OUTDOOR CONDENSER BUSHINGS

Type N Plastic Encased and Type ON Oil Encased For Oil Circuit Breakers and Transformers

INSTRUCTIONS

1. These instructions should be studied carefully before unpacking, handling, and installing Westinghouse type "N" or type "ON" condenser bushings.

2. The type "N" condenser bushings have a plastic filler in the space between the condenser and porcelain weather casing, and the type "ON" have oil in this space.

SHIPPING

3. Whenever practicable, the bushings are shipped in a vertical position rigidly supported from the flange in a crate of suitable size. The end is free from contact with the crate. Clearances between and around the bushings permit handling any one bushing without bumping other bushings in the same crate.

4. Large bushings and bushings which are not shipped on flat cars with other apparatus are packed in boxes in horizontal position. They are supported at both ends and on the flange by corrugated cardboard supports, and the box is completely filled around the porcelain with tamped shavings and sawdust.

5. The exposed parts of the condenser are protected from moisture by wrapping in water-proof paper. The lower end of the bushing is wrapped with treated cloth and dipped in gum to protect the exposed part of the condenser from moisture, dust, and damage due to rough handling.

UNPACKING

6. Care should be used in unpacking to prevent the bushings from being injured by tools, or parts of the packing case.

7. Use care in handling the bushing to avoid mechanical damage to the porcelain or the condenser.

LIFTING

8. The type "N" and type "ON" condenser bushings should be lifted out of the packing case by means of a rope looped around the flange. The ends of the bushing should be stayed or guyed by means of ropes so that it will not upset during lifting. During installation, it is recommended that the bushing be lifted as shown on Figure 1. If it is desirable to lift the bushing in a more vertical position for mounting in transformers, it can be accomplished by using a second lifting rope in a position 180° from the one shown.

CLEANING

9. The lower end of the bushing is wrapped with treated cloth and dipped in gum to protect the bushing from moisture, dirt, and damage due to rough handling. This protection should not be removed until installation or immediately before the end is placed under oil for storage. See paragraphs ✱13 and ✱14. Rip cords are provided for removing the treated cloth and gum. A downward pull starting from the bushing flange will permit the treated cloth to be removed with ease. After removing the wrapping, be sure that all gum is removed from the condenser or bushing flange as it will discolor the oil in the tank or in the arc shield of the circuit breaker. Use a clean cloth saturated with WEMCO "C" oil to remove these spots of gum.

10. After installing in the apparatus, the outdoor end of the bushing should be wiped clean of all dust, grease, or particles of packing material before the apparatus is put into service. This cleaning should be done thoroughly, using cloths rung out in gasoline or carbon tetra-chloride and finishing with a dry cloth.

STORAGE

11. Bushings that are not put into service should be stored vertically in a clean dry place, where moisture will not condense on the surface of the lower end. The ideal storage is mounting vertically with a small tightly sealed tank or tube enclosing the lower end. Fill the tank with oil, leaving an air space at the top equal to one-fifth the volume of oil.

12. The condition of stored bushings should be periodically checked with the power factor test. If they have a high or increasing power factor, place in a drier location or improve the condition of present location. Check power factor of stored bushings before putting in service. For detailed instruction, care and maintenance, see Bushing Manual Technical Data 33-156.

INSTALLATION—TRANSFORMER BUSHINGS

13. The treated cloth and gum on the lower end of the bushing should be removed and the bottom end of the condenser should be cleaned (see paragraphs ✱9 and ✱10) before the bushing is lowered into place. Spare transformer bushings furnished for a given transformer are supplied without cable lead if they are duplicates of those they are to replace. In this case, the cable inside the transformer will fit the bushing without alteration. If bushings are of different design from the bushings they replace, they are furnished with a length of cable brazed into the cable terminal. In order to install such a bushing, it will be necessary to cut off the old cable and to splice the new cable to the old one. The spliced joint should preferably be within the condenser tube, provided there is room for such joint. The splice should be brazed or soldered. The location of the splice may be obtained by measuring the length of the bushing and the length of the cable to the surface of cover boss, adding two inches to measurement to give proper slack in cable. On most transformers cover bosses are flat, though bevel seats may be used. The gaskets should be cemented on the boss before installing the bushing. If bevel seats are used, care must be taken to see that the bushing is at right angles to boss cover so proper clearance from the tank and other internal parts is adequate.

