GE AKD-10 Low Voltage Switchgear

Installation and Maintenance Instructions

Wave Pro™
Low Voltage
Power Circuit Breakers

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Appendices

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. These instructions are intended for use by qualified personnel only.

1-1 General Information

This manual contains procedures for receiving, handling, storage, equipment installation, operation, and maintenance and service of AKD-10 Low Voltage Switchgear.

NOTE: The personnel responsible for installing, operating, and servicing this equipment should be thoroughly familiar with the contents of this manual.

NOTE: La ou les personnes responsables de l'installation, l'opération et du service d'entretien de cet équipement devraient être pleinement familiers en ce qui concerne le contenu de ce manuel.

Before any installation work is performed, thoroughly read and understand the material in this instruction manual and the drawings furnished with the equipment. The documentation shipped with the equipment includes the Summary, Front View, Elementary Diagram, Connection Diagram and Instruction Book. This material is located in a forward compartment tagged "INSTRUCTIONS IN THIS COMPARTMENT." The documentation provides all of the information necessary for installation of the switchgear. When requesting information from the General Electric Company, include the complete data appearing on the equipment nameplate, requisition number, summary number, and elementary diagram number. The nameplate is located in the lower left, front corner of the lineup.

When requesting information concerning any specific item furnished with the switchgear, refer to that item by description, part number, its location within this manual, and any applicable drawing number. Any material external to the equipment, which may be required to meet local codes (such as mats, screens, railings, etc.), is not furnished by the General Electric Company.

If there are any questions or requirements not covered in this manual or in the accompanying drawings, please contact the local sales office of the General Electric Company.

1-2 Instruction Book Arrangement

Information and procedures in this instruction book are divided into Chapters as follows:

- **Chapter 1, Introduction,** gives a brief account of the equipment's function and provides for general information, and applicable data for the equipment and its components.
- **Chapter 2, Receiving, Handling and Storage,** describes procedures required for receiving and handling the equipment and how to prepare it for short- or long-term storage.
- **Chapter 3, Description,** describes the AKD-10 Low Voltage Switchgear and its various components. Included are the section enclosure, breaker compartment, circuit breakers, instrument panels and instrument compartments, bus bar arrangement, incoming cable and busway, ground and neutral bus, outdoor equipment, and auxiliary section. This section also explains how the electrical and mechanical components perform their assigned functions.
- **Chapter 4, Equipment Installation,** provides the information needed prior to installation, site location and foundation requirements, and how to anchor the equipment properly and safely. It also covers installation of peripheral equipment and includes information on electrical connections and mechanical construction.
- **Chapter 5, Installing and Removing Circuit Breakers,** gives a step-by-step procedure for lifting the breaker from the floor, installing it on drawout rails, and moving it into the connected position. A further procedure is given to withdraw a breaker, remove it from the drawout rails, and lower it to the floor. Also included is a description of the rejection system provided to avoid the inadvertent use of an incorrect breaker in a breaker compartment.
- **Chapter 6, Testing and Inspection,** reviews items which should be tested or inspected prior to energizing and operating the switchgear.
- **Chapter 7, Operating the Switchgear,** covers how to operate the breakers, and contains information concerning draw-out provisions, doors, and various accessories.
- **Chapter 8, Energizing the Switchgear,** outlines the steps to be taken before and during the electrical energization of the equipment.
- **Chapter 9, Maintaining the Switchgear,** provides instructions for all preventive maintenance, servicing, and lubrication information for the switchgear equipment. Included is service and maintenance data for the circuit breakers, instrument compartments, instruments, bus bar joints, and cable and busway connections. This section also includes paint refinishing requirements.
- **Appendices A through G,** contain information concerning screw and bolt torque values, circuit breaker ratings, rejection features, accessory device ratings, repetitive duty data, and fuse data.

1-3 Related Publications

Addendum's to this instruction book are the available service and maintenance publications supplied separately for circuit breakers, relays and other devices not described in this instruction book.

In addition to instruction books, the following drawings will be supplied as required for each order of AKD-10 switchgear equipment:

1. General arrangement drawings, including front view and floor plan.
2. Elementary and connection drawings (or wiring routing tables) which indicate and identify test and connection points including terminal blocks, device studs, switch contact developments, and remote connections.
3. Summary of switchgear equipment which is a list of all the components furnished with the switchgear, including the breakers, identified by catalog number.

