

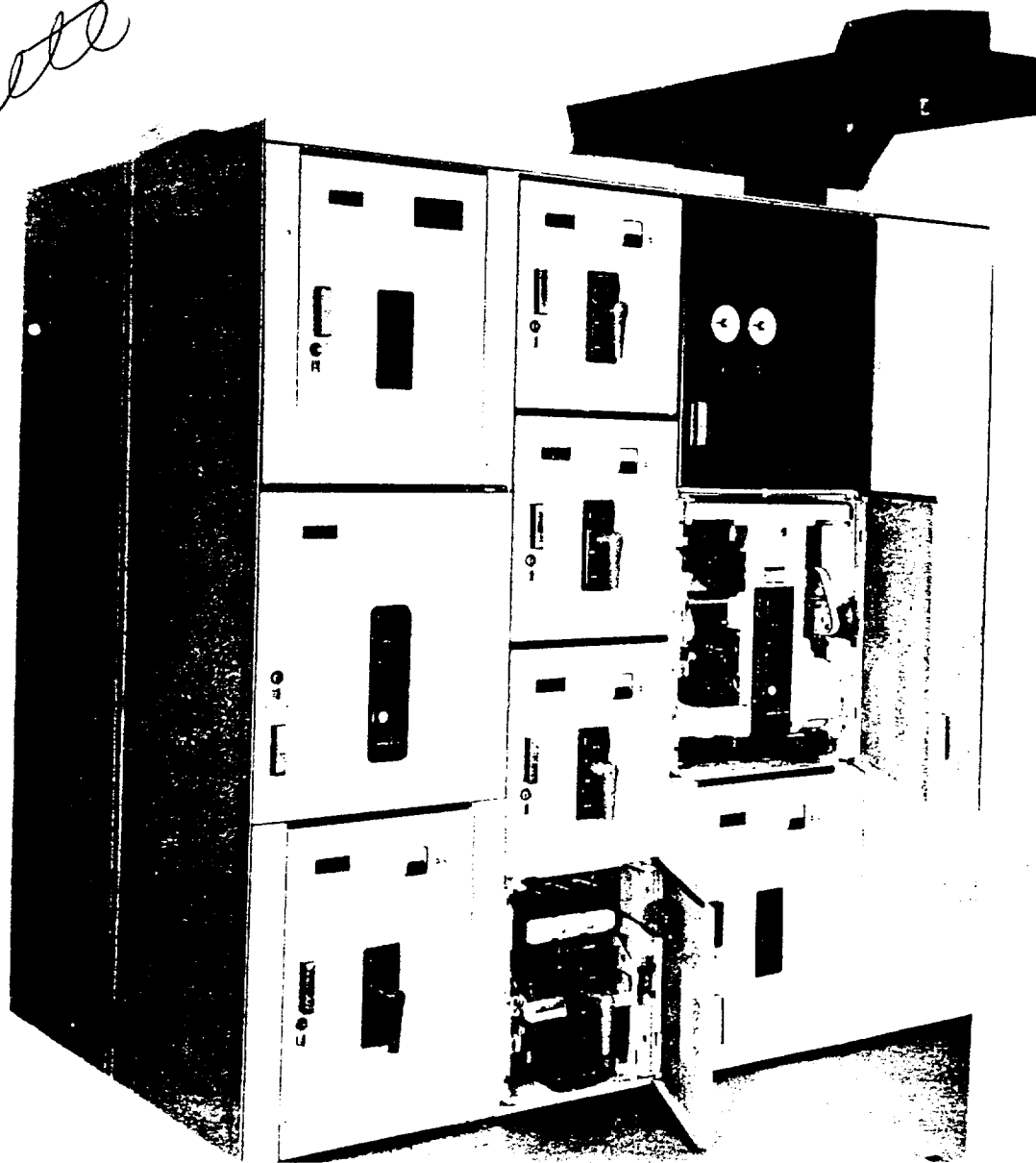
INSTRUCTIONS

GEI-90890A
SUPERSEDES GEI-83902C

AKD-5 POWERMASTER

LOW VOLTAGE DRAWOUT SWITCHGEAR

obsolete



SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

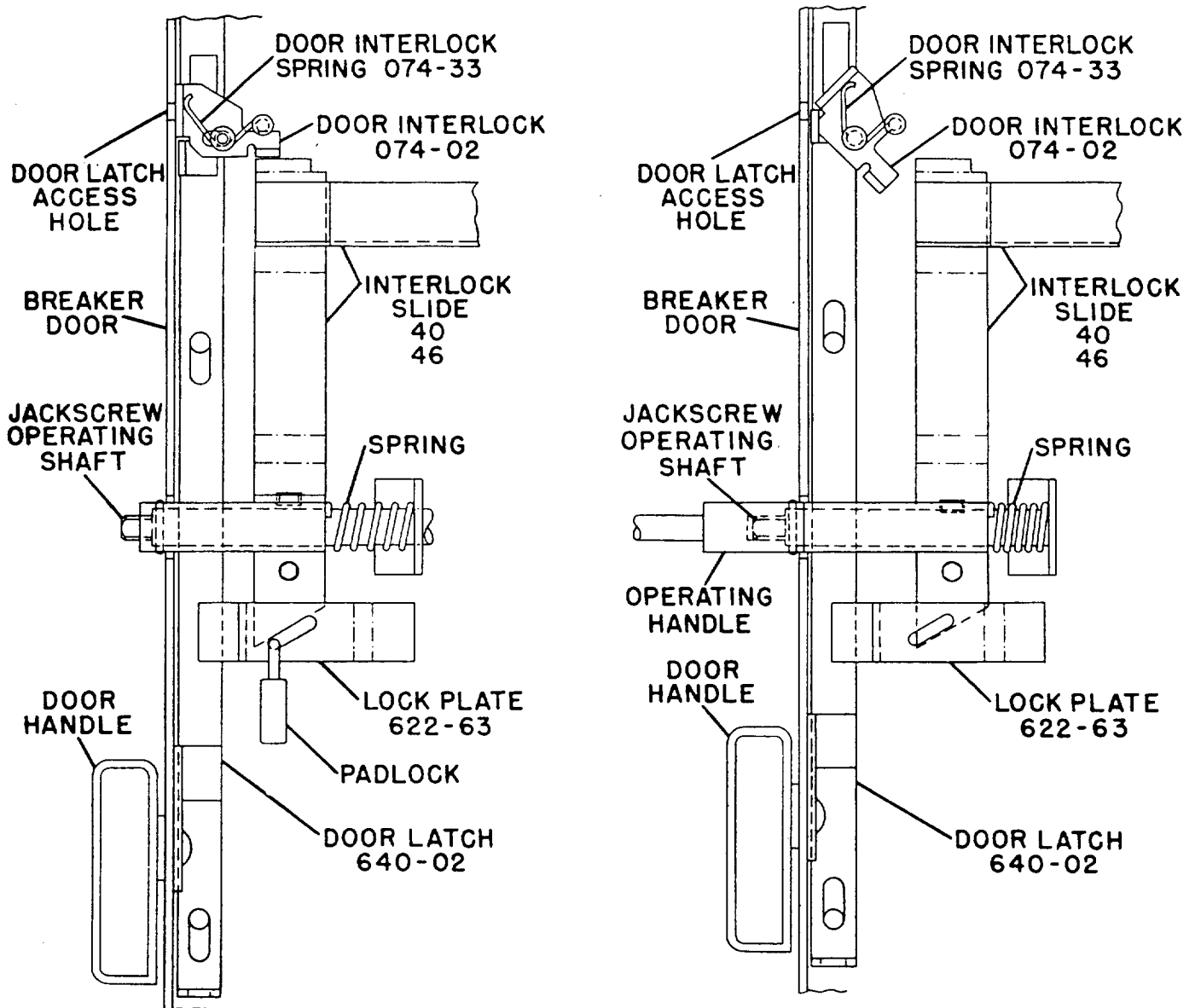


Fig. 23 (0121C1509-0) Door Interlock And Padlock Device.

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 jackcrew 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.

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.

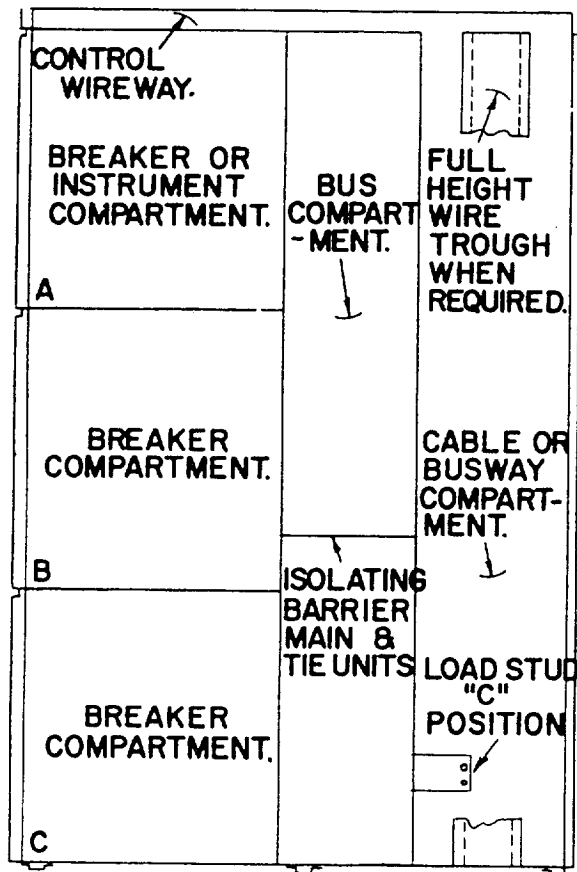


Fig. 2 (0148A5073-0) Side View Showing Compartmentation.

