INSTRUCTIONS FOR OPERATION AND MAINTENANCE OF TYPE KC CIRCUIT BREAKERS

BULLETIN IB-1300-KC

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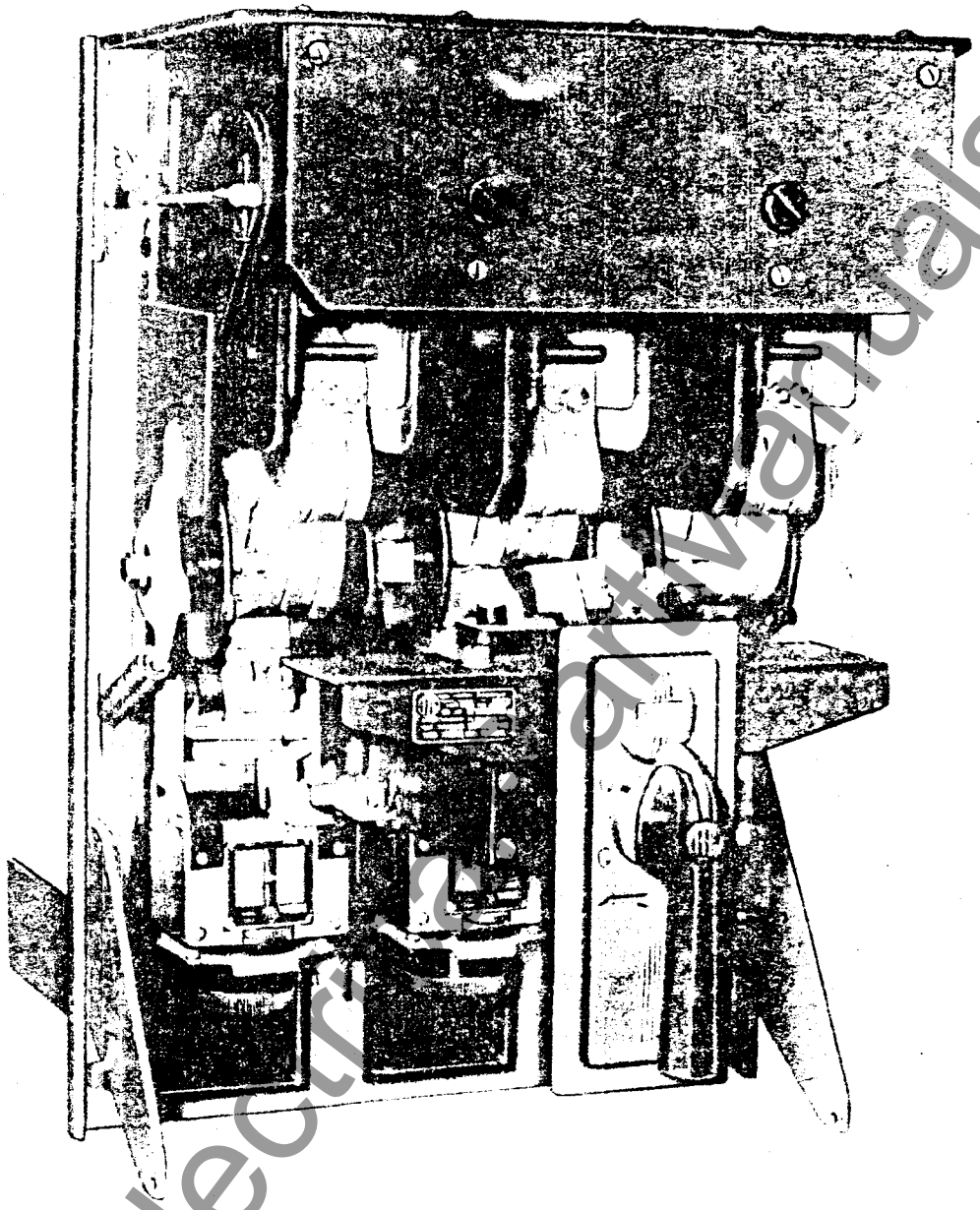


