or label(s) shall comply with 110.21(B).

Optional standby systems that have a solid (unswitched) neutral in the transfer equipment (nonseparately derived system) rely on the grounding and bonding connections in the normal source supply equipment to ensure that the ground-fault current path is completed from a ground fault to the alternate source. If a main or system bonding jumper is removed [e.g., to perform testing on ground-fault protection of equipment (GFPE) systems], service personnel could inadvertently become part of the current path if a ground fault occurs.

Δ **(C) Power Inlet.** Where a power inlet is used for a temporary connection to a portable generator, a warning sign shall be placed near the inlet to indicate the type of derived system that the system is capable of based on the wiring of the transfer equipment. The sign shall display one of the following warnings:

WARNING:
FOR CONNECTION OF A SEPARATELY DERIVED (BONDED NEUTRAL) SYSTEM ONLY
or
WARNING:
FOR CONNECTION OF A NONSEPARATELY DERIVED (FLOATING NEUTRAL) SYSTEM ONLY

Part II. Wiring

702.10 Wiring Optional Standby Systems. The optional standby system wiring shall be permitted to occupy the same raceways, cables, boxes, and cabinets with other general wiring.

702.11 Portable Generator Grounding.

(A) Separately Derived System. Where a portable optional standby source is used as a separately derived system, it shall be grounded to a grounding electrode in accordance with 250.30.

(B) Nonseparately Derived System. Where a portable optional standby source is used as a nonseparately derived system, the equipment grounding conductor shall be bonded to the system grounding electrode.

702.12 Outdoor Generator Sets.

(A) Portable Generators Greater Than 15 kW and Permanently Installed Generators. Where an outdoor housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.

The disconnecting means on an outdoor generator set can be used as the disconnecting means required in 225.31, provided the disconnecting means, and not just the generator, is readily accessible and is within sight of the building.

(B) Portable Generators 15 kW or Less. Where a portable generator, rated 15 kW or less, is installed using a flanged inlet or other cord-and-plug-type connection, a disconnecting means shall not be required where ungrounded conductors serve or pass through a building or structure. The flanged inlet or other cord-and-plug-type connection shall be located outside of a building or structure.

Δ **(C) Power Inlets Rated at 100 Amperes or Greater, for Portable Generators.** Equipment containing power inlets for the connection of a generator source shall be listed for the intended use. Systems with power inlets not rated as a disconnecting means shall be equipped with an interlocked disconnecting means.

Exception: Supervised industrial installations where permanent space is identified for the portable generator located within line of sight of the power inlets shall not be required to have interlocked disconnecting means nor inlets rated as disconnects.

This requirement ensures that a portable generator can be safely disconnected from a power inlet rated 100 amperes or more. A generator that is disconnected (unplugged) under load can present a safety hazard if the inlet is not rated for load break. The power inlet is required to be equipped with an interlocked disconnecting means to ensure that the disconnecting means is opened prior to disengaging the inlet. The exceptions recognize power inlets that are load break rated and those installed in supervised industrial installations where certain conditions exist.

ARTICLE 705

Interconnected Electric Power Production Sources

Part I. General

705.1 Scope. This article covers installation of one or more electric power production sources operating in parallel with a primary source(s) of electricity.

Informational Note No. 1: Examples of the types of primary sources include a utility supply or an on-site electric power source(s).

Informational Note No. 2: See Informational Note Figure 705.1.