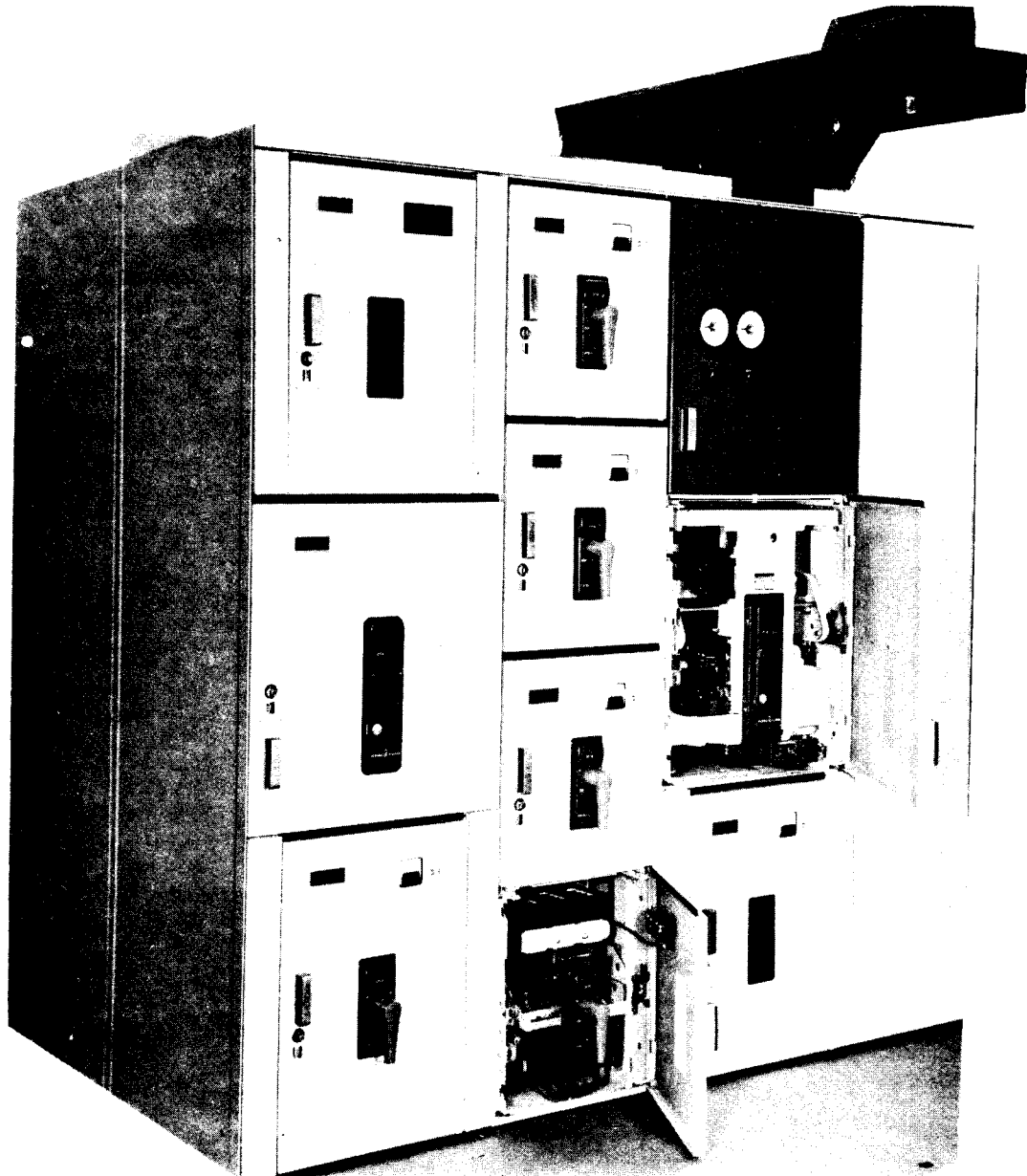


INSTRUCTIONS

GEI-90890A
SUPERSEDES GEI-83902C

AKD-5 POWERMASTER

LOW VOLTAGE DRAWOUT SWITCHGEAR



SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

RECEIVING, HANDLING AND STORAGE

RECEIVING

Every package leaving the factory is plainly marked with case number, requisition number and customer's order number. If, for any reason, it is necessary to divide the equipment for shipment, the unit numbers of the portion of the equipment enclosed in each shipping package are identified.

All equipment leaving the factory is carefully inspected and packed by personnel experienced in the proper handling and packing of electrical equipment. Upon receipt of any apparatus, make an inspection immediately for damage sustained while enroute. If injury is evident, or indication of rough handling is visible, file a claim for damage at once with the transportation company. Notify the General Electric Company Apparatus Sales Office promptly. Information on damaged parts, part number, case number, requisition number, etc., should accompany the claim.

The contents of each shipping package are listed in the packing details attached

to the package. When unpacking, to avoid the loss of small parts, the contents of each case should be carefully checked against the packing details before discarding the packing material. A list of miscellaneous parts as required that are forwarded with the equipment, and how they are normally packed or shipped, is included below.

Located in Package "E"

- CLF* Fuses
- Splice Plates
- Tube of Contact Lubricant D50H47
- Can of Sand Gray Paint
- Can of Blue Paint
- Weld Splices
- Can of Black (Gray Scale-N) Paint (for hoist if furnished)
- Bag of Hardware
- Can of Thinner
- Rubber Seal
- Cement
- Test Plugs
- Floor Clamps
- Breaker Closing Device (for electrical breakers only)

Located in Package "F" (Indoor Only)

- Hoist Dolly
- Hoist Carriage

Package "L" or "R"

Auxiliary Unit Adapter Box (On large transformers only)

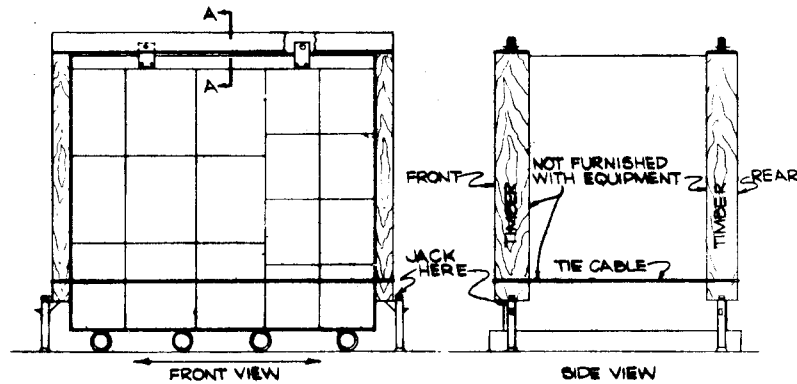
Separate Carton

Power Circuit Breaker (one per carton)

Located inside the switchgear Auxiliary Unit in the top compartment will be found the following items:

- Instruction Books
- Installation Drawing
- Front View & Floor Plan
- Drawings
- Elementary & Electrical Diagram

* A Trade-Mark of the General Electric Company.

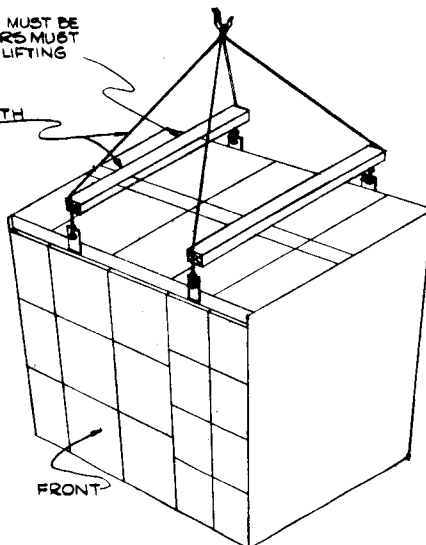


RECOMMENDED METHOD OF JACKING

AFTER SHIPPING CHOCKS ARE REMOVED, ROLLERS MAY BE USED TO ROLL EQUIPMENT PARALLEL TO FRONT ONLY

LIFTING SPREADERS MUST BE USED AND TOP COVERS MUST BE IN PLACE WHEN LIFTING EQUIPMENT

NOT FURNISHED WITH EQUIPMENT



(2) ANGLES 4" X 3" X 5/16" THK (FRONT AND REAR) NOT FURNISHED WITH EQUIPMENT

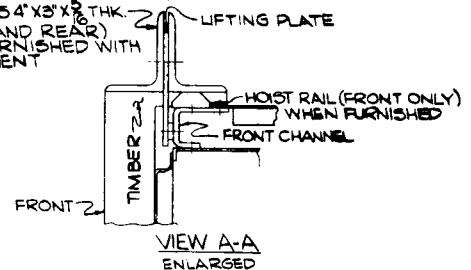


Fig. 9 (0673D0500-002-5) Methods Of Handling Indoor Equipment.

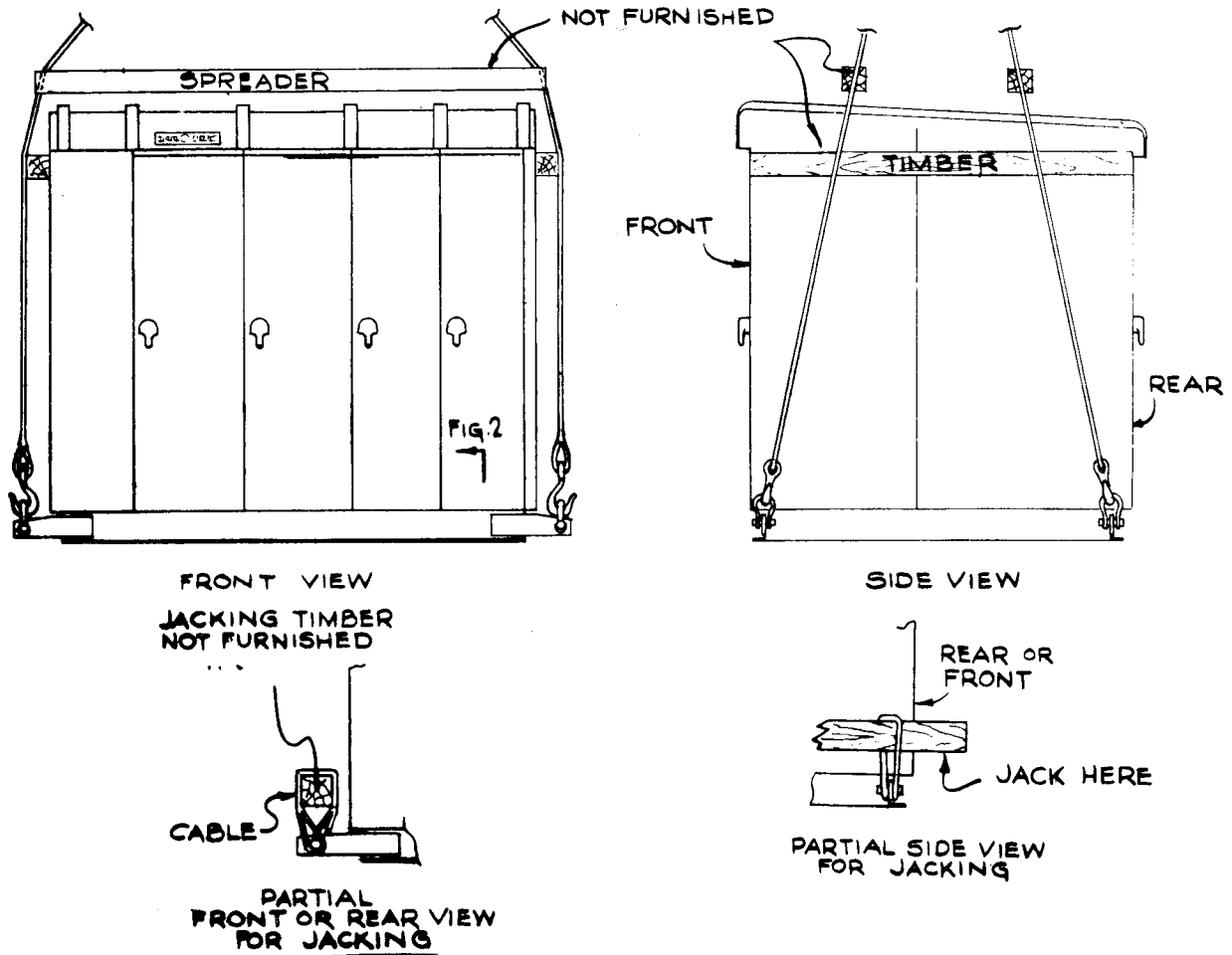


Fig. 10 (0673D0500-003-3) Methods of Handling Outdoor Equipment.

HANDLING

The switchgear units, may be most conveniently handled by a crane. Removable lugs are provided on top of the switchgear. If the installer uses a crane for lifting a cable spreader must be used to obtain a vertical pull on the lifting lugs. Recommended lifting methods are shown in Figs. 9 and 10.

If crane facilities are not available, the equipment may be moved into position by means of construction rollers placed under the shipping skid. Where overhead is too low, the shipping skid may be removed and the equipment moved by rollers placed under the three channels under the equipment.

CAUTION: Be sure the rollers used are spaced such that the three channels rest on top of the rollers, as a direct application of the rollers between the channels may tear or distort the equipment. Jacks may also be applied to handle the equipment when a crane is not available, as shown in Figs. 9 and 10.

Remove all outer crating after the equipment has been moved to the desired location.

Methods of handling outdoor switchgear, shown in Fig. 10, are much the same as for indoor equipments except that lifting plates are provided at the base of the structure. The lifting plates should be removed after the equipment is permanently anchored, so that passageway at the ends of the equipment will not be obstructed.

Air circuit breakers are shipped separately in individual cartons with the breaker in the open position. The circuit breaker should be unpacked as soon as possible after it has been received and inspected.

Store the circuit breaker in a clean dry location in an upright position. It must be properly supported to prevent bending of the studs or damage to any of the breaker parts. Do not remove any protective grease until it is ready to be installed. A covering of kraft or other non-absorbent paper will prevent dust from settling on the breaker.

STORAGE

If the breaker is not to be placed in service at once remove it from its shipping carton and thoroughly inspect it. If everything is in satisfactory condition replace the breaker in its shipping carton for storage. Do not remove the shipping members at this time.

If it is necessary to store the equipment for any length of time, the following precautions should be taken to prevent breakage, corrosion, damage or deterioration.

1. Uncrate the equipment. Check thoroughly for damage.
2. Store in a clean, dry, rodent free location with moderate temperature and cover with a suitable canvas to prevent dust, dirt, water, or other foreign substances from entering the switchgear.
3. If dampness or condensation may be encountered in the storage location, heaters must be placed inside the units to prevent moisture damage. Approximately 250 watts of heaters per unit are required. On outdoor switchgear this may readily be accomplished in making a temporary power supply connection to the heaters already installed in the equipment.

CAUTION: Remove all cartons and other miscellaneous packing material from inside the units before energizing any heaters.

One bar per phase (1600 ampere equipments).

1. Tack weld the splice on the top on one side only.
2. Weld this side completely. Strive for penetration, particularly on the root pass. The finished weld should be convex about 1/8". Burn in and fill the top and bottom of the weld.
3. Allow the splice to cool until you can hold your bare hand on it before welding the other side.
4. Tack the top of the other joint and weld using the same procedure.

Two bus bars per phase (3000 amp equipments).

5. Follow the preceeding steps for the inside bar. Allow it to cool until you can hold your bare hand on it.
6. Loosen the bus support bolts and add 1/8" of washers to the spacer between bars. This makes the distance between bars 1-1/4".
7. Tighten bars and weld (follow steps 1-4).
8. Remove washers and replace bus support bolts after the bars are cool.

TESTING AND INSPECTION

After the equipment has been installed and all connections made, it must be tested and inspected before putting it in service. Although the equipment and devices have been tested at the factory, a final field test must be made to be sure that the equipment has been properly installed and that all connections are correct. The primary equipment must be completely de-energized while the tests are in progress.

Directions for testing relays, instruments, and meters, are given in the instruction book furnished for each device. The settings of the protective relays must be coordinated with the other relays on the system and therefore these relays must be set by the purchaser. General instructions on setting the relays are given in the Relay Instruction Book.

The extent of the tests on the equipment as a whole will depend on the type and function of the equipment. Tests which should be performed, however, include circuit breaker operation, and switchgear metering, phasing, and grounding checks.

High potential tests to check the integrity of the insulation are not necessary if the installation instructions are carefully followed. If local codes demand this test or the purchaser wishes to make high potential tests, the voltage should not exceed 75% of the AIEE factory test voltage. For the power circuit the AIEE factory test voltage is two times switchgear rating plus 1000 volts. Potential and control power transformers must be disconnected during high voltage testing.

Key Interlocks

After initial installation of the switchgear equipment, all necessary interlock keys should be inserted into the appropriate locks and all spare keys should be placed in the hands of a responsible person. Refer to the key interlock schematic included in the summary furnished with the equipment to determine the sequence of operation and the correct number of operating keys required. This precaution is necessary since improper use of spare keys will defeat the interlocking scheme.

Breaker Operation Test

All compartments housing all AK circuit breakers have a TEST position, in which the breaker primary contacts are disconnected, while the secondary contacts are still engaged. This TEST position permits complete testing of the electrical control circuit without energizing the primary power circuit. When the breaker is first put into service, its control circuit must be thoroughly tested while in this position to make sure that all closing and tripping circuits are complete and functioning properly.

The TEST position is not suitable for inspection and maintenance of the breaker, and should therefore be used only for testing breaker operation.

Refer to the appropriate breaker instruction manual for other pre-operational checks on the breakers.

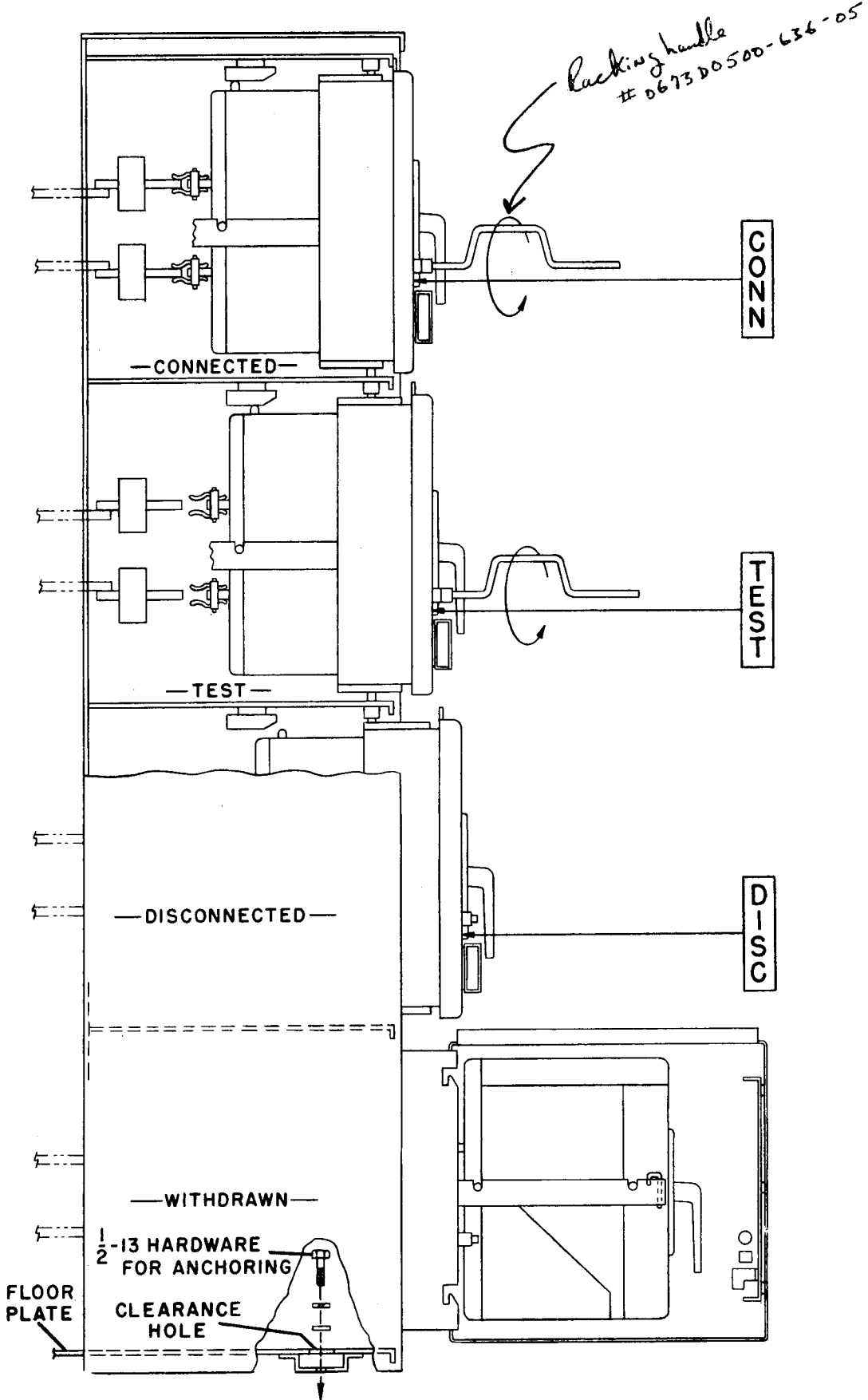


Fig. 14 (0121C1508-0) Side View Of Breaker Stack.

