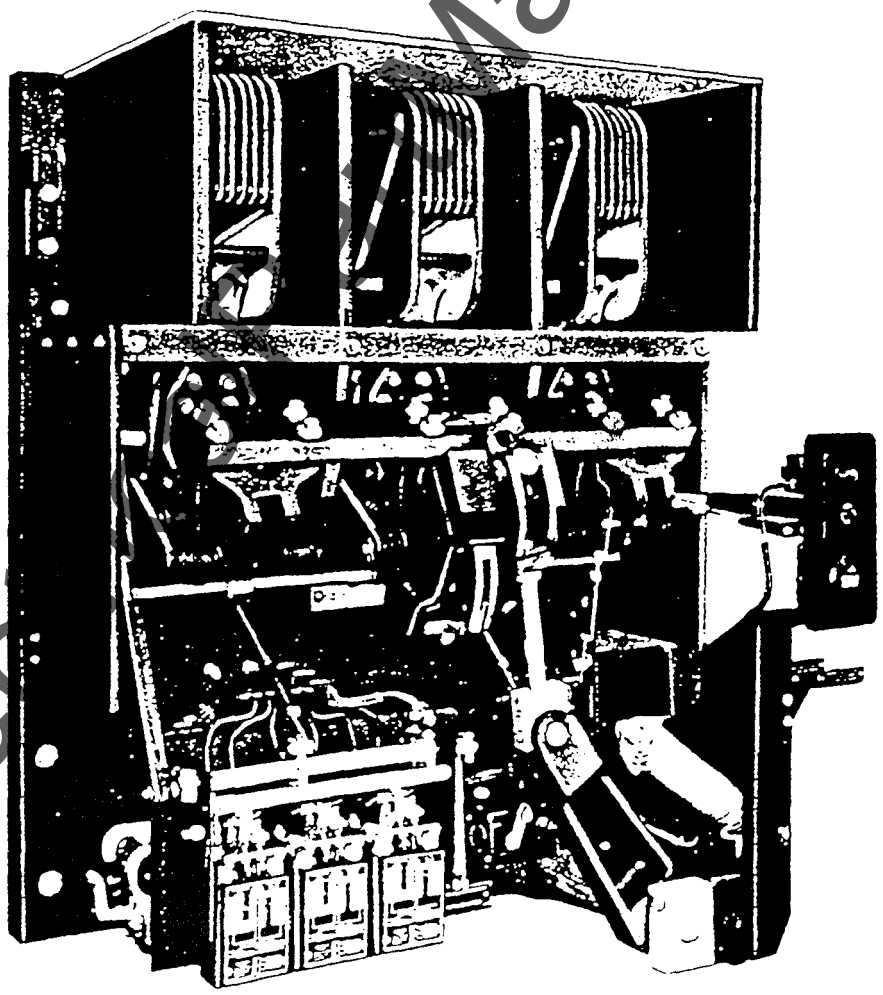
LOW VOLTAGE SWITCHGEAR

INSTRUCTIONS

TYPE LG
CIRCUIT BREAKERS

(MODELS D AND E)



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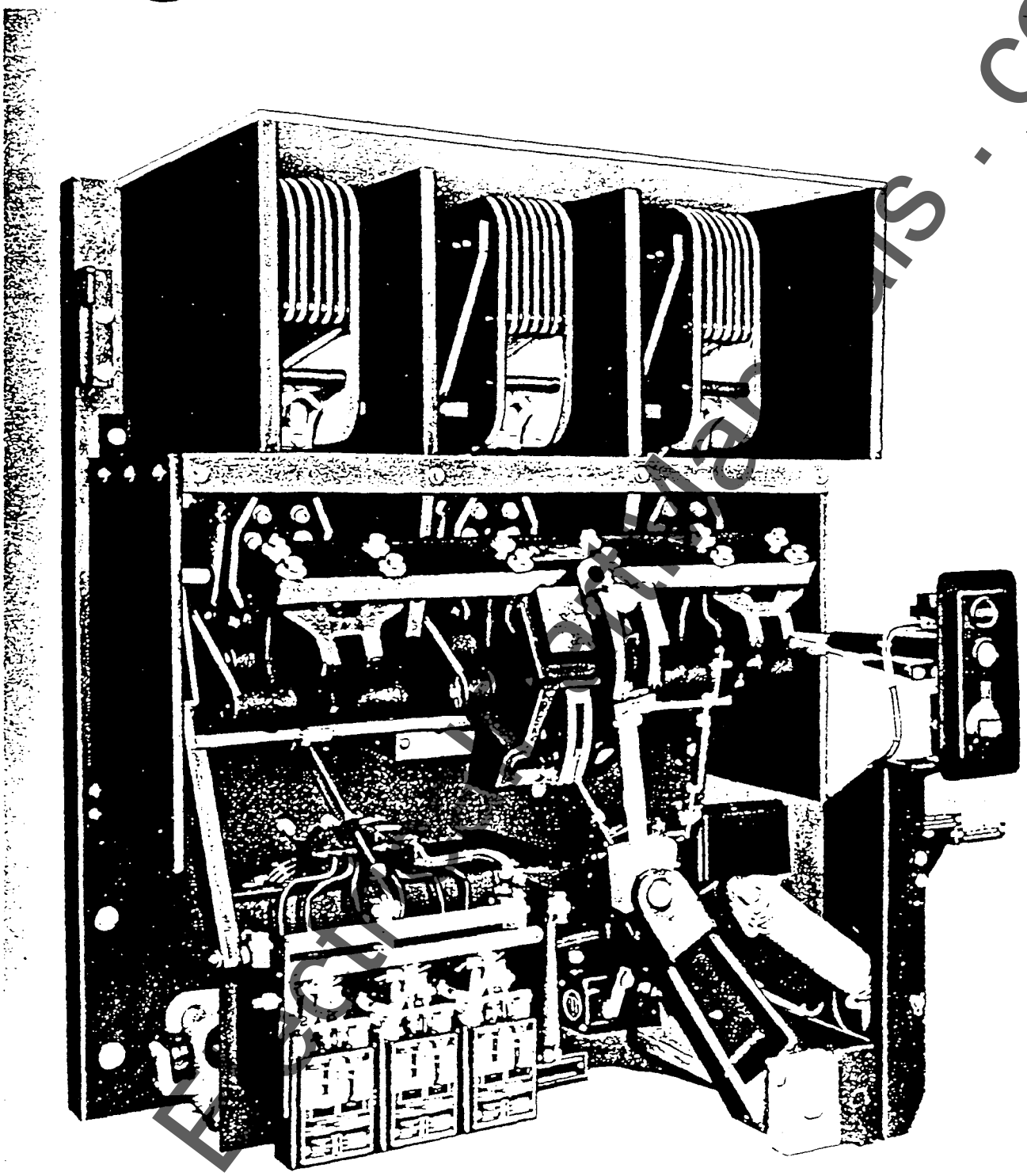


Photo 19937-R

Fig. 1—Type LG Circuit Breaker for Drawout Mounting Showing Arrangement of Standard Devices

INSTRUCTIONS FOR TYPE LG CIRCUIT BREAKERS MODELS D AND E

INTRODUCTION

These instructions apply to Type LG circuit breakers having serial numbers with the prefix D (Model D) or E (Model E).

Read these instructions thoroughly and carefully before installing or attempting to operate the Type LG circuit breaker. The operator can prolong the life and usefulness of this equipment by following these instructions.

After the circuit breaker is installed and operating properly, file these instructions in a convenient place with any other drawings or switchgear data pertaining to the installation.

The Type LG circuit breakers can be furnished as a two-pole, three-pole, or four-pole breaker which may be either manually or electrically operated, depending upon the application. A three-pole, electrically operated circuit breaker is shown in Fig. 1.

APPLICATION

The Type LG circuit breaker is designed for use on circuits where the interrupting requirements approach the interrupting ratings shown in Table II, and where the continuous current requirements are as shown in Table I.

The Type LG circuit breakers may be used as a main circuit breaker for a system, as a bus-tie circuit breaker between sources of electrical power, and as a feeder breaker if the interrupting requirement and the continuous current requirements warrant it.

RATINGS

The Type LG circuit breakers can be furnished in the ratings listed in Table I.

TABLE I RATINGS

Type of Mounting	Continuous Rating Amperes	Rating Volts
ENCLOSED "URELITES"	2000 to 6000 A-C	600 A-C
	2000 to 5000 D-C	250 D-C
LIVE FRONT	2000 to 6000 A-C	600 A-C
	2000 to 5000 D-C	250 & 750 D-C
	8000 to 10000 D-C	250 D-C
DEAD FRONT	2000 to 6000 A-C	600 A-C
	2000 to 5000 D-C	250 & 750 D-C

The interrupting ratings for Type LG circuit breakers are listed in Table II.

TABLE II INTERRUPTING RATINGS

Type of Operation	Continuous Rating Amperes	Interrupting Rating Amperes
ELECTRICAL	2000- 3000 A-C or D-C	75,000
	4000- 6000 A-C or D-C	100,000
	8000-10000 D-C	100,000
MANUAL LIVE FRONT	NOT TO EXCEED 4000 A-C, 5000 D-C	10,000
MANUAL DEAD FRONT	NOT TO EXCEED 4000 A-C, 5000 D-C	50,000

RECEIVING, HANDLING, AND STORAGE

Each circuit breaker, before leaving the I-T-E Circuit Breaker Company, is carefully inspected and tested for proper operation, and then it is crated by workmen who are experienced in the proper handling and packing of electrical equipment.

TRANSPORTATION DAMAGE

Immediately upon receipt of the circuit breaker, examine the crates 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 Circuit Breaker Company. The I-T-E Circuit Breaker Company is not responsible for damage of goods after delivery to the carrier. However, the company will lend assistance in securing any adjustment if notified of such claims.

HANDLING

Unpack the cirucit breaker 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 bending, breaking, or damaging any of the circuit breaker parts. Check the contents of each package 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 Circuit Breaker Company. Information specifying the purchase number, crate number, and part numbers of the damaged or missing parts should accompany the claim.

STORAGE

When a circuit breaker can be installed immediately in its permanent location, it is advisable to do so even though it will not be placed in service for some time.

If the circuit breaker can not be installed in its permanent location, and it is necessary to store the equipment, the following precautions should be taken.

1. Uncrate the circuit breaker as described under HANDLING.

2. Store in a clean, dry place with moderate temperatures.

3. Cover with heavy wrapping paper to prevent dirt or foreign substances from settling on the movable parts and electrical contact surfaces.

DESCRIPTION

The Type LG circuit breakers are manually or electrically operated against heavy springs located back of the contacts and in the operating mechanism and linkage. During inspection and maintenance periods, electrically operated circuit breakers may be closed manually by a removable maintenance closing bar. Pantograph or truck mounted circuit breakers should be either in the "TEST" position or withdrawn from the switchboard. The circuit breaker contacts are opened by the opening springs when a roller latch is released either by pushing the manual trip button or automatically by any trip device with which the breaker is equipped.

Basically, each pole consists of a main current carrying solid bridge protected by intermediate and arcing contacts. The complete pole, mounted in an individual frame or housing, is operated through a double-toggle system from either a manual operating handle or closing solenoid. The frame or housing encloses a direct-acting series trip device which is adjusted easily and accurately.

Multi-pole circuit breakers have the closing arms of all poles rigidly tied together by a horizontal insulated bar so that the poles move in unison. The tripping movement of any pole is communicated from the overcurrent trip coils to the latch mechanism through a horizontal bar. A single latch with trip-free mechanism is mounted in the pole unit which carries the operating arm or handle. A buffer is mounted in the upper part of the operating arm to absorb the momentum of the mechanism at the end of the opening movement.

For electrically operated breakers, the closing solenoid assembly is mounted on the lower portion of the circuit breaker panel. The auxiliary devices necessary for electrical operation are mounted on or adjacent to the solenoid.

MAIN CONTACTS

The movable bridge (43, Fig. 2) consists of a solid copper bar to which silver-alloy inserts are brazed. Two bridges, their associated springs and travel limiting pins, are assembled in a bracket to form a complete contact unit. One or more contact units may be attached to each bridge arm and are brought into contact with the upper and lower stationary main contacts by a force-multiplying system of toggles.

INTERMEDIATE CONTACTS

The stationary and movable intermediate contacts (4 and 47, Fig. 2) are faced with silver-alloy blocks and provide a secondary path for the current. These contacts should always open after the main contacts but before the arcing contacts.

ARCING CONTACTS

The stationary and movable arcing contacts (3 and 48, Fig. 2) are faced with silver-alloy blocks. The arcing contacts should always open last and close first. If the arcing contacts "make" after the the intermediate contacts, excessive burning of the main and intermediate contacts may result. In addition to opening last, the arcing contacts on all poles of the circuit breaker should open at approximately the same instant.

