Safety Advice

everyone home safe every day

Operational Restrictions on use of FSKII Circuit Breakers

Issued to: **E&P Community, Sentinel Sponsors and registered contractors**
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Location: National

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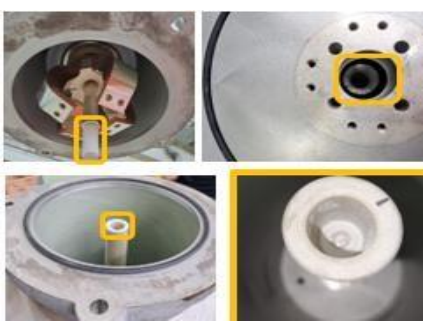

Overview
During Test before Earth of an isolation between Finnieston and Rutherglen in Scotland it became apparent that one of the electrical sections was still live.

Applying the "test before earth" Life Saving Rule, the team avoided an accident which could have led to a fatality or life changing injury and instead led to the identification of a failure of this circuit breaker;

Subsequent investigations have found that a Circuit Breaker, which is an ABB supplied FSKII Circuit Breaker (top photo), had failed in the
closed position;

Failure Investigation

Investigations were carried out with collaboration of the supplier, ABB. It has been determined that:

- **Failure Cause:** The operating rod became detached from its base within the high- voltage (HV) pole. This detachment
disrupted the mechanical transmission chain between the actuator and the
vacuum interrupter, preventing proper operation.
- **Vacuum Interrupter Condition:** The vacuum interrupter was inspected and found to be free of abnormalities. It remains fully functional.
- **Supplier Investigation:** A detailed review of the operating rod's supplier did not reveal an underlying design flaw.
- **Site Testing & Inspection:** Mechanical testing was conducted on the remaining FSKII units installed in Finnieston. Measurements of closing and opening time-travel curves were compared against Factory Acceptance Test (FAT) certificates, confirming consistent alignment and positive results.
- **Analysis of Similar Units**: A detailed examination of FSKII (FT/PR2), which had similar operational exposure to the original faulty FSKII (FT/PR1), was performed. Upon disassembly, the operating rod did not exhibit the same failure
mode.

Further Investigation: A detailed analysis of an FSKII manufactured in the same batch as the
faulty unit is planned to determine any potential batch-related issues.

Implementation of Operational Restrictions

Emergency Switch-Offs

Where an ABB FSKII Circuit Breaker is being used to effect an Emergency Switch-Off, a second open point shall be created in series with the FSKII breaker before confirming that the ESO has been
taken.

Where available, the second open point should be a motorised air-break disconnector (e.g. Busbar disconnector), but otherwise may be the TNO/DNO Circuit Breaker, Feeder circuit breaker, bus coupler, set of track feed circuit breakers or overhead line switches and may be another FSKII circuit breaker.

Overhead Line Isolations

Where practicable, the same principle of creating a second open point should be applied to overhead line isolations. Where such facilities are not practicable to use, then secondary indications (where available) may be used to confirm that the associated circuit breaker has correctly opened
(e.g. through a low volts alarm). The ECO should draft and use a switching schedule to identify the actions being taken to disconnect the equipment and validate the associated secondary indications.

This shall be done before issuing the Form B permission to test and apply earths.

The test before earth and earthing of the equipment is the final confirmation that the equipment is disconnected from the supply and protected against re-energisation.

Immediate action required

Based on the investigation and testing conducted during this failure analysis, all findings indicate a one-off failure. However, to definitively rule out the possibility of a faulty manufacturing batch, further testing is required.

Until testing is completed, the operational restriction indicated above may be lifted for all FSKII breakers installed in NR infrastructure, except those manufactured in 2018.

Manufacturing information
The manufacturing date can be found in the rating plate in the HV pole, refer to the following pictures

Rating plate in HV Pole, located at the magnetic actuator enclosure.

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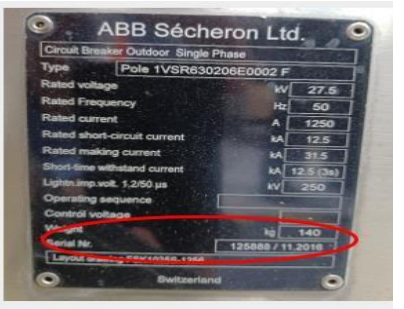

HV Pole Serial Number (125888)/ Manufacturing Date (11.2016)

Identification and Implementation of Operational Restrictions

If there is any uncertainty over the locations of ABB FSKII Circuit Breakers manufactured in 2018, contact your Regional or Route (E&P) Engineering team.

Investigation of Trips

In the event of any fault with the protection system (i.e. Circuit Breakers which are not normally
associated with a section or area are seen to operate) and where ABB FSKII circuit breakers may be a contributory cause (i.e. by failure to open), you must raise a fault against the associated FSKII circuit breaker. Regional and Maintenance teams shall investigate it to confirm the integrity of the operating rod and that the vacuum bottle is correctly operating.