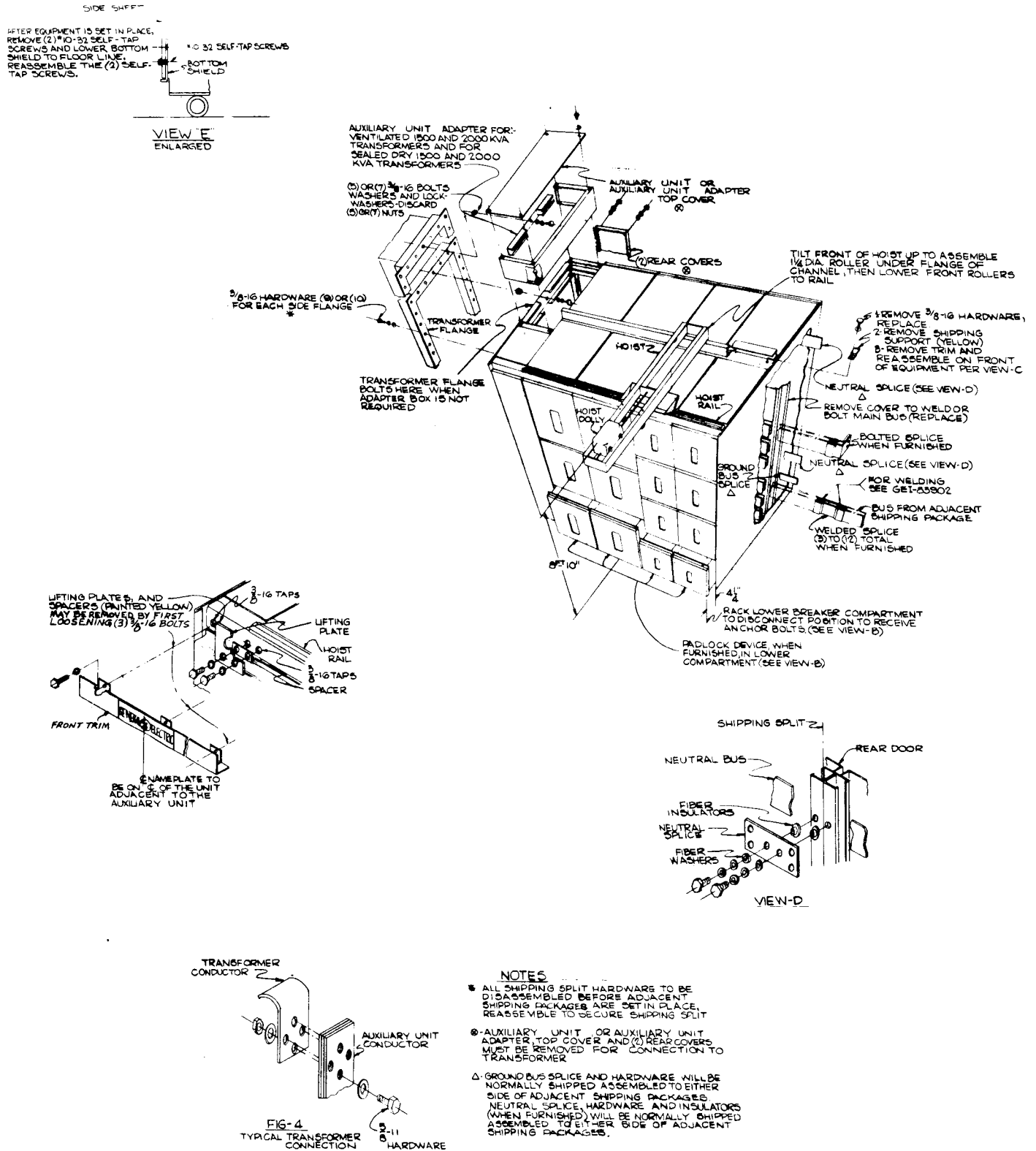


Fig. 15 (0673D500-002-05) Assembly Of Indoor Equipment.



Fig. 17A (8035634) Place Breaker In Front Of Proper Compartment. Operate Drawout Mechanism To Disconnect Position.

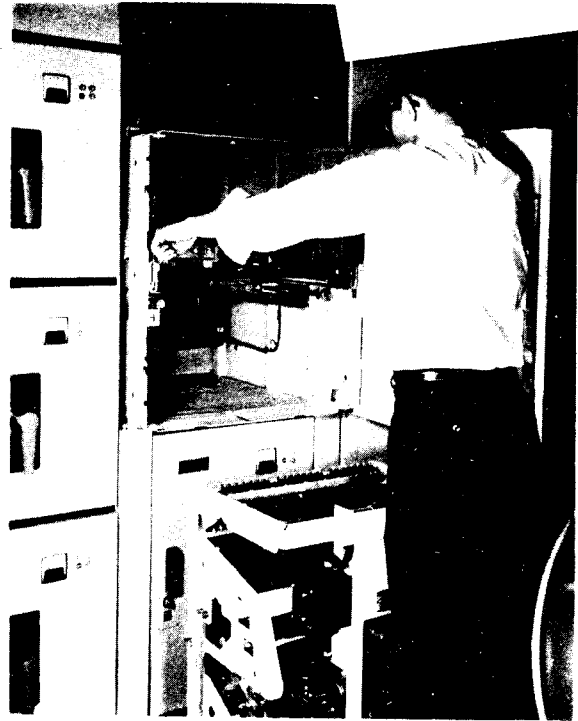


Fig. 17B (8035642) Open The Compartment Door. Rotate The Two Lock Links.

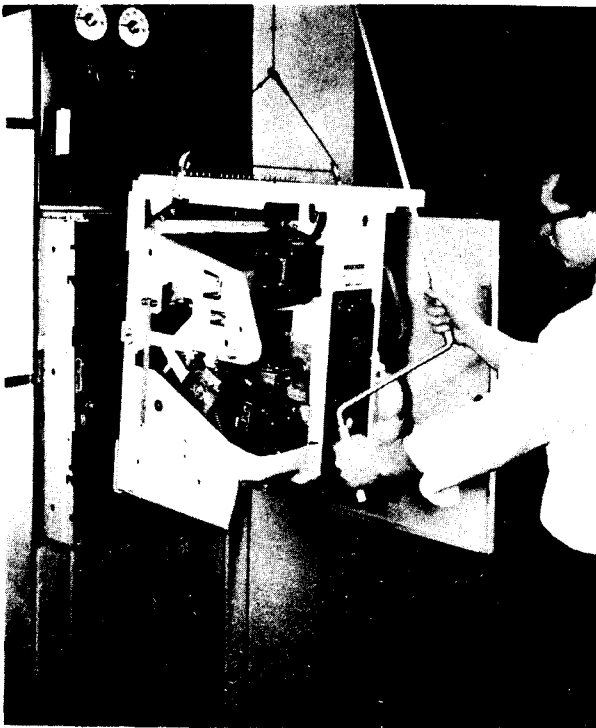


Fig. 17E (8035637) Raise Breaker To About One Inch Above Tracks.

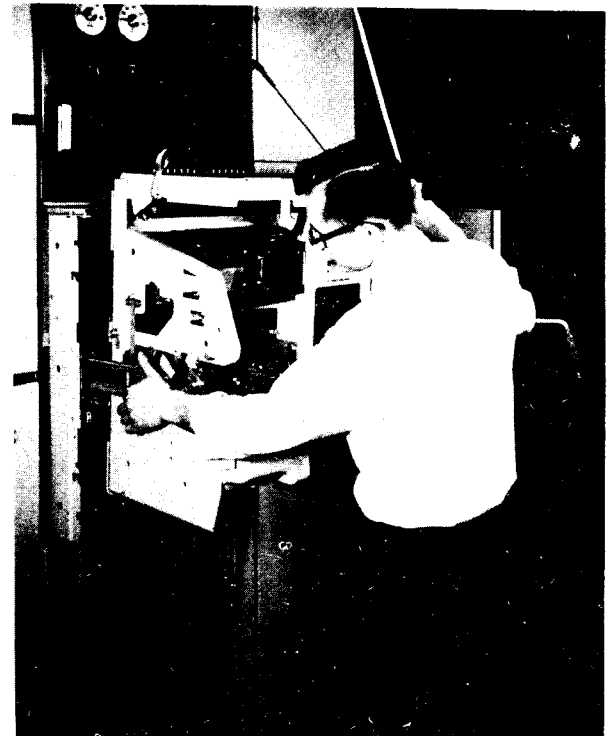


Fig. 17F (8035641) Pull Both Tracks Out Completely.



Fig. 17C (8035640) Let Out Hoist Cable. Place Hooks In Slots.

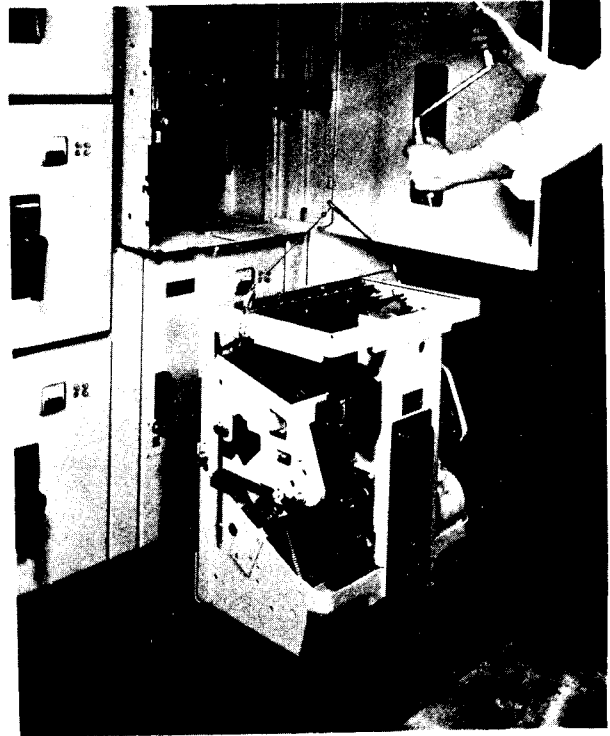


Fig. 17D (8035639) Adjust Cable To Balance Breaker. Proper Ball Must Be Under Cable Eye.

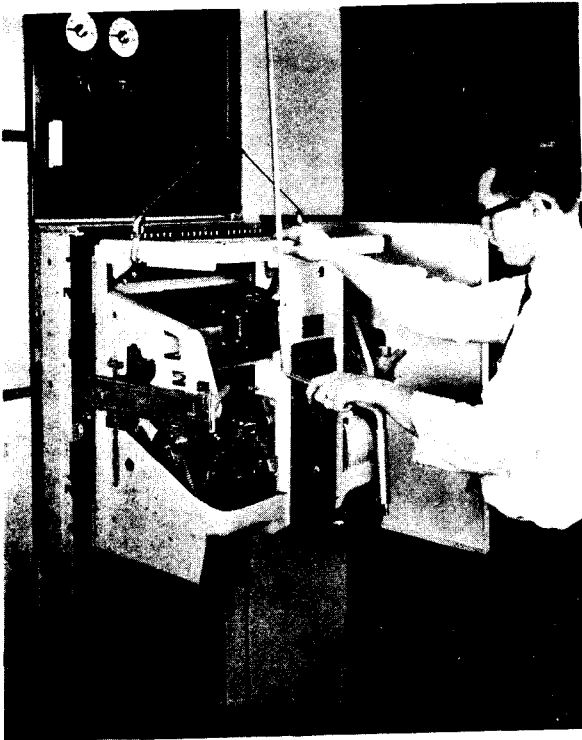


Fig. 17G (8035635) Lower The Breaker Into The Track Slots. Remove The Hoist Cable.



Fig. 17H (8035636) Push The Breaker In Completely And Rotate The Two Lock Links. Close The Door.

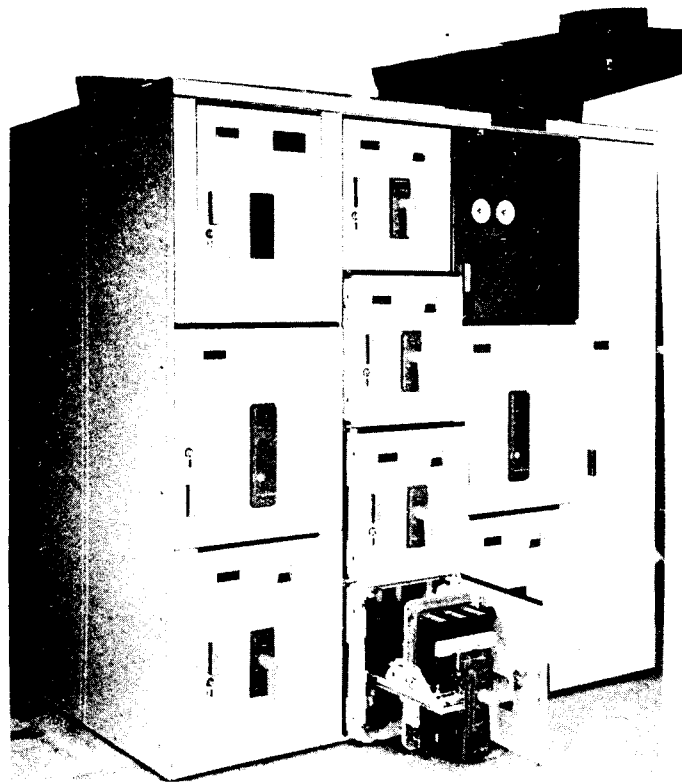


Fig. 18 (8035631) Stairstep Arrangement Of Breakers In Connected, Test, Disconnected And Fully Withdrawn Positions.

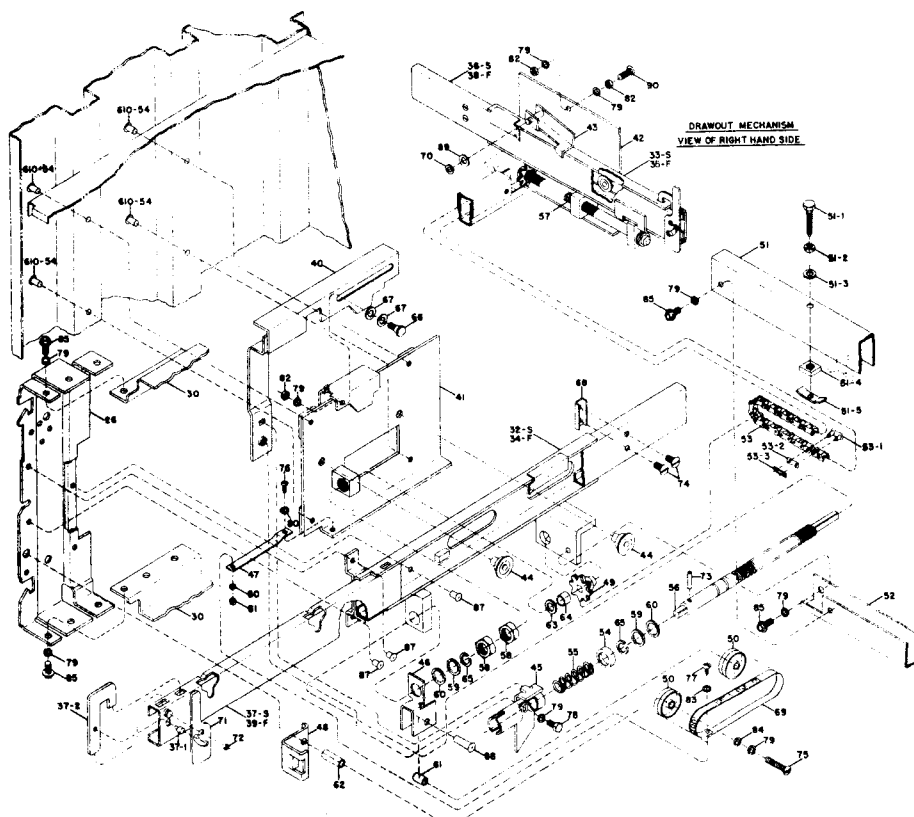


Fig. 19 (0625B0375-0) Rackout Mechanism For AK-25 Breaker

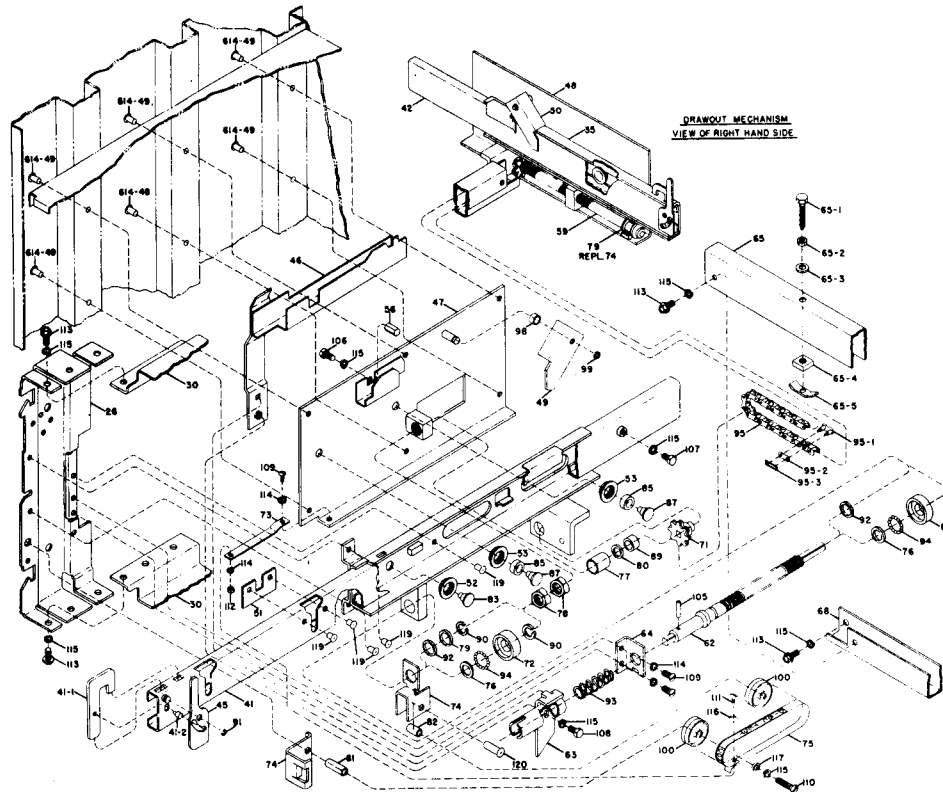


Fig. 20 (0625E0376-0) Rackout Mechanism For AK-50, 75, 100 Breakers

DRAWOUT MECHANISM OPERATION

Part numbers refer to Fig. 19 (AK-25) (First nos. in sequence).

Part numbers refer to Fig. 20 (AK-50, 75, 100) (Second nos. in sequence).

The rackout mechanism is operated by pushing the handle onto the end of the jackscrew shaft (56) (62) and rotating the handle. Clock-wise rotation moves the breaker into the house and counter-clockwise rotation moves the breaker out. Approximately 17 turns of the handle will move the breaker from the disconnect to the connect position. To properly engage the handle with the jackscrew shaft, the slot in the end of the handle should align with the pin (73, 105) through the shaft. When the pin is so aligned, the square hole in the handle will be engaged with the square drive end on the shaft.

The rackout mechanism is interlocked so that the circuit breaker must be open before the operating handle can be inserted. When the breaker is closed, an interlock link operated by the breaker cross bar blocks the interlock linkage on the rackout mechanism and prevents the tube (45) (63) from being moved back to fully expose the square shaft end. The pin (73) (105) in the jackscrew shaft engages in a slot in the tube. This slot prevents rotation of the shaft and also assures that the interlock linkage must be moved through a prescribed distance before operation of the mechanism is possible. When the tube is pushed back so that it will clear the pin, a cam surface on the interlock slide (40)(46)

engages a trip link on the side of the breaker and holds it trip free as long as the handle is engaged or the interlock tube is in the retracted position.

There is also a stationary cam in the house which holds the breaker trip free as it is moved between the connect and test positions. This stationary cam comes into operation before the primary disconnects have parted and is operable whether or not the rackout handle is engaged. The breaker thus cannot be closed when it is between the test and the connect positions. From the test to the disconnect position, the breaker can be closed when the rackout handle is disengaged and the pin in the jackscrew is aligned with the slot in the interlock tube so that the interlock linkage is in the reset position.

An indicator (69) (75) which is visible through an opening in the front of the door shows the position of the breaker in the house. The test position is reached when the line on the indicator label marked TEST is aligned with the stationary line on the indicator housing. In this position, the breaker can be operated when the pin (73) (105) and the slot in the interlock tube are aligned and the rackout handle is disengaged. The secondary control power disconnects are engaged and the primary power disconnects are open in this position.

The Disconnect and Connect positions are indicated by the sight indicator and by the jackscrew reaching the end of its travel. The adjusting nuts (58) (78) are adjusted so that when the connect position is reached, the pin and the interlock tube slot will

be aligned and the breaker can be closed upon removal of the rackout handle. In the disconnect position, it may be necessary to rotate the jackscrew back slightly after the travel limit has been reached in order to align the jackscrew pin and the slot in the interlock tube.

The motion of the rackout mechanism can be reversed at any point in the cycle by reversing the direction of rotation of the handle.

EMERGENCY OPERATION

If necessary, it is possible to remove the breaker from the house without using the rackout mechanism. This is done by rotating the release levers (71) (45) after the breaker has been tripped and pulling the breaker manually off of the primary disconnects.

However, the breaker cannot be reinserted into the house far enough to engage the primary disconnects unless the stop link (43) (49, 50) is retracted. This stop link (43) (49, 50) retracts automatically when the rackout mechanism is operated to the disconnect position. If it is necessary to insert the breaker into the house when the rackout mechanism is in the connect position, the stop link (43) (49, 50) must be retracted and held until the interference pin or the breaker mounting pin has passed the stop link. It is recommended that the stop link be held up with masking tape when attempting to insert the breaker in this manner. The inertia of the breaker can then be used to aid in pushing it onto the primary disconnects.

INTERLOCKS

Several interlocks are available as accessories. They are described in the following paragraphs:

Kirk Key Interlocks

Part numbers refer to Fig. 21 (AK-25)
First nos. in sequence

Part numbers refer to Fig. 22 (AK-50,75,
100) Second nos. in sequence.

The Kirk key interlock is mounted with two (2) 1/4-20 one-way screws and lock washers to the left side of the inner house.

