BBC BROWN BOVERI

Brown Boveri Electric, Inc.
Manufacturer of I-T-E Electrical Power Equipment

FACTORY SPECIFICATIONS

TYPE 15HKV	MODEL "03C"	SPEC. NO. TD-9335	
		SECTION A	
		PAGE 1 OF 2	
COMPILED D.H.L.	CH'D. D.H.L.	APP. L.H.S.	REV. 0
DATE 10-14-83	DATE 2-1-84	DATE 2-1-84	

SPECIFICATION NO. TD 9335

TYPE 15HKV - MODEL 03C

CIRCUIT BREAKER

(VACUUM INTERRUPTERS)

[redacted]

5HKV-250 5HKV-350 7.5HKV-500 15HKV-500 15HKV-750 15HKV-1000	1200A 2000A 3000A

Any variations from these specifications require Circuit Breaker Production Engineering approval.

This specification is intended for factory internal use only.

RE IONS

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SECTION B

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Interphase Barrier Assembly

1. The barriers shall be clean and wiped free of dust on all surfaces prior to installation on the circuit breaker.

2. Warning signs, caution stickers and BBC logo shall be attached to the outside of the front sheet per L-11469 and 163777-T1.

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Vacuum Interrupters

1. Vacuum interrupters should be kept in their cartons until ready for assembly.
2. On removing the interrupter from its carton, do not grasp it by the movable electrical terminal or rock the rod from its centered position. Excessive radial displacement can permanently distort the bellows or cause deformation of other internal parts.
3. Inspect each vacuum interrupter visually, for obvious damage.
4. The insulating vacuum envelope should be examined carefully for cracks, especially in the areas of the metal-to-insulation seals.
5. If there is a midband ring and if it has been bent by an accidental impact, that area should be especially inspected for glass seal damage.
6. The pinch-off tube seal located at the end of the stationary contact stud is coated with epoxy for protection. The pinch-off tube should be inspected for any cutting or denting, which could result in loss of vacuum.
7. A slight rattling of the condensating shield may occur if the interrupter is shaken, this is a normal condition.
8. Twisting of the moving lower terminal must be strictly avoided when making either electrical or mechanical connections to the interrupter. Any rotational twist in excess of two degrees from the normal free position of the terminal will cause permanent damage to the bellows. Do not pull the movable electrical terminal out any more than the normal .46" air gap + 0.098.
9. After all production tests, the breaker shall be closed for shipment and the closing springs discharged. The unit shall carry a warning to the effect that the breaker is closed and the tripping mechanism is charged.

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Current Carrying Parts RE: 1200A - L13046 L03047 (500 AND 750 MVA)
2000A - L13045 L13048

1. Before assembling current carrying parts, make sure mating surfaces are silver plated, clean and free of raised metal.

2. The moving contact (1200A - 164837; 2000A - 164812) must be silver plated on the O.D. and burnished. The tapered I.D. of the 1200A and the threads of the 2000A moving contact must be silver plated.

3. Install the lower brass plate and the lower terminal on the interrupter with the brass plate set to the initial dimension shown on the layout drawing. SEE FIG. D-1.

   1200A - L13046 (7.420 dim.)
   2000A - L13045 (7.429 dim.)

   The lower terminal should be turned as close to the 1/2" brass plate as possible. Note that the red erosion indicator on the bottle should be at the front of the breaker when assembled.

4. Cut the multilam to 8" (LESS 1 LOUVER) long when used with the 2 1/2" dia. moving contacts. Cut to long when used with the dia. moving contact.

5. Make sure that the guide rings are fully seated in the grooves and the ends of the multilam do not overload.

6. Installation of moving contact and connector on the interrupter.

   6.1 Moving contact, 2 1/2 dia., with tapered hole (1200A). (See note 1.)

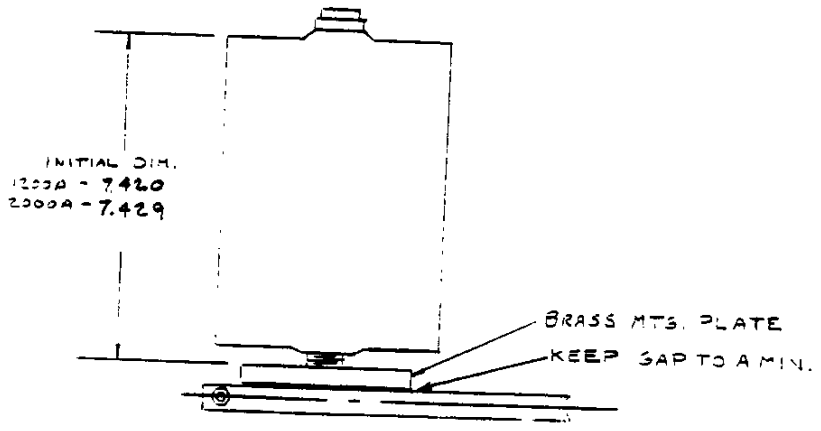

FIG. D-1

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6. Con't

~~6.1.1~~ Lightly lubricate both the I.D. and O.D. of the tapered sleeve with No-Ox-Id "A" special grease. DHL 3-16-84

6.1.2 Install the tapered sleeve on the bottle until it rests on the hex. Force the moving contact onto the taper by tightening the connector (164838-A) to 60 ft. lbs. using tool (TG-163775). Install set screw 50347-D5 in the connector.

6.2 Moving contact, 2 1/2" dia., with threaded hole (see note 1).

6.2.1 Screw the moving contact on the bottle and torque to 100 ft. lbs. using tool (TF-163775).

Check that the moving contact is tight against the hex and that the recessed shoulder of the moving contact extends above the shoulder that is at the base of the bottle 5/8 dia. thread. SEE FIG. D-1A

6.2.2 Install connector (164813-A) and torque to 90 ft. lbs. using tool (TG-163775).

NOTE 1: Whenever applying torque to the interrupter moving contact, make sure to hold the large hex of the interrupter with a wrench so that no stress is put between the moving terminal and bottle. Make sure the wrench is not put on the red flat that also serves as the erosion indicator.

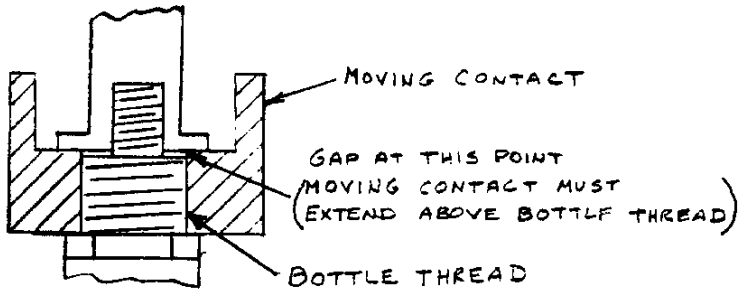

FIG. D-1A

7. The O.D. of the moving contact to be lubricated with Aerodag "G" Lubricant (16 oz. spray can, Acheson Colloids Co., Port Huron, Michigan 48060).

8. Insert the steel mandrel (TH-163775) into the multilam and stationary assembly. Move it up and down several times and rotate it several times to remove any irregularities in the multilam.

9. Using the steel mandrel tool (TH-163775) as a guide, install the stationary contact and multilam assembly onto the moving contact. Do not allow the stationary contact assembly to slide past the normal position.

10. Install the bottle, lower brass plate, lower terminal and contact assembly into the chair assembly. Check that the red erosion indicator is toward the front of the breaker. Install a total of 6 - 7/8" long bushings at the mounting holes along with 2 flat washers (spacers 50702-A14) at the front two lower mounting bolts. Install the mounting hardware and tighten evenly so the assembly is correctly seated. Torque each of the 6 bolts to 20 ft. lbs. Tighten the clamp bolt at the lower bottle terminal. DO NOT UNTIL JUST BEFORE THE 50 BREAKIN OPERATIONS.

11. Lightly apply Anderol 757 to the connector shaft and spring washers and install the proper combination of spring washers on the connector. 10 HL 3-16-84

    A 500 MVA breaker should have 10 spring washers in series plus a spacer. SEE FIG. D-2.

    A 750 MVA breaker should have 20 spring washers in series-parallel and no spacer. SEE FIG. D-2.

Use of stacked Belleville Spring Washers

FIG-D2

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APPLY PRIMER AND LOCTITE 290 TO THE CAM PIVOT PINS 164816-A AND ASSEMBLE

12. ~~Assemble the cam pivot pins~~ in the spring retainer 164815-A using tool TE-163775. Lock pivot pins in place with set screws 50347-E3 after first applying Loctite 290 to the set screws.