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.

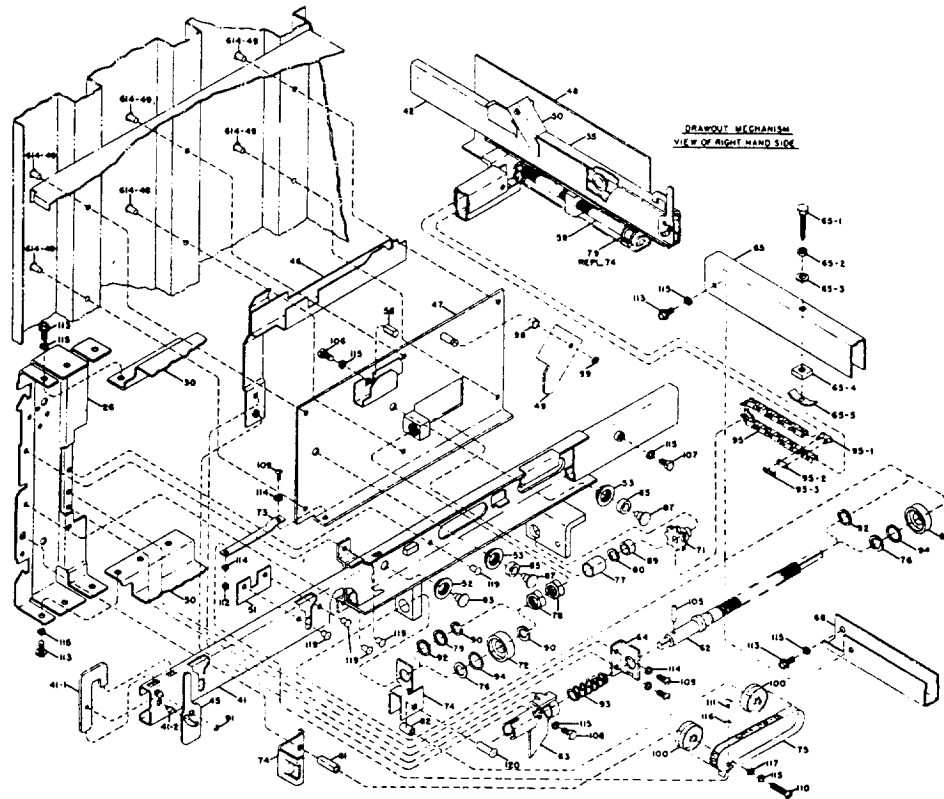


Fig. 20 (0625E0376-0) Rackout Mechanism For AK-50, 75, 100 Breakers

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.

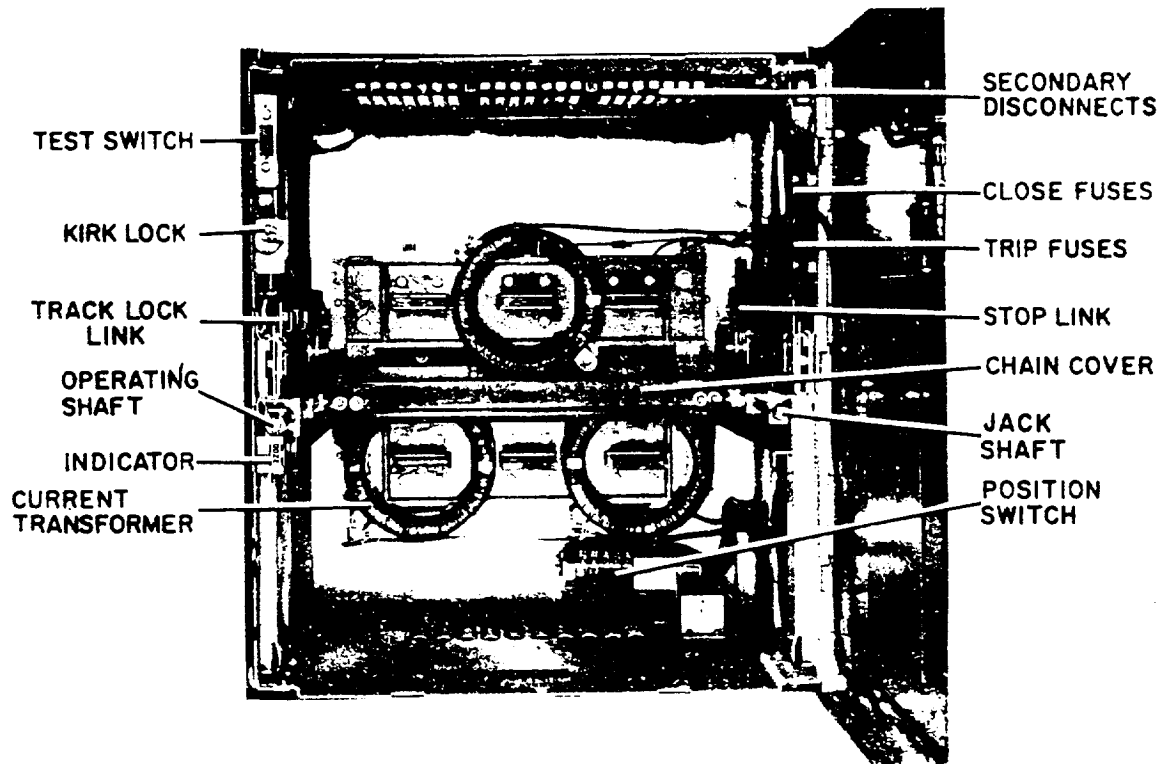


Fig. 4 (8035633) AK-50 Compartment.

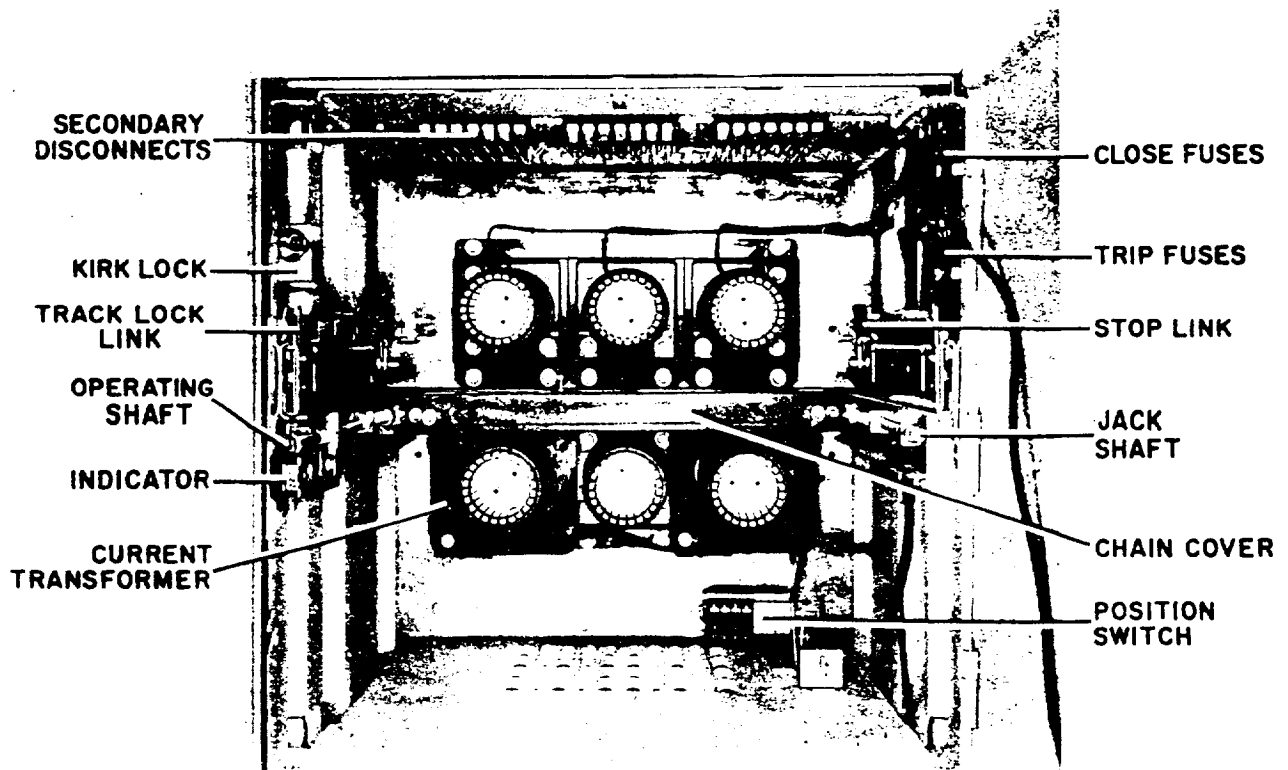


Fig. 5 (8035629) AK-T5 Compartment.



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.

