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SERVICE ADVISORY - SA009

PowlVac Endurance Testing

Powell Electrical MFG. Co. has earned an excellent reputation for reliability over the past 50 years. In a proactive attempt to improve our breaker products, we periodically conduct "life tests" on production breakers. The following advisory addresses possible performance issues with specific vacuum circuit breakers. **These performance issues have not been experienced on breakers presently in service.** They have however, been observed on some of the endurance tests conducted in our breaker lab. We have identified three interrelated issues, which are worthy of preventative maintenance consideration. This notice is intended to help our customers maximize the safe operating life of their Powell equipment.

PRODUCT: PowlVac medium voltage circuit breakers manufactured with two specific types of Cutler-Hammer vacuum interrupters. Both vacuum interrupters are distinguished by the "flat top" upper electrode mounting assembly. All other PowlVac breaker models manufactured before and after the dates listed below, utilize stem-mounted vacuum interrupters and are not included in this advisory.

The first issue involves the WL35315 vacuum interrupter, which shipped on 5PV0350, 15PV1000, 15PV1300 models between May 1998 and June 1999.

The second issue involves the WL34999C vacuum interrupter, which shipped on 15PV750 models between January 1995 and September 1999.

The third issue involves the turnbuckle, which is used to adapt the lower stem of the WL35315 and the WL34999C vacuum interrupters.

All of the aforementioned PowlVac models are identified by a specific dash numbers, "-8", "-9", "-G", "-F" suffixes. (Example: 15PV1000-81CCCX).

CONDITION: The condition is that of possible reduced mechanical operating life of specific type Cutler-Hammer vacuum interrupters when used in the PowlVac circuit breaker. An unacceptable failure rate of the external upper terminal pad of vacuum interrupters was experienced during design reconfirmation of mechanical endurance tests on the breaker ratings listed above. An adaptive turnbuckle used in both models which screws into the lower stem, also experienced a shorter than expected mechanical life.

The failure is not a "loss of vacuum" issue, but a mechanical fatigue and fracture of the stem components external to the vacuum chamber. We have only encountered this problem when circuit breakers are subjected to high repetitive test operations. Fatigue failure of the upper fixed electrode assembly has occurred on some test samples. Although the ANSI required design tests are typically much more severe than normal breaker service applications, we do not expect to experience this type of vacuum interrupter component fracture.

No upper stem fractures have occurred on test samples with less than 1000 operations, and most were much higher. The majority of the test samples exceeded 5000 operations.

The lower stem turn buckle adapter exhibited signs of loosening prior to 1000 operations on some breakers. When the turnbuckle was not serviced and tightened, it had a tendency to fatigue and fracture. **Again, no field incidents have been reported for these conditions.**

CAUSE: The performance issues are related to the design and manufacture of specific Cutler-Hammer "flat top" vacuum interrupters manufactured during a specific time period.

The first issue with the WL35315 interrupter involves one of the two braze joints of the fixed upper pad assembly. One of the braze joints is consistently complete, while the second is **not** consistently complete. The variability of this second braze joint can lead to metal fatigue of the upper pad assembly. All mechanical endurance tests conducted with interrupters identified as having properly completed braze joints have exceeded 5,000 operations. Cutler-Hammer has acknowledged the variability of the brazing and has redesigned the upper pad assembly to resolve this issue. Subsequent mechanical endurance tests have confirmed this new design.

The second issue with the WL34999C vacuum interrupter is related to the reduced diameter of the "flat top" upper stem design. The diameter is smaller than all of the previously utilized "stem mounted" vacuum interrupters used in PowlVac circuit breakers. Stem fractures experienced on this model occurred at much higher operations than with the WL35315.

The third issue with the lower stem turnbuckle assembly is directly related to the first two issues. The flexibility of the upper stem may lead to a loosening of the turnbuckle threads.

INSPECTION: The inspection requirement is classified as low priority unless the breaker is currently in a high duty cycle application. The inspection requirement is classified as URGENT if the circuit breaker is currently used in a high duty cycle application where more than 500 operations per year or total breaker counter operations of 1000 may be exceeded.

No visible inspection, other than checking the operations counter, is possible for predicting a stem fracture. The operations counter should be checked during a routine maintenance period as recommended in the PowlVac instruction bulletin. The maintenance interval should be established by an evaluation of specific applications and operational experience.

The turnbuckle can be checked for signs of loosening. The turnbuckle must be fully seated against the lower stem and spacer washer. This connection must be **hand tightened only!** Caution must always be exercised when applying torque to a vacuum interrupter lower stem. Over torquing the connection can damage the bellows leading to a vacuum loss.

CORRECTIVE ACTION: Due to the nature of the potential problem, immediate corrective action is not warranted, except in those applications where breakers are subjected to high operations.

Cutler-Hammer has developed a simple life extending modification. The modification consists of applying epoxy under the upper electrode pad of the VI. The upper construction of the VI assembly forms a natural cup. A pre-measured quantity of epoxy is injected into this cup with a self-mixing tube. The process takes only minutes, and the breaker can be placed in service immediately. Powell has conducted numerous endurance tests and has verified this process for extending the life of PowlVac breakers. This epoxy kit is recommended for all breakers regardless of the number of expected operations.

Although the epoxy has been shown by test to alleviate the turnbuckle issue, it is prudent to check the tightness of the turnbuckle during each maintenance interval.

This advisory should be inserted into all applicable PowlVac instruction bulletins used to maintain the equipment.

SAFETY: Breakers operated more than 500 times per year or breakers accumulating operations over 1000, could experience a failure to open the main contact of the vacuum interrupter. Under certain conditions, this type of failure could initiate an electrical arcing fault. **SUCH A FAULT CAN CAUSE SERIOUS INJURY TO OPERATING PERSONNEL OR EXTENSIVE EQUIPMENT DAMAGE.** Please contact PASD for additional information or other questions concerning this issue.



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