

# Westinghouse

## Type 50-DH-100, 50-DH-150

### Air Circuit Breakers

Installation

Operation

Maintenance

## INSTRUCTION BOOK

### CAUTIONS

Safety for Personnel . . . . .	Page 6
Storage . . . . .	Page 7
Handling, Unloading, Unpacking . . . . .	Page 7

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## INDEX

Subject	Page
<b>PURPOSE</b> .....	3
<b>DESCRIPTION</b> .....	3
General.....	3
Operating Mechanism.....	4
Contact Assembly.....	4
Arcing Chambers and Magnetic Circuit.....	4
Interphase Barriers.....	4
Operation of the Breaker in Extinguishing the Arcs.....	6
<b>SAFETY FOR PERSONNEL</b> .....	6
<b>STORAGE</b> .....	7
<b>HANDLING, UNLOADING AND UNPACKING</b> .....	7
Weights.....	7
<b>INSTALLATION AND ERECTION</b> .....	7
<b>OPERATION AND MAINTENANCE</b> .....	8
Starting Up.....	8
Maintenance.....	8
High Voltage Parts.....	8
Mechanism.....	11
Tripping Attachments.....	13
<b>RENEWAL PARTS</b> .....	16

# Westinghouse

## Type 50-DH-100 and 50-DH-150

### Air Circuit Breakers

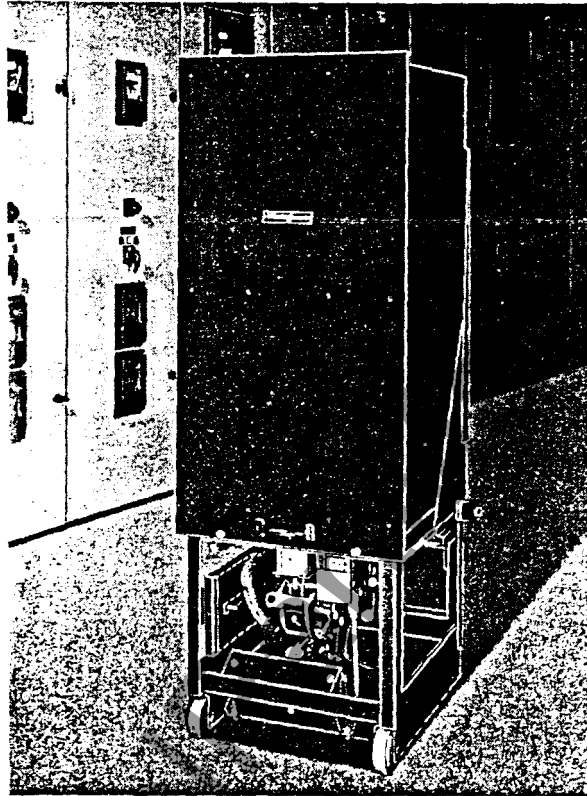


Fig. 1—Type 50-DH-100, 5000 Volt, 600 Ampere, 3 Pole Air Circuit Breaker

#### PURPOSE

The purpose of this instruction book is to acquaint the recipient with the characteristics of the 50-DH-100 and the 50-DH-150 Air Circuit Breakers. Instructions necessary for the installation, operation and maintenance will be found between the covers of this book. The type DH Air Circuit Breaker has proven very satisfactory in service since it was first marketed in 1939. Recent improvements in manufacturing facilities have made it possible to redesign these breakers to reduce the weight of the removable unit and to make the various parts more accessible than on the previous models.

Fundamentally a power circuit breaker is a device for interrupting a circuit between separable contacts under normal or abnormal conditions. Ordinarily circuit breakers are required to operate only infrequently although some breakers are suitable for frequent operations. The type "DH De-ion" Air Circuit Breaker is designed to operate in a normal atmosphere and is not dependent on the maintenance of any stored medium, such as air or liquid dielectric. Its performance is dependable, clean-cut and free from uncertainty.

These air circuit breakers are designed for indoor service at a-c voltages of from 2100 to 5000, for normal current loads up to and including 2000 amperes and for an interrupting duty of 100 or 150 thousand kva at 60 cycle frequency. The figure (100 or 150) following the letters "DH" in the type specification designates the interrupting rating of the breaker in thousands of kva, the figure 50 preceding "DH" the voltage in hundreds of volts. The breakers may be used on indoor applications where an air circuit breaker is desired. They are characterized by long life and moderate maintenance requirements when operated under severe duty.

#### DESCRIPTION

##### General

Figure 1 above, shows a 600 ampere, 5000 volt, type 50-DH-100, 3-pole air circuit breaker mounted as a removable unit which was developed for Metal Clad switchgear use. The breaker consists essentially of a chair-shaped framework the back of which is used to support the individual pole units, each with its own contacts, arcing chamber and

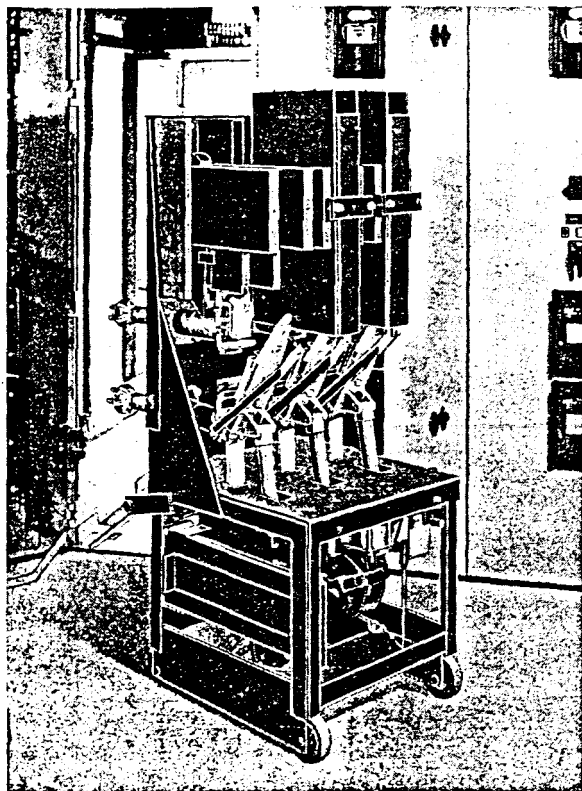


Fig. 2—Type 50-DH-100, 5000 Volt, 600 Ampere, 3 Pole Air Circuit Breaker. Barrier and One Arc Chamber Removed

magnetic circuit. The three contacts are operated, in this case, through a cross-bar and push rods by a single electric mechanism. Figure 2 shows a side view of the same breaker with the barrier and one arc chamber removed.

Figure 3, page 5, shows a drawing of the breaker locating the various parts,—the primary disconnecting contacts have 5, 9 and 15 segments in each stud cluster for the 600, 1200 and 2000 ampere ratings respectively. The operating mechanism with auxiliary switches, secondary contacts, tripping accessories and all low voltage wiring are located below the high voltage parts and isolated from them by a horizontal steel barrier. A vertical framework rising upward from the horizontal isolating plate supports the bushings, contacts, magnetic circuits and arcing chambers, all these parts being at high potential. A metallic plate fastened across the front ends of the interphase and phase to ground barriers confines the high potential zone to the space behind that vertical metallic barrier.

### Operating Mechanism

The electrical operating mechanism supplied with these type DH breakers is of the direct-current solenoid type. It is mounted so that the moving core, operating in a horizontal plane, acts through a toggle linkage to open and close the breaker contacts. The necessary tripping devices form a part of the mechanism. In the earlier models the tripping devices were mounted on the left side of the

mechanism while in the later models these devices are mounted on the right side of the mechanism to make for better accessibility. Auxiliary switches with from six to ten contacts are supported from the removable unit framework and mechanically connected to the linkage which operates with the breaker contacts. A cut-off switch, operated by the closing solenoid core is supplied to close or open a control circuit for interruption of the closing coil circuit. For applications where rapid reclosing duty is required, a latch checking switch may be supplied. This switch is also operated by the position of the moving core as shown by Figure 15, page 16.

### Contact Assembly

The breaker contact assembly must be capable of carrying normal load currents and of drawing the current during the interrupting periods in a manner so that after the interruptions the contacts will be in such condition that the load currents can be carried without undue temperature rise. The stationary main contacts consist of silver-nickel inserts which are brazed to the bushing studs. The moving main contacts are of the same material and are brazed to self-aligning bridge members. In the closed position the silver bars engage to complete the main current path through the breaker. Contact pressure is maintained by compression springs placed between the bridging members and the moving arms which carry the bridging members.