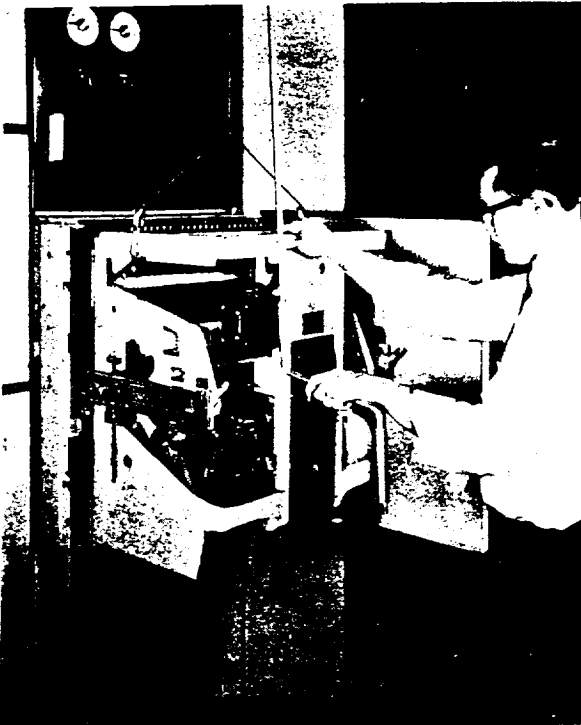


Fig. 17E (8035635) Lower The Breaker Into The Track Slots. Remove The Hoist Cable.



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

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.

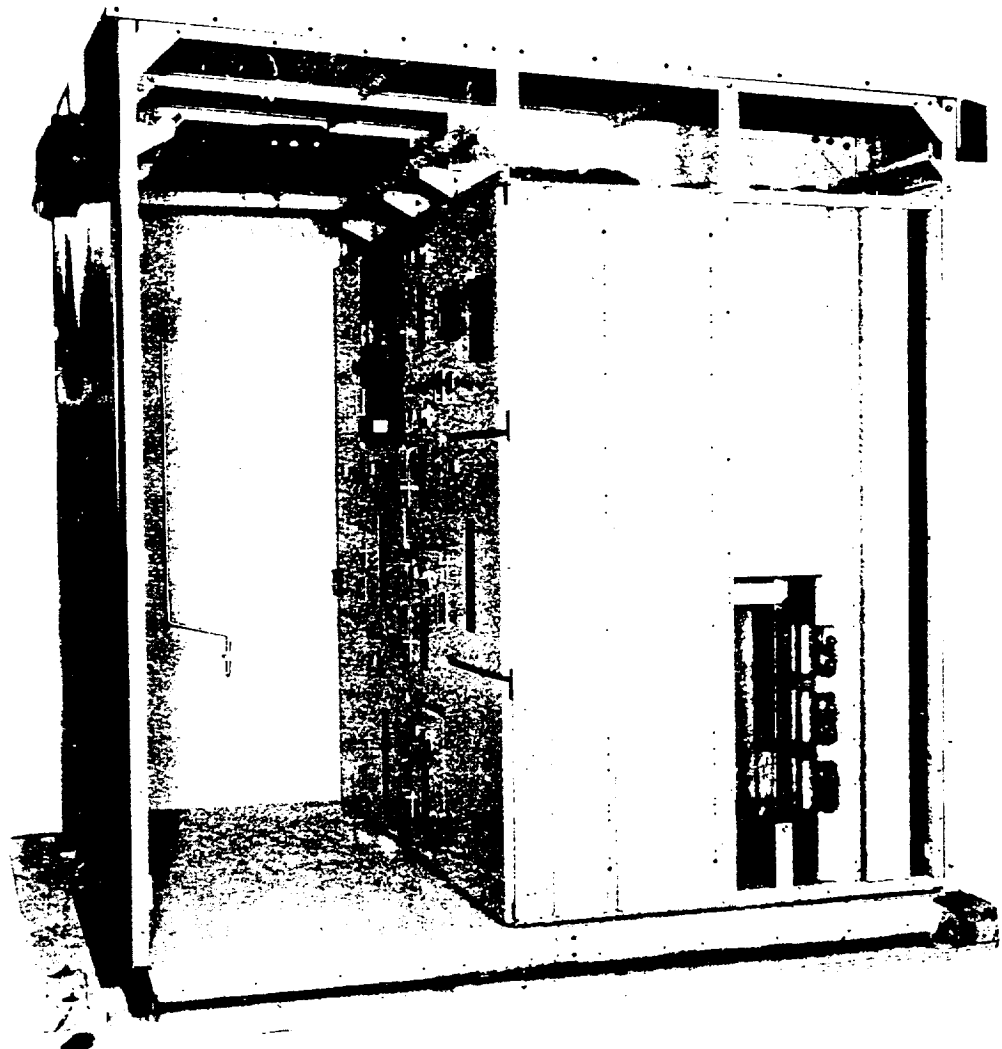
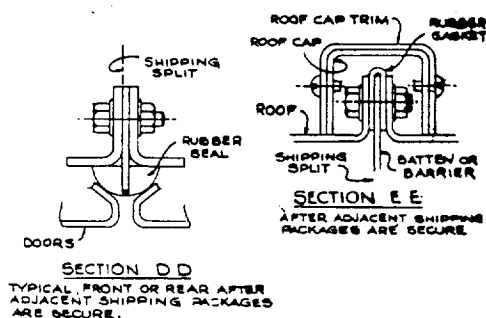
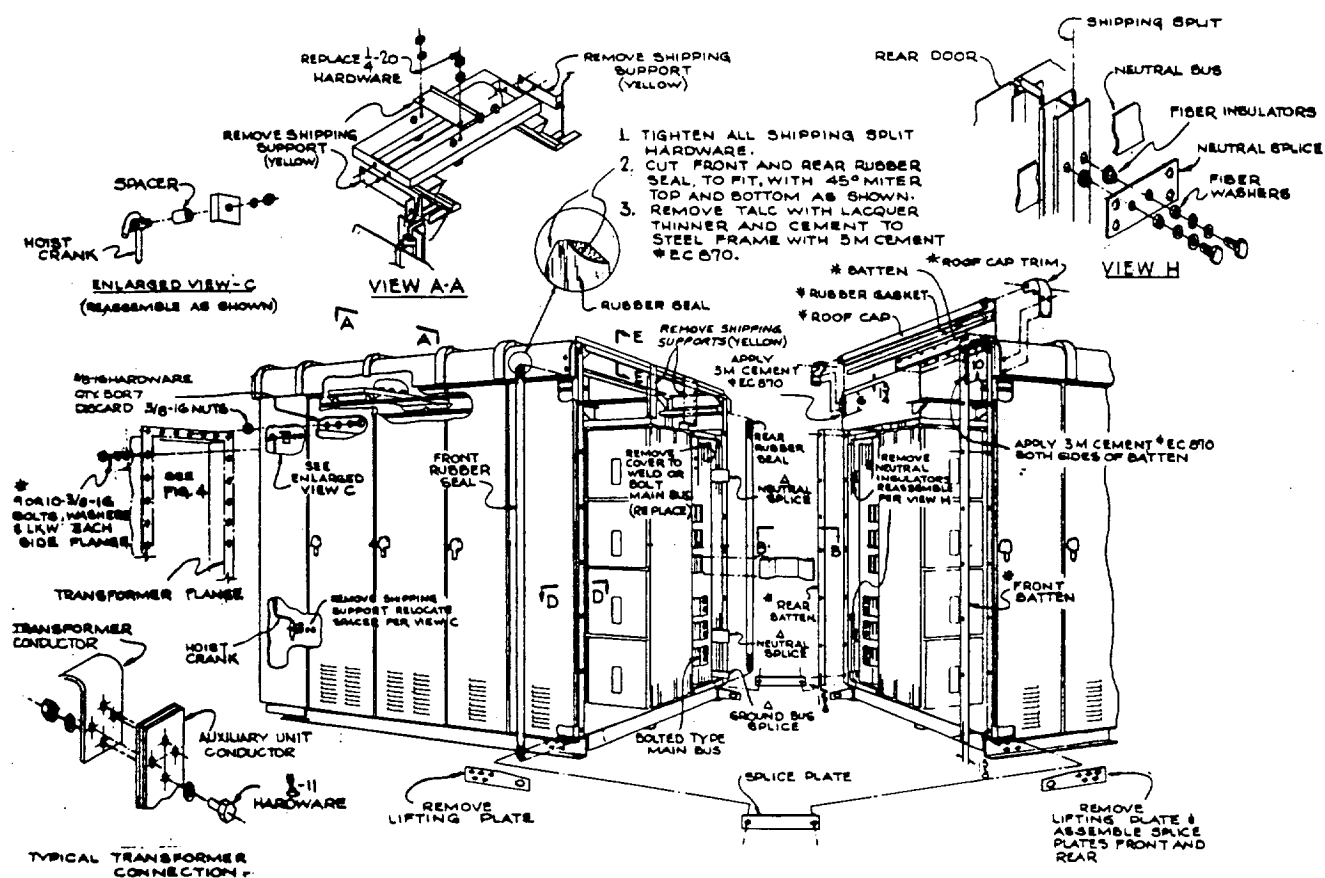


Fig. 8 (8035634) Typical Outdoor Shipping Section.



NOTES

- * ALL SHIPPING SPLIT HARDWARE
BATTENS, ROOF UNDERBASKET, ROOF CAP
FRONT AND REAR ROOF FRAMES
TO BE DISASSEMBLED BEFORE ADJACENT
SHIPPING PACKAGES ARE SET IN PLACE,
REASSEMBLE TO SECURE SHIPPING SPLIT.
- Δ GROUND BUS SPLICE AND HARDWARE WILL BE
NORMALLY SHIPPED ASSEMBLED TO EITHER
SIDE OF ADJACENT SHIPPING PACKAGES.
CENTRAL BUS SPLICE INSULATORS AND HARDWARE
(WHICH FURNISH THE CENTER) NORMALLY
SHIPPED ASSEMBLED TO EITHER SIDE OF
ADJACENT SHIPPING PACKAGES.

