

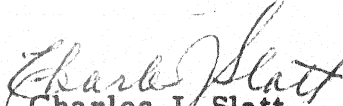
SUBSTATION MAINTENANCE STANDARD	TITLE COMPLETE SERVICE G. E. TYPE FGK-230 OCB	Page
		No. 6401 026 1 Rev.
Date August 21, 1962		

TRANSMITTAL LETTER NO. S-(S)-63-4

Subject: New Tool for use on G. E. Type FGK-230 OCB

Attached is a revision of page C3 and C4 of Maintenance Standard No. 6401-026-1 covering the use of a tool used to facilitate removal of pilot valve seats in G. E. Type FGK-230 OCB's.

Please remove and destroy page C3 which the attached page replaces.


Charles J. Slatt
 Chief of Maintenance

Enclosure

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PART A

I. PURPOSE:

To specify the principle steps in a complete service of a General Electric Type FGK - 230, 230 Kv, 1600 Amp, oil circuit breaker.

II. GENERAL:

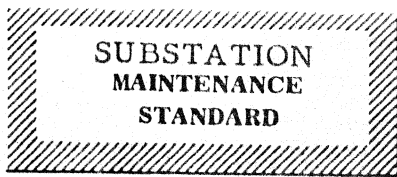
A scheduled complete service shall be performed at an interval determined by engineering judgment based on evaluation of standard schedules, diagnostic tests, and operating conditions. Unscheduled services may be required as a result of abnormal duty or indication of distress in the equipment.

Instruction books, drawings, and other data submitted by the manufacturer for the equipment worked on should be used with this standard. Measurements and tolerances will generally be found in the manufacturer's data.

III. PROCEDURE:

The work to be done after obtaining clearance and observing the other necessary precautions shall include:

	Maintenance Report Reference <u>BPA Form - Line</u>	
1. Record counter reading (as found) and operations since last complete service	730	
2. Make speed test; including close, open, trip-free and reclose (if applicable)	731A	101-104
3. Power close breaker and measure insulation resistance (megger) of each pole as found	731	1
4. Measure contact resistance (millivolt drop)		
a. request removal of differential relays from service	731	2
b. perform test		
c. request restoration of differential relays to normal		
5. Test oil, as found, for dielectric strength, acid number, color and visual examination, IFT and power factor. Start removing oil, filter as necessary.	731	3 - 7



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PART A (continued)

BPA Form - Line

- III. 6. Perform the following:
 - a. open electrical controls
 - b. apply safety device (modified C-clamp as outlined in suggestion BPA-60-385) to prevent tripping
 - c. close air shut-off valves
 - d. bleed off pressure from operating valves
- 7. Make the following closed-position measurements: (Note measurements)
 - a. bell crank 731 10
 - b. lift rod stops 731 11
 - c. mechanism dashpot 731 70
 - d. buffers (in interrupters) 731A 121
 - e. impulse pumps 731A 122
 - f. make reference mark to obtain lift rod travel
- 8. Remove safety device and open breaker slowly, measuring lift rod travel. 731 12
- 9. If phase overall insulation resistance (step 3) is less than 10,000 megohms at 68° F or has changed significantly from last measurement, and reason for low value has not been identified, measure insulation resistance of lift rod assembly. Investigate for moisture, tracking or carbon. 731A 110
- 10. Inspect moving contact assembly including lift rod, crossarm and guide. 731A 130-135
- 11. Check interrupter insulation condition and note insulation resistance. This and step 12 may be accomplished by lifting resistor tap leads. For interrupter condition, measure from the bottom of interrupter to the interrupter lower tap connection. Investigate if insulation value is less than 10,000 megohms at 68° F, or has changed significantly. A low reading may indicate moisture or a carbonized path. 731A 112-114
- 12. Before reconnecting resistor tap connections, measure resistance of each tapped section and record. Investigate if any resistor tapped section is less than 160,000 or more than 176,000 ohms. Reconnect leads. 731A 115-117

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PART A (continued)