Photo. 17552-R

FIG. 1—TYPE KC CIRCUIT BREAKER, MANUALLY OPERATED WITH THREE DUAL MAGNETIC OVERCURRENT TRIP DEVICES

INTRODUCTION

These instructions may not cover all details or applications in connection with this equipment. Should further information be desired or some specific problem arise which is not covered sufficiently for the purchaser's purpose, the matter should be referred to the I-T-E Circuit Breaker Company. Filing these instructions in a readily accessible place, together with any drawings or descriptive switchgear data will facilitate proper maintenance of the equipment and prolong its life and usefulness.

GENERAL CONSTRUCTION

The KC circuit breaker shown in Fig. 1 is standard 3 pole manually operated construction. The breakers may be multiple construction depending on the application. An additional pole is provided for a 4 pole breaker, while the center pole is omitted for 2 pole construction.

A metal panel forms a barrier between the front of the breaker and the bus or cable connections. Insulating moldings set in the breaker panel cut-outs support and isolate current carrying parts and provide increased creepage distances from phase to phase and from phase to ground.

Each pole consists of a movable and stationary main contact with protective intermediate arcing contacts. The movable contacts close against the upper terminals and are connected to the lower terminals by flexible conductors. The moving contact structure are mounted on a heavy square insulated connector bar which assures that all poles will open and close simultaneously. The arc chutes which surrounds the main and arcing contacts are mounted to the breaker panel moldings. The arc chutes are readily removed for contact inspection. Interphase and roof barriers provide additional insulation between poles.

The operating mechanism is located between two supports, which are bolted to the breaker panel. Its construction assures simultaneous closing of all poles. The breakers are mechanically trip-free, so that it is impossible to hold them closed on a fault.

The manual operating handle is directly connected to the operating mechanism by a shaft which passes through an escutcheon assembly. The escutcheon seals the necessary clearance opening in the compartment door. A position indicator extends through the escutcheon and has a two color target which shows red marked "Closed" and green marked "Open."

For electrically operated breakers a solenoid closing mechanism is attached directly below the operating mechanism. Circuit breakers operated by a-c currents are provided with suitable rectifiers mounted on back of the breaker base or remote from the breaker. A control relay and a "bb" switch are mounted to the side of the solenoid.

A shelf mounted to the operating mechanism support provide a top cover for the mechanism and a mounting support for the shunt trip and undervoltage trip when used.

Other tripping devices such as instantaneous and dual magnetic over-current trip, dual thermal and selective overcurrent trip devices are mounted to base moldings which are fastened to the breaker base. When used, the reverse current trip device is usually mounted outside the right hand pole.

SAFETY PRECAUTIONS

Before making any adjustments or replacement of renewal parts, make certain all control circuits have been DE-ENERGIZED. If circuit breakers are drawout pantograph mounted in a switchboard, completely withdraw breakers or rack out to test position. If circuit breakers are rigidly mounted, DE-ENERGIZE bus. Disconnect cables from leads if there is a power source on load side.