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

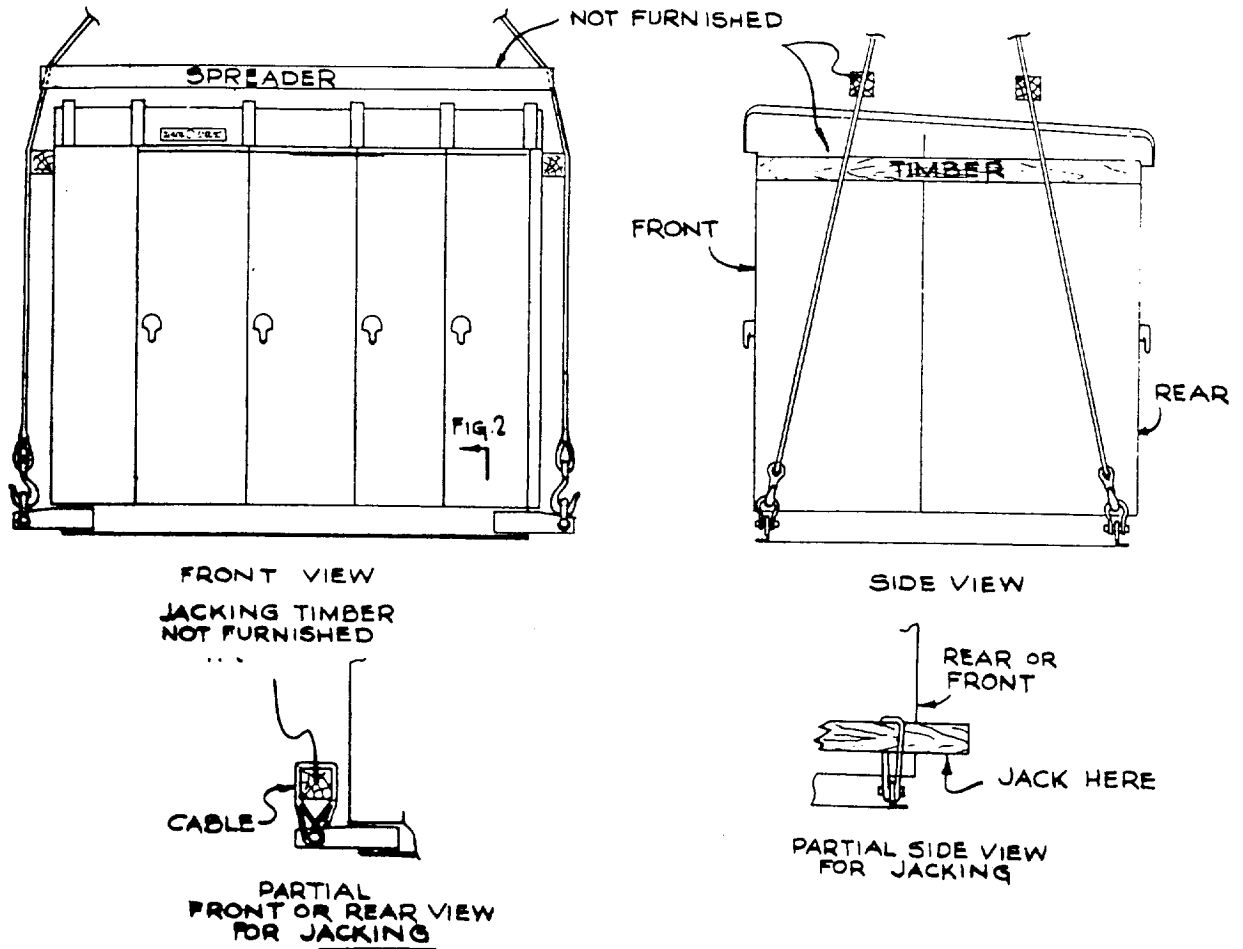


Fig. 10 (0673D0500-003-3) Methods Of Handling Outdoor Equipment.

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.

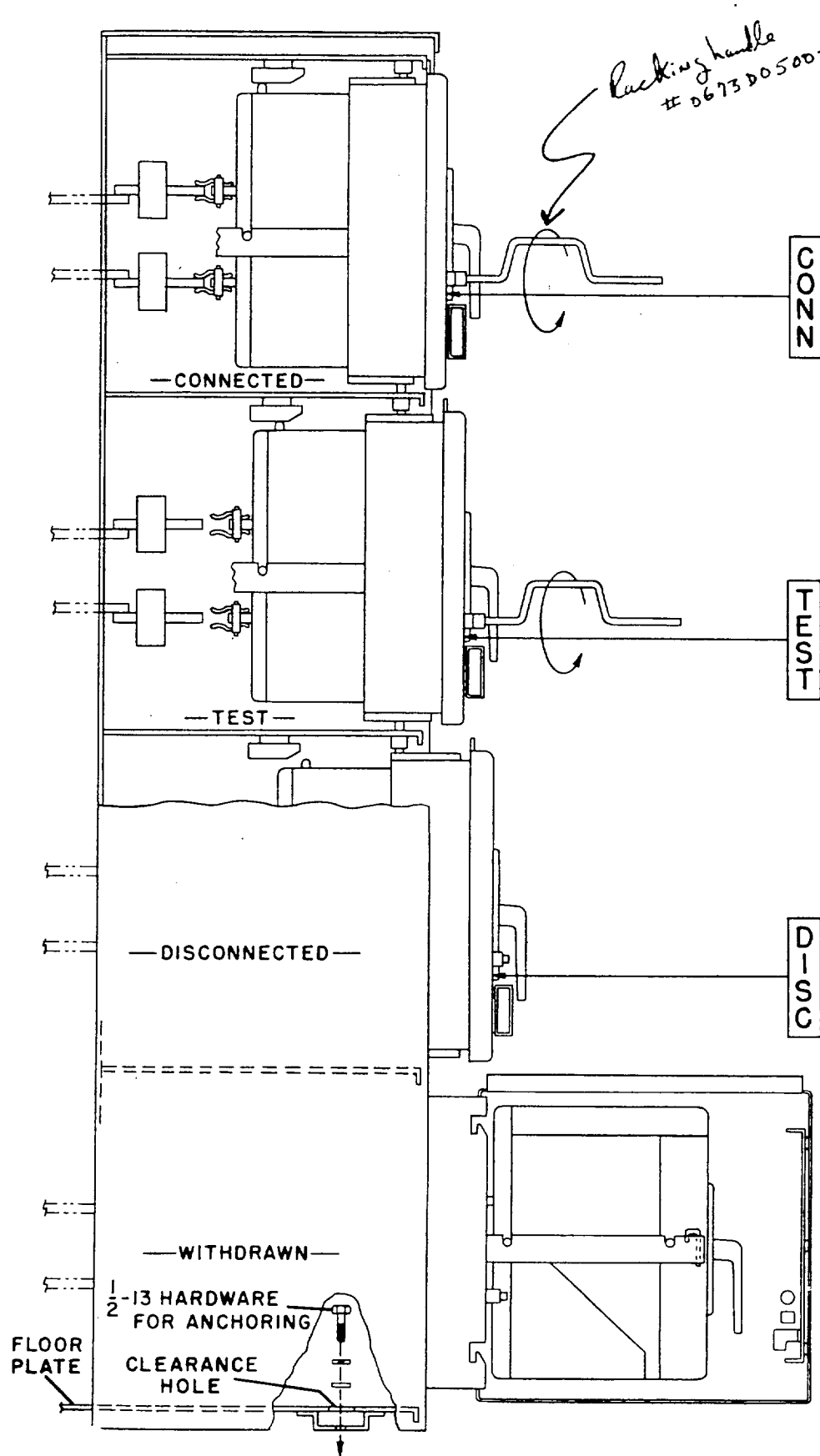


Fig. 14 (0121C1508-0) Side View Of Breaker Stack.

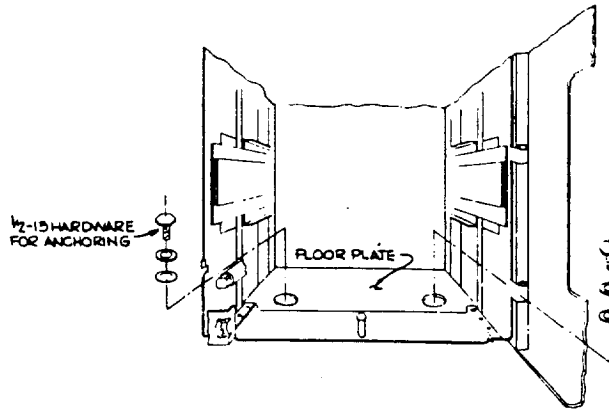


Fig. 13 (0673D0500-002-05) Location Of Anchor Bolts In Front Of Indoor Equipment.

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 it 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.

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:

- 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.
- 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:

- Check alignment of doors on outdoor equipment to see that the weatherproof seal has not been disturbed.
- 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:

- Route the cables as required and lash them to supporting structure.
- Bolt terminal connectors to the breaker load studs in the cable compartment.
- 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:

- 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.

- Route the control cables from the conduits 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.
- If the control conduits enter from above, drill the top cover within the available space indicated.
- 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.
- 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:

- Before welding, all joints must have 1/8" minimum space at the root of the weld.
- The joint and joint area must be clean of any foreign material.
- Protect the insulation from the arc and weld splatter.
- Always weld uphill.
- 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:

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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.

