



HVB AE Power Systems, Inc.

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Maintenance Advisory

New Hardware Torque Value

SIL 0903 Rev.0

362kV HPI

Dear Valued Customer,

During field investigations, an issue with hardware has been found on several of our 362 kV HPI Series “single break” SF₆ gas circuit breakers manufactured between 1988 and 2007. Our current data on these 362kV HPI units indicate an actual failure rate of less than 1%.

To ensure your continued satisfaction with our product, we are suggesting that you perform the attached maintenance procedure on your 362 kV HPI Series gas circuit breaker.

Failure to perform the procedures included with this letter could result in loose hardware, which **could damage or disable the circuit breaker.**

Specifically, this issue involves the M8 socket head hardware that is used to hold the Teflon nozzle assembly together and to hold this assembly to the face of the puffer cylinder. The hardware can loosen causing the involved assembly to partially or completely separate from the face of the puffer cylinder resulting in failure of the breaker.

The standard 8–10 ft. lbs of torque for the M8 socket head hardware was found to have a low safety factor for this assembly. Theoretically the existing safety factor should have been satisfactory, but with variances in torque values (different tools), variance in assembly from person to person or variances where the hardware is sourced could result in loose hardware. Design type tests and 10,000 mechanical operation testing were performed on the original HPI design without hardware failure.

To increase the safety factor in this application, the torque for the M8 socket head hardware for both the M8x18 and M8x30 on the interrupter should be increased to 18 ft-lb. Calculations have been performed to assure that this torque value will increase the safety factor to more than double and will not damage the thread on the receiving parts.


HVB believes performing the outlined maintenance and inspections will prevent potential problems due to loose hardware in the future and will help to ensure your continued satisfaction with the HVB AE Power Systems gas circuit breaker. HVB will hold training sessions for customers who are interested in hands-on procedural training and additional information regarding this maintenance upgrade.



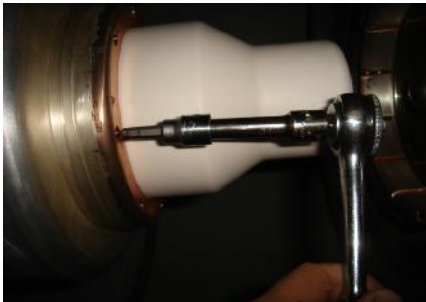
We also strongly recommend that you perform the internal, periodic maintenance described in our instruction book in conjunction with this advisory. This will further expand the life cycle of your circuit breakers, reducing the potential of unscheduled outages and limiting future expenditures for parts. Details of this maintenance plan and service advisory can be discussed by calling Derek Engelhard at 770-495-1755, ext. 101.


Larry Brideau

QA Manager




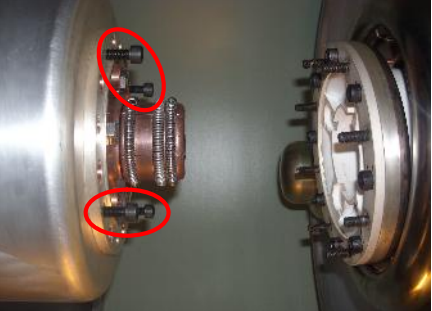
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Procedure for Hardware Maintenance Upgrade - Torque increase, replace Teflon nozzle and hardware inspection						
This procedure will explain the proper method for inspecting the hardware on the 362 HP single break models and increasing the torque to 18 ft-lbs.					Check off steps	
No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
1	Preparation	1) Tools needed a) M8 Allen socket with extension to clear nozzle b) Torque wrench for 18 ft-lbs for socket head hardware c) Torque wrench for 32 ft-lbs for resistor arm hardware(if applicable) d) Torque wrench for 18 ft-lbs for M10 hardware(17mm socket, on puffer face) e) Torque wrench for 75-80 ft-lbs for manhole cover hardware (24mm,15/16" socket/wrench) also for crank box retainer plate hardware f) Desiccant kit with o-rings for 3-poles; HVB part# 63-5007-00 g) Red Loctite 271 threadlocker h) Blue Loctite 242 threadlocker i) drop light and mirror j) Isopropyl alcohol and lint free wipes k) Ohm meter l) Gas cart m) Vacuum pump				
2	Safety first	1) Isolate gas circuit breaker. Open the gas circuit breaker, open disconnects, lockouts in place, and grounds are installed per your Safety Procedure. 2) Disconnect all control ac and DC power at the breaker.				
		3) Install manual operating screw in poles to be opened to mechanically block the breaker from closing.				