13. Complete the assembly of housing 164809-K1, spring retainer, actuator arms, bushings, retainers, etc. Lubricate with Anderol 757. The arms must pivot freely with a slight amount of end play at the pivot pins.

4 HOUSING BOLTS TORQUED TO 25 FT. LBS. 2 BOLTS FASTENING UPPER TERMINAL TO STATIONARY CONTACT TORQUED TO 25 FT. LBS.

14. Lightly apply Anderol 757 to the I.D. of the spring retainer and install the complete assembly over the connector shaft until seated fully on the stationary contact and engages the pushrod. Install the mounting hardware.

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15 Slow close the breaker. Adjust the pushrod so that the gap between the cam follower roller and the end of the slot is .170 ± .005. SEE FIG. D4.

16. Install the castle nuts and adjust for the .156 ~~dim.~~ DIM. +.000 -.005. SEE FIG. D3. DHL 3-16-84

17. Open and close the breaker several times. Check that the breaker opens and closes fully. During closing there must not be noticeable hesitation before latching in.

18. Close the breaker and check the distance from the top of the spring retainer to the top of the connector: SEE FIG. D3.

1200A - ~~1.195~~ 1.192 ± .020 DHL 3-16-84

2000A - 1.205 ± .020

ALSO ADJUST FOR 1.032/1.064 AND .156. SEE FIG. D3.

Readjust if required: Remove castle nut. Open the breaker. Loosen the locking bolt at the lower bottle terminal. Rotate the bottle down to decrease the dim. Rotate the bottle up to increase the dim. Note that the bottle must be rotated so that the red indicator mark

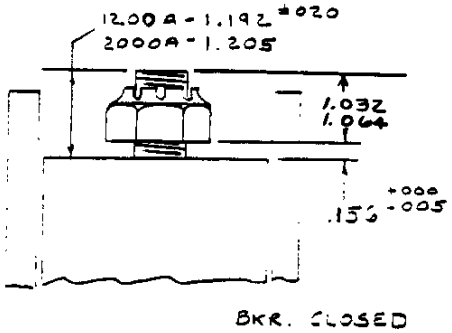

FIG. D3

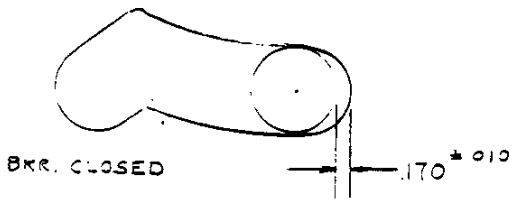

FIG. D4

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18. (con't)

is still at the front. Also, one complete turn of the bottle is approx. .060 in. The bottle is to be rotated without excessive force since excessive force may damage the bottle bellows. Spread the lower clamp if necessary to reduce the required rotational force. Retighten the lower bottle clamp bolt. To 25 FT. LBS. DHL 3-16-84

19. Repeat paragraphs 15, 16, 17 and 18, if readjustment per 18 was required. RETORQUE LOWER TERMINAL TO BOTTLE CLAMP TO 25 FT. LBS. DHL 3/16/84

20. Record on data sheet "before 50 operations."

21. Install the cotter pins thru the castle nuts.

22. Using the test fixture, align the 6 terminals per Figure D5 Record on data sheet.

23. Operate breaker 50 times (space 50 opers. over a min. of 5 minutes).

24. Recheck and record on data sheet "after 50 operations".

25. Retighten all hardware.

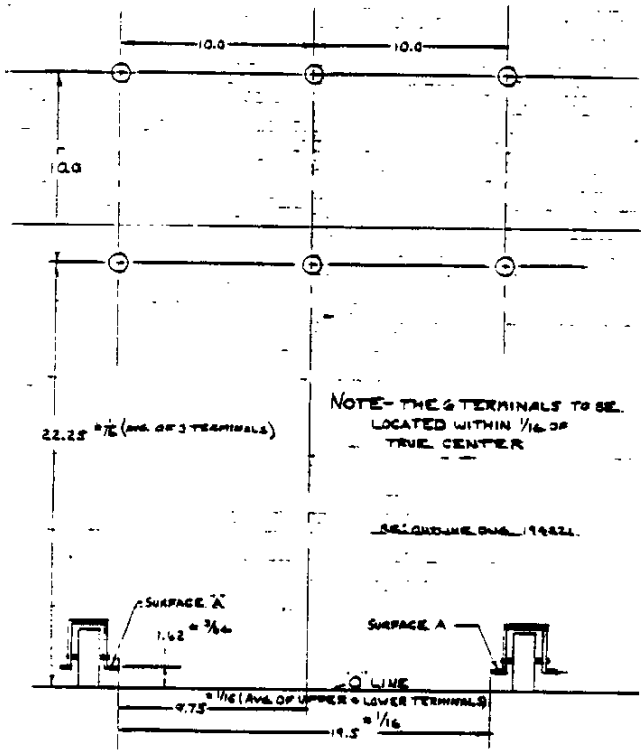

FIG. D5

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15HKV-03C, 1200 and 2000A

BREAKER SER. NO. _____ DATE _____

		L	C	R
Before 50 Operations				
.156 ± .005 check	X			
.170 ± .015 check	X			
Record Actual Dimension 1.192 ± .020(1200A)	X			
1.205 ± .020(2000A)	X			
All Hardware Above Truck Are Tight. Check		X	X	X
Terminal Alignment Within 1/16 of True Center				
After 50 Operations				
.156 ± .005 check	X			
.170 ± .015 check	X			
Record Actual Dimension 1.192 ± .020(1200A)	X			
1.205 ± .020(2000A) 1.032/1.064	X			
Retighten All Hardware Above Truck. Check				

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OPERATING MECHANISM

1. All parts shall be assembled without forcing.
2. All latch faces and rollers shall be clean, free of nicks or burrs, free of any cadmium-iridite, and shall be chrome plated.
3. All cotter pins shall be rolled snugly.
4. All retainers shall be in place and secured.
5. All pivot pins, linkages, and friction areas shall be liberally lubricated with Anderol 757 lubricant.
6. "Caution" labels (180072-A) shall be installed on each closing spring guide.
7. All rotating latches, rollers, linkages and shafts must operate freely and reset firmly by hand, prior to installing the closing springs.
8. The closing spring crank arms shall have a minimum of two flat washers on the inside of the closing spring guide and one flat washer on the outside.
9. Major operating mechanism lubrication points (21) are the shaded pivot areas shown in Figure E- 2
10. The manual trip linkage on opposite side of operating mechanism is also a major lubrication area.
11. Each mechanism shall be charged manually during inspection to assure proper manual operation.
12. The force required to operate the manual trip button shall not exceed 18 #.
13. When trip latch is reset, a gap of from .005" to .030" must be maintained between the latch face and the trip roller.
14. The motor guide link 650457-B shall be positioned with the projection adjacent to the link connecting the motor to the ratchet mechanism.

