SWITCHBOARD
Technical Manual

PART 2 CHAPTER 2

NAVY TYPE ACB-640R CIRCUIT BREAKER

WESTINGHOUSE TYPE DBN 406

REMOVABLE ASSEMBLY

640 AMPERE FRAME SIZE

STANDARDIZED DIMENSIONS

WESTINGHOUSE ELECTRIC CORPORATION
EAST PITTSBURGH, PA., U.S.A.

TECHNICAL MANUAL 32-855-1C1

BUREAU OF SHIPS • NAVY DEPARTMENT • FEBRUARY, 1960

PRELIMINARY DATA

PURPOSE

A circuit breaker has two fundamental purposes: First, to perform normal switching operations to isolate a circuit, and second, to isolate a circuit under fault conditions.

CAUTION - WARNING - THE CIRCUIT BREAKER SHOULD BE IN THE OPEN POSITION AND THE SWITCHBOARD DE-ENERGIZED BEFORE INSTALLING, ADJUSTING, INSPECTING, REPLACING PARTS, OR REMOVING THE CIRCUIT BREAKER. IF THE BUS CANNOT BE DE-ENERGIZED, USE INSULATED HANDLE TOOLS, RUBBER GLOVES, AND A RUBBER FLOOR MAT.

INSTALLATION

The movable component must be removed before stationary component can be bolted in switchboard. Normal care in handling the stationary component is sufficient.

After securing the stationary component the movable component should be lifted by hooks in the "lifting holes".

When installing the circuit breaker, care should be taken to see that the supporting surface is even and vertical, and that all leads to be connected to the circuit breaker are de-energized. Protect the circuit breaker from dirt and possible damage.

The connections to the circuit breaker studs should be cleaned, flat and free of burrs to assure full contact area, and firmly clamped or bolted in place to prevent excessive heating. The connecting cables should have adequate current carrying capacity. Connecting cables should be supported so that the circuit breaker studs will not be subjected to unnecessary strain.

At no time should the circuit breaker be allowed to rest upon or be supported by the current studs. This will result in unnecessary damage and stress to the studs and the insulated moldings.

Any discoloration or pitting of the circuit breaker contacts in evidence when the circuit breaker is received from the manufacturer is caused by calibrating the breaker and will in no way interfere with proper functioning of the circuit breaker.

MAINTENANCE

Periodic inspection of the breaker is recommended. An inspection should always be made after it is known that the breaker has opened on a severe short circuit. When a circuit breaker is not operated for long periods of time, a high resistance oxide or sulfide may form on the contact surfaces which results in overheating. To burn off this high resistance film, operate the circuit breaker several times under normal load at regular inspection periods.

Be sure the breaker is disconnected from all sources of power before inspecting or repairing.

If excessive heating occurs, look for loose or corroded contacts or connections.

When inspecting the breaker, examine the contacts to see if there has been any severe pittings or burning of the contact surfaces which will prevent proper contact wipe. Rough or high spots should be removed with a very fine clean file or fine clean sandpaper.

LUBRICATION

In general, the breaker mechanism requires very little lubrication which should be applied sparingly. Any excessive amount of oil on the breaker parts is apt to collect dust and dirt and is to be avoided.

The lubrication applied during manufacture should be sufficient for the life of the breaker.

REPLACING PARTS

Before replacing any part, the operator should note the position of each part before removing.

When removing or replacing tension springs with hooks, the work may be facilitated by pulling on the hooks with a cord or a wire.

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CHAPTER 1
GENERAL INFORMATION
Section 0—General Data

1-0-1 CIRCUIT BREAKER CHARACTERISTICS

The circuit breaker classification data is listed in Table 1-0-1.

TABLE 1-0-1—CIRCUIT BREAKER CLASSIFICATION DATA

Type	Navy Type ACB 640R (W.E. Corp. Type DBN 406)
Frame Size (continuous rating)	640 Amperes
Voltage	500 Volts
Current	A-C
Frequency	60 Cycles
Poles	3
Continuous Current Ratings (Trip Coil)	160, 250, 320, 400, 480, 560, 640 Amperes
Interrupting Capacity	40,000 (RMS) Amperes
Short Time Rating	25,000 (RMS) Amperes
Short Time Duration	30 Cycles
Protective Function	Overcurrent Long Delay Tripping Short Delay Tripping (Bands 1, 2 & 3) Instantaneous Tripping Shunt Trip Undervoltage Trip
Means of Closing	Manual or Electrical
Auxiliary Switch	8
Mounting	Removable Assembly - Dead Front
Connections	Back
Insulation Class	B
Shock Classification	Class HI
Ambient Temperature	50°C
Master Drawing - 3,318,903	Westinghouse #900-J-103 (2 sheets)
Navy Test Approval Specification Applicable	MIL-C-17587 (Modified)
Weights -	
Complete Removable Assembly	184 lbs
Movable Component Only	114 lbs
Stationary Component Only	70 lbs
Overcurrent Device	8 lbs
Auxiliary Switch	3/4 lbs
Shunt Trip	1-1/4 lbs
Closing Solenoid and Relay	18 lbs

1-0-1-1 Rating of Components

The rating of the components are listed in Tables 1-0-2 and 1-0-3.

1-0-1-2 Auxiliary Switch

The interrupting capacities of the auxiliary switch contacts are listed in Table 1-0-4.

TABLE 1-0-2—CURRENT RATING OF COMPONENTS

Components	Duty (Amperes)	Load Duration (Seconds)	Allowable Operations Per Minute
115V. Closing Relay	2 Intermittent	1/5	10
450V. Closing Relay	1/2 Intermittent	1/5	10
115V. Closing Magnet	60 Intermittent	1/10	10
450V. Closing Magnet	15 Intermittent	1/10	10
115V. Shunt Trip	4 Intermittent	1/10	10
450V. Shunt Trip	1 Intermittent	1/10	10
450V. Undervoltage	1/10 Continuous	--	--
Auxiliary Switch	15 Continuous	(For interrupting rating see table)	
Secondary Disconnects	15 Continuous	(No interrupting rating)	
Wiring to Aux. Switch	10 Continuous	(Unless contact specifies more)	

TABLE 1-0-3—VOLTAGE RATING OF COMPONENTS

Components	Nominal Rating (Volts)	Voltage Range (Volts)	Minimum Pickup and Seal (Volts)	Dropout Range (Volts)
Closing Relay and magnet	115	90-130	-	-
	450	370-500	-	-
Shunt Trip	115	80-130	-	-
	450	360-500	-	-
Undervoltage	450	360-500	360	45-290

TABLE 1-0-4—AUXILIARY SWITCH

VOLTS	NON-INDUCTIVE CIRCUIT	INDUCTIVE CIRCUIT
115 a-c	75 amps.	15.0 amps.
450 a-c	25 amps.	5.0 amps.

Section 1—Introduction

1-1-1 GENERAL

This technical manual describes a Navy Type ACB-640R (Westinghouse Type DBN-406) 640 ampere frame size air circuit breaker, meeting the requirements of Specification MIL-C-17587 for Naval Shipboard service.

Each circuit breaker is supplied as a complete removable switchboard assembly consisting of circuit breaker, separable disconnects and associated control wiring, drawout mechanism and assembly structural supports and back plate including stationary main bus connections, and stationary terminals for connection of the necessary external control wiring.

The complete removable assembly consists of two major components, the stationary component that is bolted into the switchboard frame, and the movable component which is the operating mechanism of the circuit breaker and may be drawn out for inspection, maintenance or isolation from the shipboard electrical system.

The general arrangement of this equipment is shown in Figures 1-1-1 and 1-1-2.

The DBN-406 air circuit breaker is a complete removable assembly for installation within a switchboard cubicle.

The circuit breaker is designed as an assembly including the drawout mechanism. These assemblies incorporate disconnect features for both main current connections and secondary current connections. This mounting allows easy removal and installation of the movable component when maintenance operations are required. The circuit breaker is closed manually by depressing the handle latch and turning the operating handle quickly and smoothly as far as it will go (90^{o}) in a clockwise direction. It may be tripped manually by depressing the handle latch and turning the handle 45^{o} in a counterclockwise direction. In addition the electrically operated circuit breaker may also be closed by a switch from a remote location.

The breaker movable component consists of a rigid steel chassis to which are bolted various sub-assemblies. Each sub-assembly is a complete unit and is readily interchangeable between breakers. In addition, each sub-assembly may be removed intact and easily replaced for minimum outage time.

The sub-assemblies required in all breakers are the mechanism, pole units, arc chutes auxiliary switch, secondary disconnects, anti-shock-closed device and anti-shock-open device. The remaining sub-assemblies that may be included are closing relay, closing magnet, undervoltage trip device, overcurrent trip device and shunt trip device.

The circuit breaker for three phase a-c service is normally provided with series overcurrent trip devices in the two outer poles, otherwise the three poles are identical.

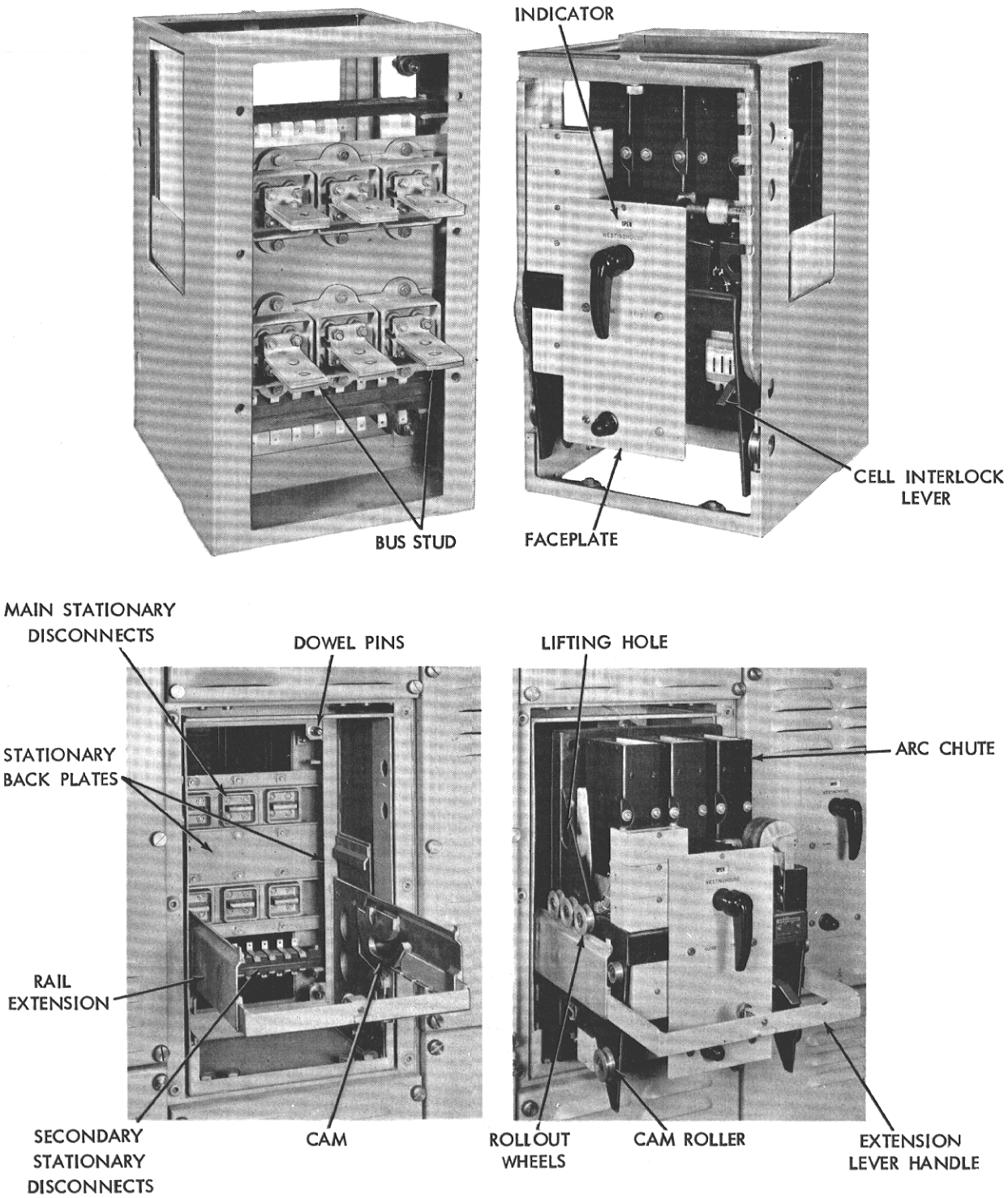
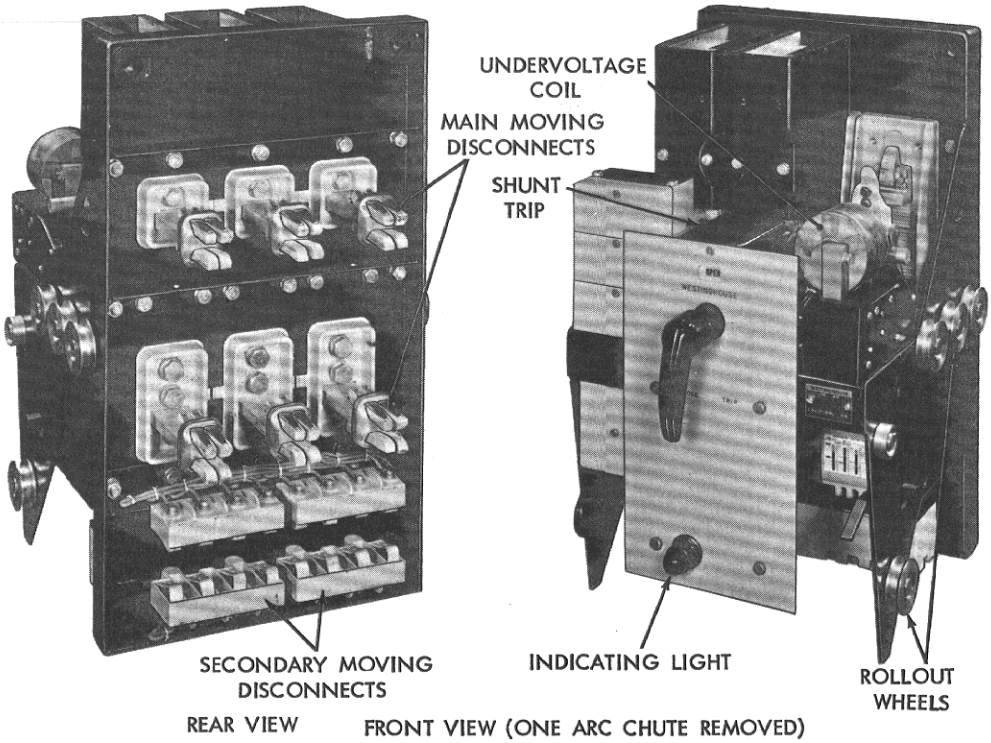


FIGURE 1-1-1 — Removable Assembly and Stationary Component



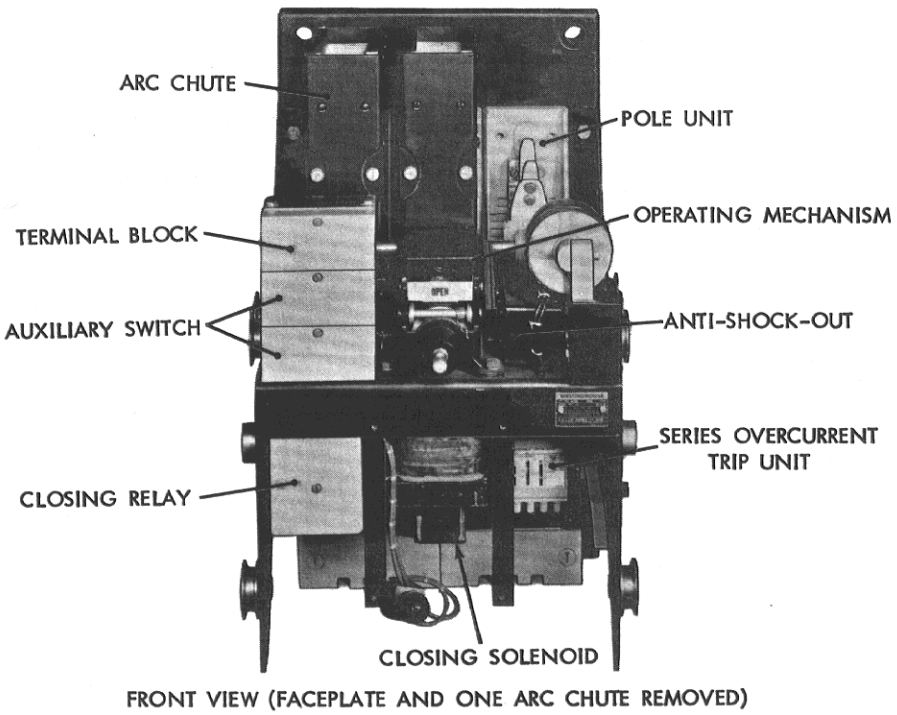


FIGURE 1-1-2 — Movable Component

Section 2—Detailed Description

1-2-1 CIRCUIT BREAKER

1-2-1-1 General

Paragraph 1-1-1 describes the general details. Subsequent paragraphs describe the various sub-assemblies in detail.

1-2-1-2 Movable Component—(See Figure 1-2-1)

This assembly consists of a rigid steel panel (141), two supporting frames (142), and shelf (143). The supporting frames are bolted to the front of the steel panel and support the shelf. Drawout rollers and the lever roller are attached to the side of each of the supporting frames. A lifting hole has been drilled in each of the supporting frames to assist in raising the movable component when drawn out of the stationary component.

1-2-1-3 Pole Unit—(See Figure 1-2-2)

Three separate pole units are bolted to the front of the steel panel, one for each of the three phases. Each pole unit consists of a base, a stationary contact assembly and a moving contact assembly. The base is molded from Navy type MAI-60 insulating material and isolates the stationary and moving contacts from the chassis.

The stationary contact assembly consists of the main contact extruded integral with the upper stud (105) and arcing contact (108) fastened to the extruded copper section by two screws (107). Contact surfaces (109) are special arc-resisting alloy inserts.

The moving contact assembly consists of a contact base (118) of copper to which is fastened arcing contact (114) by two bolts (115) which are locked with locking clips (116). Main and arcing contact surfaces (109) and (117) are silver alloy inserts welded to their respective bases. Contact base (118) is riveted and soldered to shunt (127) which is bolted at its lower end either to a connector (128), when a series overcurrent trip device is not supplied, or to an overcurrent tripping device (310). The shunt (127) is a flexible bundle of thin copper strips that carries current from the moving contact assembly to the lower contact stud. Contact base (118) is connected to contact link (123) with pin (119) and has a limited freedom of rotation about this pin. Contact link (123) is hinged by pin (125) to bracket (130) fastened to molded base (100) by two screws (102). Pin (126) mounted in bracket (130) has the function of restraining shunt (127) when the circuit breaker is tripped.

The moving contact assembly is attached to the mechanism cross bar (197) (Figure 1-2-1) by molded insulating link (120) which is screwed on metal link (122) and locked by nut (121). When the breaker is tripped all force is removed from the cross bar and accelerating spring (103) quickly snaps the moving contact assembly from the closed to the open position.

1-2-1-4 Arc Chute—(See Figure 1-2-2)

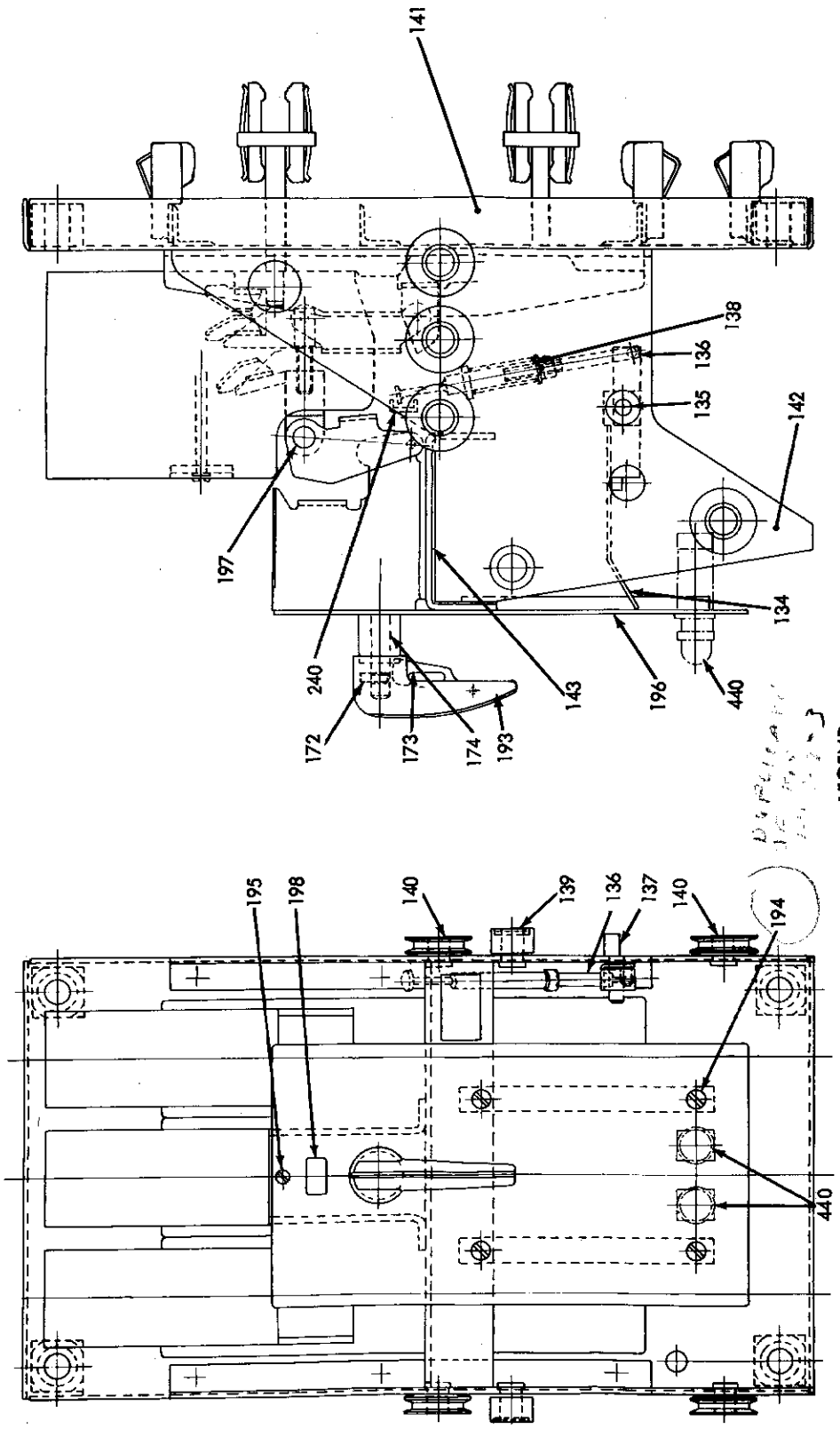
The arc chute (111) mounted above and surrounding the contact assembly of each pole, stretches and cools the arc drawn between the separating contacts so that the arc may be extinguished and the circuit opened in the least possible time. The arc chutes are an extremely important part of the circuit breaker and a breaker should never be energized without their being mounted in place.

Each arc chute consists of a number of metal plates and asbestos plates (110) supported in a laminated case and held in place by a clamping plate insulating tube spacers (113) and two screws (112) through the insulating spacers to the molded base (100). When the arc is drawn by the separating contacts, it moves up into the chute by magnetic and thermal action where it is quickly de-ionized and extinguished.

1-2-1-5 Operating Mechanism—(See Figure 1-2-3)

The operating mechanism opens and closes the circuit breaker by moving the crossbar (197) (Figure 1-2-1) to which the moving contact assemblies are attached. It is mounted on the top of the shelf at the center of the circuit breaker.

