22 Eaton's Electrical Services & Systems

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Solving the Operating Performance Puzzle

As electrical equipment and systems become increasingly sophisticated and complex, so too does the challenge of maintaining peak levels of availability, performance, security and protection.

Eaton's Electrical Services & Systems (EESS) recognizes that superior hardware is only part of the answer. Effective power strategies require intelligent system design, integration, coordination and control. That means working with a dedicated service partner who understands on-site and remote access diagnostics, installation, modernization and predictive maintenance. Whether it's a single power strategy application or a total Integrated Project Solution, EESS has the method by which to enhance power performance, to reduce operating costs and to maximize the reliability, safety and integrity of your electrical equipment and system assets.

Uptime

Reliability

EESS is a one-stop service provider focused on integrating and maintaining power quality. In addition to complying with IEEE® and ANSI standards, many EESS engineers and technicians are 1E-certified to perform a full scope of on-site service operations in nuclear plants, including hardware retrofits.

EESS offers intelligent solutions for maximizing operating performance. Some of these solutions include:

Power Equipment Services

Critical electrical equipment requires systematic maintenance to ensure maximum performance and in-service life… while minimizing unscheduled downtime, aging, wear related hazards and total operating costs.

EESS is the ideal complement to your existing in-house service. For more complex projects, they can act as a single point outsource for all of your facility's ongoing maintenance needs, including:

- **Installation/Startup**
  EESS can install any make or manufacturer of power equipment to precise vendor specifications, with minimal disruption of ongoing facility operations
- **Routine/Emergency Service**
  EESS is on call 24/7, providing an unrivaled array of services, including disaster recovery and crisis response. One call to **1-800-498-2678**, and uptime engineers and technicians can be assembled with the sole purpose of bringing electrical systems back online quickly
- **Warranty Service**
  EESS delivers a new level of confidence to customers by adding an additional one-year warranty extension to the Eaton products they install
- **Strategic Alliances**
  because Eaton is truly universal in presence, scope and capability, EESS offers exceptional partnership opportunities to customers who operate multiple facilities on a regional, national or international level. As a dedicated service extension, EESS can establish and maintain consistent levels of availability, reliability and performance across your operation. Additionally, EESS can create uniform methods and procedures for performance benchmarking, predictive maintenance programs, inventory management and an array of other services designed to help maximize your investment

Life Extension

PowerChain Management Solutions

PowerChain Management™
Solutions from Eaton

PowerChain Benefits

How Managing the PowerChain Empowers Business

By actively managing an enterprise's power infrastructure in a holistic manner, PowerChain Management solutions offer a company these advantages:

Greater Reliability

Among the clear advantages of a PowerChain Management solution are enhanced reliability and availability afforded by state-of-the-art technologies, such as predictive analysis and remote monitoring, to ensure business continuity.

Operating Cost Efficiencies

PowerChain Management solutions encompass savings that begin with intelligent design and innovation and continue through heightened energy management and a system-wide approach to cost-effective management practices, including life-cycle management.

Effective Use of Capital

By providing a single point of coordination, a PowerChain Management solution speeds the time from planning to installation and commissioning. In terms of life-cycle management, this approach provides for timely upgrades to avert the high cost of complete rebuilds.

Safety

A PowerChain Management solution enhances safety by working at the system level, applying the right equipment, supporting technology, training and procedures. By definition, it always optimizes system design and engineering for safety.

Risk Mitigation

With a single point of accountability for every aspect of the PowerChain, enterprises gain broad improvements in managing risks, including: meeting critical schedules, launch windows and compliance requirements; protecting critical data and equipment; and ensuring safety and regulatory compliance.

PowerChain End-to-End Capabilities

End-to-End Capabilities for Your PowerChain's Entire Life Cycle

Eaton has over 100 years of experience and support behind its products. Our vast team of field engineers and a global service network ensures the highest level of responsiveness to your PowerChain needs. In addition, Eaton offers replacement part depots that make it easy to keep your electrical system running at peak performance.

