CONTENTS

INDEX

Westinghouse

Single Tank . . . Frame Mounted Outdoor Oil Circuit Breakers

TYPE BKO-B, BJO-B, BNO-B, BPO-B

Instruction Book H-33-000-A Parts I and II

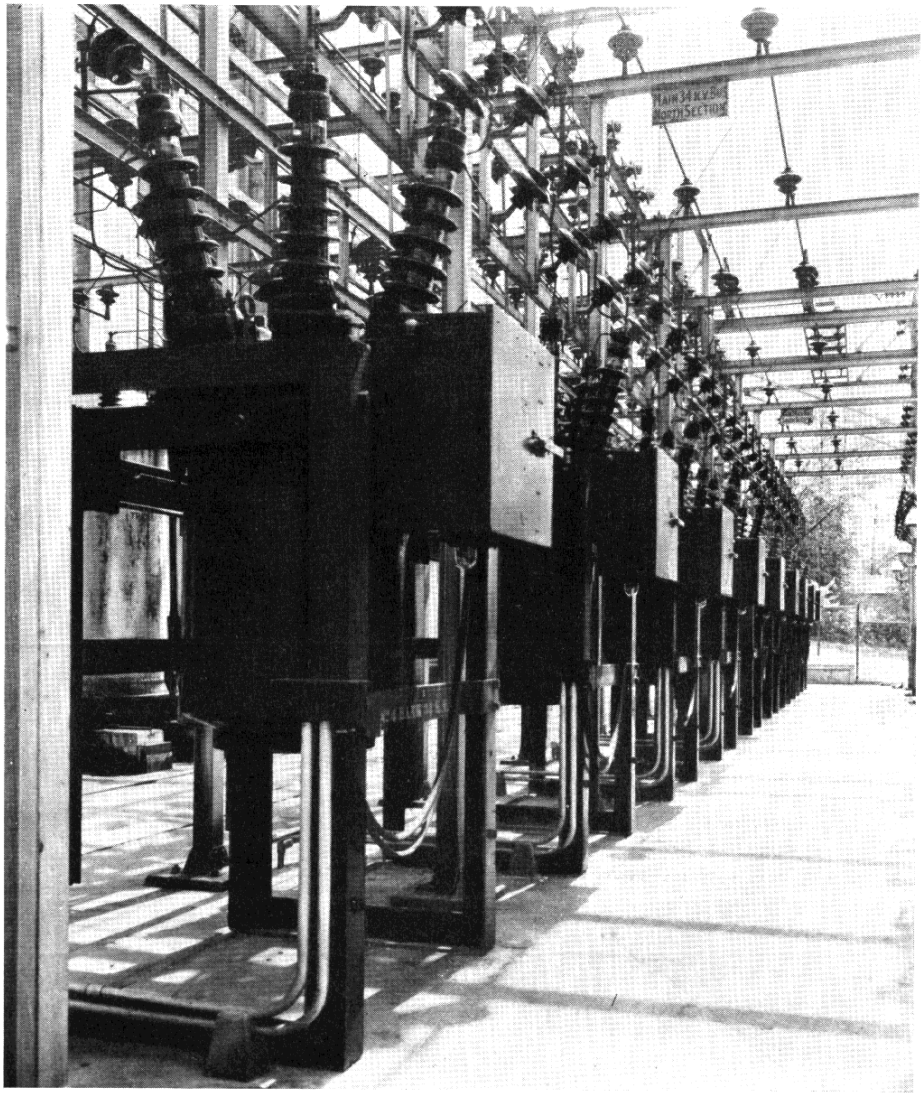


Fig. 1—600 Amp., 46,000 Volt, Type BNO-B Circuit Breakers in British Columbia Electric Railway Company's Burnaby Substation at Vancouver, B. C.

Canadian Westinghouse Company Limited

HAMILTON - ONTARIO - CANADA

Supersedes IBH-33-000

440-P-5428-2M-8-52

Westinghouse

Outdoor Oil Circuit Breakers
Single Tank Construction . . Frame Mounted

600 to 4000 amperes, 15,000 to 69,000 Volts
Rupturing Capacities up to 1,500,000 KVA at 69 KV

Part I - Installation

GENERAL

The outdoor oil circuit breakers described in this instruction book comprise a complete line of modern oil tight shaft operated breakers in ratings as listed above.

The single tank construction presents a compact and rugged design, it embodies the latest developments in the art, based on the extensive research work, high power laboratory tests, and field experience of Westinghouse.

While these breakers are listed as outdoor breakers they can, also be furnished with bushings and details designed for indoor service if desired.

The oil circuit breaker is a very important unit in the modern transmission system, being depended upon for protection and flexibility of control. It should not be installed in places where it will be called upon to operate at voltages or currents greater than those given on the nameplate. The short circuit conditions to be imposed on the breaker must not exceed those specified at the time the breaker was purchased.

Proper installation and maintenance are necessary to ensure continued satisfactory operation of the circuit breaker. Attention is called to Section 19 of the Standards of the American Institute of Electrical Engineers, and to the NEMA Switchgear Standards, published by the National Electrical Manufacturers' Association. A number of the instructions for the general installation and care of circuit breakers have been copied without change from the NEMA Standards.

SHIPMENT

All oil circuit breakers are assembled and tested completely at the factory. They are shipped assembled in as complete units as handling and transportation facilities will permit. Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment.

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

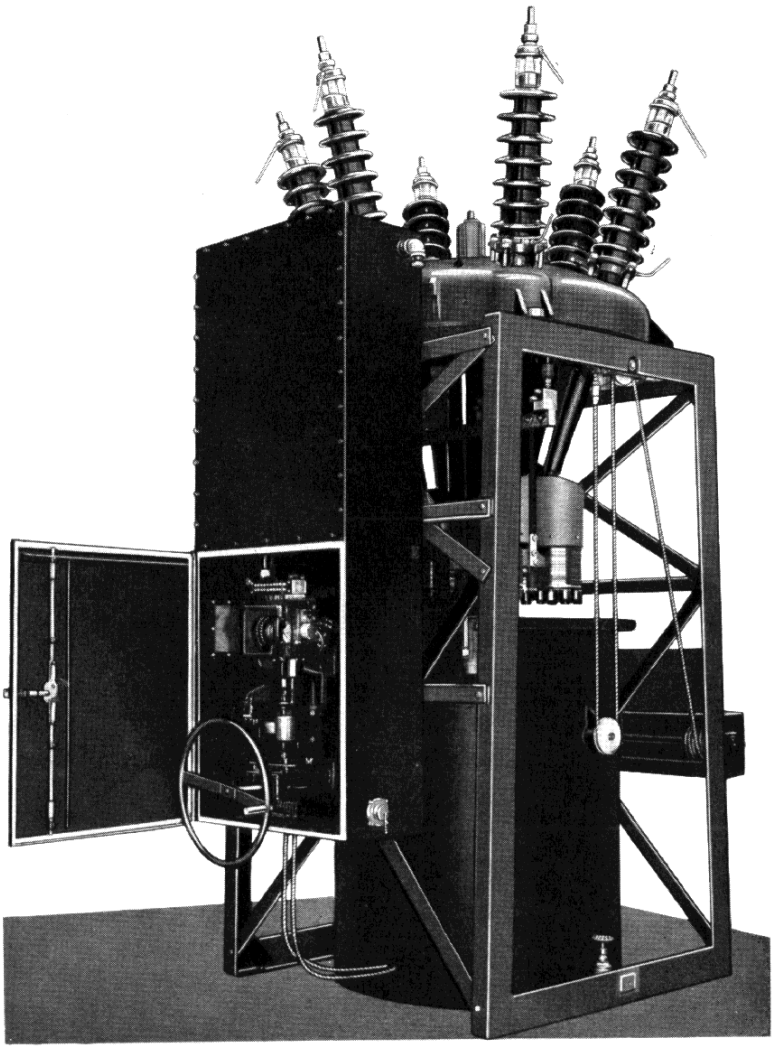


Fig. 2—800 Amp., 69,000 Volt, 1,500,000 Kva Interrupting Capacity, Type BPO-B Oil Circuit Breaker, Tank Lowered (With Geared Hand Closing Device and Motor Operated Tank Lifter)

carrier (Transportation Company), and the nearest Canadian Westinghouse Sales Office notified promptly.

STORAGE

Provision is made when the breakers are shipped for excluding moisture from the breaker during a storage period not to exceed six (6) months. All openings and outlets in the breaker tank, as well as in the motor mechanism housing, are hermetically sealed. Silica Gel is distributed in containers located inside the domes, between tank lining compartments (in some cases) and in the mechanism housing.

These Silica Gel containers must be removed before filling the breakers with oil. The vent opening at the top is sealed with a pipe cap. On the mechanism housing, the inlet vent at the bottom is sealed off with a steel plate and gasket. The steel plate sealing the bottom and the pipe cap at the top opening must be removed and care taken that the wire gauze openings are in place and clear, before placing the breaker in service.

The sealing of these breakers for shipment also requires the removal of the oil gauges and plugging these openings and sealing the muffler vent holes and the valves. It is therefore imperative that the muffler vent holes be opened to atmosphere and the oil gauges reinstalled before attempting to place the breaker in service.

All unpainted parts inside the breaker tank and the mechanism housing should be thoroughly cleaned before filling the breaker with oil or placing in service.

Particular care should be taken to protect insulating parts, which might absorb moisture. It is desirable that these parts be stored in a dry room.

Precaution should be taken to make sure that the "De-ion" grid stacks are kept dry at all times. If these parts are to be stored before assembled, they must be kept in a dry place and they should be stored in Wemco "C" Oil. When being put into the breaker they must not be allowed to come in contact with any moisture.

HANDLING

The total weight of the breaker is given on the outline drawing of the breaker. This information should serve as a guide to the strength of cranes or other lifting means required for handling the breakers. The eye bolts in the dome of the breaker are of adequate strength for lifting the entire unit.

When using cable slings for supporting the apparatus, do not allow the slings to strike the bushing as any strain on these may cause them to crack or break. Do not lash the breaker down to a truck or car by the condenser terminals when transporting it. The skids on which the breaker is mounted should be left with the circuit breaker and will be found convenient for use in moving the breaker to its foundation. Special care must be exercised to see that the apparatus is not injured through shock or jars, due to rough handling.

The centre of gravity of some of these breakers is high, so when handling care should be taken to prevent their tipping over.

LOCATION

The breaker should be located so that it will be readily accessible for cleaning and inspection. Sufficient space must be provided for operation of the hand closing device and tank lifter. The breaker should be supported sufficiently high so that flood conditions will not cause water to enter the operating mechanism. See outline and drilling plan, supplied prior to shipment for necessary clearances and foundation bolt locations.

UNPACKING

When unpacking the circuit breaker, the crating or boxing must be removed carefully. Parts are sometimes broken by driving the wrecking bar into crates or boxes carelessly.

When the breaker has been unpacked, the various parts should be placed in proper position for mounting on the permanent foundation. To avoid delay in assembly, the parts should be arranged so that they will be accessible and ready to put in place.

Check all parts with the shipping list. Avoid bending, breaking or injuring any part.

Do not leave screws, bolts, nuts, etc. in the packing material.

See that the Instruction Book and tags are kept with the circuit breaker.

