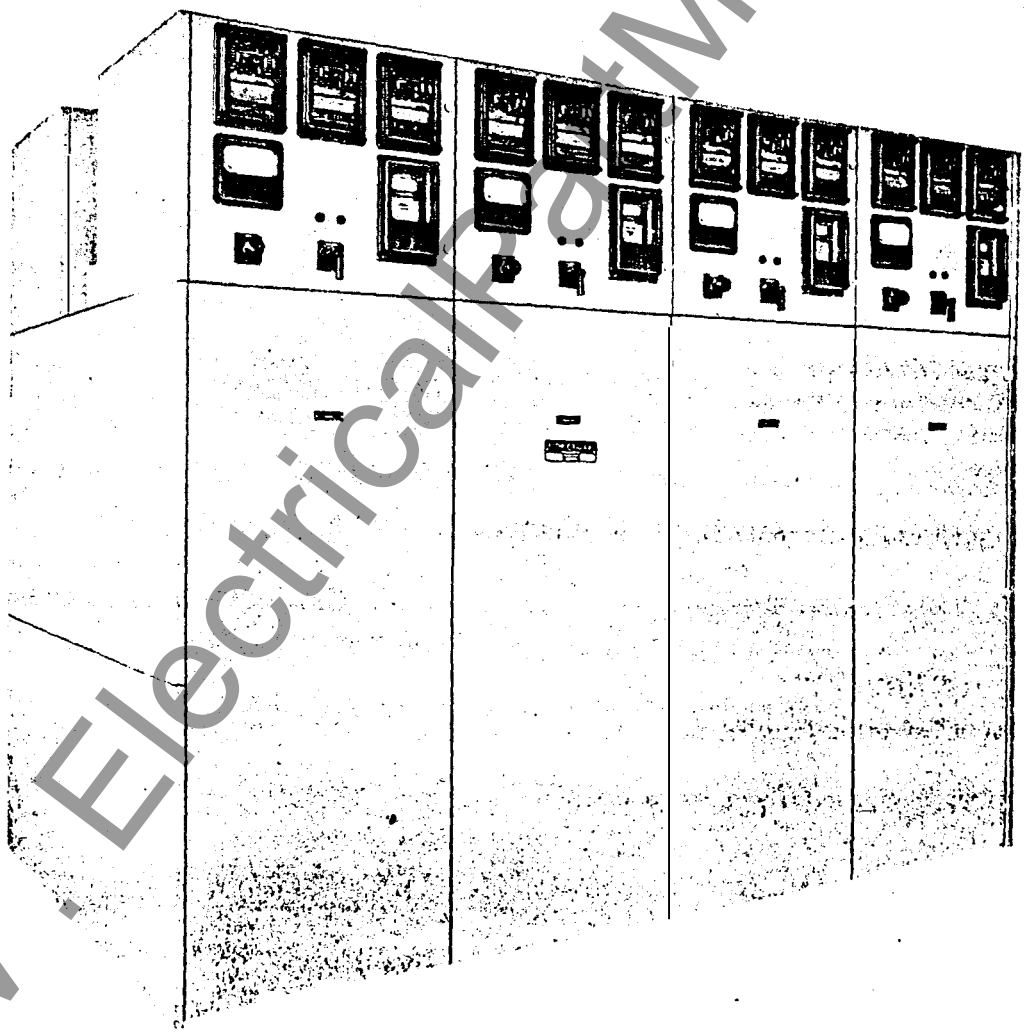
IB-5909

METAL-CLAD SWITCHGEAR

INSTRUCTIONS

INSTRUCTIONS FOR TYPE 5HV-75, 5HV-150, 5HV-250 AND 5HV-350 METAL-CLAD SWITCHGEAR

5000 VOLT—1200, 2000 AND 3000 AMPERE



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INSTRUCTIONS FOR TYPE 5HV-75, 5HV-150, 5HV-250 AND 5HV-350 METAL-CLAD SWITCHGEAR

5000 VOLT—1200, 2000 AND 3000 AMPERE

INTRODUCTION

Instructions for installation, operation and maintenance of type 5HV metal-clad switchgear are furnished with each shipment.

These instructions should be read carefully and used as a guide during installation and initial operation.

File these instructions in a readily accessible place together with drawings and descriptive data of the switchgear. The use of these instructions will facilitate proper maintenance of the equipment and prolong its life and usefulness.

SCOPE OF INSTRUCTIONS

These instructions are general. They cover requirements for installation as applied to all metal-clad switchgear of the 5HV-75, 5HV-150, 5HV-250 and 5HV-350 classification. A typical example is show on the front cover.

Specific information on particular applications is furnished in the form of job drawings.

1. Front view showing arrangement of relays and instruments.

2. Single line diagram showing power connections.

3. Floor plan indicating available space for power and control conduits.

4. Section views for each unit.

5. Special construction details.

The first sheet of the Bill of Material indicates the application of the drawings.

TRANSPORTATION

Prior to shipment, the 5HV switchgear undergoes careful factory inspection and crating. Each crate is plainly marked at convenient places with crate number and position. When size or other reasons make it necessary to divide the equipment for shipment, the unit number of the particular equipment enclosed is also marked on the crate, along with its weight. The circuit breakers are shipped in individual crates.

Immediately upon receipt of the switchgear, examine for any damage or loss sustained during transportation. Check the contents against the packing list before discarding any packing material.

If there is any shortage notify the nearest I-T-E Circuit Breaker Company representative at once.

The I-T-E Circuit Breaker Company is not responsible for damage after delivery of shipment to the carrier. However, if the company is notified of such claims, it will furnish forms to facilitate securing any adjustments. If damage to the shipment indicates rough handling, claim for damage should be filed at once with the carrier and the I-T-E Circuit Breaker Company promptly notified.

The switchgear housings are crated and shipped in groups of one to six units. Each group is provided with heavy wooden skids. The remainder is crated for protection. Unloading and handling at the site is usually done by placing rollers under the skid. To avoid distortion to the switchgear, any force to move the structures should be applied to the skid by means of crowbar, block and tackle, crane, etc.

STORAGE

Remove crating from the switchgear units, but leave each group on its skid for subsequent moving. Uncrate circuit breakers and accessories.

Observe the following precautions:

1. Check for missing or damaged parts.

2. Store in clean, dry place.

3. Cover parts susceptible to rust with heavy oil or grease.

4. Cover with heavy wrapping paper to keep dirt or dripping water from entering. Dirt or moisture may foul working parts or deteriorate contacts and insulation.

5. If the switchboard is to be stored for any length of time, or in any place where dampness may be present, then heaters should be used to keep the switchboard dry until it is placed in service. When outdoor switchboards equipped with heaters are stored, the power source for the heaters should be brought to the load terminals of the ET thermal circuit breaker or cutout device which controls the heater circuits.