The interlock is designed so that the key may be removed from the lock only if the breaker is tripped and the bolt in the lock is extended. When the Kirk lock is extended, the breaker is rendered trip free only in the connected position in the house. The breaker may be operated (closed and tripped) in the test or disconnect positions even when the Kirk lock bolt is extended and the key removed.

The operation of the Kirk key interlock should be checked as follows:

1. With the breaker in the connected position, manually trip the breaker. This then allows the rackout interlock slide (40) (46) to be retracted. The preferred way to do this is with the rackout operating handle. When the interlock slide is retracted, the bolt in the Kirk lock may be extended and the key removed. The interlock slide may then be allowed to return to its normal reset position. The breaker will remain trip free in the connected position until the key is returned and the Kirk lock bolt is retracted.
2. If desired, the breaker may be moved to either the test or the disconnect position while the Kirk lock key is removed from the lock. In these positions the breaker can be operated for checking or maintenance.

DOOR INTERLOCK

For part numbers refer to Fig. 23.

A door interlock which prevents opening of the compartment door when the breaker is closed can be provided as an optional accessory.

The door interlock consists of a link (074-02) mounted on the inner house side sheet of the breaker compartment. A combination torsion, compression spring (074-33) is mounted on the link pivot pin and biases the link in a forward and counter-clockwise direction. One end of the link engages a clip on the door latch (640-02), the other end engages with the rackout mechanism interlock slide (40) (46). When the breaker is closed, a link operated by the breaker cross bar engages in a slot in the interlock slide. This prevents the slide from disengaging with the door interlock link and hence, the door handle cannot be lifted.

When the breaker is open, the interlock slide can be moved by pushing in on the interlock slide (40, 46) preferably using the rackout handle. The door can then be

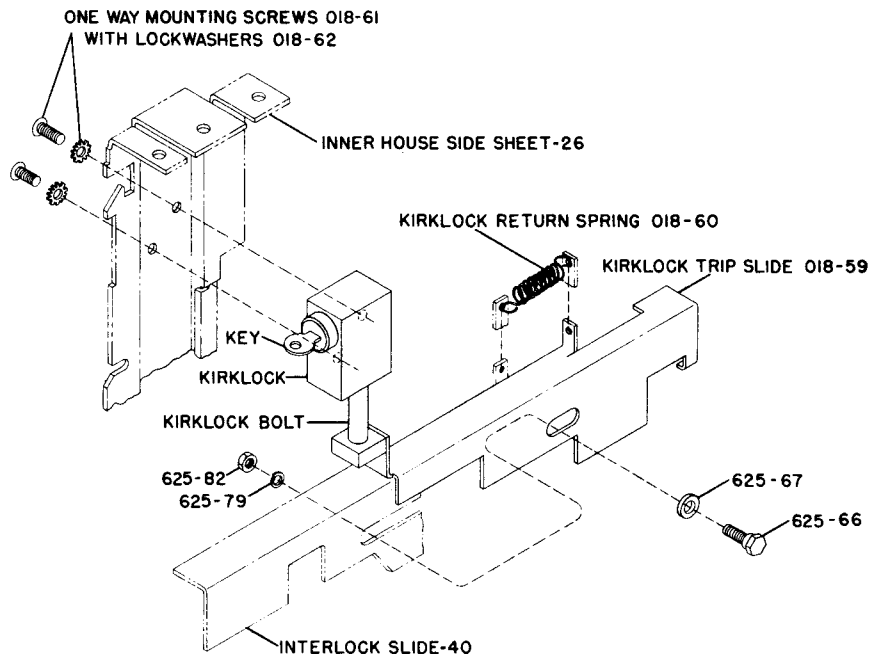


Fig. 21 (0121C1506-0) Kirk Key Interlock For AK-25 Breaker.

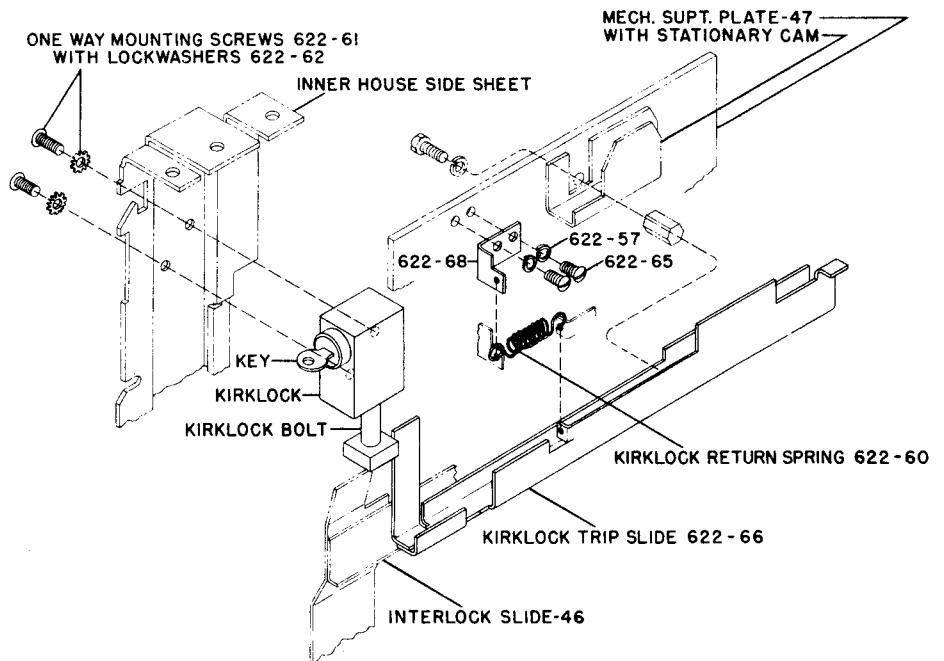


Fig. 22 (0121C1507-0) Kirk Key Interlock For AK-50, 75, 100 Breakers.

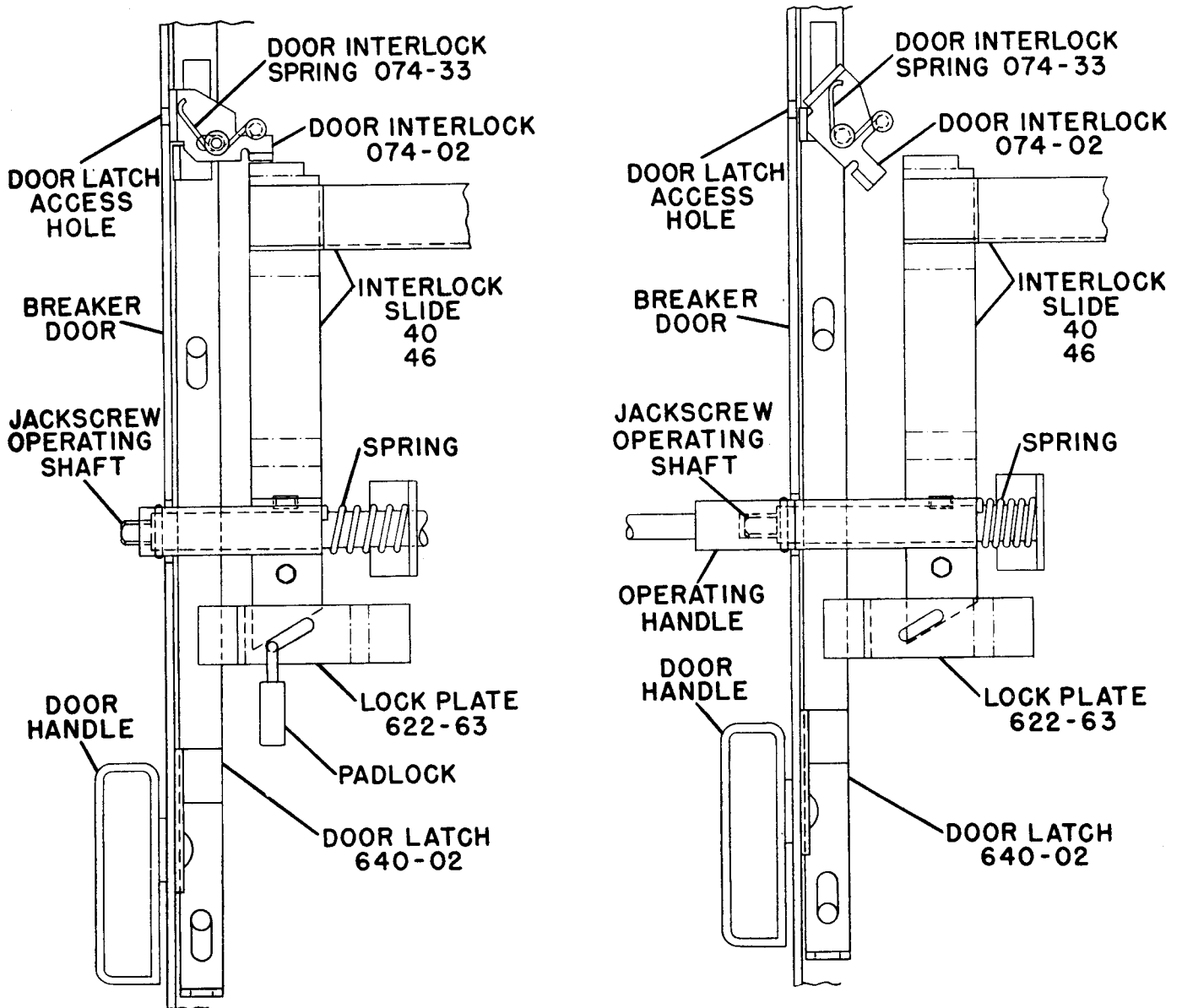


Fig. 23 (0121C1509-0) Door Interlock And Padlock Device.

unlatched by raising the door handle while the interlock slide (40) (46) is held in the retracted position.

If required, the door interlock can be defeated. A small hole is provided in the door in front of the interlock link. By inserting a tool such as a screwdriver through this hole, the interlock link can be pushed back until it is free of the door latch. With the link held in this manner, the door latch can be raised and the door opened.

MECHANISM PADLOCK DEVICE

For part numbers refer to Fig. 23.

An accessory is available to padlock the rackout mechanism.

This accessory consists of a slotted plate (622-63) which is riveted to the inner

house side sheet. The slope of the slot matches the slope of the extension on the interlock slide (40) (46). When one to three padlocks are inserted into the slot in the plate the interlock slide cannot be retracted and the jackscrew cannot be turned. The rackout mechanism can be locked anywhere in its travel. It is necessary to open the compartment door in order to place the padlocks in the device, but once the locks are secured, there is no interference with the door and the door may be opened or closed at will.

MAINTENANCE

A periodic maintenance schedule must be established to obtain the best service from the switchgear. An annual check and overall maintenance procedure for the switchgear devices and all connections, must be followed as a minimum requirement. Equipment subject to highly repetitive operation may require more frequent maintenance.

A permanent record of all maintenance work must be kept. The record should include a list of periodic checks and tests made, the date they were made, the condition of the equipment, and any repairs or adjustments that were performed. Maintenance employees must follow all recognized safety practices, such as those contained in the National Electrical Safety Code and in company or other safety regulations during maintenance.

WARNING: Solid insulation surrounding an energized conductor and power apparatus must never be relied upon to provide protection to personnel.

For specific information regarding the maintenance of devices, such as circuit breakers, relays, meters, etc., refer to the separate instruction book furnished for each device.

BREAKER AND INSTRUMENT COMPARTMENTS

Breakers - Test and inspect all circuit breakers for proper operation as follows:

- a. Operate each breaker while in the TEST position and check all functions. This is particularly important for breakers that normally remain in either the opened or closed positions for long periods of time.

WARNING: De-energize equipment completely except for test circuits.

- b. Remove the breaker from its compartment to a clean maintenance area. Perform the maintenance operation suggested in the appropriate breaker maintenance manual.

Instruments Instrument Transformers and Relays

Check and inspect all devices to see that they are functioning properly. Check that all electrical connections are tight. Check mounting of the device.

Breaker Compartment Interiors

- a. Thoroughly clean interior of the breaker and instrument compartments. Use a vacuum cleaner and clean rags only. Do not use steel wool, or oxide papers. Blowing with compressed air is not recommended.
- b. Check indicating devices, mechanical and key interlocks.

- c. Check primary disconnecting device contacts for signs of abnormal wear or overheating. Discoloration of the silvered surfaces is not ordinarily harmful. These contacts should be cleaned only by wiping with a lint-free cloth.

Before replacing the breaker, check the alignment and wipe off the primary disconnecting device contacts, and apply a thin coat of contact lubricant, D50H47, to the house studs and fingers and to the primary disconnects on the breaker.

BUS COMPARTMENT

Before the following can be performed, remove the steel formed cover between units.

- a. Inspect the busses and connections carefully for evidence of over-heating or weakening of the insulating supports.
- b. Check that all bus mounting bolts and splice connection bolts are tight.
- c. Wipe and vacuum clean the busses and supports.
- d. Check the insulation of the breaker studs that pass through the bus compartment.
- e. After cleaning, megger and record the resistance to ground and between phases of the insulation busses and connections. Disconnect all control circuits before checking resistance. Do not use over a 1500 volt megger. Since definite limits cannot be given for satisfactory insulation resistance values, a record must be kept of the readings. Weakening of the insulation from one maintenance period to the next can be recognized from the recorded readings. The readings should be taken under similar conditions each time, if possible, and the record should include the temperature and humidity.

Feeder Cable and Bus Duct Terminal Compartment

- a. Inspect all main cable connections for signs of overheating, and tighten all connections.
- b. Check that all secondary control wiring connections are tight and all control cabling is intact.
- c. Check all bolts that secure the terminals to the breaker studs for tightness.
- d. Check the ground bus connection and mounting bolts for tightness, and clean the ground bus.

Overall Switchgear

- a. Clean and inspect all painted surfaces and retouch where necessary.
- b. Check to see that all anchor bolts and other structural bolts are tight.
- c. Check that all breaker compartment panel door latches operate properly.

Under normal conditions, the protective relays do not operate; therefore, it is important to check the operation of these devices regularly. Refer to the Relay Instruction Book for detailed instructions.

PAINT REFINISHING

Indoor and Outdoor Primer

1. Remove all loose paint, rust, scale, oil or grease. Sand scratches smooth before priming.
2. Materials
 - a. Synthetic phenolic, alkyd paint 214-488 Sand Gray as made by Arco Co.
 - b. Thinner Xylol made by Standard Oil Co.
 - c. Viscosity 30 seconds Zahn #2 cup.
3. Application
 - a. Primer is preheated to 185°F and sprayed with DeVilbiss type hot spray unit.
 - b. Air dry 30 minutes.
 - c. Thickness of paint coating 0.45 to 0.65 mils.

Indoor Finish Coat

1. Materials
 - a. Sand Gray lacquer 246-84296 as made by DuPont Co.
 - b. Blue lacquer 254-84299 as made by DuPont Co.
 - c. Lacquer thinner.
 - d. Viscosity Sand Gray 25 seconds Zahn #2 cup. Blue 27 seconds Zahn #2 cup.
2. Application
 - a. Spray one wet coat.
 - b. Air dry 30 minutes.
 - c. Thickness 1.00 mil.

Outdoor Finish

1. This finish is applied to surfaces previously cleaned and primed.
2. Materials
 - a. Acrylic Sealer 881-007 as made by DuPont Co.
 - b. Acrylic Lacquer ASA-24 as made by G.E. Co. #200.
 - c. Acrylic thinner E-615 as made by Geo. Senn Co.
3. Application - Sealer Coat
 - a. Reduce sealer to spraying viscosity using 5 parts 881-007 to 6 parts E-615.
 - b. Spray one coat of sealer.
 - c. Air dry one hour.
4. Application - Finish Coat
 - a. Reduce G.E. 200 with E-615 to spraying viscosity of 17 seconds Zahn #2 cup.
 - b. Apply one coat of finish.
 - c. Air dry 30 minutes.
 - d. Thickness of finish coat 1.00 mil.

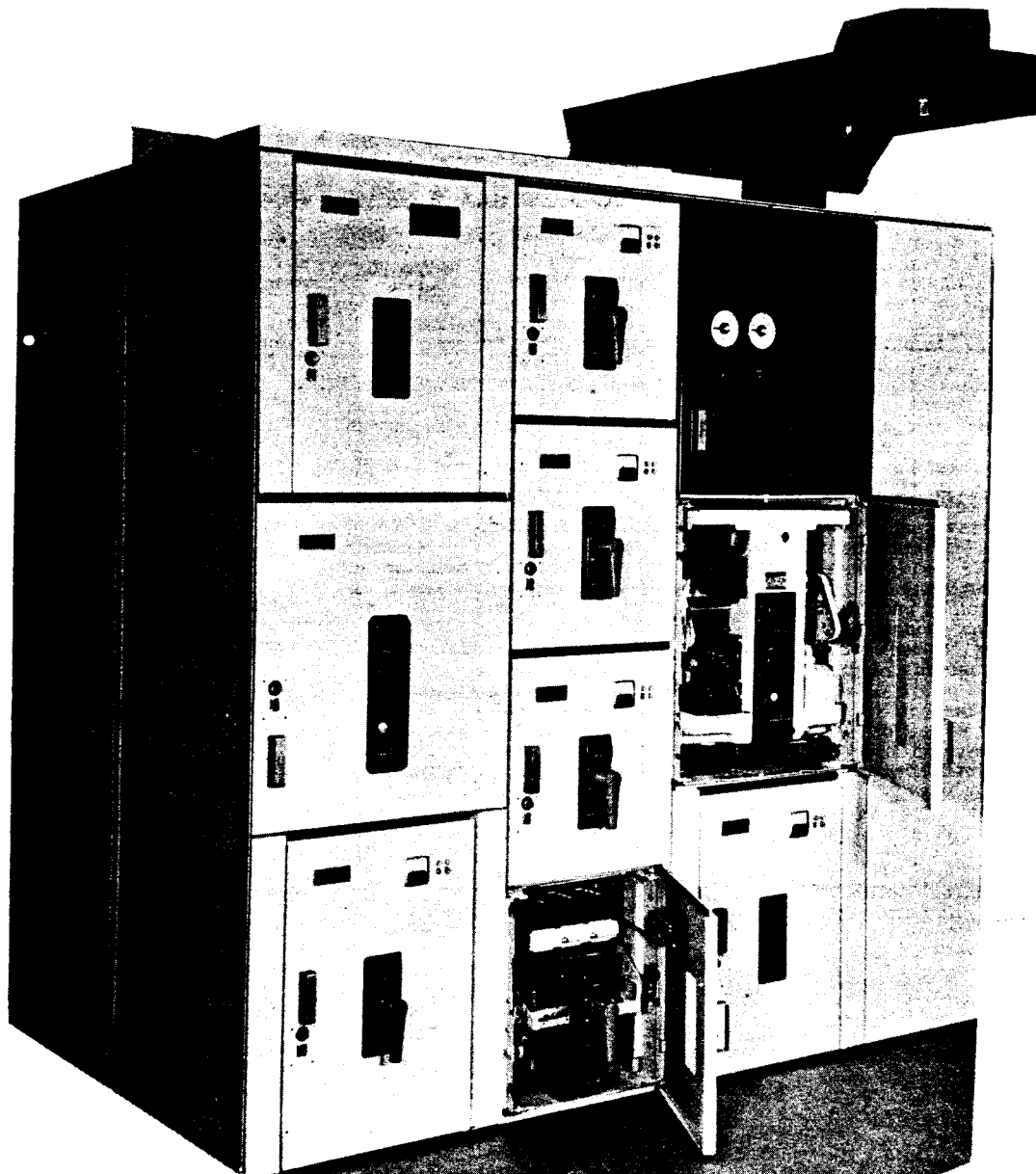


INSTRUCTIONS

GEI-90890A
SUPERSEDES GEI-83902C

AKD-5 POWERMASTER

LOW VOLTAGE DRAWOUT SWITCHGEAR



SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

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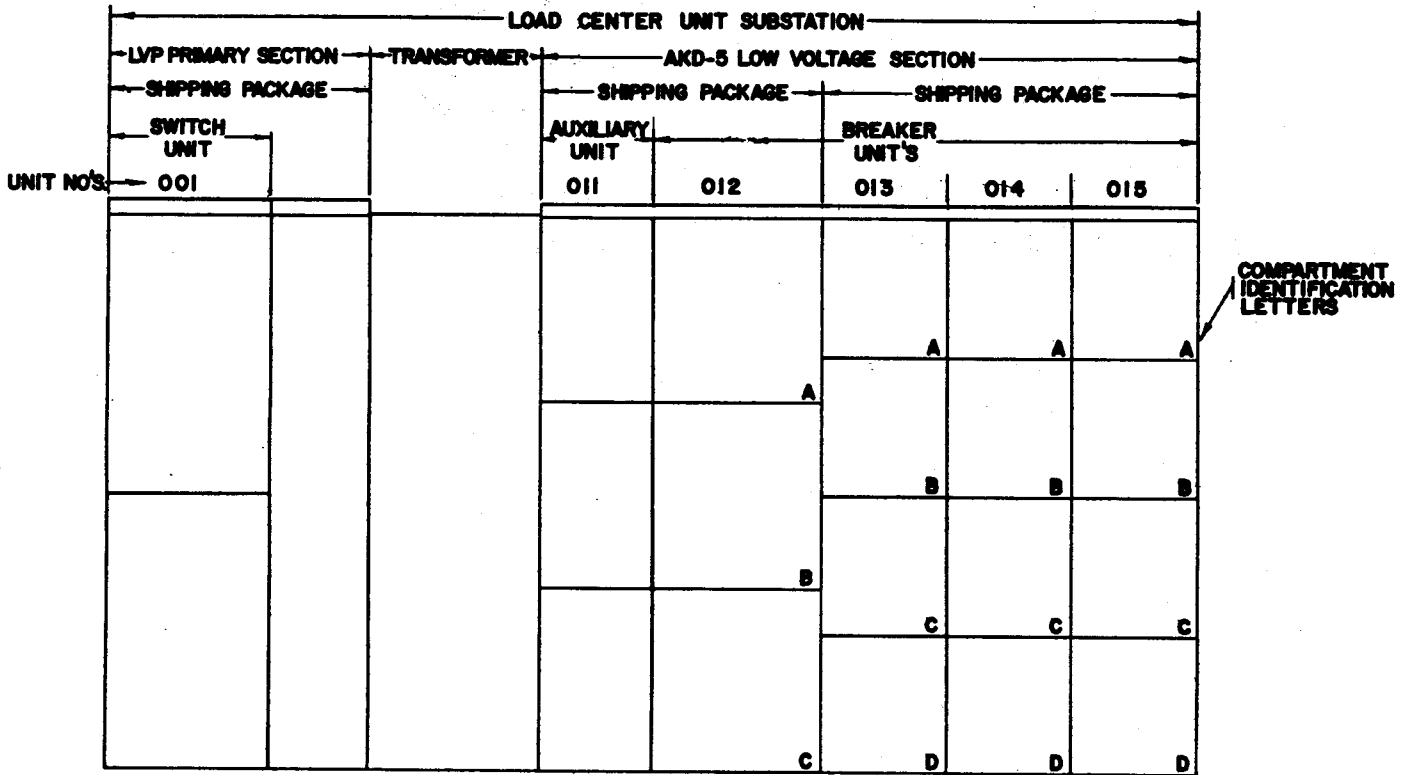


Fig. 1 (0102C5207-0) Outline Of A Typical Load Center Showing Nomenclature.