### Arcing Chambers and Magnetic Circuit

The arcing chambers are located immediately above the arcing contacts of each pole unit. The insulating sides of the chambers extend downward past the upper contact members to insure a positive transfer of the arcs into the chambers. Each chamber consists of laterally spaced ceramic plates having V-shaped slots and held together with a moisture and heat-resisting cement. An arcing horn is provided at each end of the chamber. The series of V-shaped slots in the plates form a vented groove or slot extending the length of the arcing chamber into which the arc is drawn and extinguished.

A multi-turn coil, located immediately behind the arc chamber and above the stationary contact is inserted into the electrical circuit by the transference of the arc terminal from that arcing contact to the arcing horn which is immediately above it. This coil then generates a magnetic flux which is directed across the arc path by the magnetic pole faces which are along the sides of the arc chamber. The flux across the gap between the pole faces and through the chamber forces the arc upward into the interrupting slot.

### Interphase Barriers

The interphase and front barriers are built into a single assembly which slides in place and is held in that position by two bolts which attach the lower end of the front barrier to the removable unit frame.

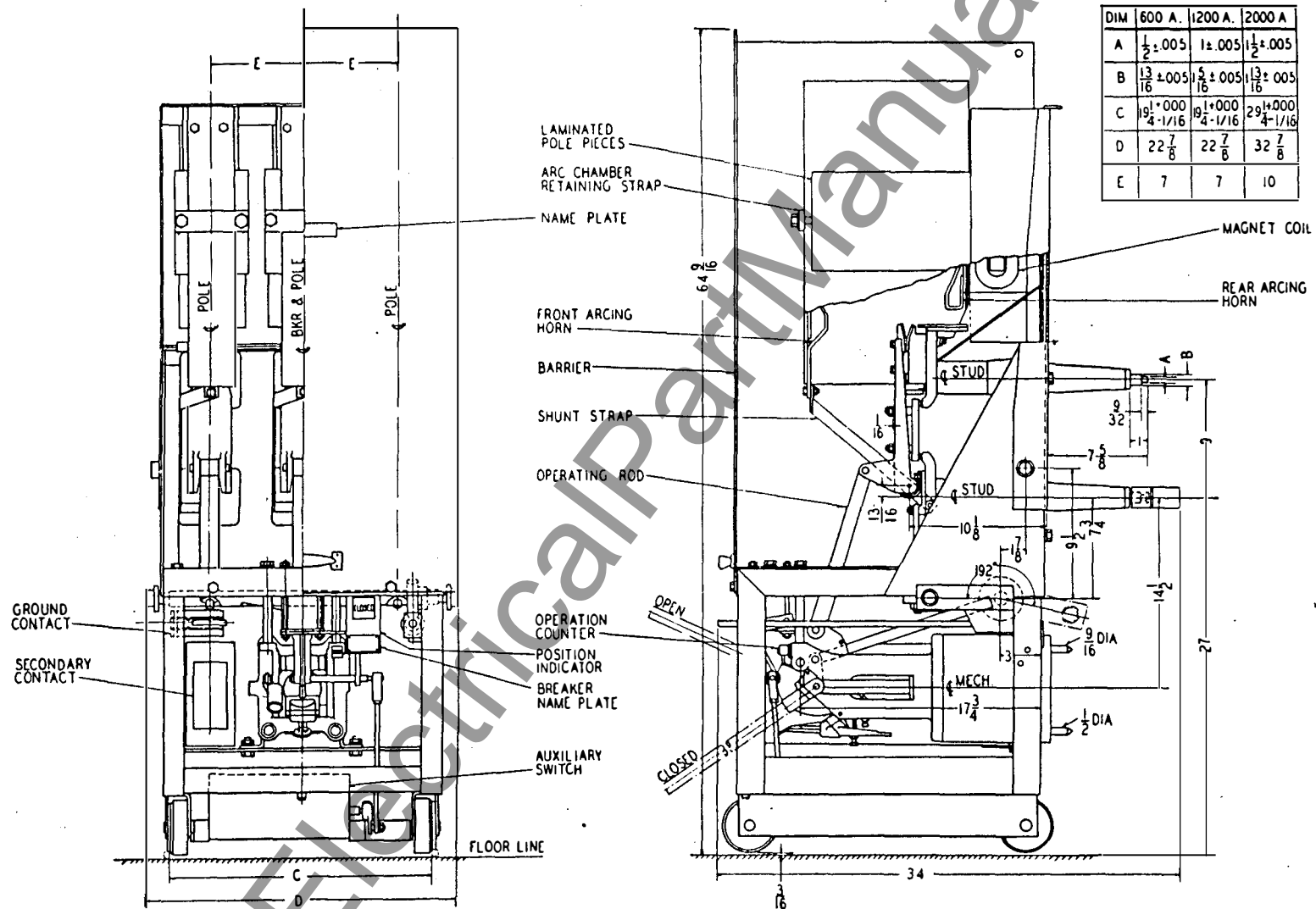


Fig. 3—Type 50-DH-100/150, 5000 Volt, 3 Pole, Air Circuit Breaker, Assembly

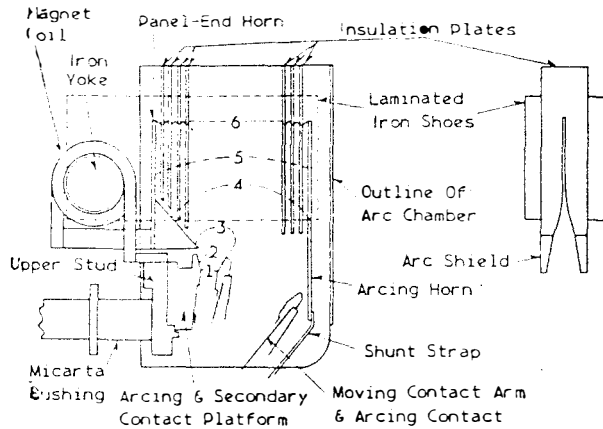


Fig. 4—Typical Arrangement of Component Parts

### Operation of the Breaker in Extinguishing Arcs

Figure 4 shows a typical arrangement of the fundamental part of the type "DH De-ion" Air Circuit Breaker. The operation of the circuit breaker will be more clearly understood by referring to that figure while reading the remainder of this paragraph. The arcing contacts are so arranged that they form a loop in the current path through the breaker, (1). The magnetic effect of this loop extends the arc rapidly upward as the contacts open, (2). Due to this looping effect, the arc almost instantly impinges against the fixed horn in the

arcing chamber immediately above the stationary contact so that one arc terminal transfers to this horn, the other arc terminal remaining on the moving arcing contact momentarily, (3). The transfer of the arc to the arc horn alters the current path through the breaker to include the multi-turn coil as that coil is not carrying current when the breaker is in the closed position. Current flowing through that coil produces a magnetic flux which moves the arc upward into the arcing chamber and the second arc terminal from the moving arcing contact to the arcing horn at the front end of the arcing chamber, (4). A shunt strap connects this front horn to the lower breaker terminal, thus relieving the contacts of current carrying duty, until the arc is extinguished in the slot of the arc chamber.

### SAFETY FOR PERSONNEL

The installation, operation and maintenance of circuit breaker equipment requires that certain precautionary measures be taken to prevent accidents. The following list presents a few suggestions of that character.

#### (1) Do Not Touch a Live Breaker.

Parts of the circuit breaker above the horizontal isolating barrier are at line potential of the circuit to which the circuit breaker is connected. The circuit breaker should be isolated from the circuit by disconnecting switches and the contacts solidly grounded, in conformance with conventional safety practice, before attempting any work on the breaker.

(2) Whenever possible the breaker should be in the open position when any work is being done on it. If that is impossible it is desirable to secure a loop over several moving contact arms and around the upper part of the stationary contact blocks so that the contacts will not accelerate out to the full-open position should the breaker be accidentally tripped.

(3) Before placing the circuit breaker in service make certain that the unit is effectively grounded and that minimum clearance for the rated voltages are maintained between live parts and ground. The same check as to clearances should be made between phases if barriers other than those supplied with the breaker are to be used.

(4) Never lay tools, such as wrenches and screw drivers, etc., on any portion of the circuit breaker.