	<u>BPA Form</u> - <u>Line</u>
III. 13. Inspect contacts and baffle stacks, removing only parts as required to check for high contact resistance (step 4); questionable interrupter insulation (step 11), or other trouble indication.	731A 119
14. Inspect impulse pump cylinder (check for delamination).	731A 122
15. Check contact penetration if abnormal conditions are found. A jig similar to the one shown in suggestion BPA-60-23 should be used to facilitate this adjustment.	731A 127-129
16. Inspect opening dashpots.	731 14
17. Determine that all necessary adjustments have been properly made and left secure.	
18. Reassemble shields and other parts which have been removed.	
19. Preliminary (as left) insulation resistance (megger)	731 1
20. Wash inside of tanks with a clean oil spray.	
21. Replace oil (minimum dielectric-VDE 18 Kv, ASTM 30 Kv)	731 3-4
22. Clean and inspect compressor, filters, motor, belts, etc.	731 17-23
a. replace oil in compressor	
b. lubricate motor	
23. Remove, service and replace:	
a. Main control valve. (Check condition and adjustment of pilot armature utilizing the gauge outlined in suggestion BPA-61-508	731 26-27
b. Auxiliary control valve (Check condition and adjustment of pilot armature utilizing the gauge outlined in suggestion BPA-61-508.	731 29-30
c. check valve	731 33
d. air strainers and screens	731 35
24. Clean and lubricate mechanism linkage.	731 38-44
25. Check latch clearance and latch wipe.	731 38-44
26. Check coils, thermostats and heaters.	731 46-49
27. Lubricate main piston.	731 24

NOTE: The special tool outlined in suggestion BPA 60 - 310 should be used when lowering of main cylinder and dump valve casting is necessary.

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PART A (continued)

	<u>BPA Form</u>	<u>- Line</u>
III. 28. Check adjustment and operation of auxiliary (aa-1, bd & ac) switches and relays.	731	50-58
29. Check pump-up time of compressor from atmospheric to normal operating pressure. Note time and pressures at the operating point of each pressure switch.	731	61-66
30. Adjust and maintain pressure switches, as necessary. (See 29)	731	61-66
31. Inspect safety valves for leakage (<u>do not operate</u>).	731	34
32. Inspect closing dashpot.	731	70
33. Inspect all wiring.	731	71
34. Inspect CT boxes and connections.	731	78
35. Power close breaker and apply safety device.		
36. Recheck lift rod stops and bell crank measurements.		
37. Remove safety device and open breaker.		
38. Measure latch prop and cut-off switch clearances.	731	55-56
39. Make speed test; including close, open, trip-free, reclose (if applicable), and 1st and 5th rundown test.	731A	101-109
a. Check lift rod overtravel		
b. Test trip-free operation of auxiliary air piston		
c. Adjust tailspring as required	731	
d. Investigate differences between these and previous travel records; when OK use final records with other appropriate data as basis for next major maintenance period.		
40. Measure contact resistance (millivolt drop)		
a. Request removal of differential relays from service		
b. Perform test	731	2
c. Request restoration of differential relays to normal		
41. Measure as left insulation resistance (megger) of each pole	731	1
42. Test oil, as left, for dielectric strength, color, and visual examination.	731	3-4
43. Restore all control circuits to normal.		

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PART A (continued)

- III. 44. Make final inspection.**
45. Test operate breaker.
46. Record counter reading (as left)
when breaker is returned to service,
or clearance is released.
47. Complete maintenance report.

BPA Form - Line

730
730,731,731A

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PART B

I. RECURRING OR SERIOUS TROUBLE:

Special attention should be given these items when performing service on this type breaker:

1. Shrinkage and deterioration of rubber pads mounted on inside tank walls.
2. Delamination of impulse pump cylinder walls.
3. Grooving and deterioration of pilot armature seals in main and auxiliary control valves (orifice restricted) delaying breaker closing operation. This delay may result in destruction of grading resistors and burning of contacts. The permanent magnet may also suffer damage.
4. Excessive rust or corrosion in air receivers.
5. Rust in air lines and valves resulting in clogging of screens in main air lines, mis-operation of valves, and slow closing of the breaker with resultant resistor and contact damage.
6. Cracked main piston and rings due to bottoming of piston in main cylinder.
7. Flashover to tank wall.
8. Failure to latch or slow closing due to items 3 or 5 above, for example, may cause severe damage to the interrupters.
9. Delamination of resistor tubes.

