

(Unclassified)

NAVSHIPS 0962-073-6010

SWITCHBOARD

TECHNICAL

MANUAL

PART 2

CHAPTER 3A CIRCUIT BREAKER

MANUAL AND ELECTRICAL OPERATION

**Navy Type ACB-1600R
General Electric Type AK-2-60N
1600 Ampere Frame Size**

(Applicable to Units Manufactured After 1972 and Starting with Serial # 0224A3564-31)

GENERAL  ELECTRIC
PHILADELPHIA, PA.
(FSC 03497)

GEI-83900A

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CAUTION

PRIOR TO INSPECTION, MAINTENANCE OR REPAIR OF CIRCUIT BREAKER EXERCISE ELECTRICAL SAFETY PRECAUTIONS SPECIFIED IN NAVSHIPS TECHNICAL MANUAL 0901-000-0020, SECTION 9600.22.

THE INPUT POWER MAY BE CONNECTED TO EITHER THE TOP TERMINALS OR BOTTOM TERMINALS OF THE BREAKER. IF INPUT POWER IS CONNECTED TO THE BOTTOM TERMINALS PRACTICALLY ALL OF THE BREAKER MECHANISM IS ENERGIZED EVEN THOUGH THE BREAKER MAIN CONTACTS ARE IN THE OPEN POSITION. EVEN THOUGH THE BREAKER IS IN THE OPEN POSITION THERE MAY BE SOME BREAKER DEVICES, SUCH AS UNDERVOLTAGE TRIP, WHICH MAY BE ENERGIZED FROM ANOTHER SOURCE.

SHIPBOARD INSULATION RESISTANCE TESTING OF CONNECTED POWER CABLES.

The shipboard periodic insulation resistance testing of the main power cables with a 500 volt dc tester will not damage the circuit breaker.

TECHNICAL MANUAL. This manual covers a circuit breaker with the maximum number of attachments available, various combinations of circuit protective settings and typical wiring diagrams.

(1) For full description data of a specific circuit breaker refer to the applicable Certification Data Sheet.

(2) For maintenance or troubleshooting of a specific circuit breaker installation you must refer to the complete switchboard wiring diagram shown in the applicable technical manual.



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AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

CLASSIFICATION DATA

Manufacturer	General Electric Co., Philadelphia, Pa., U.S.A.
Type	Navy Type ACB-1600R, General Electric Type AK-2-60N
Continuous Current Rating	1600 amperes
Voltage	500 volts, 60 Hertz
Poles	3
Rated Interrupting Current	60,000 amperes, asymmetrical
Short-time Rating	50,000 amperes, asymmetrical
Short-time Rating Duration	1/2 sec.
Mounting	Removable assembly
Main Connections	Back
Normal Closing	Manual or electric
Overcurrent Coils	320, 400, 480, 560, 640, 800, 1000, 1200, 1400, and 1600 amperes
Characteristic Time Curve	Bands 1, 2 or 3
Temperature	50°C
Shock Classification	Class HI
Insulation Class	B
Protective Functions	Overcurrent trip
	Long-time delay and instantaneous
	Long-time delay, short-time delay, and instantaneous
	Short-time delay and instantaneous
	Instantaneous
	Shunt trip, when required
Accessories	Auxiliary switch (5a and 5b)
	Indicator light
	Instantaneous undervoltage device
	Undervoltage lockout device
	Overcurrent lockout device
Master Drawings	7078F28 (2 sheets)
Certification of Approval	
Applicable Military Specification	MIL-C-17587
Weights	
Three-pole Manual Circuit Breaker Complete	475 lb
Three-pole Electrical Circuit Breaker Complete	540 lb
Stationary Component Only	160 lb

Note: Shunt trip device or undervoltage device, when required, add 2 lbs.



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION B-1

General Instructions

PURPOSE

The fundamental purpose of a circuit breaker is to isolate a circuit from the source of power. This purpose can be served by normal off-on switching operations of normal continuous current or it can be served automatically under fault conditions. When the breaker is equipped with a shunt trip device, with the proper control wiring installed, the breaker may be opened from a location that is remote from the switchboard in which the breaker is installed.

WARNING

BEFORE INSPECTION, INSTALLATION, OR REMOVAL PROCEDURES, THE CIRCUIT BREAKER SHOULD BE IN THE OPEN POSITION AND THE BREAKER IN THE WITHDRAWN POSITION. IF THE STATIONARY COMPONENT IS TO BE REMOVED, THE SWITCHBOARD SHOULD BE DE-ENERGIZED. IF THE BUS CANNOT BE DE-ENERGIZED, USE INSULATED TOOLS, RUBBER GLOVES, AND A RUBBER FLOOR MAT.

ON ELECTRICAL BREAKERS CARE MUST BE TAKEN WHEN ANY MAINTENANCE WORK IS BEING DONE SO THAT THE BREAKER IS IN THE OPEN POSITION, THE MOTOR POWER IS OFF, AND THE CLOSING SPRINGS (1) (SEE FIGURE 1) ARE EXERTING THE LOAD ON THE SAFETY PIN (2). THE CLOSING SPRINGS SHOULD BE CHARGED WITH THE MAINTENANCE HANDLE, SO THAT THE SAFETY PIN CAN BE PLACED IN THE LOWER HOLE OF THE PUSH ROD (4). (THE UPPER HOLE IS USED IN THE INITIAL ASSEMBLY OF THE SPRINGS.) CONTINUE TO OPERATE THE MAINTENANCE HANDLE, THUS CLOSING THE BREAKER. THIS IS DONE SO THAT THE SAFETY PIN TAKES THE LOAD OFF THE SPRINGS.

FOLLOWING THE INSPECTION, THE CLOSING SPRING MUST BE RECHARGED, THE SAFETY PIN REMOVED FROM THE PUSH ROD, AND THE PIN PLACED IN THE SPRING CLIP (3).

HANDLING

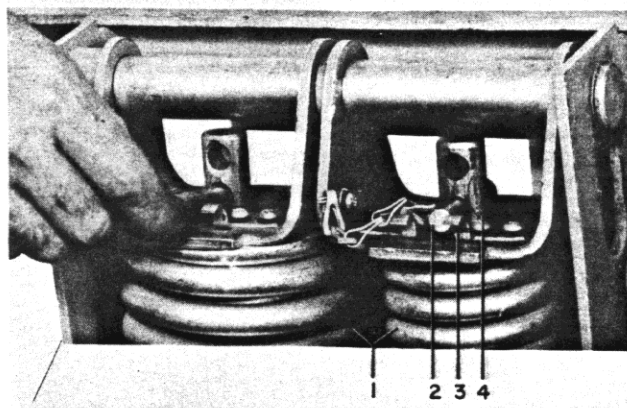
Care should be exercised in unpacking to avoid damage to breaker parts. Be sure that no loose parts are missing or left in packaging material. Blow out any dirt or loose particles of packaging material remaining on or in the breaker unit.

If the breaker is not to be placed in service at once, it should be stored in a clean dry location in an upright position. It is also advisable not to cover the breaker with any material that absorbs moisture that may cause corrosion of breaker parts. A covering of kraft or other non-absorbent paper will prevent dust from settling on the breaker.

INSTALLING STATIONARY COMPONENT

1. Place the stationary component in the switchboard compartment and push to the rear of the enclosure. Secure the stationary component to the switchboard vertical member with six bolts and to the switchboard front horizontal member with four bolts.

2. Bolt the switchboard bus and cables to the stationary component terminals. Provide the re-



- | | |
|-------------------|-------------------|
| 1 Closing springs | 3 Safety pin clip |
| 2 Safety pin | 4 Push rod |

Figure 1. Installing safety pin in push rod

R CIRCUIT BREAKER, NAVY TYPE ACB-1600R

work and cables to prevent caused by possible short terminals.

circuit wiring in accordance wiring diagram.

primary component, reverse

CIRCUIT BREAKER MOVING COMPONENT

NOTE

installing or removing refer to the preceding. Before installing, sparingly apply a primary and secondary stationary component.

breaker contacts are open.

a position approximately of the enclosure tray.

tray under the breaker as by moving the breaker down and pulling the tray

to a distance of about pins on the tray and push compartment so that the breaker is against the guides of the dowel pins.

breaker onto the tray and at that the holes in the rear over the two dowel pins. The breaker is correctly positioned and side bottom frame the tray.

each hexagonal head bolts the front of the side angles and them part way into the DO NOT TIGHTEN BOLTS self-alignment of the primary the subsequent racking

back into the compartment pins butt against the outer cam. In this position, the racking arm on the cam which

allows the racking handle to be lifted enough to allow the pawl to engage the first notch on the cam.

8. When the pawl engages the first notch on the cam, push the handle down again to its normal position. This causes the cam to rotate about the racking pin. Repeat this operation five times to rack the breaker into its final "connected" position.

NOTE

It is imperative that each stroke be performed with a positive motion and carried to its limiting position.

Interlocks hold the breaker trip-free until it is racked into the fully "connected" position. The fifth stroke of the handle is only a partial stroke and does not result in any further movement of the breaker. However, it does serve three useful purposes: (a) it positions the cam so that it cannot rotate and allow the breaker to back out under short-circuit stresses; (b) the partial stroke signals that the racking operation is complete; and (c) it releases the trip interlock which was engaged by the racking pin during the previous four pumps of the racking arm.

NOTE

Once a racking operation has been started, it should be completed because the breaker cannot be reversed until the racking operation is completed.

9. After completing the fifth racking stroke, lift the handle as high as it will go and allow it to drop to its normal position. This operation will reverse the pawl so that it is set for a racking-out operation.

NOTE

Any strokes beyond this point will cause the breaker to be trip-free.

Tighten the 3/8-inch hexagonal head bolts inserted in the front holes of the drawout tray. The breaker is now in the "connected" position.

WITHDRAWING CIRCUIT BREAKER MOVING COMPONENT

1. Trip the breaker to release the positive racking interlock and open the compartment door.

2. Lift the racking handle as far as it will go. This operation will re-engage the trip interlock to



T BREAKER, NAVY TYPE ACB-1600R

remainder of the
am is rotated
g the breaker
ult of pushing

arrangements be made to open and close it several times in succession, preferably under load.

l position and
performed five
ns from their
stroke, let the
s will reverse
m for racking

If overheating, not caused by overcurrent, is observed, a complete inspection of the breaker should be made, including connections and contacts. Inspect cable and bus connections for signs of overheating, and tighten all loose connections. Check to ascertain that all secondary connections are secure and all control wire is intact.

andle down and
compartment

A complete contact inspection, including contact wipe and pressure, should be made at regular inspection periods and always after a known short-circuit current has been interrupted, to determine the condition of the contacts. It is necessary to remove the arc quenchers to properly inspect the contacts. Arcing contacts and arc quencher barriers should be replaced when they are eroded to half their original thickness.

exagonal head
ay.

y 1/2 inch off
all the breaker
clear the com-

At all times it is important that no pencil lines, paint, oil or other foreign materials remain on the insulating surfaces of the breaker since they may cause low resistance between points of different potential and result in eventual electrical breakdown.

back into the
completely free

Inspect all mounting bolts in the stationary component; tighten all bolts that appear loose.

powered to the
breaker, make
om the front of
do not interfere
apartments be-

Before replacing the breaker, check alignment and wipe clean the stationary primary and secondary contacts. Discoloration of the silvered surfaces is not ordinarily harmful unless atmospheric conditions cause deposits, such as sulphides, on the contacts. These deposits may be removed from the primary and secondary contacts by racking the breaker in and out several times. After cleaning the contacts, sparingly apply a fresh coat of grease to the stationary primary and secondary contacts.

uit breaker is
. More frequent
evere load con-
nfavorable con-
of the breaker,
ers, should be
rupted a short

REPLACING PARTS

Before replacing any part it is strongly recommended that the operator familiarize himself with all parts involved in making the replacement.

e breaker should
e contact align-
ism parts move
friction.

TROUBLE SHOOTING

osed for a period
commended that

Table 1 lists typical symptoms of breaker malfunctions, together with their causes and remedies. If at any time these symptoms are observed, their causes should be determined and the necessary corrective action taken.

R CIRCUIT BREAKER, NAVY TYPE ACB-1600R

TABLE 1
TROUBLE SHOOTING

CAUSE	REMEDY
Contacts not aligned Contacts dirty, greasy or coated with film Contacts badly burned or pitted Current-carrying surfaces dirty Inhibitive atmosphere Insufficient bus or cable capacity Loose bolts and nuts at terminal connections Tight Current in excess of breaker rating Excessive ambient temperature Excessive heating	Adjust contacts. See Section D-3. Clean contacts. Replace contacts. See Section E-1. Clean surfaces of current-carrying parts. Check enclosure. Increase capacity of bus or cable. Tighten, but do not exceed, elastic limit of bolts or fittings. Check breaker application or modify circuit by decreasing load. Provide adequate ventilation. Correct bus or cable arrangement.
Release of tripping device does not provide positive release of tripping latch Worn or damaged trip unit parts Fault in overcurrent trip device Contacts binding in arc quencher	Re-adjust. See Section D-13. Replace trip unit. See Section E-1. Adjust overcurrent trip device. See Section D-13. Remove high spots, or align arcing contacts. Replace arc quencher. See Sections E-1 and D-3.
Overcurrent pickup too low Overcurrent time setting too short Fault in overcurrent trip device	Check application of overcurrent trip device. Check application of overcurrent trip device. Replace overcurrent trip device. See Section E-1.
Binding in attachments preventing setting of latch Latch out of adjustment Return spring too weak or broken Hardened or gummy lubricant Safety pin left in push rod Motor burned out Faulty control circuit component	Re-align and adjust attachments. Adjust latch. See Section D-4 or D-5. Replace spring. See Section D-4 or D-5. Clean bearing and latch surfaces. Remove safety pin. See Section B-1. Replace motor. See Section E-1. Replace or adjust faulty device. See Section E-1.
Control voltage low	Increase control voltage.
Improper contact sequence (main contacts not sufficiently parted when arcing contacts part)	Increase arcing contact wipe. Adjust contact sequence by raising or lowering main movable contact pivot block. See Section D-3.
Instantaneous current level above interrupting rating of breaker	Requires system study and possible replacement with breaker having adequate interrupting capacity.
Wear of contact wipe or pressure	Replace stationary contact springs and dress up or replace contacts. See Section E-1.



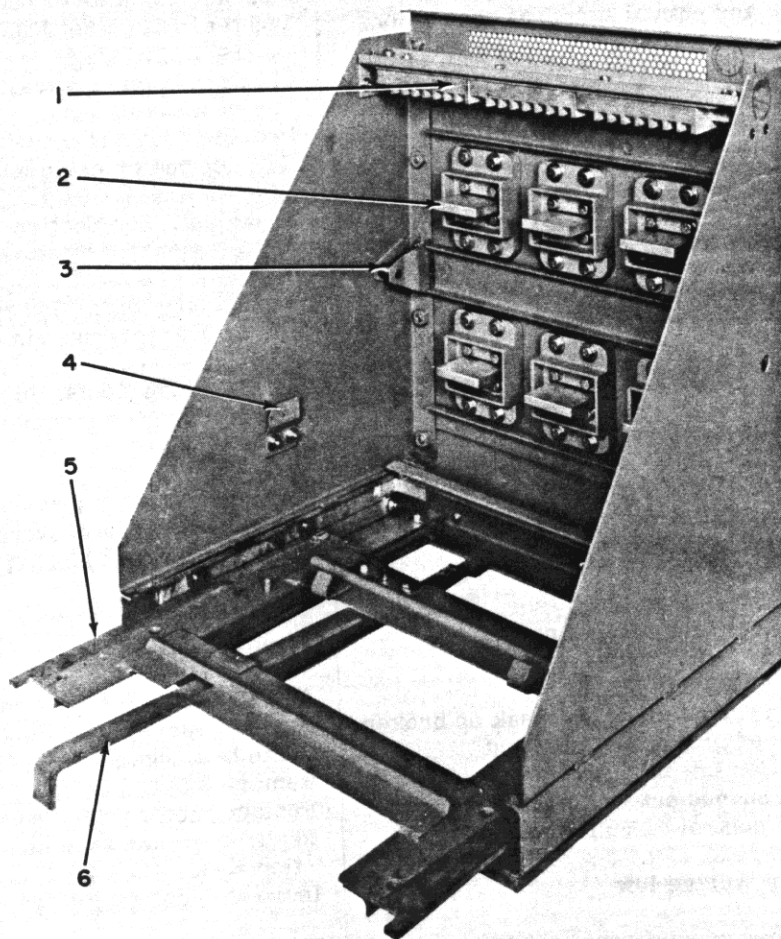
AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION B-2

Description of Removable Assembly

The complete assembly of the ACB-1600R circuit breaker consists of a stationary component (see figure 2) that is mounted in the switchboard frame, plus a drawout-type moving component (see figure 3). The stationary component is an open box-type unit that is bolted to the front horizontal member in the switchboard frame. The stationary component contains the following parts: the six

primary disconnects which serve as a separable connection between the switchboard stationary copper and the breaker moving component; the stationary portion of the secondary or control disconnects; a drawout tray which guides the circuit breaker element into the proper location; and two rollers which provide a support for the racking mechanism on the breaker.