The operating mechanism consists of a group of toggle links, and a latch attached to the operating mechanism frame on fixed pins (156), (168), (170), (184), and (186). The cross bar is held by the closing lever (159). Rotating the operating handle clockwise moves the mechanism linkage from the open position shown in Figure 1-2-3 to the closed position shown. This is accomplished when the roller (178) on the end of the operating handle shaft (174) forces the first toggle link (169) upward pushing second toggle link (163), third toggle link (161) and

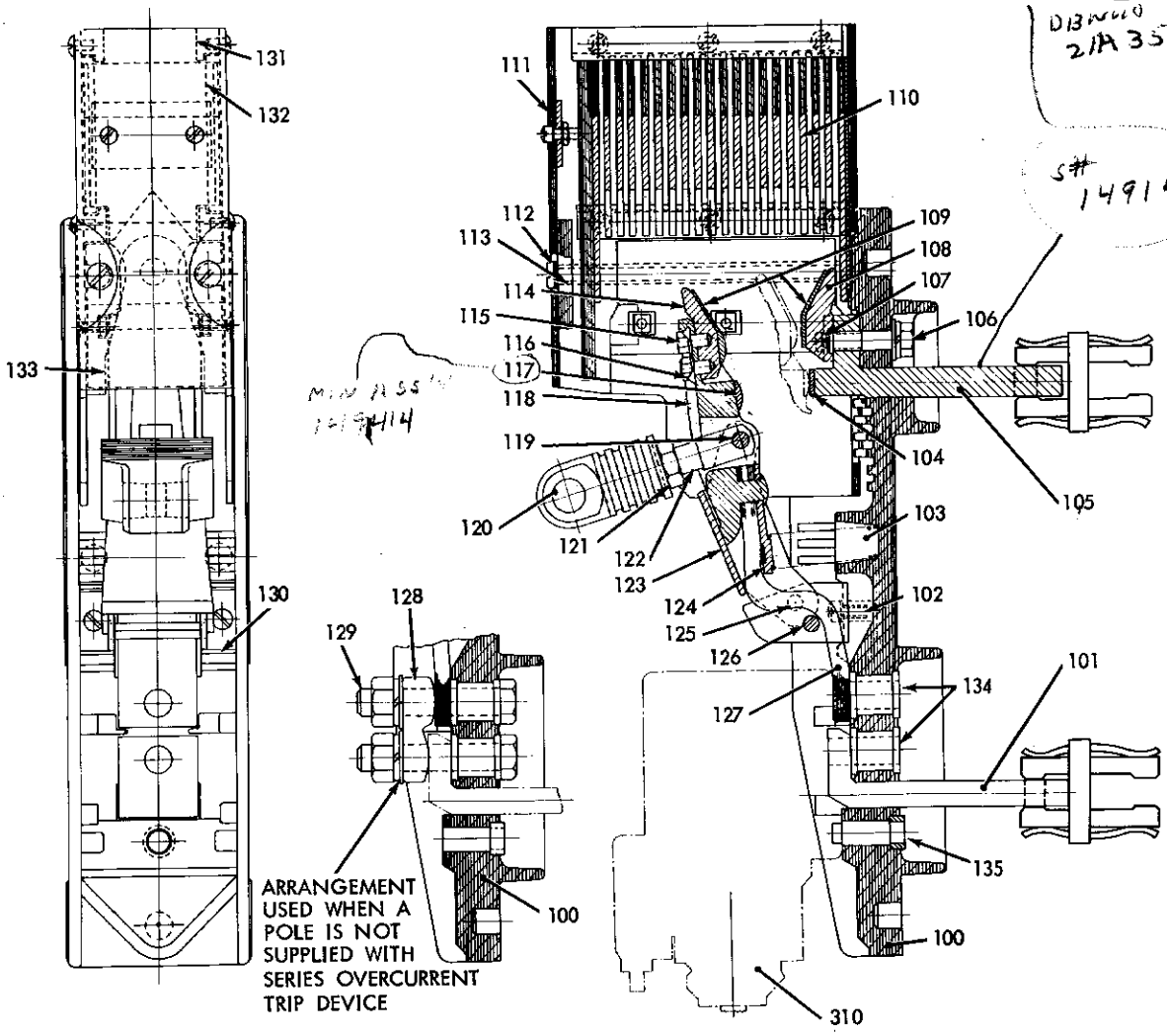


LEGEND

134	LEVER HANDLE	141	PANEL	194	MACHINE SCREW
135	PIN	142	FRAME	195	MACHINE SCREW
136	LEVER UNIT	143	SHELF	196	FACE PLATE
137	STOP PIN	172	SET SCREW	197	CROSSBAR
* 138	SPRING	173	HANDLE LATCH	198	POSITION INDICATOR
139	LEVER ROLLER	174	SHAFT	240	TRIP BAR
140	ROLL-OUT WHEELS	193	HANDLE	440	INDICATING LIGHTS

* REPAIR PARTS

FIGURE 1-2-1 — Circuit Breaker Movable Component



LEGEND

100	BASE	118	CONTACT BASE
101	LOWER STUD	119	PIN
102	MACHINE SCREW	120	INSULATING LINK
* 103	SPRING ACCELERATING	121	LOCK-NUT
104	STATIONARY CONTACT TIP	122	LINK
105	UPPER STUD	123	CONTACT LINK
106	BOLT	124	ARMATURE
107	MACHINE SCREW	125	PIN
* 108	STATIONARY ARCING CONTACT	126	PIN
109	MOVING CONTACT TIP	127	SHUNT
110	PLATE	128	CONNECTOR
111	ARC CHUTE	129	BOLT
112	MACHINE SCREW	130	BRACKET
113	TUBE SPACER	131	GUIDE
* 114	MOVING ARCING CONTACT	132	SPACER
115	BOLT	133	SHIELD
116	LOCKING CLIP	134	BOLT
117	MAIN MOVING CONTACT TIP	135	BOLT
* REPAIR PARTS		310	OVERCURRENT DEVICE

FIGURE 1-2-2 — Arc Chute and Pole Unit Assembly

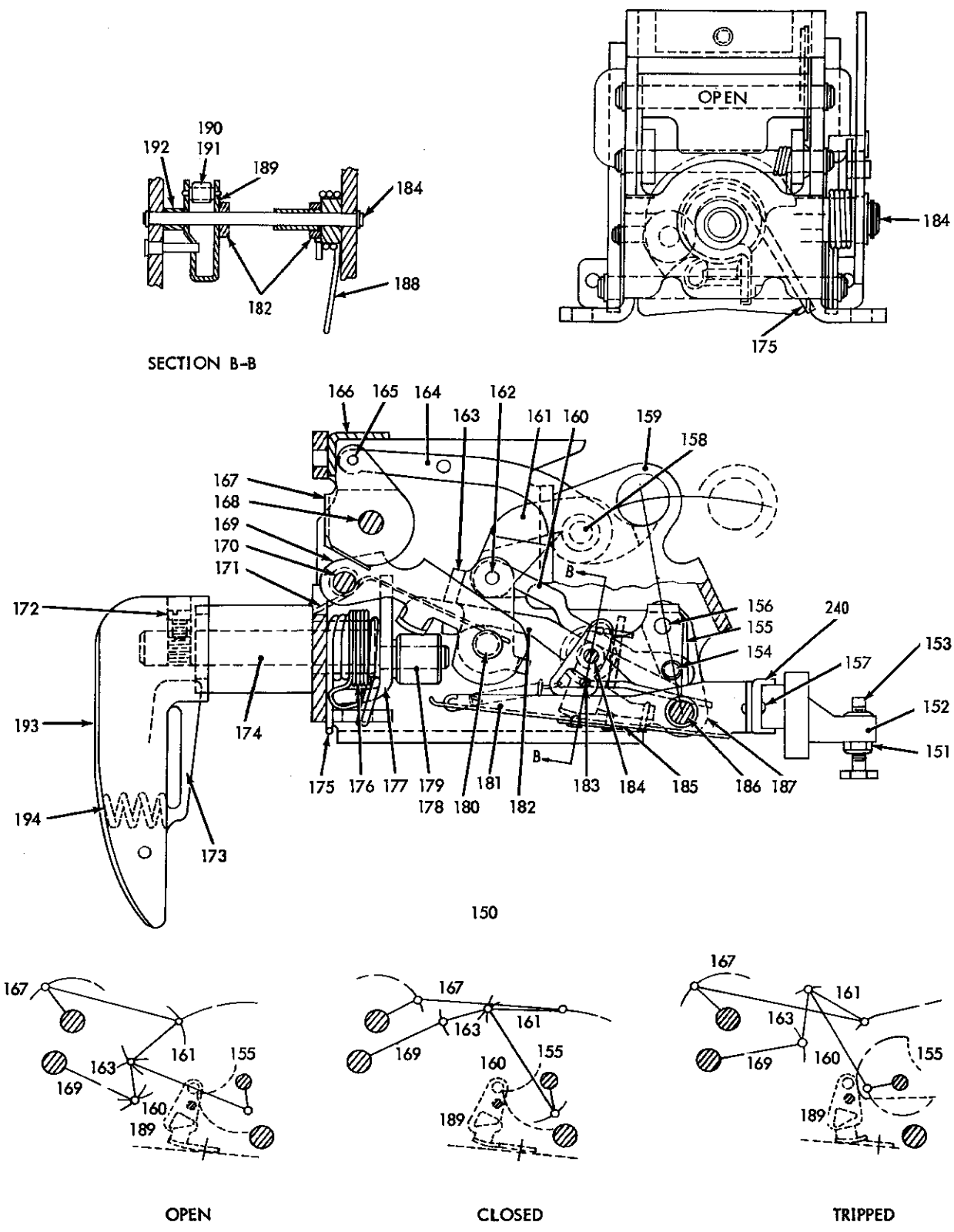


FIGURE 1-2-3 — Operating Mechanism with Position Indicator

150 Operating Mechanism
151 Lock Nut
152 Trip Finger
153 Trip Screw
154 Pin
155 Latch
156 Pin
157 Rivet
158 Pin
159 Closing Lever
160 Link
161 Third Toggle Link
162 Pin
163 Second Toggle Link
164 Indicator Link
165 Pin
166 Cover
167 Indicator
168 Pin
169 First Toggle Link
170 Pin
*171 Spring, Retrieve
172 Set Screw
173 Handle Latch
174 Shaft
*175 Spring, Trip
*176 Spring, Return
177 Lever
178 Roller
179 Needle Bearing
180 Pin
*181 Spring, Roller Latch
182 Pawl
183 Latch Stud Pin
184 Pin
185 Trigger
186 Pin
187 Trip Lever
*188 Pawl Spring
189 Roller Latch
190 Roller
191 Pin
192 Spacer
193 Handle
*194 Spring, Handle Latch
240 Trip Bar

* Repair Parts

FIGURE 1-2-3 — Operating Mechanism with Position Indicator

closing lever (159) ahead of it. The motion of the toggle linkages is directed by link (160) which is pivoted at its lower end on pin (154) in latch (155). Latch (155) in turn is restrained from moving by roller latch (189) which is pivoted on pin (184) and engages trigger (185) on trip lever (187). The linkage is held in the closed position by pawl (182) which latches under pin (180). The handle shaft and lever are returned to the normal position after closing by handle return spring (176).

The mechanism is opened by rotating trip lever (187) counterclockwise. This is accomplished either by rotating handle counterclockwise, in which case the handle shaft roller strikes the extreme left end of trip lever (187) to move it downward; or by an attachment pushing up on trip bar (240) or trip screw (153). In either case the counterclockwise rotation of the trip lever (187) moves trigger (185) out of engagement with the lower end of the roller latch (189), which in turn permits the roller latch to rotate counterclockwise out of engagement with latch (155). Latch (155) is then free to rotate in response to the pull of the latch link (160) so that the mechanism assumes the trip free position shown in Figure 1-2-3 in which the contacts are open but part of the mechanism levers are in the closed position. In this position pawl (182) is disengaged from pin (180) by a lug on link (163) which pushes it up permitting the linkage to collapse to the open position. Trip spring (175) returns operating handle to the normal vertical position after manual tripping.

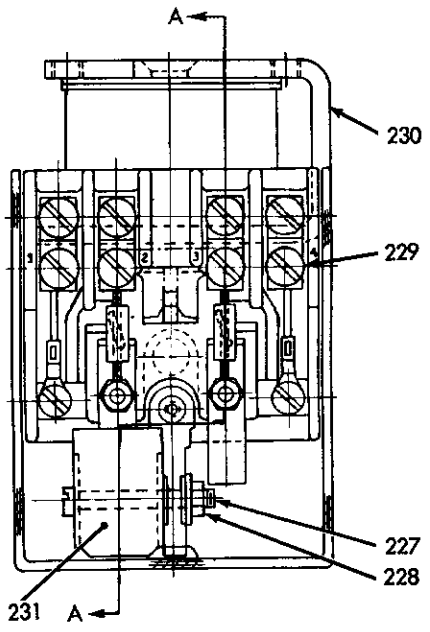
Position indicator (167) is an integral part of the mechanism, formed from sheet metal and pivoted on pin (168). It is visible from the front of the circuit breaker through a window in the faceplate and mechanism frame. With the circuit breaker in the open position shown in Figure 1-2-3, the yellow face of the indicator shows through the window. The word "OPEN" is stamped on this yellow face. When the breaker closes, pin (158) of the closing lever (159) pulls indicator link (164) to the right, thus rotating the other face of the indicator up into a position visible through the window. This face is painted blue and is stamped with the word "CLOSED". The position indicator provides a positive visual indication of the operating condition of the circuit breaker.

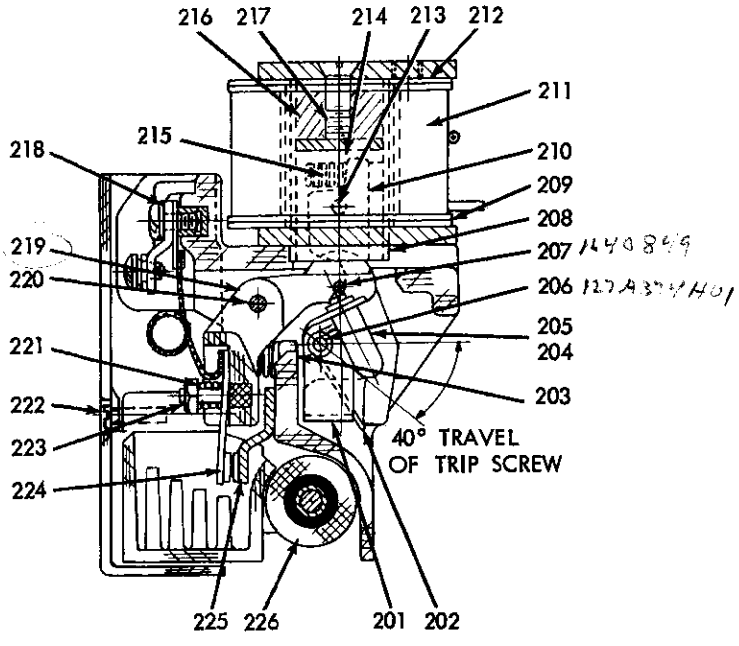
1-2-1-6 Closing Relay—(See Figure 1-2-4)

The closing relay is used on electrically operated breaker only and is mounted on the underside of the breaker shelf to the left of the closing magnet. This relay closes and opens the closing coil circuit of the solenoid in electrical operation. The relay provides a means of closing the circuit breaker electrically from a remote point through a control switch.

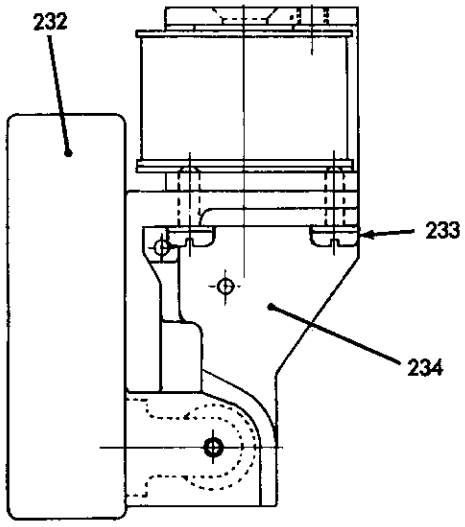
The relay base (234) is molded from insulating material. The contact assemblies, coil assembly and other parts are attached to the base. Frame (230) serves as part of the magnetic circuit of coil (211) also holds the coil in place. The frame or yoke is secured to the molded base by three screws (233). The coil (211) is wound on a molded spool (209) and is held in place by guide tube (208) which extends from the top of the molded base through the bottom of the frame (230) and through the center of the spool. At its upper end, the guide tube (208) centers on the stationary core (216).

The moving core (214) is free to slide up and down in the guide tube (208). In moving up in response to the magnet pull from the stationary core when the coil is energized, the





SECTION AA



200

LEGEND

200	CLOSING RELAY	
201	RELEASE BRACKET	
* 202	SPRING TRIP	
* 203	SPRING, CONTACT ARM	
204	TRIP PIN	
205	PIN FASTNER	
206	RELEASE BRACKET PIN	
207	LATCH PIN	
208	GUIDE TUBE	
209	MOLDED SPOOL	
210	LATCH	
* 211	OPERATING COIL	
212	SPRING WASHER	
213	PIN	
214	MOVING CORE	
* 215	SPRING, LATCH	
216	STATIONARY CORE	
217	SCREW	
218	TERMINAL	
219	MOVING CONTACT ARM	
220	CONTACT ARM PIN	
* 221	SPRING, CONTACT	
222	SCREW	
223	ELASTIC STOP NUT	
* 224	MOVING CONTACT	
* 225	STATIONARY CONTACT ASSEMBLY	
* 226	BLOWOUT MAGNET	
227	MACHINE SCREW	
228	NUT	
229	TERMINAL SCREWS	
230	COIL FRAME	
231	ARC CHAMBER	
232	COVER	
233	SCREW	
234	RELAY BASE	

* REPAIR PARTS

FIGURE 1-2-4 — Closing Relay

moving core pulls up latch (210) which is fastened with pin (213) to the moving core. When the coil (211) is energized, spring (215) bearing against latch (210) holds latch in such a position that it is hooked under latch pin (207), thus causing moving contact arm assembly (219) to rotate counterclockwise around contact arm pin (220), thereby compressing spring (203). The moving contacts (224) are thus pulled against the stationary contacts (225), completing the circuit. In Figure 1-2-4, the moving core is shown in the upper or contacts closed position.

As soon as the contacts close, current starts flowing through the coil of the closing solenoid. The moving core (253) (Figure 1-2-5) of the closing solenoid moves up, closing the circuit breaker. Trip bracket (256) fastened to the moving core moves up with the core and strikes trip pin (204) (Figure 1-2-4) of the relay. The trip pin is fastened to release bracket (201), which is caused to rotate counterclockwise around pin (206) against the torque exerted by torsion spring (202). When release bracket (201) is rotated in this direction, it strikes the bottom of latch (210) rotating it counterclockwise around pin (213) against the force of spring (215). The rotation of latch (210) disengages latch pin (207), and spring (203) rotates the moving contact assembly (219) clockwise to snap the moving contacts (224) away from the stationary contacts (225) to open the circuits.

With the circuit breaker in the closed position, trip bracket (256) (Figure 1-2-5) on the moving core of the closing magnet holds trip pin (204) (Figure 1-2-4) of the relay in the trip position. Therefore, even though the relay coil may be inadvertently energized when the circuit breaker is latched, the relay contacts will not close and no current can flow through the circuit breaker closing coil.

With the circuit breaker in the closed position, if the control switch is held closed, the moving core (214) will remain up with normal or low control voltage. If breaker is tripped open, relay latch (210) can not engage latch pin (207) until control switch is opened. Thus breaker is "ANTI-PUMP" under low voltage conditions and will not reclose until control switch is opened and closed again.

The moving contacts (224) are resiliently mounted by means of springs (221) around studs set into the moving contact arm (219) and are secured by elastic stop nuts (223). This arrangement causes a slight rolling and wiping action on the spherically shaped contact surfaces, as they meet, which helps to insure a positive electrical connection.

The relay is provided with a "seal-in" feature through the right hand contact which can be connected in parallel with the control switch in the relay coil circuit. If this connection is made, once energized, the relay will remain closed until breaker closing solenoid completes its stroke.

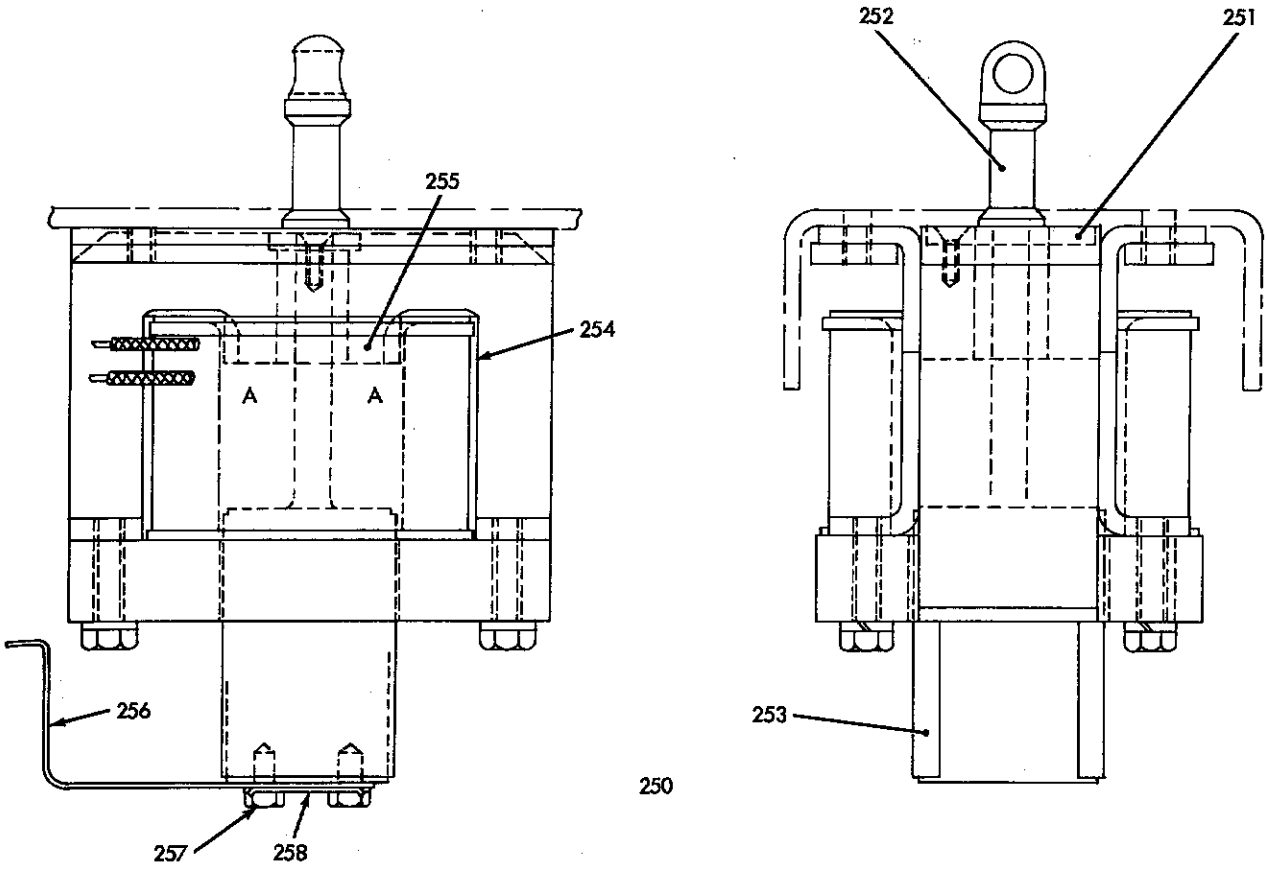
The left hand contact makes and interrupts the closing coil circuit. An arc chamber (231) molded from an arc resistant material surrounds the left hand contacts. It is held in place by two iron plates of the blow out magnet assembly (226) which in turn is secured by screws (227) to the molded base (234). The blow out magnet coil is connected in series with the left hand contacts, which causes flux to flow through the magnetic circuit and the air gap of the blow out magnet assembly. The magnetic circuit is positioned so its air gap is across the arc chamber and the arc. At the time the contacts part and draw an arc, the arc is deflected by the magnetic force down into the arc chamber where it is extinguished due to the stretching and cooling process. This arrangement makes possible a small and efficient relay.