It is well to remember that details which have been removed from the breaker after test are identified by number markings which correspond to the number of the terminal location as indicated on the wiring diagram.

Blocks and wire used to hold the parts in the closed position during shipment must be removed. Always look for a wire holding the mechanism triggers and latches from slipping during shipment.

MOUNTING

All circuit breakers must be set level in order that the moving parts within the breaker operate freely. Otherwise friction will develop, and undue strains will be imposed upon the lift rods and other moving contact details which will cause breakage or defective operation. The foundation bolts should be left loose to permit the frame to be properly plumbed and leveled by inserting shims where necessary to insure the breaker to rest solid on the foundation. The drilling plan for the individual breaker should be carefully followed. When properly lined up and leveled, the foundation bolts should be securely tightened.

The smaller, frame mounted breakers are shipped with the bushings, contacts, and operating mechanisms all in place so that it should only be necessary to carefully remove the breaker from its skids onto the permanent foundation.

BREAKER INSTALLATION

Due to shipping limitations, the large frame mounted breaker (Type BPO-B) is shipped separately from its supporting structure. The first step in setting up this breaker is to assemble the heavy angle iron structure on the permanent foundations in such a manner that top cross members of the structure are absolutely level when the structure is permanently bolted to the foundations.

With this operation completed, the whole breaker assembly, including the tank and operating mechanism housing, may be lifted by the four lifting lugs located on the edge of the dome, and moved into position through the open side of the breaker supporting structure. It will be necessary to turn the breaker slightly sideways, when placing it into position on the structure, to permit the pulleys mounted on the sides of the tank to enter between the upright members of the structure. The breaker is then bolted to the top of the structure and the two cross members on the back of the mechanism housing bolted to the upright members of the structure. On the 46 KV breaker, on other side of the frame, the cross brace bottom end only is put inside the frame. A hand-operated winch, having sufficient capacity to handle the breaker tank when filled with oil, is mounted on the back of the breaker supporting structure for lowering and raising the breaker tank. For lowering the breaker tank, the steel cables from the hand-operated winch are passed

over the pulley fixed to the top of the structure then under the pulleys on the sides of the tank and the special fitting on the end of the cables slipped over the twin hook arrangement at the top of the structure. The hand winch is then turned in such a manner as to take up all the slack in the cables, the special fitting at the ends of the cables should be so adjusted as to have both cables sharing the load equally. The nuts on the tank supporting bolts may now be removed and the tank lowered to the floor by unwinding the hand-operated winch, exposing the complete breaker assembly for inspection of the contacts and operating mechanism.

CONNECTIONS

Leads should be flexible and brought down from above the circuit breaker if possible. Ample room must be provided between these leads and parts of the station or overhead steel structure.

All terminals must be fastened securely to the leads and tightly clamped to the connection studs. Connections to the breaker are usually made by solderless clamp type terminals fastened to the ends of the bushings. When tightening the terminal or clamp bolts, care must be taken not to place unnecessary strain on the top of the bushing. **See also under "Terminal Bushings" in Part II of this book.**

All joints must be clean, bright and free from dents or burrs.

All nuts on the current carrying parts must be securely tightened to obtain good contact. If the joints are not made correctly, dangerous heating of the breaker may result at these points.

Cables should be properly supported so that the bushings are not subjected to unnecessary strain. Any strain which at first has no apparent effect may eventually loosen the insulator cap and permit moisture to enter the bushings.

To avoid heating, the connection leads must be of a current carrying capacity at least equal to that of the current carrying part of the breaker.

CONTROL WIRING

All control wires should be run in conduit when practicable. A diagram is supplied with each breaker which shows the proper connections for operating circuits and indicating lamps.

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

The cover on the lower end of the transformer case must not touch bushing flange.

GROUND CONNECTIONS

The frame of each breaker should be permanently grounded. The usual practice is to connect a heavy cable to the frame and to the station ground. A good permanent low resistance ground is essential for adequate protection. A poor ground may be worse than no ground at all, since it gives a false feeling of safety to those working around the equipment.

FINAL INSTALLATION INSPECTION

After the breaker has been installed with all mechanical and electrical connections completed except energizing the power line, the following inspection and test should be made:

1. All insulation and parts within the breaker tank including the inside of the tank should be wiped carefully to remove any dirt and moisture which may have collected. When furnished, tank linings should be examined for possible mechanical damage.

2. See that the breaker is properly set up and leveled on its foundation.

3. See that all bearing surfaces of the operating mechanism have been lubricated.

4. Close the breaker slowly by hand, noting that the operating rod and contacts are properly adjusted for correct alignment and that good contact made when the breaker is closed. The movement of the breaker on opening and closing should be free and without friction.

5. All nuts must be tightened so that moisture cannot enter the circuit breaker. The bolts on the bushing, flanges, tanks and fittings must be kept tight.

6. Pipe fittings may become loose because of vibration and shock received during handling, lifting and transportation. They should be checked immediately after the breaker is installed and tightened where necessary.

7. Inspect all insulated wiring to see that no damage has resulted during the process of installation.

8. Test the wiring for possible grounds or short circuits.

9. See that all current carrying parts outside the oil tanks are correctly insulated in accordance with standard practice. See that all joints, in the control circuits, are made correctly.

10. The electrical operation may be checked a few times without oil in the tanks. **Breakers with hydraulic type bumpers must not be tripped without oil in the tanks.** They should be brought to the open position by means of the manual operating device. Excessive operation without oil may damage the breaker and should be avoided.

MOTOR OPERATED BREAKER

A hand-closing device is supplied for closing and opening the breaker during inspection. Provisions are made for mounting this device to the underside of the operating mechanism housing and connecting to the closing motor shaft by an extension shaft. For the hand-closing of the breaker, the clutch pin, which is normally threaded to the type HD push-button interlocking switch on the control panel (See diagram furnished with each job) is removed and used to mechanically connect the clutch coil casing and the clutch face-plate together through a clearance hole in the clutch coil casing and a tapped hole in the clutch face plate. The removal of the clutch pin from the interlocking switch on the control panel renders the closing of the breaker electrically inoperative. Extreme care should be taken when closing the breaker by means of the hand-closing device that the crank be turned only in the direction indicated on this device, since if the crank is turned in the wrong direction while attempting to close the breaker, it will unwind the band clutch spring off the drum, rendering it useless for further operation. For the same reason, care should be taken when opening the breaker by hand that there be no obstructions to the downward travel of the moving contacts, such as scaffolding, etc., inside the tank. When opening the breaker by hand, the crank should be stopped immediately, the moment the breaker is fully opened. It should be remembered that the hand closing device

is only to be used for inspection and checking the contacts and the breaker should never be closed on live circuits, unless closed electrically.

See also under motor operated mechanism and under Solenoid Operated Mechanism in this book.

Before attempting to close the breaker electrically, the hand-closing device should be disconnected from the motor shaft, with the breaker in the open position and the clutch pin removed from the clutch and replaced into the interlocking switch on the control panel. In order to cushion the breaker opening stroke, oil bumpers are provided for each pole. These bumpers are ineffective when the breaker tank is empty, therefore, the breaker should not be tripped without having the tank filled with oil to the proper level. It should be opened only by means of the manual operating device.

PLACING OIL IN SERVICE

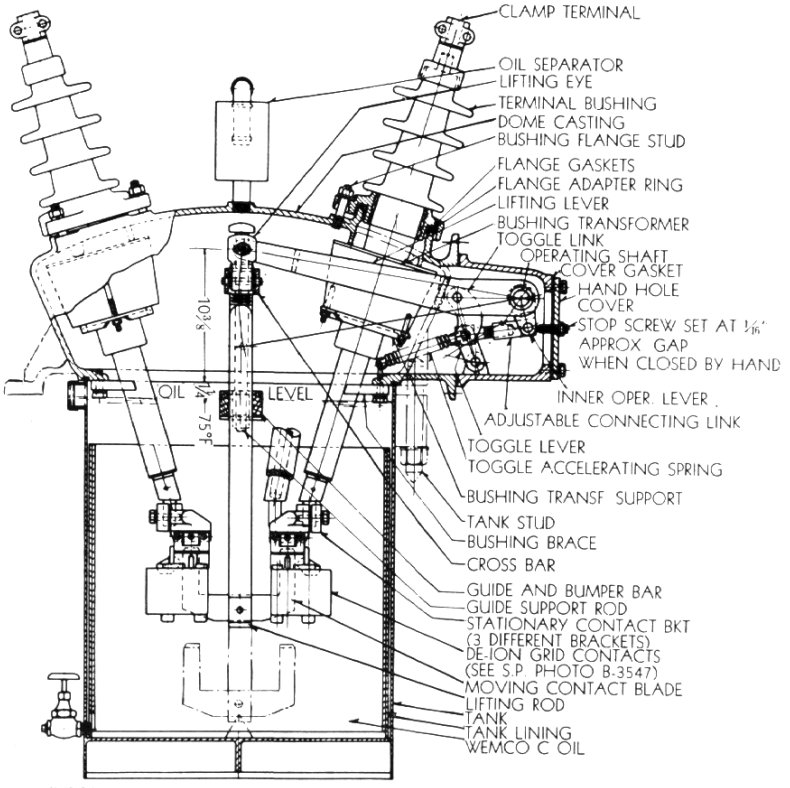
The most careful precautions must be taken to ensure the absolute dryness and cleanliness of the apparatus before filling it with oil, and to prevent the entrance of water and dirt during the transfer of the oil to the apparatus. When putting a new circuit breaker into service, see that the tank is free from moisture and foreign material. When carbonized oil is removed from a circuit breaker in service, thoroughly clean all carbon from the interior of the circuit breaker, so that the new oil will not be contaminated. This may be done by flushing with clean insulating oil and wiping with clean dry cotton cloths. Cotton waste is undesirable on account of the lint which may be introduced into the oil. The preparation and filling of outdoor apparatus should be preferably done on a clear dry day. If this is not practicable, protection against moisture must be provided.

Precaution should be taken against the handling of oil at a temperature different from the container into which the oil is being poured as condensation will occur and moisture will be introduced into the oil. Extra care must be taken in case oil drums are exposed and stored in open weather. Sufficient clearance from ground is essential to permit circulation of air to prevent condensation. As far as possible, lowering the tanks should be avoided at times when there is an appreciable difference between the temperature of the oil and the surrounding air.

Oil which has been used in lightning arresters contains water and harmful chemical impurities which cannot be removed without refining, and must not be used in circuit breakers.

Fill the oil tanks to the proper level with WEMCO "C" oil. Special precaution must be used in handling the oil in accordance with detailed instructions given in Westinghouse Instruction Book 44-820-1.

Oil which has a dielectric strength of less than 22,000 volts when tested by the usual method should not be put into the circuit breaker. New oil may test considerably higher than this. Don't allow the tank-holding bolts to go without one or two inspections after the breaker is installed. The nature of the packing against which the tanks are drawn up, permits it to adjust itself slowly under pressure. Draw the nuts as tight as possible when first installing the breaker, then after a period of from three (3) days to one (1) week take up whatever slack may be found. To ensure a positive tight joint, a third inspection should be made after about twenty (20) days.



