

Eaton's Electrical Engineering Services & Systems
Solutions Focus

Seamless Solutions for Reliable,
Efficient and Safe Power Systems



Engineering innovation

Progressive solutions for today's
power systems

EATON

Powering Business Worldwide

We'll focus on your power system... you focus on your business

A properly designed and operated power system can save you money and increase productivity while meeting the growing and changing demands of your business. Through surveys, studies, predictive maintenance solutions, energy management, monitoring and evaluation Eaton's power system engineers will help you:

- Increase reliability and reduce costly system disturbances and downtime
- Maintain IEEE recommended power quality levels, including proper operating voltages
- Mitigate safety issues such as shock and arc flash hazards
- Improve inefficient system designs and equipment applications
- Maximize system efficiency and make your facility more cost-effective
- Integrate the latest smart grid solutions and renewable energy technologies into your power system

Eaton's Electrical Engineering Services & Systems (EESS) offers a comprehensive portfolio of services tailored for every stage of a power system's life cycle and boasts a complete portfolio of engineering, design, analysis, and consulting services.

We can assist at every stage of the power system: from substation and distribution system design to renewable energy and smart grid engineering; from safety and reliability-focused studies to power quality and grounding-related audits and analyses.

With Eaton's help defining strategies for your power system, you'll witness a range of business benefits, from reduced costs to more effective use of capital. Our engineering and consulting services help you manage your power system as a strategic resource that will give you a competitive advantage.



Vast industry experience



Complete North American coverage

Eaton has one of the largest and most experienced team of power system engineers in the industry, with industry-standard software and advanced modeling and analysis capabilities at their fingertips.

Eaton's power system engineers bring extensive skills and expertise to power system analysis and design. Active participation in technical societies such as IEEE and collaboration with a variety of utilities and industries ensures that our engineers are knowledgeable about today's cutting edge engineering techniques.

Eaton's large U.S. and Canadian team of engineers includes professional engineers in most states and provinces. They provide professional engineering, design, analysis, and consulting services, for systems ranging from low voltage to over 345kV, that focus on understanding your requirements and setting strategies for your power system to satisfy your business needs.

With an emphasis on precision and accuracy, Eaton's engineers provide a focused and systematic approach to enhance your system's performance and

ensure that your electrical systems operate more reliably, efficiently and safely.

These engineers include authors of industry standards and have years of experience engineering and analyzing systems containing multiple manufacturers' equipment.

Traditional engineering & analysis offerings

We offer more than 15 standard and specialized power system studies to precisely target specific power issues, utilizing a variety of measurement instruments and specialized analysis software packages.

Power system studies offer the most focused and systematic approach available to enhance power system performance and identify inefficient system designs, incorrect equipment selection, and potential problems between your equipment and the rest of the power system. Our traditional engineering and analysis offerings include:

Short-circuit analysis

Calculates the available short-circuit currents at equipment locations throughout the power system. Evaluation of equipment ratings ensures equipment can withstand, and, where applicable, interrupt an electrical fault. Results are critical for proper system design, including specification and selection of equipment. If the study reveals problems,

the study will recommend changes to improve system performance.

Protective device coordination

Determines the characteristics, ratings, and settings of overcurrent protective devices that will ensure that the minimum unfaulted load is interrupted when the protective devices isolate a fault or overload anywhere in the distribution system. In addition, the devices and settings are selected to provide satisfactory protection against overloads on equipment and interrupt short circuits as rapidly as possible. The coordination study evaluates protective relay characteristics and settings, fuse ratings, and low-voltage circuit breaker ratings, characteristics, and trip settings.

Arc flash analysis

Calculates arc flash hazards associated with energized work at locations throughout the power system in accordance with NFPA 70E, IEEE1584, National Electric Safety Code, and CSA Z462 requirements. Calculations include flash protection boundary and incident energy, with the resulting information being provided on arc flash warning labels to be installed on the distribution system electrical equipment.



Load flow analysis / power factor correction study

Analyzes the system capability to supply the connected load under steady state conditions, determination of appropriate continuous ratings for electrical equipment, and optimal placement and characteristics of reactive power compensation equipment. If the study results indicate that power factor correction equipment is necessary, the appropriate hardware will be properly specified and located to maintain desired power factor at the metering point.

Motor starting study

Evaluates the motor's impact on the power system and the power system's impact on the motor. Motor starting studies are typically performed for new motor installations to insure system reliability, provide data for motor protection, and to identify any system modifications that may be necessary to avoid starting problems. The study will recommend solutions, such as reduced voltage starting techniques, to address any problem discovered.

