Inerteen and Oil-Insulated Network Feeder Grounding Switches

INSTRUCTIONS

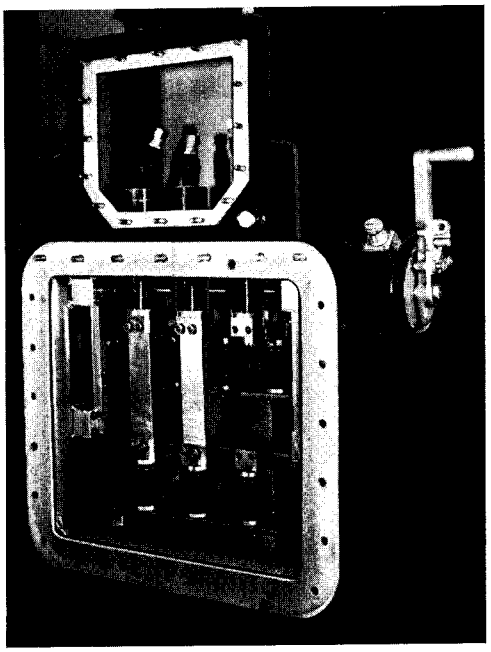

FIG. 1—STRAIGHT-LINE SWITCH IN TRANSFORMER POSITION.

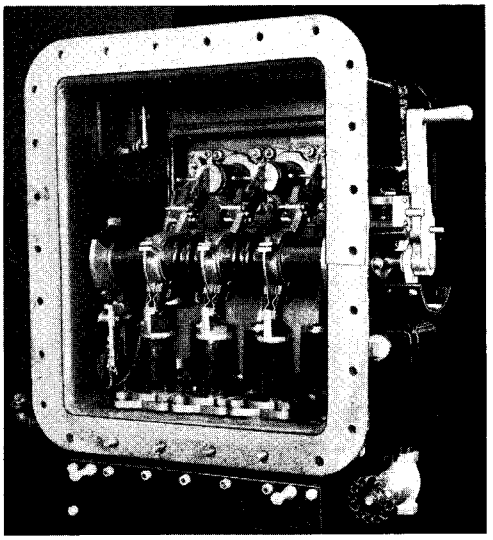

FIG. 3—ROTARY SWITCH IN TRANSFORMER POSITION.

GENERAL

Westinghouse switches are ruggedly constructed to give many years of uninterrupted service. The switches are designed with an ample margin of safety. Switches will carry 200 amperes continuously without exceeding a 30°C. rise. In the "ground" position the switch will withstand a short circuit current of 15,000 amperes for two seconds without an appreciable movement of the contacts. The switch may be one of several types. The Westinghouse Electric & Manufacturing Company manufactures three types to fit various requirements; these are the Straight-Line, V-Motion, and Rotary or Drum types.

CONSTRUCTION

Straight-Line Type

In the straight-line type, the moving contacts are supported on a bridge which is made to move in a vertical straight line by guides on the chamber wall. See Fig. 1 and 2. The transformer leads and the incoming line leads are supported by porcelain bushings at the top of the chamber. The ground contacts are mounted at the bottom of the chamber as are a set of insulators which are connected to the outlet bushings by a short length of bus bar.

In the "transformer" position, the moving contacts are in their upper position and connect the line and transformer bushings.

In the "open" position the moving contacts are in their middle position and the line is not connected.

In the "ground" position the moving contacts are in the bottom position in which the line and ground bushings are connected.

V-Motion Type

In the V-Motion switch the main moving element is in the form of an "H" frame. The moving contacts are mounted upon this frame. Flexible connectors join these bushings to the incoming leads.

One end of the vertical members of the "H" frame are guided in slots on the chamber wall while the other end is connected to the outer end of a rotating arm, which is keyed to the operating shaft. By rotating this shaft, the "H" frame is raised and lowered while the guided end swings either into the transformer terminals on one side of the shaft or into the ground terminals on the opposite side forming the "V". The "open" position is located at the vertex of the "V".

Rotary or Drum Type

The rotary type switch consists of a porcelain insulating tube keyed to the operating shaft. On this porcelain tube there is a segment of a disk and a wedge-type contact for each phase.