IMPORTANT NOTE: When ordering spare or renewal parts always use same designation as on illustration and give marking on nameplate on breaker. For Example:- 3 Lifting Rods for 600 A., BKO-B OCB S.O. 670901

Fig. 3—600 Amp., 15,000 Volt, Type BKOB-B Breaker—Sectional View

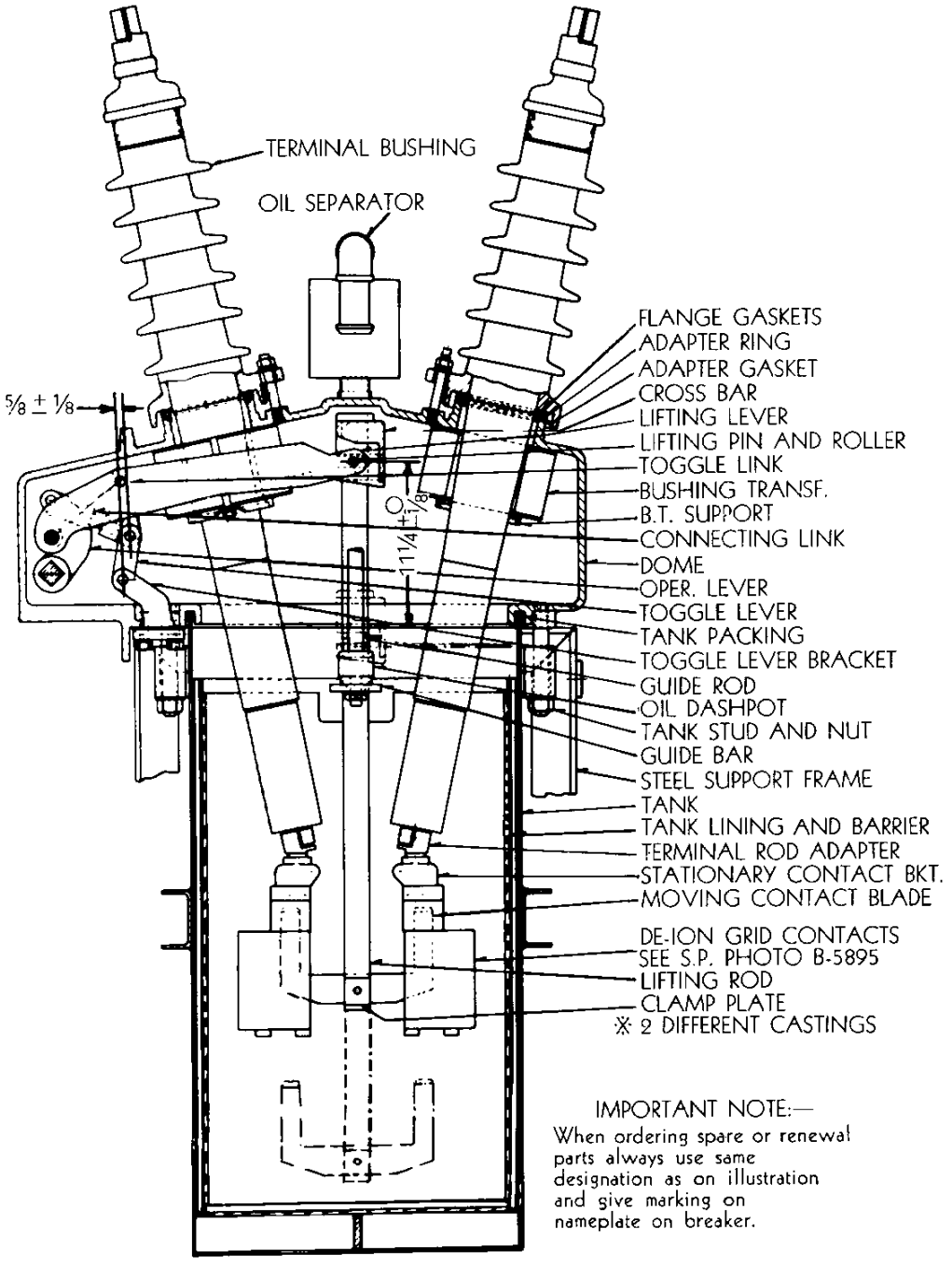


Fig. 4 —600 Amp., 34,500 Volt, Type BJO-B Breakers—Sectional View

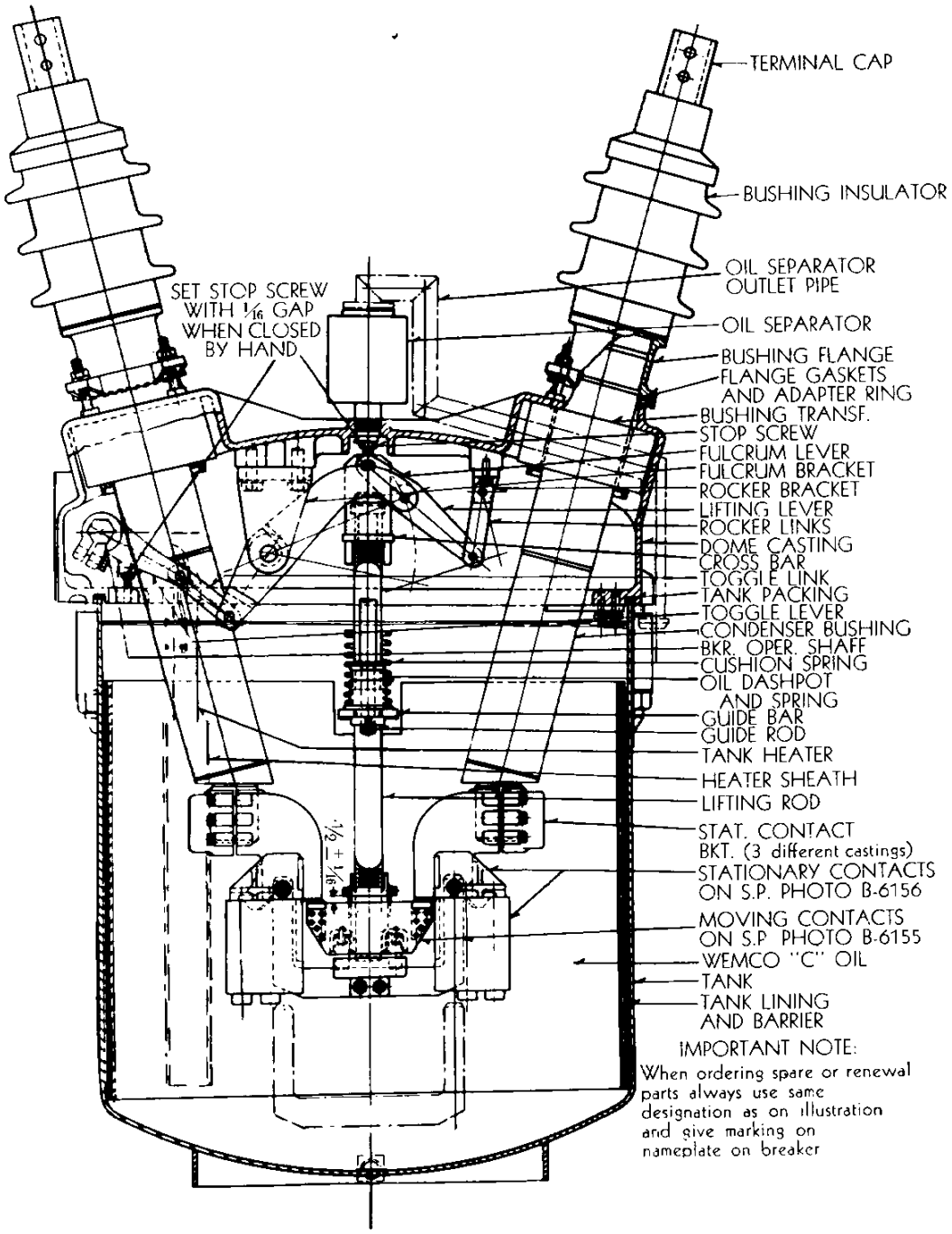


Fig. 5—4,000 Amp., 15,000 Volt, Type BNO-B Breaker—Sectional View

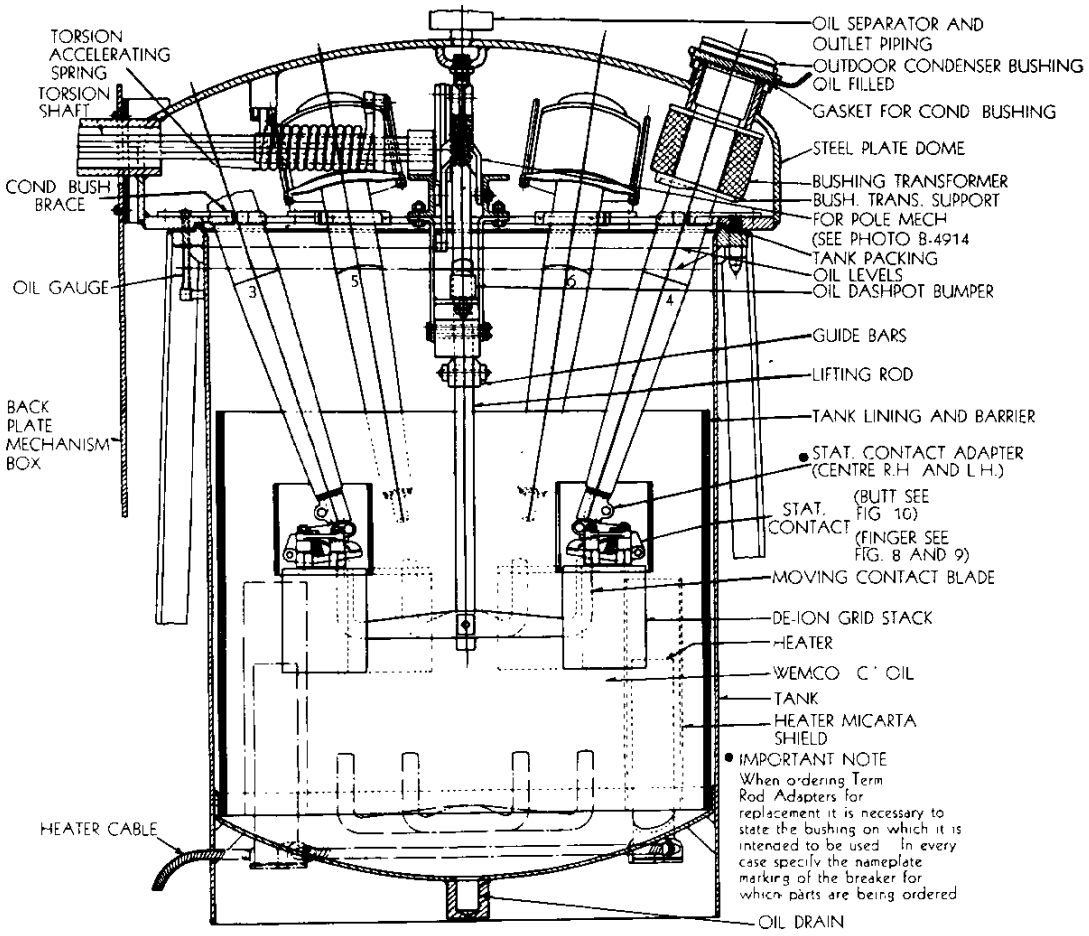
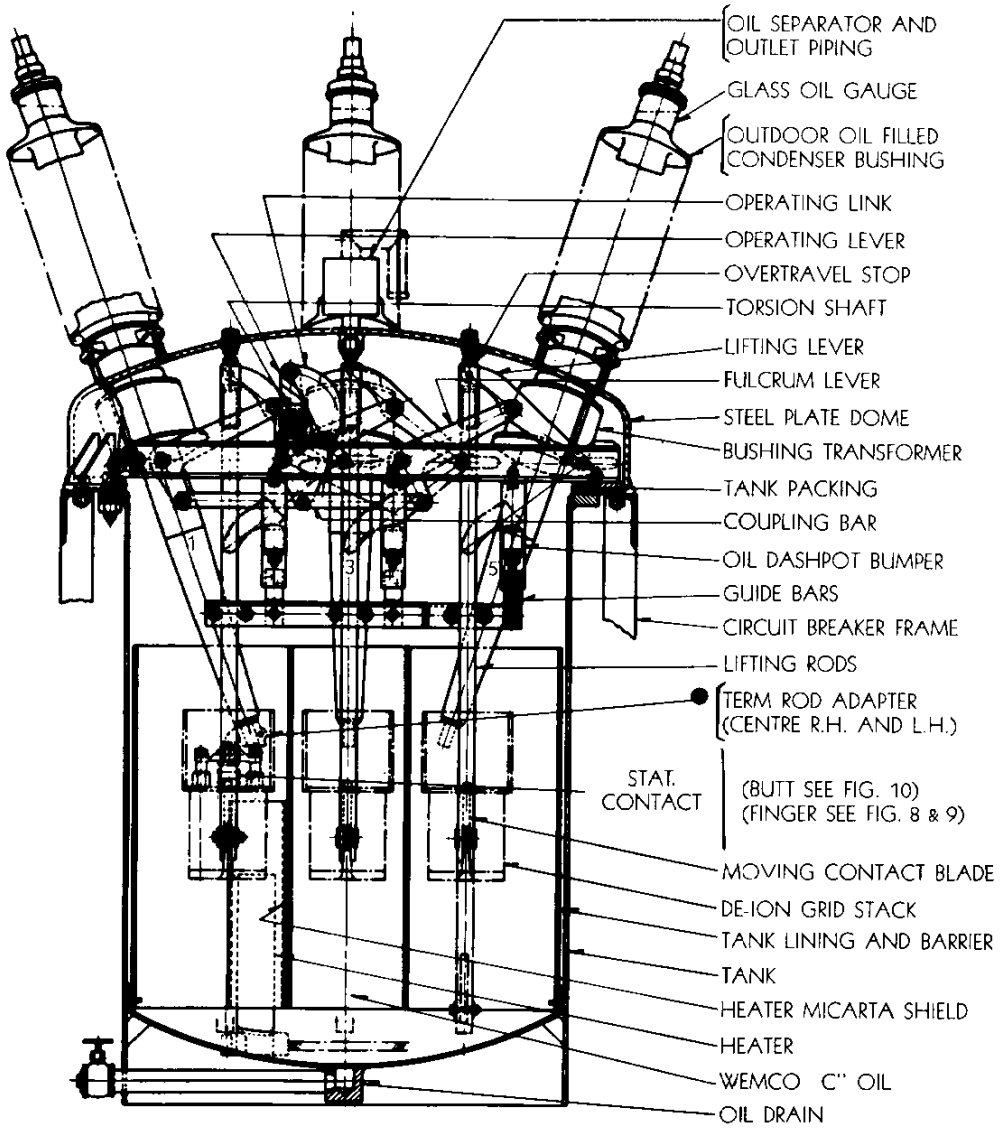


Fig. 6—800 Amp., 69,000 Volt, Type BPO-B Breaker, Bushings and Contacts—Sectional View



IMPORTANT NOTE:—When ordering term rod adapters for replacement it is necessary to state the bushing on which it is intended to be used. In every case specify the nameplate marking of the breaker for which parts are being ordered.

Fig. 7—800 Amp., 69,000 Volt Type BPO-B Breaker, Pole Mechanism—Sectional View

Westinghouse

Outdoor Oil Circuit Breakers

Part II - Operation and Maintenance

GENERAL

It has become the practice of operating companies to establish a system of regular and frequent inspection of their apparatus. Oil circuit breakers, especially, due to the nature of their function, should be inspected thoroughly at least once every six months. Oil samples should be taken out and tested and the operation tried out.

Operation counters are often mounted on the electric mechanisms to show the number of closing and tripping operations of the breaker. However, neither the number of operations nor the length of time between inspections is to be taken as the only basis for determining the maintenance required.

Short circuit or heavy load interruptions place mechanical strains upon the breakers as well as reduce the dielectric strength of oil. After each case of severe duty the mechanical operation should be checked and the condition of the oil tested.

Use care to prevent the entrance of moisture at the several gaskets, conduits, and tank fittings. **Always open and place "Hold Off" on disconnects on both sides of the breaker, connect the breaker terminals to ground, place "Hold Off" on the breaker control switch and open the breaker control circuit before working on the circuit breaker to ensure personal safety.**

In case of trouble with any part of the circuit breaker it is necessary to understand thoroughly the construction and adjustment of the individual parts. In general, it is advisable to work only on a part which needs attention and not to disturb the rest of the apparatus.

TOGGLE MECHANISM

This mechanism, located in the upper part of each pole unit, operates the lift rod which carries the moving contact.

It should be remembered that the stops have been set and blocked at the factory. Unless it is obvious that they have been disturbed, all adjustments should be made to give the approximate 1/16 inch clearance at the stops without changing the position of the stop screws. This clearance should exist with the breaker in the noraml latched closed position with full contact and spring load when breaker has been manually closed.

The toggle must not be permitted to pass over centre as such a condition would prevent the breaker from tripping open.

