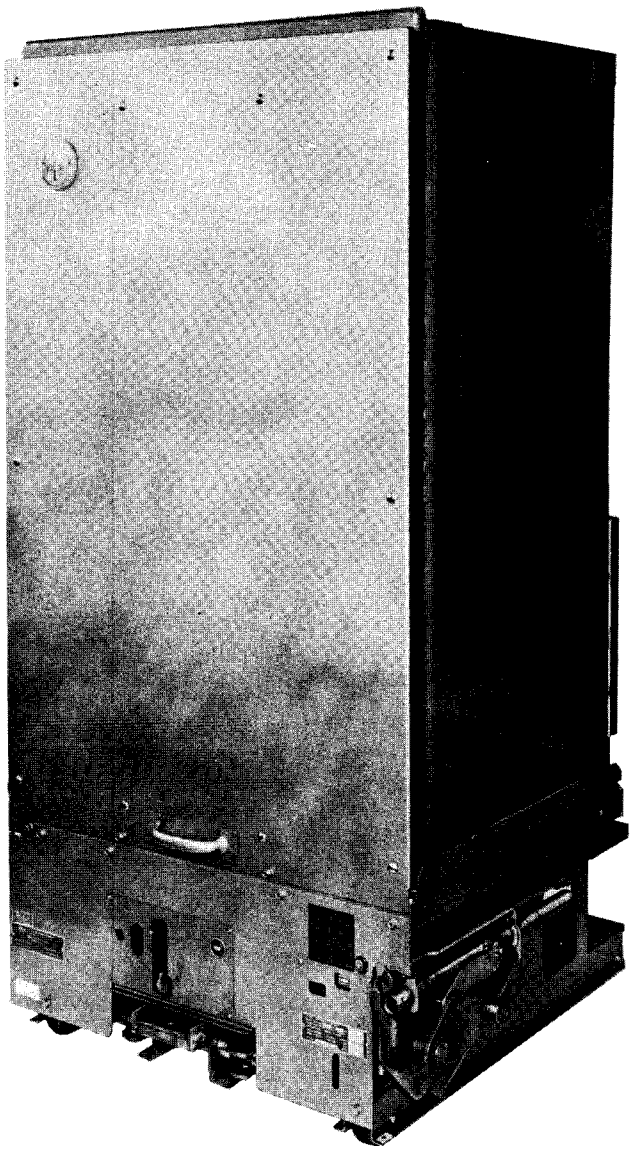
IB-8.2.7-4
ISSUE C

METAL-CLAD SWITCHGEAR

INSTRUCTIONS

7.5 & 15 KV POWER CIRCUIT BREAKERS
TYPE 7.5HK250 AND 500
15HK150, 250, 500 AND 750



I-T-E Imperial Corporation

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INSTRUCTIONS FOR 7.5 & 15 KV POWER CIRCUIT BREAKERS TYPE 7.5HK250 AND 500 15HK150, 250, 500 AND 750

INTRODUCTION

These instructions for installation, operation and maintenance of HK circuit breakers shoud be read carefully and used as a guide during installation and initial operation.

The specific ratings of each model circuit breaker are listed on the individual nameplates.

File these instructions in a readily accessible place together with drawings and descriptive data of the switchgear. These instructions will be a guide to proper maintenance of the equipment and prolong its life and usefulness.

RECEIVING AND STORAGE

Immediately upon receipt of the circuit breakers, examine the cartons to determine if any damage or loss was sustained during transit. If injury or rough handling is evident, file a damage claim at once with the carrier and promptly notify the I-T-E Imperial Corporation. The I-T-E Imperial Corporation is not responsible for damage of goods after delivery to the carrier. However, the I-T-E Imperial Corporation will lend assistance if notified of claims.

Unpack the circuit breakers as soon as possible after receipt. If unpacking is delayed, difficulty may be experienced in making a claim for damages not evident upon receipt. Use care in unpacking in order to avoid damaging any of the circuit breaker parts. Check the contents of each carton against the packing list before discarding any packing material. If any shortage of material is discovered, promptly notify the nearest representative of the I-T-E Imperial Corporation. Information specifying the purchase order number, carton number and part numbers of the damaged or missing parts should accompany the claim.

Circuit breakers should be installed in their permanent location as soon as possible. If the breakers are not to be placed in service for some time, it is advisable to provide adequate means of protection. This may be done by keeping the breaker in its original shipping carton and storing in a warm, dry and uncontaminated atmosphere. If the circuit breaker cannot be stored properly due to circumstances, it must be thoroughly checked before going into service to insure it has not absorbed moisture, rusted or become generally contaminated in any way.

CIRCUIT BREAKER INSTALLATION

GENERAL

Prior to the initial installation of the circuit breaker into switchboard, certain preliminary inspections should be made to insure proper operation. The inspection procedures for this are given in this section.

FOR SAFETY: Prior to any disassembly or inspection of the circuit breaker, the closing springs should be discharged, and the breaker should be open.

If it is necessary to raise or move the breaker, attach a lifting yoke at points 7 (Fig. 2) or a fifth wheel at point 5 (Fig. 3) to transport the breaker as required.

INSTALLATION INSPECTION

Inspect condition of circuit breaker arc chutes, contacts and electrical connections prior to installing the circuit breaker into the switchboard. Even though each circuit breaker is completely adjusted and tested at the factory, shipping and handling conditions could cause defects.

REMOVING INTERPHASE BARRIER (See Fig. 1)

Remove two lower front sheet screws (9) and lift front sheet up and away from the breaker. Remove arc chute tie bar (6) at upper front of arc chutes. Pivot rear brace (1) at rear of each barrier upward, unhook back barrier (10), when installed, and slide the separate barriers (3) forward and away from the circuit breaker.

CAUTION: The barriers will not stand unsupported and must be braced.

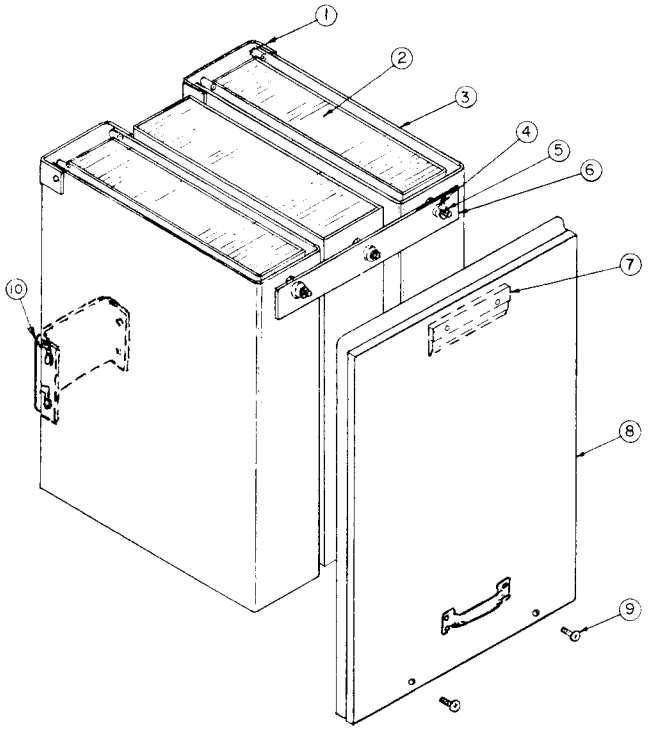


Fig. 1 — Method of Attaching Barrier Assemblies

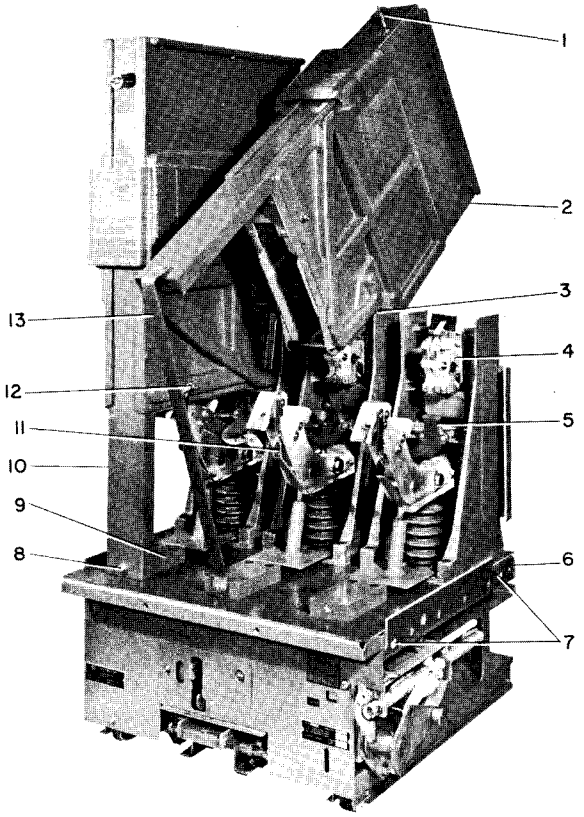


Fig. 2 — View Showing Arc Chute and Contact Structure

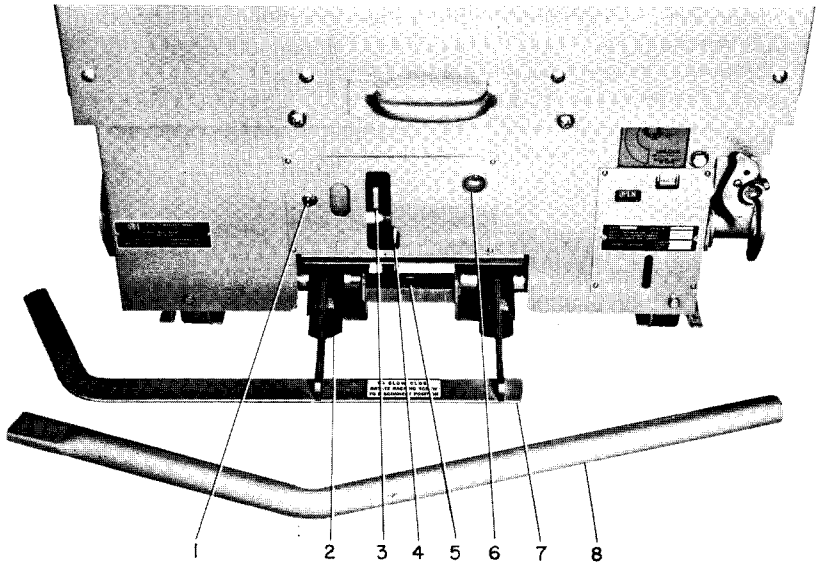


Fig. 3 — Front View of Control Panel

REMOVING ARC CHUTES (See Fig. 2)

Remove nut (12) and gently disconnect return connection (11). Remove bolt (8) connecting the front leg (10) of the arc chute to the block (9) on the base sheet of the circuit breaker. Attach the accessory lifting bracket to the tie bar bushing (1) at the top front of the arc chute and slowly raise the arc chute as required by means of a hoist. It will pivot at its terminal connection and then should be guided straight out of the pivot guide slot and fingers and removed away from the circuit breaker. If only a visual examination is to be made, each arc chute may be tilted back gently, hand held and arc chute tilt support (13) bolted into place between arc chute leg (10) and block (9).