- 1 Stationary secondary disconnects
- 2 Stationary primary disconnects
- 3 Racking pin
- 4 Drawout interlock cam
- 5 Drawout tray
- 6 Breaker stop pin release handle

Figure 2. Stationary component, with rollout tray shown in partial drawn-out position



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION B-3

Description of Circuit Breaker

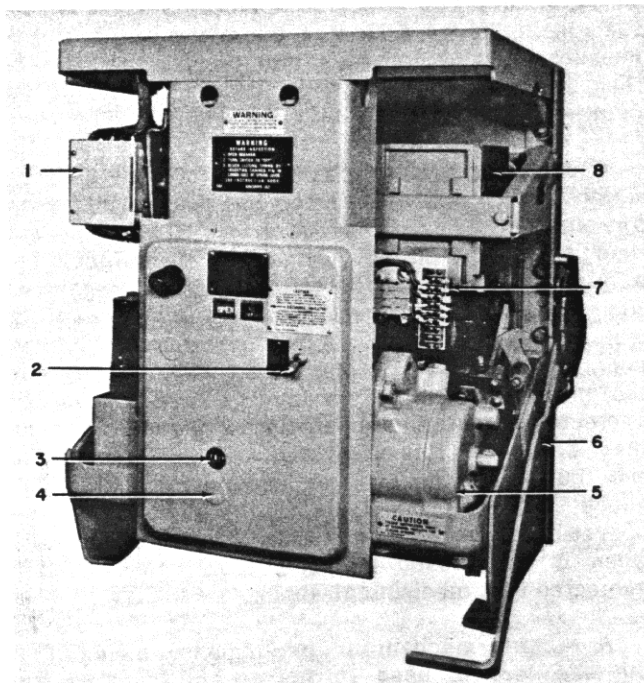
The Navy Type ACB-1600R circuit breaker is a device for interrupting in air a circuit between separable contacts under infrequent, normal and abnormal conditions. The interrupting rating is 60,000 amperes RMS at 500 volts, 60 cycles. The continuous current rating is 1600 amperes. Over-current trip coil ratings are 320, 400, 480, 560, 640, 800, 1000, 1200, 1400, or 1600 amperes.

The complete assembly of the ACB-1600R circuit breaker consists of a stationary component that is mounted in the switchboard frame, plus a drawout-type moving component (see figures 3, 4, and 5).

The stationary component (see figure 2) is an intermediate frame that is bolted to the vertical members in the back and to the horizontal member in the front of the switchboard frame. The stationary

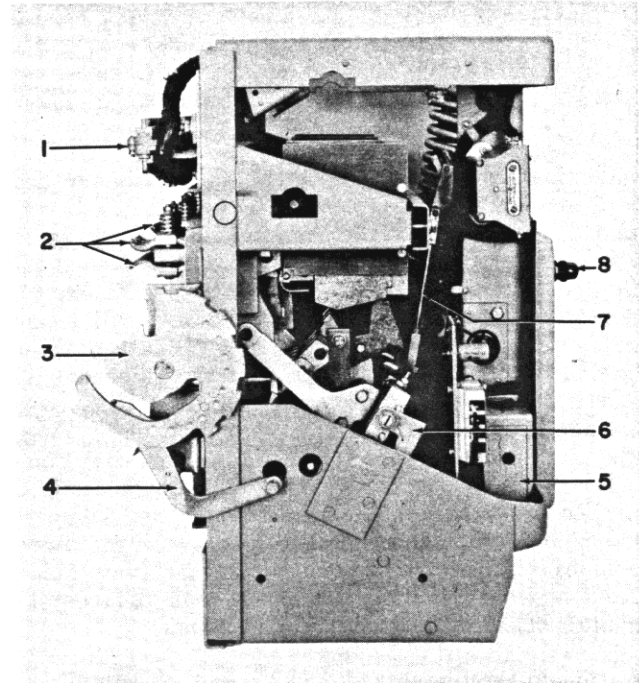
component contains the following parts: the six primary disconnects which serve as a separable connection between the switchboard stationary copper and the breaker moving component; the stationary portion of the secondary or control disconnects; a rollout tray which guides the circuit breaker element into the proper location; and two rollers which provide a support for the racking mechanism on the breaker.

The circuit breaker moving component (see figure 4) consists of two major parts: the back frame assembly and the front frame assembly. The back frame assembly (see figure 7) contains three pole unit assemblies, each mounted on an insulated molding. These moldings isolate the main current-carrying structure from the metal supporting base of the circuit breaker. Each pole base serves as a



- 1 Auxiliary switch*
 - 2 Motor power switch
 - 3 Trip button
 - 4 Close button
 - 5 Gear reduction unit
 - 6 Drawout racking mechanism and handle
 - 7 Cut-off switches*
 - 8 Arc quencher assembly
- * Repair part

Figure 3. Electrically-operated moving component

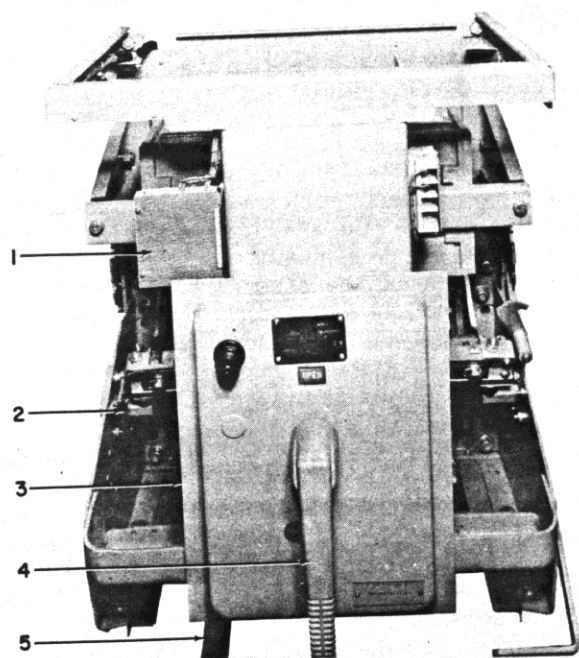


- 1 Movable secondary disconnects
 - 2 Movable primary disconnects
 - 3 Racking cam
 - 4 Drawout interlock link
 - 5 Control relay*
 - 6 Anti-rebound hook
 - 7 Auxiliary switch operating linkage
 - 8 Indicating light*
- * Repair part

Figure 4. Side view of electrically-operated moving component



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R



- | | |
|---------------------|--------------------|
| 1 Auxiliary switch* | 4 Operating handle |
| 2 Anti-rebound hook | 5 Breaker stop pin |
| 3 Opening spring* | release handle |

* Repair part

Figure 5. Manually-operated moving component

mounting for the upper stud, the stationary and movable main contacts (2 and 4) (see figure 7), the stationary and movable intermediate contacts (1 and 3), the stationary and movable arcing contacts (8 and 9), the lower terminal (23) (see figure 8), series overcurrent coil, and the lower stud. These components are connected in series, in the order named, except the arcing contacts which are in parallel with the main contacts. The pole base linkage is arranged in such fashion that on opening, the main contacts open first, the intermediate contacts open second, and the arcing contacts open last to draw the arc into the arc quencher where it is promptly extinguished. The linkages of the three pole base units are connected together by an insulated crossbar (5) (see figure 7) that assures simultaneous operation of the three poles.

The coil of the series overcurrent trip device is mounted in series with the terminal and lower stud to detect the presence of an overcurrent. When an overcurrent condition exists, the movement of the armature to the closed air gap position engages the trip paddle, causing the trip shaft to rotate counterclockwise. This releases the trip latch and trips the breaker open.

The front frame assembly (see figures 9 and 10) contains the operating mechanism which controls

the opening and closing of the contacts on the back frame assembly.

On electrically-operated breakers, the front frame assembly contains a motor and gear reduction unit, closing spring assembly and mechanism assembly. The motor and gear reduction unit operates through an output crank to pre-charge the closing spring assembly. When a closing operation is desired, further charging of the closing springs results in the release of the energy stored in the closing springs. This energy is directed into the closing mechanism to close the contacts of the breaker. As the closing springs are discharged to close the breaker, the breaker is held closed by a prop in the mechanism assembly.

On manually-operated breakers, the front frame assembly consists of the handle and shaft, gear and roller, and operating mechanism assemblies. The breaker is closed by turning the operating handle approximately 150 degrees counterclockwise to reset the latch, and then turning the handle approximately 150 degrees clockwise, which, through the action of the operating mechanism assembly, closes the breaker. The operating mechanism transmits the closing force from the operating handle to the crossbar and contact assemblies. The mechanism then latches and holds the contacts in the closed position.

Closing the breaker charges the opening springs which return the breaker to the open position on any subsequent tripping operation. The shunt trip device, mounted on the mechanism frame, provides a means for tripping the breaker without regard to load conditions on the circuit. An auxiliary switch, which contains normally-open and normally-closed contacts and which is operated through linkage by the breaker crossbar, is incorporated for use in protective and control circuits. Manual tripping may be accomplished by manual operation of the trip button on the breaker escutcheon plate. The shock lock device, mounted on the right side of the operating mechanism, prevents the circuit breaker, when in the closed position, from tripping when subjected to a mechanical shock.

A racking mechanism, permanently mounted on the breaker, is used to insert and remove the breaker into and from the connected position. The drawout interlock is co-ordinated with the racking mechanism to prevent the insertion or removal of a closed breaker into or from the connected position.

The anti-rebound hook (6) (see figure 4) on the left side of the crossbar prevents accidental closing of the circuit breaker contacts, from the open position, when the circuit breaker is subjected to mechanical shock.



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION C-1

Operation of Circuit Breaker

CLOSING THE MANUAL CIRCUIT BREAKER

The manually-operated circuit breaker is closed by rotating the operating handle approximately 150 degrees counterclockwise and then rotating the operating handle approximately 150 degrees clockwise. The closing motion should be a reasonably fast snapping action in order to prevent unnecessary heating of the breaker contacts.

CLOSING THE ELECTRICAL CIRCUIT BREAKER

Manual Operation (Maintenance Closing)

To observe the operation of the breaker without power, with the breaker open and springs discharged, proceed as follows:

1. Place the special ratchet-type maintenance handle, furnished with switchgear, on shaft (12) (see figure 14).
2. Charge the closing springs with the maintenance handle until the indicator (4) (see figure 13) reads "charged."
3. Continue to operate the maintenance handle until the breaker closes.

Electrical Operation (Normal Operation)

With the breaker opened and the closing springs discharged, the cycle for electrical operation is as follows:

1. The breaker will close only when the closing mechanism is in the charged position and the breaker is in the open position, as shown by their respective indicators. This is the reset position.

2. The motor and gear reducing mechanism charges the closing springs in the front frame through the linkage of the operating mechanism. This occurs automatically whenever the breaker is opened and the control power is still on.

3. When the closing control circuit is energized, the motor mechanism forces an over-center cam to travel past dead center. This releases the closing springs which close the breaker. The closing mechanism is now discharged and the breaker is closed.

TRIPPING THE CIRCUIT BREAKER

The breaker may be tripped by using the manual trip button, the shunt trip device, the undervoltage device, or by the overcurrent trip unit.

To trip the breaker manually, depress the trip button on the breaker escutcheon. This will trip the breaker manually through mechanical linkage. When the trip button is released, it will return to its normal position.

To trip the breaker electrically, turn the control switch, which is remotely located, to the TRIP position to energize the shunt trip coil. With this trip coil circuit closed, the shunt trip device will operate, causing the trip shaft to rotate in a counterclockwise manner, displacing the trip latch and tripping the breaker.

The undervoltage trip device will trip the circuit breaker, through the action of trip paddles, when voltage on the coil falls below the predetermined value.

The overcurrent trip unit will open the circuit breaker by rotating the trip shaft, through the action of the trip paddles, whenever the current exceeds the designated pickup values.



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION C-2

Typical Wiring Diagrams

Figure 27 shows a typical elementary and connection diagram for the control of electrically-operated breakers. The diagram shows the breaker in the open position with the closing springs discharged. When the normal control voltage is applied to the control circuit, the motor will be energized through the normally-closed contacts F(3-4), R(Z1-Z2), X(8-4), E(3-4), L(2-2C), R(Z3-Z4), and J(1-2), until the precharging of the closing springs is completed. This occurs approximately 30 cycles before the spring-charging cam reaches the top dead-center position. The precharging operation is then concluded by the operation of the E and F switches. Cam-switch contact F(3-4) isolates the motor from the control power source and a dynamic brake is applied by reversing the motor field R(Z1-Z2) through the contacts E(2-1), X(4-8), R(Z2-Z1), X(7-3), F(1-2), L(2-2C), and R(Z3-Z4). The closing operation can then be obtained, using either the push-button switch PB or a remote close switch to complete the circuit. Operation of the closing switch causes relay X to pick up, closing X(1-7), and thus completing the motor circuit through X(1-7), R(Z1-Z2), X(8-2), F(1-2), L(2-2C), and R(Z3-Z4). The motor carries through the spring-charging operation until the cam goes over the top dead center. At

this point the springs will discharge independently of the motor and close the breaker. The motor circuit is then interrupted by the contacts of switches E and F, which will revert to their original positions as shown in figure 27. The precharging operation, for the succeeding closing operation, is blocked by contact X(8-4) if contact is maintained on the push-button contact (PB) or the remote switch and contact L(2-2C). If the remote switch contact has been released and the breaker is in the open position, the breaker will precharge the closing springs automatically as long as control power is available.

NOTE

Figure 27 contains a typical elementary and connection diagram for explanation of operation of breaker. For checkout and maintenance purposes, use complete switchboard wiring diagram included in switchboard manual.

The operation of the remote trip switch, with the breaker closed, will cause the shunt trip coil to be energized and trip the breaker. The trip impulse is interrupted by the "a" contact of the auxiliary switch as the breaker opens.

SECTION D-1

General Assembly of Circuit Breaker

The various components and attachments of the moving component of the ACB-1600R circuit breaker are mounted on the front frame. Current-carrying parts are insulated from the breaker frame by the use of insulated bases. The main current-carrying contacts and arc chutes are located at the top of the breaker. The series overcurrent trip devices are mounted on the bottom of the insulated bases. The operating mechanism is centrally located in the front of the breaker. A mechanical position indicator is mounted on the front escutcheon just below the breaker nameplate. The shock lock for the trip shaft is mounted on the right side of the mechanism frame and the latch is mounted on the

trip shaft. The manual trip button is located on the front escutcheon under the open and close indicator.

The gear reduction unit is mounted to the right of the front channel with the motor mounted behind it. The closing relay is located on the lower left side of the front channel below the auxiliary switch. The shunt tripping device is mounted to a bracket attached to the left side of the operating mechanism, and operates in series with an auxiliary switch contact. The undervoltage device is mounted to a bracket attached to the left side of the breaker side sheet, and trips the breaker when voltage falls below a predetermined setting.



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-2

Arc Quencher

DESCRIPTION

The arc quencher extinguishes the arc when the circuit is interrupted. It also confines the arc products and isolates the pole units.

OPERATION

Each arc quencher (see figure 6) is made up of a

number of inner barriers (5), two side barriers (3), and two pocket barriers (4). The inner barriers are held in place by the spacer block (9), steel back plate (8), compound support (7), and the muffler (6). The side and pocket barriers are held in place by the stud (1) and cap (2).

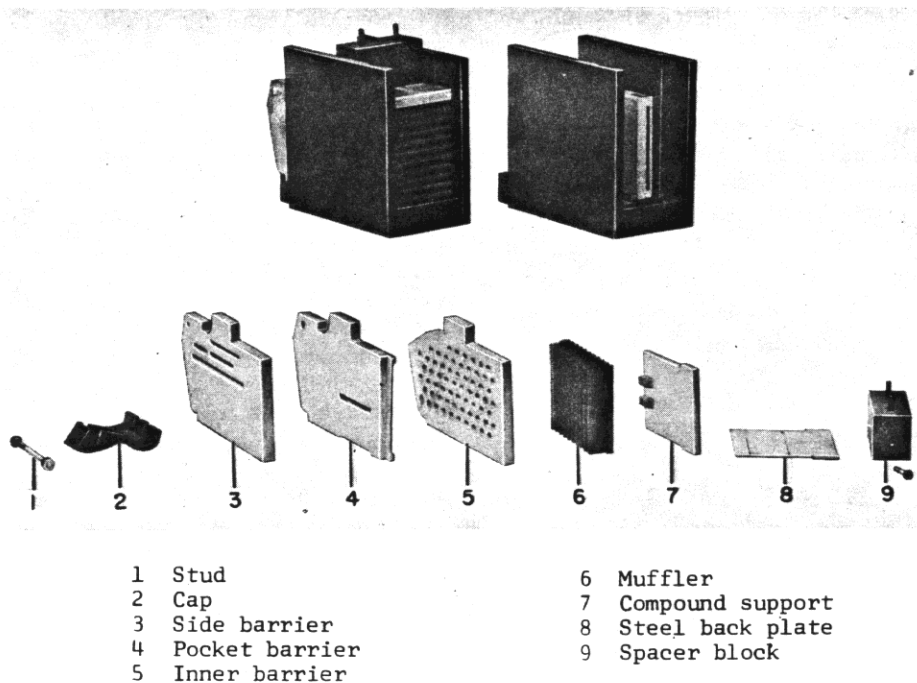


Figure 6. Disassembly of arc quenchers



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-3

Contact Assembly

DESCRIPTION

The function of the contact assembly is to open and close the circuit and to minimize the possibility of damage due to arcing.

OPERATION

Each pole unit assembly (see figure 8) consists of a set of arcing contacts, a set of main contacts, the actuating linkage, and the mounting base.

The stationary arcing contact consists of a set of parallel contact fingers (4), pin (8), and compression springs (5 and 6). These springs provide continuous contact pressure for the full travel of

the contacts. Conducting leaf springs (9) shunt the pivot pin to prevent possible pitting at the pivot pin when interrupting high currents.

The movable arcing contact assembly consists of parallel contact arms (11) carried on two movable pivot pins (18 and 29). The contacts interleaf and pivot with respect to the main contacts about the pin (29). This relative motion is obtained by linkages from the upper pin (16) to the breaker mechanism.

The stationary main contact assembly includes current-carrying contacts and intermediate contacts at one end of the assembly.

The movable main contacts pivot around a stationary pin (27) which holds them to the terminal. These contacts are actuated by a second pin (16), connected by an insulated link (17) to the breaker mechanism. The conducting leaf springs (24) serve as shunts and also force the contacts against the pins to prevent pitting at the pivot point. The intermediate contacts are built up higher than the main contacts and subsequently will make before and break after the main contacts.