AKD-5 POWERMASTER LOW VOLTAGE DRAWOUT SWITCHGEAR

INTRODUCTION

This book contains instructions for installing, operating and maintaining AKD-5 Low Voltage Drawout Switchgear. It should be carefully read before installation and initial operation of the equipment.

For application and specification information refer to GEA-3592N "Powermaster AKD-5 Low Voltage Switchgear."

Separate Publications will be supplied for breakers, relays or other devices not described in this publication.

In addition to instruction books, the following drawings will be supplied:

1. Front view and floor plan drawings - These show the general arrangement, height, recommended aisle space, etc.
2. Summary of switchgear equipment - This is a partial parts list, giving catalog numbers of all breakers, devices, etc.

3. When required:
 - a. Control wiring diagram.
 - b. Elementary or schematic wiring diagrams.

All of these documents are needed for installation, operation and maintenance of the equipment.

A pocket has been provided in the top compartment of the auxiliary unit for permanent safekeeping of one set of these documents.

DESCRIPTION

The General Electric AKD-5 Low Voltage Drawout Switchgear is an assembly of metal enclosed, free standing units of Power Circuit Breakers and other auxiliary power circuit protective devices. It is used for protection and control of power circuits and electrical apparatus on low voltage power distribution systems where the utilization voltage is 600 volts a -c or less.

The current rating of the equipment is 4000 amperes maximum. AK-2A Power Circuit Breakers used in the equipment are rated from 15 amperes to 4000 amperes.

The AKD-5 Low Voltage Drawout switchgear consists of one or more units mechanically and electrically joined to make a single coordinated equipment.

This equipment may consist of either free-standing units or a complete load-center unit substation.

A load-center unit substation consists of an incoming line (primary) section providing the necessary high voltage primary cable termination facilities, sometimes including an interrupter switch, a transformer section to transform from the primary voltage (nominally 2.4 to 13.8 kv) to the utilization-voltage of 600 volts or less, and an outgoing section for connection to one or more outgoing low-voltage feeder units.

The load-center unit substation may be single ended, with only one power transformer; or double-ended with a power transformer on both ends.

If an equipment is too long for handling in one piece, it is split into two or more packages in the factory for assembly at the job site.

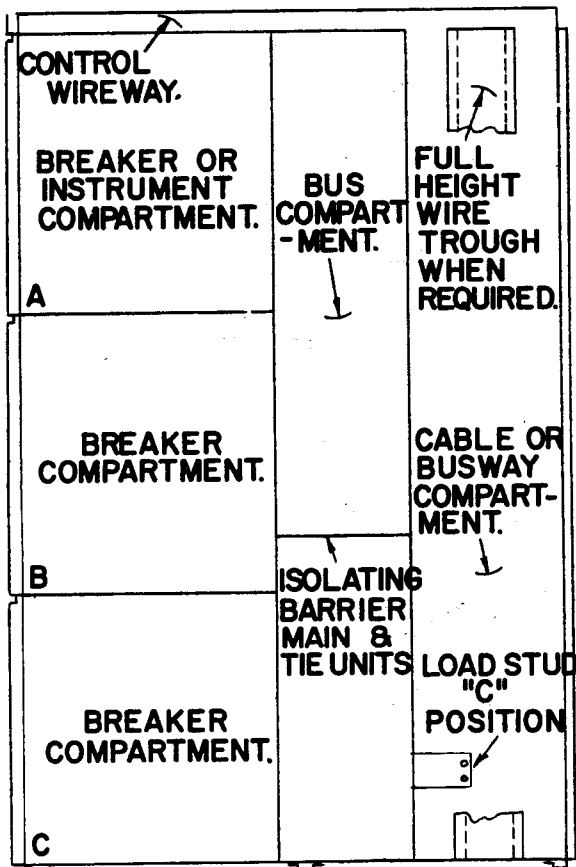


Fig. 2 (0148A5073-0) Side View Showing Compartmentation.

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

Figure 1 shows the outline of a typical single-ended load center unit substation showing nomenclature used. Figure 2 shows the outline of the side section of a typical unit showing compartmentation.

All of the switching and protective devices, control and metering devices as well as the control fuses and necessary instrument transformers are mounted in this enclosure. The breaker positions are all of the drawout type. The breakers are provided with self-coupling primary and secondary disconnecting contacts and incorporate positive and indirect interlocks to insure proper operating sequence. Each of the individual units, compartments and

devices is described in the following paragraphs.

FRONT ENCLOSURE

The front enclosure of each breaker and device unit is divided into individual breaker compartments which house the power circuit breaker or instrument compartments that contain instruments and other protective devices and control components.

BREAKER COMPARTMENT

The breaker is supported within its compartment by a rollout track which is part of the drawout mechanism attached to

the sides of the compartment, Fig. 4. The drawout mechanism is shown in an exploded view, Fig. 19, and its operation is explained in detail later in the manual under Drawout Mechanism Operation.

All AK-2A power air circuit breakers of the same type and rating, which have duplicate wiring, may be interchanged.

Each breaker compartment has four positions. They are:

1. The Connected Position - The breaker is in the operating position, both primary and secondary contacts made and the door closed.

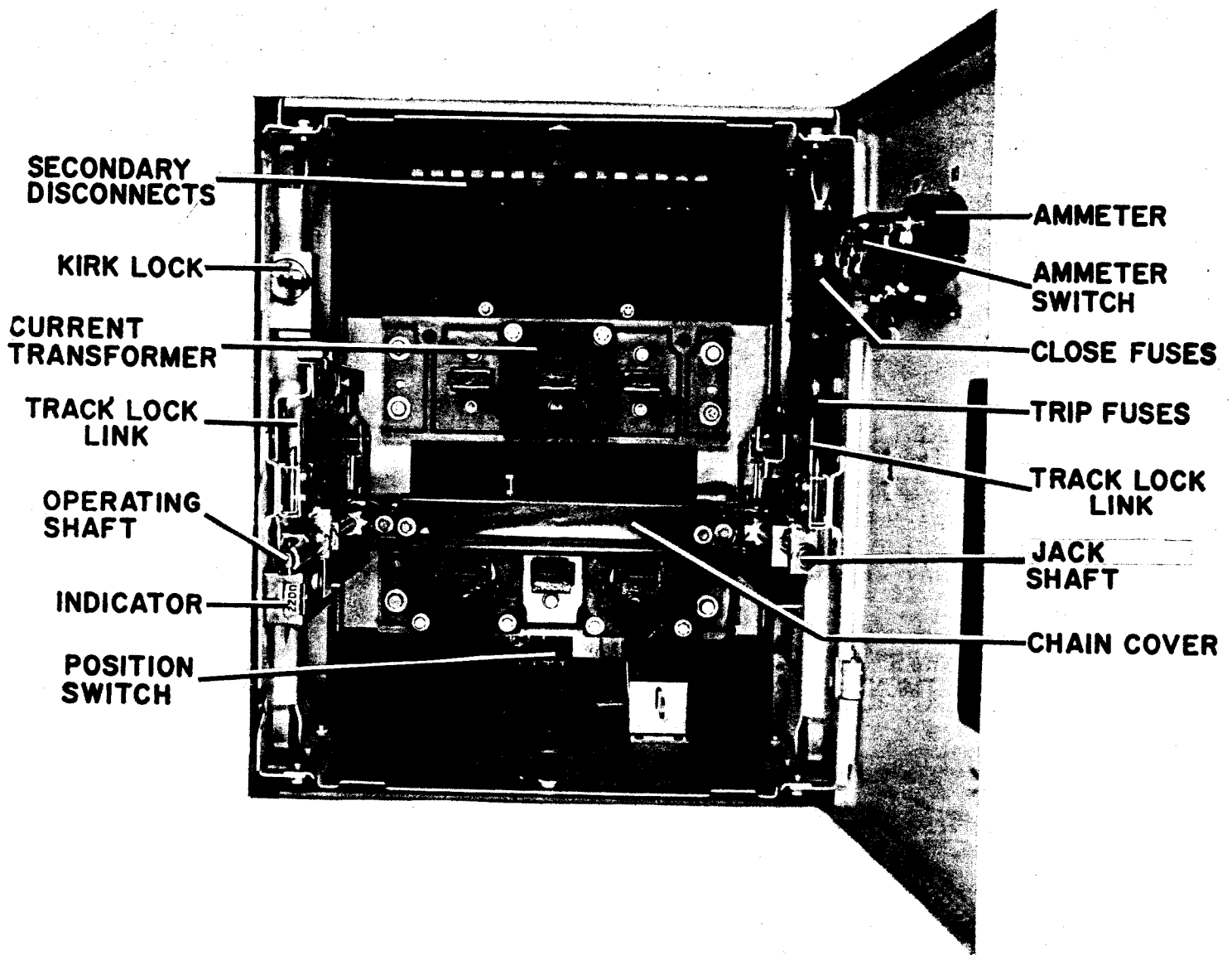


Fig. 3 (8035643) AK-25 Compartment.

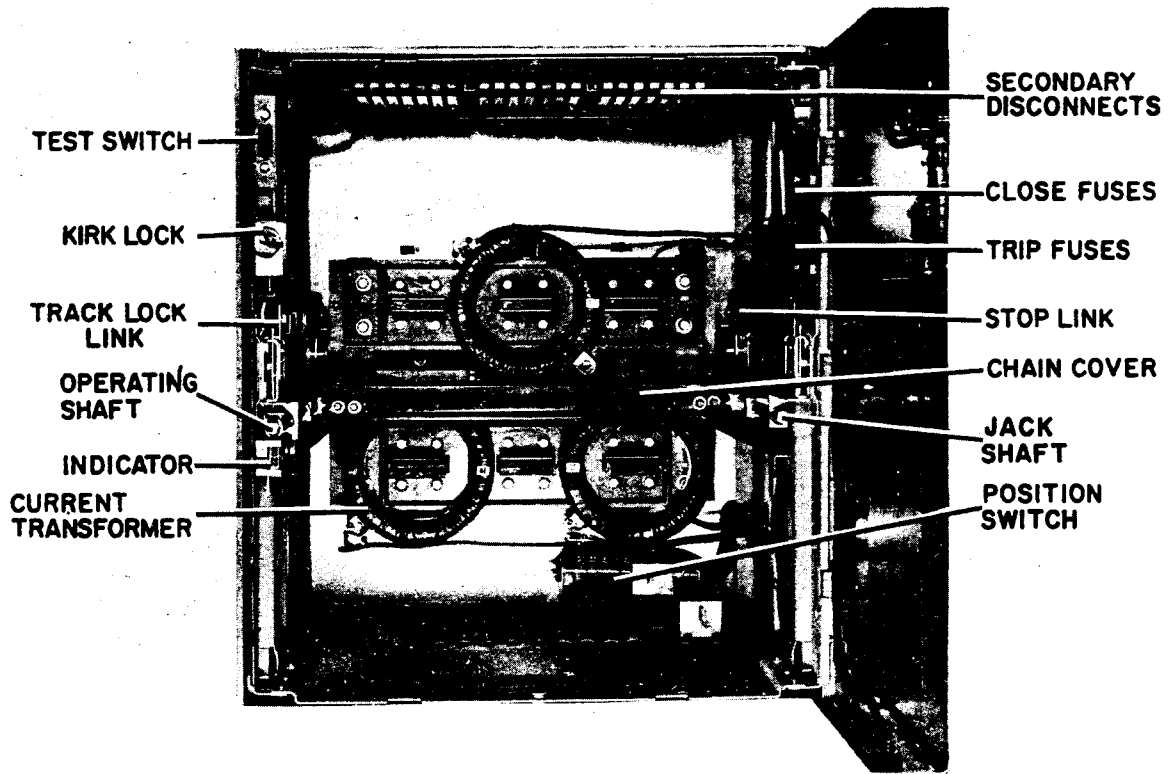


Fig. 4 (8035633) AK-50 Compartment.

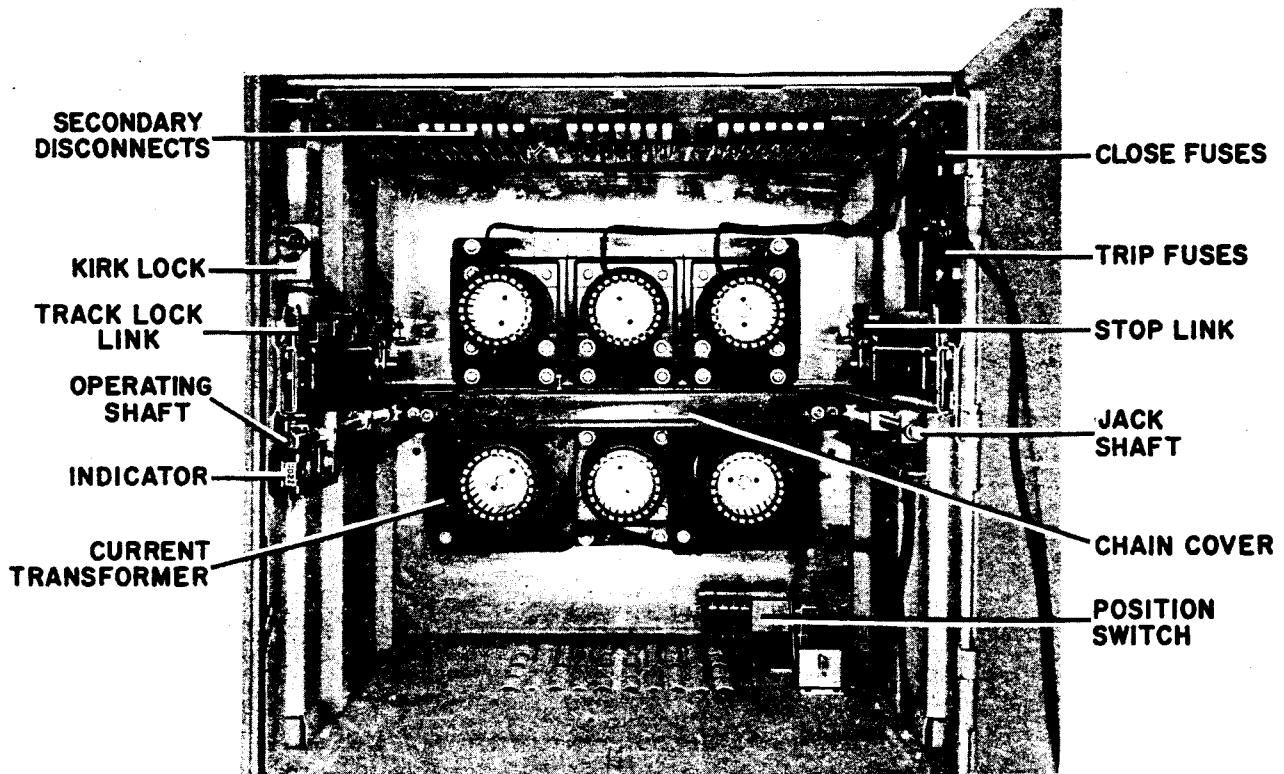


Fig. 5 (8035629) AK-75 Compartment.

2. The Test Position - The primary (power) contacts are not made but the secondary (control) contacts are made. Any breaker test not involving power may be made in this position. The door may be closed in this position.
3. Disconnect Position - Neither the primary nor the secondary contacts are made. The door may be closed.
4. Fully Withdrawn Position - The breaker is completely out of its compartment ready for removal from the equipment. The door must be open in this position. See Fig. 18.

The drawout mechanism is designed with mechanical advantage for ease of breaker insertion and withdrawal. The doors on the breaker compartments do not have to be opened to move the breakers in or out. Each door panel is provided with a double latch, operated by a vertical slide lift handle. Although the breaker

compartment door panel may be opened in any position, it is recommended that the door only be opened with the breaker in the fully disengaged position. Never open the breaker door when the breaker is energized.

BUS COMPARTMENT

The bus compartment, between the front breaker enclosure and the rear cable compartment, contains all of the welded aluminum bus and necessary bus supports for a particular switchgear section. This bus compartment, which has a depth of 14-1/4 inches, is isolated from the other two compartments by barriers.

A typical bus arrangement is shown, with the rear barrier removed in Fig. 6. The all-welded aluminum bus reduces maintenance since only a minimum number of bolts are used. Bolts are used for supports or at connections which must be made in the field.

In the 38 inch wide section used for housing an AK-2A-100 breaker, the bus compartment extends all the way to the rear.

On main breaker and tie breaker units the bus compartment is divided into an upper and lower section by an isolation barrier, providing greater reliability and safety. The upper section contains the incoming line bus, fed from the incoming line bus connections in the auxiliary unit, while the lower section contains the main bus which connects with the other breaker and device units.

Where the aluminum bus runs from one unit to another, a factory welded joint is provided. At shipping splits, or where connections are to be made to other units or equipment during installation, provision is made for either making a field welded aluminum joint or a bolted copper joint, whichever the purchaser requests. When bolted joints are provided, copper angle brackets are welded to the aluminum bus in the factory.

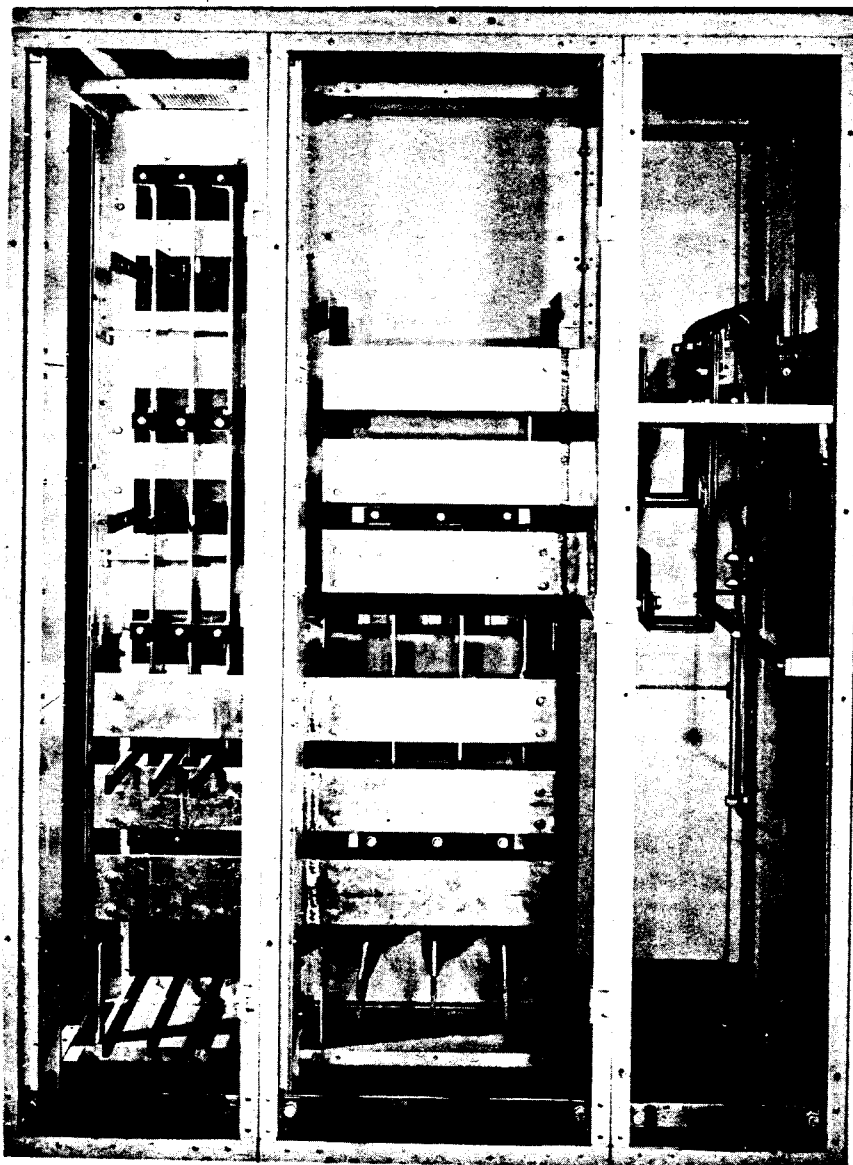


Fig. 6 (01063356) Bus Compartment With Rear Barrier Removed.

