Westinghouse

Type CHM Air Circuit-Breaker

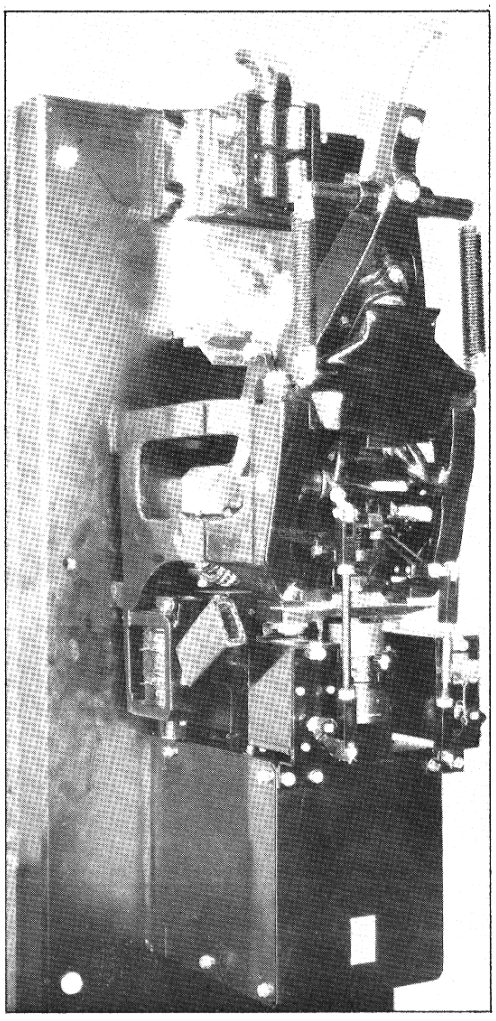

FIG. 1—PANEL MOUNTED BREAKER

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

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IB 5772-A
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INDEX

INSTRUCTIONS FOR OPERATION

Important

Type CHM Air Circuit-Breaker

Keep Main Copper Contacts Clean

In contrast to copper oxide, silver oxide or sulphide is a comparatively good conductor so that circuit-breakers having silver plated main contacts do not require the removal of oxide. As a matter of fact sandpaper should never be applied to silver plated contacts since the useful silver plating would thereby be removed.

Maintain Proper Main Contact Pressure

While it is true that after the main brush contacts have been properly adjusted they will remain so indefinitely, occasional inspections should be made to see that all adjusting screws are tight and if any of these screws are found loose to see that the brush adjustment has not shifted.

Lubrication

Lubrications of the various parts of the mechanism as applied at the factory should be sufficient for many months of service. Experience indicates that lubrication is generally applied too freely rather than insufficiently. If a bearing seems to require lubrication, apply only sufficient oil to provide a thin film on the working parts. Excessive use of oil promotes the accumulation of dirt, and oil is very detrimental to any contact surface to which it may spread or upon which it may be thrown. Alemite fittings are provided for the lubrication of the main toggle pin bearings. It is very important that these bearings have lubrication at all times.

Instructions for Operation

RATING: 2000 to 10,000 amperes, 750 volts D-C Single Pole. Panel or Pedestal Mounting.

APPLICATION: Type CHM breakers are used chiefly in steel mills, d-c. railway power plants, automatic substations, and in general wherever breakers are required to operate on high power d-c. supply systems at 550 to 750 volts with the minimum of maintenance.

MOUNTING: Panel mounted breakers are mounted on thick slabs of insulating material for bolting to steel framework. Pedestal mounted breakers are built on individual pedestals for bolting to the floor.

There is no difference in rating between the two forms of mounting but pedestal mounting is preferred where the heaviest duty is imposed due to its greater inherent mechanical strength.

GENERAL: In these instructions, somewhat more than the usual porportion of space is taken up by descriptions of the several parts of the breaker, because many of the details are worked out on principles that apply only where extremely high currents have to be considered, and an explanation of the reasons for such special features should be helpful in the operation and maintenance of the apparatus. Also, some of the mechanism details which are not easily seen when looking at the completely assembled breaker are described or explained by reference to the figure included herein.

High interrupting capacity is obtained by quick opening, to a wide air gap, of contacts tipped with arc resisting alloys and supplemented by heavy arcing horns, these parts being massive enough to withstand a heavy flash without serious burning.