CAUTION: Be sure return connection is clear and does not catch on the arc chute. Also block wheels to prevent breaker from rolling.

ARC CHUTE EXAMINATION

Examine arc chutes carefully before placing into service. Look for any breakage to liner plates and arc chute plates. Check for presence of any foreign particles such as chips of ceramic and metal. Inspect exterior for any damage or deformation. The polyester glass moldings occasionally have some small cracks develop in resin rich areas but these cracks do not indicate defective material and should not cause concern.

INSULATION STRUCTURE

All insulated parts should be checked for damage. Any dust or dirt should be removed by air or wiped with a clean lintless cloth saturated with an oil-free solvent. This is important because the soot or dirt can accumulate and, with moisture, can place the circuit breaker in jeopardy, dielectrically. The lead support moldings are polyester glass and occasionally have some resin rich cracks or crazing develop but these do not indicate defective material and should not cause concern.

MANUAL SLOW CLOSE TO CHECK CONTACT PRESSURE (See Fig. 3)

Turn racking screw clockwise approximately two to three turns until the racking-unlocking lever snaps into the first position corresponding to the "DISCONNECT" position.

Engage manual charge handle (8) with charging lever (3). Pump charging lever until breaker closing springs snap into charge position, then remove handle.

Insert BOTH tangs of spring retainer bracket (7) into holes of closing spring guides (2).

Pull manual close lever (4) to discharge closing springs onto tangs of spring retainer bracket (7). At this time the contacts will partially close.

Re-engage manual charge handle (8) with charging lever (3), then slowly pump to slow close breaker contacts. Check contact pressure as listed in Adjustment Section, using the manual trip button (6) to open the breaker.

To remove spring retainer bracket (7) from circuit breaker, continue pumping until closing springs are again heard to snap into charged position. Spring retainer bracket can now be removed.

Discharge closing springs by pulling manual close lever (4) and pushing manual trip button (6) at the same time to effect a trip free operation. (Or the breaker can be closed first and then tripped.)

INSTALLING ARC CHUTES (See Fig. 2)

Position arc chute (2) in tilted position, squarely down into its rear pivot guide slots and fingers (avoid bumping and chipping of all moldings), then lower slowly into position.

CAUTION: Be sure return connection (11) is clear and does not catch on the arc chute.

Securely fasten return connection by its nut (12) and rebolt the front arc chute support leg to its hold down block.

INSTALLING INTERPHASE BARRIER (See Fig. 1)

Slide the right and left interphase barriers (3), as marked, in place between the lead support moldings and inside of the clips on the outside moldings, and pivot the rear brace downward behind the arc chutes. Install the arc chute tie bar at the upper front on the arc chutes. Then, lift front sheet in place so that it hooks over the arc chute tie bar. Secure the barrier front sheet in place with the two lower front sheet screws.

CAUTION: For older unmarked barriers, ensure that the flux shunt pad is installed between poles.

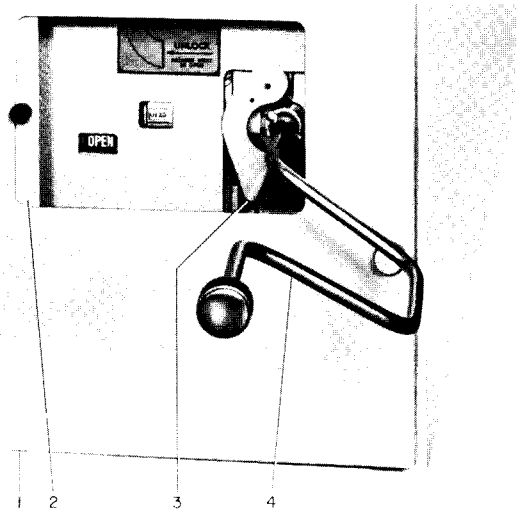


Fig. 4 — Method of Racking Circuit Breaker

INSTALLING CIRCUIT BREAKER INTO COMPARTMENT
(See Figs. 3 & 4)

NOTE: CLOCKWISE ROTATION of racking crank for inserting breaker. COUNTERCLOCKWISE rotation of racking crank for removal of breaker.

Turn motor disconnect switch (if supplied) (1, Fig. 3) to "OFF" position.

Engage racking crank (4, Fig. 4) and push racking unlocking lever (3) to left, then rotate racking crank counterclockwise only until resistance to motion is felt. (DO NOT FORCE.)

Engage the fifth wheel with hole (5, Fig. 3); guide and push circuit breaker into compartment until stopped. (If closing springs were left in charged condition, they will automatically discharge.) Again engage racking crank and rotate clockwise until racking mechanism automatically stops at "DISCONNECT" position. (Breaker is now held captive in compartment.)

To rack circuit breaker to "TEST" position, push racking unlocking lever (3, Fig. 4) to left, rotate racking crank approximately ¼ turn clockwise, then release unlocking lever. Continue cranking until racking mechanism automatically stops at "TEST" position.

With the circuit breaker racked to "TEST" position, it should be checked for proper operation by operating all possible means of opening and closing, this includes control switches, relays, etc. Turn motor disconnect switch (1, Fig. 3) to "ON" position to charge the closing springs, and operate the breaker as required. (If motor disconnect switch (1, Fig. 3) is not provided, springs will automatically charge when approaching "TEST" position.)

FOR SAFETY: When racking circuit breaker to "CONNECTED" position, close compartment door (1, Fig. 4) and insert racking crank (4, Fig. 4) through sliding panel (2, Fig. 4).

Push unlocking lever (3) to left and turn racking crank (4) approximately ¼ turn clockwise, then release unlocking lever. Continue cranking until racking mechanism automatically stops at "CONNECTED" position.

CAUTION: Do not attempt to rack any further.

The circuit breaker now may be put in service and be operated as required.

CIRCUIT BREAKER REMOVAL
(See Fig. 4)

To remove circuit breaker from "CONNECTED" position, open the breaker as required.

Open sliding door (2) in front compartment door (1). Engage racking crank (4) and push racking unlocking lever (3) to left. Rotate racking crank (4) counterclockwise approximately ¼ turn, then release unlocking lever. Continue cranking counterclockwise until racking mechanism automatically stops at "TEST" position.

Repeat same operation for "DISCONNECT" position.

To position the racking mechanism for withdrawal of the circuit breaker from the switchboard, again push the racking unlocking lever to the left and turn the racking crank counterclockwise only until resistance to motion is felt. (Approximately 2-3 turns—DO NOT FORCE.) The circuit breaker can now be removed from the compartment by pulling on the handle located at the bottom of the front barrier.

NOTE: The closing springs, if charged, will automatically discharge when the circuit breaker is withdrawn from the switchboard.

MAINTENANCE AND ADJUSTMENTS

GENERAL INFORMATION

The HK circuit breakers are designed for minimum maintenance and tested to insure that minimum maintenance will be required. There is only one basic adjustment normally required and that is contact adjustment. This should be checked to the dimensional values required as described elsewhere. The few other adjustments that are noted are required only when an operational check indicates a problem. Of course, during the maintenance checks, all accessible bolts, nuts and screws should be routinely checked to insure that they are tight.

It is recommended that the circuit breakers be normally inspected after 2000 operations. These operations can be either no-load mechanical or load current switching where the power factor is relatively high. When the circuit breakers are used for direct bulk capacitor or reactor switching operations or for motor starting applications, it is recommended that the circuit breakers be inspected after 1000 operations because of the switching severity.

If however, after the first inspection period, there is no indication of any problems, actual operating experience can then dictate the inspection cycle.

Regarding maintenance recommendations following fault duty, reference is made to ANSI Standard C37.04 to which the circuit breakers have been tested. In accordance with this standard, a total of 400% asymmetrical fault duty can be accumulated. This is to be ten or less close-open operations at less than 85% of full fault duty, but it can be an accumulation over a long time period of lower currents. The condition of the breaker should be such that after this duty it is capable of one more close-open operation at full fault current. Inspection is to be made at this time to insure this and then the final operation can be made if everything is satisfactory. At this time, maintenance should be performed and reconditioning done and replacements made as indicated.

Further, in accordance with the same standard, it is recommended that after a major fault duty cycle (CO-15 SEC. -CO) which is known to be between 85 and 100% of the circuit breaker rated asymmetrical short circuit current that the circuit breaker be inspected regardless of any time period or number of operations. Also, when the circuit breaker is applied on reclosing duty, it should be inspected immediately after the series of fault operations in the same range of currents.

The condition of the circuit breaker after interruption depends on the circuit conditions regarding such things as power factor, X/R ratio and relay delay times. Experience with specific circuits will indicate the future amount of maintenance that will be required for the various breakers and then modification in procedure can follow.

Of course, where unusual service conditions, as covered by ANSI Standard C37.04, exist, it must be assumed that these conditions were considered at the time of order; that the equipment supplied was designed for the special application; and that an appropriate supplemental maintenance program has been developed. These maintenance instructions only cover circuit breakers used under the standard usual service conditions.

After normal service without major fault interruption, the following tests and adjustments should be made:

NOTE: The following tabulated tests and adjustments are all that are normally necessary for proper maintenance and operation of the HK circuit breaker. The remaining portions of the breaker — close coil assembly, shunt trip device, control relay, auxiliary switch and motor — require no maintenance during the standard life of the circuit breaker regardless of the operating duty.

MILLIVOLT DROP TEST

During normal maintenance periods, the condition of the circuit breaker can easily be determined by performing a millivolt drop test. This test should be performed regardless of whether the circuit breaker had interrupted low or high currents or has minimum operations.

The following table lists the millivolt drop and resistance values for the circuit breakers covered by this instruction book, from terminal to terminal, exclusive of the primary disconnects.

CIRCUIT BREAKER	MAXIMUM MV DROP*	MAXIMUM MICRO-OHMS
7.5HK250 15HK150, 15HK250, 15HK500 1200 Ampere	7	35
7.5HK250 15HK150, 15HK250, 15HK500 2000 Ampere	6	30
7.5HK500 & 15HK750 1200 & 2000 Ampere	6	30
* Millivolt drop with 200 amperes flowing.		

If the millivolt drop does not exceed 150% of the above values, on breakers with normal loading, no maintenance is necessary. If the millivolt drop does exceed 150% of the above values, the main and arcing contacts should be dressed with a fine file, cleaned and be adjusted for proper contact pressure and then rechecked. If the values are still in excess of the 150% value, the bridge pivot pressure should be readjusted as outlined elsewhere.

However, for optimum performance of the circuit breakers during periods of increased loading, it is recommended that the listed values be met.