(5) When assembling the arcing chambers onto the breaker, check to see that, (a) the contact tongue on the stack has engaged the lead to the blow-in coil, (b) that the arcing chambers are centrally located so that there is no interference with the travel of the moving contacts, (c) that the chambers are securely held in a position by the retaining straps at the front of the arcing chamber so that the top of the arcing chamber is parallel to the upper surfaces of the magnetic pole faces, (d) that the shunt strap connecting the front arc horn to the lower bushing is tightly bolted in place, and (e) that arcing chamber and breaker ratings, as shown by markings and name plate, agree.

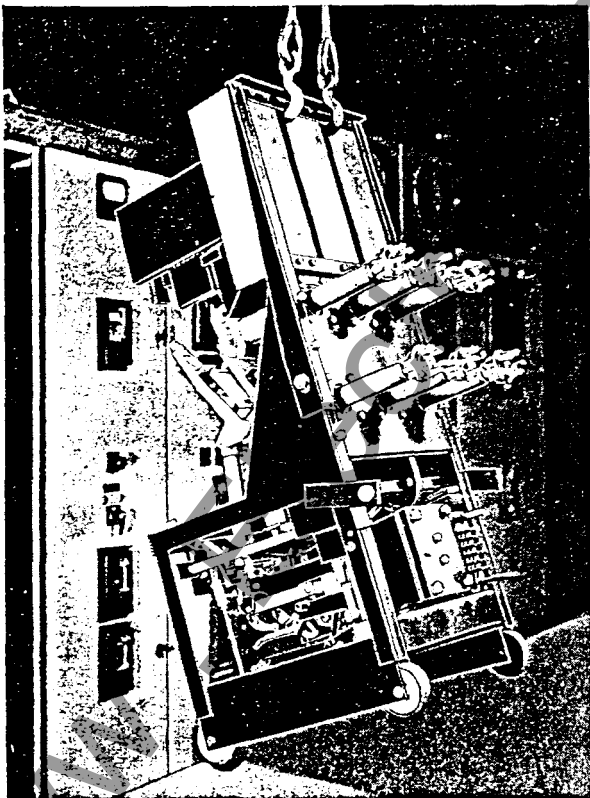


Fig. 5—Lifting the Breaker

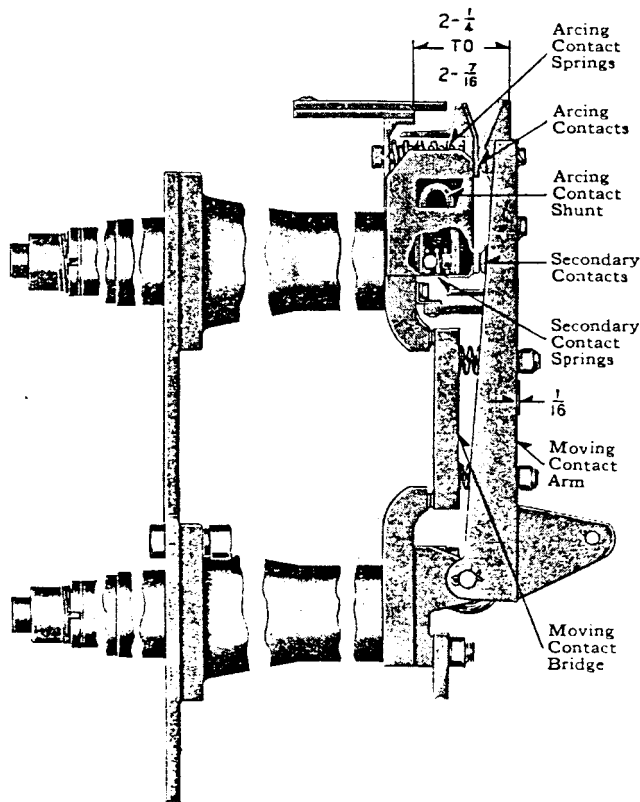


Fig. 6—Contact Assembly

(6) When lifting the breakers, remove the arcing chambers and main barrier and make the lift by using the upper horizontal tie angle as shown by Figure 5.

(7) Do not replace any arcing chamber after the ends of the slots have become  $\frac{3}{16}$  inch wide through erosion. (See "Arcing Chambers" under "Operation and Maintenance".)

### STORAGE

The arcing chambers and barriers are shipped in containers separate from the breakers to guard against rough handling and for more secure protection against dust and moisture.

These breakers are designed for indoor service and should be put in a clean dry place immediately upon arrival. During this storage period they should be kept sufficiently warm to prevent condensation until placed in service.

### HANDLING, UNLOADING AND UNPACKING

The shipment of a Type DH Air Circuit Breaker requires careful handling and ample packing to protect the breaker from serious shocks while in transit. The breakers are completely assembled and tested at the factory and then dismantled to permit the arcing chambers and barriers being shipped separately.

Immediately upon receipt of a circuit breaker an examination should be made for any damage sustained while enroute. If injury is evident or indication of rough handling is visible, a claim should be filed at once with the Transportation Company

and the nearest Westinghouse Sales Office notified promptly.

Unloading and uncrating the breaker requires very careful work. The base of the crate to which the breaker is fastened may be used as a skid in moving the breaker around. Also a handling dolly is provided to facilitate moving the breaker when the skids are removed. DO NOT USE LONG BARS to uncrate the breaker as they may slip through the crating and damage the equipment; a NAIL PULLER is recommended for that particular purpose. If a crane is available for removing the breakers from the crates considerable time can be saved in unpacking. The lift should be made by using the upper horizontal tie angle as shown by Figure 5, page 6. Care should be exercised in attaching the lifting hooks to the tie angle to make certain that the chains are not lowered too far as to become entangled in some part of the breaker when the lift is made.

The approximate net weights are as follows:

600 Amp. 3-pole brkr. without Arc Chamber and Barrier, 800 lb.

1200 Amp. 3-pole brkr. without Arc Chamber and Barrier, 825 lb.

2000 Amp. 3-pole brkr. without Arc Chamber and Barrier, 980 lb.

600-1200 Amp. 3-pole brkr. Main Barrier, 70 lb. each.

2000 Amp. 3-pole brkr. Main Barrier, 90 lb. each.

50-DH-100 Arc Chamber, 37 lb. each.

50-DH-150 Arc Chamber, 40 lb. each.

### INSTALLATION AND ERECTION

With the exception of the arcing chambers and barriers these breakers are shipped completely assembled and adjusted. No change in adjustments should be required and none should be made unless it is obvious that they have been disturbed. However, before attempting to operate the breaker electrically it should be closed carefully by hand to make certain that all parts are functioning properly.

At this time it is well to check the contacts to make certain that the settings have not been disturbed. Refer to "Contacts" under "Operation and Maintenance" page 9, for the contact settings.

A light film of graphite grease is applied to both the arcing and main contacts before the breaker is operated on the test floor. This film is removed before shipment. Before the breaker is placed in service the arcing contacts should be inspected to see that they are free of oil.

As the breakers are more easily handled with the arc chambers and main barrier removed it is advisable not to mount these parts on the breaker until the breaker has been installed in its permanent location, and all connections made, or in the case of Metal-clad units, until the housings are ready to receive the circuit breaker units. Before installing arcing chambers, inspect them to make certain that the vents and slots are open and free from

foreign material. The arc chambers may then be assembled by resting their supporting surfaces on the pole faces of the magnetic circuits and sliding them into position, using the pole faces as a guide. After the arcing chamber has been placed in position check to see that, (1) the contact blade of the rear arcing horn has engaged the lead to the blow-in coil, (2) that the chambers are centrally located so that there is no interference with the travel of the moving contacts and (3) that the chambers are securely held in such a position by the retaining straps at the front of the arcing chambers so that the top of the arcing chambers are parallel to the tops of the magnetic pole faces. Connect the shunt strap to the front horn in the arcing chamber. Check the tightness of the lower connection of the shunt straps as they may have loosened during transit. The breaker should then be operated slowly by hand to observe that there is no interference in the movement of the moving contact.

The interphase barrier may then be bolted into position.

## OPERATION AND MAINTENANCE

### Starting Up

Before placing a breaker in service the power lines as well as the control wiring should be thoroughly tested for possible grounds and short circuits that might have developed during the installation period, also a final check should be made on the various control circuits to make certain that they are all operating correctly.

### Maintenance

The frequency of inspection, cleaning, etc., will depend upon the activity and duty to which the breaker is subjected and upon the cleanliness of the atmosphere and surroundings of the breaker. For normal applications of the breakers described herein it is recommended that a preliminary or visual inspection be made every three months. A complete inspection, including removal of the stacks for cleaning, should be made every twelve months.

