



# IEEE IAS Atlanta Chapter Meeting

*January 17, 2023*

# Agenda

*January 2023*

- ▶ Members Open Forum
- ▶ Main Presentation
- ▶ Q&A
- ▶ Next Meeting Announcement

# Members Open Forum

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



# Designing Generator Docking Station Installations

*Presenter: Andrew Varilone, P.E. - Principal | Senior Electrical Engineer – SmithGroup*

- ▶ Bachelor of Science, Electrical Engineering, University of Michigan
- ▶ Based in Detroit, MI
- ▶ Joined SmithGroup in 2008
- ▶ Broad experience in Power Distribution, Lighting Design, Communications, Fire Alarms, and Security Systems
- ▶ Specializes in low voltage and medium voltage power distribution systems design for healthcare applications

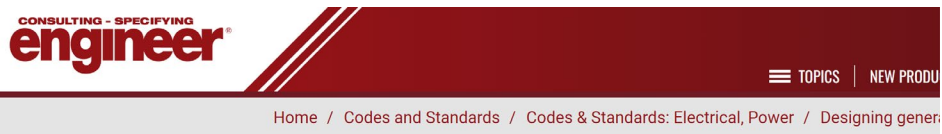


[andrew.varilone@smithgroup.com](mailto:andrew.varilone@smithgroup.com)

# Generator Docking Stations

CSE Article

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



## Designing generator docking station installations

Adding a generator docking station to a new or existing facility is a useful solution which requires careful planning to ensure a successful and safe installation.

BY ANDREW VARILONE, PE, LEED AP BD+C 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

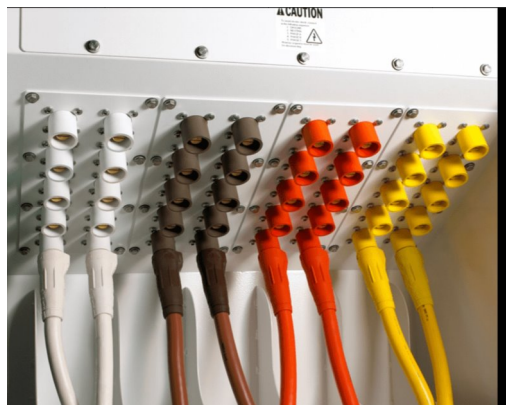


Basic Docking Station

# 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.



# Generator Docking Stations

*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

# Generator Docking Stations

*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

# Generator Docking Stations

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

TRANSFER SWITCH  
POWER INLET

**CAUTION**

To avoid electric shock, connect  
in the following sequence:

- 1: GROUND
- 2: NEUTRAL
- 3: PHASE A
- 4: PHASE B
- 5: PHASE C

Reverse sequence must be used  
for disconnecting.

SUITABLE FOR USE AS SERVICE EQUIPMENT

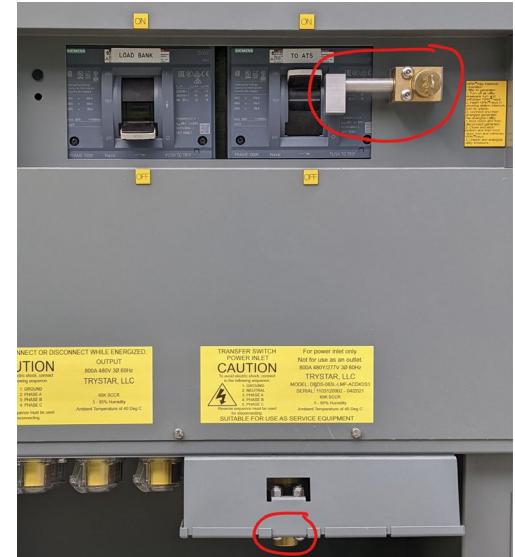
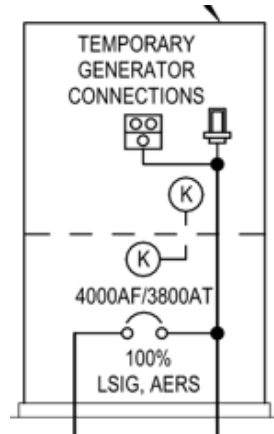
For power inlet only.  
Not for use as an outlet.  
800A 480Y/277V 3Ø 60Hz

TRYPSTAR, LLC  
MODEL: DBDS-085L-LMF-ACDK2S3  
SERIAL: 1103120002 - 04/2021  
65K SCCR  
5 - 95% Humidity  
Ambient Temperature of 40 Deg C

# Generator Docking Stations

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



# Generator Docking Stations

*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.