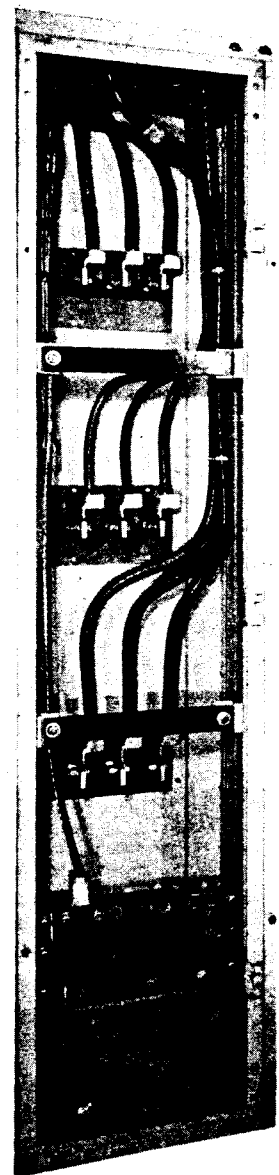


Fig. 7 (8914419) Typical Cable Arrangement In A 20" Wide Unit

FEEDER CABLE AND BUS DUCT COMPARTMENT

The rear cable and terminal compartment, which is isolated from the bus compartment provides adequate room for easy cable installation. Straight cable runs to the load studs at the load side of the feeder circuit breakers are provided from conduits entering from above or below. Various arrangements of single or double cable terminals are provided with the equipment, depending upon the purchaser's requirements. One typical terminal arrangement is shown in Fig. 7.

Conduits for large cables should be near the rear of the compartment to provide space for bending these cables as necessary.

The terminals can accommodate cables from size #8 to 1000 MCM. Beside power cable connections, some equipments include an enclosed wiring trough on the right side

of this compartment, providing for control circuit cabling and connections. Terminal boards for use in installation are provided at a convenient height for making control wiring connections.

A neutral bus is provided in the cable and terminal compartment on switchgear equipment designed for four wire systems. It consists of bolted copper bars with silver plated connections. It is installed at either a height of about 18 inches from the floor or at about 6 feet. In some equipments the neutral bus is provided at both heights. The neutral bus is insulated from ground. A grounding link is provided in auxiliary bus entrance units for grounding the neutral on grounded four wire systems.

Ground Bus

CAUTION: It is very important that the equipment be adequately grounded for safety.

The ground bus is bolted to the rear of the switchgear cable compartment near the bottom. A 4/0 ground connector will be included as standard on each equipment for connection to the station ground. Where AKD-5 switchgear is shipped in more than one package, the ground bus must be connected at the shipping split. A recommended location for making the station ground is shown on the floor plan drawing furnished with the equipment.

OUTDOOR EQUIPMENT

The outdoor switchgear is constructed with a basic indoor equipment, completely enclosed in a weatherproof housing with a walk-in front aisle, Fig. 8. Space heaters are provided in all outdoor equipments to keep the inside temperature a few degrees higher than that outside. This helps prevent condensation and the resultant corrosion which might otherwise occur. The heaters should be energized at all times.

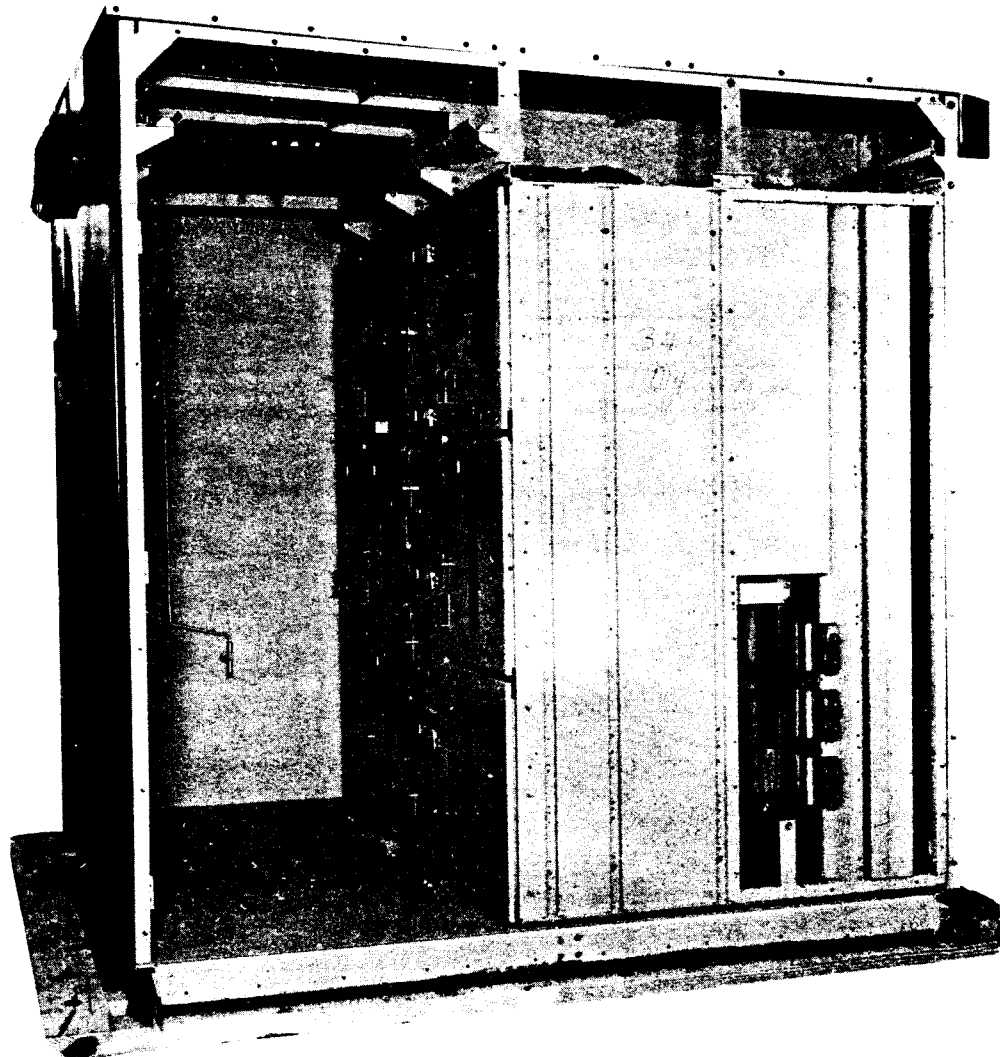


Fig. 8 (8035638) Typical Outdoor Shipping Section.

RECEIVING, HANDLING AND STORAGE

RECEIVING

Every package leaving the factory is plainly marked with case number, requisition number and customer's order number. If, for any reason, it is necessary to divide the equipment for shipment, the unit numbers of the portion of the equipment enclosed in each shipping package are identified.

All equipment leaving the factory is carefully inspected and packed by personnel experienced in the proper handling and packing of electrical equipment. Upon receipt of any apparatus, make an inspection immediately for damage sustained while enroute. If injury is evident, or indication of rough handling is visible, file a claim for damage at once with the transportation company. Notify the General Electric Company Apparatus Sales Office promptly. Information on damaged parts, part number, case number, requisition number, etc., should accompany the claim.

The contents of each shipping package are listed in the packing details attached

to the package. When unpacking, to avoid the loss of small parts, the contents of each case should be carefully checked against the packing details before discarding the packing material. A list of miscellaneous parts as required that are forwarded with the equipment, and how they are normally packed or shipped, is included below.

Located in Package "E"

- CLF* Fuses
- Splice Plates
- Tube of Contact Lubricant D50H47
- Can of Sand Gray Paint
- Can of Blue Paint
- Weld Splices
- Can of Black (Gray Scale-N) Paint (for hoist if furnished)
- Bag of Hardware
- Can of Thinner
- Rubber Seal
- Cement
- Test Plugs
- Floor Clamps
- Breaker Closing Device (for electrical breakers only)

Located in Package "F" (Indoor Only)

- Hoist Dolly
- Hoist Carriage

Package "L" or "R"

- Auxiliary Unit Adapter Box (On large transformers only)

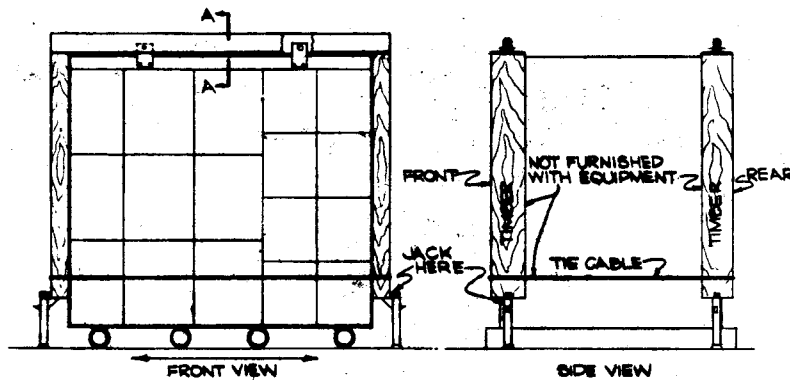
Separate Carton

- Power Circuit Breaker (one per carton)

Located inside the switchgear Auxiliary Unit in the top compartment will be found the following items:

- Instruction Books
- Installation Drawing
- Front View & Floor Plan
- Drawings
- Elementary & Electrical Diagram

* A Trade-Mark of the General Electric Company.

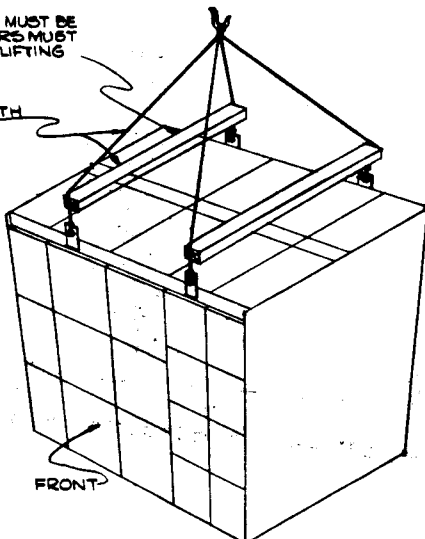


RECOMMENDED METHOD OF JACKING

AFTER SHIPPING SKIDS ARE REMOVED, ROLLERS MAY BE USED TO ROLL EQUIPMENT PARALLEL TO FRONT ONLY

LIFTING SPREADERS MUST BE USED AND TOP COVERS MUST BE IN PLACE WHEN LIFTING EQUIPMENT

NOT FURNISHED WITH EQUIPMENT



(2) ANGLES 4" X 3" X 1/2" THK (FRONT AND REAR) NOT FURNISHED WITH EQUIPMENT

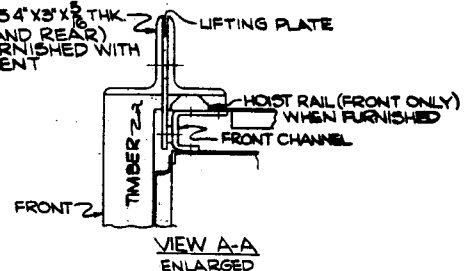


Fig. 9 (0673D0500-002-5) Methods Of Handling Indoor Equipment.

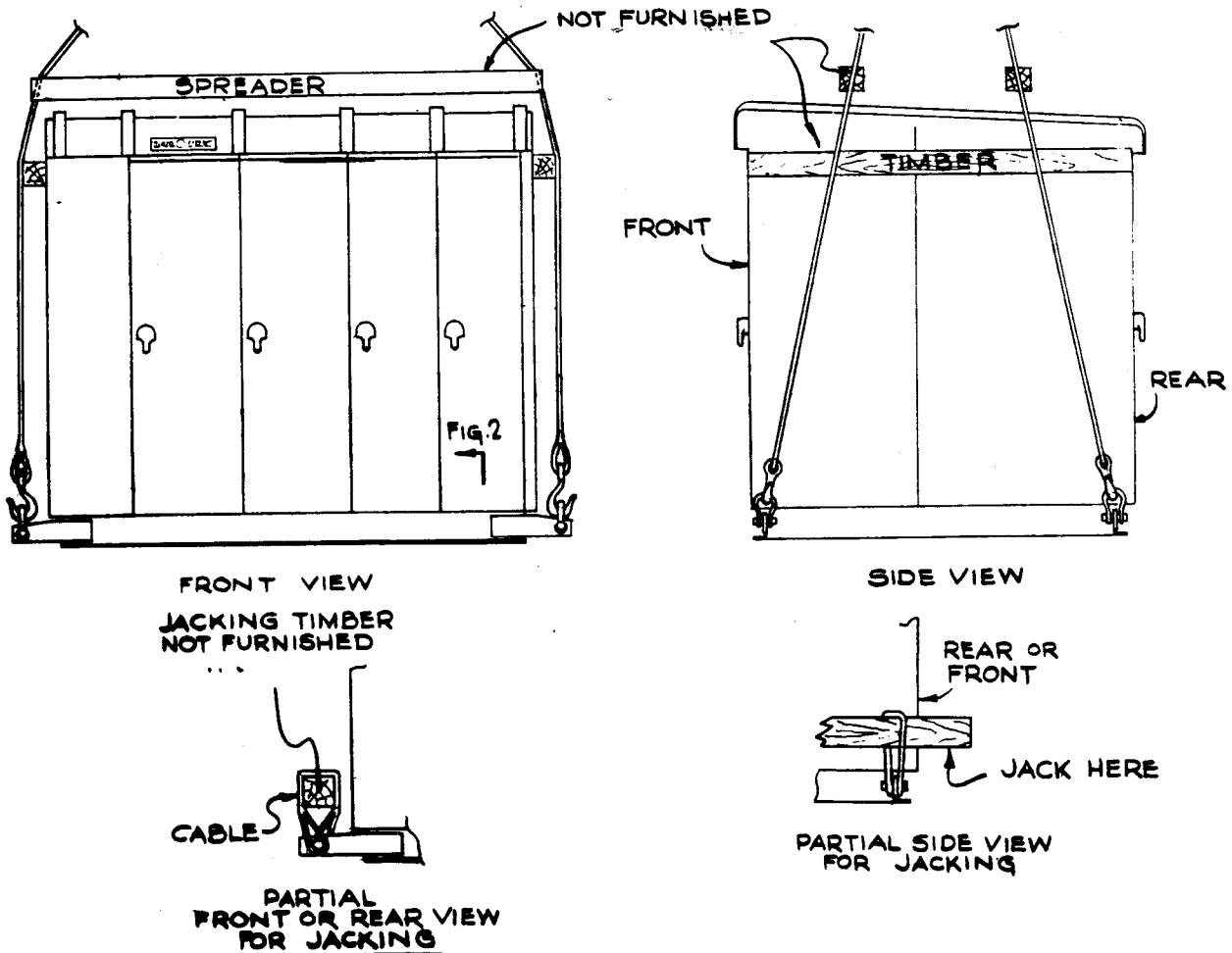


Fig. 10 (0673D0500-003-3) Methods Of Handling Outdoor Equipment.

HANDLING

The switchgear units, may be most conveniently handled by a crane. Removable lugs are provided on top of the switchgear. If the installer uses a crane for lifting a cable spreader must be used to obtain a vertical pull on the lifting lugs. Recommended lifting methods are shown in Figs. 9 and 10.

If crane facilities are not available, the equipment may be moved into position by means of construction rollers placed under the shipping skid. Where overhead is too low, the shipping skid may be removed and the equipment moved by rollers placed under the three channels under the equipment.

CAUTION: Be sure the rollers used are spaced such that the three channels rest on top of the rollers, as a direct application of the rollers between the channels may tear or distort the equipment. Jacks may also be applied to handle the equipment when a crane is not available, as shown in Figs. 9 and 10.

Remove all outer crating after the equipment has been moved to the desired location.

Methods of handling outdoor switchgear, shown in Fig. 10, are much the same as for indoor equipments except that lifting plates are provided at the base of the structure. The lifting plates should be removed after the equipment is permanently anchored, so that passageway at the ends of the equipment will not be obstructed.

Air circuit breakers are shipped separately in individual cartons with the breaker in the open position. The circuit breaker should be unpacked as soon as possible after it has been received and inspected.

Store the circuit breaker in a clean dry location in an upright position. It must be properly supported to prevent bending of the studs or damage to any of the breaker parts. Do not remove any protective grease until it is ready to be installed. A covering of kraft or other non-absorbent paper will prevent dust from settling on the breaker.

STORAGE

If the breaker is not to be placed in service at once remove it from its shipping carton and thoroughly inspect it. If everything is in satisfactory condition replace the breaker in its shipping carton for storage. Do not remove the shipping members at this time.

If it is necessary to store the equipment for any length of time, the following precautions should be taken to prevent breakage, corrosion, damage or deterioration.

1. Uncrate the equipment. Check thoroughly for damage.
2. Store in a clean, dry, rodent free location with moderate temperature and cover with a suitable canvas to prevent dust, dirt, water, or other foreign substances from entering the switchgear.
3. If dampness or condensation may be encountered in the storage location, heaters must be placed inside the units to prevent moisture damage. Approximately 250 watts of heaters per unit are required. On outdoor switchgear this may readily be accomplished in making a temporary power supply connection to the heaters already installed in the equipment.

CAUTION: Remove all cartons and other miscellaneous packing material from inside the units before energizing any heaters.

EQUIPMENT INSTALLATION

PRIOR TO INSTALLATION

Before any installation work is performed, study all drawings furnished by the General Electric Company for the particular installation. These include arrangement drawings (front and plan view), connection and elementary diagrams, installation drawings and a summary or parts list of the equipment. All of these items, plus the instruction books, will be found inside the top compartment of the auxiliary unit. When requesting information from the factory on any specific item furnished with the equipment, refer to the item by summary and identification number wherever possible. Any material external to the equipment which may be required to meet any local codes, such as mats, screens, railings, etc. is not furnished.

LOCATION

In locating the AKD-5 switchgear, consideration should be given to the aisle space required at the front and rear of the equipment. The recommended aisle space is shown on the floor plan drawing furnished for the particular installation. The space at

the front must be sufficient to permit the opening of doors, the insertion and withdrawal of the removable breakers and their transfer to other compartments, the operation of breakers while in the test position, and the operation of the breaker hoist. The space at the rear must be sufficient for opening of doors, installation of cables, inspection, and maintenance. Check local codes for special aisle space requirements.

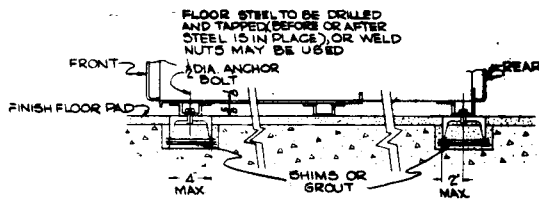
FOUNDATION REQUIREMENTS

Indoor Equipment - The station floor or foundation must be strong enough to prevent sagging by the weight of the switchgear structure. If the foundation is subject to vibrations, special mounting must be provided to prevent the transmittal of vibrations to the equipment.

Suitable means must be provided by the purchaser for mounting and anchoring the switchgear to the floor. It is recommended that recessed steel channels be installed by the purchaser for supporting the switchgear equipment. The steel channels should be embedded in a level concrete slab with the top surface of the channels

extending above the concrete (about 3/4 inch), the required amount to be flush with the finished floor. It is essential that these steel channels be level and aligned with each other prior to the final anchoring to avoid distortion of the switchgear structure. The recommended foundation construction and method of mounting the switchgear to the foundation is shown in Fig. 11. This information is also sent to the purchaser with other requisition drawings as mentioned previously. At the time the foundation channels are being installed, any conduits or sleeves required for power and control cables that are to enter the equipment from underneath should be located and installed within the available space shown on the floor plan drawings. Consideration should be given to installing conduits or sleeves which might be required for future connections. The conduits should terminate at the switchgear with the appropriate conduit connectors.

Outdoor Equipment - Foundation recommendations for outdoor equipment are given in Fig. 12. Otherwise, comments under Indoor Equipment apply.



METHOD OF ANCHORING
ANCHOR BOLTS, FLOOR CHANNELS, AND SHIMS BY PURCHASER

FOUNDATION DATA
EQUIPMENT IS FURNISHED WITH BUILT-IN CHANNEL, THUS ELIMINATING THE NEED FOR FLOOR STEEL WHEN MOUNTING DIRECTLY ON SMOOTH LEVEL FLOOR. IF EMBEDDED CHANNELS ARE DESIRED, THESE SHOULD BE SET LEVEL WITH EACH OTHER AND SHOULD BE LEVEL OVER THEIR ENTIRE LENGTH. 4" x 5.4 #/FT CHANNELS ARE RECOMMENDED FOR LEVELING PURPOSES. FINISH FLOOR SHOULD HAVE SLIGHT PITCH AWAY FROM MOUNTING CHANNELS AND IN NO CASE SHOULD THE FINISH FLOOR BE HIGHER THAN MOUNTING CHANNELS.

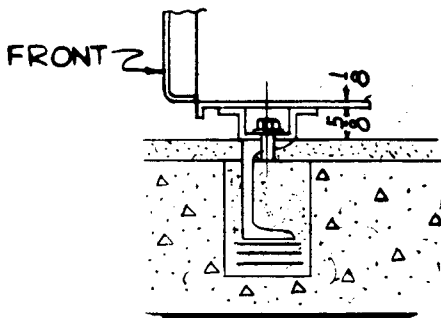


Fig. 11 (0673D0500-002-05) Foundation For Indoor Equipment
Anchor Bolts, Floor Steel and Other Foundation Material
Is To Be Furnished By The Purchaser.

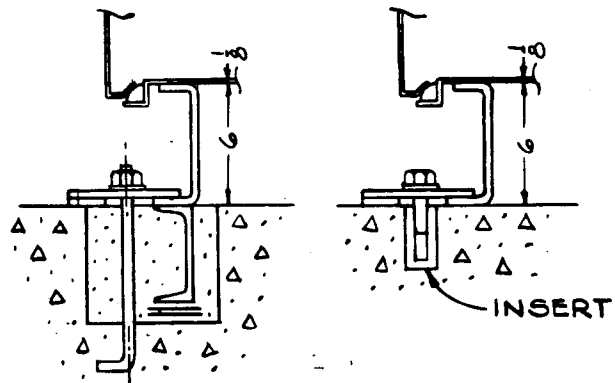
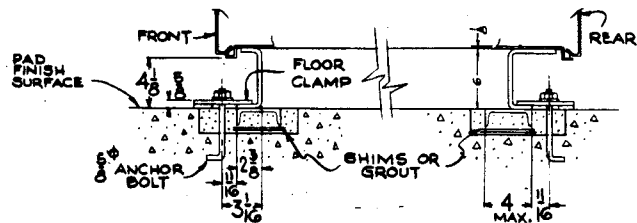


Fig. 12 (0673D0500-003-03) Foundation For Outdoor Equipment
Anchor Bolts, Floor Steel and Other Foundation Material
Is To Be Furnished By The Purchaser.