FINAL INSTALLATION INSPECTION

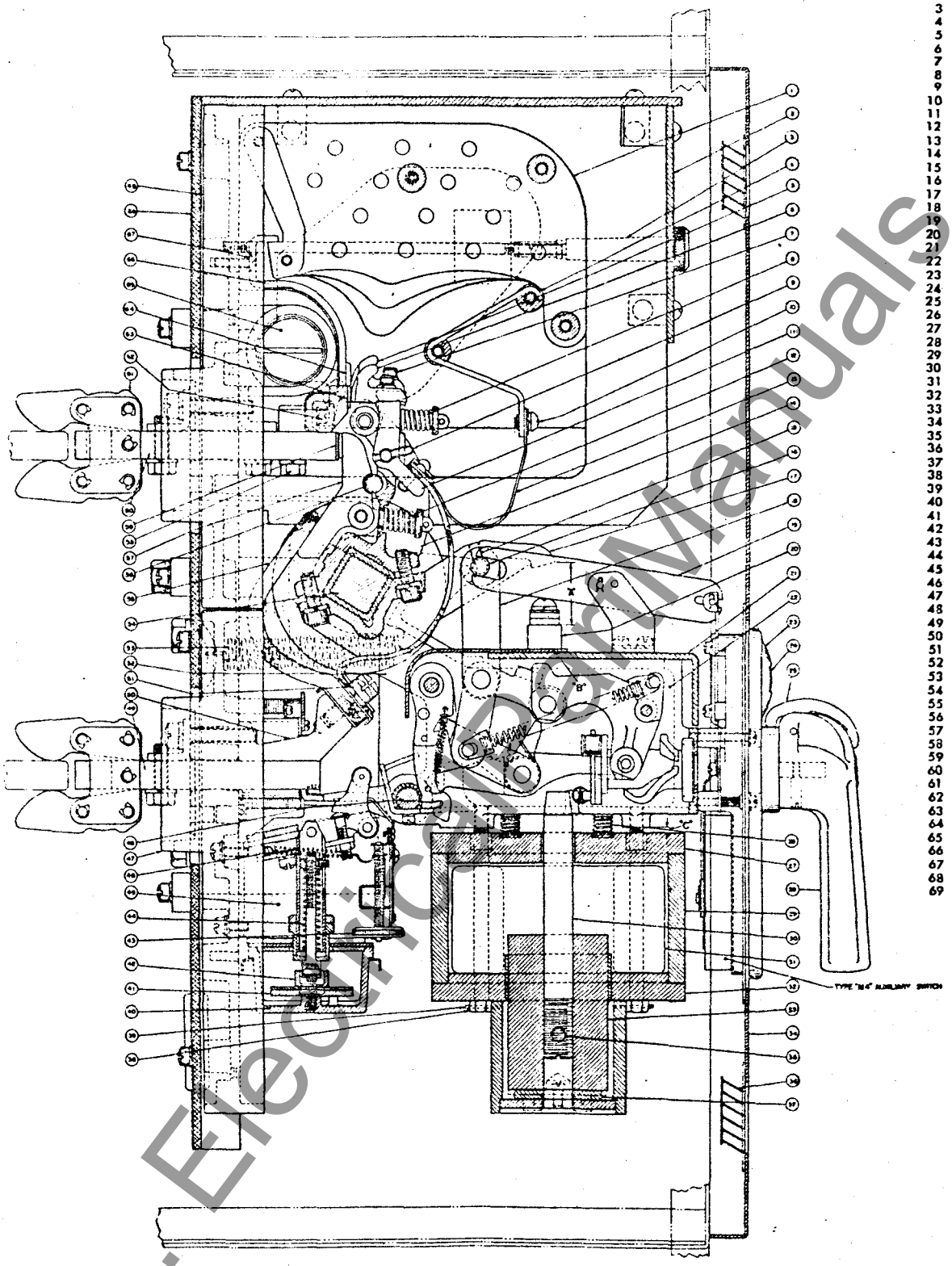
After a circuit breaker has been installed with all of its mechanical and electrical connections completed, the following inspections and tests should be made.

1. See that the circuit breaker is properly set-up and leveled on its supporting structure (panels, pipes, structural iron or steel frame, etc.)
2. Close the circuit breaker slowly by hand (when it is dead), 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 has resulted during the process of installing the circuit breaker.
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 wire or cables, are made correctly.

CONTACT STRUCTURE

MAIN CONTACTS. The entire moving contact structure as shown in Fig. 2 with its associates flexible conductors and supporting connecting bar may be removed from the breaker as a complete unit if necessary. Each moving main contact lever is faced with a silver alloy contact insert. Flexible conductors which are securely fastened to each contact lever run down to the lower terminal.

