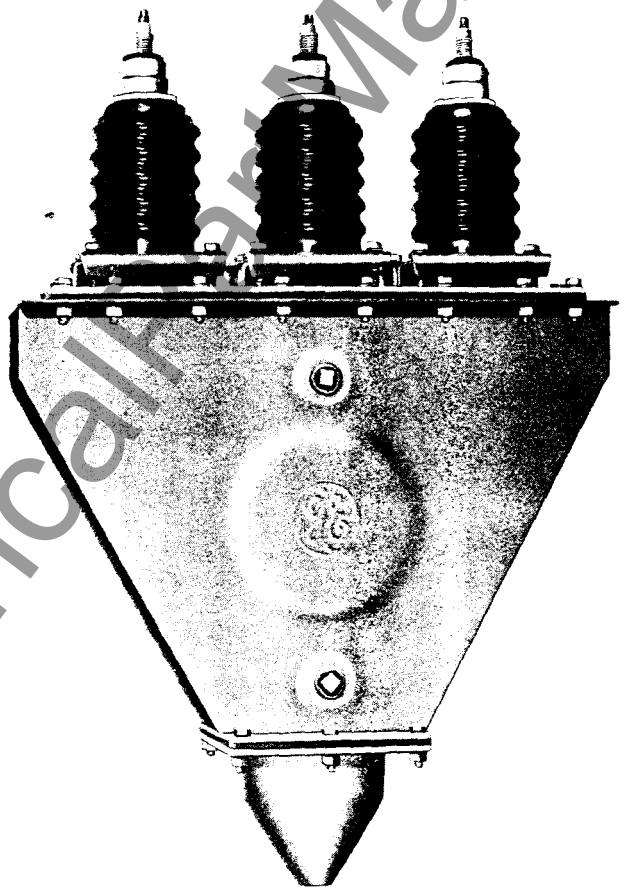
INSTRUCTIONS

GEI-28838D

INSTALLATION OF PRIMARY CABLES IN METAL-ENCLOSED SWITCHGEAR



MEDIUM VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

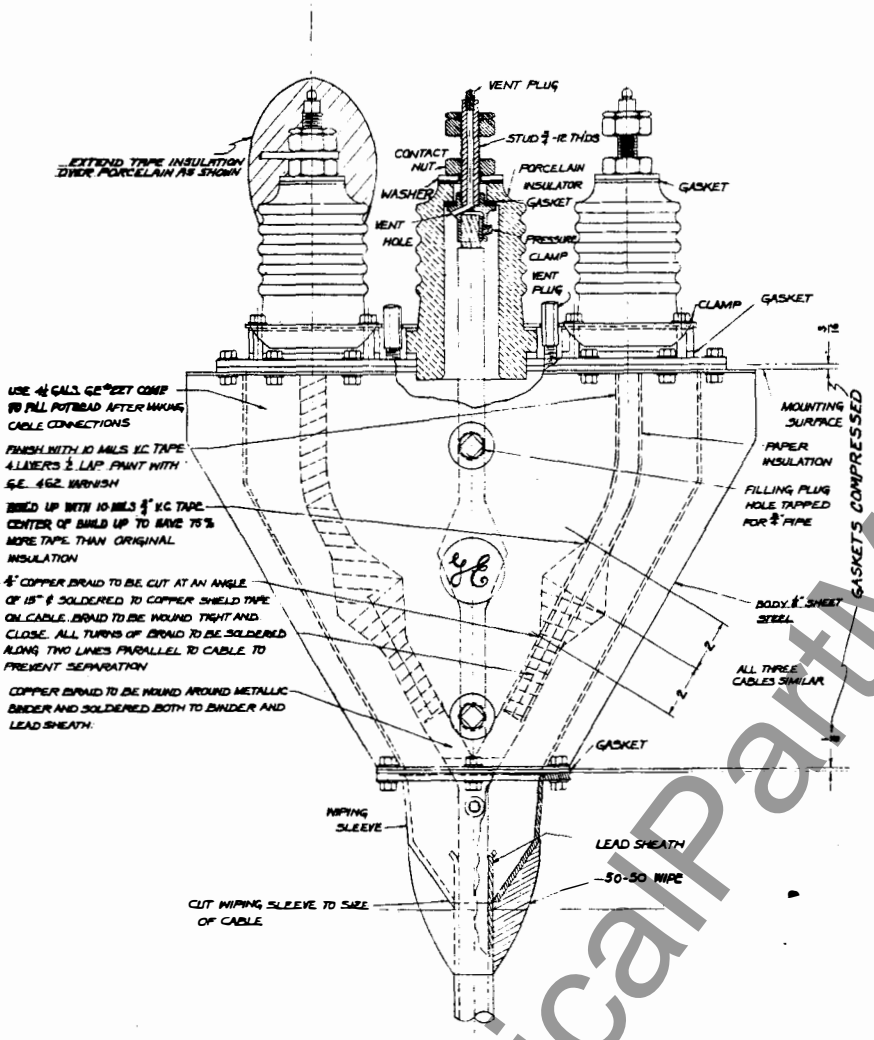


Fig. 1 (T-6595322)

Fig. 19 (K-6006614)

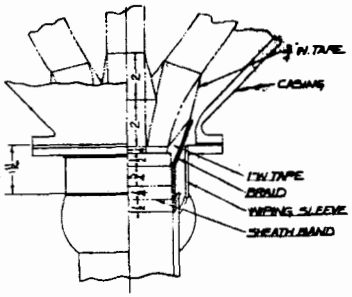
Cover (8006225)

Fig. 20 (4144757)

FOR BELTED CABLE

APPLY ¾" TAPE IN TIGHTLY DRAWN WRAPPINGS ON EACH CONDUCTOR IN THE REGION OF THE CABLE CROTCH, AS INDICATED ON THE DRAWING. THE AXIAL DIMENSIONS FOR THE REINFORCEMENT ARE INDICATED. THE MAXIMUM THICKNESS OF THE APPLIED TAPE SHOULD EQUAL APPROXIMATELY THAT OF THE ORIGINAL CONDUCTOR INSULATION. AFTER COMPLETION OF THE INDIVIDUAL REINFORCEMENTS, APPLY 1" WIDTH TAPE OVER THE THREE CONDUCTORS FORCED TOGETHER IN THE CROTCH REGION

SHIELD A PORTION OF THE OVER-ALL REINFORCEMENT AS INDICATED. TRIM ONE END OF THE COPPER BRAID TO AN ANGLE APPROXIMATELY 15 DEG. AND LAY IT ON THE SHEATH BAND WITH THE CUT EDGE TOWARD THE SHEATH. SOLDER IT TO THE SHEATH. THEN COVER THE SHEATH BAND, EXPOSED BELT INSULATION, AND THE ADJACENTLY TAPERED SURFACE OF OVER-ALL REINFORCEMENT, WITH A SINGLE LAYER OF TIGHTLY DRAWN BUTT WRAPPINGS OF BRAID AS SHOWN. SOLDER TOGETHER