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Co. Reg. No: 198301832-C GST Reg. No: M2-0060144-X

## Investigation Report

**Address: A Government ITS Center**

**Reported by:** Schneider and Fengsheng Electric Pte Ltd (also known as “FS”)

**Date:** 26th January 2017

**Subject:** Air Circuit Breaker Analysis

**Equipment Ref :** Low-voltage Air Circuit Breaker

**Model :** NW25H1 with neutral left pole

**Switchroom Ref :** Generator Room (Generator Control panel)

**Serial Number :** 2130085611-1

## Key highlights

The kinematic measurement bounces duration results for the closing coil at minimum and nominal voltage for closing are not within the specifications and out of tolerance. Presently based on this report results, there is **no immediate need** to change the ACB.

However, we recommend customer to base on the cost analysis of changing a new ACB as compared conducting a routine ACB Analysis in the next 6 months time to check if the result maintained or drifted and decide the next step of options per our recommendations mentioned in section 1.4.

*(This report below is based on the work done and results in the Appendices 1 and 2 attached.)*

*The Distributor who knows best*

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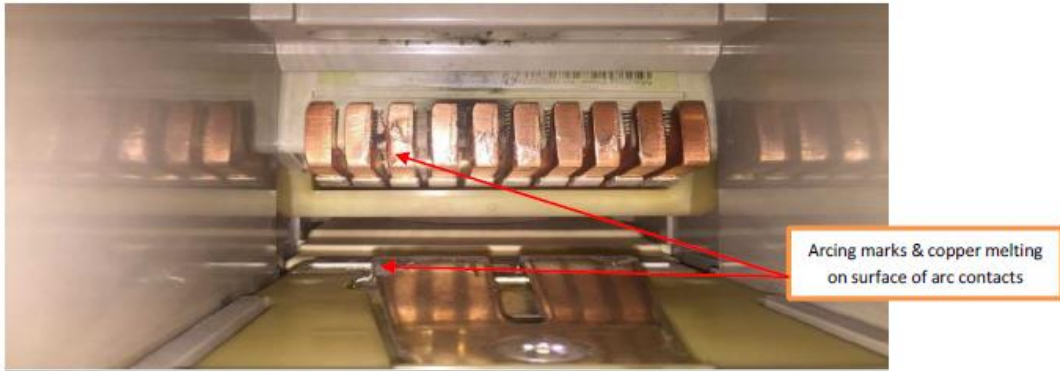
**Report:**

**1.1 Historical**

o Schneider and FS were informed to assist customer as they have found the generator outgoing circuit breaker arc contacts for L1 and L3 phase have burnt marks.

**1.2 Actions Taken on site**

- o Schneider and FS attended to the site on 26 January 2017 to carry out investigation work on the affected circuit breaker.
- o Upon reaching site, customer switch off the generator breaker and racked it out from service position.
- o Upon opening the arc chutes, we observed burnt mark on phase 1 and phase 3 of arc contacts.



- o Upon further inspection there was no signs of corrosion of circuit breaker internal parts.
- o There were also no signs of lubricant hardening and internal contamination.
- o Perform circuit breaker manual on and off operation and breaker mechanism was tested in good operating order.
- o Perform contact resistance test on the circuit breaker before cleaning the arc contact as reference and the results were within the acceptable range.(all in micro-ohms unit)

Neutral	Phase 1	Phase 2	Phase 3	Acceptable Range
26 $\mu\Omega$	14.1 $\mu\Omega$	15.5 $\mu\Omega$	16.6 $\mu\Omega$	<50 $\mu\Omega$

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**1.2 Actions Taken on site (continued)**

- o Schneider proceeded to clean and polish the arc contacts on all the phases and neutral pole.
- o Perform another contact resistance test to check if the values were reduced after cleaning the arc contacts and result improved further

Neutral	Phase 1	Phase 2	Phase 3	Acceptable Range
14.9 μΩ	10 μΩ	12.7 μΩ	12.5 μΩ	<50 μΩ

- o Schneider proceeded to perform the prodiag analysis on the circuit breaker at minimum and nominal voltage. The purpose of the prodiag test is to measure:
  - Charging time of control mechanism
  - Opening and closing times
  - Opening and closing speed
  - Simultaneousness of contacts at closing and opening
  - Over-travel (Safety to close and open)
  - Contact resistance and insulation resistance test.

o Results of the prodiag test at minimum voltage (93.5V) for closing coil indicate the over-travel rate is within the acceptable range at 12.2% (words in blue in Appendix 2) **but the bounces duration at 22.8ms is above the limits. (in red Appendix 2)**

There is no abnormality for the opening speed at minimum voltage (77V) and the opening speed results are good and within the criteria.

o Results of the prodiag test at nominal voltage (110V) for closing coil indicate the over-travel rate is within the acceptable range at 12.6% (words in blue Appendix 2) **but the bounces duration at 36.3ms is above the limits. (in red Appendix 2) The response time for the closing coil is also above the limits at 90ms.**

There is no abnormality for the opening speed at nominal voltage (110V) and the opening speed results are good and within the criteria.

**1.3 Summary**

o Based on the investigation conducted by Schneider Electric, there are possible few scenarios whereby the breaker arc contacts will have the same outcome example like a circuit breaker sudden opening due to a high fault current and also when opening / switching off breaker at a very high load.

o The results of the contact resistance were good but the mechanical measurement at nominal voltage for the closing time is out of tolerance at 90ms.

o The kinematic measurement bounces duration results at minimum and nominal voltage for closing are also not within the specifications and out of tolerance. (measured value at V min at 22.8ms and V nom at 36.3ms)

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### 1.3 Summary (continued)

o The kinematic measurement for over-travel at V minimum at 12.2% is still within the OEM spec.

### 1.4 Recommendations

- o To conduct one more ProDiag Analysis in 6 months time to check if the result maintained or drifted
  - > If drifted, the ACB needs to be replaced
  - > If result remained the same, the ACB can be continued to be used and apply the standard OEM maintenance procedure
  
- o Alternatively, to assess the cost of replacing the ACB with new latest compatible ACB as compare to conducting one more ProDiag Analysis.

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