II. PERTINENT STANDARDS:

1. No. 6476 - 000 - 2
2. No. 6409 - 026 - 1

III. SPECIAL INSTRUCTIONS & WARNINGS:

- A. Breaker should remain de-energized for at least 8 hours to permit de-aeration of oil after refilling. (Manufacturer's recommendation.)

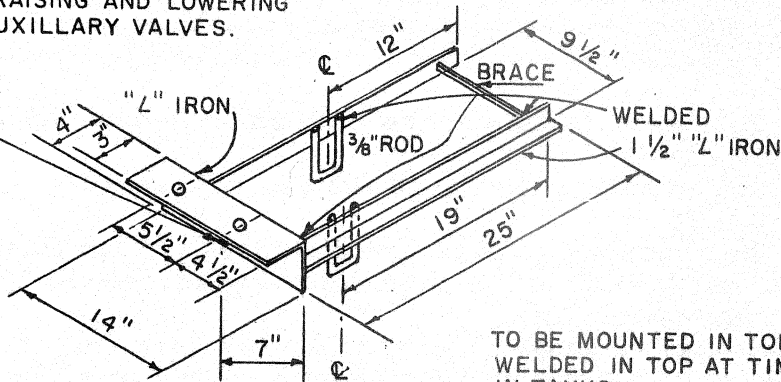
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PART C

I. SPECIAL TOOLS:

1. Jig for lowering main cylinder and dump valve casting
(Suggestion BPA 60 - 310).

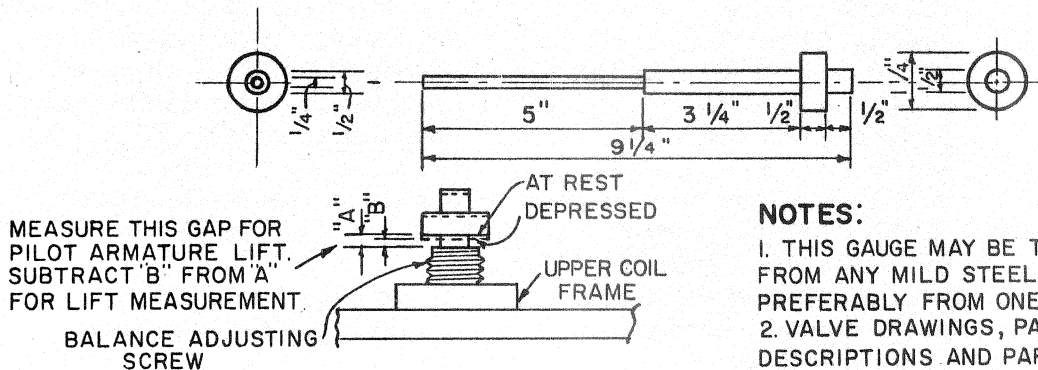
HOLE LARGE ENOUGH FOR CABLE
HOIST FOR RAISING AND LOWERING
MAIN AND AUXILLARY VALVES.



TO BE MOUNTED IN TOP OF CABINET USING BOLTS
WELDED IN TOP AT TIME BLANKETS WERE INSTALLED
IN TANKS.

- a. Mount in top of mechanism cabinet utilizing the bolts which were installed at time of breaker modification.
- b. Remove only the two bolts in casting necessary for attaching hoist hooks (other components may be left in place).
- c. Attach cable hoist to jig for lowering or raising assembly.

2. Pilot armature lift gauge (Suggestion BPA 61 - 508).



NOTES:

1. THIS GAUGE MAY BE TURNED FROM ANY MILD STEEL ROD. PREFERABLY FROM ONE PEICE.
2. VALVE DRAWINGS, PARTS DESCRIPTIONS AND PARTS NO'S MAY BE FOUND IN G.E. INSTRUCTION MANUAL NO. G.E.I-38997.