There must be clearance at the stops in the normal closed position so that the closing mechanism will have time to latch and not put an undue strain on any of the parts.

With the toggle too far from centre in the closed position the breaker will be hard to close.

LIFTING ROD STOP

In the top of most of these breakers will be found the lifting rod stop or moving contact stop. This is to prevent over-travel of the lift rod and moving contacts. It will prevent the inertia of the moving contacts from taking up the clearance in the various links and pins.

TOGGLE STOP

Some of the breakers do not require a toggle stop.

Other breakers have a toggle stop in addition to the lift rod stop. The setting at this stop should be approximately 1/16", the same as for the lift rod stop.

BUMPERS

All of these breakers are provided with the hydraulic type of bumper using the oil in the circuit breaker tank to cushion the shock at the end of the opening stroke. The form of the dashpot varies with the size of the breaker but the principle of operation remains the same.

When the tank is empty, the bumpers will also be empty. It is therefore desirable to avoid unnecessary tripping of breakers without having the tanks filled to the proper oil level. In this case the breaker should be opened only by means of the manual operating device.

In the full open position, the levers of all three poles must rest solidly on the bumpers. Care must be taken to see that no one bumper is taking all of the load, but that each is taking the load of its pole unit.

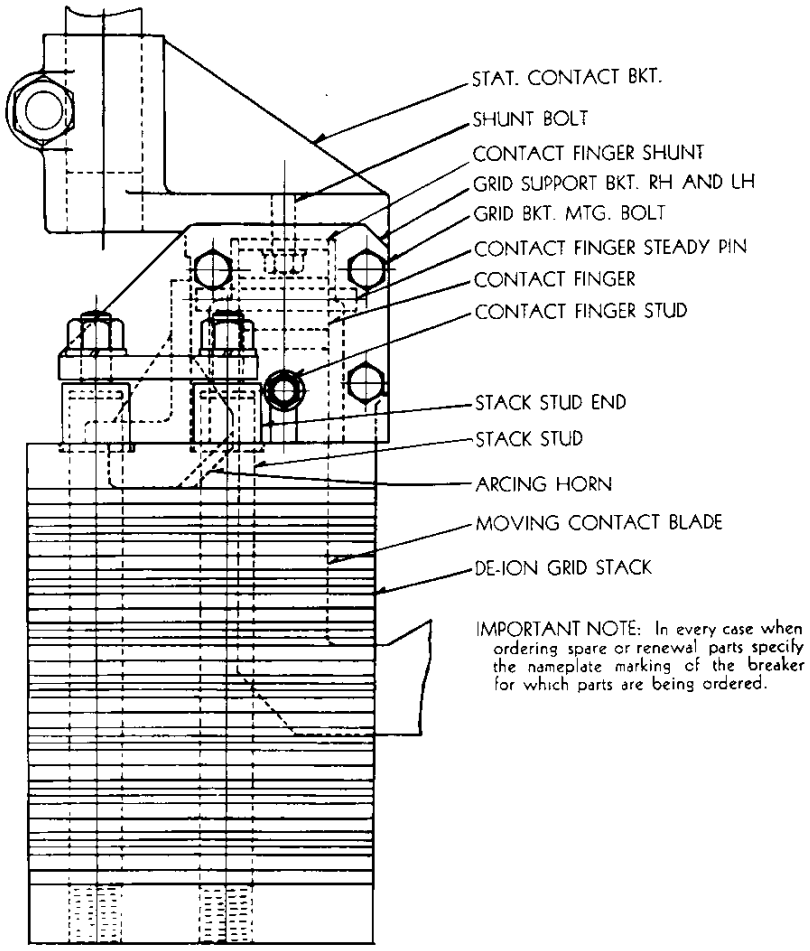


Fig. 8—Typical De-ion Grid Stack, with Finger Type Contact

CONTACTS

The condition of the moving contact may be easily observed. The stationary finger contact may be observed by removing the stationary arcing horn. Slight pitting and minor burns to the contact surfaces may be dressed by filing for several inspections. However, after the contacts have been dressed or replaced, if severe burns are apparent, all contacts should be checked and re-adjusted if necessary. For correct amount of contact making, the moving contact should extend above the top of the top end plate of the grid stack not more than 1 5/8" and not less than 1 3/8". The contact should be made simultaneously on all six bushings as near as possible. This condition is obtained by either raising or lowering the grid stack assembly on the bushing contact adapter. The moving contacts must enter the stack centrally and parallel with the centreline of the slot. With the breaker closed, there should be approximately 3/16" clearance between the arcing horns and the edge of the moving contacts

DE-ION GRIDS

Although the stack of "De-ion" Grids is shipped assembled to the contact supports, it will usually be found more convenient to separate these two parts before attempting to dismantle the contact supports on the end of the condenser bushing. Four bolts are used to hold the contact bracket to the contact support and these bolts may be removed in order to separate the stack of grids from the contact supports.

The stacks have been assembled under pressure and the nuts on the studs should not be removed. The whole stack should be handled as a unit. If it is necessary to remove the stack from the contact bracket this may be done by loosening the four steel nuts at the upper end of the studs. (See reference to literature at back of book).

