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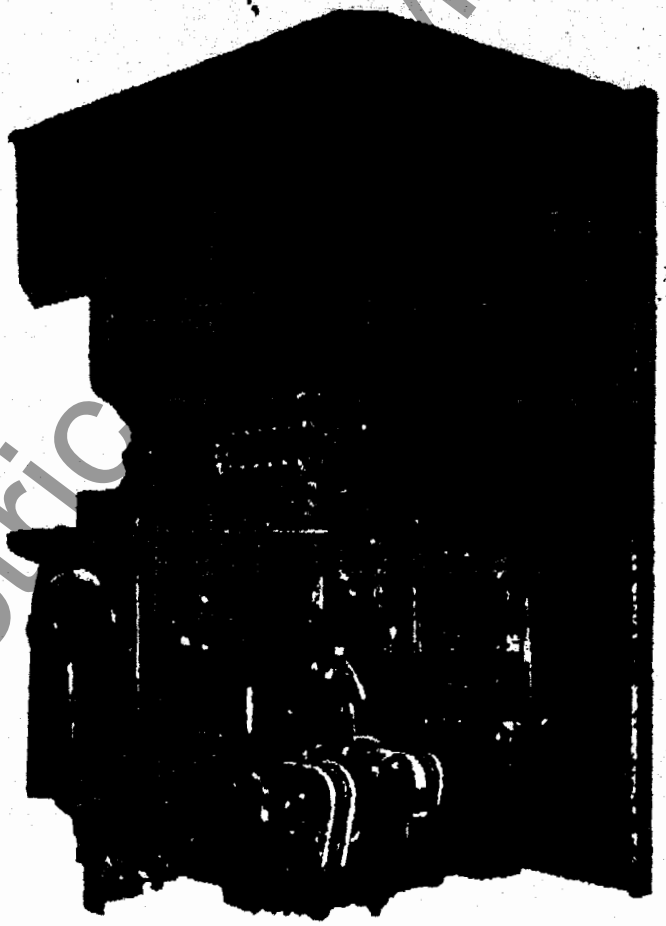
IB-5507

LOW VOLTAGE SWITCHGEAR INSTRUCTIONS

TYPE KC CIRCUIT BREAKERS

(MODELS F AND G)



I-T-E CIRCUIT BREAKER COMPANY • PHILADELPHIA 30, PENNSYLVANIA

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INSTRUCTIONS FOR TYPE KC CIRCUIT BREAKERS MODELS C, D, AND E

INTRODUCTION

These instructions apply to the Type KC circuit breakers having serial numbers with the prefix C (Model C), D (Model D), and E (Model E).

Read these instructions thoroughly and carefully before installing or attempting to operate the Type KC circuit breakers. By following these instructions, the operator can prolong the life and usefulness of the equipment.

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

APPLICATION AND RATINGS

The Type KC circuit breakers were designed for the protection of feeder circuits and as main circuit breakers on systems rated 600 volts a-c or 250 volts d-c, and where the interrupting requirements do not exceed 50,000 amperes. The Type KC circuit breakers are particularly adaptable to general industrial and switchgear applications where severe service, requiring frequent opening and closing operations, is encountered in general power and lighting circuits.

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 crated by workmen who are experienced in the proper handling and packing of electrical equipment.

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 circuit 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 of the 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 missing or damaged parts should accompany the claim.

STORAGE

It is recommended that the circuit breakers be installed in their permanent location even though they may not be placed in service for some time. When set up in buildings under construction, they should be protected from damage, dirt, dust, and moisture.

If the circuit breakers can not be installed in their permanent location immediately and it is necessary to store the equipment, it should be kept in a clean, dry place. It must not be exposed to dirt, to the action of corrosive gases such as chlorine, or to possible mechanical injury. Special care should be taken to prevent injury to the apparatus through shocks or jars due to rough handling.

DESCRIPTION

The Type KC circuit breakers can be furnished as a two-pole, three-pole, or four-pole circuit breaker, having either a manually or electrically operated mechanism, depending upon the application. A three-pole manually operated circuit breaker is shown in Fig. 1. A two-pole circuit breaker omits the center pole; while an additional pole is added for a four-pole circuit breaker.

Each pole is mounted on individual insulating moldings. These moldings isolate the main current carrying structure from the metal supporting base of the circuit breaker.

CONTACTS

Each pole consists of movable and stationary main contacts with their protective intermediate and arcing contacts. The movable contact structure for each pole is mounted on an insulated, square, steel connector bar which assures that all poles open and close simultaneously.

The correct contact closing sequence is as follows: (1) the arcing contacts close, (2) the intermediate contacts close, and (3) the main contacts close. The contacts open in the reverse order when the circuit breaker opens.

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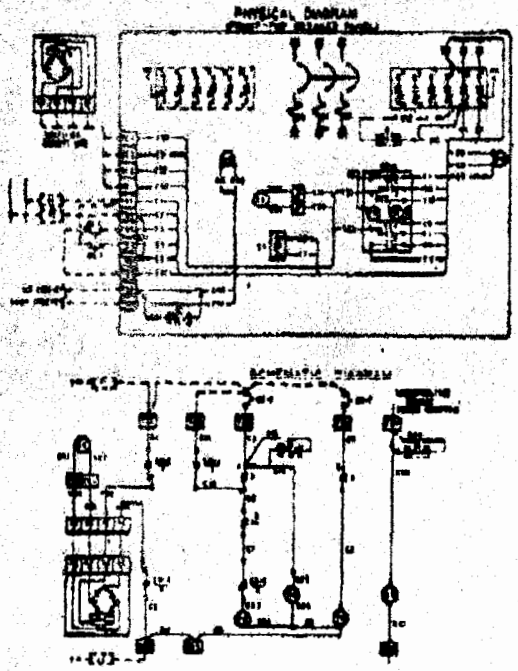

LEGEND

a — Contact Closed when Circuit Breaker is Closed.
b — Contact Closed when Circuit Breaker is Open.
bb — Contact Closed When Closing Solenoid is in Non-operative Position.
CC — Closing Coil.
CH — Coil End.
CR1-4 — Closing Control Relay (Trip Free).
CR1/1, CR1/2, CR2/1, CR2/2 — Contacts Close When Pickup Coil is Energized.
CR1/3, CR1/4 — Contact Open Only When Pickup Coil is De-energized and Holding Coil is Energized.
CS — Control Switch.
CS-C — Control Switch Close Contact—Maintained or Momentary.
CS-T — Control Switch Trip Contact.
HC — Holding Coil of Closing Control Relay.
OC — Overcurrent Trip Coil (Omit for Non-automatic Breakers).
PC — Pickup Coil of Closing Control Relay.
TB — Terminal Block.
TC — Shunt Trip Coil.
UV — Undervoltage Trip Coil.