When the breaker operating duty is high or when atmospheric conditions are dirty, the inspections should be made more frequently. The following material is recommended as a guide for intervals between inspections until such time as accumulated experience from any particular application shall indicate that the periods may be lengthened, or perhaps should be shortened.

The frequency of repetitive operations should be limited to a maximum of 20 in 10 minutes. Air circuit breakers are now applied on the basis of certain maximum permissible numbers of opera-

tions before replacement of parts may be required, depending upon the nominal interrupting and voltage rating of the breaker. Two types of operating duty are considered (1) Non-fault, where the breaker is not relayed to trip on a system short circuit but operates only on load currents or overload currents within the limits of machines, or on transformers such as for arc furnaces, which are relayed only for secondary or furnace faults. (2) Combined Fault Duty and Repetitive Operation, where the breaker may be used for load or overload switching and also is relayed to trip on system short circuits.

For the breakers within the scope of this Instruction Book, the maximum permissible number of operations for Non-Fault duty is 5000 and for Combined Fault Duty and Repetitive Operation it is 2500. For operations at or near interrupting rating, the breaker should be inspected in line with AIEE and NEMA Rules.

For more detailed information regarding the application of Power Circuit Breakers refer to Westinghouse Application Data 33-115.

### Caution

Parts of the circuit breaker that are in the high voltage compartment are at line potential; consequently the breaker should be isolated from the line by disconnecting switches or contacts before attempting any work on the breaker. For additional safety measures see "Safety For Personnel", page 6.

### General

Inspect the breaker structure in general and see that all bolts, nuts, etc., are tight and that all cotter pins, locking clips, etc., are in place. Note evidence of excessive wear or other improper operation of the various parts.

Clean off any accumulation of dust and dirt from external surfaces. Dry compressed air is best suited for this purpose. Waste the air for a few seconds so that any residue of moisture that has accumulated in the air line will not be sprayed over insulating surfaces. Direct the air stream thoroughly into all joints and crevices. In addition, all accessible insulating surfaces should be wiped clean with a dry, clean cloth. If there is an accumulation of gummy or tightly adhering dirt, use a cloth dampened with benzol, carbon tetrachloride, or other

### Inspection Detail

### Frequency of Operating Duty

	Normal 5 Oper. per dy.	Moderate 15 Oper. per dy.	Repetitive 30 Oper. per dy.	Highly Repetitive 60 Oper. Upward per dy.	
Clean External Surfaces	3 Mos.	3 Mos.	2 Mos.	Every 2500 or 5000 Operations	(see above paragraph under Maintenance.)
Blow Out Arcing Chamber	6 Mos.	3 Mos.	2 Mos.	Every 2500 or 5000 Operations	
Remove and Clean Arc Chamber	12 Mos.	6 Mos.	4 Mos.	Every 2500 or 5000 Operations	
Inspect Contacts	6 Mos.	6 Mos.	4 Mos.	Every 2500 or 5000 Operations	
Inspect Mechanical Parts	12 Mos.	6 Mos.	4 Mos.	Every 2500 or 5000 Operations	



solvent known to be satisfactory for purposes of this kind. If a combustible solvent is used, make sure that the parts are thoroughly dry and that all vapors are gone before placing the breaker in service.

### Magnetic Circuit

The magnetic circuit assemblies consist of the blow-in coils, the magnetic poles and yokes. Each assembly is attached to and insulated from the upper rear part of the frame by a mica strip and channel.

### Arcing Chutes

It should be borne in mind that the insulating parts of the arcing chamber remain in position across the contacts at all times. During the time that the contacts are in the open position these insulating parts are subjected to the full potential across the breaker. Ability to withstand this potential will depend upon the care given to the insulation in the arcing chamber.

On general inspections the arcing chambers should be blown out with compressed air by directing the air stream upward from the contact area and out through the stack. Play the dry air stream thoroughly over the arc shields (boxlike compartment in which the arc is drawn) and through the spaces between plates in the stack. Any remaining dirt or dust should be wiped off as specified under "General", page 8.

The arcing chamber should be removed periodically for thorough inspection and cleaning. The surfaces of the arc shields will be found to have darkened in irregular areas from the effects of arc interruption. Immediately adjacent the arc tips there will be some glazing of the refractory surface from fault current interruption. Some discoloration is permissible and does not have an appreciable effect on the surface dielectric strength. However, the discolored areas should be cleaned as well as possible on periodic maintenance. This cleaning should be done with sandpaper or other non-conducting abrasive. Files or wire brushes should not be used because they may leave a metallic deposit which will lower the surface resistance. The edge of a file or a chisel may be used to remove globules from the surface but should not be used to clean extensive areas.

After cleaning the arc shields, dust and loose particles should be blown out with dry compressed air, directed first from the top of the arc chamber and then from the bottom.

If the arc chutes have seen considerable duty and if facilities are available, a potential test of 12 to 15 kv, 60 cycles for one minute should be applied to the terminals after maintenance.

Inspect the stack of plates for breakage or evidence of undue deterioration. The arc chambers derive considerable of the interrupting ability from the narrow upper end of the V-slots. That portion of the slot is nominally  $\frac{1}{16}$ -inch wide. When the interrupting duty, when on highly repetitive serv-

ice, has caused the upper extremity of the slot to increase in width to  $\frac{3}{16}$ -inch the ceramic plates should be replaced. Arc chutes which are no longer deemed suitable for service either should be replaced by complete new assemblies or they should be returned to the factory for reconditioning.

After the arcing chamber has been replaced in position, inspect to make certain that the contact tongue of the rear horn in that chamber has engaged the jaw connecting to the blow-in coil, that the upper edge of the arcing chamber is parallel to the magnetic pole faces and that the front arcing horn is securely connected to the lower terminal by means of the shunt straps. Also check by operating the moving contacts to make sure that the arcing chamber sides do not interfere with their travel.

### Contacts

The contacts should be inspected periodically for wear and for evidence of undue burning. Under normal conditions the contacts should be usable for a large number of operations within the rated interrupting capacity of the breaker. A moderate amount of burning on the main contact surfaces will not impair their current carrying ability because of the liberal surfaces and high contact pressure used. Any roughness on the main contact surfaces may be removed with a fine file or sand paper. Emery cloth is not recommended for this purpose.

The breaker should be opened slowly by hand to determine whether the several contact surfaces part in proper sequence. The sequence on opening should be as follows: (1) main contacts part; (2) secondary contacts part; (3) arcing contact part. When the contacts become worn to the point of changing this sequence of parting they should be replaced. This condition should not appear until the breaker has had a large number of operations.

The breaker should be operated slowly by hand to make sure that there is no excessive friction or binding and that the moving contact arm passes to the full-open position.

### Lower Bushing Ties

Micarta ties are located between the contact ends of the lower bushings and the formed channels just below the top plates in the breaker frames. These ties serve to hold the bushings in place as they are subjected to the upward thrust of the pushrods during the closing operation. Adjustment in the length of these ties is secured by castle nuts on clevises that are attached to the lower extremities of the micarta. With the circuit breaker contacts in the open position the castle nuts are turned one to two flats past finger tightness and locked in place with cotter pins. The contact adjustments should be checked after making any change in the length of a lower bushing tie assembly.

In the earliest designs the micarta ties were  $\frac{3}{8}$  inch thick and were fastened to the bushings by two  $\frac{3}{8}$  x  $\frac{1}{2}$  inch diameter shoulder studs. At that time the contact feet were drilled and tapped  $\frac{3}{8}$ -16

(2 holes);—the moving contact bearings were drilled  $\frac{3}{8}$  inch and the ties for  $\frac{1}{2}$  inch and with this arrangement the shoulders of the studs were used to secure the lower part of the bearings against the contact feet. Because of manufacturing difficulties the shoulder studs were replaced by  $\frac{3}{8}$ -16 Hex. Hd. bolts and  $\frac{1}{2}$ -13 Flat head bolts were used midway between the  $\frac{3}{8}$  bolts to hold the bearings in place. In May of 1948 the thickness of the Micarta Ties was increased to  $\frac{1}{2}$  inch so that the same thickness micarta plate could be used on the 5000, 7500 and 15,000 breakers. At that time the clevis was redesigned so that the newer assemblies would be interchangeable with the old. Ordering specifications for the newer assemblies with thicker plates are: — 19-B-2673, Group 1 or Group 2 depending on whether the breaker is equipped with  $\frac{3}{8}$  x  $\frac{1}{2}$  shoulder studs or the  $\frac{3}{8}$  hex. head bolts, respectively.

