On The Job: In The Field

Working Backward

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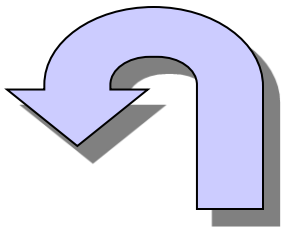

Begin at the End – What Answer Would You like to Have?

Simplifying arc flash calculation studies

Would you like to know a little secret about how to simplify an arc flash calculation study? Perform the study backward. Well, not actually backward, it just seems that way.

Performing the study: Arc rating > incident energy

An arc flash calculation study (AFCS) is one method that can be used to determine the level of flame-resistant clothing and personal protective equipment (PPE) that is appropriate for protection from the thermal energy of an arc flash.

At the study's core are incident energy calculations that are performed for each piece of equipment. These results, defined in terms of calories per square centimeter (cal/cm^2) are used to select the minimum arc rating of the protective equipment, which is also defined in terms of cal/cm^2. The concept is quite simple. The arc rating of the protective equipment must meet or exceed the calculated incident energy.

Although the concept is simple, the actual study process can be quite complicated. Deciding which calculation methods to use, which equipment to include in the study, what data is required, how many operating scenarios to evaluate as well as many other factors can quickly have you second guessing yourself and ultimately make you lose sight of the main objective of the study—to determine the appropriate level of arc flash protection to wear.

Depending on the number of panels, switchboards and other equipment that make up the power distribution system, the study could result in a wide range of incident energy values. This could ultimately lead to the selection of many different protection levels, possibly creating confusion.

Performing the study backward: Incident energy < arc rating

A very popular method used for AFCS is to select a desired minimum protection level first. This initial selection is only preliminary and is based on the arc rating of protective equipment that is considered reasonably comfortable. A common choice in the industry is flame-resistant clothing and PPE with a minimum arc rating of 8 cal/cm^2. Whatever desired arc rating is ultimately selected, the results of the AFCS are used to confirm locations where the desired rating is adequate. The study results may also indicate locations where either a higher protection level is required or where further steps are necessary to reduce the incident energy to a level below the desired rating.

To illustrate how simple working backward is, see the table, which lists the results of a sample study. Included is a list of equipment and the calculated incident energy. Since the incident energy is dependent on variables, such as each location's available short-circuit current as well as the equipment's protective device operating characteristics, the calculated results of this example vary widely. In this example, they range from 0.9 cal/cm2 to 21.3 cal/cm^2.

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Arc Flash Calculation Study Results Brainfiller.com		
Location / Equipment	Incident Energy (cal/cm^2) 18 inch working distance	Minimum PPE Arc Rating (cal/cm^2)
Main Switchboard SWBD-1	21.3	25
Power Panel PP-1	6.4	8
Power Panel PP-2	4.8	8
Motor Control Center MCC-1	10.3	25
Lighting Panel LP-1	1.9	8
Lighting Panel LP-2	2.4	8
Lighting Panel LP-3	0.9	8

Instead of selecting many different levels of protection based on each individual incident energy value, it is much easier to simplify the selection process and use a maximum of only two levels of protection.
For this example, the desired minimum protection level was selected using an arc rating of 8 cal/cm^2. The study results indicate where this level is appropriate, i.e., which locations have a calculated incident energy equal to or less than 8 cal/cm2. The study also indicates where the protection level requires a higher arc rating.

The results listed in the table indicate that the 8 cal/cm^2 protection level is adequate for every location except SWBD-1 and MCC-1. For these two locations, the incident energy is greater than the 8 cal/cm^2, so a higher protection level must be used. How much higher? Since the highest calculated incident energy of these two locations is 21.3 cal/cm^2, an arc rating of 25 cal/cm^2 could be used for both locations.
The final result shows that only two levels of PPE are necessary, and the study confirms which protection level is used at each location.

Although this simplified method appears to have you select the desired minimum protection level first, the best answer will always be to place the equipment in an electrically safe working condition first.

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