The disk segment slides in a wedge contact mounted on the outlet or line bushing. This makes contact through the entire range of travel of the drum. See Fig. 3.

The wedge type contact mounted on the rotating drum makes contact with the transformer bushing and the ground bushing which are arranged on the arc of a circle.

This type of switch is designed to have the "open" position between "transformer" and "ground" but may be arranged with "open" position at one end of the travel.

Two-position switches are also manufactured. These may have "open" and "transformer" positions, or have "transformer" and "ground" positions. The following instructions apply to all the above mentioned types of switches.

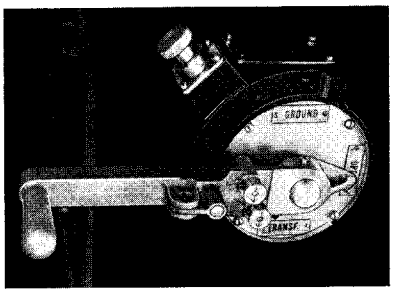

FIG. 2—OPERATING MECHANISM FOR STRAIGHT-LINE SWITCH WITH PHASING OUT BUTTON.

Operating Mechanism

On three-position switches, the operating mechanism is designed to enforce the following sequence: "open", "transformer", "ground". This mechanism also compels a pause in "transformer" position to allow the electrical interlock to "pick-up", or lock the switch in position, in case the feeder is energized. This prevents grounding a live feeder. Various types of mechanisms are furnished and a nameplate mounted on the switch chamber gives operating instructions. These instructions should be carefully read before attempting to operate the switch.