### Contact Adjustment

These breakers are fully adjusted and tested at the factory and no readjustment should be necessary unless it is evident that something has been changed. If it becomes necessary to remove the contacts or if for some reason the breaker has been disassembled, refer to Figure 6, page 7, and proceed with the contact adjustment.

### Primary Disconnecting Contacts

To remove the female primary contact cluster without deforming the springs, the bolt and washer at the end of the bushing should first be removed before attempting to slide the contact cluster off.

### Adjustment of Moving Contact Arms

The linkage between the moving contact arms of a multi-pole breaker and the closing mechanism consists of the insulating operating rods and the cross-bar. The cross-bar is omitted in manufacturing the single pole breaker. The length of this linkage is adjusted to satisfy each pole unit requirement by turning the rod in or out of the threaded hole in the cross-bar, then locking in place with the locknut at that point. This linkage should be so adjusted that when the mechanism is in the latched-closed position the distance between the upper forward surface of the top upper stud block and the inner surface of the moving contact arm is from  $2\frac{1}{4}$  to  $2\frac{7}{16}$  inches.

Considerable effort is often spent in adjusting the moving contact arms and operating rods to make the arcing contacts on the several poles strike simultaneously on closing. This adjustment is checked by closing the breaker slowly by hand and is sufficiently close if when the first arcing contacts touch the greatest distance between arcing contacts on the other poles is not more than  $\frac{1}{8}$  or  $\frac{3}{16}$  inch respectively when the pole units are on 7 or 10-inch centers. The 600 and 1200 ampere pole units are spaced on 7-inch centers,—spacing of the 2000 ampere breaker is 10 inches.

### Care and Adjustment of Main Contacts

The main contact bridging members are held in position on the moving contact arm by studs which pass through the main contact springs. Adjustment of the main contacts is made, when the breaker

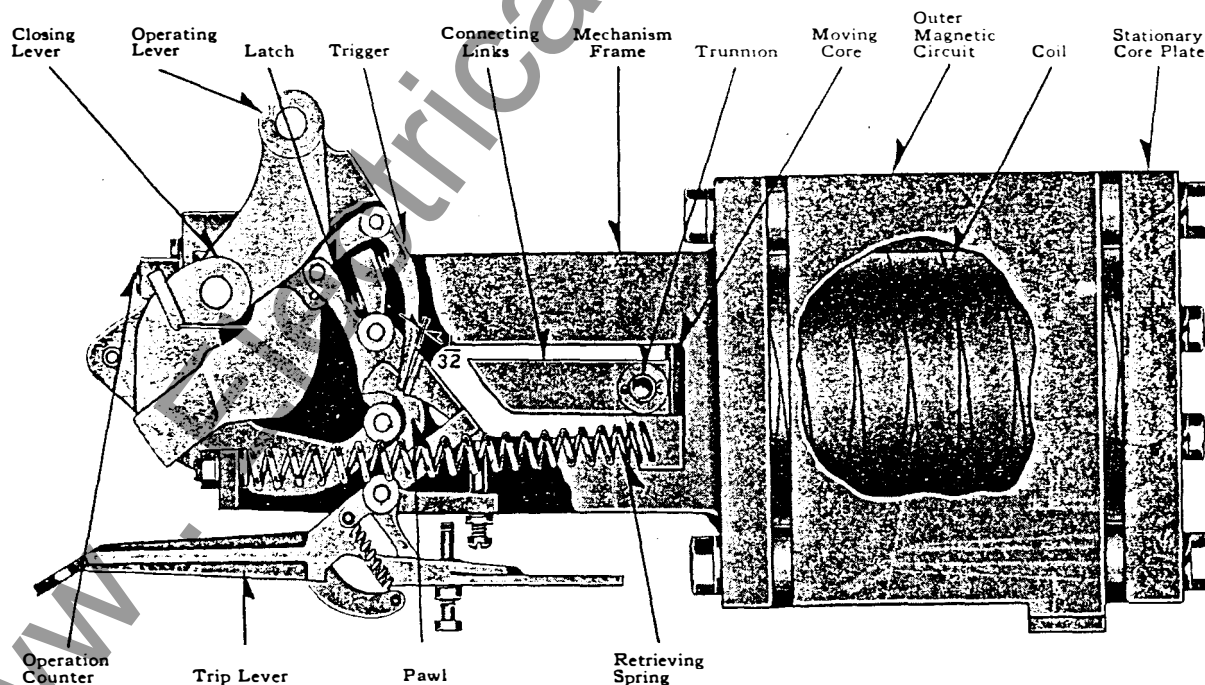


Fig. 7—Operating Mechanism

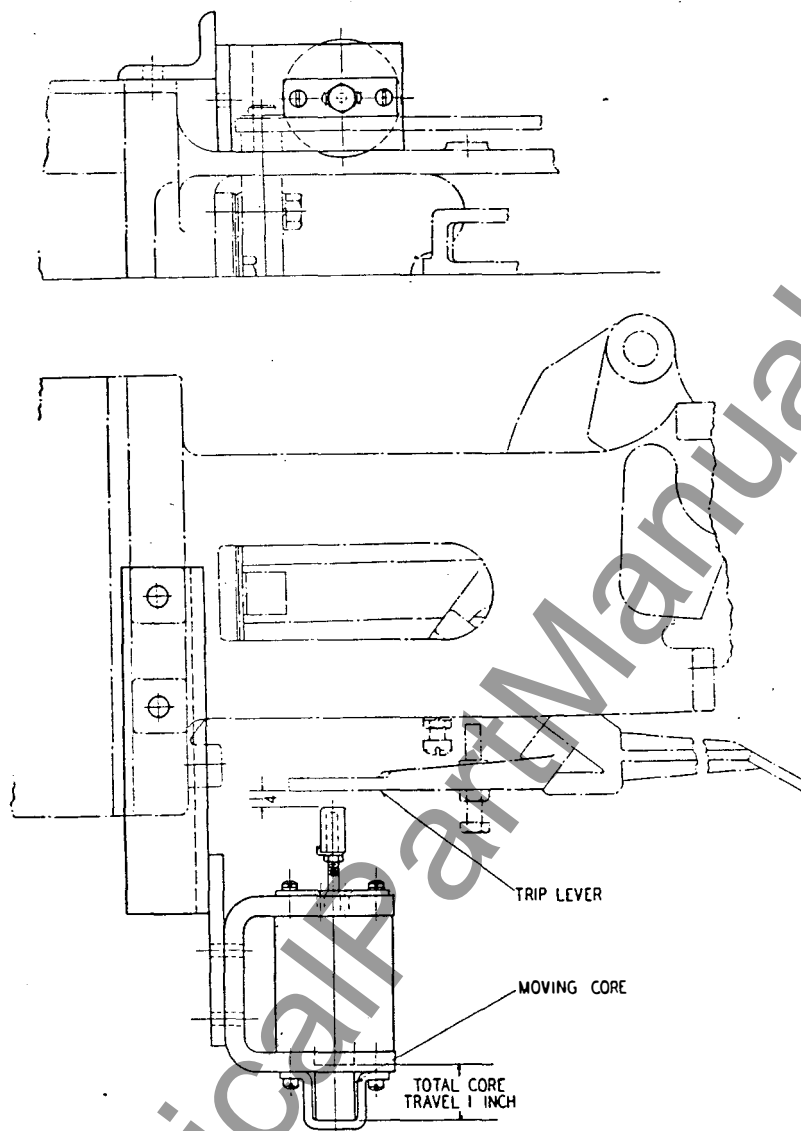


Fig. 8—Shunt Trip

is in the latched position, by setting the stop nuts on these studs so that there will be approximately  $\frac{1}{16}$  inch clearance between the face of the nut and the back of the moving contact arm. If new contacts are being installed or if the contacts have just been smoothed it is well to operate the breaker electrically several times so that the surfaces assume their permanent shape before making this adjustment.

On the opening stroke, the stationary element of the arcing contact should follow the moving arcing contact approximately one inch before parting.

### ELECTRIC OPERATING MECHANISM

The electrical operating mechanism Figure 7, contains a number of moving joints and operating parts all of which are subject to wear or sticking

if not kept in proper condition. The mechanism should be inspected at regular intervals, making a number of operations both electrically and by hand to assure that it is functioning properly. It is desirable to apply a light lubricating oil to the various pin joints but not to the extent of causing them to become gummed or sticky. Moving parts, particularly the trigger and switches, should be kept free from dirt and foreign matter.