UNLOADING AND HANDLING

The following is a recommended method for unloading and handling type 5HV metal-clad switchgear housings.

INDOOR INSTALLATION

1. Prior to uncrating, the switchgear should be moved near installation site. This operation may be completed by raising switchgear shipping skid with track jacks to allow rollers to be placed under skid.

2. After switchgear housings have been moved to site, uncrate and remove lag screws located

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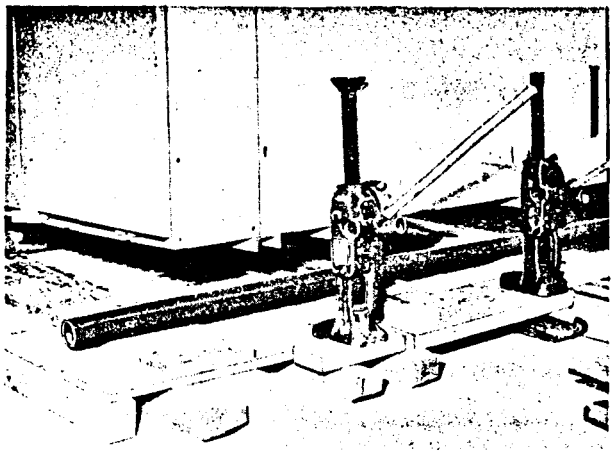

Fig. 1—Method of Raising Switchgear by Use of Jacks Rollers in Place

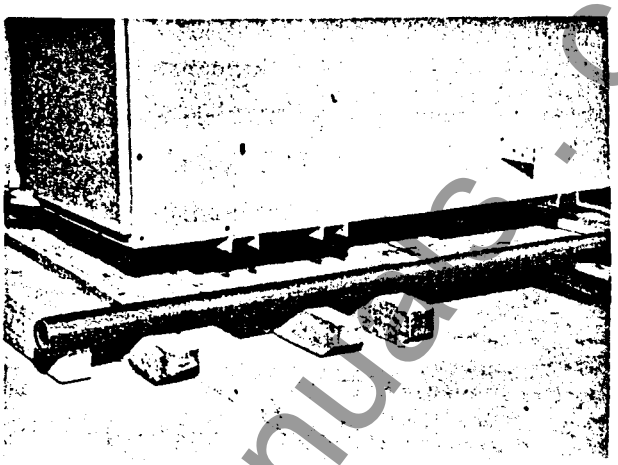

Fig. 2—Switchgear Lowered on Rollers Prior to Moving Onto Track Timber

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Photo 21673-R

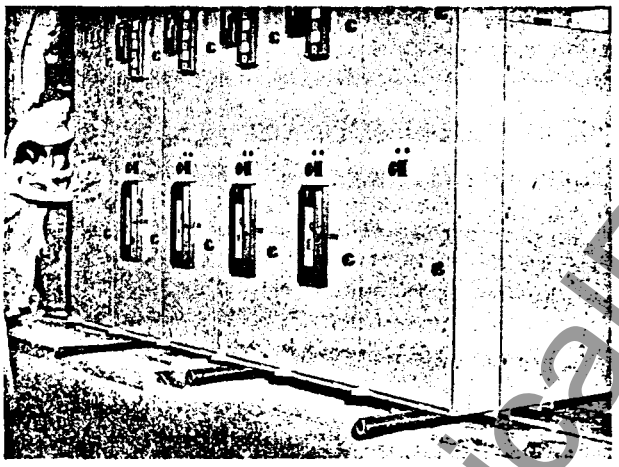

Fig. 3—Longitudinal Moving of Switchgear from Shipping Skid

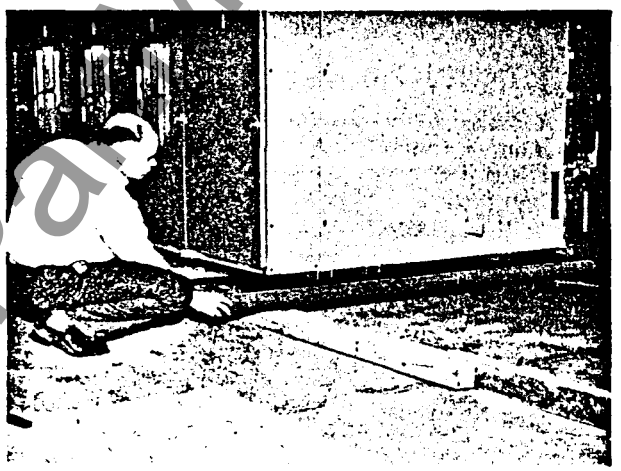

Fig. 4—Method of Applying Rollers as Switchgear Progresses Onto Track Timber

Photo 21674-R
Photo 21675-R

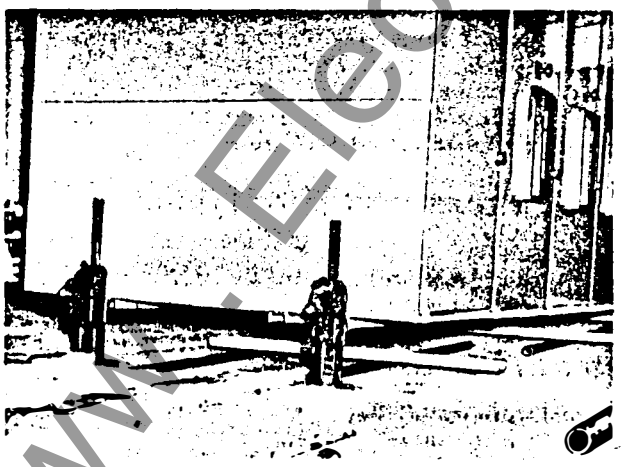

Fig. 5—Switchgear Raised, Rollers and Channels in Place Prior to Lateral Moving

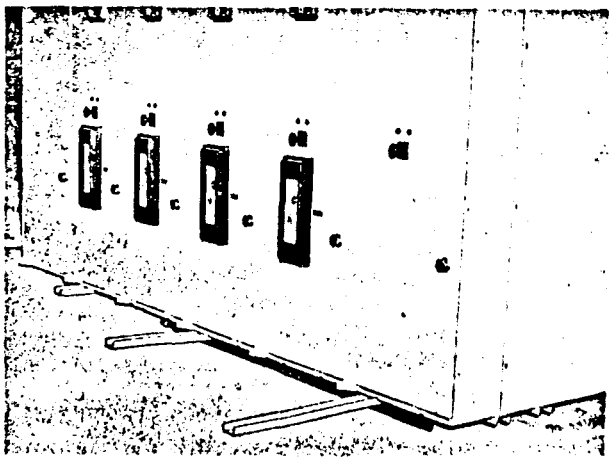

Fig. 6—Jacks Removed and Switchgear Ready for Lateral Moving

Photo 21676-R
Photo 21677-R

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inside of housings. Raise housings by placing jacks under both shipping channels under main housings as shown in Fig. 1. Caution: Do not apply jacks to the housings at any other point except the channels. Raise housings evenly and just enough to position rollers. Repeat operation at other end of housing, so that rollers are equally distributed under housings.

