

# TARGET MAINTENANCE USING ON – LINE PARTIAL DISCHARGE

*Being able to test live high voltage cables whilst in service and still meet all safety codes of practice!*

**A**t a hydro powered turbine generating plant in New Zealand, HIGH VOLTAGE SOLUTION.Com met with an electrical engineer who had inherited a station full of 11kV paper lead cables with pitch filled terminations. It was discovered that they all had an average age 45 years.

Annual maintenance tests have shown deteriorating Insulation Resistance (IR) results for both red and yellow paper lead cables that are 45 years old.

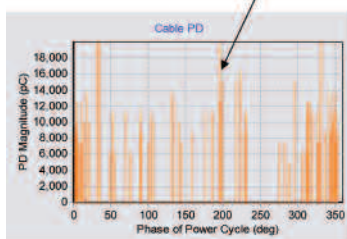
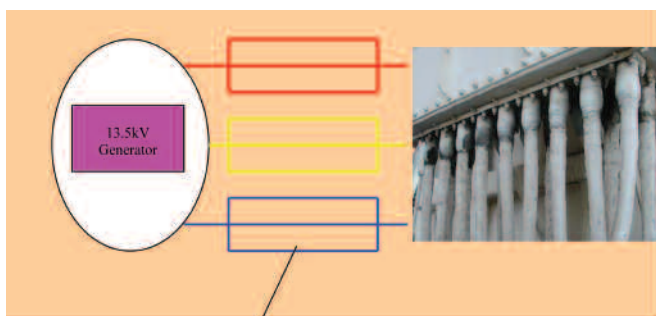
The task was to identify which 11kV paper lead cable or which termination was at risk of failure. Out of sixty cables tested on-line, five were found to have established a level of Partial Discharge that would lead to failure if urgent repairs were not undertaken immediately.

It is quite a challenge to identify which cable is causing low results and where the problem is located. In addition, repairs usually need to be done within a small outage window whilst being unable to disconnect cables due to pitch filled cable at the generator unit transformer.

With sufficient experience and the use of modern On-Line Partial Discharge equipment it is, however, possible to look further into cable networks than previously.

## MAINTENANCE APPROACH CHANGED

The original cable installation was of a high standard, but due to ownership changes that lead to the plant working harder, planned maintenance was changed to Target Maintenance i.e.the use of On-Line Partial Discharge surveys for cables and DGA sampling for transformers.



**By using on-line Partial Discharge, it is now possible to selectively determine which cable is causing low IR and to locate the source of the low IR.**



**View of active Partial Discharge on a generator termination.**

The company concerned found that the Target Maintenance approach for cable management has provided significant advantages such as:

1. Direct cost savings - 6% of cables out of 75 surveyed required immediate maintenance. This has resulted in extensive cost savings. (The original plan was to replace cables by "age").
2. Provides for higher plant availability than previously.
3. Allows for timely planned replacement and/or repairs rather than forced outages.
4. Allows for pre-arrangement of suitably qualified cable specialists.
5. Allows for consultation with the cable supplier to ensure correct cable is sourced in a timely manner.
6. Secondary damage due to the primary fault is reduced or eliminated altogether. For example, a failed bushing that explodes inside an enclosure will cause further damage, or a high voltage spike stressing stator winding insulation.
7. On-hand stocks or availability of original spares on equipment no longer exists.
8. Reduced personnel injury to operational staff by ensuring all "best practices" are adopted. This also applies to switchgear.

## PROGRAMMED SURVEYS

On-Line Cable Partial Discharge is now a recommended method of determining the condition of cables and switchgear while in service. The methodology in achieving this is to carry out programmed surveys to establish a trend and monitor any deterioration that may occur. By carrying this out on-line, true in service conditions are measured. This will ensure a continued reliable operation of these cables.

## SUMMARY

Where a change is occurring within the internals of cables or terminations, the location can be located more efficiently by using on-line location methods.

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. This allows the asset owner sufficient time to source a suitable contractor and suppliers of jointing materials in a timely manner. (Cable jointing is a specialised business and requires a high skill level and full understanding of cable systems.)

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# HVVS

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## ON-LINE CABLE PARTIAL DISCHARGE DETECTION AND LOCATION

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