Optimize the Performance of New Electrical Equipment Installations

by Steven Maling

Executive summary

Electrical equipment that has been properly engineered, commissioned, and maintained is generally considered to have a 20-year useful life expectancy. But there are ways to extend and optimize the useful life of equipment. This life cycle strategy begins even before the equipment is installed. This paper presents 6 steps to get the most out of new electrical equipment, including key considerations for each.

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1.0 Abstract

In today's economy, budgets are being cut, capital projects have decreased over time and operating expenditures are being more closely scrutinized. Especially in circumstances such as these, it is critical to keep in mind that nothing can operate without a reliable flow of electricity. This paper will address the importance of optimizing your new equipment's performance at installation, specifically:

- Six service solutions recommended for new equipment and the benefits of each
- Key considerations when incorporating these six solutions

Ways to optimize existing electrical distribution equipment will also be discussed.

2.0 Introduction

Industry trends point to companies downsizing their workforce and increasing productivity through technology and efficiencies. New technologies are being built into the electrical equipment that can increase reliability, enhance workplace safety, and/or ultimately lower the overall lifecycle costs of the electrical distribution system. A facility's life cycle must be planned based upon the infrastructure of the various components which have a finite life. Items to address include technology obsolescence, component upgrades, and modernization options for the electrical infrastructure.

Generally speaking, twenty years has been the traditional useful life expectancy for electrical power distribution equipment that has been properly installed, commissioned and maintained according to the electrical manufacturer's recommendations. Of course, there are numerous installations of equipment that have been in operation for well over 20 years.

In many of these cases, the equipment may appear to be working, but there are operational issues that need to be addressed. Even with annual preventive maintenance, there may be instances where the life span is shortened. Factors to consider include the operating environment and the availability of spare parts. But there are also ways not only to extend, but to optimize the useful life of the equipment.

A sound lifecycle strategy for the electrical infrastructure begins with the design, installation and commissioning phases. The balance of this white paper will focus on six key areas to address for new equipment installations.

3.0 Six Ways to Optimize the Performance of New Equipment

The following services/solutions are recommended to help maximize a company's investment in new electrical equipment

1) Analytical Studies
2) Start-Up and Commissioning
3) Maintenance Agreements
4) Extended Warranty Plans
5) Training Services
6) Spare Parts

Each topic will be will be covered in more detail as to why it is important to the overall lifecycle strategy.

3.1 Analytical Studies

Analytical studies are extremely important when it comes to the application of new equipment to provide power to a process or building. The studies should be performed by professional engineers and implemented at the appropriate time during the project.

- A short circuit analysis should be performed prior to release for manufacturing
- The time-current coordination study should be completed prior to equipment energization
- The arc flash analysis should also be completed before equipment energization

Short Circuit Analysis – This study calculates fault-current levels throughout the electrical network to determine if the electrical equipment can withstand worst-case events. A short circuit analysis identifies underrated or misapplied equipment. Recommendations are made to reduce high fault-current levels and to comply with industry codes and standards.

Protective Device Time-Current Coordination Study – This analysis determines the optimal settings/ratings for protective devices which include: relays, fuses and circuit breaker trip units. New equipment is shipped with the minimum factory settings applied and should be installed according to the manufacturer's specifications.

During start-up and commissioning, the settings should then be adjusted based upon the results from the time-current coordination analysis. Proper setting of devices, along with verification testing, will reduce and/or eliminate nuisance tripping that could potentially occur after the system is started-up. In addition, these settings will help minimize potential equipment damage.

3.0 Six Ways to Optimize the Performance of New Equipment (con't.)

Arc Flash Analysis – This study evaluates the available incident energy and also defines the arc flash boundaries and personal protective equipment (PPE) requirements. As required by NFPA 70E, an arc flash analysis should be completed:

- For new equipment installations
- When changes occur to the electrical system, or
- A minimum of every five years

In addition, NFPA 70E requires equipment to be labeled with the results of the arc flash analysis.

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3.2 Start-Up and Commissioning

Start-up and commissioning confirms the new equipment has been properly installed, meets factory standards and passes stringent performance tests. The on-site testing will establish the base line for future trending and analysis. Site testing is highly recommended since equipment can incur potential damage during loading, shipping, off-loading and/or rigging into position.