Inerteen and Oil-Insulated Network Feeder Grounding Switches—Continued

INSTRUCTIONS—Continued

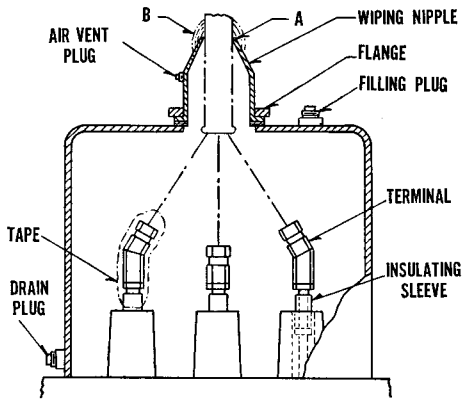

FIG. 4

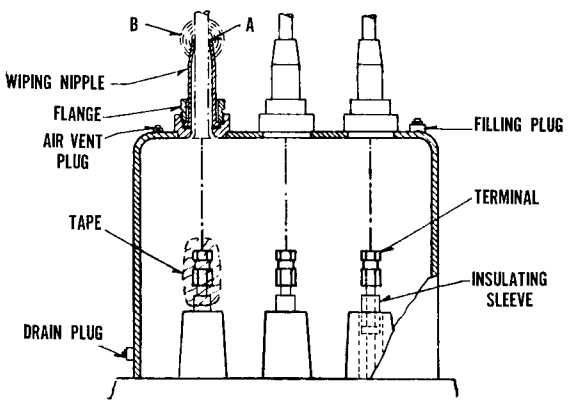

FIG. 5

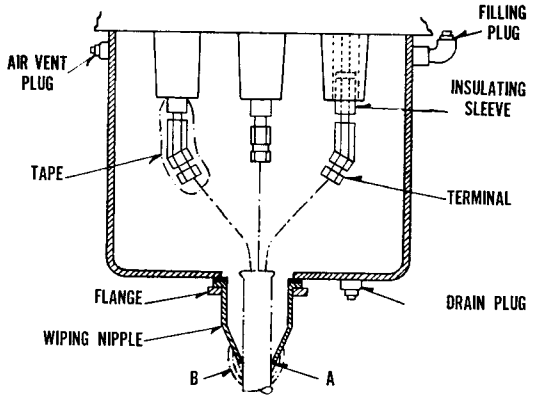

FIG. 6

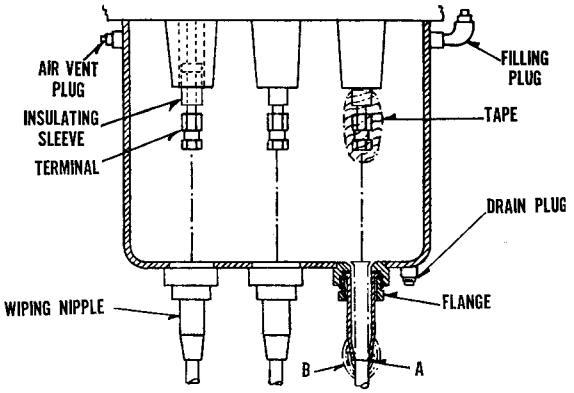

FIG. 7

Terminal Chamber Cable Connections

The operating mechanism on the two-position switch is much more simple. An electrical interlock prevents grounding or opening the feeder unless it is de-energized.

The switch is assembled in the switch chamber which is either bolted or welded to the transformer tank. The incoming cables are brought into a terminal chamber which is an integral part of the switch chamber.

INSTALLATION

Before the transformer is installed the switch chamber should be carefully checked for leaks. All switches are tested at the factory at 7½ lbs. per square inch pressure to check all welds and gasket seals. It is advisable to make a test at installation to make sure that no joints have opened. Check the packing gland seal on the operating mechanism end of the shaft carefully for leakage at this point. Where the enclosed type mechanism is used it will be necessary to remove the top cover plate to make this check. On other types the gland is available for adjustment. If oil leaks are discovered at this point, tighten the two clamping nuts, which will compress the packing, until the leak stops.

Operate the switch a few times to make sure that all parts operate freely.

The switch chamber is shipped filled with oil (unless otherwise requested) and cover is sealed in place. It is not necessary to open the chamber since all cables are terminated in the terminal chamber.

Terminal Chamber

The terminal chamber cover gasket and wiping sleeve gasket are furnished cemented to the chamber but with vaseline on the other side for ease of removal. The terminal chamber is furnished dry.

Refer to Figures 4 to 7 using figure which applies.

Install cable as follows:

1. Remove the wiping nipple (s) and cut off end at (A) until inside diameter is slightly larger than the diameter of the lead cable. Slip flange and wiping nipple back over lead cable.

2. Remove the lead covering from cable (s) for a distance of approximately 8″ and bell end away from conductor approximately ½″. This forming of the lead sheath is important and care should be taken that all sharp edges are removed.

3. Remove insulation from conductor (s) for a distance of approximately 1″. Slip the cable (s) into the terminal. Tighten union connection (s) and tape from 1″ above the connection to the porcelain bushing with treated tape (supplied by customer) to a minimum thickness of ⅛″.

4. Replace the wiping nipple (s) and tighten the bushing flange. Wipe lead cable (s) to nipple (s) at point (B). Metal parts of bushing pothead should be warmed to drive off all moisture and the porcelain bushings should be wiped dry.

5. Replace the filling plug with standpipe and remove air vent plug. Fill pothead with bushing compound No. 571 until compound comes out at air vent plug. Insulating compound No. 571 should be heated to a temperature of 105 to 115°C. for a period of one hour before pouring into pothead. It should be poured into pothead while compound is hot.

6. Disconnect standpipe, replace plugs.

NOTE—In case it is desired to fill the terminal chamber with oil instead of compound it is recommended that a short length of pipe and a container with a sufficient capacity for space for oil expansion be substituted for the filling plug. This container should be filled ¾ full of oil. This expansion chamber will then provide a means of keeping the terminal filled with oil. If desired, a container with a flush type gauge, a filling

Inerteen and Oil-Insulated Network Feeder Grounding Switches—Continued

INSTRUCTIONS—Continued

plug, and provision for connection to the terminal chamber can be obtained from the Westinghouse Electric & Manufacturing Company, Sharon, Pa.

OPERATION

These switches are provided with an electrical interlock which will prevent the movement of the switch from the "transformer" position if the H.V. feeder is energized. The operating mechanism compels the movement to "transformer" position before moving to the "ground" position so as to prevent grounding of the feeder while energized.

On switches with the "transformer" position in the middle a sequence compelling device is not required. In this type of switch a toggle or latch is provided in the "transformer" position which will enforce a pause in passing through this position. To continue movement of the main switch it is necessary to depress the interfering button; the handle can then pass over the depressed button.

