LET'S BE PACIFIC™

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Introducing MAVRiC® Magnetically-Actuated Vacuum Interrupters With Visible Disconnects

Figure 1. The ultra-compact MAVRiC® incorporates visible disconnect and vacuum interrupters on a common frame. Manual operation of the visible disconnect takes place on the side of the switchgear.

With a history of nearly 55 years of innovations for the electric power industry, MAVRiC®, Federal Pacific's latest product offering, was recently given its introductory unveiling at the 2012 IEEE Power and Energy Society Transmission and Distribution Conference & Exposition held May 7-10, 2012 in Orlando, Florida. MAVRiC® is the air-insulated, modular, configurable, resettable vacuum interrupter with an integral visible disconnect and operating mechanism that is suitable for virtually any switching and protection application on underground distribution systems.

MAVRiC® is air insulated

- replaces switches and fuses with resettable vacuum interrupters
- eliminates the environmental and health concerns associated with SF6 gas and liquid dielectrics
- no leaking insulating medium to compromise the dielectric integrity
- provides an easy to see and clearly discernible visible disconnect, which is the most desirable operational feature needed when vacuum interrupters are utilized
- isolates the vacuum interrupters from the environment

MAVRiC® offers greater load switching and short-circuit interrupting capabilities

- provides higher continuous currents
  - To 1000 amperes at 15kV
  - To 800 amperes at 25kV
- higher short-circuit ratings
  - To 20,000 amperes at 15kV
  - To 16,000 amperes at 25kV
- greater load switching frequency
  - 50,000 operations at 15kV
  - 30,000 operations at 25kV
- greater mechanical no-load switching frequency

MAVRiC® is modular

- all components are on an integral compact heavy-gauge steel frame
- size is minimized using insulating sleeves and covers
- designs to match the footprint of conventional air-insulated dead-front pad-mounted switchgear
- visible disconnect is interlocked with the vacuum interrupters - opening the visible disconnect trips a closed vacuum interrupter, open; the vacuum interrupter can't be closed if the visible disconnect is open
- visible disconnect is operated from the side of pad-mounted switchgear enclosures
- visible disconnect is operated from the front of metal-enclosed switchgear enclosures

MAVRiC® can be configured in a variety of enclosure styles

— mild steel or stainless steel
— dry-vault arrangements
— dead-front pad-mounted switchgear enclosure styles
— in compact metal-enclosed switchgear enclosure styles that require half the space of conventional size metal-enclosed switchgear

MAVRiC® can be configured in various switching and protection packages

— in virtually any circuit configuration
— in 2, 4, 5 or 6 ways
— in single-bay or multi-bay metal-enclosed switchgear lineups
— in unique customer-specific Custom Solutions configurations too

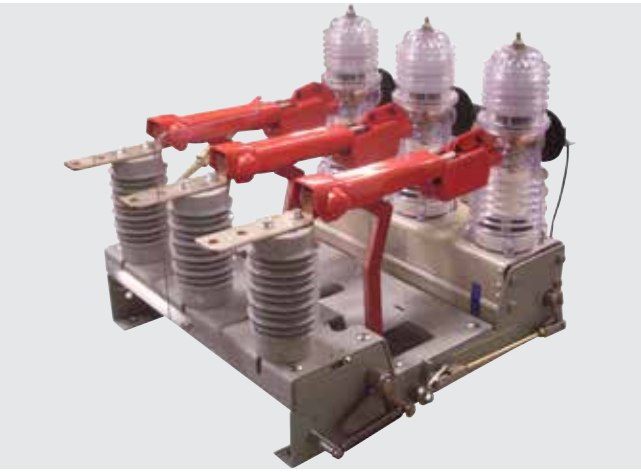

Figure 2. Solid-material housing shielding the vacuum bottles and conformal, insulating sleeves on disconnect blades and hinges make possible the ultra-compact modular MAVRiC® arrangement.

Figure 3. Viewing windows are provided to allow inspection of the blades of the visible disconnect to verify the integrity of the visible open gap.

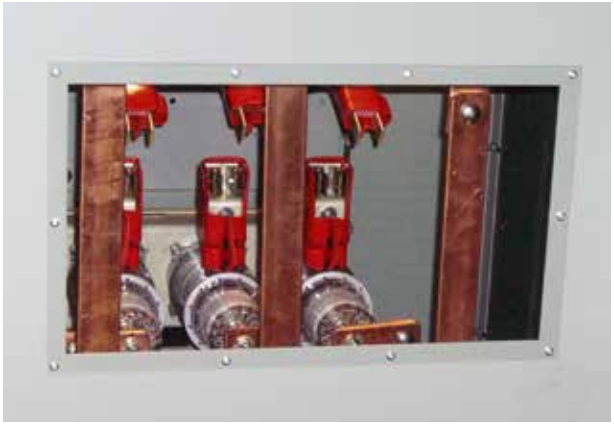

Figure 4. The visual open established by opening the visible disconnect is easy to identify.

Figure 5. A Custom Solution configuration of four MAVRiC® units is arranged in a vertical orientation (at left) to match available space in an existing above-grade uncovered vault and to replace SF6 gas-insulated equipment that was prone to leaking and vulnerable to the environment. The relay and control package (at right) is designed to be wall-mounted independent of the switchgear and is also provided with a symbiotic hand-held controller to allow local operations to be performed outside the vault and outside the arc-flash boundary, allowing for maximum security for operating personnel.