1-2-1-7 Closing Solenoid—(See Figure 1-2-5)

The closing solenoid is designed to operate on alternating current and is used to close the circuit breaker electrically. It is mounted directly below the mechanism under the shelf of the circuit breaker and is secured to the shelf by the same four bolts that hold the mechanism in place.

The closing solenoid (250) (Figure 1-2-5) consists of an iron frame of yoke (251) which is bolted to the circuit breaker shelf, a plunger or moving core (253), an operating rod (252), a stationary core (255) and a coil (254).

The operating rod (252) connects the moving core (253) to pin (180) (Figure 1-2-3) of the mechanism. When coil is energized through the contact of the closing relay (Refer to Paragraph 1-2-1-6), the moving core (253) moves upward in response to the magnetic attraction between the stationary and moving cores across air gap "A". About one-tenth of a second is required for the solenoid to close and latch the circuit breaker. The moving core is provided with a trip bracket (256) and when the moving core moves into the "breaker closed" or "closed gap" position, trip bracket (256) engages the trip pin (204) (Figure 1-2-4) of the closing re-



LEGEND

250	CLOSING SOLENOID	255	STATIONARY CORE
251	FRAME	256	TRIP BRACKET
252	OPERATING ROD	257	BOLT
253	MOVING CORE	258	LOCK PLATE
* 254	COIL		

* REPAIR PARTS

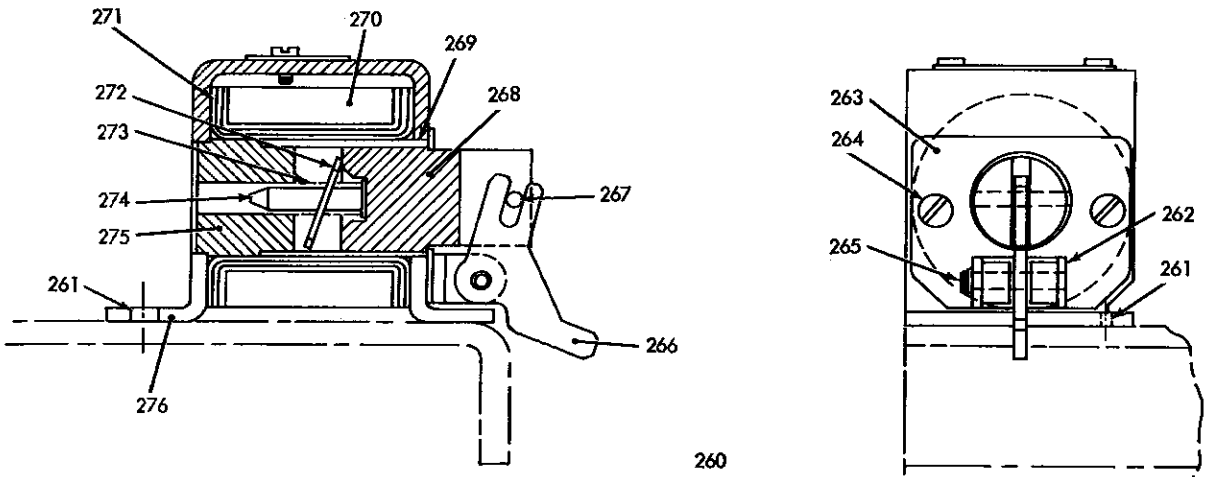
FIGURE 1-2-5 — Closing Solenoid and Relay Trip Assembly— Electrically Closed Breakers

lay to trip the relay mechanically and the relay contacts open, de-energizing the closing magnet. The closing coil is momentarily rated and serious damage will result if potential is allowed to remain on its terminals through improper adjustment of trip pin (204) of the relay, so that the relay does not trip and interrupt the closing coil circuit (Refer to Paragraph 1-2-1-6). When the moving core and operating arm have pushed the mechanism linkage to the closed and latched position, pin (180) holds the moving core in the "closed gap" position. When the mechanism is tripped, pin (180) falls, allowing the operating arm and moving core to fall to the "open gap" position.

1-2-1-8 Shunt Trip Device—(See Figure 1-2-6)

The shunt trip device is used on both manual and electrically operated breakers and is mounted on top of the breaker shelf.

The shunt trip device consists of a frame (276), stationary core (275), moving core (268) and the trip coil (270). Energizing the trip coil (270) sets up a magnetic attraction between stationary core (275) and moving core (268). The moving core moves to the left which rotates trip lever (266) about pin (265). The trip lever raises trip bar (240) (Figure 1-2-1) to trip the circuit breaker. The opening of the



LEGEND

260	SHUNT TRIP DEVICE	269	SLEEVE
261	BOLT	* 270	COIL
262	SPACER	271	COIL SPOOL
263	PLATE	272	NON-MAGNETIC WASHER
264	MACHINE SCREWS	* 273	SPRING
265	PIN	274	GUIDE PIN
266	TRIP LEVER	275	STATIONARY CORE
267	PIN	276	FRAME
268	MOVING CORE		

* REPAIR PARTS

FIGURE 1-2-6 — Shunt Trip Device

circuit breaker de-energizes the shunt trip coil through a normally open auxiliary switch contact. Spring (273) then returns the moving core (268) to its normal position. Non-magnetic washer (272) prevents residual magnetism from holding the cores together when the coil is de-energized.

1-2-1-9 Anti-Shock-Close Device—(See Figure 1-2-7)

The anti-shock-close device (280) is mounted on the side of the operating mechanism. This device prevents the circuit breaker contacts from closing from shock when open. This device also, functions as an anti-bounce latch.

The anti-shock-close latch (281) is pivoted on the side of the mechanism. The plate is so shaped that the impact of shock rotates the device, and the hook engages pin (155) of the operating mechanism to momentarily hold the breaker open. The anti-shock-close device also serves as an anti-bounce latch to prevent the closing lever (159) from bouncing off its stops and re-closing the circuit when the circuit breaker interrupts maximum short circuit currents. Under these conditions the pin (155) knocks the latch up, causing the latch to engage the pin (155) to momentarily hold the breaker open. Return spring (282) returns the latch to its original position when conditions are normal.

1-2-1-10 Anti-Shock-Open Device—(See Figure 1-2-8)

The anti-shock-open device prevents tripping of the circuit breaker due to rotation of the trip lever caused by shock and is mounted on the circuit breaker shelf to the right of the operating mechanism frame.

The bracket (286) is secured to the shelf by two bolts (298). Lever (288) and plate (291) are pivoted on pin (289). Studs (293) are suspended on pin (292). Weight (296) pivots about pin (295) against spring (297).

The lever (288) and plate (291) are connected by bolt and elastic stop nut (290). As the lever rises due to the action of the trip bar, a slot in the plate allows the plate to slide freely over the conical shaped studs (293), permitting the breaker to trip. Under shock conditions, the weights on the two outside studs (293) cause the studs to rotate counterclockwise and the weight (296) on the center stud

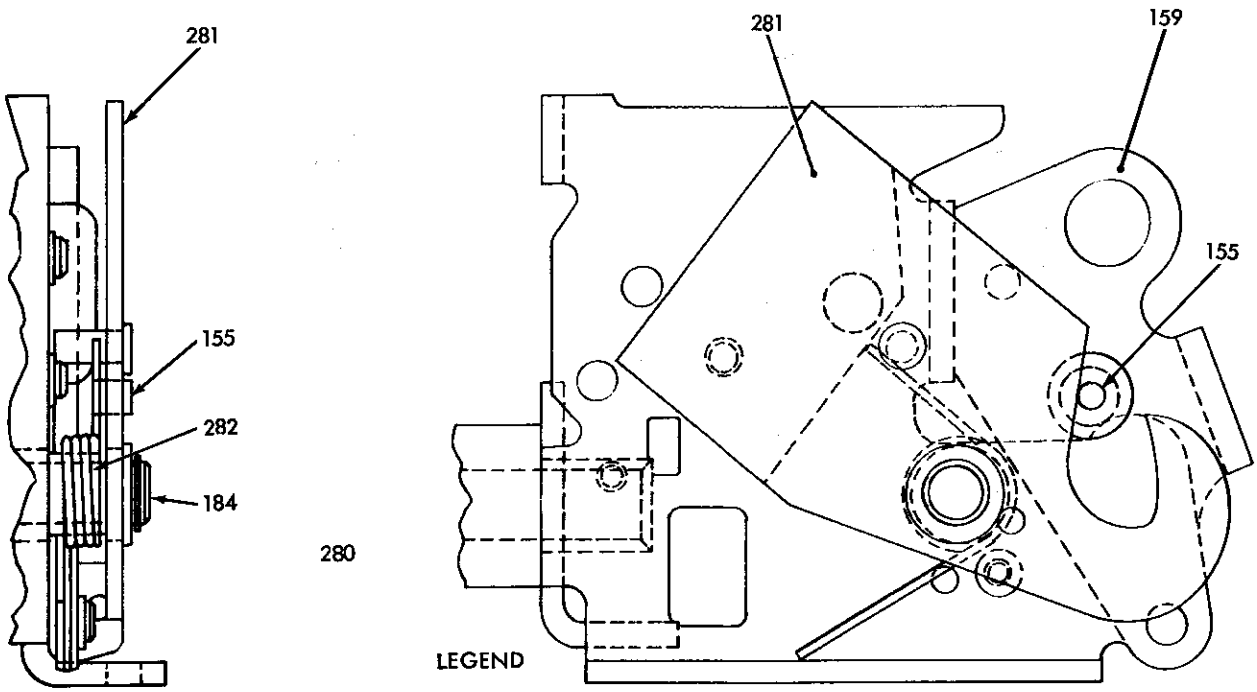


FIGURE 1-2-7 — Anti-Shock-Close Device and Retriever Assembly

(300) causes it to be rotated clockwise, compressing spring (297). The ends of the studs jam against the sides of the slot in the plate preventing the plate and lever from rotating on pin (289). The breaker trip bar is held down by the lever and the breaker is momentarily held closed.

1-2-1-11 Series Overcurrent Trip Unit—
(See Figures 1-2-9 and 1-2-10)

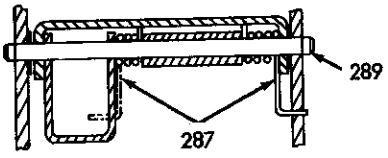
The series overcurrent trip unit provides for selective protection under three distinct conditions of overcurrent: First, low overcurrents will trip breaker after LONG DELAY; Second, moderate overcurrents will trip breaker after a SHORT DELAY; and third, high overcurrents will trip breaker INSTANTLY.

Two calibrated long delay pickup settings are marked on scaleplate (329) in amperes (at approximately 150 and 200% of coil rating). The long delay time is factory set per Figure 1-2-9. By turning dial (323) the long delay time can be approximately halved or doubled; but is locked to prevent excessive adjustment.

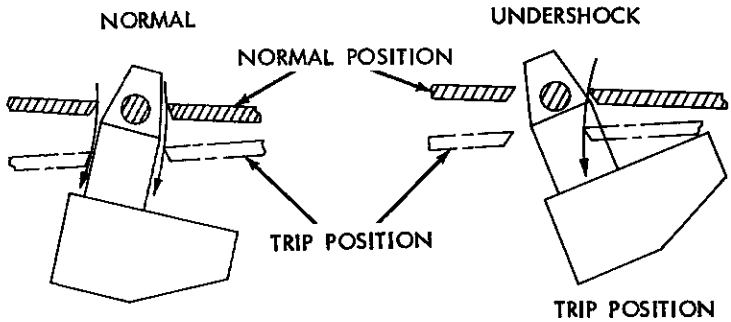
The short delay pickup, short delay time, and instantaneous pickup are all factory set and sealed. The pickup currents and time delay are marked on scaleplate.

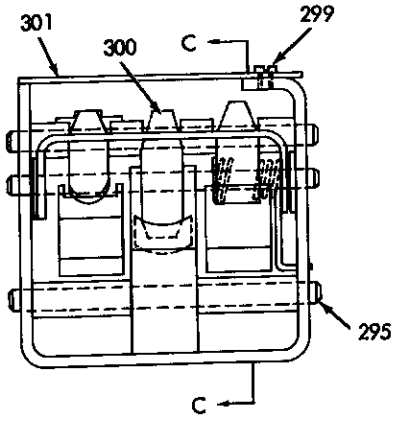
Figure 1-2-9 shows a typical "Time-current curve". The upper line of a given band shows the MAXIMUM time for breaker to clear the circuit for any given overcurrent. The lower line shows the MINIMUM time an overcurrent can exist before returning to normal without tripping breaker.

The series coil (311) is connected between the lower stud and moving contact arm of the breaker. Current flow in coil creates a magnetic attraction between stationary core (312) and moving core (314) with yoke (316) and ring (315) completing the magnetic circuit. When moving core moves up, spring (317) transmits force to stem assembly (313). The top end of

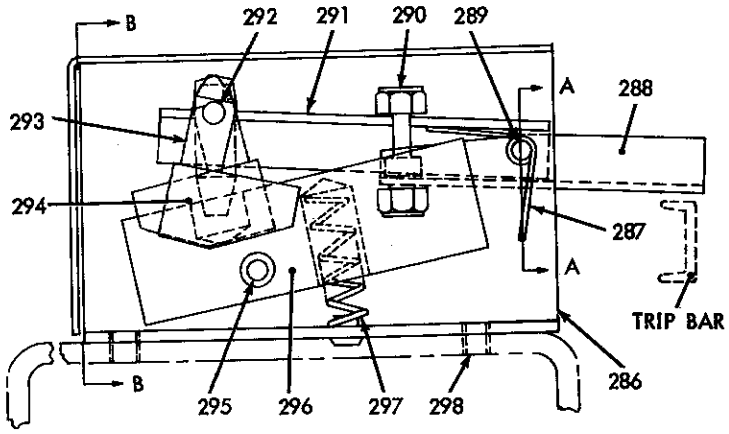


SECTION A-A





SECTION B-B



SECTION C-C

285

LEGEND

285	ANTI-SHOCK-OPEN DEVICE	294	WEIGHT
286	BRACKET	295	PIN
* 287	SPRING, PLATE	296	WEIGHT
288	LEVER	* 297	SPRING, WEIGHT
289	PIN	298	BOLTS
290	ELASTIC STOP NUT	299	MACHINE SCREW
291	PLATE	300	STUD
292	PIN	301	COVER
293	STUD		

* REPAIR PARTS

FIGURE 1-2-8 — Anti-Shock-Open Device

the stem assembly actuates the breaker trip bar.

The long delay pickup is adjusted by turning screw (321) which moves pointer (320) and lower end of springs (319). Spring (319) via lever (318) hold down stem assembly (313) unless overcurrent exceeds calibrated pickup. The rate at which the stem will rise depends on the vacuum drag on the diaphragm (327). (The diaphragm is part of stem assembly (313)). Valve (324) controls the amount of air which can flow into the vacuum chamber. Turning dial (323) clockwise closes the tapered long delay orifice shown in Section "D". Spring (322) and clip (326) prevent accidental change in adjustment and screw (325) prevents excessive intentional adjustment.

The instantaneous pickup is factory set by turning screw (334) which moves pointer (332) and lower end of spring (331). Spring (331) will

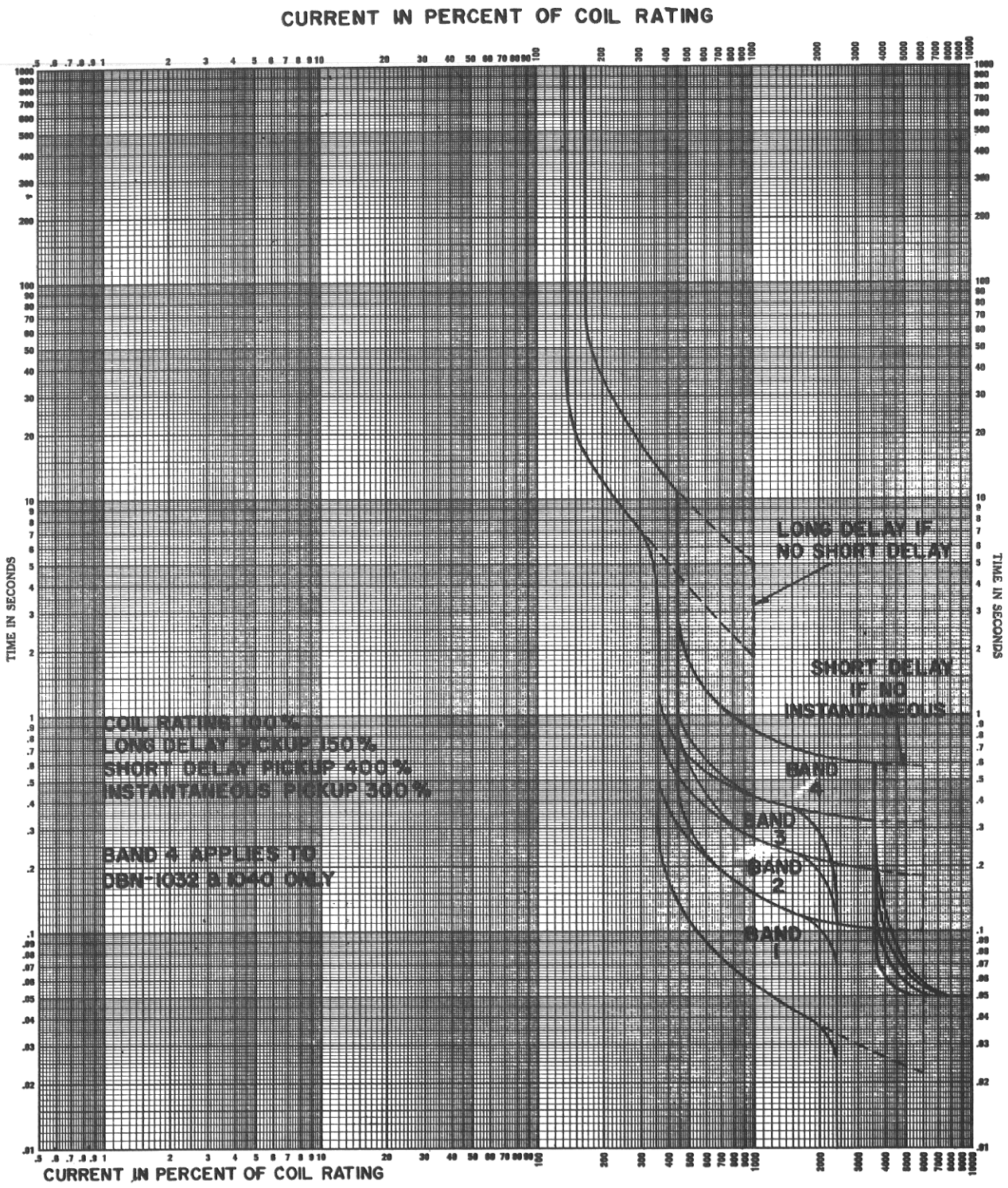
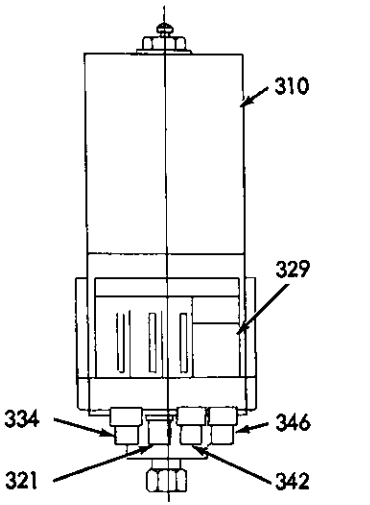
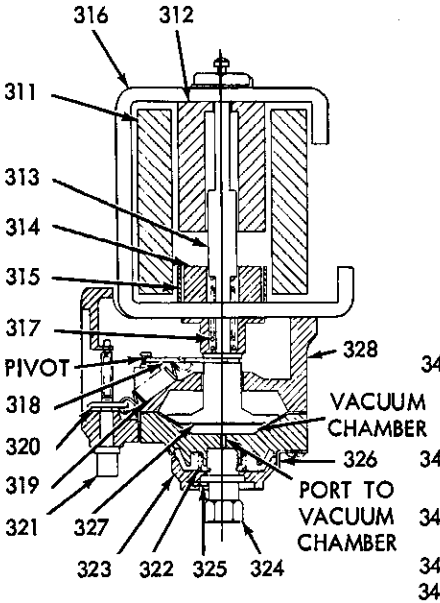


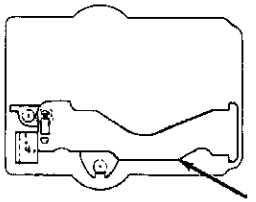
FIGURE 1-2-9 — Typical Time Current Curves

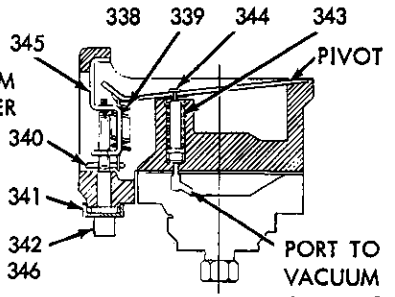


FRONT VIEW

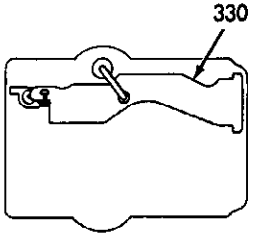


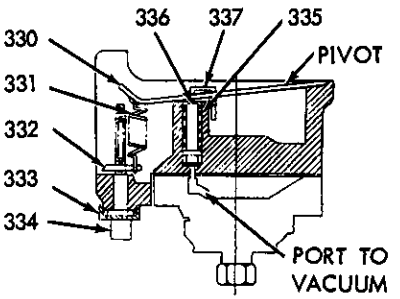
SECTION "A"



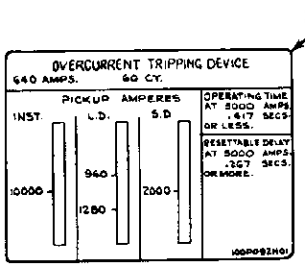


SECTION "B"

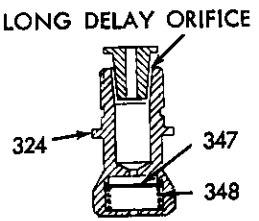




SECTION "C"



TYPICAL SCALEPLATE MARKING



LONG DELAY VALVE
SECTION "D"

310	OVERCURRENT TRIP DEVICE	324	VALVE (L.D. TIME)	336	VALVE (INSTANTANEOUS)
311	SERIES COIL	325	SCREW	337	QUICK RELEASE STEM
312	STATIONARY CORE	326	CLIP	338	ARMATURE (S.D.)
313	STEM ASSEMBLY	327	DIAPHRAGM (PART OF 313)	* 339	SPRING (S.D. PICKUP)
314	MOVING CORE	328	MOULDED CASE	340	POINTER (S.D. PICKUP)
315	RING	329	SCALEPLATE	341	CLIP
316	YOKE	330	ARMATURE (INSTANTANEOUS)	342	SCREW (S.D. PICKUP)
* 317	SPRING (LIMIT)	* 331	SPRING (INSTANTANEOUS)	* 343	SPRING (S.D. VALVE)
318	LEVER	332	PAINTER(	344	VALVE (S.D.)
* 319	SPRING (L.D. PICKUP)	332	PAINTER (INSTANTANEOUS)	345	BRACKET
320	POINTER (L.D. PICKUP)	333	CLIP	346	SCREW (S.D. TIME)
321	SCREW (L.D. PICKUP)	334	SCREW (INSTANTANEOUS)	347	DISC (RESET)
* 322	SPRING (L.D. DIAL)	* 335	SPRING (INST. VALVE)	* 348	SPRING (DISC)
323	DIAL (L.D.)				

* REPAIR PARTS

FIGURE 1-2-10 — Series Overcurrent Trip Device

hold down armature (330) until magnetic attraction of yoke (316) lifts armature. When the armature rises it will lift valve (336) and allow unlimited air to flow thru port to vacuum chamber. This releases (diaphragm) stem assembly to trip breaker instantly. Clip (333) is cemented to screw (334) to protect factory setting.