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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:

- 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.
- 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:

- Check alignment of doors on outdoor equipment to see that the weatherproof seal has not been disturbed.
- 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:

- Route the cables as required and lash them to supporting structure.
- Bolt terminal connectors to the breaker load studs in the cable compartment.
- 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:

- 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.

- Route the control cables from the conduits 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.
- If the control conduits enter from above, drill the top cover within the available space indicated.
- 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.
- 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:

- Before welding, all joints must have 1/8" minimum space at the root of the weld.
- The joint and joint area must be clean of any foreign material.
- Protect the insulation from the arc and weld splatter.
- Always weld uphill.
- 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:

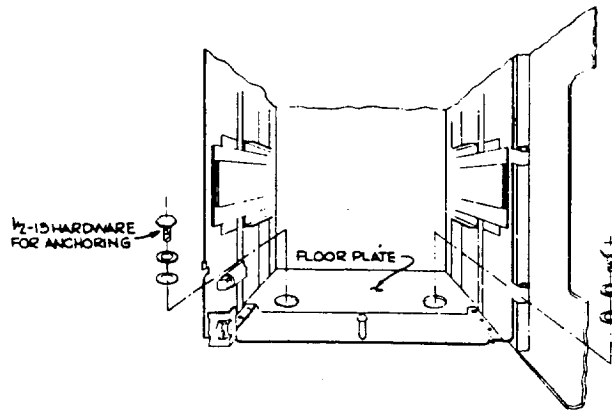


Fig. 13 (C673D0500-002-05) Location Of Anchor Bolts In Front Of Indoor Equipment.

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.

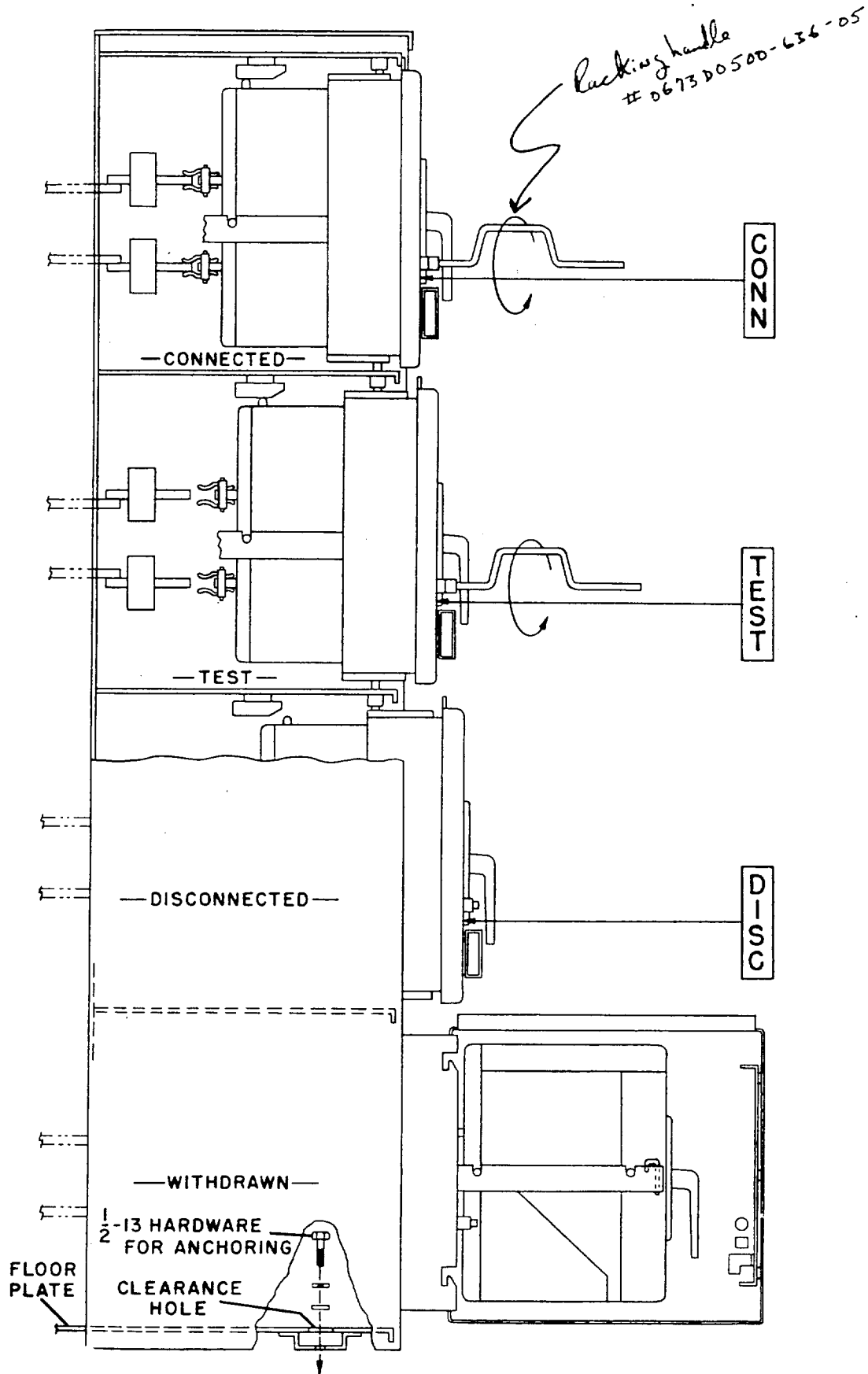


Fig. 14 (0121C1508-0) Side View Of Breaker Stack.

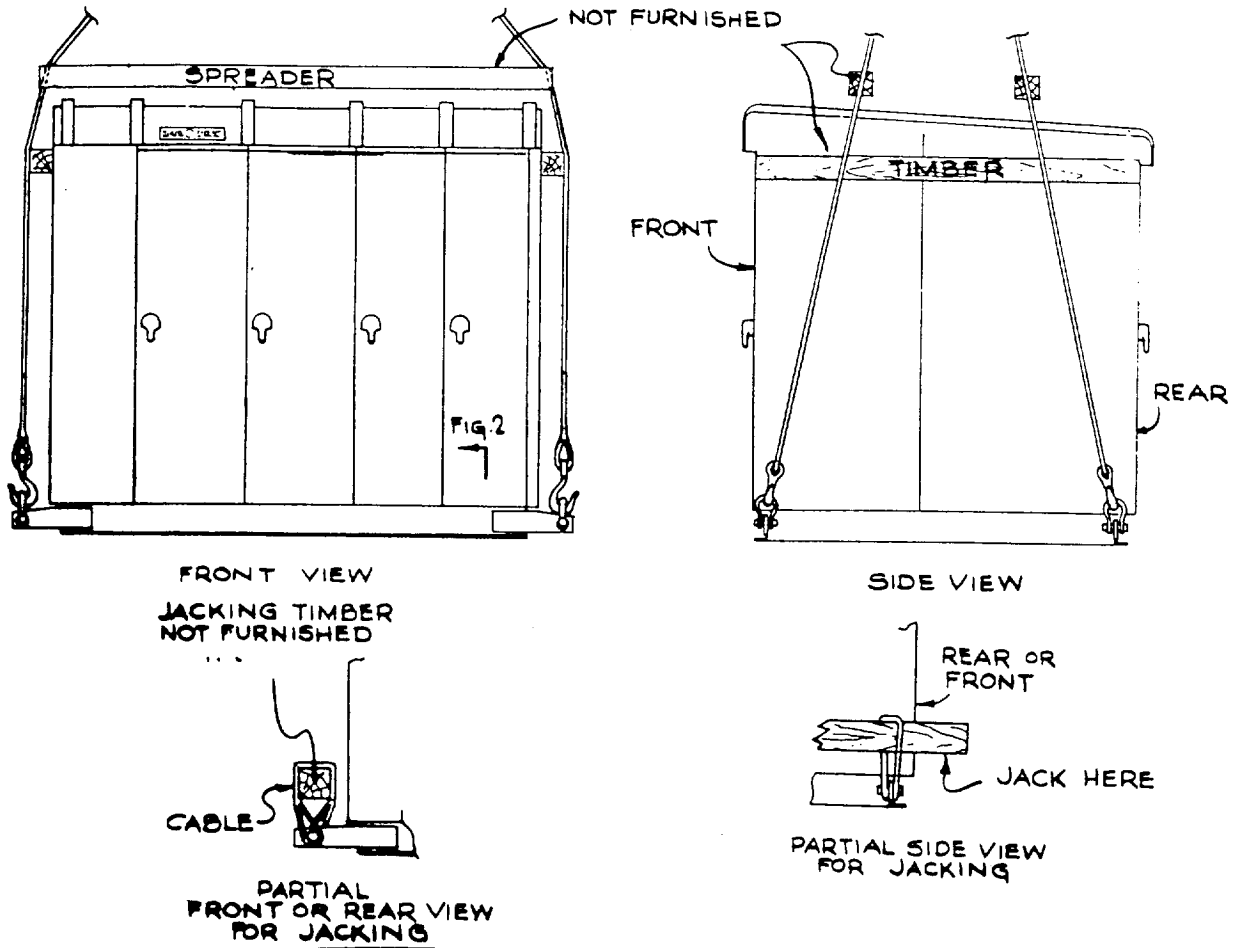


Fig. 10 (0673D0500-003-3) Methods Of Handling Outdoor Equipment.

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.

