S&C Arc-Flash Hazard Analysis
What Is Arc Flash?
The flashover of electric current in air—from one phase conductor to another phase conductor, or from one phase conductor to ground—causes an arc flash that can heat the air to 35,000°F, vaporizing metal and causing severe burns to workers from direct heat exposure and ignition of clothing. And the arc blast that results from the release of the concentrated radiant energy creates a pressure wave that can damage hearing and knock down personnel, causing trauma injuries.

You Need to Protect Your Workers from Arc Flash
The best way to prevent arc-flash incidents is to make certain that equipment is electrically safe before working on it. But it’s not always possible to de-energize, lockout/tagout, voltage test, and ground equipment prior to commencing work . . . for example, when the equipment serves critical loads that cannot be shut down.

A number of industry regulations and standards address the need to protect personnel who work on energized equipment. These regulations and standards require determination of the arc-flash hazard, and appropriate personal protective equipment and equipment labeling. You are obligated to protect your personnel from arc-flash hazard, whether or not OSHA regulations apply.

The following table summarizes the requirements of applicable regulations and standards.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>OSHA</th>
<th>NEC (NFPA 70)</th>
<th>NFPA 70E</th>
<th>IEEE 1584</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications</td>
<td>Utilize safe working</td>
<td>Label all equipment to</td>
<td>Perform an arc-flash hazard</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>practices</td>
<td>warn of potential arc-flash</td>
<td>analysis</td>
<td></td>
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<td></td>
<td></td>
<td>hazards</td>
<td>Determine the flash protection</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>boundary</td>
<td></td>
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<td></td>
<td></td>
<td>Determine the personal protective</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>equipment required within the</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>N/A</td>
<td>N/A</td>
<td>208 V to 15 kV: Use empirical method or theoretical method</td>
<td>208 V to 15 kV: Use empirical method or theoretical method</td>
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<td></td>
<td></td>
<td></td>
<td>&gt;15 kV: Use theoretical method</td>
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<td></td>
<td></td>
<td></td>
<td>Refers to IEEE 1584</td>
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</table>

Who Is Qualified to Determine Arc-Flash Hazard?
To assess the arc-flash hazard to your personnel, you’ll need to determine the incident energy level that could result from an arc flash, at each equipment location. This assessment must be made by qualified personnel—typically an electrical engineer having an understanding of the short-circuit behavior of power systems along with knowledge of protective device coordination.

Based upon the results of the analysis, recommendations can be made with respect to appropriate personal protective equipment and equipment warning labels.

S&C’s Power Systems Services is uniquely qualified for this task. As specialists in high-voltage switching and protection, S&C engineers have the experience and comprehensive knowledge needed to prepare such assessments.
What an S&C Arc-Flash Hazard Analysis Includes

S&C’s Power Systems Services engineers will do the following:

- Identify the equipment locations where an arc-flash hazard analysis needs to be made.
- Collect pertinent data at each equipment location:
  - Transformer ratings, including voltage, power, percent impedance, winding ratio, and X/R ratio.
  - Protective device ratings, including current, time-current characteristics, settings, and time delays.
  - Switchgear data, including conductor phase spacing, type of grounding, and appropriate working distances.
- Prepare an appropriate system model and single-line diagram.
- Prepare a short-circuit study to determine the three-phase bolted fault current at each location.

- Prepare arc-flash calculations in accordance with NFPA 70E and IEEE 1584, using SKM and CYME software:
  - Calculate arc current in accordance with applicable guidelines.
  - Determine protective device total-clearing times based upon the time-current characteristics.
  - Calculate arc-flash incident energy level based on the protective device total-clearing times and the working distance.
- Determine appropriate personal protective equipment in accordance with risk levels defined in NFPA 70E.
- Calculate the arc-flash protection boundary distance.
- Document the results:
  - Prepare a written report of the findings.
  - Prepare single-line diagrams.
  - Prepare proposed equipment warning labels.
  - Label the equipment.

Let S&C Help You Reduce the Exposure

For equipment locations requiring greater than Level 2 personal protective equipment, a re-evaluation of system design should be considered. Although personal protective equipment is available through Level 4, the additional protective layers reduce dexterity and cause fatigue, introducing new problems.

If the arc-flash incident energy level at any equipment location requires greater than Level 2 personal protective equipment, S&C’s Power Systems Services engineers can make recommendations for mitigating arc-flash incident energy at such locations.

Contact your local S&C Sales Office to schedule an arc-flash hazard analysis for your system.