

# Vista® Underground Distribution Switchgear: Closing on a Blade Reduces Switching Transients

## Transformer-Switching Transients: Ideal Switching Versus Painful Reality

When switching transformers, the interaction of system parameters (i.e., the upstream grid, switchgear, cabling, transformer, and load) may result in voltage transients that can exceed transformer winding insulation capabilities. Dry-type transformers are particularly susceptible to voltage transients. These transients can damage insulation and result in an internal transformer fault.

An ideal switching device instantly applies system voltage to the transformer terminals when the switch is closed and removes the voltage instantly when the switch is opened. Switches in reality are not ideal: when closing, a switch can experience prestrikes, and contacts can bounce that result in multiple reignitions. Multiple reignitions or restrikes can create transients with frequencies close to internal transformer winding resonance frequencies, leading to internal overvoltages in excess of what is measured at the terminals.

## Vista Underground Distribution Switchgear: Industry-Leading Design

Vacuum interrupters can be particularly susceptible to prestriking, reigniting, and current-chopping. Vista Underground Distribution Switchgear design uses a combination of bladed-switch and vacuum-interrupter technologies that reduce the risk of transformer switching transients. The Vista switchgear's closing design is unique: it does not use the vacuum interrupter as the closing device. Fault-interrupting mechanisms are built with fault interrupters and a separate bladed switch that provides a visible break readily visible through a viewing window. See Figure 1.

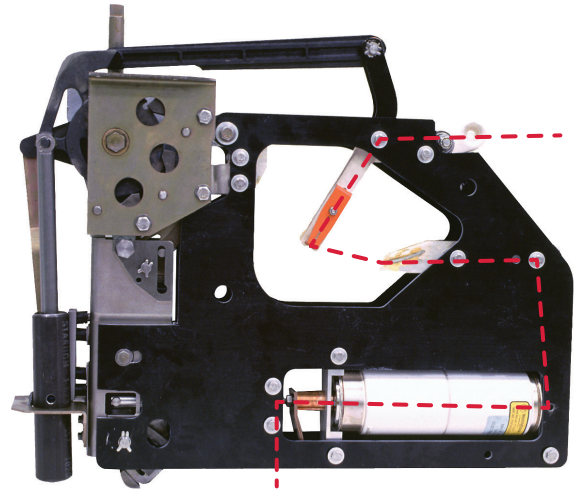


Figure 1. The Vista switchgear interrupter mechanism—vacuum interrupter in series with blade. Current path is shown.



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## Reduce Risk: Close on a Bladed Switch

After current is interrupted in a vacuum interrupter, the interrupting mechanism then resets and closes the vacuum interrupter as a final step once the blade is fully open. See Figure 2. The closing sequence then starts with the vacuum interrupter already closed and the circuit open. See Figure 3. The circuit is then closed on the bladed switch. See Figure 4. This bladed switch provides a clean contact make on closing without bouncing or reignitions.

This design inherently does not result in the types of transients that can be generated when closing a vacuum interrupter. Testing performed at the S&C Advanced Technology Center demonstrated that closing Vista interrupters produced no significant transients. Additionally, while the Vista switchgear still interrupts fault current with vacuum interrupters, additional testing demonstrated the Vista switchgear vacuum interrupter design does not result in chopped currents.

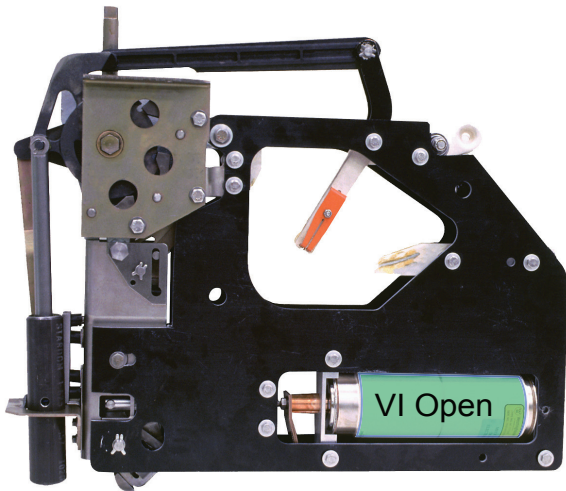


Figure 2. Circuit is open. The vacuum interrupter is open and the blade is moving to the Open position.

## Effective Interrupting Performance

S&C recommends users ask switchgear suppliers about vacuum interrupter switching transient performance when designing transformer switching solutions. Vista switchgear units have been used for transformer switching applications for decades. Most notably, Vista switchgear has been applied in thousands of particularly difficult wind-turbine applications that use dry-type transformers. Switchgear solutions inherently less susceptible to switching transients can greatly reduce risk to transformers. Contact your S&C sales representative to learn more how Vista switchgear reduces risk and to develop effective protection schemes and methods to reduce switching transients for highly inductive or non-linear loads.

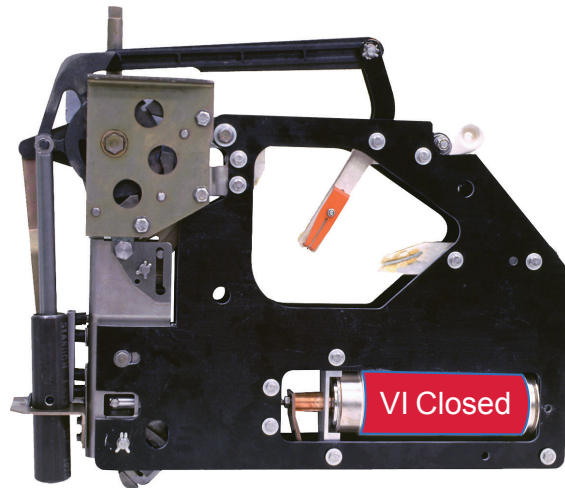


Figure 3. Once the blade is fully open, the vacuum interrupter is reset and closed. The circuit is still open.

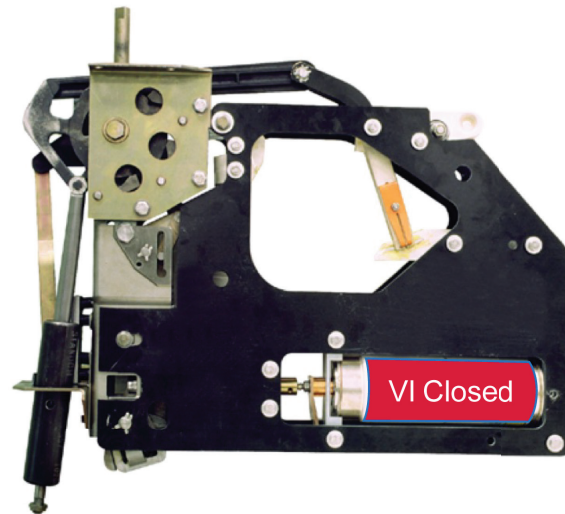


Figure 4. On closing the circuit, the circuit-making current is on the blade.