ALL TURNS ON OPPOSITE SIDES OF THE CABLE, AND TERMINATE THE BRAID BY CUTTING ½" BEYOND A SOLDERED POINT. THE LOOSE END OF THE BRAID SHOULD BE TURNED BACK AND SOLDERED TO THE PRECEDING TURNS SO THAT NO FRAYED ENDS OF COPPER EXTEND OVER THE VARNISHED CLOTH.



METHOD OF STRESS RELIEF FOR BELTED LEADED CABLE

NOTE
PHASE ROTATION TO BE CHECKED BEFORE CONNECTING TO POTHEAD TERMINALS

Fig. 1 G.E. Triple-Conductor Pothead Assembly

INSTALLATION OF PRIMARY CABLES IN METAL-ENCLOSED SWITCHGEAR

INTRODUCTION

Before any primary cable connections are made, the cables should be identified to indicate their phase relationship with the switchgear connections. This is necessary to insure that the connections are made so that motors will rotate in the proper direction, and the phase rotation is the same when tying two different sources of power together.

There are two common methods of making primary cable connections:

(a) Potheads, Figs. 1 and 20 are used when it is desired to hermetically seal the end of the cable to make a moisture proof connection between the cable and the switchgear copper. A pothead also prevents seeping of oil from the end of oil impregnated varnished cambric or paper insulated cable.