# Generator Docking Stations

*NEC 700.3(F)*

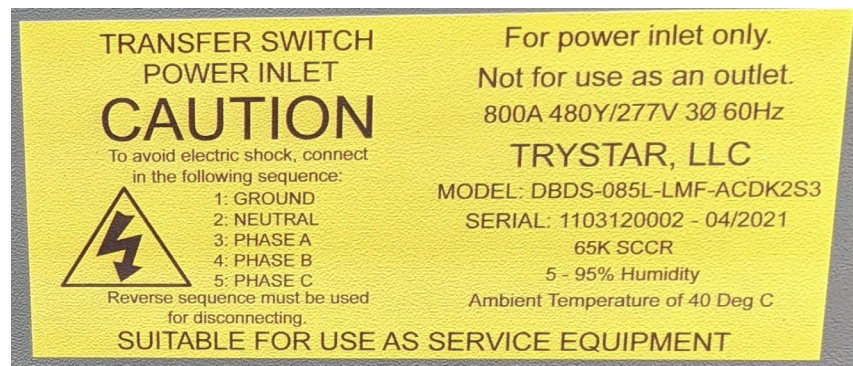
- ▶ (6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.



# Generator Docking Stations

*NEC 700.3(F)*

- ▶ (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.



# Generator Docking Stations

## 700.3(F) Exceptions

**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.

# Generator Docking Stations

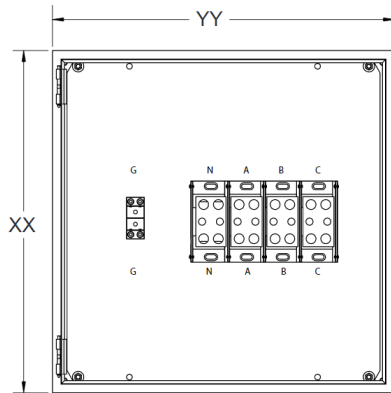
## 700.3(F) Exceptions

**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*

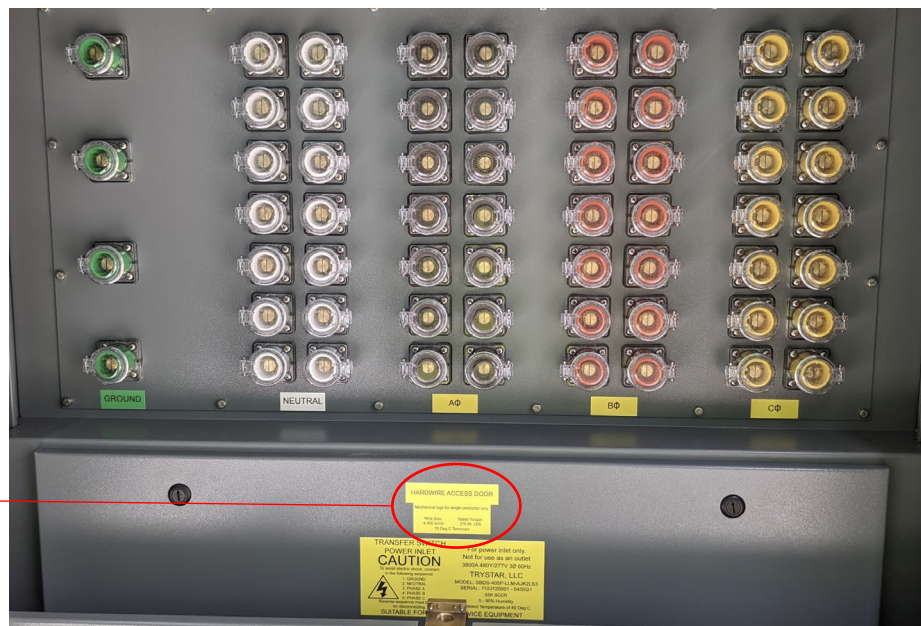
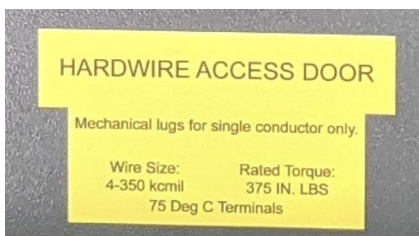
- ▶ Provides a simple, low-cost hard-wired connection point



# Generator Docking Stations

## Docking Station Types - Camlocks

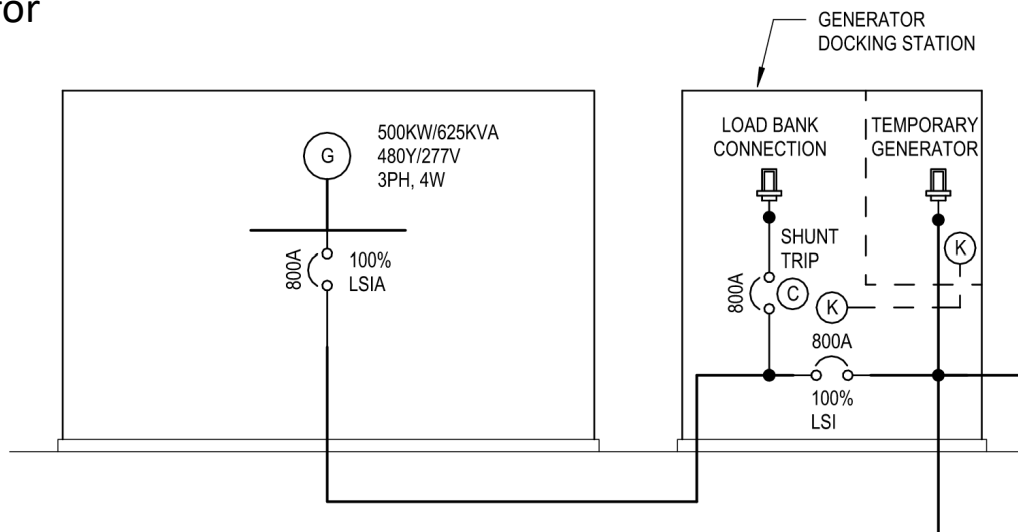
- ▶ Camlocks are the typical and preferred method of connecting temporary cables
- ▶ Hardwired mechanical terminals are also available and can be specified in conjunction with camlocks



