

IMPROVE SAFETY WITH ARC FLASH LABELING

COMPLY WITH THE 2015 NFPA 70E STANDARD



The Occupational Safety and Health Administration (OSHA) is citing and fining employers for failure to protect employees from the dangers of arc flash. For guidelines on how to protect employees, OSHA refers employers to the NFPA 70E standard, “Standard For Electrical Safety In the Workplace.”

This document provides information on the most current arc flash labeling requirements, as well as best practices for creating and maintaining such labels. In the 2015 version of the NFPA 70E standard, arc flash labeling requirements are covered under Article 130.5(D) and 130.7(E)(1). Additional labeling requirements are also included in Article 110.16 of the 2014 version of the National Electric Code (NEC). This whitepaper will provide guidance for complying with both standards.

What Needs to be Labeled?

Arc flash labeling is the responsibility of the employer, not the manufacturer or installer of the equipment. The NEC provides the following examples of electrical equipment that must be field marked with a warning label (This is not an all inclusive list):

- Switchboards
- Panel boards
- Motor control centers
- Industrial control panels
- Meter socket enclosures

Labeling is required for any piece of electrical equipment that is likely to require examination, adjustment, service or maintenance while energized, creating the potential for an arc flash incident to occur. Thus, many employers are also labeling bus ducts and other electrical equipment not specifically called out in the NEC.

Any modifications or renovations to electrical equipment that will change data on the label will require an updated arc flash risk assessment and label according to the 2015 NFPA 70E standard. At minimum, the safety program needs to be audited at intervals not to exceed 3 years and arc flash risk assessment shall be periodically reviewed at intervals not to exceed 5 years. The labeling requirements for equipment installed prior to the 2002 NEC Provision are not specifically stated. However, OSHA's general duty clause for hazard warning may apply here. Should the equipment be modified or upgraded in any way, then a label must be affixed. In fact, an OSHA representative has stated that even changing a fuse or circuit breaker could be considered a modification that would require labeling. Labels applied prior to September 30, 2011 are acceptable if they contain the available incident energy or required level of PPE.

From a safety perspective, the hazard is the same regardless of when the equipment was installed. Consequently, most employers are simply labeling all the appropriate equipment, regardless of when it was installed.

The NEC requirement states that the marking must be in a location that is clearly visible to qualified persons before they begin work. Typically, the label is placed outside the panel or enclosure door. In some cases, companies choose to put the label inside the door to protect it from harsh environments; however, this should only be done if the door must be opened (allowing the label to be seen) in order to remove the panel face or enclosure. The key point is that the label should be easily noticeable by workers before they may be exposed to any potentially dangerous live parts.

What Needs to Appear on the Label?

Article 110.16 in the NEC states that relevant electrical equipment shall be “field marked to warn qualified persons of potential electric arc flash hazards.”

In Article 130.7(E)(1), the NFPA 70E standard further notes that the design and formatting of the labels should conform with ANSI Z535 Series of Standards For Safety Signs & Tags. Thus it is recommended that the header, message and pictogram, if used, be formatted according to ANSI standards. Currently there is not a widely-accepted symbol for indicating an arc flash hazard. Brady offers stock arc flash labels both with and without a symbol, employing a pictogram composed of a red explosive graphic inside of a triangular border for this purpose. Neither the NFPA 70E nor the NEC requirements specify whether to use a “Danger” or “Warning” header; however, NFPA 70E does recommend identifying those situations in which there is a hazard to the worker. A commonly used guideline is to use a red “Danger” header when the voltage is over 600 volts or when the incident energy is over 40 cal/cm². Many employers have also

standardized to using the “Danger” signal word to indicate a situation where serious injury or death WILL occur. If it is less than that threshold, an orange “Warning” header is used. The employer has the final decision on which words appear on the labels, but it is imperative that consistency be maintained on all the labels throughout the facility.

It is also important to note that arc flash labels must be able to withstand their usage environment. This means that the print should not fade and the adhesive should be aggressive enough to avoid peeling. When necessary, an overlaminated should be applied to protect the printed surface from harsh chemicals and exposure to sunlight.

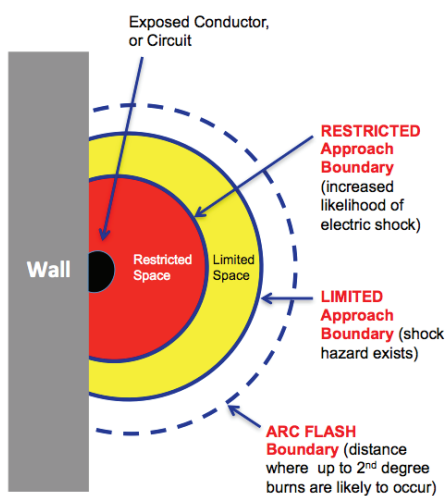
Once an arc flash risk assessment has been conducted, in which the arc flash boundary, the incident energy at the working distance and the personal protective equipment required has been determined, Article 130.5 (C) in the 2015 edition of NFPA 70E further dictates that the label must contain these important elements:

1. Nominal System Voltage

A value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g. 120/240 volts, 480/277 volts, 600 volts).

2. Arc Flash Boundary

The distance at which an electrical arc can flash outward, which may endanger employees working on electrical equipment, where up to 2nd degree burns are likely to occur.



Among key changes from 2012 standards, the Prohibited Approach Boundary has been deleted. No additional protective equipment was required when crossing the prohibited boundary after the LIMITED and RESTRICTED boundaries were previously implemented, therefore this delineation was removed. Also the hazard/risk category 0 has been deleted because because the new PPE table only specifies for work within the arc flash boundary.