INSTALLATION—BREAKER BUSHINGS

14. After the bushing is lowered into place, the treated cloth and gum on the lower end of the bushing should be removed and the bottom end of the condenser cleaned (see paragraphs ✱9 and ✱10). If arc shields are used, they should be assembled as shown in Figure 3, after the bushings are mounted in the breaker. The hood is screwed far enough into the adapter to allow the static shield under porcelain to screw the full length of central conductor threads. The complete structure is made tight and the gaskets compressed by turning the adapter and holding the hood stationary. Fill the arc shield through the filling pipe with new WEMCO "C" oil until oil runs out vent hole. Seal the assembly by screwing on filling cap and vent plug. Check sample of oil from arc shield at breaker periodic inspection. Oil that shows discoloration or has a test below 18-kv. on a $\frac{1}{10}$" gap, should be replaced with good oil.

15. Some bushings are provided with a removable bevel ring at the flange (See Fig. 4). This should be removed when using the bushing on a flat seat cover. When the bevel ring is used, a flat gasket coated with cement is applied between the bevel ring and bushing flange, and a bevel formed gasket without cement is used between the bevel ring and tank top.

16. Outside connections should not throw strains on the bushing.

POTENTIAL DEVICE CONNECTION AND ADJUSTMENT

17. The type "N" and "ON" bushings are furnished with two-layer potential tap for using with the PB-2 (high capacity) bushing potential device. By making a few modifications, bushings 92-kv. to 161-kv. inclusive, can also be used with devices normally designed to operate from a single layer tap. These devices are identified as type PB-1 or PB-11.

18. The mechanical changes necessary to use the PB-1 or PB-11 devices on

two layer tap bushings are illustrated in Figure 4. These changes are necessary because the bushings have a porcelain type voltage tap receptacle which is not interchangeable with the Moldarta voltage tap receptacle used on earlier bushings. The adapter is required on the bushing to accommodate the union joint connection on lead-in cable. The new contact insert is required in the lead-in cable to accommodate the added length of tap receptacle due to the use of the bushing adapter. To change the contact insert in the lead-in cable, unscrew the present contact insert from the porcelain fitting, pour sufficient tung oil #6008 (in separate can) into the porcelain opening, so that it will be entirely full when the new contact is assembled. Place a new gasket covered with cement #7247 (in separate can) over the end of the insert shank and assemble the contact insert into the porcelain as shown on Figure 4. Open slot if necessary for good contact. Assemble the lead-in cable into the bushing adapter, use cement #7247 on the gasket, and carefully seal all joints. Fill the assembled tap and adapter chamber with petrolatum sufficiently warmed to flow into the tapped holes provided for this purpose.

19. The application of the PB-1 or PB-11 device with the two layer tapped bushing requires readjustment of the device to reduce the tap voltage of the bushing to 4000 volts or less. This is accomplished by using more capacity across the secondary terminals of the potential transformer than formerly used. In most cases, there is sufficient condenser capacity available in the device for this purpose; however, in case this is not sufficient, a 4MF., 350 volt condenser can be installed in the device housing and connected across the transformer secondary terminals in parallel with the condenser switches A1 to L. The tap voltage of the bushing is determined by measuring the voltage across the midpoints of dials #4 and #5, and multiplying by the transformer ratio of the connected taps, as described in Instruction Book 5441. This readjustment should be made with the service burden (or equivalent) connected to the device to obtain the desired secondary voltage and phase angle. The resulting overall performance will be superior to that obtained from the same device when used with the single layer tapped bushing.

CAUTION—The dial arms of dials #4 and #5 should not be left in the "off" position because this will remove the condenser connection from the transformer secondary, allowing the tap voltage to rise and causing arc-over of the potential device protective gap.

MAINTENANCE AND TESTS—TYPES "N" AND "ON"

20. (a) Exposed surfaces including the weather casing and glass gauge should be cleaned at regular maintenance periods.

(b) Make power factor and capacitance tests at the end of the first year.

(c) Re-check annually with a power factor test set any bushings that are noticeably higher in power factor than the average power factor for bushings of this type.

(d) Re-check every two years with the power factor test set any bushings that are consistently well under safe power factor limits as indicated by the power factor curve in the Bushing Manual Technical Data 33-156.

20. (e) The type N and ON bushings are intended to be kept tightly sealed. These bushings were all tested for tightness before leaving the factory and should remain tight. However, mishandling during transportation or injuries received in installation or service may result in leaks which should be repaired without delay. It is recommended that a check for tightness of the cap should be made when power factor tests are made.