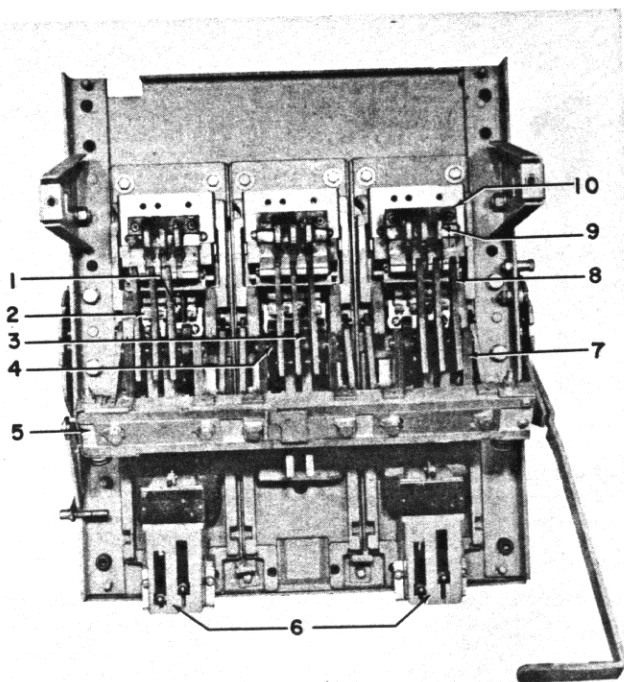
To function properly, a definite amount of contact pressure must be exerted between the movable and stationary contacts and a definite amount of contact wipe must exist on all contacts. Table 2 gives the figures for contact wipe and contact pressure which should be checked during regular inspections.

CONTACT ADJUSTMENTS

Measuring Contact Pressure

1. Remove arc quenchers (refer to Section D-2).
2. Close the breaker and measure dimension "B" (see figure 8).

3. Open the breaker. Place a push-type scale against the stationary arcing contacts at a point measured in line with the break between the contact stop and the contact pivot block. Push the contact backward until dimension "B" recorded in step 2 is reached. The scale should then be read.

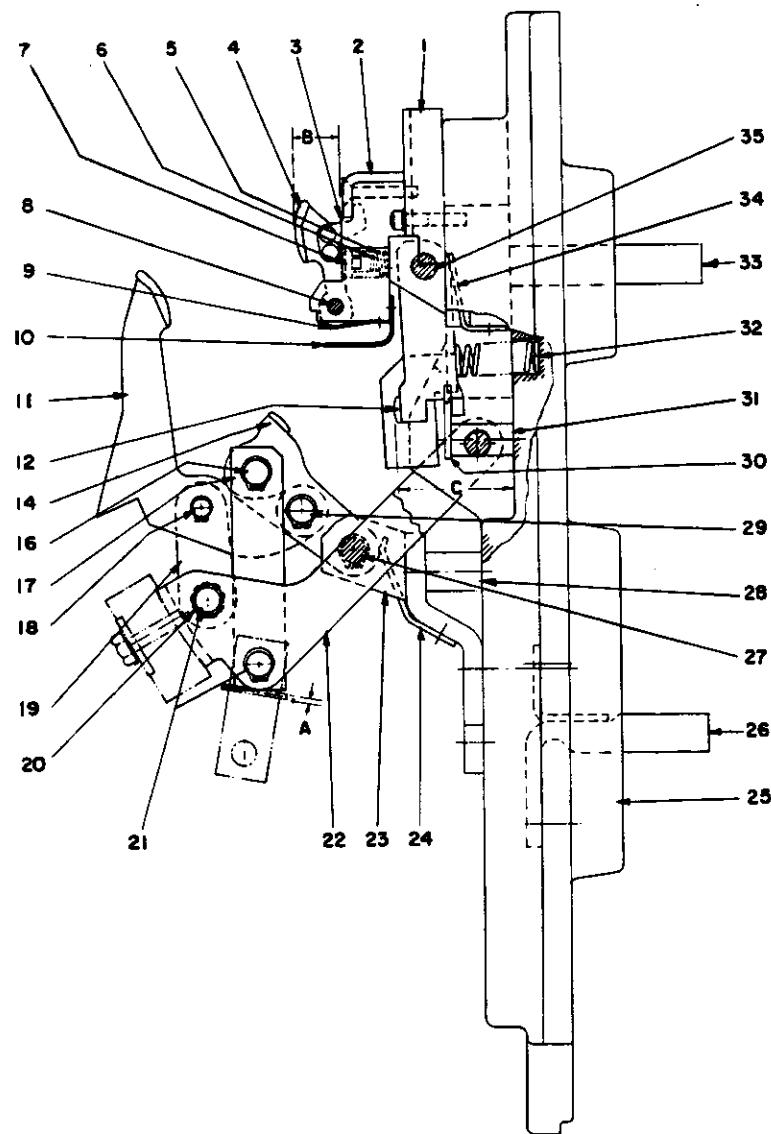


- | | |
|------------------------------------|------------------------------|
| 1 Stationary intermediate contact* | 6 Overcurrent devices |
| 2 Stationary main contact* | 7 Link |
| 3 Movable intermediate contact* | 8 Movable arcing contact* |
| 4 Movable main contact* | 9 Stationary arcing contact* |
| 5 Crossbar | 10 Stop *Repair part |

Figure 7. Front view of back frame assembly, moving component



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R



- 1 Spacer
- 2 Stop
- 3 Block
- 4 Stationary arcing contact*
- 5 Spring (outside)*
- 6 Spring (inside)*
- 7 Spring guide
- 8 Pivot pin
- 9 Leaf spring
- 10 Insulation
- 11 Movable arcing contact*

- 12 Stationary main contact*
- 14 Movable main contact*
- 16 Pin
- 17 Link
- 18 Pin
- 19 Link
- 20 Insulating tube
- 21 Pin
- 22 Side link
- 23 Terminal
- 24 Leaf spring

- 25 Pole unit base
- 26 Lower stud
- 27 Pivot pin
- 28 Spacer
- 29 Pivot pin
- 30 Contact stop
- 31 Spacer
- 32 Contact spring*
- 33 Upper stud
- 34 Leaf spring
- 35 Pivot pin

* Repair part

Figure 8. Pole unit assembly



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4. If the pressure is not within the requirements listed in Table 2, refer to the paragraph below, "Adjusting Contact Wipe and Pressure."

3. To prevent overstressing the clevis threads, dimension "A" should not exceed 3/16 inch and space "A" should be filled with 0.005 shims until solid.

Measuring Contact Wipe

1. Remove arc quenchers (refer to Section D-2).
2. With the breaker open, measure the horizontal distance from the edge of the stationary contact to the stationary block behind it ("B" dimension for arcing contacts; "C" dimension for main contacts). (See figure 8.)
3. Close the breaker and take the measurements discussed in step 2. The difference between the readings in steps 2 and 3 determines the wipe of the contacts.

WARNING

BE EXTREMELY CAREFUL NOT TO TRIP THE BREAKER.

4. If the wipe is not within the requirements listed in Table 2, refer to paragraph below, "Adjusting Contact Wipe and Pressure."

Adjusting Contact Wipe and Pressure

1. To obtain proper contact wipe and pressure on the center pole, dimension "A" (see figure 8) should be increased to increase wipe and decreased to decrease wipe.
2. To change dimension "A," remove the clevis pin (12) (see figure 11) and rotate the clevis (13) (see figure 11) as necessary.

4. With the proper center pole wipe obtained, moving the crossbar adjusting plate on the center pole to the right will simultaneously increase the wipe on both outside poles; moving the adjusting plate to the left will have the reverse effect.

5. To increase the wipe on either outside pole individually, move the crossbar adjusting plate of that pole to the left; to decrease the wipe, move the adjusting plate to the right and at the same time move the serrated side link (22) up or down in relation to the crossbar as required.

NOTE

If the proper contact pressure does not exist when the contact wipe is within its limits, the stationary contact springs should be replaced.

Contact Sequence (See Figure 8)

On the horizontal plane, the difference in the making of the arcing contacts on the same pole must be no greater than 1/32 inch; the difference between arcing contacts on separate poles must be no greater than 1/16 inch. If it is desired to advance or retard the closing of the main contacts of a pole, loosen the bolts holding the adjustment plate of that pole and slide the plate to the left to advance contact closing and to the right to retard contact closing. Make this adjustment on the outer poles, using the center pole as a reference. When retightening the adjustment plate bolts, make sure the locking tabs are turned up around the bolt heads to lock the bolts securely in place.

TABLE 2

CONTACT PRESSURES AND WIPES

	No. of Contacts per Pole	Pressure (Lbs)	Wipe (Inches)
Main Contacts	3	55 to 65	1/16 to 3/32
Intermediate Contacts	1	55 to 65	(1/16 inch greater than main contact wipe)
Arcing Contacts	3	31 to 43	12/64 to 18/64



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

Contact sequence in the vertical plane should be such that when the arcing contacts are just touching, the intermediate contact gap should be at least $3/16$ inch, and the main contact gap at least $1/4$ inch.

NOTE

This check can best be made using the maintenance handle, with the safety pin restraining the closing springs.

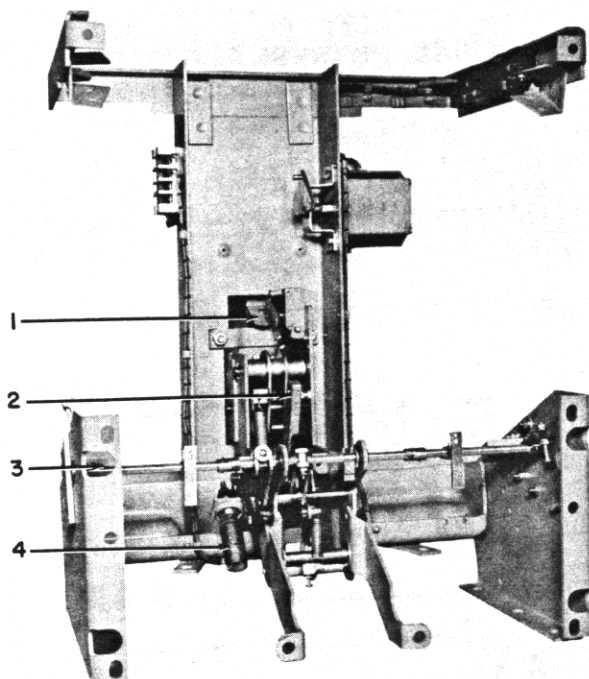
If the gap is under the required minimum, it is usually possible to form the arcing contacts and obtain the required dimensions. To form the contacts, place a piece of conduit, approximately two feet long, over the contact and form the contact

either forward or backward. If the proper dimensions are still not obtained, the movable arcing contacts should be replaced.

If it has been necessary to make any adjustments while obtaining proper contact sequences, the contact wipe and pressure must be checked and, if necessary, adjusted.

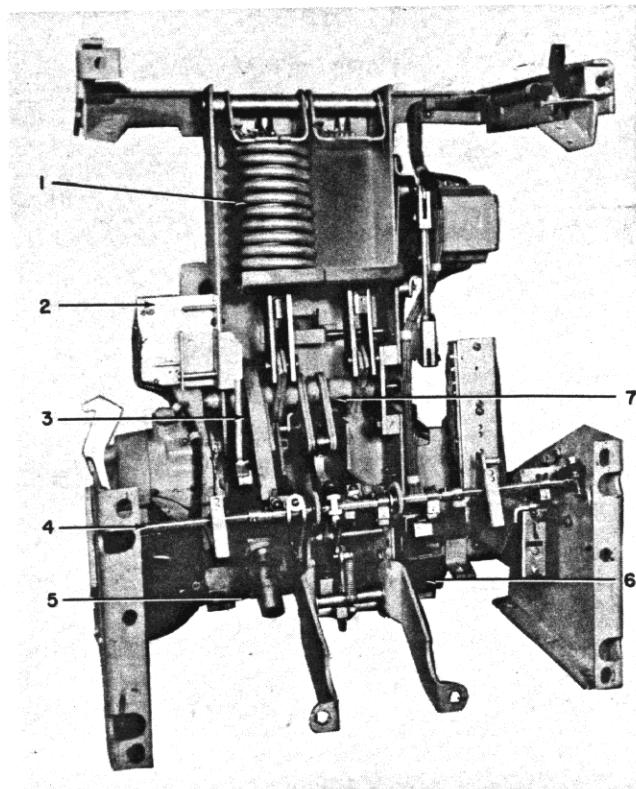
Contact Gap

When the breaker is open, the gap between the movable and stationary contacts should be between $2-5/8$ inches and $2-3/4$ inches. The gap may be adjusted, after contact wipes are maintained within tolerance, by adding or removing washers between the crossbar and the head of the buffer bolt.



- 1 Open and close indicator
- 2 Cam
- 3 Trip shaft
- 4 Shock lock device

Figure 9. Rear view of manually-operated front frame assembly, moving component



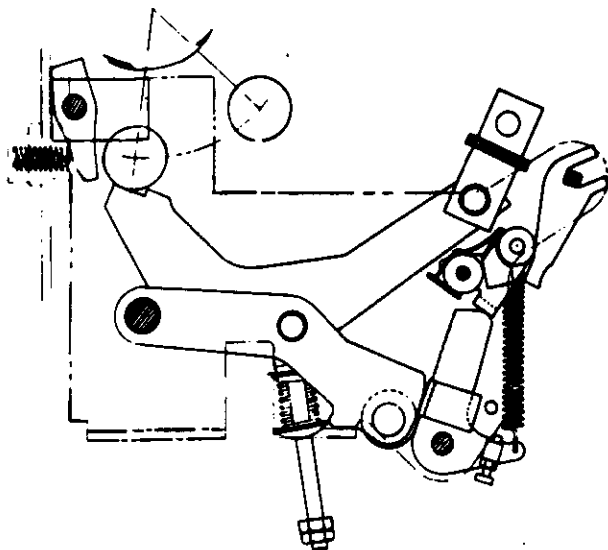
- 1 Closing springs
- 2 Cut-off switch*
- 3 Paddle
- 4 Trip shaft
- 5 Shock lock device
- 6 Shunt trip
- 7 Crankshaft and spring charging arms

*Repair part

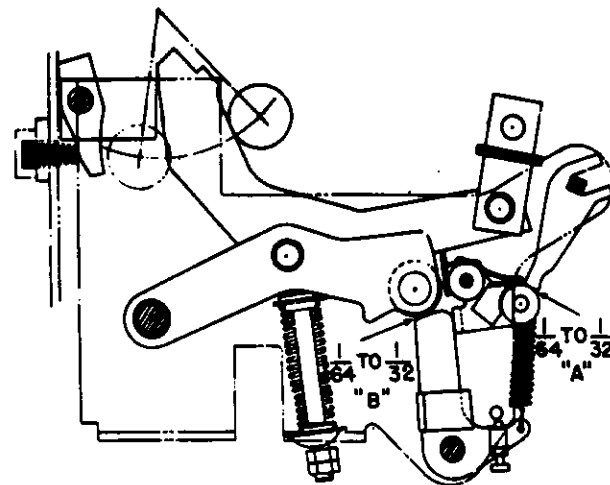
Figure 10. Rear view of electrically-operated front frame assembly, moving component



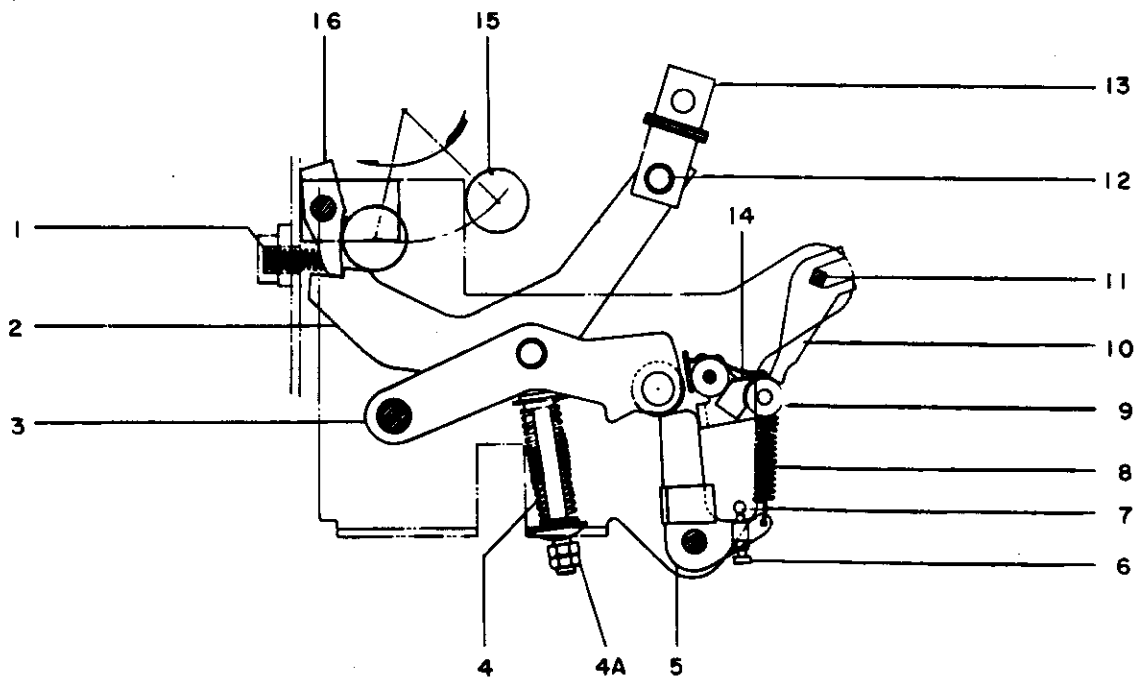
AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R



PART A
MECHANISM IN MOTION BEFORE
RESETTING



PART B
MECHANISM IN RESET POSITION



PART C
MECHANISM IN CLOSED POSITION
(CLOSING SPRING DISCHARGED)

- | | | | |
|-----------------|-------------------------|---------------|--------------------|
| 1 Spring* | 5 Prop | 10 Latch | 14 Mechanism latch |
| 2 Cam | 6 Adjusting screw | 11 Trip shaft | 15 Roller |
| 3 Link | 7 Stop pin (adj. screw) | 12 Clevis pin | 16 Prop |
| 4 Reset spring* | 8 Prop return spring* | 13 Clevis | |
| 4A Nut | 9 Roller | | |

* Repair part

Figure 11. Operating mechanism assembly



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-4

Manual Operating Mechanism

DESCRIPTION

The operating mechanism is used to close the breaker manually by means of an operating handle.