Each lever pivots about a bearing pin which is held in position by pressure against the contact arm by two spring links and two compression springs. When the breaker is open, the lower end of the contact lever bears against the contact arm, limiting the free open travel position. When the breaker is closed, the contacts carried by their contact levers are pressed against the stationary main contacts. This operation provides a wiping action for maximum contact pressure. The stationary main contacts also have silver alloy inserts brazed to each upper current studs and are so positioned to engage the moving main contacts as the breaker is closed.



1 Arc chute
2 Interphase barrier-roof
3 Arc chute retainer screw
4 Arc chute arcing horn
5 Arcing contact (center)
6 Arcing contact (outside)
7 Screw
8 Arcing contact spring
9 Spring clip
10 Arcing conductor screw
11 Contact lever
12 Main contact spring
13 Arc chute conductor
14 Contact arm
15 Set screw (eccentric cam)
16 Eccentric cam
17 Contact arm cap
18 Upper toggle (insulating link)
19 Visual link
20 Buffer block
21 Support shelf
22 Operating mechanism
23 Escutcheon
24 Position indicator
25 Locking hasp
26 Solenoid shock spring
27 Solenoid top plate
28 Operating handle
29 Solenoid center section
30 Solenoid plunger rod
31 Solenoid closing coil
32 Solenoid bottom plate
33 Solenoid plunger
34 Formed door
35 Solenoid plunger set screw
36 Baffle plate (ventilating louvre)
37 Solenoid bumper block
38 Solenoid mounting bolt
39 Locking wire
40 Oil cup
41 Stationary adhesive disc
42 Moving adhesive disc
43 Adjusting knob (calibration)
44 Instantaneous spring
45 Dual magnetic overcurrent trip
46 Calibration spring (short time)
47 Lower base molding
48 Tripper bar
49 Lower terminal current stud
50 Lower terminal
51 Screw
52 Mechanism support
53 Opening spring
54 Insulated connector bar
55 Main conductor
56 Main contact pivot pin
57 Main contact lever
58 Screw
59 Stationary main contact
60 Upper terminal current stud
61 Separable contact (main)
62 Screw
63 Stationary outside arcing contact
64 Stationary center arcing contact
65 Blowout coil
66 Arcing horn
67 Screw
68 Metal base (breaker)
69 Upper base molding

FIG. 2—TYPE KC CIRCUIT BREAKER
SIDE SECTION VIEW—MOUNTED IN SWITCHBOARD COMPARTMENT
ELECTRICALLY OPERATED

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ARCING CONTACTS. Each moving arcing contact structure consists of one and two outside (intermediate) contact levers pivoted about a yoke passing through flanges of the contact arm. This yoke is held in place by two "U" shaped springs. Two compression springs bear against these arcing contact levers so that spring pressure is divided between the three levers. The center and the two outside moving contacts are attached to their respective levers by socket head screws.

The center stationary arcing contact is supported by an arcing horn, which connects to the terminal stud through the magnetic blow-out coil. The stationary outside (intermediate) contacts are connected directly to the upper studs, and are removable.

The correct sequence require that the contacts close in this order. First the center (arcing) contacts, secondly the outside (intermediate) contacts and thirdly the main contacts. The contacts open in reverse order but the quick action prevents observation.

MAINTENANCE

The safety and the successful functioning of connected apparatus depends upon the proper operation of the circuit breaker. Therefore, the operation of the circuit breaker must have regular systematic care and inspection.