# 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

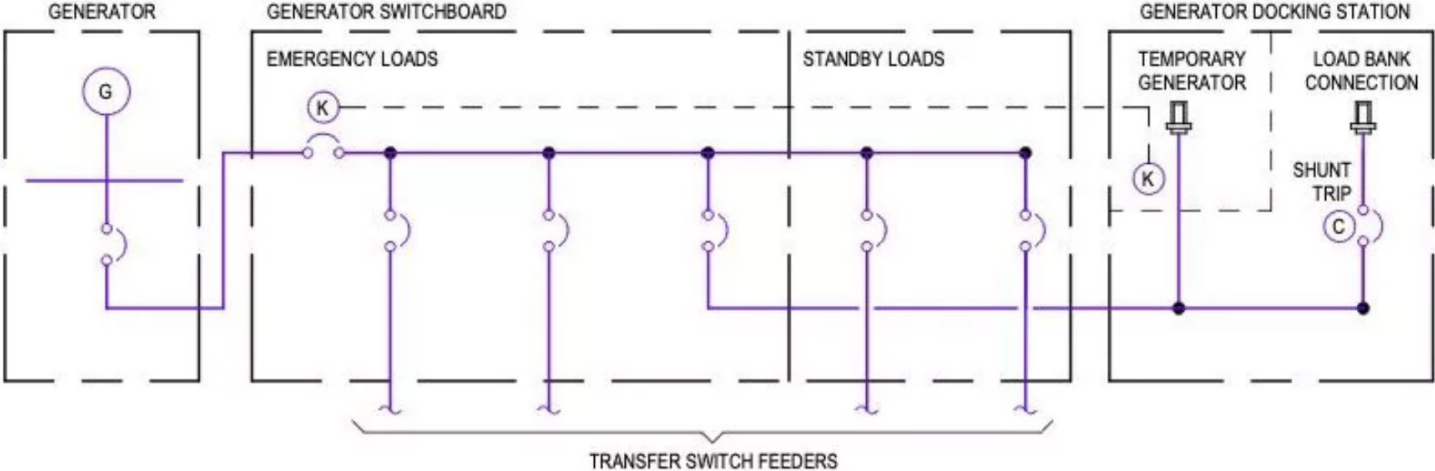


Figure 1A: The common load bus configuration connects the docking station directly to a generator distribution panelboard. Courtesy: SmithGroup