The closing mechanism consists essentially of the mechanism frame, outer magnetic circuit, stationary core and plate, coil, coil tube, moving core, retrieving springs, moving core trunnion, closing lever, connecting links, operating lever, trigger and latch assembly, pawl and trip lever. The brass coil tube in the earlier mechanisms was held in place by shoulders on the stationary core and in the hole in the mechanism frame casting. In the later

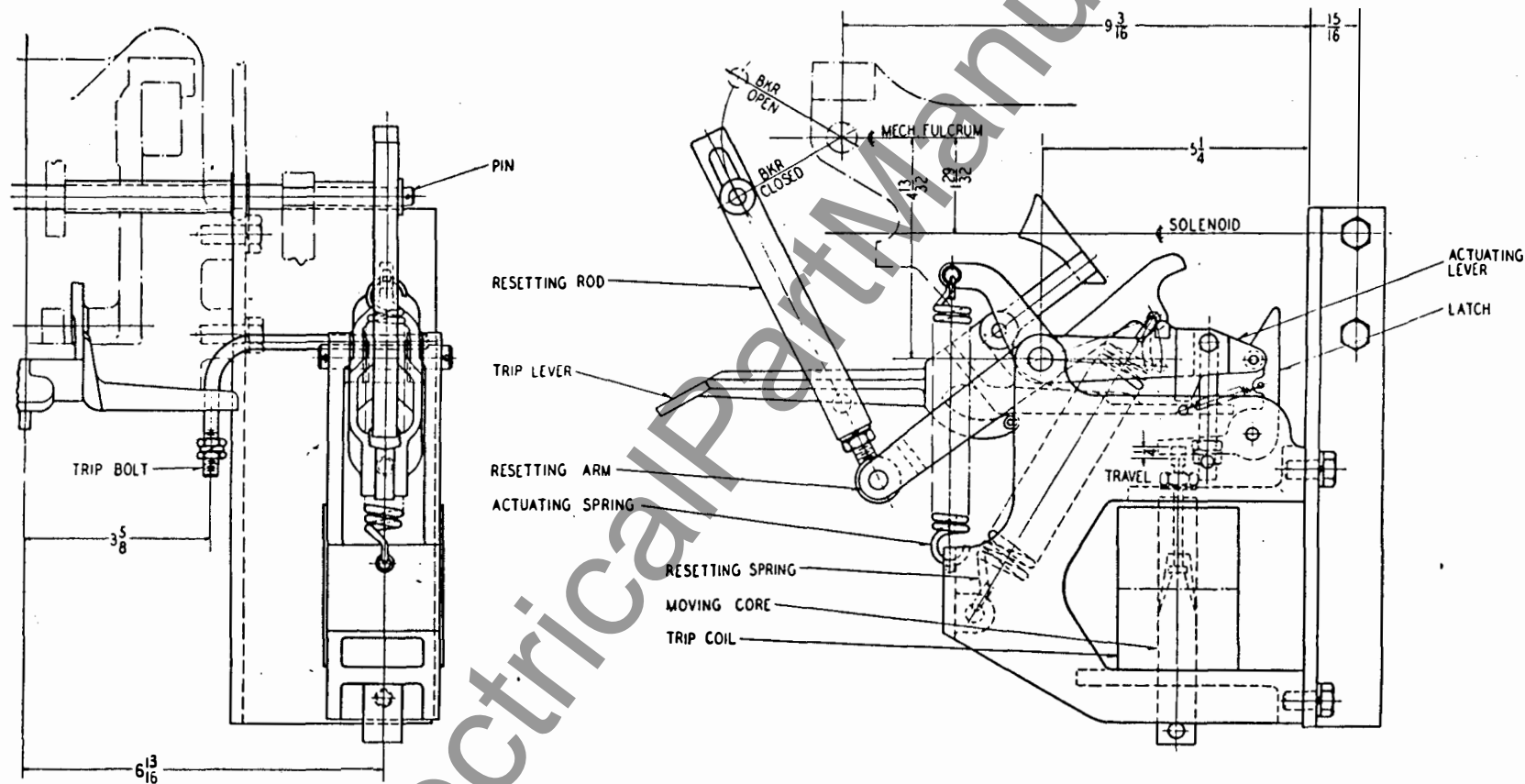


Fig. 9—Capacitor Shunt Trip

Type 50-DH-100 and 50-DH-150 Air Circuit Breakers

[www.ElectricalPartManuals.com](http://www.ElectricalPartManuals.com)

mechanisms this tube was spun onto the stationary core and the end projected through the hole in the mechanism frame casting so as to be visible,—its end extending along the side of the moving core.

The closing coil can be removed by unscrewing the four bolts at the back of the mechanism. In the earlier models the moving core retrieving spring was located within the moving and stationary cores. In this case the back plate acts to restrain the spring and should be removed with care and with the breaker in the open position. This precaution need not be observed if the mechanism is of the later type with external retrieving springs that are located along the closing links. The back plate, stationary core, and closing coil can then be removed. In replacing the coil make certain that the moving core travels freely in the brass coil guide tube and that the coil is held firmly in position with wooden wedges to avoid damaging the insulation during electrical operations. Thus no adjustment of the breaker need be disturbed in replacing a closing coil.

When shipped from the factory the mechanism has been adjusted and tested and no changes should be necessary. If for any reason reassembly in service becomes necessary, certain relations should be obtained.

In the factory the mechanism is bench assembled and during that operation the stops on the closing lever and the mechanism frame are filed to secure from .092 to .094 clearance when the parts are in the latched closed position and the solenoid core retrieving springs are pushing the closing lever roller against the holding pawl. The shims between the moving core and the trunnion are selected to secure .001 to .006 clearance between the stops when the mechanism is held closed with the hand closing lever. Then when the mechanism is assembled into the breaker the stops will have .078 to .092 clearance when latched closed and .038 to .046 clearance when the closing coil is energized.

The tripping lever position is controlled by two bolts. The lever normally rests on a screw which is so set as to obtain a clearance of approximately  $\frac{1}{32}$ -inch between the lever and the tail trigger. The travel of the tripping lever into the tripping position is limited by setting the screw which extends upwards through the trip lever to secure a  $\frac{5}{32}$ -inch clearance between that screw and the mechanism frame when the trip lever is in the normal position. **CAUTION:** A breaker should never be tripped when the air dash pot (bumper) is disconnected from the operating mechanism.

## TRIPPING ATTACHMENTS

### Shunt Trip

Two shunt trip mountings have been used with these breakers. The tripping unit Figure 8, is mounted on the left side of those mechanisms having hollow cores and internal retrieving springs, a right side mounting is used with those mecha-

nisms having the solid cores and external retrieving springs. The action of either is the same in that upon energizing a trip coil a magnetic flux is generated which causes the moving core to operate, through a rod or bolt, upon a trip lever to trip the breaker. The total travel of the moving core in either arrangement is approximately one inch and the mechanism is so adjusted that the core can move approximately  $\frac{1}{4}$  inch before engaging the trip lever. When moving the core slowly upward by hand there should be at least  $\frac{1}{16}$ -inch permissible travel of the core when the circuit breaker trips.

Shunt trip coils are designed for momentary current-carrying service and for that reason the shunt trip circuit should be interrupted by auxiliary contacts immediately after the breaker is tripped. It is Westinghouse Practice to use for this purpose the first and third contact segments as counted from the auxiliary switch operating arm.