With an exceptionally broad portfolio of award-winning AC and DC products, Eaton is an industry leader. From the invention of the circuit breaker, our roots are steeped in innovation. Our worldwide research centers continue to deliver advanced hardware and software solutions that are enabling new generations of proactive, intelligent electrical systems. And Eaton's global brands are helping our customers meet their needs for global standards such as IEEE, NFPA®, UL®, ANSI, IEC, NEMA® and CNCA.

Optimizing your organization's electrical system via PowerChain Management solutions offers you a breadth of resources including the following services and products.

Services

Engineering and Consulting Services provide upfront analysis and design prior to project implementation. Through a PowerChain Management Audit, our power system engineers will help you to quickly diagnose problems or proactively identify ways to improve your electrical system's performance and operation. Included are:

- System design engineering
- Power audits and studies
- Arc flash and safety studies
- Energy management
- Consulting support

Turnkey and Modernization Services offer field resources to get your project plan underway. From project management on a rebuild or refurbishment, to turnkey services for a new facility or upgrade, we can help you reduce time and costs. Included are:

- Project management
- Switchgear and UPS modification
- Integrated project solutions
- Existing equipment upgrades and rebuilding
- Installation, startup and commissioning assistance

Contract and Support Services ensure that your PowerChain continues to operate optimally around the clock. In addition to scheduled maintenance programs, Eaton offers a world-class service and emergency response capability with 24/7 monitoring so that you have peace of mind and confidence. Included are:

- Factory trained and certified field technicians
- Predictive and calendar-based preventive maintenance programs
- Spare part kits, modifications and upgrades
- On-site training and technical support
- Remote monitoring and diagnostic support
- Battery monitoring with replacement coverage (asset optimization)
- Parts and labor service contracts with on-site response times

PowerChain Life-Cycle Approach

Eaton's PowerChain Management Solutions— A Life-Cycle Approach

Because Eaton's PowerChain Management solutions bring a system-wide view, address all decision points —planning, design, finance, engineering, construction, installation, upgrading and monitoring— and consider life-cycle impacts to the PowerChain, they free up businesses to concentrate on core capabilities. This provides a far more strategic partnership, one in which Eaton brings to bear its wide range of expertise and field-proven performance for which it has been known for over a century.

The ease of doing business with a single point of accountability gains enterprises these advantages: better schedule management over the course of an entire project; an advanced ability to anticipate and solve problems; and a more comprehensive approach to prevention and troubleshooting.

Eaton's electrical group has recognized the criticality of addressing the entire PowerChain in an integrated way to give organizations the benefits of greater reliability, operating cost efficiencies, effective use of capital, safety and risk mitigation. Through a combination of acquisitions, alliances and internal development, Eaton now delivers the products, services, in-depth expertise and exceptional performance to address complete PowerChain needs.

Eaton's PowerChain Management solutions encompass:

- **Power Audits**
  Eaton's extensive audit capabilities assess an enterprise's complete PowerChain in terms of reliability, safety and energy management issues.
- **System Design/ Build/Engineering/ Construction/Installation**
  Eaton is renowned for innovation. Our specialized knowledge transforms concepts into practical PowerChain solutions that take into account cost/benefit, multi-vendor integration and equipment selection. On-site construction management and engineering staff are well versed in the practical aspects of integrating power protection into existing buildings, as well as in new construction.
- **Monitoring and Analysis**
  Assessing the status of equipment, predicting imminent failures and identifying power anomalies are critical to a PowerChain Management solution. Eaton provides a full complement of these services.
- **Life-Cycle Management**
  Life-cycle management services begin with product design and engineering, and continue through monitoring, maintenance, upgrades and, ultimately, replacement
- **End-to-End Equipment Capabilities**
  Eaton's PowerChain Management solutions extend from research, design, enhancement and factory testing, to on-site installation

PowerChain Audit

The PowerChain Management Audit

Many facilities have gone through upgrades and changes over the years. Electrical loads have been added to automate processes, computer loads have been added to the facilities, harmonics have been introduced to the system, and the loads are often much more susceptible to power quality issues. Dealing with these issues is most efficiently done systematically by performing a site audit looking for specific problems and potential areas of improvement. By using proven techniques and strategic monitoring, Eaton will identify the areas of greatest vulnerability and will address the options for providing protection from utility issues, as well as system protection from new and ever-changing load requirements.