Additional Boundary Requirements:

Conductive Articles of Jewelry and Clothing - Watchbands, bracelets, rings, key chains, necklaces, metal frame glasses, etc. shall not be worn within the restricted approach boundary.

Working Space - Shall not be used for storage. Space shall be kept clear to permit safe operation and maintenance.

Barricades - When the arc flash boundary is greater than the limited approach boundary, barricades shall not be placed closer than the arc flash boundary.

Insulated Tools - Employees shall use insulated tools when working inside the restricted approach boundary of exposed energized electrical conductors.

2015 Arc Flash Boundaries

Note: Depending on the application the arc flash boundaries may extend to the other side of the wall.

3. At least one of the following:

- a. Available incident energy and the corresponding working distance (*An incidental energy analysis is used to help predict the incident energy of an arc flash for a specified set of conditions. Incident energy is the amount of energy impressed on a surface, a certain distance away from the source, generated during an electrical arc event. This should be measured and labeled in cal/cm².*) Or the arc flash PPE category in Table 130.7(C)(15)(A) (b) or 130.7(C)(B) for equipment. But not both.

OR

- b. Minimum arc rating of clothing (*This also should be expressed in cal/cm². Arc rated clothing indicates it has been tested for exposure to an electrical arc. This was formally expressed as flame resistant in previous NFPA editions.*)

OR

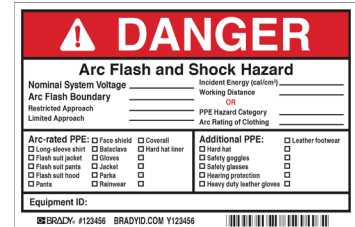
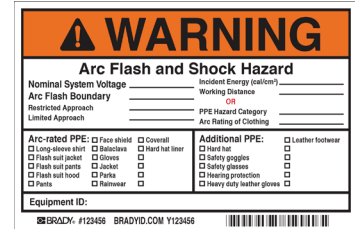
- c. Site specific level of PPE.

Finally, some safety-conscious employers go one step further by including shock hazard information on the label. After all, as long as you are going through the trouble to warn employees of arc flash hazards, why not provide similar safety guidance for the other electrical hazard – shock? These labels provide complete arc flash hazard information, plus shock hazard information on the applicable voltage, approach boundaries, and insulated glove and tool requirements.

Brady Write-On Labels

Brady provides several versions of stock arc flash labels, which can be written on using a permanent pen or marker. The labels shown at the right meet all current NEC and NFPA 70E requirements, including the updated 2015 version, and are available with either “Danger” or “Warning” headers.

These labels include write-in fields for indicating the arc flash boundary incident energy and corresponding working distance, nominal system voltage, arc rating of clothing, PPE hazard category and check boxes for designating the required PPE. This type of extensive label provides employees with the most complete information for protecting themselves from arc flash hazards.



Labels With Pre-Printed Arc Flash PPE Category and PPE Lists

Brady also offers pre-printed arc flash labels with the arc flash PPE category and a list of the required PPE, relieving the employer from having to hand-write this information. As with the check box labels, a version for both arc flash and shock hazards is available.

Make-it-Yourself Arc Flash Labels

Large facilities may need to create hundreds - if not thousands - of customized arc flash labels. In this case, Brady’s industrial printing systems are the ideal solution. This option avoids the time and trouble associated with handwriting many labels and it allows labels to be printed in batches as the project transitions from one area of the plant to another.

Brady’s printer options for creating arc flash labels include the IP™ Thermal Transfer Printer, the PR Plus Printer, BBP®31, BBP®33 and BBP®85 Sign and Label printers.

Brady label materials are designed for industrial, smooth or rough surfaces and outdoor use and employ thermal-transfer printing to provide the optimum in UV, chemical and abrasion resistance. For single color printers, label materials with a pre-printed colored ANSI “Danger” or “Warning” header are available; this allows users to print only the black text while still creating a color label that meets the ANSIZ535 standard for safety signs and labels. If you want to print multiple colors, Brady has printer models with that capability as well, where the printer will produce the entire multi-color label on a white label stock.



In addition, MarkWare™ and LabelMark™ software applications include preformatted arc flash templates that allow users to quickly fill in the blanks on their PC, then send the file to a Brady printer to print. The templates can also be easily customized to include a logo or other company-specific information.

When large quantities of labels need to be created and managed, users often prefer to store the label information in a spreadsheet. Brady software allows this data to be downloaded and automatically merged into the label creation software for output to the Brady printer.

Finally, many companies have begun using commercial power management software from companies such as SKM, EasyPower® and ETAP® to assist in mapping out their electrical system and creating one-line diagrams. In recent years, many of these third-party applications have added arc flash analysis modules which use the one-line information to calculate incident energy values, flash protection boundaries and other pertinent arc flash variables.

Brady software and printing systems can also be used throughout the plant for other forms of safety and facility identification, such as pipe marking, equipment identification, chemical labels, barcode labels and inventory labels. This provides an even greater and faster return on your system investment, since it can have ongoing, beneficial use for a variety of purposes long after the primary arc flash labeling project is complete.

Your Opportunity to Reduce the Risk

With the rising frequency of reported arc flash accidents, and the potential for serious injury or death, arc flash deserves the concern it is generating within OSHA and the safety industry.

To increase safety and ensure compliance throughout the workplace, it is essential to learn and identify arc flash hazards in your facilities. Train your employees in safe work practices and utilize the labels and awareness aids that are available to you to keep the message in the forefront of your workers' minds, and reinforce the desired behavior in your own facility.

Brady can help you achieve these goals with industry-leading products, training resources, services and more. For more information on arc flash label solutions, go to www.BradyID.com/arcflash. Or call 1-888-272-3946 to arrange for a Brady salesperson to visit your site.