In addition to the contact details for minimizing the heating effects of the arc, all parts have exceptional mechanical strength in order to withstand the severe mechanical stresses resulting from the magnetic effect of the short-circuit currents that the apparatus may be required to interrupt.

By arranging the contacts with the laminated stationary brush and on the inside of the magnetic loop formed by the studs and contact-bridging details, the magnetic force is utilized to increase the brush pressure during the interval between the occurrence of a short-circuit and the release of the breaker latch. The solid copper bridging member is substantial enough to resist the magnetic force tending to bend it away from the brushes but if it were laminated, as in the standard arrangement of breakers for lower interrupting duty, the outer laminations would have their

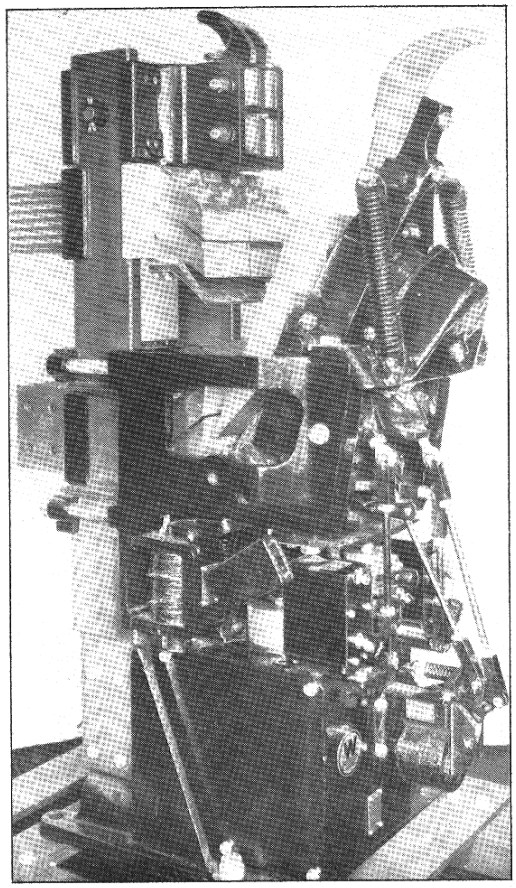


Fig. 2 - Pedestal Mounted Breaker

pressure reduced or might even be "blown-off" the stationary contact before the latch could have time to release.

The main contact brushes are built up of straight sections of copper strap of equal length, riveted together in groups forming equal angles at the ends, and clamped to make permanent contact with the stud heads at one end and to connect with the bridging contact at the other. There is an inner and an outer row of laminations, held by concealed bolts on the inner row, in addition to the bolts passing through the outside clamp.

CIRCUIT INTERRUPTING DETAILS: Main contact parts, both the laminated stationary brushes and the solid copper bridge, are silver plated to maintain low contact resistance over a long period of service.

When the breaker opens, the main

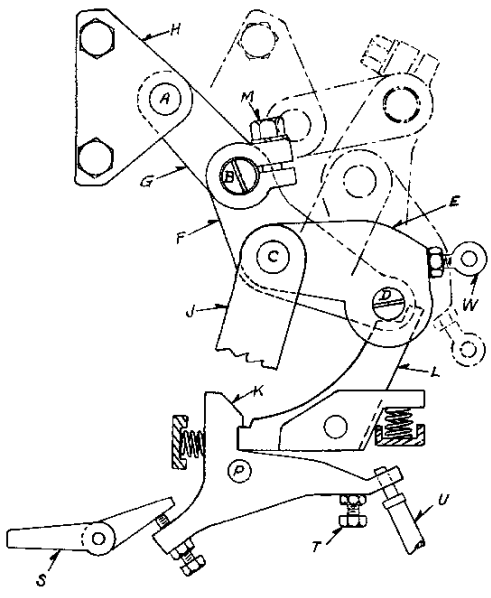
contacts separate first and the entire current is carried momentarily by the secondary and arcing contacts. A flexible shunt maintains electrical connection at all times between the lower stationary contact and the lower end of the bridging contact, thus preventing any potential difference that could cause an arc to form at that end.