3. Place timber to extend longitudinally from skid as shown in Fig. 2. While crew push switchgear, Fig. 3, have one man insert roller as shown in Fig. 4. Continue this operation until housing is entirely on track timber.

4. For lateral moving, raise housings by jacks and remove track timber. Place rollers laterally with steel channels resting on rollers as shown in Figs. 5 and 6. Move housings over mounting site and proceed with fastening of housings.

OUTDOOR INSTALLATION

Outdoor installation is handled similarly to the indoor type. Outdoor switchgear is constructed with a steel base forming an integral part of the floor. For shipment, lifting pads with towing eyes are bolted near the four corners of this base. Jacks may be placed under these lifting pads to raise the whole structure for positioning rollers. The pads may be removed after the gear is completely installed.

INSTALLATION OF HOUSINGS

GENERAL

Before attempting any installation operations consult all drawings furnished by the I-T-E Circuit Breaker Company for the particular order. These drawings are in the form of floor plans, front and section views, primary and secondary wiring and a bill of material of the equipment furnished. Sections of housings consisting of six indoor units or less are shipped on a single skid. Larger switchboards are divided in sections for shipment and each section is on its own skid. In addition each section is provided with two or more three inch channels running the full length of the section. The purpose of these channels is to reinforce the switchgear for shipment, and to provide means of moving the section into position by use of rollers. The floor plans for indoor switchgear indicate recesses in the foundation to receive these channels.

PREPARATION OF FLOOR

Floor plan drawings are supplied for each installation and frequently the channel iron sills are shipped in advance of the switchgear. Typical floor plan drawings are not enclosed since they usually vary with each installation due to length and arrangement of housings.

Channel iron sills may be embedded in concrete. It is important that these sills be straight and level their full length, and correctly spaced. To insure this condition, it is recommended that ties be bolted between the sills at various intervals after which the lower flange of the sill be shimmed to proper height. Temporary bolts should be inserted in all tapped holes while grouting, to prevent filling or damage to the threads.

Where necessary, power and secondary (control) conduits should be installed before the installation of the housings. Available space for the conduits is given on the floor plan accompanying each order. These conduits should not extend more than one inch above the station floor level. Take precautions to plug conduit openings before pouring cement.

The concrete floor in front of the housings should be smooth to facilitate the handling of the circuit breakers. The finished floor level should be 1/8 inch above the channel sills so that the circuit breaker will roll evenly into the housing. A 1/8 inch thick strip attached to the channel sills will permit trowling flush when the cement is poured. The cement should be prepared in accordance with instructions issued by the Portland Cement Association, available at their offices in the large cities.

ASSEMBLING THE HOUSINGS

When the floor has been properly prepared, assembly of the switchgear may be started. Sections of the housings may be moved on their skids adjacent to final positions. They may be moved from skids to final location by putting rollers under the shipping channels.

If the switchgear consists of a number of sections, the center sections should be installed first, and the remaining sections added at each end. When the first section is in position, it should be checked for distortion in shipment. This may be done by dropping a plumb bob from the center of the front and rear doors. If the structures are not true, they should be straightened before proceeding. As each section is added, it should be checked for distortion, otherwise considerable pressure may be required to bring the sections into alignment in order to insert the fastening bolts.

Bolts are provided to anchor the housings to the channels. Provision is also made for tack welding the housings to the channel base. Alignment of holes is sometimes difficult. If a welder is available it is preferable to use the tack weld method.

When shipment is made in sections, the main bus, control wiring, and inter connections are dismantled at the point where the switchgear is separated. These should now be reassembled with all insulation in place and all bolts and screws tightened. Incoming and outgoing connections should be made for both the main power circuit and all control circuits.

Most main circuit joints are covered with a molded box with insert plates located in the four edges to admit bus and insulation where desired. With this box, wrapping is *not* required, since entrances at edges are of the same size as the molded insulations which seal the joint without addition of sealing materials.

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The tape with sealer is used almost exclusively on short runs, close consecutive bends, and where the bus work runs into apparatus mounted on the switchboard (potheads, current transformers, etc.).

Tape and sealer are provided for covering main connections, bends made in the field, and flexible connectors. When such a connection is to be made in the field, the wrapping should be as follows:

Use the sealer to fill all voids and to cover hardware and all irregular surfaces by 1/8". Wrap five (5) windings of tape with one half of each winding lapped-over to form ten (10) layers. The overlaps should be staggered. Do not leave any voids or air spaces in the sealer or between the layers of tape. The tape should extend 1-1/2" over the bus insulation tubing where possible.

CONNECTION OF PRIMARY CABLES

In general, there are three common methods of making primary cable entrance connections.

Synthetic Covered Cable with Clamps

For this type cable, prepare for entrance to connection lugs, and securely tighten lug clamps. The cable should be prepared as specified by the cable manufacturer. Use sealer and tape as described in previous section. Mount cable through insulating support and clamp securely.

Lead Covered Cable with Wiping Sleeve

When cable diameters are specified on order, the wiping sleeves are furnished cut off to fit the cables. Uncut wiping sleeves are fitted to the cables as follows:

Wrap a cord (or tape) around the cable to obtain the circumference. Then wrap the cord around the wiping sleeve cone and mark the cone slightly above the cord. Saw off cone. Ream sharp edges of cone with round file.

Wiping sleeves are furnished untinned unless tinning is specified. Sleeves should be freshly tinned by applying flux and dipping in hot solder.

When installing the wiping sleeve, the lead sheath should extend into the sleeve fitting for one inch minimum. The end of the sheath should be belled over and if required by the operating voltage, a stress relief cone applied.

To wipe the joint, scrape the lead sheath clean approximately three inches beyond the end of the cone. Apply stearine flux to the cleaned sheath and to the cone. Then make the wiped joint in the usual manner. Fill wiping sleeve with the compound supplied.

Lead Covered Cable with Pothead

The same method of fitting as for wiping sleeves can be used to fit the pothead wiping sleeve to the cables. In the case of the pothead with wiping sleeve, the lead sheath should extend into the pothead for one inch minimum, bell over the end of the sheath, and add a stress relief cone if required. Clean the sheath about three inches beyond the end of the cone and apply stearine flux to end of the cone and the sheath. Wipe the joint in the usual manner.

On inverted potheads, the lead sheath should be extended down into the pothead body beyond the wiping sleeve flange joint so that the sheath will terminate below the level of the compound. To vent the top end of the inverted pothead sleeve while compounding, wipe the joint with a greased wire inserted between the sleeve and the sheath. Pull out the wire to provide a small hole to vent the air. After the pothead has been filled with compound, seal the hole with solder.

