ArcFlashPlus© Services

Arc Flash Hazard Analysis

SPGS America's engineering staff can provide a complete arc flash hazard analysis, or supervise your team through the process. SPGS America can provide a large variety of services to help meet your arc flash needs:

- Show the step-by-step process to compliance
- Evaluate the needs of your facilities for arc flash hazard analysis
- Provide implementation support
- Review software needs, application training requirements
- Define the amount of engineering services required for your facilities' compliance
- Evaluate various electrical system configurations and operating modes
- Determine arc flash protection boundaries
- Develop proper PPE requirements, work procedures, warning labels, and floor stripes
- Identify ways to manage PPE requirements, while avoiding costly productivity losses and safety risks due to over-specification of PPE
- Print high quality, weather-resistant vinyl warning labels

Our staff engineers can visit the site, gather information, perform the analysis, and if desired, provide training to plant engineers and electricians and help ensure ongoing compliance.

Our system study report includes the results of the Easy Power analysis, recommendations, and a prioritized action plan. The report is provided to help ensure proper electrical equipment ratings and settings, PPE selection and electrical service efficiency.

Flicker Analysis

Flicker is a name given to frequent voltage variations caused by cyclical loads. The most troublesome aspect of flicker is usually the visible variations in output of incandescent lamps and TV screens in plants and neighboring homes.

Quality-control problems or production interruptions can also be the result of severe flicker. Flicker can be caused by arc furnaces, welders, thyristor-fed DC drives, reciprocating compressors, chipper drives, hammer mills and frequent motor starting. Available solutions to a flicker problem include alterations to operator control, var-compensation, or system configurations.

SPGS America engineers conduct measurements and analysis to determine cost-effective solutions to control flicker issues.

Harmonic Analysis

The increasingly widespread application of SCR-controlled drives in industrial processes has brought harmonic consideration into the design of electrical systems. It is common practice for industrial plants with major harmonic sources to add harmonic filters to limit voltage distortion and harmonic current flows into the utility system. On existing systems, harmonic measurements are usually made to determine the extent of voltage and current distortion and are used as a base for further calculations. If calculations show that harmonic filters are required to meet specified criteria, filters can be designed and analytically tested.

Harmonic filters must be integrated with power factor correction capacitors and must withstand any harmonics absorbed from a utility system or neighboring plant. Filters must also continue to function

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when loads in the plant vary or major elements such as transformers are taken out of service for maintenance. With careful planning, filters can be designed to reliably serve their intended purpose without creating new problems.

SPGS America's harmonic analysis will reveal:

- Harmonic current paths
- Amount of harmonic current flowing into the utility system
- Generated harmonic voltages
- Potential resonances
- Performance of filter and capacitor bank tuning options
- Comparison of results against the latest IEEE 519 standard

Load Shedding Analysis

Load shedding is a special form of dynamic study most frequently associated with electrical systems having in-plant generation. The time period of examination is usually longer due to the slower response of governors. Loss of a major source, usually the utility, can have a severe effect on plant voltage and frequency. Rapid corrective action may be required.

A SPGS America load-shedding study can help determine if standard load-shedding relays are adequate or if a computer-based load-shedding system is required. SPGS America's engineers examine different operating scenarios to determine the speed and amount of load to be shed for successful recovery, while keeping critical loads through a disturbance.

Power Factor Analysis

Power-factor improvement is a cost-effective method to meet the reactive demand of a plant or distribution system. Power-factor improvement may be warranted simply from the benefits it provides in voltage increase and reduced loading of transformers, cables, and generators.

The technical and economic value of power factor improvement is verified through an analysis of the plant electrical system and loads. Also, planning for present and future kVAR needs may require additional studies. If harmonics are present, the selection of capacitors will be more complex and the location more critical. Frequent switching of capacitors can cause transient over-voltages, and isolated motors on capacitors may have to be examined for self-excitation.

SPGS America uses software programs as an excellent tool to evaluate power factor improvement alternatives. Using software programs, SPGS America's engineers can provide power flow analysis to reveal actual power factor correction, while providing analysis of potential problem areas. Excessive voltage regulation may indicate a need for including automatic voltage control equipment.

Power Flow Analysis

SPGS America's power-flow analysis utilizes a computer model to examine normal steady state and contingency conditions in an electrical system. A power-flow solution provides voltages and equipment loadings under a given set of system conditions. A series of power-flow cases can show the effects of various design alternatives or equipment outages on system operation.

