



# *Service Division*

## **Maintenance Guideline MG2009**

rev. 0, Oct. 21, 2009

### **PowlVac Circuit Breaker – Upgrade and Reconditioning**

#### **"MVA Model numbers 1983 to 2001"**

The PowlVac breaker has been in continuous production since 1983. The MVA models gave way to the k1 rated models in 2001. Several upgrades and design changes had been implemented since that time. The following maintenance guideline is intended to identify possible upgrades for PowlVac breaker maintenance, reconditioning, and repair. These suggested upgrades are derived through years of breaker design improvement, testing, component enhancement, and field experience. This guide does not attempt to address all of the minor changes made during this time period. Some of the upgrades are not intended for field implementation, except as conducted by qualified Powell service personnel.

**THE UPGRADE RECOMMENDATIONS ARE NOT INTENDED FOR USE AS A REQUIRED UPGRADE, BUT ONLY AS AN INFORMATIONAL DOCUMENT TO HELP DIRECT MAINTENANCE ACTIVITY. SOME OF THE RECOMMENDATIONS ARE LISTED IN CONJUNCTION WITH SERVICE ADVISORIES. THE SERVICE ADVISORY MUST BE EVALUATED TO DETERMINE IF THE UPGRADE IS VALID FOR THE SPECIFIC MODEL.**

**PowlVac Model dash number description with 17 digit model number**

\_\_\_ PV \_\_\_ -  \_\_\_ example: 15PV1000-61CCCX234

**Dash (0)** – PowlVac breakers with; PVS-1 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, Mitsubishi vacuum interrupters, G.E. SBM auxiliary switch assembly. For units shipped after August 1985, GE Type SB 12.

**Maintenance Upgrade Recommendation: 1, 2, 3, 5, 6, 11**  
**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C.**

**Dash (1)** – PowlVac breakers with; PVS-1 mechanism, **porcelain** VI support assembly, filament wound push rods, filament wound pole support, Mitsubishi vacuum interrupters, G.E. SBM auxiliary switch assembly. For units shipped after August 1985, GE Type SB 12.

**Maintenance Upgrade Recommendation: 1, 2, 11**  
**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C**

**Dash (2)** PowlVac breakers with; PVS-1 mechanism, **Cycloaliphatic (epoxy)** VI support assembly, push rods, pole support, Mitsubishi vacuum interrupters, **Electroswitch auxiliary switch assembly.**

**Maintenance Upgrade Recommendation: 1, 2, 3, 4, 5, 6, 11**  
**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C**

**Dash (3)** – PowlVac breakers with; **PVS-3 mechanism**, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **G.E. vacuum interrupters**, Electroswitch auxiliary switch assembly. The GE vacuum interrupters used in PowlVac circuit breakers are obsolete and no replacements are available.

**Maintenance Recommendation: 1, 3, 4, 5, 6, 11**  
**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C.**

**Dash (4)** PowlVac breakers with, PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole



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support, **G.E. vacuum interrupters**, Electroswitch auxiliary switch assembly, **epoxy coated primary stab assemblies**. The GE vacuum interrupters used in PowlVac circuit breakers are **obsolete and no replacements are available**.

**Maintenance Upgrade Recommendation: 1, 3, 4, 5, 6, 11**

**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C.**

**Dash (5)** PowlVac breakers with, PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **Mitsubishi vacuum interrupters**, Electroswitch auxiliary switch assembly, **epoxy coated primary stab assemblies**.

**Maintenance Upgrade Recommendation: 1, 2, 3, 4, 5, 6, 11**

**Interrupting Upgrade Recommendation: NOT AVAILABLE. See note 1C.**

**Dash (6)** PowlVac breakers with; PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **Cutler-Hammer (WL35296/WL35297) vacuum interrupters**, Electroswitch auxiliary switch assembly.

**Maintenance Upgrade Recommendation: 1, 3, 4, 5, 6, 11**

**Interrupting Upgrade Recommendation: MVA upgrade only, (i.e.; 500 to 750 or 750 to 1000). Upgrade to K1 is not available. See note 2C.**

**Dash (7)** PowlVac breakers with; PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **Cutler-Hammer (WL35296/WL35297) vacuum interrupters**, Electroswitch auxiliary switch assembly, **epoxy coated primary stab assemblies**.

**Maintenance Upgrade Recommendation: 1, 3, 4, 5, 6, 11**

**Interrupting Upgrade Recommendation: MVA upgrade only, (i.e.; 500 to 750 or 750 to 1000). Upgrade to K1 is not available. See note 2C.**

**Dash (8)** PowlVac breakers with; PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **Cutler-Hammer (WL34999C/WL35315, flat top) vacuum interrupters**, Electroswitch auxiliary switch assembly.

**Maintenance Upgrade Recommendation: 1, 3, 4, 5, 6, 7, 8, 11**

**Interrupting Upgrade Recommendation: MVA upgrade only, (i.e.; 500 to 750 or 750 to 1000). Upgrade to K1 is not available. See note 2C.**

**Dash (9)** PowlVac breakers with; PVS-3 mechanism, Cycloaliphatic (epoxy) VI support assembly, push rods, pole support, **Cutler-Hammer (WL34999C/WL35315, flat top) vacuum interrupters**, Electroswitch auxiliary switch assembly, **epoxy coated primary stab assemblies**.