OPERATION

The operating mechanism is supported in a "U" shaped steel side frame in front of the center pole unit. It consists of a cam (8) (see figure 12), linkage (9), prop (7), trip latch (15), reset latch (12), and trip shaft (14).

The breaker is closed manually by rotating the operating handle approximately 150 degrees counterclockwise which allows the cam reset spring (10) to pull the cam (8) into the reset position. The handle is then turned approximately 150 degrees clockwise, thereby causing roller (5) to engage cam (8), thus causing the linkage to straighten, which moves the crossbar (5) (see figure 7) and movable contacts to the closed position.

The breaker mechanism is tripped by rotating the trip shaft (14) and releasing the trip latch,

which causes the linkage to collapse, allowing the opening springs to pull the crossbar and movable contacts forward to the open position. The latch does not reset until the cam is reset by means of the operating handle.

ADJUSTMENTS

All adjustments should be made with the operating mechanism in the reset position, contacts open. (The mechanism of the manual operating circuit breaker is reset by turning the operating handle approximately 150 degrees counterclockwise.)

1. The gap between the trip latch (10) (see figure 11) and the roller (9) of the reset latch should be between 1/64 inch and 1/32 inch. This adjustment can be obtained by turning adjusting screw (6).

2. The center line of the trip latch (10) should pass through the center of the roller (9). This adjustment is maintained by forming the latch buffer stop (14).

SECTION D-5

Electrical Operating Mechanism

DESCRIPTION

The operating mechanism is used to open and close the breaker electrically.

OPERATION

The electrically-operated mechanism includes a motor and a gear reduction unit which charges the closing springs (16) (see figure 13) through a crankshaft (14). The crankshaft has an arm (13), with a roller (12), which rides on the closing cam (2) (see figure 11) of the operating mechanism. The position of this closing cam roller (12) is shown in figure 13. The closing cam is pinned to the center pole unit with a clevis and, through the crossbar, controls the opening and closing of the contacts.

With the breaker "open" and closing springs "discharged," the sequence of operation is as follows:

Charging the Closing Springs

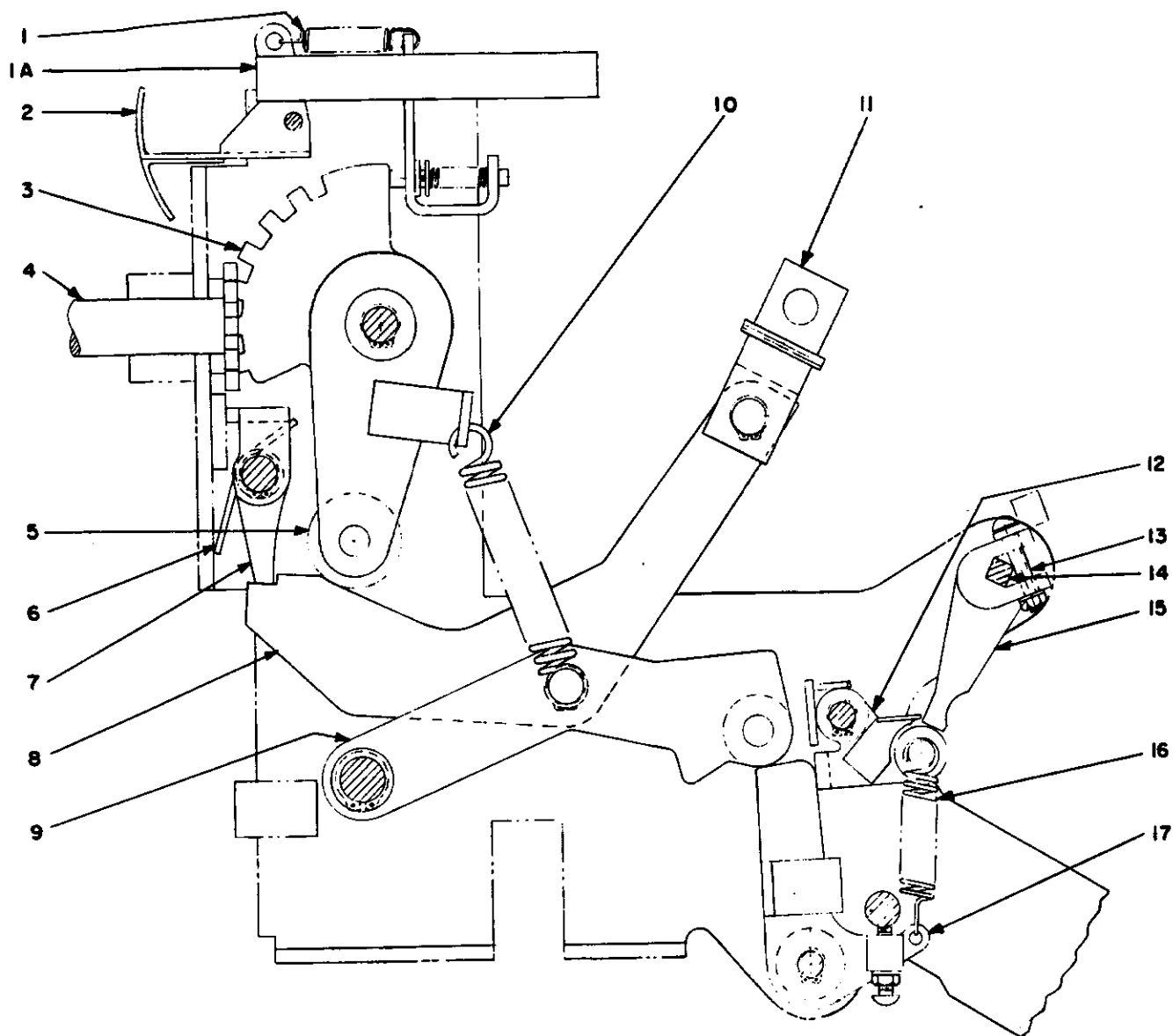
1. The mechanism is in the position shown in figure 11A.

2. The motor (9) (see figure 13) turns the crank (10) which is mounted on the output shaft of the gear reduction unit. The charging roller (7), which is on the face of the crank, has paddle arm (11) bearing on it.

3. As the crank turns, the roller pushes the paddle arm upward, thereby charging the closing



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R



- 1 Spring*
- 1A Indicator link
- 2 Indicator assembly (open - close)
- 3 Crank and roller assembly
- 4 Shaft assembly
- 5 Roller

- 6 Prop spring*
- 7 Prop
- 8 Cam
- 9 Link assembly
- 10 Spring*
- 11 Coupling

- 12 Reset latch
- 13 Latch bolt
- 14 Trip shaft
- 15 Trip latch
- 16 Prop return spring*
- 17 Prop

* Repair part

Figure 12. Mechanism assembly, manually-operated breaker

springs, through the spring charging arm (15) of the crankshaft (14).

4. As the charging roller (7) approaches dead center, the cut-off switches reverse their contacts. This action applies the dynamic brake to the motor which prevents the charging mechanism from coasting to an over-center position allowing discharge of the closing springs.

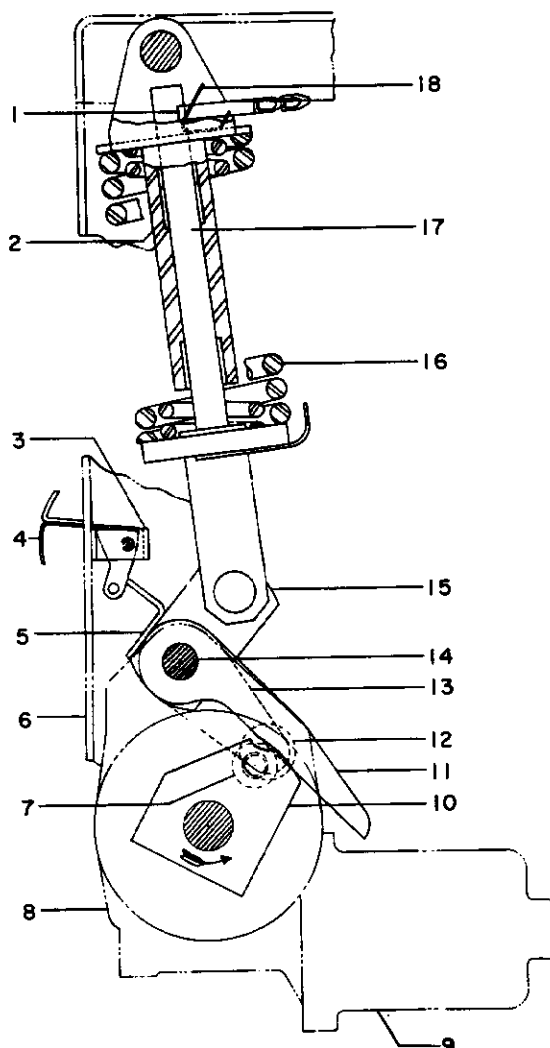
5. The mechanism is now in the reset position (figure 11B), and the breaker is ready to close when a closing signal is given.

Closing the Breaker

1. With the mechanism in the position just described, and the closing springs charged, the ap-



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R



- | | |
|-----------------------|------------------------|
| 1 Pin | 10 Crank |
| 2 Bushing | 11 Paddle |
| 3 Bracket | 12 Closing cam roller |
| 4 Indicator | 13 Closing cam shaft |
| 5 Bracket | 14 Crankshaft |
| 6 Frame | 15 Spring charging arm |
| 7 Charging roller | 16 Closing spring* |
| 8 Gear reduction unit | 17 Push rod |
| 9 Motor* | 18 Clip |
- * Repair part

Figure 13. Closing spring and charging mechanism on electrical breakers

plication of a closing signal will cause the motor to continue to charge the closing springs. As the charging roller (7) (see figure 13) passes its top dead-center position (maximum spring charge po-

sition), the closing springs are free to discharge. Crank (10) can be overdriven independently of the motor so that roller (7) assumes its bottom dead-center position without restraint.

2. As the springs discharge, the rotation of the crankshaft (14) causes roller (15) (see figure 11) to rotate cam (2) and raise clevis (13). Prop (16) holds cam (2) in this position.

3. Raising clevis (13) closes the breaker contacts through the pole base linkage.

Opening the Breaker

Operation of any of the trip devices rotates the trip shaft (11) (see figure 11) which allows the trip latch (10) to release the latch prop (5). This allows the forces of the contact and opening springs to reposition the operating mechanism linkage to the position shown in figure 11B, if the closing springs are pre-charged. In this position the operating cycle may be repeated. If the closing springs are not pre-charged, the operating mechanism linkage will return to the position shown in figure 11A.

ADJUSTMENTS

All adjustments should be made with the operating mechanism in the reset position as shown in figure 11B. (The mechanism should be reset by manual operation with the safety pin in place.)

1. The gap between the trip latch (10) (see figure 11) and the roller (9) of the reset latch should be between 1/64 inch and 1/32 inch "A" dimension. This adjustment can be obtained by turning adjusting screw (6).

2. The center line of the trip latch (10) should pass through the center of the roller (9) to provide 5/32 inch + 1/32-0 inch latch wiper. To maintain this adjustment, the latch buffer stop is on the mechanism frame and can be adjusted by loosening the retaining screws to reposition the mechanism latch (14).

3. The distance between the roller on link (3) and prop (5) should be between 1/64 inch and 1/32 inch "B" dimension. To obtain this gap, advance or retard the nuts (4A) on the bottom of the rod, using the reset spring (4).

SECTION D-6

Motor and Gear Reduction Unit

OPERATION

The motor (9) (see figure 14) is mounted on the side of the gear reduction unit. Through a worm gear (1) and planetary gear train, the motor drives the crank with a reduction of 1000:1 to charge the closing springs.

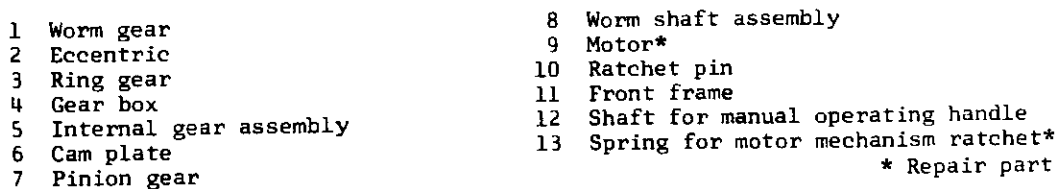


Figure 14. Motor and gear reduction unit



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-7

Manual Trip

DESCRIPTION

The manual trip is used to trip the breaker manually through mechanical linkage.

OPERATION

The manual trip button device protrudes through

the front escutcheon and extends through the operating mechanism frame. When the push button is pushed inward, it rotates the trip shaft counterclockwise, thus opening the breaker. The push button, when released, is brought back to its original position by a return spring.

SECTION D-8

Position Indicator

DESCRIPTION

This position indicator shows whether the breaker is in the open or closed position.

OPERATION

Manual Breakers

When the breaker closes, the movement of the crossbar engages the link (1A) (see figure 12) of the position indicator assembly and moves the indicator down. The indicator target (2) is rigidly fastened to the link and will be in the position shown in figure 12 when the breaker is closed. When the breaker opens, the crossbar moves down allowing the spring (1) to return the indicator target to its original (open) position.

Electrical Breakers

When the breaker opens, the operating rod (5) (see figure 15), which is attached to the crossbar (4), turns the triangular link (6) clockwise, thus moving the link (7) to the rear. The indicator target (2) is rigidly fastened to link (7) and will be in the position shown in figure 15 when the breaker is completely opened.

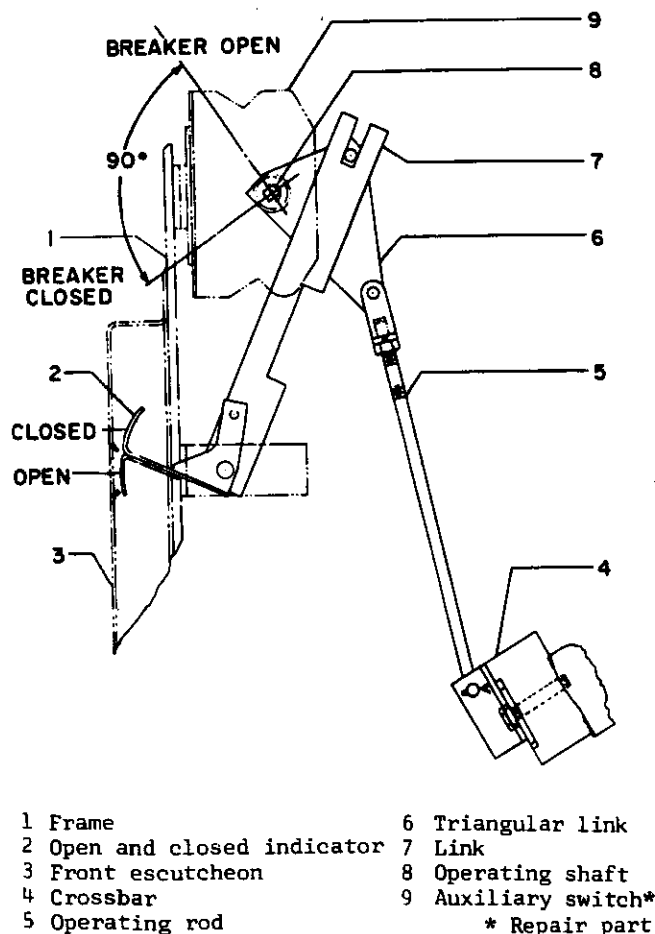


Figure 15. Open and closed indicator and auxiliary switch linkage



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-9

Springs Charged and Discharged Indicator

DESCRIPTION

The charged and discharged indicator shows the position of the closing springs.

OPERATION

When the springs are charged, the charging

roller (7) (see figure 13) pushes up the paddle (11) which is tied to a link. The link is fastened to the indicator target (4) which will be in the position shown in figure 13. When the springs are discharged, the indicator will move down, indicating that the springs are in the discharged position.

SECTION D-10

Auxiliary Switch

DESCRIPTION

The auxiliary switch is used in various control circuits to make and break circuits as the circuit breaker is opened and closed.

OPERATION

The auxiliary switch is mounted on the left side of the front frame (looking from the front). As the cross-bar (4) (see figure 15) moves with the contacts to the open or closed position, it operates a triangular link (6), rotating the operating shaft (8) of the auxiliary switch. This shaft, through its cams, opens and closes the auxiliary switch contacts. Normally, the top terminals of the switch are "a" contacts (open when the breaker is open) and the bottom terminals are "b" contacts (open when the breaker is closed).

REVERSAL OF CONTACTS

In order to change "a" contacts into "b" contacts or vice versa, proceed as outlined in the following paragraphs.

Top Contacts (Normal "a" Contacts)

1. Remove top and bottom covers (4 and 6) (see figure 16).

2. Remove auxiliary switch from the breaker and place in position shown in figure 16A.

3. Unscrew four tie bolts (2) and remove end plate (5).

4. Remove pin (16).

NOTE

The pin is in parallel with the arrow on the auxiliary switch shaft (3).