# Generator Docking Stations

## Configurations

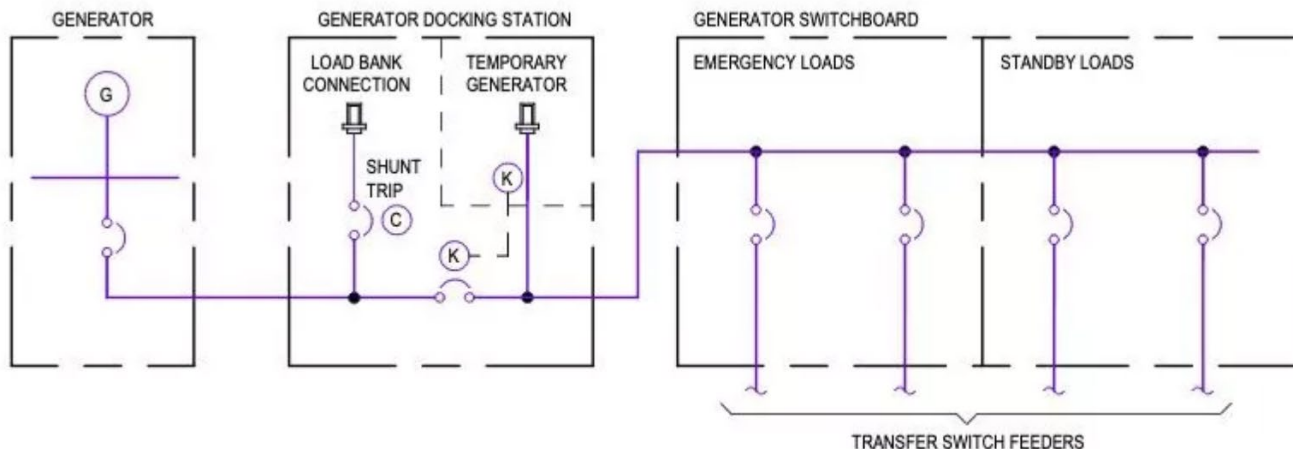
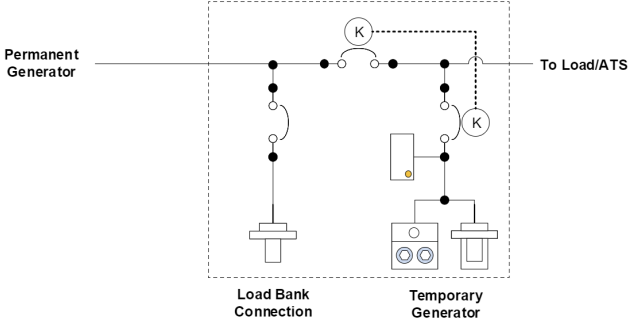
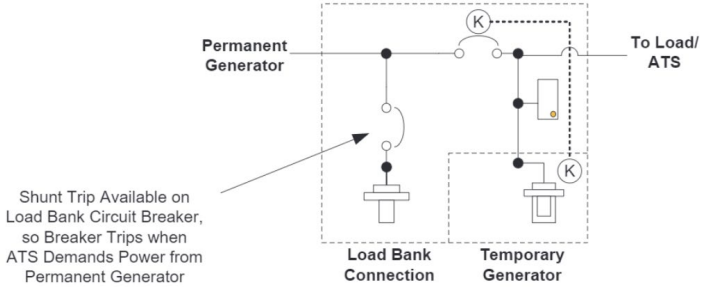
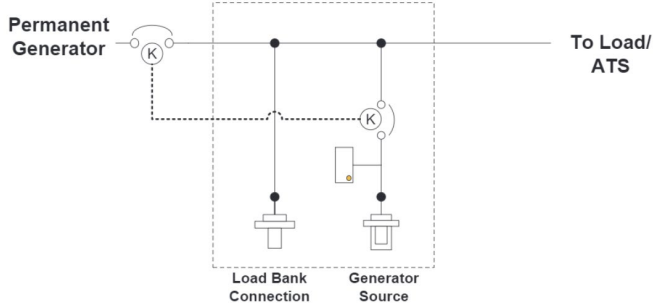
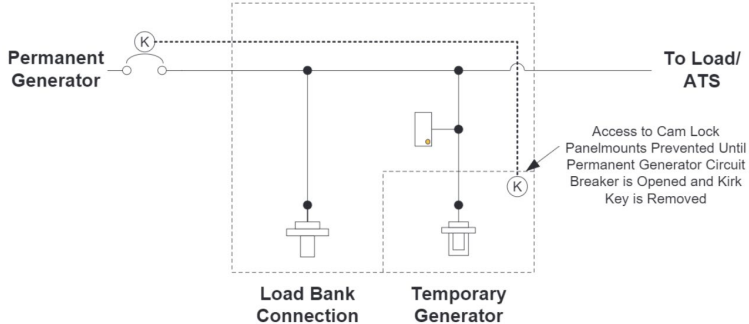


Figure 1B: The in-line configuration places the docking station between the generator and the generator distribution panelboard. Courtesy: SmithGroup