Switches having the "open" position in the middle do require a sequence compelling device. The device is an integral part of the operating mechanism and is controlled by one or two buttons.

Instructions for the operation of these mechanisms are given on a separate nameplate attached to the switch chamber cover.

SPECIAL ACCESSORIES

Switches are equipped when so ordered with auxiliary devices, such as quick-break mechanism, phasing-out contacts, and switch to tap changer interlocks.

Quick-Break Mechanism—When quick-break contacts are supplied, an auxiliary switch is provided. This switch is so arranged as to lock the interlock cam and thereby lock the switch when the load is on the transformer. A lead is usually brought from the interlock coil through the L.V. throat for connection to the auxiliary switch on the L.V. breaker and then to the network bus. See separate instructions. With the transformer energized from the H.V. feeder and with the load breaker open, the mechanism will permit movement between "transformer" and "open" positions. A mechanical stop prevents movement to "ground" position.

On switches using the enclosed type mechanism, an auxiliary switch is provided which is controlled by a small lever located on the face of the operating mechanism. This switch has two positions, "ground" and "quick-break". If it is desired to break the exciting current of the transformer, it is necessary to move the lever to the quick-break position. This operation opens the interlock coil connection to the L.V. winding and permits movement of the main switch from "transformer" to "open" unless the load breaker is closed. If the lever is at its "ground" position, the interlock coil is connected to the L.V. winding of transformer and the switch can not be moved unless the H.V. feeder and transformer are de-energized. The mechanical stop does not operate in this position and the feeder can be grounded.

Instead of the above stated arrangement, switches may be equipped with two interlock coils, one being connected to the network through the auxiliary switch and the load breaker housing and the other to the transformer L.V. winding.

NOTE—Care must be exercised when installing a unit with quick break mechanism. Some load interlocks are arranged to lock when energized while others are locked when de-energized. The load switch must be arranged for the proper connection.

Phasing-Out Contacts—These contacts are provided so that one phase of the cable can be grounded at a time. Buttons on the operating handle are provided for operation. Sequence of grounding may be either H1-H2-H3 or H3-H2-H1. H1-H2-H3 is standard and will be furnished unless ordered otherwise. See Fig. 8 and 9.

To Phase Out H.V. Cables—Move the switch handle from "transformer" toward "ground" with the latch pins on the switch control set for phasing out cable. Note, H.V. cable must be de-energized.

(1) When pin marked "A" on the handle stops the movement, the contacts are engaged for phase "A" as shown in Fig. 8. Phases "B" and "C" are open-circuited. Check for circuit through phase "A" with test voltage then tag.

(2) Release pin "A" on the handle and move the switch handle until pin marked "AB" stops movement. The contacts are then engaged for phases "A" and "B". Phase "C" is open-circuited. Check for a circuit through phase "B" with test voltage then tag.

(3) With the switch in "ground" position, all three contacts are fully engaged.

Tap Changer Mechanical Interlock—This interlock is a manually operated interlock which is designed to prevent operation of the tap changer unless the switch is in "open" or "ground" position. It also prevents operation of the switch from "open" or "ground" position unless the tap changer is on one of its various positions. The interlock will normally be in position to lock the tap changer. To operate, move the switch to "open" or "ground" position and then the interlock arm can be moved, which will free the tap changer operating mechanism. The arm must be moved back, locking the tap changer, before the switch can be closed.

MAINTENANCE

Periodic examination should be made at least every six months to keep the switch in first class operating condition and to insure trouble-free operation. All cover bolts should be tightened, using a wrench for ½" bolts. The push buttons on the operating mechanism should be oiled using a fine grade of light machine oil. The packing gland should be checked for possible leaks. An inspection plate is provided on the top of the enclosed mechanism for this purpose. A ratchet type socket wrench for a ⅜" bolt is convenient for tightening the gland through this opening. In the open type mechanism the packing gland is exposed and is easily adjusted.

Repacking the Gland—If, after several years of service, the packing becomes worn and it is impossible to tighten the gland sufficiently to stop leaks, it will be necessary to repack the gland. To do this will be necessary to drain the oil from the chamber to a point below the shaft. Ring-type packing, S# 1165666 can be obtained from the Westinghouse Electric & Manufacturing Company.