(b) Clamp type terminals and wiping sleeve or cable clamp.

In all cases carefully follow the cable manufacturer's recommendations for installation of the type of cable being used, as well as the instructions contained herein.

INSTALLATION

The following description applies to the installation of a three-conductor lead-sheathed cable with a wiping sleeve cable entrance fitting on the pothead. This is the type most generally used. Instructions for installation of other types are included in the text following:

(a) Remove the wiping sleeve and cut the tapered end at a point where the cable will enter it freely, and file off sharp edges. Temporarily reassemble on the pothead.

(b) Train the cable in front of the pothead allowing it to extend about two inches above the top of the porcelain bushings. Handle with care and avoid sharp bending which might damage the insulation. Mark a point on the lead sheath of the cable about 1-1/2 inch above the bottom of the wiping sleeve.

Fig. 2 (8001619)

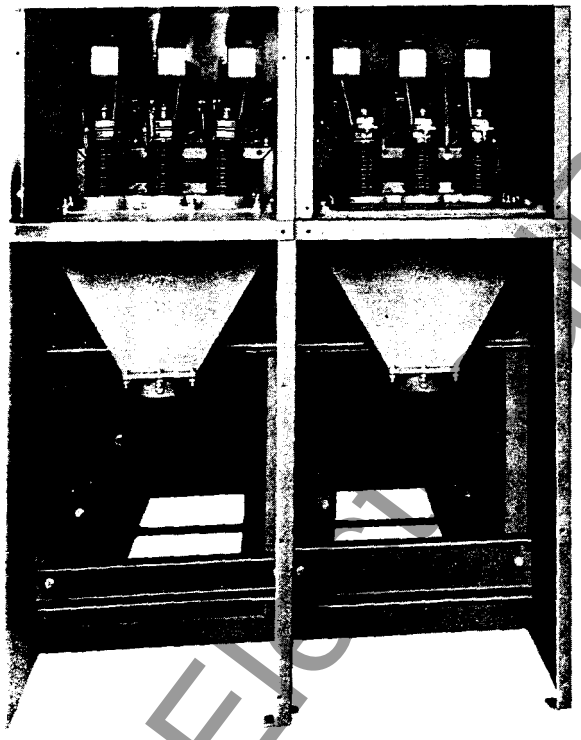


Fig. 2 G-E Potheads Mounted

Fig. 3 (8008094)

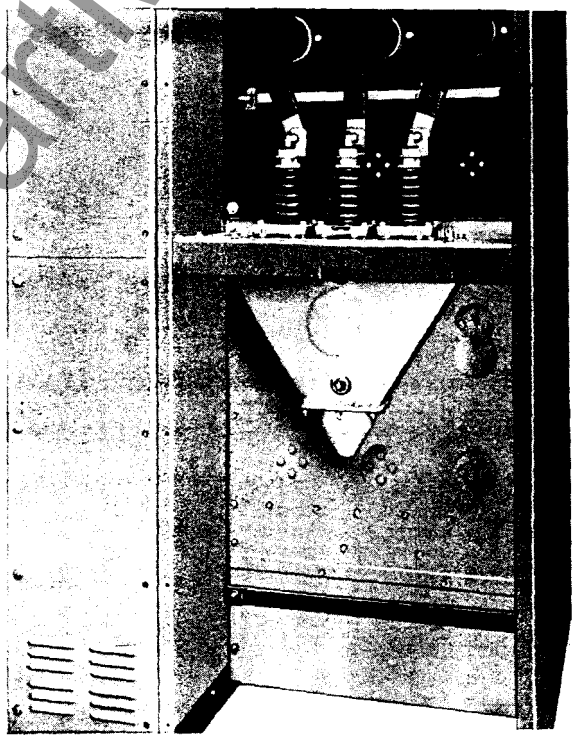


Fig. 3 G-E Potheads Mounted

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

(c) Remove the pothead from the unit, disassemble the wiping sleeve and slip it and its gasket over the cable as shown in Fig. 4.