Eaton offers PowerChain Management Audits to evaluate power system designs and to improve the availability and reliability of the power system. This method uses proven IEEE Gold Book methods for analysis and helps to determine whether upgrading critical elements of the power system, modernizing the system or simply rehabilitating the system is the most cost-effective method of improving reliability prior to a failure.

Eaton's PowerChain Management Audits consist of visual inspections, electrical measurements using power quality monitoring equipment, interviews with on-site personnel, and reviews of utility bills and data. Specifically, Eaton will address interruptions, voltage sags, harmonics, surge protection, grounding, energy management and arc flash safety.

Eaton will investigate methods of improving the reliability of the power system to help you avoid costly downtime and repairs. The present state of the existing personal protective equipment is also evaluated. Cost and payback information will be presented where appropriate.

Eaton reviews energy consumption to determine possible savings with utility rate structures, energy usage, time of use (on- or off-peak), power factor correction and various methods of metering. By monitoring trouble areas of the facility, Eaton will identify other potential areas for improvement and savings.

Eaton's electrical group recognizes the criticality of addressing the entire PowerChain to give organizations the benefits of greater reliability, operating cost efficiencies, effective use of capital, safety and risk mitigation. With a PowerChain Management Audit, power management problems can be resolved through a single, integrated solution at every level in a facility, delivering products, services, expertise and exceptional performance to address your complete PowerChain needs. The purpose of this audit is to show areas of improvement in the electrical infrastructure and to point out areas that are well designed, maintained and operating at or above expectations.

PowerChain Management Audit Features

- Evaluate wiring and grounding methods
- Evaluate backup protection including the use of UPS power, backup generation, sag correction and power conditioning
- Review energy management processes to determine demand-side management opportunities and analyze energy-efficient electrical loads
- Evaluate surge protection at the utility connection point and at the downstream loads
- Evaluate the use of harmonic solutions including tuned filters, line reactors and phase shifting transformers
- Evaluate and review present arc flash safety compliance status
- Evaluate the quality of the voltage and current at the main service equipment
- Interview key electrical personnel on site to determine the type of operating problems, the equipment affected, and the time of occurrences

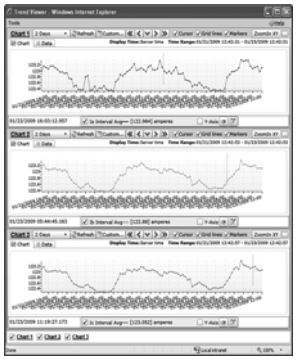
Power Systems Engineering Solutions

As technology advances and more businesses come to rely on sophisticated equipment, the demand for consistent, top-quality power increases. Power systems that were installed 15, 10 or even 5 years ago were not designed to handle today's power demand. The key to a healthy power system is consistent configuration and familiarity with the operating power system. The most definitive way to accomplish this is through a Protection and Coordination Study by Eaton's Power Systems Engineers.

Energy Efficiency

EESS provides methodical testing and monitoring practices on power systems. Tests are run to analyze safety, reliability, power quality and energy management.

These services have proven to be an effective way of protecting expensive equipment and preventing downtime.



Screen Shot

Preventing future system distress and creating a safe power environment that will be both economical and electrically sound is another reason to bring in the power systems specialists. It is a proactive, system conscious move involving power systems engineers and technicians when upgrading to a new distribution system, adding additional loads or processes to the current power system, or contracting with a utility. Power quality and energy management studies can take place during normal plant operation or scheduled around an annual plant shutdown.

The first step to consistent and safe power is to fully understand the intricacies of the power system. No one can do that better than Eaton's Electrical Services & Systems.

System Testing

Predictive Maintenance

Eaton predictive maintenance applies the latest technologies to support online condition assessment of critical electrical distribution equipment. Advancements have resulted in new applications that allow for predictive diagnostics measurements via existing electrical components.

