ALLIS-CHALMERS

METAL-CLAD SWITCHGEAR

5 kv and 15 kv...

with *RUPTAIR* circuit breakers

18X9587B

TABLE OF CONTENTS

GENERAL

INTRODUCTION

These instructions cover the installation, operation and maintenance of Allis-Chalmers horizontal drawout, metal-clad switchgear. Described are standard construction details of the switchgear, auxiliary equipment and necessary accessories. Special mechanical and electrical devices, in accordance with purchase order requirements, are covered by supplementary instructions submitted with this instruction book.

Standard ratings are in accordance with NEMA, IEEE and ASA requirements. The *Ruptair* power circuit breakers associated with this switchgear are listed along with ratings in table below.

WARRANTY

Allis-Chalmers warrants each piece of new equipment to be free from defects in material and workmanship for a period of one year after date of shipment to the original purchaser. This warranty is limited to the furnishing of any part which, to the supplier's satisfaction, has been proved defective.

DRAWINGS AND WIRING DIAGRAMS

All drawings and wiring diagrams needed for installation are furnished in advance. These drawings and wiring diagrams will include changes originated by the purchaser during manufacture and changes to the purchaser's corrections by the supplier necessary to insure proper installation and operation.

RECEIVING

UNLOADING

Each shipping group of the switchgear assembly is securely blocked and braced for shipment. It is crated, boxed, or covered — depending on shipping conditions. Whatever the method of shipment, every precaution is taken to insure its safe arrival. If special handling is required, it is so indicated. All moving parts are blocked, but because relatively delicate instruments are included, care must be taken to avoid rough handling.

Two shipping channels with lifting holes are bolted to the top of the indoor switchgear assembly to facilitate handling. On single unit assemblies, lifting eyebolts may be furnished instead. If cranes or other lifting means are not available, the group can be rolled into position.

Typical Side Views

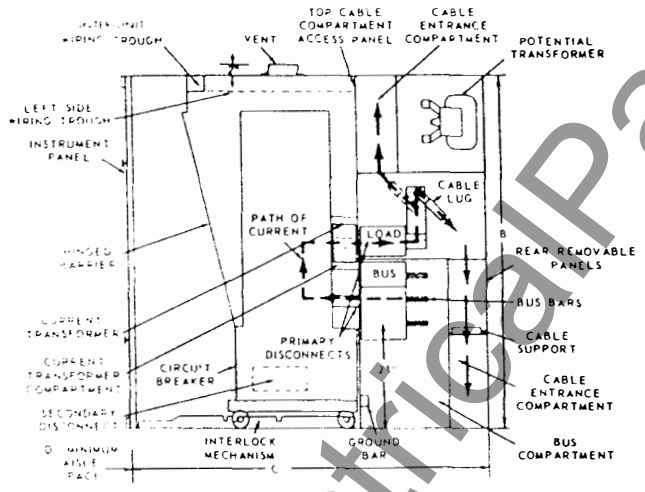

Fig. A — 5-kv Breaker Unit.

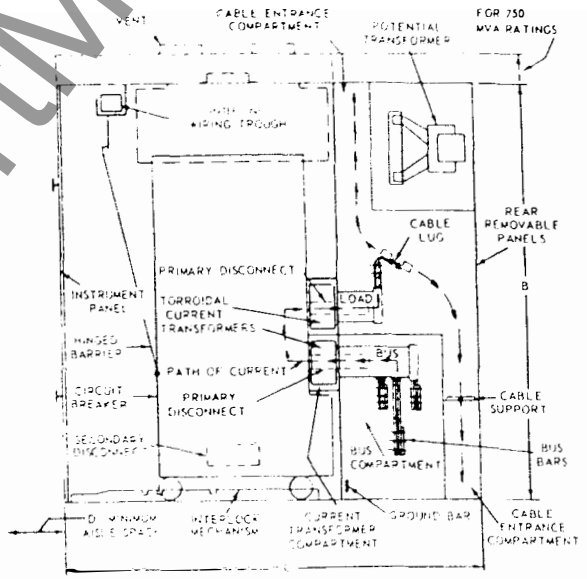

Fig. B — 15-kv Breaker Unit.

BREAKER RATINGS					STRUCTURAL DIMENSIONS (in.)						
Breaker Type (mva)	Rated Kv	Max. Design Kv	Cont. Current (amps)	Weight (lbs)	Type	Fig.	A Width	B Height	C Depth	D Drawout Aisle	Weight (lbs)
MA-75	4.16	4.76	1200	875	DF	A	26	72	74	50	1200
MA-250	4.16	4.76	1200	875	DM	A	26	72	74	50	1200
MA-250	4.16	4.76	2000	900	DM	A	26	72	74	50	1200
MA-350	4.16	4.76	1200	925	DN	A	26	72	74	50	1200
MA-350	4.16	4.76	2000	950	DN	A	26	72	74	50	1200
FA-350	4.16	4.76	3000	2000	DN	B	36	92	94	66	1800
FB-500	7.2	8.25	1200	1400	FO	B	36	92	94	66	1800
FB-500	7.2	8.25	2000	1425	FO	B	36	92	94	66	1800
FC-500	13.8	15.0	1200	1400	FO	B	36	92	94	66	1800
FC-500	13.8	15.0	2000	1425	FO	B	36	92	94	66	1800
FC-750	13.8	15.0	1200	1450	FQ	B	36	92	94	66	1800
FC-750	13.8	15.0	2000	1475	FQ	B	36	92	94	66	1800
FC-1000	13.8	15.0	1200	3300	FR	B	36	100	105	77	2000
FC-1000	13.8	15.0	3000	3450	FR	B	36	100	105	77	2000

At 2.3 kv; MA-75 = 50 .nva, MA-250 = 150, MA-350 = 200 mva.

Lifting lugs can be used to help in lifting rollers under the skids and to remove the rollers and the skids after positioning. After removing the rollers and skids, lower the group slowly (do not drop it as the impact may damage delicate instruments). Under no circumstances should the shipping channels be removed from the bottom of the units until the equipment is installed in its final location and the rollers and skids have been removed.

Because of the absence of bottom rear cross members, the units may be easily rolled into place after the cable has been pulled in or primary conduit stubbed up.

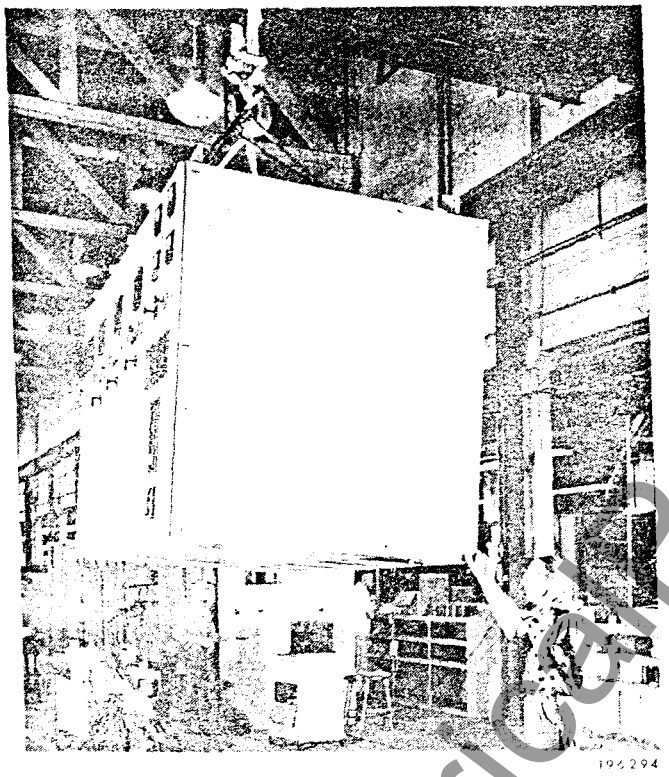

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Fig. 1 — Top mounted lifting channels facilitate handling by crane.

ACCESSORIES

The following accessories are crated separately:

1. Test device for testing breaker when it is out of but adjacent to cubicle.
2. Manual closing and racking lever.
3. Fifth wheel to facilitate moving breaker when outside of cubicle.
4. Arc chute support.
5. Spring charging crank for stored energy operated breakers.
6. Pothead compound and touch-up paint, as required for installation.
7. Test plug, loss cable, for drawout relays and watthour meters. Equipment specified for remote mounting may also be included.

SHIPMENT INSPECTION

As soon as possible after uncrating, inspect the equipment for any damage that may have occurred in transit. Check the shipping manifest to be certain all items have been received. If there is a shortage, note on the freight bill and contact the carrier immediately.

Notify the representing Allis-Chalmers sales office of any shortage or damage.

Unusual circumstances may require partial shipments of switchgear. In these cases, provision is made for easy installation of these portions.

STORING

When switchgear is not to be erected immediately, uncrate, inspect and store in a clean, dry location.

When space heaters are supplied with an order, energize the space heaters, as in the final installation, to eliminate condensation. In some locations, condensation occurs whether the unit is stored or in operation.

Space heaters are not considered standard equipment with indoor switchgear (recommended 500 watts per unit). When indoor switchgear not equipped with space heaters is stored indoors, space heaters must be applied inside the cubicles to prevent condensation. Standard indoor units are not drip-proof and therefore should be stored indoors. If indoor units must be stored outdoors, adequate covering must be provided together with a heat source of approximately 500 watts per unit distributed between breaker and bus compartments and mounted inside the cubicles to prevent condensation.

Batteries should be connected to a charger and never be left in dead storage.

INSTALLING

CONDUIT

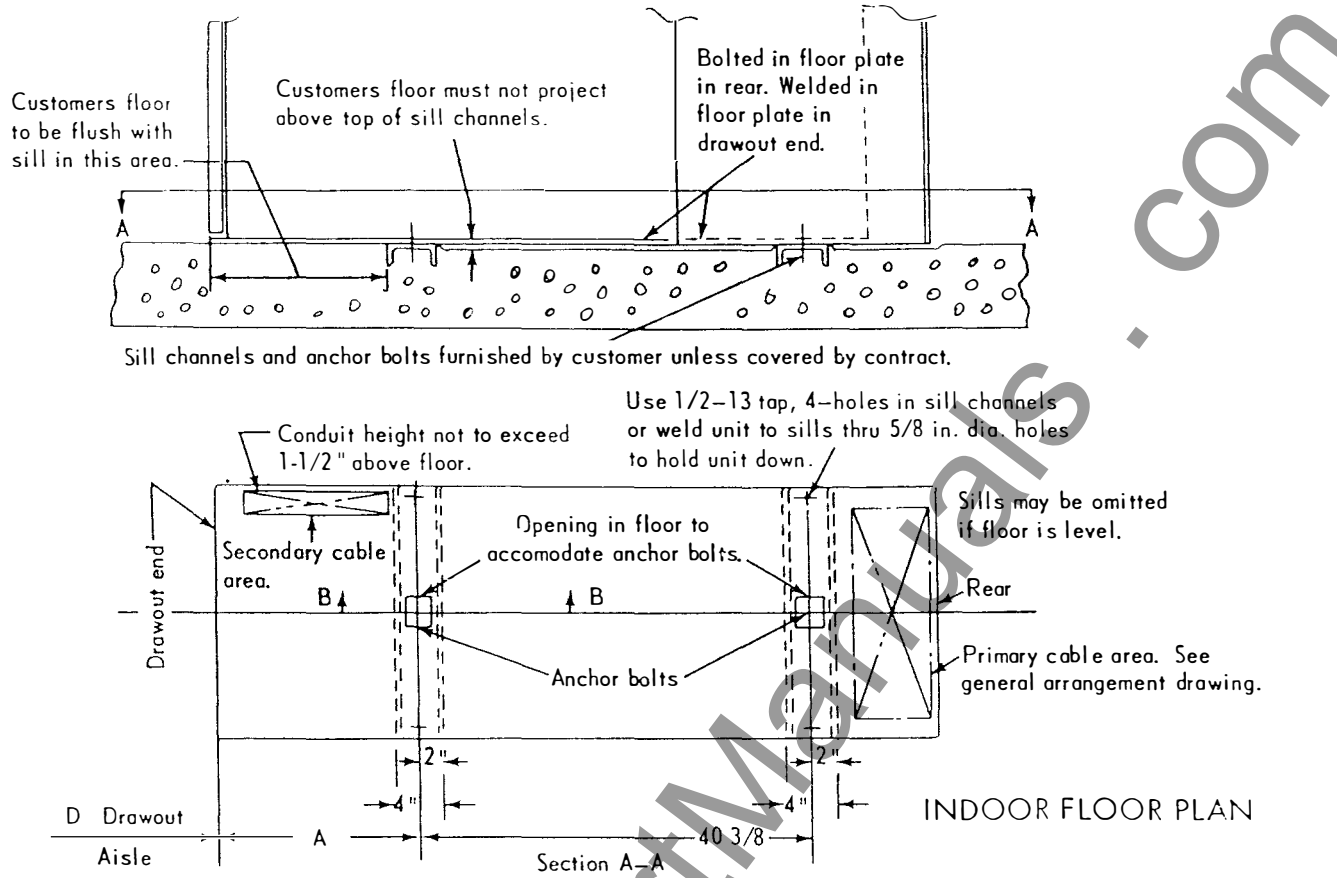
Conduit for power and control connections may be installed in the areas indicated on the General Arrangement Drawings and Floor Plan with due regard for the ease of training the cables in the switchgear. Conduit ends should be about one inch (maximum 1½ in.) above the finished floor to prevent washing water from soaking cables. They should also be capped and taped to keep out moisture and vermin.

FOUNDATIONS

Dimensions of sill channels and anchor bolts should be in accordance with the General Arrangement and Floor Plan whether the switchgear is to be installed on an existing floor or a new floor. Refer to Figure 2 for recommended sill channel mounting of indoor installations.

ERECTION

The proper erection method depends on whether the units are shipped as one complete group or in two or more sections. In any case, the General Arrangement Drawing will indicate the shipping groups. Units are assembled and wired exactly as they are to be arranged in the final installation. Prior to shipment to the job site, the lineup is separated into the appropriate size shipping groups and crated for shipment.



BREAKER TYPE (MVA)	D (In.)	A (In.)
MA-75, -250, -350	50	20⅝
FA-350	66	20⅝
FB-, FC-500, FC-750	66	20⅝
FC-1000	77	31⅝

Fig. 2 — Typical floor plan and sill channel mounting.

SINGLE GROUPS

The unit is brought to the site, being handled as instructed under "UNLOADING." Before placing on previously installed sill channels, make sure the channels are level. After the channels are level, the unit is placed in its final position and bolted or welded to the sill channel. (Figure 2.)

MULTIPLE GROUPS

When a shipment is made in two or more groups, the procedure is, in general, the same as for single groups. However, individual groups must be carefully aligned and set as closely as possible. The fronts of the groups are aligned first and then bolted together.

After erecting single or multiple groups, check with a plumb bob, or similar device, to be certain each group is vertical and has not shifted during handling. The breaker units of each shipping group have been checked and marked at the factory. The plumb bob lining up to within plus or minus 1/16-inch of the factory marked "plumb" insures alignment. (Figure 3.)

