INSTRUCTIONS

GEH-1802C
(SUPERSEDES GEH-1802B AND GEF-3837)

METAL-CLAD SWITCHGEAR

Types M-26 and M-36
For Magne-blast Air Circuit
Breaker Types AM-4.16 and
AM-13.8

MEDIUM VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

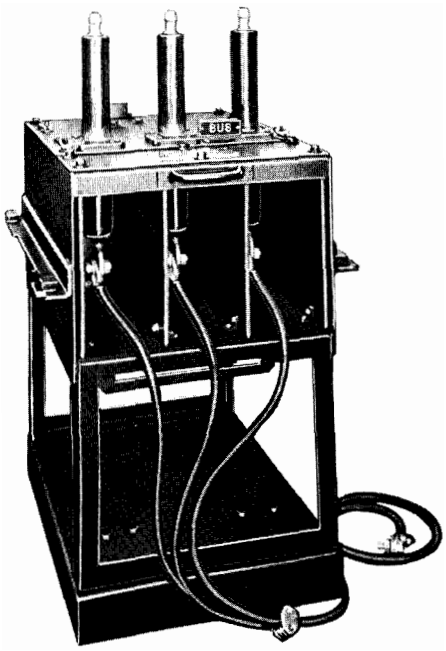


Fig. 13 Ground And Test Device
(Cable shown not furnished by G. E. Co.)

Fig. 14 Tandem Lock For Outdoor 13.8 Units

Fig. 13 (8004507)

Fig. 14 (8011450)

TANDEM LOCK (WHEN FURNISHED) FOR OUTDOOR UNITS

Outdoor metal-clad equipments with more than one unit may be provided with a tandem locking arrangement which makes it necessary to padlock only one door on each side. (In exceptionally long installations two or more locks may be required on each side). The unit containing the operating arm of the tandem lock is clearly marked on the drawings and also by nameplate on the equipment itself. Refer to Figure 14.

Before any door in the equipment can be opened it is necessary to open the padlocked door and operate the tandem locking arm to the open position. In locking the equipment the reverse procedure should be used.

Where it is desired to separately lock any particular door, the tandem lock can be disconnected in that unit by unbolting a connecting clip between the tandem bar and the locking bar, and a separate padlock used on that door.

The light switch, front and rear, will be located in the units with the tandem lock.

INSTALLATION

Before any installation work is done consult and study all drawings furnished by the General Electric Company for the particular requisition.

These drawings include arrangement drawings, wiring and elementary diagrams and a summary of the equipment. Mats, screens, railings, etc., which are external to the switchgear, but which may be required to meet any local codes, must be furnished by the purchaser.

LOCATION

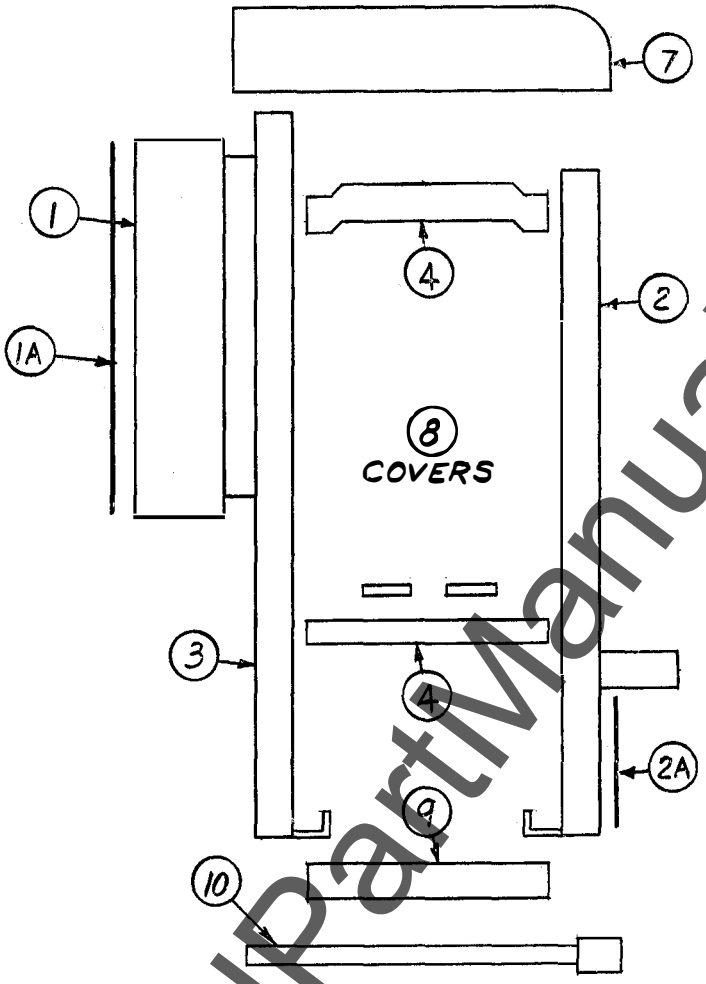
The recommended aisle space required at the front and at the rear of the equipment is shown on the floor plan drawing furnished for the particular requisition. The space at the front must be sufficient to permit the insertion and withdrawal of the circuit breakers, and their transfer to other units. The space at the rear must be sufficient for installation of cables, for inspection and maintenance, and on some equipments to draw out potential transformers.

PREPARATION OF FLOOR - ANCHORING

Indoor Equipment

The station floor must be strong enough to prevent sagging due to weight of the switchgear structure and to withstand the impact stress caused by the opening of the circuit breakers under short circuit conditions. The impact loading is approximately 1-1/2 times the static load.

INSTRUCTIONS FOR INSTALLATION OF TRANSITION



The transition section is removed from the metal-clad switchgear, assembled and shipped separately. Should the switchgear be positioned on its foundation prior to the power transformer, the complete transition can be mounted on the metal-clad as assembled. Remove covers #8 and apply Glyptal* varnish #1201 to gasket 2A before bolting transition to metal-clad throat. Before jacking the power transformer into its final location, apply Glyptal* varnish #1201 to gasket 1A and place over mounting studs on transformer tank wall. Slide transformer in place guiding the transformer mounting studs through the mounting holes in #1. Center rubber seal between #1 and #3 before tightening nuts, maintaining 24" between transformer tank wall and end of metal-clad.

If the power transformer and metal-clad switchgear are in place, disassemble transition as follows: Remove covers #8 and #9, adapter #1, dome #7, braces #4. Apply Glyptal* varnish #1201 to gasket #2A before bolting #2 to metal-clad throat. Apply Glyptal* varnish #1201 to gasket #1A and loosely fasten #1 and #1A to transformer tank. Slide throat of #3 into #1 and maintain approximately 4 1/2" from #3 to tank. Assemble braces #4 top and bottom to maintain size and proper alignment, then tighten #1 to transformer tank. Assemble copper, terminals, supports and complete all joints. Assemble dome #7, side covers #8 and bottom cover #9. Cut secondary conduit #10 to length and assemble under the transition.

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Suitable means must be provided by the purchaser for anchoring the equipment to the floor. It is essential that the floor be level to avoid distortion of the switchgear structure and the equipment be completely aligned prior to final anchoring. The recommended floor construction is shown in Figure 6. The floor channels must be level and straight with respect to each other. Steel shims should be used for final leveling of the switchgear if necessary. Care should be taken to provide a smooth, hard, and level floor under and in front of the units to facilitate installation and removal of the breaker. If the floor is not level and flush with the floor channels, it will be difficult to handle the breaker because it will not be level with respect to the stationary element.

Recommended practice is to weld the switchgear structure to the floor channels, using a tack weld at points indicated for anchoring on the drawing. If welding facilities are not available the gear should be bolted to the floor channels.

Provision should be made in the floor for conduits for primary and secondary cables, located as shown on the floor plan drawing furnished for the particular requisition. If desired, the conduits may be installed before the switchgear. Consideration should be given to conduits which might be required for future connections.

Fig. 15 (261C416)

Outdoor Equipment

Recommendations for the foundations for outdoor equipment are given in Fig. 7. Primary and secondary conduits should be installed in accordance with the requisition drawings, before the equipment is put into place.

Since outdoor equipments are provided with a 6" base a transfer truck is required to place the breaker in the housing. The level adjustment on the truck is shown on Fig. 7.

When outdoor equipments are shipped in more than one section, the joint in the roof between sections must be weatherproofed. Apply G. E. #1201 *Glyptal varnish to the gaskets which are furnished and assemble the gasket between the roof and roof cap and bolt together. See Figure 16. Joints between transformer throats and the switchgear should be weatherproofed in the same manner. Refer to Figure 15.

BREAKER REMOVABLE ELEMENT

Before installing or operating the removable element consult the circuit breaker instructions for directions on installation, adjustments and inspection. The operation of the interlock device is given below.

The elevating mechanism is accurately leveled and checked at the factory and should need no adjustment. Do not install or remove the breaker or make any adjustments unless the breaker is open.

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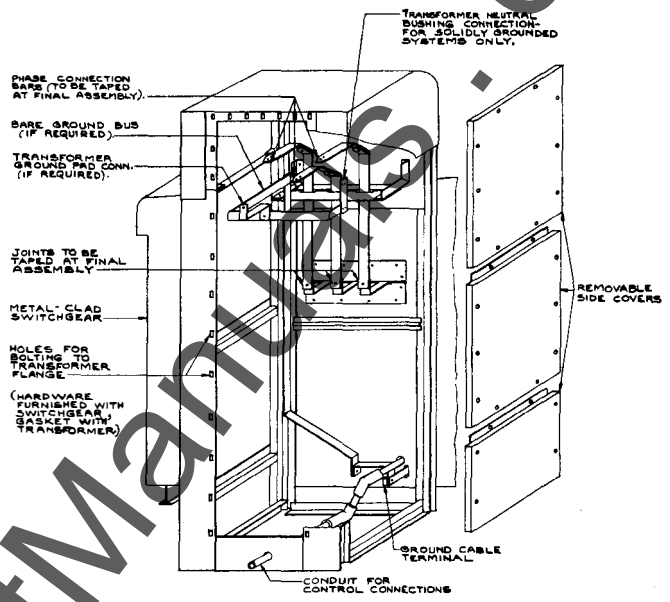


Fig. 15 Outdoor Transition Compartment

Rub a small amount of Contact Lubricant D50H28 on the silvered portion of the breaker studs to form a thin coating for contacting purposes.