The short delay pickup is factory set by turning screw (342) which moves pointer (340) and lower end of spring (339). Spring (339) will hold down armature (338) until magnetic attraction of yoke (316) lifts armature. When the armature rises it will lift valve (344) and allow a controlled amount of air to flow thru port to vacuum chamber. Turning screw (346) moves bracket (345) which limits motion of armature (338). This adjustment controls air flow around valve (344) and predetermines short delay time required for stem to trip breaker. Two clips (341) are cemented to screws (342) and (346) to protect factory setting.

These overcurrent trip units have two additional features that insure good performance. First, if a unit has partially or completely reacted to an overcurrent condition and then the current subsides to zero or normal, a quick reset is desirable. As stem assembly (313) comes down, air is expelled thru port to bottom of long delay valve (324). Pressure moves disc (347) down providing a large opening for the expelled air. Spring (348) returns the disc to the sealed position after reset is completed. Second, during a tripping operation the breaker trip load should have a negligible affect on the time delay. Shortly after breaker trip load is engaged, lever (318) lifts quick release stem (337). This opens instantaneous valve (336) and allows stem assembly (313) to complete the tripping stroke instantly.

1-2-1-12 Auxiliary Switch—(See Figure 1-2-11)

The auxiliary switch is mounted on top of the circuit breaker shelf to the left of the operating mechanism.

The eight pole auxiliary switch (400) consists of two four pole switches; one mounted above the other. A third switch case, which contains a terminal block (422), is mounted above the switches.

Each auxiliary switch is a shaft operated four pole rotary type containing both normally open or normally closed contacts or a combination of normally open and normally closed contacts. The normally open or "a" contacts are open when the circuit breaker is in the open position and the normally closed contacts or "b" contacts are closed when the circuit breaker is open.

The rotor assembly consists of a square shaft (404), rotor ends (415) and (417), three rotor sections (416), moving contacts (401), arm (412), bushing (418) and screw (419) which clamps together the rotor assembly.

Each finger contact (405) backed by spring (406), is secured by a rivet and is attached to stem (407), which is secured to the case by collar (408). Screws (411) and crimp washer provide the terminal connections.

Link (420) is attached to the breaker lever of the operating mechanism. As the link is rotated by the action of the operating mechanism, arm (412) rotates the shaft (404) to reposition the moving contacts.

The moving contacts are set 60 degrees apart for a 60 degree rotation of the shaft. The contacts can be converted in the field to either normally open or normally closed by rotating the appropriate rotor section 60 degrees on the shaft.

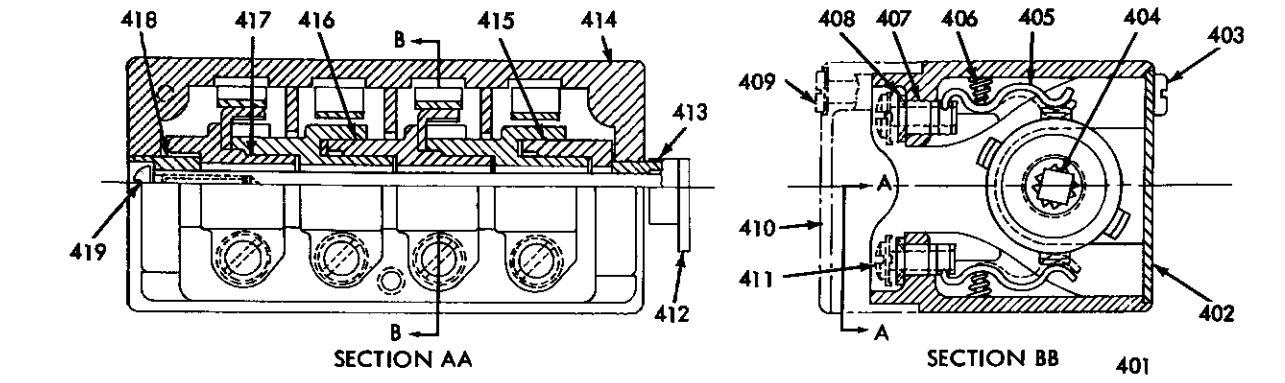
1-2-1-13 Main Disconnects—(See Figure 1-2-12)

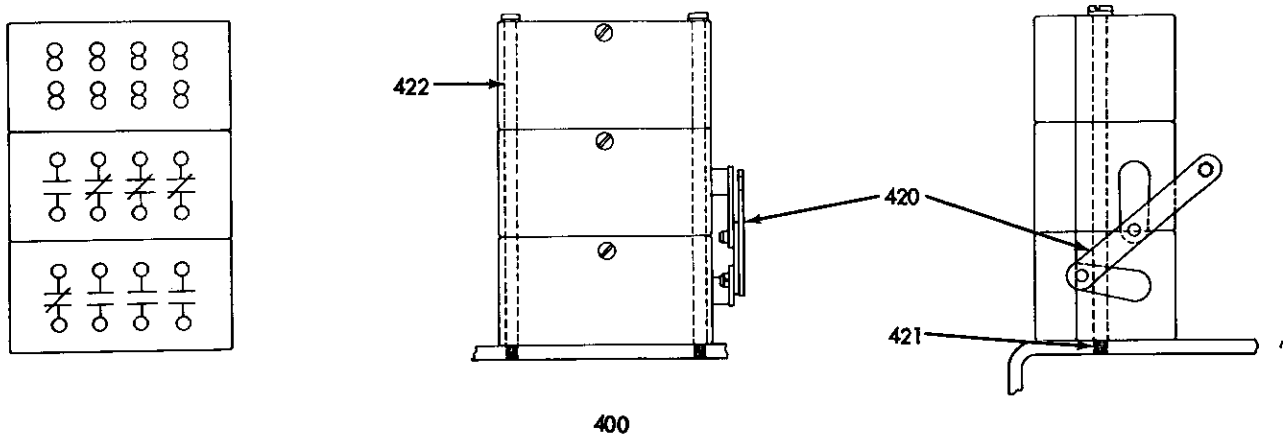
The main disconnects are mounted on the studs of the circuit breaker, one on each of the six breaker studs.

Each main disconnect consists of a finger retainer (428), the finger cluster (426) and two finger springs (427). The assembly is held on the studs by a protrusion on the finger cluster which fits in a slot in the stud. The finger cluster is held captive by a leaf type spring which is partially compressed in its normal position. When the mating stud of the stationary component enters the contact assembly, the fingers are forced open for additional spring compressing which exerts a double acting force on the contact fingers. The assembly, although secure on the studs is free to move up and down to rectify any slight misalignment of the two components.

1-2-1-14 Secondary Disconnects—(See Figure 1-2-12)

The secondary disconnects consist of two assemblies; the moving assembly, which is mounted on the breaker panel and the stationary assembly, which is mounted within the stationary component. The secondary contacts provide a means of connecting the breaker control circuit to the bus.



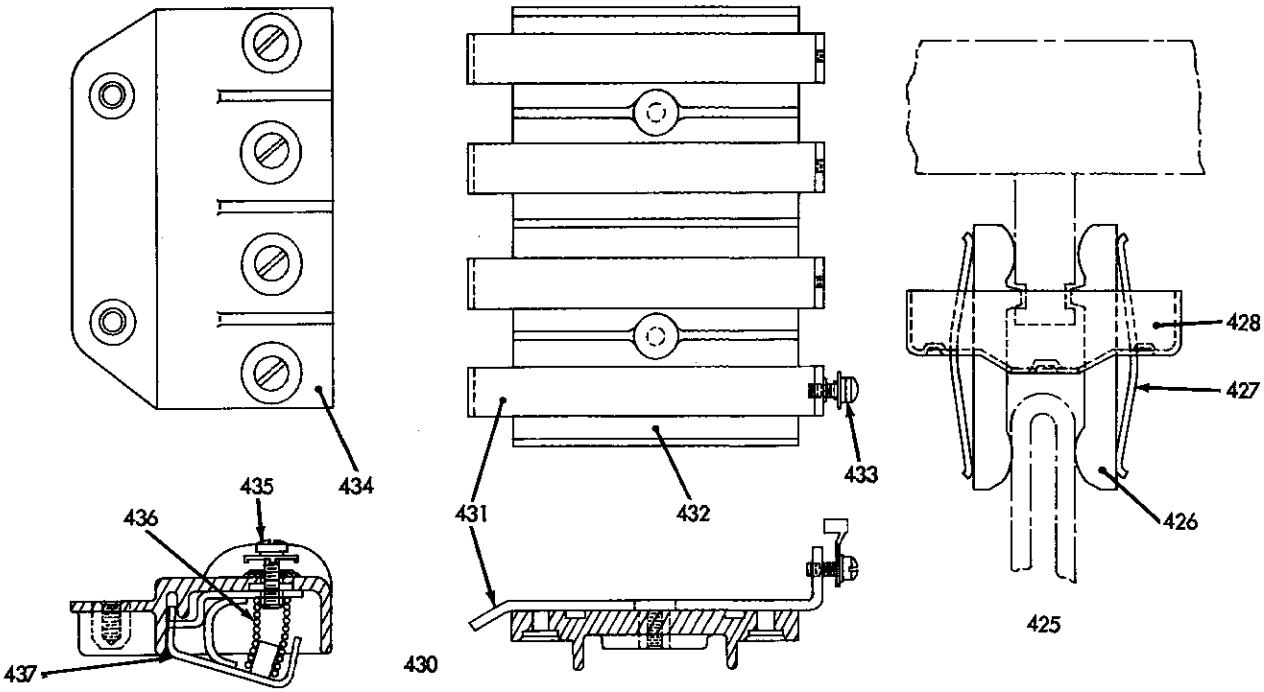


LEGEND

*400	AUXILIARY SWITCH	412	ARM
401	CONTACT	413	SPACER
402	BOTTOM COVER	414	CASE
403	SCREW	415	ROTOR END
404	SHAFT	416	ROTOR SECTION
405	CONTACT FINGER	417	ROTOR END
406	CONTACT SPRING	418	BUSHING
407	STEM	419	MACHINE SCREW
408	COLLAR	420	CONNECTION LINK
409	MACHINE SCREW	421	MACHINE BOLT
410	COVER	422	TERMINAL BLOCK
411	TERMINAL SCREW		

* REPAIR PARTS

FIGURE 1-2-11 — Auxiliary Switch



LEGEND

* 425	MAIN DISCONNECT	432	STATIONARY BASE
426	FINGER CLUSTER	433	TERMINAL CONNECTION
427	FINGER SPRING	434	MOVING BASE
428	FINGER RETAINER	435	TERMINAL CONNECTION
* 430	SECONDARY DISCONNECT	436	SPRING
431	STATIONARY FINGER ASSEMBLY	437	MOVING FINGER ASSEMBLY

* REPAIR PARTS

FIGURE 1-2-12 — Main and Secondary Disconects

The moving assembly consists of a base (434) on which are mounted four separate but identical contacts. Each contact consists of moving finger assembly (437) which is riveted to the base. Spring (436) forces the moving finger against the stationary finger assembly (431) when the breaker is in place.

The stationary assembly consists of a stationary base (432) and four separate but identical stationary finger assemblies. Each finger assembly is provided with a terminal (433) for the wiring connection.

1-2-1-15 Indicator Lights—(See Figure 1-2-13)

The a-c indicator lights when specified are mounted on the face plate and are used to indicate the operating state of the circuit breaker.

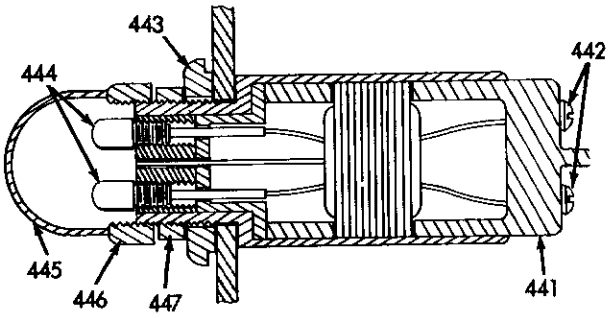
Each indicator light consists of a transformer assembly (441) and two lamps (Type TS-159), 2.5 volts. The lamps are connected in parallel as a safety precaution to insure visual indication of the signaled condition in the event of a lamp failure.

Two types of indicator lights are available. One is used in 450 volt, 60 cycle circuits; the other is used in 117 volt, 60 cycle circuits. The indicator lights are types B-27A or B-27B as covered by Navy standard drawing #9000-S6202-F-73907.

1-2-1-16 Cell Interlock—(See Figure 1-2-1)

The cell interlock assembly automatically opens the breaker prior to removal or installation of the breaker movable component in case it is in the closed position. It is located on the right side of the circuit breaker.

The cell interlock consists of lever handle (134) pivoted on pin (135) and lever unit (136). When the handle is pushed down, the breaker stop pin (137) is disengaged from the slot in



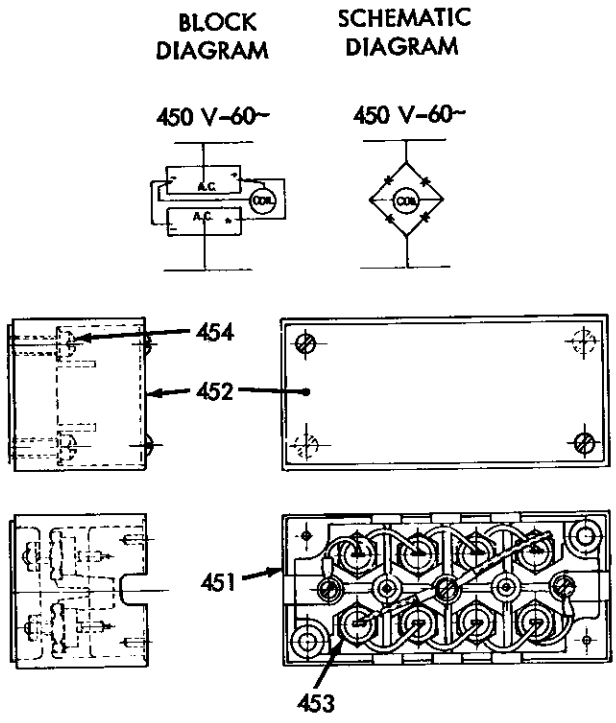
440

LEGEND

*	440	INDICATOR LIGHT ASSEMBLY
	441	TRANSFORMER ASSEMBLY
	442	TERMINAL SCREW
	443	TRIM PLATE
	444	LAMP
	445	GLOBE
	446	KNURLED RING
	447	LOCK NUT

* REPAIR PARTS

FIGURE 1-2-13 — Indicator Light



450

LEGEND

*	450	SILICON RECTIFIER
	451	CASE
	452	COVER
	453	RECTIFIER ELEMENT
	454	MOUNTING SCREWS

* REPAIR PARTS

FIGURE 1-2-14 — Silicon Rectifier

the extension rails and the lever unit rotates the circuit breaker trip bar to trip the circuit breaker. When the lever is released spring (138) returns the lever to its normal position.

1-2-1-17 Extension Rails—(See Figure 1-1-1)

The extension rails are an integral part of the stationary component on which the movable component rolls in and out of position. The rails are pivoted on the rail pivot pin and may be lowered by loosening the thumbscrew and pulling the lever handle down. As the levering handle is pulled down, the cam section of the extension rails acts on the cam roller of the circuit breaker to disengage the main and secondary disconnect contacts. The rails permit racking out of the movable component to a position where it is possible to inspect the main and secondary disconnects within the switchboard cubicle without removing the movable component.

If the operator releases a movable component that is being drawn out, the free roll of movable component will be limited to about one inch by the cell interlock lever. After the cell interlock lever has latched, it must be depressed before further motion is possible.

1-2-1-18 Silicon Rectifier—(See Figure 1-2-14)

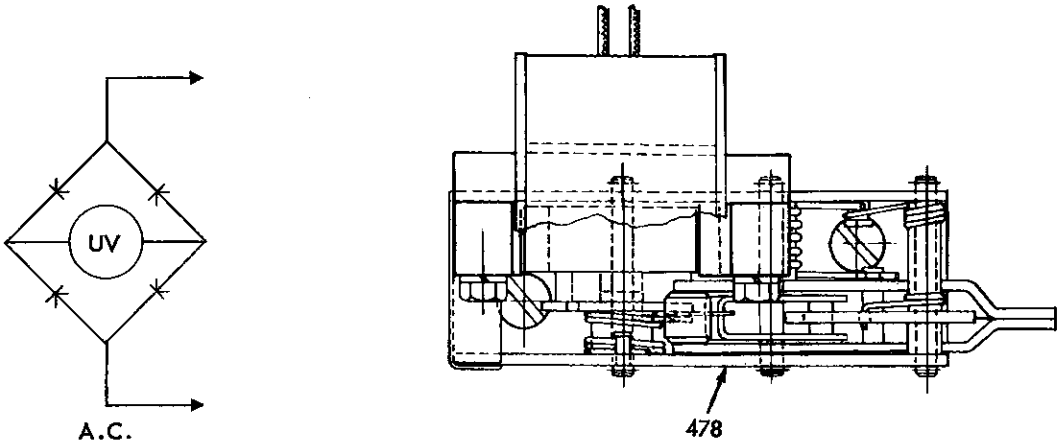
The Silicon Rectifier Assembly converts alternating current (a-c) to direct current (d-c).

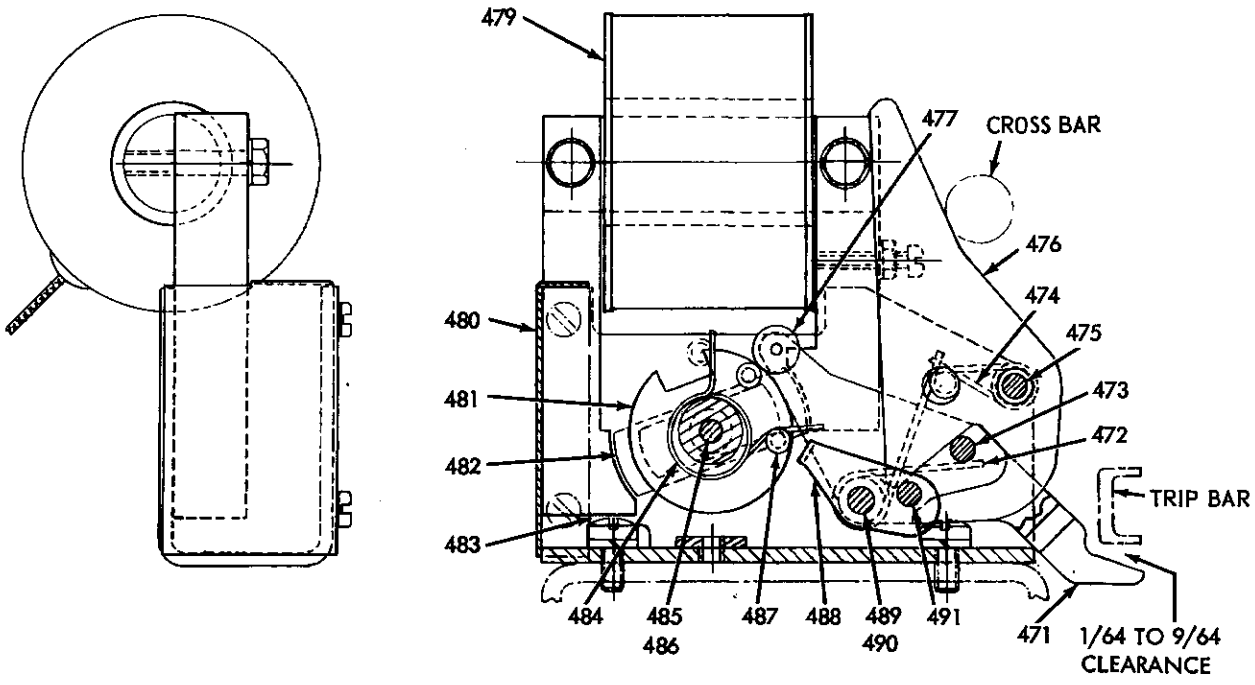
When used in conjunction with the undervoltage trip device, it is located on the front of the movable component metal base underneath the overcurrent trips.

The rectifier is composed of two units. Each consists of case (451) and cover (452) which encloses eight rectifier elements (453). The rectifier units are wired in a bridge type arrangement as shown in Figure 1-2-14.

1-2-1-19 Undervoltage Trip Device—(See Figure 1-2-15)

The undervoltage trip device is provided to trip the circuit breaker when the line volt-





470 Undervoltage Trip Device	481 Cam
471 Trip Lever	482 Armature
*472 Trip Spring	483 Side Bar
473 Pin	*484 Armature Spring
*474 Reset Spring	485 Pin
475 Pin	486 Truarc Ring
476 Reset Lever	487 Pin
477 Roller	488 Spring Release
478 Frame	489 Pin
*479 Coil	490 Truarc Ring
480 Cover	491 Pin

* Repair Parts

FIGURE 1-2-15 — Undervoltage Trip Device

age drops below the nominal transient voltage level. It is secured to the front shelf of the circuit breaker by two bolts. The device operates on the main trip bar to open the circuit breaker without intentional time delay and is automatically reset by breaker action.

At nominal rated voltage the armature (482) is held in place between the pole faces against the torque of armature spring (484). Under normal conditions roller (477) rests on the surface of cam (481) and holds lever (471) away from the trip bar. When the voltage falls below a predetermined value, armature spring (484) rotates the armature and cam assembly clockwise until roller (477) is forced into the cam slot by trip spring (472) which causes the trip lever (471) to rotate the circuit breaker trip bar.

As the circuit breaker opens, the crossbar rotates reset lever (476) counterclockwise about pin (475), and the reset lever (476) rotates spring release (488) clockwise about pin (489) thereby, removing the spring load on the armature-cam assembly. In addition the reset lever (476) rotates trip lever (471) clockwise which forces the roller (477) out of the slots.

After the line voltage is restored the magnetic force aligns the armature (482) with the pole faces. As the circuit breaker closes, cross bar (197) releases the reset lever (476) and the trip lever (471). The trip lever is rotated counterclockwise by trip spring (472) until roller (477) resets on the cam surface.

CHAPTER 2
PRINCIPLES OF OPERATION
Section 1—Basic Principles

2-1-1 GENERAL

2-1-1-1 Description

The DBN-406 circuit breaker is a device for interrupting, in air, a circuit between separable contacts under infrequent, normal and abnormal conditions. It is a type ACB-640R circuit breaker with interrupting and continuous current rating as follows:

Interrupting
Rating . . . . . 500 V., 60 Cycles A.C.
R.M.S. Amperes A.C., 40,000

Continuous Current Rating:
Circuit Breaker Copper
Rating . . . . . 640 Amperes
Overcurrent Trip Coil
Rating . . . . . Amperes

160	480
250	560
320	640
400	

The breakers are furnished with 3 pole construction for removable assembly type mounting. Each pole unit is mounted on individual insulated moldings. These moldings isolate the main current carrying structure from the metal supporting base of the circuit breaker. The main power circuit consists of the upper stud, stationary contact, moving contact assembly and laminated conductors, overcurrent trip coil, and lower stud, all connected in series in the order named.

The operating mechanism simultaneously actuates the moving contacts of all poles. It is a complete removable unit in which are housed the closing toggles and latches.

The closing force is transmitted through the toggles and links to the cross bar on which the moving contact assemblies are bolted. At the end of the closing sequence, the mechanism latches and holds the contacts closed.

On manually operated circuit breakers, the closing force is initiated by means of the operating handle. On electrically operated circuit breakers, the closing solenoid supplies the closing force. The closing relay regulates the current drawn by the solenoid closing coil.

Each moving contact is connected directly to the lower terminal of the series overcurrent coil by its laminated flexible conductors. The moving contacts make or break a main circuit by moving in or out from the stationary contacts. The contacts are quick break under all conditions of operation. Arc chutes are installed to split, lengthen, cool, and extinguish the arc that is drawn when the contacts open.

The circuit breaker is mechanically trip free; that is, the tripping mechanism can trip even though: (1) In a manually operated circuit breaker, the operating handle is held in closed position or, (2) In an electrically operated circuit breaker, the closing control circuit is energized. The closing mechanism will not reclose it after tripping until the closing control circuit is opened and again closed.

The shunt trip device provides an electrical means for tripping the breaker without regard to the load conditions in the circuit. An auxiliary switch is incorporated to open or close contacts for use in protective and control circuits. Shunt trip and indicating lamp circuits are connected through the auxiliary switch. Manual tripping is accomplished by rotating the closing handle.