**Maintenance Upgrade Recommendation: 1, 3, 4, 5, 6, 7, 8, 11**

**Interrupting Upgrade Recommendation: MVA upgrade only, (i.e.; 500 to 750 or 750 to 1000). Upgrade to K1 is not available. See note 2C.**

**Dash (A)** Same as Dash (3) except "closed-door racking"

**Dash (B)** Same as Dash (4) except "closed-door racking"

**Dash (C)** Same as Dash (6) except "closed-door racking"

**Dash (D)** Same as Dash (7) except "closed-door racking"

**Dash (F)** Same as Dash (8) except "closed-door racking"

**Dash (G)** Same as Dash (9) except "closed-door racking"

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### **Maintenance recommendations and notes:**

1. **Noryl sleeving.** The Noryl sleeving used on the runback bus of early model PowIVac breakers is occasionally found cracked or missing. This material is damaged by petroleum based cleaning solvents. The sleeving can be removed, if damaged, and no replacement is necessary. Only dry rags of denatured alcohol should be used to clean this sleeving. If the customer desires, a heat shrink 3M or Raychem material can be applied. See **SA002**.
2. **Equalizing block for 3000 amp standard PowIVac.** This block should be installed on the lower stab bus of all 3000 amp "dash" (0), (1), (2) breakers if not previously added. The block insures equal current distribution between the two runback bus bars. All other breakers should have this block. No advisory was issued for the installation of this block.
3. **Wishbone insulators.** Wishbone integrity should be checked on all early model breakers without the strut assembly. Replace only cracked or damaged units. Adding the VI strut kit should be added to enhance mechanical margin. See item 6, **SA006**, MP1005.  
**Powell changed to a 3<sup>rd</sup> generation wishbone insulator with the K1 PowIVac breaker. All inventories of old style wishbones have been depleted. The new style is interchangeable, but only in sets of all top or all bottom units. This is due to the difference in mounting plates. It will also require enlarging the two mounting holes in the copper from 5/16" to 11/32".**
4. **Primary disconnect springs.** In rare cases the springs and guide pins suffered degradation due to partial discharge. Replace only if the springs and pins appear to be burned or rusted. See **SA005**.
5. **Epoxy push rod.** Prior to a design change in March of 1998, we experienced rare and random fractures of epoxy push rods, most of which were infant mortality. This incidence appears to be confined to the higher ratings, specifically on the early model 1000MVA & 350MVA breakers. The X-ray process, originally used to evaluate epoxy components, is no longer required for the newer style filament wound push rod design. While reports of fractures are even rarer today, the replacement of epoxy push rods should be strongly considered for replacement during the maintenance cycle.
6. **Strut upgrade kit.** The strut was added to increase the endurance of higher breaker ratings and 3000 amp PowIVac breakers. Due to the ease of installation and the benefits of increased mechanical margin, the strut kit should be added on all breakers, except "dash" (1) models, if not already equipped. See **SA007**, MP1002.
7. **VI epoxy kit.** The kit should be installed on all early model "dash" (8), (9), (F) and (G) breakers. See **SA009**, MP1007.
8. **VI turnbuckle kit.** The turnbuckle should be checked on all early model "dash" (8), (9), (F) and (G) breakers. The replacement kit should be installed only if the breaker is in a high operation application. See **SA009**, MP1007.
9. **Modified push rod end cap.** Push rod end caps were modified to reduce the possibility of contact with the lower wish bone. The addition of the strut kit resolved issues previously thought to be caused by end cap interference. No change out should be required on existing breakers. See note 5 for pushrod replacement recommendations.

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10. **Enhanced pole support.** The PowlVac pole support was enhanced by changing the inserts to non-ferrous material and adding material to the area around the inserts. Field problems were minimal but, following PowlVac thermal testing in 1999, 3000 amp over-dutied breakers could see fractures of this part. Replace the pole support on all breakers which are received for repair or upgrade.
11. **Double "D" operating shaft.** Improved mechanism components were developed for the k1 model circuit breakers. This proved to greatly improve endurance and reliability. These mechanism components can be installed in most MVA style circuit breakers. This kit should be considered for all breaker repairs. Installation of these components requires an experienced breaker technician and is not recommended for customer installation. Note: DUE TO THE LIGHTER FORCES APPLIED TO THE TRIP PROP, A DAMPENING SPRING IS REQUIRED ON THE TRIP LINKAGE ASSEMBLY ON ALL "CDR" BREAKERS WITH THIS UPGRADE.
12. **Primary Trip Prop Assembly.** The primary trip was improved in response to testing in March of 2005 for k1 rated breakers. The improvement prolongs life and reliability. During Powell's breaker repair history we discovered that a variety of cleaners and lubricants were being used by customers during past maintenance programs. This uncertainly, coupled with the difficulty of cleaning, and re-lubrication of the existing trip prop, suggests replacement as the best maintenance option. All breaker maintenance should include this new trip prop assembly. MP1008 and MP1010 should be referenced for adjusting the tripping system and latch check switch should be used during this installation.

### **INTERRUPTING CAPACITY UPGRADES**

**Increasing the interrupting ratings of MVA breakers by rebuilding the breaker is only practical when increasing the MVA rating. MVA to K1 rating upgrades are not a practical solution.**

- 1C. **Increasing the interrupting rating of breakers using Mitsubishi or GE VI's with current vintage Eaton VI's is not economically practical.**
- 2C. **MVA rated breakers with Cutler Hammer/Eaton VI's can be upgraded to the next MVA rating. A K1 rating cannot be obtained unless the operating shaft and pushrods are replaced. At this level a new breaker should be recommended unless time is an issue. The K1 upgrade cost is 75% of a new breaker.**

### **Maintenance Precautions**

The circuit breaker must be carefully inspected and critical dimensions recorded before initiating any of the upgrades above. After completing the modifications, verify all critical dimensions against the pre-maintenance readings.

### **TESTING**

Testing of circuit breakers for maintenance purposes do not include the full 300 operations normally conducted on new breakers. Operate the breaker a minimum of 25 open-close operations. Timing and speed should not be affected by these procedures, if properly performed. A Kellman test can be performed to confirm timing.