DESIGN PLUS

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PROFESSIONAL ENGINEERING SERVICES FOR *MISSION CRITICAL* INDUSTRIES

The FEA designPLUS newsletter always strives to provide articles that are timely and informative, so you will find this issue emphasizing the economy and what can be done to improve operations during a time of minimal capital expansion. Energy savings is always going to be a key issue and reviewing operations to find potential savings should be an ongoing endeavor. The first page article "Mission Critical Facility Considerations in 2010", reviews other areas that can be addressed during these times. There are also other articles pertaining to maintaining up-to-date record drawings and problems relative to arc flash analysis that is becoming an ever increasing safety concern. Your reaction to this economy and your commitment to improving your operation will pay substantial dividends when the economy improves.

We hope you find the articles interesting and informative.

FEA

Mission Critical Facility Considerations in 2010

By Marc A. Soucy

2009 was a very difficult year for most companies and it looks as though 2010 may only show a slight improvement as there is a reluctance to embark on major capital projects. With many companies taking a wait and see approach regarding investment in their mission critical facilities, this provides an excellent opportunity for mission critical facility managers to reassess maintenance practices and operational capabilities. There are always areas that need improvement and during these times you most likely have the time to invest in these more mundane activities. During times when we are all very busy, we come across many issues that we wish we had the time to delve into but don't. Now is the time. This includes organization of critical information, developing metrics to assist in managing and maintaining the facility, performing deferred maintenance and training.

While these activities do not seem very glamorous, engaging your staff will provide them with in-depth exposure to critical areas that they may not have had before. Also, soliciting their input can provide a new perspective into problems and maintenance issues thereby acknowledging their unique talents and foster better teamwork.

Some of the activities should include evaluating your present documentation including drawings, equipment information, maintenance procedures and maintenance records. Is this information available, up-to-date, properly filed for easy retrieval and relevant? Many times the information is "somewhere" but not easy to locate and finding the appropriate information is difficult.

The other major asset is your personnel. This is the time to engage them in your operations by having them assist in developing and cataloging your documentation, reviewing existing maintenance procedures, developing additional maintenance procedures, developing the means to track maintenance issues, reviewing re-occurring equipment problems and developing long term repairs and upgrades.

Your personnel have intimate knowledge of your operations and can be a great resource as you re-evaluate you operations. You should also take time to objectively evaluate your personnel regarding their strengths and weaknesses. With this information you can develop targeted training programs to increase their technical competence and overall knowledge of the facility.

Factors Determining Arc Flash Hazards

By Brian T. Soucy, P.E.

An arc flash hazard analysis quantifies the hazards to personnel by determining the arc energy or incident energy of equipment during fault conditions. The incident energy is measured in calories/cm2 or cal/cm2. While there are many factors influencing the incident energy, three of the main factors include:

1. Fault current magnitudes
2. Protective device clearing times
3. Working distances

This article will discuss how each of these factors influences the arc flash hazard.

Fault Currents

Fault currents are a product of the contribution and characteristics of all sources and the system impendence. The first step of any arc flash analysis will model each potential source and all system impedances. System sources include the utility, on-site generators and motors larger than 50 hp, individually and aggregate. The system impendence includes transformers, generators, cables and the fault itself.

Arc flash hazard analysis using the IEEE 1584-2002 equations will consider two fault conditions. The first fault condition is the bolted fault which assumes zero fault impedance and results in the highest fault currents. The second condition is an arcing fault where it assumes a fault impendence that limits the fault current to 85% of the bolted fault. An arc flash hazard analysis will determine the incident energy for both fault conditions and apply the category rating commensurate with the higher calculated incident energy.

The bolted faults and the arcing faults are influenced by the sources contributing fault currents and the system impendence. The system impedence is generally constant with the exception of alternate power paths available through tie circuits. The contributing sources, on the other hand, can change between utility and generator power and whether large motors are operating. Generally speaking, utilities can provide large fault currents because they are stiff sources. On the contrary, generators are weaker sources and will contribute much less fault current. This can, and often does, increase incident energy levels because it may mean lower magnitude faults which will take longer to clear.

Clearing Times

Of the two factors, clearing times have a much larger impact on incident energy levels than fault currents but the two are related. All protection devices operate according to a time-current curve. In general, the higher the fault current the faster the protection device will operate. This inverse relationship of current and time impacts the incident energy calculations. Consider the time-current curve and fault currents shown in figure 1 for a thermal magnetic breaker.

The high fault current is cleared very quickly by the breaker's instantaneous element while the lower fault current takes much longer to clear. Of the two, the lower fault current produces more incident energy because it takes so long to clear. In this case, a higher fault current is considered an asset in protecting personnel.