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PART C (continued)

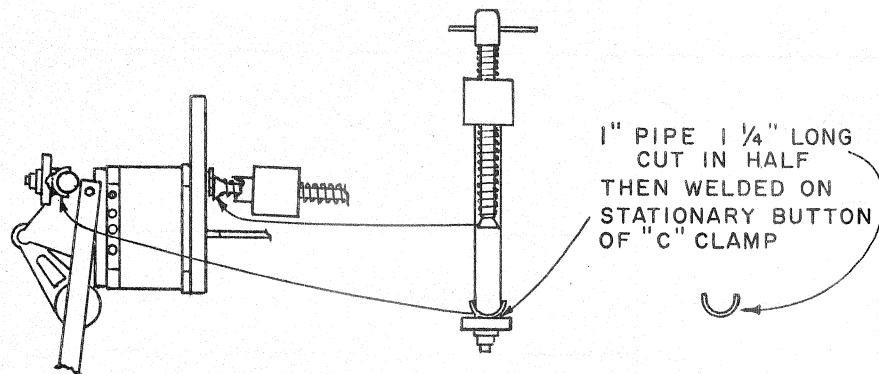
Instructions for use:

- a. This gauge may be used to measure pilot armature lift in the main control valve and auxiliary control valve.
- b. Valve may be left in OCB or removed for measurements.
- c. Begin by removing air line (10) main valve only, Top cylinder (1), Top piston (9), spring (10), balance adjusting screw (13), balance spring (14), plunger (15) and pin (17). Drawing of valve with part names and numbers may be found in G.E. Instruction Manual No. GEI-38997, Pages 12 and 13.
- d. Replace balance adjusting screw only and run down until it is finger tight.
- e. Insert pilot armature lift gauge until it touches pilot armature (24).
- f. Using a thickness gauge measure distance between flange on gauge and surface of balance adjusting screw. Record this measurement ("A").
- g. Apply pressure to gauge forcing pilot armature away from pole piece (20) and causing it to seat in closed position. **CAUTION!** Use only enough pressure to close pilot valve, otherwise valve seat may be compressed resulting in an inaccurate measurement.
- h. Again repeat step f. This measurement will be "B".
- i. Subtract measurement "B" from measurement "A". The difference is the pilot armature lift.
- j. The pilot armature lift may be adjusted by adding or removing shims between the upper coil frame (2) and the shell(3).
- k. To measure the pilot armature lift in the auxiliary control valve, Step c would require only the removal of the balance adjusting screw (1) from Fig. 13, Page 13 of G.E. Instruction Manual GEI-38997, the balancing spring (10), and plunger (9). Step d remains the same. Step e requires that the V-X coil (13) be energized at low voltage to hold the pilot armature in the open position while measurement "A" is taken. Step f remains the same. In step g no pressure will be required as gravity will return the pilot armature to the closed position. Steps h, i, and j are the same as for the Main Control Valve.
- l. Recommended pilot armature lift is .080" - .090" for the main control valve, and .070" - .080" for the auxiliary control valve.

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PART C (continued)

**3. Clamp for locking mechanism in closed position
(Suggestion BPA 60 - 385)**

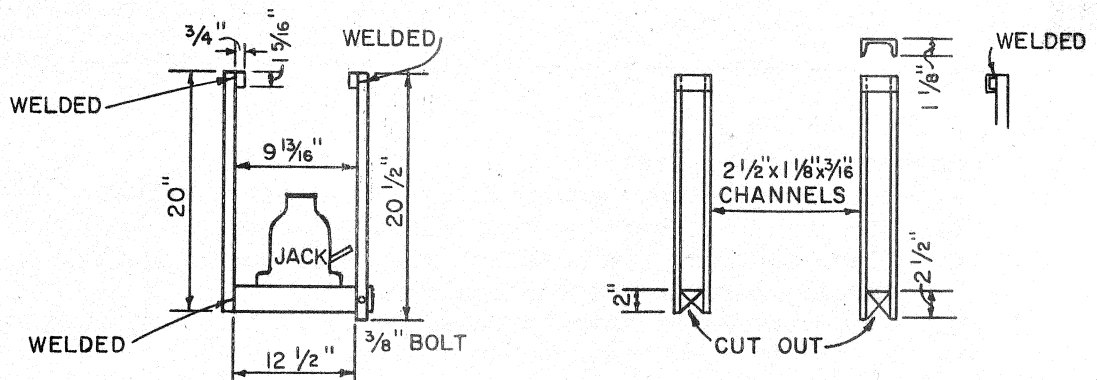


MAGNETIC LATCH IN CLOSED POSITION

Instructions for use:

- a. Clamp manual opening pin to latch as per above sketch.