NOTES

1. Use #16-7 Strand Wire on All Circuits, Except #12-7 Strand on Closing Solenoid.
2. Pole Positions Reading Left to Right:
   One-pole Breakers Use #2 Pole Only.
   Two-pole Breakers Use #1 & #3 Poles.
   Three-pole Breakers Use #1, #2, & #3 Poles.
   Four-pole Breakers Use #1, #2, #3 Poles As Shown & #4 Pole in Addition.
3. Main Separable Contacts on Individually Enclosed Pullout Breakers and Switchgear.
4. Adjustable Resistor-adjustment for Aging Rectifier.

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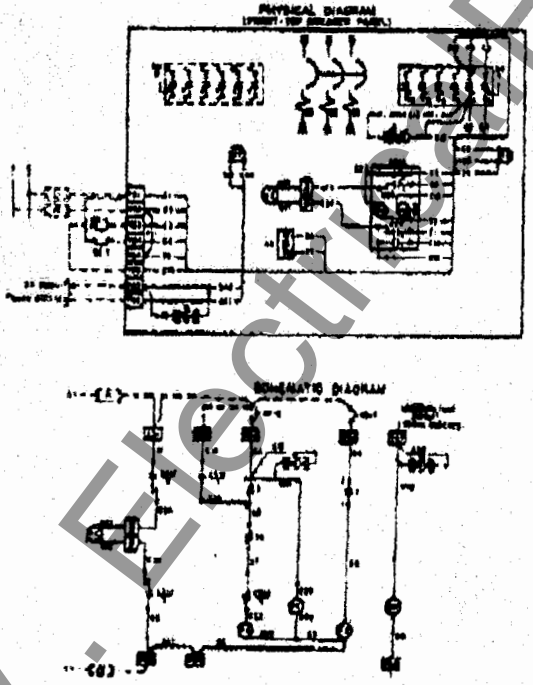
Fig. 2—Typical Diagram of Connections for Type KC Circuit Breakers Using A-C Control Voltage



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   Three-pole Breakers Use #1, #2, & #3 Poles.
   Four-pole Breakers Use #1, #2, #3 Poles As Shown & #4 Pole in Addition.
3. Main Separable Contacts on Individually Enclosed Pullout Breakers and Switchgear.
4. Adjustable Resistor-adjustment for Aging Rectifier.

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Fig. 3—Typical Diagram of Connections for Type KC Circuit Breakers Using D-C Control Voltage

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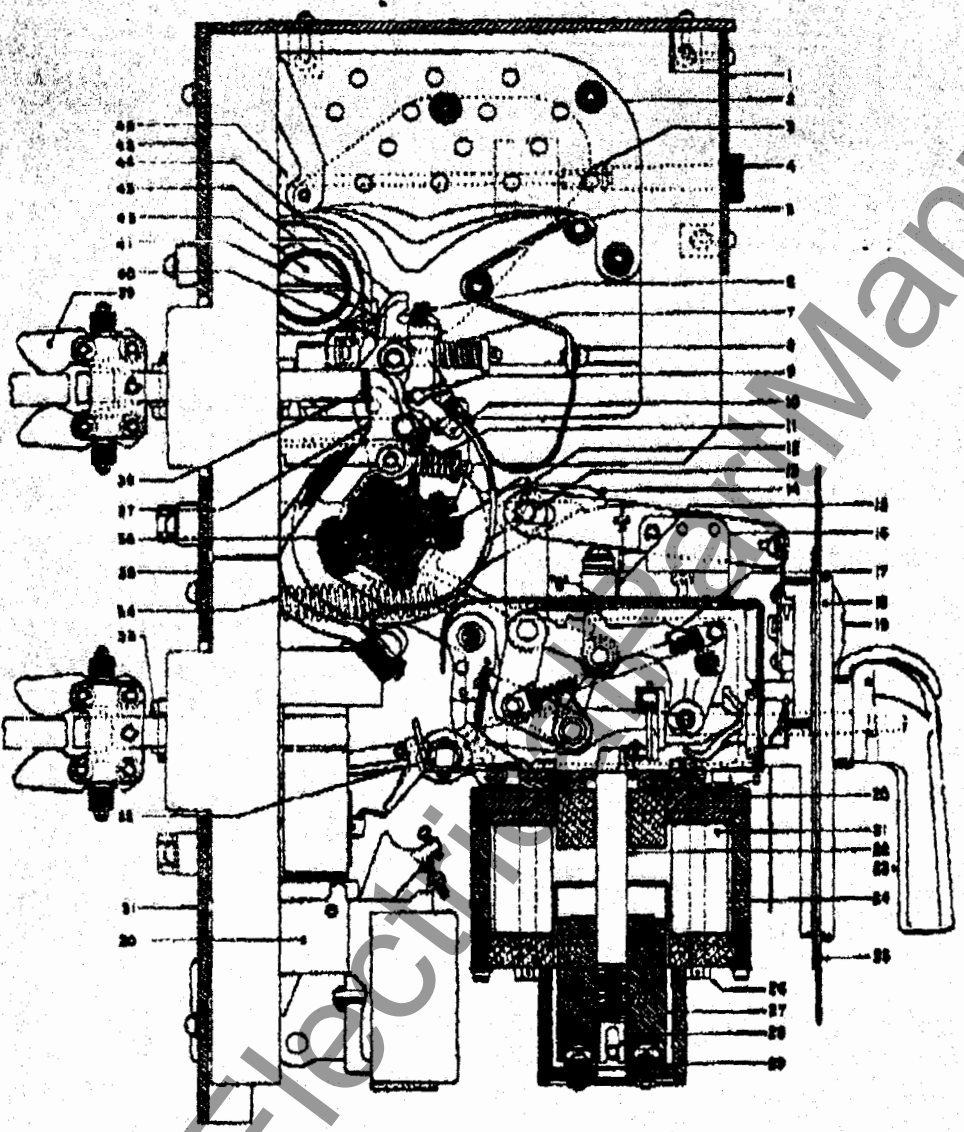

1. Interphase Barrier and Rear Assembly
2. Arc Shield
3. Retaining Nut
4. Retaining Stud
5. Arc Runner
6. Screw
7. Movable Arcing Contact Spring
8. Screw
9. Spring Clip
10. Contact Lever Assembly
11. Movable Main Contact Spring
12. Set Screw
13. Eccentric Cam
14. Contact Arm Cap
15. Roller Block
16. Support Block
17. Operating Mechanism
18. Mounting Assembly
19. Trip Indicator
20. Reset Spring
21. Solenoid Assembly
22. Plunger Rod
23. Operating Handle
24. Closing Coil
25. Formed Cover or Front Sheet
26. Mounting Bolt
27. Plunger
28. Pin
29. Jumper Block
30. Type CO-1 Dual Overcurrent Trip Device
31. Metal Base
32. Flipper Bar
33. Lower Current Stud
34. Opening Spring
35. Lower Base Molding
36. Connecting Bar
37. Movable Main Contact and Conductor Assembly
38. Upper Current Stud and Stationary Main Contact
39. Main Separable Contact Assembly
40. Stationary Intermediate Contact
41. Movable Intermediate Contact
42. Flexout Coil Assembly
43. Stationary Arcing Contact
44. Movable Arcing Contact
45. Upper Base Molding
46. Mounting Stud

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Fig. 1—Type KC Electrically Operated Circuit Breaker

The closing force of the operating mechanism is transmitted through a short insulating link pivoted to the contact arm cap which is fastened to the center of the contact arm bar.