- Performance-based maintenance
- PM program design and implementation
- Periodic testing and PM services
- Thermographic survey
- Troubleshooting
- Testing
- Predictive diagnostics
- Transformer oil processing

With extensive field experience, EESS can quickly develop a customized application to schedule and document essential system services, which allows for cost savings while improving system reliability. Limited maintenance dollars are prioritized for equipment that is critical and is in greater need of service. By implementing our predictive maintenance software with complete monitoring capabilities, equipment outages are anticipated and averted before they happen.

Continuous and Remote Partial Discharge Monitoring for Medium Voltage Equipment

Eaton InsulGard

Eaton Corporation understands the pressures that you face trying to reduce costs while at the same time maximizing your electrical system's uptime and reliability. That's why we invented the Eaton InsulGard™, a system that changes the rules of power equipment maintenance. Until now, there were only two options.

1. Wait for equipment to break down and fix it and/or
2. Periodically take equipment out of service to perform tests and maintenance—whether it's needed or not.

Now there is a third, revolutionary option. InsulGard is the first continuous, online, medium voltage, predictive maintenance system that can be used in a variety of applications including switchgear, bus duct, power centers, generators and motors. Through monitoring, it can ascertain the relative condition of insulation, the deterioration of which is the leading cause of electrical failures. And, it can monitor these conditions better than alternative testing methods. Further, you won't have to take equipment out of service or send personnel to conduct tests. In effect, the InsulGard system is a lower-cost alternative to forced outages and rigid, and sometimes unnecessary, maintenance schedules. We believe that you will find the InsulGard system to be the best planning tool available today.

At the heart of the system is the InsulGard monitor. Whether you use it to monitor switchgear or rotating equipment, only some internal circuitry changes. The variable part of the system is the broad array of sensors we've developed to function with key electrical assets. Yet, each sensor is specifically designed to work with the InsulGard monitor to provide seamless and accurate data. They are also designed to work with existing Resistive Temperature Devices (RTDs) already present within the windings of generators and the motor. Design integrity is important when it comes to protecting your investment. The InsulGard system has it.

Generators and Motors

The InsulGard system is available with a variety of sensors appropriate for motors and generators. One of these is the RTD module that connects to existing resistive temperature devices (RTDs) already embedded within the windings of the generator or the motor. Another sensor that checks for partial discharge is the coupling capacitor, which is used on the line side. A third sensor, ideal for generators and motors, is the radio frequency current transformer (RFCT). The RFCT embraces cable shielding and is used in the line part of the winding. Used alone or in combination, the sensors connect to the InsulGard monitor where partial discharges and other variables such as humidity, load and temperature are monitored and recorded for analysis.

Specifically, here are the issues that partial discharge analysis can tell you about your rotating equipment:

- Early stages of insulation deterioration
- Sparks in voids and between windings
- Corona on end windings

Switchgear

Available sensors for switchgear include coupling capacitors or a combination of radio frequency voltage sensors (RFVSs) and radio frequency current transformers (RFCTs). Coupling capacitors detect partial discharges in a cubicle and/or adjacent cubicles and are typically installed on the load side of the feeder breakers or on the main bus. Radio frequency voltage sensors (RFVSs) are also used to detect discharges within the cubicle. They are typically installed on the load side of the feeder breakers, or on the main bus. They are connected to the current or the potential transformer's secondary neutral terminal.

Large Power Transformers

Eaton InsulGard G is available for transformers that contain a capacitive tap at the base of the bushing. This top is normally used for power-factor measurements. Transformers with a primary voltage of 13.8 kV can be monitored using our standard partial discharge sensors.

Software

InsulGard software is part of the InsulGard system. It allows you to view the dynamics captured by the monitor and to analyze the condition of insulation based on the guidelines and parameters provided by Eaton predictive diagnostics specialists. The eventual goal of predictive diagnostics is to create a Web-based service whereby you can statistically compare the relative condition of your equipment to others who have similar equipment in operation by equipment type, manufacturer, voltage class ratings, partial discharge activity longevity, etc. Users will benefit by comparing their own measured partial discharge data with our extensive database to predict outcomes and to plan maintenance. This database will not identify customer sites or locations in order to guard the privacy of our customers.