# Generator Docking Stations

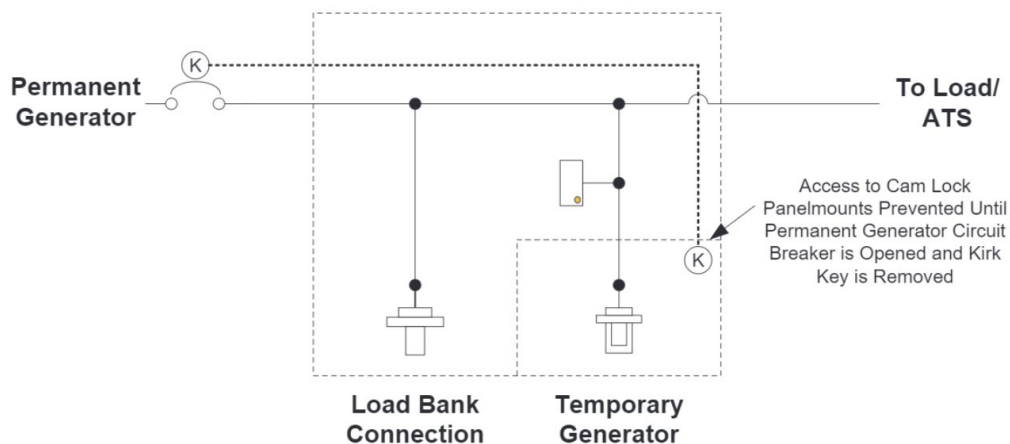
## Configurations



# Generator Docking Stations

## Configurations – No Breaker

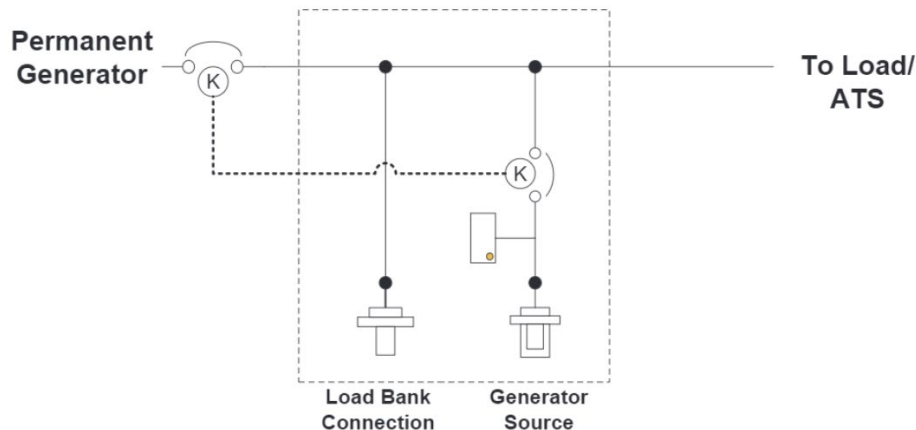
- ▶ Most cost effective
- ▶ Fewer breakers aids with selective coordination
- ▶ Requires trap key to be moved between two separate locations, key must be fit to different breaker types
- ▶ Load terminals of permanent generator breaker are energized during temporary generator operation
- ▶ Load bank cannot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



# Generator Docking Stations

## Configurations – Single Breaker

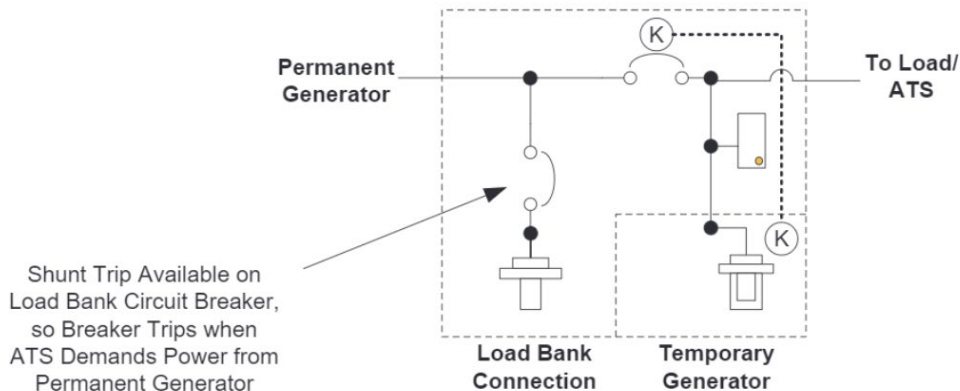
- ▶ Cost effective
- ▶ Requires trap key to be moved between two separate locations, key must be fit to different breaker types
- ▶ Load terminals of permanent generator breaker are energized during temporary generator operation
- ▶ Load bank cannot be automatically disconnected upon engine start call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



# Generator Docking Stations

## Configurations – Dual Breaker

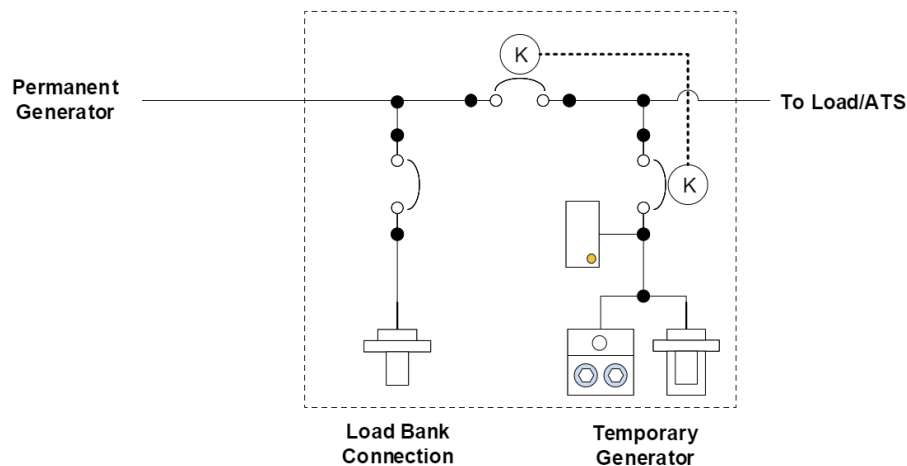
- ▶ Less cost effective
- ▶ Trap key stays within the docking station
- ▶ Load terminals of permanent generator breaker are NOT energized during temporary generator operation
- ▶ Load bank can be automatically disconnected upon engine start call from ATS