The following points require especial attention:

1. Be sure that the circuit breaker and its mechanism are disconnected from all electric power, both high voltage and operating current, before being inspected or repaired.
2. Inspect the operating mechanism periodically and keep it clean.
3. Examine the contacts frequently. See that they are aligned and that contact surfaces bear with a firm, uniform pressure. Replace badly pitted or burned contacts before they are burned away sufficiently to cause damage to other parts of the apparatus.
4. The contact members of all types of disconnecting or interrupting devices must be kept clean and bright to insure maximum operating efficiency. It has been found by experience that operating the circuit breaker several times at intervals of not over 2 weeks will remove the effects of oxidation and materially prolong the effective life of the circuit breaker. It is recommended that this practice be followed except that a circuit breaker which is regularly operated every few days will not require such attention.
5. See that bolts, nuts, washers, cotter pins and all terminal connections are in place and tight.
6. Clean the circuit breaker at regular intervals where abnormal conditions such as salt deposits, cement, dust or acid fumes prevail to avoid flashovers as a result of the accumulation of foreign substances on the surfaces of the circuit breaker.

CONTACTS. The contacts Fig. 2 should be inspected at least once every six months and especially after each short circuit. The interphase barriers and arc chutes must be removed before making an examination. The main contacts should not show any serious burning. If they do, the arcing contacts may be badly burned, or the circuit breaker may be opening at currents beyond its interrupting capacity. A very slight burning or "pitting" does no harm. A moderate amount of burning is to be expected on the arcing contacts which does not interfere with good operation. Occasionally it may be necessary to dress-up the arcing contacts. This should be done sparingly with light wipes of a fine file or sand paper. No emery cloth should be used. Take precautions to prevent filings or abrasive particles from falling into the mechanism. Badly burned contacts should be replaced. Conductors should be inspected for broken or pinched laminations.

CONTACT ADJUSTMENT. Contacts are adjusted by the I-T-E Circuit Breaker Company before shipment. If readjustment is found necessary it should be done in accordance with the following procedure.

1. Slowly close the breaker manually until the last engaging main contacts just touch.
2. Measure the gap between the buffer block and the contact arm cap at point "A" Fig. 2.
3. Complete the closing motion until the breaker is fully latched closed. Repeat measurement at point "A" which should show an additional 3-32 inch travel of the contact arm cap. Should adjustments be required, open breaker, loosen two set screws for eccentric cam and turn. Tighten set screws and close the breaker and remeasure gap at "A" Fig. 2.

ARC CHUTE AND INTERPHASE BARRIER

Each arc chute is held in place by two mounting studs screwed to the upper base molding. The interphase barrier and arc chutes are readily removed.

The arc chutes consists of an assembly of insulating barriers which confine the arc within a limited insulated area. Magnetic blowout irons placed on the outside of the chutes are magnetized as the 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 arcing horn in each chute is electrically connected to the upper terminal side of the contacts by a laminated conductor.

Arc chutes should be examined when removed for inspection or replacement of contact renewal parts. Any arc chute having any loose, broken or burned parts, such as liners or side plates particularly on d-c circuits, require new arc chute

replacement. When installing arc chutes and barriers be sure they are firmly held by their fastening nuts and screws. Attach the arc chute arcing horn conductor by its holding nut.

OPERATING MECHANISM

The operating mechanism which consists of closing toggles and latching parts is supported between two housing frames which are securely bolted to the breaker base. Closing force from the operating mechanism is transmitted through a short insulating link pivoted to a contact arm cap fastened to the middle of the connector bar.

TRIP-FREE OPERATION. The breaker is mechanically trip-free on overload. Immediate tripping occurs when an instantaneous overcurrent protective device responds to a fault. As soon as the contacts touch under fault conditions, the trip device will operate the tripping mechanism releasing the tripping toggle and allow the partly compressed opening springs to return the contacts to fully open position.

For electrically operated breaker, "pumping" or repetitions of the closing stroke is prevented by a "non-repeat" relay, (See Section for R14 Control Relay) which will not pick up again until the closing control switch has been opened and then reclosed. Breakers equipped with undervoltage or reverse current trip device are also trip free under conditions against which these devices give protection.

MECHANISM RESET ADJUSTMENT. Failure of the mechanism to reset should not be confused with failure of the tripper bar latch holding. Should the mechanism fail to reset, a thin shim of 0.015 inch maximum thickness should be placed under the buffer block at "B" Fig. 2. Reset failure may be detected by pushing the contacts a slight distance towards the closed position.

