

Technical Paper

Codes and regulations for panel builders

Hitting a moving target

The last two years have brought many changes to this complex world. Keeping current with the latest releases from many sources requires careful attention.

Byline: Gerhard Flierl, consulting engineer, standards, codes and panel design

Control panels are a critical element of virtually every piece of industrial equipment, but they're something most customers take for granted. Few think about the functions they perform, how difficult they are to design effectively, and the complex world of standards and regulations governing their design and execution.

A control panel, whether it is designed and built by a machine OEM, a system integrator, or a dedicated panel shop, has to perform all the functions a customer needs, work reliably day after day, exhibit high-quality workmanship, fill as little space as possible, and maintain a low lifecycle cost. One element that is always present but often unnoticed is compliance with a long list of codes and standards designed to ensure safe operation and protection for personnel.

When it comes to codes and standards for control panel design, the world of panel builders can be divided roughly into two parts:

- The first part is North America, dominated by the U.S. Here there is a group of relevant agencies, e.g., the NFPA (National Fire Protection Association), NEMA (National Electrical Manufacturers Association), and UL (Underwriters Laboratories), just to name a few. These organizations develop standards in addition to their other activities.
- The second part follows the widely-used international standards developed by the IEC (International Electrotechnical Commission). The majority of countries worldwide adapt and align their local standards to IEC standards.

Where in the world?

When an OEM or integrator is building a panel, the ultimate customer's location will determine which set of regulations is applicable. A builder in Europe or Asia that will be shipping equipment to the U.S. will have to follow U.S. regulations and hence standards, and vice versa. Even if the end user is based somewhere else, the equipment has to comply with local codes and standards, regardless of its source or ownership. In the U.S. for instance, this is monitored and enforced by authorities having jurisdiction who monitor and enforce whether the codes and standards have been applied before granting final approval for the electrical installation. No single group publishes a fully comprehensive set of standards and regulations, and in many cases, they refer to each other on specific points.

NFPA publishes the NEC (National Electrical Code) with updates every three years. It is arguably the most important code for electrical installation including industrial control panels in that it is the most comprehensive and is enforceable by law. The current edition is from 2014, which was released in November, 2013. It is a hugely broad document, covering, for example, industrial, commercial, and residential installations. Panels are covered specifically under Article 409 and there is also relevant information in Article 670 on industrial machines. In the most recent edition, there have been updates and changes that affect panel builders directly.

NFPA also publishes the NFPA 79: Electrical Standard for Industrial Machinery, which has chapters that touch on panel design and construction. The latest edition is the NFPA 79 Edition 2015, released in May 2014, and it also has changes over previous versions.

Two actual examples

There are many actual examples in which standards overlap, have references to other standards, or have changed in concepts and details. Here are just two that we have encountered many times working with customers.

First, as an example of how standards published by different organizations interconnect, consider that NEC has had a requirement in force since 2006 requiring panel builders to mark the panel with an SCCR (short-circuit current rating) provided it contains power circuits. However, the NEC does not offer an appropriate calculation method to determine the actual SCCR for the panel. In Article 409, NEC has several informational notes and refers users to the UL 508A, Standard for Industrial Control Panel, Second Edition (December 2013) to Supplement SB, for an appropriate procedure. Users have to ensure that they have the latest editions of all cross-referenced information.

Second, the way in which UL rates motor starters has also changed. IEC created a standard governing what should happen to a motor starter or contactor that has been subjected to a short circuit in order to protect technicians working on the equipment after the incident. UL adapted IEC's approach for use in North America, and has worked to harmonize the two. UL now specifies Type 1 and Type 2 coordination, indicating which devices must be replaced against those that can be expected to survive the incident intact, or can be inspected thoroughly enough to verify integrity.

Under IEC

The rest of the world, for the most part, uses the IEC 61439 standard series. This standard series consists of Parts 1-7 covering low-voltage switchgear and controlgear assemblies for different, numerous applications. The IEC 61439 Part 1 with general rules and Part 2 with additional requirements for power switchgear and controlgear assemblies can be partially compared to the North American UL508A, Standard for Industrial Control Panels.

Individuals who have been in the business for some time may think back to an earlier series, IEC 60439, which was in effect for many years. There were numerous critics, and compared to some North American standards, it was far less specific with its requirements and recommendations, leaving more gray areas where a user had to formulate his or her own opinion as to implementation. Eventually, it was disregarded by some manufacturers and it was clear that major revisions were required.

In 1998, IEC launched a whole new standard writing effort, allowing a decade for the process. In 2009, it published the

first edition of IEC 61439-1, followed by other parts of the standard series with a transition time until November 1, 2014. This long transition time spoke to the extent of the changes involved. Since the initial release, there was a second edition issued in 2012 and a third edition is expected in 2015. While this new series has been in effect for only a matter of months, most companies have been phasing it in over the last several years. Now it is fully implemented and IEC 60439 is obsolete.

Can one solution fill both worlds?

Unfortunately, at this time, there are still many differences between North American and IEC practices, but there are some practical ways to design and build a panel with some degree of complexity capable of satisfying requirements for both worlds simultaneously, provided that a couple of design criteria are fulfilled.

Resources to help

Siemens produces a wide variety of products used in control panels, and we work with builders in all parts of the world. Given the complexity of codes and standards, how they're implemented in different parts of the world, and how frequently details change, it is a challenge for any single user to keep current on all aspects of so complex a topic.

To help keep our customers up to date, Siemens offers a variety of resources, including instructional white papers on critical topics. For example, there are detailed discussions of the two examples discussed earlier in this article:

- *Guidelines on the Short Circuit Current Rating for Industrial Control Panels*
- *Type 1 and Type 2 Coordination for Contactors and Motor Starters According to UL 60947-4-1*

And an extensive (394 page) practical guide:

- *Reference Manual: Industrial Control Panels and Electrical Equipment of Industrial Machinery for North America*

Siemens also provides in-person training sessions to help guide panel builders through the maze of practices, codes, and standards. The schedule for these is available at:

www.usa.siemens.com/controlpaneldesign

Siemens Industry, Inc.
3333 Old Milton Parkway
Alpharetta, GA 30005

1-800-241-4453
info.us@siemens.com

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