MAVRiC® can be combined with a variety of relay and control packages

— with an economical self-powered relay
— with traditional relays
— relays and controls integral to the switchgear
— or relays and controls in free-standing pedestals
— with symbiotic hand-held controllers to take you out of the arc-flash hazard zone when initiating local operations

MAVRiC® utilizes magnetically-actuated vacuum fault interrupters

— for fast operation
— for automation without requiring a motor operator
— for long service life without maintenance
— for dependable operation without requiring any adjustment

MAVRiC® can be utilized in equipment types suitable for most every application

— in conventional pad-mounted and metal-enclosed projects
— in portable, skid-mounted or fixed substations
— for smart-grid underground distribution feeders
— for pad-mounted capacitor banks
— for renewable energy grid interconnects – Solar, Wind and Biofuel

In each of the foregoing equipment types and applications MAVRiC® is selected because of its ability to perform one or more of the following functional capabilities:

- to sectionalize primary feeders
- to protect transformers and load circuits
- to carry and interrupt higher continuous currents
- to carry and interrupt higher short-circuit currents
- to perform frequent switching operations whether load switching or fault interrupting

MAVRiC® can be automated

— all of the foregoing functional capabilities are equally applicable to automated distribution applications

— automatic source transfer – functions initiated independently based on on-board programmed intelligence
  • to insure power to critical loads
  • to initiate generator startup
  • to perform totally self-contained stand alone switching and protection functions

— remote-supervisory control SCADA functions initiated based on man/machine interface decisions
  • to allow system reconfiguration
  • to balance feeder loading
  • to initiate outages for service maintenance
  • to disconnect interruptible-rate power users
  • to obtain real-time status of system conditions
  • to isolate faulted sections and restore power to unaffected sections
  • all requiring direct interface by operating personnel

— for automatic sectionalizing in sophisticated self-healing schemes – functions initiated based on the conditions identified and interpreted among the involved units
  • to detect system disturbances using distributed assets
  • to identify and locate the condition among the units in the scheme with peer-to-peer communication
  • to automatically isolate faulted sections
  • to automatically restore power to unaffected loads
  • all accomplished without any man/machine interface

Figure 6. Controls for MAVRiC® units equipped for automatic source transfer utilize the SEL-451 preprogrammed with Federal Pacific software developed to provide all the functionality, including field programmable timer settings, and voltage and current level pick up and dropout settings. MAVRiC® utilizes magnetically actuated vacuum interrupters so that motor operators are not required for automatic transfer operations to be performed. In addition to the capability to operate both MAVRiC® units even when one power source is lost, the control package for automatic source transfer includes a UPS to insure that control functionality is maintained even when both sources are lost.

MAVRiC® offers two ideal choices for overcurrent protection

— self-powered relays, which do not require a separate control-power source
  - control-power is derived from the output of CTs, which also provide sensing for the overcurrent protection scheme
  - a magnetic latch

– actuated by the relay when the overcurrent is sensed and trips the vacuum interrupter open to clear the fault
  - the magnetic latch is manually reset following the fault
  - the relay features a choice of both fuse curves and relay curves so that coordination is easy to achieve
  - adjust the dip switches to select the desired TCC curve
  - dial the rotary pointer to the desired continuous current trip setting
  - position the CTs on the cables

— SEL-501 Dual Overcurrent Relay
  - favored by some electric power utilities for reliability and service
  - utilizes a control-power source
  - utilizes a UPS to make certain the relay is always powered up even when source voltage is lost
  - supports two load-feeder circuits
  - includes current transformers

MAVRiC® is suitable for application in all market segments and settings

— for utility electric power distribution infrastructure
— for industrial complexes and waste water treatment facilities where concentrated blocks of power are utilized
— for commercial developments – data centers, malls, and office buildings wherever power is distributed and consumed
— for hospital, medical complexes and primary care facilities with critical loads
— for campus style installations – colleges and universities as well as military installations and prisons
— for renewable and recyclable energy markets

MAVRiC® has a place wherever electric power is produced, distributed or consumed. Explore the world of MAVRiC® with every customer visit. Discuss how it is installed in various switchgear products. Promote customer interest and answer questions about its capabilities and ratings, along with its potential for application on all types of power distribution systems. And, explore other aspects of the design or other configurations with the customers too – Custom Solutions is available to solve those requests. MAVRiC® has the flexibility to meet virtually any application need — show them how.

Figure 7. The self-powered relay components include (1) the relay that provides all the settings and controls necessary to initiate vacuum fault interrupter operations based on the programmed parameters; (2) the magnetic latch that provides mechanical trip actuation of (and is physically mounted on the frame of) the vacuum fault interrupter; and (3) the current transformers that provide sensing and power input to the relay and trip circuits and that are mounted on the power cables.

Figure 8. The overcurrent protection scheme implemented with the SEL relay includes (1) the SEL-501 Dual Universal OCR, which handles two load feeders; (2) a fused voltage transformer to provide control power for the relay and MAVRiC® units; (3) a UPS for backup power if control power is lost and (4) current transformers to sense the overcurrent condition and provide that input to the SEL relay for interpretation and action.