Secondary contacts below the upper stationary contacts are faced with an alloy having low contact resistance which at the same time will endure considerable arcing without injury to the contact surface. Arcs form on these parts only on the heavier interruptions. A fibre barrier prevents such arcs from flashing along the surface to the main brush. After the secondary contacts part, the current is carried by the arcing contacts at the upper end of the breaker. These arcing contacts have low resistance due to the large copper-to-bronze contact surface between the sides of the movable part and the jaws of the stationary part between which the movable part enters. Good contact between the stationary jaws and the movable arcing contact is assured by a self aligning mounting of the stationary jaws, and springs which exert pressure in the direction of the contact surfaces. Travel of the jaws is limited, so that there is always room for the moving contact to enter the space between them.

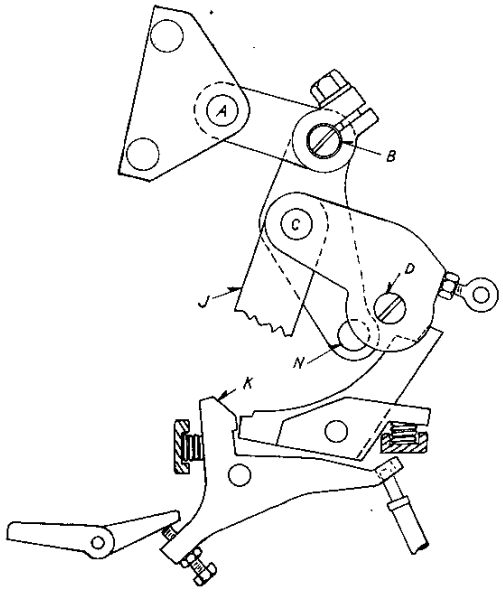
As these contacts, last in the circuit, approach the point where they separate, their curved edges, which are below the plane of the contact surfaces make the final lines of contact whereon the arc forms when they part. These curved edges are equipped with tips of an alloy having high arc-resisting properties. The arc formed on the tips is forced immediately by magnetic repulsion into a pair of arcing horns directly above, and in metallic contact with the point of formation of the arc. These horns are solid castings of a special bronze which resists arcing and are massive enough to absorb a great deal of heat without excessive burning at the surface. Accelerating springs assist in rapidly widening the air gap. As the breaker is single-pole and trips free of the operating mechanism, there is no unnecessary weight to retard its speed.

BUMPER: A combination pneumatic and rubber pad bumper brings the moving parts to rest. First, the moving arm strikes a thick rubber pad which is mounted on the top of an air dash-pot. Close fitting, and the use of piston rings, prevent an appreciable escape of air from the dash-pot at the moment of impact and provide an air cushion for bringing the parts to rest without jarring. A ball valve in the piston of the dash-pot obstructs the escape of air when the piston is pressed down but allows air to enter freely when the parts are retrieved to normal position by a spring on the inside of the bumper.

ELECTRIC OPERATING MECHANISM: Normally, the breaker is closed by means of an electromagnet built into the lower end. A detachable extension handle which fits into the same closing lever that is operated by the electromagnet provides for manual operation in an emergency or when inspecting or making adjustments. The electromagnet is a solenoid with round stationary and movable cores on the inside and a rectangular frame completing the magnetic cir-



SOLID LINES SHOW CLOSED POSITION
BROKEN LINES SHOW OPEN POSITION



TRIPPING FREE – (PARTLY OPEN POSITION)

Fig. 3 - Action of the Latch and Toggle Mechanism

cuit on the outside. Piston rings and a close fitting brass cylinder between core and coil form an air cushion which together with the damping effect of the currents induced in the brass cylinder, prevent slamming and maintain a reasonably uniform closing speed over a wide range of control voltage.

Figure 3 is for the purpose of explaining the action of the latch and toggle mechanism. When the breaker is fully closed and latched, as shown by solid lines, or when retrieved by the springs immediately after opening, the operating lever E and the link F are locked together to act as a single piece. Toggle link (F), latch, lever (L) and trigger (K) retrieve automatically after tripping, so that E and F are already locked together at the beginning of the closing stroke.