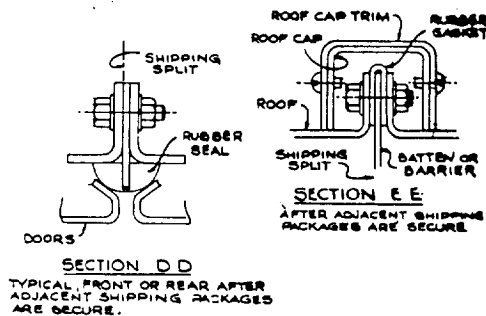
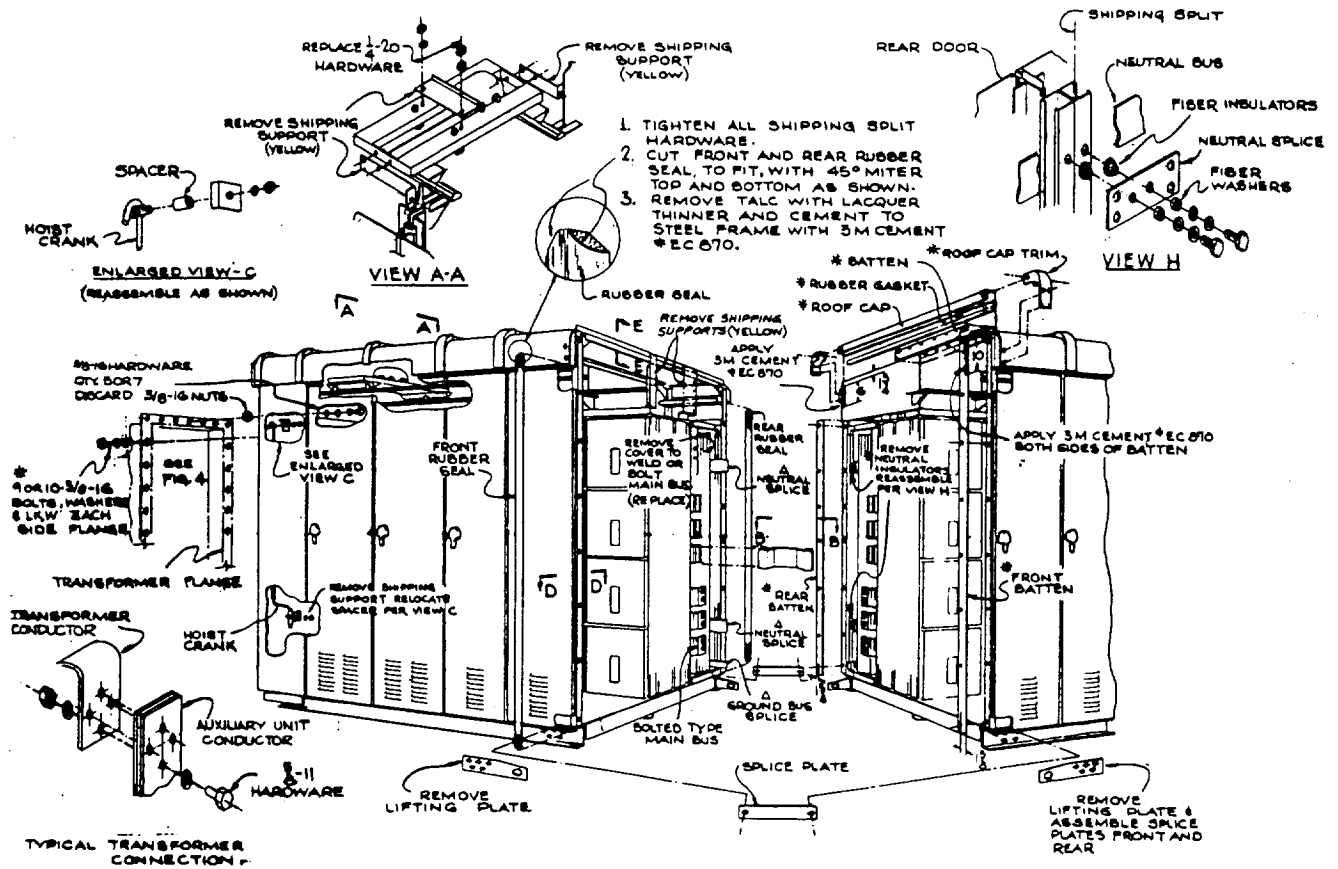
STORAGE

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.



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.
- Δ 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.

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.

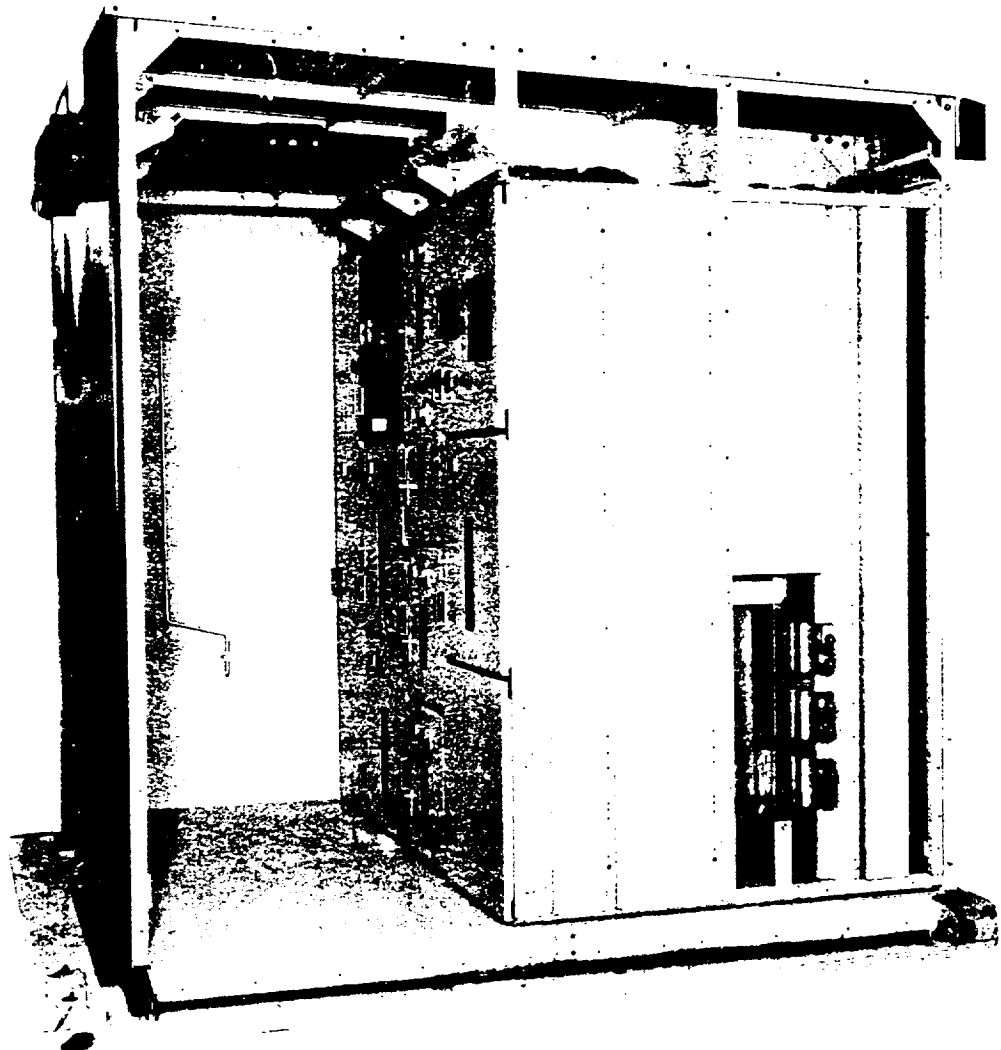


Fig. 8 (8035672) Typical Outdoor Shipping Section.



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.

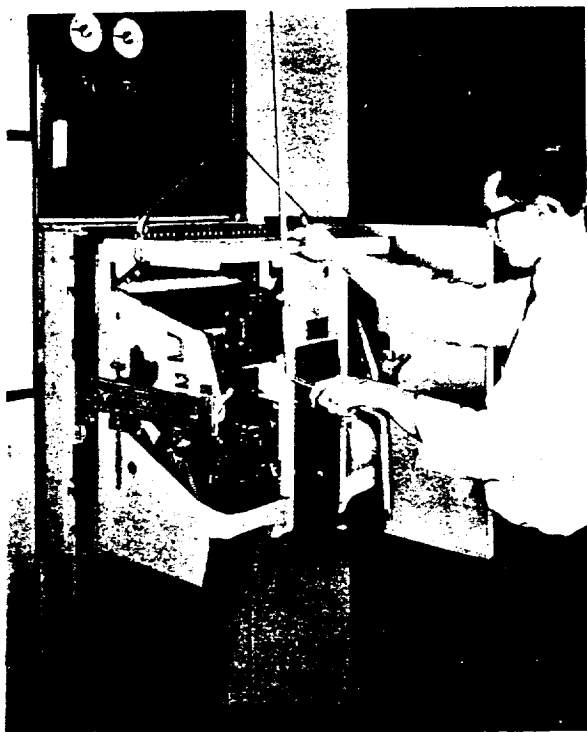


Fig. 17G (8035635) Lower The Breaker Into The Track Slots. Remove The Hoist Cable.