Lower the elevating mechanism lifting brackets until the lifting brackets are in the fully lowered or test position. The breaker should then enter the housing freely. The lower limit switch can be adjusted, if necessary, to allow the breaker to enter the housing. Push the breaker into the housing until it rests against the stop at the rear of the elevating mechanism frame. The stop has been adjusted at the factory so that the breaker will be in the correct position relative to the lifting brackets. Raise the lifting brackets until the breaker is lifted clear of the floor. Check to see that the breaker is properly seated on the lifting brackets.

Carefully raise the breaker to the connected position where the breaker plate or support solidly meets the upper stop bolts on the frame and then lower and remove it from the unit. When elevating, note that breaker studs center with respect to the stationary disconnecting device or injury to the contacts may result.

Inspect the contact surfaces of both the breaker studs and the stationary disconnecting devices.

(a) Each segment of the stationary disconnecting device should make a heavy impression in the Contact Lubricant D50H28 on the breaker studs.

(b) The wipe of the breaker stud inside the stationary disconnecting device, as indicated by the Contact Lubricant D50H28, should be 7/8". This indicates that the breaker studs contacted at the full pressure center of the silver band on the stationary disconnecting device. The maximum permissible variation in the wipe is 3/32".

(c) Should the inspection of the contacts show that the breaker is not being raised to the proper position readjust the upper stop bolts and limit switches to raise or lower the breaker to the proper location. Lock the stop bolts in the new position.

(d) If proper contacting cannot be attained by the above methods, it is necessary to adjust the stationary disconnecting device tube. DO NOT MAKE ANY ADJUSTMENT. COMMUNICATE WITH THE NEAREST GENERAL ELECTRIC CO. OFFICE FOR ADDITIONAL INFORMATION.

The trip interlock, see Figure 4, should be checked to see that the breaker cannot be raised to or lowered from the operating position unless the breaker has been tripped.

The breaker is provided with an arm which is pushed forward or pulled back when the breaker is open or closed. This arm engages and holds a vertical bar when pulled back (breaker closed) and prevents the clutch being pulled forward to engage the motor. When the breaker has been tripped the clutch can raise the vertical bar and engage the motor. A limit switch on the vertical bar closes the electrical circuit to the motor, if the elevating control selector switch has been turned to either "raise" or "lower". Refer to Fig. 17.

TESTING CABINET

The testing cabinet, Figure 19, should be installed on the wall at a location where maintenance and testing of the breaker can be conveniently done. Conduits must be installed to carry cables to supply control power for testing.

ADDITION OF UNITS TO EXISTING EQUIPMENT

Figure 16 indicates the special procedures involved to add new metal-clad units to an existing equipment. Otherwise the installation procedure is the same as described above.

CONNECTIONS

BUS BARS

Where bus bar connections are made to join groups or separate units together, proceed as follows:

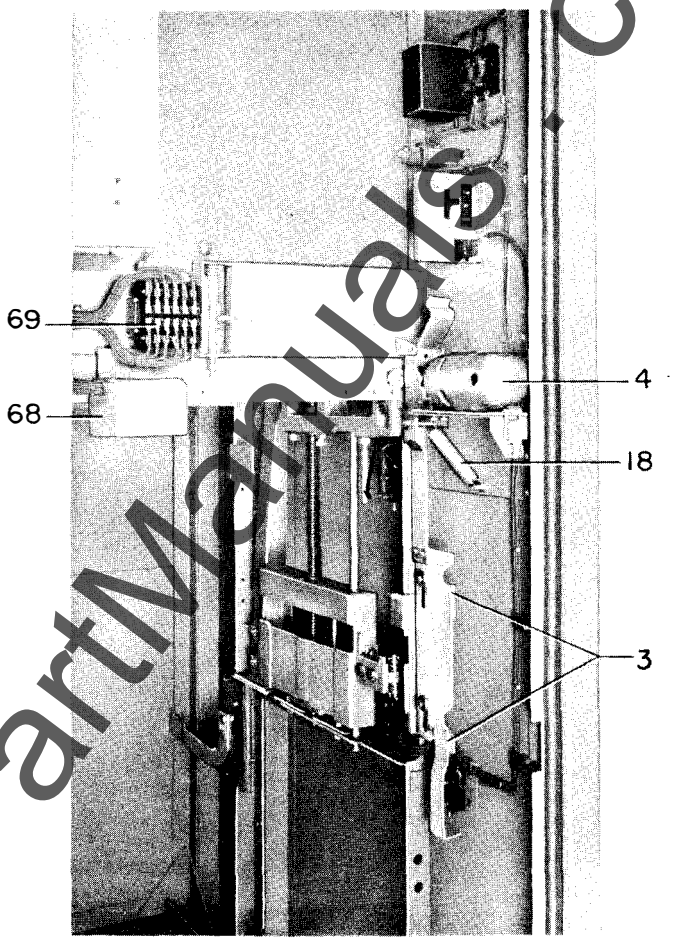


Fig. 17 (8020156)

Fig. 17 View Showing Elevating Mechanism Motor and Control Unit

TABLE A

Torque Values for Metal-clad Switchgear

(Torque in Inch-Pounds)

Bolt Size	Copper or Steel	Aluminum or Compound
3/8"-16	180-300	180-240
1/2"-13	360-540	360-480
5/8"-11	420-600	420-540

Fig. 18

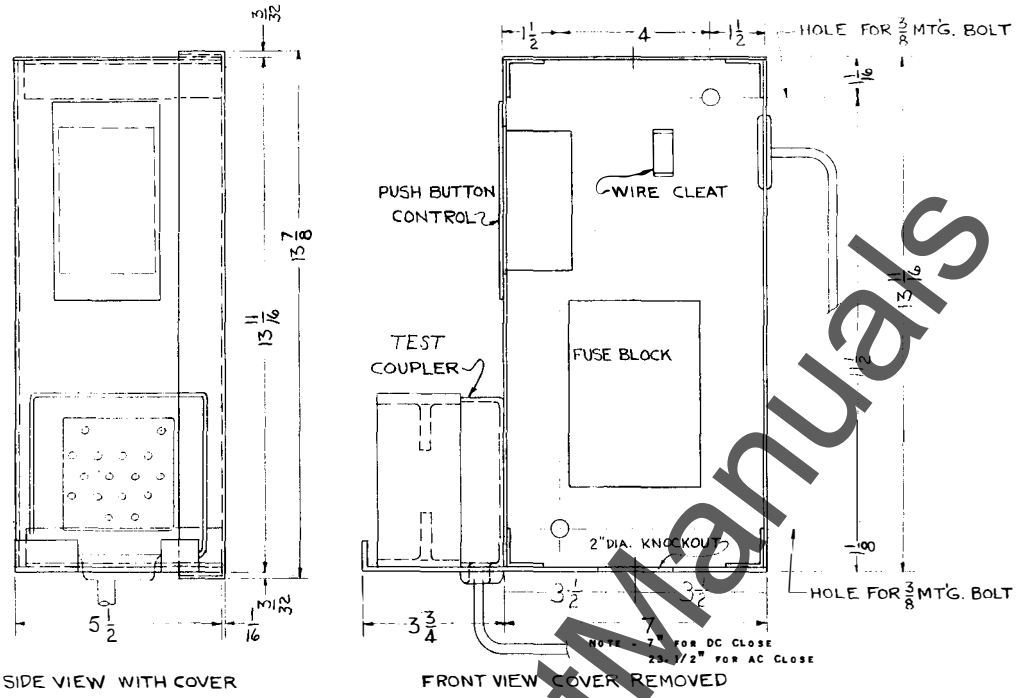


Fig. 19 (K-6515226)

Fig. 19 Inspection Box for 13.8 KV Metal-clad Switchgear

(a) Remove compartment covers.

(b) Bolt splice plates and bus bars together, see Figure 20 and Table A, Fig. 18. Clean silvered contacts with silver polish. Be sure all polish is removed. Do not use sand paper.

(c) Complete the taping of the vertical riser bars using varnished cambric tape (2/3 lap) stopping the tape at the bus bar. If the riser bars connect to the bus from below, sufficient tape should be added to prevent compound leakage when filling. Apply a layer of cotton tape (1/2 lap) over the varnished cambric tape, stopping the cotton tape just inside molded splice cover.

(d) Place molded covers around the bolted splice joints. Note that compound filling space is at top of joint, and add filler pieces furnished for the purpose to the bottom of box and around bus bar laminations (Fig. 20) to prevent compound leakage while filling. Duxseal should be placed over the joints to make the box free of leaks while filling. The Duxseal should be removed after the compound has set. G. E. #860 cord should be used to hold the molded parts securely in place.

(e) Heat G.E. #1347 compound (furnished) to minimum 200°C and maximum of 220°C. Avoid overheating the compound for the dielectric strength may be seriously affected. Pour the compound into the molded covers intermittently, allowing an interval of cooling to prevent formation of gas or

Fig. 20 (K-650903)

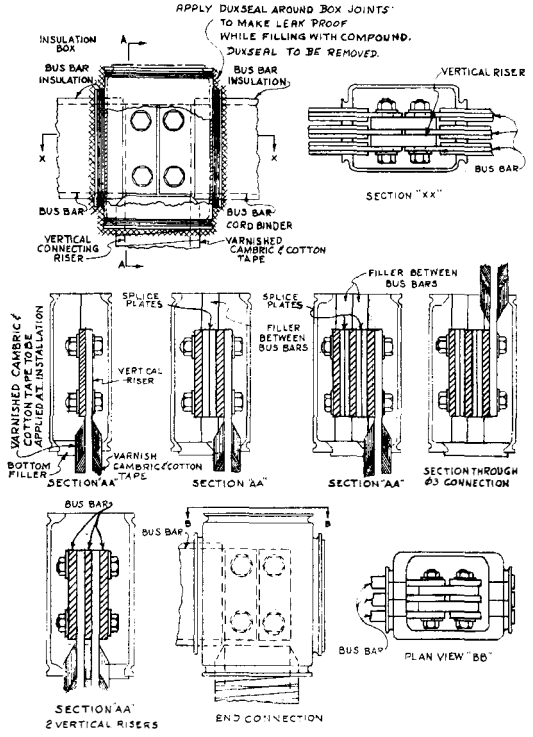


Fig. 20 Method of Making Bus Bar Connections

air pockets. The final pouring should be level with the top of the box and should be done only after due allowance for shrinkage is made. Refer to Figure 11.