The procedure for repacking will vary on different type mechanism. The following two sub-sections give the procedure to follow for enclosed and open type of mechanisms.

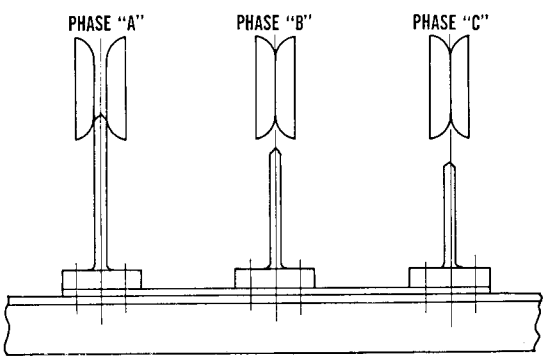

FIG. 8—PHASING SEQUENCE A-B-C OR H_1-H_2-H_3

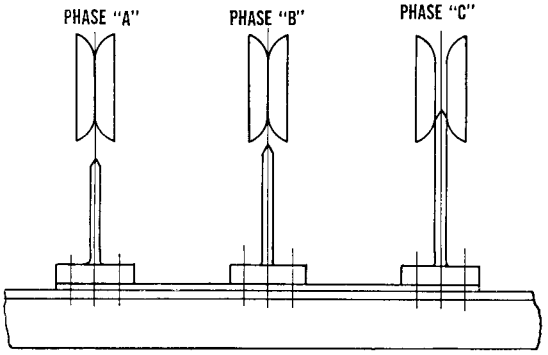

FIG. 9—PHASING SEQUENCE C-B-A OR H_3-H_2-H_1

Inerteen and Oil-Insulated Network Feeder Grounding Switches—Continued

INSTRUCTIONS—Continued

Enclosed Type Mechanism—To repack the gland, remove the operating handle by driving out the taper pin. Remove the face plate (which has the nameplates mounted on it). The housing can be removed by taking out four bolts around its periphery. Slide the housing forward and remove from the shaft.

This then exposes the internal parts which are removed by driving out the taper pins and sliding off the shaft. Note sequence carefully so that the parts can be replaced in proper order. Remove nuts which hold the packing gland and take the gland off the shaft, using sharp, hooked instrument. Dig out old packing, making sure all particles are removed. Slip new ring of packing in place, taking care that pointed end is on the inside. Replace gland and nuts. Reassemble the parts on the shaft, driving taper pins in until tight. Lubricate all parts with vaseline and apply vaseline to parts inside of housing. Slide housing on shaft using a screw device to hold latch clear so that housing can slide into position. Replace bolts and cover plate, taking care that nameplates are in proper position. Refill chamber and test for leaks at packing gland. Place a few drops of light machine oil around push button to insure free operation. Check switch for free operation and to insure correct assembly.

Open Type Mechanism—On this mechanism, the packing gland is open and is removed by driving out the taper pin that holds the handle in place. Take off guide plate for the toggle and remove nuts from the gland. Take off gland and remove packing using a sharp hooked instrument. Slip new packing in place, taking care that pointed end is on inside and replace gland, guide plate, and handle. Make sure handle is in correct position and pin to shaft. Refill chamber and test for leaks. Oil the toggle buttons with light machine oil.

Gaskets—All gaskets used on Network switches are made of a fine grade of cork, and for satisfactory results, they should be replaced with gaskets made of cork. Before replacing a gasket, the gasket surface should be carefully and thoroughly cleaned to remove rust, oil, grease, paint, and other foreign material. The cleaning may be done by scraping or wire-brushing and then wiping the gasket surface with denatured alcohol.

Gasket cement M-7386, obtainable from the Westinghouse Electric & Manufacturing Company as S# 1150419, should be used in applying gaskets. Thoroughly brush the cement on the gasket surfaces and on all sides of the gaskets. Place gasket and cover in place and immediately bolt together under uniform pressure. After unit has been in service for a period of six months all the bolts should be retightened.

Dielectric Tests—Take sample of the oil from the switch chamber and test as per IB-5336.