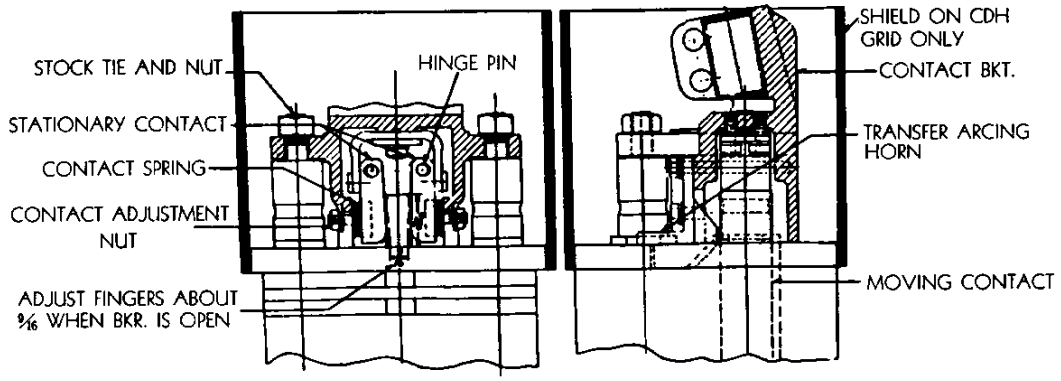


Fig. 9—Typical Contact Assembly, with Finger Type Contact and De-ion Grid—Sectional View

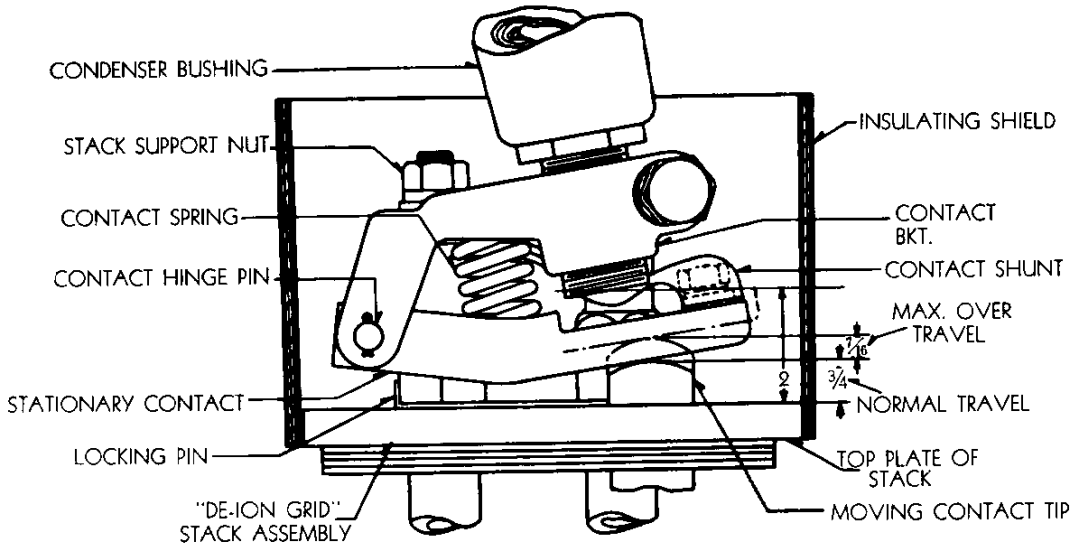


Fig. 10—Stationary Contact Assembly, with C-Size De-ion Grids—Sectional View

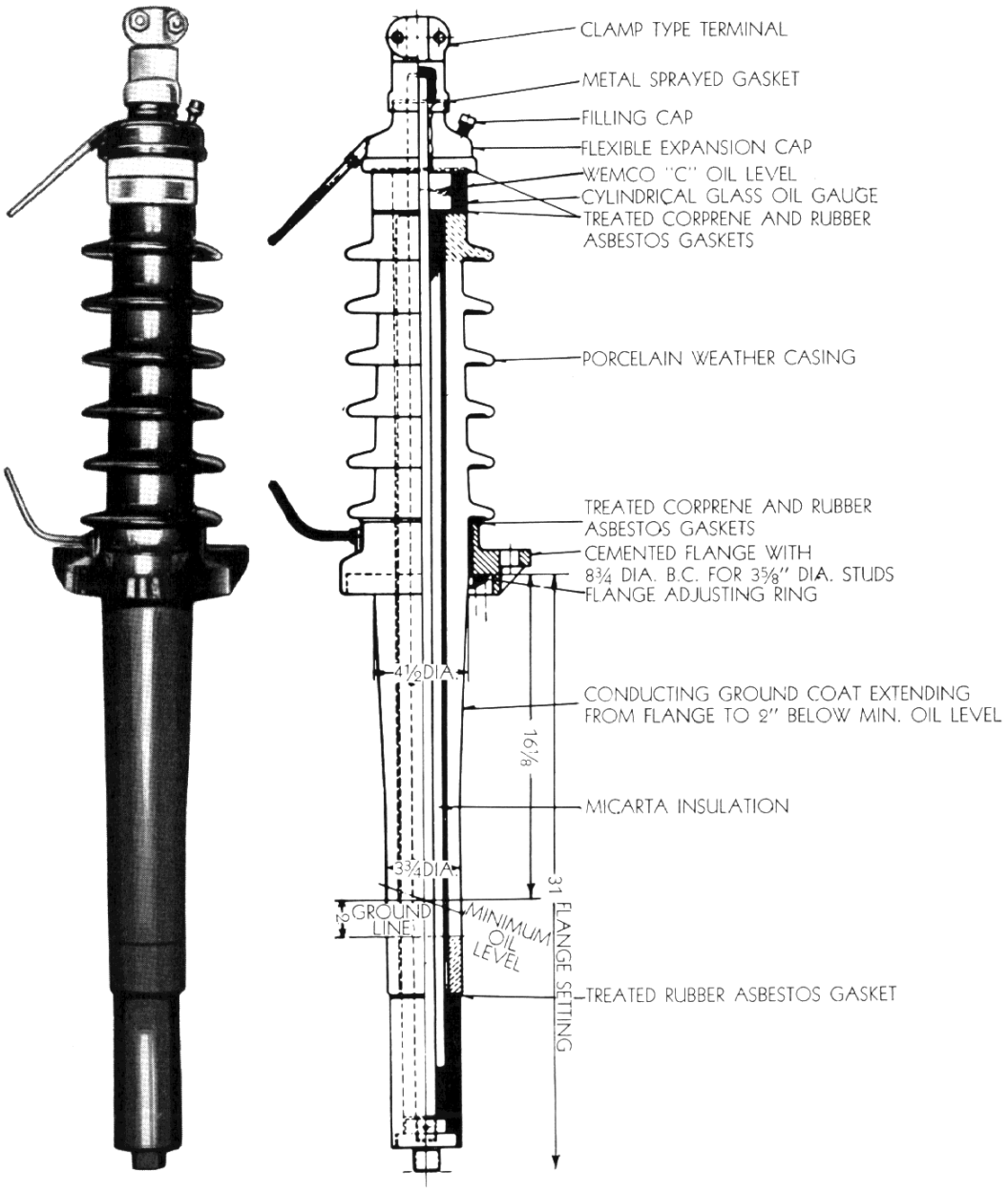


Fig. 11—600 Amp., 34.5 KV Oil Filled Terminal Bushing for Type BJO-B Breakers

Bushings for 15 KV Type BJO-B and Type BKO-B Breakers are similar but are not oil filled and therefore have no oil fittings such as gauge glass, etc.

TERMINAL BUSHING

The terminal bushings must be handled with great care to avoid breakage or the entrance of moisture in the insulation before and during installation. Unpacking should be carefully done so that the porcelain will not be broken in taking the bushing from the crate. The lifting of the bushing should be done entirely as instructed in IL H-565 attached to the bushing. Care must be taken not to strike the lower portion of the bushing. In putting the bushing in the breaker, see that it does not strike the sides of the bushing port as it is being let down into place. Striking or scraping the bushing might cause damage to an extent resulting in failure in service.

Remember to put the weatherproofing gasket in place between the bushing flange and the bushing seat.

It is very important that the bushings be kept dry. The lower portion, designed to operate under oil, is not weatherproof and must be kept dry. On condenser type bushings the plastic and tape covering is put on at the factory to protect the exposed micarta during shipment and must be removed before the bushing is put into the breaker. To remove the tape, (just below the clamping flange), take hold of the projecting end of the rip cord and pull down to the lower end. Then unwind the tape from the bottom end of the bushing. **Do not cut the tape with a knife!** Be sure that the bushing is thoroughly cleaned before installing. When working with the bushing in a horizontal position, be sure to support it on a clean well padded surface.

Bushings with potential device taps should be assembled with the tap for the potential device connection outward.

The lower end of the bushings should be located so that the contact adapters are in line with the lift rod and equally spaced each side of the lift rod. It is essential that this spacing be correct so that the moving contacts will freely enter the slot in the De-ion grid stacks. A little time spent in locating the lower end of the bushing with contact adapter will save considerable time later when assembling the contact details.

The flange bolts should be tightened uniformly around the bushings with the gaskets in place so as to prevent moisture from entering the breaker tank. (See reference to literature at back of book).

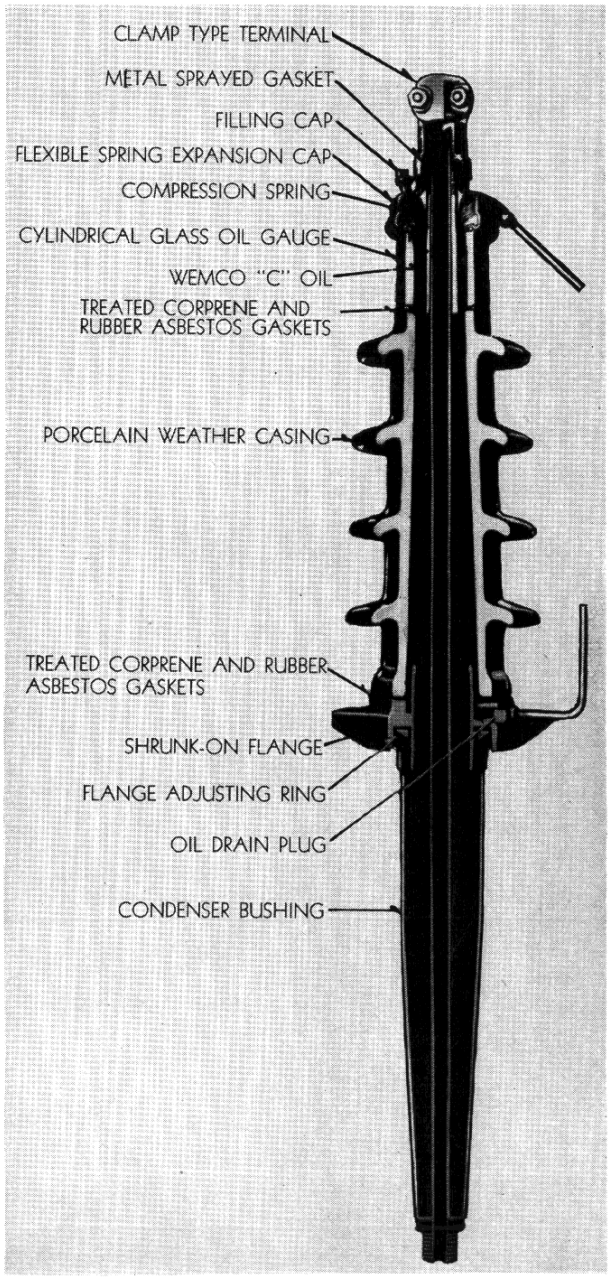


Fig. 12—800 Amp., 34.5 KV Oil Encased Condenser Bushing for Type BNO-B Breakers

Bushings for 15 KV and 46 KV Type BNO-B Breakers and 46 KV and 69 KV Type BPO-B Breakers are similar except for physical dimensions which vary with each rating.