5. Lift top cam (14) off the shaft (3), rotate 90 degrees, and turn it upside down.

6. Replace cam (14) on shaft (3). It should now be in the position shown in figure 16C.

7. Replace all parts in the reverse order of disassembly.

Bottom Contacts (Normal "b" Contacts)

1. Follow steps 1, 2 and 3 outlined for top contacts in the preceding paragraph.

2. Lift top cam (14) (see figure 16) off the shaft (3).

3. Lift top cam follower (11) off its pivot pin.



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NOTE

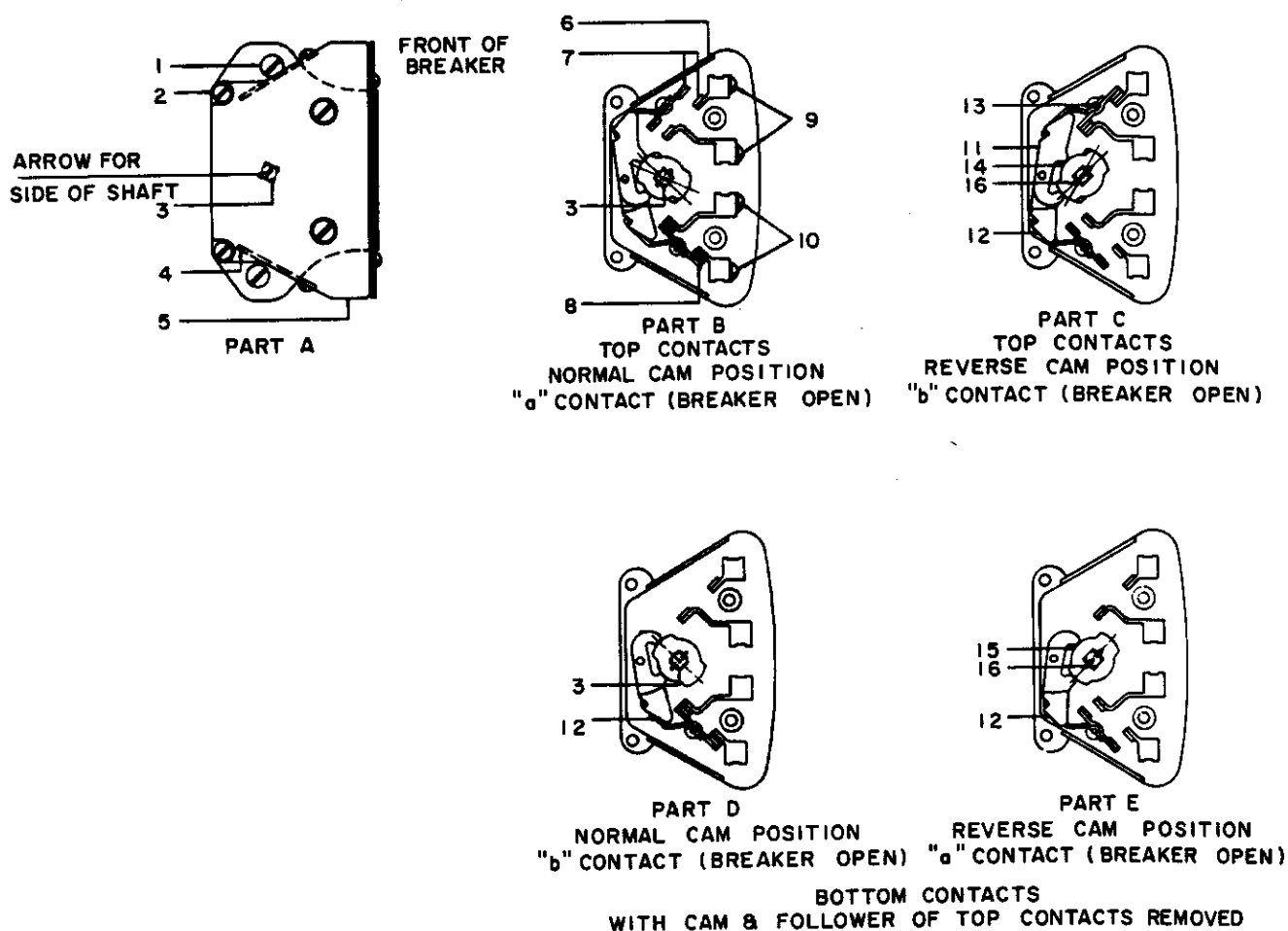
Do not allow contact pivot pin (13) to drop out.

4. Lift bottom cam (15) off the shaft (3), rotate it 90 degrees, and replace it on shaft. It should now be in the position shown in figure 16E.

5. Replace all parts in the reverse order of disassembly.

NOTE

The adjustments described in the preceding two paragraphs can be made on any desired stage; each stage (one set of top and bottom contacts) can be individually lifted off the shaft. In replacing stages, be sure to check cam positions against the diagrammatic sketches shown in figures 16A, B, C, and D.



- 1 Mounting screws
- 2 Tie bolt
- 3 Auxiliary switch shaft
- 4 Bottom cover
- 5 End plate
- 6 Top cover
- 7 Top contacts
- 8 Bottom contacts
- 9 Top terminals

- 10 Bottom terminals
- 11 Top cam follower
- 12 Bottom cam follower
- 13 Contact pivot pin
- 14 Cam (top)
- 15 Cam (bottom)
- 16 Pin

* Repair part

Figure 16. Auxiliary switch*



AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R

SECTION D-11

Shock Lock

DESCRIPTION

The purpose of the shock lock is to prevent the breaker from opening because of shock.

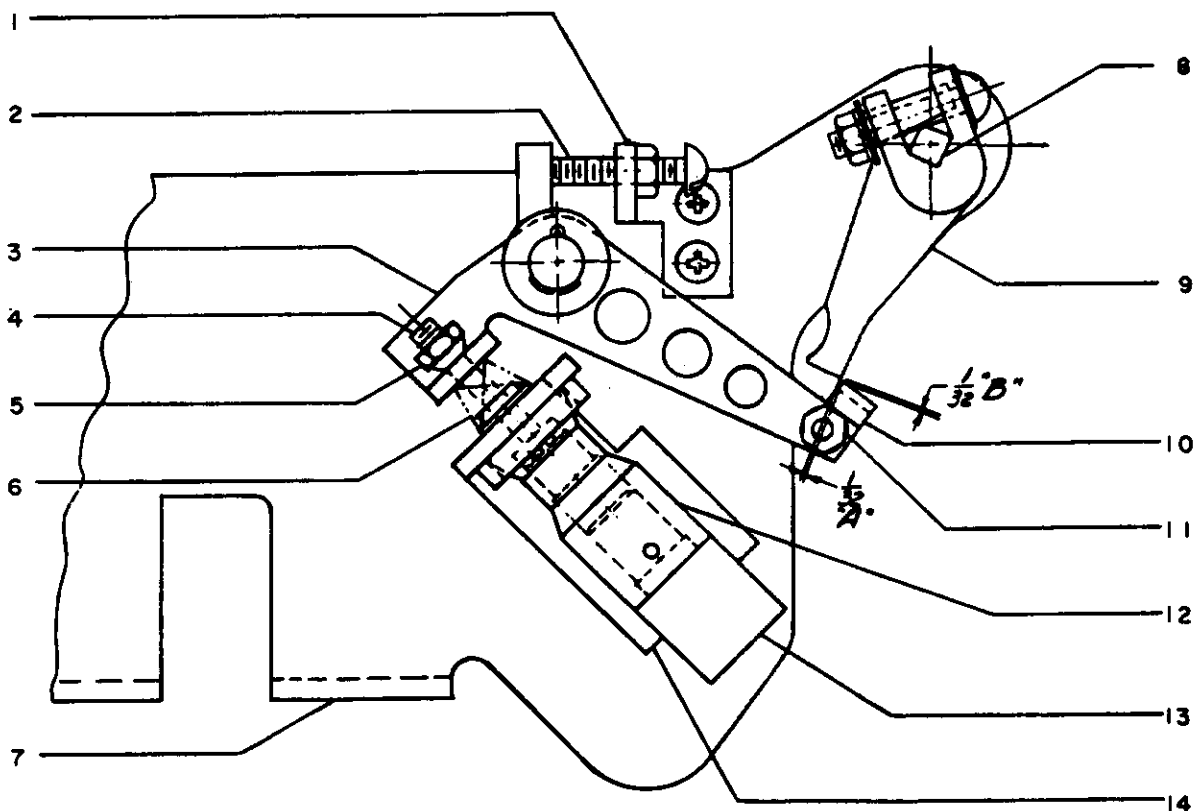
the weights (12 and 13) force latch arm (3) over latch (9), thereby preventing the trip shaft (8) from rotating and tripping the breaker. After the shock subsides, the lever return spring (6) will return the latch arm (3) to its original position.

OPERATION

The shock lock consists of weights (12 and 13) (see figure 17), latch arm (3) and a latch (9). The weight and latch arm assemblies are mounted on the right side of the mechanism frame and the latch is mounted on the trip shaft (8). When a shock occurs,

ADJUSTMENTS

The adjusting nut (11) (see figure 17) and screw should be set on the serrated portion of the mating surface of the latch arm (3). Plate (10) should be firmly seated before tightening the adjusting nut (11).



- 1 Bracket
- 2 Adjusting screw
- 3 Latch arm
- 4 Adjusting screw
- 5 Stop nut
- 6 Spring*
- 7 Mechanism frame

- 8 Trip shaft
- 9 Latch
- 10 Latch plate
- 11 Adjusting nut
- 12 Upper weight
- 13 Lower weight
- 14 Mounting bracket * Repair part

Figure 17. Shock lock device



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The "B" adjusting screw (2) should be set so that the "B" dimension is 1/32 inch maximum. The adjusting screw (4) is used to tighten the tension on spring (6) and to keep weights (12 and 13) taut. To check the operation of the shock lock to make sure that it will not interfere with the tripping of the breaker, proceed as follows:

WARNING

WHEN CHECKING THE OPERATION OF THE SHOCK LOCK, BE SURE THAT ALL MEMBERS OF THE OPERATOR'S BODY ARE CLEAR OF THE MOVING PARTS ON THE BREAKER.

1. Close breaker.
2. Hold the weight in the deflected position.
3. Push the trip button on the breaker front escutcheon.
4. Release the weight while maintaining pressure on the trip button.
5. The shock lock should reset and should not prevent the breaker from opening.



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SECTION D-12

Electrical Closing Devices and Controls

OPERATION

The closing switch, relay and motor mechanism are provided for closing the breaker electrically.

DESCRIPTIONS

Motor Power Switch

The motor power switch (2) (see figure 3) is located on the front escutcheon and is used to turn the motor power off and on.

Closing Switch

The closing switch is located on the bottom of the front escutcheon behind the closing button (4) (see figure 3) and is mounted on the front frame.

Control Relay

The control relay (5) (see figure 4) is mounted on a plate to the left of the front escutcheon. It is used to open and close the motor circuit.

Cut-off Switches

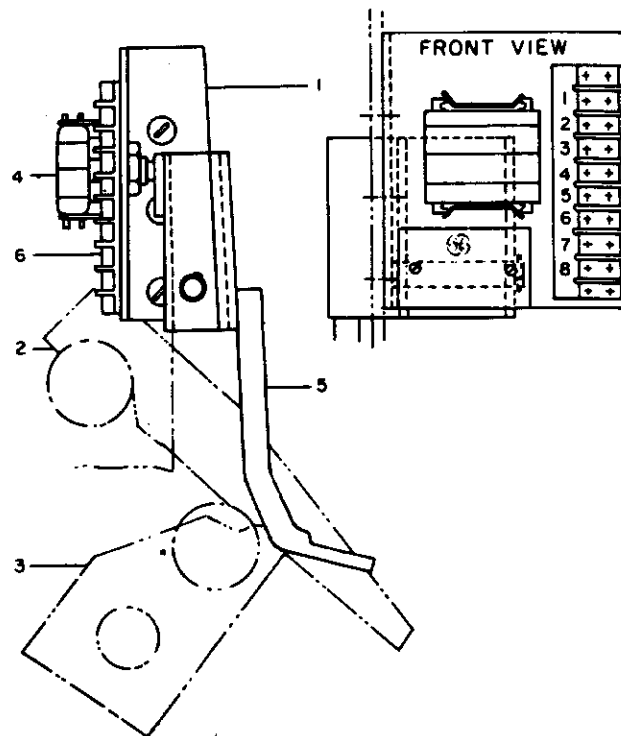
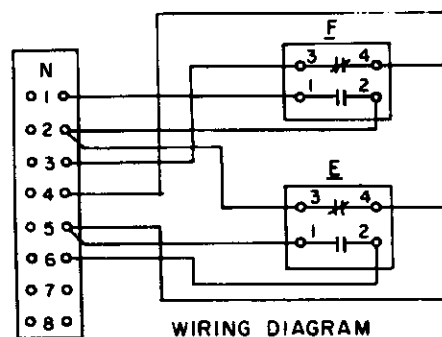
The motor cut-off switches are mounted as shown in figure 18. In this position, the closing springs are charged. When lever (5) reaches a predetermined position, the cut-off switches operate.

ADJUSTMENTS

The switch assembly is pre-adjusted at the factory and no further readjustment should be required.

If considered necessary shipboard check of the adjustments should be made as follows:

Obtain positive toggling of the F and E switch by forming Part 5, figure 18. The switches must toggle as Part 5 climbs the step on Part 3.



- | | |
|--------------------|------------------------|
| 1 Mounting bracket | 4 Motor cut-off switch |
| 2 Paddle | 5 Lever |
| 3 Crank | 6 Terminal block |

*Repair part

Figure 18. Cut-off switch*



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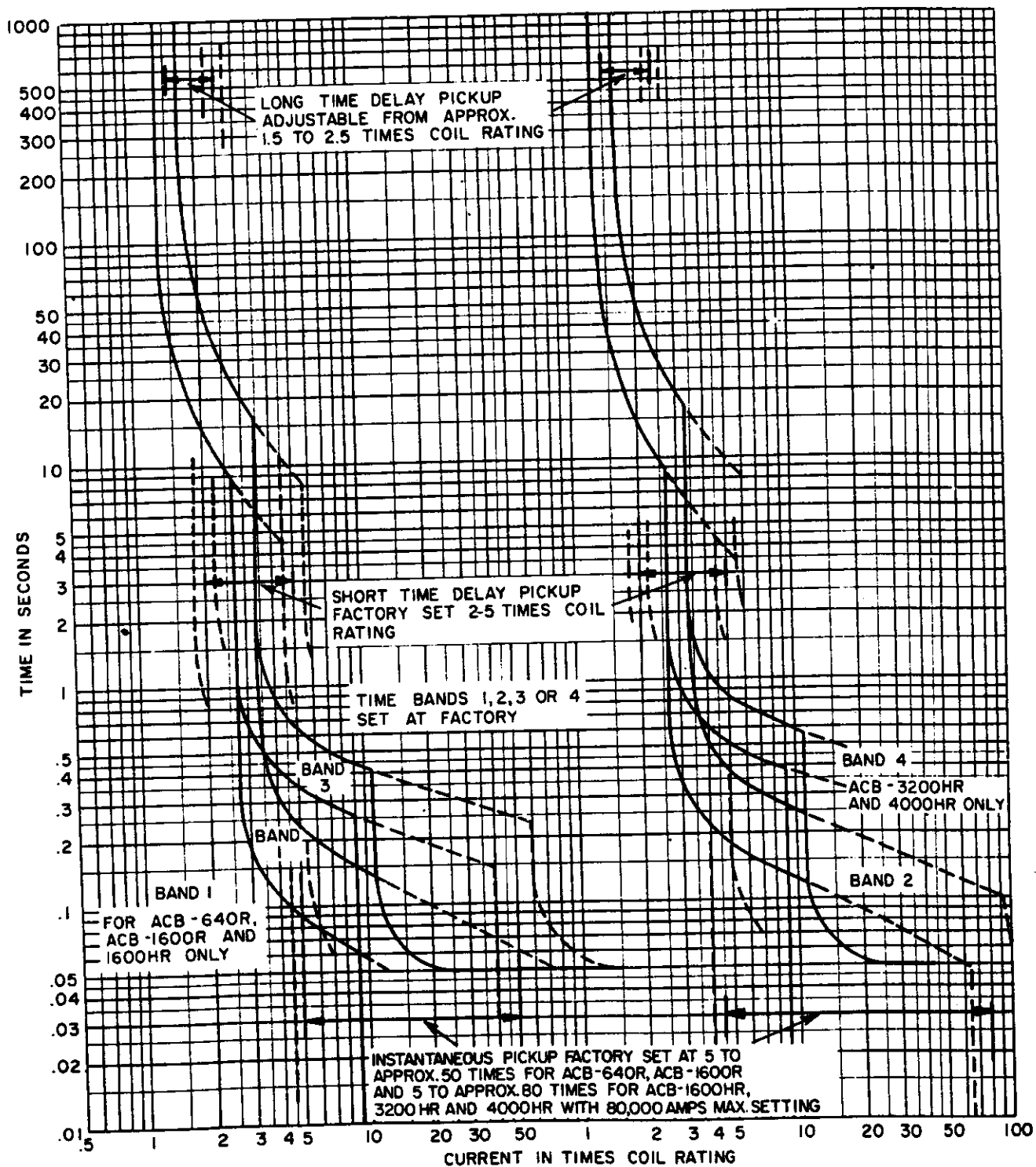


Figure 19. Line-current characteristic curves



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SECTION D-13

Series Overcurrent Trip Device

DESCRIPTION

The series overcurrent trip device will cause the breaker to open within a predetermined time range depending on the magnitude of the fault current.

OPERATION

The series overcurrent trip device can be provided with the following tripping combinations:

1. Long-time delay, short-time delay, and instantaneous tripping
2. Long-time delay and short-time tripping
3. Long-time delay and instantaneous tripping
4. Short-time delay and instantaneous tripping
5. Short-time delay tripping only
6. Instantaneous tripping

Short-time-delay Tripping (Factory Adjustment Only)

The armature (7) (see figure 20) is restrained by a calibrating spring (8). After the magnetic force produced by an overcurrent condition overcomes this restraining force, the armature movement is further retarded by an escapement mechanism which produces an inverse time-delay characteristic. The mechanism is shown in figure 20A.

Long-time-delay Tripping (Three Settings Available)

The armature (11) (see figure 20) is restrained by a calibrating spring (12). After the magnetic force produced by an overcurrent condition overcomes this restraining force, the armature move-

ment is further retarded by the flow of silicone oil in a cylinder (16). This mechanism produces an inverse time-delay characteristic. The mechanism is shown in figure 20B.

Instantaneous Tripping (Factory Adjustment Only)

Non-adjustable instantaneous tripping is accomplished when the magnetic force overcomes the force of a heavy restraining spring (19) (see figure 20) connected between the armature and the support fastened to the frame of the device.