After all above steps have been taken and the millivolt drop is still excessive, contact I-T-E for recommendations.

CONTACT AND INSULATION CLEANING

Any dirt, soot or grease should be removed from the circuit breaker contacts and surface of entire current carrying structure, as well as all insulation surfaces, with a cloth saturated with an oil-free solvent. Cleaning of the insulation is important because the soot and dirt can accumulate and, with moisture, can place the circuit breaker in jeopardy, dielectrically.

A degree of burning and pitting on the circuit breaker arcing contacts is to be expected from normal operation; also, on highly inductive or capacitive circuits and after major interruptions, some pitting may occur on the main contacts. A moderate amount of pitting will not interfere with the operation of the contacts. When necessary to dress the contacts, cover the puffer nozzle (5, Fig. 2) with a cloth, then follow the contour of the contacts with a fine file. Do not attempt to eliminate pitting entirely. After this maintenance, the contact pressure and millivolt drop should be checked.

NOTE: Replacement of contacts need only be considered when: after repeated dressing of any contacts, less than 50% of the original contact material thickness is left (Moving arcing contact can be inverted when working surface is reduced to less than 50%.); the tips of the stationary arcing contacts have been eroded away; any contact has been broken or cracked.

CONTACT PRESSURE (See Fig. 5)

A. With the circuit breaker withdrawn from the switchboard, the following step-by-step procedure should be followed for properly checking and/or adjusting the contact pressure on an "HK" type circuit breaker.

1. Remove interphase barrier assembly and remove arc chutes as described previously.

2. Turn racking screw clockwise approximately two to three turns until the racking-unlocking lever snaps into the first position corresponding to the "DISCONNECT" position.

3. Manually slow-close the circuit breaker as described on page 5, but only to the point that the arc contacts just touch. All arcing contacts should touch within 1/32".

4. Continue the slow-close operation to fully close the breaker. Each pole should have between 7/64" minimum and 3/16" maximum main contact compression measured at "A" between the EDGE of the metal stop plate and the main contact stop. (This dimension measured on either side is sufficient.) A rod or drill of these sizes can be used for measuring.

At this point, if the adjustments are correct, complete steps B6, B7, B8 and B9 following.

B. If any adjustment is incorrect, use the following procedure to readjust contact pressure or to initially adjust when changes are made:

1. Completely slow-close the circuit breaker and set each pole for 7/64" main contact compression at "A". (A 7/64" rod or drill should fit tightly between the EDGE of the metal stop plate and the main contact stop.)

2. Open the circuit breaker, manually recharge the closing springs, and partially slow-close the circuit breaker until the arcing contacts of any pole or poles just touch.

3. Advance the adjustment of the lagging pole or poles so that the three arcing contacts touch simultaneously within 1/32". This adjustment is made by loosening locking bolt or set screw (depending on model) (2) and rotating adjusting stud (3).

4. Complete slow-close operation to fully closed position and check that the main contact compression of the pole or poles that were advanced does not exceed 3/16". Also, the arcing contact springs on these poles should not be fully compressed. If the 3/16" dimension is exceeded, the entire procedure should be repeated to obtain the correct gap at "A".

NOTE: Occasionally, the center pole contact pressure may slightly exceed 3/16". However, if the outer poles are within the 3/16" dimension and the arcing contact springs of the center pole are not fully compressed no readjustment need be made. When this condition exists, the center pole parts before the outer poles on opening.

5. Open the circuit breaker, recharge the closing springs, remove the slow-close bracket, fast-close the breaker, recheck adjustments and trip open.

6. Tighten the locking bolt (2) on each adjusting stud (3) to lock the contact pressure adjustment stud in place.

7. The arc chutes can now be replaced, and the interphase barrier assembly can now be reinstalled.

8. Return the racking screw to its original position by turning it counterclockwise approximately two to three turns until it stops.

9. The circuit breaker can now be replaced in its compartment and returned to service.

PUFFERS (5, Fig. 2)

The performance of the puffers can be readily checked during a maintenance interval. Each puffer should provide a moderate blast of air at the breaker contacts, on opening of the circuit breaker. This can be detected by holding the hands or arm over the top of the contacts and opening the circuit breaker. All three poles must have puffing action or else the circuit breaker must not be placed in service.

FOR SAFETY: Keep clear of all moving parts.

CLOSING AND OPENING TIMES

After the operation intervals noted previously or a change in bridge pivot adjustment, the closing and opening times are recommended to be checked by use of a cycle counter, time-travel analyzer*, oscillograph etc. to monitor the time from energizing to arcing contact touch or part.

*Analyzer mounting support and instructions available on special order.

The circuit breaker closing and opening times should be within the following time ranges for normal operation.

CIRCUIT BREAKER	CLOSING TIME RANGE - MS	OPENING TIME RANGE - MS
7.5HK250, 15HK150, 15HK250, 15HK500 1200 Ampere	115 - 145	23 - 30
7.5HK250, 15HK150, 15HK250, 15HK500 2000 Ampere	120 - 140	23 - 30
7.5HK500 & 15HK750 1200 & 2000 Ampere	115 - 145	23 - 30

NOTES:

1. Below 0° C., the closing times will increase (but with no reduction in closing force); and opening times will be within the limits.

2. Adjustments to correct speeds, if found to be outside limits, are critical and I-T-E should be contacted for recommendations.

ARC CHUTES

The arc chutes should be inspected internally to insure that no breakage occurred to the liner plates or arc plates. Further, there may be a crust formed on the

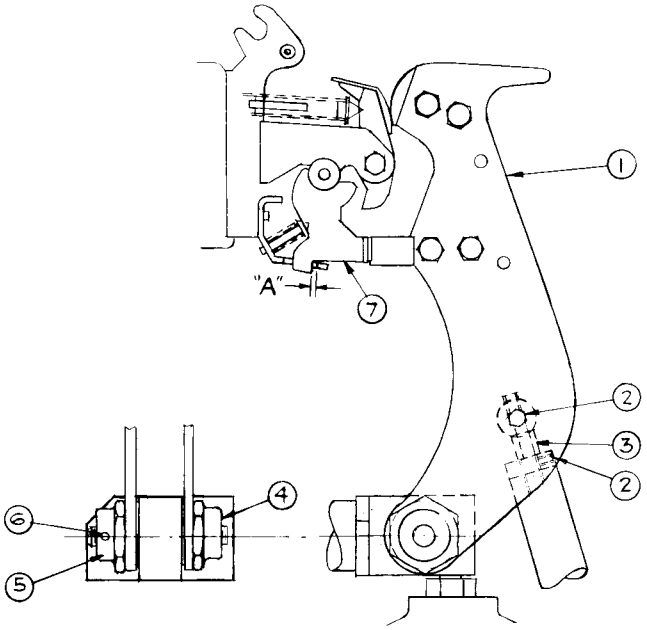


Fig. 5 — Contact Pressure and Bridge Pivot Pressure

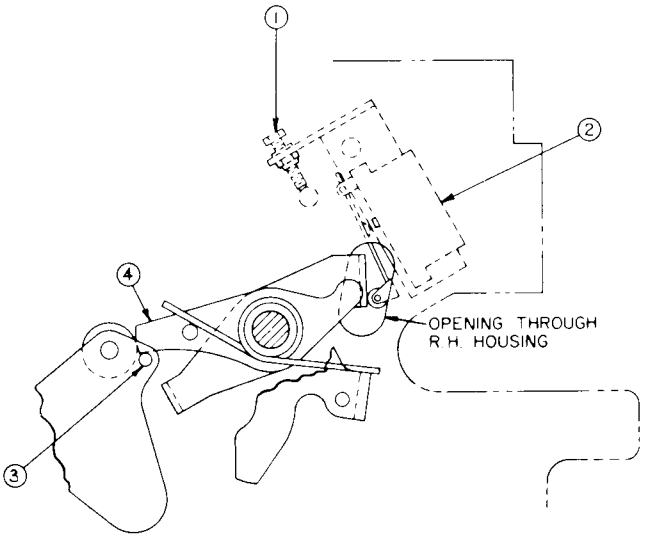


Fig. 6 — Latch Check Switch Adjustment

liner plates if the load current interruptions were close to the continuous current rating of the breaker or moderate faults were interrupted. This crust should be removed by carefully using a carborundum stone or scraper. Then the arc chute should be blown out with air to remove the resultant dust and particles.

After 400% accumulated current or major interruptions occur, the circuit breaker should be inspected immediately afterwards, as stated previously. All maintenance checks or tests noted above should be carried out plus the arc chutes should be looked at closely. Arc plate and liner plate breakage should be carefully looked for, along with excessive erosion of the arc plates. The arc plates are made of ceramic material and perform the function of extracting heat from the arc as it is being forced into and elongated by them. The leading edges become coated with glass that comes to the surface from the extreme heat. The direct measure of use is the amount of glass beads evident.

When the entire leading edge and portions of the flat arc plate are noted to be heavily encrusted with glass beads, the arc chute should be replaced. It should be noted that this condition will vary between arc chutes on the same breaker because of single-phase fault and asymmetrical current incidences. If there are any questions, I-T-E should be consulted for recommendations.

BRIDGE PIVOT PRESSURE (See Fig. 5)

Bridge pivot pressure should be adjusted only when the millivolt drop test indicates a problem.

When this adjustment is necessary, the following steps should be done.

1. Locking bolt (2) should be loosened on solid pushrod models. Spring-loaded pushrod models do not require disconnecting.

2. Bridge (1) should be disconnected from adjusting stud (3) on solid pushrod models.

3. Loosen one set screw (6) in one pivot nut — either side.

4. Tighten bridge pivot nut (4 or 5) securely (approximately 75 ft. lbs.). Then gradually back up pivot nut (approximately ½-1½ flats) until bridge motion is just free when bridge is moved by hand. On spring-loaded pushrod models, lift bridge against spring and then slowly release, insuring that it resets freely.

5. Tighten set screw (6) in nut that was loosened, reconnect adjusting stud, if disconnected, and readjust contact pressure as described elsewhere.

OPERATING MECHANISM (See Fig. 6)

The operating mechanism is adjusted at the factory for proper operation and should not be disturbed unless the circuit breaker does not close electrically on reclosing duty.

This condition is caused when the latch check switch (when used) is not actuated. Circuit breaker should not close before trip latch (4) has reset.

Adjustments should be made with latch (4) against reset stop pin (3). Turn in adjusting screw (1) until contacts of switch (2) "break" (as indicated by an audible click or check with bell ringer). Retract adjusting screw until switch contacts "make", then rotate adjusting screw one turn more. (Adjusting screw is self-locking.)

