

Introduction

This second installment of the **NEC Essentials for Architects** white paper series aims to outline some very general requirements found in *NFPA 70-2020 (NEC)* for the installation of the following pieces of low voltage (1,000 volts or less) electrical distribution equipment:

- Panelboards.
- Switchboards.
- Dry-type transformers.
- Enclosed switches (aka “safety switches”).

Accessibility

Generally, all equipment is required to be accessible. There are limited exceptions to these requirements, which are not addressed within this white paper.

Location in or on Premises

With some limited exceptions, all overcurrent protective devices (fuses and circuit breakers) are required to be installed in “readily accessible” locations. As such, this requirement inherently requires the panelboards, switchboards, and safety switches the overcurrent protective devices are installed within to also be installed in “readily accessible” locations.

“Readily accessible” is defined as, “Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth.” In short, panelboards, switchboards, and safety switches are required to be installed in locations where they can be accessed easily and freely.



“Readily Accessible”



Not “Readily Accessible”

Maximum Mounting Heights

Circuit breakers and switches containing fuses are required to be installed such that the center of the grip of the operating handle, when in its highest position, does not exceed 79 inches above the working platform.

Note that this requirement does not prohibit the top of a panelboard, switchboard, or safety switch enclosure from being above 79 inches above the working platform. The requirement applies to the overcurrent protective devices installed within the panelboard, switchboard, or safety switch and those overcurrent protective devices are typically installed several inches below the top of the enclosure.

Minimum Mounting Heights

Minimum mounting heights are not dictated. As such, panelboards are permitted to be stacked vertically, provided the center of the grip of the operating handle, when in its highest position, does not exceed 79 inches above the working platform.

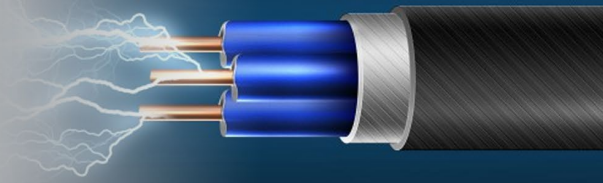
However, the practice of stacking panelboards is generally frowned upon due to the upper panelboard obstructing the path of the conduits exiting from the top of the lower panelboard.



Accessibility to Occupants

Overcurrent protective devices are required to be installed in locations where each occupant has ready access to the overcurrent devices serving their respective occupancy.

This requirement is most often met by providing each tenant of a multi-occupancy building with panelboards that are dedicated to their tenant space.

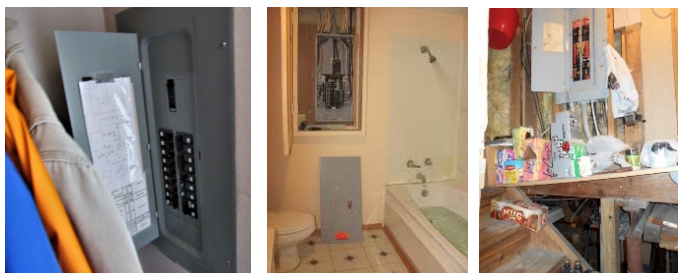


Prohibited Locations

Overcurrent protective devices are prohibited from being installed in the following locations:

- In the vicinity of easily ignitable material, such as clothes closets.
- In bathrooms of dwelling units, dormitory units, and guest rooms or guest suites.
- Over steps of a stairway.

Because overcurrent protective devices are prohibited from being installed within these locations, the panelboards, switchboards, and safety switches housing the overcurrent protection devices are also inherently prohibited from being installed in these locations.



Examples of Prohibited Locations

In addition to the prohibited locations noted above, the electrical service disconnecting means, which serves as the main power disconnect for the building, is prohibited from being installed in bathrooms of any occupancy.

Panelboard Mounting

Panelboards are supported by and secured to walls.

Lighting and Appliance Panelboards

Indoor lighting and appliance panelboards can be surface- or flush- (recessed) mounted. Outdoor lighting and appliance panelboards are always surface-mounted.