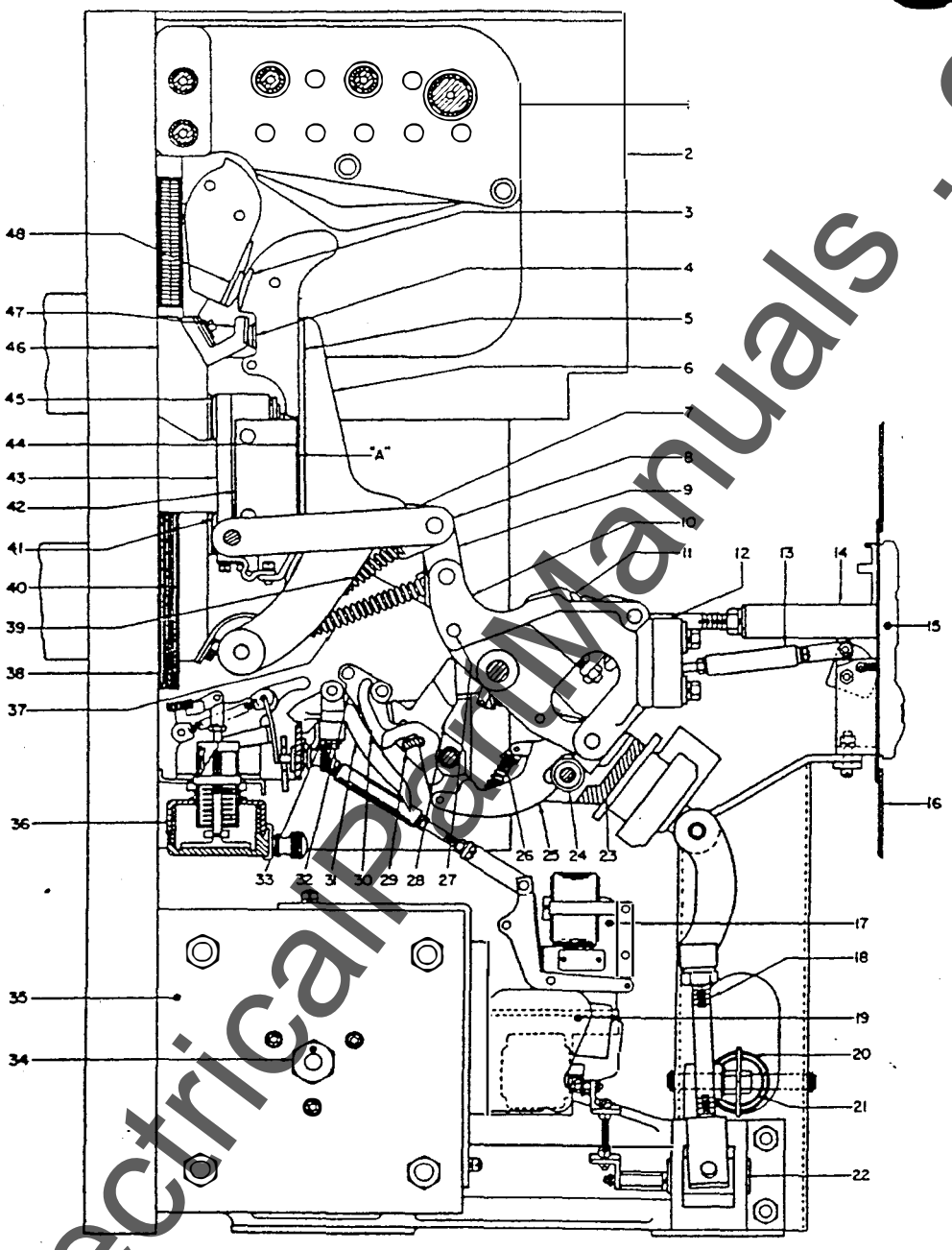
ARC CHUTE

The arc chute (1, Fig. 2) is an efficient form of the magnetic blowout structure, and is easily removed for inspection and maintenance of the contacts. The arc chute consists of an assembly of insulating barriers which confines the arc within a limited insulated area. Magnetic blowout irons placed on the outside of the arc chute side plates are magnetized as the arcing contacts open. The magnetic field thus set up forces the arc into the extinguishing chamber between the insulating barriers where the arc is cooled and extinguished.

On steel enclosed circuit breakers, a hooded barrier assembly is added which covers the entire top and sides of the arc chutes.

BUFFER ASSEMBLY

The buffer assembly (11, Fig. 2) is arranged so as to absorb the kinetic energy of the bridge arm assembly as it reaches the open position. The assembly consists of a buffer with pieces of brake lining on its upper and lower surfaces, and a crank that acts as a brake shoe. The force of the brake shoes is derived from a spring which is compressed by the impact from the bridge arm assembly.



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1	Arc Chute	17	Shunt Trip Device	33	Tripper Bar
2	Barrier	18	Connector Rod	34	Air Check Valve
3	Movable Arcing Contact	19	Control Relay	35	Solenoid Assembly
4	Movable Intermediate Contact	20	Return Spring (Outer)	36	Dual Magnetic Overcurrent Trip Device
5	Bridge Conducting Strip	21	Return Spring (Inner)	37	Operating Spring (Center)
6	Bridge Arm	22	Shaft	38	Magnet
7	Bridge Arm Toggle Link	23	Th ow-in Arm	39	Operating Spring (Outside)
8	Operating Link	24	Main Latch Roller	40	Lower Terminal
9	Operating Arm Toggle Link	25	Main Latch	41	Lower Bridge Contact
10	Operating Arm	26	Main Latch Spring	42	Bridge Contact Bracket
11	Buffer Assembly	27	Kick-off Pin	43	Bridge
12	Connector Bar	28	Hook Trigger	44	Bridge Shim
13	Visual Indicator Linkage	29	Auxiliary Latch Plate	45	Upper Bridge Contact
14	Manual Trip Linkage	30	Auxiliary Latch	46	Upper Terminal
15	Escutcheon	31	Trigger Tripper	47	Stationary Intermediate Contact
16	Front Sheet or Door	32	Hook Trigger Latch Plate	48	Stationary Arcing Contact

Fig. 2—Type LG Circuit Breaker, Electrically Operated
Side Section View

OPERATING MECHANISM

The operating mechanism, as shown in Fig. 2, of the circuit breaker is a system of links forming two toggles in series which provides high contact pressure with relatively small operating force. The bridge arm is pivoted near the panel and carries the bridge arm toggle link which is connected through a pair of horizontal operating links to the housing.

A second system of toggles is made up of a short operating arm toggle link which pivots on the pin common to the bridge arm toggle link and operating links and the pin through the inner end of the operating arm. Both systems of toggles approach center when the circuit breaker is closed. Springs from the operating arm toggle pin to the bridge arm pivot pin assist the contact springs in opening the circuit breaker.

Trip Free Construction

The circuit breaker operating arm and throw-in arm are connected by a compound latch which may be released during closing by any tripping device after the arcing contacts touch.

A roller on the throw-in arm is engaged by the main latch which pivots on the operating arm. The angle of the latch surface forces it away from the roller. This action is normally prevented by the auxiliary latch which pivots on the main latch and engages a latch plate secured to the throw-in arm.

The latch plate must be positioned so there is approximately 0.020 of an inch between the surface of the auxiliary latch and plate when the throat of the main latch is against the roller. The springs assist in engaging the latches, and stops are provided for limiting their movement. The circuit breaker is held in the closed position by the hook trigger which pivots on the throw-in arm. The hook trigger engages a latch plate which is bolted to the right-hand housing. The hook is released during the opening of the circuit breaker when the kick-off stud strikes the cam surface of the trigger.

The latch tripper is pivoted to the housing and carries the tripper bar which is actuated by the tripping device. The operation of any protective device therefore moves the tripper bar. Movement of the tripper bar disengages the latch which results in the circuit breaker tripping.

Therefore, the tripping action is as follows: (A) the tripper bar moves the tripper against the auxiliary latch and disengages it from the latch plate. (B) This causes the main latch to slip off the roller and the breaker opens. (C) The stud on the operating arm releases the hook trigger and allows the throw-in arm to be lifted to engage the latches.

AUXILIARY SWITCH

The auxiliary switch (12, Fig. 4) is used primarily to protect the coil of a shunt trip device by opening the trip coil circuit. The auxiliary switch may also be used to control indicating lamps and interlocking or alarm circuits.

The Type L auxiliary switch instruction bulletin number is listed in the bibliography at the back of this bulletin. Copies of this instruction bulletin will be furnished on request.

CONTROL RELAY

The Type R-14 control relay (19, Fig. 2), furnished only on electrically operated circuit breakers, has the heavy duty contacts required to control the relatively large current drawn by the solenoid closing coil.

The instruction bulletin number for the control relay is listed in the bibliography at the back of this bulletin. Copies of this instruction bulletin will be furnished on request.

RELAY CUT-OFF SWITCH

The relay cut-off switch ("bb" switch) (14, Fig. 4) is a two contact Type L auxiliary switch used to de-energize the pick-up coil of the control relay at the end of the solenoid plunger's closing stroke.

The instruction bulletin number listed for the Type L auxiliary switch in the bibliography at the back of this bulletin also applies to the "bb" switch.

INSTALLATION

The Type LG circuit breakers are adjusted, tested, and inspected before leaving the factory. However, it is possible that unusually rough handling during transit or severe operating conditions after installation may have loosened bolted parts or changed some of the adjustments. Refer to the MAINTENANCE and ADJUSTMENT sections for adjustments and procedures that may be required.

CAUTION: DE-ENERGIZE THE PRIMARY AND CONTROL CIRCUITS BEFORE INSTALLING THE CIRCUIT BREAKER OR ANY RENEWAL PARTS.

LOCATION

Indoor circuit breakers should be installed in a clean, dry place which is free from destructive action of acids, alkalies or gases, and where good ventilation can be secured. Open type circuit breakers should be mounted high enough to prevent injury to the operator during an automatic opening of the breaker, and it should be so located that it will be readily accessible for cleaning and inspection. Ample space must be provided above the circuit breaker to insure proper operation and to prevent damage to other equipment from arc conditions when opening under fault.

MOUNTING

Individually Enclosed

The Type LG circuit breakers that are individually enclosed in a steel housing (Urelite) may be installed in any convenient location. Because of its weight, the Type LG Urelite is designed for floor mounting but it can be wall mounted if adequate structural steel supports are used.

The Type LG Urelite includes a front enclosure which covers the operating mechanism and contact structure of the circuit breaker and a rear enclosure or pull box. The pull box is designed so that cutouts can be made in the sheet steel for the introduction of conduit, buses, or bus ducts.

For some applications, the pull box is omitted. This exposes the rear of the breaker panel, the studs, and all rear switchboard wiring. Under these conditions, the purchaser must make his own arrangement for enclosing the bus work and breaker studs.

Dead Front

Exclusive of Urelite, a dead-front mounting consists of a metal enclosed, dead-front switchboard. In this type of mounting, each circuit breaker is enclosed in an individual compartment having a flat front sheet or formed door for a front cover. The Type LG circuit breaker, in the switchboard compartment, may be stationary mounted, pantograph mounted, or truck mounted.

The instruction bulletin numbers applying to pantograph mounted and truck mounted circuit breakers are listed in the bibliography at the back of this bulletin. Copies of these instructions will be furnished on request.

Live Front

In live front mounting, the insulating base of the circuit breaker is stationary mounted to steel supports without benefit of any type of enclosure or protective cover. However, in some installations, live front circuit breakers are mounted in enclosures or switchboards furnished by the purchaser.

ELECTRICAL CONNECTIONS

Before making any electrical connections, every precaution must be taken to see that all leads which are to be connected to the circuit breaker are de-energized.

All leads must be fastened securely to the terminals and tightly clamped to the connection studs. All joints must be clean, bright, and free from dents and burrs. All nuts on the current-carrying studs must be securely bolted against the terminal connection to obtain good contact. The nuts should turn freely on the studs and not be forced. If the joints are not made correctly, dangerous heating of the circuit breaker may result.

Cables and connections should be supported properly so that the circuit breaker is not subjected to unnecessary strains.

To avoid overheating of the circuit breaker, the connecting leads must have a current-carrying capacity at least equal to that of the current-carrying parts of the circuit breaker which in turn must be adequate for the maximum continuous current of the load.

Shunts for ammeters, resistors, or similar devices which operate at relatively high temperatures must be mounted far enough away from the circuit breaker so that they will not conduct heat to the breaker.