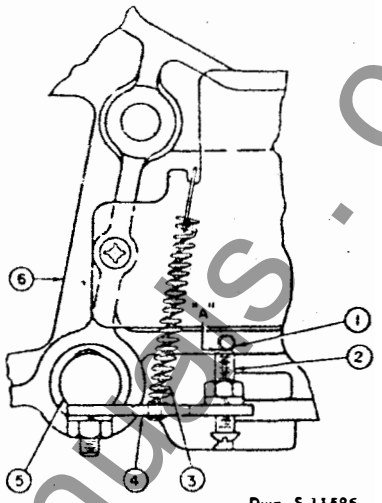
LATCH ADJUSTMENT. If the circuit breaker does not close properly due to slipping of the latch, adjust the tripper bar stop screw Fig. 3 so that breaker will trip with 0.045 inch feeler gauge at point "A" and will hold with 0.035 inch gauge.

MANUAL OPERATION

TO CLOSE THE BREAKER requires 90 degrees (approx.) clockwise turn of the operating handle. When the handle is released after the closing operation, it will return to the vertical position automatically.

TO TRIP THE BREAKER turn the operating handle counter-clockwise 45 degrees (approx.) and again release the handle. Operating instructions are also indicated on nameplate under the operating handle.

Locking the breaker in the open position is accomplished by a locking hasp in the operating handle which will accommodate one, two or three padlocks.



1 STOP
2 TRIPPER BAR STOP SCREW
3 SPRING
4 ADJUSTING LEVER
5 TRIPPER BAR
6 MECHANISM HOUSING

FIG. 3—LATCH ADJUSTMENT FOR TYPE KC CIRCUIT BREAKERS

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

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

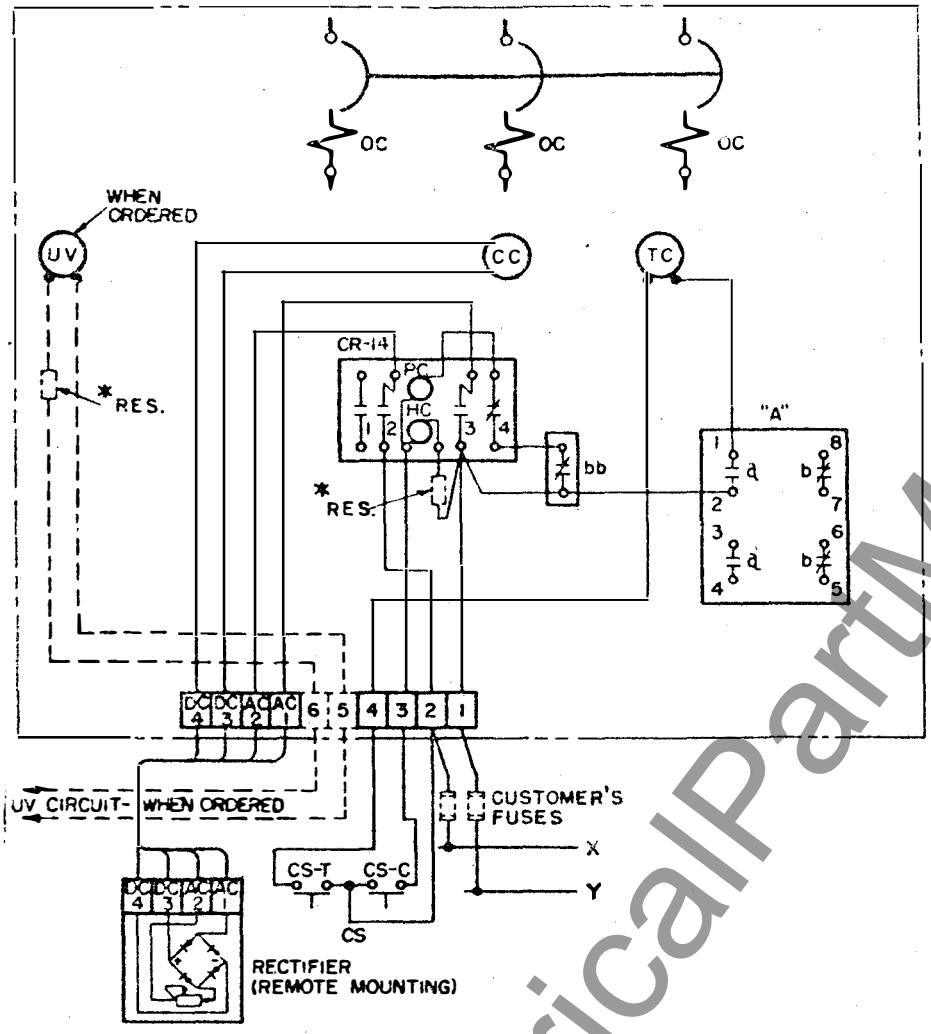
To avoid overheating of the circuit breaker, the connecting leads must have a current-carrying capacity at least equal to that of the current-carrying parts of the circuit breaker.

