

Arc Flash Mitigation with Entellisys™

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As time goes by, we are finding a growing number of customers that are becoming more concerned with arc flash and the injuries that can occur. We all hear the questions “Is this really a dangerous situation?” or “Does it really concern me or my facilities?” The answer is yes. Arc flash is a condition that exists with all pieces of electrical equipment. The real question becomes, how do I reduce the threat?

Let us start by reviewing the 3A's to arc flash 1) Awareness, 2) Analysis, and 3) Action. All of these are incorporated into your design process. You are aware of the hazard. The power system design contributes to the available interrupting current which is a significant variable used in the analysis. You also consider what other design actions you can take such as the functionality and selection of equipment. You also have the opportunity to consider broader elements, such as operating personnel practices that will impact the hazard level. As you can see from just from these few elements, the arc flash hazard cannot be solved with one “silver bullet” solution, as much as we wish it could be. For example, arc resistant equipment contains an arc-flash event's energy provided all of the doors are closed. Unfortunately many, if not the majority of arc-flash incidents occur when maintenance is being performed to the gear. This implies a door is open resulting in an incident energy level significantly higher than calculated for closed-door equipment. Consequently a multi-layer approach consisting of power system design, equipment functionality and operator practices provides a more robust arc flash reduction strategy.

Today, we are going to review how using a multi-layered approach in the design and selection of switchgear can impact operator's actions as well as reduce the arc flash incident energy level.

First, let's consider traditional switchgear with trip units, meters, relays, PLCs and other devices mounted in the gear and on the doors. An operator must stand directly in front of the energized equipment to monitor the power system. Opening or closing a circuit breaker also requires a person to stand directly in front of the breaker being operated. All of these actions are well inside the arc flash hazard boundary. As a layer of defense, keeping operators out of the arc flash boundary makes sense. Let's call this the 4th A for Avoidance.

You now have a choice and can select switchgear that keep operators *outside* the arc-flash hazard boundary. Entellisys Low Voltage Switchgear offers multi-layered solutions to a complicated problem.

Avoidance – Operators Outside the Arc Flash Boundary

Near Gear. This is a term commonly used with the Entellisys product. Like all ANSI class switchgear, there are times when you must interface with the equipment such as reading metering functions, opening or energizing the breakers or reviewing the sequence of events. Entellisys offers a number of solutions to help the end user do these tasks more safely. In lieu of standing in front of the equipment to do these functions, an HMI (Human Machine Interface) is provided so you can do these functions at a further distance from the gear. The HMI is the system interface to the gear via a touch screen to easily view all the functions of your lineup as well as open and close circuit breakers. The HMI can be located, in a wall mounted enclosure, or in it's own stack located near the gear but outside of the hazard zone. The Near Gear wall enclosure or stack is located within 300 cable feet of the lineup.

A Control Stack is another option with Entellisys. This is a stand alone stack, again located up to 300 cable feet from the equipment. It houses the HMI as well as the key Entellisys components consisting of the redundant Central Processing Units (CPUs) and UPSs. This control stack away from energized

equipment has only 120V control power present. In addition to monitoring and controlling the breakers, if an operator wants to check battery status of the redundant UPS they can do so outside the Arc Flash zone of the equipment.

Remote Access

If desired the HMI functionality for monitoring and control can be loaded on a laptop or stand alone PC. This allows access to view the equipment status as well as change settings or control breakers. Two versions of software are provided. One is Remote HMI View Only, which only permits users to monitor the equipment condition. The Remote HMI User Interactive allows full operability of the gear based on the user's password access. You can also have a wall mount unit outside the arc flash boundary as shown in Figure 1 below.



Figure 1

Remote Racking This option is almost always used as a very simple way of keeping workers clear of immediate danger when installing or removing a breaker. This device is simply a gear motor in a small enclosure with a 30' cord. The device has a small pushbutton station on the end of the cord which when engaged turns the shaft forward or reverse depending on the desired breaker movement. A mechanical cover on the circuit breaker will prevent access to the racking mechanism unless the breaker is open or in the disconnect position (and opened).

As you can see, Entellisys provides elegant solutions for keeping operators outside the arc flash hazard zone. This is one layer of protection. Another layer of protection is sensing arcing faults quickly enabling fast protection and thus reducing the incident energy level of an arcing fault.

Fast and Selective Arc Flash Protection

Bus Differential This protective function measures every amp of every phase entering or leaving a zone. The settings associated with this protective function are independent of the settings required to serve the load. As found in IEEE arc fault testing, arcing faults are typically 40-60% of bolted fault levels. This means that current overload settings that are selected to serve the load may very likely take time before it reacts to the fault. Bus differential solves this problem and provides fast arcing fault protection without compromising the selectivity of the system. The Entellisys bus differential function can be set at very low levels, which are more sensitive in detecting bus and breaker faults. In fact, you can set the bus differential function as low as 20% of the main bus rating, so for example on a 4000A bus Entellisys will detect an 800A arcing fault and respond within 25ms.

Reduced Energy Let-Through (RELT) This option provides a lower arc flash risk to end-users when they have to work at, or near the equipment. Another set of bus differential settings allow the user to set these at more sensitive levels than the normal operating settings. . By enabling this function (at the HMI) the more sensitive settings used in Bus Differential are engaged to protect the system. Once the work has been completed the appropriate personnel can reengage the primary settings at the HMI

and move on to other tasks. This function is part of the main menu and labeled “Reduced Let-Thru Mode”. The user simply enables the functions with a check box and then hits OK. To return to the normal operations reverse this procedure. The difference between the RELT functions with Entellisys compared to other products is the co-ordination of the system. The Entellisys system does NOT require, or change to a lower Instantaneous Settings, as do other products. Therefore, it does not compromise the co-ordination of your system, as do other products.

The ability to sense arcing faults quickly and clear the fault reduces the incident energy level of an arc flash event. Entellisys is able to provide this functionality easily, adding another layer to your arc flash mitigation strategy.

Let’s look at how Avoidance and Fast and Selective arc fault protection is implemented in the field.

As an example, we will walk through a summary of steps removing a circuit breaker for maintenance in a typical Entellisys system.

- Engage the Reduced Energy Let-Thru at the HMI which is located in a control stack outside of the arc flash zone.
- Confirm the breaker being service is the correct one through visual confirmation. The operator selects the “Locater LED” on the selected breaker’s control screen. A blue LED light on the breaker’s messenger will be blinking.
- Open the breaker to be serviced. This again is done at the HMI and requires a confirmation ‘open’ command.
- Approach the opened breaker with the Remote Racking device, while wearing the proper PPE. (Personal Protection Equipment)
- Open the mechanical release on the front of the breaker and attach the Remote Racking device.
- Proceed to a safe distance and engage the Remote racking device to withdraw the circuit breaker, as your breaker is now ready for maintenance.

A replacement breaker can be installed by reversing the above steps. Once all the work near the equipment is complete, as you prepare to leave the area, return to the HMI and disengage the Reduced Energy Let-Thru and continue to your next task. It’s as easy as that.

Three layers of protection have been used: Avoidance by keeping operators outside the arc flash zone for the majority of tasks, Incident Energy Reduction by using bus differential protection, and as a last line of defense wearing the proper PPE.



Entellisys Switchgear

Most customers and end users are concerned with safety, and the Entellisys switchgear safety features have some of the most comprehensive tools in the industry today.