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Ask the electrician: Arc flash - What it is, why it happens and how to prevent it - by Brian Leborgne

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You have probably seen warning labels about arc flashes on electrical equipment, but do you know what an arc flash actually is?

An arc flash is when electric current leaves its intended path rather than flowing along the intended conductive path. “Arc” is used to describe electricity moving through the air between two points. Have you ever gotten a shock when you touched a light switch or a doorknob - that is an arc. Lightning is an arc too - just on a significantly larger and more dangerous scale.

When dealing with high-energy electrical equipment, an unexpected arc causes the release of electrical energy in the form of heat and pressure -- essentially, an explosion. Arc flashes are caused by many factors, some being: equipment failure, worn or loose connections, dust, gaps in insulation, corrosion, condensation, faulty installation or even dropping tools. Because none of these factors are inherently predictable, anyone working on electrical equipment must always be aware of the risks and adhere to NFPA guidelines to avoid working on live equipment and in fireproof electric rooms. This risk awareness is where arc flash warning labels come in.

These warning labels give key information about that specific piece of electrical equipment, usually including voltage, various safety boundaries and guidance on safety gear required. With this information, not only is the general public warned of the danger, but an electrician is able to determine the precautions and level of protection necessary before commencing any work on equipment.

Gathering the necessary information to calculate arc flash risk is no easy task. In theory, if a building has up-to-date schematics and design documents, those would give some guidance. But in many cases (especially in New England with older buildings) -- that documentation does not exist or has not been properly updated. Once data has been updated, electrical engineers can perform an arc flash study. This study is a comprehensive analysis of the electrical system to determine the potential for arc flash hazards and to provide recommendations for mitigating those hazards.

Here are the general steps involved in performing an arc flash study:

Gather Information: The first step in performing an arc flash study is to gather information about the electrical system, including equipment data, system configuration and operating conditions.

Create a One-Line Diagram: A one-line diagram is a graphical representation of the electrical system that shows the flow of power and the location of equipment. This diagram is used to identify the electrical system’s components and their interconnections.

Calculate Fault Currents: Fault currents are the currents that flow through the electrical system when a fault occurs. These currents are calculated using the one-line diagram and equipment data.

Determine Protective Device Settings: Protective devices, such as circuit breakers and fuses, are designed to interrupt the flow of current when a fault occurs. The settings of these devices are determined based on the calculated fault currents.

Perform Arc Flash Calculations: Arc flash calculations are performed to determine the potential for arc flash hazards at each piece of equipment in the electrical system. These calculations take into account the available fault current, protective device settings and other factors.

Label Equipment: Once the arc flash calculations are complete, equipment is labeled with the appropriate arc flash hazard information, including the incident energy level and the required personal protective equipment (PPE).

Provide Recommendations: Based on the results of the arc flash study, recommendations are provided for mitigating arc flash hazards. These recommendations may include changes to protective device settings, equipment upgrades or changes to operating procedures.

Review and Update: An arc flash study should be reviewed and updated periodically to ensure that it remains accurate and up-to-date with any changes to the electrical system.

Overall, an arc flash study is a complex process that requires specialized knowledge and expertise. Arc flash studies, warning labels and proper precautions are increasingly required by property owners and insurance providers. All electrical equipment in a facility adds liability for the owners, and it is always in the best interest of everyone involved to make sure the appropriate knowledge is shared to prevent any harm or hazards from happening.

Performing an arc flash study before and during construction of a facility can also help mitigate unnecessary costs and incidents by making sure each piece of equipment can handle the potential load and will function properly in the case of equipment fault in the system. It is important to work with a qualified electrical engineer to ensure that the study is performed correctly and that the recommendations are appropriate for your specific electrical system.

Arc flash risk mitigation should extend after the study is completed. It is recommended that arc flash hazard analysis be added to your preventive maintenance schedule. This analysis is performed by electricians who use thermal diagnostic imaging and infrared technology to identify hot spots which could potentially result in an arc flash.

Arc flash studies and preventive maintenance are indispensable aspects of electrical safety to prevent serious injuries and damage. Don’t take the risk – take preventative measures to prevent arc flashes.

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