The overcurrent device is a calibrated unit which offers protection to the equipment in the circuit when the current reaches limits in excess of the predetermined settings. It will cause the breaker to open by direct action on the trip bar.

The undervoltage device trips the breaker open when the voltage drops below the normal transient level.

2-1-1-2 Closing

On manually operated circuit breakers, closing is accomplished by rotating the operating handle clockwise approximately 90°. The closing motion should be smooth and quick. After closing the circuit breaker, allow the operating handle to resume its normal position.

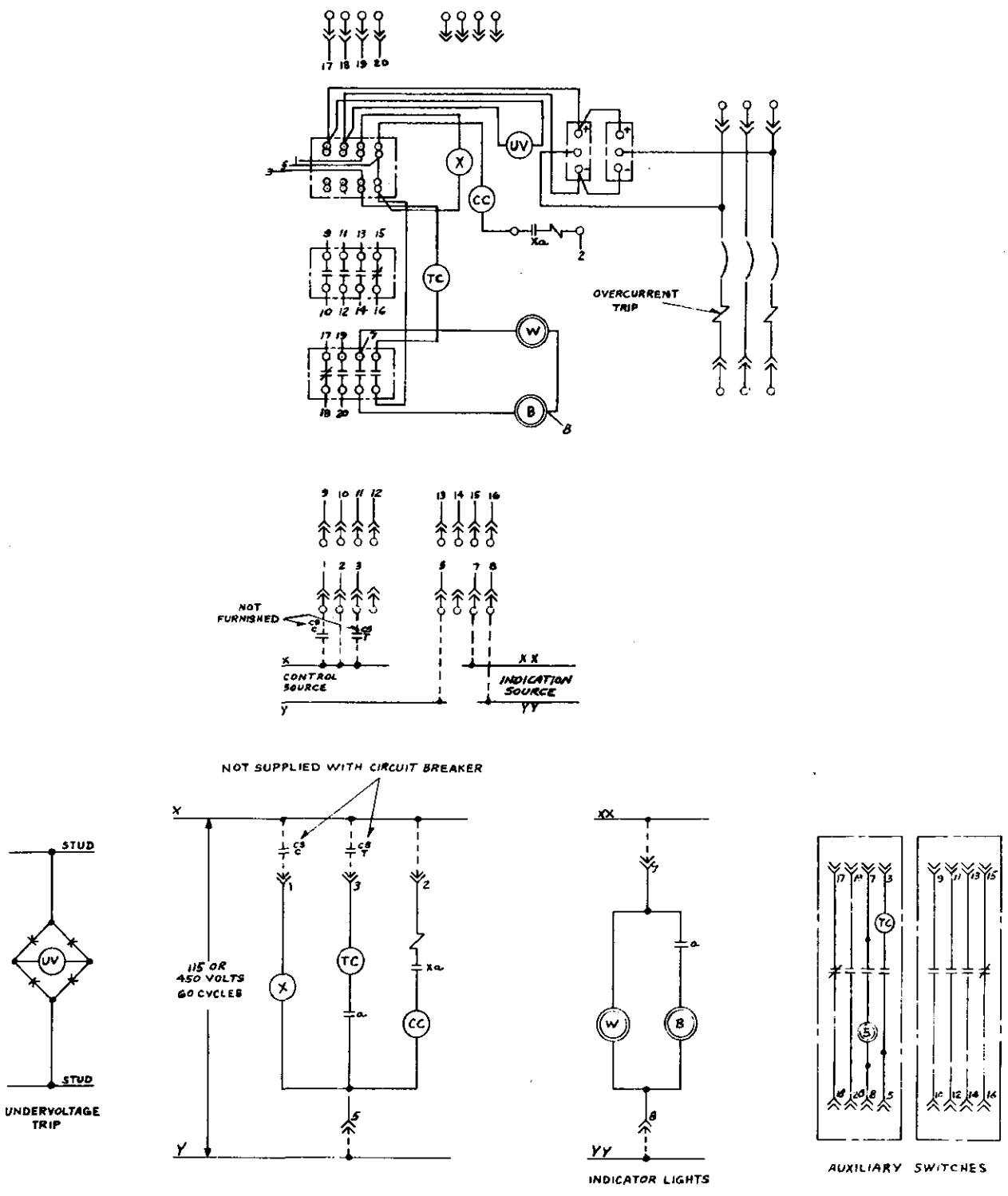


FIGURE 2-1-1 — Wiring Diagram

On electrically operated circuit breakers, the closing solenoid provides a means for closing the circuit breaker. To close the breaker electrically, turn the control switch, which is remotely located, to the "CLOSE" position to energize the pickup coil of the closing relay.

This closing relay controls the supply of current necessary to energize the solenoid closing coil. When the closing coil is energized, the plunger push rod in the closing solenoid rises to close the circuit breaker.

Electrically operated circuit breakers may also be closed manually by rotating the operating handle clockwise approximately 90°.

2-1-1-3 Tripping

Tripping of the circuit breaker, whether manually operated or electrically operated, can be accomplished by means of the manual handle, the shunt trip device, or the overcurrent trip unit.

To trip the circuit breaker electrically, turn the control switch, which is remotely located, to the "TRIP" position in order to energize the shunt trip coil. With this trip coil circuit closed, the shunt trip device will operate to rotate the trip bar and trip the circuit breaker.

The overcurrent trip unit will also cause the circuit breaker to open by direct action on the trip bar whenever the current exceeds the designated pickup values.

2-1-1-4 Electrical Operation

Figure 2-1-1 shows the wiring diagram and the schematic diagram for an electrically operated circuit breaker. When the close switch (CSC) is closed, the closing relay is actuated which closes contacts Xa to energize the closing magnet. The closing magnet closes the breaker as described in Chapter 1, Section 3. When the breaker is closed, the normally open circuit breaker contact "a" closes to set up the shunt trip circuit. Closing the circuit breaker trip switch (CST) energizes the trip coil to trip the circuit breaker as described in Chapter 1, Section 3.

This figure also includes a schematic diagram of the indicating light circuit. The white lamp is energized whenever control power is available. When the circuit breaker is closed auxiliary contact "a" closes to energize the blue indicating lamp. These indicating lamps provide a convenient means of observing the operating state of the circuit breaker.

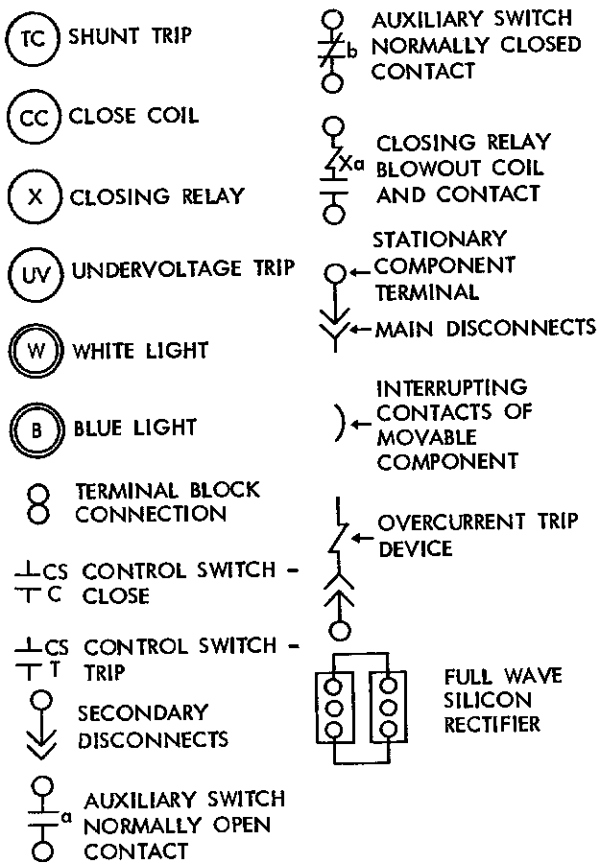


FIGURE 2-1-2 — Schematic Symbols

CHAPTER 3
OPERATING INSTRUCTIONS

Section 1—Precautions

3-1-1 SAFETY PRECAUTIONS

3-1-1-1 When operating or working on the circuit breaker at any time, the following safety precautions are to be adhered to:

A. Never attempt any maintenance operation unless breaker is open and in a withdrawn position.

B. Never use kerosene, gasoline or other combustible solvents to clean the circuit breaker as their use is dangerous and may result in an explosion.

C. Never clean or dress contacts with emery cloth since the abrasive dust is a conductor and may cause trouble if allowed to settle on insulating surfaces. Rough or high spots should be removed with a fine file or sandpaper.

CHAPTER 4
INSTALLATION

Section 1—Installation Instructions

4-1-1 GENERAL

4-1-1-1 For information in regard to unpacking and handling see preliminary data on page iii. Refer to Figures 7-1-1 and 7-1-2 for outline and mounting dimensions.

4-1-1-2 To install the stationary component:

(a) If the movable component is in the stationary component, remove it following instructions in paragraph 4-1-1-4.

CAUTION

If circuit breaker is to be removed from a stationary component that is not mounted in a switchboard, care must be taken so the assembly does not tilt forward when removing the breaker.

(b) Insert stationary component into switchboard compartment making certain that it moves all the way in so that it is tight against the structural members at the rear of the compartment.

(c) Secure the stationary component to the switchboard structure by means of: (1) six 1/2-13 hex-head bolts inserted from the rear of the switchboard through holes in the vertical members at the rear of the compartment and into the tapped holes in the rear of the stationary component, and (2) four 3/4-10 hex-head bolts inserted through four holes in the lower front edge of the stationary component and into the tapped hole in the switchboard structural member.

NOTE

If the stationary component is to be mounted in the bottom compartment of the switchboard, the bolts used for securing the switchboard to its foundation must first go through the lower front edge of the stationary component, then through the base member of the switchboard and into the switchboard foundation structure or channels.

(d) Make the necessary control wiring connections to the stationary secondary disconnect fingers.

(e) Connect the switchboard bus work to the primary breaker studs following Navy accepted practices.

4-1-1-3 To install the movable component into the stationary component.

(a) Turn the knurled screw that secures the rail extension assembly in a vertical position counterclockwise until the threads are fully disengaged, and lower the rail extensions.

(b) Remove the screw at the far end of each of the two flat bars of the extension lever handle that slide into the rail extensions. Remove the extension lever handle by pulling straight out.

(c) Lift the movable component by means of suitable hooks placed in the lifting holes, and place it on the rail extensions making sure that the front roll-out wheels are directly behind the stop on the front end of the top edge of the rail extensions. The two flanges on the roll-out wheels should straddle the rail extensions.

(d) Depress the cell interlock lever on the front lower-right-hand portion of the movable component and push the movable component into the stationary component until the cam roller hits the cam on the far end of the rail extensions.

(e) Replace the extension lever handle following instructions in paragraph (b), above, in reverse order.

(f) For this step it is not necessary to depress the cell interlock lever. Push up on the extension lever handle until the rail extensions are almost in a vertical position, then slide the extension lever handle into the rail extensions all the way, and continue then to push on the extension lever until the rail extensions are vertical. During the above procedure the cam rollers on the movable component engage in the cam on the rail extensions to move the movable component into the connected position. When the connected position is reached the cell

interlock lever will move up to lock the rail extension in a vertical position.

(g) Secure the extension lever handle by turning and tightening the knurled screw in a clockwise direction.

(h) The movable component is now in the operating position.

4-1-1-4 To withdraw the movable component.

(a) Turn the knurled screw that secures the rail extension assembly in a vertical position counterclockwise until the threads disengage, depress cell interlock lever and pull out slightly on the extension lever handle. Remove manual pressure from the cell interlock lever and continue to pull on the extension lever handle until the rail extensions are in a horizontal position. During this procedure the cam rollers, engaged to the cams, pull the movable component to the disconnected position.

(b) In this position both the primary and secondary disconnect fingers are disconnected, and the movable component is trip free and cannot be closed either electrically or manually until it is pulled forward so the cell interlock on the right side of the moving component engages in one of the notches on the lower edge of the right hand rail extension.

4-1-1-5 To insert the movable component follow the instructions in paragraph 4-1-1-4 part d, f, and g.

4-1-1-6 To install replacement movable component: Four dowel pins are furnished on the stationary component. These dowel pins fit into four holes, one in each corner, in the back plate of the movable component. When the stationary component and the movable component are shipped as one assembly, the dowel pins are adjusted at the factory. When the movable components in an installation are changed the dowel pins should be adjusted as follows:

(a) With movable component removed, loosen dowel pin nuts and make finger tight.

(b) Mount the movable component in the stationary component and move it to the connected position.

(c) Tighten the dowel pin nuts from the rear while holding the front end of the pin with a screw driver.

CHAPTER 5
MAINTENANCE

Section 1—Preventive Maintenance

5-2-1 GENERAL INSTRUCTIONS

5-1-1-1 General

The ACB-640R circuit breaker should be completely inspected as a preventive maintenance procedure at least once a year. However, any circuit breaker that has opened under a heavy short-circuit current should be inspected as soon as possible.

When inspecting a circuit breaker, examine the contact surfaces; rough or high spots should be removed. Refer to corrective maintenance procedure. Arc chutes that are badly burned or corroded should be cleaned or replaced.

If excessive heating not caused by overcurrent is observed, look for loose or corroded contacts or connections. Examine the internal wiring for damage or breaks and make the necessary repairs.

Keep the components clean and free of dust, dirt, oil and foreign matter, if allowed to accumulate it could contaminate the insulation and lead to circuit breakdown. Accumulated dirt and dust should be removed. Vacuum cleaning or hand dusting is satisfactory. If used compressed air must be clean and free of condensation.

Section 2—Corrective Maintenance

5-2-1 GENERAL INSTRUCTIONS

5-2-1-1 General

The need for corrective maintenance can be considerably reduced by performing the preventive maintenance procedure. Should any of the sub-assemblies require repair or replacement, refer to the appropriate paragraph in Section 5-2 for detailed instructions.

5-2-1-2 Chassis

Refer to Paragraph 1-2-1-2 for description of the chassis of the air circuit breaker. The chassis will require no maintenance other than keeping it clean, free of dirt, dust and other foreign matter.

5-2-1-3 Pole Unit—(See Figure 1-2-2)

Refer to Paragraph 1-2-1-3 for description and operation of the pole units. The correct contact pressure of the DBN-406 is obtained when the arcing contact surfaces are 3/32 inch apart when the breaker is closed. This gap may be adjusted after removing arc chute (111) and crossbar (197) (Figure 1-2-1). Loosen locknut (121) and turn insulating link (120) counterclockwise if the gap is too small and clockwise if the gap is too large. The locknut must be retightened after the adjustment has been completed. Then replace crossbar and arc chutes (Paragraphs 5-2-1-4 and 5-2-1-5).

The arcing contacts should be replaced if they are severely pitted or when they are excessively worn. To replace a moving arcing contact (114), remove screw (112) then remove arc chute (111). Bend down locking clips (116) and remove two bolts (115). Remove arcing contact and replace with new arcing contact. Reassemble in reverse order of disassembly, making sure to relock bolts by bending up locking clips. To replace stationary arcing contact (108), remove arc chute (111), then remove two screws (107) and remove arcing contact. Place new arcing contact in position and replace screws (107). Replace arc chute and secure with screw (112).

Sluggish or slow operation of the moving contact assembly will result in excessive arcing and rapid deterioration of the arcing contacts. This condition could be caused by a broken or defective contact arm accelerating spring (103). To replace the contact arm accelerating spring, remove the arc chute (112). Compress accelerating spring until it is free of projection on contact arm, and remove spring. Replace new spring in similar manner, making sure end of a spring is centered on the projection on the contact arm.

5-2-1-4 Arc Chute—(See Figure 1-2-2)

Refer to Paragraph 1-3-1-4 for description of the arc chute. The arc chute requires no maintenance other than keeping clean and free of foreign matter. When inspection shows that the plates of the arc chute are badly burned, it should be replaced.

To replace the arc chute, remove screw (112) and lift arc chute free of breaker. Place new arc chute in position and replace screw (112).

5-2-1-5 Operating Mechanism—(See Figure 1-2-3)

Refer to Paragraph 1-2-1-5 for description and operation of the operating mechanism. The only maintenance required other than keeping the operating mechanism clean and free of foreign material will be the replacement of a broken or defective spring.

To replace any of the springs, first remove the terminal block and auxiliary switch, then remove the mechanism from the circuit breaker. Refer to the appropriate Paragraph for removal instructions of the aforementioned items. Rotate handle (193) clockwise until pin (180) is visible through a hole in the right side of the mechanism frame. Using a small rod as a pusher, shove the pin (180) part way through the hold until the retrieve rod, in the case of manually operated circuit breaker, or the rod of the closing magnet, in the case of electrically operated circuit breaker, drops off. Remove handle (193) by removing set screw (172). Tag and disconnect the wires from the indicating light terminals. Remove face plate (196) by removing five screws (194) and (195) and sliding face plate forward. Remove four bolts securing mechanism to shelf and remove mechanism. These four bolts also free either the retrieve rod of manually operated breaker or the closing solenoid of electrically operated breaker which should be temporarily replaced while repairs to the mechanism are being made. Remove trip lever (187) by removing pin (186) and unhook spring (181) from the roller latch (189) and the trip lever (187). Reassemble in reverse order to disassembly procedure.

To replace the pawl spring (188) remove the mechanism from the circuit breaker as described above. Slide pin (184) out far enough to release pawl (182). Roller latch (189) which is pivoted on the same pin will then remain in place. Replace springs (188), making sure that the spring ends are supported correctly as indicated in Figure 1-2-3. Reassemble in reverse order to disassembly procedure.

To replace trip spring (175) or handle return spring (176), remove the mechanism from the circuit breaker as described above. Remove pin and drop pawl (182) and roller latch (189) out of frame. Remove snap ring from handle shaft (174) and push handle shaft back into frame and remove the defective spring (175) or (176). Reassemble in reverse order to disassembly instructions.

To replace retrieve spring (171) remove the mechanism from the circuit breaker as described above. Remove cover (166), then remove pins (168) and (170). Remove retrieve spring (171). Reassemble in reverse order to disassembly instructions.

5-2-1-6 Closing Relay—(See Figure 1-2-4)

Refer to Paragraph 1-2-1-6 for description and operation of the closing relay. The required maintenance will consist of replacing a broken or defective spring and repairing or replacing the contacts.

Remove the closing relay (200) from the circuit breaker before attempting any disassembly. To remove the closing relay from the circuit breaker, remove screw (222) and lift off molded cover (232) to expose the terminal connections. Tag, then remove the terminal connections by loosening four screws (229). Remove the two screws securing the closing relay to the circuit breaker shelf (143) (Figure 1-2-1). Remove relay from circuit breaker.

To replace a defective relay coil (211), remove three screws (233) holding coil frame (230) to molded base (234) and remove frame from base. Pull out guide tube (208) and screw (217) which allows stationary core to drop out. Reassemble, using new coil, in reverse order to disassembly procedure.

To replace a defective or broken latch spring (215), remove three screws (233) holding coil frame (230) to molded base (234) and remove from base. Lift moving core assembly (214). Then, rotate latch counterclockwise as far as possible. The spring will drop out. Replace spring and reassemble in reverse order to disassembly procedure.

To replace a defective or broken trip spring (202), remove release bracket pin (206). To reassemble, re-position pin, using new spring.

To replace a defective or broken contact arm assembly spring (203), remove ring from one end of contact arm pin (220) and push pin

out. Remove contact arm assembly (224) and spring (203). Reposition contact arm assembly and new spring, making certain that the ends of the spring encircle the projections on the arc chamber (231) and the contact arm.

To replace a defective or broken moving contact spring (221), remove elastic stop nut (223) and withdraw spring. Insert new spring and install stop nut.

The moving and stationary contacts can be cleaned with fine sandpaper or a fine file. However, if the contacts are seriously pitted or excessively worn, they should be replaced, To replace a moving contact (224) remove elastic stop nut (223), withdraw spring, disconnect contact lead from the applicable terminal screw (229) and remove contact. Reassemble in reverse order to disassembly after positioning new contact.

To replace a right hand stationary contact (225) remove applicable screw and replace contact. If left hand stationary contact is to be removed, it requires prior removal of the blowout magnet assembly as outlined below.

Excessive arcing could be caused by a defective blow out coil. This results in rapid deterioration of the contacts. To replace a defective magnetic assembly (226), disconnect blow out coil leads, remove screw (227) and withdraw blow out coil. Replace with new coil and secure with screw. Reconnect blow out coil leads.

5-2-1-7 Closing Solenoid—(See Figure 1-2-5)

Refer to Paragraph 1-2-1-7 for description and operation of the closing solenoid (250). The closing coil is the only part of the closing solenoid which may require replacement.

To replace a defective closing coil, remove handle (193) (Figure 1-2-1) by removing set screw (172) and slide handle off shaft (174). Tag, then remove wire connections from indicating light (440) terminals. Remove five screws (194) and (195), then remove face plate. Remove trip bracket (256) by removing bolts (257), and lock plate (258). Disconnect closing coil leads from terminal block and closing relay. Remove coil from yoke and insert new or serviceable coil. Reassemble in reverse order to disassembly procedure.

5-2-1-8 Shunt Trip Device—(See Figure 1-2-6)

Refer to Paragraph 1-2-1-8 for description and operation of the shunt trip device (260). The shunt trip device requires no maintenance other than the normal cleaning procedures. If a trip coil or spring becomes defective, it must be replaced.

To replace a defective coil (270), disconnect the shunt trip coil leads from the auxiliary switch. Remove two bolts (261) and remove shunt trip device from shelf. Remove holding plate (263) by removing two screws (264). Slide out the moving core (268), stationary core (275), spring (273), washer (272) and sleeve (269). Lift out coil (270). Reassemble the shunt trip device with new or serviceable coil in reverse order to disassembly procedure.

To replace a defective or broken reset spring (273), follow above disassembly instructions until spring is removed. Replace spring and reassemble in reverse order to disassembly instructions.

5-2-1-9 Anti-Shock-Close Device—(See Figure 1-2-7)

Refer to Paragraph 1-2-1-9 for description and operation of the anti-shock-close device. Maintenance procedures consist of replacing a broken or defective return spring.

To replace a defective return spring (282) remove truarc ring from end of pin (184) and slide off latch plate (281) and return spring (282). Renew spring and reassemble in reverse order to disassembly instructions.

5-2-1-10 Anti-Shock-Open Device—(See Figure 1-2-8)

Refer to Paragraph 1-2-1-10 for description and operation of the anti-shock-open device. Maintenance procedure consists of replacement of a broken or defective plate spring (287) or weight spring (297).

To replace a defective plate spring, remove cover (301) by removing screw (299). Remove screws (298) and remove anti-shock-open device from circuit breaker. Remove right hand truarc ring from pin (289) and withdraw pin enough to free spring (287). Remove spring. Reassemble in reverse order of disassembly procedure.

5-2-1-11 Series Overcurrent Trip Device—(See Figure 1-2-10)

Refer to Paragraph 1-2-1-11 for description and operation of the series overcurrent trip device. No corrective maintenance should be attempted on the overcurrent trip device, since the proper operation of this unit is dependent not only on the characteristics of a re-

placed part but also is related to the combined characteristics of all associated springs or valves. If the overcurrent trip device fails to function properly or should it be accidently damaged, the unit must be returned to the manufacturer for repairs and re-calibration.

The long time delay pickup adjustment is the only field adjustment that should be made. To change the pickup current setting of the long time delay unit, turn the adjusting knob (321) until the indicator points at the desired setting. Adjusting screw (334), (342) and (346) are sealed so they cannot be turned accidently.

Repair springs are included with onboard repair parts, however they should be used only under supervision of manufacturers representative.

To replace overcurrent trip device with copper connector, remove overcurrent trip by removing bolts (134) and (135). (Fig. 1-2-2). Bolt copper connector (128) in place as shown in Figure 1-2-2.

5-2-1-12 Auxiliary Switch—(See Figure 1-2-11)

Refer to Paragraph 1-2-1-12 for description and operation of the auxiliary switch. At least once each year, the auxiliary switch should be inspected and cleaned. Any parts showing obvious wear or damage should be replaced.