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An engineer can use power flow cases to:

- Examine benefits of load-tap-changing transformers
- Examine benefits of power-factor correction capacitors
- Select locations for power-factor correction capacitors
- Set taps on fixed-tap transformers
- Explore steady state performance of expansion alternatives
- Determine ratings for new or upgraded circuits
- Determine equipment loading

In addition, a power flow case can provide a snapshot of system voltages during motor starting, impact loading, or other short-term events that affect system voltages.

Motor Starting Analysis

SPGS America's motor starting analysis identifies the expected voltage dip and acceleration time for a motor and the effects of motor starting on a system. Alternate starting methods, such as across-the-line, reactor, capacitor, or autotransformer start, can be explored.

If system voltage dips are a concern, SPGS America's engineers will propose the appropriate solutions. For calculating acceleration times, they will employ advanced, dynamic simulation with inertia and other machine data.

Relay Coordination Analysis

Proper application and coordination of over-current relays and other protective devices is vital in a system requiring reliable electrical service. SPGS America's engineers bring the critical experience needed for the proper application of ANSI and NEC requirements to equipment protection.

In addition to relays that respond to short circuits, low-voltage breakers, differential, directional, power, under-voltage, out-of-step, and other special protective relays often need to be set. This SPGS America's study will include detailed tables listing the recommended settings and discussion of any limitations.

Short Circuit Analysis

Short-circuit calculations are required to correctly apply equipment in accordance with NEC, and ANSI standards. Depending on the size and utility connection, the amount of detail required to perform these calculations can vary greatly. SPGS America's short-circuit analysis will include calculations performed in accordance with the latest ANSI standards.

Switches, fuses, and breakers that need to interrupt or close into a fault are of special concern. Cables and buswork also have short-circuit withstand limitations, and a thorough study will examine non-interrupting equipment, as well as switches and breakers. Standards such as ANSI C37.010 and C37.13 outline the recognized calculation methods for these equipment-rating analyses.

Short-circuit calculations are required for the application and coordination of protective relays and the rating of equipment. All fault types can be simulated. SPGS America's short-circuit study provides a detailed report identifying breaker ratings, breaker fault duties, discussions, and recommendations for any deficiencies found.

System Reliability Analysis

Industrial electrical power systems can be designed to provide a wide range of reliability levels. Generally, system costs increase as the reliability of the design increases. The applicable process

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costs should include not only lost production, but risks to equipment and personnel when interruptions occur.

SPGS Americas reliability studies can be conducted according to:

- Recommendations provided by a SPGS America engineer experienced with industrial power systems, advising alternate means of serving critical loads.
- Analysis, using software programs and industry-obtained outage rates for equipment and downtime for repair.

Analytical tools and experienced engineers can be combined to evaluate alternative electrical system arrangements, and provide quantitative measures of reliability. The costs of reliability can then be compared with the potential losses due to process interruptions. This allows for informed decisions regarding electrical system investment.

System Stability Analysis

The stability of synchronous motors and generators has long been a design consideration in industrial and co-generation plants, as well as utility systems. It is necessary to ensure the network, synchronous machines, and protective systems will function adequately so faults do not interrupt operation.

Where instability is shown to be a potential problem, several practical alternatives can usually be used to eliminate the source of the problem. In some situations, changes to the network can improve stability; while in others, protective systems can be installed to avoid machine damage and minimize the disturbance.

A SPGS America system stability study can include:

- Induction generator over-excitation from capacitors
- Induction motor low- and high-voltage effects
- Motor transfer analysis when switching sources
- Reaccelerating analysis to guide plant operators
- Impact loading on motor shafts
- Emergency generator performance applied to load recovery
- General system stability

One form of output from a dynamic study is graphical time response or impedance plots. These plots can show variations in voltage, machine angle, frequency, line flows, and apparent impedance.

Surge Protection Analysis

SPSG surge-protection studies examine transient over-voltages that may result from lightning and equipment switching. Surge-protection studies are required where there is high incidence of lightning exposure or where capacitors are switched frequently. These transient problems may become evident after an installation is complete and equipment is in operation. In such cases, there are significant constraints on solutions.

The SPGS America study may range from simple selection of surge arresters to extensive field measurements, which determine whether the switching equipment is working correctly.

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