(d) Remove the lead sheath from the cable to the point marked in operation "b" as shown in Figs. 5 and 6 proceeding as follows:

First, make a cut around the cable half through the sheath at the reference point. Second, split the sheath lengthwise between the cut and the cable, holding the cutting tool at an angle to the cable radius to avoid damaging the insulation. Third, remove the sheath by catching the split edge with pliers and pulling directly away from the cable axis.

Clean and tin the outside of the lead sheath for about 3 inches and bell out the end of the lead sheath.

(e) Remove the belt and interphase insulation down to within 1-1/2 inches of the lead sheath as shown in Fig. 7. The last few layers should be torn off to avoid damaging the individual conductor insulation. To reinforce and protect the conductor insulation, wrap two layers of half lapped varnished cambric tape over the factory insulation.

(f) Disassemble insulator support plate from pothead body. The insulator should not be removed from the support plate because they are factory assembled for proper compression of their gaskets. Place pothead body over cable and then fan out the conductors into approximately the final position, as shown in Figs. 8 and 9. The middle conductor should be bowed slightly for final adjustment of length. Avoid sharp bends and damage to the insulation, particularly at the crotch.

(g) For system voltage above 7500 volts it is recommended that stress relief cones be built up when single-conductor or three-conductor shielded cable is used. Construct stress relief cones in accordance with the recommendations of the cable manufacturer. See Fig. 1 for one recommended method. On lower voltage cables, belling out the end of the lead sheath ordinarily provides sufficient stress relief. (Stress cone material will not be furnished with pothead).

(h) Bolt pothead body to metal-clad adapter plate. Shape conductors into final position, then cut off each conductor to fit its terminal.

(i) Remove pothead terminals from insulators. Remove two inches of insulation from the end of each conductor and assemble pothead terminals to cables.

(j) Assemble gaskets where shown in Fig. 1 and bolt insulator support plate and wiping sleeve to pothead body. Compress gaskets by a partial turn on each bolt successively until the gasket is uniformly compressed to dimensions shown in Fig. 1. Check to be sure the terminal studs are seated properly on their gaskets, then screw contact nut in place after assembling top gaskets and washers. See Figs. 9, 10 and 11.

Fig. 4

Fig. 5

Fig. 4 (857623)
Fig. 5 (857622)

Fig. 6

Fig. 7

Fig. 6 (857621)
Fig. 7 (857618)

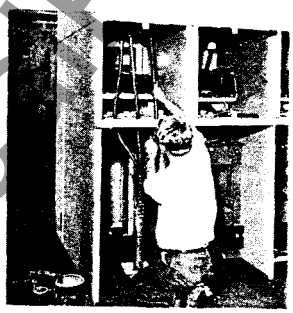


Fig. 8

Fig. 9

Fig. 8 (857611)
Fig. 9 (857606)

Fig. 10

Fig. 11

Fig. 10 (857619)
Fig. 11 (857610)

(k) Make a plumber's wiped joint between the wiping sleeve and the lead sheath of the cable, as shown in Figs. 12 and 13.

(l) Remove the 3/4" filling plug in the pothead body, the pipe plugs in the top of the studs and in the insulator support plate. Insert a stand pipe and funnel in the filling hole of sufficient height to extend above the top of the studs as shown in Fig. 14.

Fig. 12 (857609)
Fig. 13 (857604)

Heat #227 compound to the pouring temperature, 165 C. Do not overheat compound as higher temperatures may injure cable insulation and also result in excessive shrinkage of the compound while cooling. Before and while filling, warm pothead body and stand pipe to prevent sudden chilling of compound which may result in the formation of air voids. The pothead may be warmed by playing a blowtorch over the body, taking care that no direct heat reaches the porcelains or gaskets.

Pour until the compound appears at the insulator support plate plug holes. Insert plugs and continue filling until it appears at holes at the top of terminal studs. Insert plugs and continue pouring while the pothead and compound cools to fill air voids which might form.

Fig. 14 (857607)
Fig. 15 (857608)

When the pothead has cooled, remove filling pipe and insert plug. Clean off compound which might have overflowed on the outside of the porcelains.

(m) Assemble pothead connection bars (see Fig. 15), and insulate connections as follows:

(1) Fill all cavities around bolts and nuts with Duxseal compound to form smooth surface for taping, thus preventing air voids. This compound is not an insulating medium and should not be used for that purpose.