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

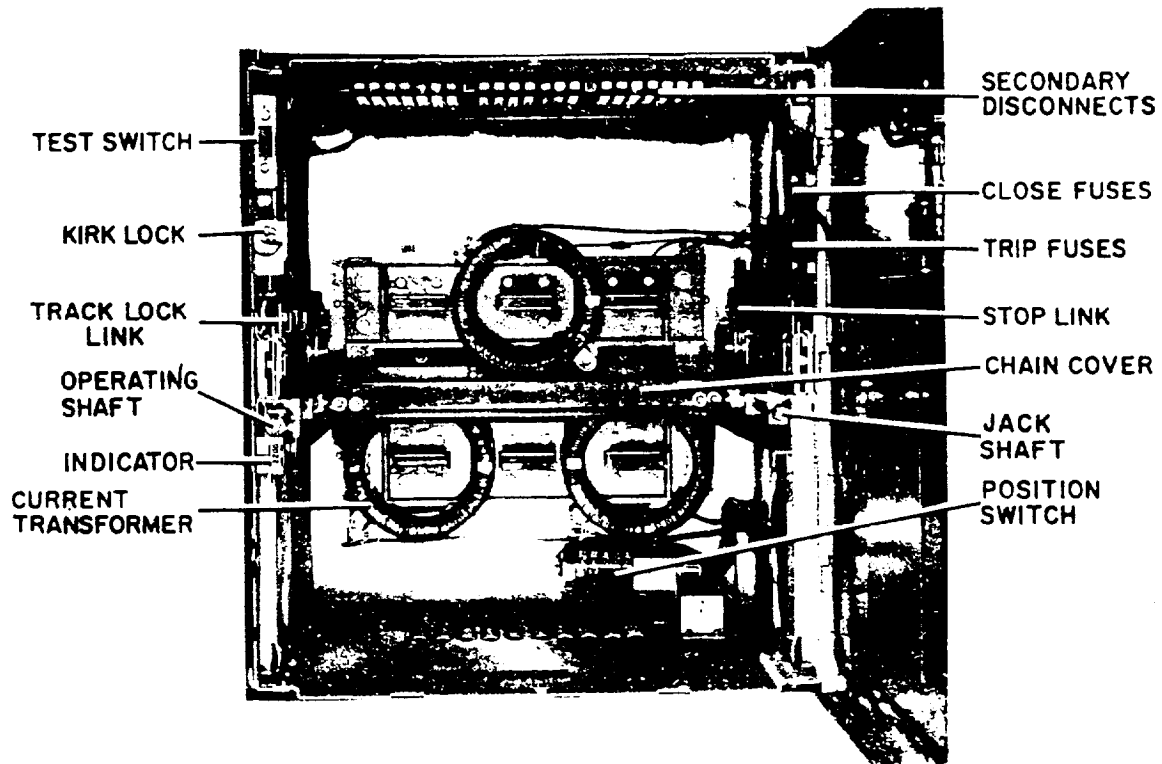


Fig. 4 (8035633) AK-50 Compartment.

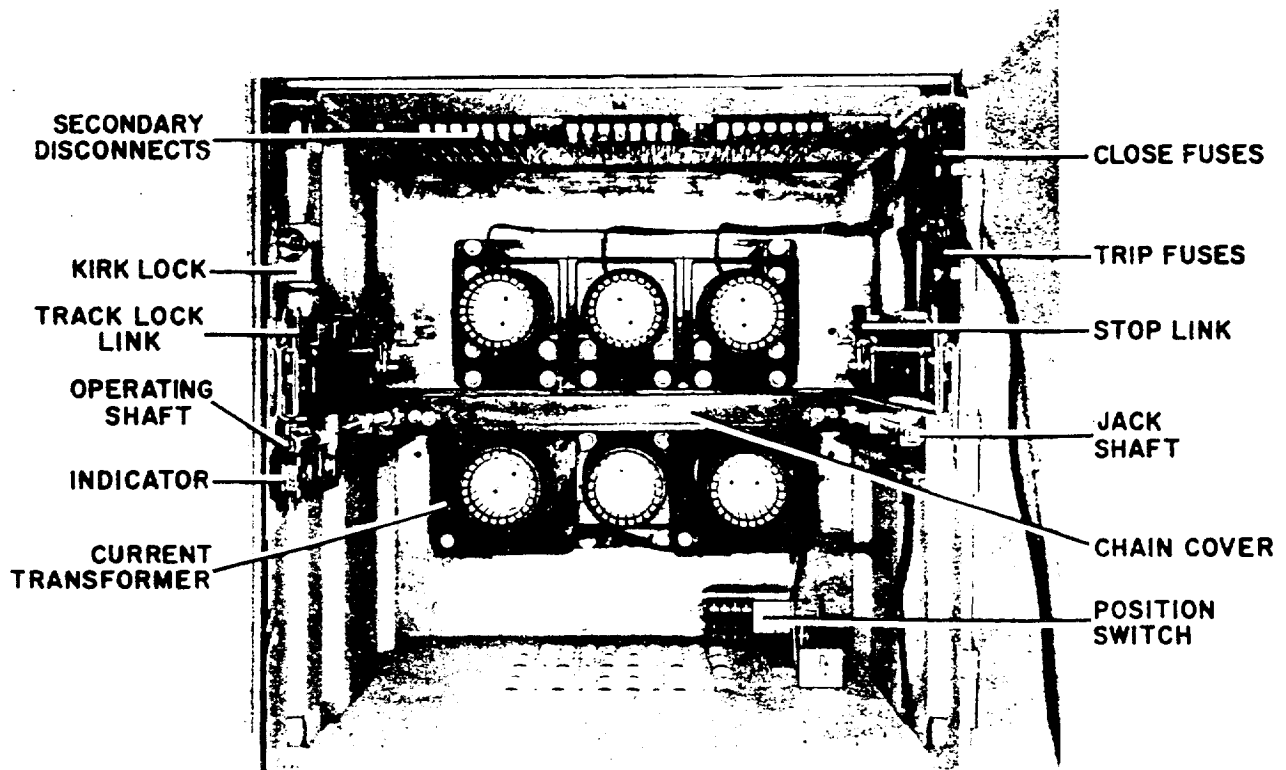


Fig. 5 (8035629) AK-75 Compartment.

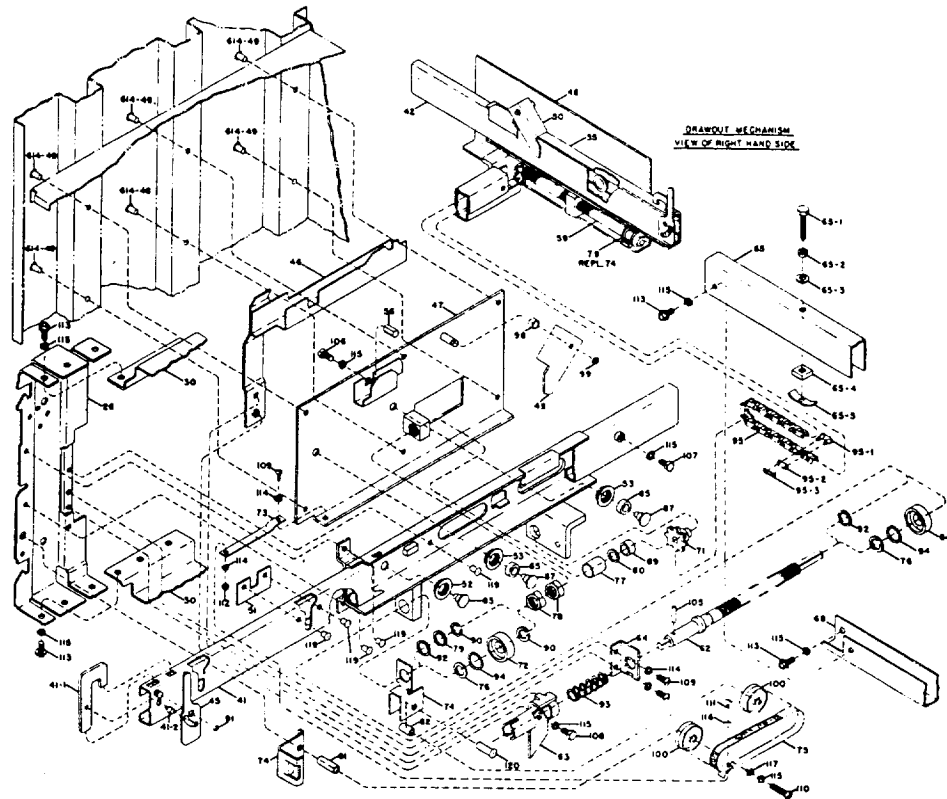


Fig. 20 (0625B0376-0) Rackout Mechanism For AK-50, 75, 100 Breakers

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.

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.

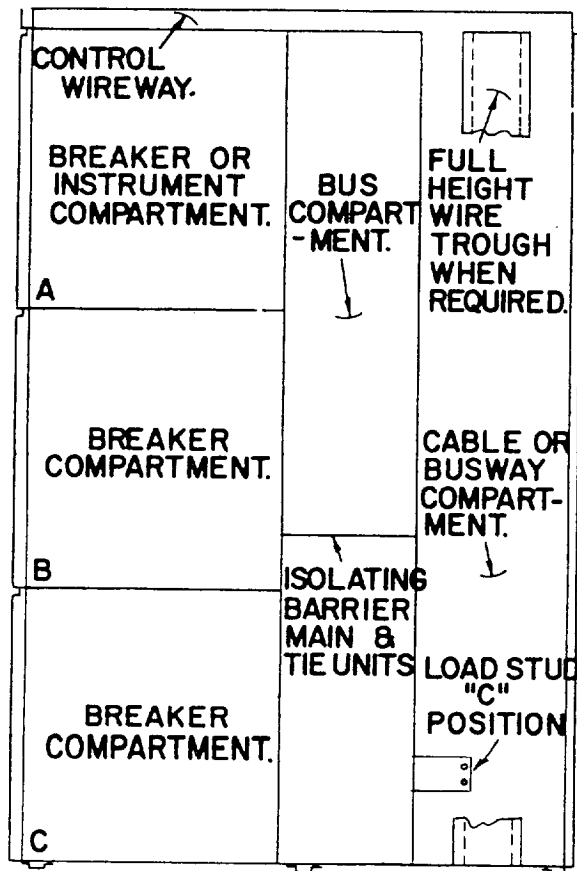


Fig. 2 (0148A5073-0) Side View Showing Compartmentation.