# Generator Docking Stations

## Configurations – Three Breakers

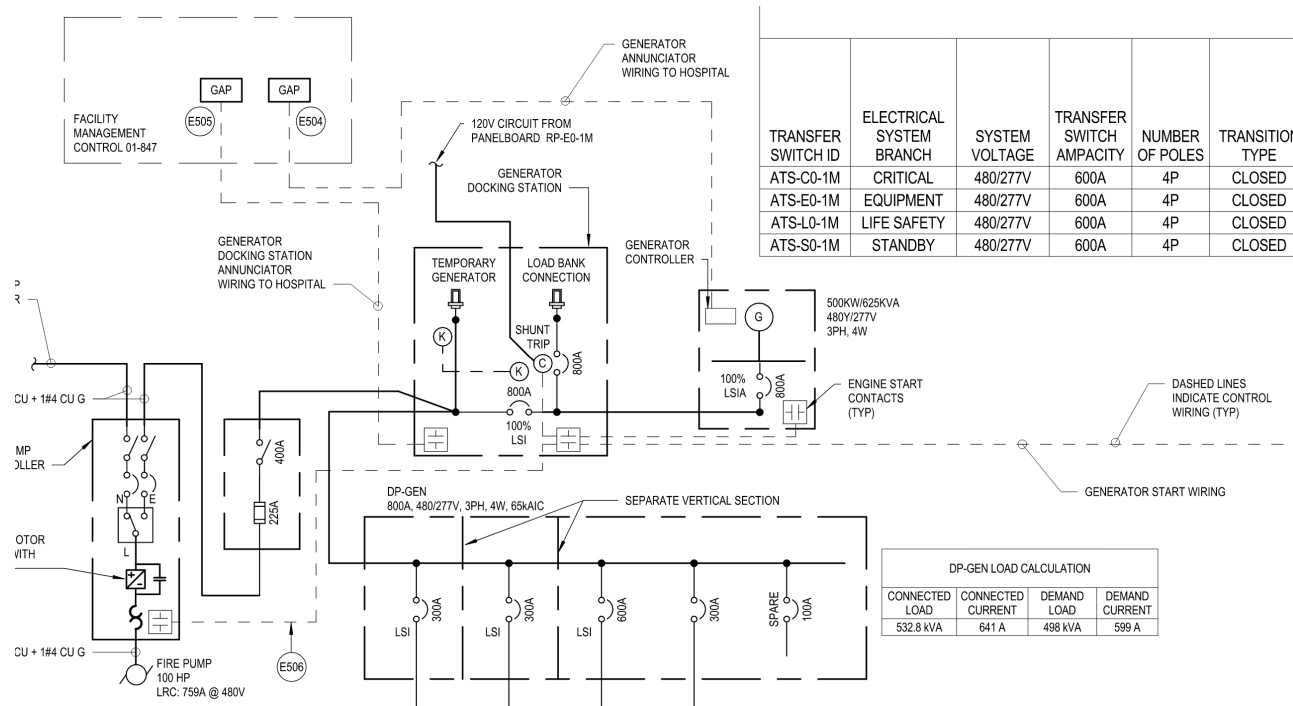
- ▶ Least cost effective
- ▶ Trap key stays within the docking station
- ▶ Load terminals of permanent generator breaker are NOT energized during temporary generator operation
- ▶ Load bank can be automatically disconnected upon engine start call from ATS



# Generator Docking Stations

## Controls and Monitoring

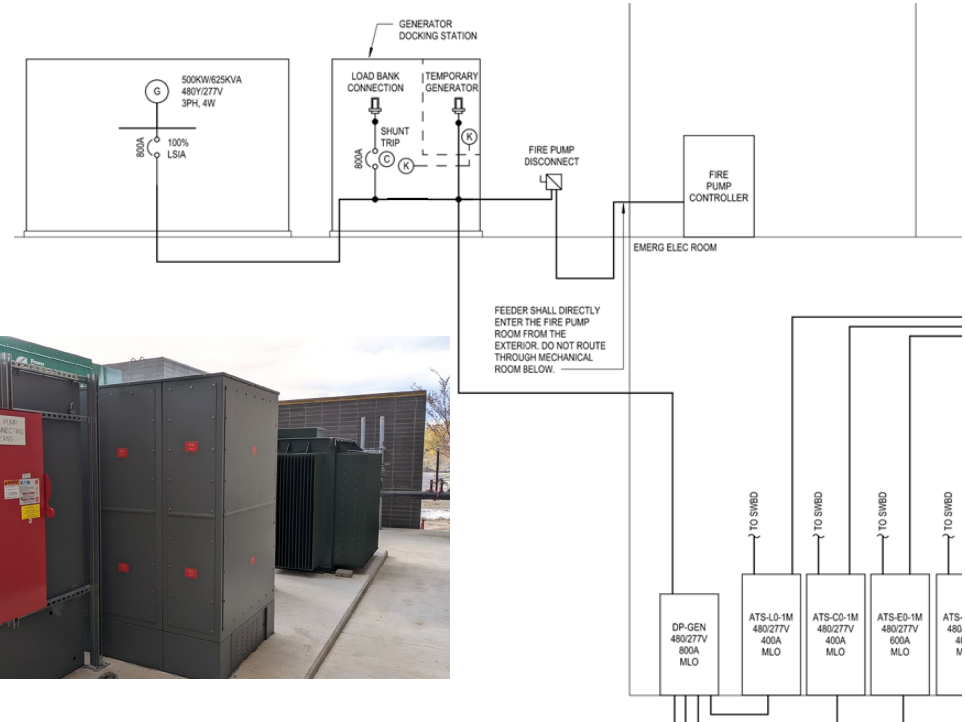
- ▶ The switching means must annunciate that the permanent emergency power source is disconnected
- ▶ Engine start contacts must be integrated into the design