These are all the documents necessary to install, operate, and maintain the equipment. One complete set of drawings and instruction books is shipped with the equipment.

Fig. 1-1. General Electric AKD-10 Low Voltage Switchgear

2-1 Receiving

Equipment Packages

Every package leaving the factory is plainly marked with the case number, requisition number, and customer's order number. If the equipment has been split for shipment, the section numbers of the equipment enclosed in each shipping package are identified.

NOTE: To avoid the loss of any parts when unpacking, the contents of each container should be carefully checked against the packing list before discarding the packing material.

NOTE: Le contenu de chaque conteneur devrait être soigneusement vérifié avec la liste d'emballage avant de décharger le matériel empaqueté, ceci dans le but d'éviter la perte de pièces lors du déballage.

The contents of each shipping package are listed on the Master Packing List. In addition, this list includes the number of the shipping crate in which miscellaneous parts needed to install and operate the equipment (such as hardware, contact lubricant, touch-up paint, breaker closing devices, etc.) are located. Normally, such devices are packed in a cardboard carton and the carton secured in an empty switchgear compartment. See Fig. 2-1. If such items are packed in a switchgear section instead of a separate crate, the list will indicate the appropriate section number in which they are stored. Large items (such as hoist dollies and hoist carriages used with indoor equipment) will always be shipped in separate crates or cartons. See Fig. 2-2.

Inspecting for Damage

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 equipment, immediately perform a visual inspection to ascertain if any damage has been sustained in shipping or if there are any loose parts.

Circuit breakers may be shipped separately in individual containers with the breaker in the open position. Circuit breakers should be unpacked and visually inspected for damage or loose parts as soon as possible after they have been received.

Be sure to inspect all devices mounted or packed inside compartments of each section to see if any have been dislodged or damaged.

Filing a Claim

If any damage is evident, or indication of rough handling is visible, file a claim for damage at once with the transportation company and notify the nearest General Electric Company Sales Office immediately. Information on damaged parts, part number, case number, requisition number, etc., should accompany the claim.

1. Spare compartment
2. Carton containing loose material
3. Shipping label listing contents of carton

Fig. 2-1. Packaging of loose material for shipment

Fig. 2-2. Carton containing breaker lifting device

2-2 Handling

NOTE: It is preferable to leave the shipping skids in place under the switchgear until it reaches its final location. The equipment should be installed in its final location prior to installing the circuit breakers.

NOTE: Il est préférable de laisser l'emballage d'expédition en place sous le dispositif de commutation jusqu'à ce qu'il atteigne son emplacement final. L'équipement devrait être installé à son emplacement final avant que ne soient installés les disjoncteur.

Lifting

The switchgear sections are best handled by lifting with a crane as shown in Fig. 2-3. Removable lifting plates are provided, as standard equipment, on the top of each switchgear section. To preserve the external appearance of the equipment, it is suggested that the lifting plates be left in place except where adjacent equipments must be bolted together, i.e. shipping splits, etc.

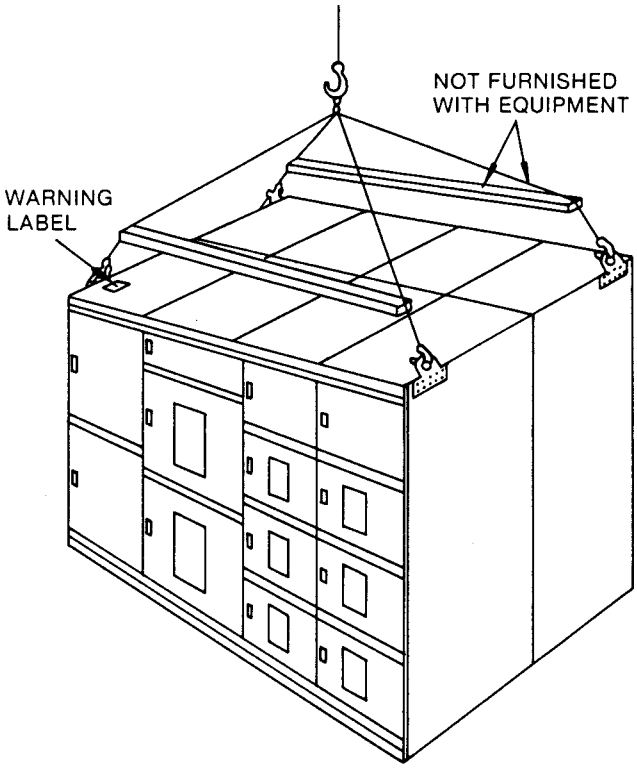
Utilize four equal length cables and an overhead crane, each with a minimum load rating of twice the weight of the switchgear. Estimated weights for shipping splits appear on the Front View drawings.