(f) Paint the exposed cotton tape on vertical riser bars with G. E. #1201 varnish.

(g) In unit substations, the connection bars should be assembled in the transition compartment (Fig. 15) and the connections at the transformer terminals taped and painted as indicated above. The conduit for secondary circuits should also be assembled in the transition compartment.

PRIMARY CABLES

The primary cable connections in indoor switchgear are reached by removing the rear bolted covers. In outdoor switchgear the hinged instrument panel, if present, must be swung open and the bolted covers behind it removed.

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 motors will rotate in the proper direction, and that the phase rotation is the same when interconnecting two different sources of power.

There are two common methods of making primary cable connections:

(a) Potheads, see Figures 34 and 36, 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 varnish 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, see Figs. 37 and 38.

POTHEADS

Potheads are mounted on an adapter plate extending across the width of the metal-clad unit as shown in Figure 8. The adapter plate is split into two parts to facilitate the installation of the potheads. The potheads will usually be shipped arranged for cables to enter from below; however, the steel and copper are usually interchangeable for the potheads arranged for cable entrance from above.

Three Conductor Potheads

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 from the pothead and cut the tapered end at a point where the cable will enter it freely, and file off sharp edges. Tin the sleeve by applying flux and dipping in hot solder. Temporarily assemble the wiping sleeve and gasket 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. When training the cable 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 inches above the bottom of the wiping sleeve.

(c) Remove the pothead from the unit, and slip the wiping sleeve and its gasket over the cable as shown in Figure 21.

(d) Remove the lead sheath from the cable to the point marked in operation "b" as shown in Figures 22 and 23 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 Figure 24. 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.

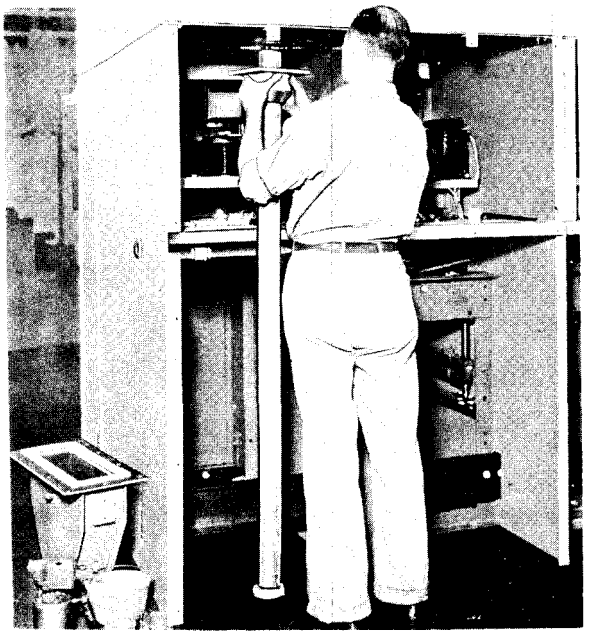


Fig. 21 (857623)

Fig. 21 Slipping Wiping Sleeve and Gasket Over Cable

Fig. 22 (857622)

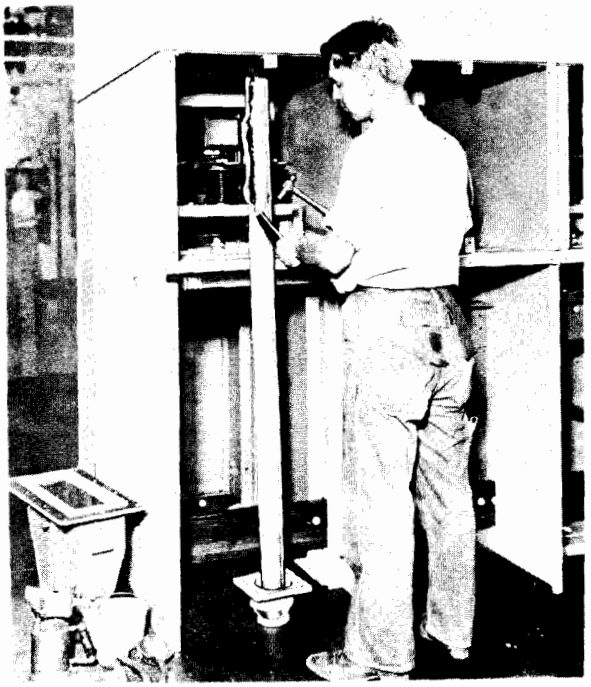


Fig. 22 Second Step in Removing Lead Sheath

Fig. 23 (857621)

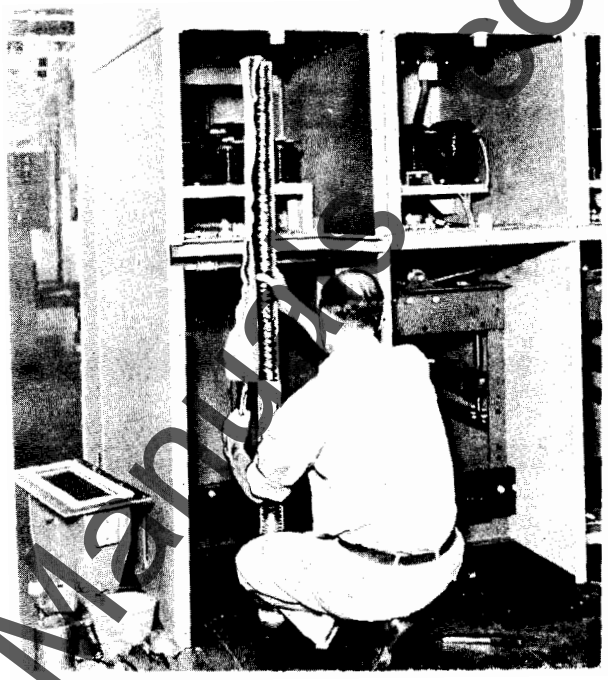


Fig. 23 Third Step in Removing Lead Sheath

Fig. 24 (857618)

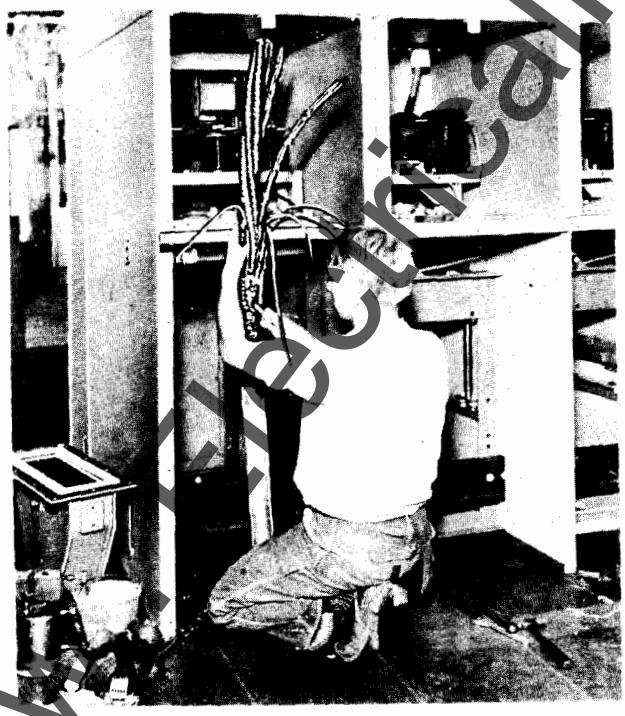


Fig. 24 Removing Belt and Interphase Insulation

Fig. 25 (857611)

Fig. 25 Approximating Final Position

(f) Place pothead body over cable and then fan out the conductors into approximately the final position, as shown in Figs. 25 and 26. 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 Figure 21 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 conductor into final position then cut off each conductor to fit its terminal.

(i) Remove 2 inches of insulation from the end of each conductor and assemble pothead terminals as shown in Fig. 27. Potheads are furnished with standard cable solderless lugs.

(j) Bolt insulators and support and wiping sleeve to the pothead body. Thoroughly clean all gaskets and gasket surfaces. Cement all gaskets with G.E. Glyptal #1201 varnish. Compress gaskets by a partial turn on each bolt successively until the gasket is

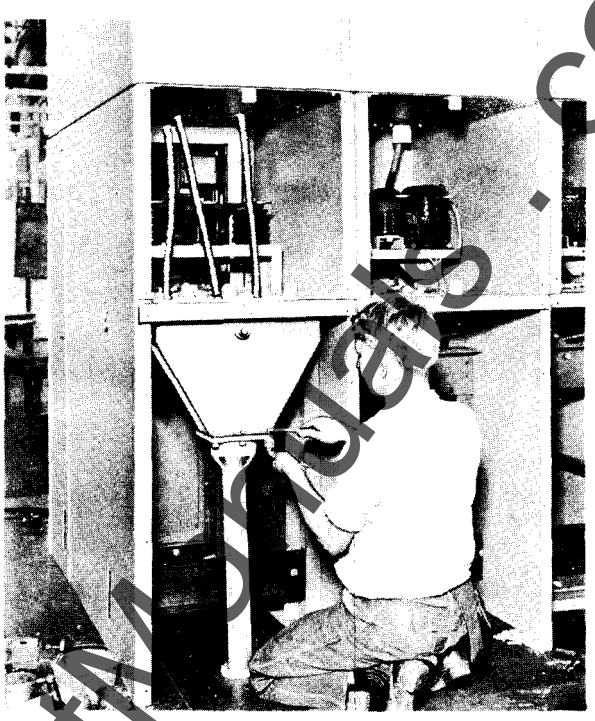


Fig. 26 (857606)

Fig. 26 Bolt Wiping Sleeve to Pothead Body

Fig. 27 (857610)