The auxiliary switch is not adjustable. However, the contacts can be converted to either normally open or normally closed by rotating the appropriate rotor section 60 degrees on the shaft. To convert a normally open or normally closed contact; tag, then remove the terminal connections. Disconnect link (420) from closing lever. Remove the two mounting bolts (421) and remove switch from breaker. For identical reassembly, note the exact position of the rotating contacts with respect to the stationary contacts with the exception of the contact that is to be converted. Remove screw (419) and bushing (418), withdraw shaft (404) completely. Lift the rotor assembly out of case. Pull the rotor apart slightly at the contact to be changed to disengage positioning lugs. Rotate the contact 60 degrees clockwise to convert a normally open contact to a normally closed contact when effected contact is in the lower switch and counterclockwise to convert a normally open contact to a normally closed contact when the effected contact is in the top switch. Reverse this procedure when converting a normally closed contact to a normally open contact. Push the rotor assembly together to lock in place. Reassemble in reverse order to disassembly instructions making certain the position rotor assembly is in its identical original position. This precaution is required since it is possible to insert shaft with the rotor rotated 30 degrees either direction.

To replace an auxiliary switch; tag, then remove the terminal connections. Disconnect link (420) from closing lever and disconnect arm (412) from link of switch to be replaced. Remove two mounting bolts (421) and remove switch. Tag and disconnect terminal connections between terminal block and auxiliary switch to be replaced. Replace with new switch making sure that contacts of new switch are positioned identical with contacts of switch being replaced. Refer above for instructions regarding positioning of contacts. Reassemble auxiliary switch in reverse order of disassembly procedure.

5-2-1-13 Main Discounts—(See Figure 1-2-12)

Refer to Paragraph 1-2-1-13 for description and operation of the main disconnects. The main disconnects require no maintenance except to keep the contacts clean. If the contacts become badly pitted or worn, the entire assembly must be replaced.

To remove a finger cluster, depress both leaf type finger springs (427) and slide retainer off. Reassemble, using new assembly in reverse order to disassembly instructions.

5-2-1-14 Secondary Contacts—(See Figure 1-2-12)

Refer to Paragraph 1-2-1-14 for description and operation of the secondary contacts.

The contacts should be inspected and cleaned occasionally. Note that stationary contacts may be energized even though breaker is withdrawn.

Since these are not interrupting contacts, corrective maintenance will be required only if moving contact assemblies are damaged by handling. In this case complete moving contact assembly must be replaced.

To replace the secondary contact assemblies; tag, then remove all wiring at the terminal connections. Remove the two mounting screws from each assembly and remove the assembly. Replace new assembly in reverse order to disassembly procedures.

5-2-1-15 Indicator Lights—(See Figure 1-2-13)

Refer to Paragraph 1-2-1-15 for description and operation of the indicating lamps.

Maintenance procedure consists of replacing a defective lamp.

To replace a defective lamp, remove globe (445) by turning knurled nut (446) counterclockwise and turn defective lamp out. Reassemble in reverse order to disassembly procedure.

5-2-1-16 Cell Interlock

Refer to Paragraph 1-2-1-16 for description and operation of the drawout interlock. The drawout interlock requires no maintenance other than keeping clean.

5-2-1-17 Extension Rails

Refer to Paragraph 1-2-1-17 for description and operation of the extension rails. The extension rails require no maintenance other than keeping clean.

5-2-1-18 Silicon Rectifier—(See Figure 1-2-14)

Refer to Paragraph 1-2-1-18 for description and operation of the rectifier. The rectifier assembly requires no maintenance other than keeping clean. A defective rectifier must be replaced. Never attempt to repair or replace a damaged element.

To replace a rectifier, remove cover (452); tag, then disconnect wiring connections. Remove screws (454) and lift rectifier unit clear of circuit breaker. Remove second unit in similar manner. Replace both units and reassemble in reverse order to disassembly procedure.

5-2-1-19 Under Voltage Trip Device—(See Figure 1-2-15)

Refer to Paragraph 1-2-1-19 for description and operation of the undervoltage trip device. Maintenance procedures consist of replacement of a defective coil, reset lever spring or a trip spring. The clearance between the trip lever and trip bar is not adjustable but should be as shown in Figure 1-2-15.

To replace a defective coil (479) remove two pan head machine screws and lift up coil and core. Reassemble in reverse order to disassembly procedure.

To replace a defective armature spring (484) remove coil (479) and cover (480). Release armature spring (484) from the stop on the side of the frame (478). Remove truarc rings (486) from pin (485) and push pin (485) until the armature spring (484) and its spacer drops out.

To replace the armature spring, place the spring on spacer and slide the spring and spacer forward until the bent end slides on to the cam stop and over the spring release (488). Slide pin (485) into position and replace truarc rings (486). Using small hook pull the other end of the armature spring (484) on to its stop.

To replace the reset spring (474), release the reset spring from its stops. Remove truarc rings from pin (475) and withdraw pin (475). Rotate reset spring clockwise to slide off bushing. Renew spring and reassemble in reverse order of disassembly procedure.

To replace the trip spring (472), release the trip spring from its stops. Remove truarc ring from coil end of pin (489) and slide pin forward until trip spring and its spacer drop out. Renew trip spring and reassemble in reverse order to disassembly procedure.

CHAPTER 6
REPAIR PARTS LIST

Section 1—Parts List Introduction

6-1-1 REPAIR PARTS IDENTIFICATION

6-1-1-1 Circuit Breaker

Each sub-assembly of the movable component is a complete unit which is readily replaceable.

Certain types of parts within the various sub-assemblies have been shown by years of naval experience to be the most subject to wear and breakage. Repair parts are normally provided for these in accordance with Navy Specifications.

The sub-assemblies as well as the replaceable parts within the various sub-assemblies are listed in Section 2, Parts Tabulation. This repair parts list provides the manufacturer's service part number, part name and indicates the figure number of the drawing on which it is identified.

Refer to the ship's allowance list or to the certification data to determine the actual number of spare sub-assemblies or parts for a specific installation.

6-1-1-2 Repair Part Ordering

When ordering a part not identified by manufacturers part number, be sure to state S.O. (Shop Order) number that appears on front of breaker platform on "Breaker Identification Plate".

Section 2—Repair Parts Tabulation

6-2-1 REPAIR PARTS TABULATION

6-2-1-1 Repair Parts

See Paragraph 6-1-1-1 for explanation of the following tabulation.

IDENTIFIED ON FIGURE NO.	REPAIR PART NO.	NAME OF REPAIR PART	MFG. PART NO.	NO. OF SPARES SUPPLIED PER BREAKER
1-2-1	138	Spring cell interlock	13D8370H08	1
1-2-2		Pole Unit	30A1995G13	0
1-2-2	103	Spring, accelerating	30D9774H06	1
1-2-2	108	Contact, stationary arcing	1574797	3
1-2-2	114	Contact, moving arcing	1574789	3
1-2-2	111	Arc Chute	1802741	0
1-2-3	150	Operating Mechanism	445D381G01	0
1-2-3	171	Spring, retrieve	1491448	1
1-2-3	175	Spring, trip	1491444	1
1-2-3	176	Spring, handle return	1491497	1
1-2-3	188	Spring, pawl	128A703H01	1
1-2-3	181	Spring, roller latch	1584498	1
1-2-3	194	Spring, handle latch	1589485	1
1-2-4	200	Closing Relay	-----	0
1-2-4	202	Spring, trip	127A371H01	1
1-2-4	203	Spring, contact arm	1574332	1

IDENTIFIED ON FIGURE NO.	REPAIR PART NO.	NAME OF REPAIR PART	MFG. PART NO.	NO. OF SPARES SUPPLIED PER BREAKER
1-2-4	211	Coil	*	1
1-2-4	215	Spring, latch	1491484	1
1-2-4	221	Spring, contact	1491306	1
1-2-4	224	Contact, moving	1589495	2
1-2-4	225	Contact, R.H., stationary	1589492	1
1-2-4	225	Contact, L.H., stationary	1589493	1
1-2-4	226	Magnet, blowout	1802612	1
1-2-5	250	Closing Solenoid	-----	0
1-2-5	254	Coil, closing	*	1
1-2-6	260	Shunt Trip	-----	0
1-2-6	270	Coil	*	1
1-2-6	273	Spring, reset	1802869	1
1-2-7	280	Anti-shock-close Device	-----	0
1-2-7	282	Spring, return	126-A-803H01	1
1-2-8	285	Anti-shock-open Device	-----	0
1-2-8	287	Spring, plate	1574793	1
1-2-8	297	Spring, weight	300P318H17	1
1-2-10	310	Overcurrent Trip Unit	-----	0
1-2-10	317	Spring, Limit	*	1
1-2-10	319	Spring, L.D. Pickup	*	1
1-2-10	322	Spring, Dial	*	1
1-2-10	331	Spring, Instantaneous	*	1
1-2-10	335	Spring, Inst. Valve	*	1
1-2-10	339	Spring, S.D. Pickup	*	1
1-2-10	343	Spring, S.D. Valve	*	1
1-2-10	348	Spring, Disc	*	1
1-2-11	400	Auxiliary Switch	*	1
1-2-12	425	Main Disconnects	17B8070G03	2
1-2-12	430	Secondary Disconnect	18B1225G05	2
1-2-13	440	Indicator Light	*	1
1-2-13	441	Transformer	-----	0
1-2-13	444	Lamp (2.5V)	Type TS-159	0
1-2-13	445	Globe	-----	0
1-2-14	450	Silicon Rectifier	*	1
1-2-15	470	Undervoltage Trip	-----	0
1-2-15	479	Coil	*	1
1-2-15	484	Spring, Armature	126A805H01	1
1-2-15	474	Spring, Reset	200B643H02	1
1-2-15	472	Spring, Trip	200B643H03	1
		Truarc Kit	*	1
1-2-2	128	Connector	1491435	0

* See Certification Data Sheet for Correct Mfg. Part No.

CHAPTER 7
DRAWINGS

Section 1—General

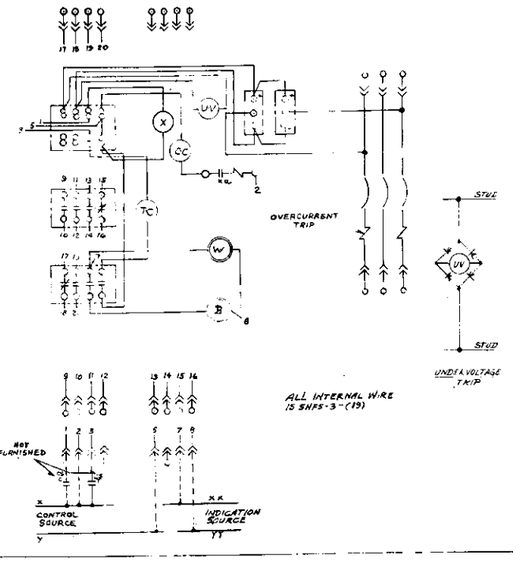
Figure 7-1-1 Air Circuit Breaker. (Westinghouse Drawing 900-J-103 Sheet 1) . . . . . Page 7-3,7-4

Figure 7-1-2 Air Circuit Breaker Stationary Components. (Westinghouse Drawing 900-J-103 Sheet 2) . . Page 7-5,7-6

WIRING NOTES

M CS-C – CONTROL SWITCH (OPEN EXCEPT DURING CLOSING)
M CS-T – CONTROL SWITCH (OPEN EXCEPT DURING REMOTE ELECT. TRIPPING)
P a – BKR. AUX. CONTACT (OPEN WHEN BKR IS OPEN)
P b – BKR. AUX. CONTACT (CLOSED WHEN BKR IS OPEN)
N X – CLOSING RELAY COIL (INTERMITTENT DUTY ONLY)
N X-a – CLOSING RELAY CONTACTS (CLOSES WHEN X COIL IS ENERGIZED MECHANICALLY TRIPPED BKR. DURING CLOSING STROKE. CANNOT BE RESET UNTIL CS-C IS OPENED & RECLOSED.)
N TC – SHUNT TRIP COIL
N ⊗ – WHITE LIGHT (ON - INDICATES SOURCE ENERGIZED)
N ⊗ – BLUE LIGHT (ON - INDICATES BKR CLOSED)
N CC – CLOSING COIL
N UV – UNDERVOLTAGE COIL
SC – SECONDARY CONTACTS - 12 FURNISHED ON MANUAL BREAKER
24 FURNISHED ON ELECT. BREAKER

M TO BE SUPPLIED BY SWITCHBOARD MANUFACTURER
N TO BE SUPPLIED ONLY WHEN SPECIFIED
P B AUX. SWITCH CONTACTS SUPPLIED AS SHOWN BUT MAY BE ROTATED TO ANY COMBINATION OF a & b CONTACTS.



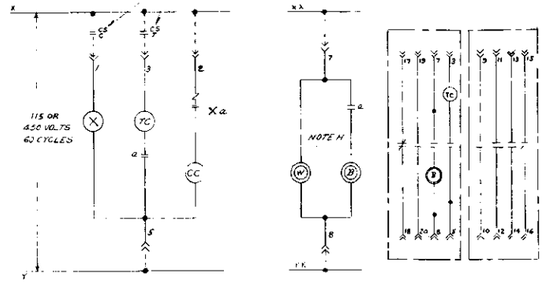


FIGURE 4

TYPICAL WIRING OF A.C. ELECTRIC OPERATED BREAKER

NOTES

NOTE A AS PER CERTIFICATION DATA SHEET

NOTE B

	NORMAL VOLTAGE	VOLTAGE RANGE
CLOSE COIL + RELAY	115 AC	90-130
	450 AC	360-500
SHUNT TRIP	115 AC	80-130
	450 AC	360-500

NOTE C

	NORMAL VOLTAGE	VOLTAGE RANGE
	120 DC	70-140

NOTE D REPAIR PART AUXILIARY SWITCH SUPPLIED WITH 3 MAKE & 1 BREAK CONTACTS. WHEN REPLACING SWITCH ON BREAKER REFER TO CERTIFICATION DATA SHEET FOR CORRECT CONTACT ARRANGEMENT. CONTACTS MAY BE CHANGED FROM OPEN TO CLOSED IN FIELD

NOTE H SUPPLIED ONLY WHEN SPECIFIED IN CONTRACT

NOTE E – UNDERVOLTAGE TRIP

NOMINAL VOLTAGE	VOLTAGE RANGE	PICK UP & SEAL VOLTS	DROPOUT VOLTS
450 A.C.	360-500	360 MIN.	180-45

NOTE F SUPPLIED WITH 115 OR 450V. UNDERVOLTAGE
3 = 3085741G11 FOR 115V-60CY – REQ 1
3 = 3085741G12 FOR 450V-60CY – REQ 2

FOR DETAILS OF STATIONARY COMPONENT OF CIRCUIT BREAKER, SEE SHEET 2 OF THIS DWG.
COMPONENTS OF CIRCUIT BREAKER ARE FULLY COVERED BY TECHNICAL MANUAL NAVSHIPS 362-

MOVING COMPONENT OF CIRCUIT BREAKER MAY BE REMOVED FROM SWITCHBOARD BY UNLATCHING & LOWERING RAIL EXTENSIONS THEN DEPRESSING CELL STOP LEVER & MANUALLY PULLING BREAKER OUT

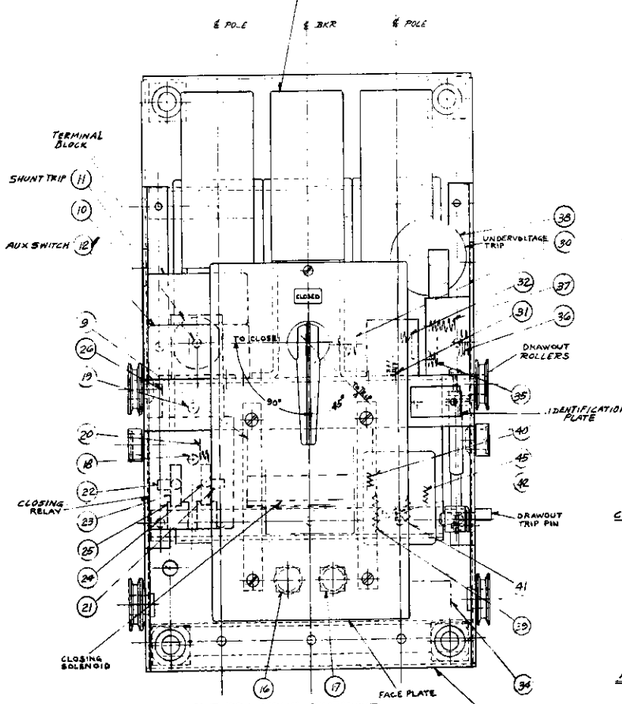
ATTEMPT TO RACKOUT BREAKER WILL TRIP THE BREAKER

TYPICAL REPAIR PARTS L

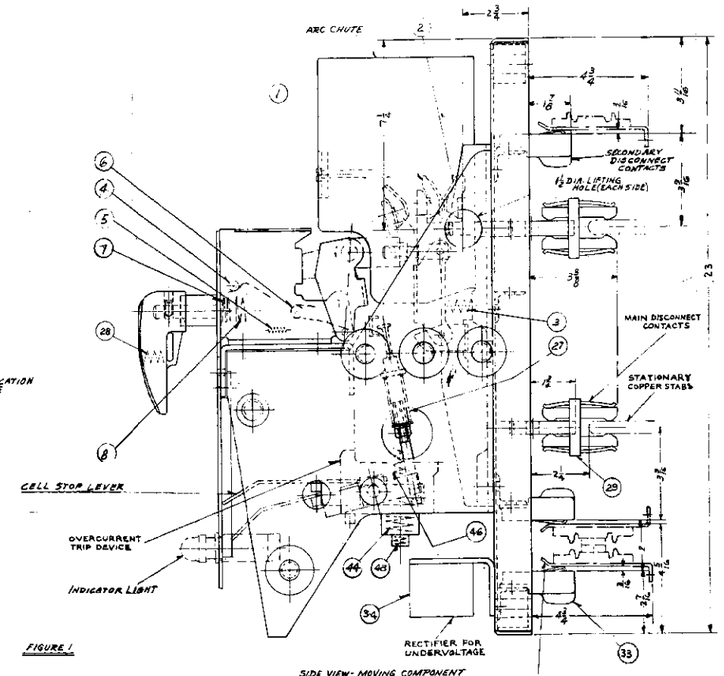
NOTE	PC NO	NAME OF PART OR TOOL	QUANT PER SET	
	1	CONTACT - MOVING - ARCING	3	
	2	CONTACT - STAT. ARCING	3	
	3	SPRING - ACCELERATION	3	
	4	SPRING - RETRIEVE - MECH.	1	
	5	SPRING - ROLLER LATCH	1	
	6	SPRING - PAWL	1	
	7	SPRING - HANDLE TRIP	1	
	8	SPRING - HANDLE RETURN	1	
H	9	COIL - SOLENOID	1	
H	10	SPRING - RESET - SHUNT TRIP	1	
H	11	COIL - SHUNT TRIP	1	
P	12	SWITCH - AUXILIARY -	2	
	15	TRUARC FASTENERS & PLIERS	–	
H	16	LIGHT - BLUE - INDICATOR	1	
H	17	LIGHT WHITE - INDICATOR	1	
H	18	SPRING, CONTACT ARM - RELAY	1	
H	19	SPRING - LATCH - RELAY	1	
H	20	SPRING - TRIP - RELAY	1	
H	21	CONTACT - B H STAT - RELAY	1	
H	22	CONTACT - L H STAT - RELAY	1	
H	23	CONTACT - MOVING - RELAY	2	
H	24	SPRING - CONTACT - RELAY	2	
H	25	MAGNET - BLOWOUT - RELAY	1	
H	26	COIL – RELAY	1	
	27	SPRING - CELL INTERLOCK TRIP	1	
	28	SPRING - HANDLE LATCH	1	
	29	CONTACT - MAIN DISCONNECT	6	
	30	SPRING - ANTI - SHOCK IN LATCH	1	
	31	SPRING - WEIGHT - ANTI - SH. OUT	1	
	32	SPRING - RESET - ANTI - SH. OUT	1	
	33	BLOCK - 4 CIRCUIT - SEC. DISC.	6	
H	34	RECTIFIER - SILICON U.V.	1	
H	35	SPRING - TRIP U.V.	1	
H	36	SPRING - ARMATURE - U.V.	1	
H	37	SPRING - RESET - U.V.	1	
H	38	COIL - U.V.	1	
	39	SPRING - INSTANTANEOUS P.U. - O.C.	2	
	40	SPRING - INSTANTANEOUS VALVE - O.C.	2	
	41	SPRING - SHORT DELAY P.U. - O.C.	2	
	42	SPRING - LONG DELAY - O.C.	4	
	43	SPRING - RESET VALVE - O.C.	2	
	44	SPRING - DIAL - O.C.	2	
	45	SPRING - SHORT DELAY VALVE - O.C.	2	
	46	SPRING - LONG DELAY FOLLOW - O.C.	2	

(REFER TO APPLICABLE C.D. SHE

FOR 2 POLE APPLICATION THE CENTER POLE IS OMITTED.



FRONT VIEW - MOVING COMPONENT



SIDE VIEW - MOVING COMPONENT

FIGURE 1

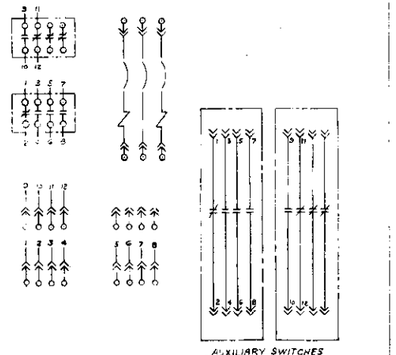


FIGURE 5

TYPICAL WIRING OF A.C. MANUAL OPERATED BREAKER

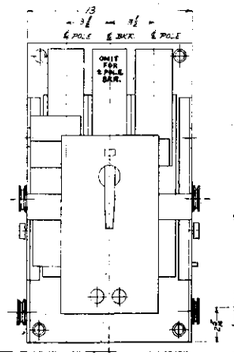
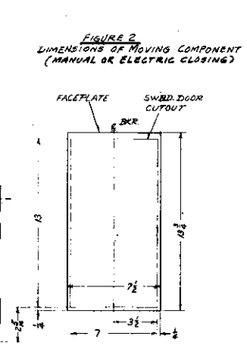
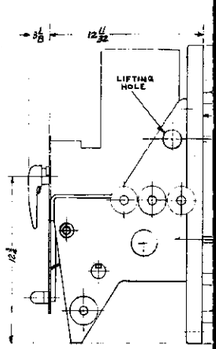
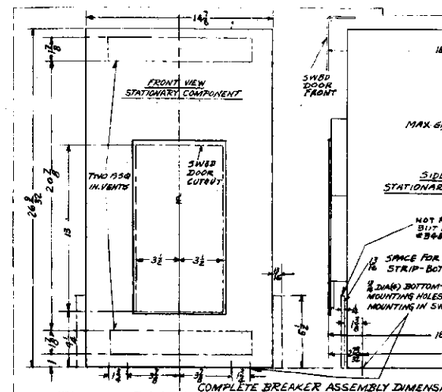


FIGURE 2

DIMENSIONS OF MOVING COMPONENT (MANUAL OR ELECTRIC CLOSING)







COMPLETE BREAKER ASSEMBLY DIMENSIONS - FOR MOUNTING IN SWITCHBOARD CUBICLE

FIGURE 3

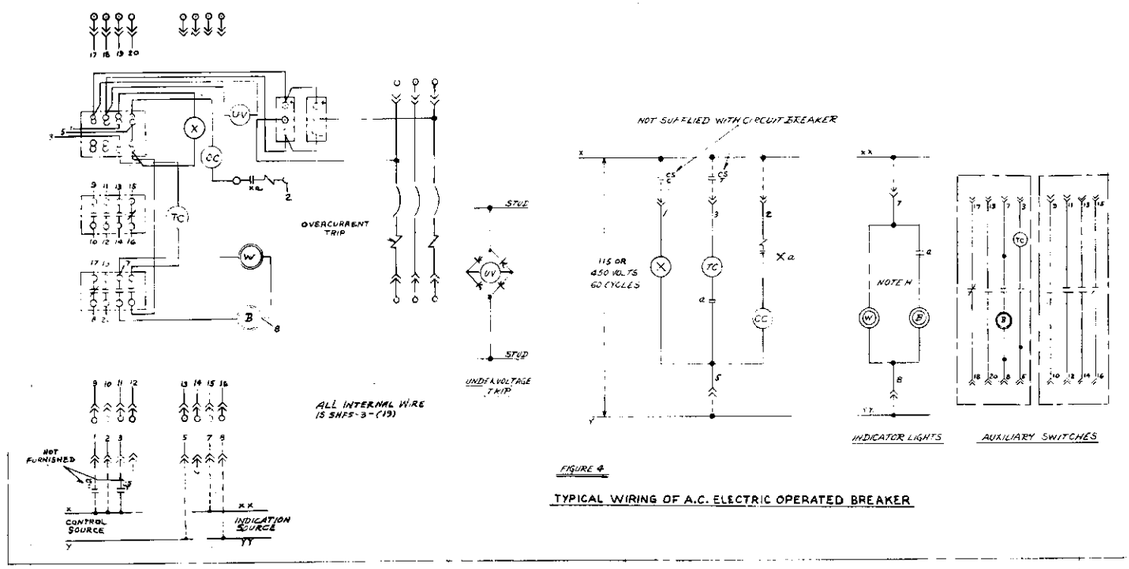


FIGURE 4

TYPICAL WIRING OF A.C. ELECTRIC OPERATED BREAKER

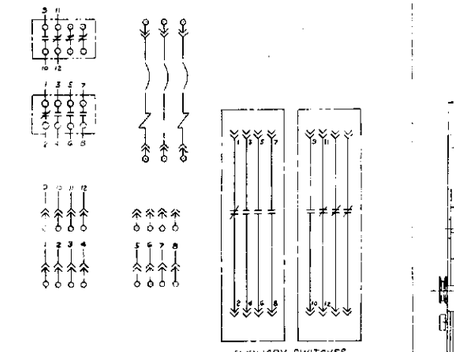


FIGURE 5

TYPICAL WIRING OF A.C. MANUAL OPERATED BREAKER

NOTES

NOTE-A AS PER CERTIFICATION DATA SHEET

NOTE-B

	NORMAL VOLTAGE	VOLTAGE RANGE
CLOSE COIL		
RELAY	115 AC 450 AC	90-130 360-500

NOTE-C

	NORMAL VOLTAGE	VOLTAGE RANGE
	120 DC	90-140
SHUNT TRIP	115 AC 450 AC	80-130 360-500

NOTE-D REPAIR PART AUXILIARY SWITCH SUPPLIED WITH- 3 MAKE & 1 BREAK CONTACTS. WHEN REPLACING SWITCH ON BREAKER REFER TO CERTIFICATION DATA SHEET FOR CORRECT CONTACT ARRANGEMENT. CONTACTS MAY BE CHANGED FROM OPEN TO CLOSED IN FIELD.