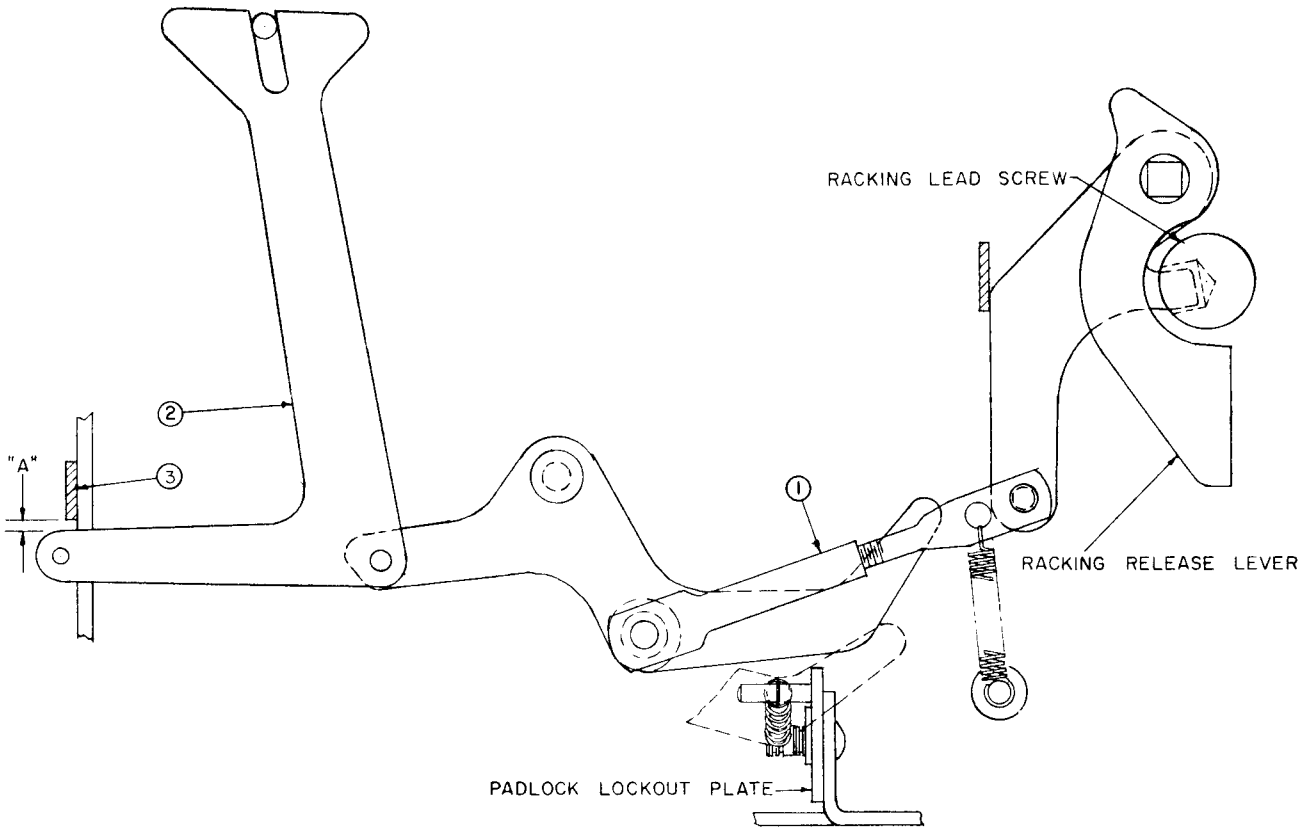


Fig. 7 — Racking Mechanism

RACKING MECHANISM (See Fig. 7)

The circuit breaker racking mechanism is adjusted for proper operation and should not be disturbed unless it becomes possible to close the breaker during a racking operation.

It may be possible that interlocked blocking members are not positioned properly, which should be corrected as follows:

Remove the lower front mechanism coverplate and with the circuit breaker closed, make adjustments by regulating the length of connecting rod (1) for 1/8 inch minimum to 3/16 inch maximum clearance at "A" between trip link (3) and blocking lever (2).

LUBRICATION

The HK circuit breakers are lubricated during factory assembly as follows:

1. All mating surfaces of moving current-carrying joints have been lubricated with NO-OX-ID special grade "A" grease manufactured by Dearborn Chemical Company.

2. All other mechanism parts, bearings, pins, etc. have been lubricated with NEBULA EP 5F manufactured by the Humble Oil and Refining Company.

The circuit breaker requires no lubrication during its normal service life. However, if the grease should become contaminated or if parts are replaced, any relubrication should be done with NO-OX-ID or NEBULA grease as applicable.

NOTES:

1. Do not use NO-OX-ID grease on any main and arcing contact surfaces.

2. It is recommended that the primary disconnects be maintained by renewing the NO-OX-ID grease during maintenance periods.

3. Do not use light oil to lubricate any mechanism parts.

4. The charging motor is sealed and no lubrication is required.

DIELECTRIC TESTS

If it is desired to make dielectric tests during maintenance periods, the following test values should be used and are to be applied for a one minute period.

	60Hz	DC
Primary Circuit	21.5kV	30kV
*Secondary Circuit (Control)	1100 V	1500 V

*It is necessary that the charging motor be disconnected for this test by turning the motor disconnect switch to the "OFF" position. If a test is desired on the motor, then the motor disconnect switch should be turned to the "ON" position and the circuit re-tested at 540V, 60Hz or 760V DC.

ELECTRICAL CHARACTERISTICS OF CONTROL DEVICES

For operating voltage ranges for various nominal control voltages refer to Table 1.

For average current values at various nominal control voltages, refer to Table 2. The current values given in this table are average, steady state values and momentary inrush currents for all charging motors and AC coils are approximately six to eight times these values.

ELECTRICAL OPERATING SEQUENCE

Please refer to the specific schematic diagrams and other operational information furnished with your order.

Fig. 8 is provided as a typical schematic for general information on electrical operation.

RENEWAL PARTS

I-T-E recommends only those renewal parts be stocked that will be required to insure proper and timely maintenance for normal operation of the HK circuit breakers. Copies of the applicable Renewal Parts Bulletin for specific circuit breakers will be furnished on request to the nearest sales office of the I-T-E Imperial Corporation.

The minimum quantity of assemblies and items recommended in these bulletins are predicated on infrequent replacement of parts based on accumulated tests and operating experience. Total assemblies are recommended for fast replacement, when necessary, to return the breaker to service as quickly as possible. Then certain replaced assemblies, such as the stationary upper terminals, can be returned to the factory for nominal reconditioning. The bulletins contain specific part ordering instructions; and if desired, specific instructions regarding replacement of those part assemblies recommended, that are not obvious, are also available if ordered.

TABLE 1 - OPERATING VOLTAGE RANGE

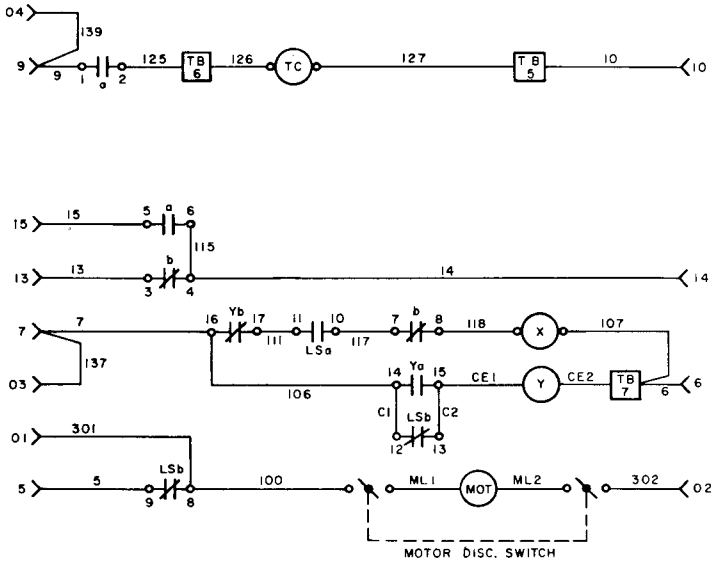
NOMINAL CONTROL VOLTAGE	SPRING CHARGING MOTOR	CLOSE COIL	TRIP COIL	UNDERVOLTAGE	
				PICK-UP	DROP-OUT
24 V dc	-	17-25	13-28	14-19	7-14
48 V dc	35-50	35-50	28-60	29-38	15-29
125 V dc	90-130	90-130	70-140	75-100	38-75
250 V dc	180-260	180-260	140-280	150-200	75-150
115 V ac	95-125	95-125	95-125	69-92	35-69
230 V ac	190-250	190-250	190-250	140-180	69-140

TABLE 2 - AVERAGE CURRENT VALUES

NOMINAL CONTROL VOLTAGE	SPRING CHARGING MOTOR	CLOSE COIL	TRIP COIL	LOCKOUT COIL	UNDER VOLTAGE	N.E.C. FUSE
24 V dc	-	22.0	22.0	0.30	0.9	30
48 V dc	20.0	10.7	10.7	0.15	0.5	30
125 V dc	10.0	6.7	6.7	0.06	0.2	30
250 V dc	5.0	2.2	2.2	0.03	0.1	30
115 V ac	10.0	4.5	4.5	0.40	0.2	30
230 V ac	5.0	2.3	2.3	0.20	0.1	30

6 > < 5
9 > < 7
10 > < 13
15 > < 14
04 > < 03
02 > < 01

REAR VIEW OF SECONDARY DISCONNECTS



LEGEND

a - Auxiliary Switch Contact Closed When Breaker Is Closed.
b - Auxiliary Switch Contact Open When Breaker Is Closed.
LCb - Latch Check Switch Contact Closed When Breaker Operating Mechanism Is Reset.
LSa - Limit Switch Contact Open When Springs Are Discharged, Closed When Springs Are Charged.
LSb - Limit Switch Contact Closed When Springs Are Discharged, Open When Springs Are Charged.
TC - Shunt Trip Coil.
X - Closing Latch Release Coil.
Y - Control Relay Lockout Coil.
Ya - Normally Open Control Relay Contact.
Yb - Normally Closed Control Relay Contact.
TB - Terminal Block Point.
ML - Motor Lead.
CE - Coil Lead End.
C1, C2 - Terminal Jumper (Control Device).
> - Female Secondary Disconnect Contact.
UV - Undervoltage Trip Device.
UVb - Normally Closed Undervoltage Trip Device Contact.
69 - Permissive Control Switch.
BL - Blocking Lever Switch (Open When Ground Switch Is Locked In Ground Position).