Control Wiring

The control circuit wiring should be in accordance with the diagram accompanying the circuit breaker. A typical connection and schematic diagram for a-c application is shown in Fig. 3. Typical connection diagrams for d-c applications, or for a specific application may be obtained from the I-T-E Circuit Breaker Company.

FINAL INSPECTION

The following inspections and tests should be made after the circuit breaker has been installed and all of its mechanical and electrical connections completed.

1. See that the circuit breaker is properly mounted and leveled on its supporting structure (panels, structural iron or steel, steel frame, etc.).
2. Close the circuit breaker slowly by hand, with the primary and control circuits de-energized, noting whether the contacts are adjusted for correct alignment, and that good contact is made with the breaker closed.
3. Inspect all insulated wiring to see that no damage to the insulation has resulted during the process of installing the circuit breakers.
4. Test the wiring for possible grounds or short circuits.
5. See that all joints, whether bolted joints of copper bars or soldered (or clamped) joints made with wires or cables, are made correctly.

OPERATION

The manual and electrical operations are independent of each other. Therefore, the interruption of control power does not render the circuit breaker inoperable, and the circuit breaker may be kept in service as a manually operated device.

TRIP-FREE OPERATION

The Type LG circuit breakers are mechanically and electrically trip free so that the circuit breaker mechanism may be tripped in any part of the clos-

ing stroke by the operation of the tripping device. As soon as the arcing contacts touch under fault conditions, the trip device will operate the tripping mechanism, releasing the tripping toggle, and allow the opening springs to return the contacts to the fully open position.

Circuit breakers equipped with undervoltage or reverse current trip devices are also trip free under undervoltage or reverse current conditions respectively.

D-C SOLENOIDS FROM A-C SOURCE

The dry plate rectifiers, used for conversion of alternating current to direct current, consist of a series of alternate treated copper and lead washers assembled on an insulated bolt.

It is characteristic of this type rectifier that, for a definite load, the d-c voltage will decrease slightly with age. This aging gradually disappears so that the output finally becomes nearly constant. To compensate for this change, it is customary to include in the circuit an adjustable resistance that may be reduced when necessary.

For higher control voltages, the series resistor provides a means of compensating for aging and reduces the a-c voltage to the rating of the rectifier. On voltages above 220 volts, some resistance must be kept in the circuit to prevent damage to the rectifier.

In case of a failure or excessive heating of any unit of the rectifier, the whole group must be replaced because a new unit may have different characteristics than the unit being replaced and cause unbalanced loading to occur.

Rectifier aging should never cause failure on full control voltage. It will, however, increase the minimum voltage on which the circuit breaker will close. A small adjustment of the resistance should compensate for this condition.

Refer to the schematic diagram Fig. 3 when following the electrical closing procedure described in the following section.

ELECTRICAL CLOSING

To close the Type LG circuit breaker electrically, push the "CLOSE" button. This energizes simultaneously the pick-up coil (PC) and holding coil (HC). The stronger of the two coils, the pick-up coil, attracts the relay armature and closes contacts CR-1, CR-2, and CR-3. (Note: Contact CR-4 is closed when the relay is de-energized and remains closed when the armature is attracted to the pick-up coil magnet). This energizes the solenoid closing coil (CC) and the solenoid plunger moves toward its closed position. At the end of the solenoid plunger's travel, the "bb" switch opens and de-energizes the pick-up coil (PC). The relay armature is then attracted by the magnet of the weaker or holding coil (HC) and opens all the CR contacts. The opening of contacts CR-2 and CR-3 de-energizes the solenoid closing coil (CC) and completes the closing cycle.

If the momentary "CLOSE" contact is held closed or if a control switch having a maintaining contact in the closing circuit is used, the circuit breaker will not attempt to reclose if it failed on the first attempt due to some fault. The reason for this failure to reclose is that the relay armature remains attracted to the magnet of the holding coil since it is still energized, thus preventing the CR contacts from closing. Therefore, a second attempt to close the circuit breaker can not be made until the "CLOSE" button is released or the control switch is turned to the "OFF" position which de-energizes the holding coil and closes the CR-4 contact.

The control relay is now in its normal de-energized position and will not function to close the circuit breaker until the "CLOSE" button is pushed. This non-repeat feature of the control relay prevents cyclic reclosing of the circuit breaker and assures that the momentarily rated pick-up coil receives only intermittent service.

ELECTRICAL TRIPPING

The Type LG circuit breaker can be electrically tripped by pushing the trip button mounted remotely from the breaker. The circuit breaker may also be tripped electrically by any of the following devices.

Shunt Trip Device

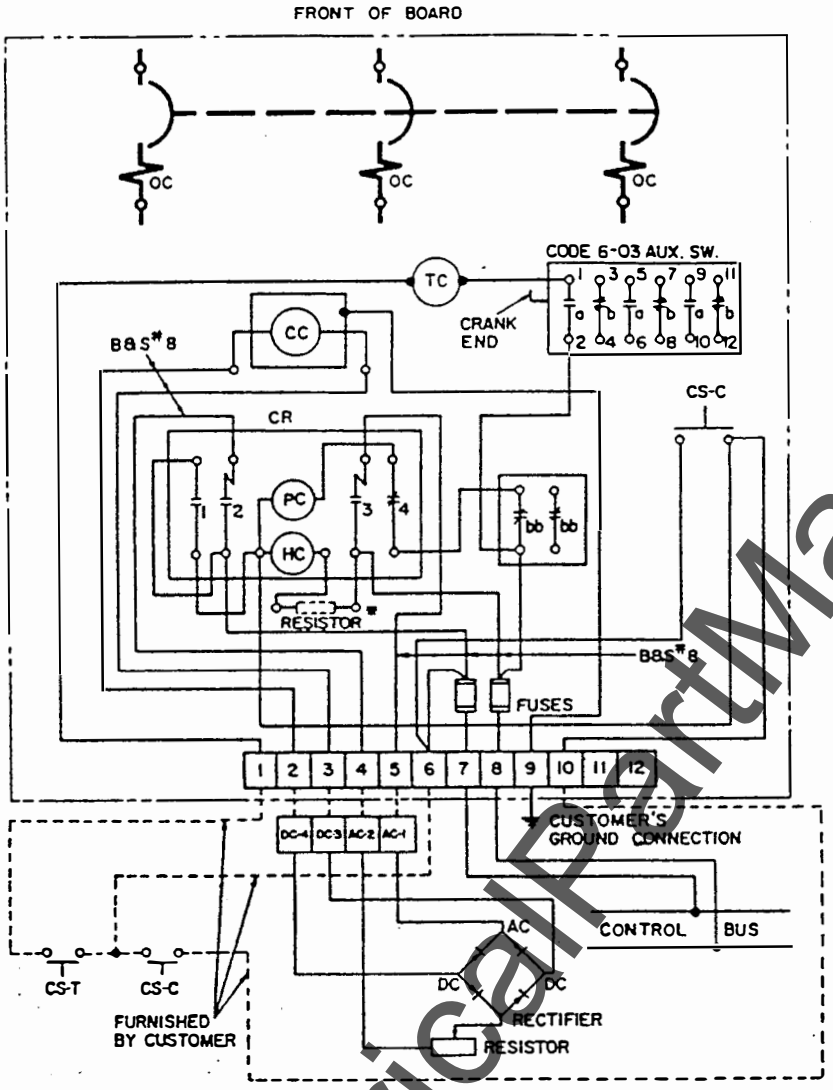
The shunt trip device is used to trip the circuit breaker electrically from a remote control point without regard to the load conditions of the circuit. The shunt trip devices furnished on the Type LG circuit breakers vary with the current rating, and with the type of overcurrent trip device (direct acting, series connected or current transformer trip).

The standard shunt trip device (11, Fig. 4) is furnished on the following:

1. D-C circuit breakers rated 6000 amperes and under.
2. A-C circuit breakers rated 3000 amperes and under having direct acting, series connected adhesion type dual magnetic overcurrent trip devices.
3. A-C circuit breakers rated 4000 amperes and under having either a Type OD-1 or Type OD-2 transformer overcurrent trip assembly.

The heavy duty shunt trip device is mounted on the circuit breaker panel. They are furnished on the following:

1. D-C circuit breakers rated 8000 and 10000 amperes.
2. A-C circuit breakers rated 5000 and 6000 amperes having either a Type OD-1 or Type OD-2 transformer overcurrent trip assembly.



LEGEND

a — Auxiliary switch contact closed when circuit breaker contacts are closed.
b — Auxiliary switch contact closed when circuit breaker contacts are open.
bb — Contact closed when closing solenoid plunger is in non-operated position.
CC — Closing coil (plunger remains in operated position until circuit breaker opens).
CR — Control relay, breaker closing.
CR-1, CR-2, CR-3 — Closing control relay contacts—closed when pick-up coil is energized.
CR-4 — Closing control relay contact — open only when pick-up coil is de-energized and holding coil is energized.
CS-C — Close switch contact.
CS-T — Remote trip switch contact.
HC — Closing control relay holding coil.
OC — Overcurrent trip coil.
PC — Closing control relay pick-up coil.
TC — Trip coil.

NOTES

1—Use B&S #14 stranded rockbestos wire (Spec. 1ESE-P1) except as noted.
2—Adjustable resistor to be used as adjustment for aging of rectifier only.
3—For two-pole breaker omit left-hand pole.
* Resistor when required by 220V. (25 Cyc.) or 380-600V. (25 & 50 Cyc.).

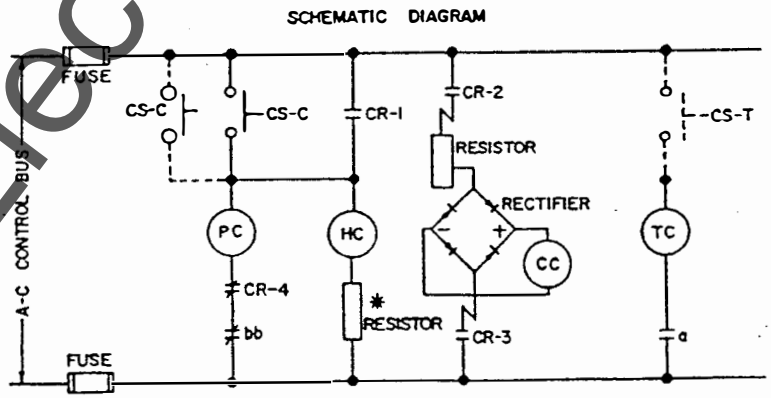


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Fig. 3—Typical Diagram of Connection for Type LG Circuit Breakers

The instruction bulletin number for the above shunt trip devices is listed in the bibliography at the back of this bulletin. Copies of this instruction bulletin will be furnished on request.

Shunt trip devices furnished as a part of a transformer overcurrent trip assembly are mounted to the right of the overcurrent trip devices. This type of shunt trip is furnished on a-c circuit breakers rated 4000 amperes and over having an adhesion type dual magnetic transformer overcurrent trip assembly. For additional information on shunt trip devices which are mounted on the transformer overcurrent trip assembly, refer to the instruction bulletin listed in the bibliography at the back of this bulletin on adhesion type dual magnetic overcurrent trip devices.

DUAL MAGNETIC OVERCURRENT TRIP DEVICE—ADHESION TYPE

The dual magnetic overcurrent trip device (36, Fig. 2) combines an oil film time delay device having inverse time characteristics with an instantaneous trip element. The device provides overload protection with instantaneous short circuit protection. The standard range of overcurrent tripping value is 100 to 200 per cent of the continuous ampere rating of the circuit breaker.

The instruction bulletin number for the dual magnetic overcurrent trip assembly is listed in the bibliography at the back of this bulletin. Copies of this instruction bulletin will be furnished on request.

TRANSFORMER OVERCURRENT TRIP ASSEMBLY

The transformer overcurrent trip assembly is mounted on the solenoid assembly for electrically operated circuit breakers, and panel mounted for manually operated circuit breakers. The overcurrent devices furnished, depending on the circuit breaker application, may be the adhesion type dual magnetic overcurrent trip, Type OD-1 dual overcurrent trip, or Type OD-2 dual selective overcurrent trip. The overcurrent devices are actuated by the secondaries of current transformers which may be mounted either on the load studs at the rear of the breaker panel for stationary mounted circuit breakers or in the primary bus for drawout mounted circuit breakers.

Transformer overcurrent trip assemblies using adhesion type dual magnetic overcurrent trip devices are furnished on a-c circuit breakers rated 4000 amperes and over.

Transformer overcurrent trip assemblies using Type OD-1 dual overcurrent trip devices or Type OD-2 dual selective overcurrent trip devices are furnished on a-c circuit breakers rated 2000 amperes and over.