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.

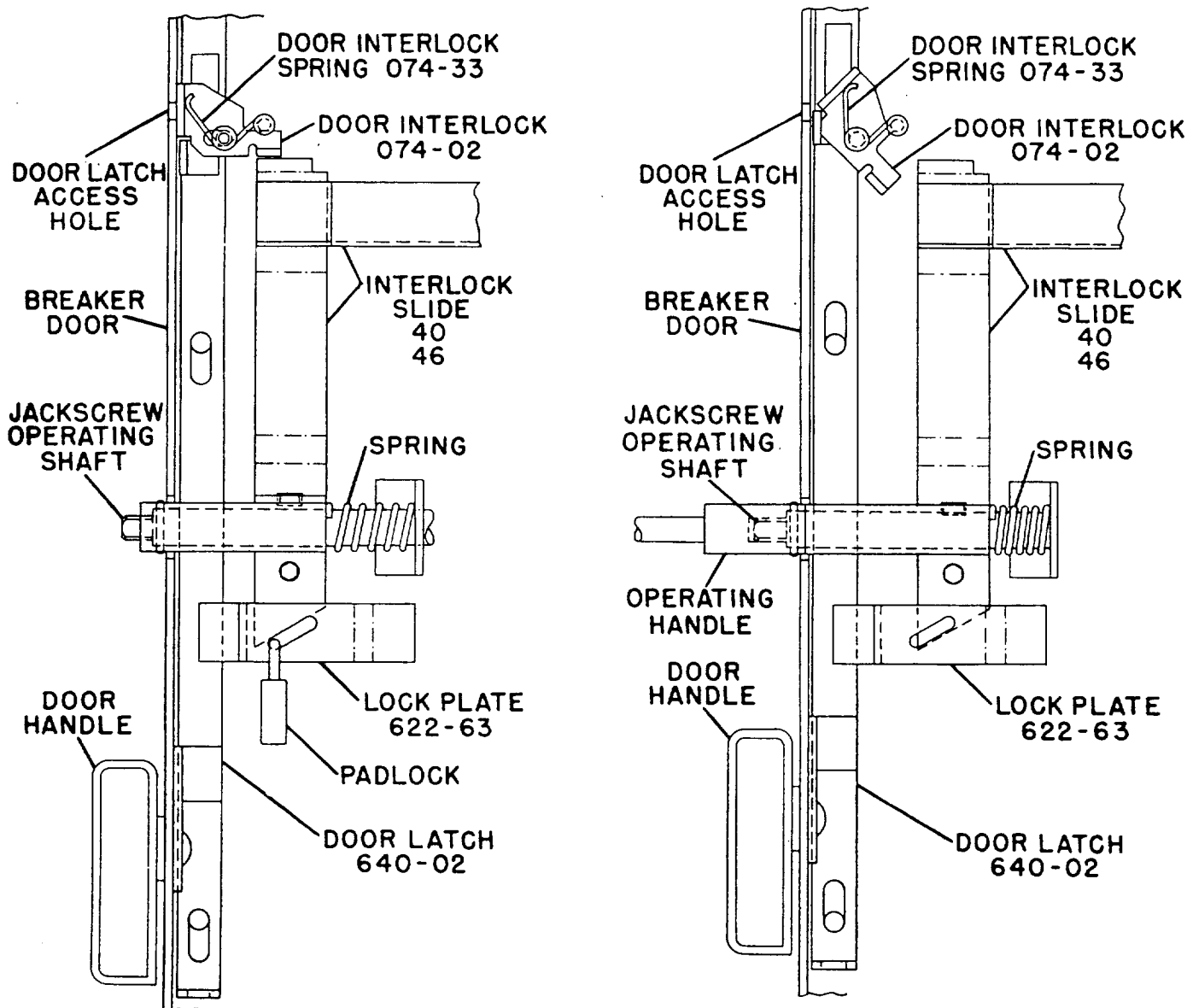


Fig. 23 (012101509-0) Door Interlock And Padlock Device.

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.

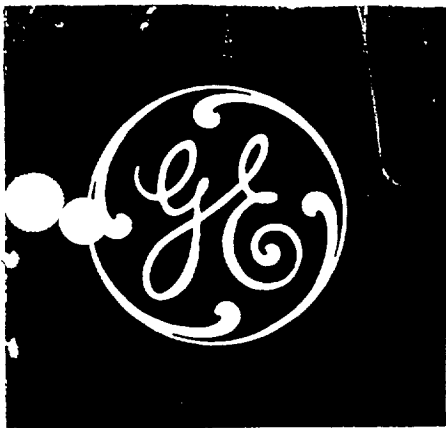
MECHANISM PADLOCK DEVICE

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.



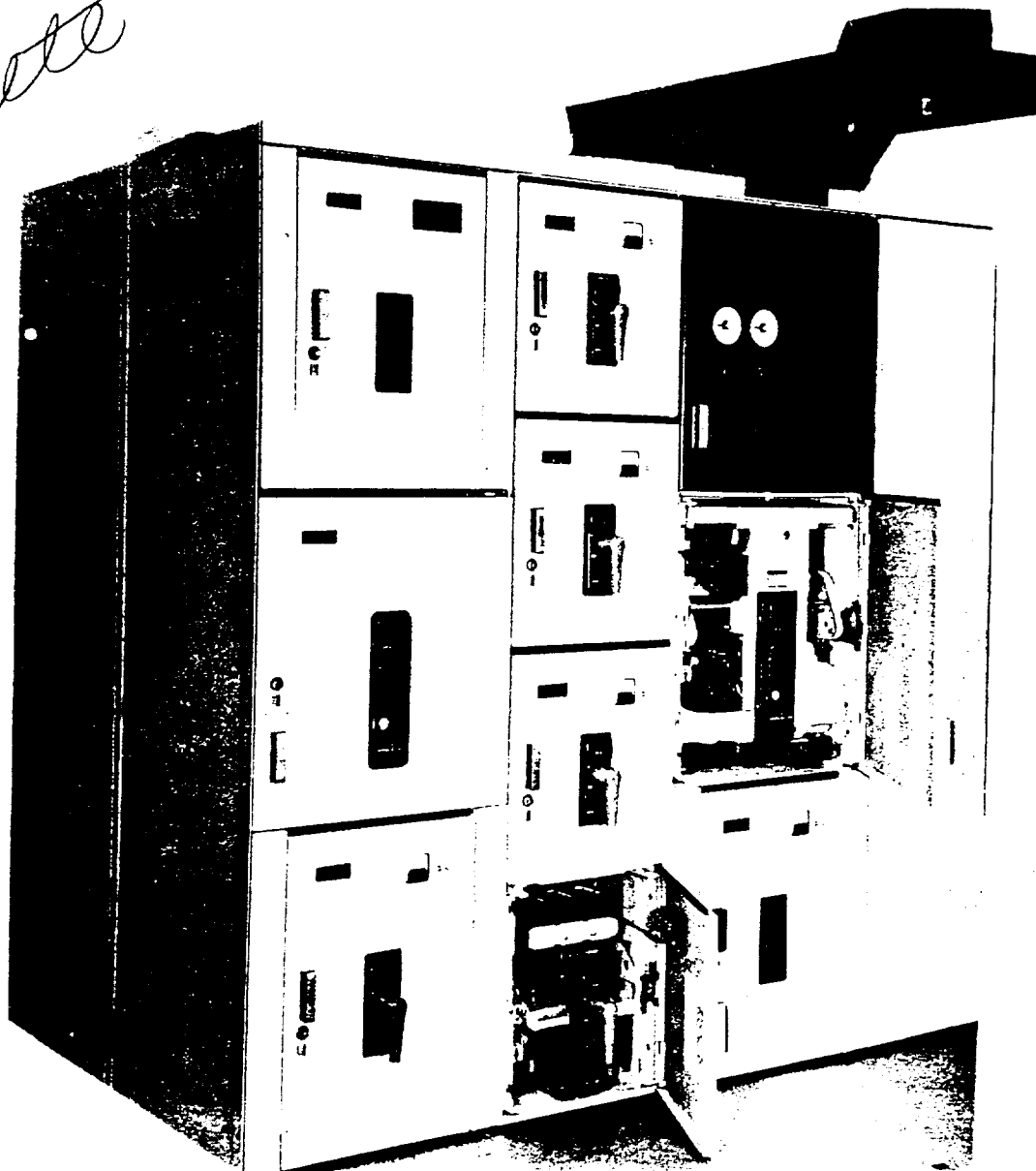
INSTRUCTIONS

GEI-90890A
SUPERSEDES GEI-83902C

AKD-5 POWERMASTER

LOW VOLTAGE DRAWOUT SWITCHGEAR

obsolete



SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.