Scope of Work

- Electrical testing (insulation and current path)
- Mechanical testing (functionality and sequencing)
- Visual inspection to ensure proper set-up and function
- Control and protection schemes verify proper sequencing and automated operation

The following equipment should have start-up and commissioning performed per the manufacturer's recommendations:

Automatic Transfer Switches
Busway
Cables
Circuit Breakers
- MV: Vacuum and SF6
- LV: Molded case and power

Grounding Systems
Instrument Transformers
Motor Control Centers
Relays and Meters
Starters (MV)
Surge Arresters

Switchboards
Switchgear (LV and MV)
Transformers
- Dry type and liquid filled

Voltage Regulators

3.0 Six Ways to Optimize the Performance of New Equipment (con't.)

3.3 Maintenance Agreement

Once new equipment has been purchased, it is advised to begin its 'life cycle' planning process. A multi-year maintenance agreement can help meet the requirements of NFPA 70E standards and also mitigate risks of unplanned downtime. Ranging from basic to complex, maintenance agreements can be customized to cover:

- Power equipment
- Automation and control systems
- Facility management software
- Preventive / predictive maintenance
- Extended warranty
- Employee training
- Monitoring systems
- Emergency management
  - On-site emergency response agreement
  - Temporary emergency generator
- Spare parts

Due to the technological advances in equipment mentioned in Section 2.0, maintenance staffs now require an elevated understanding and skill set to be able to operate and maintain the equipment. As a key focus in reducing the overall operating cost, many companies look to outsource services to maintain the equipment infrastructure, enabling them to focus more on their core product offer.

Following are guidelines and questions to consider when selecting a maintenance service provider:

1) Do they have the flexibility to meet the facility's specific requirements?
2) Do they offer payment/billing options?
3) In case of an emergency, how quickly can they guarantee a response?
4) Do they provide local, regional or nationwide service?

Finally, it is critical to understand the scope of work that is being proposed. Pre-job site visits for estimating and project planning are highly recommended. Ask questions up front relative to the Field Personnel Competency Training to to determine product knowledge. Inquire into and review the service provider's safety training program to ensure their employees are "qualified" personnel according to NFPA 70E and OSHA requirements. Ultimately, the company outsourcing the work is responsible for workplace safety, whether the maintenance worker is an employee or a contractor.

3.0 Six Ways to Optimize the Performance of New Equipment (con't.)

3.4 Extended Warranties

Extended warranties are often incorporated into the specification document for new equipment purchases. While they may be purchased after the point of sale, discounts are often offered if the extended warranty is purchased at the point of sale.

As with any contractual agreement, thoroughly review the extended warranty plan. Specifically, note if parts and labor are included. Are there in/out charges for equipment or fees for expediting parts? Does the extended warranty address on-site emergency response? Finally, consider opportunities to leverage warranty extension with multi-year service agreements.

3.5 Training Services

There are many benefits to workplace training. First and foremost, OSHA mandates that employers provide safe places of employment. With respect to electrical systems, NFPA 70E: Standard for Electrical Safety in the Workplace is the standard enforced by OSHA. The 2012 edition of NFPA 70E requires the development and enforcement of an Electrical Safe Work Practices (ESWP) policy.

3.0 Six Ways to Optimize the Performance of New Equipment (con't.)

3.5 Training Services (con't)

The ESWP policy addresses topics such as lock-out/tag-out procedures, method of qualifying workers, the selection and application of personal protective equipment (PPE), methods of establishing a safe work area, arc flash and shock protection calculations, equipment labeling and worker audit procedures.

Employees are to be trained on the contents of the ESWP policy. NFPA 70E-2012 requires the policy be audited on a three-year cycle. Should an audit determine the principles and procedures of the ESWP are not being followed, appropriate revisions to the training program or to the procedures shall be made. Workers must be evaluated for compliance to the standards and the policy; any deviations must be documented.

Training also enhances employee competency along with career development. Courses may range from broad topics to product specific. Most training providers have a diverse portfolio of options for course delivery which may include in-class, at the customer's facility, on-line, or even virtual courses. Verify the training provider is accredited. Questions to ask include:

1) Are job aids (workbooks, manuals, etc.) included with training?
2) What portion of the training is hands-on?
3) Are CEUs offered?
4) Are there opportunities to bundle courses to obtain price discounts?

3.6 Spare Parts

Keeping spare parts on hand can play a crucial role in minimizing equipment downtime. As a rule, spare parts should be purchased at the time of the equipment point of sale, since after-market pricing is typically higher.

For the new equipment being purchased, identify the critical components that would have the most impact on production and, at a minimum, purchase those spare parts. If purchasing in the after-market, select OEM authorized parts to minimize any negative impact to the warranty.

4.0 Conclusion

When purchasing new electrical equipment, consider incorporating the six steps outlined in this paper to optimize its useful life. If properly engineered, commissioned and maintained, electrical equipment can exceed its traditional useful life expectancy.

The life cycle strategy of a facility's electrical infrastructure begins prior to new equipment being installed. The strategy should also include plans for technology obsolescence, how to upgrade system components and ultimately, modernization of the electrical system.

For existing or aging electrical equipment, companies should at least incorporate more predictive maintenance technology into their overall lifecycle strategy. Data analysis and diagnostics can often detect a problem before it becomes a catastrophic event. Modernization and upgrade solutions are also available for the protective devices (active components) to enhance electrical reliability and workplace safety.

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