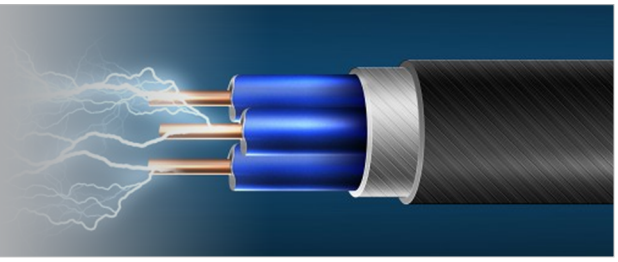
NEC Essentials for Architects

Introduction

WHITE PAPER MARCH 2021



White paper Series Purpose

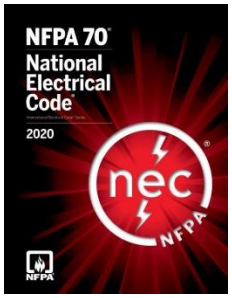
The purpose of our ***NEC Essentials for Architects*** white paper series is to provide architects with a summary of the requirements found in the *National Electrical Code* that have a direct impact on space planning and the architectural design of buildings.

This white paper series will focus on the specific requirements 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").

Codes Used Throughout Series

The information within this white paper series is based on the *2020 National Electrical Code (NEC)*. Many people do not realize it but the NEC is actually part of the National Fire Protection Association series of codes, specifically the *NFPA 70-2020*. The 2020 version is the most recent edition of this code.



It is important to note that previous versions of the *NEC* may have different requirements. Additionally, while the *NEC* is adopted nationally, many local jurisdictions and power utility companies have adopted amendments that may be more stringent than the requirements outlined in this white paper series and the base code.

Introduction

Because the code requirements vary depending on the type of electrical distribution equipment in question, it is important to be familiar with the different types of electrical equipment in order to apply the requirements appropriately.

This first white paper is intended to familiarize the audience with the basic nomenclatures and general characteristics of low voltage panelboards, switchboards, transformers, and safety switches.

Panelboards

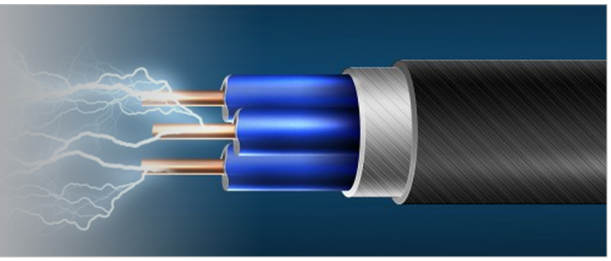
Panelboards are typically the most common piece of electrical distribution equipment found throughout commercial buildings. There are two basic categories of panelboards – lighting and appliance panelboards and power panelboards.

Lighting and Appliance Panelboards

Lighting and appliance panelboards serve as distribution points for branch circuits, such as circuits that serve lighting, receptacles, appliances, small motors, and mechanical equipment.

Although exceptions exist that are dependent upon the specific construction of a panelboard, the overcurrent protective devices (fuses or circuit breakers) found in lighting and appliance panelboards are typically limited to 100 amperes or less. Because of the small loads typically served, lighting and appliance panelboards will typically house a large quantity of single-pole overcurrent protective devices as compared to multipole overcurrent protective devices.

The enclosures for indoor lighting and appliance panelboards are typically 20 inches wide by 5.75 inches deep. The heights vary depending on a number of variables, but are primarily driven by the number of overcurrent protective devices installed within the panelboard. Sometimes panelboards are ganged together into a "double-wide" panelboard, which simply increases the width to 40 inches since two standard panelboards are set side by side.



Another variant is a column width panelboard, which is typically 8 to 9 inches wide and are intended to be installed directly on columns in industrial or storage warehouse installations.

Load centers are residential-grade lighting and appliance panelboards commonly used within dwelling units and sometimes in smaller, low cost commercial buildings. The enclosures for indoor load centers are typically 14.25 inches wide by 3.75 inches deep, allowing them to physically fit within the 2-inch by 4-inch stud walls commonly found in residential construction. Load centers are considered less durable in construction and should not be used for heavy duty commercial use.

Power Panelboards

While a lighting and appliance panelboard typically distributes power to receptacles, lighting, and other small loads that are rated 100 amperes or less, power panelboards typically distribute power to larger loads rated between 110 amperes and 1,200 amperes, inclusive.

The enclosures for power panelboards vary widely in dimensions, depending on the ampere rating of the power panelboard and the ampere rating of the overcurrent protective devices installed within. However, most enclosures will typically fall within 24 inches to 48 inches wide and 8 inches to 16 inches deep.

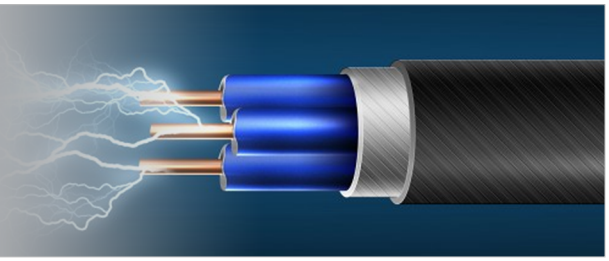
Because of the larger loads typically served, power panelboards will typically house more multipole overcurrent protective devices, as compared to single-pole overcurrent protective devices. While single-pole overcurrent protective devices are available for power panelboards, they are very expensive for the loads served.

Switchboards

A switchboard typically consists of two or more equipment sections mounted side-by-side and internally electrically interconnected by busbars. Switchboards are typically used when the required rating of the equipment exceeds 1,200 amperes and the equipment's primary purpose is to distribute power to other panelboards or other large equipment loads.

Because a switchboard typically consists of two or more sections of equipment, the physical dimensions of a switchboard can vary widely based on the various components installed within the switchboards and the quantity of sections required to house those components. Switchboards are very custom in nature and are not an off-the-shelf product.

The width of each section will vary between 24 inches and 48 inches wide and switchboard sections are typically 90 inches to 91.5 inches high. The ampere rating of the horizontal busbars that electrically interconnect the sections of the switchboard often drives the depth of each section, however they typically vary between 24 inches and 36 inches for most installations, except for very large service capacities. The following table provides reliable initial estimates of the depths of indoor switchboards based on standard horizontal busbar ratings:



Horizontal Busbar Rating	Depth
1,600 amperes	24 inches
2,000 amperes	24 inches
2,500 amperes	24 inches
3,000 amperes	36 inches
4,000 amperes	48 inches
5,000 amperes	60 inches

Transformers

Transformers are easily identifiable – they are the metal boxes that hum, vibrate, and emit heat. Transformers are used to increase or decrease the voltage of a circuit and are nearly always found in facilities where the incoming power is something other than a standard 120/240 volt or 120/208 volt system.

Transformers are rated using a kilovolt-ampere (kVA) power rating. The physical dimensions of a transformer will vary based on whether the transformer is single phase or three phase and the kVA rating of the transformer.

Safety Switches

The term "disconnect switch" is often used to designate an enclosed switch used for disconnecting a load. The official name is a safety switch.

Safety switches are used to provide a local disconnecting means, and possibly overcurrent protection, for various components of an electrical installation.

The physical dimensions of a safety switch will vary based on a number of factors including the voltage classification of the switch, the duty rating of the switch, the ampere rating of the safety switch, and whether the switch is fusible.

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.