

Engineering Services & Systems

Contents

Description

Engineering Services & Systems Overview	
Power System Engineering	J-2
VR-Series Medium Voltage Vacuum	
Replacement Circuit Breakers	J-3
Class 1 Reconditioning of power circuit Breakers	J-3
Automation Services Group	J-4
Predictive Diagnostics	J-5



Eaton Offers a Wide Range of Products and Services



Engineering Services & Systems Overview



Eaton Offers a Wide Range of Engineering Services

You've just seen the innovative and powerful products that Eaton offers. Now take a look at their total solution organization — E ESS.

Eaton Engineering Services & Systems is a one-stop, power strategy source focused on integrating and maintaining power quality. These performance-driven specialists bring a new level of confidence to the customer by adding a one-year warranty to any Cutler-Hammer product that they install.

The E ESS team is available 24 hours a day, 7 days a week, providing an unrivaled array of services. One of the services, Predictive Maintenance, includes non-destructive testing and monitoring technologies to assess the condition of medium and high voltage electrical equipment. Another vital service within E ESS is Disaster Control. One call to 1-800-498-2678, and a group of relief engineers can be assembled, in most cases, within 48 hours with the sole purpose of bringing electrical systems back on-line quickly.

The Power Systems Engineering group of E ESS provides methodical testing practices to Eaton and their customers. Studies on safety, reliability, power quality, and energy management ensure consistent system configuration.

The E ESS Power Breaker Centre can extend the life of switchgear products with the VR Series, a replacement solution for older, air magnetic circuit breakers. These brand new Medium Voltage Vacuum Replacement (MVVR) breakers are completely interchangeable with original breakers without causing mechanical or electrical modifications. Older breakers can be reconditioned

through E ESS's Aftermarket Centres of Excellence. Their six-step state-of-the-art Class 1 reconditioning process can raise breakers to a new standard.

With their Automation Services Group, E ESS can provide system design, programming, panel building, installation, project management, start-up, customer training and complete documentation — integrating Cutler-Hammer and all major OEM's hardware, software and systems.

With their reputation as the best-in-class power solution strategists, it is obvious why more and more industry leaders are turning to E ESS for uncompromising safe and reliable electrical power distribution systems. The following will provide you with detailed information on how Eaton's Engineering Services and Systems group is the authority on electrical system start-up, design, reconditioning, and power crisis intervention.

Power Systems Engineering



Our Power Systems Engineers Can Perform On-Site Studies

Power Systems Engineering is comprised of 30 power systems engineers. A core group is located in Pittsburgh, PA and the remainder of the engineers are located throughout the USA and Canada. The PSE charter is to provide analytical services to Eaton and their customers through power system studies and on-site investigations.

Study Benefits

- Protect expensive equipment and investments
- Prevent expensive downtime
- Minimize capital equipment expenditures by setting priorities

- Facilitate maintenance, training, and troubleshooting by developing the single-line diagram

Types of Studies?

- Safety and Reliability
- Power Quality
- Power Flow/Energy Management

Safety and Reliability Studies

- Short Circuit and Protective Device Evaluation
- Protective Device Coordination
- Power System On-site Investigations
- Grounding/Ground Grid Design

When are Safety and Reliability Studies Needed?

- New distribution system design or addition of loads or processes
- Changes to utility supply
- Major outages and/or nuisance trips
- Voltage elevation between grounded components

Power Quality Studies

- Power Quality Site Surveys
- Effective Grounding Evaluation
- Electrical Disturbance Monitoring
- Harmonic and/or Transient Analysis

When are Power Quality Studies Needed?

- Process misoperation or shut-down
- Product misapplication
- Component overheating or failure
- Nuisance tripping
- Metering inaccuracies

Power Flow/Energy Management Studies

- Load Flow and Power Factor Correction
- Motor Starting
- Transient Stability
- Energy Monitoring and Management
- Power System Design

When are Power Flow and Energy Management Studies Needed?

- Identify reserve transformer capacity
- Correct power factor to avoid utility penalties
- Predict energy requirements and identify energy savings
- Verifies feasibility of contingent system configuration and operation

July 2008

VR-Series Medium Voltage Vacuum Replacement Circuit Breakers



We Can Replace Your Vintage Air Magnetic Breakers With New Vacuum Breakers

Product Description

New Replacement Breakers from the Ground Up

VR-Series Medium Voltage Vacuum Replacement (MVVR) breakers are designed, manufactured and fully tested to be functional electrical and mechanical replacements for most manufacturers' original air magnetic circuit breakers. All parts are new. No reconditioned components are used to manufacture the VR-Series of Medium Voltage Vacuum Replacement Circuit Breakers.

