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Arc flash is responsible for about 80% of electricalrelated injuries. It occurs when an arc fault superheats the air around it, expanding and creating a pressure wave within the enclosure. The resulting arc plasma then vaporizes everything with which it comes in contact.

In industrial settings, many things could compromise the air space that acts as insulation to prevent electrical energy from igniting an electrical arc. The conductor could be as simple as a rodent, snake or water accidentally entering the electrical equipment, or human error-*like leaving a tool in the equipment or forgetting to tighten a connection.*

"The best prevention is an in-house safety program with compliance to NFPA 70E standards," says Joe Sheehan, P.E, principal electrical engineer at The National Fire Protection Association (NFPA). "Then my most important advice is ‘shut it off.' Electrical equipment should never be worked on live, unless it's for diagnostic testing for correct amperage. It's the culture in industry that we're trying to change to keep workers safe."

Another important safety measure is appropriate personal protective equipment (PPE). While PPE can be effective, it also can be heavy and cumbersome.

While prevention is the best possible solution, sometimes an arc flash explosion occurs regardless of best intentions. That's where technology can help protect employees. As part of their arc flash prevention programs, companies now can install arc-resistant motor control equipment and intelligent control systems that offer enhanced safety features and remote operation and monitoring capabilities.

The way of the future Arc-resistant motor control centers (MCCs) are designed to contain the arc energy and direct it away from personnel- they cannot prevent an arc flash. "Arc-resistant" describes equipment designed to control arc flash exposure by extinguishing the arc, by controlling the spread of the arc or by channeling the arc pressure wave away from personnel.

John Kay, manager of Medium-Voltage MCC Engineering at Rockwell Automation Canada, has over 20 years experience working with MCCs. He compares advances in this technology to advances in automobile safety features.

"Fifty years ago, seatbelts didn't exist," Kay notes. "Eventually, they became standard in new vehicles, and are now legally mandatory. Newer safety features include anti-lock brakes and air bags, which will eventually become mandatory. The same can be said for arc-resistant MCCs. Arc-resistant designs represent enhanced safety technology and, therefore, an enhanced level of safety."

According to Kay, Rockwell has a unique design in its Allen-Bradley ArcShield medium-voltage (up to 7,200 volts) arc-resistant MCC. The design redirects arc flash energy out relief vents at the top of the unit and away from personnel through an overhead plenum. These products have been successfully tested in accordance with ANSI C37.20.7: IEEE Guide for Testing Medium-Voltage Metal- Enclosed Switchgear for Internal Arcing Faults. During testing, cotton squares (similar to 4.5 oz/yard untreated T-shirt material) are mounted a meter from the ArcShield MCC. Acceptance criteria require that none of the cotton indicators ignite during or following a test.

"One of the key differentiators of the medium-voltage ArcShield MCC is that it maintains IEEE C37.20.7 Type 2 protection, even with the low-voltage door open for maintenance purposes," says Kay. "The controllers are compartmentalized and the low-voltage panel is reinforced and sealed to prevent arc flash materials from entering it." Specific testing is done to meet the requirements of each level of "arc-resistant accessibility" based on appropriate codes and standards. IEEE Type 2 accessibility means that all four sides offer protection, therefore anywhere within the perimeter of the equipment-not just in front of the door. The risk level is reduced for normal tasks to a Zone 0 category, which results in a reduced level of PPE.

To contain the pressure blast, the ArcShield controller's cabinet is heavily reinforced with additional support members and plates, and uses 12-gauge steel for all doors, side, roof and back sheets. Extra strength, multipoint latches and robust door hinges add to the security of the unit's main doors.

To redirect the arc exhaust gases, specialized silicone coated, aluminum pressure relief vents on the unit's roof open to release the pressure. A plenum system above the enclosure channels the superheated gas and vaporized copper and steel to a safe and controlled location.

Kay also points out that Rockwell is the first equipment manufacturer to apply arc containment

features to NEMA® low-voltage motor control centers (up to 600 volts). These MCCs do not use a plenum system, instead, they release the arc gases and pressure out the front of the cabinet in a lateral direction, away from personnel.

ArcShield products also can incorporate intelligent motor control solutions, including remote monitoring and isolation features to help prevent accidental exposure to energized parts. For example, networking these MCCs with Rockwell's IntelliCENTER software permits realtime monitoring, configuring or troubleshooting of both medium- and low-voltage products. This information can be accessed from anywhere in the world via a secure Internet link.

Both medium- and low-voltage models can be specified with built-in DeviceNet™ wiring for remote monitoring of the equipment's operating parameters, which keeps personnel out of the MCC room.

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