

THE NATIONAL ELECTRICAL CODE AND ARC FLASH

In recent years, the National Electrical Code (NEC) has added some requirements associated with Arc Flash. With regard to its application in industrial environments, a simplified summary of these requirements is given below with some application notes.

Notes on NEC Article 110.16 Arc-Flash Hazard Warning:

1. This article was added to the NEC in 2002 under *Article 110 – Requirements for Electrical Installations*. It underwent minor revisions every three years through 2014.
2. It is a general requirement that certain electrical equipment “be field marked or factory marked to warn qualified persons of potential electrical arc flash hazards.” It originally did not require any detailed information on the label. To meet this requirement, a general warning label was applied to new equipment when it was shipped from the factory.
3. In 2017 and 2023, additional requirements were included for equipment rated 1000 amps or more. An arc flash label is to be applied in accordance with applicable industry practices, and the date the label was applied is to be included.

Notes on NEC Article 240.87 Arc Energy Reduction:

1. This article was added to the NEC in 2011 under *Article 240 – Overcurrent Protection, Part VII – Circuit Breakers*.
2. It underwent a fairly significant revision in 2014.
3. It was further revised in 2017.
4. As of 2017, circuit breakers rated 1200 A or higher must have a fast means of clearing the arcing fault current when energized work is going to take place down-line of the circuit breaker. These methods could include zone-selective interlocking, differential relaying, maintenance switch, energy-reducing active arc-flash mitigation system, instantaneous trip, instantaneous override, or an approved equivalent.
5. The key focus is that **the arcing current** must be cleared quickly. To understand the implications of this requirement, consider a 2500 kVA transformer feeding a 480V system:
 - a. The maximum short circuit current from the transformer at 480V would be approximately 50 kA.
 - b. The average arcing current would be approximately 26 kA.
 - c. The minimum arcing current would be approximately 22 kA.
 - d. Using the 22 kA value, the traditional instantaneous trip would typically not be used, as this would likely miscoordinate with down-line protective devices. One of the other methods would be preferred for maintaining overcurrent coordination on the system.

Notes on NEC Article 240.67 Arc Energy Reduction:

1. This article was added to the NEC in 2017 under *Article 240 – Overcurrent Protection, Part VI – Cartridge Fuses and Fuseholders*. The requirement became effective on January 1, 2020.
2. The article was updated in the 2020 revision of the NEC.
3. Fuses rated 1200 A or higher must have a clearing time of 0.07 seconds or less at the available arcing current, or one of the following shall be provided: differential relaying, energy-reducing maintenance switching, energy-reducing active arc-flash mitigation system, current-limiting electronically actuated fuses, or an approved equivalent.
4. To understand the implications of this requirement, consider a 2500 kVA transformer feeding a 480V system:
 - a. The maximum short circuit current from the transformer at 480V would be approximately 50 kA.
 - b. The average arcing current would be approximately 26 kA.
 - c. The minimum arcing current would be approximately 22 kA.
 - d. Using a typical Class L fuse to have a clearing time of < 0.07 seconds at 22 kA, a fuse size of approximately 1800 A would be the maximum that would meet the 0.07-second criteria.
 - e. In conclusion, fuses of 2000 A or higher are unlikely to meet this criterion on 480V systems.

The specific NEC articles should be reviewed for more details when applying the summary information given in this document.