Eaton helps Ash Grove improve arc flash safety at Texas cement plant

"Eaton’s remote racking technology for medium-voltage circuit breakers is enabling our employees to remain outside the arc flash protection boundary when performing switchgear maintenance."

David Fisher, electrical manager at Ash Grove Cement Company

**Location:**
North Texas

**Segment:**
Mining, metals and minerals

**Solution:**
Eaton’s motorized technology (MR2) enables remote operation and racking of medium-voltage circuit breakers, assuring operators are safe from arc flash hazards

**Problem:**
Reduce the risks and hazards associated with performing energized electrical work on vintage switchgear

**Results:**
Improved switchgear maintenance safety procedures, enabling Ash Grove to meet evolving industry standards and dramatically reduce arc flash risk for plant personnel

**Background**
For over a century, Ash Grove Cement Company has provided portland and masonry cements to construct highways, bridges, commercial and industrial complexes, homes, and other structures across the U.S. The company is one of the largest cement producers in the U.S., shipping over 8.5 million tons of cement from its plants and terminals across the country.

Ash Grove maintains an enterprise-wide safety culture, protecting employees with an active health and safety management system to ensure a safe work environment. This system includes audits, compliance management, injury prevention and training. The company has recently initiated a variety of programs to bring best practices to its facilities, customizing them to situations unique to each location.

Ash Grove’s initiatives were bolstered through an improved understanding of evolving industry standards designed to reduce electrical shock and arc flash hazards. One of the most important standards in this area is National Fire Protection Association (NFPA) 70E-2018, “Standard for Electrical Safety in the Workplace.” Earlier versions of NFPA 70E addressed electrical hazards and risks together, based on a holistic approach. The latest update to this standard considers hazards and risks separately, as two distinct issues that need to be considered to protect personnel from potential electrical injuries.

The standard defines the hazard as the calculated heat energy at any given point of the electrical system. It is either present or it isn’t. On the other hand, risk is a task-based evaluation driven by a combination of the likelihood and severity of electrical injury. The latest standard requires a risk assessment that considers the possibility and potential injury to an electrician based on the specific task.

**Challenge**
At its cement plant in Midlothian, Texas, Ash Grove completed site studies using calculations to quantify the arc flash heat energy as outlined in the Institute of Electrical and Electronics Engineers (IEEE) Standard 1584-2002 “Guide for Performing Arc Flash Calculations.” The company also affixed warning labels to all electrical panels that designated the electrical shock and arc flash hazard based on the NFPA70E-2018 standard.

One of the existing electrical assemblies at the plant was a 4160V medium-voltage metal-enclosed motor control center (MCC). The existing MCC was a vintage assembly manufactured in the 1970s that included an incoming compartment incorporating Eaton’s VCP-W vacuum main circuit breaker to distribute power to the MCC motor loads. The breaker was
used at the site as a lockout point in the system. This meant prior to any work being performed on the motor controls, the vacuum breaker in the incoming section needed to be at zero energy. Establishing zero energy required two points of isolation:

1. Confirmation the vacuum breaker was open
2. Confirmation the breaker was physically racked off of the energized MCC main bus

Ash Grove analyzed the hazards associated with this energized work, which were significant at 12.2 cal/cm². The risk of this activity was also considered. An energized work risk assessment evaluated both the likelihood and severity of an arc flash incident. In this case, both the likelihood and severity were significant concerns. Across industries, many documented arc flash events have occurred during manual racking of circuit breakers. All three phases of the primary and secondary finger clusters (six medium-voltage power connections) need to be disconnected and then reconnected. If one of those connections was damaged or misaligned during breaker racking, the likelihood of an arc event and also the severity of injury to the worker during breaker racking would be unacceptably high.

Since this main breaker MCC was a vintage design, the assembly was manufactured before the emergence of arc-resistant testing. Although the door was closed during breaker racking, an arc flash event would likely result in high enough pressure and heat energy to blow open the enclosure door during the process of inserting or removing the breaker from the energized bus. Due to the high risk, the electrician performing this work would be compelled to wear the plant’s highest level of PPE, a 40 cal/cm² suit. This high level of PPE may help protect the worker, but also introduced other risks — such as heat exhaustion and loss of dexterity.

Solution
To address the significant risk of this work activity, Ash Grove elected to install Eaton’s integrated motorized remote racking (MR2) solution, which enables personnel to remotely rack the VCP-W circuit breaker from the MCC main bus. This innovative retrofit offering addressed both the likelihood and severity of the risk associated with racking the main circuit breaker on and off the vintage MCC main bus.

Eaton’s field-based service engineers provided a turnkey solution, replacing the vacuum circuit breaker carriage/cell subassembly with a new design that incorporated an integral motor operator. With this retrofit, personnel could use a remote pendant station connected at the MCC enclosure, standing outside the flash protection boundary to first de-energize the circuit breaker and then remotely rack the circuit breaker from the energized 4160V bus. After the breaker was confirmed opened and then isolated from the energized bus, a system lockout/tagout was completed. Before the system was again energized, the remote breaker racking pendant station was used to safely rack the breaker back onto the energized bus prior to returning the MCC to service.

The new cell assembly included a sophisticated torque sensing controller that ceases breaker racking should the racking mechanism or circuit breaker bind or become jammed during the racking process. The handheld pendant station connects at the front of the switchgear, which allows the operator to open/close the circuit breaker and rack the de-energized vacuum breaker on or off the MCC main bus. The pendant is powered from the MCC’s 120V control circuit and includes indicating lights confirming the circuit breaker status (open/closed) and position in the cell (connected/test/disconnected). The lights are controlled by cell-mounted switches, assuring positive indication of the breaker status and position in the cell.

Results
Ash Grove quantified the hazard and also analyzed the risks, both likelihood and severity, associated with performing energized work on vintage metal-enclosed MCCs. By installing Eaton’s MR-2 safety solution, which allowed personnel to stand outside the arc flash protection boundary during racking, the likelihood of electrical injury from an arc flash event was virtually eliminated.

David Fisher, an electrical manager at Ash Grove Cement Company noted that, “The internal remote racking device upgrade to our two VCP-W breakers on site solved two problems for us. First and most important, it is enabling our employees to remain outside the arc flash protection boundary when implementing plant lockout procedures prior to routine maintenance. Second, it eliminated the use of a portable remote racking device that had to be hauled up and down the stairs from substation to substation — which presented another risk of injury to our employees during transportation.”

Electrical workplace safety standards continue to evolve toward a better definition and understanding of both the hazard and risk associated with arc flash events. To this end, there is a rising demand to protect personnel from the dangers of potential arc flash occurrences by increasing the distance between an operator and the front of an electrical assembly lineup during scheduled maintenance and troubleshooting. Through its new remote racking solution for medium-voltage assemblies, Eaton continues to innovate with new safety solutions at this Ash Grove plant and other industrial facilities, while helping to develop evolving industry standards and delivering solutions to enhance safety in industrial workplaces.

For more information about Motorized Remote Racking, visit our website.