When instantaneous tripping is used in conjunction with long-time-delay tripping, the heavy instantaneous spring effectively connects the armature to the dashpot for overcurrents of low magnitude. For high levels of overcurrent, the force on the magnet is sufficient to stretch the instantaneous spring and allow the armature to move to the closed air gap position independently of the long-time-delay dashpot.

ADJUSTMENTS

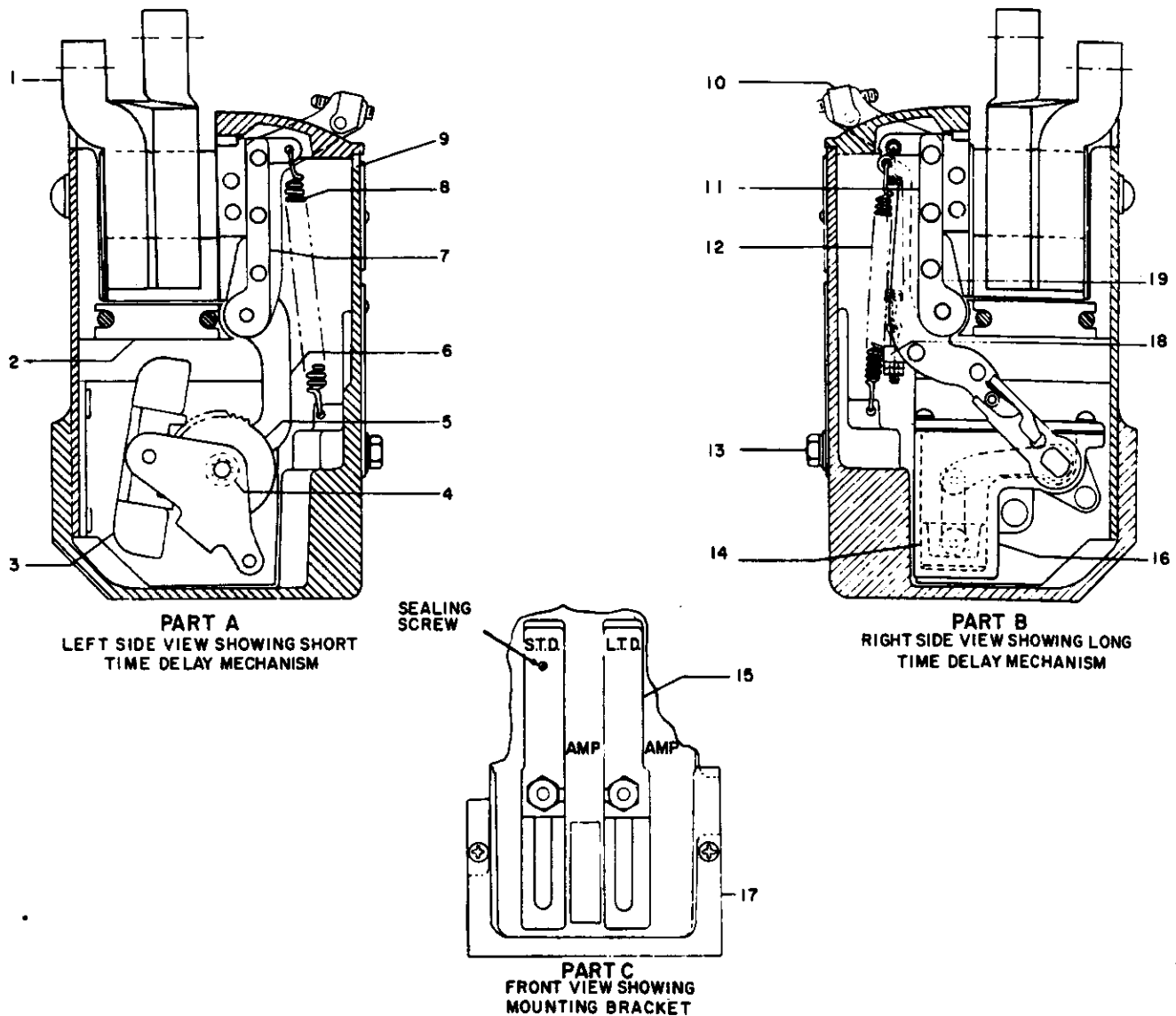
Calibration clamping nuts (13) (see figure 20) are used to set the desired pickup for the long-time-delay element.

To adjust for approximately 1/32-inch over-travel of trip arm (10) after tripping:

1. Check trip latch engagement. (See "Adjustments" in Section D-4 or D-5, and figure 11.)
2. Loosen the lock nut and turn the adjusting screw on the trip arm (10). The screw should not touch the trip paddle when the breaker is "open" and the latch is reset, but should have a clearance not exceeding 1/32 inch.
3. Tighten the adjusting screw lock nut on the trip arm.



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- 1 Series coil
- 2 Magnet
- 3 Pallet
- 4 Pinion
- 5 Escape wheel
- 6 Driving segment
- 7 Short-time-delay armature
- 8 Short-time-delay calibration spring
- 9 Plastic case
- 10 Trip arm

- 11 Long-time-delay armature
- 12 Long-time-delay calibration spring
- 13 Calibration clamp nut
- 14 Plunger
- 15 Calibration plate
- 16 Cylinder
- 17 Clamp
- 18 Spring holder
- 19 Instantaneous trip spring

Figure 20. Series overcurrent trip device



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SECTION D-14

Overcurrent Lockout Device

DESCRIPTION

The overcurrent lockout device is mounted on the left side of the mechanism frame (looking from front). This device will cause a breaker to be trip-free after operation of one of the protective trip devices. The lockout device can be reset by operation of the manual trip button on the front escutcheon. This device also operates a switch with two sets of contacts, one normally open, the other normally

closed. This switch may be used to open or close an external circuit, giving a bell or light indication of a protective trip device operation.

OPERATION

The lockout device is operated by the movement of the breaker's crossbar. The device operating link (2) (see figure 21) is engaged with the breaker crossbar side-link pin (1), thereby operating the

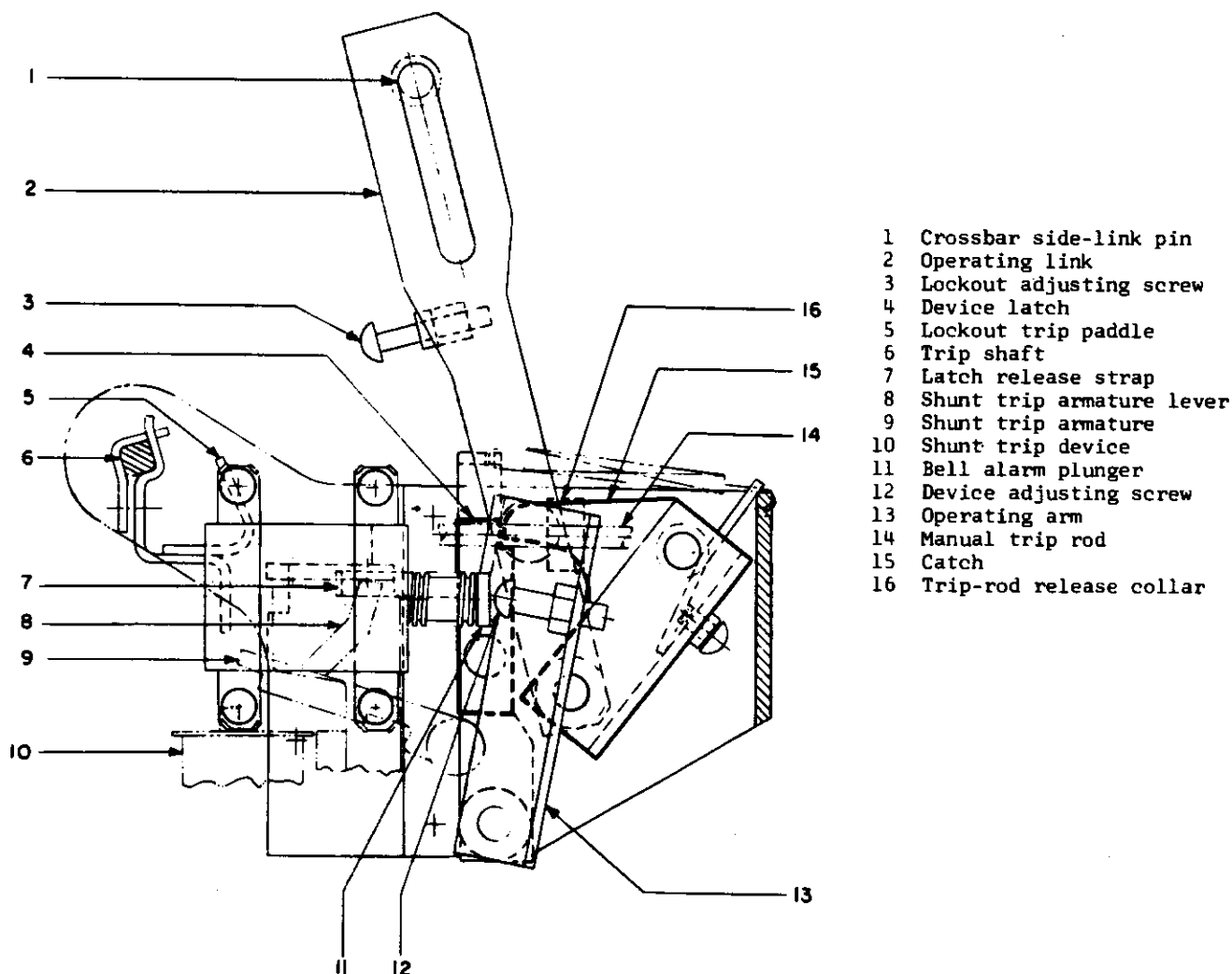


Figure 21. Overcurrent lockout device

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device whenever the breaker is tripped by the over-current trip devices, the undervoltage device and the drawout trip interlock. The shunt trip device and the manual trip button will defeat the device. The lock-out device can be reset only by the manual trip button on the front escutcheon.

ADJUSTMENTS

1. Adjust the lockout device latch (4) (see figure 21) so that a clearance of $1/16$ inch \pm $1/64$ inch is maintained with the catch (15) when the breaker is closed.

2. With the breaker fully open, adjust the device adjusting screw (12) on the operating arm (13) for an over-travel of $1/16$ to $3/32$ inch after the device contacts are just touching. This will assure that the device is operated when the breaker is tripped by an overcurrent or undervoltage condition, and by the drawout trip interlock.

3. The lockout adjusting screw (3) should be adjusted so that it engages the lockout trip paddle (5) and displaces the trip shaft (6) when the breaker is opened. This assures that the breaker is locked open until the device is reset as previously described.

4. With the manual trip button fully depressed, position the trip-rod release collar (16) on the trip rod (14) so that the latch (4) and catch (15) are disengaged before the breaker opens.

5. This device is equipped with latch release strap (7) which is engaged by the shunt trip armature lever (8) when the shunt trip device is operated. This defeats the device when the shunt trip device operates. The latch release strap (7), which is a part of the device latch (4), must be formed to hook around the shunt trip armature lever (8) in a manner that will assure that the device latch and catch are disengaged before the breaker opens.

SECTION D-15

Shunt Tripping Device

DESCRIPTION

The shunt tripping device provides a means for tripping the breaker by using a remote switch or relay contacts.

OPERATION

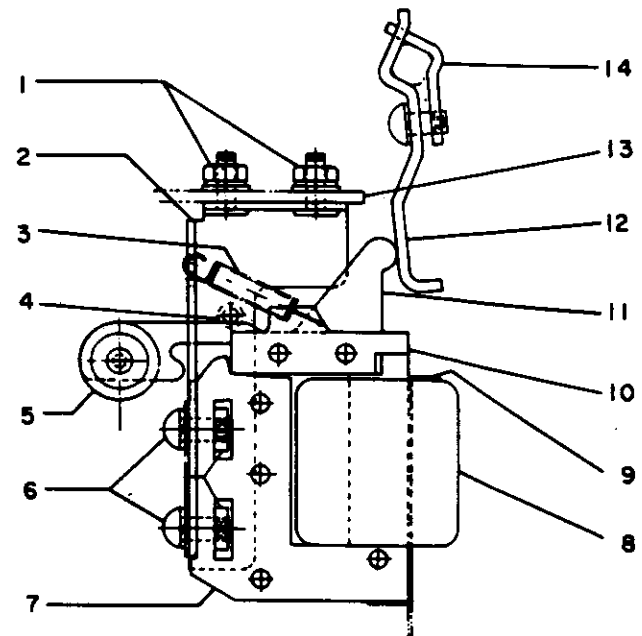
The shunt tripping device is mounted on a bracket attached to the left side of the operating mechanism (looking from the front).

A remote switch or relay contacts are used to close the circuit of the device. This causes the armature arm (11) (see figure 22) to engage the trip paddle (12), thereby tripping the breaker. The spring (3) is used to return the armature (10) to the neutral position after the breaker trips.

To prevent overheating, the momentary-rated coil (8) is cut off by contacts of the auxiliary switch which are open when the breaker is open.

ADJUSTMENTS

When the breaker is tripped, the armature should have $1/32$ -inch to $1/16$ -inch overtravel. If any adjustment is necessary to provide this amount of overtravel, the trip paddle (12) is formed in or out accordingly.



1 Nut	8 Coil*
2 Frame	9 Clamp
3 Spring*	10 Armature
4 Rivet	11 Armature arm
5 Weight	12 Trip paddle
6 Screws	13 Mechanism frame
7 Magnet	14 Clamp

* Repair part

Figure 22. Shunt trip device



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SECTION D-16

Undervoltage Trip Device

DESCRIPTION

The function of the undervoltage trip device is to trip the breaker when the undervoltage coil is de-energized by loss of voltage.

OPERATION

The undervoltage trip device is mounted on a bracket attached to the left side of breaker frame (looking from front). The undervoltage trip device consists of a coil (8) (see figure 23), magnet (7), armature (3), and spring (4). With rated voltage applied, the armature is attracted to the magnet. If the voltage falls below the predetermined value, the magnet releases the armature. The spring then pulls the armature upward, rotating the trip paddle (14), thereby tripping the breaker. This device will keep the breaker trip-free until the rated voltage is applied and the coil is energized.

ADJUSTMENTS

An adjusting screw (13) (see figure 23) in the trip paddle (14) is used to obtain from 1/32-inch to 1/16-inch overtravel after tripping the breaker.

Adjusting screw (2) and spring (4) are used respectively to adjust the armature so that it will pick up at 80 percent of rated voltage and drop out at between 30 and 60 percent of rated voltage.

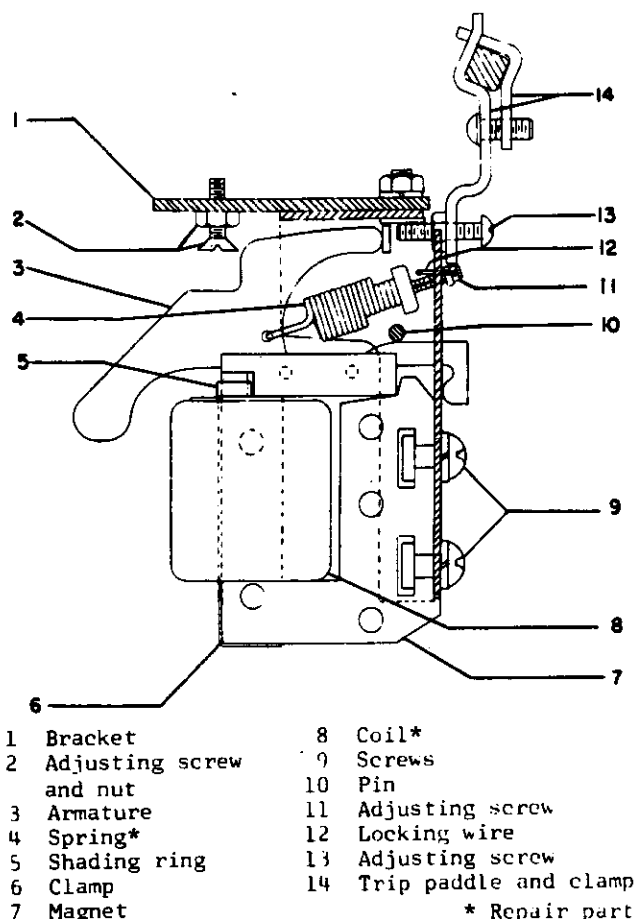


Figure 23. Undervoltage trip device



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SECTION D-17

Undervoltage Lockout Device

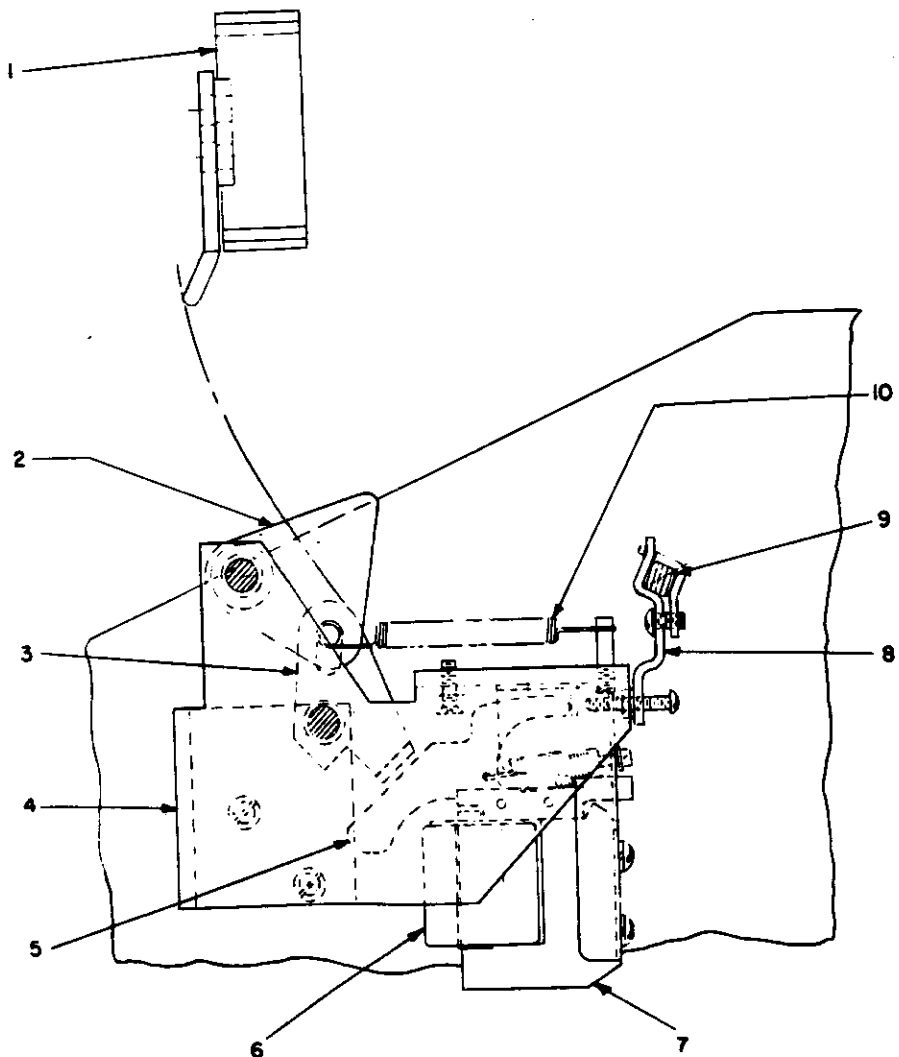
DESCRIPTION

The undervoltage lockout device holds an open breaker trip-free when the coil of the device is de-energized. When the breaker is in the closed position, the linkage operated by the breaker crossbar positions itself to mechanically hold the undervoltage device armature in the closed air gap position to prevent tripping in the event the undervoltage device coil is de-energized. This feature when used in conjunction with normally-closed auxiliary contacts of an alternate breaker presents

a convenient method of mechanically interlocking two or more breakers to assure that no two breakers may be closed at the same time.

