

# Incorrect direction of backfeed protection causes supply loss

# **ISSUE IDENTIFIED:**

Earlier this year our customers were impacted by a loss of supply at a substation when two supply transformers tripped. Backfeed protection intended to operate for high voltage side system faults incorrectly operated for a low voltage side distribution network fault instead.

Incorrect 'directionality' of the backfeed protection was not picked up during design, review, or approval processes, or during commissioning, and testing of the modified scheme.

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### **CONTRIBUTING FACTORS:**

- 1. Backfeed overcurrent element 'direction' was incorrect due to failure to identify pre-existing nonstandard CT wiring (circa 2015).
- 2. During commissioning of new backfeed overcurrent elements in existing relays appropriate tests were not performed to verify the 'directionality' of the element.
- 3. The 'directional arrow' for this backfeed element was not shown on issued R&ID.
- 4. The testing recommendation section of the setting change **documentation** was incomplete in **not requesting** 'directional' tests.

# **ACTIONS TAKEN TO PREVENT REOCCURENCE:**

- 1. The relevant non-standard CT wiring for both transformers has been corrected.
- 2. In the released Protection & Automation Update document (Issue 13, S:68), designers have been asked to check polarities of relevant CTs and VTs (including referring to circuit diagram drawings) while implementing directional elements in a relay where they are not already present.

## **LEARNINGS FROM THIS**

- 1. When implementing directional protection elements in a relay where they are not already present, designers should take care that polarities of CTs and VTs to which the concerned relay is connected are correct such that relay directionality has the intended effect. This should include referring to circuit diagram drawings. It is not sufficient to assume directional elements function correctly simply because power measurements are provided to SCADA.
- 2. When a directional element is implemented for the first time in a relay, correctness of its 'direction' should be proven by implementing appropriate wiring checks and tests as specified in Transpower's policy TP.CP 01.05. Make sure to implement post livening test to confirm relative polarity of CT and VT (e.g. protection directional test) using displays of the numerical protection relays.
- 3. Designers must mark "direction arrows" for the directional protection elements in the relay instrumentation diagrams as specified in the TP.DP 01.31 to avoid confusions of the designed directionality.

Service Management
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