For Type "ON" Only

(f) Check oil level periodically, and adjust height by adding a small amount through the plug in the cap when necessary.

(g) Check condition of oil at maintenance periods by making a dielectric test on a sample drawn at the flange. If oil tests below 18 kv. on a $\frac{1}{10}$" gap it should be replaced. Be certain the sample is not contaminated by coming in contact with the hands of the operator or with unclean tools.

21. To remove a sample of oil, the cap on the flange sampling valve should be removed and the valve stem backed off one turn (see Fig. 2). The oil will come out of the opening covered with the knurled cap.

22. If the dielectric strength of the oil is found to be low, it is suggested that the cap be checked for tightness. This can be done by testing with dry air at 15 pounds pressure. Check for leaks by coating the cap surface with soap lather, or with the pressure source removed, hold the pressure for 30 minutes without drop. If no leaks are found on this test, it means that the filling plug, through which the test was made, had been improperly sealed.

23. The flange sampling valve is above the sump in the bushing, and hence, all of the oil in the sump cannot be removed by draining from the sampling valve. If it is desired to remove all of the oil, it will be necessary to siphon this oil out, or to place the bushing in a horizontal position. If it is desired to siphon the oil out, this may be done by opening the sampling valve and replacing the cap and gasket on the sampling valve. A suitable pipe or hose should be connected to the opening covered with the knurled cap. The end of the pipe or hose must be below the flange seat of condenser bushing, and in order for the assembly to act as a siphon, there must be no air leak in the hose connection or at the cap and gasket on the end of the sampling valve.

24. Before filling, the bushing should be flushed out with clean oil and thoroughly drained. Refill bushing to proper level through sampling valve at flange, and then close and seal openings at flange and cap.

25. The proper oil level and change in oil level for the various bushings is tabulated in the following table:

Kv. Class	Oil Level Above Bottom of Glass at 25°C.	Variation in Oil Level Inches for 10°C. Change
92	$1\frac{3}{8}$ in.	$\frac{9}{64}$
115	$1\frac{3}{8}$ in.	$\frac{5}{32}$
138	$1\frac{3}{8}$ in.	$\frac{13}{64}$
161	$1\frac{3}{8}$ in.	$\frac{17}{64}$
196	$1\frac{3}{4}$ in.	$\frac{3}{16}$
230	$1\frac{3}{4}$ in.	$\frac{19}{64}$
288	$1\frac{3}{4}$ in.	$\frac{9}{32}$

On the type "ON" condenser bushing the gauge glass is tinted to stop ultraviolet light. It takes on a contrasting color below the oil level due to the reflection from a differently colored MICARTA tube which is behind the gauge glass, thus making the oil level easily visible.

WEATHER CASING

26 The porcelain weather casing on the type "N" or "ON" cap is held in place by compression on the ends. The compression is provided by six coil springs located in the cap. (See Fig. 5).

27. The amount of compression has been carefully calculated for bushings of different sizes, and springs of the proper dimensions to provide the correct pressure are supplied in the bushings.

28. If it is necessary to dismantle a bushing at any time, care should be used to see that the springs are compressed to the proper point in re-assembling (see Instructions for Rebuilding). Excessive pressure will overload the gaskets and shorten their life. Too little compression will not produce adequate pressure on the gaskets.

FLANGE

29. The flanges for the type "N" and "ON" bushing are the same in structure except an oil sampling valve is added to the flange on the type "ON" condenser bushing (See Fig. 2).

COMPOUND

30. The type "N" condenser bushing is filled with PLASTIC #7399-1. This material will not absorb or emulsify with water. However, the presence of water on top of the plastic would indicate that a fault exists, which permits water to enter the bushing. If a bushing is found with water on top of the plastic, it should be reconditioned by dismantling to the condenser and rebuilding with new gaskets, new plastic and any other parts found defective. Complete instructions for reconditioning are given on page 84 of the Bushing Manual—Technical Data 33-156.

OIL

31. The type "ON" condenser bushing is filled with Wemco "C" oil, between the condenser and the weather casing. When put in the bushing, it tested 22-kv. or more.