Medium Voltage Vacuum Replacement Breakers (MVVR)

New Replacement Breakers from the Ground Up

VR-Series medium voltage vacuum replacement (MVVR) breakers are brand new breakers that have been designed, manufactured and fully tested to be functional electrical and mechanical replacements for almost any manufacturers' original air magnetic and some vacuum circuit breakers. However, if cell structure modifications are required, they are reversible.

Unnecessary downtime is avoided because the breakers are new, and only require one outage for removal and installation. By only replacing the breakers, equipment costs are reduced while the life of the existing switchgear is extended.

Many circuit breakers require additional contacts, mechanism operated contacts (MOCs), that are mounted external to the circuit breaker mechanism. When these contacts are operated by high speed vacuum breakers, they travel almost four times faster than existing air magnetic circuit breakers and can transfer up to 16 times the kinetic energy to the MOC switch. The increased forces can damage the existing MOC switch and cell components, and in some cases, stall the breaker when trying to close. A *SURE CLOSE* MOC system balances the speed and force of the breaker's MOC operator to prevent stalling and damage to the cell and the MOC switch.

Replacement

Eaton manufactures over 158 different models of VR-Series MVVR breakers that replace air magnetic circuit breakers originally manufactured by: Westinghouse®, General Electric®, Allis-Chalmers, Federal Pacific Electric®, ITE® and McGraw-Edison®.

Competitive Upgrades—Low Voltage Power Air Breakers

AR-Series Replacement Breakers

The AR-Series (air-replacement) breakers are not retrofits. They are 100% new breakers used to completely replace the original drawout type power air circuit breaker. This solution uses state-of-the-art Eaton Magnum™ breaker technology that provides maximum life-extension and switchgear modernization. The offering includes a new breaker, a cassette with extension rails and a standard door. No modifications are required to the original line/load power stabs or to the secondary disconnect contacts.

This solution can eliminate safety problems caused by defective racking and/or operator mechanisms. Additional safety against arc flash incidents can be obtained by equipping the breaker with ARMs Technologies, thereby reducing the arc flash energy available at downstream devices during maintenance periods. Additional switchgear maintenance problems such as parts unavailability and lengthy maintenance procedures can be eliminated. This solution often provides a substantial total installed cost savings when compared to completely replacing the switchgear assembly.

In many instances, the AR-Series replacement breaker can be combined with engineering services to provide continuous current and/or interruption rating upgrades.

The AR-Series breakers are designed, manufactured and tested to modern IEEE/ANSI standards.

Designs are available for a wide variety of drawout type low voltage power air circuit breakers (LVPACB) originally manufactured by Westinghouse, Federal Pacific Electric, Allis-Chalmers, ITE and General Electric.

Pictured on this page are several examples of available designs. Contact your local Eaton sales representative for information on other breaker types.

Westinghouse

Original DB-25 *DB25-AR600NM*

Original DB-50 *DB50-AR1600M*

Original DB-75 *DB75-AR3000M*

Allis-Chalmers

Original LA-600 *LA600-AR600NM*

ITE

Original K-600 *K-600-AR600NM*

Federal Pacific Electric

Original FP-25 *FP25-AR600NM*

Original FP-50 *FP50-AR1600M*

Original FP-75 *FP75-AR3000B*

General Electric

Original AK-2A-50 *AK2A50-AR1600M*

Original AKR-4A-30 *AKR4A30-AR800NM*

Class 1 Reconditioning

Better Than New

The useful life capacity and performance of vintage or damaged motor controls and power distribution equipment can be extended and enhanced through Eaton's Aftermarket Centers of Excellence (ACE). Their strategic locations enable rapid response through a cost-effective program of selective hardware retrofits.

Each ACE strictly adheres to all national standards and quality processes. Field experts use evolving technology to ensure the most advanced retrofit upgrade possible. Access to vintage parts won't be a problem; each ACE has both Cutler-Hammer and Westinghouse renewal parts available.

Proven

In the ongoing battle of maximizing operating performance and safety, Eaton's Class 1 reconditioning service helps to restore the integrity of electrical protection equipment to its required level of reliability.

Automation Services

Effectively applying leading-edge technologies is often the key to enhanced performance, improved output, and reduced frequency and severity of outages. Engineering these new technologies into an existing equipment configuration is an EESS specialty.