When the closing coil is energized the closing magnet pulls downward through intermediate levers on the link J and pin C at one end of the operating lever E. The other end of E is pivoted on stationary pins D. Lever E is a wide bronze casting with two bearings at each end. Fixed pivots at D, around which E turns extend only to the inner ends of the two bearings at that end of E. Link F, pivoted on pin C, is located with its vertical center line in the same plane with the vertical center line of E. Link F carries the latch roller which, except during a tripping operation, is held by the latch L in a direct line with the pins D. Centers C and D being equidistant on lever E and link F, E and F act as a single piece as long as the latch holds the end of F in the position of alignment with pins D.

Before closing, the several parts are in the position shown by broken lines in the figure. After closing, the toggle formed on the centers A B D is over center and is prevented by permanently fixed stops from going beyond a predetermined position. This toggle makes a rigid support for holding the bridging contact against the stationary brushes.

The opening toggle A B C is held closed by the latch lever L and the release of this latch lever by trigger K permits this toggle to collapse thus opening the breaker.

OVERLOAD TRIP: Overload tripping is controlled by magnetic attraction between the steel frame of the breaker serving as the poles of a magnet in which the studs and main contacts serve as a one turn coil, and a T-shaped armature located centrally below the mechanism. A calibrating ring and guide surrounding the stem of the T armature provide an adjustment for varying the pressure of the armature spring. As the ring turns to the right or left the spring pressure is lowered or raised thus changing the force required by the overload magnet to pick up the armature.

Currents that will pick up the armature and trip the breaker are engraved on a scale plate. The trip point is changed by loosening the thumb screw at the front of the frame and turning the ring until the white index line crossing the center of the pin socket is in line with the scale reading for the trip current desired.

The standard range of calibration is 100% to 200% of breaker rating in five steps 100-125-150-175 and 200%.

INVERSE TIME LIMIT ATTACHMENT: The inverse time limit attachment prevents the breaker tripping on short time overloads. This attachment is calibrated without oil. With current flowing through the breaker the same as the calibration setting and with oil in the pot the armature will not pick up. The current flowing must be more than the calibration setting before the breaker will trip.

The inverse time limit attachment used on this breaker is the sucker type. The sucker which is a smooth surfaced metal disc is attached to the armature and normally rests on the smooth bottom surface of the pot containing a small quantity of oil (approximately 1/8" deep). The resulting sucker action retards the starting movement of the overload armature unless the overload which occurs is very heavy. A considerable time will elapse before the armature can move. The amount of surface in contact between the sucker and pot can be varied, thus providing variation in time limit. Further variation can be obtained by using oils of different viscosities. To keep the inverse time limit in good working order it is necessary that the oil be kept clean. A single particle of dirt between the two contact surfaces will sometimes greatly reduce the time lag. If imperfections appear on the contact surfaces due to bruising or other causes all high spots should be removed with a scraper.

CARE SHOULD BE TAKEN NOT TO INTERCHANGE OVERLOAD DETAILS.

INSTANTANEOUS TRIP: The instantaneous trip attachment is the same as the inverse time limit attachment except no oil is used in the pot and the breaker will trip when the current flowing through the breaker is the same as the calibration setting.

The calibration setting should not be set lower than the minimum calibration point or higher than the maximum calibration point.

BUS CONNECTIONS: Laminated studs are used in all of these breakers. Horizontal or vertical laminations can be had in any combination required. When the overload trip is calibrated, current is brought to the breaker through bus bars in the position that corresponds with the position to be occupied by bus bars when the breaker is in service. If a change in bus lay-out is made, the calibration of the overload trip should be checked. There may be an appreciable change of calibration, especially in the higher rated breakers.

INSPECTION AND MAINTENANCE: Periodic inspection of all breakers in service is recommended. Routine inspections should be scheduled according to the severity of the service, six-month inter-

vals being suitable for the average installation. A special inspection should be made as soon as possible after a breaker has been subjected to extraordinarily heavy duty. A little attention at the right time may prevent the need of repairs later on.

Good condition of auxiliary and arcing contacts is necessary in order that they will protect the main contacts. Burns and roughening of the contact surfaces should be smoothed off with fine sandpaper, or a file if necessary. Sandpaper should never be used on silver plated contacts. Where there is exposure to dirt that cannot be wiped off with a dry cloth or waste, a liquid cleaner such as carbon tetrachloride may be used sparingly but the liquid should not be left to dry on the surfaces.