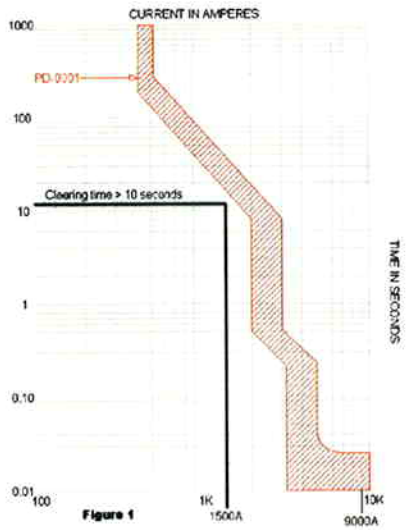

Figure 1

Consider for a moment the difference between utility and generator sources. Utilities are capable of producing large fault currents so it may be prudent to perform work while on utility power rather than generator. An arc flash hazard analysis for your site can help determine which is better.

Manufactures offer features designed to temporarily set breakers to their minimum levels with the idea that this will allow for quicker operation of the protection device and thus limit the fault current. These are all very good but need to be coordinated with the available fault current. Consider the case of the molded case circuit breaker. If the instantaneous element was set to its lowest setting it would not cause the breaker to trip any faster with the low level fault current shown.

Working Distance

The farther you are from a fault the less incident energy you will be subjected to. The arc flash category rating is based on the incident energy at the working distance which is anywhere from 18 inches to 36 inches depending on the work performed and the equipment. The incident

energy is inversely proportional to the square of the distance; therefore, increasing the working distance can dramatically reduce the arc flash hazard. For instance, working distance can be increased by using hot sticks or remote breaker operators .

Conclusion

Presented here are only three of the many factors influencing your sites arc flash hazard. Other factors include system configurations and equipment construction. A proper arc flash hazard analysis should consider all influencing factors and how live work is performed. A final thought: even sites that perform no live work still must complete an arc flash hazard analysis because all equipment is considered live until it is confirmed, through testing, that no voltage is present.

Record Drawings

By Marc A. Soucy

In today's ever changing society, there is always a push to improve and expand; bigger is always better, right? Well, expanding your facility without keeping accurate records could lead to a substantial task of creating up-to-date AS-IS drawings, and potentially leave you paralyzed during an emergency. The importance of record drawings often goes unnoticed until they are absolutely needed. It is at that critical time that a good set of record drawings can prove to be the difference between locating and solving a problem quickly or being lost in a series of questions and unknowns. Many people rely on their most seasoned employee to step up in a crisis situation, seeing they know all the 'ins-and-outs' of the facility, but putting all your faith in a single employee may not be the best practice either.

Millions of dollars are spent providing redundancy for the infrastructure but usually this is not carried through to the documentation of that redundant facility.

In deciding how to tackle the task of creating an up-to-date set of record drawings, a couple of questions need to be thought through before you begin;

- Do you have the means (time and manpower) to create the record set on your own?
- Are the people in your facility able to correctly identify all the necessary components you want to include in your record set?
- Do you have the CAD capability and an efficient CAD operator to take on such a task?
- Is it better to handle the task in-house or hire a third party professional?
- Once complete, how will you handle incorporating new equipment installs into the record set?

Once these questions have been answered and you are well on your way to creating a good record set of drawings, you will quickly see how beneficial they can be. Not only can a good record set be a beneficial tool during a crisis, it can also be used as a training tool for new employees or continued education for existing employees. They can be used to help with your maintenance program planning or help take the guesswork out of some of your everyday operations.

FEA's standard practice is to maintain a master set of drawings for all projects and always document any system revisions and upgrades on the master set so the information is always available and current.

Emissions Standards

Unfortunately, emissions standards are ever changing for standby generators. Some areas that need to be reviewed prior to purchase, setting operational criteria and overhaul are as follows:

- Tier classification requirements at the state and federal level – states can be more stringent than federal.
- Scrubber requirements are changing to include particulate. Previous installation may not meet this requirement.
- Operation of a standby generator in anticipation of an impending storm is not considered "standby service" and requires a more stringent tier classification.
- Overhaul of an existing engine or standby generator for more than 50 percent of the cost of a new engine, or if there is an increase in the "potential to emit", may result in reclassification of the standby generator to a new higher tier classification.

Remember, what you knew about the regulations may not be applicable today.

Policy

designPLUS Newsletter is published to keep the readers current with the latest trends in mission critical systems.

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