OPERATION

The undervoltage lockout device is mounted on a bracket attached to the left side of the breaker frame (looking from front). This device is identical to the undervoltage trip device (Section D-16) with the addition of the lockout feature. The lockout feature consists of arm (2) (see figure 24), spring

- 
- The diagram illustrates the mechanical components of the undervoltage lockout device. It shows a cross-section of the device with various parts labeled with numbers 1 through 10. A separate view at the top shows the device's position relative to the breaker crossbar. The main assembly includes a bracket (4) mounted on the breaker frame, which houses the armature (5), coil (6), magnet (7), trip paddle (8), trip shaft (9), and spring (10). An arm (2) is shown extending from the crossbar (1) to the lever (3), which is part of the lockout mechanism.
- 1 Breaker crossbar
 - 2 Arm
 - 3 Lever
 - 4 Bracket
 - 5 Armature
 - 6 Coil*
 - 7 Magnet
 - 8 Trip paddle
 - 9 Trip shaft
 - 10 Spring*

* Repair part

Figure 24. Undervoltage lockout device



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(10), and lever (3). The lockout linkage is activated by the movement of the breaker crossbar (1). When the breaker is closed, the crossbar and lockout linkage is in the position shown and the undervoltage device is defeated by the lever holding the armature in the closed air gap position. When the breaker opens, the crossbar moves down, forcing the arm down and thus moving the lever up, releasing the

armature (5) and allowing the undervoltage device to operate normally.

ADJUSTMENTS

The adjustments for the undervoltage lockout device are the same as for the undervoltage trip device (refer to Section D-16).

SECTION D-18

Drawout Interlock Device

DESCRIPTION

The drawout interlock prevents the breaker from being racked in or out of the "connected" position until after the breaker is tripped open.

OPERATION

The circuit breaker element is equipped with a positive mechanical interlock (4) (see figure 4) which

engages the trip interlock cam (4) (see figure 2) in the skeleton enclosure and prevents the breaker from being racked in or out of the "connected" position until after the breaker is tripped open. This interlock also holds the breaker trip-free and prevents the breaker from being closed while it is being racked in or out of the "connected" position.

SECTION D-19

Movable and Stationary Secondary Disconnect Assemblies

DESCRIPTION

Secondary disconnect assemblies permit the withdrawal of a drawout-type circuit breaker to the completely disconnected position without secondary wiring removal. The secondary disconnect assembly consists of two separate assemblies: the movable assembly mounted on the breaker, and the stationary assembly mounted in the stationary component.

The movable secondary disconnect assembly consists of two molded pieces bolted together which hold seven individual contacts and springs. The stationary secondary disconnect assembly consists of a compound base with seven contact strips. The contact

strips are separated by a barrier wall which provides adequate creepage distance between contacts. Three assemblies to provide a total of 21 circuits may be mounted per breaker.

OPERATION

When the breaker is in its final "connected" position, the secondary disconnect assemblies are engaged. In this position the contact spring (5) (see figure 25) forces the contact (3) of the movable secondary disconnect assembly against the contact strip (2) of the stationary disconnect assembly, making a good electrical contact.



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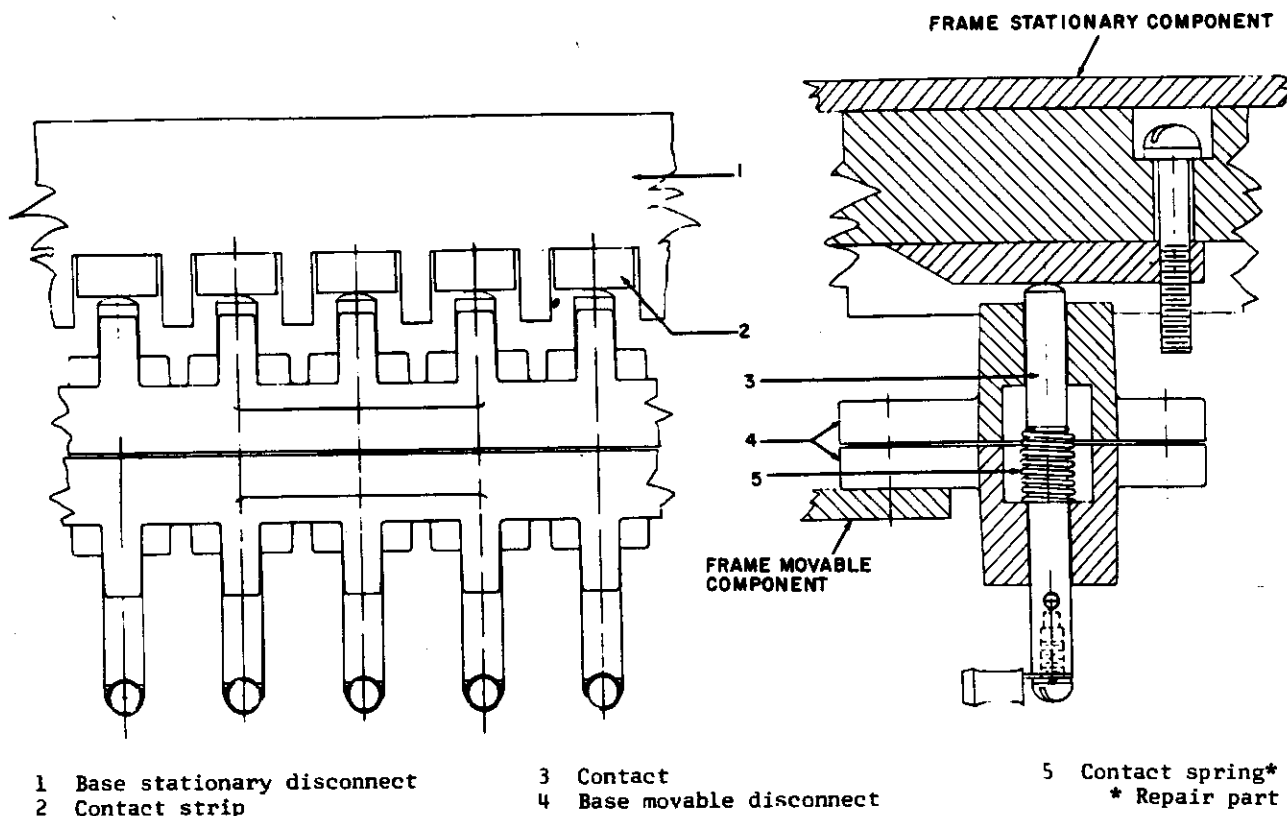


Figure 25. Movable and stationary secondary disconnect assemblies

SECTION D-20

Movable Primary Disconnect Assembly

DESCRIPTION

The purpose of the disconnect is to serve as a connecting device for mounting the breaker to the stationary component.

OPERATION

The disconnects are attached to the circuit breaker studs on the rear side of the breaker.

Each disconnect consists of eight contact fingers (7) (see figure 26) secured to each breaker stud

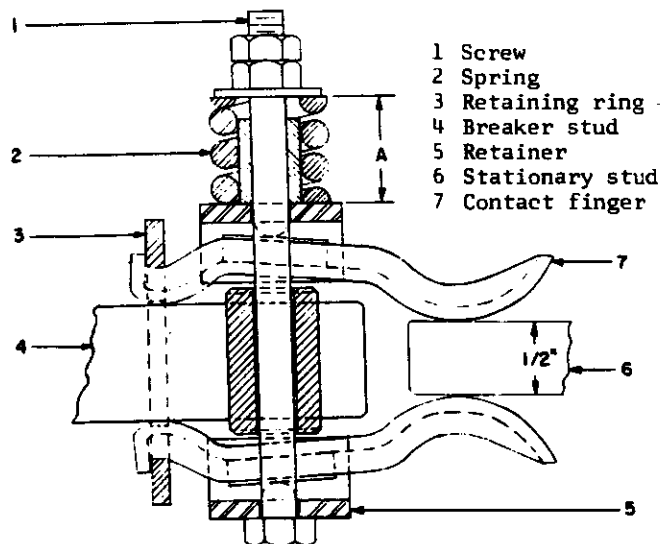


Figure 26. Primary disconnect assembly

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(4) by screw (1), retainers (5) and retaining rings (3). A spring (2) exerts pressure on the contact fingers when engaging the stationary studs (6). Retainers (5) and retaining rings (3) also serve to maintain the proper alignment of the fingers when engaging the stationary studs.

ADJUSTMENTS

The disconnect fingers should exert 80 to 100 pounds pressure on stationary stud (6) (see figure 26). Insert 1/2-inch thick bar in place of the stationary stud (6), and tighten nut and locknut on screw (1) until deflected length "A" of spring (2) is 25/32 inch.

SECTION E-1

Replacement of Repair Parts

NOTE

Before replacing any part it is strongly recommended that the operator familiarize himself with all parts involved in making the replacement.

1. Separation of Front and Back Frames of Moving Component

In order to replace the contacts, operating mechanism, or the overcurrent devices, the front frame must be separated from the back frame. To separate the two frames proceed as follows:

MANUALLY-OPERATED BREAKERS

- a. With the breaker open, remove the two opening springs (3) (see figure 5) from the outside of the pole units.
- b. Remove clevis pin (12) (see figure 11) from the center pole unit.
- c. Remove the six nuts which hold the back frame to the front frame and then separate the two frames.
- d. Replace parts in reverse order.

ELECTRICALLY-OPERATED BREAKERS

- a. The breaker contacts must be open with the safety pin in place (see Section B-1).
- b. Remove the two opening springs (3) (see figure 5) from the outside pole units.
- c. Remove the clevis pin (12) (see figure 11) from the center pole unit.
- d. Remove the six nuts from the back frame using a socket wrench with an extension. This includes the two nuts at the top of the frame.

- e. Remove the auxiliary switch operating rod (5) (see figure 15).

- f. Check along trip shaft for mechanical interference or connection between the overcurrent trip device and the trip paddles. Remove the mechanical connection if present; if interference exists, use extreme care when removing or reassembling the front and back frames to avoid mechanical breakage of trip devices. In reassembling the front and rear frames, the two frames should be positioned vertically so that the trip shaft is horizontally aligned.

NOTE

It is recommended that the breaker be fastened to a suitable mounting base with the front frame supported by a sling or hook as the bolts are being installed or removed.

CAUTION

CAREFULLY POSITION THE LOCATION OF CRANE HOOKS NEAR THE VERTICAL CHANNEL WHEN REMOVING OR REPLACING THE FRONT FRAME.

2. Replacement of Arc Quenchers (See Figure 6)

To replace arc quenchers, remove the channel-shaped retaining bar by removing two screws and two nuts. The arc quenchers can now be removed by lifting out and up, free of the movable arcing contacts. To disassemble these arc quenchers proceed as follows:

- a. Remove screws holding spacer block (9).
- b. Remove spacer block (9), steel plate (8), and compound support (7).



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c. Rock muffler (6) slightly and remove. The inner barriers (5) can now be removed for inspection.

d. Remove nut and withdraw stud (1).

e. Remove cap (2). The side barriers (3) and pocket barriers (4) should be free.

f. Reassemble and replace the arc quencher in the reverse order. Tighten the fastenings after replacement.

3. Replacement of Stationary Arcing Contacts (See Figure 8)

a. Remove arc quenchers (see Section E-1-2).

b. Remove top contact block (3) and stop (2) by removing two screws. Remove insulation (10).

c. Remove pin (8) and free the stationary contacts (4) and springs (5 and 6).

d. Install new springs and stationary arcing contacts in the reverse order.

e. Adjust contact wipe and pressure (see Section D-3).

4. Replacement of Movable Arcing Contacts (See Figure 8)

The movable arcing contacts should be replaced when the stationary arcing contacts are replaced.

a. Separate the front frame from the back frame (see Section E-1-1).

b. Remove pins (18) and (29) and withdraw the contacts.

c. Reassemble parts in the reverse order. The arcing contacts should be spaced by adding shims between the arcing contact and the insulating link (19) to assure proper alignment. The arc quencher may be used to restrict, to a minimum, sidewise motion of the movable contact.

5. Replacement of Stationary Intermediate and Main Contacts (See Figure 8)

a. Remove stationary arcing contacts (see Section E-1-3).

b. Loosen the four cap screws which hold the upper stud (33) to the pole unit base (25).

c. Remove the Truarc retaining rings from pin (35) and remove pin. The contacts can now be lifted out.

d. Reassemble contacts in the reverse order. Be careful to replace the intermediate contact in the proper position.

6. Replacement of Movable Intermediate and Main Contacts (See Figure 8)

a. Remove the movable arcing contacts (see Section E-1-4).

b. Loosen spring (24).

c. Slide link (17) to the side and off of pin (16).

d. Slide pins (16) and (27) far enough to the side to allow the movable intermediate and main contacts to be replaced.

e. Reassemble parts in the reverse order.

NOTE

Always check contact wipe and pressure following contact replacement (see Section D-3).

7. Replacement of Mechanism Assembly (See Figure 13)

a. Remove the front frame from the back frame (see Section E-1-1).

b. Remove pins holding spring charging arm (15) to the closing spring assembly (electrical breakers only).

c. Remove two bolts underneath frame and two bolts from the front of the frame.

d. Remove any wiring which is attached to the mechanism frame.

e. Note the position of the trip paddles on the trip shaft. Remove the dowel pins from the trip shaft couplers which hold the sections of the trip shaft together. The mechanism is now free to be removed.

f. Reassemble the parts in the reverse order. Be sure to replace the trip shaft with the trip paddles in the correct position.

**AIR CIRCUIT BREAKER, NAVY TYPE ACB-1600R****8. Replacement of Auxiliary Switch
(See Figure 16)**

- a. Disconnect all leads to the auxiliary switch.
- b. Remove two mounting screws.
- c. Disengage auxiliary switch shaft (3) from the crank.
- d. Set arrow on new auxiliary switch as shown in figure 16A.
- e. Push auxiliary switch shaft (3) into the square hole in the crank (breaker in open position).
- f. Replace mounting hardware.

**9. Replacement of Shock Lock
(See Figure 17)**

- a. Remove stop nut (5).
- b. Remove weights (12 and 13) and adjusting screw (4) from mounting bracket (14).
- c. Remove spring (6) from between mounting bracket (14) and latch arm (3).
- d. Remove latch arm (3) by removing cotter pin.
- e. Replace in the reverse order and make adjustments as outlined in Section D-11.

10. Replacement of Latch

- a. Remove the latch bolt and remove the wedge by pushing it upward.
- b. Replace in the reverse order, making sure that the wedge lock is tight.

**11. Replacement of Series
Overcurrent Trip**

- a. Remove front frame (See Section E-1-1).
- b. Remove bolts holding the coil to the lower stud.
- c. Remove bracket and mounting screws.
- d. Before installing a new device, check travel of the trip arm: Insert a stiff rod or wire through the right hole in the overload device nameplate and push the armature solidly against the magnet. The trip arm should move at least 3/32 inch. If there appears to be insufficient movement of the

trip arm, or if the armature appears to be binding, the device should not be used.

- e. Replace new device in reverse order.
- f. Adjust device as described in Section D-13 under "Adjustments."

**12. Replacement of Shunt Trip Coil
(See Figure 22)**

- a. Disconnect leads to coil.
- b. Remove magnet (7) and coil (8) from frame (2).
- c. Form lower end of clamp (9) straight and remove.
- d. Remove coil (8) and install new coil in the reverse order of disassembly.

**13. Replacement of Undervoltage
Trip Coil (See Figure 23)**

- a. Disconnect leads to coil (8).
- b. Remove mounting screws and remove magnet (7) and coil assembly.
- c. Straighten laminations around shading ring (5).
- d. Remove shading ring and straighten lower end of coil clamp (6).
- e. Remove coil. Install new coil in reverse order.

**14. Replacement of Primary
Disconnect Spring
(See Figure 26)**

- a. Remove nuts and washer from screw (1).
- b. Lift spring (2) from screw.
- c. Replace spring and assemble parts in reverse order of disassembly.
- d. Adjust pressure as outlined in Section D-20.

**15. Replacement of Primary
Disconnect Contact Finger
(See Figure 26)**

- a. Remove nuts and washer from screw (1).
- b. Lift spring (2) and cylindrical spacer from screw.