The instructions for transformer overcurrent trip assemblies with adhesion type dual magnetic overcurrent trip devices are included in the dual magnetic overcurrent trip device (adhesion type) bulletin listed in the bibliography in the back of this bulletin. Instructions for transformer overcurrent trip assemblies with dual magnetic overcurrent trip devices (displacement type) are included in the Type OD-1 and OD-2 overcurrent trip device bulletin listed in the bibliography. Copies of these bulletins will be furnished on request.

Undervoltage Trip Device (A-C and D-C)

The undervoltage trip device is a combination of an undervoltage unit and a spring trip mechanism. The operating coil of this device is responsive to a decrease in voltage below a predetermined value of main circuit voltage. The dropout voltage, which is not adjustable, is approximately 30 to 60 per cent of the circuit voltage.

When it is required that the circuit breaker remain closed for a short interval following a voltage failure, an adhesion type time delay device is added. This device delays the operation of the undervoltage trip device for approximately 3 seconds at no voltage.

The instruction bulletin number for the undervoltage trip device is listed in the bibliography at the back of this bulletin. Copies of this instruction bulletin will be furnished on request.

MANUAL CLOSING

Manually operated dead front circuit breakers having a formed front door or Urelite mounted breakers use a side rotating handle. To close the circuit breaker, rotate the handle to the left with enough force and speed so that the contacts close smartly without having the parts slam against their stops.

Manually operated live front circuit breakers or dead front breakers having a flat front sheet are furnished with a spade handle. To close the circuit breaker, lift the spade handle until the latches engage and then press down until the contacts close.

Electrically operated circuit breakers may be manually closed by placing the maintenance bar in the socket provided in the universal joint support. To close the circuit breaker, press down until the contacts close.

MANUAL TRIPPING

To manually trip the circuit breaker, push trip button (8, Fig. 4).

MAINTENANCE

The safety and successful functioning of the connected apparatus depends upon the proper operation of the circuit breaker. Therefore, it is recommended that a maintenance program be established that will provide for an inspection of the

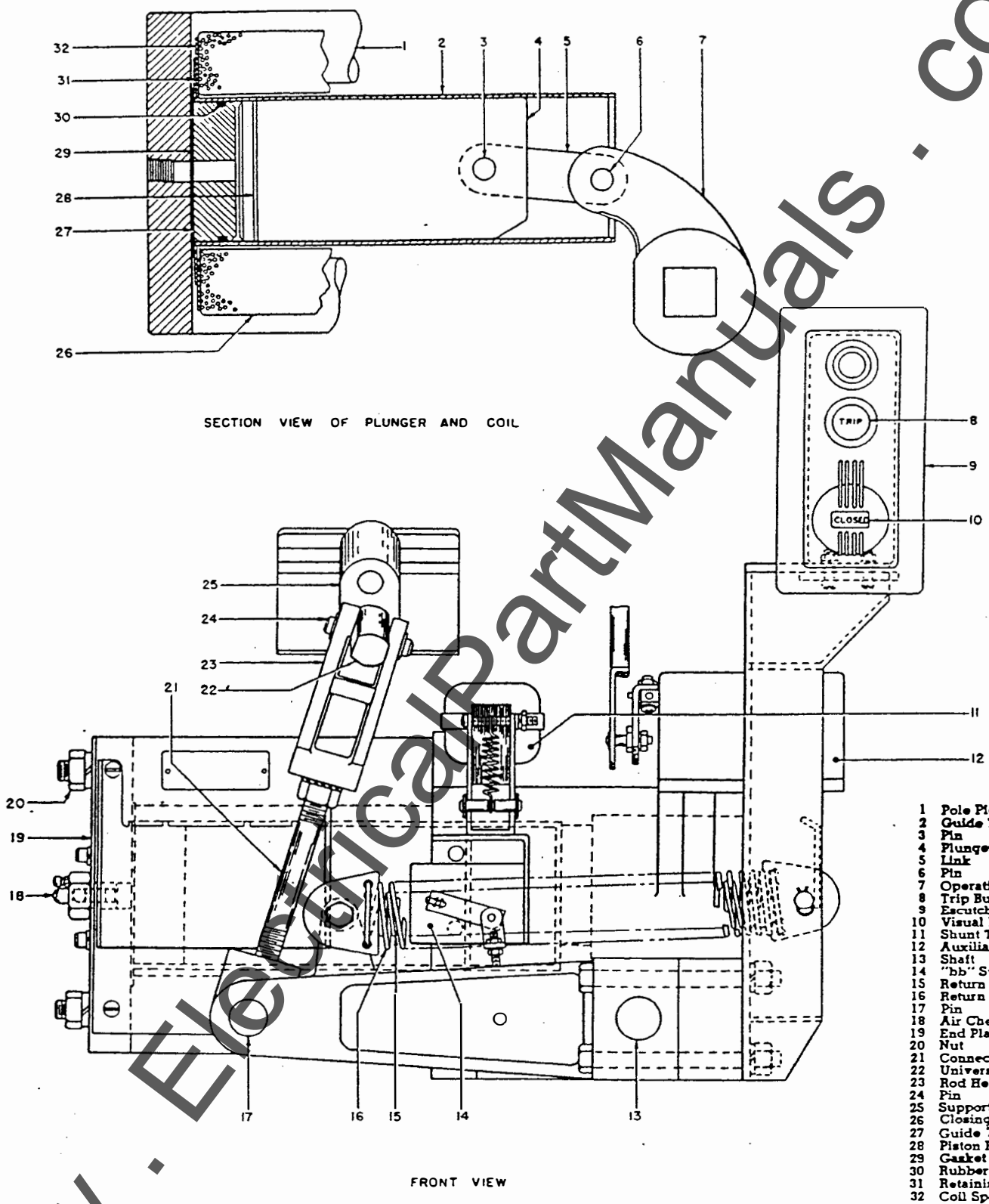

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Fig. 4—Solenoid Assembly for Type LG Circuit Breakers

circuit breaker at least once every six months and immediately after operating to interrupt a fault.

CAUTION: TRIP THE CIRCUIT BREAKER AND DE-ENERGIZE THE PRIMARY AND CONTROL CIRCUITS BEFORE MAKING ANY INSPECTIONS, ADJUSTMENTS, OR REPLACEMENT OF PARTS.

CONTACTS

In general, any dirt or grease on the contacts should be removed by wiping them with a cloth saturated with carbon tetrachloride. Discoloration of the contact surfaces is not harmful. The dark brown tarnish that often appears may be removed with silver polish.

Main Contacts

The main contacts should not show any signs of serious burning. If they do, the arcing and intermediate contacts may be in bad condition, the circuit breaker may be opening at currents beyond its interrupting capacity, or the contacts may be out of adjustment. Check for correct contact adjustment as described under ADJUSTMENTS.

Intermediate Contacts

A slight amount of pitting is to be expected and will not interfere with the operation of the intermediate contacts. Occasionally it may be necessary to remove small burrs with several light wipes of a fine file. Always follow the contour of the contacts and do not attempt to entirely eliminate the pitting. Contact overlap must be maintained, that is, the contacts must open well after and close before the main contacts. Prevent any filings from falling into the mechanism by covering it with a cloth. After filing the contacts, carefully remove the cloth and blow out any dust or particles that may have fallen into the mechanism with low pressure, dry air.

Arcing Contacts

A moderate amount of pitting is to be expected and will not interfere with the operation of the arcing contacts. It is seldom advisable to file or smooth down the arcing contacts. Severely pitted or eroded contacts should be replaced and the contact sequence carefully checked.

COIL REPLACEMENT

Solenoid Closing Coil

On some Type LG circuit breakers, it may be necessary to remove some of the accessories mounted on or adjacent to the solenoid assembly before proceeding to replace the closing coil.

Refer to Fig. 4 and,

1. Disconnect the closing coil leads.
2. Remove three socket head screws in end plate (19).
3. Remove four nuts (20) and remove end plate (19), gasket (29), retaining washer (31), and coil spacer (32). Do not remove plunger tube end (27), guide tube (2), or plunger (4).
4. Remove the solenoid closing coil (26). Take care so as not to damage the guide tube (2).

After removing the closing coil, inspect gasket (29) for damage and replace with a new gasket if necessary. Also, inspect the guide tube (2) and remove any accumulation of dirt or oil.

Replace the closing coil and re-assemble the solenoid using the reverse of the above procedure. It may be necessary to remove the air check valve (18) in order to properly "line up" the holes in the end plate, gasket, and plunger tube end.

After replacing the closing coil and any other accessories that may have been removed, check for short circuits, grounds, and correctness of wiring before operating the circuit breaker electrically.

ADJUSTMENTS

The Type LG circuit breakers are adjusted, inspected, and tested before leaving the factory. However, it is possible that rough handling during transit or abnormal usage may cause a change in some of the adjustments.

The individual tripping devices may be adjusted as described in the respective tripping device bulletins listed in the bibliography at the back of this bulletin.

CONTACTS

The upper and lower contacts of the bridge should bear against the contacts on the terminal blocks so that the contact springs are compressed 3/32 of an inch (maximum) in addition to their initial compression.

To determine the compression of the contact springs, slowly close the circuit breaker until the main contacts just touch. Measure the distance from the bridge arm (6, Fig. 2) to the panel. Complete the closing operation and again measure the distance from the bridge arm to the panel. (This measurement should be taken at a point midway between the upper and lower contacts on the bridge). If the movement is less than the 3/32 inch (maximum) allowed, remove the contact bolts and insert a thin shim at point "A" Fig. 2. Tighten all bolts after making any adjustments.

RENEWAL PARTS

It is recommended that sufficient renewal parts be stocked to facilitate proper maintenance and replacement of parts. The quantity of parts and items carried in stock should be based on the number of circuit breakers in service and previous operating service.

When ordering renewal parts, address the nearest Sales Office of the I-T-E Circuit Breaker Company. Specify the type of circuit breaker, serial number, description of parts, and quantity required.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the I-T-E Circuit Breaker Company.

BIBLIOGRAPHY

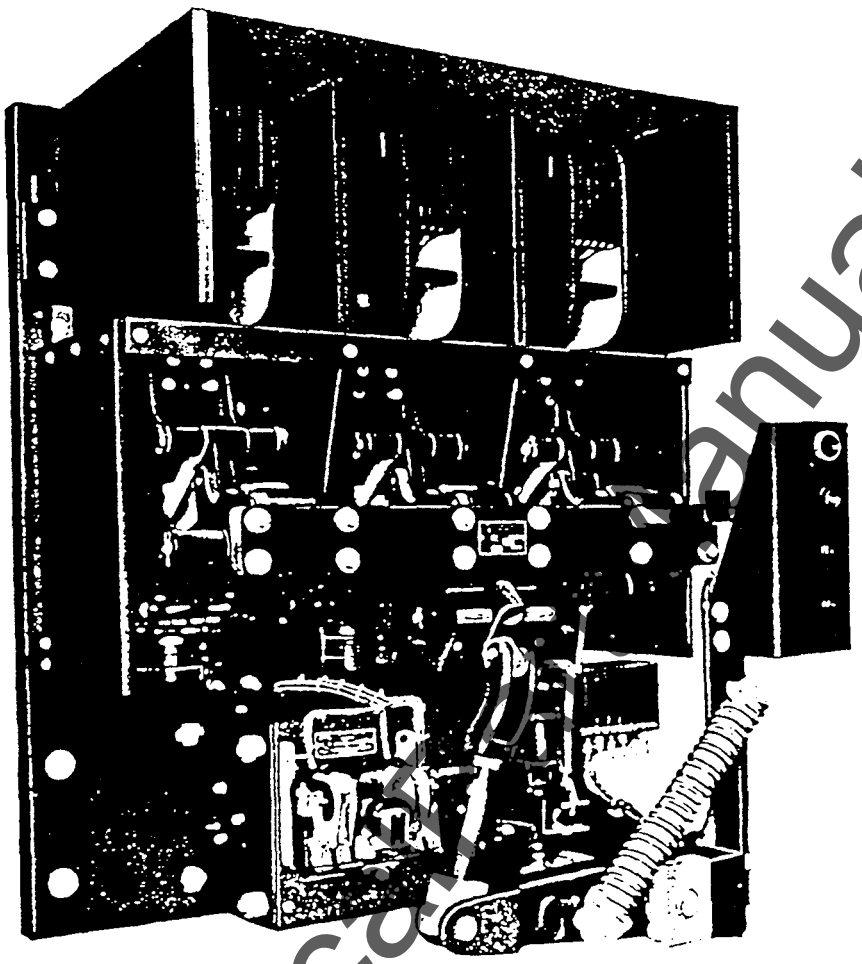
Title	*Bulletin No.*
Dual Magnetic Overcurrent Trip Device—Adhesion Type	IB-5408
Shunt Trip Devices	IB-5405
Type OD-1 and OD-2 Overcurrent Trip Devices	IB-1003-OD1 & OD2
Type L Auxiliary Switch	IB-1003-AUX
Type R-14 Control Relay	IB-5412
Undervoltage Trip Devices	IB-5406
Type LG Pantograph Mounted Circuit Breaker	IB-6000-L
Type LG Truck Mounted Circuit Breakers	IB-6000-LT
Key Interlocks on Type LG Pantograph Mounted Circuit Breakers	IB-6000-IL

The above listed instruction bulletins can be obtained by requesting copies from the nearest Sales Office of the I-T-E Circuit Breaker Company.