Example: Switchgear Section Weight = 5,000 pounds. The crane and the four lift cables must have a minimum load lifting capacity of 10,000 pounds.

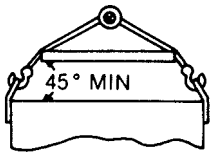
NOTE: The angle between the cables and the top of the equipment must be at least 45 degrees. If this is not possible because of lack of headspace, spreader bars must be used. Also, lift cables with greater load capability may be necessary, depending upon the angle between the cables and the crane hook.

NOTE: Il faut que l'angle entre les câbles et le haut de l'équipement soit d'au moins 45 degrés. Si cela est impossible à cause d'une insuffisance d'espace de dégagement, il faut utiliser des barres d'extension. Il se peut aussi que des câbles de levage ayant une capacité de poids supérieure soient nécessaires dépendant de l'angle entre les câbles et le crochet de la grue.

Connect a cable from the crane to the four lifting plates located on the top-front and rear of the switchgear (Fig. 2-3).

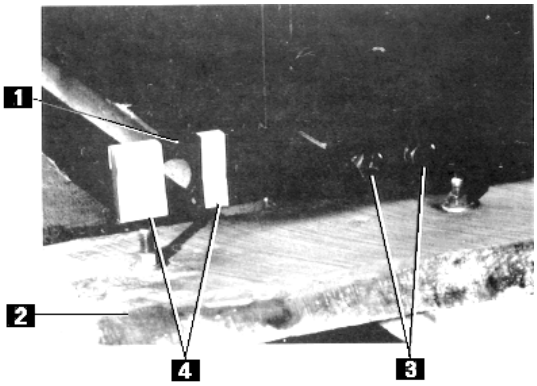


WARNING	ADVERTISSEMENT
WHEN LIFTING THIS EQUIPMENT, USE LIFTING HOLES PROVIDED. ANGLE OF SLING MUST NOT BE LESS THAN 45 DEGREES. IF HEAD SPACE IS INSUFFICIENT, USE A SPREADER BAR.	Lorsque cet équipement est levé, il faut utiliser les trous de levage qui sont fournis. Il ne fuat pas que l'angle d'élinguje soit de moins de 45 degrés. Si l'espace de dégagement est insuffisant utiliser une barre d'écartement.