SEE FIG. E1

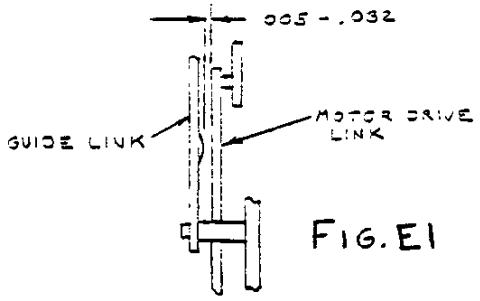

FIG. E1

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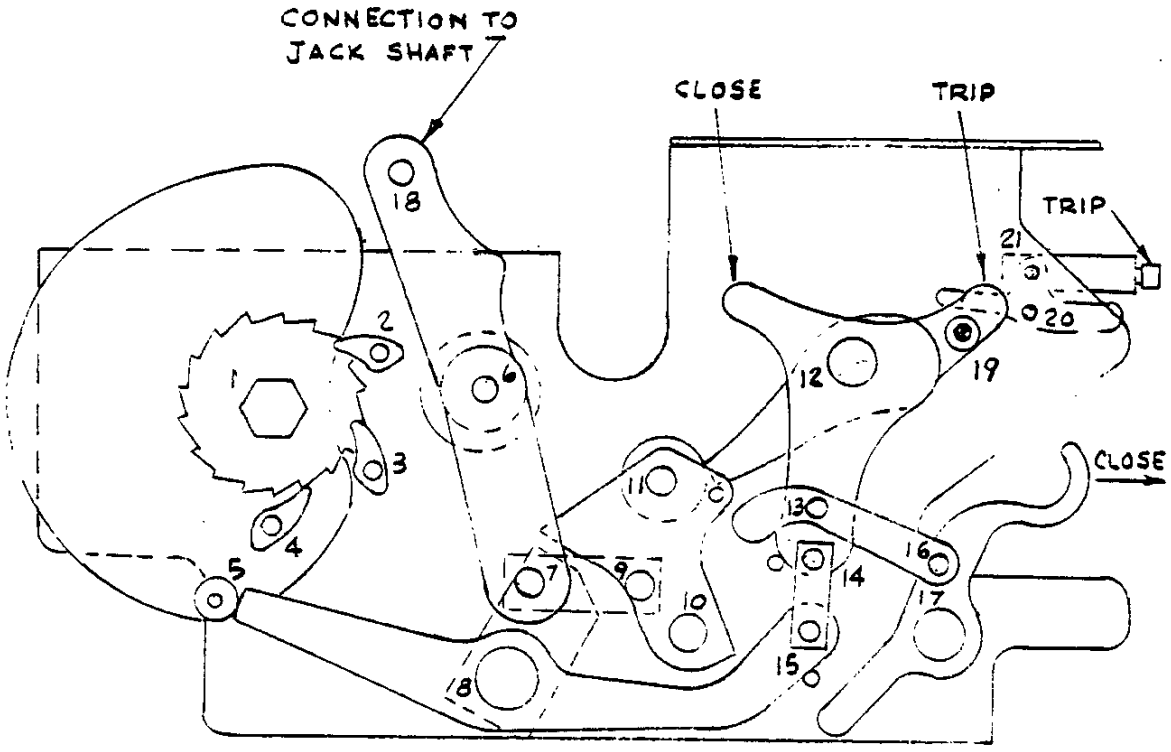

FIGURE E-2

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TRUCK

1. All moving parts shall move freely after assembly.
2. All retainers shall be secured in place.
3. All pivot pins, linkages and friction areas shall be liberally lubricated with Anderol 757 lubricant.
4. Lubricate "Ground Shoe" pivots and contact surfaces with No-Ox-Id "A" special contact lubricant prior to assembly.
5. Coat joint between ground shoe and truck with No-Ox-Id "A" special contact lubricant.
6. Interference angle shall correspond in position according to rating of breaker (See Figure F-1).

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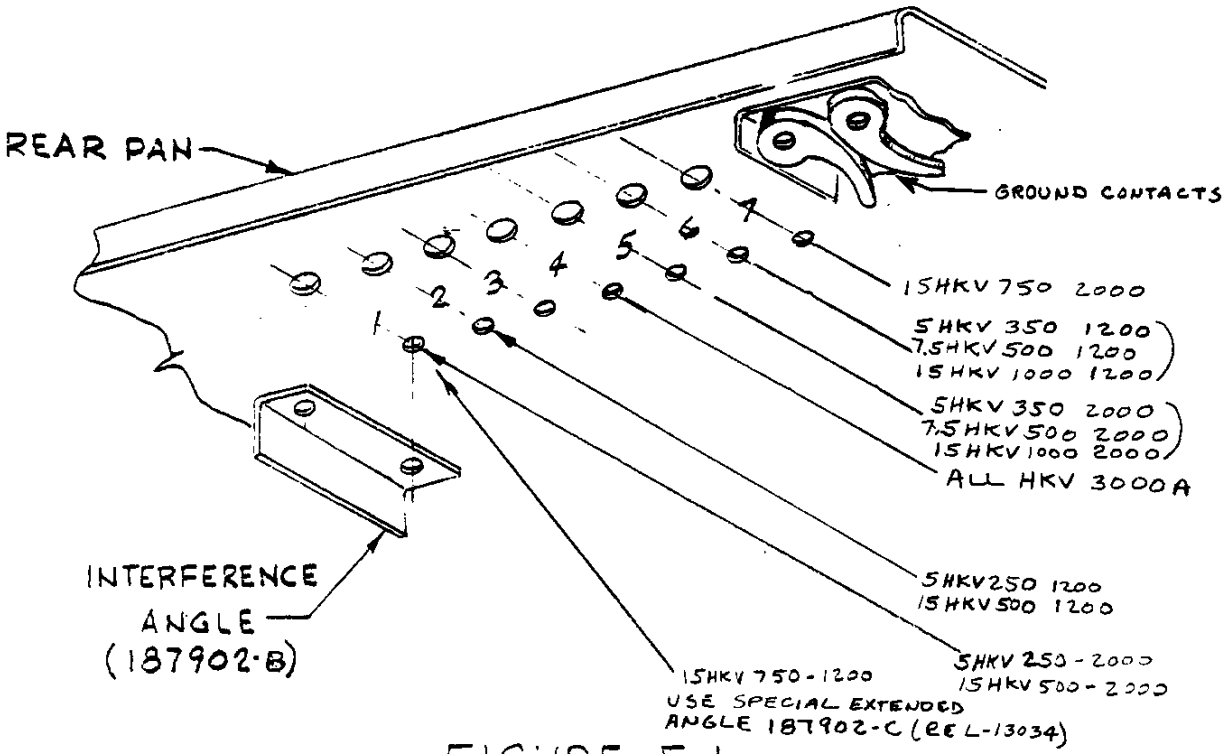

FIGURE F-1

RE: L-8530

NOTE:
1. Breaker: Install angle per breaker rating.
2. G & T: Omit angle unless specifically called for.
3. Dummy: Install two angles (Pos. #1 & #5).
4. Interference angle keys with switchboard per dwg. no. 823924.

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7. Grounding contacts shall be checked for continuity to the truck.

8. Opening springs shall initially be adjusted to $\frac{17}{32}$ from the opening spring retainer plate to the end of the opening spring guide (see Figure F-2).

9. The bolts used to secure the operating mechanism to the truck shall torque at 100 ft. lbs. minimum.

10. The mechanism operated cell switch actuator (MOC) shall have a vertical travel of 1 3/16" ± 1/32" between the breaker open and the breaker closed position.

11. All truck wheels shall rotate freely.

12. The shutter roller shall operate the shutter position indicator on the test fixture to within the specified limits of the test fixture.

13. The ground shoe shall have a pull of 5 # (+3, -1) to simulate removal of the ground connection.

14. Rubber or brass grommets shall be used where wires run through holes in the truck.

15. The padlock hasp (furnished only when specified) functions with the racking mechanism and is described in Section G.

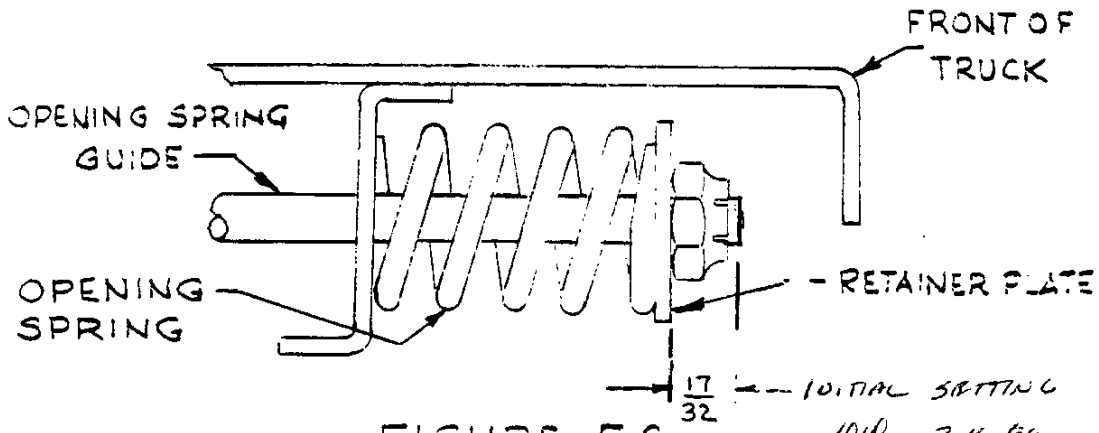

FIGURE F-2

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RACKING MECHANISM

1. All parts shall be assembled without forcing.
2. All cotter pins shall be rolled snugly.
3. All retainers shall be secured in place.
4. Racking screw threads shall be free of burrs.
5. The operation counter shall advance one count for each breaker operation.
6. The breaker position indicator shall be fully exposed through the front plate opening and shall indicate breaker "Open" or "Closed" position.
7. All pivot pins, bearing surfaces, linkages, threads and rollers shall be liberally lubricated with Anderol 757 lubricant.
8. The torque required to rotate the racking unlocking level shall not exceed 2.5 ft. lbs.
9. Not more than six turns of the racking screw shall be required to move the breaker from either "Out" or "Disconnect" position, to "Test" position.
10. Not more than sixteen turns shall be required to move the breaker from "Test" position to "Connected" position.
11. The maximum torque required to rack breaker onto switchgear primary contacts to be 40 ft. lbs. for 3000A breaker.
12. With the breaker closed, the racking lock bracket (Figure G-1) shall protrude through the front of the racking mechanism and prevent rotation of the unlocking lever, thus making it impossible to rack the breaker while in the "Closed" position.
13. The breaker shall be trip-free during racking, in either direction.
14. The trip free racking adjustment is made by lengthening or shortening the adjusting rod (Figure G-1) so that there is a minimum of 1/8" gap at Point "A" (between manual trip bell crank and blocking lever). Breaker should be closed when making this adjustment. The maximum adjustment at Point "A" should not exceed 3/16".