INSTRUCTIONS FOR TYPE LG CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY
Printed in U. S. A.—2M154

Supersedes IB-1100-L



TYPE LG 2000 3000 AMPERE CIRCUIT BREAKER FOR DRAWOUT MOUNTING, SHOWING ARRANGEMENT OF STANDARD DEVICES

12251-R

INTRODUCTION

The recipient of this instruction bulletin should carefully read and follow its contents as to the operation and maintenance of the type LG circuit breakers. It is suggested that this bulletin be filed in a convenient place to keep all the information relative to the circuit breakers. By carefully following these instructions, the life and usefulness of the equipment will be prolonged.

The type LG circuit breaker was designed for heavy duty service in which the number of operations are relatively few and where high interrupting ability is needed without great operating speed. The type LG is most apt to be used as a main breaker, as a bus tie or exceptionally large feeder breaker. In such service the breaker must carry full load continuously for long periods of time with low temperature rise.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the I-T-E Circuit Breaker Company.

INSTRUCTIONS FOR OPERATION AND MAINTENANCE OF TYPE LG CIRCUIT BREAKERS

GENERAL CONSTRUCTION

Basically each pole consists of a main current carrying solid bridge, protected by secondary and arcing contacts. The bridge is removable and replaceable. The complete pole, mounted in an individual frame or housing, is operated through a double toggle system from either a manual operating handle or solenoid. The frame or housing encloses a direct-acting series trip device which can be adjusted easily and accurately.

Multi-pole circuit breakers, in which Fig. 1 shows a section view, have the closing arms of all poles rigidly tied together by a horizontal insulated bar so that the poles move in unison. The tripping movement of any pole is communicated from the overcurrent trip coils to the latch mechanism through a horizontal insulated bar. A single latch with trip-free mechanism is mounted in the pole unit which carries the operating arm or handle. A buffer is mounted in the upper part of the operating arm to absorb the momentum of the mechanism at the end of the opening movement. This device combines friction with spring action and provides shock absorbing effect in direct proportion to the speed of opening. The buffer completely eliminates the possibility of bouncing and reestablishing the arc.

The solenoid assembly is mounted on the lower portion of the circuit breaker panel. This assembly consists of a horizontal solenoid unit and several auxiliary devices. A shunt trip device for electrical remote tripping of the circuit breaker operates through an auxiliary switch. A control relay energizes the solenoid closing coil, and a "b b" switch operates the control relay.

SAFETY PRECAUTIONS

Before making any adjustments or replacements, make certain that all control circuits have been *de-energized*. If circuit breaker is drawout type mounted in a switchboard, withdraw breaker completely or to test position. If breaker is rigidly mounted, *de-energize* bus and disconnect cables from leads if there is a power source on the load side. Avoid injury that may be caused by unexpected operation. The heavy mechanical members operated by strong springs are restrained by sensitive latches.

MAIN CONTACTS

The main contacts, Fig. 1, consist of solid copper bars to which silver alloy inserts are brazed. Two bars, together with their associate springs and travel limiting pins are assembled in a bracket to form a complete contact unit. One or more contact units may be attached to each bridge arm and are brought in contact with the upper and lower terminals by a force multiplying system of toggles.

Adjustments. During the final closing of the breaker, the main contacts should bear against the terminal blocks so that the contact springs are compressed 3/32 of an inch in addition to their initial compression.

To determine the compression of the contact springs, slowly close the breaker until the main contacts touch then measure the distance from the bridge arm to the panel. Complete the closing operation and check the measurement of the bridge arm away from the panel. (This measurement should be taken at a point midway between the upper and lower contact blocks.) If the contact pressure is light, remove the contact unit bolts and insert a thin shim at point "a," Fig. 1. Tighten all bolts after making any adjustments.

Maintenance. The main contacts should not show any serious burning. If they do, the arcing and secondary contacts are probably in bad condition or the circuit breaker is opening at current beyond its interrupting capacity. A very slight burning or "pitting" does no harm. It is caused by the current path through the main contacts having a lower resistance than that through the secondary or arcing contacts.

The dark brown tarnish that often appears is silver sulphide, caused by coal smoke or gas in the air. Silver polish may be used if the surface is very dirty. We do not recommend the use of file or sandpaper on these contacts.

Overheating. The standards for circuit breakers permit a temperature rise at the terminals of 30°C. above an ambient or room temperature of 40°C. An additional 15°C. is permitted in enclosed switchgear.

On the Fahrenheit scale, a temperature rise of 54°F. above an ambient or room temperature of 104°F. is permitted.

Overheating is often caused by a loose connection between the circuit breaker and the bus, or a loose bolted or soldered joint at a cable terminal.

It is important not to let loose joints feed heat into a breaker. One way to detect a possible source of overheating is to take the millivolt drop between the contacts. Pointed terminals carrying a low voltage direct current are applied on each side of the contacts and the drop in thousands of a volt is read on a millivoltmeter. This drop should not more than ten millivolts.

SECONDARY CONTACTS

The secondary contacts (Fig. 1) in type LG circuit breakers provide a secondary path for the current and are of a blow-on construction. Secondary contacts should always open after the main contacts, but before the arcing contacts.

Maintenance. Slight burning of the secondary contacts is not harmful. Any slight burns may be removed by careful use of a fine file. When fine-filing secondary contacts, their overlap must be maintained, that is, they must still open well after and close before the main contacts. If not, their usefulness is lost. Be careful not to let any filings get into the bearings or other parts of the breaker. Place a piece of cloth under the contacts and catch the filings in this cloth. If possible, blow out the breaker with dry air from an air hose after the work is done.

If the secondary contacts are badly burned away, the contacts should be replaced, and the sequence of contact to "make" and "break" carefully checked.

ARCING CONTACTS

The arcing contacts (Fig. 1) are also of blow-on construction and have a wiping action. Arcing contacts should always open last and close first when the breaker is opened or closed. If the arcing contacts make after the secondary contacts, excessive burning of the main and secondary may result. In addition to opening last, the arcing contacts on all poles of the breaker should open about the same instant.

Maintenance. It is seldom advisable to file or otherwise smooth down arcing contacts. A moderate amount of burning is to be expected, and does not interfere with proper performance. Badly burned arcing contacts should be replaced and sequence of contacts carefully checked.

ARC CHUTES

The arc chute (Fig. 1) used on type LG circuit breakers is an efficient form of the magnetic blow-out structure. In this structure, magnetic vanes, mounted outside insulating barriers on each side of the contacts, are magnetized upon opening of the arcing contacts, and the field set up by the current forces the arc into an extinguishing chamber. Thick plates in the chamber cool the arc and create a turbulent gas condition which forces a cooling draft across the arc core. Arcing time is shortened; the arc is confined; pressure of gases created by the arc is reduced, and heavy currents are safely handled in small space.

On steel enclosed breakers, a hooded barrier assembly covers the entire top and sides of the arc chute assembly.

It will be necessary to remove arc chutes to reach the arcing contacts. Before putting back the arc chutes, inspect them for any loose, broken or burned parts. Liners and side plates burn away in severe service, particularly on d-c circuits, and may need replacing. When the arc chutes are installed, be sure that they are firmly attached to the circuit breaker panel by their attaching studs.

OPERATING MECHANISM

The operating mechanism (Fig. 1) of the breaker is a system of links forming two toggles in series to provide a high contact pressure with relatively small operating force. The bridge arm is pivoted near the panel in the housing and carries a short toggle link which is also connected through a pair of horizontal links to the upper part of the housing.

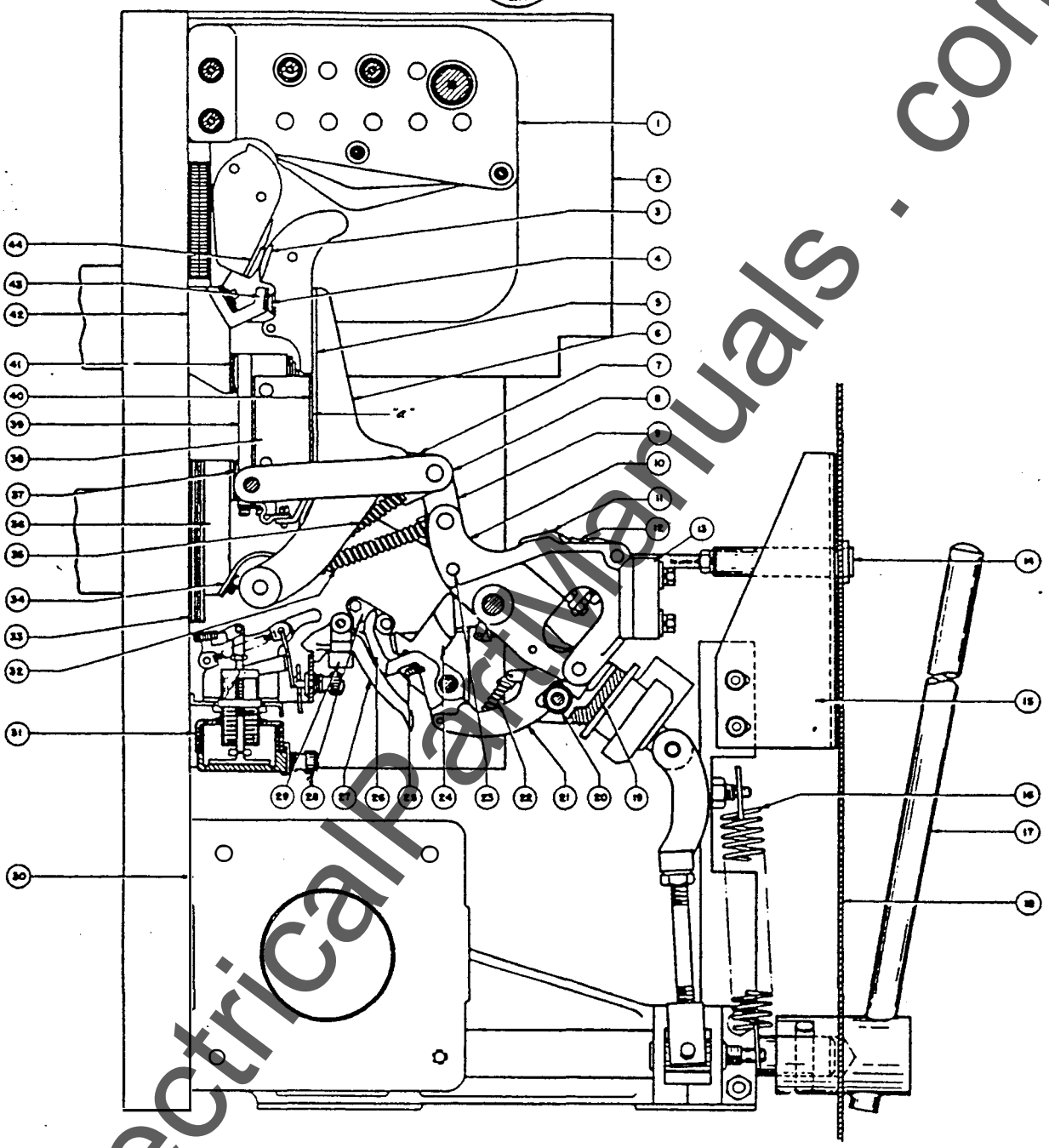
A second system of toggles is made up of a second short link pivoted on the pin common to the two other links and the inner end of the operating arm. Both systems of toggles approach center when the breaker is closed. Springs, from the operating arm toggle pin to the bridge arm pivot pin, assist the spring of the contacts in opening the breaker quickly.

A single latch mechanism may be used for all poles. A tripper bar is provided to transmit the movement of any protective device to the main latch to trip the breaker.

Trip Free Construction. The breaker operating arm and the throw-in arm are connected by a compound latch which may be released by any tripping device at any time during closing (that the contacts are touching).