FIG. 8 - 188556, Sheet 1, REV 0
188571, Sheet 1, REV 2

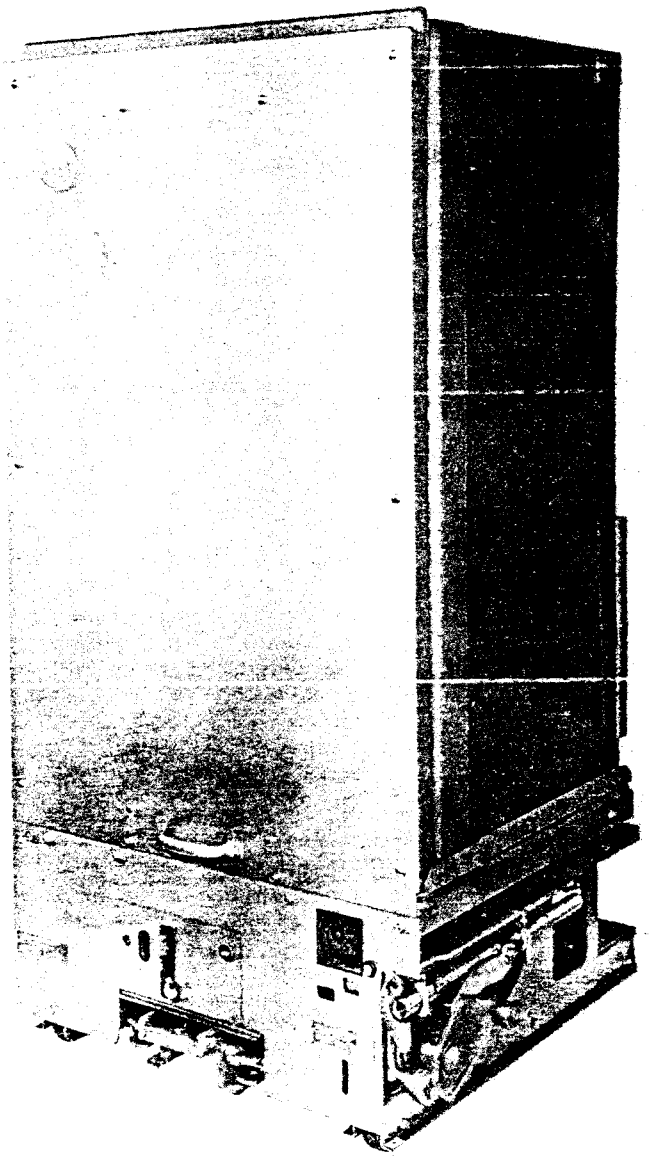
Fig. 8 — Typical DC Schematic Diagram of Control Circuit

IB-8.2.7-4
ISSUE D

METAL-CLAD SWITCHGEAR

INSTRUCTIONS

7.5 & 15 KV POWER CIRCUIT BREAKERS
TYPE 7.5HK250 AND 500
15HK150, 250, 500 AND 750



I-T-E Imperial
CORPORATION

CONTENTS

COVER - 45280-A
FIG.1 - S-16236, REV 1
FIG.2 - D39352-A
FIG.3 - D39353-A
FIG.4 - C36741-RA
FIG.5 - S-16270, REV 4
FIG.6 - S-14791, REV 1

INSTRUCTIONS FOR 7.5 & 15 KV POWER CIRCUIT BREAKERS TYPE 7.5HK250 AND 500 15HK150, 250, 500 AND 750

INTRODUCTION

These instructions for installation, operation and maintenance of HK circuit breakers shoud be read carefully and used as a guide during installation and initial operation.

The specific ratings of each model circuit breaker are listed on the individual nameplates.

File these instructions in a readily accessible place together with drawings and descriptive data of the switchgear. These instructions will be a guide to proper maintenance of the equipment and prolong its life and usefulness.

RECEIVING AND STORAGE

Immediately upon receipt of the circuit breakers, examine the cartons to determine if any damage or loss was sustained during transit. If injury or rough handling is evident, file a damage claim at once with the carrier and promptly notify the I-T-E Imperial Corporation. The I-T-E Imperial Corporation is not responsible for damage of goods after delivery to the carrier. However, the I-T-E Imperial Corporation will lend assistance if notified of claims.

Unpack the circuit breakers as soon as possible after receipt. If unpacking is delayed, difficulty may be experienced in making a claim for damages not evident upon receipt. Use care in unpacking in order to avoid damaging any of the circuit breaker parts. Check the contents of each carton against the packing list before discarding any packing material. If any shortage of material is discovered, promptly notify the nearest representative of the I-T-E Imperial Corporation. Information specifying the purchase order number, carton number and part numbers of the damaged or missing parts should accompany the claim.

Circuit breakers should be installed in their permanent location as soon as possible. If the breakers are not to be placed in service for some time, it is advisable to provide adequate means of protection. This may be done by keeping the breaker in its original shipping carton and storing in a warm, dry and uncontaminated atmosphere. If the circuit breaker cannot be stored properly due to circumstances, it must be thoroughly checked before going into service to insure it has not absorbed moisture, rusted or become generally contaminated in any way.

CIRCUIT BREAKER INSTALLATION

GENERAL

Prior to the initial installation of the circuit breaker into switchboard, certain preliminary inspections should be made to insure proper operation. The inspection procedures for this are given in this section.

FOR SAFETY: Prior to any disassembly or inspection of the circuit breaker, the closing springs should be discharged, and the breaker should be open.

If it is necessary to raise or move the breaker, attach a lifting yoke at points 7 (Fig. 2) or a fifth wheel at point 5 (Fig. 3) to transport the breaker as required.

INSTALLATION INSPECTION

Inspect condition of circuit breaker arc chutes, contacts and electrical connections prior to installing the circuit breaker into the switchboard. Even though each circuit breaker is completely adjusted and tested at the factory, shipping and handling conditions could cause defects.

REMOVING INTERPHASE BARRIER (See Fig. 1)

Remove two lower front sheet screws (9) and lift front sheet up and away from the breaker. Remove arc chute tie bar (6) at upper front of arc chutes. Pivot rear brace (1) at rear of each barrier upward, unhook back barrier (10), when installed, and slide the separate barriers (3) forward and away from the circuit breaker.

CAUTION: The barriers will not stand unsupported and must be braced.

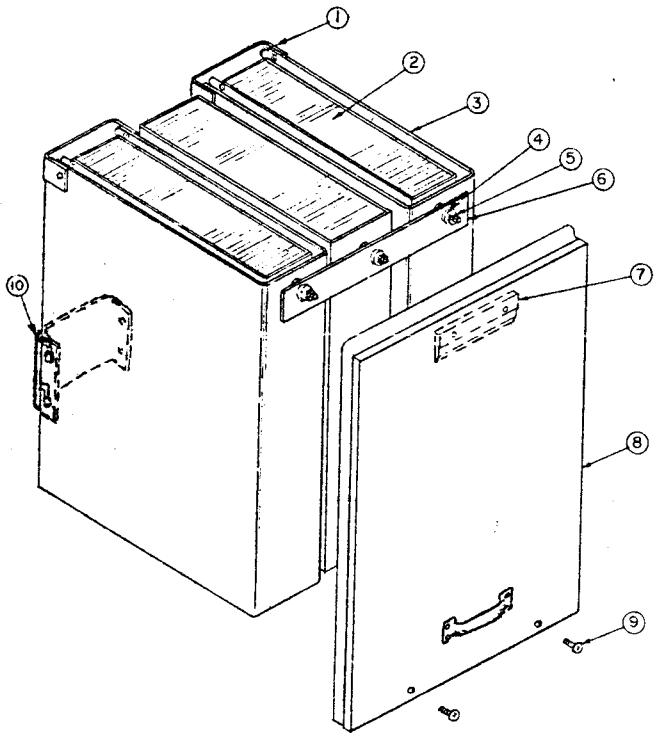


Fig. 1 — Method of Attaching Barrier Assemblies

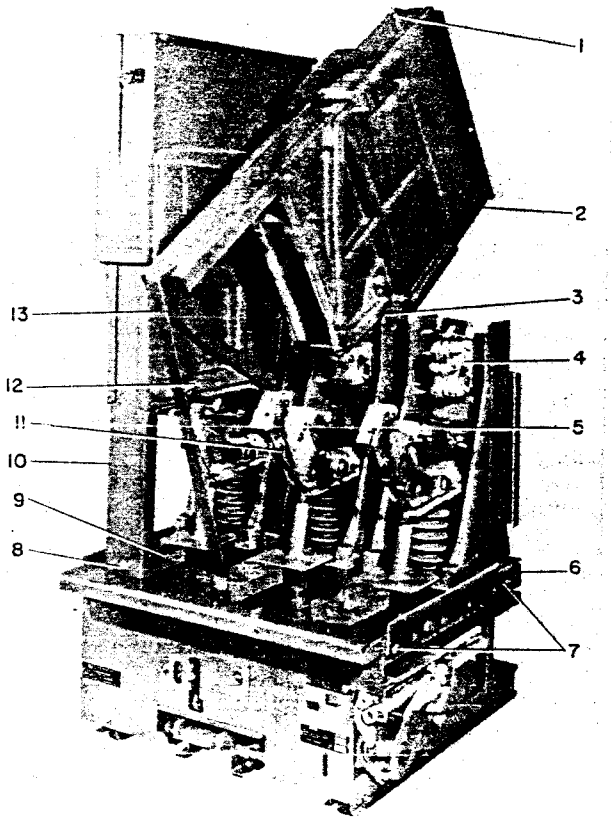


Fig. 2 — View Showing Arc Chute and Contact Structure

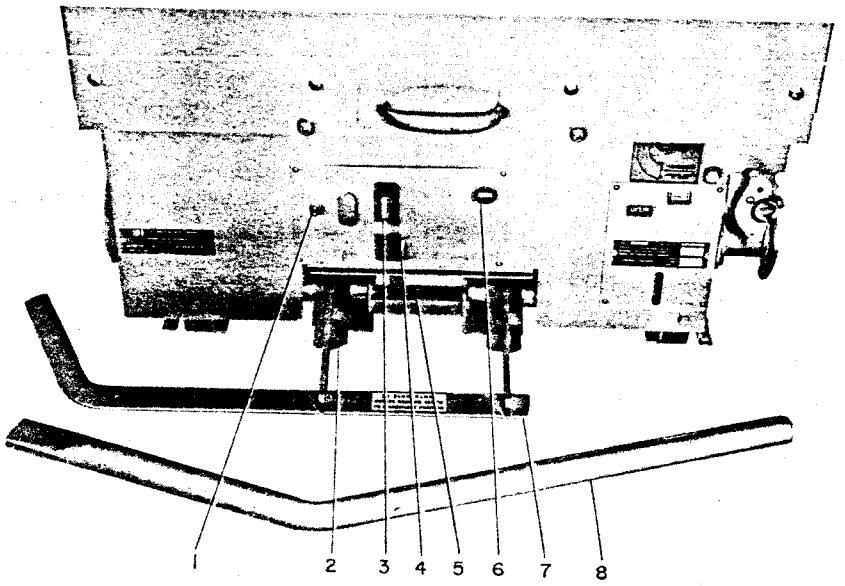


Fig. 3 — Front View of Control Panel

REMOVING ARC CHUTES (See Fig. 2)

Remove nut (12) and gently disconnect return connection (11). Remove bolt (8) connecting the front leg (10) of the arc chute to the block (9) on the base sheet of the circuit breaker. Attach the accessory lifting bracket to the tie bar bushing (1) at the top front of the arc chute and slowly raise the arc chute as required by means of a hoist. It will pivot at its terminal connection and then should be guided straight out of the pivot guide slot and fingers and removed away from the circuit breaker. If only a visual examination is to be made, each arc chute may be tilted back gently, hand held and arc chute tilt support (13) bolted into place between arc chute leg (10) and block (9).