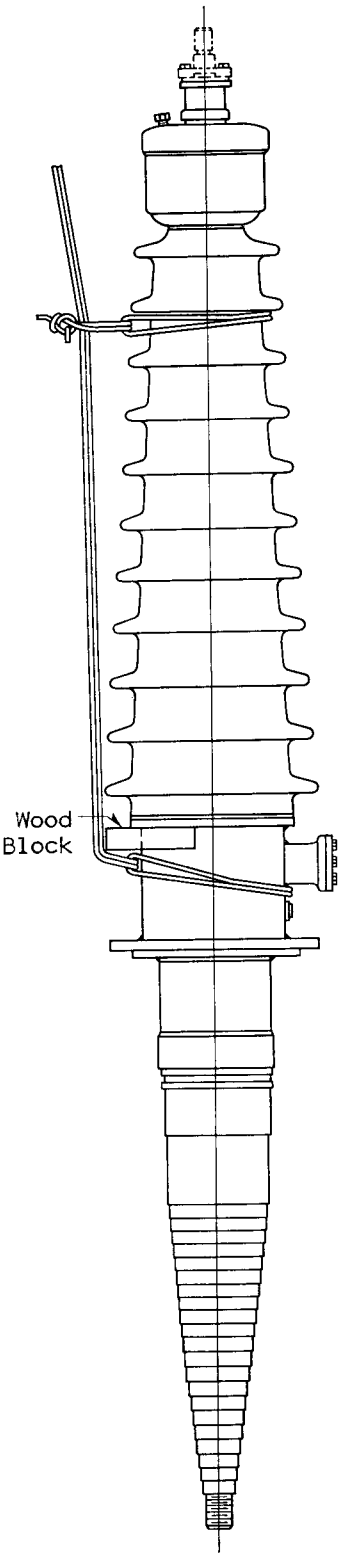


FIG. 1

REPAIR-INSTRUCTIONS FOR DISMANTLING

32. A hand wrench for dismantling the type, 'N" and "ON" condenser bushing may be secured from Westinghouse Electric and Manufacturing Company complete with detachable adapters for the different sized bushings. This hand wrench is shown in Fig. 5.

To Dismantle:

(a) Remove the six bolts holding the terminal connector to the terminal adapter.

(b) Remove the cap from the filling plug before applying wrench.

(c) Remove the terminal connector and gaskets. Where a fished through lead is used, it must be disconnected from the terminal connector. Then attach a light wire to the upper end of the fished through lead so it can be pulled back when required, and push it down into the hollow stud until the end is below the top of the terminal adapter. Install hand wrench shown in Fig. 5, aligning the bolt circle on the wrench to the bolt circle on the terminal adapter.

(d) With the six ½ inch bolts supplied with the wrench, bolt the wrench to the top of the terminal adapter. Tighten the bolts evenly until the wrench is seated solidly on the top of the terminal adapter. This will force the top of the cap away from the gasket at the bottom of the terminal adapter by increasing the compression on the springs inside the cap.

(e) Looking down on the cap, turn the wrench counter-clockwise until the adapter unscrews freely. Then loosen uniformly the bolts holding wrench to the terminal adapter and remove the wrench. Screw off the terminal adapter.

(f) Break gasket seal between spun cap and glass on "ON" bushings by sawing gasket in half. Break gasket seal on "N" bushings by heating slightly and hammering lightly. After the gasket seal is broken, the complete spun cap assembly may be lifted by hand, leaving the bushing free for detailed inspection.

(g) The gaskets between the porcelain or gauge glass and the metal parts have been cemented in place, and the cement afterwards baked to make the cement insoluble in oil. They must be sawed to separate.

INSTRUCTIONS FOR REBUILDING

33. In rebuilding, all surfaces must be thoroughly cleaned and new gaskets must be used in making all joints. It is recommended that these be obtained from the Westinghouse Electric and Manufacturing Company as the materials used are carefully selected for the purpose and for the location in which they are used.

(a) Coat gaskets with oil-proof cement and put in place. Place expansion bowl on gaskets on porcelain and carefully put spun cap assembly back into the expansion bowl so that the spun cap assembly rests on the gaskets on the expansion bowl.

(b) Press in place over center conductor the Neoprene gasket, moulded in metal ring. Use no cement on this gasket.

(c) Screw on terminal adapter with a small wrench until it rests snugly on the gasket on the spun cap assembly.

(d) Attach wrench per instruction for dismantling.

(e) Looking down on the cap, turn the wrench clockwise for 4 full turns for type "N" and 4½ for type "ON" bushings. This should give proper compression on the cap springs.