### Low Energy or Capacitor Shunt Trip

The capacitor shunt trip as applied to these Type DH breakers is a low energy tripping device as shown on Figure 9, Page 12. In it the actual power for tripping is secured by an actuating spring which is latched in the extended position while the breaker is in the open position,—the actuating spring having been extended by the action of the resetting

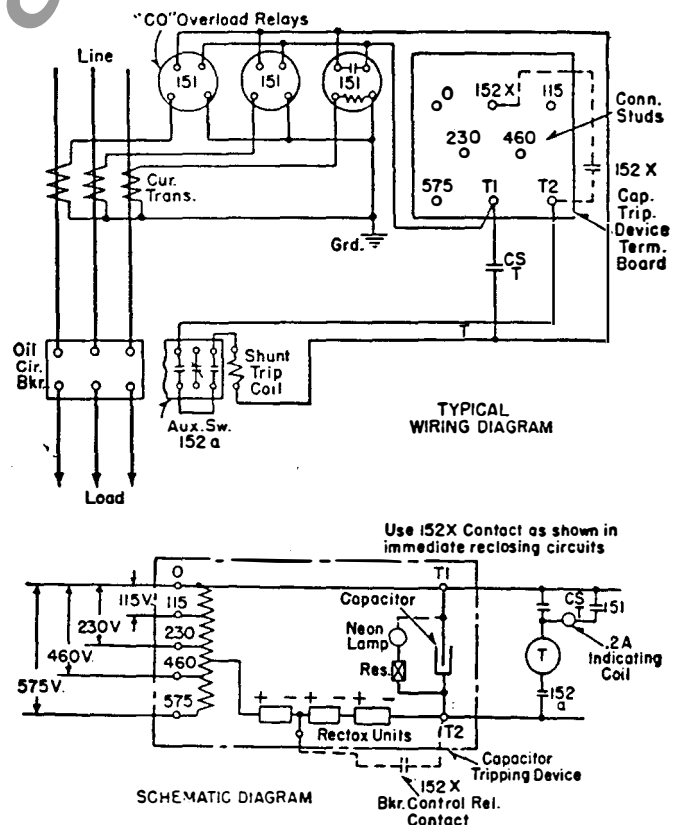


Fig. 10—Capacitor Shunt Trip, Diagram

spring and lever as the breaker opened. As the breaker closes, the influence of the resetting spring and lever is removed from the actuating spring. On tripping, the disengagement of the tripping latch on this device releases the action of the actuating spring which in turn operates on the breaker trip lever. The actuating lever is reset by the resetting spring and through the resetting rod as the breaker opens.

The travel of the moving core is approximately  $\frac{1}{4}$  inch and there should be  $\frac{1}{16}$ -inch clearance between the latch trigger and the core stem.

The electrical tripping energy is obtained from a capacitor of suitable size which is charged by a half-wave, dry-type rectifier, which in turn draws its energy from the secondary of a step down transformer, 110 to 550 volts, connected to the line side of the breaker. (This transformer can also be used for closing the breaker by means of a Rectox solenoid combination).

The steady state volt-ampere burden imposed on the voltage transformer is less than 1 volt-ampere.

The conventional current transformers are used for operating the relays but the size is independent of the tripping means and need be only of sufficient capacity to operate the relays. With low-energy relays it is therefore possible to trip at very low primary currents. When the relay operates, the capacitor discharges through the breaker low-energy shunt-trip coil, tripping the breaker.

The capacitor will hold sufficient charge to trip the breaker at least six seconds after the charging potential is entirely removed, which is ample time for relays to operate under fault conditions. However, on most fault conditions some potential is available, and the device is so designed that 65 per cent of normal potential will give the capacitor sufficient charge to trip the breaker at any time.

A low-energy glow lamp connected in parallel with the capacitor provides visual indication of the charge on the capacitor. When the supply is removed, the condensers will discharge in approximately 60 seconds to 90 volts. The glow lamp in series with the discharge resistance glows at any voltage above 90 volts.

The condenser can be recharged in approximately 0.3 second by using the special connection shown in Figure 10. This is important, especially when used with fast-reclosing breakers. It should be connected to the line side of the breaker so that it can be charged when the breaker is open.

### Undervoltage Trip

The undervoltage release is a device which trips the breaker automatically when the supply or control voltage is lowered to a predetermined value. The mechanism consists of a coil, a U-shaped holding magnet and armature and a set of levers and springs as shown by Figure 11. When normal voltage is applied to the holding coil the magnetic field is of sufficient strength to hold the

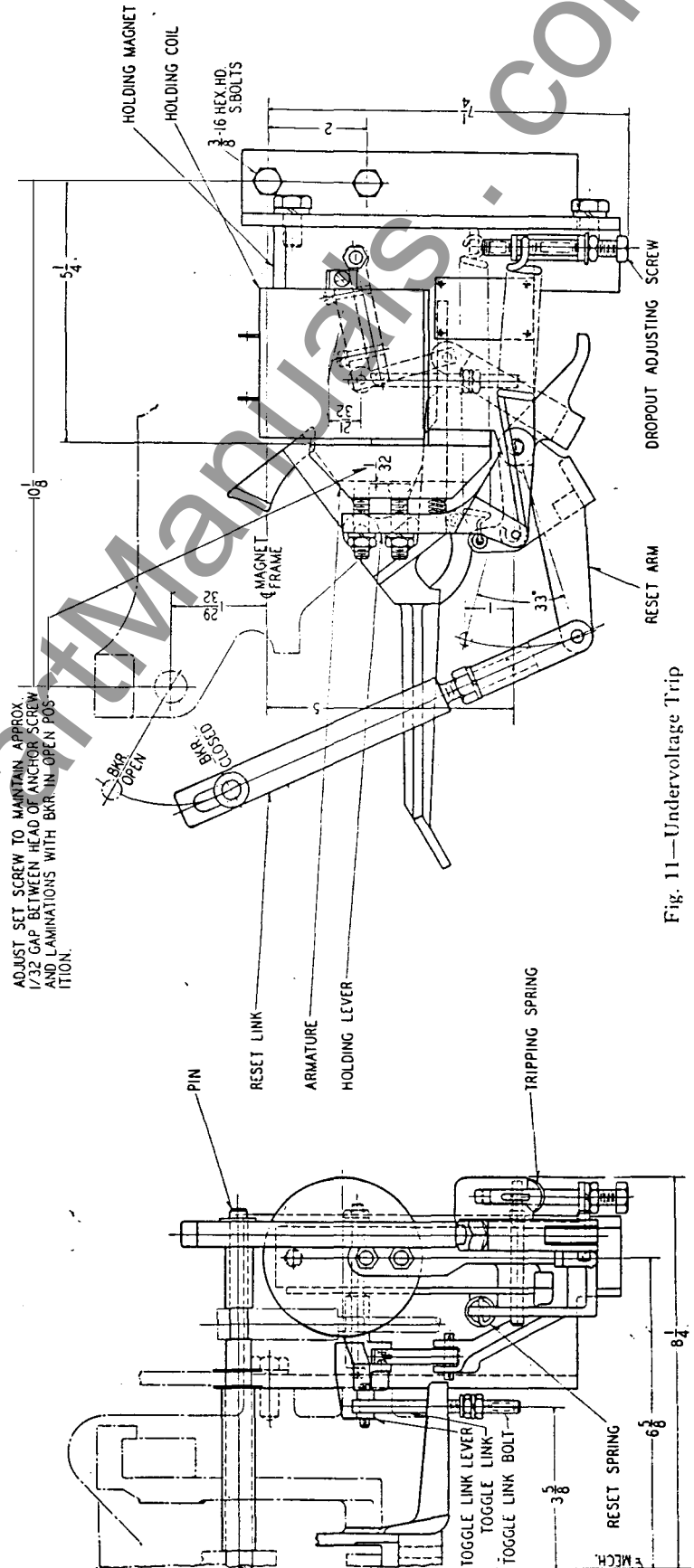
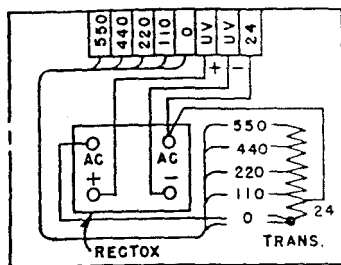
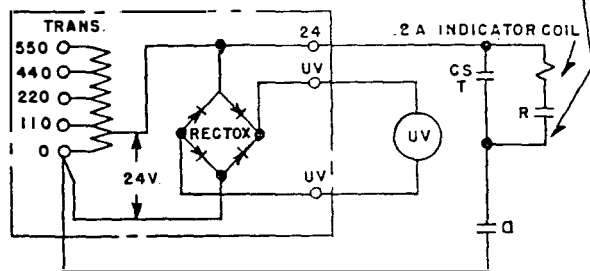


Fig. 11—Undervoltage Trip



NOTE -  
RESISTANCE OF RECTOX SHORTING  
CIRCUIT INCLUDING INDICATOR COIL  
MUST NOT EXCEED 8 OHMS



SCHEMATIC

Q = BKR. AUX. SW. CLOSSES WHEN BKR. CLOSSES

R = RELAY CONTACT

UV = UNDERVOLTAGE RELEASE COIL

Fig. 12—A-C Undervoltage Adapter

armature against the force of the tripping spring. When the voltage decreases to approximately 60 per cent of the normal value the magnetic field is no longer strong enough to counteract the force of the tripping spring so that the holding lever is rotated and through the toggle link, the toggle-link lever and the toggle-link bolt acts to move the breaker trip lever to trip the breaker. As the breaker opens the reset link permits the reset arm to rotate under the action of the reset spring so that the

armature is placed in the pick-up position.