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c. Remove upper retainer (5) and lift upper contact fingers (7) with bowtie spacers from under retaining ring (3).

d. Withdraw screw and remove lower retainer (5). The two bowtie spacers will fall free.

e. Remove lower contact fingers (7) from retaining ring (3).

f. Assemble parts in reverse order.

g. Adjust pressure as outlined in Section D-21.

NOTE

The replacement of the following parts pertain to electrically-operated breakers only.

16. Replacement of Motor and Gear Reduction Unit (See Figure 13)

a. Remove the front frame from the back frame (see Section E-1-1).

b. Remove pins from the closing spring charging arm (15).

c. Remove the plates from the right end of crankshaft (14).

d. Slide the crankshaft to the right until the left end of the shaft clears the gear unit housing.

e. Remove the buffer stop which is mounted to the side of the frame and directly over the motor (9).

f. Open the wire connections on the motor and remove the wire attached to the gear unit housing.

g. Remove four bolts on the bottom of the front frame and the bolt at the top of the gear reduction unit. The motor and gear reduction unit can now be removed.

NOTE

If it is desired to replace only the motor unit, disconnect the motor leads and remove only the hardware fastening the motor to the gear reduction unit. When removing the motor only, the front frame should be placed front side down to prevent the oil from escaping from the gear unit. The new motor and gasket may now be replaced in the reverse order. A gasket may be cut out of gasket material by using the gear housing as a pattern.

17. Replacement of Closing Switch

To replace the closing switch, remove the switch from the bracket, remove wiring, and replace with a new switch.

18. Replacement of Cut-off Switches (See Figure 19)

Remove three mounting screws and terminal board wiring and replace with new assembly available in the repair parts list.

19. Replacement of Control Relay

To replace the control relay, remove wiring and two holding screws located on the back of the plate. Replace relay and reconnect wiring.



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SECTION E-2

Repair Parts List

Fig. No.	Index No.	Name of Part	No. Required per Breaker		Contractor's Service Part No.	Manufacturer's Service Part No.	Drawings Part No.
			Man.	Elec.			
7	8	Arcing Contact, Movable	9	9		127A6452P1	2
7	9	Arcing Contact, Stationary	9	9		295B408G3	1
22	8	Coil, Shunt Trip, 115 volts, 60 cycles				K-6275081G25	9
22	8	Coil, Shunt Trip, 450 volts, 60 cycles				K-6275081G27	10
22	8	Coil, Shunt Trip, 120 volts DC				K-6275081G29	11
23	8	Coil, Undervoltage, 450 volts, 60 cycles				K-6275081G31	50
27	53	Contact Bracket, Overcurrent Lockout	1	1		K-3845725G1	53
27	54	Contact Bracket, Overcurrent Lockout	1	1		K-3845725G2	54
27	55	Contact Strip, Overcurrent Lockout	2	2		K-3805658G1	55
7	3	Intermediate Contact, Movable	3	3		293B220G4	6
7	1	Intermediate Contact, Stationary	3	3		459A385G1	4
4	8	Light, 450 volts, 60 cycles				TS-130 Mazda	7
4	8	Light, 125 volts DC				TS-158 Mazda	8
7	4	Main Contact, Movable	9	9		293B220G3	5
7	2	Main Contact, Stationary	9	9		293B221G1	3
13	9	Motor		1		5P66MA9	18
4	5	Relay, 115 volts, 60 cycles				12HGA11T70N	12
4	5	Relay, 125 volts DC				12HGA11T52N	13
8	5	Spring, Arcing Contact, Stationary	9	9		K-6509858	21
8	6	Spring, Arcing Contact, Stationary	9	9		K-6509859	22
11	1	Spring, Cam Prop Return	1	1		412A140	26
27	46	Spring, Closing Switch		1		412A218	46
27	32	Spring, Drawout Plunger	1	1		412A124	32
27	42	Spring, Discharge Indicator		1		365A305	42
27	33	Spring, Drawout Trip Latch Return	1	1		412A269	33
27	38	Spring, Handle Stop	1			365A312	38
12	10	Spring, Linkage Reset	1			K-6203985	39
8	32	Spring, Main Contact, Stationary	12	12		0412A0287	23
27	25	Spring, Manual Trip Button	1	1		412A139	25
11	4	Spring, Mechanism Reset	1	1		0148A2213	43
27	51	Spring, Mechanism Reset	1	1		0148A2214	51
14	13	Spring, Motor Mechanism Ratchet		1		K-6509871	44
5	3	Spring, Opening	2	2		K-6509914	24
12	1	Spring, Open and Close Indicator	1			K-6172558	37
27	56	Spring, Overcurrent Lockout	1	1		K-6509908	56
27	57	Spring, Overcurrent Lockout	1	1		K-6202671	57
27	58	Spring, Overcurrent Lockout	1	1		K-6172529	58
27	59	Spring, Overcurrent Lockout	1	1		412A171	59
27	31	Spring, Pawl on Drawout Handle	1	1		365A313	31
26	2	Spring, Primary Disconnect	12	12		412A222	34
11	8	Spring, Prop to Reset Latch	1	1		K-6403348	27
25	5	Spring, Secondary Disconnect	14	21		K-6403331	35
22	3	Spring, Shunt Trip	1	1		365A325	36
17	6	Spring, Shock Lock	1	1		K-6403315	29
27	28	Spring, Trip Shaft Return	1	1		412A292	28
23	4	Spring, Undervoltage Device	1	1		K-6172594	49
24	10	Spring, Undervoltage Lockout	1	1		K-6372957	60
3	1	Switch, Auxiliary (5 "a" and 5 "b")	1	1		DL-6353562NG-5	15
18		Switch, Cut-off		1		0227A7211G-1	16
3	2	Switch, Motor Power		1		127A6451P1	17
		Retaining Rings and Pliers	1			177L252G2	19
		Retaining Rings and Pliers		1		177L252G3	20

A. TRIP BREAKER BY DEPRESSING TRIP BUTTON, BEFORE OPENING THE COMPARTMENT LINGERED COVER.
B. LIFT RACK UP HANDLE, LOCATED ON LOWER RIGHT SIDE OF BREAKER, THIS WILL TRIP BREAKER IN EVENT STEP A IS OBTAINED.
C. PULL BACK COVER OF BREAKER TO EXPOSE TRIP RELEASE HANDLE.
D. PUSH BREAKER STOP PIN RELEASE HANDLE DOWN AND PULL BREAKER FORWARD TO LIMIT OF ITS TRAVEL. THE BREAKER MAY BE SAFELY INSPECTED AND MAINTENANCE PERFORMED WHILE TRIP RELEASE HANDLE IS HELD DOWN.
E. WAIT UNTIL TRIP RELEASE HANDLE IS IT MAY BE DESIRABLE TO REMOVE THE BREAKER FROM THE RACK UP THAT, THIS IS DONE BY MOVING THE POUND (4) MOUNTING BOLTS, ANCHORING THE BREAKER TO THE RACK-OUT TRAY AND LIFT BREAKER FROM TRAY USING LIFTING STRAP.
F. REMOTE.

- F. MOUNT THE AIR CIRCUIT BREAKER ON RAIL - A) TRAY AND BOLT DOWN WITH FOUR (4) MOUNTING BOLTS.
- G. PULL BREAKER STOP PIN RELEASE HANDLE DOWN AND PUSH THE BREAKER INTO UNIT UNTIL IT REACHES THE RACKING POSITION AND RELEASE BREAKER STOP PIN HANDLE.
- H. PUMP THE RACK-OUT HANDLE FIVE (5) TIMES AND THIS WILL MOVE THE BREAKER COMPLETELY INTO THE UNIT. REVERSE THE RACKET BY LIFTING HANDLE, THEN RELEASE HANDLE.
- J. CLOSE THE COMPARTMENT FRONT HINGED COVER.

NOTE: THE HINGED DOOR OF THE CIRCUIT BREAKER COMPARTMENT SHOULD ALWAYS BE CLOSED WHEN OPERATING THE CIRCUIT BREAKER IN ITS COEXTENDED POSITION.

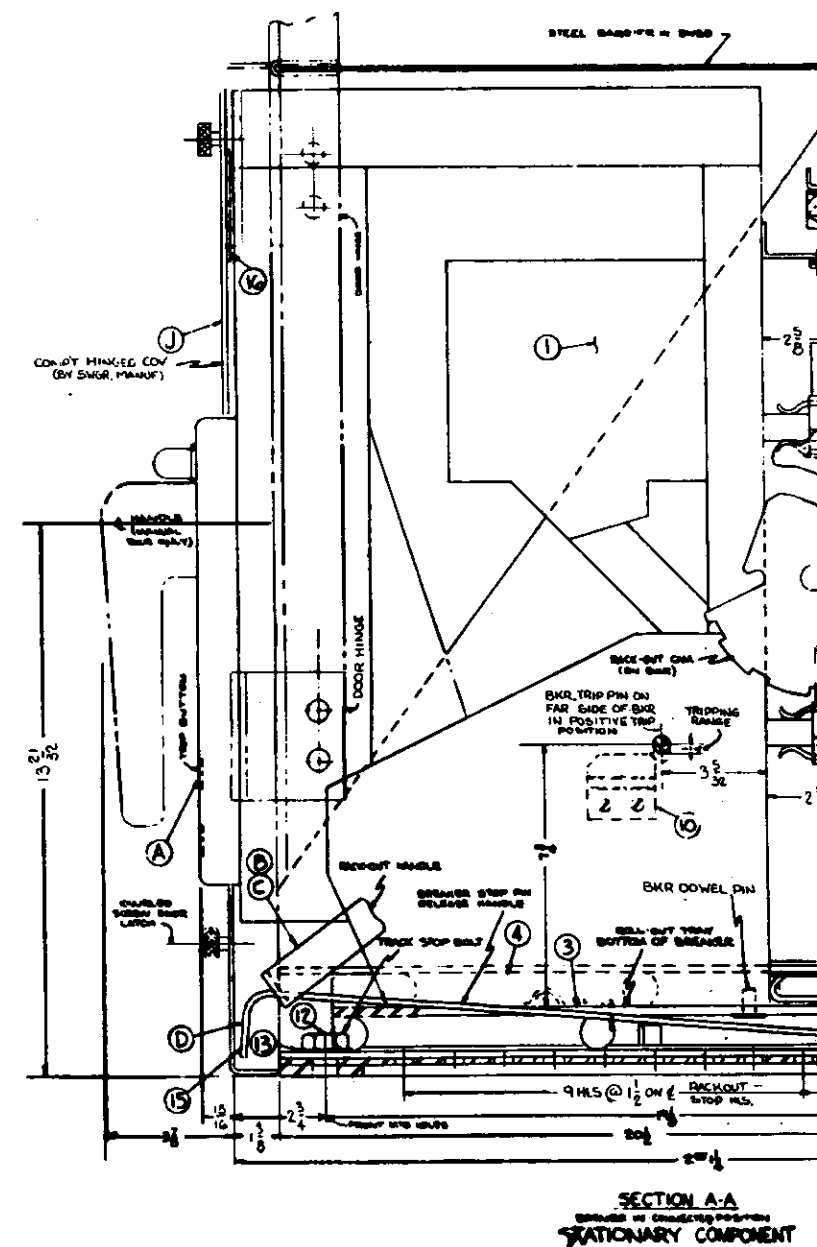


Figure 28. AK-2-60N circuit breaker master plan (sheet 2)

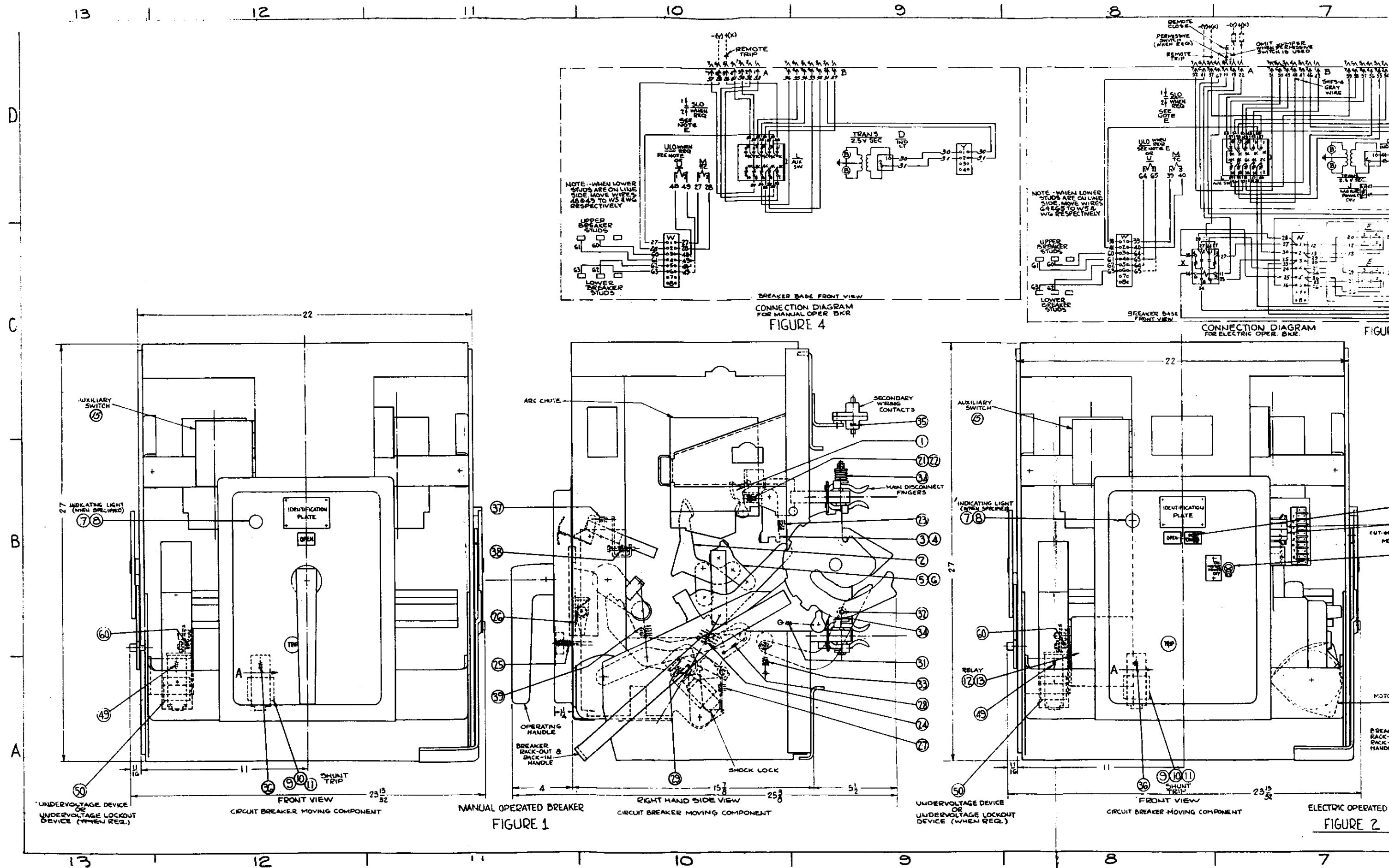


Figure 27. AK-2-60N circuit breaker

LIST OF MATERIAL					ITEM			REMARKS
PC NO	NAME	QTY	MATERIAL	MATL SPEC	QTY REQD	QTY ON HAND		
1	ACB 1600A ACB TYPE AK-2-GON	1	STEEL	MIL-S-17557	1	1		
2	STATIONARY COMPONENT	1	STEEL	MIL-S-20166	84TC760			
3	ROLL-OUT TINY	1	STEEL	MIL-S-20166	84TC764			
4	ROLL-OUT SIDE RUNNER	2	STEEL		84TC764			
5	PRIMARY DISC. DEVICE (BASE)	6	COMPOUND	MIL-P-14	1-6510000			
6	PRIMARY DISC. DEVICE	6	STEEL	MIL-S-20166	84TC762			
7	SECONDARY DISC. DEVICE (STATIONARY)	4	COMPOUND	MIL-P-14	84TC746			
8	SECONDARY DISC. DEVICE (MOVABLE)	4	STEEL	MIL-S-20166	84TC746			
9	SECONDARY DISC. DEVICE SUPPORT (SHIRT)	1	STEEL	MIL-S-20166	84TC763			
10	TRIP INTERLOCK	1	STEEL	MIL-S-20166	84TC763			
11	CAM PIN SUPPORT	2	STEEL	MIL-S-20166	84TC763			
12	ROLL-OUT STOP BOLT 3/4-10 HEX-HD	1	STEEL					
13	3/4 FLAT WASHER	1	STEEL					
14	BREAKER STOP PIN	1	STEEL		84TC765			
15	BREAKER STOP PIN LEVER	1	STEEL	MIL-S-20166	84TC765			
16	SCREENED DRAINING COVER PLATE	1	STEEL	MIL-S-20166				
17	BREAKER MTC BOLT 3/4-10 HEX. HD	4	STEEL					

NOTES: 1. FOR SWITCHBOARD MOUNTING DATA, REPAIR PARTS, WIRING DIAGRAMS AND OTHER DETAILS: SEE SHEET 1.

2. CLEANING AND PAINTING OF ASSEMBLY TO BE IN COMPLIANCE WITH MILITARY SPECIFICATIONS MIL-E-917, PAINTED SWITCHBOARD GRAY.

3. THE MAIN BRANCH DISCONNECTS MAY BE OBSERVED WHEN THE MOVING COMPONENT IS FULLY DOWN OUT.

APPROX. WEIGHT:
CALCULATED WEIGHT OF REMOVABLE ASM WITH MANUAL BCR IS 475 LBS.
CALCULATED WEIGHT OF REMOVABLE ASM WITH ELECTRIC BCR IS 540 LBS.
CALCULATED WEIGHT OF REMOVABLE ASM WITHOUT BCR IS 85 LBS.

DETAILS OF CIRCUIT BREAKER STATIONARY COMPONENT

[illegible]

Figure 28
AK-2-60N
Master plan
(sheet 2)