Surface Mounted Panelboard



Flush Mounted Panelboard

The following table outlines minimum wall depths required to flush-mount indoor lighting and appliance panelboards:

| Lighting and Appliance Panelboard Type | Minimum Wall Depth |
|--|--------------------|
| Load Center | 4 inches |
| Rated 400 Amperes or Less | 6 inches |
| Rated 600 Amperes | 8 inches |

Power Panelboards

Although there are no code restrictions on flush-mounting power panelboards, power panelboards are nearly always surface-mounted because the depth of the enclosures typically exceed the depth of the wall behind the power panelboard.

If flush-mounting a power panelboard is desired, close coordination within the design team is required to ensure the depth of the wall is sufficient for the equipment.

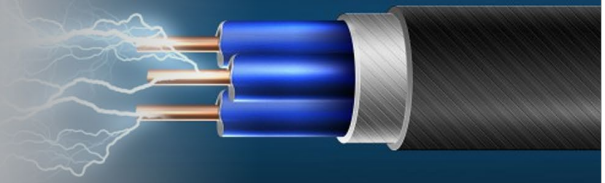
Switchboard Mounting

Switchboards are supported by and secured to the floor. As such, switchboards are always surface-mounted, typically on a concrete housekeeping pad.

The housekeeping pad is not a code requirement, but is typically incorporated into the design to provide a degree of protection from water and debris from infiltrating the bottom of the switchboard.

Transformer Mounting

Transformers are mounted using one of three methods, depending on the physical size and weight of the transformer – suspended on a trapeze from the structure above, wall-mounted, or floor- or platform-mounted. Regardless of where transformers are mounted, vibration isolators are typically incorporated into the design to mitigate the transformer's vibration from being transmitted to building elements.



Suspending on Trapeze

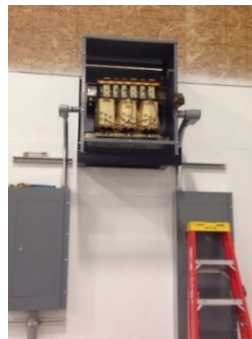
Transformers of all sizes and ratings are capable of being suspended on a trapeze from the structure, provided adequate physical space is provided and the structure can accommodate the weight of the transformer.



Transformers rated 50 kVA or less are permitted to be installed above accessible ceilings. Transformers rated greater than 50 kVA are not permitted above accessible ceilings. Transformers are never permitted in ceiling spaces that are not accessible.

Wall Mounting

Transformers rated 75 kVA or less are typically capable of being wall-mounted using the manufacturer's wall-mounting brackets, provided the transformer does not weigh more than 700 pounds. In a wall-mounting application, it is important that adequate wall backing be provided to adequately anchor the wall brackets.



Floor- or Platform Mounting

Transformers of all sizes and ratings are capable of being mounted to the floor or to a platform, such as a platform above a toilet room.



When mounting a transformer to a floor, a concrete housekeeping pad is typically incorporated into the design. The housekeeping pad is not a code requirement, but is intended to provide a degree of protection from debris from accumulating under the transformer. The concrete pad also acts as an inertia base to further mitigate vibrations from being transmitted to the structural floor. This is especially

important with a transformer is floor-mounted on a floor above grade level.

Safety Switch Mounting

Because safety switches are equipped with a manually-operable handle on the right-hand side of the enclosure, safety switches are always surface-mounted to permit operation.



Summary

Schnackel Engineers can assist you with a thorough evaluation of your building to ensure space reserved for electrical equipment meets NEC requirements. Please give us a call at (800) 581-0963 or email us at info@schnackel.com for a consultation.

About Jason



Jason Rohe, P.E. has been involved in the design of electrical systems for malls, mixed-use developments, corporate offices, national retail rollouts, schools, hospitals, medical facilities, commercial and institutional buildings for over 24 years with Schnackel Engineers. Email Jason at jrohe@schnackel.com.

About Greg



Gregory Schnackel, P.E., LEED AP has been involved in the design of mechanical, electrical, plumbing, fire protections and information technology systems for malls, mixed-use developments, corporate offices, national retail rollouts, schools, hospitals, medical facilities, commercial and institutional buildings for over 40 years with Schnackel Engineers. Email Greg at gschnackel@schnackel.com.