4. Tool to facilitate adjustment of contact penetration within interrupter (Suggestion BPA 60 - 23).



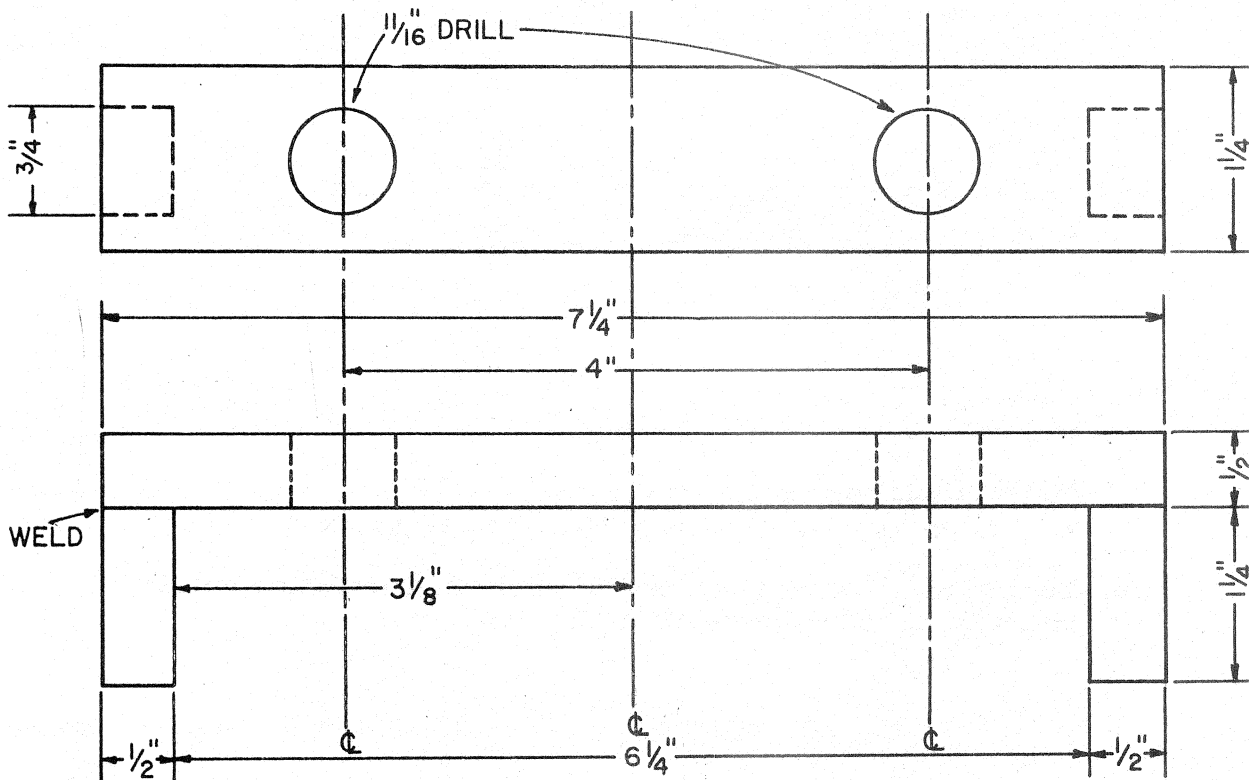
Instructions for use:

- a. Remove lower static shield and lower contact button.
 b. Hang jig in exposed openings in lower housing of interrupter.
 c. Place hydraulic jack as shown in sketch for closing and opening interrupter contacts.

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PART C (continued)

5. Tool for removal of pilot valve seat
(Suggestion BPA 62-31)



Instructions for use:

- a. Remove coil frame and coil of main closing valve.
- b. Place puller, bar up, over pilot valve seat.
- c. Place two coil frame bolts, with nuts turned full thread, through holes in puller.
- d. Screw the bolts into threaded holes in pilot valve seat.
- e. Turn nuts down against bar evenly.