# Generator Docking Stations

## Fire Pump Applications

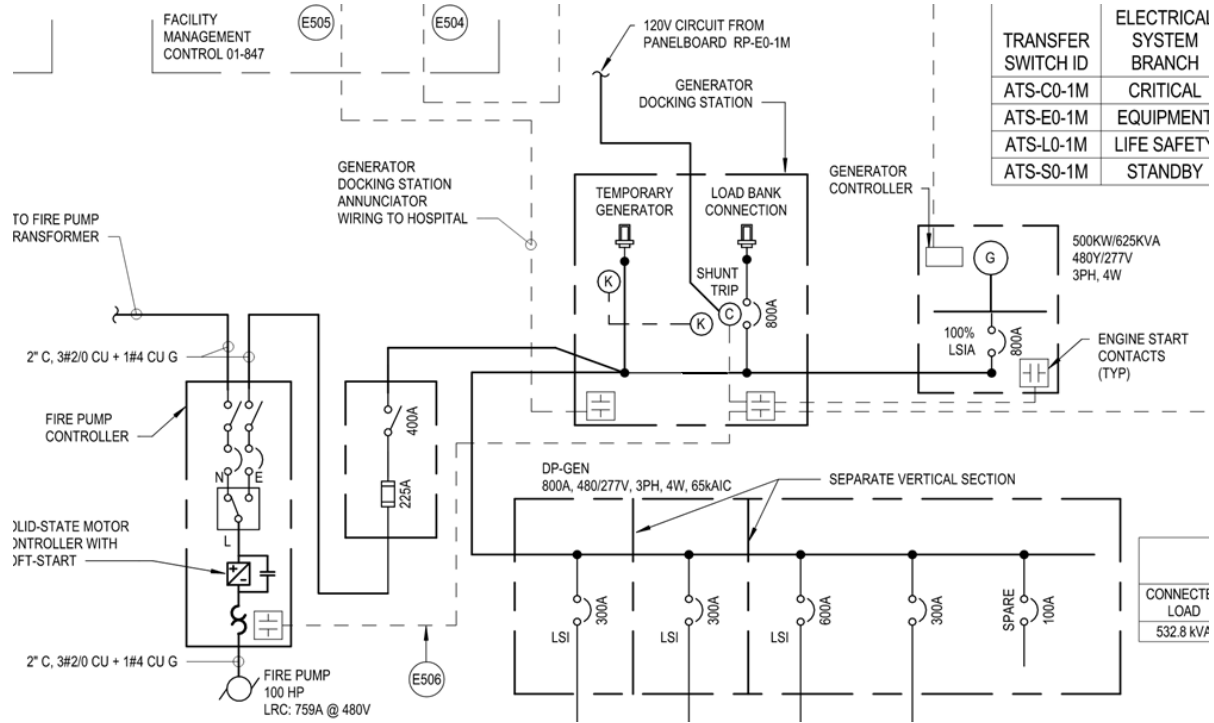
- ▶ Quantity of disconnecting means must be closely monitored
- ▶ Location of fire pump power source should be designed to allow it the fire pump to be powered from the docking station





# Generator Docking Stations

## Fire Pump Applications



# Generator Docking Stations

## *Service Entrance Applications*

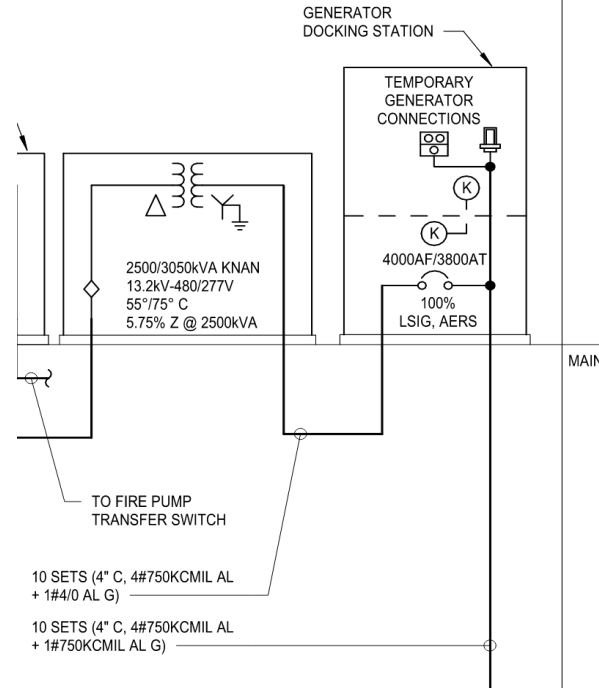
- ▶ Multiple products available for service entrance applications
  - Docking station with trap key interlock
  - Manual transfer switch
  - Automatic transfer switch



# 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  $\geq 1200A$
- ▶ Means of mechanical interlocking shall be utilized to prevent back-feeding the utility (trap key or transfer switch)