Contact adjustment for regulating the pressure of the bridge against the brushes is made by means of an eccentric pin in the toggle links. Referring to the figure, the eccentric pin is located at B, connecting links F and G. By loosening the bolt M and turning the eccentric pin with a screw driver, the effective length of the two links can be varied sufficiently to provide any necessary change of pressure.

The air outlets on the bumper and closing magnet dash-pots are not adjustable. Beyond keeping the vents free from accumulation of dirt, they need no attention.

The trigger is fitted with adjustments for adapting it to the mechanical contacts with the tripping devices. Hexagonal-head screws with lock nuts are used for adjusting the distance which the overload trip armature must travel from the time it is picked up until it strikes the trigger, and for setting the normal position of the shunt trip lever. Hexagonal nuts on the operating rod connecting the undervoltage release attachment are used for a similar purpose. Adjustment of the distance between the trigger and the overload trip armature does not change the tripping current but regulates the force with which the trigger is struck. Increasing the distance increases, and decreasing the distance decreases, the hammer effect. Similarly, adjustment of the position of the shunt trip lever by turning the adjusting screw clockwise decreases the force with which the shunt trip plunger strikes and the reverse adjustment has the reverse effect. When making either of these adjustments, a safe margin of travel within the limiting positions of the armatures must be retained. A good way to check the adjustment of any of the tripping devices is to push the tripping armature to trip position by hand with the breaker in closed position. Tripping should occur an instant before the armature reaches the end of its travel.

ATTACHMENTS: Two auxiliary switches, one nine-pole and the other two-pole, are used in the standard equipment. They are of the same general construction as the Westinghouse type W instrument and control switches. Current is cut off the closing coil by one-pole of the two-pole switch making contact during the closing stroke which de-energizes a relay that opens the circuit after the breaker is latched. Several control connections are made by the nine-pole switch. These include bell alarm or signal lamps, shunt trip and undervoltage trip. As a rule, one or more sets of contacts are available for special connections that may be required in individual installations. Positions of contacts are arranged to open the circuits to the shunt coils of tripping attachments and close the signal contacts when the breaker opens.

Adjustments of the switches are made by varying the lengths of the parts connecting them with the breaker. Lengthening or shortening the operating rod advances or retards, respectively, the making or breaking of contact on the down stroke and has the reverse effect when closing the breaker; lengthening or shortening the arm extending from the breaker mechanism increases or decreases, respectively, the total travel of the switch segments.

SHUNT TRIP ATTACHMENT: The shunt trip magnet is of the solenoid type, the movable core of which is pulled towards the stationary core when the shunt coil is energized. Movement of the core trips the breaker and the coil is immediately cut out of the circuit by the auxiliary switch. This is necessary since the shunt trip coil is short time rated and would soon burn out if the voltage were applied for any length of time.

A brass washer is placed between the moving and stationary core to prevent "freezing" due to residual magnetism. This permits the moving core to return to its normal position after the coil is de-energized and it is then ready to again perform its tripping function. Absence of this brass washer will permit sufficient residual magnetism to hold the movable core against the stationary core even after the coil is de-energized and it will then be impossible to trip the breaker open by means of the shunt trip device, until the movable core is forcibly retrieved or until the residual magnetism disappears and the core drops back of its own accord.

The standard range of coil voltage over which the shunt trip mechanism operates is 56% to 112% of normal rated coil voltage.

UNDERVOLTAGE RELEASE ATTACHMENT: The undervoltage release attachment is mounted on the front of the closing magnet. It contains an electromagnet having a stationary core and a movable armature which is hinged at one end. As long as the coil in this attachment is energized at any voltage from maximum down to about 80% of normal, the armature is held against the core and does not interfere with the operation of the breaker. If the voltage fails or drops below about half of normal, a spring pulls the armature away from the magnet and drives a trip rod against the breaker trigger, thus releasing the latch. The breaker cannot be relatched until 80% or more of control voltage

is again applied to the coil.

OPERATION COUNTER: An operation counter at the front of the auxiliary switch on the right hand side of the breaker registers the total number of operations of the breaker. Connections with the operating lever on the counter is made through a spring link which absorbs the shock of operation from a quick moving arm. No adjustment is likely to be needed, but in case the last figure on the dial gets out of line, it can be corrected by loosening the clamp at the inner end of the lever on the counter and turning the shaft through a small angle before tightening again.