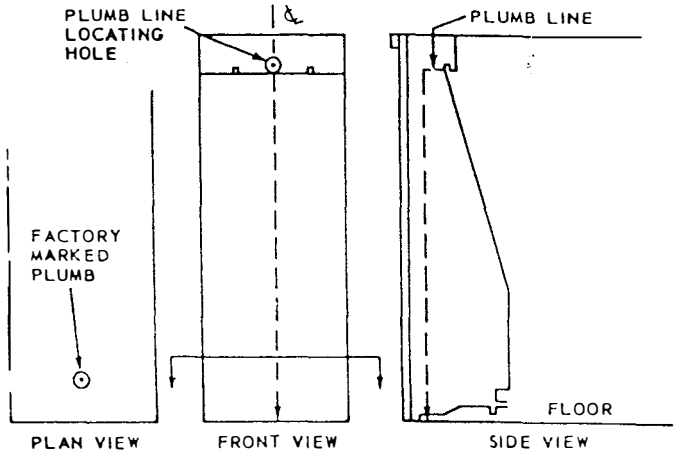


Fig. 3 — Correct method of plumbing units.

If any shipping group units have shifted during shipment and are out of plumb, the following correction procedure is recommended.

(a) Loosen bolts holding the lifting channels to the group of units.

(b) Loosen, but do not remove, bolts holding the "plumb" marked unit to its adjacent unit. Adjust until plumb bob is within plus or minus 1/16 inch of the factory marked "plumb." It may be necessary to loosen bolts in successive adjacent units to attain the necessary plumb.

(c) Tighten all bolts holding units to each other.

(d) Remove lifting channels.

(e) Check each breaker shutter operating mechanism for proper operation.

Secondary inter-group wiring at shipping breaks is then connected as tagged. (Figure 4.)

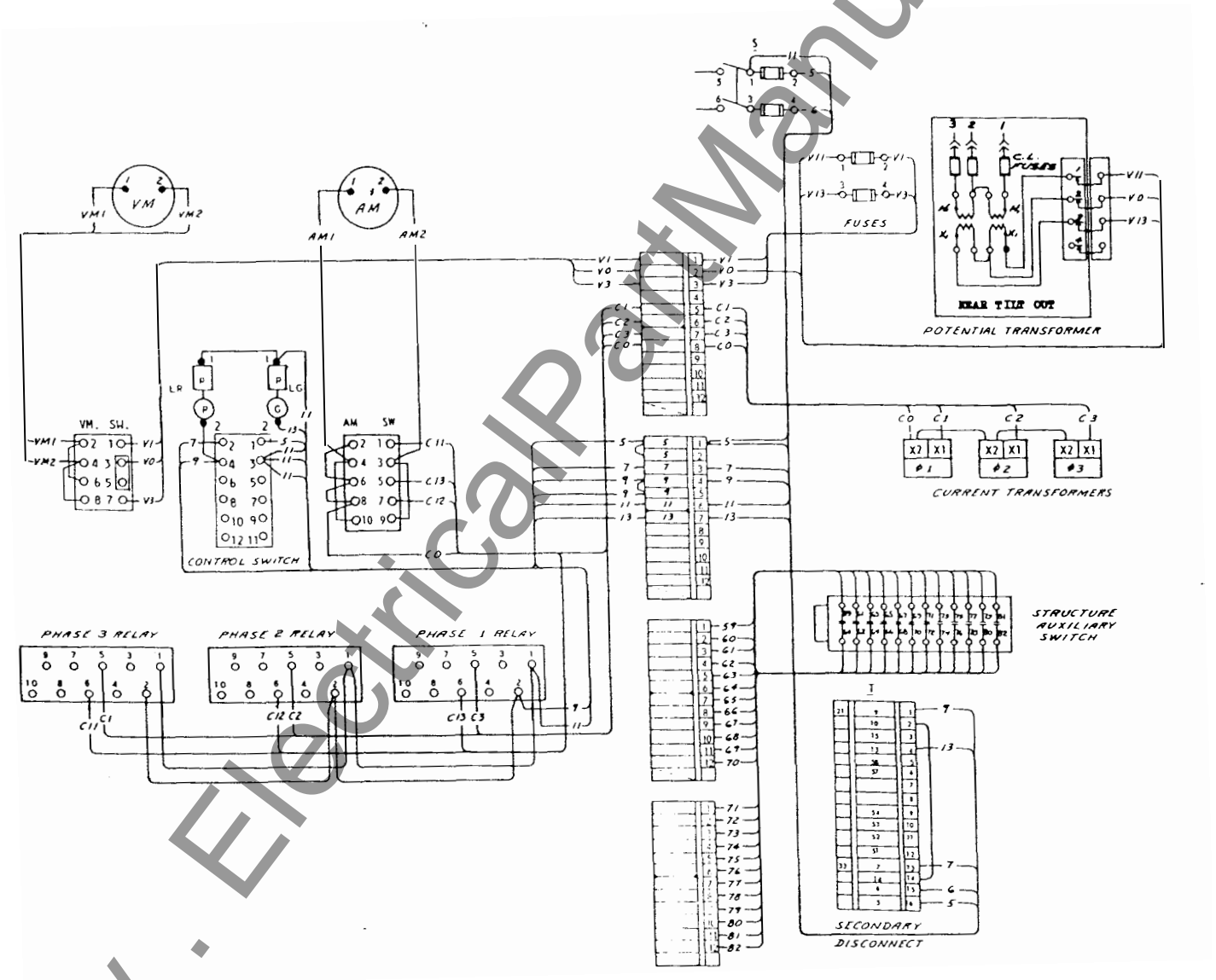


Fig. 4— Typical Wiring Diagram.

ELECTRICAL CONNECTIONS

BUS BAR JOINTS

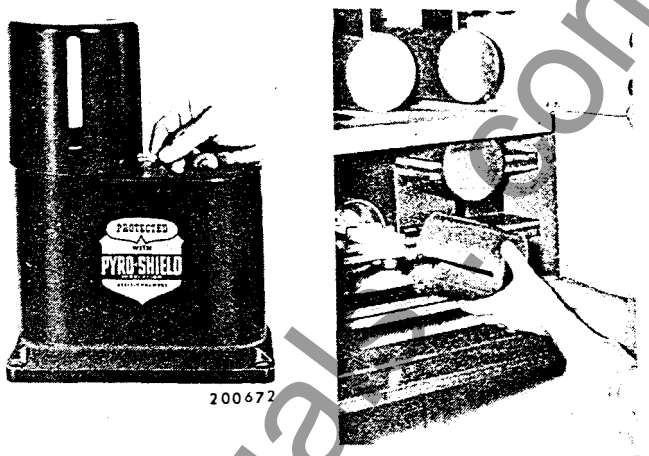
This type of joint is connected as shown in Figure 5.

Before placing the insulator cap over the bus joint, draw up all bolts and nuts tightly.

INSULATION CAPS

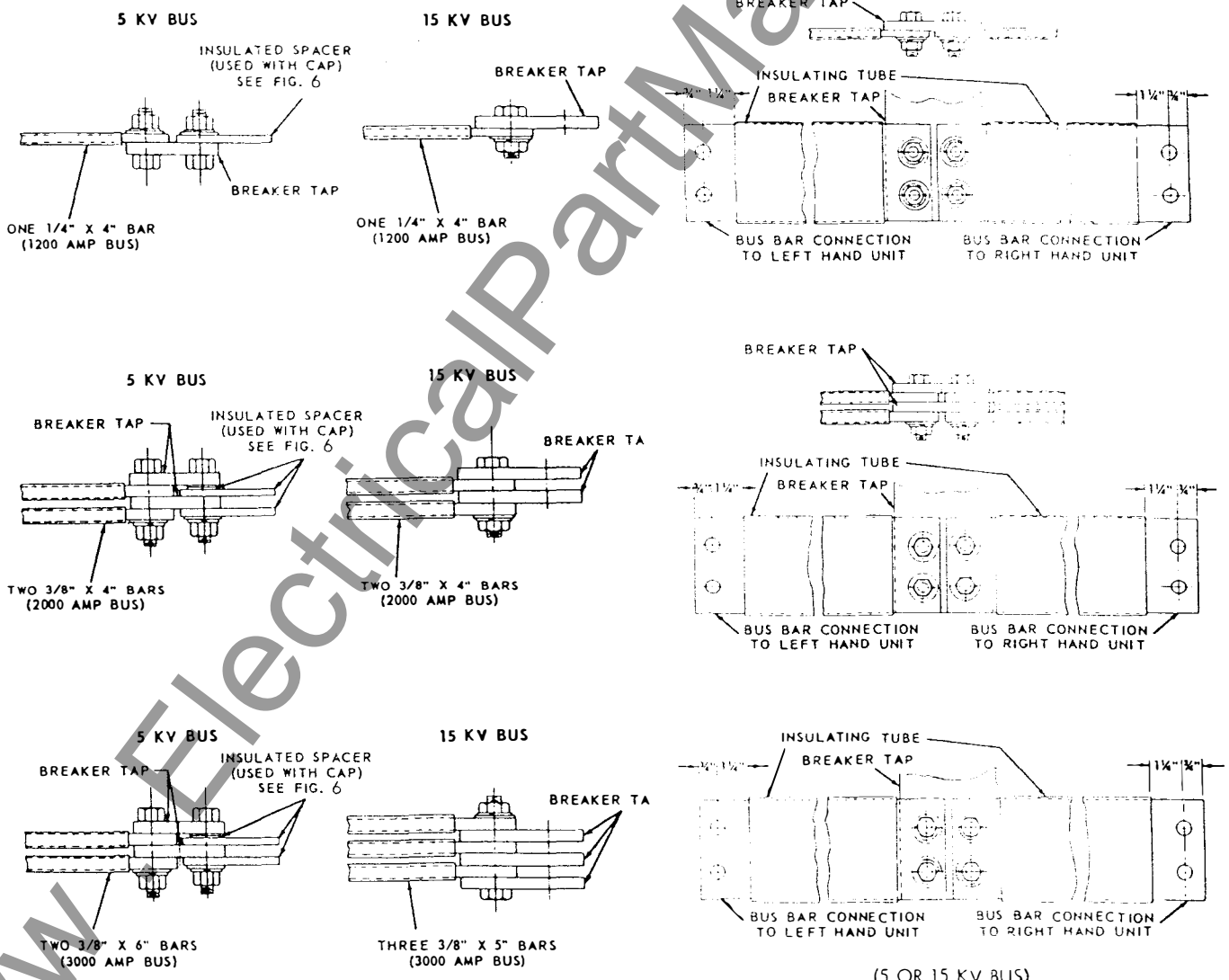
After bolting the main bus to the primary connectors, the molded *Pyro-Shield* insulator cap is placed over the joint and fastened by means of a reusable nylon rivet. Upon insertion, the rivet prongs compress to enter. Using a small hammer, drive the center pin through the hollow shank. The center pin wedges the prongs apart for positive lock, and the cap is fastened to the base assembly. To remove the rivet, the center is driven through the hollow shank. The rivet is removed and the joint can be disassembled. (Figure 6.)

Molded polyvinyl boots are used to insulate bus joints of 13.8-kv switchgear. (Figure 7.)



Placing *Pyro-Shield* insulation cap over bus joint. Simple bus joint construction eliminates need for taping or molding of joints.

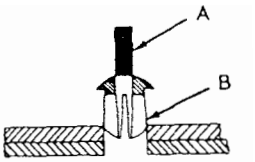
5 kv



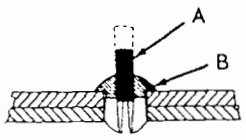
END JOINTS COPPER BUS - VIEWED FROM OPPOSITE DRAWOUT

(5 OR 15 KV BUS)
THRU BUS - VIEWED FROM OPPOSITE DRAWOUT

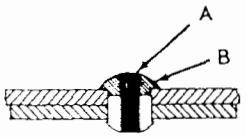
Fig. 5 — Bus bar splicing



NYLON RIVET CONSISTING OF A PIN (A) AND A PRONG (B) IS INSERTED INTO ALIGNING HOLES.



NYLON RIVET IS DRIVEN INTO THE PRONG TO SPREAD THE FINGERS.



WITH THE FINGERS SPREAD BY THE CENTER PIN, THE NYLON PIN FIRMLY FASTENS THE "PYRO-SHIELD" INSULATION CAP TO THE ASSEMBLY.

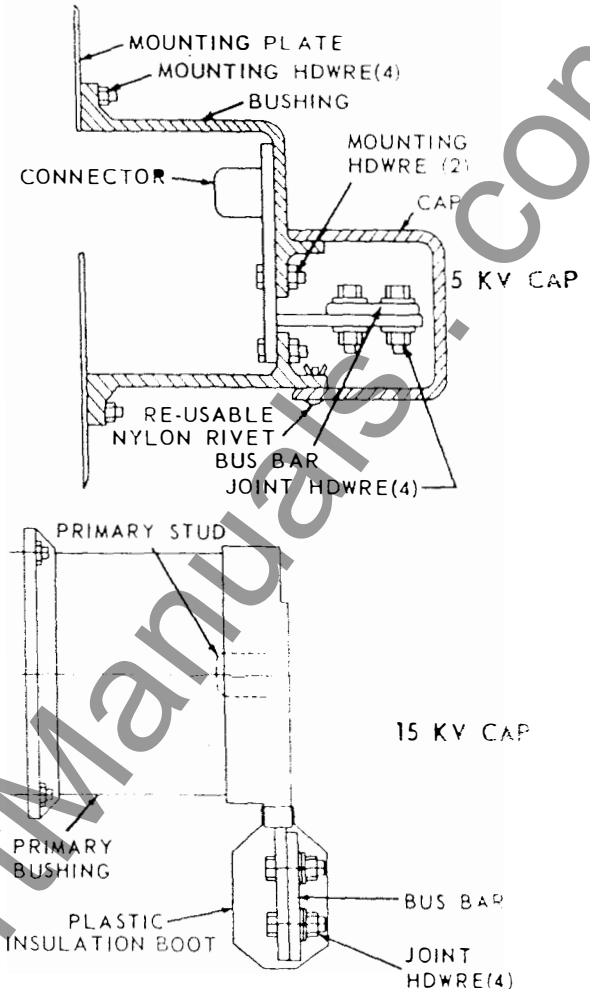


Fig. 6 — Bus joint using *Pyro-Shield* insulation caps (side views).

PRIMARY CABLE CONNECTIONS

Before primary cable connections are made, phase rotation must be considered. Viewed from the breaker drawout side, phase 1 is at the left, phase 2 in the center, and phase 3 at the right.

When the bus bars are arranged horizontally and parallel to the breaker drawout side, phase 1 is toward the front of the assembly, phase 2 is in the center, and phase 3 in the rear.

When bus bars are arranged above one another, phase 1 is at the top, phase 2 in the center, and phase 3 at the bottom.

Phasing is furnished this way unless otherwise marked on the installation drawings transmitted prior to shipment of the switchgear.

Relays and meters are connected for a phase rotation of 1, 2, 3. This means that the voltage of phase 1 reaches its maximum value 120 degrees ahead of the voltage of phase 2, and the voltage of phase 2 reaches its maximum value 120 degrees ahead of the voltage of phase 3. Lines to the switchgear must be connected accordingly to insure correct meter and relay operation.

