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ARC FLASH LABELING STRATEGY OVERVIEW

A planned arc flash labeling strategy is important. Here are some suggestions…

Before calculating incident energies and arc flash boundaries, it is important to have a plan, i.e., to have a strategy related to how the calculations will be done and how the labeling will be done. Although there are good standards and technical documents available, it is also important to use good engineering judgment in the application of this information.

This document focuses on some key items with regard to developing an arc flash labeling strategy. A 480V system is used for much of the example in this overview. This concept can be applied to other system voltages as well.

1.0 ARCING CURRENT

At 480V, the arcing current is significantly below the bolted fault current. Equations to determine the arcing current are given in IEEE Standard 1584-2018, Sections 4.4 and 4.5. See Figure 1 of this document http://www.qualtecheng.com/docs/arc-flash-hazard/QT-616.pdf for more details.

To account for variations in the arcing current, it is recommended in IEEE Standard 1584-2018 to use the average arcing current and the minimum arcing to calculate arc flash incident energy.

System conditions that give the minimum expected fault current as well as the maximum expected fault current are to be evaluated in an arc flash analysis. The highest incident energy could occur at either end of the current range, depending upon the characteristics of the fault-clearing device.

2.0 WORKING DISTANCE

There are no standards on working distances, although typical distances are given in IEEE Standard 1584-2018, Section 6.7. The following are typical minimum working distances:

208V to 1kV	18” Working Distance
1 kV to 8 kV	24” Working Distance
8 kV to 15 kV	36” Working Distance

Greater working distances are sometimes applicable.

3.0 STANDARD LABELS

NFPA 70E-2021 Annex H gives a summary of the specific sections in 70E that give incident energy ranges for specific clothing and equipment. The incident energy ranges in this Annex have limits at 1.2 cal/cm^2, 4 cal/cm^2, 8 cal/cm^2, and 12 cal/cm^2. Although they are not included in this Annex H, other cutoff levels for clothing and equipment ratings that are available include 25 cal/cm^2, 40 cal/cm^2, 65 cal/cm^2, and 100 cal/cm^2.

Generally, users have set up two or three standard incident energy ratings for use in their facilities in order to simplify and standardize the options. Three common levels are 1.2 cal/cm^2, 8 cal/cm^2, and 40 cal/cm^2. They are referred to here as

- Arc Flash PPE Level 0 $\leq$ 1.2 cal/cm^2,
- Arc Flash PPE Level 2 $\leq$ 8.0 cal/cm^2,
- Arc Flash PPE Level 4 $\leq$ 40.0 cal/cm^2.

Based on choosing standard PPE clothing and equipment, it is possible to use standard labels that reflect the levels chosen rather than the exact calculated values. A more detailed discussion of this topic is given at http://www.qualtecheng.com/docs/arc-flash-hazard/QT-610.pdf Examples of standard labels for the three PPE levels for a working distance of 18" at 480V are given in Figure 1.