For electrically operated circuit breakers, a solenoid closing mechanism (20, Fig. 2) is mounted directly under the operating mechanism by four mounting bolts. The solenoid consists of a top plate, cylindrical sides, bottom plate, plunger tube, plunger, and closing coil. The closing coil is centered by the plunger tube which also guides the plunger. The plunger return is cushioned by a bumper block at the bottom of the plunger support.

When the closing coil is energized, the upward motion of the plunger is applied to the operating mechanism toggle system which in turn transmits the force to close the contacts. The shock of the plunger closing stroke is absorbed by four springs mounted between the solenoid and operating mechanism. "Pumping" or repetition of the closing stroke is prevented by a non-repeat control relay and "bb" switch mounted at the sides of the solenoid. The solenoid closing coil, which is designed for intermittent service only, is energized by this control relay. A three-pole electrically operated circuit breaker is shown in Fig. 3.

Circuit breakers operated by a-c voltages are provided with suitable rectifier units which are either mounted on the back of the breaker panel or remotely from the circuit breaker.

A shelf mounted on the top of the operating mechanism supports provides a cover for the mechanism and a mounting support for the shunt trip device, undervoltage trip device, and auxiliary switch when used.

INSTALLATION

The Type KC 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 loosen bolted parts or change some of the circuit breaker 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 that is free from the 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 due to arcing or by the sudden movement of parts during an automatic opening of the circuit breaker. Sufficient electrical clearance must be provided for the circuit breaker, and it should be so located that it is 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

Individual Steel Enclosures

Type KC circuit breakers which are individually enclosed in a steel housing (Urelite) may be installed in any convenient location. The standard arrangement consists of a circuit breaker completely enclosed in a steel box designed for wall mounting. A standard individual enclosure consists of:

1. A pull box which may be bolted to a wall.
2. A breaker unit that is installed after the cables are pulled into place.
3. A deep front cover through which the operating handle and position indicator project.

The pull box has removable top, bottom, and side plates. Removal of the latter allows for connection of the cables to the circuit breaker connection studs.

A second arrangement, the panel-mounted Urelite, permits the circuit breaker to be mounted on a framework or steel panel. In this arrangement, a mounting panel is substituted for the pull box, leaving the connection studs exposed at the rear of the circuit breaker. An alternate arrangement omits the panel so that the enclosure may be bolted directly to any steel sheet into which the proper openings have been cut.

Dead Front Mounting

The Type KC circuit breaker is designed primarily for mounting behind a protective steel barrier. Exclusive of Urelite, a dead-front mounting usually consists of a metal enclosed, dead-front switchboard. Each circuit breaker is enclosed in an individual compartment having a flat front panel or formed door for a front cover. Only the operating handle and an escutcheon containing the position indicator project through the front cover.

ELECTRICAL CONNECTIONS

Before making any electrical connections, every precaution should 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