15. The padlock hasp (furnished only when specified) shall be checked with a 7/32" diameter pin inserted in the padlock slot, against the front of the front cover (See Figure G-2). With the pin installed, it shall be impossible to release the racking unlocking lever. With the breaker in the connected position, the hasp cannot be pulled out to install the pin. The breaker can be closed or opened with the pin installed.

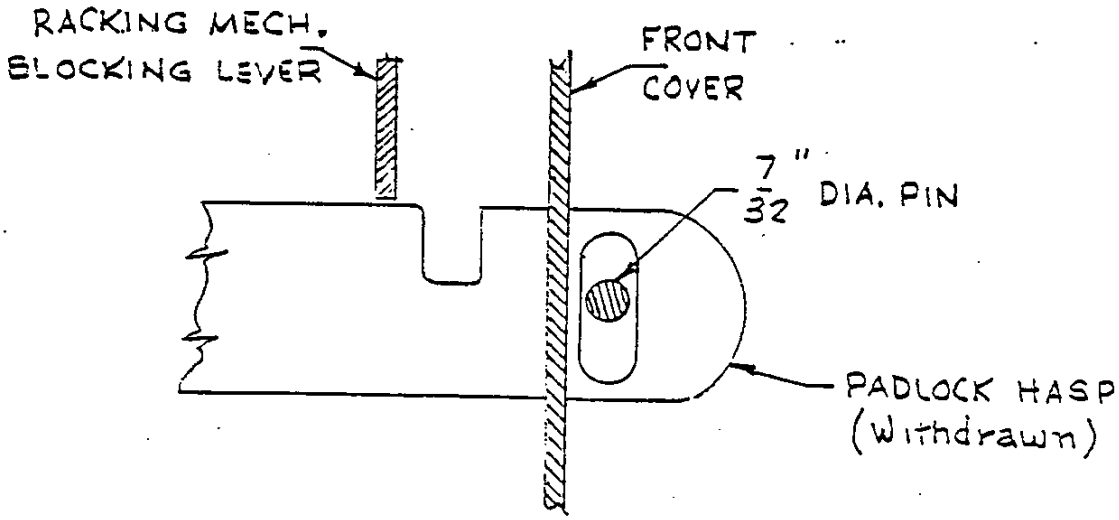

FIGURE G-2

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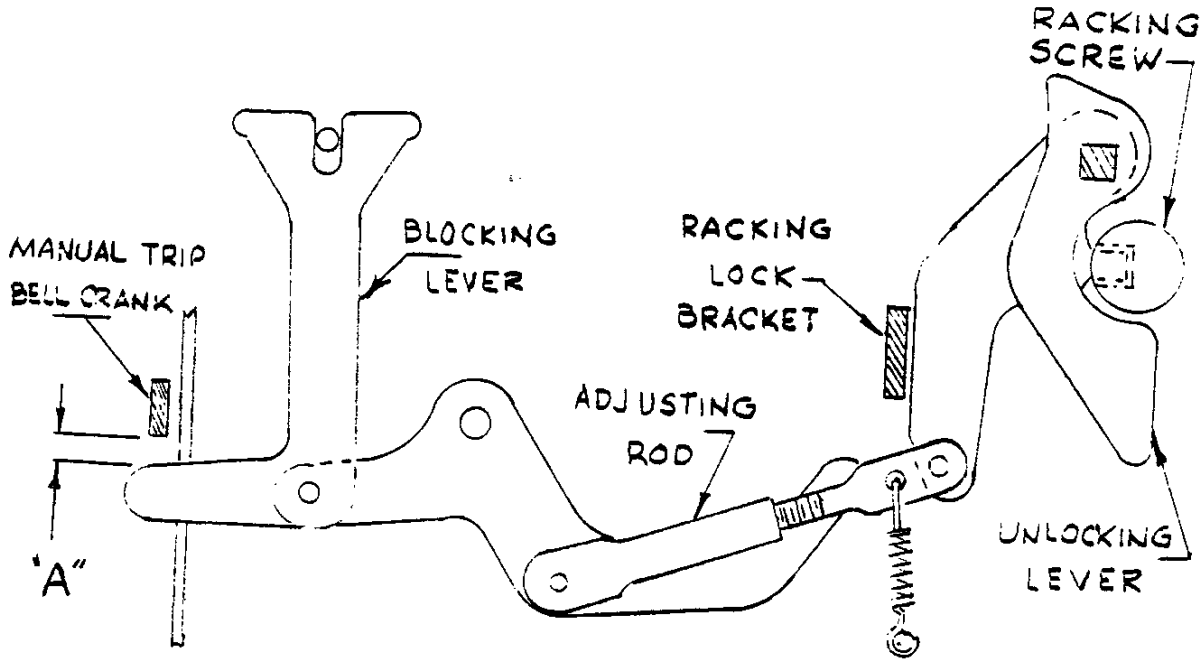

FIGURE G-1

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14. The padlock hasp (furnished only when specified) shall be checked with a 7/32" diameter pin inserted in the padlock slot, against the front of the front cover (See Figure G-2). With the pin installed, it shall be impossible to release the racking unlocking lever. With the breaker in the connected position, the hasp cannot be pulled out to install the pin. The breaker can be closed or opened with the pin installed.

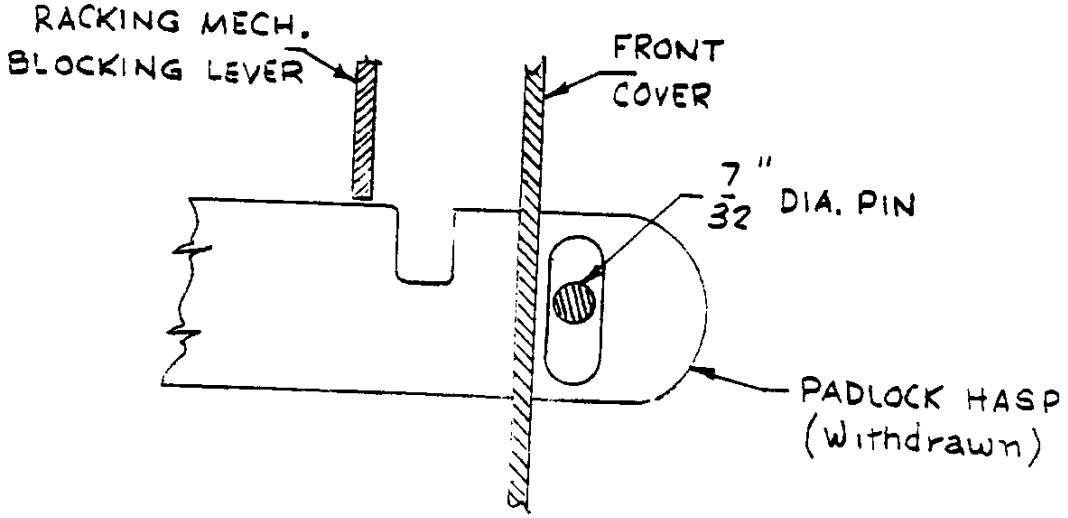

FIGURE G-2

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CONTROL PAN

1. All wiring must be neatly tied into wire packs. The wire packs must be clear of any moving parts.
2. Rubber or brass grommets shall be used where wires run through holes in the control pan or truck.
3. All control wires shall be #14 gauge.
4. All terminal screws shall have lock washers.
5. The control pan assembly shall consist of an auxiliary switch, a control device, secondary disconnect assembly and, if required, a resistor assembly.
6. The auxiliary switch shall have a nominal travel of 90° ± 10 degrees.
7. The limit switch contacts contained within the control device shall have a stroke of 5/16" ± 1/64" when operated by the limit switch actuator (timing lever).
8. The limit switch contact carrier must return to its fully reset position, without any hesitation, when the limit switch actuator is released.
9. The secondary disconnect assembly shall have a side and vertical motion for self-alignment. Side motion shall be 1/2" ± 1/8" and vertical motion shall be from 3/8" to 1/2".