A roller on the throw-in arm is engaged by the main latch pivoted on the operating arm. The angle of the latch surface forces it away from the roller. This action is normally prevented by the auxiliary latch pivoted to the main latch, which engages a latch plate secured to lugs on the throw-in arm.

This plate must be so positioned that, when the throat of the main latch is against the roller, there is approximately 0.020 inch between the surface of the auxiliary latch and plate. The springs assist in engaging the latches, and stops are provided for limiting their movement. The circuit breaker is normally held in the closed position by the hook trigger, pivoted on the throw-in arm. The hook trigger engages a latch plate which is bolted to the right hand housing. This hook is released during the opening of the breaker, when the kick-off stud on the operating arm strikes the cam surface of the trigger.



INDEX	DESCRIPTION
1	ARC CHUTE
2	BARRIER
3	ARCING CONTACT (Moving)
4	SECONDARY CONTACT (Moving)
5	BRIDGE CONDUCTING STRIP
6	BRIDGE ARM
7	BRIDGE ARM TOGGLE LINK
8	OPERATING LINK
9	OPERATING ARM TOGGLE LINK
10	OPERATING ARM
11	BUFFER SHOE
12	BUFFER SLIDE
13	CONNECTOR BAR
14	MANUAL TRIP BUTTON
15	TRIP BUTTON & CLOSE SWITCH BRACKET
16	CLOSING ARM RETURN SPRING
17	MANUAL CLOSING SHAFT
18	DEAD FRONT SHEET
19	THROW-IN ARM
20	MAIN LATCH ROLLER
21	MAIN LATCH
22	MAIN LATCH SPRING

INDEX	DESCRIPTION
23	KICK-OFF STUD
24	HOOK TRIGGER
25	AUXILIARY LATCH PLATE
26	AUXILIARY LATCH
27	TRIGGER TRIPPER
28	HOOK TRIGGER LATCH PLATE
29	TRIPPER BAR
30	COIL POT SUPPORT
31	DUAL MAGNETIC OVERCURRENT TRIP
32	OPERATING SPRING (Center)
33	MAGNET
34	BRIDGE CONDUCTING TAIL
35	OPERATING SPRING (Outside)
36	LOWER TERMINAL
37	LOWER BRIDGE CONTACT
38	BRIDGE CONTACT BRACKET
39	BRIDGE
40	BRIDGE SHIM
41	UPPER BRIDGE CONTACT
42	UPPER TERMINAL
43	SECONDARY CONTACT (Stationary)
44	ARCING CONTACT (Stationary)

Fig. 1--TYPE LG CIRCUIT BREAKER
Side Section View

The latch tripper is pivoted to the housing, and carries the tripper bar which extends between the breaker poles and is actuated by the tripping devices. The operation of any protective device therefore moves the tripper bar. Movement of the tripper therefore will disengage the latch during closing or when closed.

The tripping action is therefore as follows: (A) the tripper bar moves the tripper against the auxiliary latch and disengages it from the latch plate, (B) this causes the main latch to slip off the roller and the breaker opens, (C) the stud on the operating arm releases the hook trigger and allows the throw-in arm to be lifted to re-engage the latches.

MANUAL CLOSING

Side Rotating Handle. Grasp the handle, then rotate left with enough force and speed so that the contacts close smartly without having the parts slam against their stops.

Maintenance Bar or Spade Handle. Lift the bar or handle until the latches engage, then press down until contacts close.

MANUAL TRIPPING

To manually trip the circuit breaker, push the trip button below the "close" button as shown in Fig. 2.

ELECTRICAL CLOSING

The direct current solenoid assembly as shown in Fig. 2 is located and mounted directly to the lower area of the circuit breaker panel. Such devices as a control relay, shunt trip, auxiliary switch, and a "bb" switch are attached to the solenoid housing and its support. The electrical connections for these devices can be found in Fig. 3.

The complete solenoid has been assembled so as to provide a direct electrical closing by mechanical linkage to the circuit breaker.

To Close Electrically, push the "close" button as shown in Fig. 2. Upon depressing this button switch, the "b b" switch opens, breaking the pick-up coil circuit of the control relay, which in turn energizes the solenoid operating coil.

To Trip Electrically, the shunt trip as shown in Figs. 2 and 4 provide a direct electrical means of tripping the breaker from some remote tripping point. Further description of this device can be found in section headed SHUNT TRIP.

Coil Replacement. Refer to SAFETY PRECAUTIONS before attempting any replacement operation. Disconnect coil leads from binding posts. Remove end plate with plunger tube plug by removing four nuts from pole piece studs. Remove gasket, leaving tube and plunger in place. Allow six inches from end plate for removal clearance of coil. Care must be taken when removing coil to prevent damage to guide tube.

After removing the coil, inspect the guide tube, removing any accumulation of dirt or oil. Lubricate plunger with a light oil and wipe clean. Grease all pins, replace coil, attach coil leads, washer and gasket. Align guide tube plug with tube. Replace end plate, and four nuts with their lockwashers, and tighten securely.

After replacing coil, check the wiring for shorts, grounds or wrong connections before operating electrically. Refer to diagram of connections, Fig. 3.

OPERATION OF DC SOLENOIDS FROM AC SOURCE

The dry plate rectifiers used for conversion of alternating current to direct current consist of a series of alternate treated copper and lead washers assembled on an insulated bolt.

It is characteristic of this type of rectifier that, for a definite load, the d-c voltage will decrease slightly with age. This aging gradually disappears so that the output finally becomes nearly constant. To compensate for this change it is customary to include in the circuit an adjustable resistance that may be reduced when necessary.

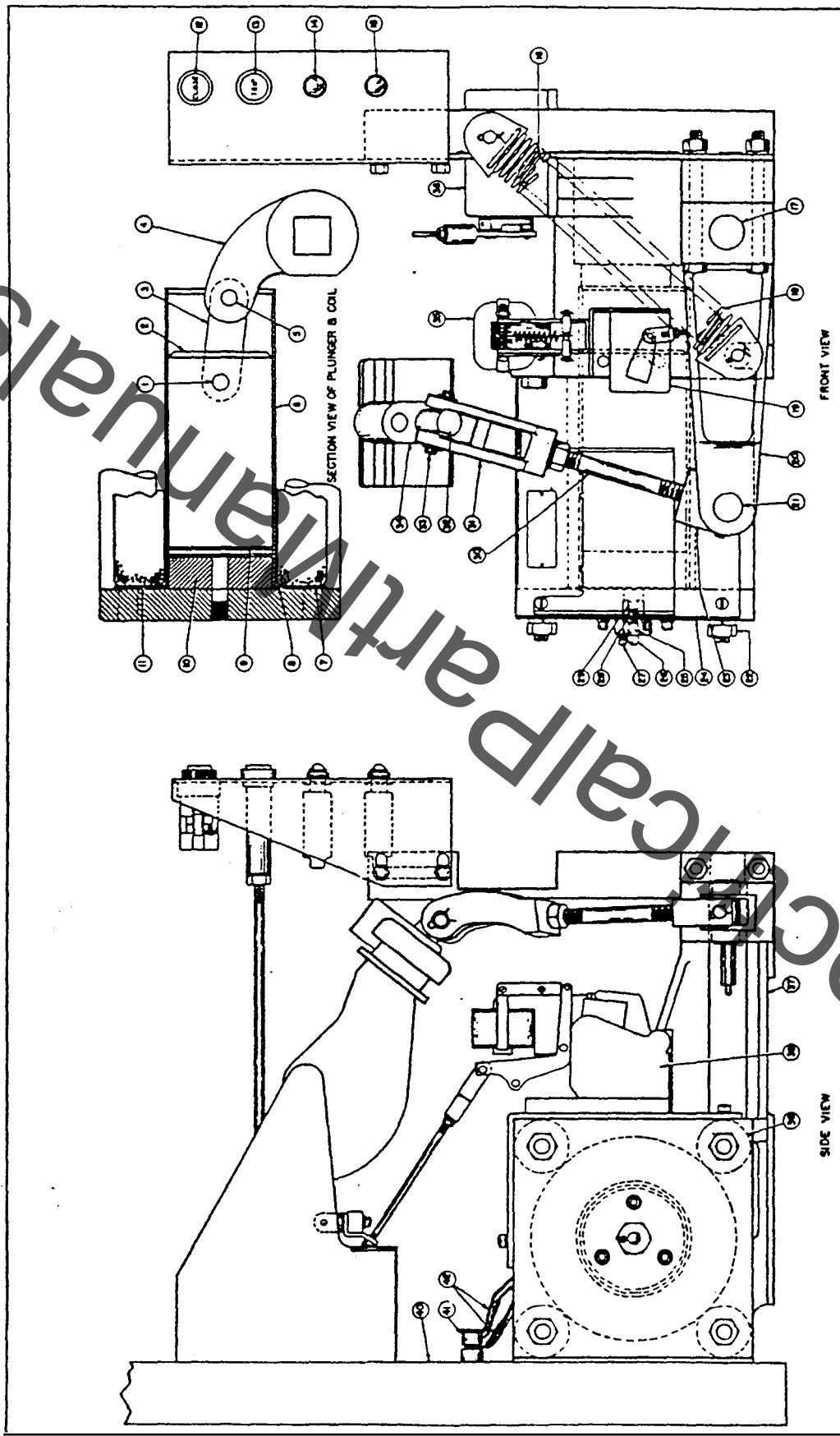
For higher control voltages, the series resistor provides a means of compensating for aging and reduces the a-c voltage to the rating of the rectifier. On voltages above 220 volts some resistance must be kept in the circuit to prevent damage to the rectifier.

In case of a failure or excessive heating of any unit of the rectifier, the whole group must be replaced, because a new unit and an old unit have different characteristics and an unbalanced loading will occur.

Rectifier aging should never cause failure on full control voltage. It will, however, increase the minimum voltage on which the circuit breaker will close. A small adjustment of the resistance should compensate for this condition.

CONTROL RELAY

The non-repeat control relay as shown in Fig. 2 has heavy duty contacts which are generally required to control the relatively large circuit drawn by the closing coil. Standard control switch contacts are not designed to handle the currents required for closing.



INDEX	DESCRIPTION
1	PIN
2	PLUNGER
3	LINK
4	OPERATING LEVER
5	PIN
6	PLUNGER GUIDE TUBE
7	SOLENOID OPERATING COIL
8	GASKET
9	PISTON RING
10	PLUNGER TUBE END
11	COIL WASHER
12	CLOSE BUTTON
13	TRIP BUTTON
14	INDICATING LAMP (Red)
15	INDICATING LAMP (Green)
16	CLOSING ARM RETURN SPRING (Inner)
17	SHAFT
18	CLOSING ARM RETURN SPRING (Outer)
19	SWITCH (bb)
20	CLOSING ARM
21	PIN
22	POLE PIECE STUD NUT
23	ROD HEAD (Lower)
24	END PLATE
25	AIR CHECK BALL
26	AIR CHECK VALVE
27	ADJUSTING SCREW
28	AIR CHECK VALVE SPRING
29	BUSHING
30	CONNECTOR ROD
31	ROD HEAD (Upper)
32	UNIVERSAL JOINT
33	PIN
34	UNIVERSAL JOINT SUPPORT
35	SHUNT TRIP UNIT
36	AUXILIARY SWITCH
37	CYLINDER SUPPORT
38	R-14 CONTROL RELAY
39	POLE PIECE
40	PANEL
41	BINDING POST
42	COIL LEADS

Fig. 2—SOLENOID FOR TYPE LG CIRCUIT BREAKER

Dwg. S-11

Inasmuch as this circuit breaker is electrically trip free, the breaker contacts may be tripped to full open position at any point in the closing stroke of the solenoid. As long as the solenoid coil remains energized, the solenoid plunger will continue its motion to fully operated position regardless of whether circuit breaker contacts have been tripped open or not.

Further information for this control relay can be found in Bulletin 46813 on request.

SHUNT TRIP

The shunt trip device shown in Fig. 4 is used to trip the circuit breaker electrically from a remote control point without regard to the load conditions of the circuit.

A U-shaped magnet is energized by a coil of fine wire. An armature is pivoted on one of the magnet poles, and is attracted to the other pole to trip the circuit breaker latch. A spring normally holds the armature against a stop, providing a fixed air gap from the magnet. During its final movement, the armature moves a trip link which disengages the latch.

An insulated auxiliary switch is in series with the shunt trip coil. This switch is closed when the circuit breaker is closed and breaks the circuit when the breaker opens. The circuit may be energized for any source of suitable voltage. A normally open push button is connected in series with the coil for remote tripping.

Coil Replacement. Refer to SAFETY PRECAUTIONS before attempting any replacement operation. The coil may be removed by withdrawing the armature pin and taking out the armature. An insulating coil retainer and washer hold the coil in position.