Interchangeable with Original Breakers

Most VR-Series MVVR breakers are directly interchangeable with the original air magnetic breakers they replace without any mechanical or electrical modifications. If cell structure modifications are required, they are reversible.

Limited Outage Required

Since the breakers are new, only one outage is required for installation.

Cost-Effective Switchgear Life Extension

VR-Series MVVR breakers are cost-effective when upgrading and extending the life of existing switchgear. Replacement breakers average 30-35% of the total cost of removing old switchgear, preparing and re-installing new switchgear and replacing cables. New switchgear may not be an option at many locations due to space limitations. MVA upgrades are also possible within the same physical envelope (bus bracing analysis and additional bracing may be required).

Features and Benefits and Functions

Yellow Zinc Di-chromate Plated Frames

Plated frames provide a positive path for all frame components to ground and resist corrosion.

Modern Insulation Components

GPO-3 glass-reinforced polyester insulation is used on 5 kV models. Primary bushing insulation is made from cycloaliphatic epoxy materials for all molded bushings on both 5 kV and 15 kV models. Cycloaliphatic epoxy is durable, has high dielectric strength and is easily cleaned.

Non-Sliding Current Transfer System

Eaton's patented current transfer system uses a mechanically swaged method to accomplish the connection between the vacuum interrupter stem and the primary conductors. The system forms a permanent, maintenance-free connection.

Proven Cutler-Hammer Vacuum Technology

The vacuum interrupters and mechanisms that are used in the VR-Series of MVVR breakers is the same proven system that has been applied in thousands of vacuum breakers throughout the world for over twenty years.

Sure Close MOC Technology

Many circuit breakers require additional contacts (Mechanism Operated Contacts — MOC) 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 sixteen times the kinetic energy to the MOC switch. The increased forces can damage the existing MOC switch and cell components and in some cases even stall the breaker when trying to close. Patented SURE CLOSE MOC Technology balances the speed and force of the breaker's MOC operator to prevent stalling and damage to the cell and MOC switch.

Service Before, During and After the Sale

Eaton's Engineering Services and Systems (E ESS) group provides analysis and assistance in selecting, commissioning and servicing VR-Series breakers. Power System studies validate the selection of proper breaker ratings to protect customers' distribution systems. Commissioning, a requirement for all medium voltage breakers, ensures

the interface and installation of the breakers in the existing cells. Continued factory maintenance and service guarantees VR-Series breakers for a lifetime of dependable service.

Product Offering

Cutler-Hammer 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
- McGraw-Edison

The breakers range from 5 kV @ 250 MVA through 15 kV @ 1500 MVA and are available in 1200A, 2000A and 3000A ratings. All models are designed and tested to meet applicable IEEE/ANSI C37 standards for new breakers and IEEE/ANSI C37.59 for breaker-to-cell interface.

Class 1 Reconditioning of Power Circuit Breakers



Pow-R-Master Software Database Tracking Can Save You Money and Time

Recondition With Reliability

Eaton is setting the standard of reliability with a Class 1 reconditioning process that involves total breaker disassembly, material specific component cleaning, detailed inspection, and state-of-the-art testing, all done to uniform documented specifications.

Class 1... The New Standard from Eaton.

Eaton maintains your breakers to the manufacturer's published technical information utilizing the most advanced equipment, processes, and testing standards. Eaton Class 1 reconditioning is a six-step process:

- Inspecting and documenting breakers received
- Disassembling the breaker to its component level
- Carefully cleaning, inspecting and replating (if necessary) each component
- Reassembling the breaker using the manufacturer's information
- Operating and testing the breaker to manufacturer's and ANSI standards
- Tracking each breaker's history in our POW-R-Master database

Class 1 Reconditioning

- Is done in focused, dedicated facilities called ACEs (Aftermarket Centres of Excellence)
- Utilizes task specific cleaning and testing equipment
- Is done by certified technicians that have completed formalized training
- Uses the Pow-R-Master Software Suite
 - A library of all manufacturer's published literature
 - An experience knowledge database of breaker assembly
 - Specialized test and analysis software
 - Permanent record of your breaker's tests
- Has standardized and documented processes and procedures.

ACEs have a large stock of breakers that can be loaned to customers while theirs are being Class 1 reconditioned.

Automation Services Group



We Ensure Your Hardware, Software and Communication Networks Perform as a Seamless System.