CAUTION: Be sure return connection is clear and does not catch on the arc chute. Also block wheels to prevent breaker from rolling.

ARC CHUTE EXAMINATION

Examine arc chutes carefully before placing into service. Look for any breakage to liner plates and arc chute plates. Check for presence of any foreign particles such as chips of ceramic and metal. Inspect exterior for any damage or deformation. The polyester glass moldings occasionally have some small cracks develop in resin rich areas but these cracks do not indicate defective material and should not cause concern.

INSULATION STRUCTURE

All insulated parts should be checked for damage. Any dust or dirt should be removed by air or wiped with a clean lintless cloth saturated with an oil-free solvent. This is important because the soot or dirt can accumulate and, with moisture, can place the circuit breaker in jeopardy, dielectrically. The lead support moldings are polyester glass and occasionally have some resin rich cracks or crazing develop but these do not indicate defective material and should not cause concern.

MANUAL SLOW CLOSE TO CHECK CONTACT PRESSURE (See Fig. 3)

Turn racking screw clockwise approximately two to three turns until the racking-unlocking lever snaps into the first position corresponding to the "DISCONNECT" position.

Engage manual charge handle (8) with charging lever (3). Pump charging lever until breaker closing springs snap into charge position, then remove handle.

Insert BOTH tangs of spring retainer bracket (7) into holes of closing spring guides (2).

Pull manual close lever (4) to discharge closing springs onto tangs of spring retainer bracket (7). At this time the contacts will partially close.

Re-engage manual charge handle (8) with charging lever (3), then slowly pump to slow close breaker contacts. Check contact pressure as listed in Adjustment Section, using the manual trip button (6) to open the breaker.

To remove spring retainer bracket (7) from circuit breaker, continue pumping until closing springs are again heard to snap into charged position. Spring retainer bracket can now be removed.

Discharge closing springs by pulling manual close lever (4) and pushing manual trip button (6) at the same time to effect a trip free operation. (Or the breaker can be closed first and then tripped.)

INSTALLING ARC CHUTES (See Fig. 2)

Position arc chute (2) in tilted position, squarely down into its rear pivot guide slots and fingers (avoid bumping and chipping of all moldings), then lower slowly into position.

CAUTION: Be sure return connection (11) is clear and does not catch on the arc chute.

Securely fasten return connection by its nut (12) and rebolt the front arc chute support leg to its hold down block.

INSTALLING INTERPHASE BARRIER (See Fig. 1)

Slide the right and left interphase barriers (3), as marked, in place between the lead support moldings and inside of the clips on the outside moldings, and pivot the rear brace downward behind the arc chutes. Install the arc chute tie bar at the upper front on the arc chutes. Then, lift front sheet in place so that it hooks over the arc chute tie bar. Secure the barrier front sheet in place with the two lower front sheet screws.

CAUTION: For older unmarked barriers, ensure that the flux shunt pad is installed between poles.

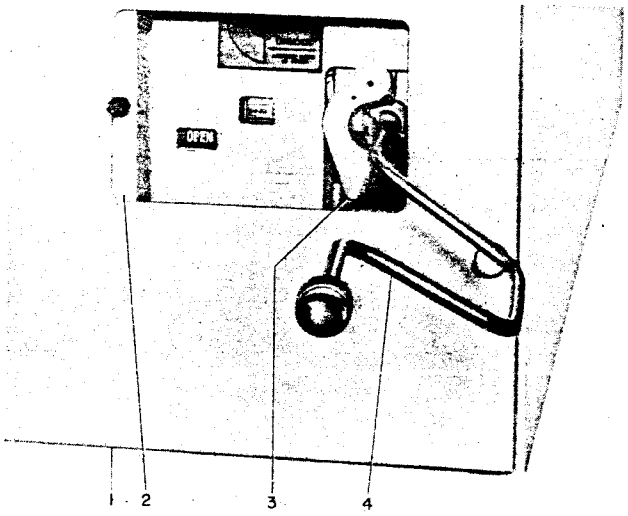


Fig. 4 — Method of Racking Circuit Breaker

INSTALLING CIRCUIT BREAKER INTO COMPARTMENT
(See Figs. 3 & 4)

NOTE: CLOCKWISE ROTATION of racking crank for inserting breaker. COUNTERCLOCKWISE rotation of racking crank for removal of breaker.

Turn motor disconnect switch (if supplied) (1, Fig. 3) to "OFF" position.

Engage racking crank (4, Fig. 4) and push racking unlocking lever (3) to left, then rotate racking crank counterclockwise only until resistance to motion is felt. (DO NOT FORCE.)

Engage the fifth wheel with hole (5, Fig. 3); guide and push circuit breaker into compartment until stopped. (If closing springs were left in charged condition, they will automatically discharge.) Again engage racking crank and rotate clockwise until racking mechanism automatically stops at "DISCONNECT" position. (Breaker is now held captive in compartment.)

To rack circuit breaker to "TEST" position, push racking unlocking lever (3, Fig. 4) to left, rotate racking crank approximately ¼ turn clockwise, then release unlocking lever. Continue cranking until racking mechanism automatically stops at "TEST" position.

With the circuit breaker racked to "TEST" position, it should be checked for proper operation by operating all possible means of opening and closing, this includes control switches, relays, etc. Turn motor disconnect switch (1, Fig. 3) to "ON" position to charge the closing springs, and operate the breaker as required. (If motor disconnect switch (1, Fig. 3) is not provided, springs will automatically charge when approaching "TEST" position.)

FOR SAFETY: When racking circuit breaker to "CONNECTED" position, close compartment door (1, Fig. 4) and insert racking crank (4, Fig. 4) through sliding panel (2, Fig. 4).

Push unlocking lever (3) to left and turn racking crank (4) approximately ¼ turn clockwise, then release unlocking lever. Continue cranking until racking mechanism automatically stops at "CONNECTED" position.

CAUTION: Do not attempt to rack any further.

The circuit breaker now may be put in service and be operated as required.

CIRCUIT BREAKER REMOVAL
(See Fig. 4)

To remove circuit breaker from "CONNECTED" position, open the breaker as required.

Open sliding door (2) in front compartment door (1). Engage racking crank (4) and push racking unlocking lever (3) to left. Rotate racking crank (4) counterclockwise approximately ¼ turn, then release unlocking lever. Continue cranking counterclockwise until racking mechanism automatically stops at "TEST" position.

Repeat same operation for "DISCONNECT" position.

To position the racking mechanism for withdrawal of the circuit breaker from the switchboard, again push the racking unlocking lever to the left and turn the racking crank counterclockwise only until resistance to motion is felt. (Approximately 2-3 turns—DO NOT FORCE.) The circuit breaker can now be removed from the compartment by pulling on the handle located at the bottom of the front barrier.

NOTE: The closing springs, if charged, will automatically discharge when the circuit breaker is withdrawn from the switchboard.

MAINTENANCE AND ADJUSTMENTS

GENERAL INFORMATION

The HK circuit breakers are designed for minimum maintenance and tested to insure that minimum maintenance will be required. There is only one basic adjustment normally required and that is contact adjustment. This should be checked to the dimensional values required as described elsewhere. The few other adjustments that are noted are required only when an operational check indicates a problem. Of course, during the maintenance checks, all accessible bolts, nuts and screws should be routinely checked to insure that they are tight.

It is recommended that the circuit breakers be normally inspected after 2000 operations. These operations can be either no-load mechanical or load current switching where the power factor is relatively high. When the circuit breakers are used for direct bulk capacitor or reactor switching operations or for motor starting applications, it is recommended that the circuit breakers be inspected after 1000 operations because of the switching severity.

If however, after the first inspection period, there is no indication of any problems, actual operating experience can then dictate the inspection cycle.

Regarding maintenance recommendations following fault duty, reference is made to ANSI Standard C37.04 to which the circuit breakers have been tested. In accordance with this standard, a total of 400% asymmetrical fault duty can be accumulated. This is to be ten or less close-open operations at less than 85% of full fault duty, but it can be an accumulation over a long time period of lower currents. The condition of the breaker should be such that after this duty it is capable of one more close-open operation at full fault current. Inspection is to be made at this time to insure this and then the final operation can be made if everything is satisfactory. At this time, maintenance should be performed and reconditioning done and replacements made as indicated.

Further, in accordance with the same standard, it is recommended that after a major fault duty cycle (CO-15 SEC. -CO) which is known to be between 85 and 100% of the circuit breaker rated asymmetrical short circuit current that the circuit breaker be inspected regardless of any time period or number of operations. Also, when the circuit breaker is applied on reclosing duty, it should be inspected immediately after the series of fault operations in the same range of currents.

The condition of the circuit breaker after interruption depends on the circuit conditions regarding such things as power factor, X/R ratio and relay delay times. Experience with specific circuits will indicate the future amount of maintenance that will be required for the various breakers and then modification in procedure can follow.

Of course, where unusual service conditions, as covered by ANSI Standard C37.04, exist, it must be assumed that these conditions were considered at the time of order; that the equipment supplied was designed for the special application; and that an appropriate supplemental maintenance program has been developed. These maintenance instructions only cover circuit breakers used under the standard usual service conditions.

After normal service without major fault interruption, the following tests and adjustments should be made:

NOTE: The following tabulated tests and adjustments are all that are normally necessary for proper maintenance and operation of the HK circuit breaker. The remaining portions of the breaker — close coil assembly, shunt trip device, control relay, auxiliary switch and motor — require no maintenance during the standard life of the circuit breaker regardless of the operating duty.

MILLIVOLT DROP TEST

During normal maintenance periods, the condition of the circuit breaker can easily be determined by performing a millivolt drop test. This test should be performed regardless of whether the circuit breaker had interrupted low or high currents or has minimum operations.

The following table lists the millivolt drop and resistance values for the circuit breakers covered by this instruction book, from terminal to terminal, exclusive of the primary disconnects.

CIRCUIT BREAKER	MAXIMUM MV DROP*	MAXIMUM MICRO-OHMS
7.5HK250 15HK150, 15HK250, 15HK500 1200 Ampere	7	35
7.5HK250 15HK150, 15HK250, 15HK500 2000 Ampere	6	30
7.5HK500 & 15HK750 1200 & 2000 Ampere	6	30
* Millivolt drop with 200 amperes flowing.		

If the millivolt drop does not exceed 150% of the above values, on breakers with normal loading, no maintenance is necessary. If the millivolt drop does exceed 150% of the above values, the main and arcing contacts should be dressed with a fine file, cleaned and be adjusted for proper contact pressure and then rechecked. If the values are still in excess of the 150% value, the bridge pivot pressure should be readjusted as outlined elsewhere.