Shielded Cable

When shielded cable is connected to any terminator, proper stress relief cones must be applied.

Roof Bushings

Roof bushings, for cable entrance, are shipped detached from the housing, and must be mounted in place when the switchgear is installed. Each bushing is furnished with a gasket that must be properly inserted between the roof and the bushing flange, using the adhesive and grease furnished for the purpose, to provide a weathertight seal. Cement the gasket to the roof using a layer of the adhesive. Then lubricate the remaining flat surface of the gasket with a thin coat of the grease. Now put the bushing in place and bolt to the structure.

CONNECTION TO GROUND BUS

Ground bus bars are bolted to the frames of the housings at the factory before shipment. When housings are shipped separately, it is necessary to bolt the ground bus to the framing. Ground bus bars should be solidly and permanently connected to the station ground by means of a cable or bus of cross section not less than that of the housing ground bus.

Cable or bus should not be in conduit, and should take the most direct path.

CONNECTION TO CONTROL SOURCE

The control source wiring to the switchgear should be of larger cross section than the balance of the control wiring in order to reduce the voltage drop, particularly when this source is some distance from the switchgear. Provision is made in the switchgear, in the form of heavy duty terminal blocks, for the connection of these control source leads. The leads should first be checked for proper electrical sequence before the connection is made.

Secondary and Control Connections

All secondary and control connections on metal-clad switchgear are factory wired in accordance

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with the wiring diagrams applying to the installation. The secondary and control connections for all outgoing connections are wired to terminal blocks accessible to the conduit connections.

Control connections between housings are provided through openings in the side sheets of the switchgear. When shipment is made in groups of several units each, the cross connections between groups are installed at the factory, one end of each of the group connectors is then disconnected and tagged. Care should be taken to insure that all these connections between groups are securely remade when the groups are placed together again.

INSTALLATION OF BUS BAR CONNECTION BETWEEN GROUPS

The main bus in each group is assembled in the factory complete, ending at the tap connections located at either end of the group. Sections of main bus for connection between groups are provided for installation in the field.

All contact surfaces at all bolted joints in the bus are silver plated. These contact surfaces should be cleaned and then bolted together. Conductivity of a bolted or clamped joint depends upon the pressure applied. The contact surfaces may be cleaned by first rubbing lightly with fine steel wool, then wiping with cloth saturated with carbon tetrachloride. Take care not to remove silver plating.

After bolting the sections of the main bus at junction point of shipment groups, insulate the connections by taping or installing a molded box over the joint.

For instructions on taping see section titled "Assembling the Housing."

TESTING AND INSPECTION

With the housings erected, assembled, and connected, observe the following precautions:

1. Remove all extraneous matter and see that all internal parts are free of dirt, grease, and moisture. If moisture has penetrated, dry out with air or heat.

2. Remove any blocks in relays used for protection in shipment.

3. Apply potential tests to check for any damaged insulation.

60 CYCLE, RMS, WITHSTAND VOLTAGES
(1 MINUTE)

Rated	Factory Test	Field Test
60 volts	500 volts	375 volts
61 to 220 volts	1500 volts	1100 volts
221 to 600 volts	2200 volts	1650 volts
4160 volts	19,000 volts	14,600 volts

CAUTION: IF PHASE TO PHASE TESTS ARE MADE IN ADDITION TO PHASE TO GROUND TEST, CARE MUST BE TAKEN THAT NO SHUNT CONNECTED COILS SUCH AS POTENTIAL TRANSFORMERS ARE CONNECTED DURING THE TESTS.

4. Check continuity of all circuits. A great deal of this work can be done after the circuit breakers are installed by energizing the control source and operating the equipment with the main circuit dead. Indicating instruments check the continuity of current transformer and potential transformer circuits after the main circuit is energized.

5. Set all relays, regulators, and other devices for proper operation of loads. Remove current transformer short circuiting strips. No relays are set at the factory.

6. If finish has been marred during shipment or installation, apply touch-up paint (which may be secured from the factory).

IMPORTANT: PROPER PHASING OF ALL MAIN CIRCUITS SHOULD BE CHECKED ACCORDING TO DIAGRAM.

FINAL INSPECTION

After the switchgear together with the apparatus which it is to control has been installed and all interconnections made, it should be given a final check and test before being put into service. This is necessary to insure that the equipment has been correctly installed and that all connections are completed. Extreme care must be exercised to prevent the equipment to be controlled from being connected to the system while the preliminary tests are being conducted.

If disconnecting switches are not part of the apparatus or switchgear, the line leads should be disconnected to accomplish this. The testing equipment required will depend entirely on the type of installation. Portable voltmeters both a-c and d-c with a wide range of scales will usually be required. If the equipment to be put into service is quite extensive and complicated, both a-c and d-c ammeters should be available in case unexpected trouble develops.

Some simple portable device for ringing or lighting out circuits should be included in the testing equipment.

STANDARD CONSTRUCTION

SHUTTERS

Shutter arrangement shown in Fig. 7 is the means of covering the live terminals of the primary circuit of the switchgear when the circuit breaker is removed from the housing.

The shutters open when the circuit breaker is installed in the housing. The breaker going into the housing engages the arms connected to one of the shutters, and actuates it, opening the shutters as the element continues into the housing toward the "RACKED-OUT" position.

Check shutter operation by actuating both arms connected to the shutters to see that they do not bind.

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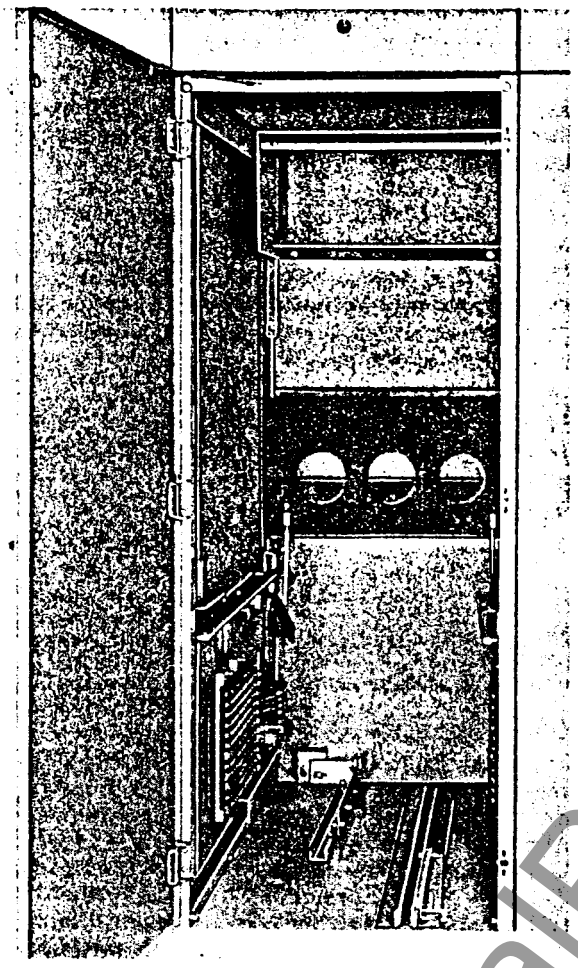

Fig. 7—Front View of Housing

The shutter in 2000 and 3000 ampere housings has different construction from that shown in Fig. 7 but its operation, as far as the breaker is concerned, is the same.