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

CONTROL WIRING. The control wiring should be so installed that trouble on one circuit breaker cannot be communicated to the control wiring of another breaker.

Control circuit wiring should be in accordance with any diagram accompanying the circuit breaker. Typical diagrams of connections for a-c and d-c application are shown in Figs. 4 and 5.

FRONT OF BOARD – CONNECTION DIAGRAM



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.
CR14—Closing control relay—trip free.
CR14/1
CR14/2 Contacts close when pickup coil is energized.
CR14/3
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 AWG #14 stranded wire.
*2. Resistor requirements per #175091.
3. Adjustable resistor — adjustment for aging rectifier.
4. Switch "A" is mounted on back of position indicator housing standard arrangement of contacts as shown. Customer to wire directly to extra contacts of switch.
5. Pole positions reading left to right:
One pole breaker uses #2 pole only.
Two pole breaker uses #1 and #3 poles.
Three pole breaker uses #1, #2 and #3 poles.
Four pole breaker uses #1, #2 and #3 poles as shown and #4 pole in addition.

SCHEMATIC DIAGRAM

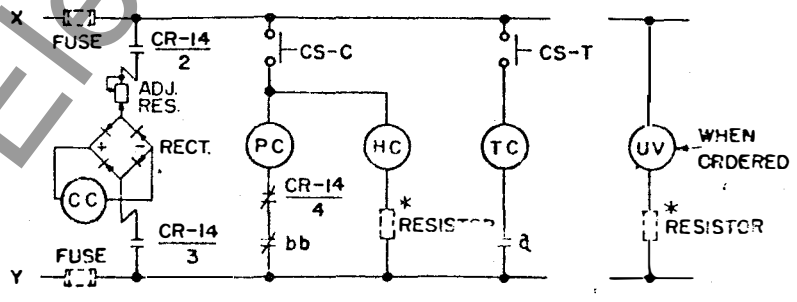


