Switchgear “Virtual Main” Arc Flash Mitigation System

Reduce Arc Flash Energy on Low-Voltage Switchgear

Low-voltage switchgear and switchboards can be subjected to dangerous levels of arc flash incident energy when fed directly from a power transformer. **Schneider Electric™ Services** offers an arc flash mitigation solution to upgrade unit substation equipment with the addition of a virtual main system. This new concept reduces the arc flash energy on the entire low-voltage switchgear, including the main incoming section. Other solutions do not protect the entire lineup.

Overview of the Virtual Main System

A digital relay and overcurrent sensing is added to the low-voltage side of the service transformer and is designed to trip an existing upstream fault breaking device, often a medium-voltage circuit breaker or other vacuum interrupter.

Components of the Virtual Main Arc Flash Mitigation System

- An engineering study to evaluate the optimum settings for the relays and circuit breakers in the unit substation.
- A switching device with fault interruption capability on the high-voltage side of the service transformer. If the high-voltage disconnecting device does not have fault interrupting capability, a circuit breaker or other vacuum interrupter can be retrofit in place (as shown in the photo to the left and described at the bottom of page 2).
- Three relaying class current transformers installed on the secondary side of the service transformer in the transformer compartment.
- A self-contained relay package including a microprocessor-based relay and the necessary terminal blocks, pilot lights, and selector switches.

> *This new concept reduces the arc flash energy on the **entire low-voltage switchgear**, including the main incoming section. Other solutions do not protect the entire lineup.*

Make the most of your energy℠

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A Virtual Main Arc Flash Mitigation System can take **one of two forms**.

The first incorporates a keyed maintenance selector switch which temporarily lowers the instantaneous short-circuit current setting. The maintenance setting lowers the available arc flash incident energy and temporarily forfeits selective coordination. The second form utilizes zone-selective interlocking with downstream branch circuit breakers in the switchgear, which eliminates the need for the maintenance selector switch.

Benefits of upgrading

- Reduces the potential damage from the arcing fault in the LV switchgear.
- Improves the overcurrent protection of the unit substation.
- Provides maintenance mode for arc flash reduction.
- Arc flash energies can be permanently reduced with zone-selective interlocking.
- Built-in fault recording and event reconstruction technology in the digital relay.
- Engineering evaluation of the protective device coordination and arc flash energy to accommodate the normal and maintenance modes.

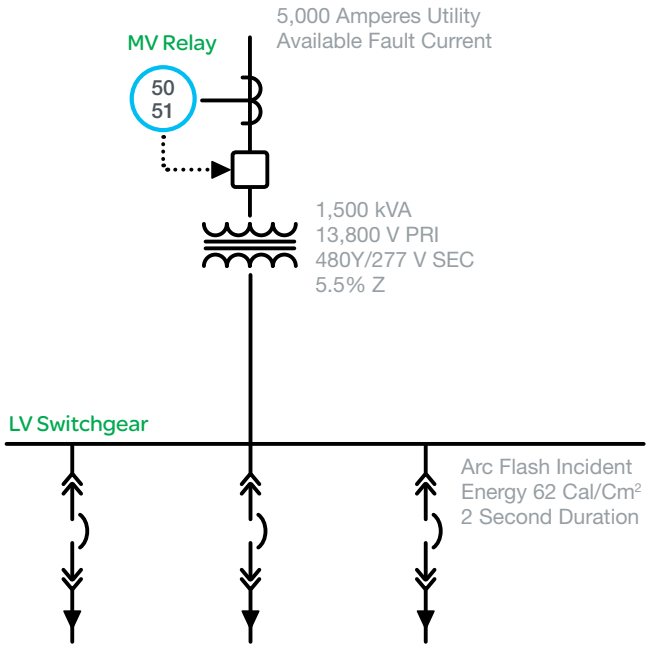
Load Interrupter Virtual Main Replacement

Many unit substations have a metal-enclosed fused interrupter switch, such as the Square D™ HVL switch, on the high-voltage side of the transformer. Schneider Electric Services makes a retrofit solution to convert any brand of these switches to a switch and breaker combination. The Load Interrupter Virtual Main Replacement is available in several different configurations (e.g., front and rear access, front-only access, top or bottom fed, left or right connected) and is customized for your application. The retrofit unit uses a non-fused disconnect switch along with a fixed-mount vacuum interrupter breaker. Various voltages and short-circuit ratings are available. The footprint is designed to fit the footprint of the existing load interrupter switch, simplifying the retrofit. Schneider Electric Services can provide a turnkey removal of the existing metal-enclosed switch and install the Load Interrupter Virtual Main Replacement section.