BUS INSULATION

All primary bus work in the housing, with the exception of the ground bus, is covered with either molded insulation or sealer and tape. The molded insulation is used for long straight through runs and the sealer and tape are used for joints and bends or any other place where molded insulation is not adaptable.

PRIMARY DISCONNECTING DEVICE

Each primary terminal of a drawout circuit breaker is equipped with a disconnect device of the blade and multi-finger type.

The multi-finger parts are mounted on the circuit breaker, permitting inspection of them when the breaker is removed. This is a high pressure self-aligning contact. All parts are silver plated, giving a low millivolt drop. The divided path through the

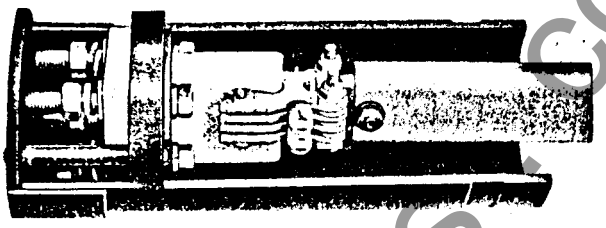

Photo 13662-R

Fig. 8—Primary Disconnecting Device

fingers tends to increase the contact pressure during a short circuit. All contact finger springs are outside the current path.

The stationary disconnecting device is rigidly mounted in an insulating molding of cylindrical shape located within the main bus housing. See Fig. 8.

For the 5HV-350 housing, the disconnecting device is similar, but mounted in a molding of rectangular outline.

SECONDARY DISCONNECTING DEVICES

All circuit breakers are provided with separable disconnecting devices of the self-aligning pressure-type. These devices are amply proportioned for carrying the required amount of current. The flexible member of the device is mounted on the breaker frame to facilitate inspection and maintenance. These devices make contact in the fully connected and test position, and no test jumper is needed. See Fig. 9 for the 5HV-75, 5HV-150 and 5HV-250 disconnecting device. The corresponding devices for the 5HV-350 are constructed differently as shown in Fig. 10, but operate in the same manner.

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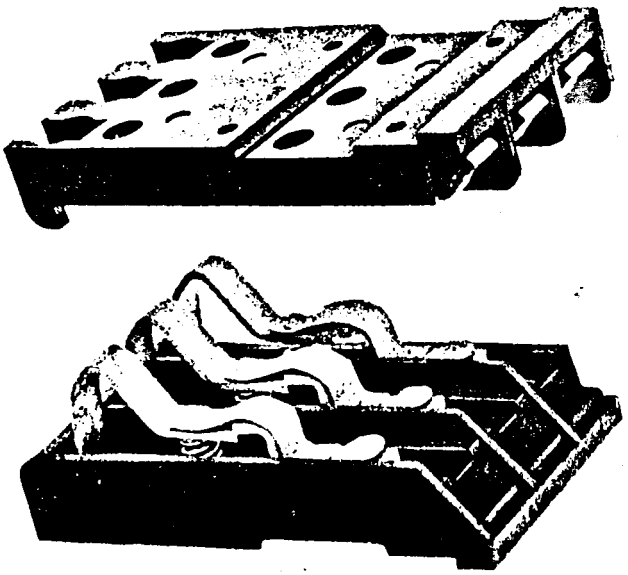

Photo 15336-R

Fig. 9—5HV-75, 5HV-150 and 5HV-250 Secondary Disconnecting Device

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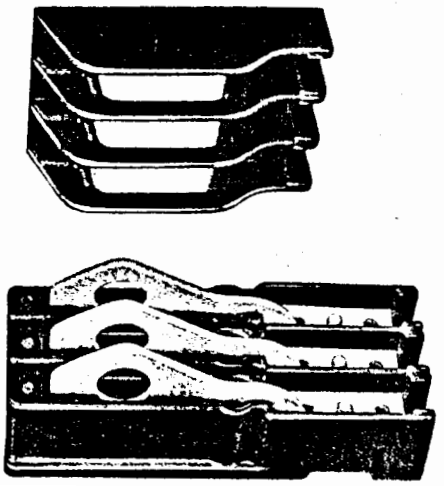

Photo 27452-R
Photo 30184-R

Fig. 10—5HV-350 Secondary Disconnecting Device

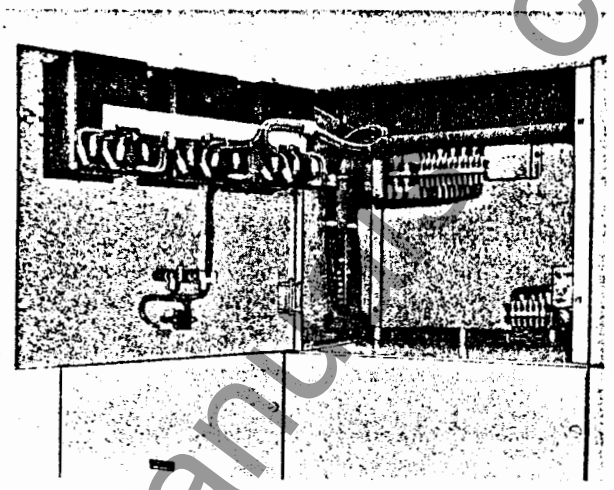

Fig. 11—Control Wires Mounted in Rear of Compartment

GROUND BUS AND CONTACTS

The ground bus is located as shown in Fig. 7 to left of guide and extends up from the floor 4 inches, and toward the front approximately 18 inches. The ground bus contacts are located in the center of the bottom rear crosspiece of the circuit breaker and engage the ground bus before breaker reaches test position. These ground contacts have a rating of twenty-five percent of the rating of the circuit breaker of which they are a part.

CONTROL WIRES

The main control leads are mounted in the rear of the metering compartment. All electrically operated equipment is connected to these control wires through a suitable control circuit protective device. See Fig. 11.

5HV-75, 5HV-150 AND 5HV-250 CIRCUIT BREAKERS

GENERAL

Circuit breakers are crated and shipped separately and without parts of the breakers being blocked or wired for shipping protection. They are ready for operation and installation into housing when uncrated.

On each switchboard all circuit breakers of like rating are interchangeable unless the secondary (control) circuit requires otherwise. In these cases interlocking will be used to prevent interchangeability.