DUAL MAGNETIC OVERCURRENT TRIP

The dual overcurrent trip device shown in Fig. 5 is a combination of the instantaneous and time delay overcurrent trip features, providing moderate overload protection with instantaneous short circuit protection.

The device is mounted on the circuit breaker panel directly beneath the pole to whose current it responds. Since all poles are rigidly connected for opening and closing, response of the tripping device on one pole affects the action of all poles.

On continuous overloads, an armature fastened to a pivoted arm is attracted to a magnet. After a predetermined time delay, adhesive disc separates from the adhesive surface of cup, allowing the armature, to which the disc connected by plunger post, to move upward and trip the circuit breaker. The standard range of overcurrent tripping value is from 100 percent to 200 percent of the continuous ampere rating of the circuit breaker.

Calibration Adjustments. The air gap between armature and magnet is a maintained gap set at the factory. The range in calibration is obtained by varying the pull of springs when knob slides in slot of plate. To adjust the overcurrent trip value, loosen knob and slide to right or left until pointer is opposite desired current setting on calibration plate and tighten knob.

If the circuit breaker trips under starting loads, an increase in time delay setting is preferable to an increase in overcurrent setting. Time delay setting is governed by the amount of surface area in contact between the adhesive disc and bottom of cup.

The lowest setting that will permit the circuit breaker to remain closed under normal conditions should be used. Zero gives instantaneous tripping and 3 indicates maximum time delay.

An instantaneous trip spring is compressed to allow armature to trip the circuit breaker without the delaying action of the adhesive discs. At current approximately 12 times circuit breaker current rating a-c and 8 times d-c, spring is compressed by pull of armature. The armature may then move upward to trip the circuit breaker. Adjustment for instantaneous trip is made at the factory and should not be changed.

TRANSFORMER OVERCURRENT TRIP

The transformer overcurrent trip device shown in Fig. 6 may be either instantaneous, or dual trip types. This device is standard on a-c breakers above 3000 ampere capacity and is actuated by the secondaries of current transformers usually installed on the load side rear of the circuit breaker. These devices are used for direct tripping of circuit breaker where relatively small power is required, or where a spring trip is used to disengage the circuit breaker latch. An adjustment is provided for changing the armature air gap so that the tripping currents may be varied over a 100 to 200 percent range. The armature is provided with an adjustable device for delaying the tripping action on momentary overcurrents.

The Dual Overcurrent Trip as shown in Fig. 6 (b) consists of a horizontal magnet core extending from its panel and is surrounded by a coil which is connected to a current transformer located back of the breaker panel.

At each end of the magnet core, pole pieces extending downward to two armatures, one straddling the other. Springs lift the inside armature at its pivot to prevent vibration on a-c currents. The outer end of the armature is adjustably supported and a calibration plate is marked in tripping currents.

The outside armature will trip the breaker instantaneously on approximately 12 times the full load current or on short-circuit. This armature pivots about its own pin and is independent of the time delay device.

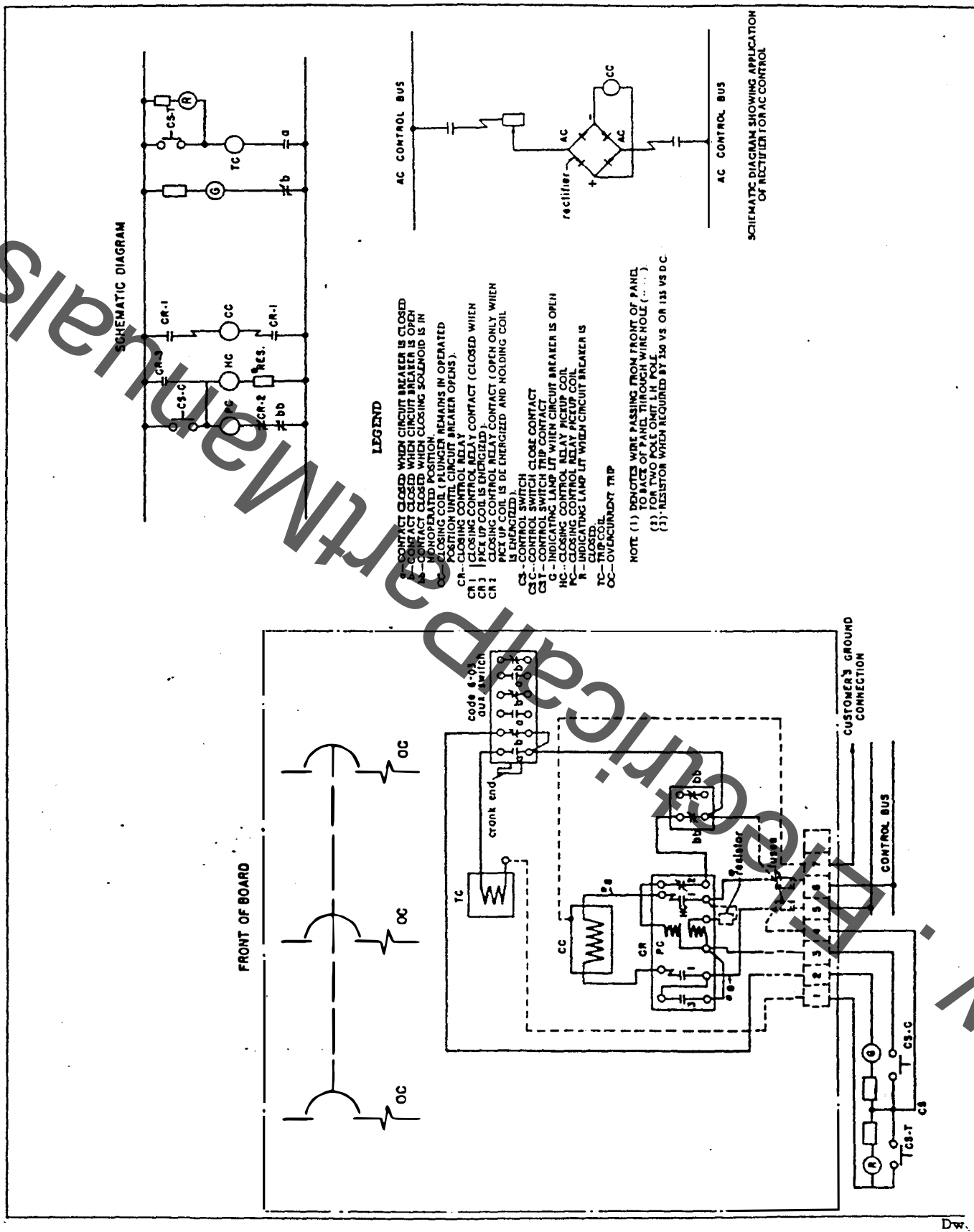
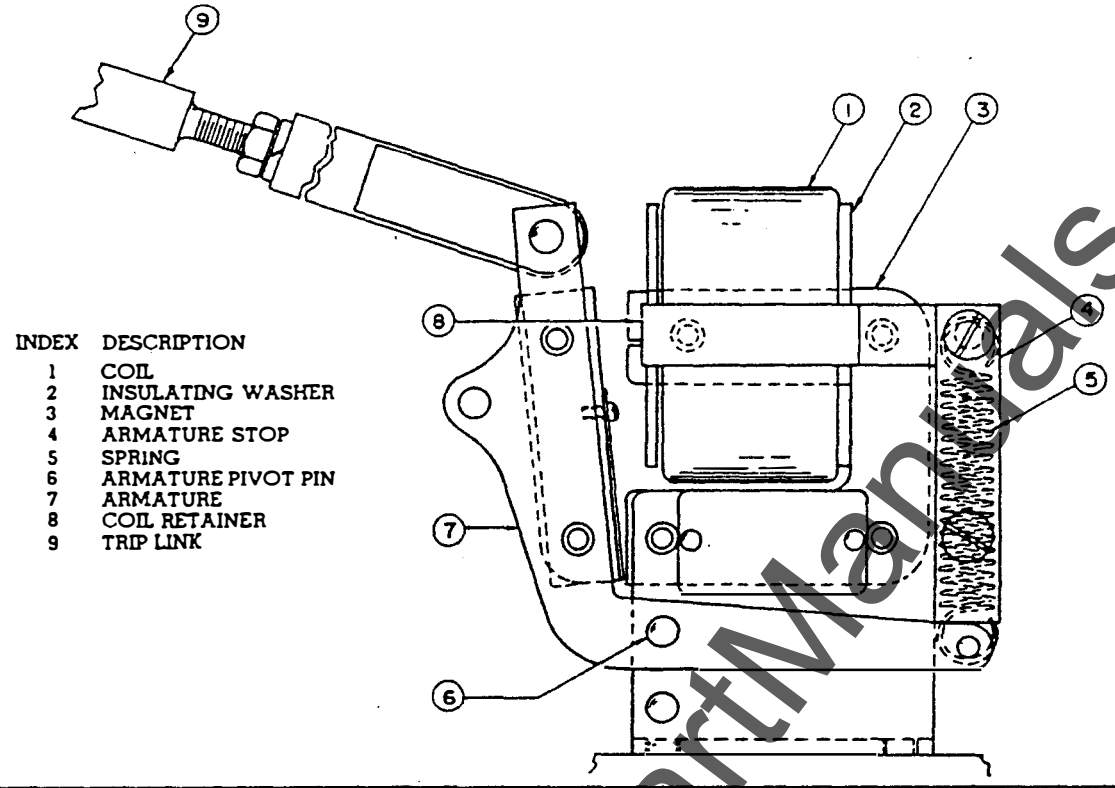


Fig. 3—DIAGRAM OF CONNECTIONS FOR TYPE LG SOLENOID OPERATED CIRCUIT BREAKERS



INDEX	DESCRIPTION
1	COIL
2	INSULATING WASHER
3	MAGNET
4	ARMATURE STOP
5	SPRING
6	ARMATURE PIVOT PIN
7	ARMATURE
8	COIL RETAINER
9	TRIP LINK

Fig. 4—SHUNT TRIP FOR TYPE LG CIRCUIT BREAKERS

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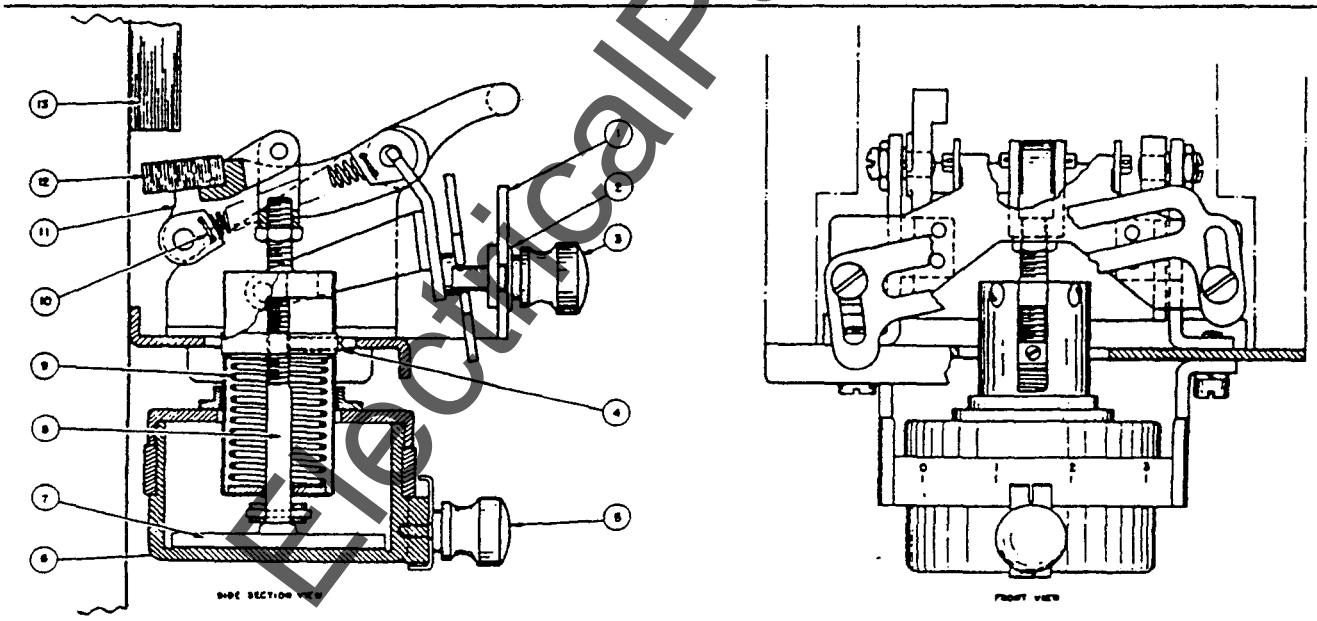

INDEX	DESCRIPTION
1	CALIBRATION PLATE
2	CALIBRATION POINTER
3	CALIBRATION KNOB (Overt. Setting)
4	SET SCREW
5	CALIBRATION KNOB (Time Delay Setting)
6	TIME DELAY OIL CUP
7	ADHESIVE DISC

INDEX	DESCRIPTION
8	PLUNGER POST
9	INSTANTANEOUS SPRING
10	ARMATURE SPRING
11	ARMATURE ARM
12	ARMATURE
13	MAGNET

Dwg. S-11416

Fig. 5—DUAL MAGNETIC OVERCURRENT TRIP FOR TYPE LG CIRCUIT BREAKERS

The inside armature pivots about its pin and is connected by linkage to the upper adhesive disc in the oil cup. The armature is restrained by the action of the time delay device, and therefore the breaker remains closed during the starting period of an overload. If the overload continues beyond a safe point, the oil film will rupture, allowing the inside armature to strike a pin, and trip the breaker. Note the time delay setting is calibrated at the factory and is not adjustable in the field.