THIS LABEL IS LOCATED
ON EACH CORNER BY
THE LIFTING HOLE

Fig. 2-3. Recommended method of lifting AKD-10 enclosure



1. Lifting plate
2. Shipping skid
3. Lifting plate mounting bolts
4. Yellow tape labeling (expendable material)

Fig. 2-4. Location of lifting plates on AKD-10 outdoor enclosure

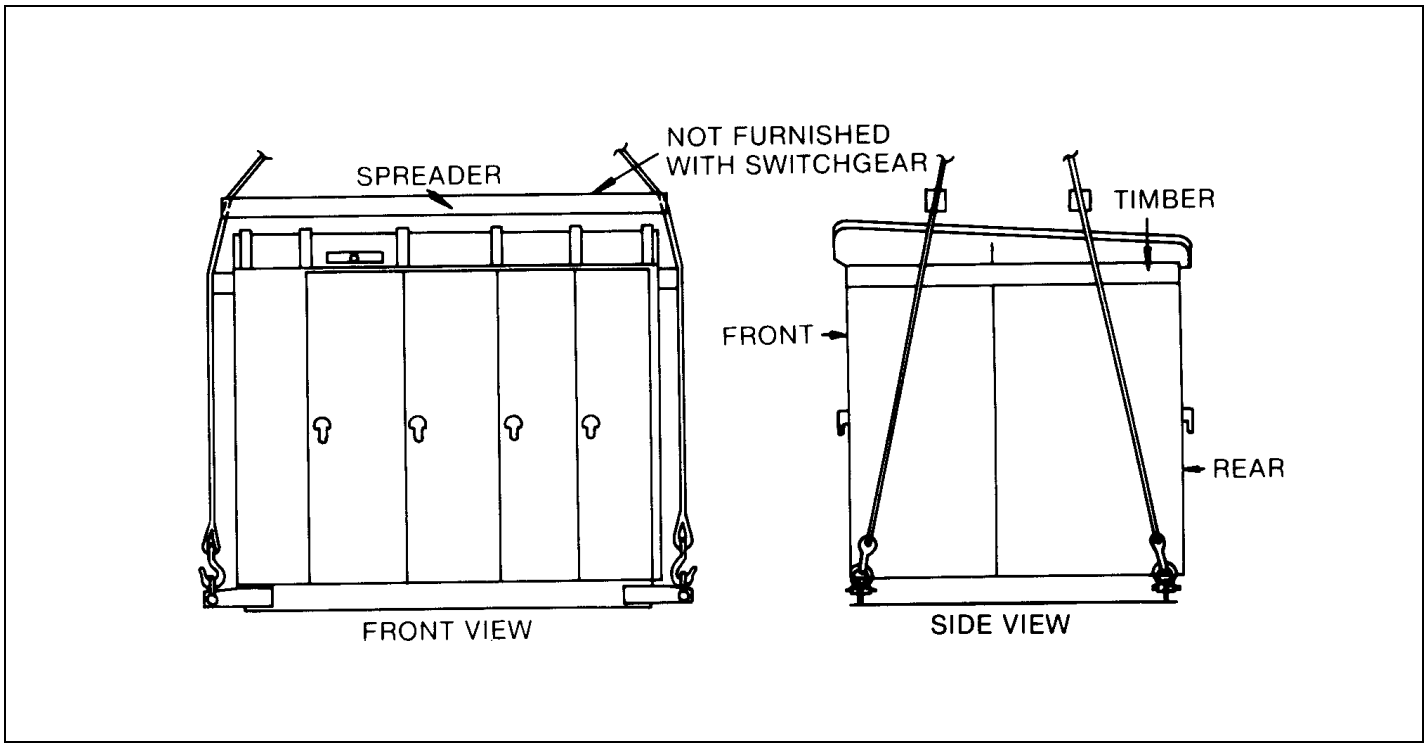


Fig. 2-5. Recommended method of lifting AKD-10 outdoor enclosure by crane using cable spreader

Take up the slack in the lifting device very carefully and manually stabilize the switchgear to prevent it from rotating.

WARNING: Do not stand under switchgear while it is being moved. Serious injury may occur if the cables or lifting device fail.

AVERTISSEMENT: Ne vous tenez pas sous le dispositif de commutation lorsqu'il est bougé. Des blessures graves peuvent survenir si les câbles ou l'appareil de levage tombent en panne.

CAUTION: Gently lower the switchgear section onto the level site location. If the switchgear is roughly handled or jarred, it is possible to damage or misalign internal components.

ATTENTION: Abaisser doucement la section du dispositif de commutation sur l'endroit d'installation nivelé. Une détérioration ou un désenlignement des composantes internes sont possibles si le dispositif de commutation est manipulé grossièrement ou soumis à des vibrations.

Methods of lifting outdoor switchgear sections are much the same as for indoor equipment except the lifting plates are provided at the base of the structure. See Fig. 2-4.

If lifting outdoor switchgear sections, side support timbers must be placed along the sides to prevent any damage that could be caused by the lifting cables. In addition, a spreader bar must be inserted between each lift cable, both front and rear, above the switchgear equipment as shown in Fig. 2-5. Proceed to lift and place the outdoor switchgear utilizing all the precautions and requirements that apply to lifting the indoor switchgear.

The lifting plates, Fig. 2-4, should be removed after the equipment is permanently anchored so passageways at the ends of the equipment will not be obstructed.

Rollers

If crane facilities are not available, the equipment may be moved into position by means of construction rollers placed under the shipping skids. The switchgear may be raised enough for the placement of rollers by means of a fork lift or jack.

There should never be less than four rollers under the equipment unless the line-up is less than five feet long. Use one roller for each 18 inches of equipment length.

Forklifts

When using a forklift to raise the line-up to position rollers underneath, proceed as follows:

1. Expand forklift tines to their maximum (widest) extension.
2. Carefully insert tines of forklift below one side of the switchgear line-up at the approximate center of the panel as shown in Fig. 2-6.