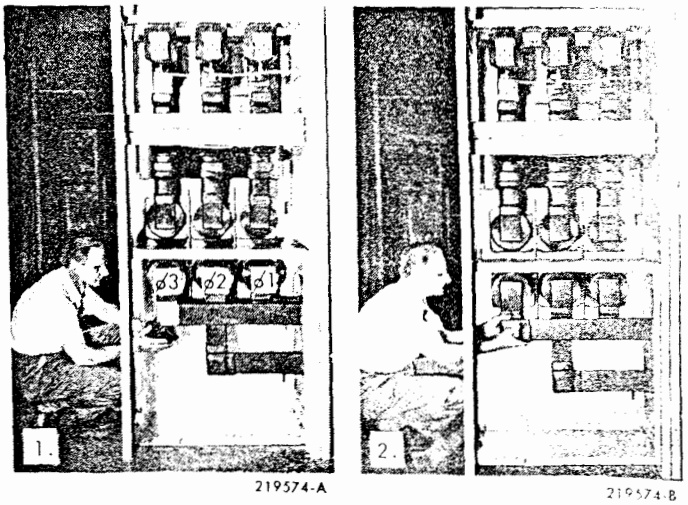
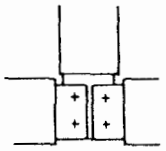
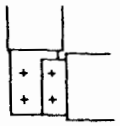
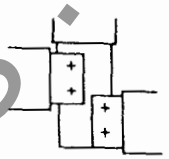
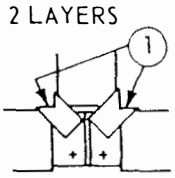
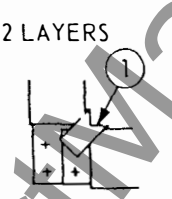
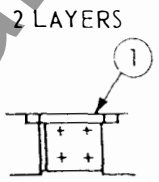
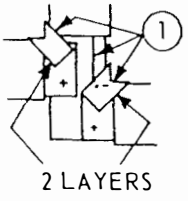
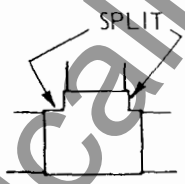
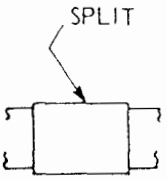
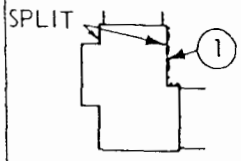
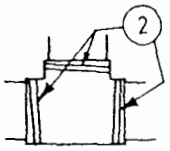
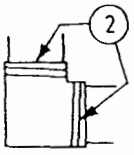
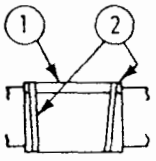
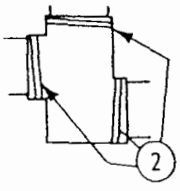
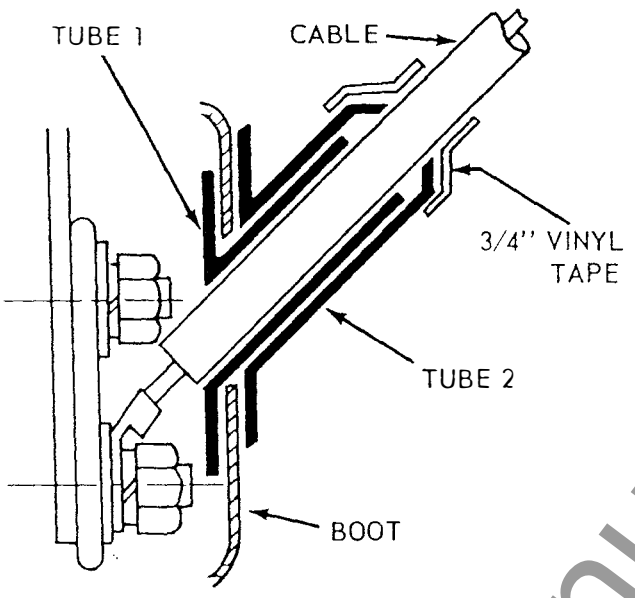


Fig. 7 — Molded polyvinyl boots are used to insulate bus joints of 13.8-kv switchgear. Molded boot is placed over bus joint **(1, 2)** and then **(3)** secured over bolted bus joint with vinyl tape.

	T CONNECTION	L CONNECTION	THRU CONNECTION	OFFSET CONNECTION
STEP 1 Make bus bar joints as instructed. Observe carefully the required placement of bolts through the joint.				
STEP 2 Place two layers of 2-inch wide black vinyl tape [1] in corners or over edge as shown, one on top of the other. Form a sharp corner over the bus bar tape or tubing. The ends of the tape should extend equally over the front and back of the joint.				
STEP 3 Place the plastic boot on the joint and align to produce the minimum gap at the split. Locate the split over the 2-inch wide black vinyl tape.				
STEP 4 Apply single layer ½ lap ¾-inch wide maroon vinyl tape [2] as shown to hold the boot in place. On the thru-connection, place a third layer of the 2-inch black vinyl tape over the split before securing the boot with the ¾-inch tape.				



INSULATION BOOT INSTALLATION WITH A CABLE CONNECTION
(except Thru-Connection) *

Step 1 Cut a one-inch diameter hole in the center of the insulation boot for the specified joint (except thru-connection).

Step 2 Slide insulation tube number 2 onto cable from the joint connection end.

Step 3 Slide boot onto the cable from the joint connection end through the one-inch hole cut in the center.

Step 4 Slide insulation tube number 1 onto the cable from the joint connection end.

Step 5 Strip cable insulation and make connection to joint.

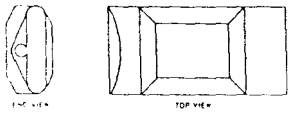
Step 6 Slide tube 1 tight against joint.

Step 7 Fit boot over the joint. Tube 1 will pass through the hole in the boot, tube 2 will remain outside of the boot.

Step 8 Holding boot tight up against the joint, slide tube 2 tight up against the outside of the boot.

Step 9 Tape the end of tube 2 to the cable with one layer of 3/4-inch wide maroon vinyl tape.

* NOTE: At Thru-Connection Joints where a cable is to be installed, a boot will be supplied to fit over the cable. Make the cable connection as instructed and install the boot in the same manner as shown on the front side of this sheet.



BOOT FOR THRU-CONNECTION WITH CABLE

CAULKING MATERIAL

"Scotchcast" Number 214 resin is supplied to caulk the air gaps around bus bars at the bus supports.

MIXING

The resin is furnished in two parts. Each part should be thoroughly mixed before combining. Mixing proportions are 5 parts "A" to 1 part "B" by weight. The combined parts should be completely mixed by mechanical means until the color is uniform. Avoid excessive whipping as it introduces air into the mixture.

POT LIFE

A batch will remain manageable for 45 minutes to an hour and a half. It can readily be used with a spatula for the first 45 minutes.

CURING TIME

The resin will gel at room temperature in four to eight hours. Complete cure is 24 hours at room temperature.

APPLICATION PROCEDURE

The compound handles much like peanut butter. It is readily applied with a spatula and remains in the exact place it is applied. Apply the resin to make a continuous fillet completely around the bus bar insulation at the support, as shown in the following figures. Care must be taken to insure that all air voids between the tubing and support are completely filled with resin.

AMOUNT REQUIRED

Each caulked support requires 1/6-pound of resin for each phase, or 1/2-pound for a three-phase arrangement. One 1-pound batch of "Scotchcast" Number 214 resin (parts A & B) is part number Q0125051.

WHERE APPLIED

Apply to all metal-clad switchgear and bus ducts rated 15kv. Also apply to Types P and Q switch units with insulated bus when included in metal-clad lineups. All three phases are to be caulked as described above.

ILLUSTRATIONS OF CAULKED AIR GAPS ON BUS BAR SUPPORTS

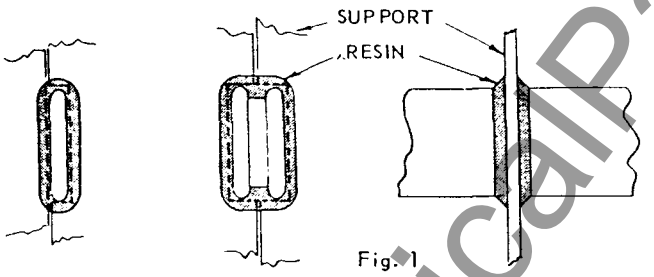


Fig. 1

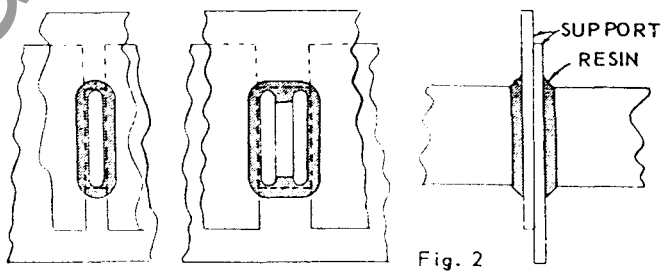


Fig. 2

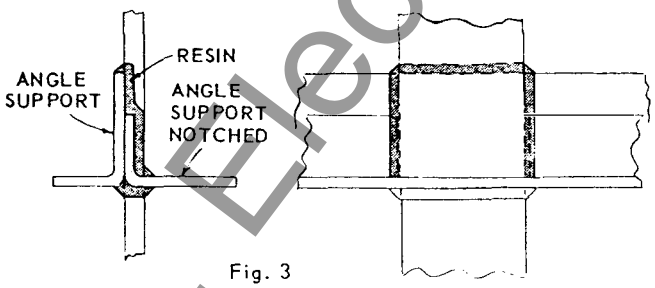


Fig. 3

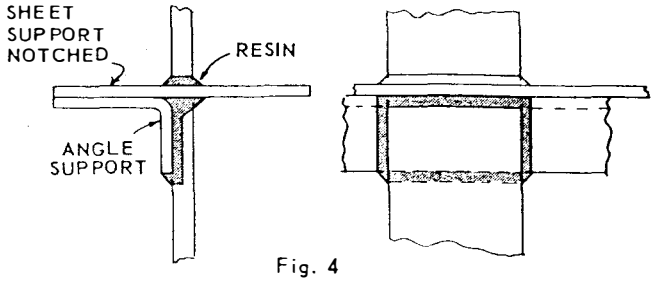
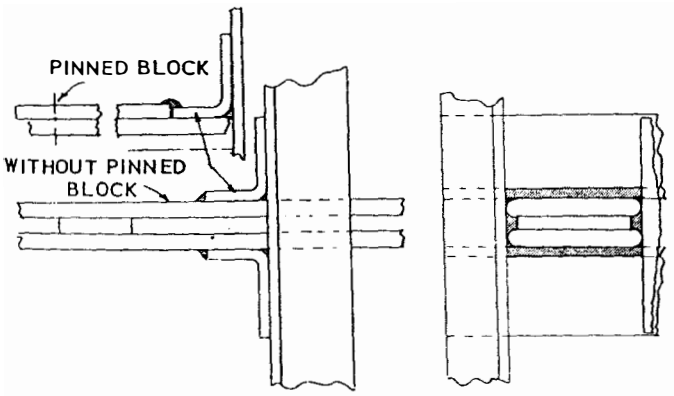


Fig. 4



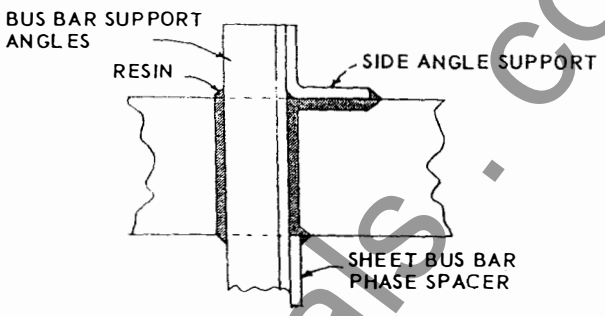


Fig. 5

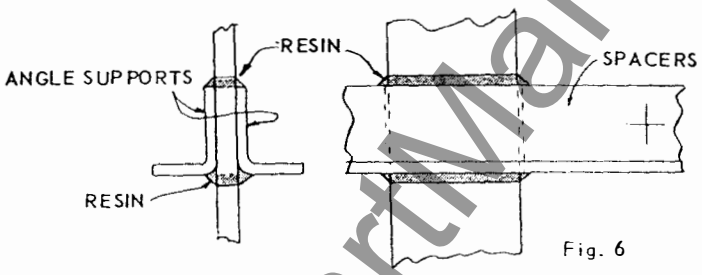


Fig. 6

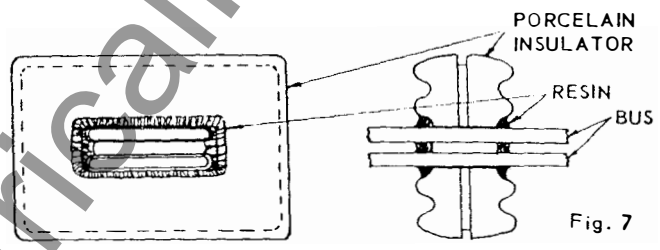


Fig. 7

Use resin to form a complete ring between the porcelain insulator and bus insulating tube. This operation must be performed on both sides of the porcelain insulator. It is not necessary to completely fill the void within the insulator or between bus bars.

POTHEAD CONNECTIONS
(Lead Covered Cable)

The following material, with the exception of the insulation compound and tarred rope, is not included with the switchgear unless covered by the contract, but is needed to properly install pothead connections:

(a) Insulating compound.
(b) Solder (50-50) for connectors.
(c) Solder (60-40) for wiping joints.
(d) Stearine for solder and wiping flux.
(e) Varnished cambric tape for reinforcing cable conductor insulation and for stress relief cones. (Rubber tape is used on rubber insulated cables.)
(f) Copper tinsel braid for stress relief cones, if required.
(g) Dry cotton tape.
(h) Tarred rope for filling clamp-type cable glands.

Tools and equipment required for installing potheads:

(a) Kit of cable jointer tools including hacksaw, knife, and wrenches.
(b) Blow torch.
(c) Gasoline furnace for heating solder and compound.
(d) Solder pot and ladle.
(e) Melting vessel for melting compound.
(f) Funnel, filling and vent pipes for compounding.
(g) Thermometer (200 to 500 degrees F).

Note the following general instructions:

(a) The conductor insulation and internal parts of the pothead should be kept clean and free of moisture.
(b) Avoid sharp bends in insulated conductors.
(c) Remove lead sheath carefully to avoid cutting the insulation. The last few layers should be torn off to prevent cutting the individual conductor insulation.
(d) If temperature is below 15 degrees F, cable must be warmed prior to bending. Potheads should always be heated to prevent compound from congealing too quickly on cold surfaces. Avoid direct application of heat on porcelains or on parts with porcelain inserts.
(e) Follow carefully the instructions shown in Figures 11 and 12. In all cases avoid the formation of air and gas pockets.
(f) Fill the potheads with compound from the bottom up to allow compound to rise evenly and force air up and out at the top, eliminating voids. Clean off all surplus and spilled compound.
(g) After pothead has cooled, re-tighten all bolts to make sure of positive tightness of all joints.