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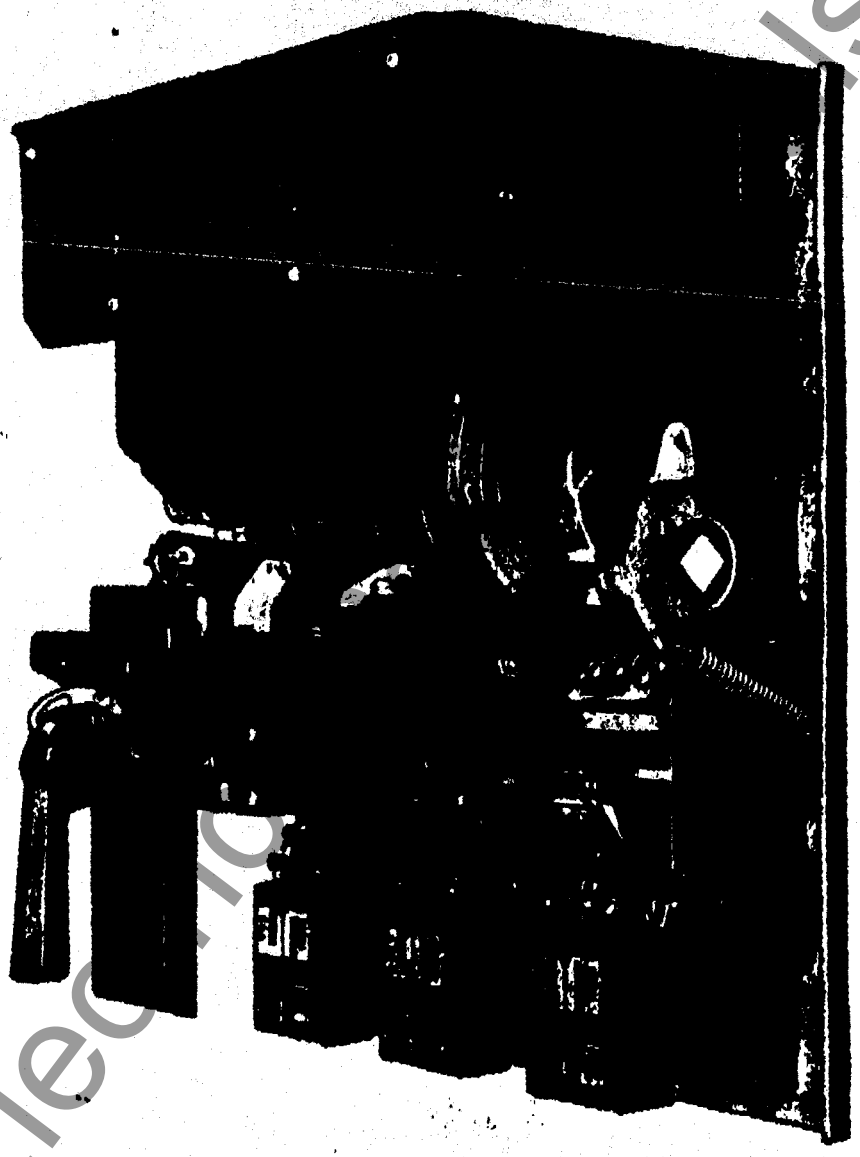
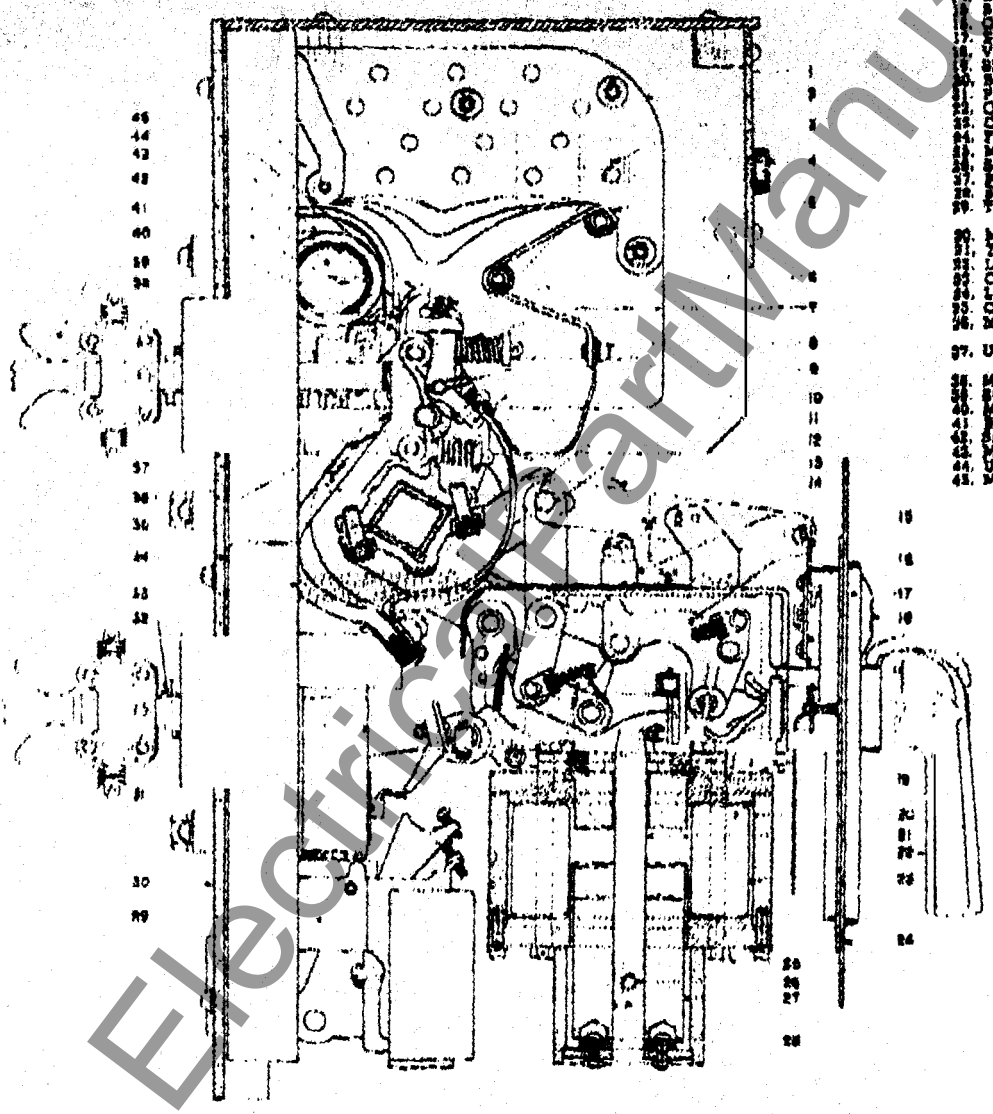


Photo 30115-B

Fig. 1—Type KC Manually Operated Circuit Breaker with Type OD-1 Dual Overcurrent Trip Devices



1. Interphase Barrier and Roof Assembly
2. Arc Chute
3. Retaining Nut
4. Retaining Stud
5. Arc Runner
6. Screw
7. Movable Arcing Contact Spring
8. Screw
9. Spring Clip
10. Contact Lever Assembly
11. Movable Main Contact Spring
12. Set Screw
13. Eccentric Cam
14. Contact Arm Cap
15. Buffer Block
16. Operating Mechanism
17. Escutcheon Assembly
18. Visual Indicator
19. Shock Spring
20. Solenoid Assembly
21. Plunger Rod
22. Operating Handle
23. Closing Coil
24. Formed Door or Front Sheet
25. Mounting Bolt
26. Set Screw
27. Plunger
28. Bumper Block
29. Type OD-1 Dual Overcurrent Trip Device
30. Motor Base
31. Tripper Bar
32. Lower Current Stud
33. Opening Spring
34. Lower Base Molding
35. Connector Bar
36. Movable Main Contact and Conduit Assembly
37. Upper Current Stud and Stationary Main Contact
38. Main Separable Contact Assembly
39. Stationary Intermediate Contact
40. Movable Intermediate Contact
41. Shunt Coil Assembly
42. Stationary Arcing Contact
43. Movable Arcing Contact
44. Upper Base Molding
45. Mounting Stud

Dwg. 5-10082

Fig. 3—Type KC Electrically Operated Circuit Breaker

Main Contacts

The movable main contact and conductor assembly (36, Fig. 2) requires two contact and conductor assemblies per pole. Each of these assemblies consists of two contact levers having silver-alloy inserts for the actual contact surface, and a laminated flexible conductor which joins the two contact levers and connects them to the lower terminal.

The contact levers pivot about a bearing pin which is held in position against the contact arm by the pressure from two compression springs.

When the circuit breaker is open, the lower end of the contact lever bears against the contact arm, limiting the free open travel position. When the circuit breaker is closed, the contacts carried by their contact levers are pressed against the stationary main contacts. This operation includes a wiping action for maximum efficiency.

The stationary main contact (37, Fig. 2) for each pole is a silver-alloy insert brazed to the upper current stud and is positioned so as to engage the movable main contacts as the circuit breaker is closed.

Intermediate and Arcing Contacts

Each pole of the circuit breaker has two movable intermediate contacts (40, Fig. 2) and one movable arcing contact (43, Fig. 2). The movable intermediate and arcing contacts are faced with a silver-alloy insert and fastened to their respective contact levers by socket head screws. These contact levers pivot about a yoke pin which is held in place by the contact arm and two "U" shaped spring clips. Two compression springs bear against the contact levers in such a manner that the spring pressure is divided between the three levers.

The stationary intermediate contacts (39, Fig. 2) are bolted to the upper surface of the stationary main contacts and are faced with silver-alloy inserts.