(2) Wrap with insulating tape provided, as shown in Fig. 19, the number of layers depending on the voltage rating of the equipment and the type of tape used. Where there are sharp angles, apply additional layers to obtain the equivalent of the insulation of the flat surfaces.

(3) Over the insulating tape, apply one layer of white cotton tape, half lap, as a binder.

(4) Over the white cotton tape, brush a good coat of G. E. Glyptal* varnish (#1201 Red for 15 KV and #462 Black for 5 KV).

Single-Conductor Potheads

The procedure for installation of single-conductor potheads is in general the same as described for three-conductor potheads. Refer to Fig. 20.

* Reg. Trade-Mark of General Electric Co.

Fig. 12

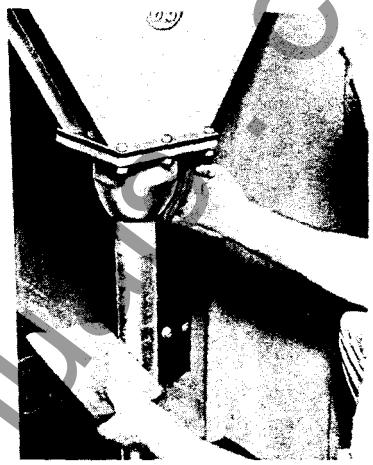


Fig. 13

Fig. 14

Fig. 15

Cable Entrances Other Than Wiping Sleeve

Stuffing box cable entrance fittings, Fig. 16, are used for nonlead-covered cable, and are installed as follows: Assemble stuffing box in pothead. Wrap graphite cord packing around the cable and compress by screwing the gland nut into the stuffing box.

A combination clamping ring and stuffing box is sometimes furnished instead of a wiping sleeve for lead-covered cables. This fitting is installed as follows: Wrap graphite cord packing around cable and compress by screwing gland nut into stuffing box. Bell over lead sheath and notch the edges to expose screw holes. (Note the openings in the fitting below the notches, which permit compound to reach the sheath and seal any splits which might occur while belling over and notching).

Clamp lead sheath with ring and trim off sheath smoothly. Leave about 1-1/2 inch of belt insulation above the clamping ring.

Cable Sheath Grounding

Where three-conductor, lead-sheathed cables are installed, it is advisable to ground the sheath directly to the ground bus in the switchgear. Where single-conductor lead-sheathed cables are used, the same procedure may be followed except that only one end of the cable sheath should be grounded.

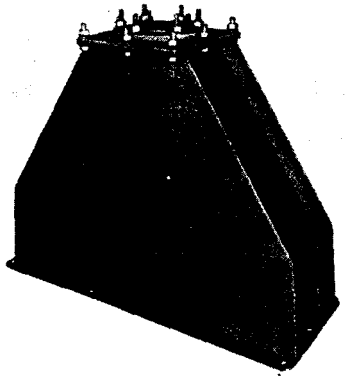
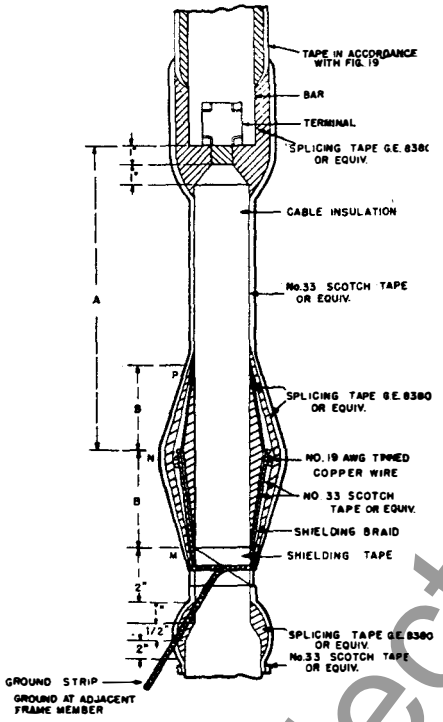


Fig. 16 Stuffing Box (with or without Clamping Ring)



Rated kv Phase to Phase	Dimensions in Inches	
	A	
	Indoors Dry Locations	B
2 to 5	5	2
6 to 10	9	3
11 to 15	13	4

Fig. 17 Termination Non-Leaded Cable Single Conductor

TERMINATION NONLEADED CABLE SINGLE-CONDUCTOR

1. Cut cable to proper length.

2. Remove jacket and cable tape for distance of A plus B plus 3 inches, plus length to be inserted into terminal lug.

3. Unwrap shielding tape to point M, cut and solder it in place avoiding excessive heat on insulation. Remove outer semi-conducting tape for same distance. Thoroughly clean surface from which the semi-conducting tape was removed.

