EFCOG
Electrical Safety Task Group

Informational Bulletin on Mobile office Units

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May 17, 2017

It has come to the attention of the electrical authorities having jurisdiction (AHJs) at the DOE sites there is inconsistency in how the National Electrical Code (NEC) rules are applied to mobile office units. Using the 2014 National Electrical Code, NFPA 70, as a reference, this informational bulletin has been created in an effort to establish a consistent understanding and application of the NEC rules related to electrical supplies to the mobile office units and the third party certifications of the mobile office units.

Mobile office units are a way of life these days around some of the DOE sites. The D & D sites will likely see an increase in their use as buildings are demolished and on-site waste disposal facilities are created or expanded.

These units are often mislabeled as temporary "office units," "manufactured homes, manufactured buildings," or "modular homes" when in fact in NEC terminology they are defined in 550.2 as "mobile homes."

It is easy to mislabel these units as the term "home" in "mobile home" implies that it is a dwelling unit. This misconception is compounded by the fact the actual NEC definition of a mobile home in 550.2, "a factory-assembled structure or structures transportable in one or more sections that are built on a permanent chassis and designed to be used as a dwelling without a permanent foundation….," actually states it is designed to be used as a dwelling unit. If one was to simply read the definition, it is likely they would stop there and not bother to look any further. However, 550.4(A) provides some limited direction on the use of Article 550 for mobile homes not intended as dwelling units.

The term “manufactured home” is also defined in 550.2 where it also specifies these units are intended to be used as dwelling units. However, these units are those where the manufacturer voluntarily files a certification with the regulatory agency, typically the US Department of Housing and Urban Development (HUD). These units are easier to identify as they generally have a HUD certification label (also known as a HUD tag). Additionally, they are not referenced in 550.4(A) where the NEC references homes that are not intended as dwelling units.

From an NEC standpoint what is often identified in the field as a “modular home” would be one that is defined in Article 545 as a “manufactured building.” These are buildings that are “stick built” but instead of being constructed on-site they are constructed in a manufacturing plant and assembled on-site. Other than a few amendments or supplements specified in Article 545, the general rules in Chapters 1-4 apply to manufactured buildings. Although these buildings are not limited to dwelling units, it is clear in the definition of a “manufactured building” in 545.2 the term does not include, manufactured homes, mobile homes, park trailers or recreational vehicles.

Section 550.4 identifies these types of mobile structures but only provides limited and somewhat open ended guidance. For example, this section limits its application to a supply voltage of 120-volt or 240/120-volt systems and it is unclear as to what is meant by “where a different voltage is required by either design or available power supply system, adjustment shall be made in accordance with other articles and sections for the voltage used.” Additionally, even if the supply system is 120-volt or 240/120-volt, 550.4 only excludes the requirements in the Article 550 pertaining to the number or capacity of circuits from applying so all the other requirements apply. The fact that all other rules apply can present some challenges and may require the site’s AHJ to consider the use of 90.4 and grant special permission for alternative methods where it is assured that equivalent objectives can be achieved by establishing and maintaining effective safety.

When considering Article 550, it is easy to recognize the requirements apply readily to mobile homes that were designed and intended as dwellings and to mobile home parks. When you consider the typical mobile home park could have hundreds of mobile homes with remote service equipment it makes perfect sense to have a feeder disconnecting means within 9.0 m (30 ft) of each mobile home. However, if I have ten mobile structures ganged together as offices on an industrial site with qualified individuals servicing the installation, is it really necessary to have a disconnecting means located within 9.0 m (30 ft) of each unit? Another example is the language in 550.25. This section requires AFCI protection for all 15 and 20 ampere outlets in mobile and manufactured homes and there is no exclusion in 550.4.

The following information will address some common requirements and issues related to electrical supplies to mobile office units and some general considerations for third party certification of branch circuit wiring.

Service Disconnecting Means

Part III of Article 550 provides the requirements for services and feeders to mobile homes. Section 550.32(A) requires the mobile home service equipment (main disconnecting means for the utility supply) to be adjacent to and not mounted on the mobile home. This section defines “adjacent” as being insight from and not more than 9.0 m (30 ft.) from the exterior wall of the mobile home it serves.

Additionally, 550.32(F) specifies the mobile home disconnecting means must be installed so the bottom of the enclosure containing the disconnecting means is not less than 600 mm (2 ft.) above finish grade or the working platform. The disconnecting means must be installed so that the center of the grip of the operating handle, when in the highest position, is not more than 2.0 m (6 ft. 7 in.) above the finished grade or working platform.