INSTRUCTIONS FOR RECLAMATION OF A POTHEAD

Following procedure can be used if cable is going to be replaced:

Steps 1 — Cut off cable at base of pothead.
2 — Remove upper pothead connections.
3 — Remove pothead from cubicle.
4 — Remove top cap nuts and vent screw as well as pipe plug in lower pothead body.
5 — Pothead can now be placed in an oven with temperature of approx. 150 degrees C and left in oven until all compound drains.
6 — When completely drained remove, disassemble and clean thoroughly with suitable solvent.
7 — *IMPORTANT*: It is recommended that new compound be used to refill pothead after reassembling as the dielectric strength of the old compound may be reduced by contaminants.
8 — New gaskets must be used for reassembling.
9 — It may be necessary to obtain new wiping sleeves or packing glands and studs, depending on new cable size to be used. If new cable will be smaller than that removed, stud and wiping sleeve or packing gland must be replaced with new. If new cable will be larger, then holes may be opened to desired size and original stud and sleeve or gland can be reused.
10 — To refill, same procedure can then be followed as if this were a new pothead. The instructions given for this refilling are in complete detail in Switchgear Instruction Books furnished with every installation.

For removing potheads where existing cable is to be reused:

Steps 1 — Remove upper pothead connections.
2 — Remove top cap nuts and vent screw as well as bottom pipe plug.
3 — Shield cable at base of pothead with asbestos or other heat insulating material as safety feature to avoid damage to cable insulation.
4 — Using a blow torch or other heating device, heat body of pothead sufficiently to melt compound and drain into bucket.
5 — Heat well around drain plug at bottom to start compound flow.
6 — *CAUTION*: Do not apply flame directly to porcelain insulators as they may crack, and if sufficient heat should travel to the top it could melt compound in insulator.
7 — When drained, pothead can be removed, disassembled and cleaned with suitable solvent.

Then follow instructions given in Steps No. 7, 8, 9 and 10, above.

PACKING, WIPING SLEEVE GLANDS AND SUPPORTS

When packing glands are furnished, cut the gland to suit the outside diameter of the cable, and pack as shown for the clamp-type terminals. (Figure 11.)

TAPING JOINTS

When supports of insulating material are furnished, the supports should be cut for the cable O.D. and suitably clamped.

Upon completing the primary cable connections (Figs. 11, 12, and 14), untaped high voltage connector joints should be insulated. After connections are made, the joints are wrapped with Allis-Chalmers no-corona tape. Use approximately two feet of this copper mesh tape to form a regular surface (not necessarily a straight surface) over the bolt heads.

Wrap joints with three layers of Empire cloth sheet 0.010 inches thick (approximately six ft long), wide enough so that edges overlap adjoining insulation about three inches, and long enough to overlap ends three inches. Stagger the overlapping of the ends as much as possible and tie the layers firmly with bias cut yellow Empire cloth tape 0.010 inches thick by ¾ inches wide (approximately 30 ft long).

Make this insulation operation with the Empire cloth twice for satisfactory insulation for 5.0 and 7.5 kv equipment, and three times for 15 kv equipment. Use six sheets of 0.010 inches thick Empire cloth per joint for 5.0 and 7.5 kv, and nine sheets for 15 kv. Then tape joints with one layer half wrapped electrical tape (one roll). See Figure 8 for typical insulated joints.

POTHEADS

Potheads must be co-ordinated with other switchgear components to meet space, dielectric, momentary current, and thermal current requirements. Allis-Chalmers potheads meet these requirements when installed as a component of metal-clad switchgear.

In standard Allis-Chalmers switchgear units, the pothead mounting is such that the pothead may be removed from the mounting without disassembly of the pothead. Each three conductor pothead, or group of three single conductor potheads, is on a separate mounting plate. The plate, in addition to serving as a mounting, separates the current transformer compartment from the cable compartment.

The potheads are mounted in a manner that the customer can, if he desires, make his cable connection outside the unit or on the floor of the unit. He may also make his cable installation in the mounted position. There is sufficient distance between the entrance of the pothead and the floor of the unit to permit dropping the pothead body over the cables to make the stress cones.

Different sizes of pothead bodies are not furnished to match the various cable sizes within an installation. One three conductor body is furnished to take all sizes up to approximately 750 mcm. One single conductor body is furnished to take all cable sizes up to approximately 1000 mcm. This permits the installation of larger cable if the loads outgrow originally selected cable sizes.

Three conductor potheads have their entrance off-set, so that if two potheads are mounted in one unit the off-sets are in opposite directions. This provides more space to work when wiping lead to the wiping sleeve of the pothead and lead of the cable.

Allis-Chalmers potheads are designed to meet circuit breaker current ratings. Maximum ratings are: Momentary current rating — 70,000 amperes; 4 second rating — 44,000 amperes.

Potheads are an integral part of switchgear and therefore are required to stand the same tests as other metal-clad switchgear components. The following are dielectric tests required to meet switchgear standards.

Table 1

Voltage Rating	Low Frequency RMS	Impulse Crest 1.5 x 40 MS Positive or Negative
7.2 KV	26 KV	75 KV
13.8 KV	36 KV	95 KV
5 KV	19 KV	60 KV

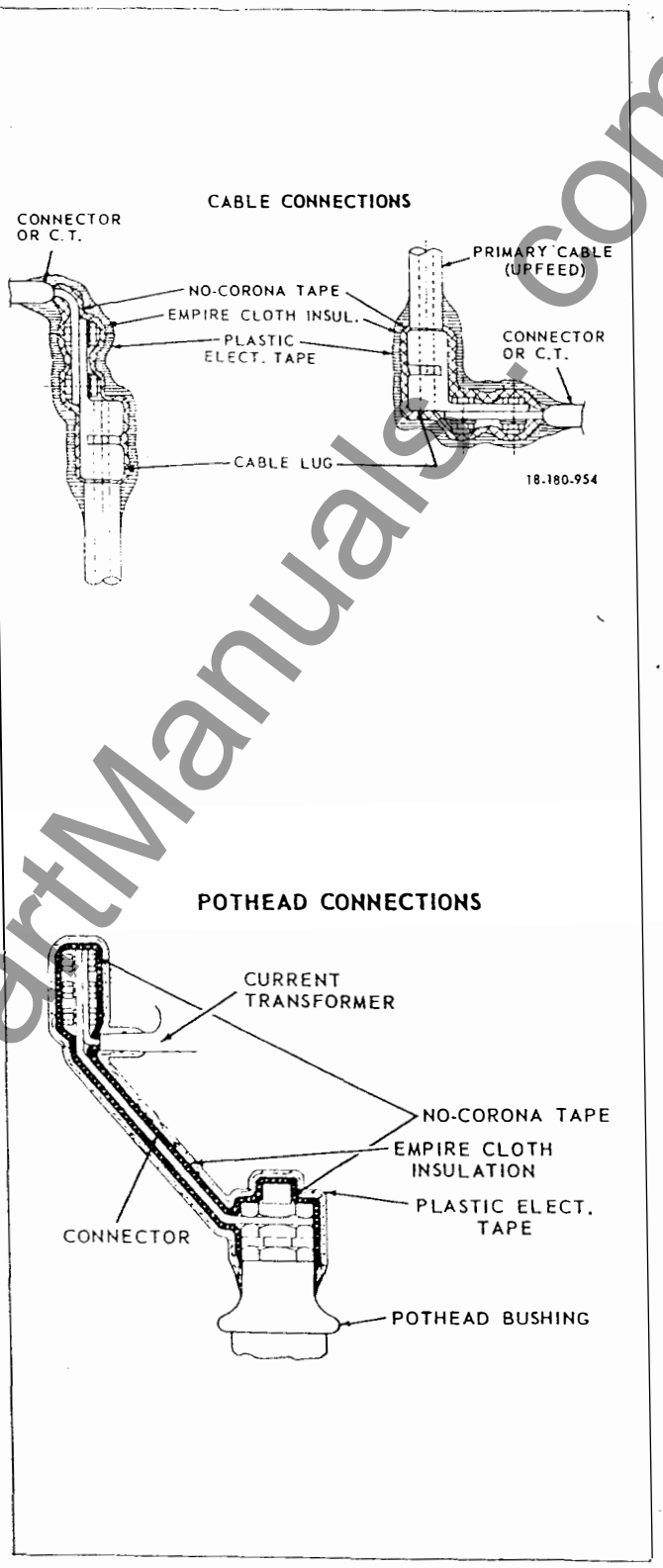


Fig. 8 — Instructions for taping joints.

STRESS RELIEF CONES

Stress relief cones increase the strength of the cable insulation against puncture at the end of the grounded shielding. They also increase overall internal dielectric strength and reliability of the cable termination. Stress cones are recommended for all shielded cables and the higher voltage single conductor lead covered cables. Belling out lead sheath is usually sufficient for lower voltage lead covered cables.

On paper or varnished cambric insulated cables, a double cone is built up of half lapped varnished cambric tape. The lower slope is wrapped with copper tinsel braid, tucked under the bell at end of lead sheath and soldered to the lead sheath and/or to the cable shielding tape. On rubber insulated cables, the double cone may be built up of dry varnished cambric tape and shielded with standard copper tinsel braid as above.

STEP A — Preparing the Cable

Determine length of each conductor to extend from position of wiping sleeve or packing gland to point of connection to the stud terminal. Establish location of stress relief cone on the cable so that it will be approximately in the center of the pothead body. Remove shielding and conducting tapes down to bottom of stress cone (point X). Bare the end of the conductor and solder to stud terminal.

STEP B — Building the Stress Relief Cone

Starting at the terminal end, wrap varnished cloth tape, half lapped down to the edge of the metal shielding tape. Continue wrapping back and forth until the double cone of proper diameter is obtained. Finish by wrapping the final layer of tape on the conductor and on up to the stud terminal. If varnished cambric tape is used, and the cable is varnished cambric or paper insulated, flushing oil should first be brushed on the cable insulation and on each layer of tape. Use long rolls of varnished cambric tape to minimize the number of splices. Wrap tightly. If tape breaks, unwrap enough to locate splices near the connector end of the cone.

INSTALLATION INSTRUCTIONS

1. Check cable gland and stud to see that they fit cable. These items may be furnished with pilot holes only. Drill out if necessary with a clearance of approximately 1/16 inch over size of cable sheath and conductor, respectively.
2. Slide cable gland, cable gasket, and pothead body down over cable.
3. Train cable into proper position allowing sufficient length to make connections.
4. Mark cable sheath approximately 1 to 1½ inches above the bottom of the gland.
5. Remove lead sheath from the cable to point marked, being careful not to damage insulation. Bell out lead sheath as shown in Figure 9. For braided cables remove braid down to point "X."
6. Remove belt insulation (outer layers of insulation around all conductors) from the cable to point "X" above the lead bell.
7. Fan out conductors into final position avoiding sharp bends (3 conductor only). Cut off conductors to proper length to fit into studs. Remove cable

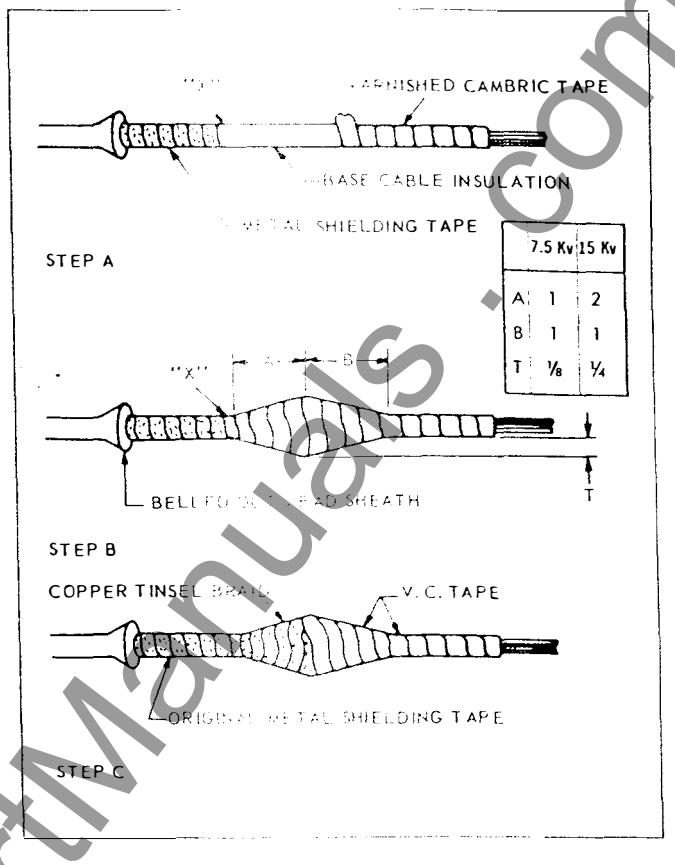


Fig. 9 — Typical cable and taped pothead connections.

STEP C — Shielding

Starting slightly below the middle of the double cone, apply copper tinsel braid to the lower half. Wrap so that the upper edge is even and continue wrapping down the cone over cable shielding or tuck under lead sheath. Solder the tinsel braid between turns and to shielding. Solder shielding to lead sheath or to ground connecting wire.

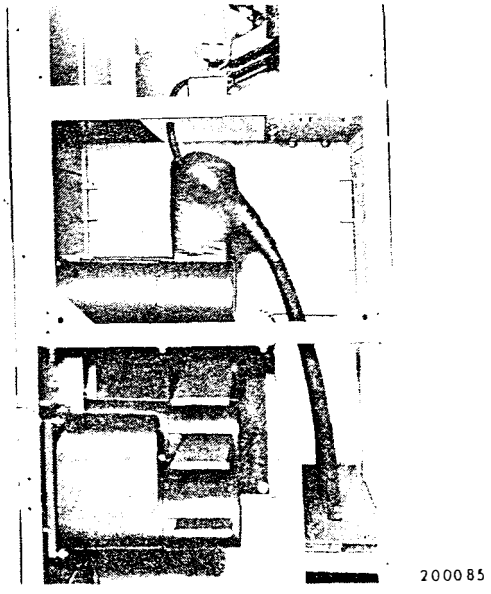


Fig. 10 — Typical cable compartment showing cable in downfeed direction. Refer to Figure 8 for cable joint insulation instructions.

insulation from end of conductor at least ¼ inch longer than depth of hole in stud.

8. Solder cables solidly into the studs. (For voltages above 7,500 stress cones should be made up on cables as shown in Figure 9.)
9. Install studs in insulators with gaskets and key washers in place. Bolt insulators firmly to their mounting plate. Tighten nut next to key washers on studs.
10. Bolt the pothead body up against insulator plate with gasket in place.
11. Bolt cable gland to pothead body with gasket in place.

12a. *For Upright Pothead* (Cable leading down). Wipe joint between cable and wiping sleeve, or pack stuffing box, and pull up tight to seal against cable sheath.

12b. *For Inverted Pothead* (Cable leading up). Wipe joint between cable and wiping sleeve, inserting a greased wire next to cable sheath if wiping sleeve gland is used. After wiping, remove greased wire to provide an air vent when filling pothead with compound. If packing gland is used, do not pack until after filling.

13a. *Filling Upright Pothead.* Remove vent screws from top of studs. Insert standpipe into pothead body and extend it above highest point of pothead. Melt compound per instructions and fill body until compound reaches vent. Keep standpipe hot and full until compound in body solidifies. Remove standpipe and insert plug and gasket.