Fig. 27 Tightening Contact Nut

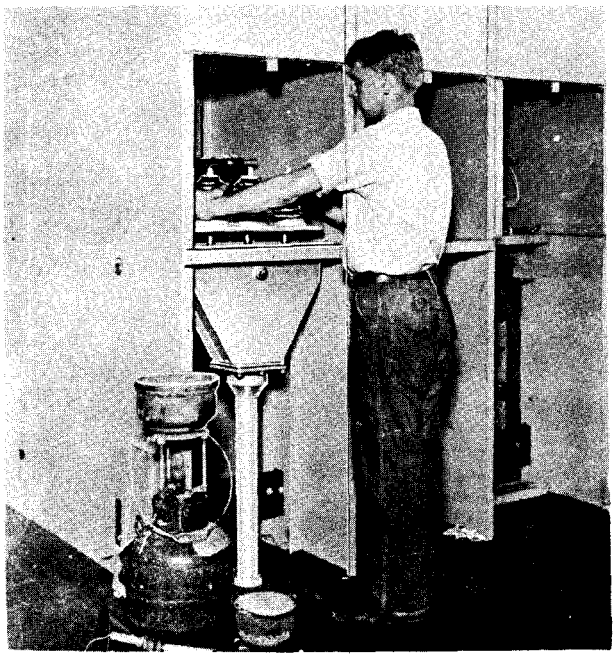


Fig. 28 (857619)

Fig. 28 Checking Terminal Stud Seating

Fig. 29 (857609)

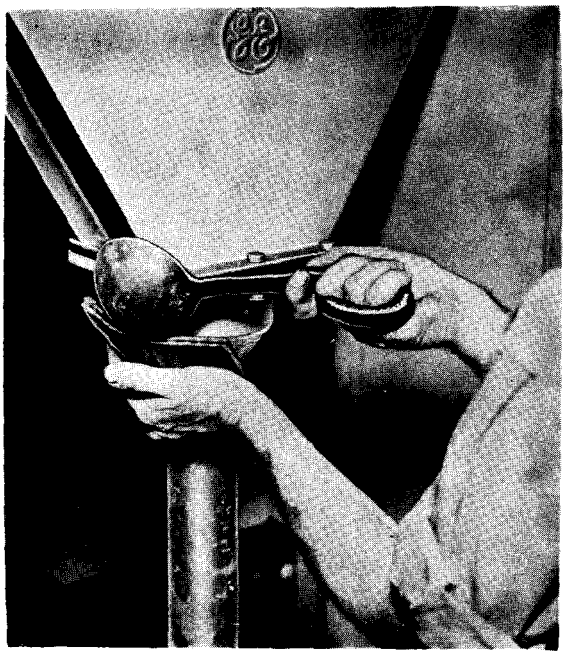


Fig. 29 Pouring Wiped Joint

Fig. 30 (857604)

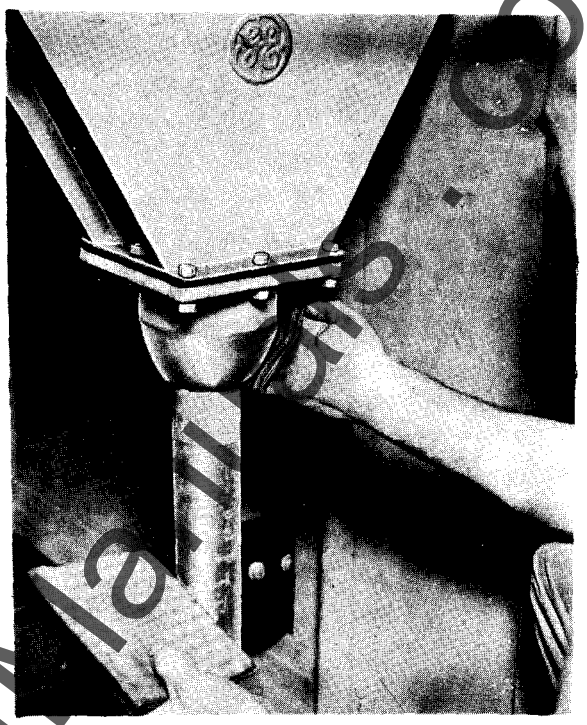


Fig. 30 Wiping Bell to Lead Covered Cable

uniformly compressed forming a tight joint. Check to be sure the terminal studs are seated properly on their gaskets then screw contact nut in place. See Figures 27 and 28.

(k) Make a plumber's wiped joint between the wiping sleeve and the lead sheath of the cable, as shown in Figures 29 and 30. Use a suitable flux to facilitate the wiping operation.

(l) Remove the 3/4" filling plug in the pothead body and the pipe plugs in the top of the studs. Insert a stand pipe and funnel in the filling hole of sufficient height to extend above the top of the studs as shown in Figure 31.

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 filling, warm pothead body 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 pothead body, taking care that no direct heat reaches the porcelains.

Pour compound through the filling pipe until the compound appears at the top of the pothead studs. While filling, play a blowtorch on the pothead body and on the filling pipe to prevent air voids and clogging. When full, insert pipe plugs in the top of the studs to trap compound in the porcelain insulators. Continue pouring compound while the pothead is cooling to fill air voids which might form while the compound is cooling.

Fig. 31 (857607)

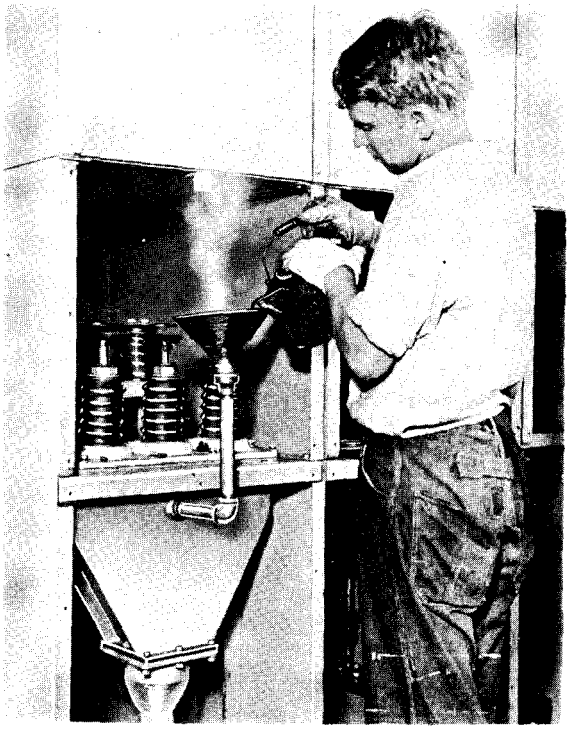


Fig. 31 Filling Pothead with Insulating Compound

When the pothead has cooled, remove filling pipe and insert plug. Clean off compound which might have overflowed on the outside of the porcelains. Retighten all bolts to be sure that all joints are tight.

(m) Assemble pothead connection bars, see Figure 32, 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 varnished cambric tape, G. E. #992, as shown in Figure 35, the number of layers depending on the voltage rating of the equipment. Where there are sharp angles apply additional layers to obtain the equivalent of the insulation of the flat surfaces.

(3) Over the varnished cambric 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 15KV. 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.

Cable Entrances Other Than Wiping Sleeve

Stuffing box cable entrance fittings, Figure 33, 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 and 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.

*Reg. Trade-Mark of General Electric Co.

Fig. 32 (857608) Assembling Pothead Connection Bars

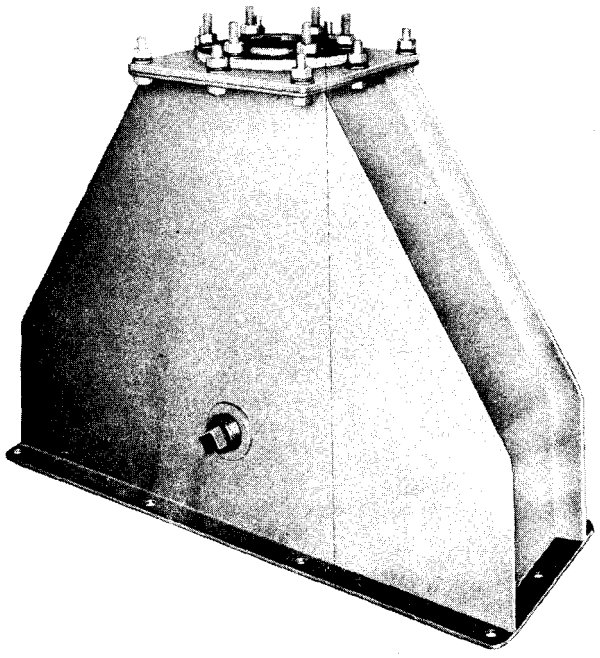
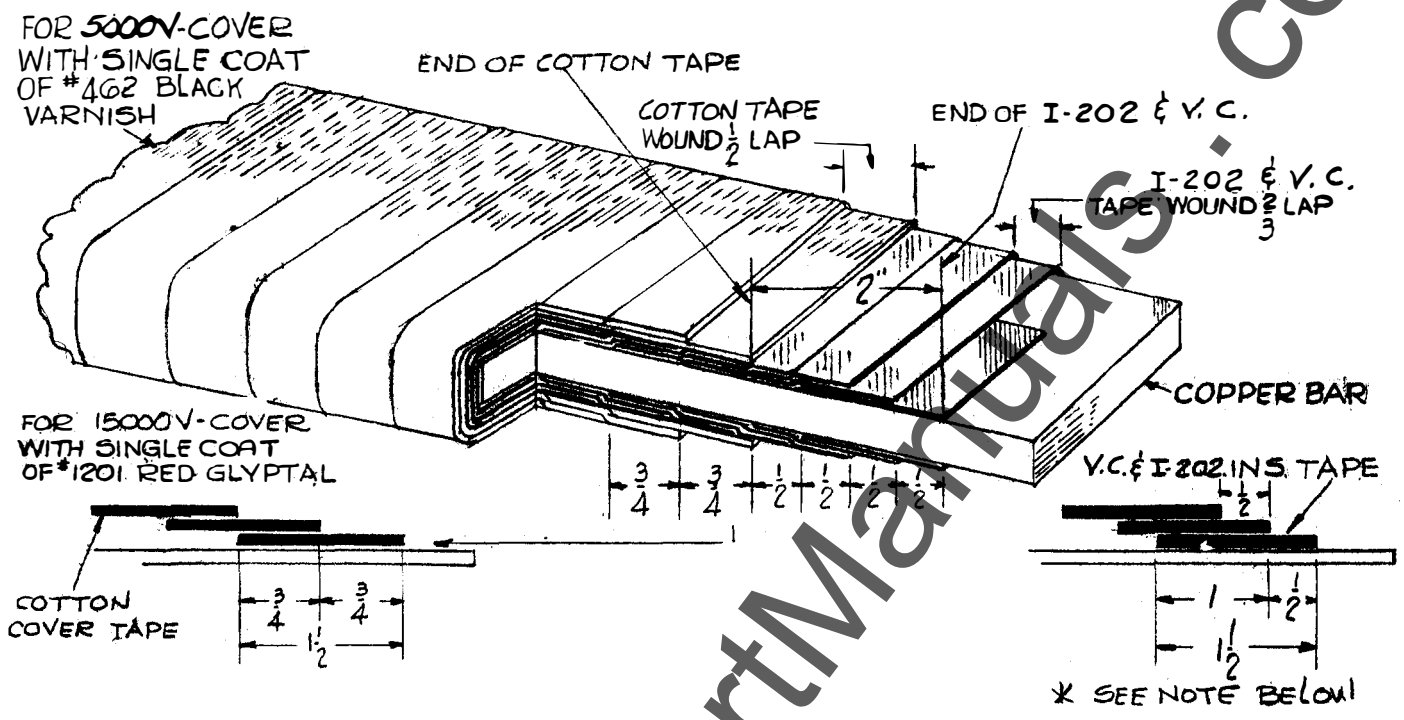