BUSHING TYPE CURRENT TRANSFORMERS

Current transformers, supplied only when ordered, are mounted in the transformer cases in the top of the pole units. When transformers are ordered with the breaker the leads are run through conduit to terminal blocks in the mechanism housing at the end of the breaker. Connections to relays may be made at the terminals on these blocks.

If it should be necessary for any reason to replace a current transformer, care must be taken to see that the end of the current transformer carrying the white mark is placed upward. The terminal foot or stationary contact must be removed. After disconnecting the transformer, the support for it is removed and the transformer slid down over the bushings. In replacing the transformer, care must be taken that the packings at top, bottom and sides of transformer are in position. **The transformer case must not touch the ground banding on the terminal bushings, bushing flange or arc shield hood.**

The polarity markers indicate Subtractive polarity. **Always check current transformer circuits for continuity and make sure the protective secondary short circuit has been removed before placing current transformers in service.**

Performance of ring type current transformers varies with the ratio, frequency of the circuit, size, and secondary burden. The space available, and, therefore, the size, varies with the different types and ratings of circuit breakers.

Care should be taken to make sure that the performance of the current transformers being used is suitable for the relays being operated therefrom—particularly when the ratios are low, say below about 300/5 amp., 60 cycles.

Figure 15 shows typical overcurrent transformer of a 400/5 amp. current transformer, indicating the effect of burden on maintenance of ratio on heavy overcurrent.

Multi-Radio Current Transformers—Current Transformers with more than one ratio can be provided by suitable secondary windings, with taps—see diagram Fig. 14.

In the case of either single or multiple ratio current transformers, lead "A" has the polarity marker. If ratios are used which do not include lead "A", the letter which precedes in alphabetical order, the other letter used, is the polarity mark lead.

Hipernik Current Transformers—Current Transformers with special cores of hipernik steel can be supplied for accurate metering and for low ratios. Such current transformers can be supplied for ratios of as low as 200/5 amp and in some cases for even lower ratios.

Current transformers with hipernik cores are suitable for low secondary burdens only, i.e. for metering application and should not be used for relaying application.

Figure 16 shows typical ratio and phase angle curves for a 600/5 amp current transformer with a hipernik core.

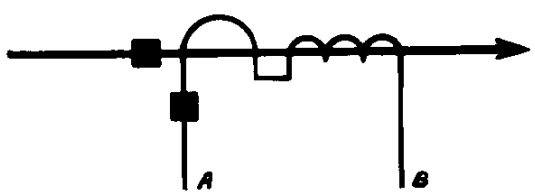


Fig. 13—Single Ratio Bushing Type Current Transformer

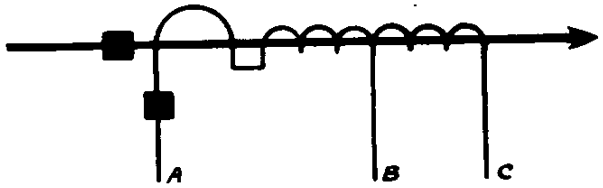


Fig. 14—Double Ratio Bushing Type Current Transformer

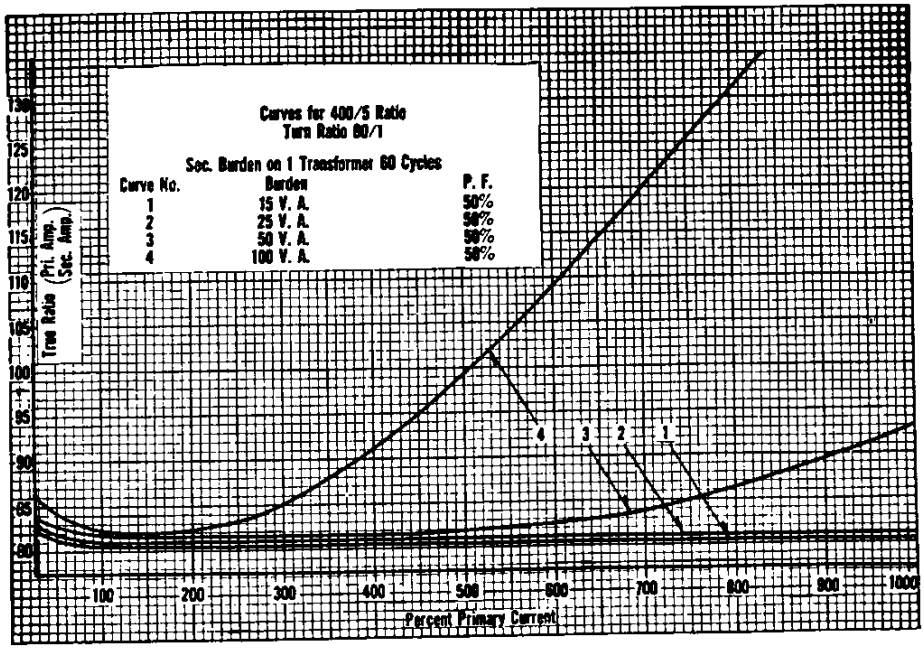


Fig. 15—Bushing Type Current Transformer for Relay Application—Typical Ratio Curves

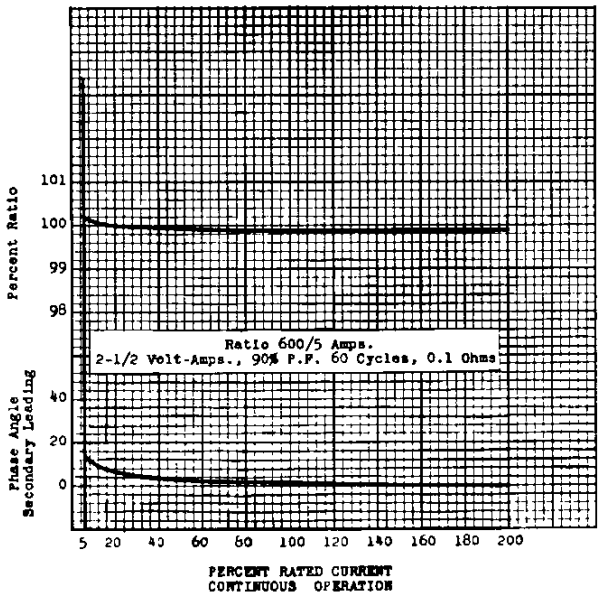


Fig. 16—Bushing Type Current Transformer for Metering Application—Typical Ratio and Phase Angle Curves

TANKS

Frame mounted breakers have removable tanks which fit against a gasket in the breaker top. It is very important that the tank bolts be drawn up tight. This is to prevent throwing of oil when interrupting a short circuit, as well as to prevent entrance of moisture. If the wrench handle is not long enough, it is well to use a piece of pipe 3 or 4 feet long so as to obtain a good leverage.

Tanks should not be left off the breaker over night because this would permit entrance of moisture in the form of dew or as a result of a sudden storm. Tanks should not be lowered in wet weather without provision for keeping rain out of them and off the internal parts of the breaker.

OIL GAUGES

All tanks are provided with glass gauges for indication of the level of oil within the tank. The oil level should show at all times. Change in temperature will cause considerable change in the depth of oil within the tank. Normal level is shown for oil at approximately 25° Centrigrade.

CIRCUIT BREAKER OIL

The Canadian Westinghouse Company Limited assumes the responsibility of circuit breaker operation only when the insulating oil employed is in accordance with its recommendations. WEMCO "C" oil is recommended for all oil circuit breakers.

All oil used in circuit breakers is subject to deterioration in service due to carbonization and to the presence of water, even under the most favourable conditions. It is, therefore, essential to provide for periodic inspection and test and to purify the oil whenever necessary in order to maintain it in good condition. The more handling which an insulating oil receives, the greater the opportunity for contamination, unless adequate precautions are taken.

It is recommended that operators prepare a schedule for inspection based on operating conditions. Reference to the station log on the operation of the record of dielectric tests of the oil should determine the frequency of inspection and test. The period between successive inspections should never be longer than six months. When the dielectric strenght of the oil drops to 20,000 volts, the oil should be looked upon with suspicion and in no case should it be allowed to drop below 18,000 volts when tested by one of the usual methods with electrodes 1" diameter spaced 0.1 inch apart. It is essential that the proper oil level be maintained in the circuit breakers. Considerable change may be caused by changing of temperature, rupturing of heavy currents, or possible leakage of oil. Low oil levels may cause flashover of bushings or failure to properly handle heavy overloads. Oil dash pots may be uncovered and fail to provide proper cushioning effect. Attention is again called to Westinghouse Instruction Book 44-820-1 which is a manual covering the care and maintenance of oil and which should be referred to before any attempt is made to test or purify the oil.

LUBRICATION

The following lubrication schedule is recommended for the Type BKOB, BJOB, BNOB, and BPOB Oil Circuit Breakers; it will serve as a general guide but must be tempered by a consideration of the customer's service conditions and experience in the field. All lubricants used must be those of a reputable supplier.

In general, pins in a heated space, such as in the mechanism housing, and when subjected to high bearing pressures, should be lubricated regularly with a heavy grease having good high pressure characteristics and of a water repellent base. Pins in an unheated space subjected to high bearing pressures and coming in contact with highly volatile oils, such as the pins in the pole unit mechanism, should be lubricated with a relatively insoluble grease having good high pressure-low temperature characteristics. Journal bearings in unheated spaces such as the bell crank shaft bearings should be lubricated with a light grease having at least fair high pressure characteristics but excellent low temperature characteristics. Anti-friction bearings should be lubricated with light grease as recommended by the supplier.

Bell Crank Pins and Hor. Pull Rod Lever Pins—*Leadolene #40 or equivalent, once every six months.

Bell Crank Shaft Bearings—Keystone 84HX light or equivalent, once every six months.

Pole Unit Mech. Pins—Dow-Corning "Valve-Seal" or equivalent, once a year and at each contact inspection.

Pins Inside Mech. Housing—*Leadolene #40 or equivalent, once every six months.

For Motor Operated Mechanism, Band Clutch (on steel drum)—A few drop of #10 Marvelube or equivalent, once a month.

Band Clutch (on bronze drum)—DO NOT LUBRICATE.

Worm Ball Bearings and Crank Roller Bearings—Keystone 84HX Light or equivalent, once every six months.

Worm and Worm Wheel—#375 Leadoline Light or equivalent, once a month.

* Substitute Leadolene #375 light or equivalent when minimum operating temperature exceeds plus 10° F.