4. Remove insulation and inner semi-conducting tape to expose conductor for distance of one inch plus length to be inserted into terminal lug.

5. Attach terminal lug to conductor.

6. Taper insulation for one inch as shown.

7. Apply end seal. Clean surface over which splicing tape is to be applied and coat with G.E. No. A50P68 adhesive cement or equivalent. When solvent evaporates, build up with splicing tape GE8380 or equivalent, as shown.

8. Build stress cone. Clean cable surface and coat with G.E. No. A50P68 adhesive cement or equivalent. When solvent evaporates, build up cone with splicing tape GE8380 or equivalent, for length B plus B. Between points M and P, tape is applied so that wrapped thickness at N is equal to 75% of the original insulation thickness - and so that the cone tapers to zero thickness at points M and P. Apply one layer No. 33 Scotch tape or equivalent, half lapped. Obtain a smooth wrapping but do not stretch tape more than necessary.

9. Pass a turn of tightly drawn braid around exposed portion of shielding tape at point M and solder in place. Then apply shielding braid in tightly drawn 1/16 inch lap wrappings to point N and spot solder Terminate the braid by cutting 1/2 inch beyond soldering point. Turn down and solder loose ends to preceding turns. Wrap four to six turns of No. 19 AWG tinned copper wire around shielding braid and solder. Solder all turns of braid together along three lengthwise lines equally spaced around braided surface.

10. Solder-attach ground strip over shielding tape near cable covering. Cover stress cone with one layer No. 33 Scotch tape, half lapped. Obtain a smooth wrapping but do not stretch tape more than necessary. Add two layers of splicing tape.

11. Pencil jacket for 1/2 inch as shown. Clean surface. Tke particular care in cleaning outside jacket surface in order to entirely remove black wax finish. Coat with G.E. No. A50P68 adhesive cement or equivalent. When solvent evaporates, apply splicing tape GE8380 or equivalent and make sheath seal as shown on drawing. Apply one layer No. 33 Scotch tape or equivalent, half lapped. Obtain a smooth wrapping but do not stretch tape more than necessary.

12. Over entire termination, apply two layers of No. 33 Scotch tape or equivalent, half lapped, in manner to shed water. Obtain a smooth wrapping but do not stretch tape more than necessary.