As seen in the above photo, this can be challenging if an outdoor panelboard like the one in the above photo is used. Mounting the equipment high enough to meet the 600 m (2 ft.) from finish grade requirement may put the upper disconnects higher than 2.0 m (6 ft. 7 in.) from finish grade. This situation may require special permission approval from the AHJ. The photo to the right shows a good example of how the 550.32(A) disconnecting means rules apply. Because the service equipment is located elsewhere on the premises, a disconnecting means is required within 9.0 m (30 ft.) from the mobile units.

Section 550.32(A) also permits the service equipment to be located remote from mobile home provided a disconnecting means that is suitable for use as service equipment is located insight from and not more than 9.0 m (30 ft.) from the exterior wall of the mobile home it serves. In the photo to the right, the service equipment is located at the far end between the two poles. "Service equipment" is defined in Article 100 as the necessary equipment connected to the load end of the service conductors to a building or other structure, or otherwise designated area, and intended to constitute the main control and cutoff of the supply. In the case of the photo on the right, the service equipment is remote from most of the mobile office units (more than 9.0 m (30 ft.)) so a disconnecting means would be required to be in sight from and not more than 9.0 m (30 ft.) from each mobile office unit that is more than 9.0 m (30 ft.) from the service equipment. Because there is overcurrent protection at the service equipment for the feeder(s) to each mobile office unit, the disconnecting means within 9.0 m (30 ft.) is not required to contain overcurrent protection.

Although the NEC defines a "service" as conductors that originate from the serving utility and run to the premises wiring and the "service point" as the connection between facilities of the serving utility and the premises wiring, most DOE sites define the service point. Usually it is at the load end of an overhead drop or at the secondary terminals of the transformer regardless if the conductors are supplied from a feeder. If a particular site does not define the service point then it is likely the mobile office units are supplied from a feeder equipment. However, this does not change the rules. The mobile office must still have a disconnecting means located within 9.0 m (30 ft.) and if the feeder panelboard or other distribution equipment is located accordingly it can serve as the disconnecting means for a mobile office unit.

Power Supply

Section 550.10(A) provides that the power supply to the mobile unit be a feeder assembly consisting of not more than one listed 50-ampere mobile home power-supply cord or a permanently installed feeder. Typically, the mobile units found at the DOE sites are supplied by a permanent feeder. In accordance with 550.33(A)(1) the feeder must consist of four insulated, color-coded conductors that shall be identified by the factory or by field marking of the conductors in compliance with 310.110.

At the mobile unit, the equipment grounding conductor run with the supply (feeder) conductors will be connected to the mobile unit disconnecting means enclosure and to the grounding electrode(s). The grounded conductor (neutral) will be isolated from the enclosure.

Mobile Unit Disconnecting Means

In accordance with 550.11(A), a single disconnecting means must be provided in each mobile unit consisting of a circuit breaker, or a switch and fuses and its accessories installed in a readily accessible location near the point of entrance of the supply cord or conductors into the mobile office unit. The main circuit breakers or fuses must be plainly marked as the main. The equipment, typically a panelboard, must be provided with a bar for the purposes of grounding and have sufficient terminals for all grounding conductors. The grounded conductors must be isolated from the equipment grounding conductors as provided in 550.16(A). The panelboard must be located in a readily accessible location and not located in a bathroom or clothes closet.

As provided in 550.10(I)(2), a metal raceway or rigid nonmetallic conduit from the disconnecting means in the mobile office unit to the underside of the mobile office unit is required. It must have provisions for attachment to suitable junction box or fitting to the raceway on the underside of the mobile office unit. The manufacturer must provide written installation instructions stating the proper feeder conductor sizes for the raceway and the size of the junction box to be used.

Grounding

In accordance with 550.16, both electrical and non-electrical parts of mobile units must be connected to the equipment grounding bus in the mobile unit panelboard. The equipment grounding bus in the panelboard will be connected, through the green insulated conductor in the supply cord or feeder conductors, to the grounding bus in service-entrance equipment located with 9.0 m (30 ft) mobile unit. In cases with the service equipment is located elsewhere, the insulated equipment grounding conductor will be connected to the equipment grounding bus in the disconnecting means enclosure within 9.0 m (30 ft) of the mobile unit. Neither the frame nor any appliance can be connected to the grounded (neutral) conductor. As specified in 550.16(A)(1), the grounded conductor (neutral) must be insulated from any equipment grounding conductors, equipment enclosures and other grounded parts.