However, for optimum performance of the circuit breakers during periods of increased loading, it is recommended that the listed values be met.

After all above steps have been taken and the millivolt drop is still excessive, contact I-T-E for recommendations.

CONTACT AND INSULATION CLEANING

Any dirt, soot or grease should be removed from the circuit breaker contacts and surface of entire current carrying structure, as well as all insulation surfaces, with a cloth saturated with an oil-free solvent. Cleaning of the insulation is important because the soot and dirt can accumulate and, with moisture, can place the circuit breaker in jeopardy, dielectrically.

A degree of burning and pitting on the circuit breaker arcing contacts is to be expected from normal operation; also, on highly inductive or capacitive circuits and after major interruptions, some pitting may occur on the main contacts. A moderate amount of pitting will not interfere with the operation of the contacts. When necessary to dress the contacts, cover the puffer nozzle (5, Fig. 2) with a cloth, then follow the contour of the contacts with a fine file. Do not attempt to eliminate pitting entirely. After this maintenance, the contact pressure and millivolt drop should be checked.

NOTE: Replacement of contacts need only be considered when: after repeated dressing of any contacts, less than 50% of the original contact material thickness is left (Moving arcing contact can be inverted when working surface is reduced to less than 50%.); the tips of the stationary arcing contacts have been eroded away; any contact has been broken or cracked.

CONTACT PRESSURE (See Fig. 5)

A. With the circuit breaker withdrawn from the switchboard, the following step-by-step procedure should be followed for properly checking and/or adjusting the contact pressure on an "HK" type circuit breaker.

1. Remove interphase barrier assembly and remove arc chutes as described previously.

2. Turn racking screw clockwise approximately two to three turns until the racking-unlocking lever snaps into the first position corresponding to the "DISCONNECT" position.

3. Manually slow-close the circuit breaker as described on page 5, but only to the point that the arc contacts just touch. All arcing contacts should touch within 1/32".

4. Continue the slow-close operation to fully close the breaker. Each pole should have between 7/64" minimum and 3/16" maximum main contact compression measured at "A" between the EDGE of the metal stop plate and the main contact stop. (This dimension measured on either side is sufficient.) A rod or drill of these sizes can be used for measuring.

At this point, if the adjustments are correct, complete steps B6, B7, B8 and B9 following.

B. If any adjustment is incorrect, use the following procedure to readjust contact pressure or to initially adjust when changes are made:

1. Completely slow-close the circuit breaker and set each pole for 7/64" main contact compression at "A". (A 7/64" rod or drill should fit tightly between the EDGE of the metal stop plate and the main contact stop.)

2. Open the circuit breaker, manually recharge the closing springs, and partially slow-close the circuit breaker until the arcing contacts of any pole or poles just touch.

3. Advance the adjustment of the lagging pole or poles so that the three arcing contacts touch simultaneously within 1/32". This adjustment is made by loosening locking bolt or set screw (depending on model) (2) and rotating adjusting stud (3).

4. Complete slow-close operation to fully closed position and check that the main contact compression of the pole or poles that were advanced does not exceed 3/16". Also, the arcing contact springs on these poles should not be fully compressed. If the 3/16" dimension is exceeded, the entire procedure should be repeated to obtain the correct gap at "A".

NOTE: Occasionally, the center pole contact pressure may slightly exceed 3/16". However, if the outer poles are within the 3/16" dimension and the arcing contact springs of the center pole are not fully compressed no readjustment need be made. When this condition exists; the center pole parts before the outer poles on opening.

5. Open the circuit breaker, recharge the closing springs, remove the slow-close bracket, fast-close the breaker, recheck adjustments and trip open.

NOTE: Fast-closing the circuit breaker results in a slight increase in contact pressure over slow-closing.

6. Tighten the locking bolt (2) on each adjusting stud (3) to lock the contact pressure adjustment stud in place.

7. The arc chutes can now be replaced, and the interphase barrier assembly can now be reinstalled.

8. Return the racking screw to its original position by turning it counterclockwise approximately two to three turns until it stops.

9. The circuit breaker can now be replaced in its compartment and returned to service.

PUFFERS (5, Fig. 2)

The performance of the puffers can be readily checked during a maintenance interval. Each puffer should provide a moderate blast of air at the breaker contacts, on opening of the circuit breaker. This can be detected by holding the hands or arm over the top of the contacts and opening the circuit breaker. All three poles must have puffing action or else the circuit breaker must not be placed in service.

FOR SAFETY: Keep clear of all moving parts.

CLOSING AND OPENING TIMES

After the operation intervals noted previously or a change in bridge pivot adjustment, the closing and opening times are recommended to be checked by use of a cycle counter, time-travel analyzer*, oscillograph etc. to monitor the time from energizing to arcing contact touch or part.

*Analyzer mounting support and instructions available on special order.

The circuit breaker closing and opening times should be within the following time ranges for normal operation.

CIRCUIT BREAKER	CLOSING TIME RANGE - MS	OPENING TIME RANGE - MS
7.5HK250, 15HK150, 15HK250, 15HK500 1200 Ampere	115 - 145	23 - 35
7.5HK250, 15HK150, 15HK250, 15HK500 2000 Ampere	120 - 140	23 - 35
7.5HK500 & 15HK750 1200 & 2000 Ampere	115 - 145	23 - 35

NOTES:

1. Below 0° C., the closing times will increase (but with no reduction in closing force); and opening times will be within the limits.

2. Adjustments to correct speeds, if found to be outside limits, are critical and I-T-E should be contacted for recommendations.

ARC CHUTES

The arc chutes should be inspected internally to insure that no breakage occurred to the liner plates or arc plates. Further, there may be a crust formed on the

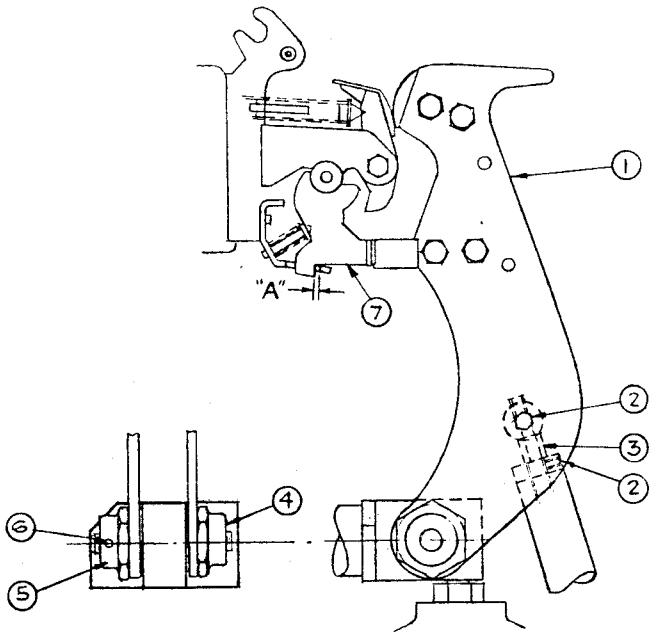


Fig. 5 — Contact Pressure and Bridge Pivot Pressure

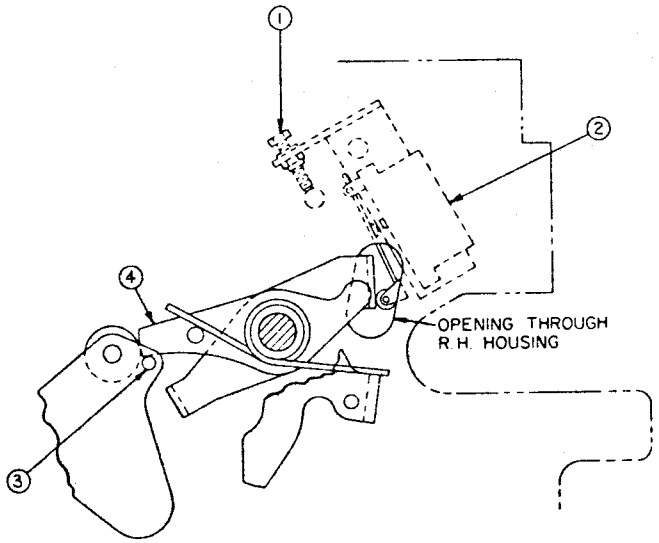


Fig. 6 — Latch Check Switch Adjustment

liner plates if the load current interruptions were close to the continuous current rating of the breaker or moderate faults were interrupted. This crust should be removed by carefully using a carborundum stone or scraper. Then the arc chute should be blown out with air to remove the resultant dust and particles.

After 400% accumulated current or major interruptions occur, the circuit breaker should be inspected immediately afterwards, as stated previously. All maintenance checks or tests noted above should be carried out plus the arc chutes should be looked at closely. Arc plate and liner plate breakage should be carefully looked for, along with excessive erosion of the arc plates. The arc plates are made of ceramic material and perform the function of extracting heat from the arc as it is being forced into and elongated by them. The leading edges become coated with glass that comes to the surface from the extreme heat. The direct measure of use is the amount of glass beads evident.

When the entire leading edge and portions of the flat arc plate are noted to be heavily encrusted with glass beads, the arc chute should be replaced. It should be noted that this condition will vary between arc chutes on the same breaker because of single-phase fault and asymmetrical current incidences. If there are any questions, I-T-E should be consulted for recommendations.

BRIDGE PIVOT PRESSURE (See Fig. 5)

Bridge pivot pressure should be adjusted only when the millivolt drop test indicates a problem.

When this adjustment is necessary, the following steps should be done.

1. Locking bolt (2) should be loosened on solid pushrod models. Spring-loaded pushrod models do not require disconnecting.

2. Bridge (1) should be disconnected from adjusting stud (3) on solid pushrod models.

3. Loosen one set screw (6) in one pivot nut — either side.

4. Tighten bridge pivot nut (4 or 5) securely (approximately 75 ft. lbs.). Then gradually back up pivot nut (approximately ½-1½ flats) until bridge motion is just free when bridge is moved by hand. On spring-loaded pushrod models, lift bridge against spring and then slowly release, insuring that it resets freely.

5. Tighten set screw (6) in nut that was loosened, reconnect adjusting stud, if disconnected, and readjust contact pressure as described elsewhere.

OPERATING MECHANISM (See Fig. 6)

The operating mechanism is adjusted at the factory for proper operation and should not be disturbed unless the circuit breaker does not close electrically on reclosing duty.

This condition is caused when the latch check switch (when used) is not actuated. Circuit breaker should not close before trip latch (4) has reset.

Adjustments should be made with latch (4) against reset stop pin (3). Turn in adjusting screw (1) until contacts of switch (2) "break" (as indicated by an audible click or check with bell ringer). Retract adjusting screw until switch contacts "make", then rotate adjusting screw one turn more. (Adjusting screw is self-locking.)