# Generator Docking Stations

## Service Entrance Applications

- ▶ Switchboard main can potentially be eliminated when using a service entrance docking station with a circuit breaker (NEC 225.32, 230.70(A)(1))

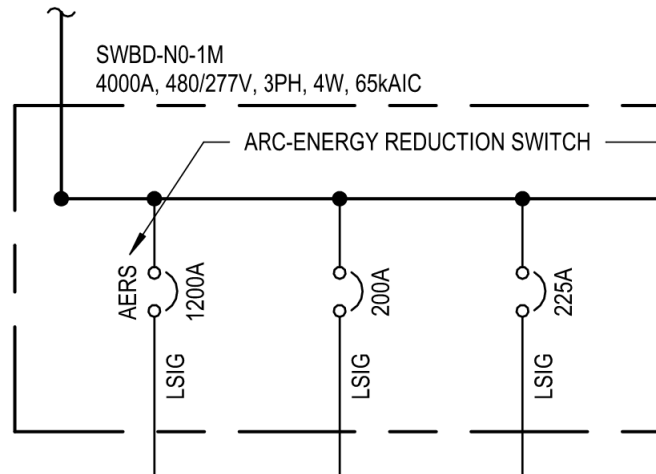
### Part VI. Service Equipment — Disconnecting Means

**230.70 General.** Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors.

**(A) Location.** The service disconnecting means shall be installed in accordance with 230.70(A)(1), (A)(2), and (A)(3).

**(1) Readily Accessible Location.** The service disconnecting means shall be installed at a readily accessible location **either outside of a building or structure or inside nearest the point of entrance of the service conductors.**

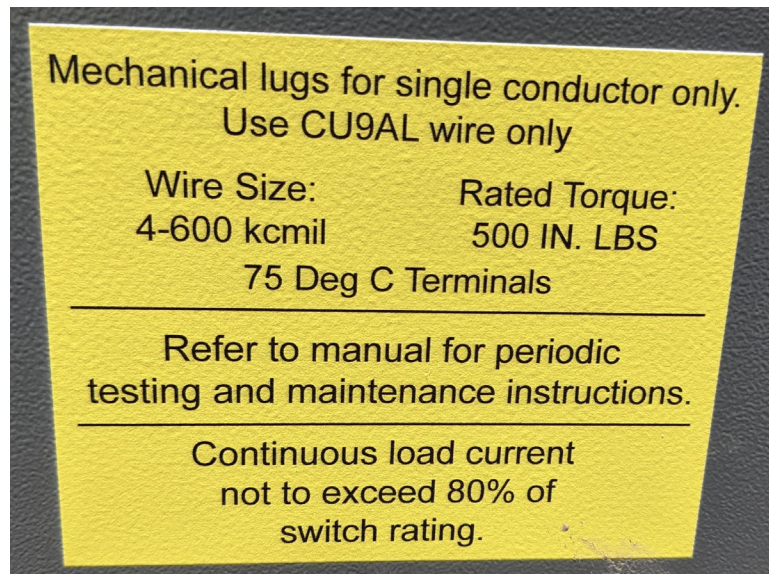
FROM EXTERIOR  
GENERATOR DOCKING  
STATION. REFER TO E5.1



# Generator Docking Stations

## *Service Entrance Applications*

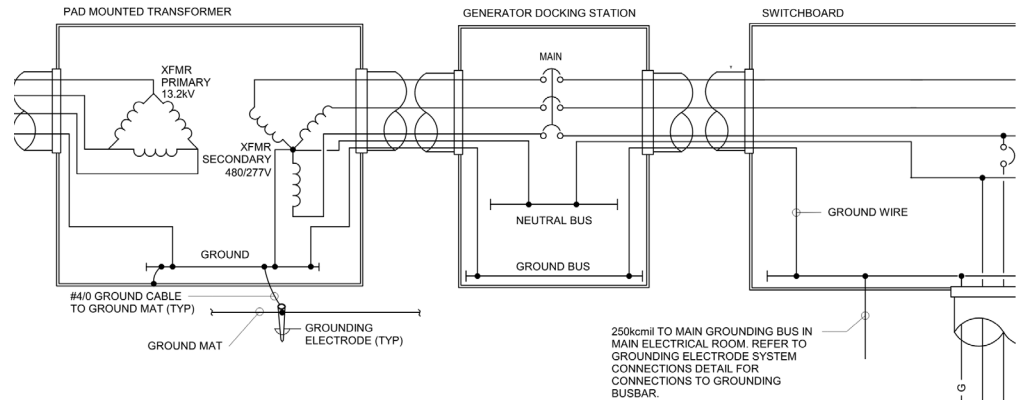
- ▶ The design engineer should verify that the specification and drawings clearly identifies the lug size required for the application as well as the conductor material (copper vs. aluminum)



# Generator Docking Stations

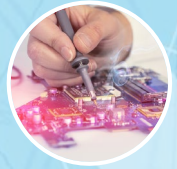
## Service Entrance Applications

- ▶ 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!