



Diversity in Switchboards

Introduction

Determining the ratings of overcurrent protective devices and in particular the use of diversity factors within Switchboards can be extremely confusing.

Square D[®] Switchboards, as well as others in the industry, are built with the assumption that loads are calculated in accordance with article 220 of the National Electrical Code (NEC). Many times it is assumed that the rating of the overcurrent device is the actual load on a circuit, which is rarely true.

The following discussion will deal with equipment construction and the appropriate sizing of the equipment.

NEC Requirements

In examining Service Entrance requirements, NEC 230.31 requires that the Service Entrance conductors sizes be based on the calculated loads in Article 220. The Service Entrance overcurrent requirements are found in NEC 230.90 which includes the following exception:

230.90 Exception No. 3. Two to six circuit breakers or sets of fuses shall be permitted as the overcurrent device to provide the overload protection. The sum of the ratings of the circuit breakers or fuses shall be permitted to exceed the ampacity of the service conductors, provided the calculated load does not exceed the ampacity of the service conductors.

Based on the exception, it is clear that the NEC permits the sum of the handle ratings of up to six disconnects utilized as the service disconnect to be greater than the calculated ampacity and the resulting service conductor size.

Switchboard Construction

How does this affect equipment? Square D switchboards are not built with any limitations on the handle ratings of devices included as part of a six disconnect Service Entrance application. Switchboards are built to the ampere rating as specified by the designer of the system. Let's look at an example where the customer specified a 2000 ampere Service Entrance section and then specified six circuit breakers that have ratings totaling 3000 amperes. A 2000 ampere Main-Lug-Only Switchboard would be supplied with the circuit breakers installed as specified even though the sum of the overcurrent devices exceeds the section rating of the switchboard.

Diversity Requirements

Many other questions arise concerning the diversity requirement in product standards such as UL 891 – Deadfront Switchboards. First, the diversity requirements are an equipment permission included in the product standard for use in sizing internal component parts of a Switchboard – THEY SHOULD NEVER BE UTILIZED by a system designer as a specification tool. If it is used as a specification tool plus additionally used by the equipment manufacturer there will be some double dipping of reduction factors which may result in undersized equipment.

Specifiers should utilize the NEC to determine loads and subsequent conductor sizes and appropriately rated overcurrent devices. The manufacturer of the equipment will then build to the appropriate product standard to produce equipment that when installed per the NEC will result in a safe installation.

Example

Below is one example of how diversity might work when utilized by the equipment manufacturer.

A customer specifies (5) 800 ampere feeder circuit breakers to be in one switchboard section of a complete line-up. The sum of the ratings of these five devices is 4000 amperes. By applying the diversity rules in UL 891, the 4000 amperes are multiplied by the 70% multiplier (as permitted in Table 13.4 for 4 to 6 overcurrent devices) resulting in a calculation of 2800 amperes. The equipment manufacturer is then permitted to reduce the vertical section bus of this section to the lower number. In this example a standard switchboard section with a current rating of 3000 ampere would be supplied with the five overcurrent devices installed.

Summary

These are long standing UL product safety standard parameters based on the history of multiple circuits not being concurrently loaded to capacity and do provide ample and safe products for the installation.

For More Information:

For more information, see the following references:

2008 NEC® Sections 230.90 and 230.91
UL 891 - Deadfront Switchboards

Visit the Schneider Electric North America Codes and Standards Electrical Shortz website:

<http://www.schneider-electric.us/support/codes-and-standards/codes-standards-technical-library1/product-documentation>

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