Circuit breakers and housing are each set in a jig at the factory. All breakers with each switchboard are tried at the factory in all housings on the board in which they could possibly be used. This makes certain of interchangeability. In cases of extensive damage in shipment, the repair should include checking those dimensions which affect interchangeability.

The crank is used to put the circuit breaker in either the "RACKED-OUT" or connected "OPERATING" positions. Inserting the crank in the center hole and turning to the limit in the counter-clockwise direction moves the pointer and racking bar from the connected "OPERATING" position out to the "RACKED-OUT" position. Turning the crank to the limit in the clockwise direction moves the pointer and the racking bar on the breaker into the connected position.

The maintenance handle is used to close the circuit breaker manually in the "TEST" position only. This is done by inserting the handle and bearing down on it until the breaker latches.

The locking device is located as shown in Figs. 12 and 13 and has two possible positions. Its purpose is to lock the circuit breaker to the housing when the former is in the "RACKED-OUT" position.

Before inserting each circuit breaker into the housing, the racking bar pointer must be in the "RACKED-OUT" position, and the locking bars must be in the "UNLOCK" position, Figs. 12 and 13. Interlocks are provided which prevent the insertion of the circuit breaker into the housing unless these initial conditions are correct.

As the circuit breaker enters the housing, a guide bar on the breaker engages a heavy guide slot on the floor of the housing and holds it in alignment. See Fig. 7.

As the circuit breaker enters further into the housing, wheels on either side of the breaker engage side rails on both sides of the housing. These rails lift the breaker off the floor and control the alignment of the breaker parts that engage the primary circuit of the housing.

The circuit breaker may be moved back into the housing until it engages the stop. The locking bars are then moved to the "LOCK" position, and the breaker is then securely fastened in the "RACKED-OUT" position. In this position the test control secondary disconnecting devices are engaged and the ground contacts on the breaker are engaged

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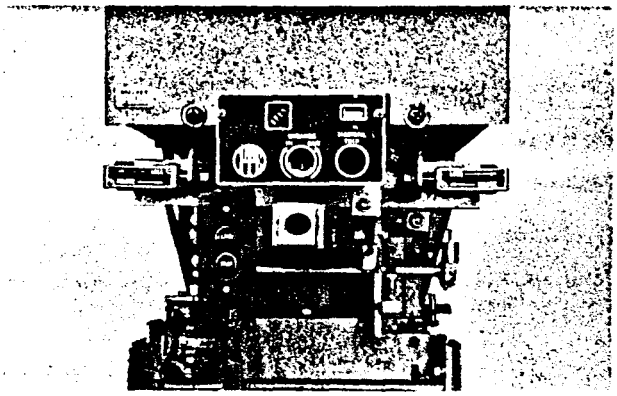

Fig. 12—5HV-75 Racking and Indicator Assembly, "Unlock" Position

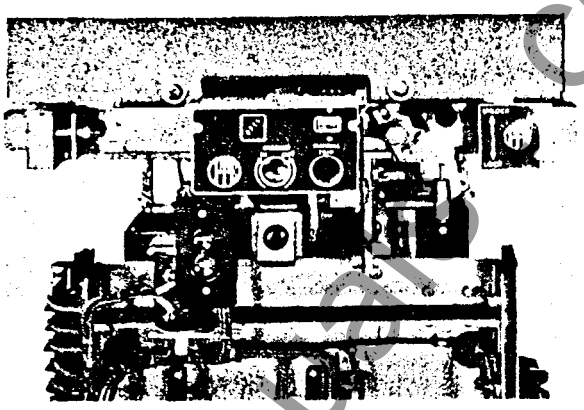

Fig. 13—5HV-150 and 5HV-250 Racking and Indicator Assembly, "Unlock" Position

Photo A-31639-R
Photo 23114-R

with the ground bus in the bottom of the housing. The main circuit movable disconnecting devices on the breaker are disengaged and separated a safe distance from the stationary part of the devices located on the housings.

If the circuit breaker is put in the "CLOSE" position, the hole for the racking bar is covered and the breaker may not be racked to the connected "OPERATING" position, but if the breaker is in the "OPEN" position the racking handle may be inserted and the breaker be racked to the connected position.

At all positions of the circuit breaker between the "RACKED-OUT" and connected "OPERATING" positions, the latch of the breaker is held in the disengaged position, so that the breaker may not be closed either manually or electrically. The interlock that holds the latch in the disengaged position is mounted on the breaker and is operated by the racking bar.

With the circuit breaker in the connected "OPERATING" position, it is usual to connect the control circuits so that the breaker can be operated from a control switch mounted on the front of the housing or from a remote point. The breaker cannot be operated from the push button station on its front panel, Figs. 12 and 13. The push button station operates the breaker only in the "TEST" position. Other connections are sometimes made at the request of the user.

An outlined procedure for installing and removing a circuit breaker from service is as follows:

INSTALLATION OF 5HV-75 CIRCUIT BREAKERS

1. The circuit breaker should be in the "OPEN" position and the indicator at "RACKED-OUT" position. Indicator for locking device should be pointing to "UNLOCK" position.

2. With the use of the drawout handle, back the breaker into the housing so that the guide bar on the breaker enters the guide slot in the housing. Push breaker toward rear until breaker reaches the floor stop which latches it in the "TEST" position.

If it is desired to test the breaker for operation electrically and manually before putting it into service, it may be done in this position by means of the push button on the front of the breaker, Fig. 12 and by means of the maintenance handle as shown in Fig. 15.

3. With the breaker in the "OPEN" position, and using the drawout handle, move the release lever toward the guide slot with the right foot, and proceed to push the breaker further toward the rear until the breaker engages the stop in the housing. Turn locking device to "LOCK" position. Breaker is now in the "RACKED-OUT" position. Rack in by inserting the crank and turning clockwise, Fig. 17, until pointer on breaker panel indicates the breaker is in the connected "OPERATING" position, Fig. 18.

REMOVING 5HV-75 BREAKER FROM HOUSING

1. Trip breaker by means of the control switch on front of housing.

2. Open door, insert crank and rack breaker, Fig. 17, to "RACKED-OUT" position as indicated by pointer on breaker nameplate.

If it is desired to remove the breaker completely from the housing, continue as follows:

a. Move locking device to "UNLOCK" position as shown in Fig. 12.

b. Apply drawout handle to front wheels and draw breaker from housing until it reaches the floor stop. Move the release lever toward the guide slot with the right foot and continue to draw the breaker from housing as shown in Fig. 19.

INSTALLATION OF 5HV-150 AND 5HV-250 CIRCUIT BREAKERS

1. The circuit breaker should be in the "OPEN" position and the indicator at "RACKED-OUT" position. Indicator for locking device should be pointing to "UNLOCK" position.