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CONTROL DEVICE

1. Limit switch and "Y" coil contact carriers must move freely when operated by hand. The contact carriers also must fully reset when released.
2. Limit switch actuating arm is to be "tin" plated for identification.
3. The voltage rating must be indicated by a service label on each device.
4. For DC coil operation, a non-magnetic shim is required in the center pole of the "Y" coil magnet frame.
5. For AC coil operation, the "Y" coil magnet frame shall have shading rings on the stationary side.
6. The normally open "Y" coil contacts shall have a break of 1/16" ± 1/64" when the armature is open.
7. The "Y" coil armature shall have a stroke of 1/8" ± 1/64".
8. SEE TABLE I-1 FOR "Y" COIL OPERATION.

9 Limit switch contacts shall have a break of 1/4" ± 1/32".
1/32 3/64

10 The gap between control device lever and limit switch crank should be ~~1/16"~~ to ~~3/32"~~ when springs are charged. Turn adjusting screw as required. Tighten jam nut.

11 The gap between control device lever and control lever stop should be ~~1/64~~ to ~~1/16~~ with discharged springs. (Shim lever stop as required.) See Figure I-1.
.005 .040

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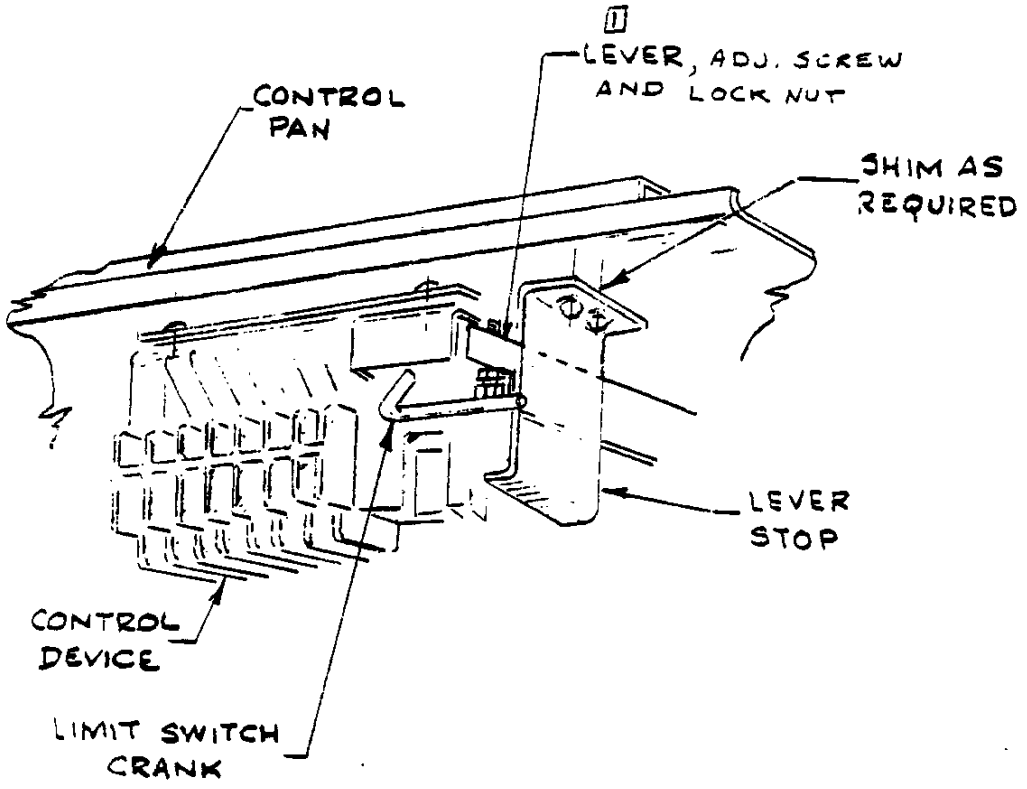

FIGURE I-1

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3. Electrical

The "Y" coil, including any resistors normally applied in the breaker circuit, shall pick up and seal, without chatter, at a voltage no higher than that listed. At nominal rated voltage, less 10%, the "Y" coil may have a "hum" but not noisy. See Table I-1

TABLE I-1

RATED VOLTAGE	CLOSING CIRCUIT VOLTAGE RANGE	MAX. PICK UP AND SEAL MIN. RANGE LESS 10% (NO CHATTER)	RATED NOMINAL VOLTS LESS 10% (NOISE TEST)	SERIES RESISTOR	HOLDING CURRENT AT RATED VOLTAGE
24 VDC				-	.03A
48 VDC	38-56	34	43	-	.15A
125 VDC	100-140	90	112	-	.06A
250 VDC	200-280	180	225	-	.03A
120 VAC (60HZ)	104-127	94	108	200 OHM	.40A
240 VAC (60HZ)	208-254	187	216	1000 OHM	.20A
Ref: ANSI C36.06 1980					

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COMPILED D.H.L.	CH'D. D.H.L.	APP. L. Schmidt
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TRIP AND CLOSE DEVICE

1. The armature must move freely through its entire operating stroke.
2. The voltage rating must be indicated by a service label on each device.
3. Refer to Drawing No. 53264 and 400022-A for specifications pertaining to fabricating, winding, taping and impregnating of operating coils.
4. Lubricate all pivot points with Anderol 757 lubricant.
5. The armature shall have a stroke of 1/2" ± 1/32".
6. The pickup and dragoff voltage values must be below the indicated maximum value given in Table I.
7. Coil resistance measurements must be within the limits given in Table I, ± 10%.

TABLE I

HK TRIP & CLOSE DEVICE

Rated Voltage	Specified Operating Voltage Range	Max. Drag-Off Volts	Max. Pick-Up Volts	Coils Resistance (Ohms)
24 V-DC	13 - 28	10	9	1.1
48 V-DC	28 - 60	17	16	4.5
125 V-DC	70 - 140	31	28	18.8
250 V-DC	140 - 280	110	95	110.0
115 V-AC	95 - 125	85	65	2.5
230 V-AC	190 - 250	152	120	10.0

REVISIONS

SPRING CHARGING MOTOR

1. Vendor (Lamb Electric) furnished motors are to be in accordance with Dwg. No. 197470.

2. The dielectric withstand tests shall be conducted at 900 volts, 60 cycles, for one minute, on the motors as received. Any subsequent dielectric withstand tests, after the motors have been operated, shall be conducted at 765 volts, 60 cycles, for one minute.

3. The motors shall operate under the load of the operating mechanism closing springs within the limits of the operating range given in Table I.

4. The average current (measured near the end of the spring charging stroke) shall be approximately equal to the values given in Table I.

5. The spring charging time at rated control voltage shall not exceed the values given in Table I.

TABLE I

HK MOTOR OPERATING CHARACTERISTICS

Voltage Rating	Operating Range (With Current Flowing)	Average Current	Maximum Charging Time (SEC.)
48 V-DC	33 - 60	20.0 A.	2.7
125 V-DC	60 - 140	10.0 A.	2.0
250 V-DC	120 - 280	5.0 A.	2.0
115 V-AC	60 - 140	10.0 A.	2.5
230 V-AC	120 - 280	5.0 A.	2.5

AUXILIARY SWITCH

1. The auxiliary switch shall consist of four contacts, two "a" contacts and two "b" contacts, unless specifically requested otherwise.

2. The auxiliary switch shall have a nominal arc travel of 90 degrees ± 10 degrees.

3. The contacts shall have a wiping action of 1/16" to 1/32".

4. The auxiliary switch contact ratings given in Table I are not to be exceeded.

TABLE I

Auxiliary Switch Contact Inductive Ratings

Voltage	Current
115 AC	30 A.
240 AC	20 A.
480 AC	10 A.
600 AC	7 A.
125 DC	10 A.
250 DC	5 A.
600 DC	0.5 A.

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LATCH CHECK SWITCH

1. The latch check switch is provided only when specified as it is an optional feature.

2. The function of the latch check switch is to monitor the position of the trip latch by operating its contacts only when the trip latch is in its reset position.

3. Adjust the latch check switch by inserting a .050" feeler gauge between the underside of the trip latch and the trip latch stop pin (Figure M-1).

4. With .050" gauge in place, turn the adjusting screw in a clockwise direction until the latch check switch contacts "break" (audible click), then turn adjusting screw counter-clockwise until the switch contacts "make" (audible click). The adjusting screw is self-locking and removal of the feeler gauge complete the adjustment.