(f) Loosen bolts holding down the wrench and remove the wrench. The correct pressure is now on all the gaskets. Next install the terminal connector and the bushing is assembled.

(g) Check the finished assembly with dry air at 15 lbs. pressure. For type "ON" bushings, flush out with clean oil and then refill with oil testing at least 25-kv. For type "N" bushing fill with bushing plastic ✱7399-1 so that the plastic is 1" deep in the cap after cooling to between 20°C. and 25°C. See Bushing Manual Technical Data 33-156 for filling bushings. If bushing is to be stored, the lower end should be wrapped with lapped layers of varnished cambric and dipped in ✱1001 gum unless the lower end is protected by a sealed tubing or tank.

(h) From Fig. 4, it may be seen that the porcelain voltage tap receptacle is so constructed that the porcelain receptacle may be easily replaced without disturbing the condenser bushing in the apparatus.

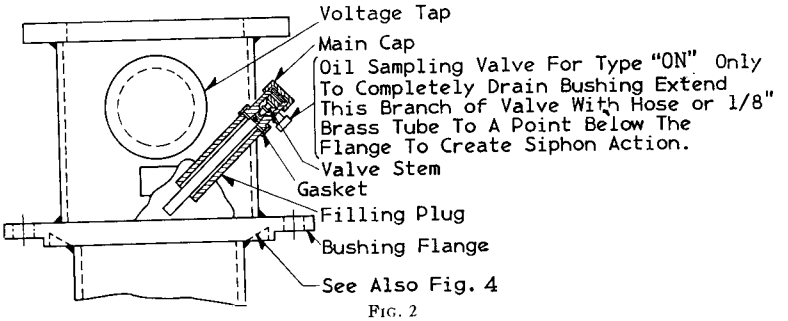


FIG. 2

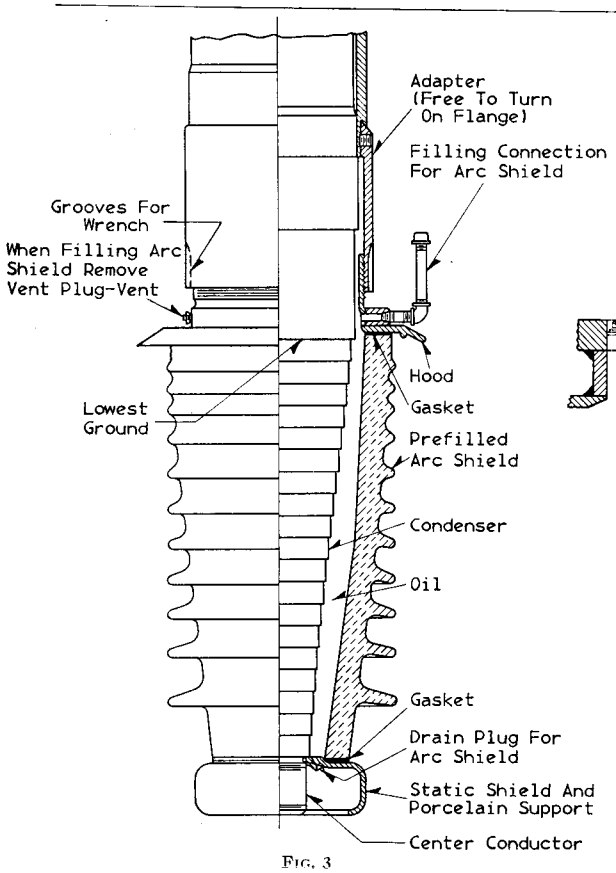


FIG. 3

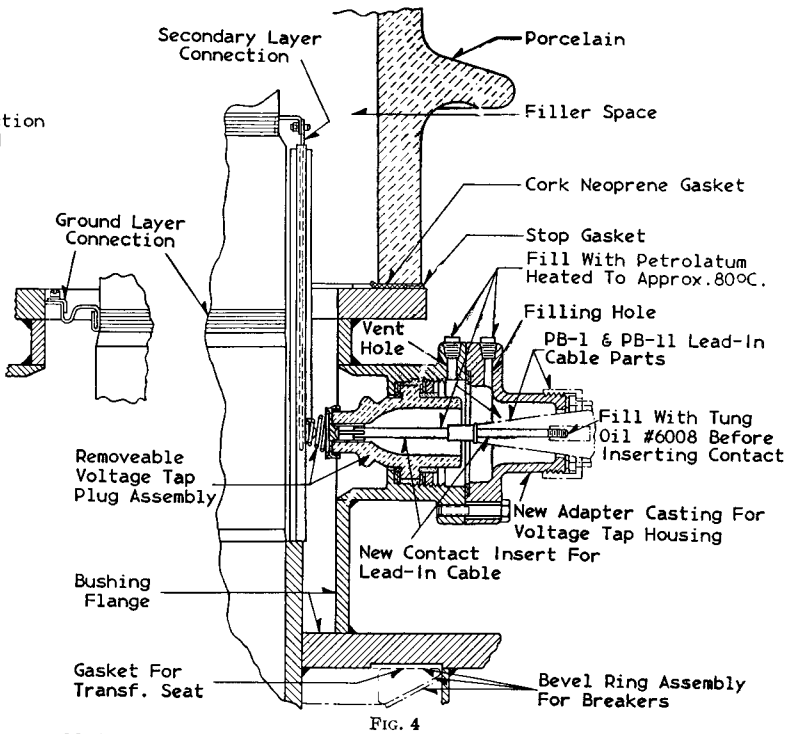


FIG. 4