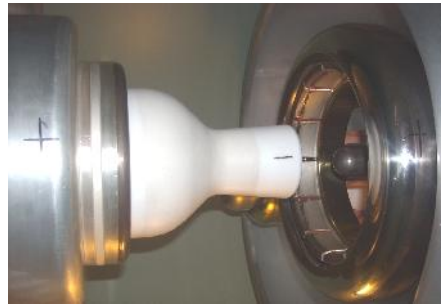
No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
		4) Drain all air for maximum safety. If for some reason air is not drained make sure to install trip blocking device in all poles to be opened to mechanically block the pilot valve and block trip function.				
3	SF6 gas removal	Remove gas from GCB per your company procedure If no company procedure exists, pull vacuum on gas cart lines, then remove gas until compressor creates vacuum. Open gas fill valve and allow air to enter tank. Remove manhole cover and allow tank to evacuate for several minutes. If available for maximum safety check tank with O2 (oxygen) sensor or equivalent before inserting head into tank to perform the inspection.				
4	General Inspection	Before working on torque upgrades inspect condition of tank interior and interrupter parts. Are all visible torque marks in place? Any particles or loose parts in tank? Any damaged or burned parts?	Keep for your records.			
5	Contact/Retainer ring removal	1) Using a ratchet and the M8 Allen socket with extension start to loosen socket head hardware on the main contact/retainer ring. See caution -----> 2) Once separated, move nozzle assembly to the right and rest on the stationary arc contact until the Arc Contact Plate removal is finished in step No. 6 below. This allows room for removal of the nozzle assembly to a bench or table to be worked on later. See picture in step 6 below. Place a wipe over the stationary arc contact before sliding the nozzle over it. This will help keep the nozzle clean.	1) Caution: Only loosen 1-2 turns at a time in sequential order round and round with fingers until the assembly has released from the puffer face. Loosening too much at one time will cause binding in the cavity that the bolt is located and possible thread damage could occur.			
						

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
6	Arc Contact Plate removal	<p>1) Using a ratchet with a 17mm socket remove M10 nuts to remove plate. There may be locktite present. Be careful not to round off nuts during this process. Take the plate out of GCB then remove nozzle assembly. Helpful hint: Grind the end of your 17mm socket until there is a square edge. This will help get the maximum bite when removing the M10 nuts.</p>	<p>Note: Check if moving arc contacts are in good condition, if not, this is the time to replace them. 1988-93 40kA units could be upgraded to 50 kA with a contact/Teflon change. Contact HVB Parts Desk for details, (770) 495-1755x163.</p> 			
7	Pre-insertion resistor arm hardware check (if applicable)	<p>While the nozzle assembly and moving contacts are removed it is a good time to check the hardware on the resistor arm on the backside of the puffer cylinder.</p> <p>1) Using a ratchet with a 19mm socket remove one M12x30mm bolts to inspect for presence of Locktite. Note: If bolt is not the correct size, contact our Warranty Parts Desk x187, for replacements.</p> <p>a) If locktite present, then clean both parts and re-apply Red 271 locktite and torque to 25 ft-lbs(if pre 1996 and no helicoil present in bolt hole) or 32 ft-lbs(if 1996 to present with helicoil present in bolt hole). Repeat torque to double check. Check remainder 3 bolts to assure bolts are torqued to proper values given above. Clean the area with alcohol then re-apply torque marks to indicate torquing complete.</p> <p>b) If locktite is not present or torque marks have moved, remove one bolt at a time, clean parts, apply Red 271 locktite and torque to 25 ft-lbs(if pre 1996 and no helicoil present in bolt hole) or 32 ft-lbs(if 1996 to present with helicoil present in bolt hole). Repeat torque to double check and clean area with alcohol. Then re-apply torque marks.</p>	<p>Note: If damage is discovered contact HVB Product Service with details to arrange repair, x101.</p>			

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
8	Main Contact/Teflon Nozzle ring dis-assembly	<p>1) Remove M8x18mm socket head bolts from ring to separate pieces then inspect and clean covers.</p> <p>2) All spring lock washers should be changed during this inspection. Check M8x18 and M8x30 washers for correct size.</p> <p>a) M8x18 washer should be the diameter of the socket head, 12.7 mm</p> <p>b) M8x30 washer should be a larger 15mm O.D.</p> <p>Caution: M8 SH bolts need to be Black Oxide(Black color), not Stainless Steel(Silver color) for torque increase. See Note: for replacement details</p> <div> </div>	<p>Note: Teflon nozzle shall be replaced with new type. (Please see No.9)</p> <p>If M8x18 SH bolts are not this size or of Stainless Steel material contact our Warranty Parts Desk, x187, for replacements.</p> <p>If M8x30 SH bolts are of Stainless Steel Material contact our Warranty Parts Desk, x187, for replacements.</p> <div> </div>			