MOTOR OPERATED MECHANISM TYPE BC-1-A

The most important part from the standpoint of accurate adjustment of this mechanism is the cam operated limit switch. While it is altogether unlikely to lose adjustment or break, it is important for operators or maintenance men to understnad that this limit switch should always be adjusted to open the circuit just before the mechanism reaches the latched position. This adjustment will vary slightly with various breakers and even with different ampere rated

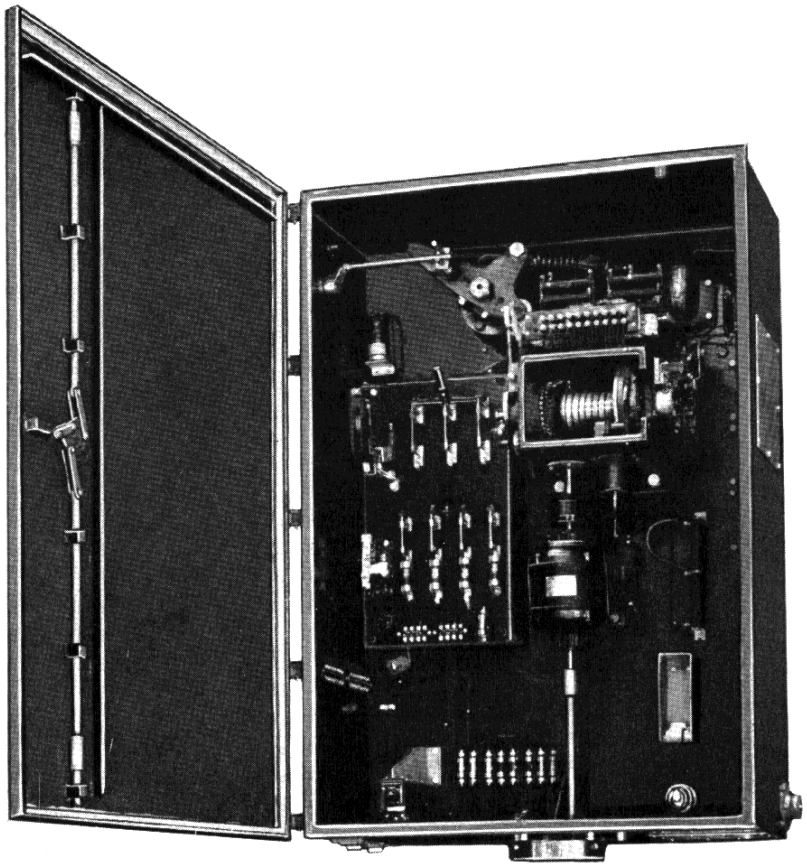


Fig. 17—Type BC-1-A Motor Operated Mechanism—Typical Assembly

breakers of the same type and is easily obtained by slight manipulation of the cam.

It will be understood that if the opening of the limit switch occurs too early in the operation of the mechanism, the latch roller will fail to reach the latching position and the breaker will fall back to the open position.

On the other hand, if the opening of the limit switch should be delayed beyond the normal time, the mechanism will come to the stop at the closed position under power and is liable to unduly strain some part or blow the closing circuit fuse.

It is unlikely that operators or maintenance men will have to touch the limit switch, but in case the switch or cam should be removed for any reason the above instructions on correct adjustment should be carefully followed.

The ball bearings on the worm shaft are totally enclosed and should not require attention. The bearings of the crank shaft should receive a little oil occasionally depending on the frequency of operation.

The worm and gear should receive a slight coat of heavy grease if the teeth appear to be dry.

A few drops of very thin oil may be used on the band spring clutch, chiefly to prevent corrosion of the surfaces of the crank shaft drum and the inside of the band spring clutch.

Bronze drums should not be oiled.

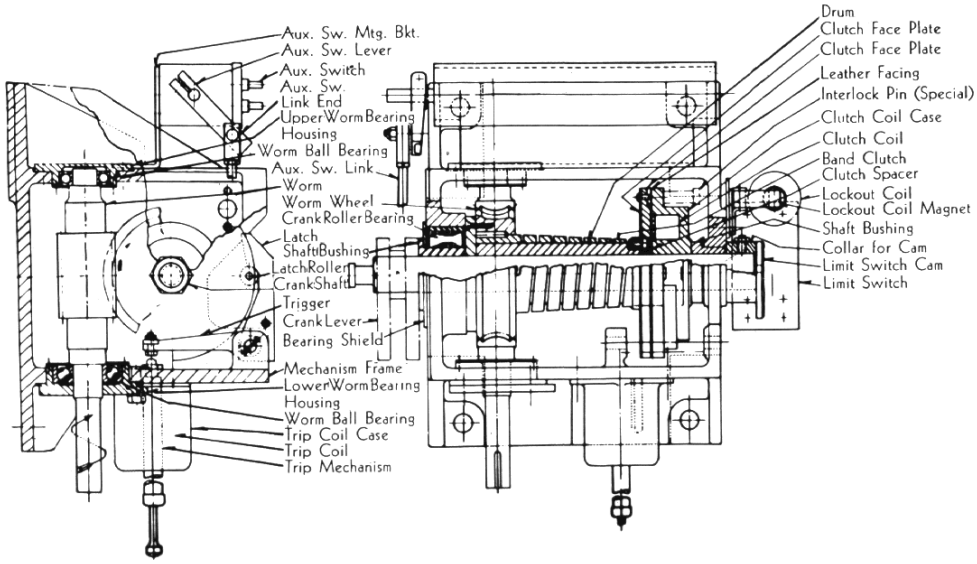


Fig. 18—Type BC-1-A Motor Operated Mechanism—Sectional View of Gear and Clutch Unit

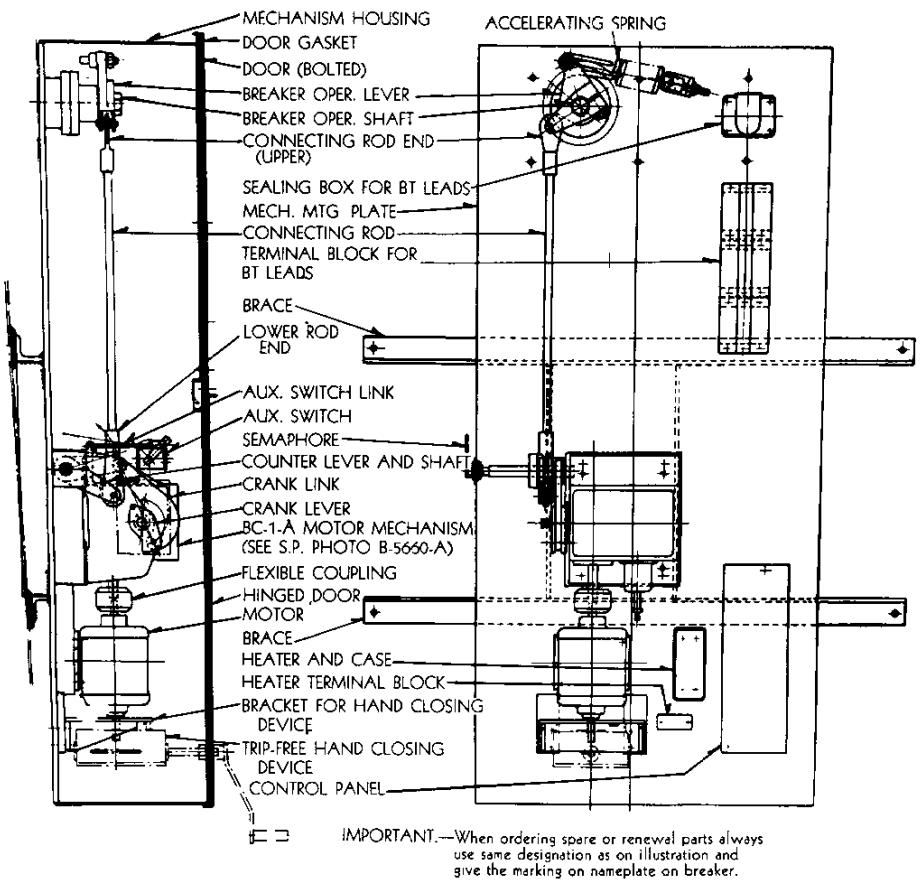


Fig. 19—Type BC-1-A Motor Operated Mechanism, Mounted on Type BPO-B Breaker—Sectional View

SOLENOID OPERATED MECHANISMS TRIP FREE

The mechanism is completely adjusted and tested with its breaker at the factory, so normally it is only necessary to check to see that these adjustments have not been altered. However, when the mechanism is to be connected to a breaker in the field considerable care must be taken to obtain the proper travel relation and correct adjustment of stops. With the breaker closed the mechanism should be latched. With the breaker in the full open position the mechanism should also be in the full open position.

For the type H-6 mechanism the over-travel at the holding latch should be set 1/16" between the latch face and the roller when the cores are touching. This is determined by closing the mechanism electrically and holding the relay contacts closed for an instant after the cores have touched. Proper adjustment is made at the factory and alteration of this adjustment should not be necessary.

A slight clearance is provided at the automatic or trip free end of the mechanism between mating parts to ensure free and positive action. When the mechanism has been tripped and is approaching the retrieved position the roller on the automatic (inner) lever engages the sloping surface of the latch forcing it backwards in a clockwise direction. As the roller continues downward in its retrieving arc and passes the nose of the latch, the latch moves forward again to engage the roller. There should be sufficient clearance between the stops on the inner and outer levers to allow the latch to move forward enough and permit the horizontal trigger to drop down in place behind it. If this sequence of operation takes place and the latches reset as described above, the latches are in proper adjustment. With the mechanism closed and latched, there should be approximately 1/32 of an inch clearance between the roller and the throat of the latch. If this clearance is not obtained, check carefully to see that no foreign matter has lodged between the stops on the levers. Second, check to see that there is nothing down between the lower corner of the latch and the pin that serves as its stop. Third, check to see that the tripping pin is free to move in the balance lever and that it rests on the trip coil housing when the trip coil is de-energized.

The trip plunger has been set for the maximum speed for tripping.

The relay cut-off switch is adjusted to function late in the closing stroke so as to allow the latch to engage properly.

The type H-4 solenoid mechanism has toggle type latch as illustrated.