The Automation Services Group (ASG) is a full-service systems integrator with proven expertise in power systems applications and material handling applications in the beverage, aggregate and warehouse industries. ASG provides a unique alternative to conventional manufacturer-integrator-contractor teams by:

- Offering project management and single point responsibility direct from a major control manufacturer.
- Focusing on specific industries to develop real application expertise.
- Focusing on applying new Eaton products effectively and appropriately and integrating seamlessly with all major manufacturers' equipment.
- Bringing Eaton-wide resources into a project to address geographic and technical challenges, and managing third-party integrators and manufacturers to handle products and services not addressed by Eaton.

ASG provides turnkey systems integration projects including system design, programming, panel building, installation, project management, start up, customer training and complete documentation — integrating Cutler-Hammer and all major OEM's hardware, software and systems. Following is a summary of services:

Power Systems Applications

- Power Monitoring, Management, and Control Systems
- Cutler Hammer — IQ, PowerNet, and existing IMPACC Systems
- Energy Cost Allocation
- Lighting Management Systems (Cutler-Hammer Pow-R Command)
- Load Management Systems
- Load Shed and Load Transfer Schemes
- Demand Management Systems
- Generator and ATS System Monitoring and Remote Testing
- Utility Rate Plan Optimization
- Healthcare Emergency Power Supply Systems Monitoring
- Energy Reporting and Analysis Services
- Web-based monitoring services

Material Handling Applications

- High speed beverage line automation
 - Glass bottles, PET (Plastic) bottles, cans
 - Integration of all line equipment

(blow mold/depalletizer, rinser, filler, labeler, capper/seamer, case packer, case conveyor, palletizer, etc.)

- Speed and efficiency optimization for overall line
- Quarry automation — new and retrofit
 - Reduced wiring and faster installation and modification using DeviceNet MCCs
 - Optimized production and reduced operating costs using:
 - Crusher feeder control
 - Automatic start up and shut down conveyor sequencing
 - Data for report generation, power monitoring
 - Reduced downtime using:
 - Alarm and trip diagnostics,
 - Zero speed switch indication,
 - Remote monitoring for technicians
 - Graphical screens for operator
 - Surge suppression and UPS
 - Single-point controls responsibility and project management to ensure satisfaction
- Warehouse conveyor automation
 - Reduced wiring and faster installation, modification and expansion using DeviceNet
 - Simplified interface to Warehouse Management Systems (WMS) from PC controller
 - Reduced maintenance costs using:
 - Diagnostic and alarm information on graphical operator screens
 - Remote monitoring for technicians
 - Single-point controls responsibility and project management to ensure satisfaction

General Capabilities

- System design — functional specification
- System Network Architecture
- CAD Drawings
- PC Control and Open Automation
- DeviceNet Applications
- PLC Design and Programming
 - Cutler-Hammer
 - Allen Bradley
 - Modicon
 - GE Fanuc
 - Siemens

July 2008

- Human-Machine Interface/Graphical User Interface Design and Configuration
 - Cutler-Hammer PanelMate and PanelMate PC
 - Genesis
 - Wonderware
 - Intellution
 - PanelView and RS View
 - Citect
 - Cimplicity
- Full Service Custom Panel Shop
 - UL Listing for Industrial Control Panels
 - Motor Starter Panels
 - PLC Enclosures and Operator Consoles
 - Design and Testing
- Turnkey Capabilities
 - Project Management
 - Contractors, systems integrators, other OEMs, etc.
 - Installation
 - Startup and Commissioning
 - Instruction Manuals
 - Customized Training
 - Complete Documentation
 - Service contracts and maintenance agreements
 - Single-point responsibility

Predictive Diagnostics



On-Line Monitoring and Partial Discharge Analysis

Eaton's Predictive Diagnostics group offers non-destructive testing technologies and sensors to assess the condition of medium and high voltage electrical equipment.

Partial Discharge Analysis (PDA)

Advanced ON-LINE assessment methods applied to operating equipment to diagnose the condition of insulation and to detect electrical problems (for equipment rated over 4000V). Ultra-sensitive 8-Channel Universal Partial Discharge Analyzer (UPDA) with total digital noise rejection is used to process and analyze data from Partial Discharge Sensors. This new breakthrough universal technology is applied to the following equipment, using our permanent PD sensors, therefore allowing for ongoing condition assessment during on-line operation:

- Motors/Generators (RTDs are used as sensors!)
- Switchgear Systems
- Bus Ducts
- Transformers
- Gas Insulated Substations
- Splices and Terminations of Cables

Vibro-Acoustic Analysis (VAA)

On-line/off-line assessment method applied to operating equipment. Special algorithms analyze vibration signal to detect shock vibration processes and identify looseness of the core and windings. Temporary sensors are used to assess:

- Transformers

Transformer Monitoring System

Continuously monitors changes in Power Factor and Capacitance in transformer bushings (it's like having a continuous on-line Doble test with TRUE electrical stress and temperature!).