Fig. 33 (800733) G-E Pothead with Stuffing Box



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. 650-116 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

SINCE THE INSULATING PROPERTIES OF V.C. AND IRRATHENE ARE DIFFERENT, CARE MUST BE TAKEN TO INSURE THAT THE CORRECT TAPING INSTRUCTIONS (ABOVE) ARE FOLLOWED.

INSULATION OF COPPER BARS

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Fig. 34 (414A757)

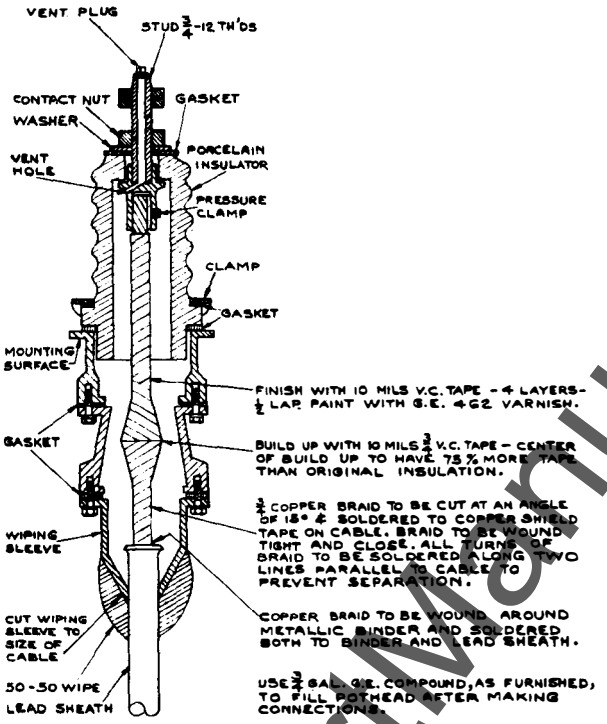
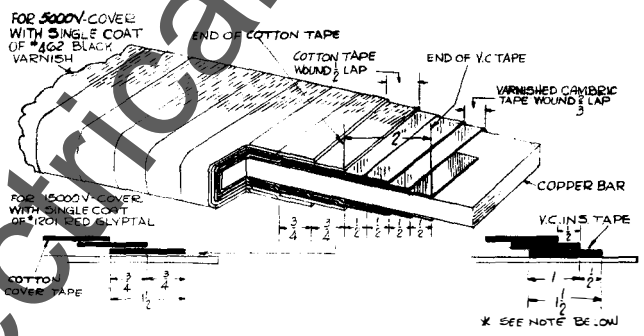


Fig. 34 Single Conductor Pothead with Stress Cone

Fig. 35 (K-6500514)



INSULATION LEVEL	INSULATION LAYERS	
	V.C.	COTTON TAPE
5000 V.	4	1
15000 V.	7	1

V.C. IS BLACK VARNISHED CLOTH (CAMBRIC) TAPE #992 WIDTH 1½"
THICKNESS 0.012 COTTON TAPE IS WHITE G.E. 650-116 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.

Fig. 35 Insulation of Connection Bars

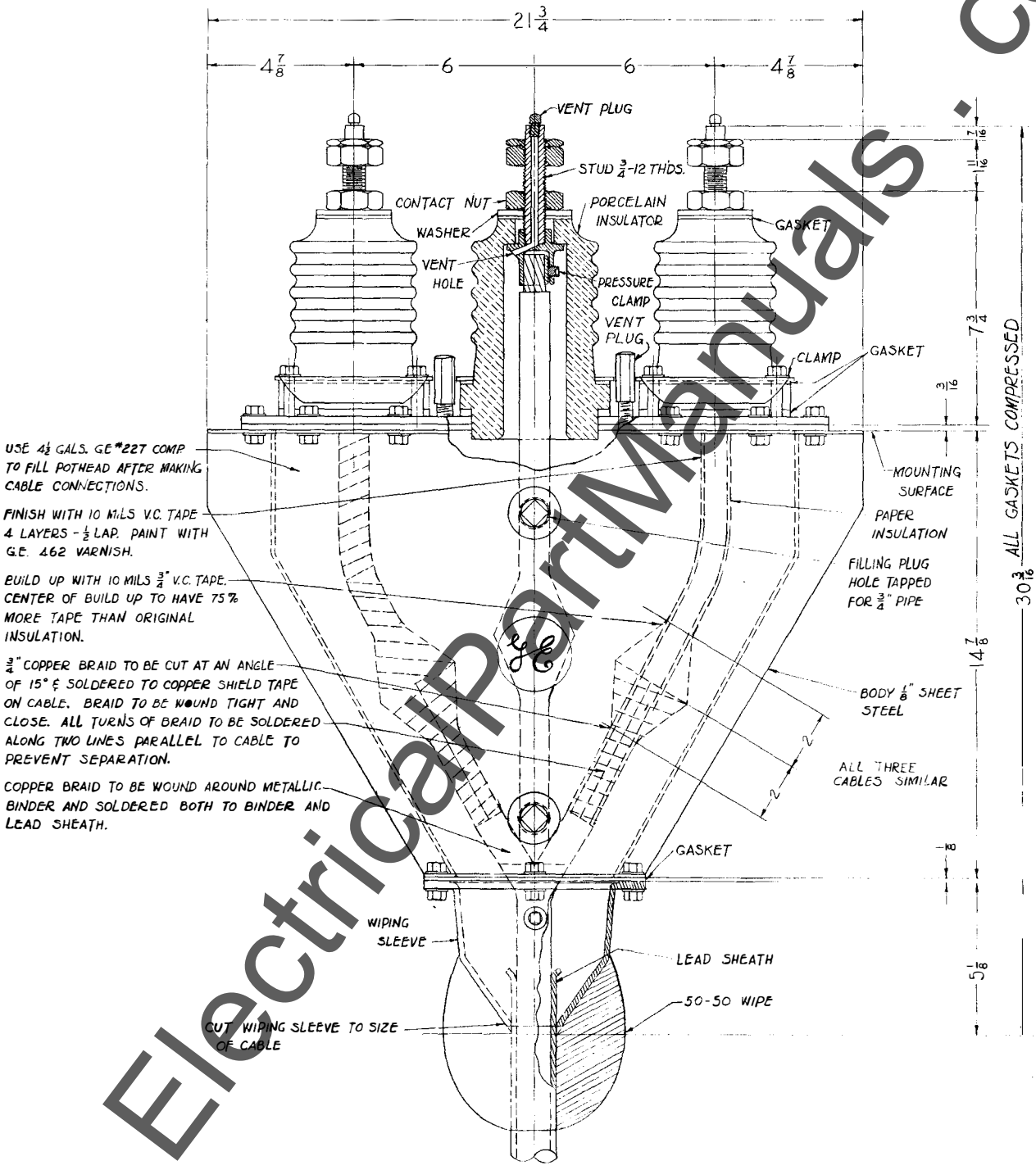


Fig. 36 (T-6595322)

Fig. 36 Pothead

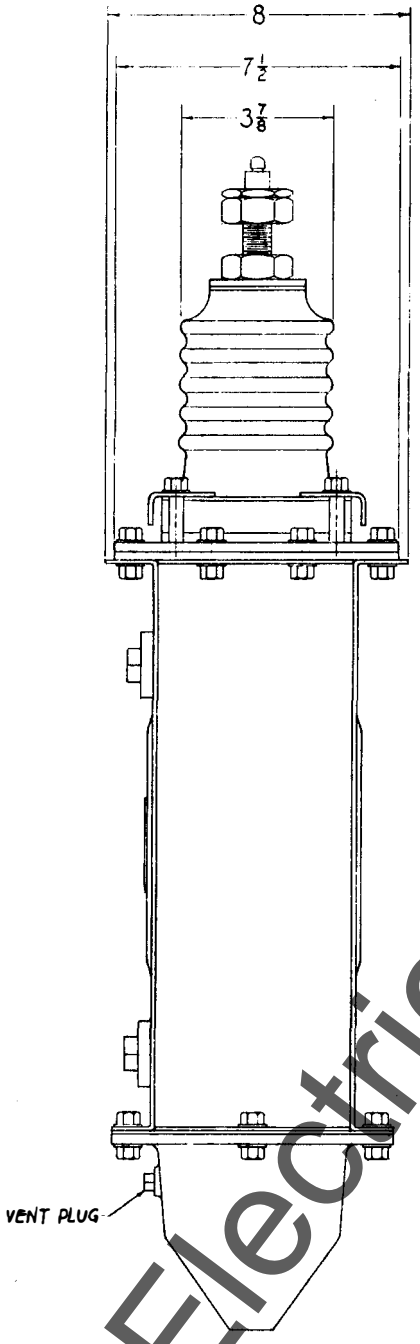


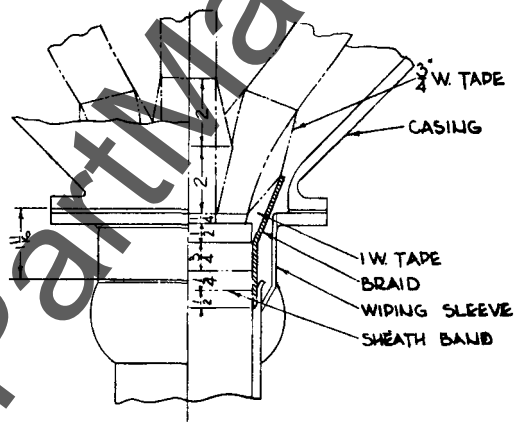
Fig. 36 (T-6595322)

Assembly

FOR "BELTED" CABLE

APPLY ¾" TAPE IN FIRMLY 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.

