



## Case Study - How we saved a Process Plant from break-down

### Background

In the earlier Case Study, we saw how we solved a Transformer mal-tripping issue during our Routine Maintenance and Testing activities. We are presenting herewith another case which demonstrates why these activities should be entrusted to experts, who can make such routine jobs more meaningful and save assets.

We were appointed to carry out the routine maintenance and testing of the Switchgears, Relays, CTs & PTs in one of the Cement Plants in India, having its own Power Plant. This Power Plant combined with Grid Supply catered to the plant load.

Usually, at generating stations, we have TIE Feeders which connects Generator and Grid to maintain availability of Power in case of various Power-Flow scenarios. In most of the cases, TIE Feeder is a Synchronising Feeder, where Generator and Grid supplies are synchronised to cater the plant load. It is **THE** most important Feeder of any Plant, any problem in this can cause the entire plant black-out.

### Findings

It was the time to test the TIE Feeder. Necessary shut-down activities were carried out and permits obtained.

A team was carrying out Relay Testing and another team was performing CT Testing. These 6.6 kV CTs were having a ratio of 2500/1 A.

As we have seen in earlier Case Study that Primary Injection testing of CT is having many limitations, plus it does not usually provide the Diagnostics of the CTs. Moreover, injection and measurements of such high currents also pose various challenges.

So, usually, we employ a state-of-the-art CT Testing Instrument, CT Analyzer of Omicron Make, which uses IEC 61869-2 standard and performs model-based testing which is far more accurate and conclusive.

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During this Testing, Protection Core (5P10) of a CT was having a very high secondary resistance, the instrument displayed “Secondary Winding resistance is too high”. CT Analyzer determines winding resistance by applying DC current into Secondary winding and checks voltage drop across Secondary Terminals.

This higher value of CT Secondary Winding indicates that CT could be open and may mal-operate the relay in case of various loading scenarios. We enquired about any such incident in the past, but the history was clean, there was no such tripping and plant operated normally.

But there was something abnormal about this CT and we decided to check the CT physically. And below is the photograph of what we found.



***Damaged CT Found in Panel***

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As we can see from the above images, Secondary Winding with its internal connection is cracked and barely hanging, a little nudge and it separated! We can also observe hotspots/carbonisation all around.

## Root Cause Analysis

- As it can be seen from the above image, there is a CT base-plate, and CTs are usually mounted in Panel by base-plates, and usually, upside down. Main Primary Bus-bar of CT is connected with main Power Bus-bar of panel.
- Here, 2 opposite forces caused this failure :
  1. Upward force by Fixed Base-plate
  2. Downward force by Main Power Bus-bars

CT was in operation under stressed condition for very long time. Over a period, Secondary Winding started getting disconnected, and during testing, it showed higher resistance.

## Conclusion – how advanced technology can help predict the failure

- Noteworthy here is, despite this damage, CT might have been transforming the currents faithfully, as the CT type was a moulded cast resin (a rubbery fibre like material), the leads somehow remained connected. So, when there was primary current, secondary current completed the path by puncturing nearby insulation, this generated high voltages and thus the arcing spots - as can be seen in the images.
- As we've seen that this CT might have transformed the Currents faithfully or with little error. There was not enough unbalance current to trip the Relay, so, the Feeder did not trip, but it was just on the verge of failure when this was detected.
- There could be many reasons for such occurrence and behaviour of Protection System and can be addressed on case-to-case basis. To know more, you may call/write to us.

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- If this remained undetected, this surely would have led to complete break-down in near future. And we all know what it could have costed in terms of production and revenue. All our efforts are viewing the problems from customers' point and resolving them in totality.

CT & PT Still remains the least tested equipment in HT / LT panels. Plant people go for Relay testing & breaker servicing routinely, but very few plants go for routine diagnostic testing of CTs & PTs. Such (Least tested) equipment's become more vulnerable and can play a role in maloperation or breakdown of plants, which we have seen in few plants in recent years.

And if you are looking for a dedicated agency that understands the direct link between your assets and your revenue, call/write to us, we will be happy to assist you.

## **SYSTEM PROTECTION**

E-Mail : [bdm@systemprotection.in](mailto:bdm@systemprotection.in)

Web : [www.systemprotection.in](http://www.systemprotection.in)

Tele : +91-265-2225137

(Servicing & Testing of Circuit Breaker, Relay, CT, PT, Transformer, Other Switchyard Equipment's, Relay Co-ordination Studies, Cable, etc.)

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