The stationary arcing contacts (42, Fig. 2) are silver-alloy inserts which are brazed to the face of the rear arc runners, and are supported by the intermediate contacts and blowout coils.

INTERPHASE BARRIER AND ROOF ASSEMBLY

The interphase barrier and roof assembly (1, Fig. 2) provides additional isolation between poles and at the top and front of the circuit breaker. The assembly is held in place by two retaining studs, and is easily removed for inspection and maintenance of the arc chutes and contacts.

ARC CHUTES

The arc chutes (2, Fig. 2) surround the main, intermediate, and arcing contacts of each pole and are bolted to the upper base molding by two mounting studs. The arc chutes are easily removable for inspection and maintenance of the contacts.

Each arc chute consists of an assembly of insulated barriers which confine the arc within a limited insulated area. Magnetic blowout irons on the outside of the arc chute are magnetized as the circuit breaker opens. The magnetic field, thus set up, forces the arc into the extinguishing chamber between the insulating barriers where the arc is cooled and extinguished. An arc runner in each arc chute is electrically connected to the lower terminal by a laminated flexible conductor.

OPERATING MECHANISM

The operating mechanism which consists of a closing cam, trip-free toggle, latches, and tripper bar is supported between two housing frames which are securely bolted to the circuit breaker panel. A manual operating handle is connected directly to the operating mechanism by a shaft which passes through an escutcheon assembly.

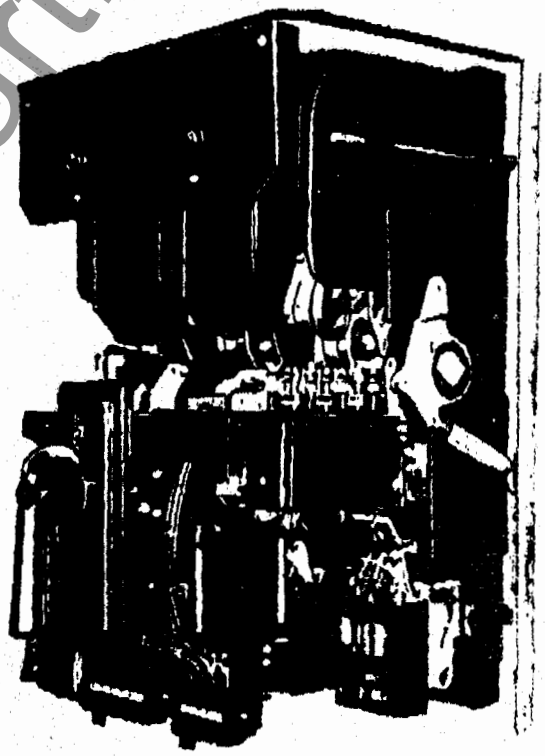


Photo 20218-B

Fig. 3—Type KC Electrically Operated Circuit Breaker Showing Arrangement of Standard Devices

The closing force of the operating mechanism is transmitted through a short insulating link pivoted to the contact arm cap which is fastened to the center of the contact arm bar.

For electrically operated circuit breakers, a solenoid closing mechanism (20, Fig. 2) is mounted directly under the operating mechanism by four mounting bolts. The solenoid consists of a top plate, cylindrical sides, bottom plate, plunger tube, plunger, and closing coil. The closing coil is centered by the plunger tube which also guides the plunger. The plunger return is cushioned by a bumper block at the bottom of the plunger support.

When the closing coil is energized, the upward motion of the plunger is applied to the operating mechanism toggle system which in turn transmits the force to close the contacts. The shock of the plunger closing stroke is absorbed by four springs mounted between the solenoid and operating mechanism. "Pumping" or repetition of the closing stroke is prevented by a non-repeat control relay and "bb" switch mounted at the sides of the solenoid. The solenoid closing coil, which is designed for intermittent service only, is energized by this control relay. A three-pole electrically operated circuit breaker is shown in Fig. 3.

Circuit breakers operated by a-c voltages are provided with suitable rectifier units which are either mounted on the back of the breaker panel or remotely from the circuit breaker.

A shelf mounted on the top of the operating mechanism supports provides a cover for the mechanism and a mounting support for the shunt trip device, undervoltage trip device, and auxiliary switch when used.

INSTALLATION

The Type KC 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 loosen bolted parts or change some of the circuit breaker adjustments. Refer to the MAINTENANCE and ADJUSTMENT sections for adjustments and procedures that may be required.

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1. A pull box which may be bolted to a wall.
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ELECTRICAL CONNECTIONS

Before making any electrical connections, every precaution should 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 connections 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.

To avoid overheating of the circuit breaker, the connecting leads must have a current-carrying capacity at least equal to 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.

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

Control Wiring

The control wiring should be in accordance with the diagram accompanying the circuit breaker. Typical connection diagrams for a-c and d-c applications are shown in Figs. 4 and 5 respectively. Diagrams for a specific application may be obtained from the I-T-E Circuit Breaker Company.

FINAL INSPECTION

After a circuit breaker is installed and all the mechanical and electrical connections complete the following inspection and tests should be made:

1. See that the circuit breaker is properly set up and leveled on its supporting structure (panels, pipes, structural iron or steel frames, etc.).

2. Close the circuit breaker slowly by hand, with primary and control circuits de-energized, noting whether the contacts are properly adjusted for correct alignment, and that good contact is made with the circuit breaker closed.

3. Inspect all insulated wiring to see that no damage to the insulation has resulted during the process of installing the circuit breaker.

4. Test the wiring for possible grounds or shorts.

5. See that all joints, whether bolted joints of copper bars or soldered (or clamped) joints made with wires or cables, are made correctly.

6 Circuit Breakers furnished with Type OD overcurrent trip devices should have the long-time delay armature on each pole operated manually a few times until the armature is restrained during the closing stroke. This is done to make sure that all of the fluid is in the lower (pressure) side of the time-delay cup.

OPERATION

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

TRIP FREE OPERATION

The Type KC circuit breakers are mechanically and electrically trip free so that the circuit breaker mechanism may be tripped in any part of the closing stroke by the operation of any tripping device with which it may be equipped. As soon as the contacts touch under fault conditions, the overcurrent trip device will operate the tripping mechanism, release 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 and reverse current conditions respectively.

MANUAL OPERATION

The direction in which to turn the manual operating handle, to "CLOSE" or "TRIP" the circuit breaker, is indicated on the escutcheon under the operating handle.

To close the circuit breaker, turn the manual operating handle clockwise with enough force and speed so that the contacts close smartly and the visual indicator shows "CLOSED." The operating handle, when released, will return automatically to a vertical position.

To trip the circuit breaker, turn the manual operating handle counter-clockwise until the operating mechanism latch is released and the visual indicator shows "OPEN." The operating handle, when released, will return automatically to a vertical position.