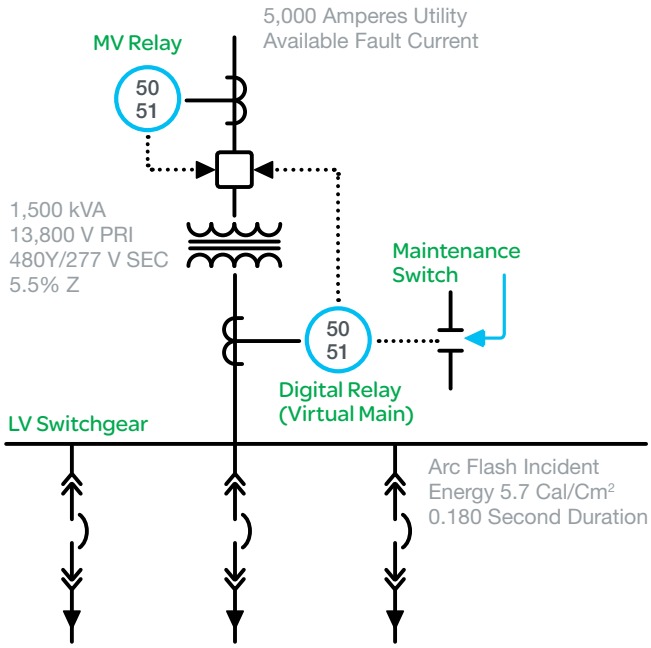
By retrofitting an existing switch with the switch/breaker combination, an interrupting device with shunt trip capability is introduced into the system on the high-voltage side of the transformer. This allows a signal from the virtual main digital relay to open the interrupting device. Options such as infrared viewing windows and UPS are available.

Before and After One-Line Diagrams (Example)

Before: **No Main on Low-Voltage Switchgear**



After: **Addition of Virtual Main**



Reduced arc flash energy is based on the virtual main relay being properly set to below 85% of the arcing current. Protective device coordination study is required.

Additional Solutions for Arc Flash Mitigation

Overcurrent Protective Device (OCPD) Coordination Study

An OCPD coordination study optimizes circuit breaker and relay settings and can be specified as a component of the arc flash study. The speed of operation of the OCPD determines the duration of an arc flash event.

Specialized Relaying Such as Light Sensing Technology

Strategically placed light sensors in switchgear compartments make it possible to sense the arc within a millisecond. Modern relays can sense this condition and trip the appropriate circuit breaker. Other relaying technologies are zone-selective interlocking and differential protection.

Infrared (IR) Windows

IR windows allow you to obtain condition and status information of electrical equipment without the need to remove equipment panels. The complete unit is permanently fitted into electrical equipment and enables infrared inspections to be performed without downtime.

Remote Racking System (RRS)

An RRS allows medium-voltage circuit breaker racking operations to be performed via a control panel located away from the cell, removing the operator from manual contact with the circuit breaker. In addition, an RRS may reduce the PPE Hazard Risk Category because the worker is removed from the flash protection boundary.

Wireless Temperature Monitoring System (WTMS)

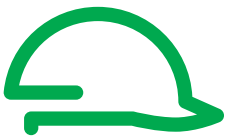
A WTMS allows for easy field installation of wireless sensors into low- and medium-voltage equipment. Sensors can be placed in locations usually not accessible with an infrared camera. They can be installed on equipment with high arc flash ratings, allowing equipment condition to be monitored without the risks associated with removing covers.

Why Choose Schneider Electric Services?

Our registered professional engineers, safety-trained and equipped, will design, specify, install, and commission your upgrade project. We have over 100 professional engineers in various geographic locations who are collectively registered in all the states of the U.S. Recognized as industry experts in power system analysis, design, and codes and standards, many of our engineers are leaders in IEEE, NFPA,® and other power system standard-making organizations.

Our Culture of Safety Helps Mitigate Your Risks

- Our North American Operating Division is the only company to hold the Robert W. Campbell Award (2009) and the Green Cross Award (2011) at the same time.
- Schneider Electric Services has been awarded 15 Operational Excellence Awards, eight Perfect Record Awards, and a Superior Record Award by the National Safety Council.



Arc flash reduction systems **do not eliminate the electric shock hazard** of working on or inside energized equipment. Personal protective equipment (PPE) is required when an arc flash energy reduction system is employed, but the level of PPE may be reduced. The amount of arc flash energy reduction will be determined by the engineering study.

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