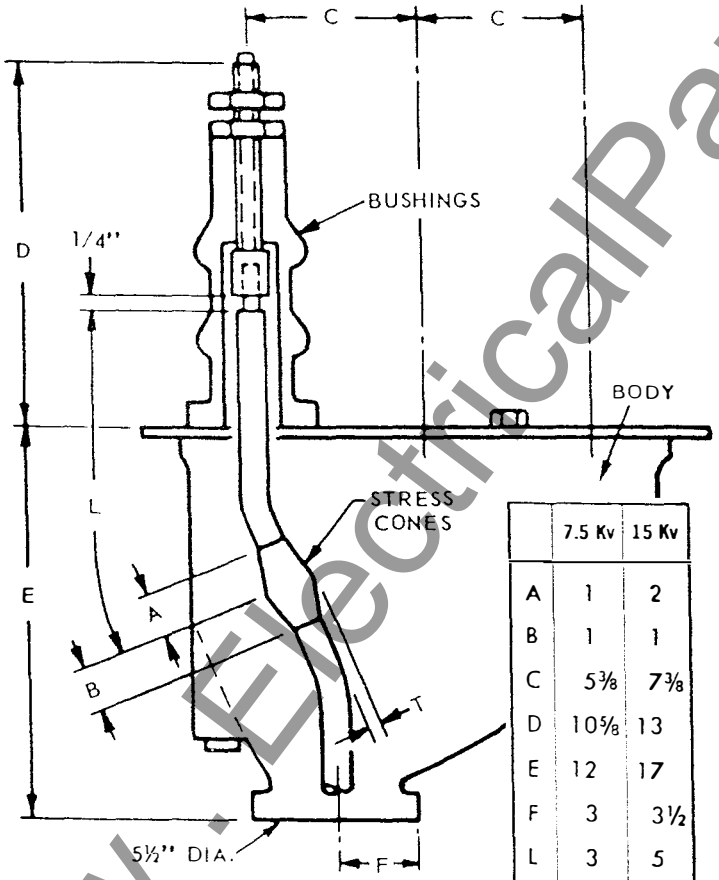
13b. *Filling Inverted Pothead.* Do not remove vent screws in studs. Make sure these are tight. Venting is provided by hole left in wiped joint or through packing space, depending on type of gland used. Insert standpipe into filling hole in insulator mounting plate and extend standpipe above highest point of pothead. Melt compound per instructions and fill body until compound reaches vents. Keep standpipe hot and full until compound in body solidifies. Remove standpipe and insert filling hole plug and gasket. Solder up hole in wiped joint, or insert packing, and tighten clamp to seal joint between cable and pothead body.

GENERAL INFORMATION

Allis-Chalmers potheads are designed with base flange to match G & W base size 4, so that G & W fittings can be used on these potheads. Fitting flange is 5⅜" O.D. for base size 4.

MAXIMUM CABLE SIZE FOR A-C POTHEADS

Single cable entering porcelain ..... 2½" O.D.
Bare cable entering connectors ..... 1⅜" max., ¼" min. O.D.
Cable entering wiping sleeve ..... 3¼" O.D.
Cable entering conduit support ..... 2¾" O.D.
Cable entering packing ring ..... 3" O.D.



	7.5 Kv	15 Kv
A	1	2
B	1	1
C	5⅜	7⅜
D	10⅝	13
E	12	17
F	3	3½
L	3	5
T	⅛	¼

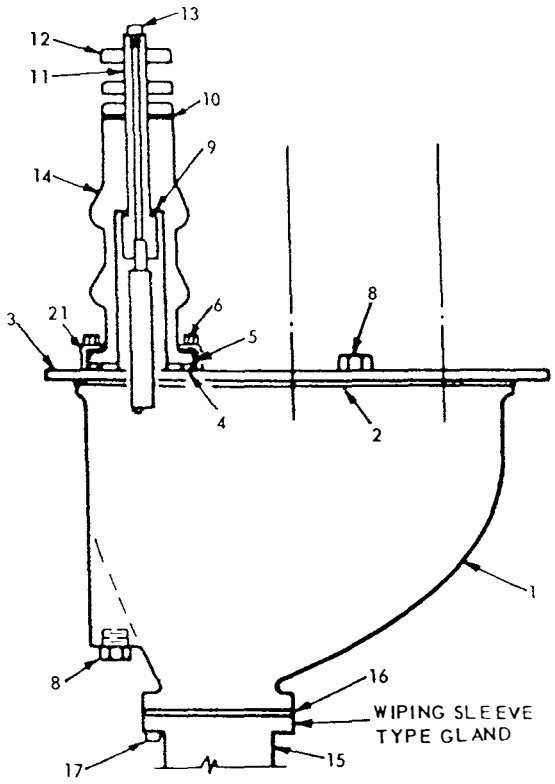
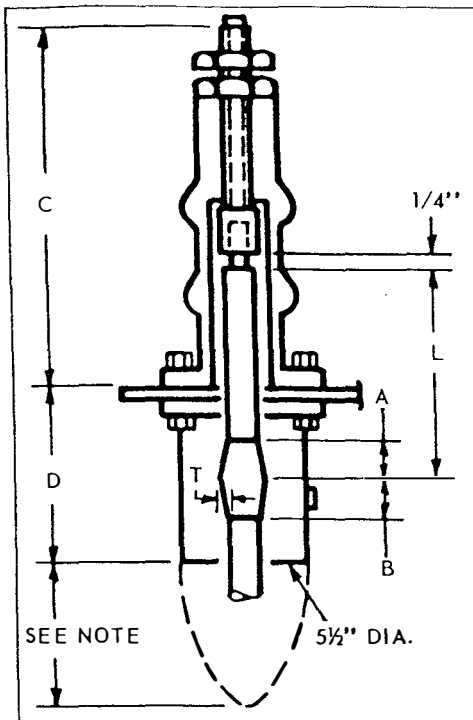
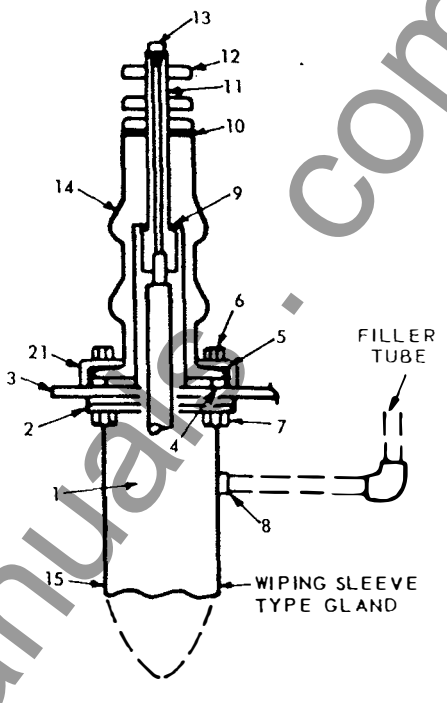


Fig. 11 — Three-conductor potheads.



	7.5 Kv	15 Kv
A	1	2
B	1	1
C	10⅝	13
D	5¾	5¾
L	3	5
T	⅛	¼



Note: Gland Dimensions
Clamp Type—1⅞"
Wiping Sleeve—4¾"

Fig. 12 — Single-conductor potheads.

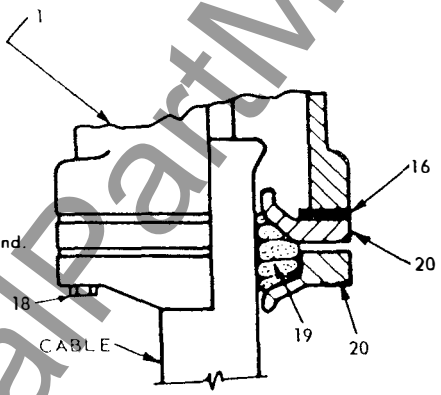


Fig. 13 — Detail of clamp-type cable gland.

PARTS LIST (Figs. 11, 12, 13)

Item	Name	**Conductors	Dwg. No.
1	Pothead Body	(3C)	18-446-161-001
		(3C)	18-446-206-001*
		(1C)	18-446-151-001②
		(1C)	18-230-399-001①
2	Gasket	(3C)	18-240-443-001
		(3C)	18-240-252-001*
		(1C)	18-140-471-001
3	Support Plate	(3C)	18-172-856-001
		(3C)	18-178-221-001*
		(1C)	18-172-856-001
		(1C)	18-178-221-001*
4	Gasket		18-140-469-001
5	Gasket		18-140-469-002
6	Cap Screw ⅜" x 2¼"	(1C)	00-611-345-476
	Screw (Brass)	(3C)	00-655-017-036
	Lock Washer		00-655-059-200
	Washer (Brass)		14-104-595-018
7	Hex Nut ⅜"		00-631-059-106
8	Pipe Plug 1"		00-711-497-006
	Gasket		18-140-469-005
	1" Washer		00-651-027-480
9	Gasket		18-140-469-003
10	Gasket		18-140-469-004
	Key Washer		18-140-468-001
11	Stud Terminal		18-270-769-002
12	Hood Nut		18-631-859-006
13	Vent Screw		00-615-471-417
	Washer		00-615-007-196
	Gasket		18-140-469-006
14	Insulator		18-363-987-001
			18-363-734-001*
15	Wiping Sleeve	(1C)	18-230-399-001
		(3C)	18-261-493-001
16	Gasket		18-160-750-001
17	Cap Screw ⅜" x 1"		00-611-289-466①
18	Cap Screw ⅜" x 1½"		00-611-289-470②
19	Hemp Rope		(Tarred)
20	Packing Ring		18-261-494-001
21	Insulator Support		18-240-300-001

*Denotes 15 kv part, all other Nos. are common to both 7.5 kv and 15 kv.
**(1C) Single Conductor; (3C) Three Conductor.
①Wipe ②Clamp

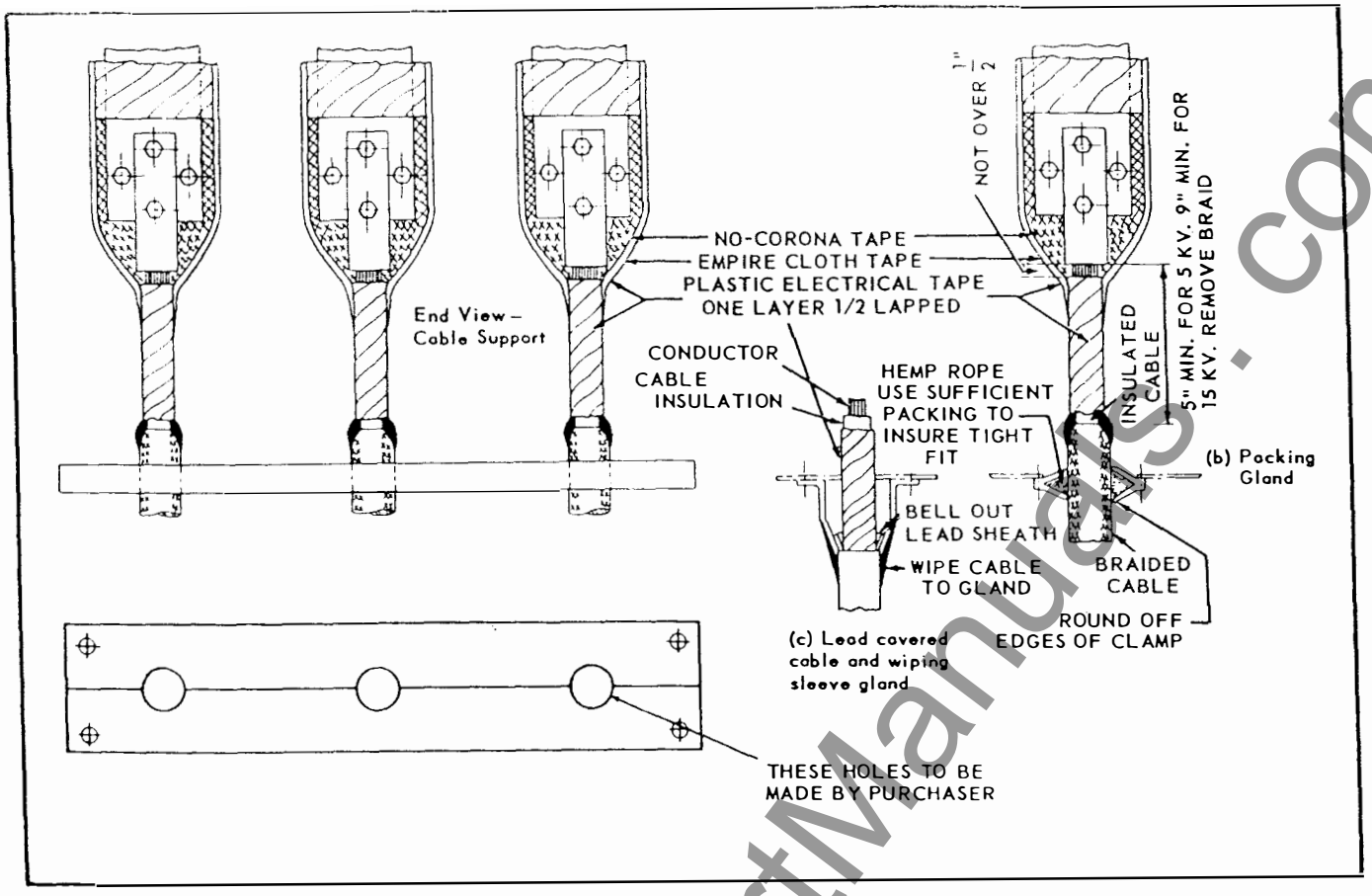


Fig. 14 — Primary cable connections.

SECONDARY WIRING

Secondary wiring is carefully installed and tested at the factory for electrical and mechanical soundness. Customer's connections are made to terminal blocks and/or secondary disconnect blocks as shown on typical wiring diagram, Figure 4.

If special connections are made, such as the inclusion of contacts on remote devices, wired terminal blocks are provided for this purpose. See Figure 15 for typical control cable connection.

GROUND CONNECTION

A common ground bus is incorporated in all units for properly grounding the equipment after installation.

The ground bus extending thru the switchgear is accessible in the primary cable area of the left hand end of the unit.

Provision for connecting this ground bus must be made in a manner that a reliable ground connection is obtained. Consult latest National Electrical Code for ground connection standards.

TEMPORARY GROUNDS

It is recommended that no work be done on current carrying parts until these parts have been disconnected from the system and solidly grounded. One method of solidly grounding the high voltage circuit is by use of a grounding device. This device is placed in a cubicle in the same manner as a breaker and provides a path to ground. It is furnished only when specified in the contract.