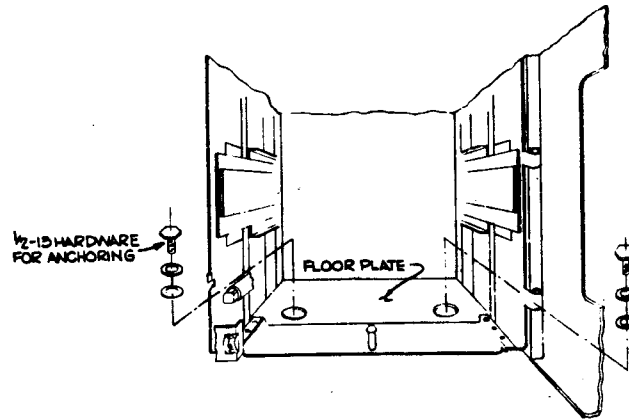


Fig. 13 (0673D0500-002-05) Location Of Anchor Bolts In Front Of Indoor Equipment.

REMOVING SHIPPING SKID INDOOR EQUIPMENT ONLY

If practical, the shipping skid should be left on the equipment until it is at or near its final location.

The skid is bolted to the equipment through the anchor bolt holes used for final installation. The bolts in the rear of the equipment may be removed by opening the rear doors. To remove the bolts in the front, the drawout mechanism must be brought out to the fully withdrawn position before removing. A tag is tied to the doors of the compartments which have the bolts. Drawout procedure is explained on page 17.

ANCHORING

The switchgear should be mounted on top of the steel channels in a position as shown in Figs. 11 and 12 and securely anchored to the channels. As the units are mounted onto the foundation channels, they should be bolted together as described under assembly.

There are several good methods of anchoring the switchgear equipment to the foundation channels. One of the methods for anchoring indoor equipment only is to use 1/2 inch anchor bolts through the holes provided in the bottom of the switchgear equipment as shown in the floor plan view drawing furnished with the equipment. Another method is to tack weld the bottom channel of the equipment to the foundation channel.

Three suggested methods for anchoring outdoor AKD-5 switchgear are illustrated in Fig. 12. All of these methods use an anchor bolt and floor clamp to secure the supporting channel to the foundation.

ASSEMBLY OF EQUIPMENT

Indoor Equipment - Before assembly of the equipment is begun, all components should be on hand so that work may proceed without delay. The individual shipping packages must be connected together in position on the foundation. When assembling individual shipping packages, start with the middle section to insure minimum deviation from the overall length dimension. Assemble the switchgear as follows:

1. If the switchgear is part of a load-center unit substation, the transformer section should be set on its pad in accordance with the proper instructions furnished with the transformer.

NOTE: When AKD-5 switchgear is installed in the same line-up with transformers and other equipment, it is imperative that all mounting surfaces be level.

2. The switchgear packages should be placed on its foundation with the aid of crane or jacks as shown in Fig. 9 for indoor equipment and Fig. 10 for outdoor equipment.
3. These packages should be connected and bolted together as follows:
 - a. Bolt the packages together using 3/8-16 bolts, lockwashers and nuts at the points shown on the installation diagram Figs. 15 and 16.
 - b. Connect together the main buses, ground buses, and neutral buses of adjacent shipping packages by bolting or welding as required. If the purchaser specified bolted connections, bolt the bus bars together using the splice bars furnished with the equipment. The ground bus splice bars must be bolted to the inside of the rear frame of adjoining sections four inches above the floor, using 3/8-16 x 3/4 HEX HD bolts, washers, lockwashers and nuts, as shown in Figs. 15 and 16. The neutral bus splice bars are to be mounted to the inside of the rear frame of adjoining sections using insulated spacers and the following size hardware: 1/2-13 HEX HD bolts, 1/2 inch flat washers, 1/2 inch lockwashers, and fiber washers, as shown in Figs. 15 and 16. See Table A required torque values for various size bolts. If welded joints are specified, the bus bars are to be welded together using bus splice sections in accordance with the field welding procedure for aluminum buses, included in this book, page 13.

TABLE A

TORQUE VALUES FOR LOW VOLTAGE EQUIPMENT HARDWARE

Insulation-Copper-Steel

Bolt Size	Foot - Pounds
1/4 - 20	6-8
3/8 - 16	20-25
1/2 - 13	50-70
5/8 - 11	80-90

- c. Route and connect control cables between units at the shipping splits. Make the necessary connections by referring to the connection diagram to determine what leads and how many are to be connected.
4. If the switchgear is part of a load-center unit substation make the necessary bus connections to the transformer. The ground connection bar in the bus entrance compartment will be shipped turned in, to reduce the size of the shipping package and to protect in from damage. This bar should be re-assembled in the correct position as required and connected at the offset portion to the transformer ground pad with a 1/2 inch bolt. The transformer ground pad is located 18-1/2 inches above the switchgear floor.
 5. The equipment should be anchored to the foundation by anchor bolts, or tack welds as specified under the paragraph headed "Anchoring".
 6. All shipping supports must be removed from the switchgear.
 7. Bus ducts and cable conduits must be lined up and connected to the equipment. The hardware for connecting a bus duct to the switchgear is furnished with the bus duct.
 8. Check to see that the breakers are in their respective compartments. Breakers are assigned to definite compartments when an order is engineered. Each breaker is assigned a part or mark number. This number is shown on the breaker sheets of the summary, the front view drawings, the breaker nameplate, and on the identification card on the breaker shipping carton.

To locate the breaker in the proper compartment refer to the breaker location list on the front view drawing. Find the proper breaker by the identification card on the breaker package. Check the mark numbers on the breaker escutcheon as a double check before installing it in its compartment. All identical breakers will have the same mark number.

Before placing AK-2A-25 and AK-2A-50 in their compartments the bolts connecting the primary disconnect stabs to the bus should be checked for tightness. These bolts are located behind the molded insulation supports for the primary disconnects. There is one 5/8-11 bolt in each AK-2A-25 connection bar and (2) 1/2-13 bolts in each AK-2A-50 connection bar. These bolts should be torqued to the values shown in Table A.

The installation procedure for the breakers is described separately under "Breaker Insertion".

9. Remove all blocking on realys and devices.
10. Make a final inspection to see that there are no tools, construction materials, or other foreign matter left in the switchgear.

Trim - The trim strip which must be attached to the top front of each indoor equipment is shipped separately on top of the switchgear assembly. After the lifting brackets have been removed from the front channel the trim strip should be located and secured to the channel with 3/8-16 bolts.

Hoist - The breaker hoist, when supplied with indoor equipment, is shipped completely assembled in a separate carton.

To install the hoist on an indoor equipment proceed as follows:

1. Lift the hoist into position on top of the switchgear so that the end with the single roller is toward the rear of the equipment. A channel is provided on the top of the equipment. This channel serves as the track for the single wheel on the rear of the hoist assembly. If space is available at the end of the equipment the hoist may be assembled by sliding the rear wheel under the top leg of the channel and then lifting the front end of the hoist over the stop clip and positioning the front wheels so that they will straddle the tapered front track. If space at the ends of the equipment is restricted, the angle which is bolted to the hoist side frames immediately in front of the single rear roller must be removed. The rear wheel can then be hooked under the channel and the front wheels can be positioned on the front track. The retaining angle at the rear should then be reassembled. This angle prevents the rear wheel from becoming unhooked in the event that the front rollers should become untracked. Stop clips are provided at each end of the front track to prevent the hoist assembly from riding off the ends of the track.

To Hoist a Breaker -

1. Put the breaker in front of the unit it is to be installed in.
2. Pay out enough hoist cable to install the hooks on the slots on the breaker side frames.
3. Pull the eye (on the end of the hoist cable) up to a point just under the proper ball on the hoist cable. If the proper ball is not used, the hoist will not raise the breaker high enough to install in the top compartment.

The proper ball is as follows:

- a. AK-15 & 25 - the ball nearest the hooks
- b. AK-50 - the second ball from the hooks
- c. AK-75 - the third ball from the hooks
- d. AK-100 - the fourth ball from the hooks (the one nearest the hoist)

CAUTION: Do not unwind cable completely from drum. Operating crank must turn clockwise to hoist the breaker; turn counter-clockwise to lower the breaker.

4. Raise the breaker to the proper position.

Breaker Insertion

Before installing or operating a breaker refer to the breaker instruction manual for preoperation inspection and test. Check thoroughly for any damaged or loose parts and for any dirt or foreign matter which may be in the breaker.

IMPORTANT AK-25 and AK-50 breaker compartments designed for future use, and certain other compartments will have a red insulating boot installed on the primary disconnects. Remove these boots before installing the breaker.

1. Insert handle on jackscrew shaft.
2. Rotate counter clockwise until jackscrew is stopped. (Indicator should read DISC).
3. Remove handle and open compartment door.
4. Pull latch release levers (71) (45).
5. Pull tracks out until they strike internal stops.
6. Lower breaker onto tracks, lining up the breaker mounting pins with the notches in the tracks (36,37) (41,42).
7. Push breaker and tracks into the house until stopped by latches (37-2) (41-1).
8. Secure latches by rotating latch release levers.
9. Close compartment door.
10. Insert handle on jackscrew shaft and rotate clockwise to move breaker into the house. Breaker is in connected position when jackscrew can no longer be rotated. (Indicator should read CONN.)

Breaker Removal

1. Trip the breaker.
2. Operate to the fully withdrawn position.
3. Remove the breaker by lifting device.

BREAKER OPERATION

Closing manually operated breakers.

AK-2A-15 & 25

The closing mechanism of these breakers is designed so its speed, when closing the breaker contacts, is independent of the speed of the operating handle. To do this, a spring is charged, and the release of the energy stored in the spring actually closes the breaker.

To close the breaker:

1. Rotate the operating handle about 90 degrees counter clockwise. This will partially charge the closing springs.
2. Rotate the operating handle clockwise back to the original position. Near the end of this stroke the springs will discharge and close the breaker contacts.

Do not operate the breaker handle when the breaker contacts are closed.

If all interlocks are not made the breaker will be trip free; that is, its contacts will not close.

AK-2A-50, 75 & 100

The closing mechanism of these breakers is similar to the AK-2A-15 & 25. To close the breaker:

1. Rotate the operating handle counter clockwise about 120 degrees until it stops.
2. Rotate the handle clockwise about 120 degrees until it stops. The charge counter on the breaker escutcheon will show the position of the charging mechanism.
3. Rotate the handle back and forth for four complete strokes. On the downward (clockwise) part of the fourth stroke, the breaker will close. It is not recommended that the closing springs be discharged with the breaker in the closed position.

Closing Electrically Operated Breakers

Electrically operated breakers may be operated by a-c control power, or d-c (normally station battery) control power.

They may be controlled by a push-button switch on the breaker escutcheon, by a breaker control switch, or by a relay contact. The control switch or relays may be located in the equipment which houses the breaker, or may be in some remote location.

Design any remote control circuit so the voltage drop will not allow the voltage at the breaker to be below accepted values.

For maintenance or further instruction refer to the instruction book furnished with the breaker.

AK-1A-25 - This breaker is closed by a solenoid. The solenoid armature is linked to the breaker mechanism and its movement, operating through the closing mechanism, closes the breaker.

AK-2A-15 & 25 - In this breaker a solenoid operates a spring-charged mechanism. The breaker is closed by discharging the spring.

AK-2A-50, 75 & 100 - In these breakers a universal motor driving a gear reducer charges a closing spring. The breakers are closed by discharging these springs.

Manual Tripping

A mechanically operated trip button, mounted on the breaker escutcheon, operates the trip shaft to open the breaker.

Electric Tripping

A shunt trip device is an accessory used for electrical tripping. A normally open auxiliary switch "a" contact opens the control circuit after the breaker opens.

Bus Bars - When making bolted bus bar connections to adjoining equipment, proceed as follows:

- a. After the silver plated contacting surfaces are cleaned with a clean cloth or solvent if needed, the contacting surfaces must be coated with lubricant, D50H47, furnished with each equipment.
- b. Bolt the bus bar brackets together using a bolt, washer (2), and stop nut for each bus connection. Refer to Table A for proper torque values.

Outdoor Equipment - Assembly of outdoor equipment is the same as for the indoor equipment with the following exceptions:

1. Check alignment of doors on outdoor equipment to see that the weatherproof seal has not been disturbed.
2. When joining shipping packages, special procedures for weather-proofing must be followed as indicated in Fig. 16. The joint in the roof between units and shipping splits must be weather-proofed. This is done as shown in Fig. 21 by placing a rubber seal over the top edge of the roof support batten so that the roof section and angles butt up against this rubber seal on both sides. Bolt this joint together, using 3/8-16 hex head bolts, lockwashers and hex nuts. A roof cap is placed over this seam and held in place by the roof trim. Joints between transformer throat and switchgear, and between shipping splits, must be weather proofed as shown in installation diagram Fig. 16. Install a front and rear batten and rubber seal at the shipping split joints and bolt them together with the furnished 3/8-16 hardware.

Remove the lifting plates from front and rear of the switchgear base at both ends of the shipping split joint and assemble the front and rear splice plates as shown in Fig. 16.

The gasket for outdoor transformers and flexible bus connectors are furnished with the transformer, while the hardware for connecting bus bars and transformer flange to the switchgear is supplied with the switchgear. The flexible connectors must be bolted to the switchgear copper shown in Fig. 16.

When a hoist is provided with outdoor equipment, it is shipped mounted and secured in place. The yellow shipping supports at either end of the hoist movable track must be removed as shown in Fig. 16. To free the hoist dolly another shipping support must be removed. The support is held by two 1/4-20 nuts and lockwashers, one on each stud of two U bolts, that must be replaced, Fig. 16.

Main Cables

When making cable connections, refer to Fig. 7, which shows a typical routing and support system. Adequate electrical and mechanical clearances must be provided between conduits, cables and bus. Where the cables enter the unit, the cables can be lashed to cable supports at the rear of the cable compartment as required.

Before any main cable connections are made, the cables should be identified to indicate correctly their phase relationship with equipment. The phase sequence is stenciled over the feeder studs. In all cases, carefully follow the cable manufacturer's recommendations for installation of cable, as well as the instructions contained in this book. A non-oxidizing lubricant such as D50H47 furnished with each equipment can be used on the terminal connection surfaces.

Bolt the cable terminal connectors as required to each load stud, depending upon the number of cables to be connected to it. All cable runs should be as straight as possible.

Two cable supports are provided at the rear of the feeder cable and bus duct terminal compartment. Using these cable supports, lash the cables at the appropriate level as required in the bottom of the cable compartment when cables enter from below. It is imperative that all cables be adequately supported to take their weight off terminals and studs, and to prevent movement during short circuit.

Connect main cables as follows:

1. Route the cables as required and lash them to supporting structure.
2. Bolt terminal connectors to the breaker load studs in the cable compartment.
3. Coat the connections with D50H47, insert the cables into the terminals and tighten the set screws securely.

Control Cables

Connect control cables to the switchgear unit as follows:

1. When control conduits enter the switchgear from below, the conduits should not extend more than one inch from the floor. The control cables may be pulled through the conduits before or after the switchgear is installed, whichever is more convenient.

2. Route the control cables from the ducts through the wiring trough at the side of the cable compartment and connect the cables to the terminal blocks in accordance with the connection diagrams furnished with the equipment.
3. If the control conduits enter from above, drill the top cover within the available space indicated.
4. Control wiring should be checked with the connection diagram to make certain that all remote connections are made, all fuses installed, current transformer circuits completed, loose connections tightened.
5. The cables from the control power source to the switchgear should be large enough to avoid excessive voltage drop when the circuit breakers are operated. See Testing and Inspection.

FIELD WELDING PROCEDURE

The field welding of aluminum bus conductors must be of the highest possible quality. Failure of a single joint in service may cause a very costly shut-down for repair or possible replacement of equipment.

Welding Operator Qualifications - Before welding the actual bus installation, welding operators should be given an opportunity to practice on typical joints. (These typical joints can be supplied by the General Electric Company if requested well in advance of the actual installation). These typical joints should be welded by the operators to be qualified, under identical conditions, (vertical) welding positions, and temperature to be encountered in the actual installation. These welds should be examined for over-all appearance. Cross-sections, removed from these joints suitably etched, must show weld metal to the joint root, be reasonably free of porosity, and have a convex shape.

If so desired, the test joints may be sent to the General Electric Company for inspection and evaluation. For this, contact the nearest Apparatus Sales Office.

The gas-shielded consumable-electrode process is recommended.

The weld joint used in splices is a modified butt joint. The following points are pertinent:

- a. Before welding, all joints must have 1/8" minimum space at the root of the weld.
- b. The joint and joint area must be clean of any foreign material.
- c. Protect the insulation from the arc and weld splatter.
- d. Always weld uphill.
- e. If the temperature is below freezing, preheat the bars to about 100° F.

Clamp the splice in place. If the total gap (both joints) is over 1/4 inch, leave 1/8" on one side and weld the largest gap first. Weld as follows:

One bar per phase (1600 ampere equipments).

1. Tack weld the splice on the top on one side only.
2. Weld this side completely. Strive for penetration, particularly on the root pass. The finished weld should be convex about 1/8". Burn in and fill the top and bottom of the weld.
3. Allow the splice to cool until you can hold your bare hand on it before welding the other side.
4. Tack the top of the other joint and weld using the same procedure.

Two bus bars per phase (3000 amp equipments).

5. Follow the preceding steps for the inside bar. Allow it to cool until you can hold your bare hand on it.
6. Loosen the bus support bolts and add 1/8" of washers to the spacer between bars. This makes the distance between bars 1-1/4".
7. Tighten bars and weld (follow steps 1-4).
8. Remove washers and replace bus support bolts after the bars are cool.

TESTING AND INSPECTION

After the equipment has been installed and all connections made, it must be tested and inspected before putting it in service. Although the equipment and devices have been tested at the factory, a final field test must be made to be sure that the equipment has been properly installed and that all connections are correct. The primary equipment must be completely de-energized while the tests are in progress.

Directions for testing relays, instruments, and meters, are given in the instruction book furnished for each device. The settings of the protective relays must be coordinated with the other relays on the system and therefore these relays must be set by the purchaser. General instructions on setting the relays are given in the Relay Instruction Book.

The extent of the tests on the equipment as a whole will depend on the type and function of the equipment. Tests which should be performed, however, include circuit breaker operation, and switchgear metering, phasing, and grounding checks.

High potential tests to check the integrity of the insulation are not necessary if the installation instructions are carefully followed. If local codes demand this test or the purchaser wishes to make high potential tests, the voltage should not exceed 75% of the AIEE factory test voltage. For the power circuit the AIEE factory test voltage is two times switchgear rating plus 1000 volts. Potential and control power transformers must be disconnected during high voltage testing.

Key Interlocks

After initial installation of the switchgear equipment, all necessary interlock keys should be inserted into the appropriate locks and all spare keys should be placed in the hands of a responsible person. Refer to the key interlock schematic included in the summary furnished with the equipment to determine the sequence of operation and the correct number of operating keys required. This precaution is necessary since improper use of spare keys will defeat the interlocking scheme.

Breaker Operation Test

All compartments housing all AK circuit breakers have a TEST position, in which the breaker primary contacts are disconnected, while the secondary contacts are still engaged. This TEST position permits complete testing of the electrical control circuit without energizing the primary power circuit. When the breaker is first put into service, its control circuit must be thoroughly tested while in this position to make sure that all closing and tripping circuits are complete and functioning properly.

The TEST position is not suitable for inspection and maintenance of the breaker, and should therefore be used only for testing breaker operation.

Refer to the appropriate breaker instruction manual for other pre-operational checks on the breakers.