To lock the circuit breaker in the "OPEN" position, turn the operating handle counter-clockwise, raise the locking hasp, and insert the padlock. The locking hasp will accommodate from one to three padlocks.

Refer to the schematic diagram, either Fig. 4 or 5, when following the electrical operation procedure described in the following section.

ELECTRICAL OPERATION

The Type KC circuit breaker is electrically closed, by the operation of a control switch located at some remote point, as follows:

Turn the control switch (CS) to the "CLOSED" position. This energizes simultaneously pick-up coil (PC) and holding coil (HC). The stronger of

the two coils, the pick-up coil attracts the relay armature and closes the CR14/2 and CR14/3 contacts. (Note: Contact CR14/4 is closed when the CR14 control relay is de-energized and remains closed while the armature is attracted to the pick-up coil magnet.) This energizes the closing coil (CC) and the solenoid plunger moves toward its closed position. At the end of the plunger travel, a stud projecting from the solenoid plunger operates a lever which opens the "bb" switch and de-energizes the pick-up coil. The relay armature is then attracted by the magnet of the weaker or holding coil (HC) and opens all the CR14 contacts. The opening of CR14/2 and CR14/3 contacts de-energizes the solenoid closing coil and completes the closing cycle.

If the control switch has a maintaining contact in the "CLOSE" circuit, or if a momentary contact is being held closed, the circuit breaker will not attempt to reclose if it failed to latch closed on the first attempt due to some fault. The reason for this failure to reclose, even though the control switch is in the "CLOSE" position, is that the relay armature remains attracted to the magnet of the holding coil thus preventing the CR14 contacts from closing. Therefore, a second attempt to close the circuit breaker can not be made until the control switch is turned to the "OFF" position or the momentary switch contact is released. This de-energizes the holding coil and closes the CR14/4 contact.

The control relay is now in its normal de-energized position and will function to close the circuit breaker when the control switch is again turned to the "CLOSE" position. 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.

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

Circuit breakers subjected to abnormal conditions, such as acid fumes, salt deposits, or cement dust, require more frequent maintenance if flashovers resulting from accumulated substance are to be avoided.

CAUTION: DE-ENERGIZE THE PRIMARY AND CONTROL CIRCUITS BEFORE MAKING ANY INSPECTIONS, ADJUSTMENTS, OR REPLACEMENTS OF PARTS. If the circuit breakers are drawout pantograph mounted, rack to the "TEST" position or completely withdraw the circuit breaker.

CONTACTS

In general, any dirt or grease on the contacts should be removed by wiping them with a clean cloth saturated in carbon tetrachloride. A very slight pitting or discoloration of the contact surfaces is not harmful. Experience has shown that several operations of the circuit breaker, at two week intervals, will remove the effects of oxidation and materially prolong their effective life.

The interphase barrier and arc chutes must be removed in order to inspect, maintain, or replace the contacts.

Main and Intermediate Contacts

A slight amount of pitting is to be expected on the main and intermediate contacts. If the contacts are badly pitted or eroded, the contacts should be replaced before other parts of the circuit breaker become damaged. Excessive pitting may be caused by badly burned arcing contacts, or the circuit breaker may be interrupting currents beyond its interrupting rating.

All flexible conductors should be inspected for broken or pinched laminations. Flexible conductors in such condition require replacement of the assembly of which they are a part.

Arcing Contacts

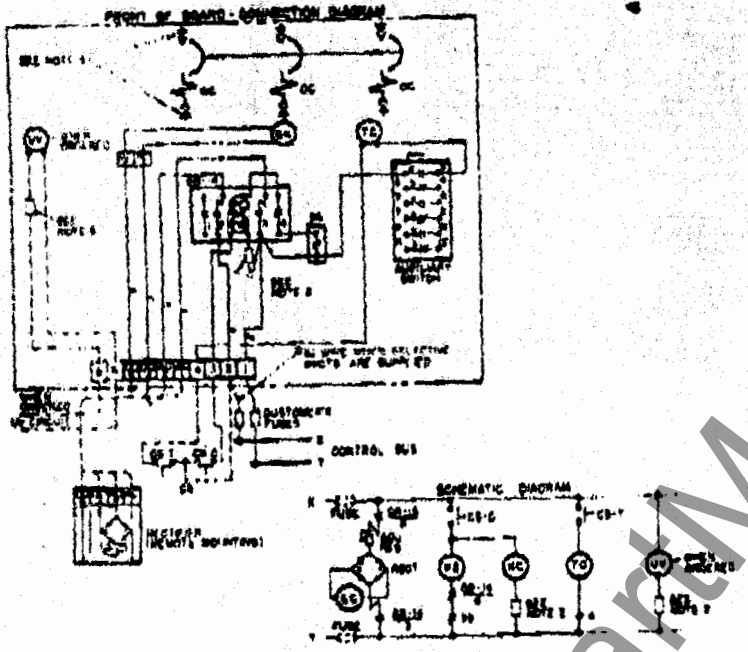
A moderate amount of pitting is to be expected and will not interfere with the operation of the arcing contacts. Occasionally it may be necessary to "dress-up" the contacts by removing small burrs with several light wipes of a fine file. Always follow the contour of the contacts and do not attempt to entirely eliminate the pitting. Prevent any filings from falling into the mechanism by covering it with a clean 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.

If the arcing contacts are severely pitted or eroded, the contacts should be replaced.

ARC CHUTES

Examine the arc chutes whenever they are removed for the inspection or replacement of contact parts. Discoloration or slight eroding of the interior of the arc chute does no harm; but if the arc chute runner or splitters show signs of serious burning or if the splitters or arc chute sides or ends are cracked or broken, the arc chute should be replaced as a complete unit.

When replacing the arc chutes, be sure they are held firmly in place by their mounting bolts. Also, be sure to replace and tighten the screw fastening the flexible conductors to the outer arc runners.



LEGEND

a — Contact Closed When Circuit Breaker Is Closed.
b — Contact Closed When Circuit Breaker Is Open.
bb — Contact Closed When Closing Solenoid Is In Non-operative Position.
CC — Closing Coil.
CR-14 — Closing Control Relay (Trip Free)
CR14/1, CR14/2, CR14/3 — Contacts Close When Pickup Coil Is Energized.
CR14/4 — Contact Open Only When Pickup Coil Is De-energized and Holding Coil Is Energized.
CS — Control Switch.
CS-C — Control Switch Close Contact — Maintained or Momentary.
CS-T — Control Switch Trip Contact
HC — Holding Coil of Closing Control Relay.
OC — Overcurrent Trip Coil — (Omit for Non-automatic).
PC — Pickup Coil of Closing Control Relay.
TC — Shunt Trip Coil.
UV — Undervoltage Trip Coil.