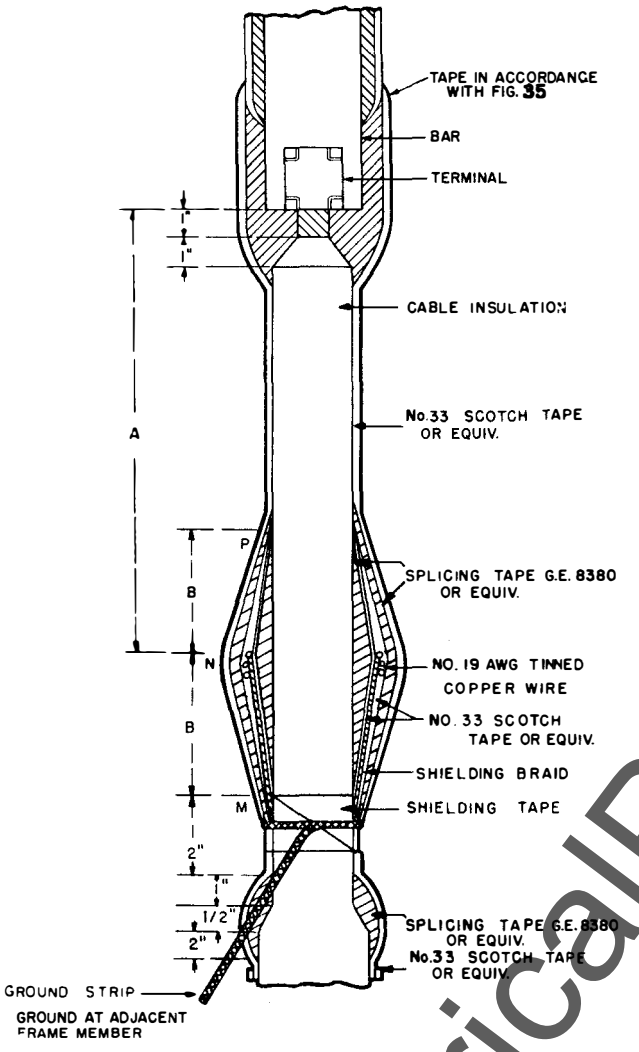
SHIELD A PORTION OF THE OVERALL REINFORCEMENT AS INDICATED. TRIM ONE END OF THE COPPER-BRAID TO AN ANGLE APPROXIMATELY 45 DEG., AND LAY IT ON THE SHEATH-BAND WITH THE CUT EDGE TOWARD THE SHEATH. SOLDER-ATTACH IT TO THE SHEATH. THEN COVER THE SHEATH-BAND EXPOSED BELT-INSULATION, AND THE ADJACENTLY TAPERED SURFACE OF OVERALL 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.
ALL GASKETS AND GASKETED SURFACES TO BE COATED WITH GLYPTAL BEFORE MOUNTING AND CLAMPING IN PLACE

DIMENSIONS SHOWN ARE FOR 15 KV. POTHEAD



+ 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

+ For ungrounded neutral use 1.33 times phase-to-phase voltage in selecting distance A.

Fig. 37 Termination Non-Leaded Cable Single Conductor

TERMINATION NON-LEADED 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. 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. 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. 37 (B-230046-C)

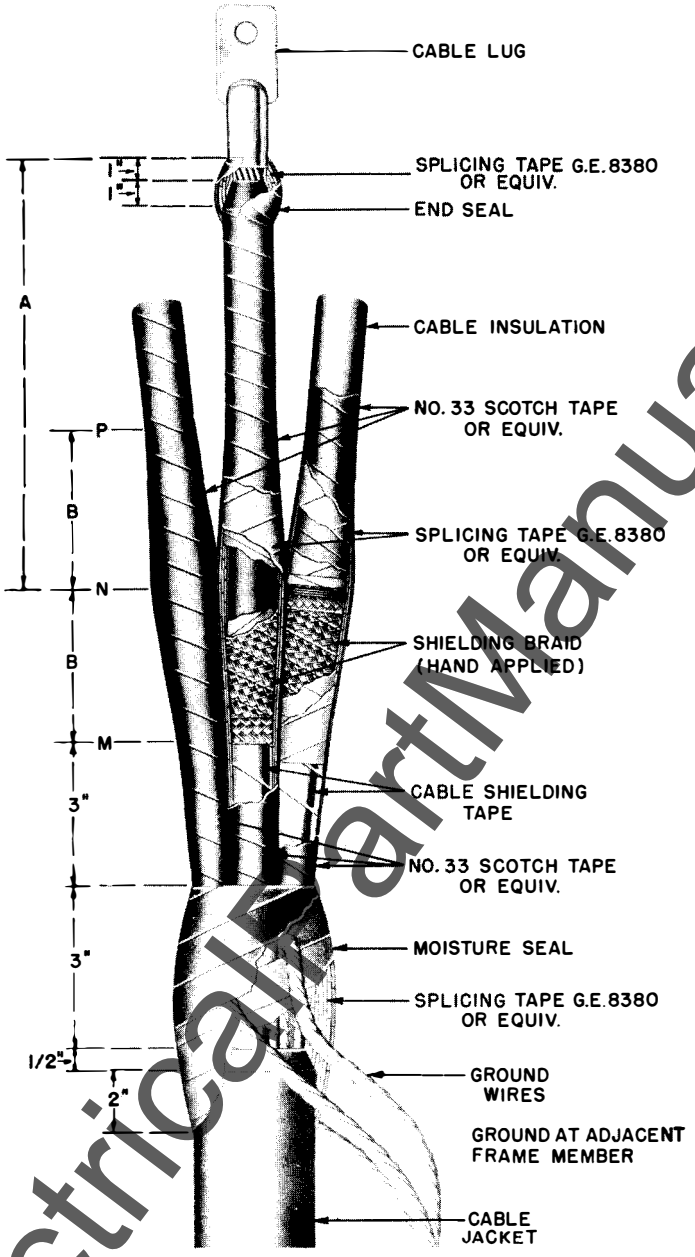


Fig. 38 (B-232004-C)

Fig. 38 Termination Non-Leaded Cable Multi Conductor

TERMINATION NON-LEADED 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.

CONTROL CABLES

When control conduits enter the unit from below, the conduit should not extend more than 4 inches above the floor. The control cables may be pulled through the conduits before or after the switchgear is installed, whichever is more convenient.

Connect the cables to the terminal blocks in accordance with the wiring diagrams furnished for the requisition.

If the control conduits enter from above, drill the top and bottom covers of the front enclosure wiring trough to suit the conduits. Fasten the conduits to the bottom cover with locknuts.

The cables from the control power source to the switchgear should be large enough to avoid excessive voltage drop when the circuit breakers are operated. See testing instructions.

Check over all screws and nuts connecting the control wiring to make sure that none have been loosened in shipment.

Where units have been split for shipment, any control or other secondary leads which must connect across the split will be arranged with terminal blocks in the cross trough or convenient side sheet so that the wires can be reconnected. The wires will be cut to length and formed before being folded back so that a minimum of time will be required for reconnecting them.

GROUND BUS

The ground bus is bolted to the rear of the frame near the bottom. It is arranged so that connections to the station ground can be made in any unit. Where the equipment is shipped in more than one group, the sections of ground bus must be connected by using the splice plates furnished with the equipment. Ground bus connections are made in the lower portion of the cable entrance compartment. The switchgear ground bus must be connected to the station ground bus by a conductor having a current carrying capacity equal to that of the switchgear ground bus. It is very important that the equipment be adequately grounded to protect the operator from injury when short circuits or other abnormal occurrences take place and to insure that all parts of the equipment, other than live parts, are at ground potential.

LIGHTNING PROTECTION

It will be the responsibility of the purchaser to provide suitable lightning arresters to protect the switchgear from damage due to lightning. The General Electric Company's recommendations as to the types of circuits requiring lightning protection, and a list of recommended lightning arresters, is contained in Bulletin GER-141, copies of which are available upon request.

OPERATION

The operation of metal-clad switchgear is similar to that of other types except that it provides maximum safety to the operator and the feature of easy removal and replacement of the circuit breaker.

All circuit breaker removable elements of the same type and rating which have duplicate wiring may be interchanged.

BREAKER POSITIONING

To place the circuit breaker in operating position, proceed as given below.

Clean contacts and cover with a very thin coating of Contact Lubricant D50H20.

Push the breaker into the unit until it rests against the stop.

To raise the breaker, operate the elevating control selector switch just inside the door on the right hand side to "Raise". A clutch handle just above the elevating motor is then pulled until it engages the motor at which time it closes the clutch limit switch to start the motor and raise the breaker in the housing. At the end of the upward travel, a limit switch on the structure opens to stop the motor. See Figures 17 and 18.

To lower the breaker proceed the same as for raising except operate selector switch to "Lower".

The clutch must be held in the engaged position otherwise a spring will return it to its normal position opening the electrical circuit to the motor.

The breaker may be raised and lowered by an emergency hand wrench which can be inserted after removing the motor. The motor is removed by taking out four mounting screws in the base of the motor and disconnecting the four motor leads.

After removing the motor, pull the clutch forward and insert the wrench over the end of the clutch shaft. The breaker must be tripped before the clutch can be engaged with the wrench.

SPACE HEATERS

Space heaters are provided in all outdoor equipment in order to keep the inside temperature several degrees higher than that outside. This helps prevent condensation and the resultant corrosion which might occur. The heaters should be turned on at all times. Heaters are also furnished for indoor equipments when it is known that abnormal atmospheric conditions exist at the installation.