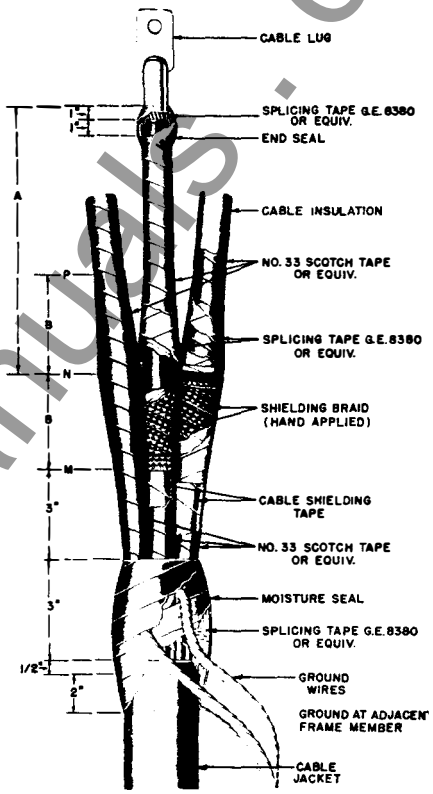


Fig. 18 Termination Non-Leaded Cable Multi Conductor

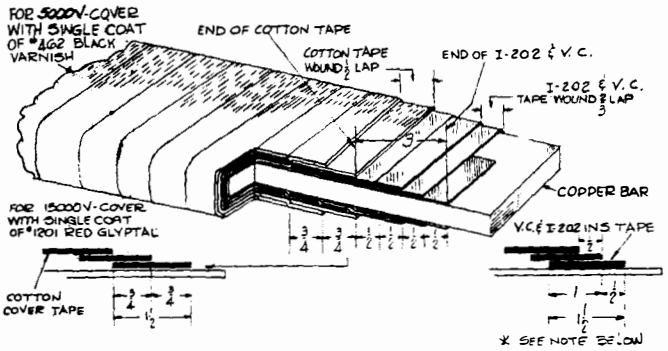
TERMINATION NONLEADED CABLE MULTI-CONDUCTOR

Make termination as indicated for single-conductor except - substitute the following for paragraphs 10, 11 and 12.

Pencil Geoprene jacket 1/2 inch. Clean surface over which sheath moisture seal is to be applied. Take particular care in cleaning outside jacket surface in order to entirely remove black wax finish. Coat with G.E. No. A50P68 adhesive cement or equivalent. Allow to dry. Apply splicing tape GE8380 or equivalent to make moisture seal as shown. This is done by starting wrapping tape near end of jacket and wrapping over ground wires for 1-1/2 inches. Bend ground wires out and back over taping just applied and continue applying lapped layers of tape to completion of moisture seal including a complete tape seal in crotch formed between the three conductors. Bond and ground the ground wires.

For a multi-conductor cable not having ground wires, the individual terminations should have grounding strips applied as for a single-conductor termination. These grounding strips are to be joined together to a common ground. This common ground must then be grounded.

Fig. 16 (8004788)
Fig. 17 (B-230046-C)
Fig. 18 (B-232004-C)



INSULATION LEVEL	INSULATION LAYERS		
	V.C.	COTTON TAPE	I-202
5000 V.	4	1	2
15000 V.	7	1	4

NOTE FOR VARNISHED CAMBRIC

V.C. IS BLACK VARNISHED CLOTH (CAMBRIC) TAPE #992 WIDTH 1½" THICKNESS 0.012 COTTON TAPE IS WHITE G.E. A12A1D10 WIDTH 1 1/2"

*ONE LAYER (WOUND 2/3 LAP) REQUIRES 3 TURNS AROUND BAR IN ONE WIDTH OF TAPE. THE THICKNESS OF ONE LAYER IS 3 TIMES THE THICKNESS OF THE TAPE.

NOTE FOR IRRATHENE

I-202 BLACK IRRATHENE TAPE WIDTH 1½" THICKNESS .010 COTTON TAPE IS WHITE G.E. A12A1D10 WIDTH 1½"

Fig. 19 Insulation of Connection Bars

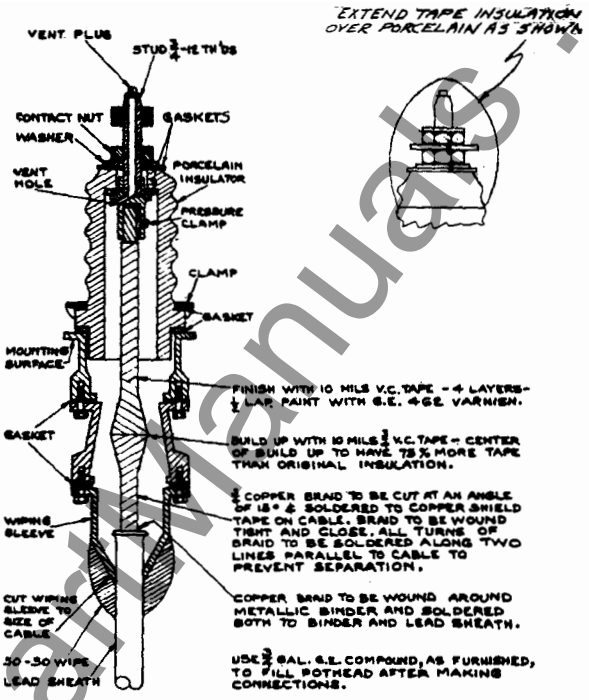


Fig. 20 Single-Conductor Pothead Assembly

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