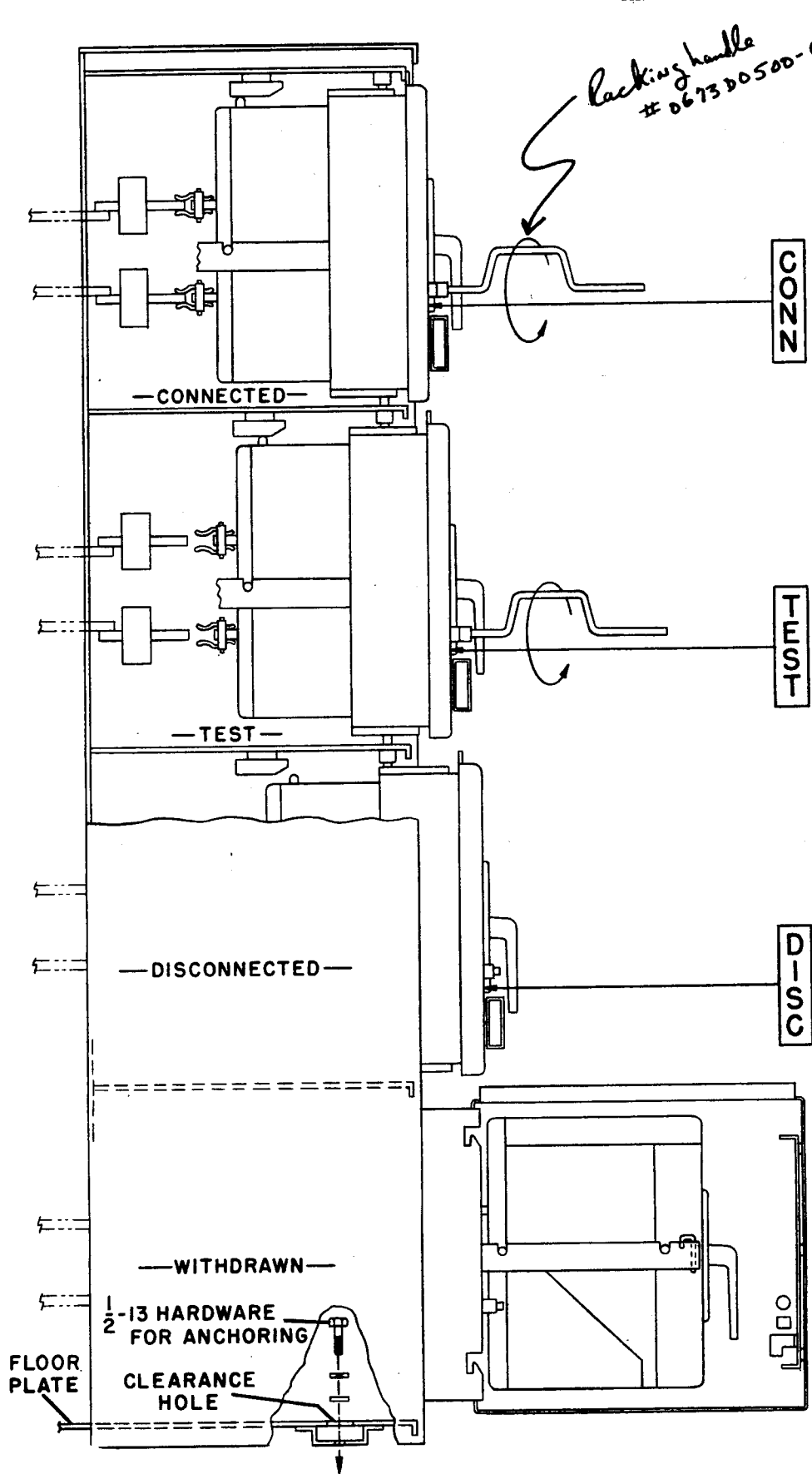
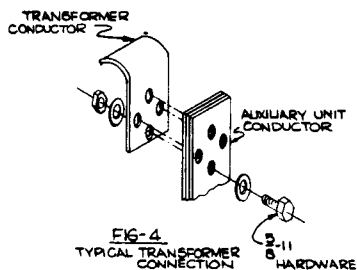
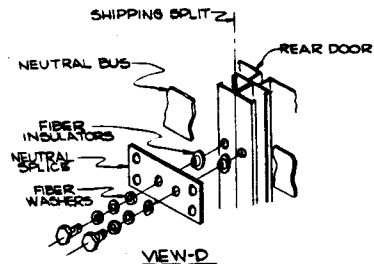
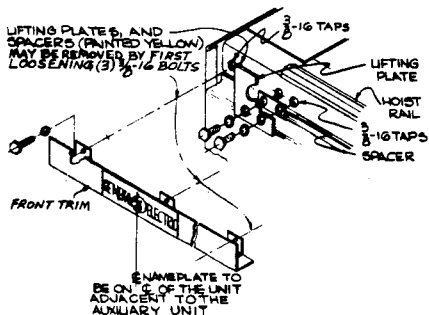
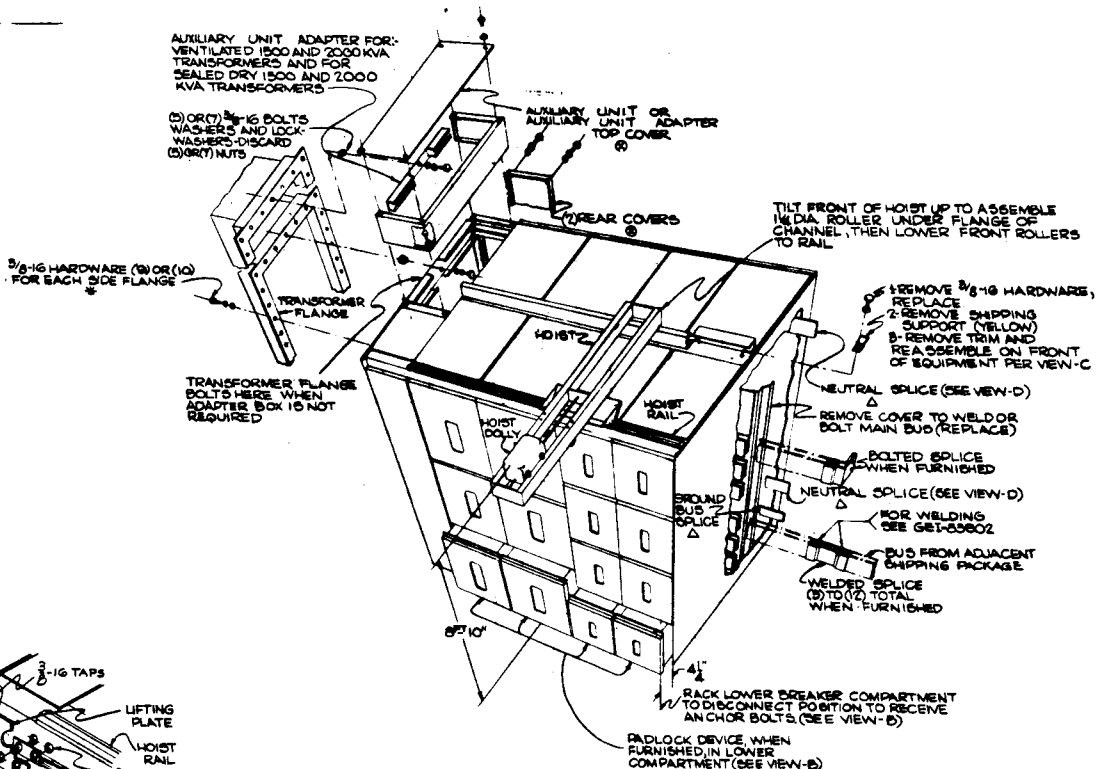
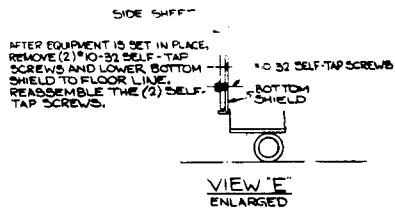
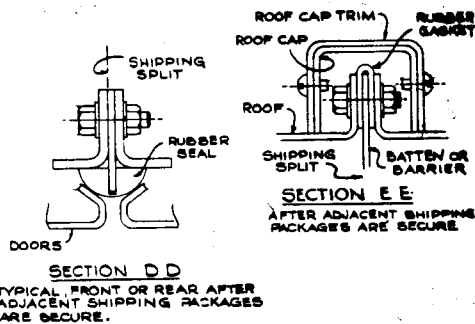
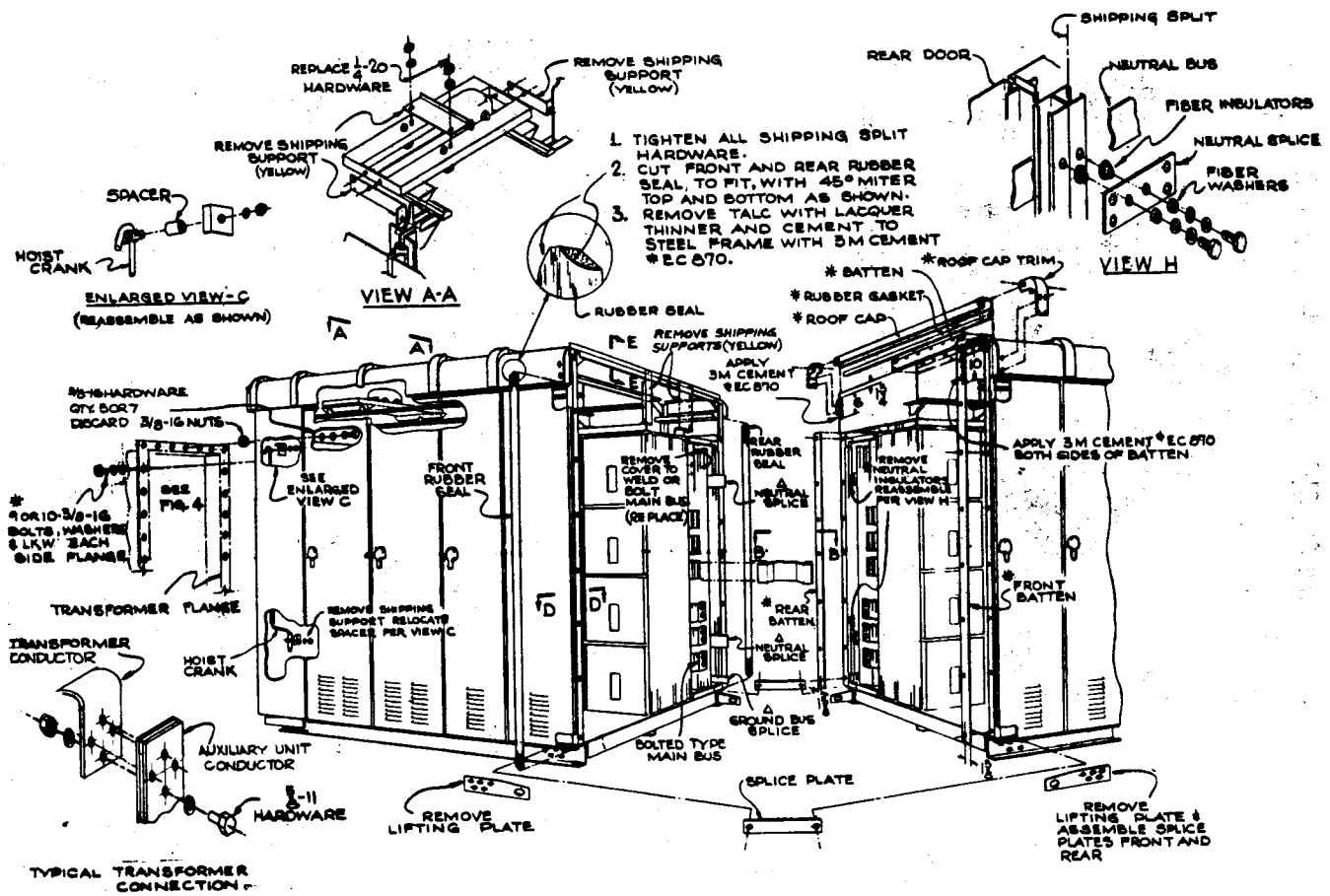


Fig. 14 (0121C1508-0) Side View Of Breaker Stack.



- NOTES
- * ALL SHIPPING SPLIT HARDWARE TO BE DISASSEMBLED BEFORE ADJACENT SHIPPING PACKAGES ARE SET IN PLACE. REASSEMBLE TO SECURE SHIPPING SPLIT.
 - 6- AUXILIARY UNIT OR AUXILIARY UNIT ADAPTER TOP COVER AND (2) REAR COVERS MUST BE REMOVED FOR CONNECTION TO TRANSFORMER.
 - Δ- GROUND BUS SPLICING AND HARDWARE WILL BE NORMALLY SHIPPED ASSEMBLED TO EITHER SIDE OF ADJACENT SHIPPING PACKAGES. NEUTRAL SPLICING, HARDWARE AND INSULATORS (WHEN FURNISHED) WILL BE NORMALLY SHIPPED ASSEMBLED TO EITHER SIDE OF ADJACENT SHIPPING PACKAGES.

Fig. 15 (0673D500-002-05) Assembly Of Indoor Equipment.



- NOTES**
- * ALL SHIPPING SPLIT HARDWARE, BATTENS, ROOF RUBBER GASKET, ROOF CAP FRONT AND REAR ROOF CAP TRIM TO BE DISASSEMBLED BEFORE ADJACENT SHIPPING PACKAGES ARE SET IN PLACE. REASSEMBLE TO SECURE SHIPPING SPLIT.
 - △ GROUND BUS SPLICE AND HARDWARE WILL BE NORMALLY SHIPPED ASSEMBLED TO EITHER SIDE OF ADJACENT SHIPPING PACKAGES. NEUTRAL SPICE, INSULATORS AND HARDWARE (WHEN FURNISHED) WILL BE NORMALLY SHIPPED ASSEMBLED TO EITHER SIDE OF ADJACENT SHIPPING PACKAGES

Fig. 16 (0673D0500-003-03) Assembly Of Outdoor Equipment.



Fig. 17A (8035634) Place Breaker In Front Of Proper Compartment. Operate Drawout Mechanism To Disconnect Position.

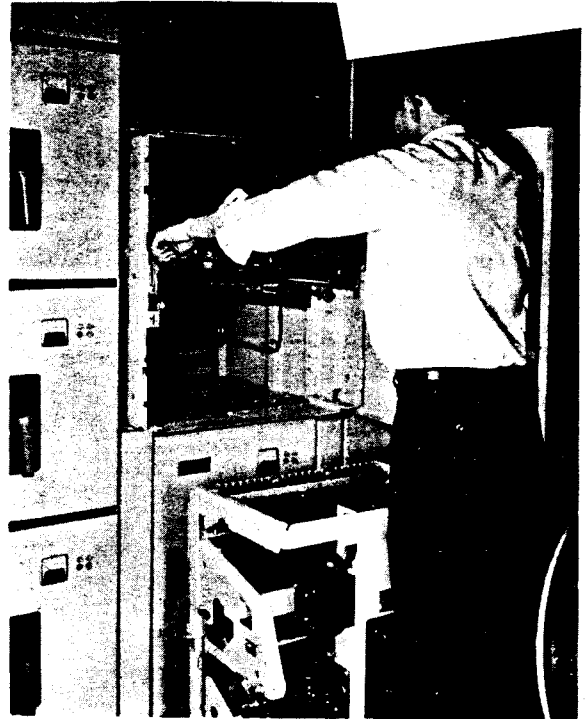


Fig. 17B (8035642) Open The Compartment Door. Rotate The Two Lock Links.

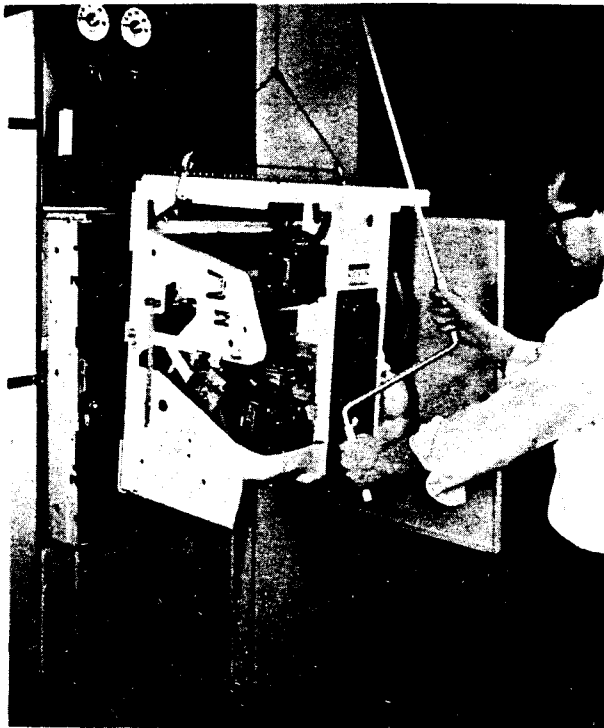


Fig. 17E (8035637) Raise Breaker To About One Inch Above Tracks.



Fig. 17F (8035641) Pull Both Tracks Out Completely.



Fig. 17C (8035640) Let Out Hoist Cable. Place Hooks In Slots.



Fig. 17D (8035639) Adjust Cable To Balance Breaker. Proper Ball Must Be Under Cable Eye.

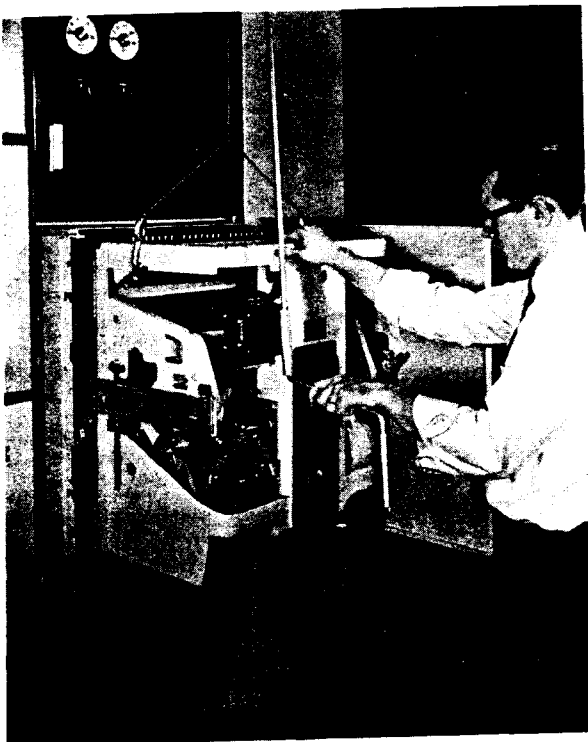


Fig. 17G (8035635) Lower The Breaker Into The Track Slots. Remove The Hoist Cable.



Fig. 17H (8035636) Push The Breaker In Completely And Rotate The Two Lock Links. Close The Door.

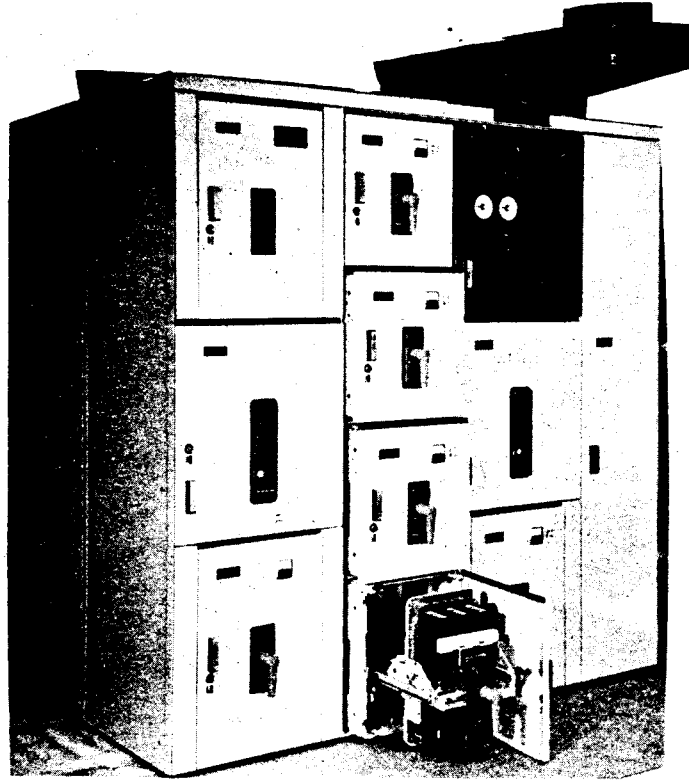


Fig. 18 (8035631) Stairstep Arrangement Of Breakers In Connected, Test, Disconnected And Fully Withdrawn Positions.

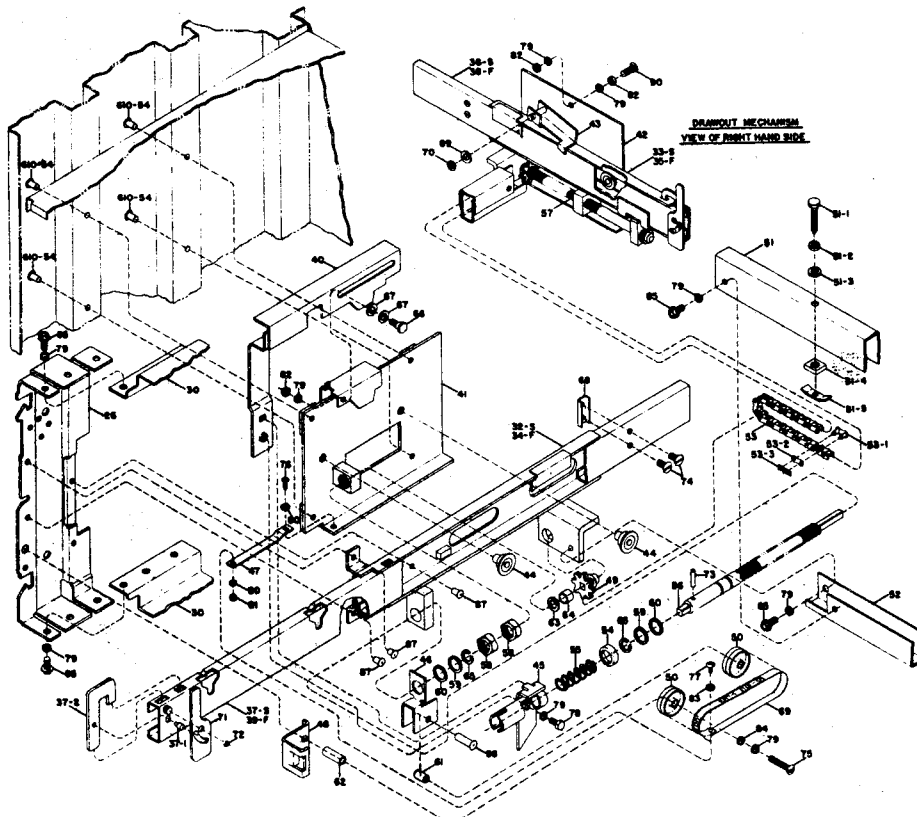


Fig. 19 (0625E0375-0) Rackout Mechanism For AK-25 Breaker

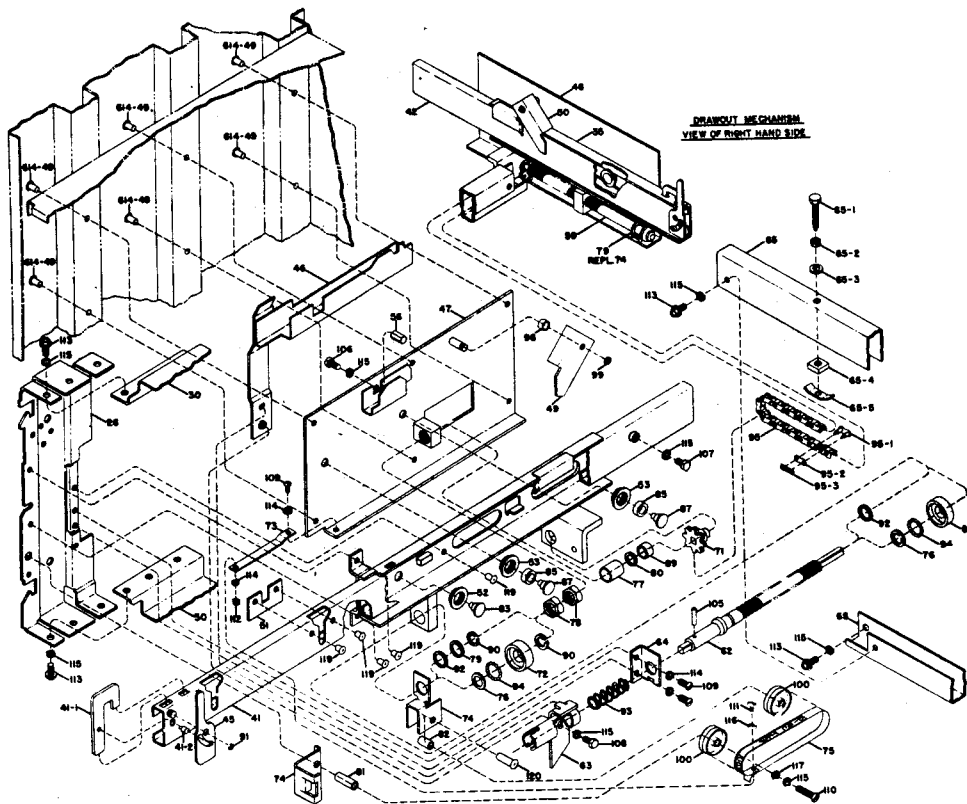


Fig. 20 (0625B0376-0) Rackout Mechanism For AK-50, 75, 100 Breakers

DRAWOUT MECHANISM OPERATION

Part numbers refer to Fig. 19 (AK-25) (First nos. in sequence).

