Agenda

January 2023

▸ Members Open Forum
▸ Main Presentation
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Members Open Forum

In an Orderly Fashion, Please Unmute Yourself or Request the Microphone

- Outreach Opportunities
- Job Openings
- Recommended Topics
- Asks
- Related Announcements
Designing Generator Docking Station Installations

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Generator Docking Stations

CSE Article

“Designing Generator Docking Station Installations”, Consulting-Specifying Engineer, September 2, 2022

https://www.csemag.com/articles/designing-generator-docking-station-installations
Generator Docking Stations

What is a docking station?

- A permanently installed piece of electrical equipment which permits the connection of a temporary power source to a power distribution system.

- Can come in multiple forms:
  - Standard docking station
  - UL 891 switchboard
  - Transfer switch
    - Manual
    - Automatic

UL 891 Switchboard

Basic Docking Station
Generator Docking Stations

*Why do we need them?*

- Reduces cost of temporary generator hook-ups
- Reduces downtime
- Increases system reliability
- Ensures compliance with current codes
Generator Docking Stations

Why do we need them?

700.3(F) Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power.

If the emergency system relies on a single alternate source of power, which will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power, which shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

1. Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.
2. Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.
3. The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.
4. Mechanical or electrical interlocking shall prevent inadvertent interconnection of power sources.
5. The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

It shall be permissible to utilize manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to utilize the switching means for connection of a load bank.

Informational Note: There are many possible methods to achieve the requirements of 700.3(F). See Informational Note Figure 700.3(F) for one example.

Exception: The permanent switching means to connect a portable or temporary alternate source of power, for the duration of the maintenance or repair, shall not be required where any of the following conditions exists:

1. All processes that rely on the emergency system source are capable of being disabled during maintenance or repair of the emergency source of power.
2. The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.
3. Other temporary means can be substituted for the emergency system.
4. A permanent alternate emergency source, such as, but not limited to, a second on-site standby generator or separate electric utility service connection, capable of supporting the emergency system, exists.
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*NEC 700.3(F)*

- (1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent wiring system

- Example of a modification of the permanent wiring system:
  - Disconnecting wiring to a circuit breaker and back-feeding that circuit breaker with temporary generator conductors
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NEC 700.3(F)

- (2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12
  - Automatic start
  - Power available at the transfer switch terminals within 10 seconds
  - Automatically transfers to emergency loads
  - Adequate fuel available
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**NEC 700.3(F)**

- (3) Connection point for the portable generator or temporary alternate source shall be marked with the phase rotation and system bonding requirements
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NEC 700.3(F)

▪ (4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources

▪ Examples of acceptable solutions:
  - Trap key interlocking
  - Manual transfer switch
  - Automatic transfer switch
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NEC 700.3(F)

(5) The switching means shall include a contact point to annunciate at a remote location to indicate that the permanent source is disconnected.
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NEC 700.3(F)

(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.
(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.
**Generator Docking Stations**

700.3(F) Exceptions

*Exception No. 1:* “All processes that rely on the emergency system source are capable of being disabled during maintenance or repair of the emergency source of power.” This exception allows the temporary source to be omitted if the emergency loads can be switched off. This may not be practical for some applications, where emergency systems such as fire alarm and egress lighting cannot be disabled.
**Exception No. 2:** “The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.” It is difficult to see how one could be confident that a building would be unoccupied during the time that an emergency generator would need to be repaired, though there may be some building types where this exception could be applied. Buildings with fire pumps that are required to have an alternate power source would not be permitted to utilize this exception.
**Generator Docking Stations**

**700.3(F) Exceptions**

*Exception No. 3:* “Other temporary means can be substituted for the emergency system.” It is not clear exactly what temporary means would be permitted in order to qualify for this exception, therefore this would need to be determined by the authority having jurisdiction.
Exception No. 4: “A permanent alternate emergency source, such as, but not limited to, a second on-site standby generator or separate electric utility service connection, capable of supporting the emergency system, exists.” This exception allows paralleled generator systems to be excluded from this code requirement as well as a separate utility service.
Generator Docking Stations

Docking Station Types - Termination Box

- Provides a simple, low-cost hard-wired connection point
Generator Docking Stations

Docking Station Types - Camlocks

- Camlocks are the typical and preferred method of connecting temporary cables
- Hardwired mechanical terminals are also available and can be specified in conjunction with camlocks
Generator Docking Stations

Docking Station Types - Dual Purpose

- Provides a single connection point for a load bank and a temporary generator
Generator Docking Stations

Accessories

2-wire Auto Start Contacts: A set of posts that provides a convenient and readily accessible set of contacts for connecting the auto start signal from the building transfer switches to the temporary generator.