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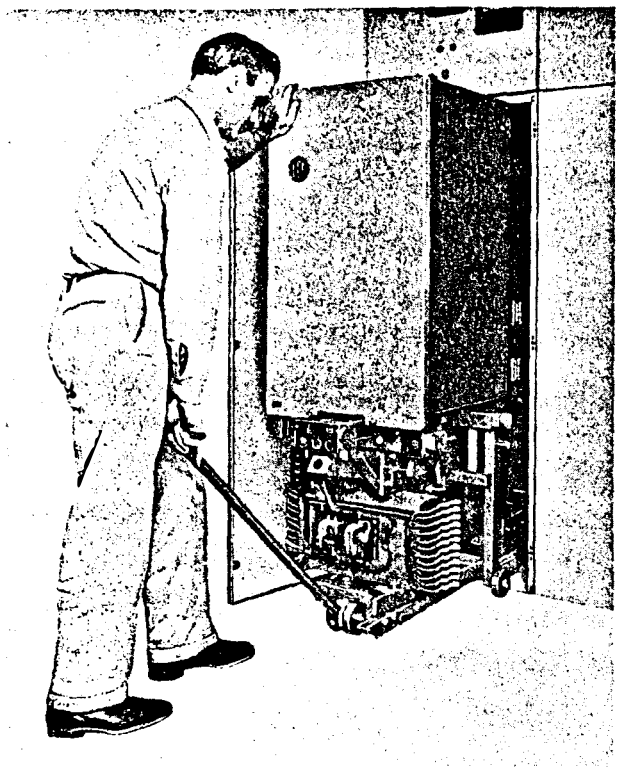

Photo 30187-R

Fig. 14—Guiding Circuit Breaker into Housing

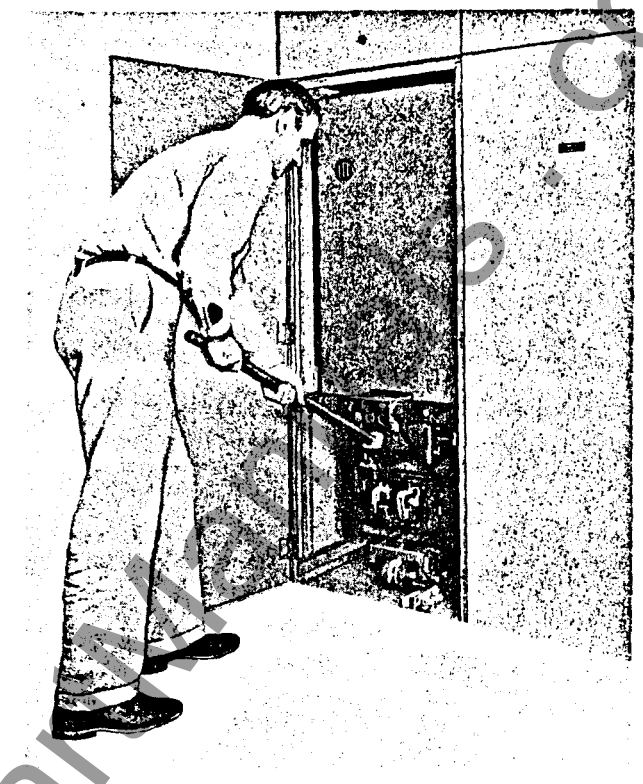

Fig. 15—Manually Closing Circuit Breaker While in Test Position

2. With the use of the drawout handle, back the breaker into the housing so that the guide bar on the breaker enters the guide slot in the housing. Push breaker toward rear until breaker reaches the floor stop which latches it in the "TEST" position.

If it is desired to test the breaker for operation electrically and manually before putting it into service, it may be done in this position by means of the push button on the front of the breaker, Fig. 13 and by means of the maintenance handle as shown in Fig. 15.

3. Seat the levering device pin into the notch at the front of the floor guide and connect the link to the bracket on the circuit breaker as in Fig. 16 with the breaker in the "OPEN" position, move the release lever toward the guide slot with the right foot and operate the levering device through one stroke until the breaker engages the stop in the housing. Turn locking device to "LOCK" position. Breaker is now in the "RACKED-OUT" position. Disconnect the levering device from the breaker. Rack in by inserting the crank and turning clockwise, Fig. 17, until pointer on breaker panel indicates the breaker is in the connected "OPERATING" position, Fig. 18.

REMOVING 5HV-150 AND 5HV-250 BREAKER FROM HOUSING

1. Trip breaker by means of the control switch on front of housing.

2. Open door, insert crank and rack breaker, Fig. 17, to "RACKED-OUT" position as indicated by pointer on breaker nameplate.

If it is desired to remove the breaker completely from the housing, continue as follows:

a. Move locking device to "UNLOCK" position as shown in Fig. 13.

b. Seat the levering device pin into the notch at the front of the floor guide and connect the link to the bracket on the circuit breaker as in Fig. 16. Operate the levering device through one stroke forward until the floor stop latches the breaker in the "TEST" position.

c. Remove the levering device and apply drawout handle to front wheels. Move the release lever toward the guide slot with the right foot and draw the breaker from the housing as shown in Fig. 19.

5HV-350 CIRCUIT BREAKER

This circuit breaker has "TEST" and "OPERATING" positions which correspond to those of the other 5HV breakers, but since it is constructed differently, it is moved from one to the other by different means. For details of the construction of the breaker, see the 5HV-350 Circuit Breaker Instruction Book listed in the Bibliography at the end of these instructions.