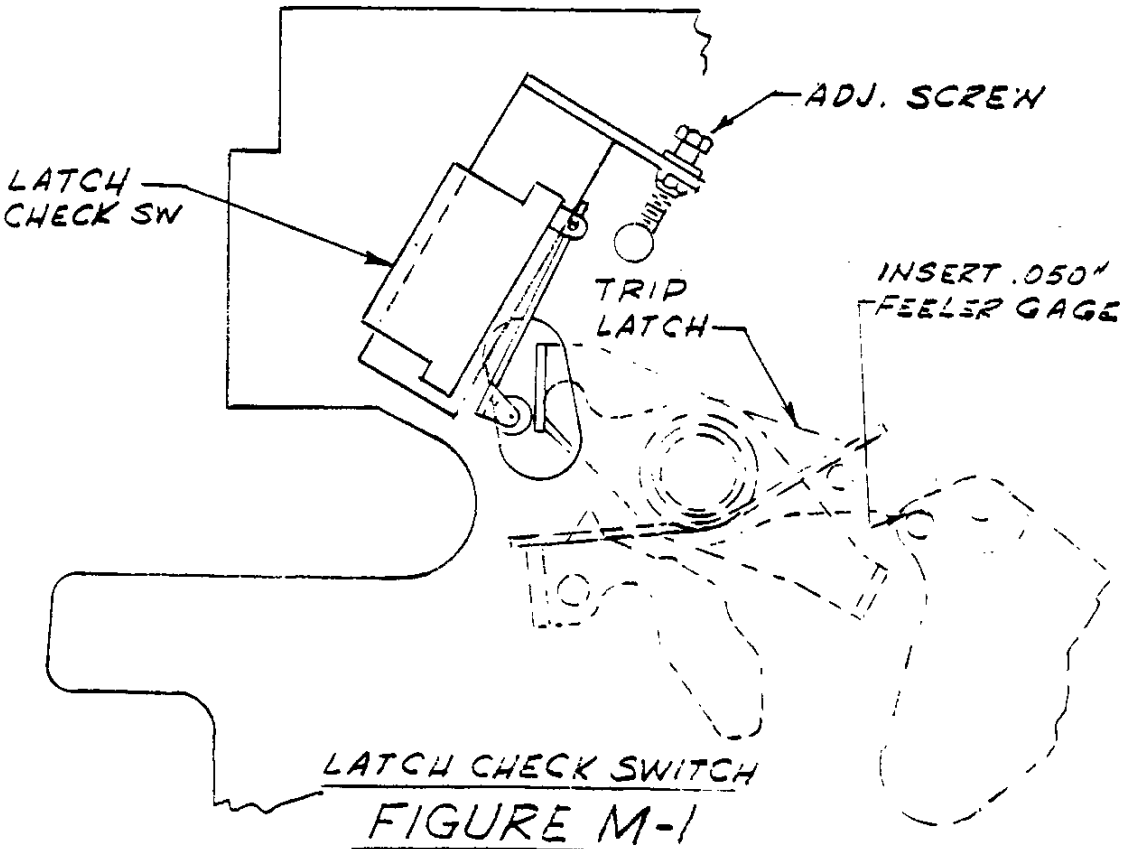


FIGURE M-1

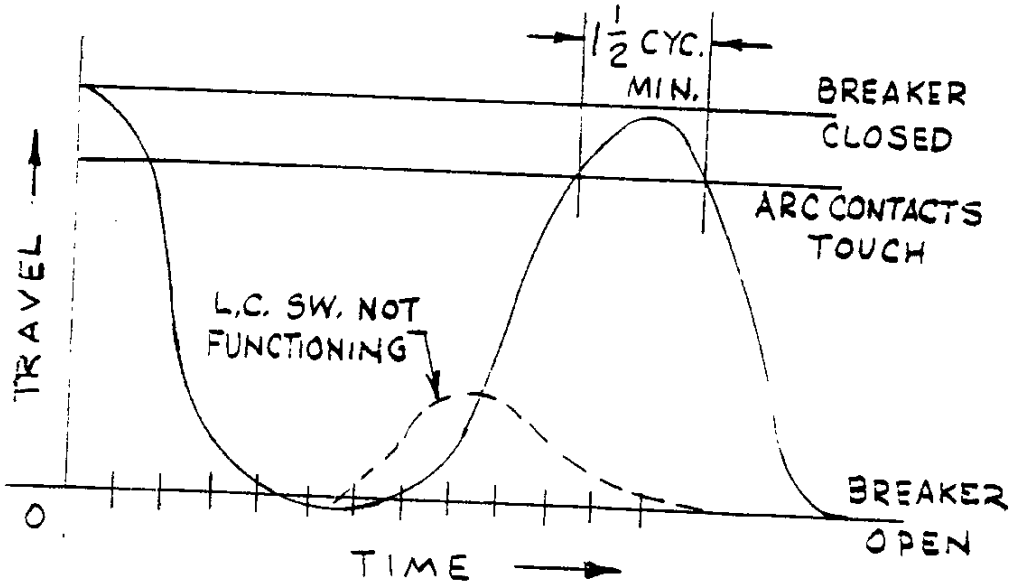
5. The latch check switch contact is to be monitored to insure that it operates electrically in the close coil circuit.

6. The latch check switch function shall also be checked by means of the Cincinnati Analyzer.

7. With the breaker in the closed position, energize the trip coil and the close coil simultaneously. The analyzer curve should resemble the solid curve shown in Figure M-2.

8. The dotted curve in Figure M-2 represents what the analyzer curve will resemble if the latch check switch is not functioning.

9. With the latch switch properly adjusted, and functioning properly, the breaker contacts shall remain closed for a minimum of 1 1/2 cycles on the close-open operation as shown in Figure M-2.



TYPICAL LATCH CHECK SWITCH ANALYZER CURVE

FIGURE M-2

REVISIONS

UNDERVOLTAGE DEVICE

1. The undervoltage device is provided only when specified as it is an optional feature.

2. The undervoltage device is intended to be preadjusted on the bench prior to mounting on the circuit breaker.

3. The voltage rating must be indicated by a service label on each device.

4. Initially set the tripping spring compression for 2 1/2 # initial load and 15 # final load measured at the trip plunger, (approx. 1" compression).

5. Check for pickup to be within the range specified in Table I, if necessary, increase or decrease tripping spring tension to adjust pickup point.

6. Check for dropout to be within the range specified in Table I. Dropout is partly controlled by the tripping spring pressure but is for the most part controlled by the series resistor. The proper values for the series resistors are given in Table I if dropout problems are encountered.

7. With the tripping spring properly adjusted, the resistor cutout switch should be adjusted to operate between 1/16" to 1/8" of final solenoid plunger stroke so as to eliminate solenoid chatter.

8. Install shims as required to operate switch between 1/16" and 1/8" of final stroke.

9. The trip plunger (with solenoid closed) shall be adjusted for 1/16" gap ± 1/32" between the bottom of the trip plunger and the top of the trip latch.

10. The rectifier assembly is furnished on "AC" undervoltage devices only.

UNDERVOLTAGE DEVICE (Cont.)