A vertical pin common to both armatures slides in a slot in the outer pole piece transmits the final armature movement to the auxiliary tripper. The auxiliary tripper bar, rotating clockwise (viewed from the right) releases a latch which being under spring tension forces a connecting stud downward to cause a rotation of the tripper bar.

The latch tripping mechanism is reset by spring linkage from the operating arm of the circuit breaker upon closing.

Latch Trip Adjustments. With the circuit breaker closed, adjust screw (3) Fig. 6 (a) so that the breaker just trips, then back out screw 1¼ turns.

Adjust stop screw (4) so that there is approximately 1/32 latch clearance at point "a". Adjust nut (5) so that when the circuit breaker is eased open there will be 1/16 inch clearance at point "b".

With the breaker closed, trip latch lever (2) allowing it to stop against stop screw (4). Ad trip rod (1), so that breaker just trips, then take one turn more and lock.

Set trip screw (7) Fig. 6 (b) so that breaker will trip with 0.015 inch feeler and not trip with 0.025 inch feeler at point "c" for instantaneous armature overtravel. After making instantaneous trip adjustments check tripping travel of push pin for time delay.

Operating spring (6) Fig. 6 (a) must be used as supplied and should not be altered.

Maintenance-Time Delay. The oil cups should be removed every six months and the cup and suction disc cleaned with carbon tetrachloride. Replace the cups and refill them with fresh oil. They should be filled until the suction disc is just covered or ½ ounce is specified. Too little oil will result in the device having no time delay action. Too much oil will cause erratic time delay and oil will be thrown out through the plunger opening in the cover.

If possible, always use oil furnished or recommended by the manufacturer. When fresh oil is needed, send breaker name plate data with order to factory.

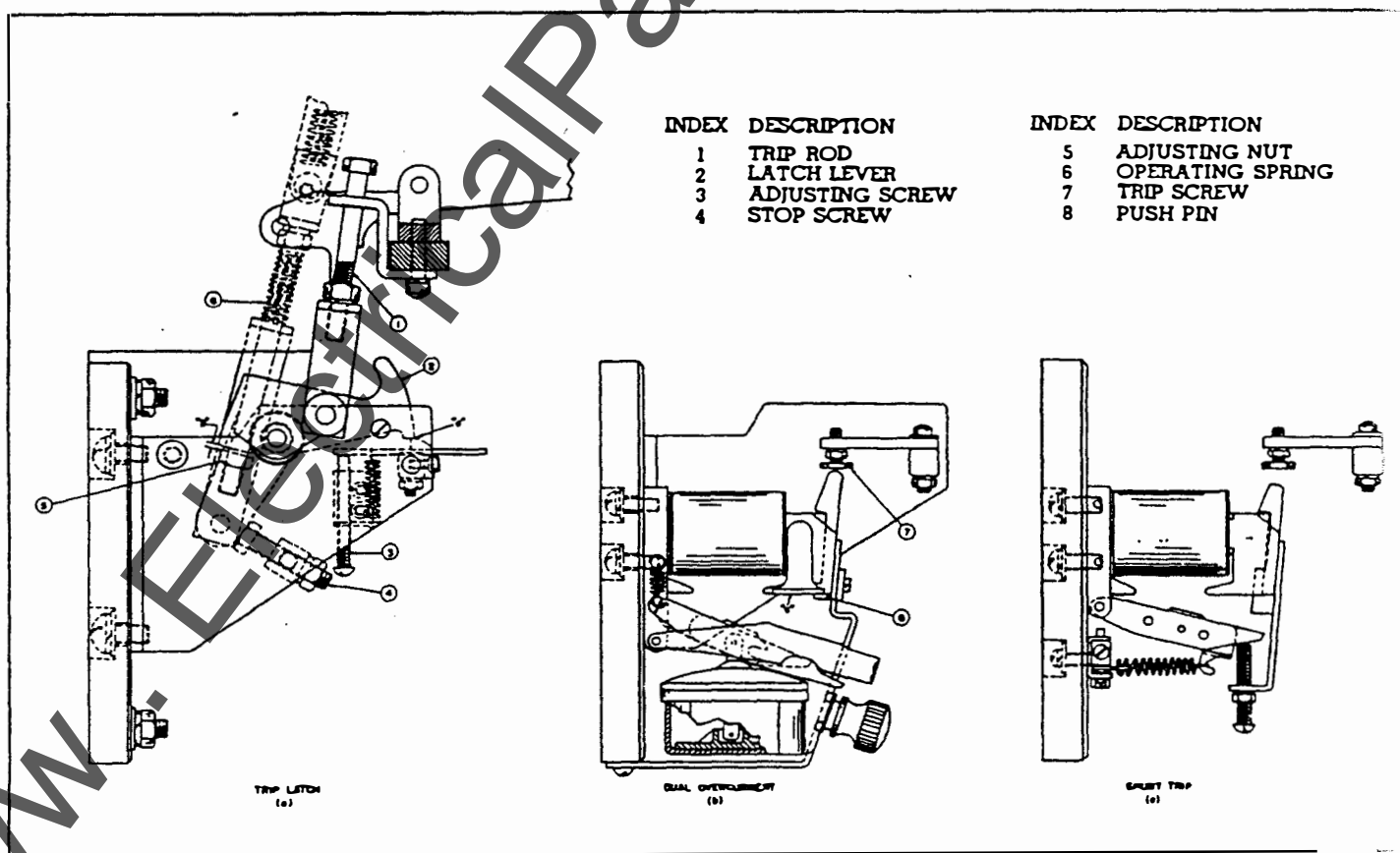

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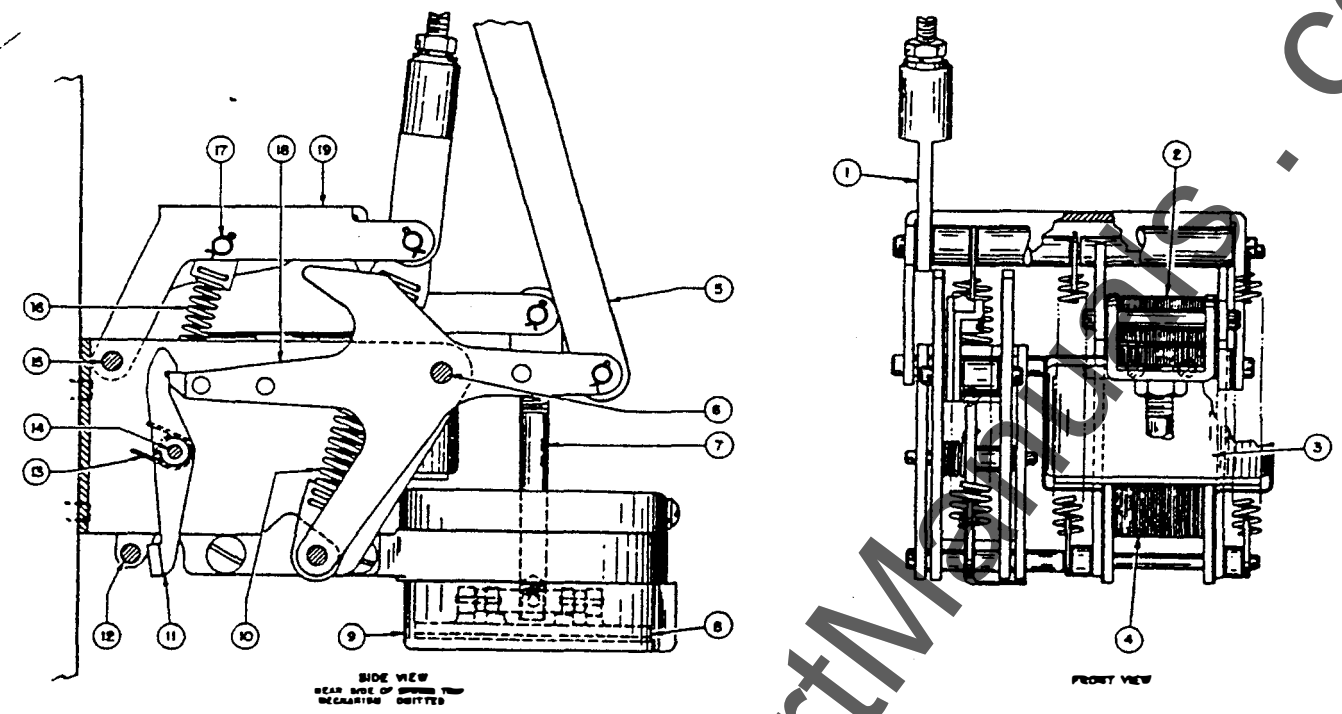
Fig. 6—TRANSFORMER OVERCURRENT TRIP FOR TYPE LG CIRCUIT BREAKERS



INDEX	DESCRIPTION	INDEX	DESCRIPTION	INDEX	DESCRIPTION
1	OPERATING LINK	8	TIME DELAY ADHESIVE DISC	15	SPRING ARM HINGE PIN
2	ARMATURE	9	TIME DELAY CYLINDER CUP	16	RESET SPRING
3	COIL	10	LATCH SPRING	17	RESET SPRING LINK (Upper)
4	MAGNET	11	LATCH	18	LATCH LEVER
5	RESET LINK	12	RESET SPRING LINK (Lower)	19	SPRING ARM
6	LATCH LEVER PIN	13	TRIP SPRING		
7	TIME DELAY PLUNGER POST	14	LATCH PIN		

Fig. 7—UNDERVOLTAGE TRIP AC & DC FOR TYPE LG CIRCUIT BREAKERS Dwg. S-11418

UNDERVOLTAGE TRIP (AC AND DC)

The undervoltage trip device as in Fig. 7 is a combination of an undervoltage unit and a spring trip mechanism.

The device consists basically of the following component parts: a U-type magnet, armature spring arm, two spring assemblies, voltage coil.

The time delay assembly as shown consists of an oil cup, which includes an adhesive disc connected by linkage to the armature.

The spring trip mechanism is located and attached to the left side of the undervoltage unit and is linked to the circuit breaker by a reset and an operating link.

Under ordinary operating conditions the armature is sealed against the magnet pole faces. When the operating voltage drops to approximately 60%-30% of normal the magnet releases the armature.

The armature pivots about its pin and moves counter-clockwise by a force generated by two springs, which have an initial tension when the breaker is opened. Further tension is applied by the rotation of the spring arm about its pin when the circuit breaker is closed.

The spring trip is reset by linkage from the breaker operating link. Upon a voltage drop, the armature is released and opens under spring tension. A pin on the lower arm of the armature strikes against a latch which in turn pivots about its pin to release the latch lever. The latch lever being under spring tension forces down a tripping link which in turn rotates the tripper bar thus opening the circuit breaker.

The time delay cup, when used, takes care of momentary voltage dips, gives an approximate delay of 7 seconds.

Coil Replacement. Refer to SAFETY PRECAUTIONS before attempting any replacement operation. To remove the coil, it is necessary to disconnect the operating and reset link and time delay plunger post head. (Time delay if used.) Pull the pivot pins to remove the spring arm and armature. Remove the coil support screws and remove coil support. After disconnecting coil leads, remove coil from magnet core.

SPARE PARTS

It is recommended that sufficient spare parts be carried in stock to enable the operators of circuit breakers to promptly replace any worn, broken or damaged parts. Should renewal parts be required, refer to Bulletin RP-1102-LG. The figure indexes in this bulletin are for instruction description only.