NOTES

1. Use A.W.G. #14 Stranded Wire, Except as Noted.
2. Resistors Furnished on Certain Voltages.
3. Adjustable Resistor — Adjustment for Aging Rectifier.
4. Pole Positions Reading Left to Right)
   One Pole Breaker Uses #2 Pole Only.
   Two Pole Breaker Uses #1 & #3 Poles.
   Three Pole Breaker Uses #1, #2 & #3.
   Four Pole Breaker Uses #1, #2 & #3 Poles as Shown & #4 Pole in Addition.
5. Disconnect Devices on Individually Enclosed KC Pullout Breakers Only.

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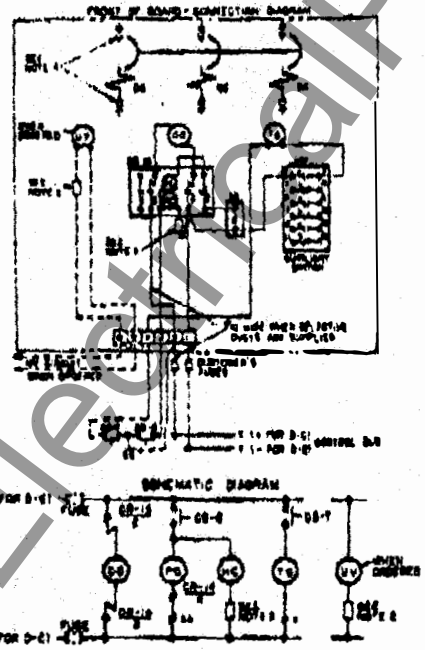
Fig. 4—Typical Diagram of Connections for Type KC Circuit Breakers Using A-C Control Voltage



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NOTES

1. Use A.W.G. #14 Stranded Wire, Except As Noted.
2. Resistors Furnished on Certain Voltages.
3. Pole Positions Reading Left to Right
   One Pole Breaker Uses #1 Pole Only.
   Two Pole Breaker Uses #1 & #3 Poles
   Three Pole Breaker Uses #1, #2 & #3.
   Four Pole Breaker Uses #1, #2 & #3 Poles As Shown & #4 Pole in Addition.
4. Disconnect Devices on Individually Enclosed KC Pullout Breakers Only.

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Fig. 5—Typical Diagram of Connections for Type KC Circuit Breakers Using D-C Control Voltage

MECHANISM AND SOLENOID

At all inspections, the circuit breaker should be operated manually to see that all parts move freely in the proper manner without binding or excessive friction. After a careful inspection shows all parts to be in proper working order, the circuit breaker can be operated electrically.

The solenoid does not require maintenance. Removal of the solenoid, for replacement of the closing coil, will require adjusting for proper clearance between the solenoid and mechanism as described under ADJUSTMENTS.

The solenoid plunger rod should be checked for proper stroke after the clearance between the solenoid and operating mechanism is adjusted. If the plunger rod stroke is too short, the circuit breaker will fail to latch closed; while, if it is too long, an excessive strain will be placed on the operating mechanism. The closing stroke of the plunger rod should be checked and adjusted as described under ADJUSTMENTS.

RESISTORS

All connections to resistors should be kept tight. Each resistor is designed for a specific duty and its longest life will be obtained if overloading is avoided. Keep the resistors free of dirt and other foreign matter and allow adequate space for ventilation. The full value of each resistor is needed for its particular duty. Short-circuiting a broken-down resistor is a dangerous practice and should be avoided. In making replacements of broken-down or burned-out resistors, the I-T-E Circuit Breaker Company's specifications should be followed explicitly.

ADJUSTMENTS

The Type KC circuit breakers are adjusted, inspected, and tested before leaving the factory. However, it is possible that rough handling during transit or abnormal usage after installation may cause a change in some of the adjustments. The circuit breaker should be checked and if adjustments are required, they should be made in accordance with the following sections.

CONTACTS

After replacing contacts or during regular maintenance inspections, the contact pressure and wipe should be checked for proper adjustment as follows:

1. Slowly close the circuit breaker manually until the last engaging movable main contact just

3. Complete the closing motion until the circuit breaker latches closed. Repeat the measurement at "A" which should indicate an additional 3/32 inch travel of the contact arm cap.

If adjustment is required, open the circuit breaker, loosen the two set screws for eccentric cam (12, Fig. 2), and turn cam in the direction required to raise or lower the contact arm cap. Tighten the set screws and repeat the above procedure until the 3/32 inch travel is obtained.

SOLENOID CLEARANCE

The clearance between the solenoid and the operating mechanism must be maintained when replacing the solenoid. Adjust the mounting studs so that the clearance at "C," Fig. 2 will be 9/16 inch (plus or minus 1/64 inch). Be sure and lock the mounting studs by replacing the locking wires when the clearance at "C" is correct.

PLUNGER ROD STROKE

The adjustment of the plunger rod stroke should not be changed if movement of the plunger is felt during the following:

Refer to Fig. 2 and,

1. Manually close the circuit breaker and hold the operating handle as far in the closed position as its stops will allow.

2. With a depth gauge, rod, or screw driver (1/2 inch diameter maximum) inserted through the hole in the solenoid bottom plate, raise the solenoid plunger as far as possible and hold in that position.

3. Slowly release the operating handle. As the handle approaches the normally closed position, a slight downward movement (0.030 to 0.045 of an inch) of the plunger should be felt by the hand supporting the plunger.

If no movement of the plunger is felt in step 3, it is necessary to adjust the length of the plunger rod as follows:

Refer to Fig. 2 and,

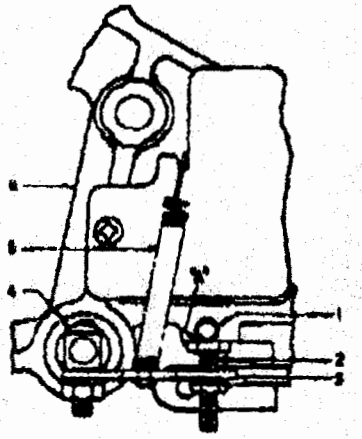
1. Loosen set screw (26).

2. Turn solenoid plunger rod (21) in the required direction to increase or decrease the effective length of the plunger rod and tighten set screw.

Repeat the above procedure until the plunger rod stroke is correct.