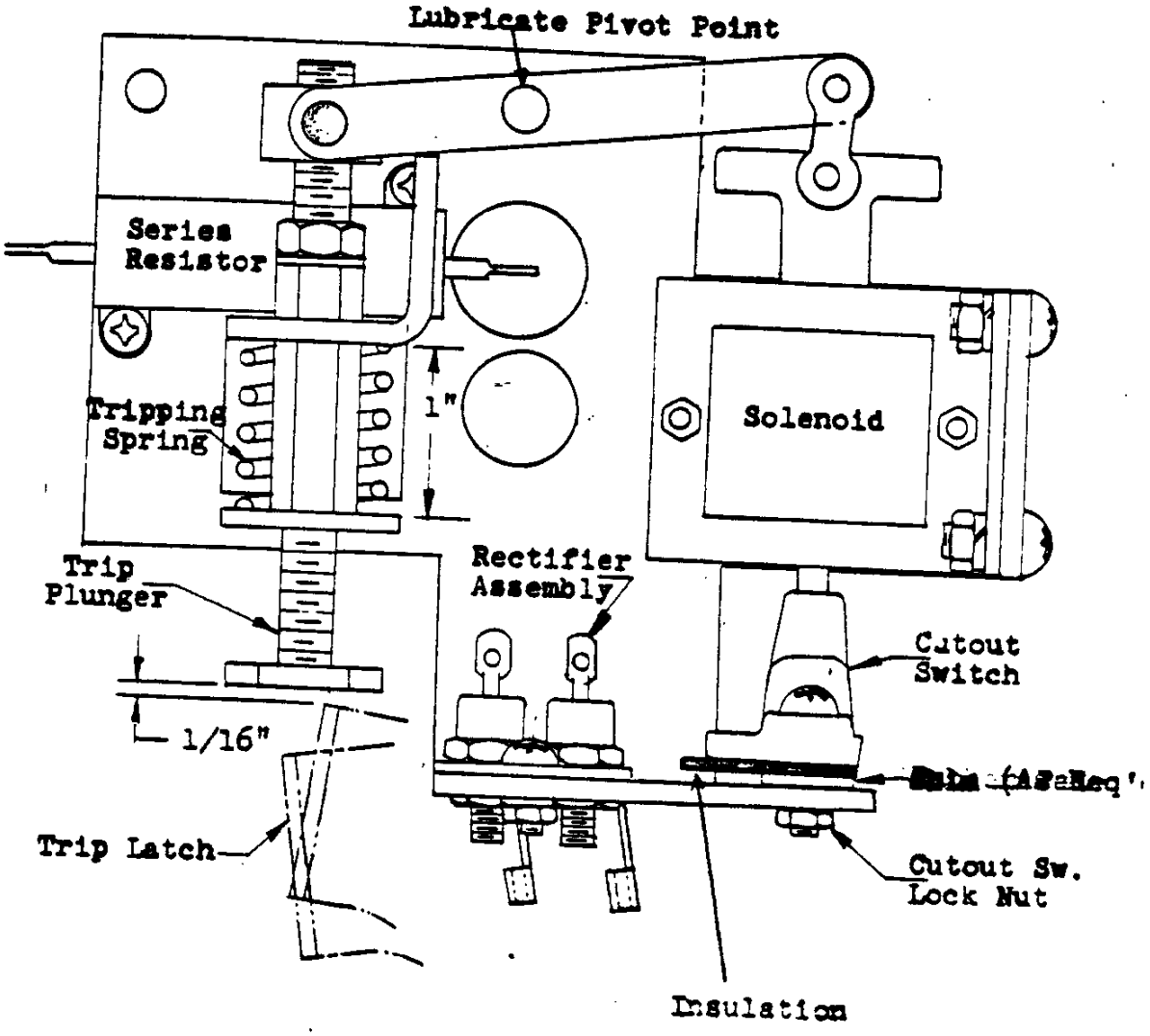


FIGURE N-1

11. Pickup and dropout characteristics shall be within the ranges specified in Table I.

12. Solenoid coil and series resistor resistance values ± 10% shall be in accordance with Table I.

13. Rectifier assemblies shall be furnished as indicated in Table I.

TABLE I

HK Undervoltage Device

Voltage Rating	Pickup Range	Dropout Range	Coil Resis.	Series Resistor	Rectifier Assembly	Avg. Sealed Current
24 V-DC	14-19	7-14	1.34	25	NO	.91
48 V-DC	29-38	15-29	5.70	100	NO	.46
125 V-DC	75-100	38-75	38.0	500	NO	.23
250 V-DC	150-200	75-150	155	2500	NO	.09
115 V-AC	69-92	35-69	38.0	500	YES	.22
230 V-AC	140-180	69-140	155	2500	YES	.09

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MOTOR DISCONNECT SWITCH AND LOCAL CONTROL PUSH BUTTONS

1. A motor disconnect switch shall be furnished on each operating mechanism.

2. The motor disconnect switch shall be wired so as to open or close both legs of the spring charging motor.

3. It is intended that this switch be used to disconnect the motor from the control source for isolation purposes only. This switch is not to be used to interrupt the motor current.

4. Local control push buttons (close and trip) shall be furnished only when specified. They are an optional feature.

5. The local control push buttons when used shall operate the circuit breaker over the operating range given in Section J, Table I, for the specified rated control voltage.

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PRODUCTION TESTS PRODUCTION TEST PER ANSI C37.09-1979.

1. Production tests are to be conducted as part of manufacturing and producing the circuit breaker.

2. Production tests are to conform to the American Standards Association test procedure for AC High Voltage Circuit Breakers (ASA 37.09-5.1).

3. Nameplates shall be checked for accuracy and completeness of identification and rating (ASA C37.09-5.6).

4. All resistors shall be checked by either operation or resistance measurements. All closing, tripping and relay coils shall be checked either by resistance or current measurements to ensure that the proper coil has been installed (ASA C37-09-5.8).

5. Control wiring shall be checked to insure that all connections are made in accordance with the wiring diagram. Relays and coils shall be checked by actual operation. Mechanically operated auxiliary switches and devices shall be checked for proper sequence of operation (ASA C37.09-5.9).

6. Charge and close the breaker manually and check that the engagement of the contacts, positions of critical members of the operating linkage and important clearances, including positions of any latches, are within the prescribed limits. Open the breaker manually and check that it has fully opened and reset (ASA C37.09-5.10).

7. Repeat item 4 but operate the breaker electrically with normal control voltage (ASA C37.09-5.10).

8. Mechanical operation tests shall be made to check the adjustments and determine the ability of the breaker to operate correctly over the entire range of specified control voltage. These tests shall include the following (ASA C37.09-5.11):

   a. Five close operations at minimum voltage.
   b. Five open operations at minimum voltage.
   c. Five close operations at maximum voltage.
   d. Five open operations at maximum voltage.
   e. Five electrically trip-free operations at normal voltage.
   f. Momentary making of the closing switch shall close the breaker.
   g. By slowly moving the shunt trip armature manually in the trip direction, the breaker must trip.

RE ONS

M

h. Check that all interlocks function

i. Check for proper buffing action.

9. A travel recorder is to be mounted on the breaker. See Figure P2. An oscillogram shall be made to determine closing and opening speeds, closing and opening times, latch check switch operation, over travel, contact sequence, contact bounce and rebound. The operating characteristics shall be in accordance with TablePI. See Section "M" for latch check switch testing. SEE FIG. P1,

BREAKER TYPE		INTERRUPTER TYPE	CLOSING SPEED (Ft/sec)	OPENING SPEED (Ft/sec)	CLOSING TIME (Millisec)	OPENING TIME (Millisec)	OVERTRAVEL MAX. (In.)	REBOUND MAX. (In.)	CONTACT SEQUENCE	CONTACT BOUNCE MAX (Sec.)
15HK500	1200	VS10B12C	2-3 All Types	3.28-4.27	50-65 ALL	38-40 ALL	.080 All Types	.100 All Types	3 Contacts Within .001 Sec. All Types	.002 All Types
	2000	VS10B20L		" "						
15HK750	1200	VS10B12H		3.94-4.92						
	2000	VS10B12H		" "						
15HK1000	Up to 3000	VS10B30C		" "						

TABLE P1

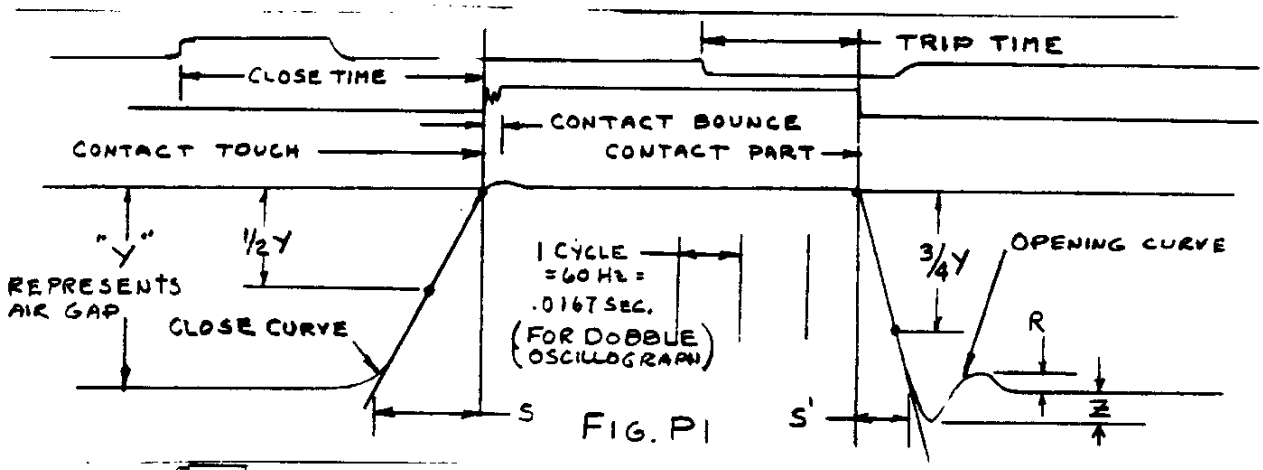

FIG. P1

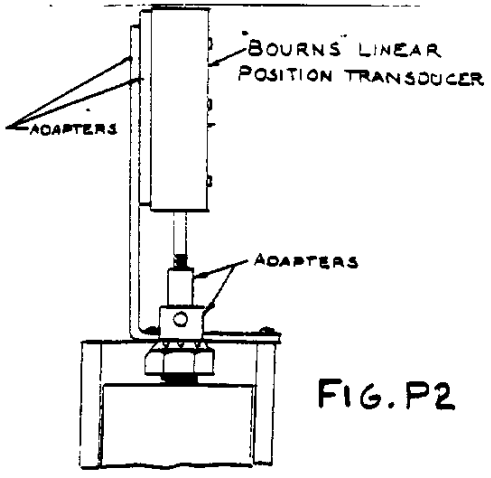

FIG. P2

$$\text{OVERTRAVEL} = \frac{Z}{Y} \times \text{ACTUAL AIR GAP}$$

$$\text{REBOUND} = \frac{R}{Y} \times \text{ACTUAL AIR GAP}$$

$$\text{SPEED}\left(\frac{Ft.}{SEC.}\right) = \frac{\text{ACTUAL AIR GAP (IN.)}}{S\ (\text{SEC.}) \times 12}$$

10. The spring charging motor must completely recharge the closing spring within three (3) seconds after a closing operation, when rated control voltage is maintained at the motor terminals (ASA C37.09-5.13.)