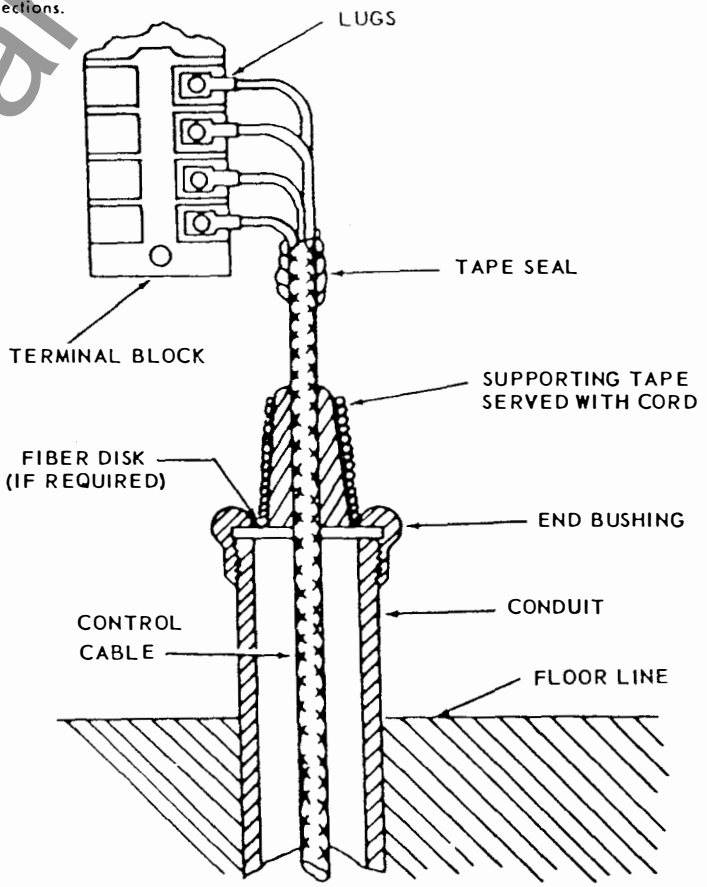


Fig. 15 — Secondary control cable connections.

CIRCUIT BREAKER

General

The stationary element (cubicle) of metal-clad switchgear and the removable element (circuit breaker) are built to master jigs so that circuit breakers of the same rating are interchangeable. All removable elements of like rating are checked with the applicable stationary element jig, and each stationary element is checked with the applicable removable element jig to insure complete interchangeability between elements of like rating.

Each switchgear unit, from the main bus to the cable terminals, is divided into compartments with access barriers for personnel safety. All conductors are insulated with flame-retardant materials. This, together with compartmentation, permits inspection and maintenance with a minimum of exposure to dangerous potentials.

INSERTING THE BREAKER

After the breaker has been inspected and prepared as instructed in the circuit breaker instruction book, it can be inserted into the unit. If the breaker is furnished with a special nameplate identifying it with a definite unit or units, do not place it in any other unit. This limitation is sometimes necessary because special devices have been furnished on that particular breaker. When no such special nameplate is used, the breaker can be used in any unit of same rating.

To insert breaker, first line up the breaker directly in front of breaker unit. The positive, straight-line, in-and-out movement of the *Ruptair* breaker is assured by the guide track assembly (Fig. 17) mounted on the floor of the unit. This track has a funnel-type entrance and simply connects the mating guide bar on the base of the breaker as it enters the unit.

MECHANICAL INTERLOCKS

Allis-Chalmers horizontal drawout switchgear has breaker interlocks that prevent:

Movement of the circuit breaker to or from the connected position when it is in the closed position.

Closing of the circuit breaker unless the primary disconnecting devices are in full contact or separated by a safe distance.

The main interlock is the right wall of the guide track fixed to the floor of the breaker compartment. A cam-follower, mounted under the breaker and connected to the trip mechanism, rides on this bar. The breaker can be closed only if this cam-follower is in the lower (test or operating) position. When the follower is in the upper position, the breaker is trip-free — it cannot be closed or held in the closed position electrically or mechanically. The circuit breaker cannot be moved to any other position from any one position (disconnected, test, or operating) without first depressing the position release pedal.

Depressions in the compartment interlock bar are provided for the disconnected, test, and operating positions. When the breaker is in the disconnected position, the primary disconnects are separated and the shutters are completely closed. However, when the breaker is in the test position, the secondary disconnects are still making contact.

Control (or secondary) circuit connections between the stationary and removable elements are made by means of automatic, self-aligning, multi-contact, slip type connectors. Contact surfaces are mounted in the stationary element and the fingers on the removable element. The contact surfaces on the stationary element are recessed to prevent accidental short circuiting of the control circuits. Contact fingers, mounted on the removable element, are designed to assure a positive contact pressure. Low contact resistance is secured by the wiping action of the curved fingers which wipe on the flat surfaces of the stationary portion.

Padlocking is accomplished by matching holes in the breaker frame with those in the release pedal arm. In

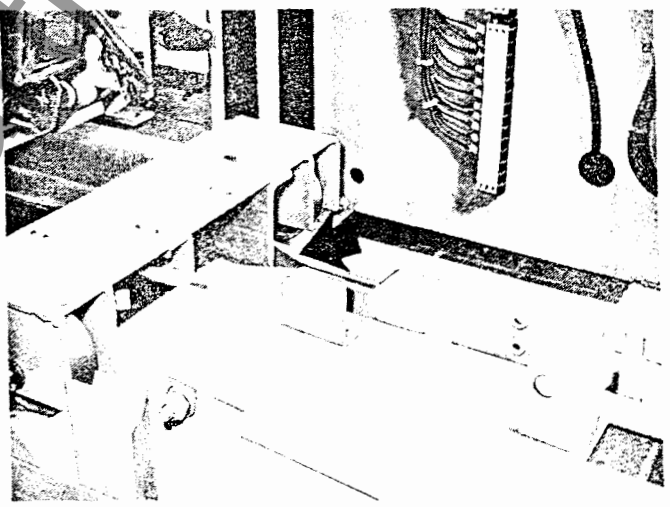


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Fig. 17 — Interior view showing guide track.

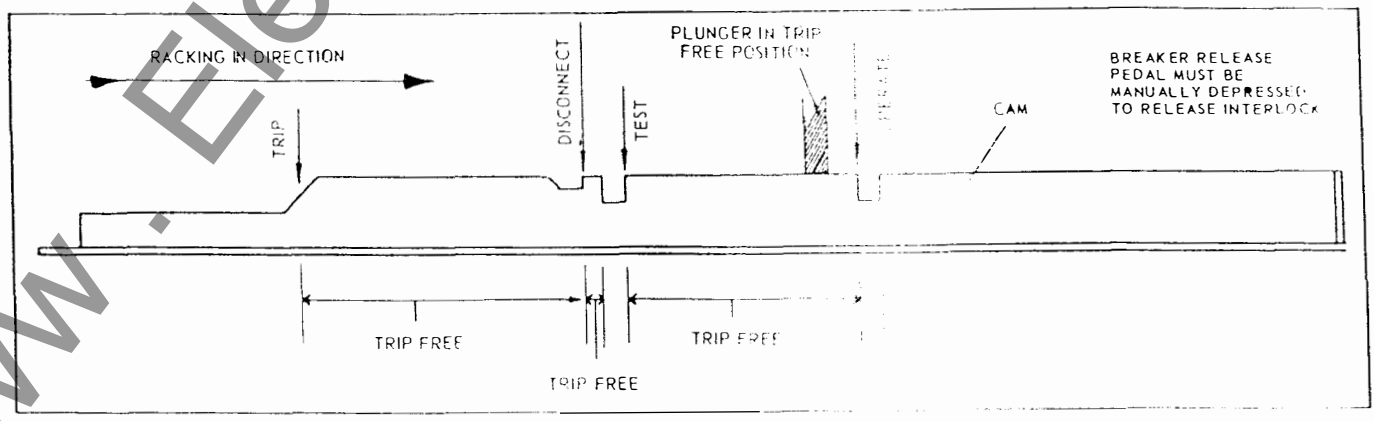


Fig. 18 — Guide track and interlock mechanism.

the padlocked position, the release pedal will be halfway down, the breaker will be trip-free and the interlock cam follower will still restrain the breaker in any of the three positions within the unit.

The shutters are counterbalanced. This results in smooth, trouble-free operation. The circuit breaker in movement in either direction operates directly on the shutter operating lever arm which is pivoted at the right inside front of the breaker compartment. A cam follower on the shutter operating lever arm mates with a follower track on the breaker which serves to raise the lever arm to open the shutter blades and lower the lever arm to close the shutter blades.

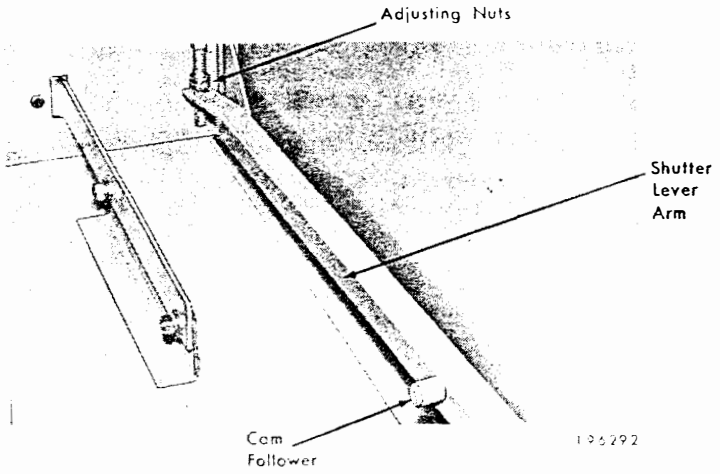


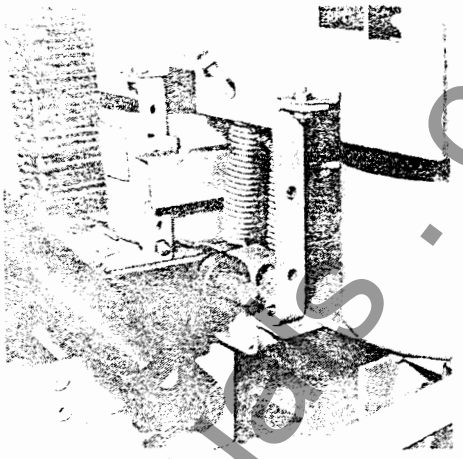
Fig. 18 — Cam follower on shutter lever arm mates with cam on breaker frame to positively open and close shutters. Adjusting nuts insure free, easy shutter operation

RACKING INSTRUCTIONS for 5-KV BREAKER

Insertion of the breaker into the unit to the disconnected position is accomplished without the operator having to do any thing more than push the breaker into position. The breaker will come to a stop in the disconnected position when the breaker cam follower is forced into the depression of the interlock. The position release pedal must be manually depressed to raise the cam follower to permit movement of the breaker to test position. Here again, the release pedal must be depressed to permit movement of breaker toward the connected position. The breaker will come to a stop when the primary breaker fingers strike the primary stud in the tube mounted on structure baseplate. To move the breaker to the fully connected position, a lever bar must be used (Figures 19, 20).

The pivot point of the lever bar is inserted into its mating hole in the fulcrum angle mounted on the compartment floor slightly to the right of the center of the breaker. A short upward stroke of the crank levers the breaker into the full operating position. Only when the breaker is in full operating position and the cam follower in the corresponding depression can the breaker be closed.

To withdraw the breaker, the fulcrum pin of the lever bar is inserted into its mating hole in the breaker carriage. Pivoting about the fulcrum angle on the floor (after depressing the breaker position release button) with a short downward stroke quickly withdraws the breaker.



Inserting when [illegible] of lever bar into left side hole of breaker bearing plate and resting against outside of fulcrum angle on floor, a short downward stroke of bar racks breaker out. The release pedal must be manually depressed to move breaker. After breaker moves [illegible] the release pedal, pull breaker with lever bar until [illegible] stops in "TEST" position.

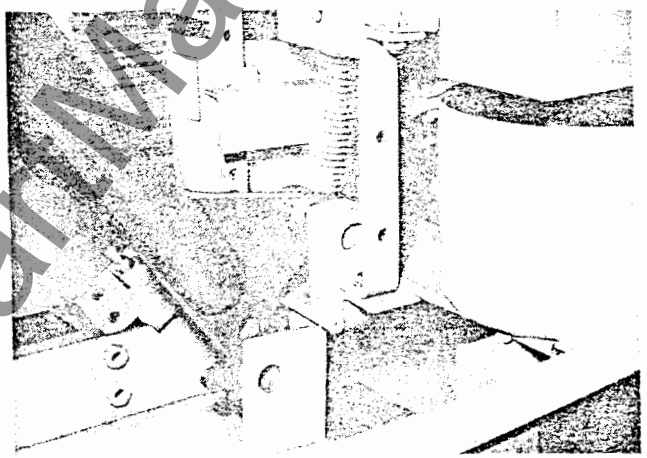


Fig. 19 — Racking instructions for 5-kv breaker. Top picture shows method of placing breaker in [illegible] position and lower picture shows method used to rack breaker [illegible] of connected position.

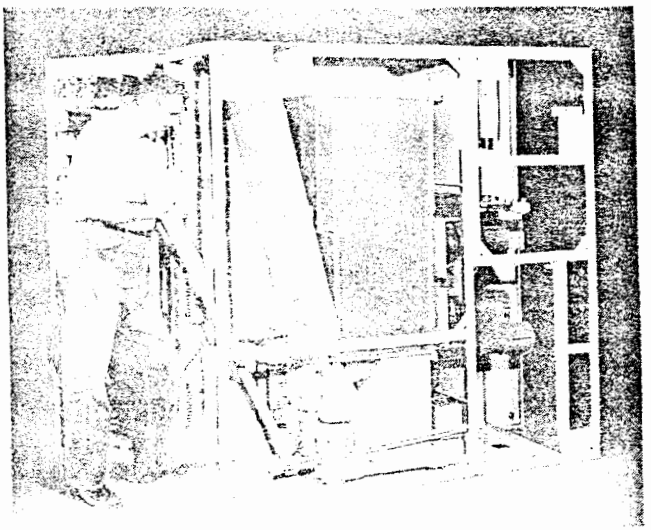


Fig. [illegible] Lever bar [illegible] operating position.

RACKING INSTRUCTIONS for 15 KV BREAKER

To insert the breaker into the cubicle, manually center the breaker at the front of the cubicle. The breaker may be manually pushed far enough into the cubicle to enable the racking lever pawl to engage the racking strip on the cubicle floor. Insert the jet on the lever into the horizontal hole at the bottom of the breaker frame. The racking lever pawl should engage the racking strip with the pawl pointing toward operating personnel. By "pumping" the lever handle, the breaker will travel toward the disconnect, test and connected positions.

To remove the breaker, reverse the pawl to point away from operating personnel and operate the lever as described above.

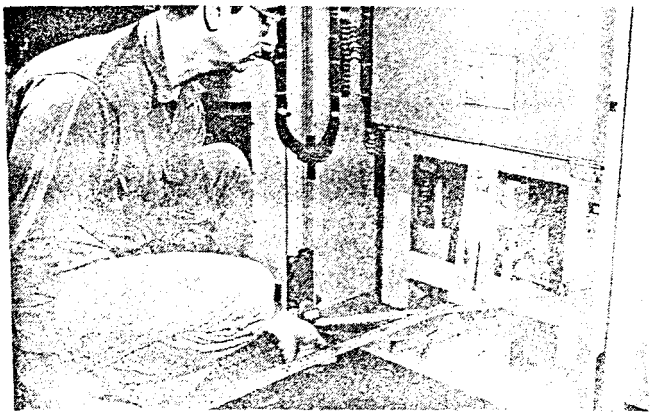


Fig. 21

It is desirable to have a rack extension on indoor equipment so that the customer's floor is not flush with the cubicle floor. The extension helps personnel move the breaker from the aisle into the cubicle opening. Ears on the extension are hooked behind cubicle frame angles. In disconnected, test or connected positions, the release pedal must be manually depressed to move breaker. After breaker moves, release the pedal and rack to desired position.