All exposed non-current-carrying parts that are likely to become energized must be effectively bonded to the grounding terminal or enclosure of the mobile unit panelboard. A bonding conductor must be installed between the mobile unit panelboard and an accessible terminal on the mobile unit chassis. This is typically done by the manufacturer of the mobile unit. The bonding conductor can be solid, stranded, insulated, covered or bare and not smaller than 8 AWG copper or the equivalent.

Grounding Electrodes

Grounding electrodes must be provided in accordance with Article 250. If the disconnecting means that is within 9.0 m (30 ft) of the mobile unit is actually the service-entrance equipment then 250.24(A) will require a grounding electrode conductor to be connected to the grounded service conductor at each service.

Because the service-entrance equipment is usually not located at the mobile units, the supply conductors are considered as feeder conductors. Until the 2017 NEC, the disconnecting means located within 9.0 m (30 ft) of the mobile units was considered to be a “structure.” From the 2002 NEC through the 2014 NEC a “structure” was defined as “that which is built or constructed.” For that reason, and because 250.32(A) requires a grounding electrode to be provided at a structure supplied by a feeder, grounding electrodes were generally required at the disconnecting means.

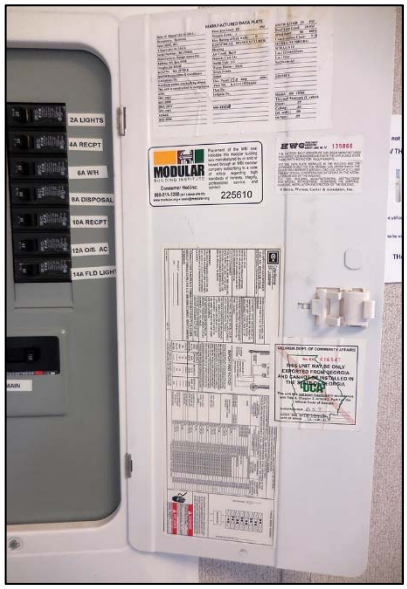
The 2017 NEC changed the definition of a “structure” to that which is built or constructed, other than equipment. This dramatically changed the way a feeder disconnecting means within 9.0 m (30 ft) is looked at. Under the 2017 NEC, the mobile unit feeder disconnecting means is no longer considered as a structure and therefore 250.32(A) does not apply. Grounding electrode conductors are not prohibited from being connected to the equipment grounding bus but this now becomes a design consideration.

Although installation of and connection to a grounding electrode may not be required at the disconnecting means within 9.0 m (30 ft) of the mobile unit, a grounding electrode connection will be required at the mobile unit. Section 250.32(A) will apply at the mobile unit as it is supplied by a feeder. This section requires a grounding electrode system in accordance with Part III of Article 250 to be installed at a building or other structure supplied by a branch circuit or feeder. The grounding electrode conductor will be connected to the equipment grounding conductor bus in the mobile unity panelboard.

Generally, the grounding electrode system for the mobile unit consists of two ground rods. Section 250.53(A)(2) provides that a ground rod must be supplemented by an additional electrode, which is typically another ground rod, unless you meet the exception by demonstrating there is 25 ohms or less resistance to earth with one electrode. Section 250.53(A)(3) specifies that a distance of no less than 1.83 m (6 ft) be provided between electrodes if the supplemental electrode is a rod, pipe or plate type.

Third Party Certification

The fundamentals of the terminology and electrical supplies related to mobile units was covered above. However, there is much to consider related to branch circuit wiring and equipment inside of the mobile unit. Because the installation of this wiring and equipment is done at the factory by the manufacturer and covered by wall and sometimes ceiling finish materials we, generally, do not have the opportunity to inspect it for compliance with the NEC. For this reason it is best specify mobile units that have had some type of third party evaluation and confirmation that what cannot be inspected at the time the mobile unit arrives on site (interior electrical wiring) is installed in compliance with the NEC. Typically evidence of the third party evaluation(s) in the form of labels or other markings that can be found on the inside of the door of the electrical panelboard enclosure.



The label on the left certifies the mobile unit has been manufactured and inspected to the applicable state third party inspection requirements. The label also notes the data plate installed in the building and the approved plans will include information regarding the parameters under which the building design was approved. The data plate, seen at the top of the panelboard door in the above photo and in the below photo indicates the mobile unit was manufactured in Florida in 2011 and wired to the 2008 NEC.