Insulation Tests—Place switch in "open" position and test to ground for one minute at the following voltages, based on the voltage rating of the transformer.

Rating	
5000 to 15000 Volts	40,000 V. a-c.
15001 to 34000 Volts	70,000 V. a-c.

Replacing Bushings—The bushings between the switch chamber and the transformer tank, as well as those between the switch chamber and terminal chamber are designed with a gasket seal between the cap and the porcelain. This seal cannot be successfully made outside the factory and if new parts are required it is advisable to order the complete bushing assembly.

To replace a bushing, remove flange and cushion washer and break the porcelain loose from the gaskets. Remove the gasket (see section on gaskets above) and replace with a new one. Set the new porcelain assembly, centering gasket as above, in place and replace cushion washer and flange. Draw down on all of the flange bolts with even pressure. After all bushings are in place, close up the chamber, using a new cover gasket, and pressure test at 15 lbs. per sq. in. Check carefully for any leaks. If leaks are discovered, the gasket must be replaced as above and the test repeated.

Mechanical Interlocks—Tap Changer and Switch—This interlock is designed to prevent the operation of the tap changer unless the switch is in either "open" or "ground" positions. It will also prevent the movement of the switch from "open or ground" position if the tap changer is off position.

The interlock may be connected with flexible metal tubing enclosing a solid rod or by a linkage mechanism. In painting the transformer, care should be taken to keep paint off the moving parts of the mechanism. Since this mechanism is exposed, it is possible that it may become inoperative due to corrosion of the parts. To prevent this, it is advisable to clean mechanism once a year. Working parts should have a light coating of vaseline applied to them. The shaft should be removed from the housing and have a light coating of graphite applied its entire length. In assembling this type of mechanism, the ends of the housing must be clamped firmly, to prevent any motion at these points.

Electrical Interlock—The electrical interlock is the counter-weighted contactor type. The contactor is equipped with an adjustable counter-weight to adjust the pick up and drop out voltages of the contactor. This assembly is adjusted at the factory to pick up at 90 volts or less and to drop out at not less than 15 volts. This adjustment should not be disturbed unless the interlock is dismantled. The adjustment is made with a screw driver through a 1" pipe plug in the side of the interlock pocket. The counterweight can be moved in a horizontal direction and after setting, the screw should be drawn down tight to prevent movement of the counterweight.

Quick Break Mechanism—Normally this mechanism will not need any maintenance. This mechanism uses a folding leg which is rigid when switch is moved from "transformer" to "open" position and follows the moving contact until it is clear of the fixed contact, breaking sharply when sufficient clearance is obtained. In moving from "open" to "transformer" the leg folds allowing the pin to clear the arm and resetting the mechanism for the next operation. The auxiliary switch on enclosed mechanisms is set at the factory and should not be disturbed.

If a bushing including the quick break arm is replaced it should be adjusted so that all arms break or snap at the same time. This may be done by filing the end of the arm as much as is necessary.

Fig. 10 shows the quick break arm.

RENEWAL PARTS

If renewal parts are required, order from the nearest Westinghouse Electric and Manufacturing Company office or direct from the Sharon, Pa., Works, giving description of parts wanted and serial or stock order number as stamped on transformer name plate.

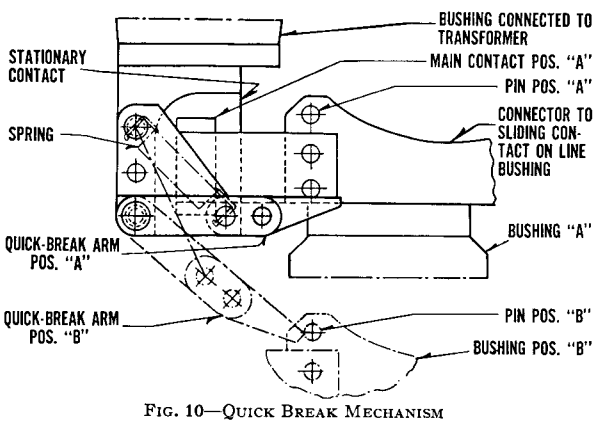

FIG. 10—QUICK BREAK MECHANISM

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