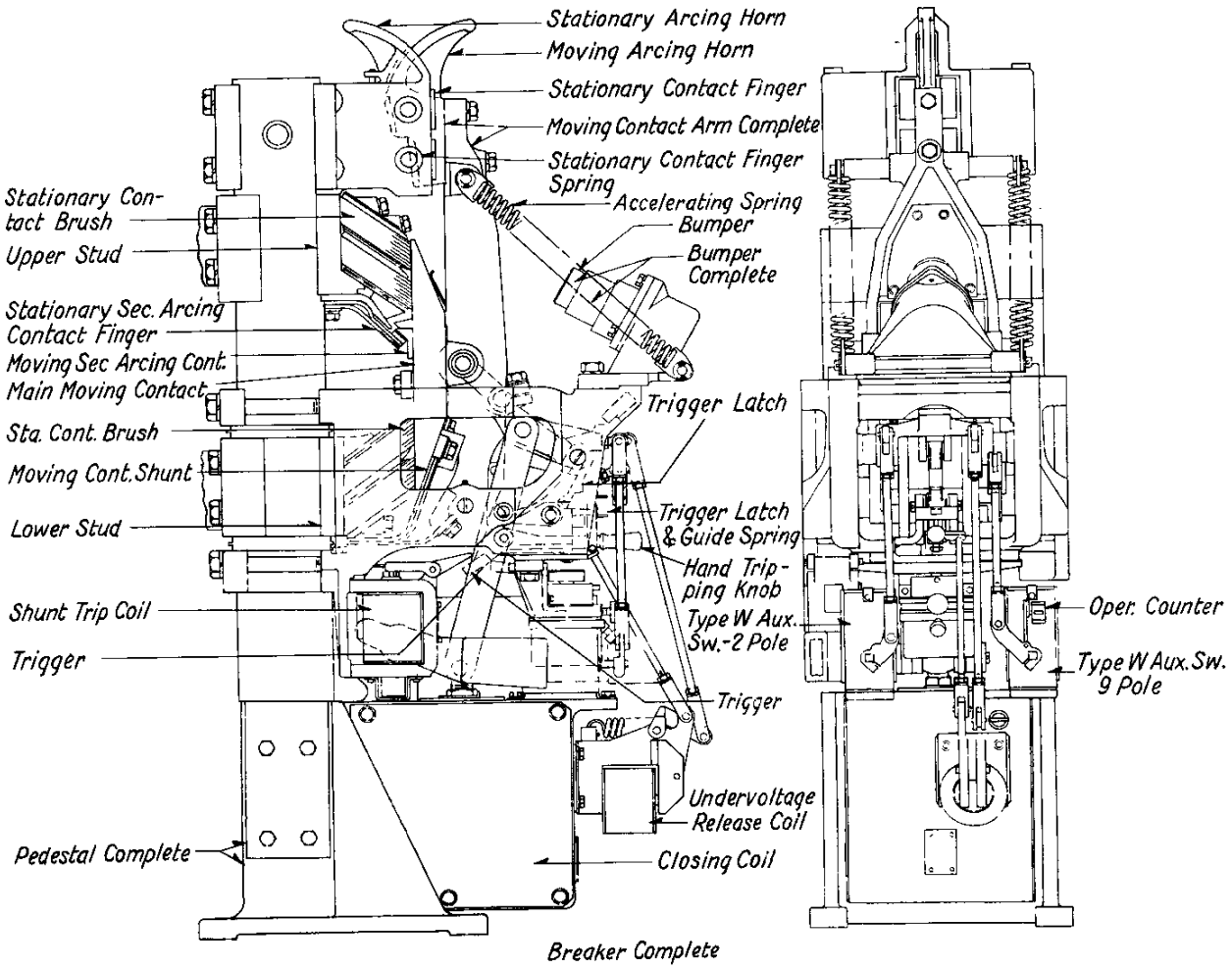


Fig. 4

WESTINGHOUSE RENEWAL PARTS DATA

Recommended Stock of Renewal Parts

TYPE CHM AIR CIRCUIT BREAKER

Indoor Service - Panel or Pedestal Mounted
Electrically Operated - Overload trip
2000 to 10,000 Amperes - 750 Volts D-C - Single Pole - Single Throw

The following is a list of the Parts on this apparatus that are most subject to wear in ordinary operation and to damage or breakage due to possible abnormal conditions.