A brass pin or washer is required between the armature and magnetic circuit to prevent freezing. Decreasing the thickness of this pin or washer or raising the fixed end of the tripping spring lowers the drop out voltage and vice versa.

An auto transformer-rectox combination as shown by Figure 12, is used when applying the undervoltage to alternating-current circuits. In this circuit a 12 volt d-c undervoltage coil is used for all applications and variations in the supply voltage are taken care of by the different taps on the auto-transformer. The same device is used on either 25 or 60 cycles.

A Capacitor type time delay device is sometimes used with the undervoltage attachment to delay the functioning of the undervoltage attachment after voltage reduction. The one device can be applied without change on voltages from 110 to 550 volts a-c, with any commercial frequency. When using this device it is necessary to substitute a special undervoltage coil for the standard coil ordinarily supplied with the undervoltage attachment.

Due to the necessity of using a normal current many times the drop out current, (to secure maximum time delay) the drop out voltage will vary from 22 per cent of normal on the No. 4 dial setting to 60 per cent of normal for the No. 1 dial setting. Variation in time delay is secured by changing the dial setting of the time delay device. No. 4 dial setting gives maximum time delay (4 seconds) and No. 1 dial setting gives minimum time delay (1.5 seconds). The dial markings are not calibration marks, but are merely numbers indicating the percentage of the potentiometer in the circuit. The time delay must be determined by test in all cases.

The volt-ampere burden (including the undervoltage attachment) is 10 volt-amperes on 60 cycle circuits and 18 volt-amperes on 25 cycle circuits.

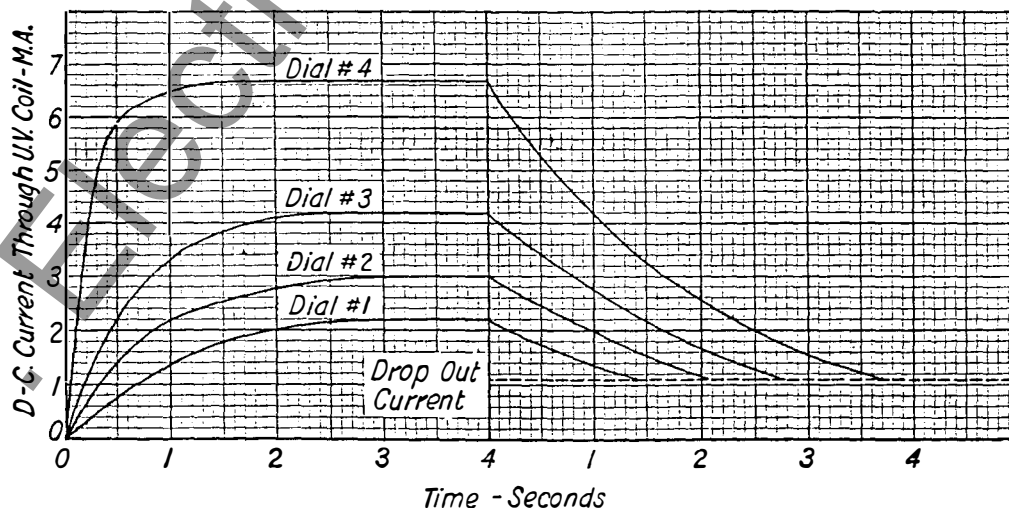


Fig. 13—D-C Current Through Undervoltage Coil for Capacitor Type Time Delay Device



The device obtains its delayed action from the energy stored in a capacitor. When the source of power is removed the capacitor continues the flow of current through the undervoltage release coil as shown in Figure 13.

The Capacitor time delay device is connected to the a-c supply as shown in Figure 14. The control switch and relay contacts are incorporated into the circuit so that, for instantaneous tripping, they operate to short circuit the undervoltage coil through a resistance of approximately 50 ohms. As the circuit breaker opens the circuit is interrupted by the circuit breaker auxiliary switch—thus reducing the duty on the relay contacts. This shorting scheme is more desirable, because of lower duty imposed on the relay contacts, than a scheme wherein the undervoltage coil circuit is broken. The tap transformer impresses approximately 320 volts a-c on the potentiometer resistor circuit. Varying the potentiometer dial 4 to 1 reduces the voltage impressed on the Rectox-capacitor circuit, which reduces the d-c current flowing through the undervoltage coil and consequently the time delay.

#### Undervoltage and Shunt Trip Combination

Breakers using the undervoltage and the shunt trip in combination usually have the accessories so designed and adjusted that the undervoltage will act to trip the breaker at a value higher than the minimum voltage at which the shunt trip will operate. This insures that as the control voltage is reduced the breaker will open by undervoltage be-

fore the voltage reaches a value at which the shunt trip becomes inoperative.

#### RENEWAL PARTS

When ordering renewal parts, specify the name of the part desired. Also give: Breaker Type, Volts, Amperes, and Stock Order Number, (S.O. No.) as found engraved on the Breaker Nameplate.

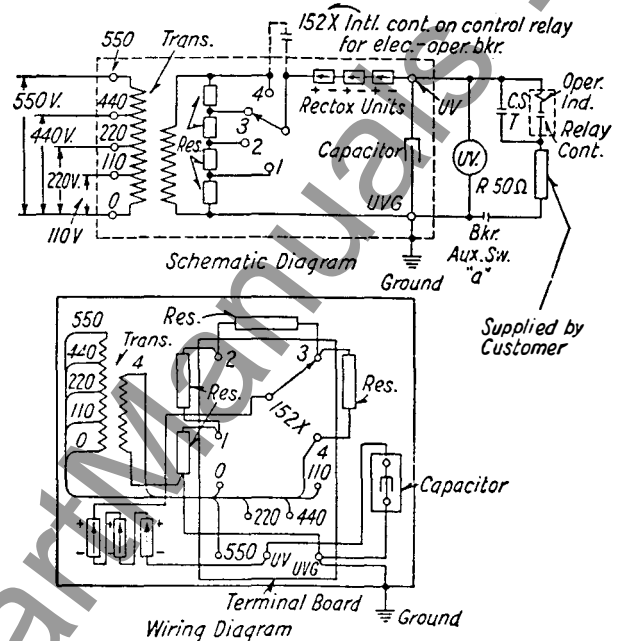


Fig. 14—Wiring and Schematic Diagrams Capacitor Time Delay Device

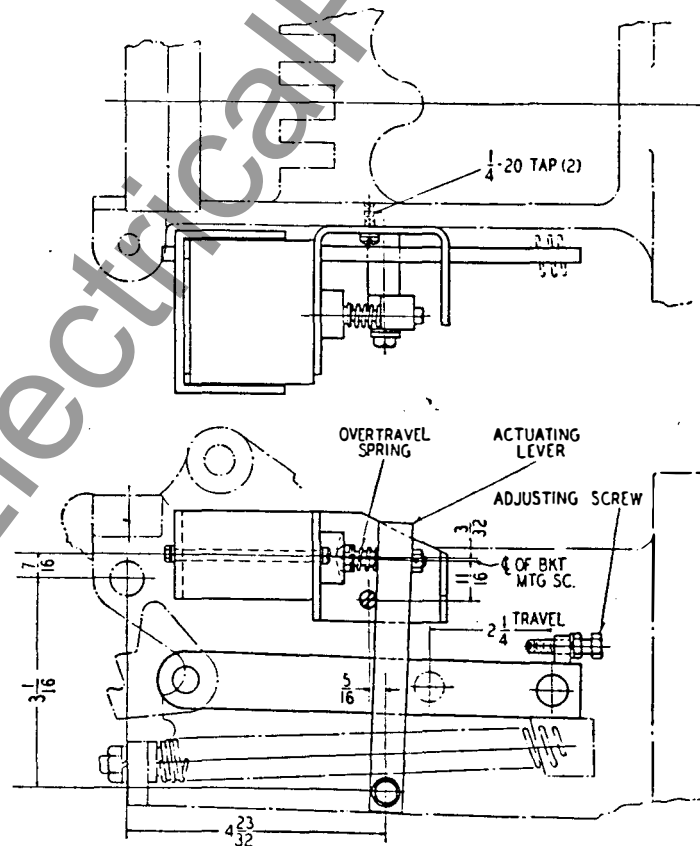


Fig. 15—Latch-checking Switch