228981-7

To rack breaker into connected position place pawl towards the operator.

RACKING SAFETY MEASURES

The rack extension is provided to facilitate movement of the breaker outside the cubicle in a manner to line up the breaker with the cubicle guide bar.

After the breaker has been initially inserted into the connected position, rack the breaker out and check the length of engagement of primary contact fingers over the straight portion of contact surface on the stationary contacts. The contact point of the fingers should travel a minimum of $\frac{1}{8}$ inch over the straight portion of the stationary contacts. This can be checked by applying putty inside the cluster of fingers before the breaker is inserted. Then, after the breaker is racked in and out, measure the distance from the contact points of the fingers to the depression in the putty made by the ends of the stationary contacts and compare this to the length of the bevel on stationary contacts.

If the unit is not energized from either the cable or bus sides, rack the breaker in and close and trip it electrically (provided auxiliary power is available) to check closing and tripping circuits.

Rack the breaker out to the test position and check to make sure it can be closed and tripped electrically in this position. The secondary contact device used with this type of breaker is such that contact is maintained up to the test position, enabling closing and tripping electrically without using a plug jumper.

Check the ground contacts to be sure they make in both test and operating positions.

CAUTION: BEFORE INSERTING THE BREAKER FOR *THE FIRST TIME*, MAKE ABSOLUTELY SURE THE BUS IS NOT ENERGIZED. Rack the breaker in slowly, at the same time observing the following:

1. Guide track engages properly.
2. Secondary contacts have good contact alignment.
3. Ground contacts properly aligned and make good contact.
4. Shutters operate properly.
5. Breaker primary contacts enter insulators and make properly with stationary primary contacts.
6. Interlocking, that prevents a closed breaker from being moved to or from the connected position, functions properly.

Fig. 23

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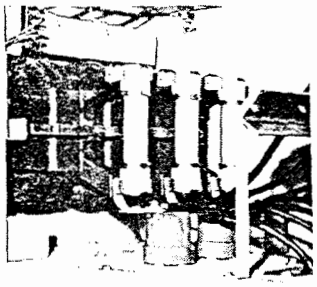

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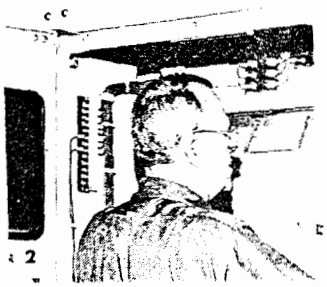

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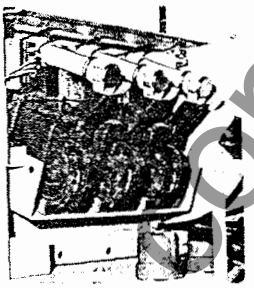

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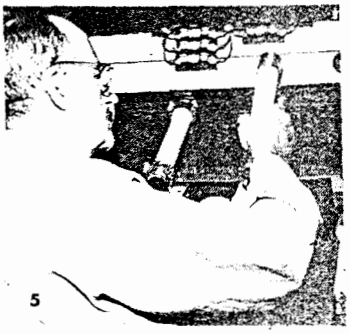


228696-9

1. Potential transformers in connected position. (228696-5)
2. Latches are turned to release trunnion mounted carriage. (228696-6)
3. Carriage is rotated to disconnect transformers. Fuse strikes grounding strap to remove static charge. (228696-7)
4. Transformers are completely disconnected and fuses are in contact with grounding strap. (228696-1)
5. Transformer carriage rotation is completed, placing grounded fuses outside of unit for safe and convenient removal and replacement. (228696-9)

POTENTIAL TRANSFORMERS

Potential transformers are mounted on a carriage which rotates in trunnions to provide the convenience of automatic disconnection when withdrawing the potential transformers for test or inspection.

The drawout carriage for the potential transformers can be located in the top rear compartment of a standard breaker unit at a convenient shoulder height location or in an auxiliary unit. Mounted on a base which pivots in a pair of trunnions, the pivoted base is easily rotated 180 degrees to the test or disconnect position.

While pivoting from the connected to the disconnected position, the transformer primary windings and transformer mounted current limiting fuses are automatically grounded to remove any charge from the windings. When the transformers are in the test or disconnect position, the base acts as the protective barrier between the stationary primary contacts and the operator. The weight is so distributed that a minimum amount of effort is needed to revolve the carriage.

To disconnect the transformers:

5 KV Units

1. Turn knurled screws holding the door and swing hinged panel open.
2. Turn latches — one at each side — to release trunnion mounted carriage.
3. Using handle, pull carriage down to rotate 180 degrees. This disconnects transformers and grounds the fuses. Fuses are now accessible for removal or replacement.

15 KV Units

1. Rotate T-handles — one on each side — to release trunnion mounted carriage.
2. Repeat step 3, above.

Potential transformers are shipped mounted in the unit and in the connected position.

CONTROL POWER TRANSFORMERS

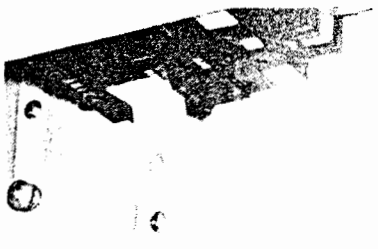
Control power transformers are stationary mounted and the primary fuses are mounted on a trunnion mounted carriage in the same manner as the potential transformers.

An interlock circuit breaker is furnished on the secondary side of the control power transformer to prohibit disconnecting the transformer unless the circuit breaker is open. Only when the circuit breaker is opened (disconnecting the load from the transformer) can the fuse carriage be rotated from the connected position.

Fig. 24 — Trunnion-mounted fuses for the stationary-mounted control-power transformer are mechanically interlocked with secondary thermal breaker to prevent load break.

218217

When the secondary breaker is closed, rotation of carriage is prevented as interlock engages breaker toggle.



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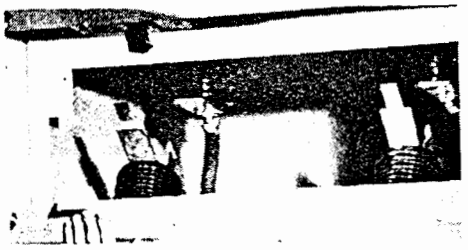

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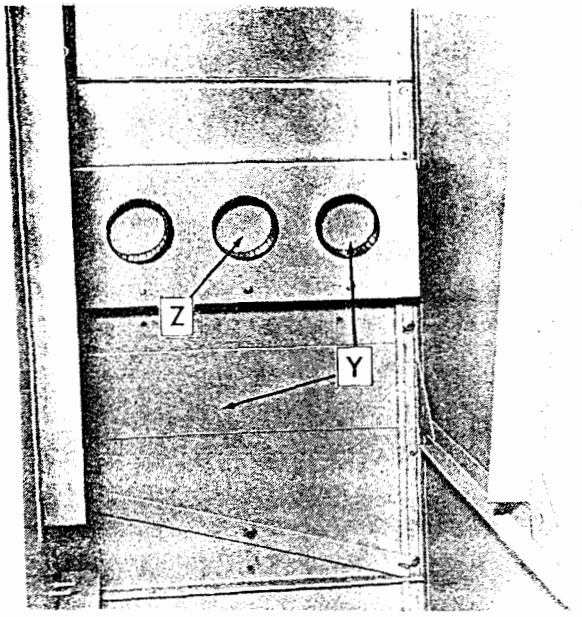
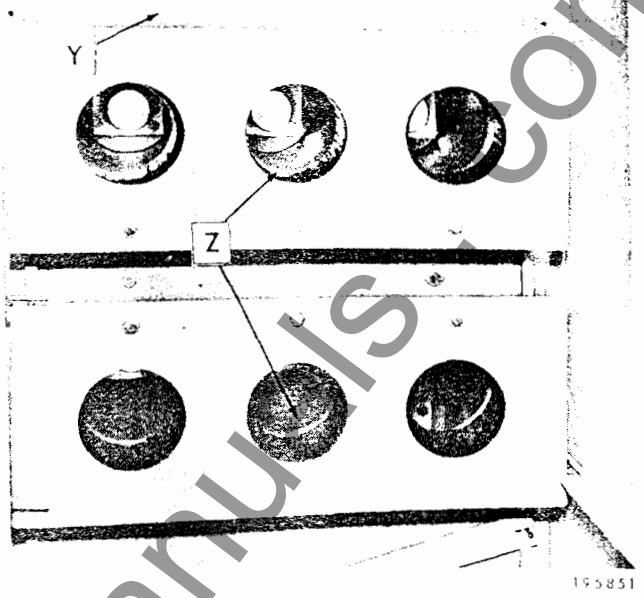
When the secondary breaker is open (left), rotation of carriage is possible (right).



Automatic shutters (Y) in closed position behind current transformers. Current transformers (Z) shown mounted on load side only.



Current transformers (Z) shown mounted on both bus and load side. Shutter (Y) blocked open to show disconnect studs.

Fig. 25

CURRENT TRANSFORMERS

Current transformers, with high ratio, are of the toroidal type mounted in the circuit breaker compartment in front of the plate which supports the high voltage disconnects.

The primary bushings of the circuit breaker serve as the primary bar of the current transformer. Therefore, removing the circuit breaker actually removes the primary bar. It is possible to test the current transformers without removing them from the unit while maintaining maximum operator safety.

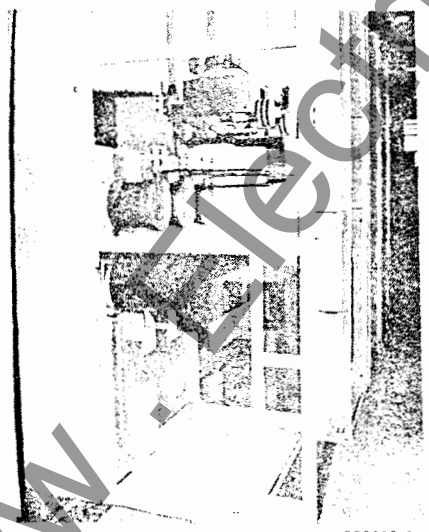
Inasmuch as the shutters are located behind the current transformers, testing of transformers located on the bus side can be accomplished without bus de-energization.

Removal of the current transformer covers is accomplished by removing cover bolts accessible from the circuit breaker compartment.

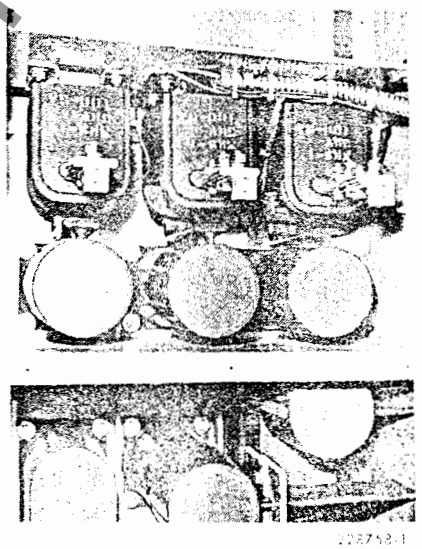
Current transformers with low ratios are of the wound type and are mounted in a separate compartment with a suitable device for terminating power cables.

Built to NEMA and IEEE standards, each current transformer has a nameplate on which is included its type, serial number and rating. If it is necessary to contact the factory in regard to these transformers, include the nameplate information and identify the unit in which the transformer is mounted.

Current transformers should not be operated with secondaries open-circuited.

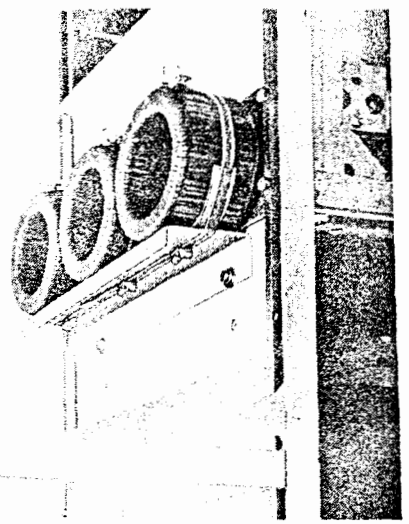


15 kv unit showing wound type current transformers arranged for upfeed connection.



5 kv unit showing the wound type current transformers arranged for downfeed cables.

Fig. 26



View of bottom of support plate beneath current transformers showing strap supports. Protective cover has been removed.

Fig. 27

SPECIAL EQUIPMENT

KEY INTERLOCK

When specified, a key interlock can be supplied to prohibit closing a breaker only when it is in the operating position. The interlock bar is attached to the guide bar. In the operating position, the lock bolt is extended, raising the cam follower bar, locking the breaker in the trip-free position. Then the key is removed to release disconnects or associated equipment for operation.

This interlock is cleared for normal breaker operation by returning disconnects, etc., to normal operating position and inserting the key into its lock, permitting withdrawal of the bolt and lowering of the cam follower bar.

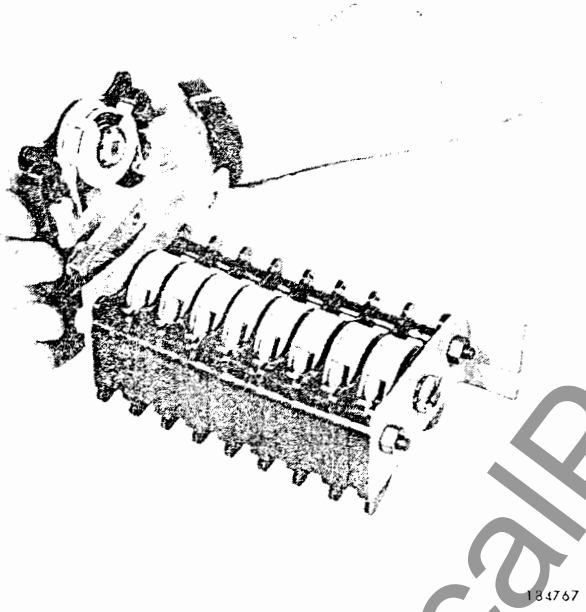


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Fig. 28 — Only a pair of pliers is necessary to adjust each Q-10 auxiliary switch stage. Each point of a stage can be individually adjusted in 15 degree steps.

STANDARD ACCESSORIES

TESTING DEVICE

When specified, a plug jumper is supplied so that a breaker can be operated (tested) outside its compartment with the control switches on the instrument panel. This plug jumper is used to bridge — with a flexible cable — the secondary disconnects so that the breaker can be electrically closed and tripped. Refer to Figure 31B for plug jumper connection instructions.

If desired, a pushbutton can be supplied on the device attached to the breaker for operation at the breaker.