For Illustration of Parts, See Figure 4

Breakers in use up to and including			1	5
Description	Style Number	No. Req	Recommended for Stock	
Breaker Complete	... ...	1	0	0
Moving Contact Arm Complete	+	1	0	0
Bumper Complete.	+	1	0	0
*Bumper Spring - Inner.	1 041 850	1	0	1
*Bumper Spring - Outer.	1 041 849	1	0	1
Bumper.	1 074 112	1	0	1
Main Moving Contact	+	1	0	0
Moving Secondary Arcing Contact	1 035 476	1	1	2
Moving Arcing Horn.	1 035 460	1	1	2
Moving Contact Shunt - Left Hand	+	2	0	2
Moving Contact Shunt - Right Hand.	+	2	0	2
Stationary Contact Finger	1 074 113	2	2	4
Stationary Contact Finger Spring.	946 830	4	1	2
Stationary Arcing Horn	+	1	1	2
Upper Stud	+	1	0	0
Stationary Contact Brush.	See Table	-	1	2
Stationary Secondary Arcing Contact Finger.	1 014 278	2	2	4
Lower Stud	+	1	0	0
Stationary Contact Brush.	See Table	-	1	2
Accelerating Spring	1 074 114	2	1	2
Trigger	+	1	0	1
*Trigger Spring.	+	1	0	1
Trigger Latch	+	1	0	1
Trigger Latch Spring.	+	1	0	1
Trigger Latch Guide Spring.	+	1	0	1
Hand Tripping Knob	677 290	1	0	0
Pedestal Complete.	+	1	0	0
Operation Counter.	478 294	1	0	0
Closing Coil	+	1	0	1
Shunt Trip Coil	+	1	0	1
Undervoltage Release Coil	+	1	0	1
Type W Auxiliary Switch - 2 Pole.	1 019 406	1	0	0
*Moving Contact Segment :	545 626	2	0	1
*Stationary Contact Finger	519 279	4	2	4
Type W Auxiliary Switch - 9 Pole.	1 019 407	1	0	0
*Moving Contact Segment - Small	545 626	7	1	3
*Moving Contact Segment - Large	808 922	2	0	1
*Stationary Contact Finger	519 279	18	9	18

* Not Illustrated

\+ Identification of these parts vary with different ratings and characteristics of Breakers. If these parts are desired, Renewal Parts Data will be supplied for your Breaker. Give the complete nameplate reading with your request to the nearest Sales Office of the Company.

Parts indented are included in the part under which they are indented

TABLE

Description	Style Number			
	1 014 271	1 014 272	1 014 273	1 014 274
	Required			
Stationary Contact Brush - 2000 Amperes	1	-	-	-
Stationary Contact Brush - 3000 Amperes	-	1	-	-
Stationary Contact Brush - 4000 Amperes	2	-	-	-
Stationary Contact Brush - 6000 Amperes	-	1	-	1
Stationary Contact Brush - 8000 Amperes	2	-	2	-
Stationary Contact Brush -10000 Amperes	1	1	1	1

ORDERING INSTRUCTIONS

When ordering Renewal Parts, always specify the name of the part wanted as shown on the illustrations in this Instruction Book, giving Shop Order Number, and the type of Circuit Breaker as shown on the nameplate. For example:

One Main Moving Contact, 4000 Ampere,for Type CHM Air Circuit Breaker, S.O. 28-Y-997, shown in Instruction Book 5772-A, Figure 4.

To avoid delays and misunderstandings, note carefully the following points:

1. Send all correspondence and orders to the nearest Sales Office of the Company.

2. State whether shipment is to be made by freight, express or parcel post. In the absence of instructions, goods will be shipped at our discretion. Parcel post shipments will be insured only on request. All shipments are at purchaser's risk.

3. Small orders should be combined so as to amount to a value of at least $1.00 net. Where the total of the sale is less than this, the material will be invoiced at $1.00