Mechanical changes to connect the PB-1 or PB-11 network lead to the bushing two layer porcelain receptacle. (See instructions under Potential Device Connection and Adjustment.)

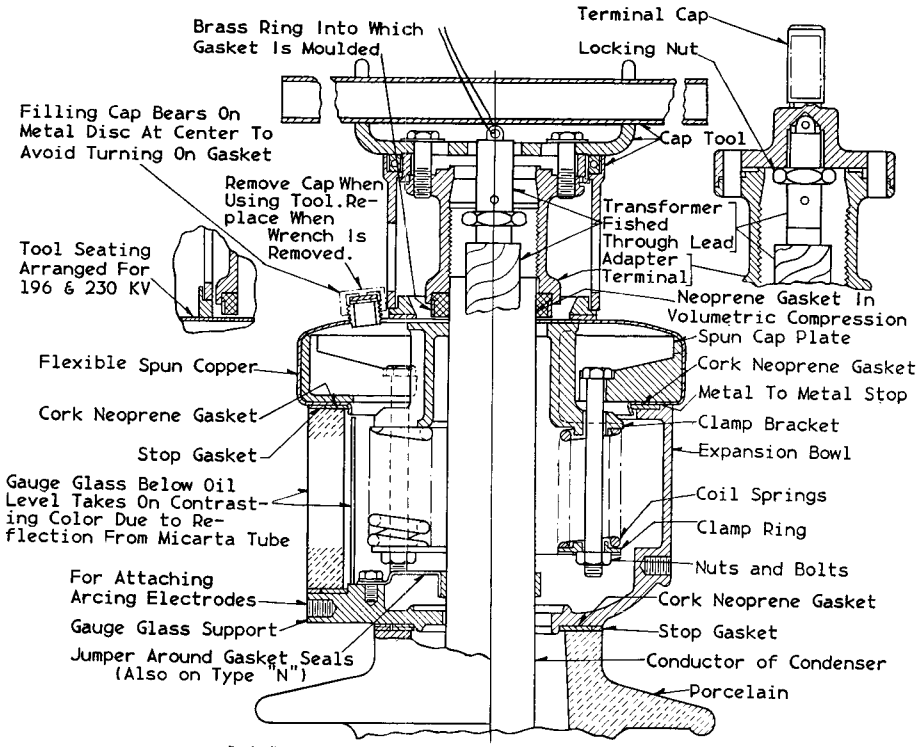
1—Unscrew the present contact insert from the cable lead, place sufficient tung oil #6008 inside the opening so that it will be entirely full when the new long contact insert is in position. Place new gasket coated with #7247 cement over long contact insert and screw in to end of cable as shown. Open slots in end of contact insert if necessary for good contact.

2—Bolt new adapter casting to the bushing with a new gasket coated with gasket cement #7247 between the two parts.

3—Insert network lead into bushing receptacle and connect by screwing the lead union on the end of the adapter casting with a new gasket coated with #7247 cement between the two parts.

4—Fill the chamber in the assembly with petrolatum sufficiently warmed to flow into the tapped holes and parts of the chamber.

5—When it is known that the type "N" or "ON" bushings are being used for spare or replacements for bushings with one layer tap these parts are furnished.



Left Side shows Type "ON"; Right Side shows Type "N"

FIG. 5