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Photo 30188-R

Fig. 16—Levering in Circuit Breaker to "Racked-Out" Position

Photo 30189-R

Fig. 17—Racking in Circuit Breaker to Fully Connected Position

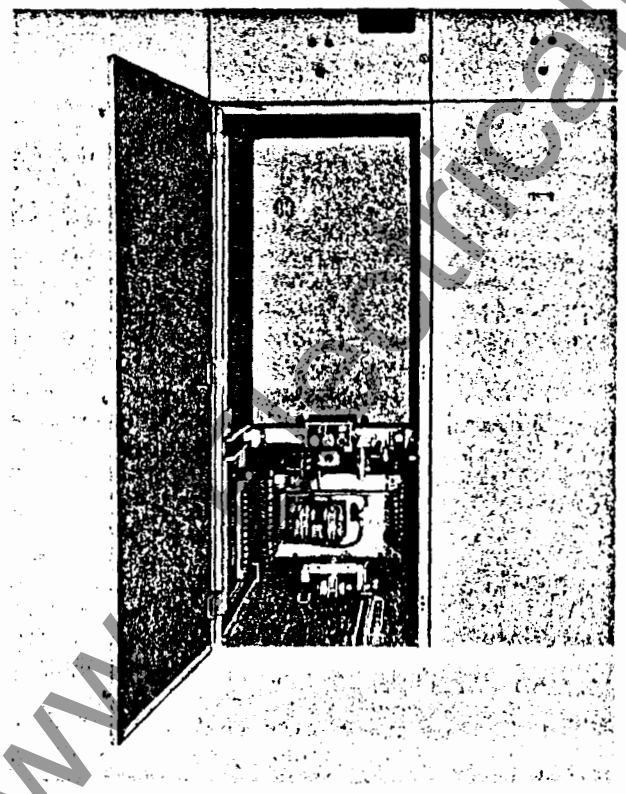

Photo 30182-R

Fig. 18—Circuit Breaker in Fully Connected Position

Photo 30185-R

Fig. 19—Pulling Out Circuit Breaker from Housing

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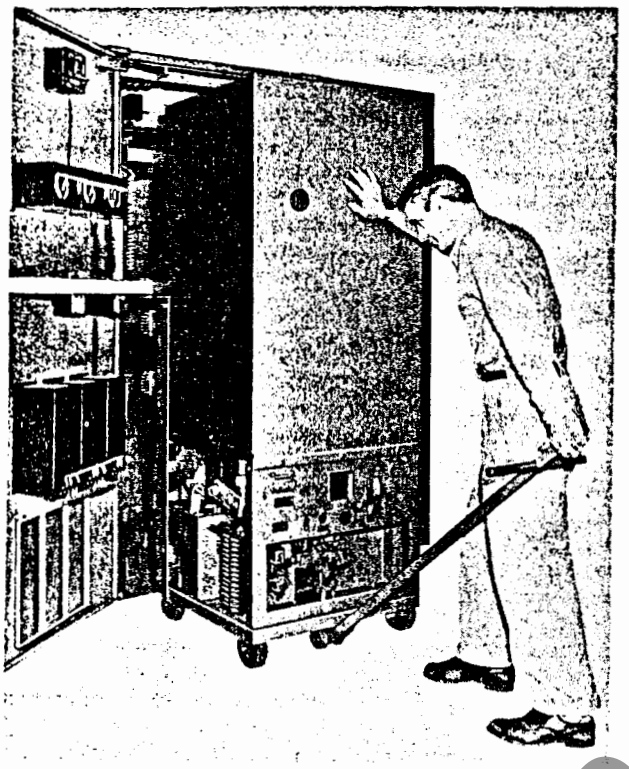

Photo 27348-R

Fig. 20—Guiding 5HV-350 Breaker into Housing

Fig. 21—Racking in 5HV-350 Breaker to Fully Connected Position

INSTALLATION OF 5HV-350 CIRCUIT BREAKER

1. The breaker should be in the "OPEN" position and the position indicator at the "TEST" position.

2. By use of the steering handle, align the sides of the circuit breaker with the sides of the circuit breaker compartment.

3. Back the breaker into the compartment so that the guide bar at the bottom of the circuit breaker enters the guide slot on the compartment floor. See Fig. 20.

4. Push the breaker approximately half way into the compartment and then remove the steering handle.

5. Using the two handles on the lower front panel, continue pushing the breaker until the rollers on the racking mechanism cranks snap up into the vertical guides in the structure. The circuit breaker is now latched in the "TEST" position.

6. If desired, energize the control circuit and electrically close and trip the circuit breaker by means of the push buttons.

7. With the circuit breaker in the "OPEN" position, insert the racking rod, push down on the racking release lever, and rack the breaker to the "OPERATING" position as shown in Fig. 21.

REMOVING 5HV-350 BREAKER FROM HOUSING

1. Trip the breaker by means of the control switch.

2. Open the compartment door, insert the racking rod, push down on the racking release lever and rack the circuit breaker out to the "TEST" position as indicated by the position indicator.

If it is desired to remove the circuit breaker from the switchboard, continue as follows:

3. Insert the racking rod into the hole in the racking wheel directly above the "TEST" position nameplate.

4. Push down on the racking release lever, and move the racking rod slightly (15 degrees) in the "IN" direction.

5. Release the racking release lever, and move the racking rod in the direction of the "OUT" arrow (upward) approximately 30 degrees. This upward motion of the racking rod must be fast enough to move the circuit breaker forward past the self-latching "TEST" position.

6. Remove the racking rod and pull the circuit breaker forward, using the two handles on the lower front panel, until the circuit breaker is approximately half way out of the compartment.

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7. Insert the steering handle and withdraw the circuit breaker from the compartment.

HOW TO PUT THE SWITCHGEAR IN SERVICE

GENERAL

Before energizing the switchgear observe that:

1. The board is completely assembled with all barriers in place, all joints taped and all extraneous material has been removed.

2. Potential tests have been made to determine that all insulation is in good condition.

3. All outgoing cables are either permanently connected or thoroughly insulated so as not to cause a fault, especially at end remote from switchboard.

4. All short circuiting strips are removed from current transformers, and relays are not blocked.

5. All circuits are properly phased.

6. There is a backup circuit breaker which is in operating condition and set so as to clear any fault that inadvertently may occur.

SAFETY PRECAUTIONS

THE CIRCUIT BREAKERS SHOULD BE IN EST POSITION WHEN PRACTICABLE. WHEN A THOROUGH INSPECTION OR WORK IS REQUIRED ON A BREAKER, IT MUST BE REMOVED FROM THE HOUSING. THE BUS SHOULD BE DE-ENERGIZED AND GROUNDED WHENEVER POSSIBLE WHEN WORK IS TO BE DONE ON SWITCHGEAR.

PROCEDURE

First energize the control circuit with the main power circuit de-energized.

With the circuit breaker in the test and connected position, open and close the breaker by push buttons on the breaker or from the control switch, or any remote operating point that may be provided. The breaker may be tripped by manually manipulating all relays and protective devices. Interlocks and special controls may be checked for proper operation.

The main power may now be applied to the switchgear after all circuit breakers have been placed in the test position. Close all doors to the switchgear as a safety measure. Those breakers necessary to energize the main bus should be moved to the connected position and closed. Observe undervoltage relays or other devices that should function properly when the main bus is energized. Next move each circuit breaker in turn to the connected position and close. (Method explained under "INSTALLATION OF CIRCUIT BREAKER.") Observe that all relays and instruments are functioning properly. Improper readings of wattmeters, power factor meters, and watthour meters usually indicate improper phasing of meter wiring.

When a switchgear installation is fed from one or more generators, it is usual to bring each generator up to speed and connect it to the bus so as to make adjustments on it for speed and voltage. The generators are then synchronized and adjusted for load division.

When a switchgear installation controls synchronous or induction motors, there may be special adjustments of relays and control devices that must be made for the proper operation of the motors.

BIBLIOGRAPHY

Description	Reference
Type 5HV-75 Circuit Breakers, 1200A	IB-5708
Type 5HV-150 Circuit Breakers, 1200A	IB-5718
Type 5HV-150 Circuit Breakers, 2000A and Type 5HV-250 Circuit Breakers, 1200 & 2000A	IB-5717
Type 5HV-350 Circuit Breakers, 3000A	IB-5707

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

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