Power quality site surveys & disturbance monitoring

Evaluates the equipment malfunction and the incompatibility between the source of power and the load. This ensures the powering and grounding of sensitive electronic equipment in a manner that is suitable to the operation of that equipment. Evaluation includes any power disturbance event that poses a threat to the continuous operation of the equipment in question. After completion of the site survey, the power system engineer will identify any system problems and recommend action for their elimination. Recommendations typically include uninterruptible power supplies, power conditioning devices, automatic transfer switches, and/or standby generation to assist sensitive electronic equipment to ride through power system disturbances.

Field harmonic measurements

Determines the sources and magnitudes of harmonic currents and voltages that are present in the electrical power system. Measurements are used to

verify harmonic generation from all significant harmonic sources and demonstrate the effect of system resonance caused by power factor capacitors. Power system engineers use the recorded measurement data in the analytical modeling of the system.

Harmonic analysis study

Calculates system harmonic voltages and currents throughout the electrical distribution system. This determines the effect of adding harmonic producing loads into a system. If the calculated magnitudes of harmonic voltages and/or currents are excessive, engineers will determine the optimal corrective solution to reduce the harmonic quantities to within acceptable limits. When a harmonic filter is recommended, a complete equipment specification will be developed. A study case will be conducted to verify that the harmonic filtering equipment will reduce harmonic levels to within acceptable standards.

Advanced offerings

Advanced design and analysis

In addition to our traditional offerings, we offer several advanced design and analysis options.

Our advanced design and analysis offerings include:

Distribution systems reliability analysis

Evaluates the present statistical availability of the power system down to the level of the critical components and loads. The present state of the existing protective equipment is evaluated according to the age of the equipment and the present methods of and frequency of equipment maintenance. Knowing which equipment needs to be protected and which can be protected at a lower level are key elements to insuring maximum return on investment (ROI). Recommendations will include upgrading critical elements of the power system, modernizing the system or simply rehabilitating the system in the most cost effective method of improving the reliability prior to a failure.



Distribution system design

Design and specification of the electrical distribution system from the point of interconnection to generation equipment.

Substation & ground grid design

Complete substation design service is available, including ground grid analysis and design, substation layout, equipment specification, protection, and control.

Protection & control design

Design of advanced electrical protection and control including transmission line protection, system automation, advanced metering and smart grid capabilities.

Transient stability study

Evaluates dynamic behavior of the renewable source and system voltages during transient conditions such as system faults or start-up. Typical recommendations include details of the load shedding scheme, including the sequence of load separation, critical clearing time, and type of relay.

Switching transient analysis

Analyzes system behavior during switching conditions to identify possible damaging voltage transients. An insulation coordination study, which compares surge arrester ratings with equipment BIL, will be completed to confirm the recommended surge protection system for the circuit being investigated. Results are used to design and specify mitigation equipment such as snubbers.

Dynamic simulation

Models and simulates interaction between the power system and controlled devices (inverters, generators, motors, etc.) in response to various system conditions. This analysis is often performed in conjunction with Eaton's design of alternative energy and battery storage systems. Results may be used to modify control parameters and enhance system design.

Specialized applications

Eaton's engineering expertise extends beyond traditional power systems. Current and past projects include development and application of battery storage systems, electrical design and analysis for wind and solar energy projects, and implementation of Smart Grid and Micro-Grid concepts for utility, military, and institutional clients.

Training

Our training group offers both standardized and customized training programs that reflect the full range of electrical power system engineering disciplines, including:

- Arc Flash & Electrical Safety
- Protection & Coordination
- Protective Relay Application
- Harmonic Analysis
- Motor Starting Analysis
- Power Quality & Grounding
- Power Quality Monitoring
- Distribution System Analysis
- Substation Design

Courses related to field engineering, maintenance and testing are also offered and include:

- Basic Electrical Testing
- Protective Relay Testing
- Insulation Testing and Evaluation
- Switchgear Maintenance
- Transformer Maintenance
- Electrical Equipment Maintenance
- Motor Control Center Testing and Maintenance
- Maintenance of AC Motors

Market segment coverage

- Institutions & Educational Facilities
- Healthcare & Lodging
- Commercial Office
- Retail Facilities
- Government and Public Facilities
- Industrial Facilities
- Airport Terminals
- Data Centers
- Ports & Marinas
- Utility Transmission & Distribution Systems
- Power Generation Facilities
- Independent Power Provider

Summary

With Eaton's help defining strategies for your power system, you'll witness a range of business benefits, from reduced costs to more effective use of capital. Our engineering and consulting services help you manage your power system as a strategic resource that can give you a competitive advantage.



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Printed in USA
Publication No. BR02703001E/MSC10037
April 2014

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