

Arrester Failure Mode Considerations

That aging arrester may not be as safe as you think

When an arrester experiences an End-of-Life event, the mode in which it fails is a function of the arrester design and the available fault current on the system.

When selecting an arrester whether for a substation or a distribution system, safety and failure mode are a consideration that needs evaluation. In a world where the term “safe” has a constantly changing definition, what was considered safe 30-50 years ago is not necessarily considered safe today.

Pressure relief devices were a common feature on station class and substation type arresters 50 years ago, but not given a second thought on distribution class arrester. However even with pressure relief capability on substation type arresters, the fault current withstand ratings were often 40kA as opposed to the more common rating of 65kA in 2008.

For these reasons, all persons responsible for reliability should consider the impact of aged porcelain silicon carbide arresters on the system reliability and safety.

Overview of an End-of-Life Event on an Arrester

When an arrester experiences an end-of-life event, it becomes a short circuit on the system. When it does so, it conducts all available power frequency fault current through its structure to earth. In doing so, significant pressure build up can be experienced. This

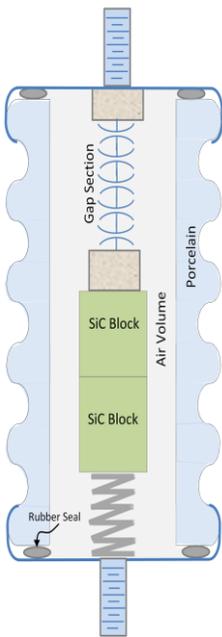


Figure 2 Distribution Type Arrester without Pressure Relief Capabilities

pressure build up is containable if the fault current is just a few amps, but if there is enough fault current, the arrester will need to relieve the pressure one way or another. For arresters with pressure relief fittings, the gas ruptures the internal diaphragm and is vented out the exhaust ports as shown in Figure 3. If the

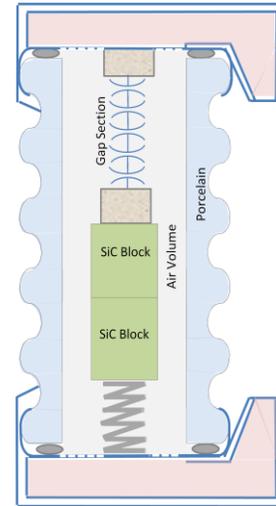


Figure 1 Station Type Arrester with Pressure Relief Capabilities

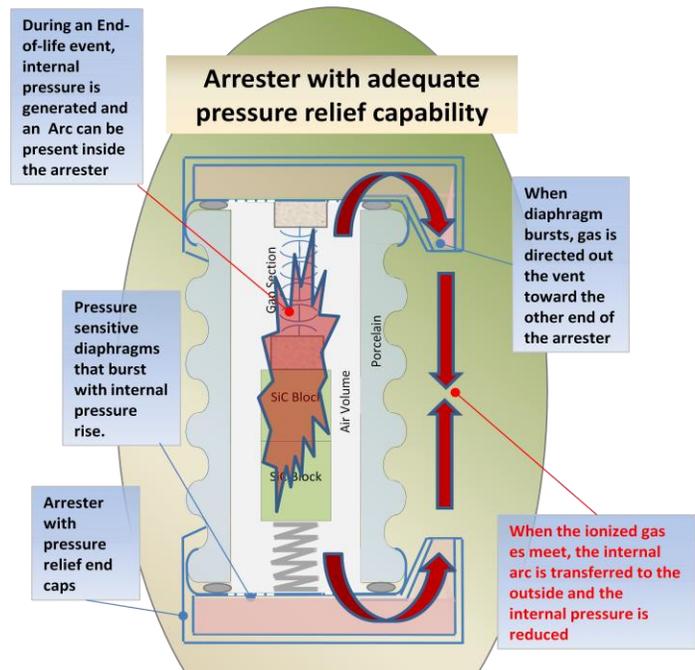


Figure 3: Arrester Properly Venting

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pressure relief devices were designed for 65kA, the arrester will vent 65kA without violent rupture of the porcelain. However if it is not capable of withstanding available fault current, there can be a rupture of the porcelain and a risk of collateral damage to nearby equipment.

When considering the rationale for removing old porcelain arresters, it is important to factor in the potential collateral damage that can be caused by an arrester that does not have a pressure relief rating consistent with the circuit on which it is installed.

When a polymer housed arrester is subjected to an End-of-Life event you can be sure that the arrester will not violently rupture. The far safer failure mode under fault current conditions is a primary reason many utilities have chosen to use a polymer housed arrester. When the event is done, the arrester will still be standing, perhaps in not the best of condition, but it will be together and collateral damage will be at a minimum.

However if porcelain arresters are subjected to the available fault current the results may be like that in Figure 5 and collateral damage is possible.



Figure 4: Typical condition of a polymer housed arrester after withstanding a fault current event.

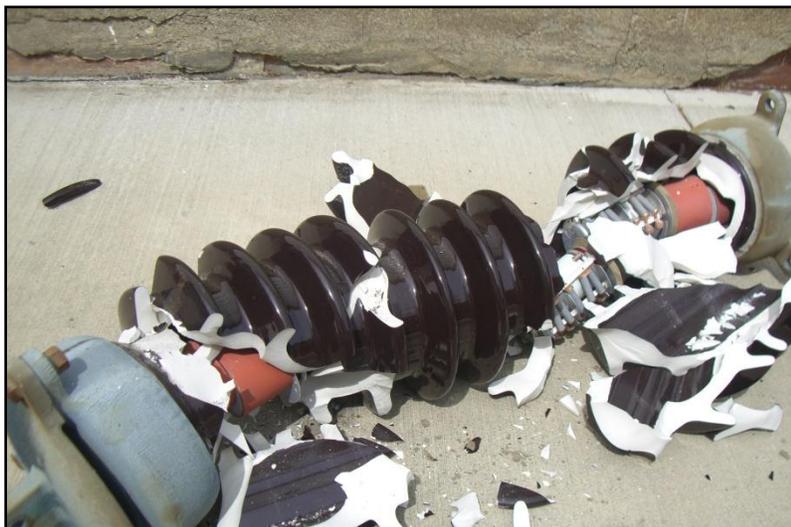


Figure 5: Old Porcelain Silicon Carbide Arrester Ruptured



An Explosive Failure Mode of an Arrester

This example is a real event where fortunately no one was hurt, but certainly could have been.



Somewhere in North America a vintage porcelain distribution arrester failed

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