

## **RMF BYLINE**

### **Arc Flash Safety: A Priority for Schools**

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In the Academy Award winning movie “Dallas Buyers Club”, Matthew McConaughey portrays Ron Woodroof, an electrician in Texas. In the beginning of the movie he is called out to an oil rig where a worker’s leg is caught in the drilling equipment and as a safety precaution he needs to de-energize the electric feeder serving the rig. Ron pulls the disconnect handle to the “off” position (appropriate action), but then he opens the door and inserts a screwdriver where there were still live wires. At that moment in the movie, there is a big, bright flash, and in the next scene Ron is in the hospital being treated for a burn on his head created from the incident.

This scene demonstrates the danger that exists when workers are exposed to energized components of an electrical system. Ron was not shocked by the electric system, but rather an arc flash – a type of electrical explosion that is produced by a combination of extreme heat, intense bright light and a pressure wave.

While this example is from a Hollywood blockbuster, it is not much different from reality. In fact, statistics show that more than 2,000 workers sustain arc flash injuries every year.

School systems can have several hundred facilities in their jurisdiction ranging in size of less than 50,000 square feet, to over 300,000 square feet, yet very few have full time qualified electricians in the buildings. This means that unqualified personnel are likely to be interacting with energized equipment and are therefore unknowingly putting themselves at risk, which can result in possible injury for the individual and a liability for the school system.

So how can facility owners ensure that their workers’ safety is protected?

#### **1. Prepare an arc flash study**

The first step to setting your school’s electrical system on the right track is to work with your engineer and contractor team to prepare an arc flash hazard study. Together, the engineer and contractor will survey the entire facility’s electrical system to obtain feeder sizes, lengths, equipment manufacturer and sizes of equipment and transformers. They will then use a technical software package to calculate each piece of equipment’s various energy levels based on a category rating from 0 to 4 – with “Category 0” being the least severe and “Category 4” being the most severe. In some cases, upon completion of the arc flash study, field adjustments can be made to the equipment to mitigate the magnitude of the energy levels and lower the category rating.

#### **2. Label all equipment**

The results from the arc flash study will serve as the foundation for all safety procedures you implement moving forward – including the labeling of all electrical equipment.

In 2002, the National Electrical Code (Article 110.16) required that all electrical distribution equipment be properly field labeled in order to warn personnel of potential electric arc flash hazards. This code requirement was in reaction to the number of injuries that were occurring to personnel working on energized equipment rather than de-energized equipment.

Based on the amount of energy given off by a piece of equipment, measured in calories per square centimeter, labels are to be provided that at a minimum indicate the arc flash boundary, nominal system voltage and required level of personal protective equipment (PPE). The PPE gear required to interface with each piece of equipment is based on that equipment’s category level, so labeling all equipment by category is key to promoting a safe work environment. For example, if the amount of energy given off by a piece of equipment is less than 4 cal/cm<sup>2</sup>, it is considered “Category 0”. When working on “Category 0” equipment, personnel are required to wear at a minimum, natural fabric long sleeved shirts (synthetic material is unacceptable), pants, ear and eye protection and leather gloves. “Category 4” equipment on the other hand, allows up to 40 cal/cm<sup>2</sup> and requires much more cumbersome and expensive PPE, including arc-related clothing, overalls, hood and gloves, hard hat, face shields and ear protection. Anything over 40 cal/cm<sup>2</sup> is considered “dangerous”, must be labeled as such and shouldn’t be interacted

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with while energized regardless of available PPE. If equipment is not labeled, school personnel will be unaware of the level of equipment they're interacting with and therefore ill prepared to do their jobs safely.

While equipment labeling may seem tedious, in the long run it is worth the effort. Should a worker be injured on the job due to improperly labeled electrical equipment, the school will be found at fault and will have to compensate the worker. Some injured workers have received millions of dollars due to facility negligence. Additionally, the Occupational Safety & Health Administration ([OSHA](#)) has fined companies tens of thousands of dollars for not having the appropriate procedures in place for workers who interact with electrical equipment on a regular basis.

### **3. Provide proper training**

In addition to preparing the study and labeling all equipment, there is a third, critical piece to administrating the electrical system: training.

Personnel need to be thoroughly trained on how to safely use all electrical equipment. Simply labeling everything isn't enough if staff members do not know what the labels mean and how those labels should inform the electrical maintenance process.

Most electrical work performed in schools should be able to be performed on de-energized equipment. But determining whether or not the equipment is actually de-energized, first requires personnel to remove the equipment cover, which can put the user in danger until he or she has confirmed that the panel board is indeed de-energized. It's imperative that personnel are trained to properly remove equipment covers and test the systems.

Personnel also need to be trained to understand when they *shouldn't* touch equipment. For example, many schools obtain their electrical power from secondary services supplied by local power companies. Arc flash studies indicated that incoming switchboards that are served by transformers 500KVA or larger, and especially those with a 208-volt incoming service, will most likely be labeled as "dangerous". In those cases, an outage by the power company is required before any work can be done on the switchboard – even for something as simple as resetting the breaker.

At a minimum, during training all personnel should learn how to interpret each label, identify the proper PPE to wear in various scenarios, safely de-energize equipment and navigate the do's and don'ts of typical electrical work.

At this point, you may be thinking about the potential cost of implementing an arc flash study, equipment labeling and personnel training.

Arc flash labeling can be accomplished with very little increase in cost on new school construction. For existing schools, the cost to prepare an arc flash study is dependent upon the size and age of the school and if good documentation already exists. Bundling as many existing schools as possible into one solicitation is a great way to make the process more cost effective. It's important to remember though, that while your school may be cost-sensitive, the opportunity cost of *not* bringing your electrical system into code compliance and experiencing a hazardous incident is much greater than the cost to actually take these precautionary measures.

All three steps – the arc flash study, equipment labeling and training – along with properly maintaining your system on an ongoing basis, minimize the likelihood of a hazardous event and a lawsuit against the school owner.

#### **Expert:**

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Steve is an electrical engineer at [RMF Engineering](#) with over 30 years of experience in program planning, feasibility studies and project management of multi-discipline projects and associated staff. He has demonstrated the ability to resolve technical issues; address owner concerns taking into consideration all factors; bring projects in within budget; communicate ideas and disseminate information both verbally and written; and making sure all schedules are met. Steve remains informed of the latest technologies of not only his discipline, but also of others to ensure the right approaches and systems are being implemented. He works to bring together the in-house disciplines and other consultants and takes into consideration construction issues to ensure a successful project. He can be reached at [steve.devon@rmf.com](mailto:steve.devon@rmf.com).

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