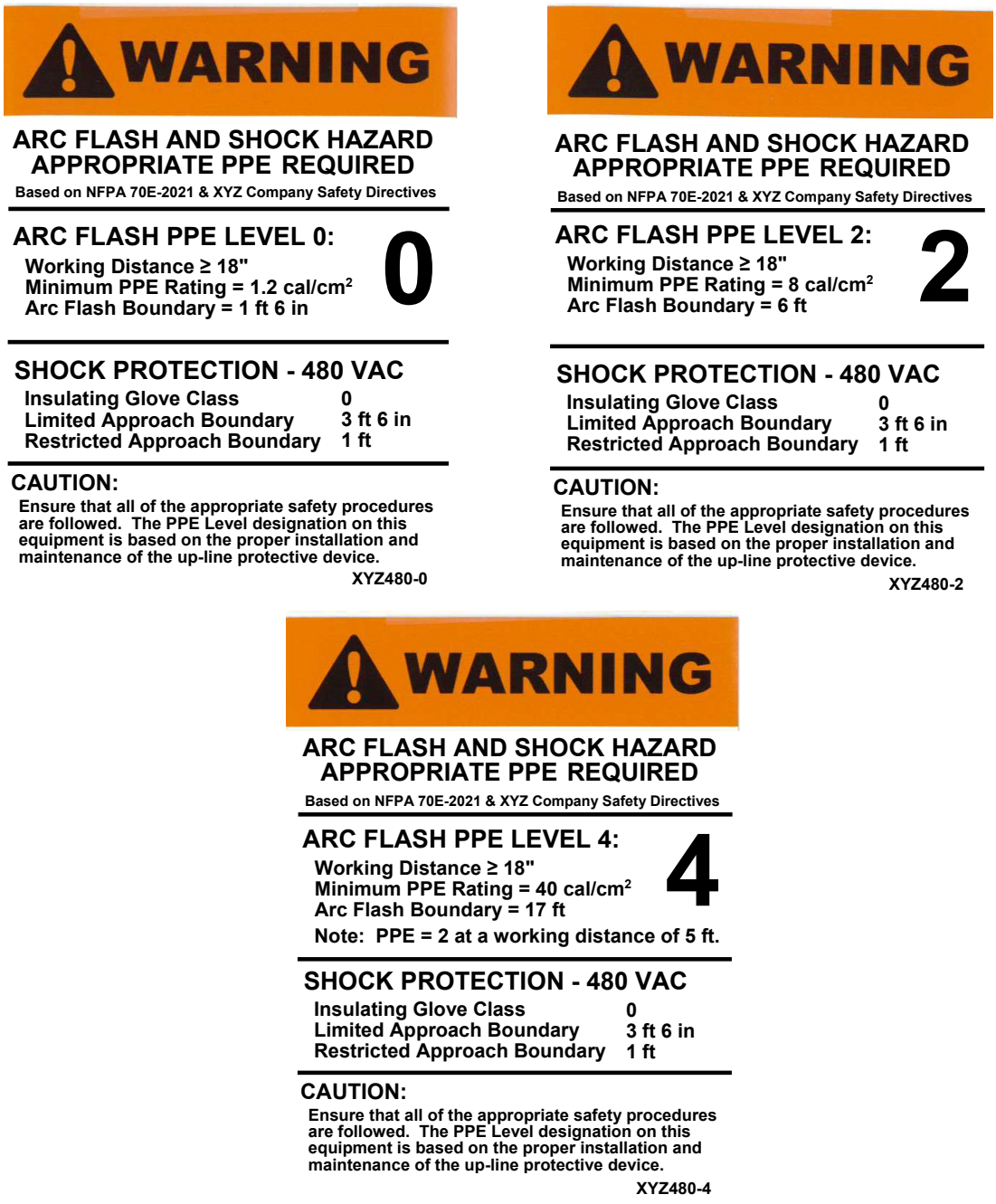

Figure 1 – Example of Standard Labels

4.0 STANDARD DISTANCES FOR STANDARD LABELS

Based on the equations in IEEE Standard 1584-2018, it is possible to set up standard labels at other voltages, similar to those illustrated in Figure 1. Table 1 gives a summary of the key parameters based on the equations for enclosed equipment such as switchgear, MCCs, panels, and cables.

Table 1
Summary of Parameters for Standard PPE Labels
Based on NFPA 70E-2021 & IEEE Standard 1584-2018
For Metal Enclosed Equipment

Arc Flash PPE Level	Nominal System Volts	Working Distance (Inches)	Min PPE Rating (cal/cm^2)	Arc Flash Boundary (feet)	PPE = 2 Distance (feet)	Glove Class	Shock Boundaries	
							Limited Approach	Restricted Approach
0	208	18	1.2	1.5		00	3 ft 6 in	1 ft
2	208	18	8.0	6.0		00	3 ft 6 in	1 ft
4	208	18	40.0	17.0	5.0	00	3 ft 6 in	1 ft
0	480	18	1.2	1.5		0	3 ft 6 in	1 ft
2	480	18	8.0	6.0		0	3 ft 6 in	1 ft
4	480	18	40.0	17.0	5.0	0	3 ft 6 in	1 ft
0	480	24	1.2	2.0		0	3 ft 6 in	1 ft
2	480	24	8.0	8.0		0	3 ft 6 in	1 ft
4	480	24	40.0	22.0	6.0	0	3 ft 6 in	1 ft
2	2,400	24	8.0	10.0		1	5 ft	2 ft 2 in
4	2,400	24	40.0	30.0	10.0	1	5 ft	2 ft 2 in
2	2,400	36	8.0	15.0		1	5 ft	2 ft 2 in
4	2,400	36	40.0	45.0	15.0	1	5 ft	2 ft 2 in
2	4,160	24	8.0	10.0		1	5 ft	2 ft 2 in
4	4,160	24	40.0	30.0	10.0	1	5 ft	2 ft 2 in
2	4,160	36	8.0	15.0		1	5 ft	2 ft 2 in
4	4,160	36	40.0	45.0	15.0	1	5 ft	2 ft 2 in
2	7,200	36	8.0	15.0		2	5 ft	2 ft 2 in
4	7,200	36	40.0	45.0	15.0	2	5 ft	2 ft 2 in
2	12,470	36	8.0	15.0		2	5 ft	2 ft 2 in
4	12,470	36	40.0	45.0	15.0	2	5 ft	2 ft 2 in
2	13,800	36	8.0	15.0		2	5 ft	2 ft 2 in
4	13,800	36	40.0	45.0	15.0	2	5 ft	2 ft 2 in