No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
9	Main Contact/Teflon Nozzle ring re-assembly	<p>1) Clean contact rings and new type Teflon nozzle(shown at right) with alcohol before assembly. Nozzle will be supplied by HVB. New nozzle part# 23-5080-00 is replacing original nozzle 23-5011-00. Please make note of this in your parts list for future parts need.</p> <p>2) Place M8x30 SH bolts with the larger M8 split lock washers head first into the holes on the larger contact ring.</p> <p>3) Set Teflon cover and new type Teflon nozzle assembly in ring and slide ring up. Note: Line up the centerline of the Teflon cover recessed holes with the M8x30 bolt threads. This will assure proper positioning for re-assembly to puffer face.</p> <p>4) Place thin contact ring on larger ring with recessed edge fitting into larger ring and onto M8x30 bolts. M8x30 bolts go into the non-countersunk hole.</p> <p>5) Install M8x18 SH bolts into counter sunk holes with the smaller split lock washer. Snug all of them up and then torque to 18 ft-lbs in the criss-cross pattern shown. Repeat the torque to double check. Apply torque mark to M8x18 heads.</p> <p>6) Clean assembly with alcohol and wipes.</p> <p>7) Slide nozzle assembly onto stationary arc contact to the right. Use wipe over contact to help keep clean.</p>	  			
10	Installation of moving arc contact plate	<p>1) Once moving arc contacts have been changed (if was necessary) install the moving arc contact plate assembly to the face of the puffer. Use Blue Loctite 274 on M10 stud thread and apply 18 ft-lbs of torque. Note: before applying torque to the nuts assure M8 bolt hole line up with plate. This can be done visually or by installing 4 M8 bolts in the holes while torqueing. This will assure hole alignment.</p>				

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
11	<p>Attachment of contact/nozzle assembly to puffer cylinder face.</p>	<p>1) Hold nozzle assembly up to the puffer face with the nozzle orientation line facing you at the 9 o'clock position. This allows for proper vent hole alignment with the puffer face. Note: If nozzle does not have this groove use a marker and make a line even with the center of notch like shown in the picture. The do step 1.</p>  <p>2) With the M8 Allen wrench socket in your hand start threading in the M8x30 SH bolts only a couple of turns at a time in sequential order round and round until assembly has pulled up snug to the face. Use a mirror to assure that the backside has pulled up evenly also. This is done so the bolts do not jamb against the top and bottom of the cavity they are in. Caution: If bolts get tight before pulling up evenly, STOP and back bolts out by hand and start over. Failure to follow this step correctly could result in damaged threads in the puffer cylinder and bent contact ring.</p> <p>a) Grab Teflon nozzle and twist back and forth. If the movement is about 1/4", this will indicate that the M10 nuts are in the recessed holes in the Teflon cover in correct position. If the Teflon does not move or moves over 1" back and forth, this indicates the M10 nuts are not in the correct position and the Teflon cover is jammed on the nuts or blocking the puffer gas vent holes. Remove assembly from puffer face and repeat steps starting at No. 11 above.</p> <p>3) Using the ratchet extension so to clear the Teflon while tightening, torque the bolts to 18 ft-lbs using the criss-cross pattern. Once finished, repeat the torque procedure to double check.</p>	<p>Remark</p>  			

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
		<p>4) Check M8/30 bolts tightness by using JIG shown in photo. There should be no gap between jig and contact face. If there is a gap the bolt has not pulled up all the way.</p> 				
12	<p>Perform internal Stroke and wipe check</p>	<p>1) Mark cross hairs on Puffer and Shield with permanent marker as shown Do not use tape because this may cause a problem if accidentally left on puffer in tank.</p> <p>2) Measure the full open position and record (back off manual operating screw slightly to make sure it's in the "on latch" position and not over travel position.</p> <p>3) Tighten back the manual screw and release the closing latch and start to close the breaker with the screw and ratchet.</p> <p>Warning: Failure to have the screw against the mechanism before releasing the close latch could result in a damaged (bent) mechanism lever. This will result in a "out of spec" short stroke.</p> <p>4) While holding a continuity or ohm meter (if with pre-insertion resistors) across the contacts, continue to close the unit until either the resistor touches or (if no resistor) the contact touches. Record both the resistor touch and the contact touch measurements while closing.</p> <p>5) Continue to close the unit until full closed. Take a bar or the manual screw ratchet handle and put in crank lever on top of crankbox (crankbox cover will have to be removed for this) and pull shut to make sure the full closed position is achieved. Some times the resistance of the contacts can hold the interrupter off a few mm unless forced completely closed. Record this as the full closed measurement.</p>				