System Integrator

EESS is a full service systems integrator with proven expertise in power and energy management systems.

EESS provides a unique alternative to conventional manufacturer-integrator-contractor teams. With project management expertise, EESS offers single-point responsibility from a major controls manufacturer. Industry knowledge allows for seamless integration of new products, regardless of equipment manufacturer.

Process Improvement

EESS has the capabilities to address the entire scope of integration and automation needs, including:

- Power management systems (IQ, IMPACC, Power Xpert® Software, Foreseer® Services)
- Automatic transfer schemes
- Distributed generation/ generator control systems
- Demand management—load shedding/peak shaving systems
- Generator and ATS system monitoring and testing
- Health care emergency power supply systems
- PLC systems (Eaton, Allen-Bradley®, Modicon®, GE Fanuc® and Siemens®)

Integrated Project Solutions

The project management group within EESS provides integrated project solutions to customers in the government, industrial, commercial and utility sectors. Eaton's Federal Systems Group also focuses on mission-critical government installations, providing project solutions, on-going maintenance and remote monitoring.

- New substation design and construction
- Integrated emergency power requirements, including UPS, generators and alternate feeders
- Plant automation
- PLC control and load shedding
- Electrical plant monitoring and control
- Process automation and system integration

Design

The integrated project solutions engineers manage the technical and commercial risk inherent in meeting project objectives. These engineers focus on performance, cost and time goals, while controlling or maintaining the scope of the project.

Speed of Response

By hiring the EESS project management group, you can release the burden of multi-supplier coordination. EESS offers single-point accountability for all technical, financial and commercial coordination within the scope of the project.

Replacement and Upgrading

OEM Equipment Serviced and Upgraded

- Westinghouse
- Cutler-Hammer
- Square D®
- General Electric
- ITE
- ABB®
- Allis-Chalmers
- Siemens
- Federal Pacific
- and others...

Plant Life Extension

- MV vacuum breaker replacement
- MV motor starter upgrading
- Generator excitation and motor control
- System metering and control—PowerNet/IMPACC
- LV breaker (all OEMs) trip systems
- Class 1 circuit breaker reconditioning
- Nuclear equipment services
- UPS or battery systems

Additional Services

Consulting and Advisory Support

- Arc flash studies and solutions
- Power system studies, design and analysis
- Failure/root cause analysis
- Reliability analysis
- Power quality and harmonic analysis
- Reliability centered maintenance (RCM)
- Short-circuit/coordination studies
- Power systems training

Startup and Commissioning

- Installation support and supervision
- Acceptance testing (NETA equivalent)
- Startup and training
- Ground-fault certifications
- Installation construction services

Instant Response Center℠

- Monitoring and diagnostics
- 24 hours a day, 7 days a week, 365 days a year
- Power quality experts
- Energy management

Eaton's Electrical Services & Systems

Asset Optimization

Outsource the responsibility for the electrical distribution system and the associated equipment to Eaton's Electrical Services & Systems. Offerings involve cost savings and performance guarantees for greater focus on the core business. Asset optimization uses all the tools and capabilities within the other service platforms, resulting in improved reliability, life expectancy and overall cost.

Knowledge Management

Collect and transform your system data to useful knowledge; allow for proactive planning, energy management, optimized decision-making, failure prediction and, ultimately, cost savings.

Integrated Project Solutions

Engineering, design, procurement, installation and commissioning of power systems equipment; a total turnkey approach.

Power Systems Engineering Solutions

Power systems automation, design engineering, training, predictive diagnostics, power quality and power systems studies/analysis to decrease costs and increase productivity.

Power Systems Modernization

Keep systems operating at peak efficiency, reliability and safety; extend the life of the electrical asset through equipment life extension and upgrade solutions using new technologies.

New Equipment Services

Installation, testing and commissioning of virtually any electrical equipment.

Field Services

Power system and equipment service, maintenance programs, testing, upgrades and Aftermarket solutions; 24/7 emergency service; crisis response and disaster recovery.

Further Information

For further information on Eaton Service Solutions, call **1-800-498-2678** or visit our Web site at: **www.eaton.com/EESS**.