MECHANISM RESET

Failure of the mechanism to reset should not be confused with failure of the tripper bar latch to hold. Upon failure of the circuit breaker to successfully close, reset failure may be detected by pushing the contacts, by hand, a slight distance toward the closed position. If the mechanism resets during this operation, it is then necessary to



Dwg. 8-13628

1 Stop
2 Tripper Bar Stop Screw
3 Adjusting Lever
4 Tripper Bar
5 Spring
6 Mechanism Housing

Fig. 6—Latch Bite Adjustment for Type KC Circuit Breakers

LATCH BITE

If the circuit breaker does not successfully close due to slipping of the latch, adjust the tripper bar stop screw (2, Fig. 6) so that the circuit breaker will trip with a 0.045 inch feeler gauge inserted at "A," Fig. 6. The circuit breaker should not trip with a 0.035 inch feeler gauge inserted at "A." Be sure and tighten the locknut on the stop screw when the adjustment is correct.

ACCESSORIES

The accessories that may be furnished with the Type KC circuit breakers should be connected in accordance with the connection diagram furnished. These devices are adjusted, tested and inspected before leaving the factory. However, operating tests under actual conditions are necessary and both the mechanical and electrical per-

TYPE R14 CONTROL RELAY

The Type R14 control relay is a trip free closing relay furnished on electrically operated circuit breakers. The operation of a remote mounted control switch energizes the control relay. The operation of the control relay contacts controls the closing operation of the solenoid. A non-repeat feature of the control relay prevents cyclic reclosing of the circuit breaker and assures that the momentarily rated relay pick-up coil receives only intermittent service.

AUXILIARY SWITCHES

The Type L auxiliary switch is a six contact, back-connected switch usually mounted on a bracket supported by the right-hand shelf support.

The auxiliary switch is used primarily to protect the coil of the shunt trip device by opening the trip coil circuit. The auxiliary switch is also used to control indicating lamps and interlocking or alarm circuits.

On applications requiring alarm contacts, a Type ML latched-contact switch is mounted on the rear of the circuit breaker escutcheon plate.

SHUNT TRIP DEVICE

The shunt trip device is usually mounted to the shelf at the right-hand side of the operating mechanism. The device is used to trip the circuit breaker electrically from some remote point without regard to the load conditions of the circuit.

UNDERVOLTAGE TRIP DEVICE

The undervoltage trip device is usually mounted to the shelf at the left-hand side of the operating mechanism. The device will trip the circuit breaker when the voltage drops to some predetermined value of main circuit voltage. The release voltage is 30 to 60 per cent of the main 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 three seconds at zero voltage.

TIME LAG INSTANTANEOUS OVERCURRENT TRIP DEVICE

INSTRUCTIONS FOR TYPE KC CIRCUIT BREAKERS

(MODELS F AND G)

INTRODUCTION

These instructions are a supplement to instruction bulletin IB-5404, which is included with this bulletin. The combination of the two form complete instructions for the Type KC circuit breakers having serial numbers with the prefixes F and G (Models F and G).

The Models F and G and Models C, D, and E are similar, except as described in the following sections. For example, the Type L auxiliary switch described in IB-5404 is replaced by the Type L2 auxiliary switch described in section AUXILIARY SWITCHES and shown on the wiring diagrams, Figs. 2 and 3, of this supplement.

DESCRIPTION

A three-pole electrically operated circuit breaker, with the Type L2 auxiliary switch and Dimense finish, is shown on the front cover.

A side section view of an electrically operated circuit breaker is shown in Fig. 1.

Typical diagrams of connections for rectified a-c and d-c control applications are shown in Figs. 2 and 3, respectively.

AUXILIARY SWITCHES

The Type L2 auxiliary switch is a front-connected switch with double-break contacts. The six-contact switch, furnished as standard on electrically operated circuit breakers, is mounted on the right-hand side of the mechanism shelf. If more than six contacts are required, an additional two, four, or six-contact switch can be mounted on the left-hand side of the mechanism shelf.

The auxiliary switch is used primarily to protect the coil of the 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. For more specific information on the Type L2 auxiliary switch, refer to IB-5504.

On applications requiring alarm contacts, a Type ML latched-contact switch is mounted on the rear of the circuit breaker escutcheon plate. For more specific information on the Type ML latched-contact switch, refer to IB-5500.

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.

DUAL MAGNETIC OVERCURRENT TRIP DEVICE

The adhesion type dual magnetic overcurrent trip device combines short period overcurrent protection with instantaneous short circuit protection. The device is mounted to the insulated base molding directly beneath the pole with which it is associated. Since all poles are rigidly connected in opening and closing, response of the tripping device of one pole to an overcurrent or short circuit will cause the opening of all poles. The time delay calibration range of the tripping adjustment is 80 to 160 per cent of the circuit breaker rating. The outside armature provides a fixed instantaneous trip which is set at approximately 8 times the continuous-current rating for d-c circuit breakers and 12 times the continuous-current rating for a-c circuit breakers.

DUAL THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

The dual thermal magnetic overcurrent trip device is designed for standard a-c circuit breakers when used on individual motor circuits. The device provides direct acting inverse time operation and is designed for tripping a circuit breaker during overcurrent, single-phase overcurrent, and short circuit conditions. It is mounted to the insulated base molding directly beneath the pole with which it is associated.

REVERSE CURRENT TRIP DEVICE

The reverse current trip device is a direct current device which operates to trip the circuit breaker upon a reversal of current flow in the circuit. Operation is through magnetic interaction of a series-connected coil and a shunt-connected coil.

The device will trip on any reverse current in excess of the calibration setting. The calibration range of tripping adjustment is 5 to 25 per cent of the continuous-current rating of the circuit breaker. Tripping action requires that voltage in excess of 70 per cent be maintained.

TYPE OD-1 AND OD-2 OVERCURRENT TRIP DEVICES

The Type OD-1 and Type OD-2 overcurrent trip devices each consist of two of the following basic elements in two combinations.

1. A long-time delay trip element using a fluid-displacement dashpot for time delays measured in seconds, minutes, and hours.
2. A short-time delay trip element using a mechanical timer for time delays measured in cycles.
3. An instantaneous trip element which operates with no intentional time delay.

The Type OD-1 dual overcurrent trip device is comprised of a long-time delay element and an instantaneous element.

The Type OD-2 dual selective overcurrent trip device is comprised of a long-time delay element and a short-time delay element.

The long-time delay trip element is calibrated and adjustable to minimum operating currents of 80 to 160 per cent of the continuous-current rating of the circuit breaker.

The short-time delay trip element is calibrated and adjustable to minimum operating currents of 500, 750, and 1000 per cent of the continuous-current rating of the circuit breaker.

The instantaneous trip element is calibrated and adjustable to minimum operating currents of 500, 1000, and 1500 per cent of the continuous-current rating of the circuit breaker.

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 stocked should be based on the number of circuit breakers in service and previous operating experience.

When ordering renewal parts, address the nearest Sales Office of the I-T-E Circuit Breaker Company. Specify the complete nameplate data of the circuit breaker, 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.