NOTE-H SUPPLIED ONLY WHEN SPECIFIED IN CONTRACT

NOTE-E UNDERVOLTAGE TRIP

NOMINAL VOLTAGE	VOLTAGE RANGE	PICK UP & SEAL VOLTS	DROP OUT VOLTS
450 A.C.	360-500	360 MIN.	230-45

NOTE-F SUPPLIED WITH 115 OR 450V. UNDERVOLTAGE
1ST 309C741G11 - FOR 115V-60CY - REQ 1
2ND 309C741G12 - FOR 450V-60CY - REQ 2

FOR DETAILS OF STATIONARY COMPONENT OF CIRCUIT BREAKER SEE SHEET 2 OF THIS DWG.

COMPONENTS OF CIRCUIT BREAKER ARE FULLY COVERED BY TECHNICAL MANUAL NAVSHIPS 362-

MOVING COMPONENT OF CIRCUIT BREAKER MAY BE REMOVED FROM SWITCHBOARD BY UNLATCHING & LOWERING RAIL EXTENSIONS THEN DEPRESSING CELL STOP LEVER & MANUALLY PULLING BREAKER OUT

ATTEMPT TO RACKOUT BREAKER WILL TRIP THE BREAKER

TYPICAL REPAIR PARTS LIST FOR ONE BKR

NOTES	PC NO	NAME OF PART OR TOOL	QUAN	MFG INF STYLE NO.	DWG NO
	1	CONTACT - MOVING ARCING	3	1370785	1BA9834
	2	CONTACT - STAT. ARCING	3	1374797	21A3538
	3	SPRING - ACCELERATION	3	8C-9774H06	
	4	SPRING - RETRIEVE - MECH	1	1491446	3D6586
	5	SPRING - ROLLER LATCH	1	1384490	21D7699
	6	SPRING - PAWL	1	120A703H01	
	7	SPRING - HANDLE TRIP	1	1491444	3D3193
	8	SPRING - HAND. E RETURN	1	1491497	3D3193
H	9	COIL - SOLENOID	1	NOTES A+B	
H	10	SPRING - RESET - SHUNT TRIP	1	1BC2862	26D9911
H	11	COIL - SHUNT TRIP	1	NOTES A+C	
D	12	SWITCH - AUXILIARY -	2	NOTE A	
	13	TRUARC PLIERS & PLIERS	-	12S4203G01	
H	16	LIGHT - BLUE - INDICATOR	1	NOTE A	
H	17	LIGHT - WHITE - INDICATOR	1	NOTE A	
H	18	SPRING CONTACT ARM-RELAY	1	1374332	17D5806
H	19	SPRING CATCH-RELAY	1	1491494	17D5806
H	20	SPRING - TRIP - RELAY	1	137A271H01	
H	21	CONTACT - R.H. STAT - RELAY	1	1383402	23A3603
H	22	CONTACT - L.H. STAT - RELAY	1	1383403	23A3603
H	23	CONTACT - MOVING - RELAY	2	1383403	23A3603
H	24	SPRING - CONTACT - RELAY	2	1491306	17D5806
H	25	MAGNET - BLOWOUT - RELAY	1	1802612	13C9668
H	26	COIL - RELAY	1	NOTES A&B	
	27	SPRING - CELL INTERLOCK TRIP	1	13D897D408	
	28	SPRING - HANDLE LATCH	1	2688985	21D7917
	29	CONTACT - MAIN DISCONNECT	6	783C704G03	
	30	SPRING - ANTI-SHOCK N LATCH	1	126A803H01	
	31	SPRING - WEIGHT - ANTI-SH. OVT	1	360P318H17	9D9236
	32	SPRING - RESET - ANTI-SH. OVT	1	1374793	18D6618
	33	BLOCK - 4 CIRCUIT - SEC. DISC.	6	18B1225G06	
H	34	RECTIFIER - SILICON U.V.		NOTE F	
H	35	SPRING - TRIP J.V.	1	200B643H01	
H	36	SPRING - ARMATURE - U.V.	1	126A805H01	
H	37	SPRING - RESET U.V.	1	200B643H02	
H	38	COIL - U.V.	1	NOTES A&E	
	39	SPRING - INSTANTANEOUS PU - O.C.	2	NOTE A	
	40	SPRING - INSTANTANEOUS VALVE - O.C.	2	NOTE A	
	41	SPRING - SHORT DELAY PU - O.C.	2	NOTE A	
	42	SPRING - LONG DELAY - O.C.	4	NOTE A	
	43	SPRING - RESET VALVE - O.C.	2	NOTE A	
	44	SPRING - DIAL - O.C.	2	NOTE A	
	45	SPRING - SHORT DELAY VALVE - O.C.	2	NOTE A	
	46	SPRING - LONG DELAY FOLLOW - O.C.	2	NOTE A	

(REFER TO APPLICABLE C.D SHEET FOR EACH BREAKER)

REVISIONS

REV	ZONE	DESCRIPTIONS	MFG DATE	MFG APPD	U.S.N. DATE	U.S.N. APPD
B		REVISED PER BUSHIPS LTR. 562/S (660K) SER. 660-5575B OF 24 JUNE 1958.				
C		APPROVED PER BUSHIPS LTR 562/S (660K) SER. 660-8801 OF 4 MAY 1959				

DESCRIPTIVE DATA

TYPE	NAVY TYPE - ACB 660 R W.E. CORP. TYPE DB-N 406
CONTINUOUS CURRENT	660 AMPS
VOLTAGE	500 V AC - 60 CYCLES
POLES	2 OR 3 POLE
RATED INTERRUPTING CURRENT	40000 AMP AC
SHORT TIME RATING	25000 AMPS. A.C. RMS (30 CYCLES)
MOUNTING	REMOVABLE ASSEMBLY - DEADFRONT
NORMAL CLOSING	MANUAL OR ELECTRIC
OVERCURRENT COILS	150-250-320-400-480-560-660
AMBIENT TEMPERATURE	50°C
SHOCK CLASSIFICATION	CLASS H1
INSULATION CLASS	B
CONNECTIONS	BACK
PROTECTIVE FUNCTION	OVERCURRENT LONG TIME DELAY SHORT TIME DELAY (BAND 1,2 & 3) INSTANTANEOUS SHUNT TRIP UNDERVOLTAGE TRIP
ACCESSORIES	CLOSING SOLENOID & RELAY INDICATOR LIGHTS ALSO SEE NOTES 1-2-4
BUSHIPS APPROVAL LTR - 562/S (660K)	SER 660-8801 OF 4 MAY 1959
TECHNICAL MANUAL - W.E. CORP.	BUSHIPS NAVSHIPS
SPECIFICATION - MIL-C-17587	
SPECIFICATION EXCEPTIONS - NONE	
TEST REPORT NO.	

DESCRIPTION	WEIGHT OF REMOVABLE ASSEMBLY COMPLETE	WEIGHT OF DRAWOUT COMPONENT ONLY
2P MANUAL	202	132
3P MANUAL	220	150
2P ELECTRIC	222	152
3P ELECTRIC	240	170

1. REMOVABLE ASSEMBLY - EACH CIRCUIT BREAKER SUPPLIED AS A COMPLETE REMOVABLE SWITCHBOARD ASSEMBLY CONSISTING OF CIRCUIT BREAKER, SEPARABLE DISCONNECTS AND ASSOCIATED CONTROL WIRING, DRAWOUT MECHANISM AND ASSEMBLY, STRUCTURAL SUPPORTS AND BACK PLATE, INCLUDING STATIONARY MAIN BUS CONNECTIONS, AND STATIONARY TERMINALS FOR CONNECTION OF THE NECESSARY EXTERNAL CONTROL WIRING.
2. UNLESS OTHERWISE SPECIFIED THE STANDARD CIRCUIT BREAKER IS FURNISHED WITH AN 8 STAGE AUXILIARY SWITCH (4 a AND 4 b CONTACTS)
3. FOR FULL DESCRIPTION AND DETAILS APPLICABLE TO THE BREAKER, OTHER THAN INSTALLATION DIMENSIONS, REFERENCE MUST BE MADE TO THE APPLICABLE CERTIFICATION DATA SHEET AND TECHNICAL MANUAL BUSHIPS & NAVSHIPS 362-
4. UNLESS OTHERWISE SPECIFIED THE STANDARD CIRCUIT BREAKER IS FURNISHED WITH 12 SECONDARY WIRING DISCONNECT TERMINALS FOR THE MANUAL OPERATED BREAKER AND 24 SECONDARY WIRING DISCONNECT TERMINALS FOR THE ELECTRIC OPERATED BREAKER

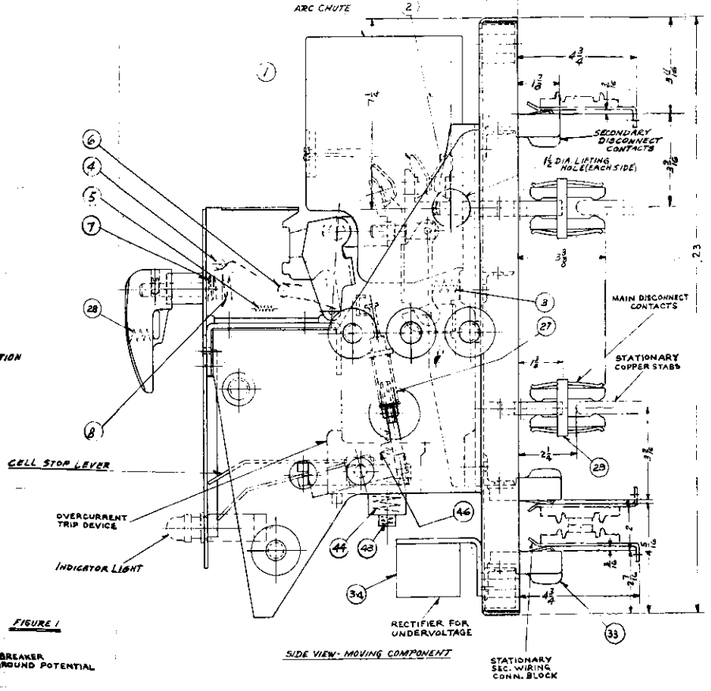


FIGURE 1

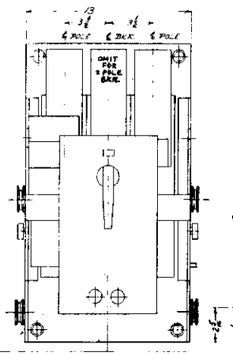
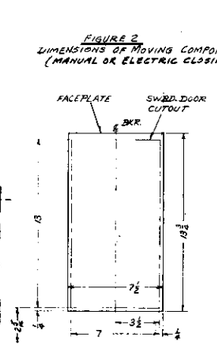
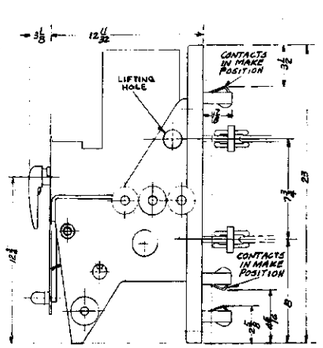


FIGURE 2

DIMENSIONS OF MOVING COMPONENT (MANUAL OR ELECTRIC CLOSING)





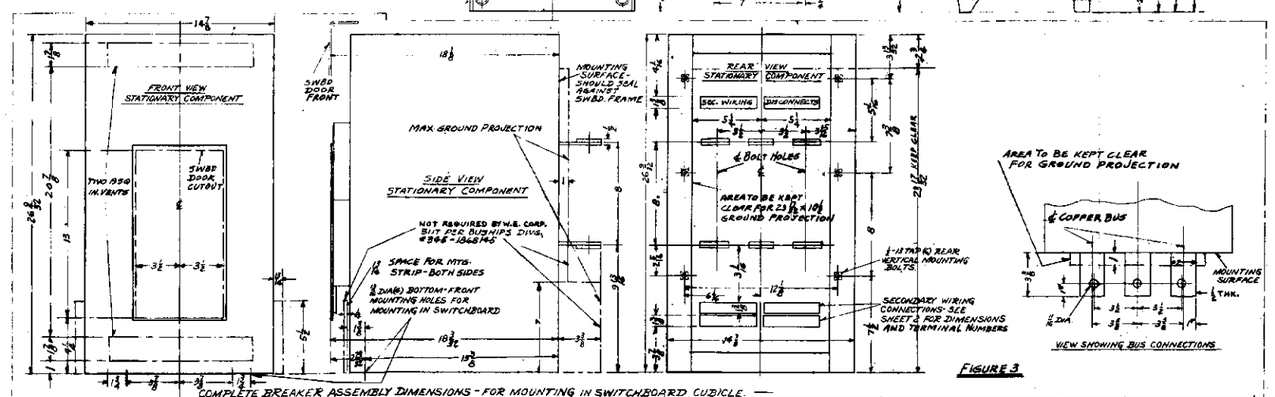


FIGURE 3

COMPLETE BREAKER ASSEMBLY DIMENSIONS - FOR MOUNTING IN SWITCHBOARD CUBICLE

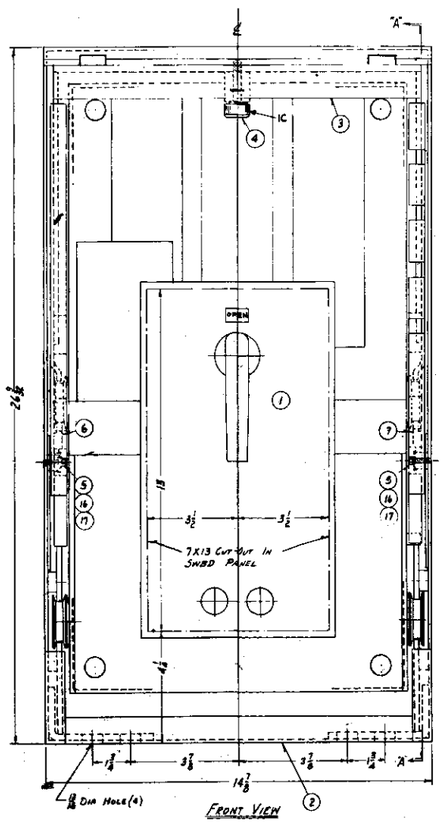
MASTER DRAWING	WESTINGHOUSE ELEC. CORP. EAST PITTSBURGH, PA., U.S.A.	SIZE E
AIR CIRCUIT BREAKER NAVY TYPE-W.E. CORP. DESIGNATION 600 TO 660 A DC CONT.-500 V AC 2 OR 3 POLE MANUAL OR ELECTRIC 40,000 A.I.C. REMOVABLE ASSEMBLY	900J103	SHEET 1 OF 2
	NAVY DWG. BUSHIPS DWG. NO.	REV
	3,318,903	C
SCALE: NONE	SH. 1 OF 2	

FIGURE 7-1-1 — Air Circuit Breaker

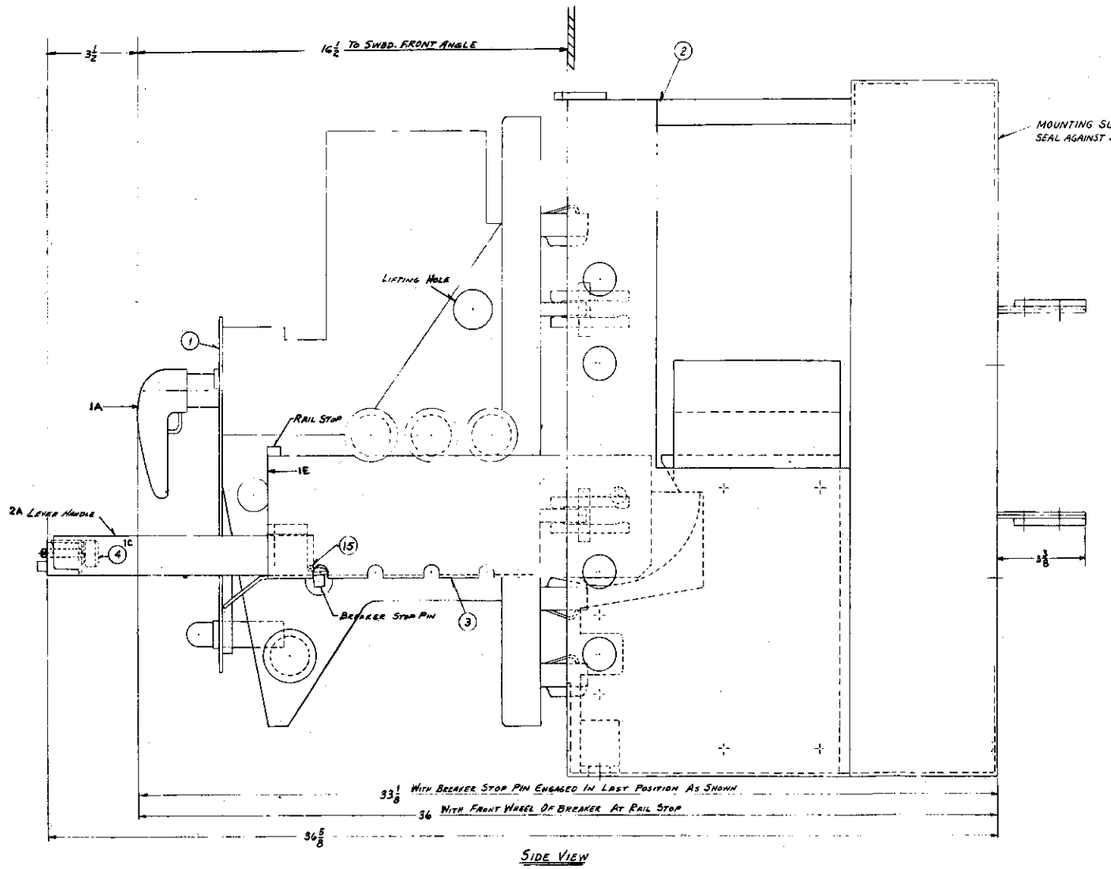
Operating Instructions

1. To Move Breaker To Disconnected Position :
   - A- Trip Breaker With Breaker Operating Handle If Not Already Open
   - B- Open Switchboard Unit Hinged Panel To 90° Or More
   - C- Loosen Captive Screw (Pt 4) By Turning Counter Clockwise To Free The Lever Handles
   - D- Depress The Extension Rail Release And Breaker Stop Lever (On Lower Right-hand Corner Of Breaker) To Unlatch The Extension Rails.
   - E- Pull Out & Down On The Lever Handles Until Extension Rails (Pt 3) Are Horizontal. The Cam On Each Extension Rail Acts Upon The Roller On Each Side Of The Breaker During This Operation To Withdraw The Breaker To The Disconnected Position.
2. To Move Breaker To The 'Withdrawn Position :
   - A- Pull Out The Breaker Lever Handles To The Extended Position.
   - B- Depress The Extension Rail Release And Breaker Stop Lever And Hold In This Position While Pulling The Breaker Out To The Desired Position, Then Release The Breaker Stop Lever So It May Engage In One Of The Notches On The Lower Edge Of The Rail Extension
3. To Operate Breaker When Disconnected
   - A - After Step 1-E Is Completed The Breaker Must Be Pulled Out So That The Breaker Release Lever Is Engaged In One Of The Notches As Explained In Step 2-B Or The Breaker Is Fully Withdrawn Until The Breaker Side Wheels Are Stopped By The Rail Stop
     - NOTE: The Breaker Is Trip Free As Long As The Breaker Stop Lever Is Not Engaged In A Notch On The Rail Extension Or Beyond The Forward End Of The Rail Extension
   - B- The Breaker May Now Be Operated As Desired
4. To Return Breaker To Connected Position
   - A- Perform Operations Outlined In Steps 1-A to E & 2-A & B In Reverse Order
5. To Remove Breaker From Switchboard
   - A- After Completion Of Steps 1-A To E & 2A Remove Stop Screws From End Of Lever Handles. (One On Each Lever Handle)
   - B- Pull Out Lever Handles To Remove Them From Rail Extensions
   - C- Pull Out Breaker To Fully Withdrawn Position Per Step 2-B
   - D- Attach Lifting Device To Be Used To The Lifting Holes Provided On Both Sides Of The Breaker
   - E- Lift The Breaker So That The Breaker Wheels Clear The Rail Stop, Then Pull The Breaker Forward. If Due To Limited Access In Front Of The Switchboard The Breaker Must Be Moved Sideways To Remove It From The Rails, The Breaker Must Be Raised High Enough So The Lower Portion Of The Breaker Base Is Above The Top Edge Of The Rail Extensions.

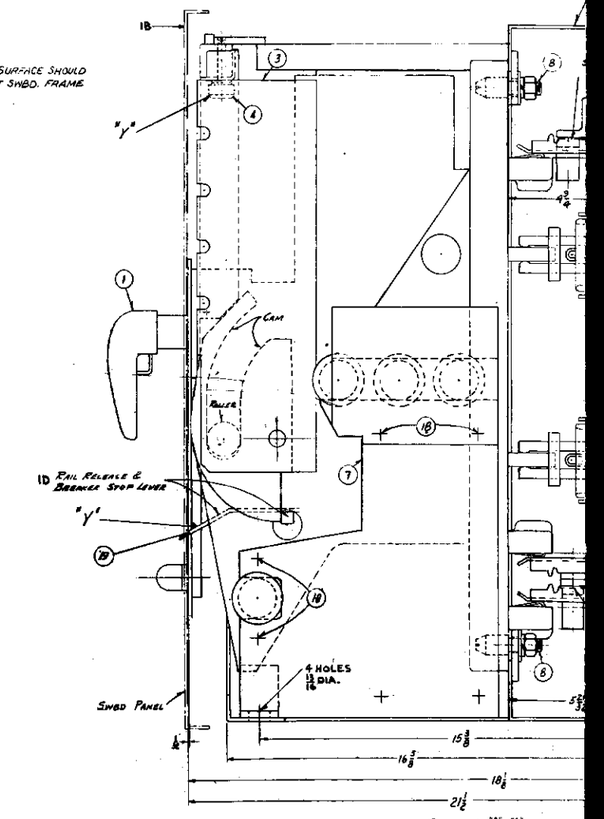
Notes:
- A- If Breaker Is Not Tripped Prior To Performing Step 1-D, The Breaker Will Be Tripped When The Extension Rail Release & Breaker Stop Lever Is Depressed In Step 1-D.
- B- If Breaker Is In Closed Position When Replacing It On The Rails, It Will Be Tripped As Soon As The Extension Rail Release And Breaker Stop Lever Is Depressed To Move The Breaker In.