Type "W" Auxiliary Switches—The 10 pole auxiliary switch is arranged

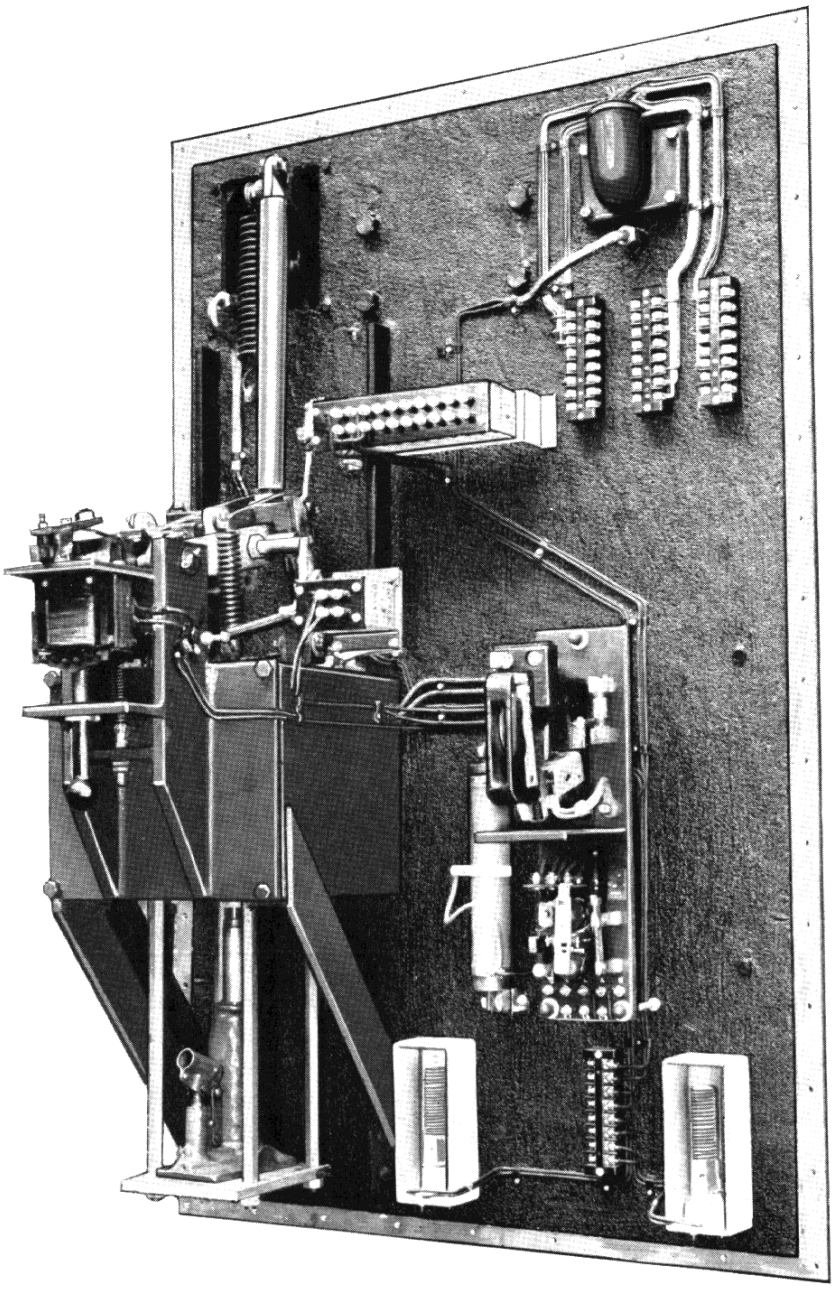


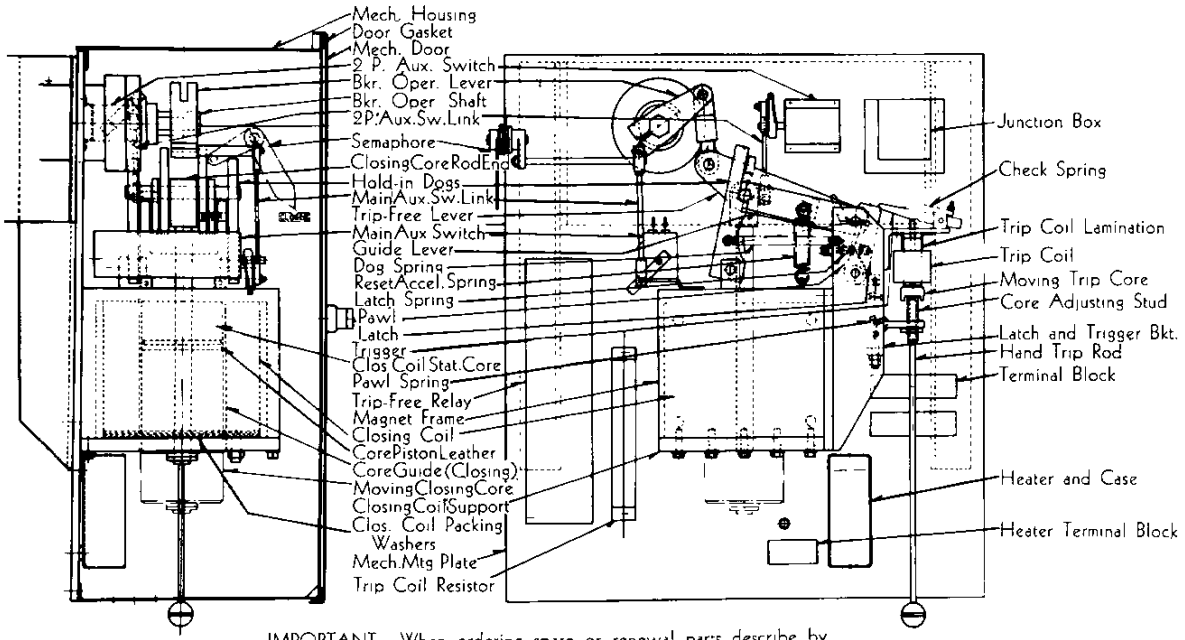
Fig. 20—Type H-6 Solenoid Operated Mechanism on Type BNO-B Breaker

for connection to the inner automatic lever thus it indicates the position of the breaker. The relay cut-off switch, used to open the closing relay when the closed position is reached, is connected to the main lever and indicates the position of the closing core.

The switch lever has an adjustable crank and the length of the link connecting it to the lever on the mechanism can be changed, so that the angle of travel can be adjusted.

It is desirable to inspect the mechanism at regular intervals and to put it through a number of operations to make sure of its good condition. It is desirable to apply a light lubricating oil to the various pins, but it should not be used to excess. It is necessary to keep the moving parts, particularly the trigger and switches, clean and free from foreign matter or rust.

The engaging surfaces of the latches and trigger may be polished with fine



IMPORTANT—When ordering spare or renewal parts describe by name given on illustration and give marking of name plate. For example:- 1 Trip Coil for Type BPO-B Bkr S# S.O. 901234 Serial 890123 Control Voltage 125 V.D.C.

Fig. 21—Type H-6 Solenoid Operated Mechanism, on Type BPO-B Breaker —Sectional View

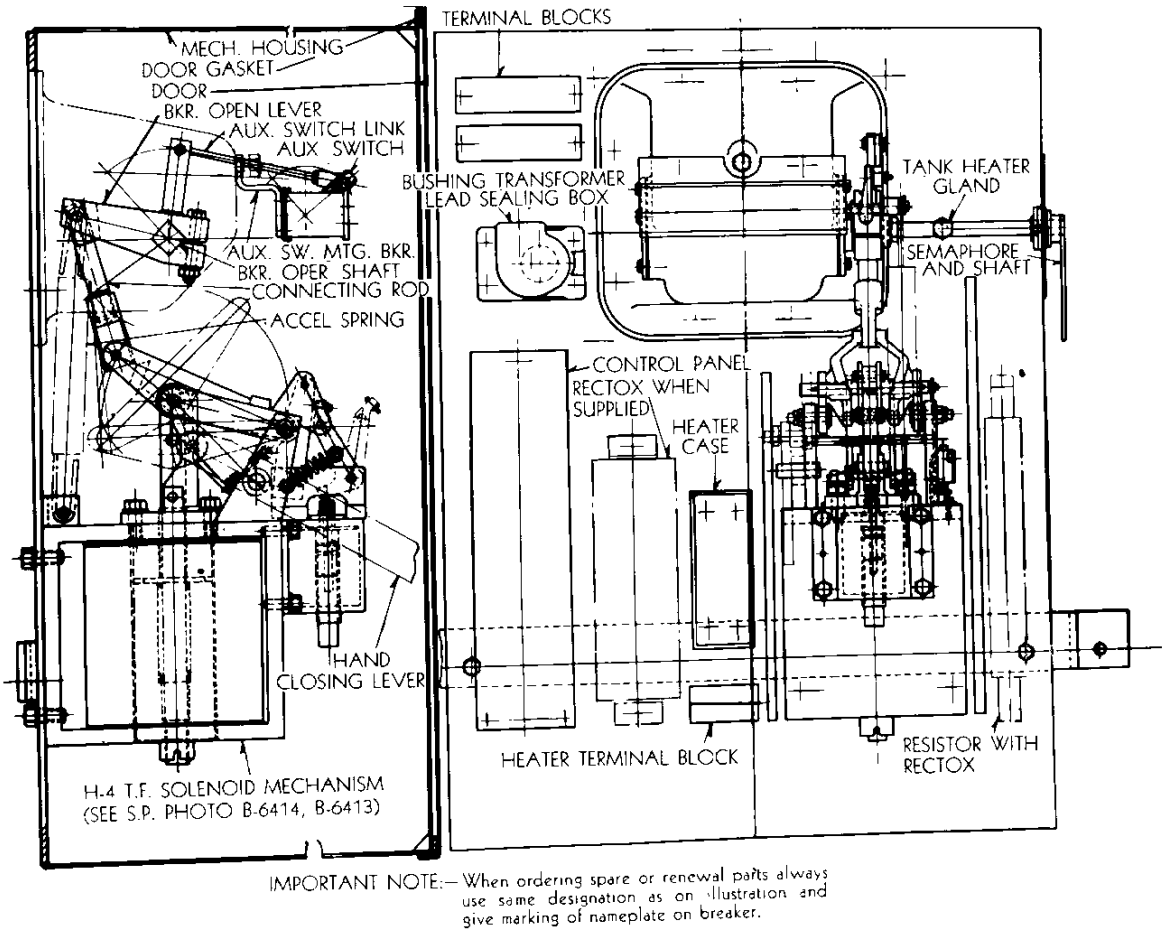


Fig. 22—Type H-4 Solenoid Operated Mechanism on Type BJO-B Breaker —Sectional View

BREAKER RENEWAL PARTS

(List of Parts Recommended for Stock)

The following is a list of the Renewal Parts and the quantities of each that are recommended for stock by the customer so that delays caused by breakdown may be minimized. The parts recommended are those most subject to wear in normal operation, or to damage or breakage due to possible abnormal conditions. This list of Renewal Parts is given only as a guide. When continuous operation is a primary consideration, additional insurance against shut-downs is desirable. Under such conditions, more renewal parts should be carried, the amount depending upon the severity of the service and the time required to secure renewals.

Description of Part	No. Req. per Unit	No. of Breakers		
		1	5	10
		Recommended for Stock		
Lifting Rod	3	1	3	6
Arcing Contact Finger	12	12	24	36
De-ion Grid Contact Complete	6	1	2	6
De-ion Grid Contact Finger	12	12	24	36
De-ion Grid Arcing Horn	6	6	12	18
Moving Contact Blade	3	1	3	6
Main Moving Contact	6	2	6	6
Closing Coil	1	....	1	1
Trip Coil, D-C	1	....	1	1
Trip Coil, A-C Shunt	1	....	1	1
Trip Coil, Overload	2	..	1	2

ORDERING INSTRUCTIONS

When ordering Spare or Renewal Parts, always use same designation as shown on illustration or table, and specify marking on nameplate on breaker. For example.

Six Arcing Horns for type BKO-B Oil Circuit Breaker, S.O. 789012, Serial Number 345678, 600 A., 15000 V.

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

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

REFERENCE LITERATURE

IB 44-820-1 — Wemco "C" Insulating Oil

ILH 565 — Breaker and Transformer Bushings

ILH 6105 — Type BC Motor Operated Mechanism

ILH 609 — Rectox for Oil Circuit Breakers

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