TESTING AND INSPECTION

After the equipment has been installed and all connections made, it should be tested and inspected before putting in service. Although the equipment and devices have been completely tested at the factory, a final field test should be made to be sure that the equipment has been properly installed and that all connections are correct and have not become loose in transportation. The primary equipment should be completely de-energized while the tests are in progress.

Directions for testing devices such as relays, instruments and meters are given in the instruction book furnished for each device. The settings of the protective relays must be coordinated with the other relays on the system and therefore these relays must be set by the purchaser. General instructions on setting the relays are given in the relay instruction books. Special instruction books are furnished for complicated automatic equipments, describing the sequence of operation of the devices required to perform the desired function.

The General Electric Company will not be responsible for defects in devices not manufactured by the Company when such devices are specified by the purchaser. All questions relative to such devices should be referred to the manufacturer.

The extent of the tests on the equipment as a whole will depend on the type and function of the equipment.

When transformers are furnished to supply the control power, the primary taps should be selected so that the control voltage indicated on the wiring diagram is obtained on the secondary of the transformer. When a battery is used to supply the control power, the cables from the battery to the switchgear should be large enough to avoid excessive voltage drop. The voltage at the terminals of the breaker closing coils, when the breaker is being closed, should not be less than 112.5 volts for 125 volt coils and 225 volts for 250 volt coils.

The operation of the breaker with its associated devices may be tested in the unit while the equipment is energized by use of the test coupler which is furnished. Lower the breaker to the test or down position. Attach the test coupler to connect the breaker secondary disconnecting device to that on the structure.

High potential tests to check the integrity of the insulation are not necessary if the installation instructions in this book are carefully followed. If the purchaser wishes to make high potential tests the voltage should not exceed 75% of the AIEE factory test voltages.

Potential transformers must be disconnected during high voltage testing.

MAINTENANCE

A regular maintenance schedule should be established to obtain the best service and reliability from the switchgear. Plant, operating and local conditions will dictate the frequency of inspection required. For specific information regarding the maintenance of devices, such as circuit breakers, relays, meters, etc., refer to the separate instruction book furnished for each device. The inspection cabinet, which is furnished, provides a convenient means for maintaining the circuit breakers. Under normal conditions the protective relays do not operate; therefore, it is important to check the operation of these devices regularly.

A permanent record of all maintenance work should be kept, the degree of detail depending on the operating conditions. In any event it will be a valuable reference for subsequent maintenance work and for station operation. It is recommended that the record include reports of tests made, the condition of equipment and repairs and adjustments that were made.

The switchgear structure and connections should be given the following overall maintenance every one to three years, depending upon the severity of the service and the atmospheric conditions around the units. Equipment subject to highly repetitive operation may require more frequent maintenance.

None of the following operations should be undertaken until it is certain that the equipment is completely de-energized.

1. Thoroughly clean removing all dust and other accumulations. Wipe clean the buses and supports. Inspect the buses and connections carefully for evidence of overheating or weakening of the insulation.

2. Measure the resistance to ground and between phases of the insulation of buses and connections. Since definite limits cannot be given for satisfactory insulation resistance values, a record must be kept of the readings. Weakening of the insulation from one maintenance period to the next can be recognized from the recorded readings. The readings should be taken under similar conditions each time if possible, and the record should include the temperature and humidity.

High potential tests are not required, but if it seems advisable, based on the insulation resistance tests or after repairs, the test voltage should not exceed 75% of the AIEE factory test voltage. The potential transformers must be disconnected during the high voltage testing.

3. Clean elevating mechanism and lubricate

jack screws and gears with General Electric Company Lubricant #D50H15 (Atlantic Refining Company #62 or equal).

4. Check primary disconnecting device contacts for signs of abnormal wear or overheating. Clean contacts with silver polish. Discoloration of the silvered surfaces is not ordinarily harmful unless atmospheric conditions cause deposits such as sulphides on the contacts. If necessary the deposits can be removed with a good grade of silver polish.

Before replacing breaker, apply a thin coat of Contact Lubricant D50H28 to breaker studs for lubrication.

5. Check to see that all anchor bolts and bolts in the structure are tight. Check tightness and continuity of all control connections and wiring.

RENEWAL PARTS

ORDERING INSTRUCTIONS

1. Renewal parts should be ordered from the Medium Voltage Switchgear Department.
2. Always specify the requisition number on which the equipment was originally furnished.
3. Specify the quantity, reference number, description and this bulletin number.
4. Standard hardware, such as screws, bolts, nuts, washers, etc., is not listed in this bulletin. Such items should be purchased locally.
5. For prices, refer to the nearest office of the General Electric Company.
6. If insulating material, such as tape, varnish, compound, etc., is required, it must be specified separately.

PRIMARY DISCONNECT DEVICES
(SEE FIG. NO. 8)

REF. NO.	DESCRIPTION
5	Front Primary Disconnect Device Assembly, 3 Pole, Complete with Connections
6	Rear Primary Disconnect Device Assembly, 3 Pole, Complete with Connections

NOTE: Insulating material required for Ref. Nos. 5 and 6 will be furnished with order.

ELEVATING MECHANISMS

REF. NO.	DESCRIPTION
7	Miter gears, pair
7A	Groov pin for miter gear
8	Shaft
9	Sprocket
9A	Groov pin for sprocket
10	Spur gear
10	Pinion gear and rod
10A	Groov pin for spur gear
11	Stop stud
12	Pinion gear and rod
12	Spur gear
12A	Groov pin for spur gear
13	Locking spring
14	Stop shaft
14A	Groov pin for stop shaft
15	Clutch spring
16	Slide clutch
17	Jack screw

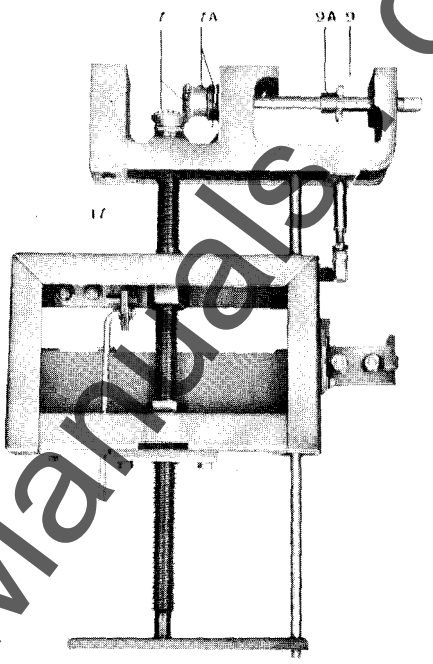


Fig. 39 (8012409) No. 1

Complete Left Hand (Ref. No. 1)

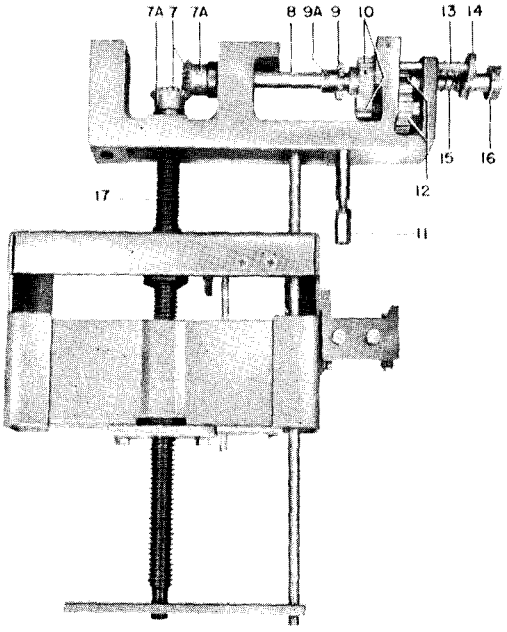


Fig. 39 (8012410) No. 2

Complete Right Hand (Ref. No. 2)

Fig. 39 Elevating Mechanisms

POSITIVE MECHANICAL INTERLOCK
(FIG. NO. 17)

REF. NO.	DESCRIPTION
3	Complete positive mechanical interlock assembly
4	Elevating mechanism motor (115 V. D-C)
4	Elevating mechanism motor (230 V. D-C)
4	Elevating mechanism motor (230 V. A-C)
18	Spring only

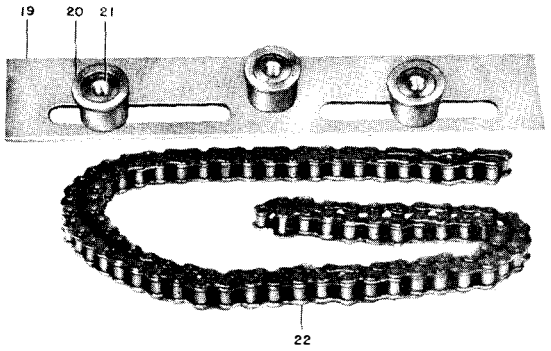


Fig. 40 Angle Bracket and Chain Drive

REF. NO.	DESCRIPTION
19	Bracket
20	Roller
21	Retainer
22	Chain

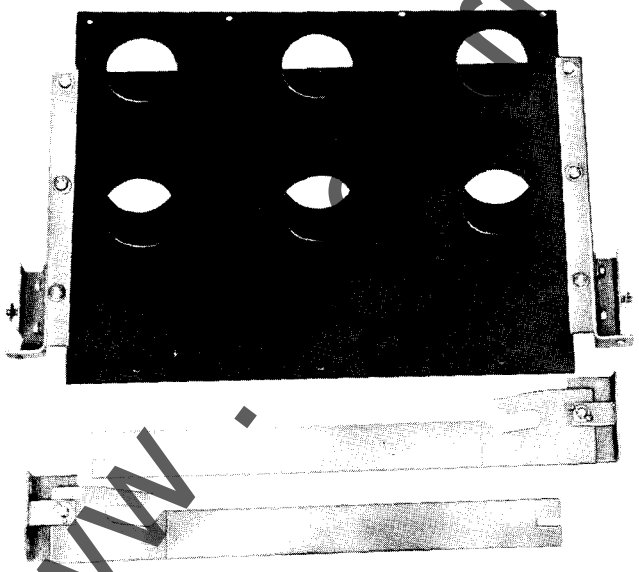


Fig. 41 Shutter Mechanism Assembly (Ref. No. 23)