Front View



Side View



Section "A"-"A"

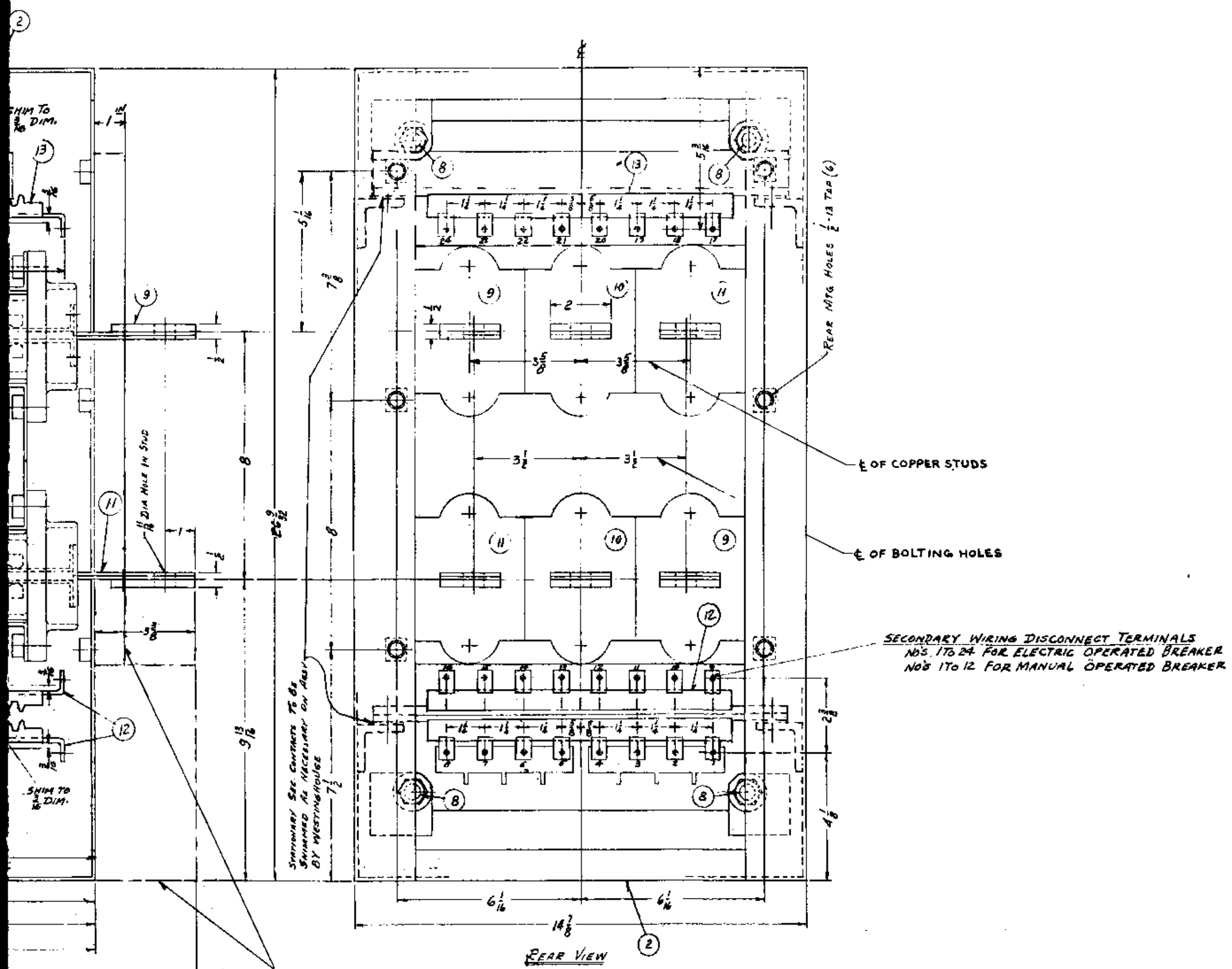
BREAKER IN DRAWN POSITION

	PC NO.	NAME	NO. REQD	MATERIAL	MATL SPEC	CONTRACTOR DWG NO.	CONTRACTOR SERVICE PART NO.	MANUFACTURER NAME	MANUFACTURER SERVICE PART OR DWG NO.	BUSHIPS DWG NO.	UNIT WT LB	STD NAVY STOCK NO.	REMARKS
	1	ACB-640A Cir Bkr (DBN-406)			MIL-C-17587	900J103	SHEET 1						
	2	Stationary Component	1	Aluminum	QQ-A-318 QQ-A-366	502F158	GR. 1						
	3	Extension Rails	1	Steel	QQ-S-633	414D232	GRS 1-2-5						
Y	4	Ext. Rail Screw Latch	1	Stainless Steel	MIL-B-857	33B2619	GR 11						
A	5	¼ 20 X ⅝ Hex Stl Bolt	2	Steel									
	6	Steel Rail (L.H.)	1	Steel	QQ-S-633	414D232	GR 5						
	7	" " (R.H.)	1	"			GR 6						
	8	Dowel Pin Assy	4	Stainless Steel	MIL-B-857	303C576	GR. 5						
	9	Main Stationary Cont. Assy (Top L.H.)	2	Mi-Co Molded Copper Assy	MIL-P-14 QQ-C-502	409D856	GR 4						
	10	" " (Top & Bot. Center)	2	"	"		GR 2						
	11	" " (Top R.H. Bot. L.H.)	2	"	"		GR 3						
	12	Stationary Sec. Contact (16 PT.)	2	Mi-Co Molded & Brass Assy	MIL-P-14 QQ-C-611		23B4796G04						
	13	" " " (8 Pt.)	[illegible]				23B4796G05						
A	14	Hardware	1 Set										
B	15	BINDING HD. SC.	2	STEEL			1090653						
A	16	¼ X Wide Stl Washer (OD ½")	2	"									
A	17	¼ Stl Lock Washer 2052-2	2	"									
C	18	Rail Screws	8	"									
Y	19	BKR STOP LEVER											

A - Finish A6AR02 (Equivalent to QQ-Z-325)
B - CUT TO ¼ LG. AND FINISH A6NA02 (EQUIVALENT TO QQ-Z-325)
C - To Be Ordered By Eng. - Sems, ¼-18 - ⅝ Lg Plain Point, Flat Slotted Hd. SAE 1010 Steel, Std Washer #1618-61 - Fin per MIL-B-857

Y - THESE ITEMS PAINTED YELLOW AT POINTS MARKED "Y"

REV.	DESCRIPTION
G	SEE SHEET 1



1. FOR SWITCHBOARD MOUNTING DATA, REPAIR PARTS, WIRING DIAGRAMS & OTHER DETAILS SEE SHEET 1.
2. CLEANING & PAINTING OF ASSEMBLY IS IN COMPLIANCE WITH SPECIFICATION MIL-E-917. STATIONARY COMPONENT PAINTED SWITCHBOARD GREY
3. THE MAIN DRAWOUT DISCONNECTS MAY BE OBSERVED WHEN THE MOVING COMPONENT IS FULLY DRAWN OUT

DETAILS OF COMPLETE REMOVABLE ASSEMBLY - MANUAL OR ELECTRIC CLOSING.

MASTER DRAWING
AIR CIRCUIT BREAKER
NAVY TYPE ACB-640A W.E.CORP. DBN-406
160 TO 640A. O.C.COILS-500V AC
2 OR 3 POLE MANUAL OR ELECTRIC
40,000 A. I.C. REMOVABLE ASSEMBLY

FOR REVISIONS SEE SHEET 1

WESTINGHOUSE ELECTRIC CORP.
EAST PITTSBURGH PA. U.S.A.
900J103 SHEET 2 OF 2
NAVY DEPT. BUSHIPS DWG. NO. 3,318,903 REV. C
SHEET 2 OF 2

FIGURE 7-1-2 — Air Circuit Breaker Stationary Components

Technical Manual Insert

for

NAVSHIPS 362-1630
WESTINGHOUSE T.M. 32-855-1C1

ELECTRIC LOCKOUT

FOR

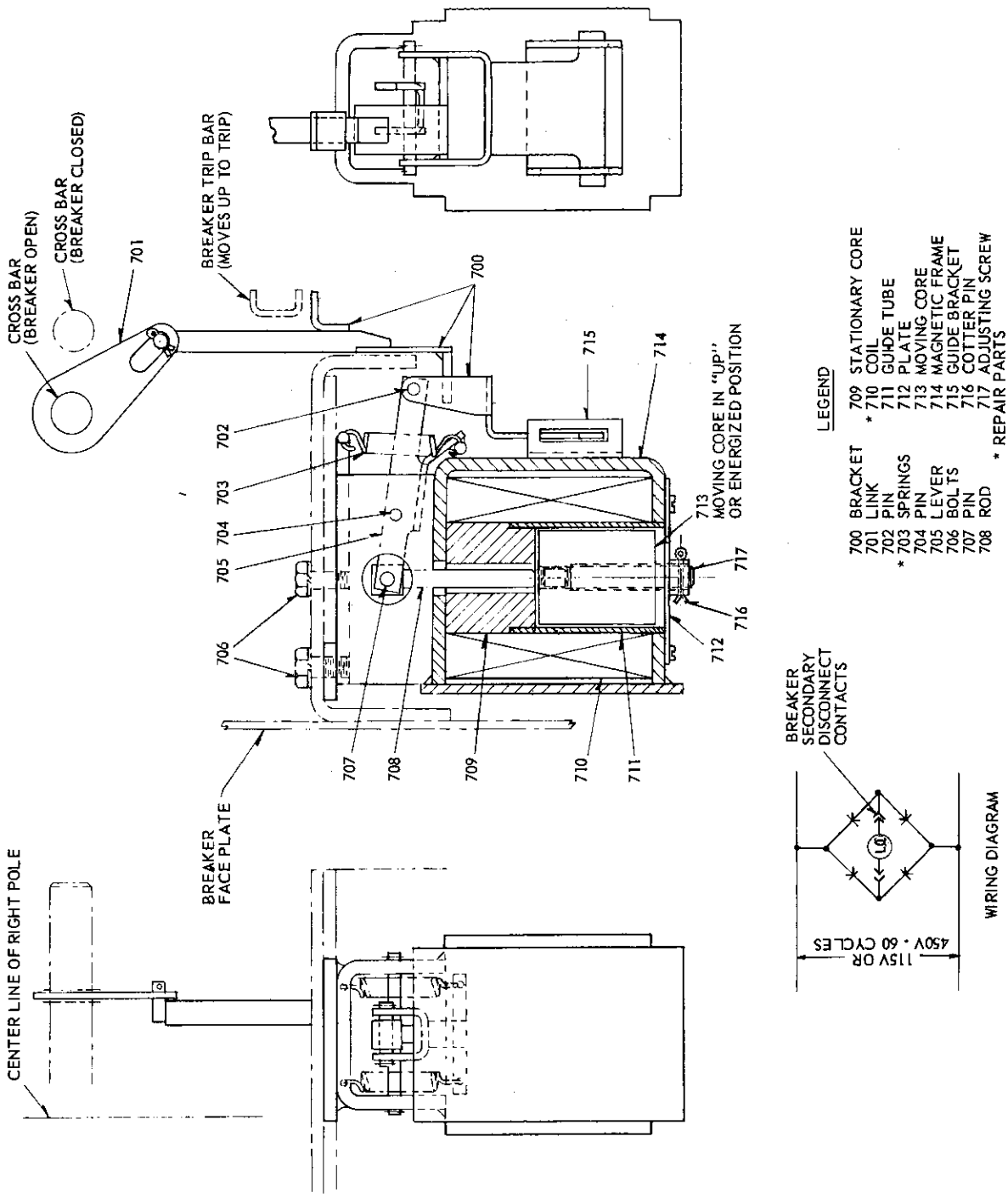
NAVY TYPE ACB-640R
CIRCUIT BREAKER

WESTINGHOUSE TYPE DBN 406

TECHNICAL MANUAL 32-855-13C1 (Supercedes 32-855-8C1)

BUREAU OF SHIPS • NAVY DEPARTMENT • NOVEMBER, 1961

ELECTRIC LOCKOUT



Westinghouse

ELECTRIC LOCKOUT

FUNCTION

The function of the electric lockout is to prevent both manual and electric closing unless power is supplied to energize the lockout coil. The electric lockout will not trip a closed breaker when the coil is de-energized.

CHARACTERISTICS

Nominal Rating (See Note Below)	Pick Up	Operating Range
115 Volts 60 Cycles	90 V	90 to 130 V
450 Volts 60 Cycles	360 V	360 to 500 V

NOTE

The above represents voltage input into rectifier. The rectifier must be furnished and mounted by the switchboard builder. See certification data sheet for correct voltage.

OPERATION

With the breaker open and the lockout coil de-energized; springs (703) rotate lever (705) counterclockwise about pin (704). Thus bracket (700) holds breaker trip bar in the up position. With the trip bar up, breaker is trip free and can not be closed.

With the breaker open and the lockout coil energized; moving core (713) will rise, rod (708) will rise, lever (705) will rotate clockwise, and bracket (700) will move down away from breaker trip bar. The breaker can now be closed.

Once the breaker is closed the lockout coil can be left energized or may be de-energized. Breaker cross bar causes link (701) to hold bracket (700) away from breaker trip bar so that lockout can not trip breaker.

REPAIR PARTS

To replace any part, first remove link (701), bolts (706) and complete lockout from breaker. Consult breaker certification data sheet for correct repair part.

To replace springs (703), unhook old springs and replace with new springs.

To replace coil (710), remove plate (712), moving core (713), guide tube (711), stationary core (709) and rod (708). Slide out coil (710) and replace.

ADJUSTMENTS

Normal maintenance should not require adjustment of electric lockout. However if required, remove cotter pin (716) and turn adjusting screw (717) in moving core (713). Turning screw clockwise will lower bracket (700) when lockout is energized. Be sure to replace cotter pin (716) after adjusting.

WESTINGHOUSE ELECTRIC CORPORATION
EAST PITTSBURGH, PA., U.S.A.

Technical Manual Insert

for

NAVSHIPS 362-1630
WESTINGHOUSE T.M. 32-855-1C1

ADDITIONAL MAINTENANCE INSTRUCTIONS

for

NAVY TYPE ACB-640R CIRCUIT BREAKER

WESTINGHOUSE TYPE DBN 406

TECHNICAL MANUAL 32-855-12-C1

BUREAU OF SHIPS • NAVY DEPARTMENT • NOVEMBER, 1961

Westinghouse

ADDITIONAL MAINTENANCE INSTRUCTIONS FOR NAVY TYPE ACB 640R

This insert was prepared to provide additional checking and adjustment instructions for coolant pump breakers where reliable closing is extremely important.

Technical manual NavShips 362-1630 covers general maintenance, but this manual was prepared to stress and add the following:

1. Mounting hardware and locking devices should be inspected and if required, tightened at least once a year.

2. Tru-arc ring retainers have proven reliable over many years of service. However, several precautions should be taken when replacing a Tru-arc ring on a pin.

a. If old ring is distorted by removal, obtain new Tru-arc ring from on-board repair parts.

b. If groove on pin is dirty, clean with wire brush before reassembly.

c. Install Tru-arc rings with sharp edge facing end of pin. Note that manufacturing dulls or rounds one edge of ring and leaves the other edge sharp.

3. The failure of a breaker to close can be the result of operating errors or a variety of equipment deficiencies. The problem of correction is usually apparent if failure is consistent. The following list attempts to help the personnel involved locate the trouble with the failures occur infrequently.

a. If personnel suspects that breaker relay was not energized, that is no clicking sound from relay, then look for:

1. Open interlock switch or external relay not function.

2. Loss of control power.

b. If personnel suspects breaker relay was energized, but that closing solenoid was not energized, look for:

1. Relay deficiencies which might prevent relay latch (210), Figure 1-2-4 from engaging pin (207). Binding of latch (210), spring (215), or release bracket (210) could cause this.

2. Relay deficiencies which might allow latch (210) to slide off pin (207). A worn hook on latch (210) or non-functioning spring (215) could cause this.

c. If personnel hears breaker solenoid move, but suspects that main contact arms of pole units did not move, then look for:

1. Failure of trip bar to reset. Due to excessive dirt or friction.

2. Failure to completely place breaker in cell, so that cell interlock holds trip bar up.

3. Electric lockout not energized or not functioning. Lockout should be energized at least 1/4 second before breaker relay.

4. Overcurrent trips failing to reset after previous operation.

d. If personnel notes that breaker contacts closed or touched, but that breaker did not remain closed, then look for:

1. Any device which might hold trip bar in partially tripped position.

2. High inrush currents or faulty overcurrent trips.

3. Breaker "relay release" tripping relay contacts free too soon. To check, draw breaker out on rails and close slowly with manual handle. The "relay release" (Figure 1-2-5) should raise relay pin (201) just before or at same time that breaker latches closed.

4. Friction preventing PAWL (182) Figure 1-2-3 from latching under Pin (177).

5. Premature de-energization of relay coil due to external interlocks and relays.

4. There is not set dimension or adjustment of cell interlock trip (Figure 1-2-1). The gap between lever unit (136) and trip bar (240) is adjusted between these limits.

a. The gap must be small enough to insure that depressing lever handle (134) will trip breaker before extension rails can be lowered.

b. The gap must be large enough to insure that depressing lever handle (134) until stop pin (137) rest on bottom of hole in breaker frame will not damage trip bar (240) by permanently distorting it.

5. The overcurrent trip screw setting is controlled by screw (153) (Figure 1-2-3).

a. Adjust gap between overcurrent trip and screw (153) until raising of stem assembly (313) (Figure 1-2-10) barely trips breaker.

b. From this position turn screw (153) 1 turn in direction to shorten gap.

REVISED 9-24-64
PRELIMINARY

INSERT

Technical Manual Insert

for

NAVSHIPS 362-1630
WESTINGHOUSE T.M. 32-855-1C1

HOLD-IN

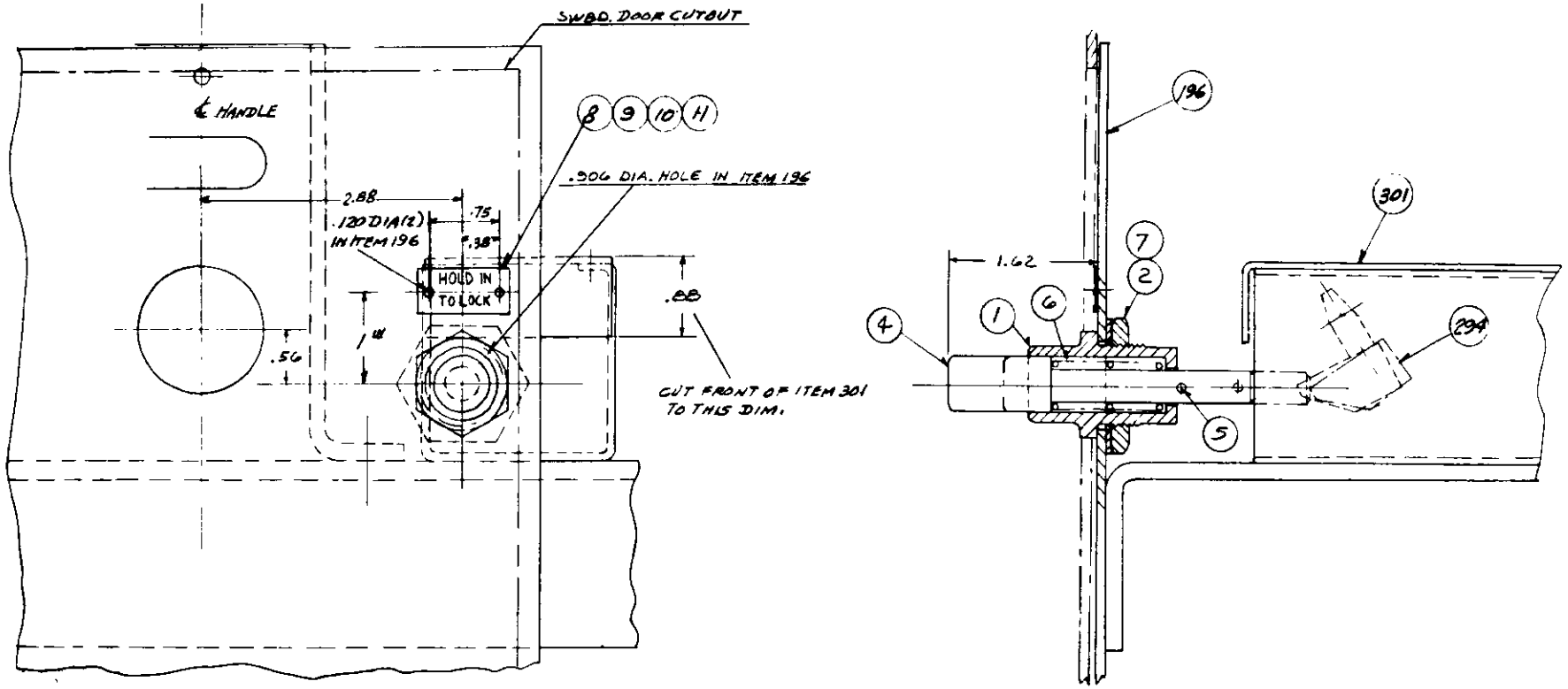
FOR

NAVY TYPE ACB-640R CIRCUIT BREAKER

WESTINGHOUSE TYPE DBN-406

TECHNICAL MANUAL 32-855-14C1

BUREAU OF SHIPS • NAVY DEPARTMENT • JULY, 1964



LEGEND

1	Bushing	8	Nameplate
2	Nut	9	.112-2/0 Screws
4	Plunger	10	.112-2/0 Nuts
5	Cotter Pin	11	.112 Lockwashers
*6	Spring	196	Faceplate
7	Lockwasher	294	Weight (Anti-shock-out)
		301	Cover (Anti-shock-out)

*Repair Part

HOLD-IN

FUNCTION

The function of a hold-in device is to permit closing of a circuit breaker on overloads which exceed the overcurrent trip settings. The breaker will stay closed as long as the hold-in is depressed.

OPERATION

Depressing plunger (4) rotates weight (294) counterclockwise which blocks plate (291) figure 1-2-8 from rotating counterclockwise. This restrains trip bar (240) from rising sufficiently to trip the breaker.

When plunger (4) is released, the breaker may trip if the overcurrent trip has never been allowed to reset.

REPAIR PARTS

To replace spring (6), remove cotter pin (5) and plunger (4), replace spring and reassemble.

ADJUSTMENTS

There is no need for adjustments unless some part has been bent and distorted. In this case the distorted part must be straightened.

INSTALLATION

In some circumstances it will be necessary to add the hold-in to breakers now in service. Place breaker in the withdrawn position.

1. Drill .906 dia. hole and two .120 dia. holes in faceplate (196) as shown.
2. Cut off anti-shock-out cover (301) to .88 inch dimension as shown.
3. Check weights (294). They must face in opposite directions, and the weight in front of .906 dia. hole must be as shown. If necessary disassemble anti-shock-out device and reassemble correctly.
4. Assemble items (1) thru (11) as shown.

Check operation by closing breaker and depressing plunger (4). With a stick apply upward pressure on trip bar (240) and note that it is restrained sufficiently to prevent breaker tripping.

Warning - Keep hands free in case breaker should open.