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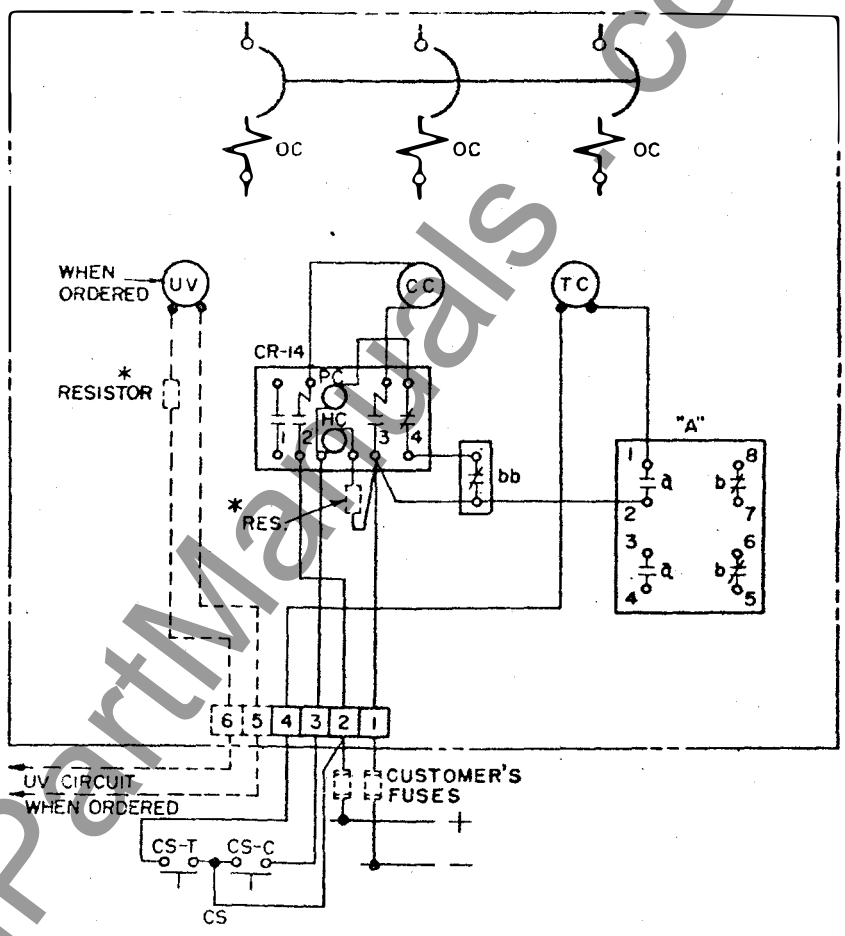
FIG. 4—DIAGRAM OF CONNECTIONS FOR TYPE KC CIRCUIT BREAKER—ELECTRICALLY OPERATED, A-C CONTROL (RECTIFIER), SHUNT TRIP 4 CONTACT AUX. SW., WITH OR WITHOUT UNDERVOLTAGE

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.
CR14—Closing control relay—trip free.
CR14/1
CR14/2 Contacts close when pickup coil is energized.
CR14/3
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 AWG #14 stranded wire.
2. Resistor requirements per #175091.
3. Switch "A" is mounted on back of position indicator housing standard arrangement of contacts as shown. Customer to wire directly to extra contacts of switch.
4. Pole positions reading left to right:
   One pole breaker uses #2 pole only.
   Two pole breaker uses #1 and #3 poles.
   Three pole breaker uses #1, #2 and #3 poles.
   Four pole breaker uses #1, #2 and #3 poles as shown and #4 pole in addition.

FRONT OF BOARD - CONNECTION DIAGRAM



SCHEMATIC DIAGRAM

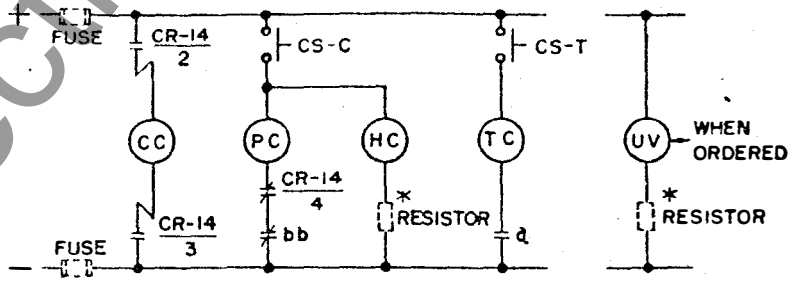


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FIG. 5—DIAGRAM OF CONNECTIONS FOR TYPE KC CIRCUIT BREAKER—ELECTRICALLY OPERATED, D-C CONTROL WITH SHUNT TRIP AND UNDERVOLTAGE TRIP. 4 CONTACT AUX. SWITCH