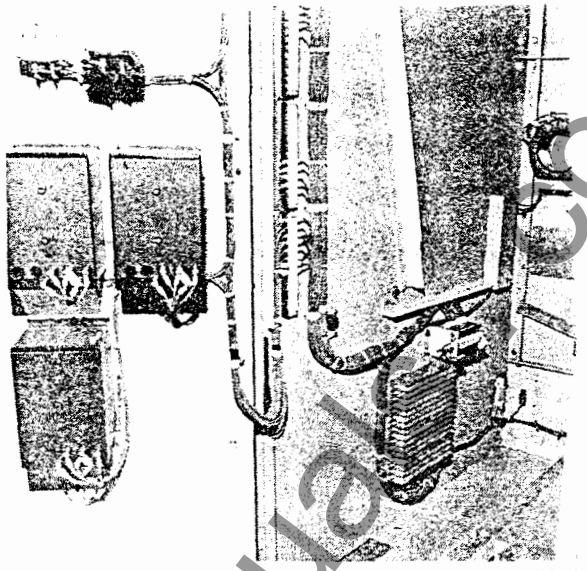

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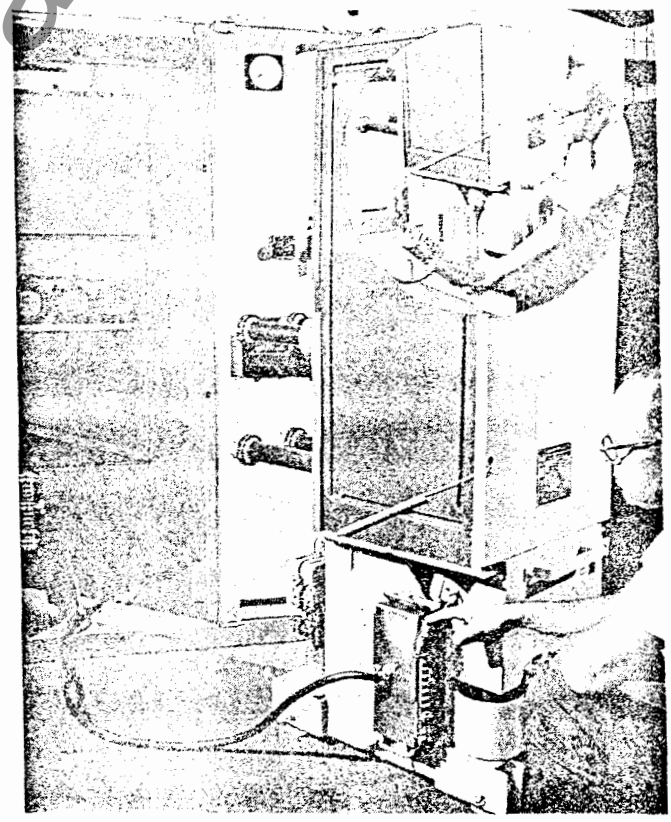
Fig. 29 — Cell mounted Q-10 auxiliary switches are operated by notched lug welded [illegible] breaker mechanism main crank.

EXTRA AUXILIARY SWITCHES

When [illegible] auxiliary switches in addition to the [illegible] switches on the breaker [illegible] can be [illegible] on the stationary structure. They are operated by a notched lug welded [illegible] mechanism main crank. Every standard [illegible] and circuit breaker is designed to accommodate this feature.

Eight [illegible] stages can be furnished.



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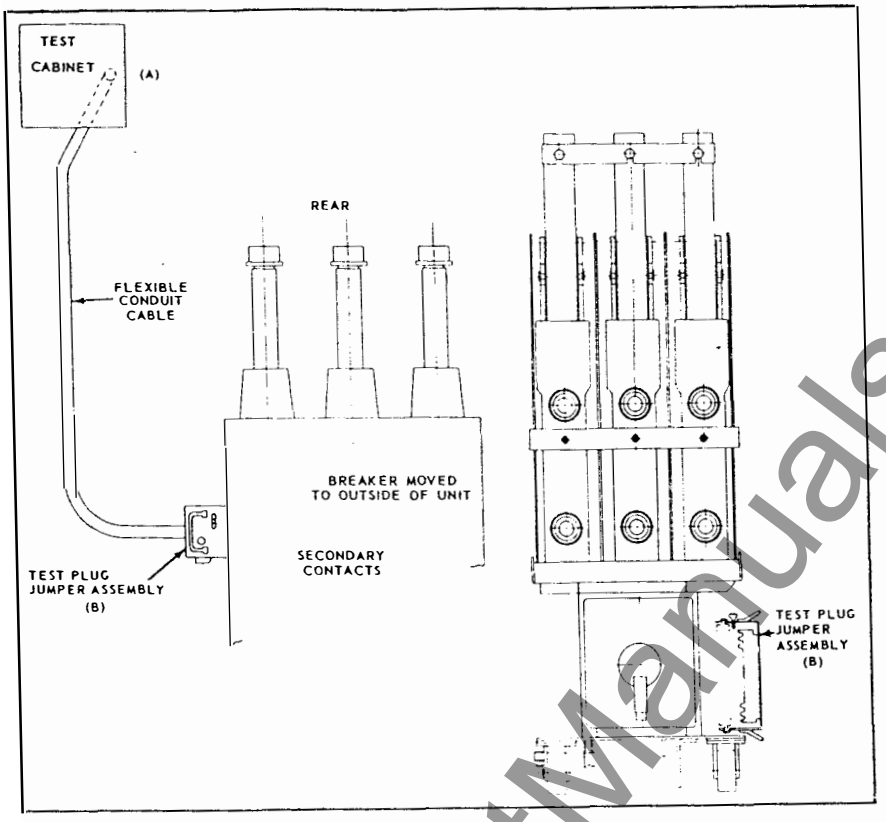

Fig. 31B — Optional test control cabinet.

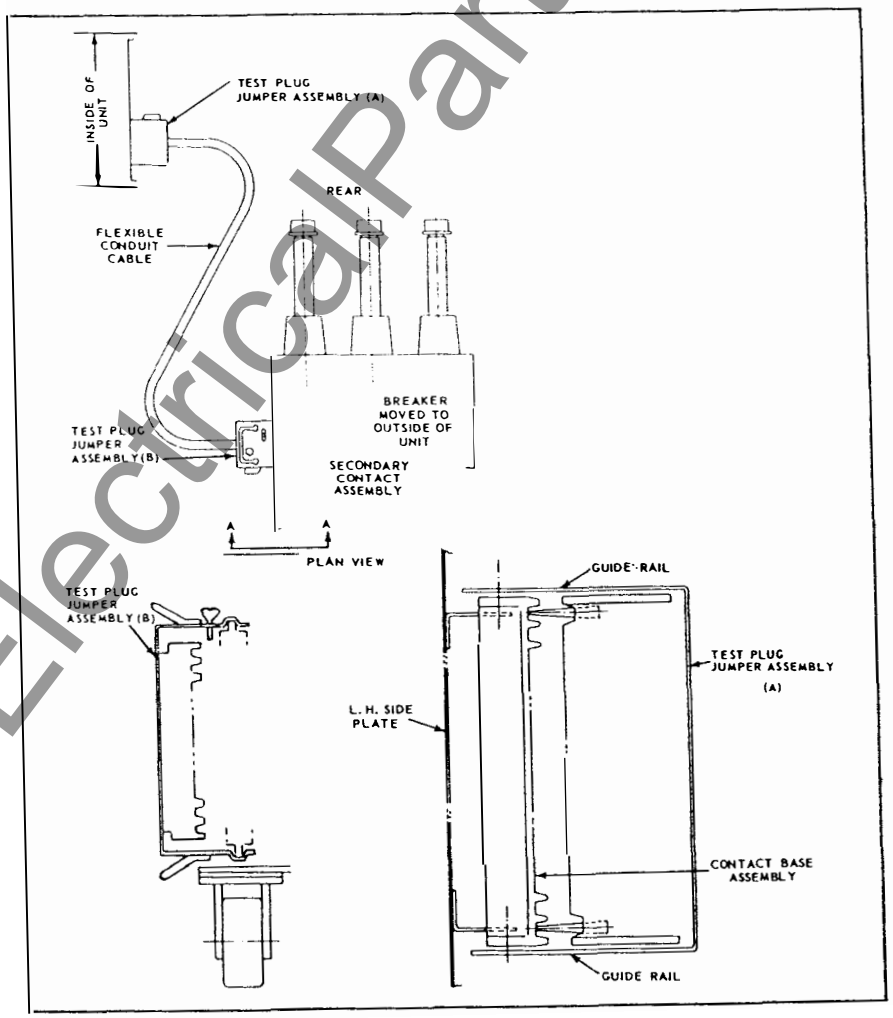

Fig. 31A — Plug jumper.

INSPECTION and TESTING

INSTALLATION, INSPECTION AND TESTING

Before the equipment is put in service, it must be thoroughly inspected and tested. Correct any defects immediately.

Check the following points:

1. High voltage connections properly insulated.
2. Electrical disconnecting contacts, machine parts, shutter, etc., checked for lubrication and operation.
3. Blockings, supports and other temporary ties removed from breakers, instruments, relays, etc.
4. Proper fuses correctly placed.
5. Temporary wiring jumpers (used on the secondaries of current transformers tied to external devices, as shown on wiring diagrams) removed.
6. Ground connections properly made.
7. Incoming primary and secondary connections properly made and checked for shorts or undesired grounds.
8. All equipment, removed during assembly, replaced.
9. Relays coordinated with other relays, etc., on the system. Refer to relay instruction book before making any adjustments. Consult local power company before making any connections to their power supply.
10. Storage battery fully charged and provided with recharging facilities.
11. Interlocks performing properly.
12. Circuit breakers checked and prepared per instruction books.

LUBRICATION

It is essential that switchgear be lubricated carefully and properly to guard against corrosion and to insure that all operating parts work freely.

Lubricate moving parts – shutter guides, bearings, tilt-out transformer trunnions, etc. — with "Lubriplate" AERO Grease, or equal. Use of lubricants not suitable for the application will make mechanisms very difficult to operate. Remove all old grease and relubricate annually, or oftener if required.

Electrical contact — all stationary silver-surface contacts are to be lubricated with "Lubriplate" AERO *prior to use.*

1. Wipe contacts clean.
2. Apply AERO to contact surfaces.
3. Wipe off excess grease, leaving a thin film.

Remove all old grease and relubricate annually, or oftener if required.

When lubricating contacts, it is important to avoid getting grease on the insulation.

For the above procedure, a tube of AERO grease (A-C Part No. 00-337-111-011) is included with each shipment of switchgear.

Where corrosive atmospheres are encountered, coat all unpainted metallic surfaces generously with AERO Lubriplate or equal. When grease becomes contaminated by the corrosive atmosphere, remove it and apply a new coat.

Refer to breaker instruction book for specific lubricating instructions on circuit breakers.

FINAL TESTING

1. A megger test is made on the high voltage circuit to be sure that all connections made in the field are properly insulated. A megger test is also advisable on the control circuit.

2. A dielectric test, if possible, should be made on the high voltage circuit for one minute at one of the following voltages corresponding to the rated volts of the equipment. (Potential transformers, control transformers, lightning arresters, surge capacitors, are disconnected during this test.)

Rated KV	Test KV	DC
5.0	14.3	20.2
7.5	14.3	20.2
15.0	27.0	38.2

A dielectric test on secondary and control circuits should be made at 1200 volts. The above voltages are in accord with NEMA Standards.

3. With breaker in the test position make the following tests on each unit.
   (a) Trip and close the circuit breaker with the control switch.
   (b) Trip the breaker by passing sufficient amps (or volts) through the coils of protective relays.
   (c) Trip and close the breaker from any remote control positions.
   (d) Operate auxiliary devices.
   (e) Test the phase sequence of polyphase high voltage circuits, particularly those used for motor starting.
   (f) Check aging resistor setting of rectifier operated breakers. This aging resistor should be set so that a maximum amount of resistance is in the circuit and still permits breaker closing at 190 volts ac minimum control voltage. The dc voltage across the closing coil should be at least 90 volts at this minimum voltage setting. The rectifier is mounted on the breaker.

OPERATION and MAINTENANCE

OPERATION

When the equipment is placed in service for the first time all circuit breakers should be open and all control circuits energized. The primary incoming power source is then connected to the switchgear bus by closing the circuit breaker, disconnect switch or other means provided. The incoming power source should be at the lowest voltage possible, and then gradually brought up to normal. Let equipment stand energized for several minutes before connecting the load. Check instruments, relays, etc., during this period.

When connecting the load, connect one unit at a time with as small a load as possible on the feeder. Again, wait several minutes before connecting the next load, meanwhile observing operation of instruments, relays, etc. When it has been determined that there are no defects, the normal load may be connected.

Check the following during the first week of operation: over-heating of primary and secondary circuits, satisfactory operation of all instruments, relays, etc.

MAINTENANCE

Thorough inspections at periodic intervals are important to satisfactory operation. The frequency of inspection and maintenance depends on installation conditions and can be determined only by experience and practice.

Make these inspections at least once every year — more frequently if local conditions require.

Conditions affecting maintenance are:

Weather and atmosphere.

Unusual number of operations.

Experience of operating and maintenance personnel.

Special operating requirements.

After the frequency of inspection has been determined, cover the following points:

(a) Inspect switchgear interior for accumulation of dust, dirt, etc. Remove dust from all insulators.

(b) Check instrument and control switches and inspect their contacts.

(c) Examine indicating lamps and replace all those that are burned out.

(d) Check test block contacts for loose connections.

(e) Inspect bus bars and connections to see that they are in proper condition. If they are over-heating, check for poor or loose connections, or for overload.

(f) Check for proper condition of instrument transformers. Replace burned out fuses, if any. Check primary and secondary connections.

(g) Examine automatic shutters for proper operation.

(h) Examine all safety interlocks

(i) Maintain circuit breakers as called for in circuit breaker instruction book.

CORROSIVE ATMOSPHERES

This switchgear is designed to give top performance when installed in normal indoor or outdoor locations. Where abnormal conditions are encountered — such as corrosive atmospheres — special precautions must be taken to minimize their effect. Exposed metallic surfaces — non-insulated bus bars, disconnect switches, primary and secondary disconnecting contacts, wire ends, instrument terminals, etc. — must be protected. Lubricate contact surfaces with a generous coat of AERO "Lubriplate" or other equally non-hygroscopic grease. If this type of grease is not available, petroleum jelly can be used. Other exposed members can be protected with a coat of glyptol lacquer or any other corrosion-resisting paint.

When old grease becomes dirty, wipe the parts clean and apply new grease immediately.

TOUCH-UP PAINT

Matching paint, one pint per three units, thinned and ready for use, is supplied with each order for touching up any scratches, etc., made during installation. Inspect the surface and retouch where necessary. Paint is furnished in spray-on one pint cans.

RELAYS AND INSTRUMENTS

To insure satisfactory relay and instrument operation, covers of these devices should not be left off for a period longer than is necessary. When a cover has been broken, cover the device temporarily and replace broken glass as soon as possible.

SPACE HEATER OPERATION

Outdoor switchgear is furnished with one space heater in each cubicle. The space heaters are controlled by thermostats mounted inside the cubicle. The thermostats are factory-set to cut in and out at definite temperatures (open 110 ±5F, close 100 ±5F). Where humid conditions exist, be sure to turn on these heaters well in advance of energizing the equipment to insure that the insulation is dry.

ALLIS-CHALMERS

MILWAUKEE, WIS. 53201