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The Impact of NEC 2008 Panelboard Definitions on Data Center Applications

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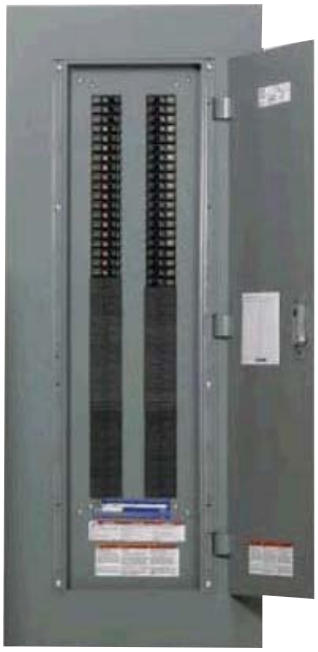
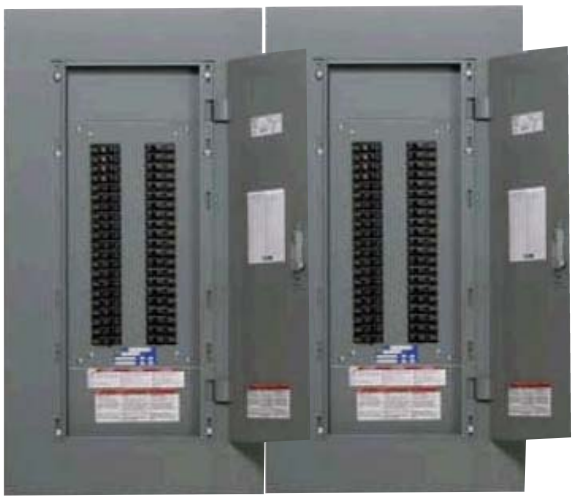
When you consider a data center power distribution system, switchboards and panelboards are commonly used products. Within a data center or computer room, branch circuit panels can be found mounted on walls, within a free-standing central PDU cabinet, or on the enclosure isle itself – within a remote power cabinet. NEC Article 408 defined the standards for distribution panelboards, which has not changed in decades. However, the traditional panelboard definitions will soon become obsolete with the adoption of NEC 2008. Here is some of what you can expect with the coming changes.

A close look at the traditional NEC 2005 Articles 408.34 and 408.35 reveals that power panels are defined and segregated into types: lighting/appliance and power. Traditionally, lighting and appliance panelboards have been limited to 42 branch circuits with over-current protective devices, while power panelboards have been limited to a maximum of 10% branch circuits. All of this restrictive language has been eliminated with the NEC 2008 standard, meaning 84 branch circuit panels are now within standards of compliance.



84 Circuit Panelboard



Two 42 Circuit Panelboards

Many manufacturers have quickly moved on this change and created products based on the new standard. You will find that the new products are still listed as lighting and appliance panelboards, but in order to accommodate 84 circuits, the tub dimensions will extend to 62 inches high or greater. When the new panels are integrated into data center power distribution, you may want to consider the following:

Heat and Space

There has already been a great deal of research done and white papers produced to address potential thermal issues that may be caused with 84 over-current protective devices in the same enclosure. Since a PDU or RPP cabinet typically incorporates 84,

168 or more branch circuits, this new change will not affect power cabinet heat issues. In fact, most engineers agree that the change will improve electrical space efficiency. Since data center facility managers are under constant pressure to do more with less space, the new distribution panel products will be especially helpful in wall applications as horizontal wall space requirements will be reduced by half. Also consider NEC Article 240 which dictates that the maximum mounting height of no more than six feet – seven inches above finished floor for the device operator handle. This requirement will place the bottom of the panel approximately 12 inches above the bottom of a power cabinet. In some cases, this may leave slightly less working space between the cabinet conduit mounting plate and the bottom of the panel, but is not significant enough to cause working restrictions.

Reliability

You may consider that a single 84 circuit panel creates a distribution system with fewer points of failure versus the traditional method of two, 42 circuit panels.

Elimination of a second panel main breaker and additional input connection points can reduce two or three separate connection points versus some traditional configurations. Also note that the 2008 NEC requires a separate equipment ground bus for every panel. This is always a good idea, and typically designed into a data center power distribution cabinet, however, now it is written in code.

It should be noted that some data center applications call for dual power feeds to the same panel system for redundancy. Typically this is used to assure maximum uptime through an unexpected outage, or provide uptime through a bypass route created for system maintenance purposes. These techniques will likely continue the use of conventional panels in more complex mission critical installations.

Safety

Another nuance by 2008 NEC 110.16 requires arc flash labeling on all panelboards. The new directive requires the owner to label his electrical equipment for safety, but isn't particularly clear on how the label should look or what it should contain. The industry has not yet to reach a consensus on how this will be handled or enforced. This labeling is completely dependent upon understanding of the field application and it cannot be labeled by the manufacturer in the factory.

NFPA 70E-2004 Article 130 already requires facility owners to define shock protection boundaries and corresponding protective clothing based upon a shock and flash hazard analysis. NFPA 70E does not require labeling of this information on the product.

Ease of Use

In a data center power cabinet application, such as an RPP, the cabinet manufacturer is in control of available wire bending space. RPP manufacturers are bound by some requirements, such as using panelboard termination lugs that are rated at 75 degrees and rely on the feeder as a heat sink. The actual wire bending space will be dictated by the design of the surrounding cabinet. Most RPP cabinet manufacturers try to strike a

balance between providing plenty of wire gutter space while preserving usable floor-space within the datacenter. The ability to provide 84 circuits in a single panel will provide yet another option to cabinet manufacturers.

In any mission critical power system, over-current coordination is a major issue. Typically the specifying engineer is responsible for designing a system that is selectively coordinated. Engineers must remember to keep the required ratios between levels of distribution when dealing with a system that must coordinate. It is important to realize that in a selectively coordinated system, the panelboard ampacity is often determined by the necessary time-current curves of the over-current protective devices, rather than the actual load on the panel. Selectivity is also highly influenced by the available fault current of the breaker most upstream in the electrical distribution network. The higher the fault current, the more critical the coordination becomes.

A data center load environment may be extremely dynamic as computing conditions change. As a result, many engineers specify panelboards with static trip circuit breakers in order to give the client as much flexibility within the electrical system as possible. As a rule your project should incorporate coordination studies before the panelboard specifications are written to assure that proper over-current protective devices are specified.

As you install this new configuration you may wonder about the useful life of the product. As with traditional panel configurations, there is little data available on how panelboards endure various environmental challenges. Under ideal conditions, such as a data center, the useful product life may reach 50 years with proper maintenance. In any mission-critical power distribution system, regular thermal scans are highly recommended. Periodic thermal scans help identify flawed connections that may have happened at the factory or in the field. Poor connections may reveal themselves over time as they deteriorate, so a thermal scan a good practice to ensure availability.

Summary

In summary, even with the introduction of NEC Article 408, most panelboard specifications have not changed. Withstand ratings, interrupting rating, and integrated equipment short circuit rating are constantly mixed and muddled when specifying panelboards. The goal is to ensure the equipment exceeds the calculated available short circuit current and is able to prevent a catastrophic failure.