Part numbers refer to Fig. 20 (AK-50, 75, 100) (Second nos. in sequence).

The rackout mechanism is operated by pushing the handle onto the end of the jackscrew shaft (56) (62) and rotating the handle. Clock-wise rotation moves the breaker into the house and counter-clockwise rotation moves the breaker out. Approximately 17 turns of the handle will move the breaker from the disconnect to the connect position. To properly engage the handle with the jackscrew shaft, the slot in the end of the handle should align with the pin (73, 105) through the shaft. When the pin is so aligned, the square hole in the handle will be engaged with the square drive end on the shaft.

The rackout mechanism is interlocked so that the circuit breaker must be open before the operating handle can be inserted. When the breaker is closed, an interlock link operated by the breaker cross bar blocks the interlock linkage on the rackout mechanism and prevents the tube (45) (63) from being moved back to fully expose the square shaft end. The pin (73) (105) in the jackscrew shaft engages in a slot in the tube. This slot prevents rotation of the shaft and also assures that the interlock linkage must be moved through a prescribed distance before operation of the mechanism is possible. When the tube is pushed back so that it will clear the pin, a cam surface on the interlock slide (40)(46)

engages a trip link on the side of the breaker and holds it trip free as long as the handle is engaged or the interlock tube is in the retracted position.

There is also a stationary cam in the house which holds the breaker trip free as it is moved between the connect and test positions. This stationary cam comes into operation before the primary disconnects have parted and is operable whether or not the rackout handle is engaged. The breaker thus cannot be closed when it is between the test and the connect positions. From the test to the disconnect position, the breaker can be closed when the rackout handle is disengaged and the pin in the jackscrew is aligned with the slot in the interlock tube so that the interlock linkage is in the reset position.

An indicator (69) (75) which is visible through an opening in the front of the door shows the position of the breaker in the house. The test position is reached when the line on the indicator label marked TEST is aligned with the stationary line on the indicator housing. In this position, the breaker can be operated when the pin (73) (105) and the slot in the interlock tube are aligned and the rackout handle is disengaged. The secondary control power disconnects are engaged and the primary power disconnects are open in this position.

The Disconnect and Connect positions are indicated by the sight indicator and by the jackscrew reaching the end of its travel. The adjusting nuts (58) (78) are adjusted so that when the connect position is reached, the pin and the interlock tube slot will

be aligned and the breaker can be closed upon removal of the rackout handle. In the disconnect position, it may be necessary to rotate the jackscrew back slightly after the travel limit has been reached in order to align the jackscrew pin and the slot in the interlock tube.

The motion of the rackout mechanism can be reversed at any point in the cycle by reversing the direction of rotation of the handle.

EMERGENCY OPERATION

If necessary, it is possible to remove the breaker from the house without using the rackout mechanism. This is done by rotating the release levers (71) (45) after the breaker has been tripped and pulling the breaker manually off of the primary disconnects.

However, the breaker cannot be reinserted into the house far enough to engage the primary disconnects unless the stop link (43) (49, 50) is retracted. This stop link (43) (49, 50) retracts automatically when the rackout mechanism is operated to the disconnect position. If it is necessary to insert the breaker into the house when the rackout mechanism is in the connect position, the stop link (43) (49, 50) must be retracted and held until the interference pin or the breaker mounting pin has passed the stop link. It is recommended that the stop link be held up with masking tape when attempting to insert the breaker in this manner. The inertia of the breaker can then be used to aid in pushing it onto the primary disconnects.

INTERLOCKS

Several interlocks are available as accessories. They are described in the following paragraphs:

Kirk Key Interlocks

Part numbers refer to Fig. 21 (AK-25)
First nos. in sequence

Part numbers refer to Fig. 22 (AK-50,75,
100) Second nos. in sequence.

The Kirk key interlock is mounted with two (2) 1/4-20 one-way screws and lock washers to the left side of the inner house.

The interlock is designed so that the key may be removed from the lock only if the breaker is tripped and the bolt in the lock is extended. When the Kirk lock is extended, the breaker is rendered trip free only in the connected position in the house. The breaker may be operated (closed and tripped) in the test or disconnect positions even when the Kirk lock bolt is extended and the key removed.

The operation of the Kirk key interlock should be checked as follows:

1. With the breaker in the connected position, manually trip the breaker. This then allows the rackout interlock slide (40) (46) to be retracted. The preferred way to do this is with the rackout operating handle. When the interlock slide is retracted, the bolt in the Kirk lock may be extended and the key removed. The interlock slide may then be allowed to return to its normal reset position. The breaker will remain trip free in the connected position until the key is returned and the Kirk lock bolt is retracted.
2. If desired, the breaker may be moved to either the test or the disconnect position while the Kirk lock key is removed from the lock. In these positions the breaker can be operated for checking or maintenance.

DOOR INTERLOCK

For part numbers refer to Fig. 23.

A door interlock which prevents opening of the compartment door when the breaker is closed can be provided as an optional accessory.

The door interlock consists of a link (074-02) mounted on the inner house side sheet of the breaker compartment. A combination torsion, compression spring (074-33) is mounted on the link pivot pin and biases the link in a forward and counter-clockwise direction. One end of the link engages a clip on the door latch (640-02), the other end engages with the rackout mechanism interlock slide (40) (46). When the breaker is closed, a link operated by the breaker cross bar engages in a slot in the interlock slide. This prevents the slide from disengaging with the door interlock link and hence, the door handle cannot be lifted.

When the breaker is open, the interlock slide can be moved by pushing in on the interlock slide (40, 46) preferably using the rackout handle. The door can then be

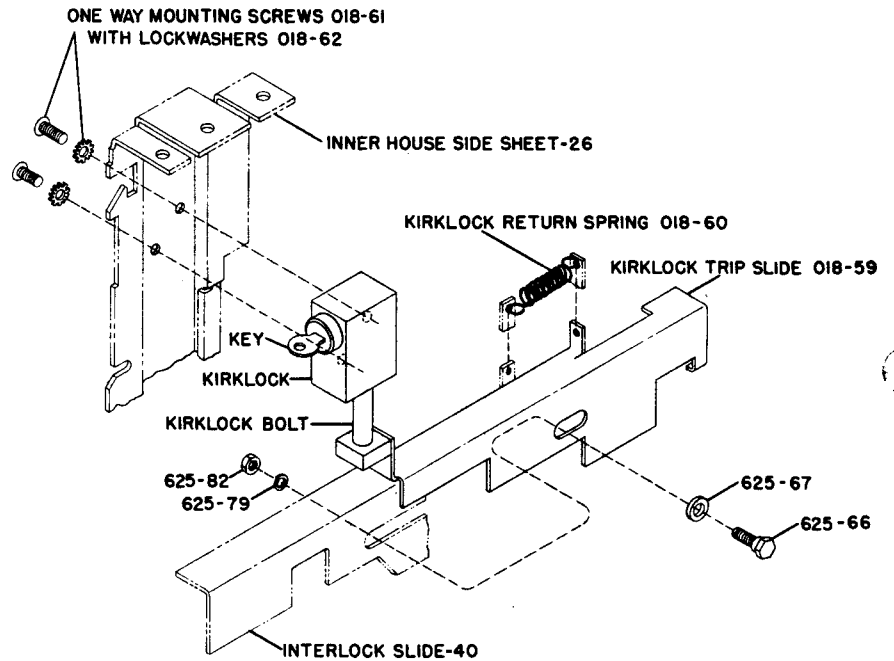


Fig. 21 (0121C1506-0) Kirk Key Interlock For AK-25 Breaker.

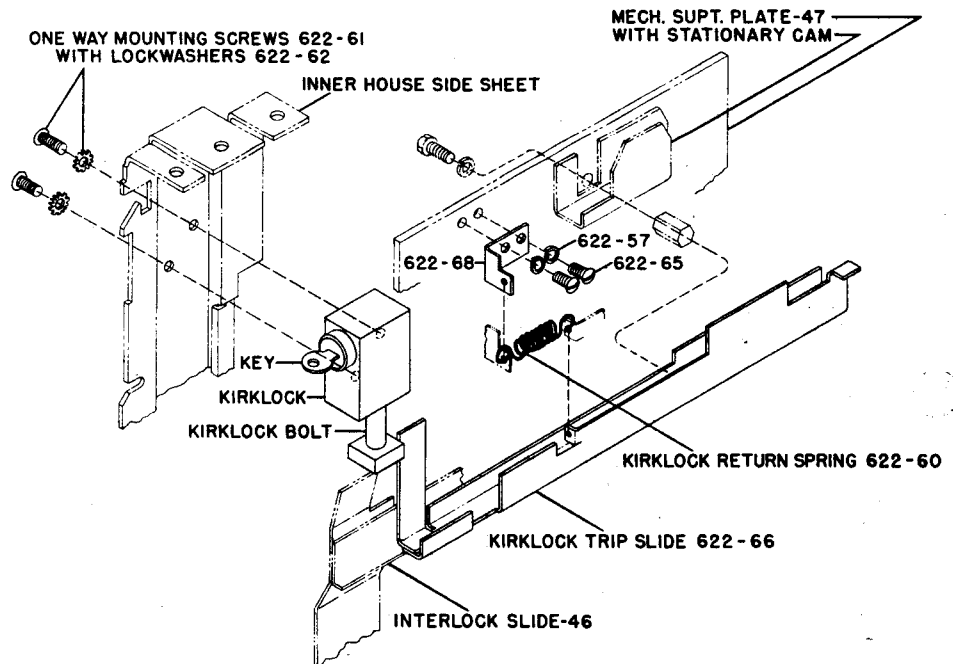


Fig. 22 (0121C1507-0) Kirk Key Interlock For AK-50, 75, 100 Breakers.

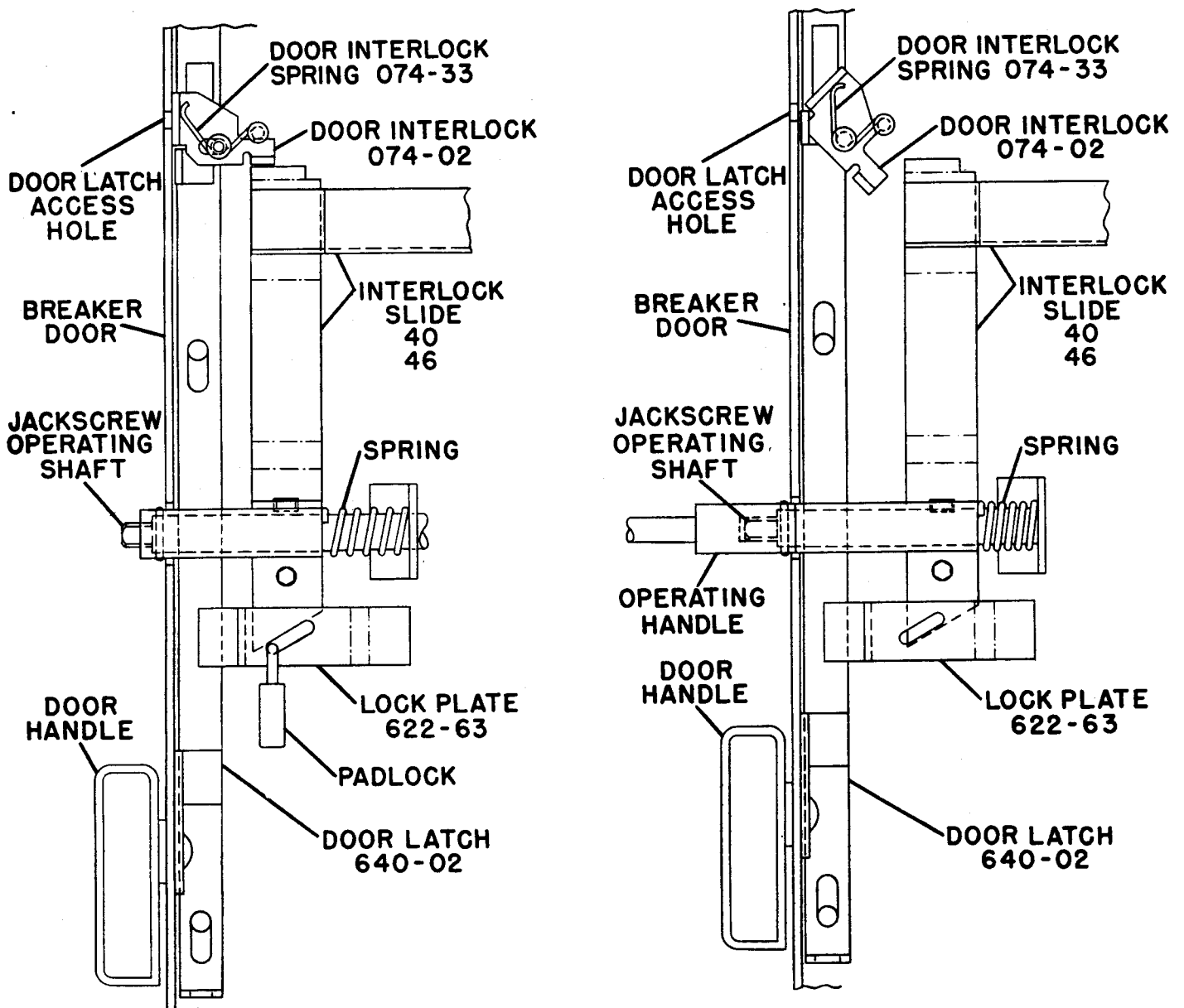


Fig. 23 (0121C1509-0) Door Interlock And Padlock Device.

unlatched by raising the door handle while the interlock slide (40) (46) is held in the retracted position.

If required, the door interlock can be defeated. A small hole is provided in the door in front of the interlock link. By inserting a tool such as a screwdriver through this hole, the interlock link can be pushed back until it is free of the door latch. With the link held in this manner, the door latch can be raised and the door opened.

MECHANISM PADLOCK DEVICE

For part numbers refer to Fig. 23.

An accessory is available to padlock the rackout mechanism.

This accessory consists of a slotted plate (622-63) which is riveted to the inner

house side sheet. The slope of the slot matches the slope of the extension on the interlock slide (40) (46). When one to three padlocks are inserted into the slot in the plate the interlock slide cannot be retracted and the jackscrew cannot be turned. The rackout mechanism can be locked anywhere in its travel. It is necessary to open the compartment door in order to place the padlocks in the device, but once the locks are secured, there is no interference with the door and the door may be opened or closed at will.

MAINTENANCE

A periodic maintenance schedule must be established to obtain the best service from the switchgear. An annual check and overall maintenance procedure for the switchgear devices and all connections, must be followed as a minimum requirement. Equipment subject to highly repetitive operation may require more frequent maintenance.

A permanent record of all maintenance work must be kept. The record should include a list of periodic checks and tests made, the date they were made, the condition of the equipment, and any repairs or adjustments that were performed. Maintenance employees must follow all recognized safety practices, such as those contained in the National Electrical Safety Code and in company or other safety regulations during maintenance.

WARNING: Solid insulation surrounding an energized conductor and power apparatus must never be relied upon to provide protection to personnel.

For specific information regarding the maintenance of devices, such as circuit breakers, relays, meters, etc., refer to the separate instruction book furnished for each device.

BREAKER AND INSTRUMENT COMPARTMENTS

Breakers - Test and inspect all circuit breakers for proper operation as follows:

- a. Operate each breaker while in the TEST position and check all functions. This is particularly important for breakers that normally remain in either the opened or closed positions for long periods of time.

WARNING: De-energize equipment completely except for test circuits.

- b. Remove the breaker from its compartment to a clean maintenance area. Perform the maintenance operation suggested in the appropriate breaker maintenance manual.

Instruments Instrument Transformers and Relays

Check and inspect all devices to see that they are functioning properly. Check that all electrical connections are tight. Check mounting of the device.

Breaker Compartment Interiors

- a. Thoroughly clean interior of the breaker and instrument compartments. Use a vacuum cleaner and clean rags only. Do not use steel wool, or oxide papers. Blowing with compressed air is not recommended.
- b. Check indicating devices, mechanical and key interlocks.

- c. Check primary disconnecting device contacts for signs of abnormal wear or overheating. Discoloration of the silvered surfaces is not ordinarily harmful. These contacts should be cleaned only by wiping with a lint-free cloth.

Before replacing the breaker, check the alignment and wipe off the primary disconnecting device contacts, and apply a thin coat of contact lubricant, D50H47, to the house studs and fingers and to the primary disconnects on the breaker.

BUS COMPARTMENT

Before the following can be performed, remove the steel formed cover between units.

- a. Inspect the busses and connections carefully for evidence of over-heating or weakening of the insulating supports.
- b. Check that all bus mounting bolts and splice connection bolts are tight.
- c. Wipe and vacuum clean the busses and supports.
- d. Check the insulation of the breaker studs that pass through the bus compartment.
- e. After cleaning, megger and record the resistance to ground and between phases of the insulation busses and connections. Disconnect all control circuits before checking resistance. Do not use over a 1500 volt megger. Since definite limits cannot be given for satisfactory insulation resistance values, a record must be kept of the readings. Weakening of the insulation from one maintenance period to the next can be recognized from the recorded readings. The readings should be taken under similar conditions each time, if possible, and the record should include the temperature and humidity.

Feeder Cable and Bus Duct Terminal Compartment

- a. Inspect all main cable connections for signs of overheating, and tighten all connections.
- b. Check that all secondary control wiring connections are tight and all control cabling is intact.
- c. Check all bolts that secure the terminals to the breaker studs for tightness.
- d. Check the ground bus connection and mounting bolts for tightness, and clean the ground bus.

Overall Switchgear

- a. Clean and inspect all painted surfaces and retouch where necessary.
- b. Check to see that all anchor bolts and other structural bolts are tight.
- c. Check that all breaker compartment panel door latches operate properly.

Under normal conditions, the protective relays do not operate; therefore, it is important to check the operation of these devices regularly. Refer to the Relay Instruction Book for detailed instructions.

PAINT REFINISHING

Indoor and Outdoor Primer

1. Remove all loose paint, rust, scale, oil or grease. Sand scratches smooth before priming.
2. Materials
 - a. Synthetic phenolic, alkyd paint 214-488 Sand Gray as made by Arco Co.
 - b. Thinner Xylol made by Standard Oil Co.
 - c. Viscosity 30 seconds Zahn #2 cup.
3. Application
 - a. Primer is preheated to 185°F and sprayed with DeVilbiss type hot spray unit.
 - b. Air dry 30 minutes.
 - c. Thickness of paint coating 0.45 to 0.85 mills.

Indoor Finish Coat

1. Materials
 - a. Sand Gray lacquer 246-84296 as made by DuPont Co.
 - b. Blue lacquer 254-84299 as made by DuPont Co.
 - c. Lacquer thinner.
 - d. Viscosity Sand Gray 25 seconds Zahn #2 cup. Blue 27 seconds Zahn #2 cup.
2. Application
 - a. Spray one wet coat.
 - b. Air dry 30 minutes.
 - c. Thickness 1.00 mil.

Outdoor Finish

1. This finish is applied to surfaces previously cleaned and primed.
2. Materials
 - a. Acrylic Sealer 881-007 as made by DuPont Co.
 - b. Acrylic Lacquer ASA-24 as made by G.E. Co. #200.
 - c. Acrylic thinner E-615 as made by Geo. Senn Co.
3. Application - Sealer Coat
 - a. Reduce sealer to spraying viscosity using 5 parts 881-007 to 6 parts E-615.
 - b. Spray one coat of sealer.
 - c. Air dry one hour.
4. Application - Finish Coat
 - a. Reduce G.E. 200 with E-615 to spraying viscosity of 17 seconds Zahn #2 cup.
 - b. Apply one coat of finish.
 - c. Air dry 30 minutes.
 - d. Thickness of finish coat 1.00 mil.