11. Low-frequency (60 cycle) withstand voltage tests for one minute shall be made at 36kV per the following (ASA C37.09-5.15).

    a. With the breaker open, energize each terminal individually with the frame and all other terminals grounded.

    b. With the breaker closed, energize each pole individually with the frame and all other terminals grounded.

    CAUTION:

    A. The main shield inside the interrupter can acquire an electrical charge which usually is retained even after the Hi-Pot voltage is removed. The shield is attahced to the mid band ring of the interrupter and a grounding stick should always be used to discharge the ring before touching the interrupter or removing it from the circuit.

    B. High voltage applied across open gaps in a vacuum can produce X-radiation which can be a health hazard on prolonged exposure at close range unless the source is adquately shielded. Do not conduct hi-pot tests with personnel closer than 4 feet from the vacuum interrupters.

12. All control wiring shall be subjected to a low-frequency withstand test of 1500 volts for one minute, excluding the spring charging motor; the motor shall be subjected to a low-frequency withstand test of 765 volts for one minute. (ASA C37.09-5.16) If the motor has not been tested previously per Sec. K, para. 21, then the test voltage shall be 1000V.

13. The corona extinction level shall be checked at the locations described in item 12. The extinction level shall be greater than 9.4kV.*

    CAUTION: Observe precautionary measure for charged mid band ring and X-radiation.

14. Power factor measurements shall be taken at each terminal, with the breaker in the open position, at room temperature. The power factor measurement, with 10kV applied, shall not exceed the values listed in Table P .

* Maximum of 10 pico coulombs discharge allowed at the extinction voltage.

RE IONS

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CAUTION: Observe precautionary measure for charged mid band ring and X-radiation.

15. X-Radiation Testing

One BREAKER for each rating shipped, shall be tested for X-radiation using the radiation survey meter. The survey meter shall be a distance of one (1) meter from the vacuum bottles during standard dielectric withstand testing. The highest values per pole are to be recorded along with the breaker serial number and filed in QC and Circuit Breaker Engineering files.

Any X-Radiation values that exceed 0.3 mR/hr shall be reported to Circuit Breaker Engineering before shipment is made.

TABLE P-2

Relative Humidity %	50	60	65	70	75
Max. Power Factor	4	5	7	10	13

16. With the primary disconnects installed on the breaker (prior to lubrication of the switchboard side), a 1.894" diameter plug must enter the disconnects freely.

17. Also, with a 1.982" diameter plug forced into the primary disconnect assembly, the force required to withdraw this plug must be in excess of 20 # for 1200A breakers and in excess of 30 # for 2000A breakers.

18. The breaker side of each primary disconnect assembly should be lubricated with No-OX-Id "A" special contact lubricant prior to installation on the breaker.

19. The switchboard side of each primary disconnect assembly should be lubricated with No-Ox-Id "A" special contact lubricant after the withdrawal requirements have been determined.

20. Primary disconnect penetration shall be checked on each terminal and shall be within the following limits (penetration is measured from the face of the switchboard terminal to the switchboard end of the primary disconnect finger):

a. 15HKV500 & 750 (1200): 0.641" min. to 1.220" max.

b. 15HKV500 & 750 (2000): 0.704" min. to 1.283" max.

21. The millivolt drop of each pole of each circuit breaker, including the primary disconnects, shall not exceed the following values, with 200 amperes flowing:

	MILLIVOLT
a. 15HKV500 (1200):	7.5
b. 15HKV500 (2000):	6.5
c. 15HKV750 (1200):	7.5
d. 15HKV750 (2000):	6.5

If high millivolts is encountered, average MV values for the various joints, Fig. P-3 , are given in Table P-3 to enable the high resistance point to be located.

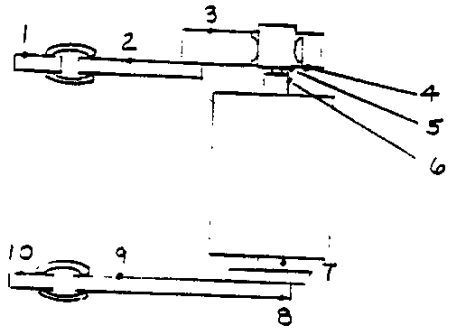

FIG. P-3

TABLE P-3

	1-10 OVERALL READ MAX.	1-2 UPPER PRI. DISCONNECT	2-3 BOLTED JOINT	4-5 THRU MULTI-LAM	5-6 MOVING CONTACT TO BOTTLE	6-7 THRU BOTTLE	7-8 BOTTLE TO LOWER TERM.	9-10 LOWER PRI. DISCONNECT
15HKV500 1200A	7.5	1.5	.3	1.25	.75	1.5	.5	1.5
2000A	6.5	1.0	.3	1.25	.75	1.5	.5	1.0
15HKV750 1200A	7.5	1.5	.3	1.25	.75	1.5	.5	1.5
2000A	6.5	1.0	.3	1.25	.75	1.5	.5	1.0
15HKV1000 1200	6.0	1.5	.2	1.0	.75	1.5	.5	1.5
2000	5.0	1.0	.2	1.0	.75	1.5	.5	1.0
2500	4.0	1.0	.2	1.0	.75	1.5	.5	1.0
3000	4.0	1.0	.2	1.0	.75	1.5	.5	1.0

22. Erosion Indicator - The red erosion indicator on each bottle to be clearly visible from the front of the breaker and the red to cover the hex as shown. See Fig P-4

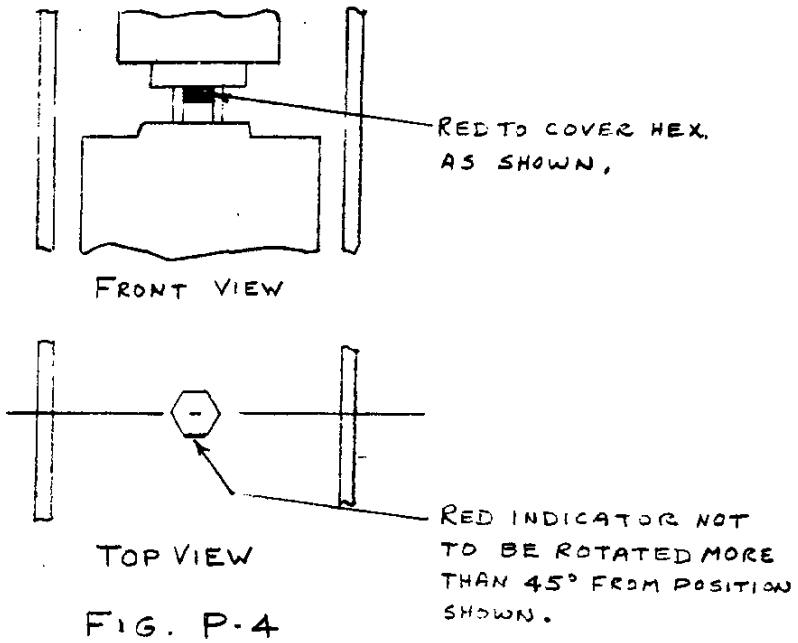

FIG. P-4

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MAILING LIST

Department	Location	Copies
Circuit Breaker Assembly	Columbia	1
Circuit Breaker Quality Control	Columbia	1
Service	Montgomeryville	1
Production Engineering	Columbia	2

RE VISIONS

Form 8415SM

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REFERENCE DRAWINGS

DRAWING NO.	DESCRIPTION
L-13050	Interphase Barrier and Front Cover
L-13047	Current Carrying Parts - 1200A
L-13048	Current Carrying Parts - 2000A
L-13060	Truck and Jackshaft
L-13046	Vacuum Bottle and Actuator Assembly - 1200A
L-13045	Vacuum Bottle and Actuator Assembly - 2000A
EPL 194111	Operating Mechanism
EPL 163775	Lead Assembly
EPL 163710	Closing Springs
EPL 194141-T8	Truck, Jackshaft

RETIONS

M

Form 8419SM