Our comprehensive transformer monitoring system incorporates permanent Partial Discharge Sensors to timely detect a wide range of electrical problems (PDs, surface tracking, arcing, sparking) in bushings, winding insulation, core, laminations, tap changer connections, ground connections, pressboard barriers, etc. Ideal system for critical transformers or to keep your troublesome unit out of trouble!

Implementation of Eaton's Predictive Diagnostics provides an analysis of your critical equipment to reduce the risk of failure and increase uptime:

- **Partial Discharge Monitoring** — detects insulation deterioration and reveals developing problems.
- **Vibro-Acoustic Analysis** — detects winding vibration that leads to accelerated aging of insulation.
- **Transformer TMS Monitoring System** — continuously detects bushing insulation degradation to prevent transformer failure, and detects internal partial discharge activity during periodic PD measurements.
- **Transformer Partial Discharge System** — allows for periodic PD measurements to determine the condition of the insulation, causes of internal gassing, and general transformer health.

Valuable information about equipment condition allows optimal and timely Predictive Maintenance actions to prevent insulation breakdown and equipment failure at a low cost (as part of an RCM — Reliability Centered Maintenance program). We invite you to browse through our web site at www.partial-discharge.com. Should you require more information, we can provide copies of our technical papers on the subject presented at IEEE, EPRI, CIGRE and Doble conferences.

Canadian and United States Region Operations Centres and Major Offices

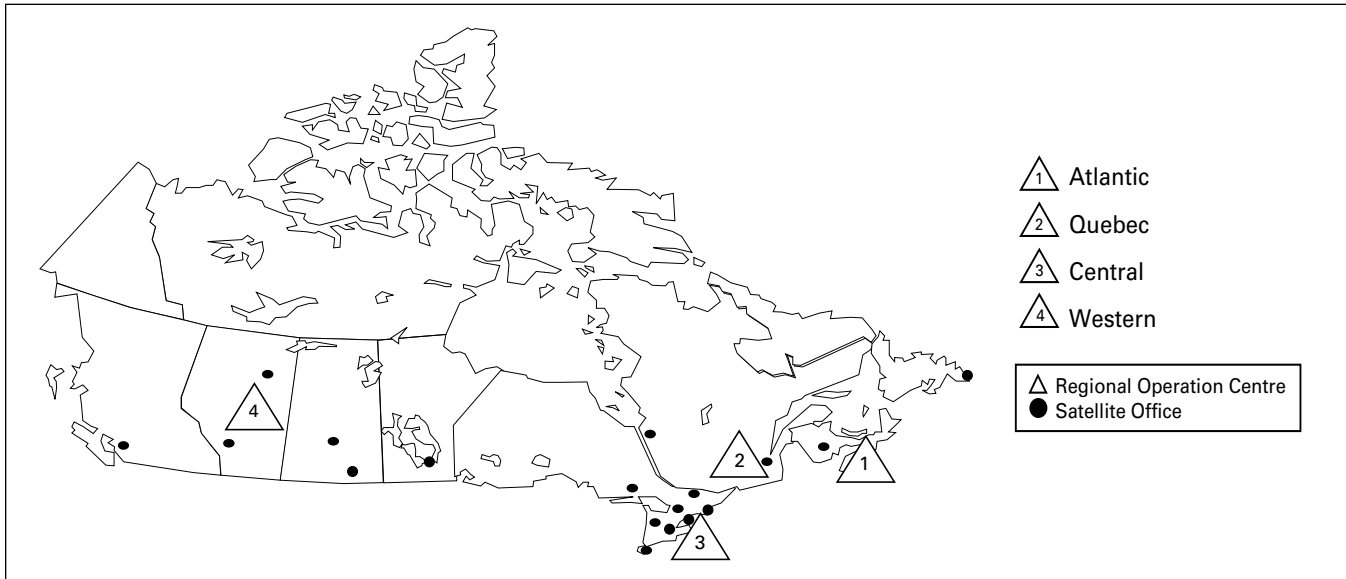


Figure J-1. Canadian Service Locations



Figure J-2. U.S. Service Locations