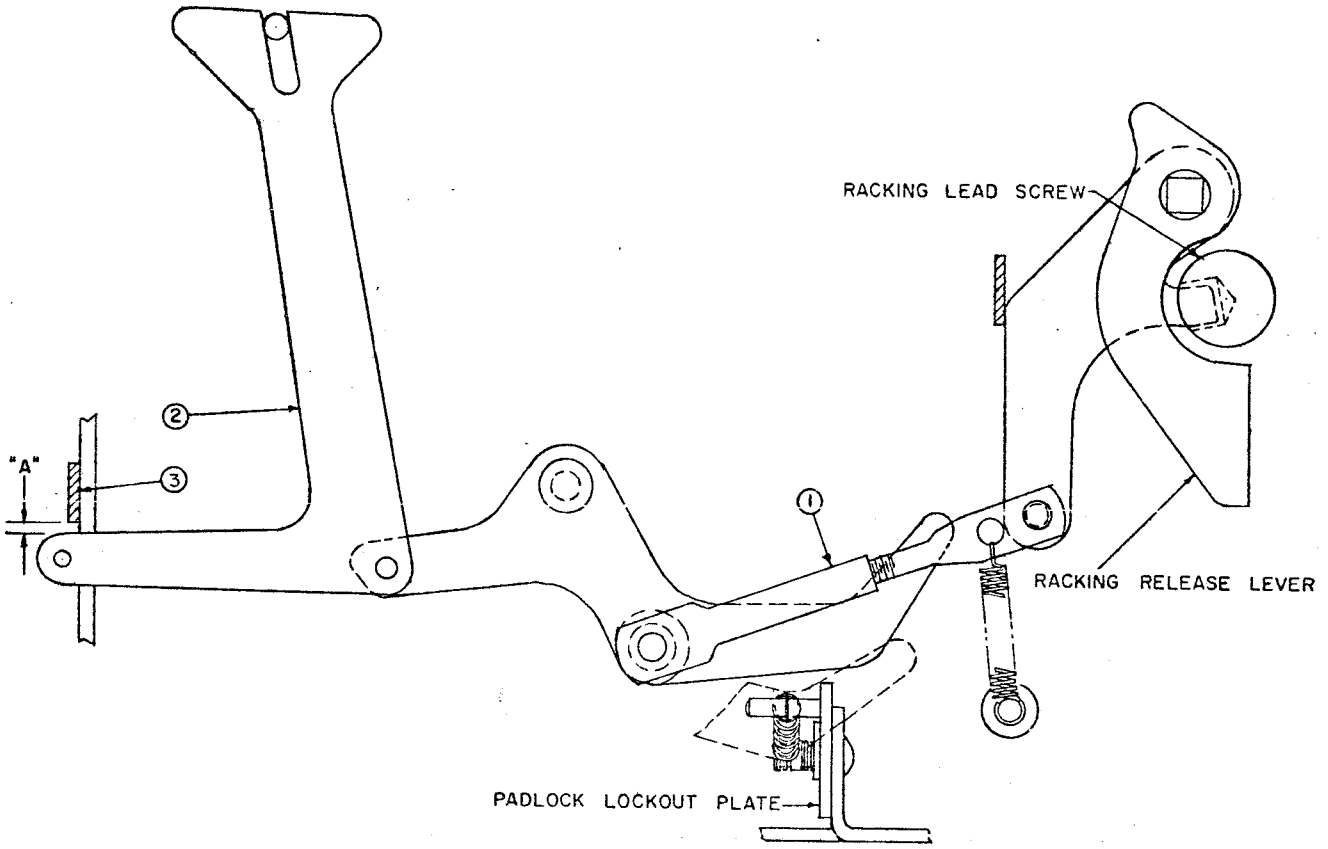


Fig. 7 — Racking Mechanism

RACKING MECHANISM (See Fig. 7)

The circuit breaker racking mechanism is adjusted for proper operation and should not be disturbed unless it becomes possible to close the breaker during a racking operation.

It may be possible that interlocked blocking members are not positioned properly, which should be corrected as follows:

Remove the lower front mechanism coverplate and with the circuit breaker closed, make adjustments by regulating the length of connecting rod (1) for 1/8 inch minimum to 3/16 inch maximum clearance at "A" between trip link (3) and blocking lever (2).

LUBRICATION

The HK circuit breakers are lubricated during factory assembly as follows:

1. All mating surfaces of moving current-carrying joints have been lubricated with NO-OX-ID special grade "A" grease manufactured by Dearborn Chemical Company.

2. All other mechanism parts, bearings, pins, etc. have been lubricated with ANDEROL L757 manufactured by Tenneco Chemical, Inc., Intermediate Division.

The circuit breaker requires no lubrication during its normal service life. However, if the grease should become contaminated or if parts are replaced, any re-lubrication should be done with NO-OX-ID or ANDEROL grease as applicable.

NOTES:

1. Do not use NO-OX-ID grease on any main and arcing contact surfaces.

2. It is recommended that the primary disconnects be maintained by renewing the NO-OX-ID grease during maintenance periods.

3. Do not use light oil to lubricate any mechanism parts.

4. The charging motor is sealed and no lubrication is required.

DIELECTRIC TESTS

If it is desired to make dielectric tests during maintenance periods, the following test values should be used and are to be applied for a one minute period.

	60Hz	DC
Primary Circuit	21.5kV	30kV
*Secondary Circuit (Control)	1100 V	1500 V

*It is necessary that the charging motor be disconnected for this test by turning the motor disconnect switch to the "OFF" position. If a test is desired on the motor, then the motor disconnect switch should be turned to the "ON" position and the circuit re-tested at 540V, 60Hz or 760V DC.

ELECTRICAL CHARACTERISTICS OF CONTROL DEVICES

For operating voltage ranges for various nominal control voltages refer to Table 1.

For average current values at various nominal control voltages, refer to Table 2. The current values given in this table are average, steady state values and momentary inrush currents for all charging motors and AC coils are approximately six to eight times these values.

ELECTRICAL OPERATING SEQUENCE

Please refer to the specific schematic diagrams and other operational information furnished with your order.

Fig. 8 is provided as a typical schematic for general information on electrical operation.

RENEWAL PARTS

I-T-E recommends only those renewal parts be stocked that will be required to insure proper and timely maintenance for normal operation of the HK circuit breakers. Copies of the applicable Renewal Parts Bulletin for specific circuit breakers will be furnished on request to the nearest sales office of the I-T-E Imperial Corporation.

The minimum quantity of assemblies and items recommended in these bulletins are predicated on infrequent replacement of parts based on accumulated tests and operating experience. Total assemblies are recommended for fast replacement, when necessary, to return the breaker to service as quickly as possible. Then certain replaced assemblies, such as the stationary upper terminals, can be returned to the factory for nominal reconditioning. The bulletins contain specific part ordering instructions; and if desired, specific instructions regarding replacement of those part assemblies recommended, that are not obvious, are also available if ordered.

TABLE 1 - OPERATING VOLTAGE RANGE

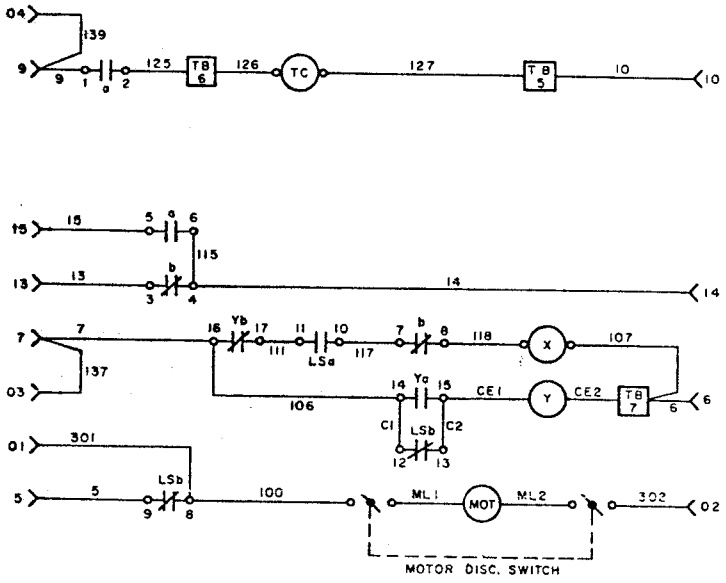
NOMINAL CONTROL VOLTAGE	SPRING CHARGING MOTOR	CLOSE COIL	TRIP COIL	UNDERVOLTAGE	
				PICK-UP MAXIMUM	DROP-OUT
24 V dc	-	19-28	14-28	21	7-14
48 V dc	38-56	38-56	28-56	41	15-29
125 V dc	100-140	100-140	70-140	106	38-75
250 V dc	200-280	200-280	140-280	212	75-150
120 V ac	104-127	104-127	104-127	102	36-72
240 V ac	208-254	208-254	208-254	204	74-144

TABLE 2 - AVERAGE CURRENT VALUES

NOMINAL CONTROL VOLTAGE	SPRING CHARGING MOTOR	CLOSE COIL	TRIP COIL	LOCKOUT COIL	UNDER VOLTAGE	N.E.C. FUSE
24 V dc	-	22.0	22.0	0.30	0.9	30
48 V dc	25.0	10.7	10.7	0.15	0.5	30
125 V dc	10.0	5.0	5.0	0.06	0.2	30
250 V dc	5.0	2.2	2.2	0.03	0.1	30
120 V ac	10.0	4.5	4.5	0.40	0.2	30
240 V ac	5.0	2.3	2.3	0.20	0.1	30

6 > < 5
9 > < 7
10 > < 13
15 > < 14
04 > < 03
02 > < 01

REAR VIEW OF SECONDARY DISCONNECTS



LEGEND

a - Auxiliary Switch Contact Closed When Breaker Is Closed.
b - Auxiliary Switch Contact Open When Breaker Is Closed.
LCb - Latch Check Switch Contact Closed When Breaker Operating Mechanism Is Reset.
LSa - Limit Switch Contact Open When Springs Are Discharged. Closed When Springs Are Charged.
LSb - Limit Switch Contact Closed When Springs Are Discharged, Open When Springs Are Charged.
TC - Shunt Trip Coil.
X - Closing Latch Release Coil.
Y - Control Relay Lockout Coil.
Ya - Normally Open Control Relay Contact.
Yb - Normally Closed Control Relay Contact.
TB - Terminal Block Point.
ML - Motor Lead.
CE - Coil Lead End.
C1, C2 - Terminal Jumper (Control Device).
>— - Female Secondary Disconnect Contact.
UV - Undervoltage Trip Device.
UVb - Normally Closed Undervoltage Trip Device Contact.
69 - Permissive Control Switch.
BL - Blocking Lever Switch (Open When Ground Switch Is Locked In Ground Position).

FIG. 6 - 108556, Sheet 1, REV 0

Fig. 8—Typical DC Schematic Diagram of Control Circuit