



SOP 437 UPDATE – ABB / HITACHI ENERGY VUBB ON-LOAD TAP CHANGER

This Technical Express supersedes EXP-11-333.

Following two incidents on ABB / Hitachi Energy VUBB on-load tap changers on Conwy T1 and Llandyrnog T1, SOP 437 was applied establishing a Risk Management Zone (RMZ) equivalent to the fire segregation zone of the transformer on all transformers fitted with this model of tap changer.

The faulty Conwy T1 tap changer was returned for investigation. Additionally, an extensive review of the VUBB product was undertaken. Sample inspections of 22 other in-service transformers with this model of tap changer were also carried out. Root Cause Analysis (RCA) has now been completed with the following main findings.

There is no evidence to suggest an issue with the actual VUBB product in terms of design, material selection or manufacturing process. The failure mechanism experienced was attempted to be replicated on full-scale tap changer endurance tests considering different scenarios of incorrectly applied tightening torques. The exact damage and fracture pattern could not be reproduced.

Inspection of the returned Conwy T1 tap changer revealed additional evidence suggesting interference with the internal mechanism of the tap changer (ie. scratch marks found due to misposition of change-over selector actuator, "batman" piece) at the transformer factory. Quality control records confirmed the tap changer required intrusive works at the transformer factory. The addition of this factor allowed a similar failure mode to be replicated in the full-scale tests. No quality control records were found for Llandyrnog T1 but the similarities are significant.

It was concluded that the most likely cause of the failures experienced by SPEN was interference and incorrect re-assembly of the tap changer internal mechanism at the transformer factory, ABB / Hitachi Energy Dudullu in Turkey.



Change-over selector actuator, "batman" piece

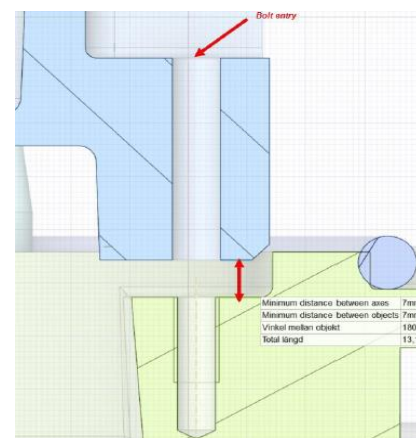


Illustration of gap created by misposition of the "batman" piece which led to excessive force applied when tightening and damage to thread

Recommendations and action points

- SOP 437 ([OPSAF-16-437](#)) scope has been reviewed to reflect the findings of the RCA. Only transformers manufactured by ABB / Hitachi Energy factory in Dudullu (Turkey) shall have SOP 437 applied. Quality control records from other manufacturers (ie. Brush Transformers, Winder Power and ABB / Hitachi Energy Monselice) were reviewed for further reassurance and confirmation that no intrusive works were necessary on VUBB tap changers fitted on SPEN transformers.
- Steps have been defined to allow removal of SOP 437 from the updated potentially affected range of transformers. Internal inspection of the VUBB on-load tap changer is required to confirm condition of the internal mechanism fixing arrangements. Methodology for these inspections has been provided by Hitachi Energy. These inspections shall only be carried out by suitably trained personnel.
- Discussions ongoing with Hitachi Energy to determine the level of support to be provided for these inspections. If the outcome is for SPEN staff to undertake part or all these inspections, adequate training will be arranged, and support will be made available as required.