Convenience Receptacles / Shore Power Connections: Many temporary generators have separate power connections for jacket water heaters, space heaters, battery chargers, and service receptacles. Receptacles can be provided integral to the docking station to keep all the connections in a single convenient location. Most temporary generator shore power connections are 120V. These shore power connections are typically only necessary for applications where the temporary generator may be sitting idle for a period of time.

Load Shed Receptacle: For applications where the docking station is serving as a connection point for a load bank, this feature will allow the load bank to automatically be shed if the utility power goes down during a load bank test.

Utility Indicator Lights: Lights which illuminate when the utility voltage is present. This feature can be helpful for the contractors to confirm that utility has been restored prior to disconnecting the temporary generator.

Thermostat and Strip Heater: Prevents condensation accumulation inside the docking station cabinet.

Phase Rotation Monitor: This device helps the contractor verify that the temporary generator phase rotation is correct prior to energizing the load. It should be noted that NEC 700.3(F) requires this accessory for docking stations serving emergency systems. Even in situations where a phase rotation monitor is not code required, it is recommended that this accessory be provided.
Generator Docking Stations

Configurations

Figure 1A: The common load bus configuration connects the docking station directly to a generator distribution panelboard. Courtesy: SmithGroup
Figure 1B: The in-line configuration places the docking station between the generator and the generator distribution panelboard. Courtesy: SmithGroup
Generator Docking Stations

Configurations

- Permanent Generator
- Load Bank Connection
- Temporary Generator
- To Load/ATS

Shunt Trip Available on Load Bank Circuit Breaker, so Breaker Trips when ATS Demands Power from Permanent Generator.

Access to Cam Lock Panelmounts Prevented Until Permanent Generator Circuit Breaker is Opened and Kirk Key is Removed.
Generator Docking Stations

Configurations – No Breaker

- Most cost effective
- Fewer breakers aids with selective coordination
- Requires trap key to be moved between two separate locations, key must be fit to different breaker types
- Load terminals of permanent generator breaker are energized during temporary generator operation
- Load bank cannot be automatically disconnected upon engine start call from ATS
Generator Docking Stations

*Configurations – Single Breaker*

- Cost effective
- Requires trap key to be moved between two separate locations, key must be fit to different breaker types
- Load terminals of permanent generator breaker are energized during temporary generator operation
- Load bank cannot be automatically disconnected upon engine start call from ATS
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*Configurations – Dual Breaker*

- Less cost effective
- Trap key stays within the docking station
- Load terminals of permanent generator breaker are **NOT** energized during temporary generator operation
- Load bank can be automatically disconnected upon engine start call from ATS

![Diagram of Generator Docking Station](image)
Generator Docking Stations

*Configurations – Three Breakers*

- Least cost effective
- Trap key stays within the docking station
- Load terminals of permanent generator breaker are **NOT** energized during temporary generator operation
- Load bank can be automatically disconnected upon engine start call from ATS
### Generator Docking Stations

**Controls and Monitoring**

- The switching means must annunciate that the permanent emergency power source is disconnected.
- Engine start contacts must be integrated into the design.
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Fire Pump Applications

- Quantity of disconnecting means must be closely monitored
- Location of fire pump power source should be designed to allow it the fire pump to be powered from the docking station
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Fire Pump Applications
Generator Docking Stations

Service Entrance Applications

- Multiple products available for service entrance applications
  - Docking station with trap key interlock
  - Manual transfer switch
  - Automatic transfer switch
Generator Docking Stations

Service Entrance Applications

- Close attention to available short-circuit current is required, especially for larger service transformer sizes
- Arc-energy reduction required for circuit breakers >= 1200A
- Means of mechanical interlocking shall be utilized to prevent back-feeding the utility (trap key or transfer switch)
Switchboard main can potentially be eliminated when using a service entrance docking station with a circuit breaker (NEC 225.32, 230.70(A)(1))
The design engineer should verify that the specification and drawings clearly identifies the lug size required for the application as well as the conductor material (copper vs. aluminum).
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Service Entrance Applications

- Consideration must be given to where the main system bonding jumper connection is made.
- A bonding jumper connection in the docking station could cause objectionable current on the equipment grounding conductor if the temporary generator has its neutral bonded to ground.
Open Discussion and Q&A
Next Meeting: February 21, 2023

Topic: Metering in Data Centers
Presenter: Alan Katz - MCMS Product Manager
Thank You and Have a Great Day!