

IN SERVICE TESTING

By having advanced warning of pending failures, a sound repair methodology can be implemented in a structured and timely manner resulting in significant cost savings.

Almost all new switchgear is self contained to comply with new safety standards; as such new testing methods need to be developed to allow non intrusive On-Line Partial Discharge Testing to be carried out. HVS have developed processes to ensure self contained switchgear like Fluair 400 Indoor Switchgear can be checked for PD in a safe and controlled manner while in-service.



View of Fluair 400 Indoor Switchgear. It looks normal but a fatal failure is in progress.

CASE STUDY : FLUAIR 400 INDOOR SWITCHGEAR Dated 12/3/08

The survey of a major 33 / 11 kV substation revealed extensive Partial Discharge. Using new procedures specially developed for Fluair 400 Indoor Switchgear it was possible to detect and locate the source of active Partial Discharge.

Failure to detect would have resulted in a complete failure of this 33kV switchboard and loss of supply.

Over time the discharges within these voids will grow under electrical stresses until they form a discharge path which develops into a breakdown path (as demonstrated below). At this stage the discharge ceases to be partial and full electrical breakdown occurs with the destructive failure of the switchgear, Fortunately the client had maintained his PD program and this failure was detected prior to complete failure.



View of multiple PD sites - note the visual signs of nitric acid, a by-product of PD

View of active PD on phase barriers



BENEFITS FOR THE CLIENT

- A controlled outage & repair was successfully arranged
- No loss of supply to clients
- Significant savings made
- No replacement switchgear required
- Other users of this switchgear notified

RECOMMENDED ACTION

Contact HVS if you have Fluair 400 Indoor Switchgear to arrange an in-service On-line Partial Discharge survey. Where extensive damage like this has occurred we would recommend a further re-inspection one month after repairs to ensure the repairs were successful and no other PD sights had developed. Localized HV testing of components is less effective than using system voltage. To reproduce actual in-service electrical/mechanical stress using a single test voltage is difficult. Using system voltage and On-Line Partial Discharge methods provides a more effective overall test envelope to ensure no further PD occurrences.

2 YEARLY SURVEYS

The customer used regular On-Line Partial Discharge surveys [conducted by High Voltage Solution Ltd (HVS)] to monitor all switchgear on a 2 yearly cycle. The detailed report graded each substation to provide the client with the following information:

1. Identified problems within each substation.

Was it a bus chamber problem/feeder/VT/cable termination problem, etc?

2. Report on each feeder concerned.

Showing levels of discharge if these were present and a rating is applied. This allows the client to plan the order of repairs based upon the rating provided.

3. By revisiting the substations every 2 years, HVS was also able to check the substations that had maintenance work carried out to ensure the work that was done did, in fact, correct the discharge problem.

In some cases the problem is not corrected due to misunderstanding. It is important that the report HVS prepare giving recommendations on how to carry out repairs gets to the field staff, rather than being a general instruction to be kept on file.

Example: Please Service Circuit Breaker.

Servicing a circuit breaker and correcting a Partial Discharge problem is completely different to normal maintenance procedures and requires experience in this area. Again, HVS can provide on-site training to staff to show them where to look/how to repair or replace the faulty part, depending upon degree of damage that has occurred.

The report is provided in Excel format to allow for other fields to be entered (rather than a specific program that prevents this).

By approaching the problem in this manner it allowed for:

- No more substation/feeder failures
- Able to target substations that needed more work than others
- Able to bring in the right resource to attend to specific problems
- Allowed one planned shutdown to be organized in conjunction with other work on the same feeder, without having to negotiate a second shutdown to clients.
- Where it was deemed not economical to repair switchgear due to age/fault clearing capacity/nature/level of partial discharge, a proper financial case can be prepared in advance (for director approval etc), rather than having an unplanned expenditure. 