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
		6) Calculate stroke and wipe values with table shown. If values are not within the specifications shown then contact HVB Product Service x101 and give details of readings.				
		7) Once correct stroke and wipe measurements are achieved, keep values for your records. Leave breaker in the open position for clean and close.				
STROKE AND WIPE MEASUREMENTS						
1 MEASURE and RECORD the FULL CLOSE (FC) Positions						
NOTE: Check the breaker is in the FULL CLOSE Position by bumping the linkage						
1a	Internal FC	Pole 1:	Pole 2:	Pole 3:		
2 MEASURE and RECORD the CONTACT TOUCH (CT) Positions						
2a	Internal CT	Pole 1:	Pole 2:	Pole 3:		
3 MEASURE and RECORD the RESISTOR TOUCH (RT) Positions						
3a	Internal RT	Pole 1:	Pole 2:	Pole 3:		
4 MEASURE and RECORD the FULL OPEN (FO) Positions						
NOTE: Check the breaker's CLOSE LATCH is ENGAGED and the manual operating device is relaxed!						
4a	Internal FO	Pole 1:	Pole 2:	Pole 3:		
5 CALCULATE STROKE AND WIPE Internal: Stroke: (FO – FC) 195-202 mm Contact Wipe: (CT – FC) 24-26 mm Resistor wipe: (RT – FC) 41-45mm						
5a	Internal Stroke	Pole 1:	Pole 2:	Pole 3:		
5b	Internal Contact Wipe	Pole 1:	Pole 2:	Pole 3:		
5e	Gap Measurement 6 mm ± 1 mm	Pole 1:	Pole 2:	Pole 3:		
6	Resistor Wipe	Pole1:	Pole 2:	Pole 3:		
7	Resistor Value	Pole1:	Pole 2:	Pole 3:		

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
13	Clean and Close	<p>1) With a mirror and light give one last thorough inspection. Try to check all accessible/viewable bolt's torque marks to assure they are still at factory position. If not, call HVB for instructions.</p> <p>2) Clean/Wash area down with Isopropyl Alcohol. Including any debris collected by the endplates using a vacuum if needed.</p> <p>3) Apply Hitalube grease to the main contact ring and arc contact tip and then wipe off with dry wipe (no alcohol) to remove excess grease.</p> <p>4) Remove old desiccant from manhole covers and o-rings from flanges. Clean all areas with alcohol.</p> <p>5) Install new desiccant to manhole covers. Torque basket bolts to 10 ft-lbs and mark bolts.</p> <p>6) Install new o-ring on flange by first applying Hitalube grease to o-ring. The o-ring should then stay in the groove.</p> <p>7) Install manhole cover using 2 bolts at the 3 and 9 o'clock positions for guide pins to help hold the weight of the cover while the other bolts are installed. While sliding the cover in place observe that the o-ring is in correct position to avoid a pinched o-ring and gas leak.</p> <p>8) Snug bolts up and torque to 75-80 ft-lbs in criss-cross pattern. Torque a second time to double check.</p> <p>9) Pull vacuum to 1mmHG and continue for 2 hours</p>				

No.	Item	Work procedure	Remark	Pole A	Pole B	Pole C
14	Additional checks	This is a good time to check the following while the breakers is open and degassed.				
15	Check crank box retainer plate hardware	Check for crank box retainer plate bolts torque marks to see if still in original position. If no locking plates are present remove a bolt and check for dimensions(should be M16x50) and for presense of Red 271 locktite. If bolts are incorrect contact HVB for replacements. Add locktite if necessary. Torque should be 80 ft-lbs. If lock plates are present and bolts have not moved, continue.				
16	Check crank box for cleanliness	Remove small inspection plate from end of crank box and inspect the internal cranbox and epoxy insulator area. If bolts were found loose above in 15 then there could be bronze particles to be cleaned. Use light to inspect and clean all possible particles from this area including up inside white epoxy insulator and fiberglass insulating drive rod.				
17	Check brass washers	Check brass washer condition on end of insulating rod. If deformed or worn, replace.				
18	Close crank box inspection cover	After cleaning o-ring groove apply a coat of Hitalube to the o-ring and install the new o-ring 01-0032-00 into groove. Install cover and apply 18 ft-lbs of torque to bolts in a criss-cross pattern.				
19	Remove trip blocking device and screw	1) remove manual operating screw and trip locking device. Caution: Failure to do this could result in burnt trip coils when attempting to operate the breaker at a later time.	