

SUCCESS STORY

Radiography

Ensuring reliability at minimum outage time and reduced maintenance cost



Hitachi ABB Power Grids high voltage service was hired to perform radiographic inspections of eight breakers for a Pacific Northwest utility in Fall of 2006. Using radiography to perform non-invasive diagnostic testing over traditional inspection techniques, reduced overall maintenance cost.

Shortly before the date the radiography was to take place, the utility removed a Westinghouse 362SFA breaker from service. During the removal, they inspected and discovered that the nozzle on one contact was broken and the guide rings from four others were missing and lying in the bottom of the tank. This situation posed the possibility of a catastrophic circuit breaker failure and meant the eight additional breakers of the same design on the system needed to be inspected for the same problems. Increasing the risk was the fact that the broken nozzle was a NON-OEM, reverse-engineered part. Hitachi ABB Power Grids provides the original Westinghouse design as an OEM part to our customers.

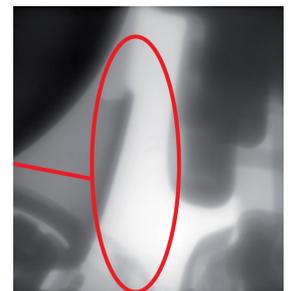
Based on these findings, the utility's maintenance supervisor asked Hitachi ABB Power Grids to incorporate the inspection of five SFA breakers to determine if they also were missing the nozzles. After three days of testing (radiography in conjunction with a Westinghouse expert's review), it was determined that there were three additional nozzles broken, on only one of the breakers. One phase was missing both nozzles and another phase was missing one. If this breaker was called on to perform a full fault interruption, the breaker could likely fail.

The use of radiography made it possible to determine that only one of the five breakers was in need of immediate repair. This saved the customer the

time and cost of having to perform internal inspections on all five breakers. Through the use of radiography to examine the five Westinghouse 362 SFA breakers, over \$60,000 was saved when compared to the cost of traditional internal maintenance inspections. This customer has continued to use radiography as a diagnostic tool for preventative breaker maintenance.



With nozzle



Missing nozzle



Non-OEM nozzle



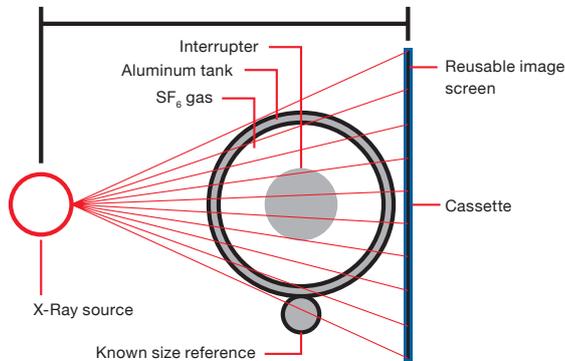
Hitachi ABB Power Grids nozzle

An Old Technology Applied in a New Way

Hitachi ABB Power Grids Mt. Pleasant, high voltage service has taken huge strides to dramatically lower the cost of traditional circuit breaker maintenance. The use of radiographic technology has successfully been added to our “Diagnostic Toolbox” for the maintenance of SF₆ gas power circuit breakers. When coupled with traditional external diagnostic testing, radiography can eliminate unnecessary or invasive internal inspections and maintenance, thus significantly decreasing maintenance costs and improving the reliability of the breaker. The use of Radiography for the diagnostic testing of SF₆ circuit breakers allows Hitachi ABB Power Grids to economically deploy a well-proven technology in a completely new way!

What is Radiography?

Radiography is the latest x-ray imaging technology, employed in an external environment, to capture detailed digital images of a circuit breaker’s critical internal components. These images are then reviewed by the OEM experts, who check dimensions and tolerances against original component and assembly drawings. Radiography eliminates the need to breach the sealing system of the equipment being diagnosed, increasing equipment reliability, making infiltration of external contaminants a non-issue. This technology can be deployed for half of the maintenance costs associated with more conventional and invasive maintenance practices.



Cost/ time reduction

Radiography allows our utility, commercial and industrial customers to reduce operating and maintenance costs while increasing circuit breaker reliability by:

- Reducing the number of unplanned outages and maximizing uptime
- Reducing outage windows
- Allocating precious financial resources more effectively
- Extending maintenance cycles

Operation and maintenance costs associated with using radiography when compared to traditional invasive maintenance procedures are proved to be reduced by at least 50%, while the outage time is reduced from 2 days to 2 hours (See table below).

Circuit breaker type	Outage times	
	Traditional invasive internal inspection	Radiography
38 - 145 kV	2 days	2 hours
242 kV	3 days	3 hours
362 kV	4 days	3 hours
550 kV	5 days	4 hours

What is the “Diagnostic Toolbox”?

The toolbox is comprised of several stand-alone diagnostic tests. The addition of radiography strengthens the toolbox by pulling the results of these tests together or providing the overall “visual” of the condition of the circuit breaker’s internal components. Radiography further increases the value of the individual tests.

The HV Service “Diagnostic Toolbox” includes:
Radiography imaging

- SF₆ Decomposition Analysis (SF₆ purity and test for presence and level of up to six additional gases)
- Contact resistance measurements
- Timing and travel tests
- SF₆ leak detection