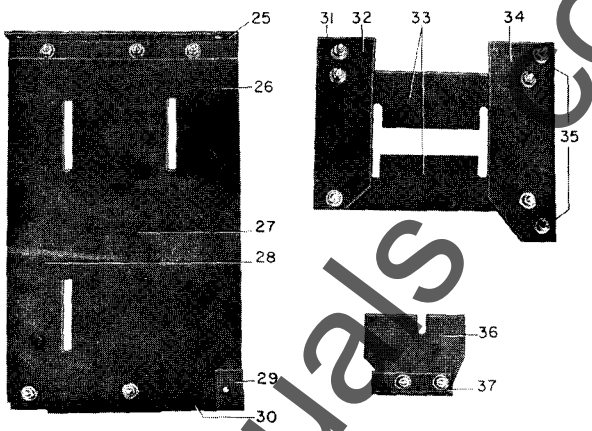


Fig. 42 Bus Supports

REF. NO.	DESCRIPTION
25	Isolating barrier support angle
26	Rear isolating barrier
27	Intermediate isolating barrier
28	Front isolating barrier
29	Isolating barrier clip
30	Isolating barrier support
31	Front support clip (not shown)
32	Front intermediate support
33	Intermediate support
34	Rear intermediate support
35	Rear support clip (not shown)
36	Lower intermediate support
37	Lower intermediate support clip

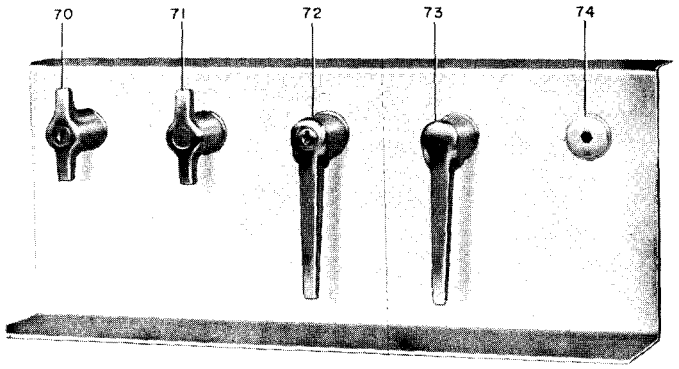


Fig. 43 Door Handles and Locks

REF. NO.	DESCRIPTION
70	Panel locking handle
71	Panel handle
72	Door locking handle
73	Door handle
74	Socket

Fig. 40 (8012364)
Fig. 41 (8012375)
Fig. 42 (8020152)
Fig. 43 (8011607)

Fig. 44 (8012365)

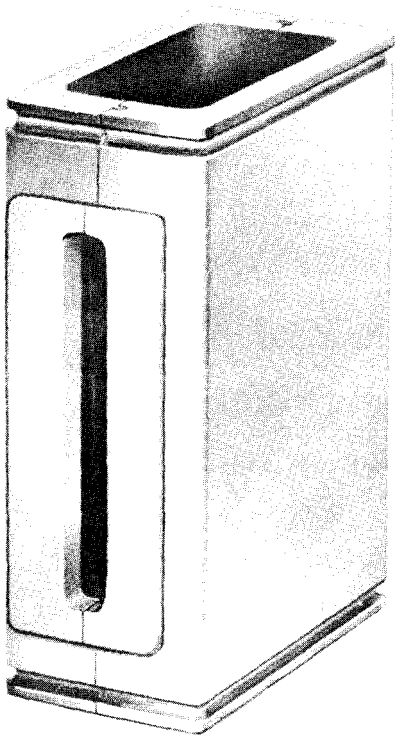


Fig. 44 Bus Connection Box

Fig. 45 (8020307)

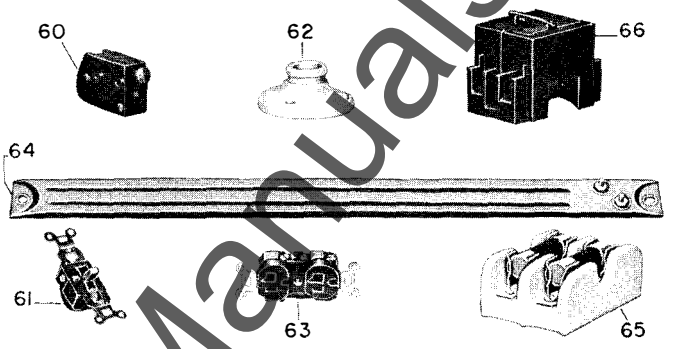


Fig. 45 Wiring Devices and Miscellaneous Parts

REF. NO.	LOCATION	RATING	DESCRIPTION
38	int.	1200A.	1 connection bar, down
39	int.	1200A.	1 connection bar, up
40	end	1200A.	1 connection bar, down
41	end	1200A.	1 connection bar, up
42	int.	1200A.	no connection bar
43	end	1200A.	no connection bar
44	int.	1600A.	1 connection bar, down
45	int.	1600A.	1 connection bar, up
46	end	1600A.	1 connection bar, down
47	end	1600A.	1 connection bar, up
48	int.	1600A.	no connection bar
49	end	1600A.	no connection bar
50	int.	2000A.	1 connection bar, down
51	int.	2000A.	1 connection bar, up
52	end	2000A.	1 connection bar, down
53	end	2000A.	1 connection bar, up
54	int.	2000A.	no connection bar
55	end	2000A.	no connection bar
56	int.	2000A.	2 connection bars, down
57	int.	2000A.	2 connection bars, up
58	end	2000A.	2 connection bars, down
59	end	2000A.	2 connection bars, up

REF. NO.	DESCRIPTION
60A	Limit switch (upper) normally closed
60B	Limit switch (upper) normally open
60C	Limit switch (lower) normally closed
60D	Limit switch (lower) normally open
61	Light and heater switch
62	Keyless receptacle
63	Duplex receptacle
64	Strip heater
65	Fuse block, open type
66	Fuse block, dead front
67A	125V. D-C close fuse (50A.)
67B	250V. D-C close fuse (30A.)
67C	125V. and 250V. D-C trip fuse (35A.)
Refer to Fig. No. 17 — 68	Complete secondary disconnect device
Refer to Fig. No. 17 — 69	Complete stationary auxiliary switch and mechanism

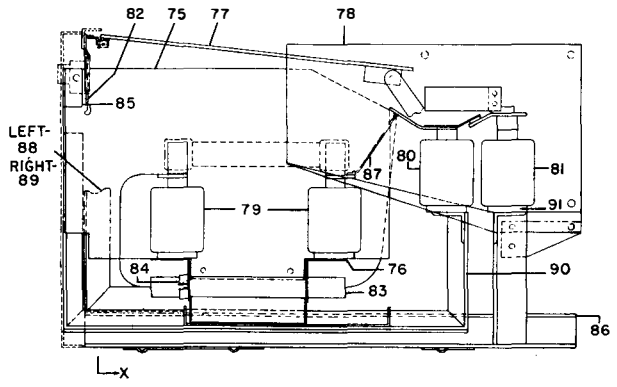


Fig. 46 Fuse Rollout Unit

REF.NO	DESCRIPTION
75	Barrier (M36 equipment only)
76	Fuse support
77	Shutter
78	Barrier
79	Contact
80	Contact
81	Contact
82	Shutter support
83	Cable tube (1-5/8 in., 1-1/8 in., x 15 in.)
84	Tube clamp
85	Angle
86	Fr. carriage
87	Fuse braid
88	Support
89	Support
90	Carriage
91	Spacer (M26 equipment only)

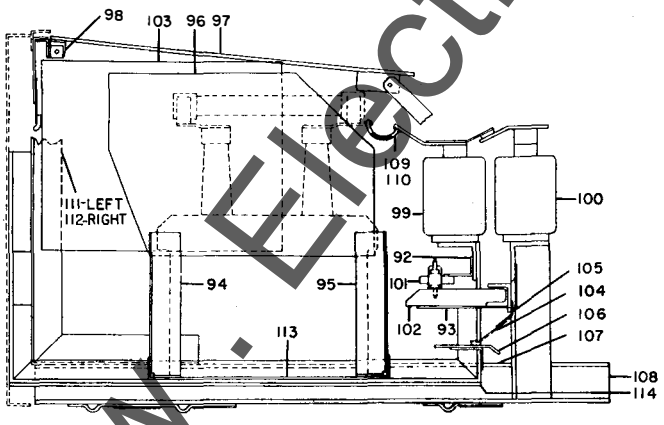


Fig. 47 Potential Transformer Rollout Unit

POTENTIAL TRANSF. ROLLOUT UNIT

REF. NO.	DESCRIPTION
92	Sec. disc. support
93	Sec. disc. support
94	Barrier support
95	Barrier support
96	P. T. barrier
97	Shutter
98	Shutter support
99	Contact (movable)
100	Contact (stationary)
101	Sec. disconnect (movable)
102	Sec. disconnect (stationary)
103	Barrier
104	Contact
105	Support
106	Grd. shoe
107	Angle
108	Frame and carriage
109	P. T. braid (5 inch)
110	P. T. braid (9 inch)
111	Support
112	Support
113	Pan
114	Carriage

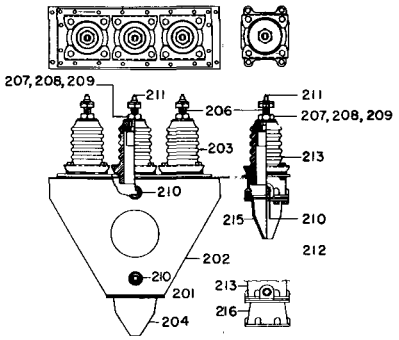


Fig. 48 Single and Triple Conductor Potheads

REF. NO.	DESCRIPTION
201	Triple conductor pothead assembly
202	Body
203	Insulators and support
204	Wiping sleeve
205	Gaskets for triple conductor pothead
206	Terminal
207	Contact nut
208	Washer
209	Palnut (3/4 in. - 12)
210	Pipe plug (3/4 in. std.)
211	Pipe plug (1/8 in. std.)
212	Single conductor pothead assembly
213	Body and insulator
214	Gaskets for single conductor pothead
215	Wiping sleeve
216	Adapter for mechanical entrance fittings

Fig. 46 (1103402)
Fig. 47 (1103403)
Fig. 48 (1103401)

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