NOTE: Do not attempt to lift or move the equipment with a forklift positioned in the front or rear of the equipment.

NOTE: Ne pas essayer de lever ou bouger cette pièce d'équipement à l'aide d'un chariot élévateur placé à l'avant ou à l'amère de celle-ci.

3. Raise equipment and position one roller under the skids close to the raised end of the line-up.
4. Carefully lower the gear until it rests on the roller as shown in Fig. 2-7.
5. Repeat the lifting process at the other end and place the appropriate number of rollers under the skids spacing them evenly across the width of the line-up.

Fig. 2-6. Placing forklift tines under AKD-10 equipment shipping skid

Fig. 2-7. Placement of rollers under shipping skid

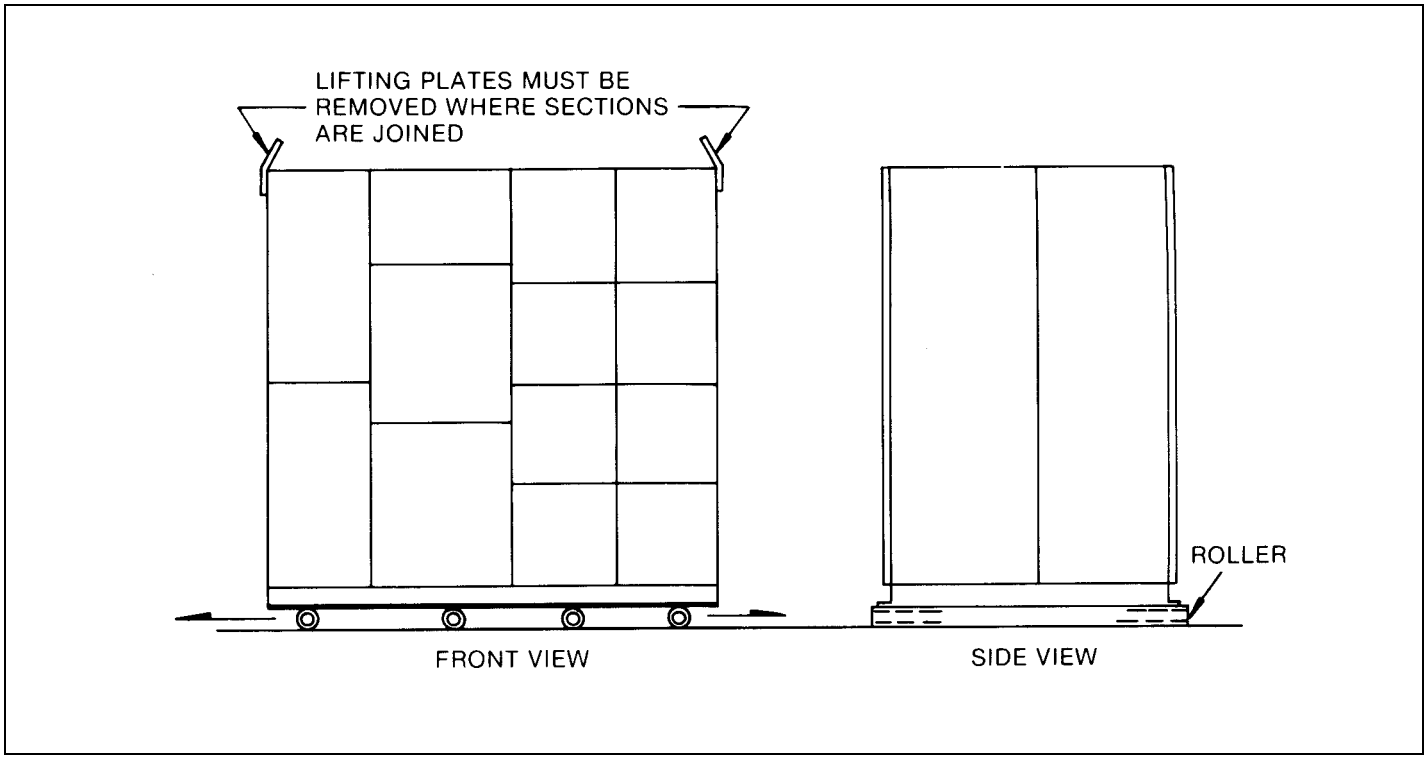


Fig. 2-8. Method of rolling equipment into place

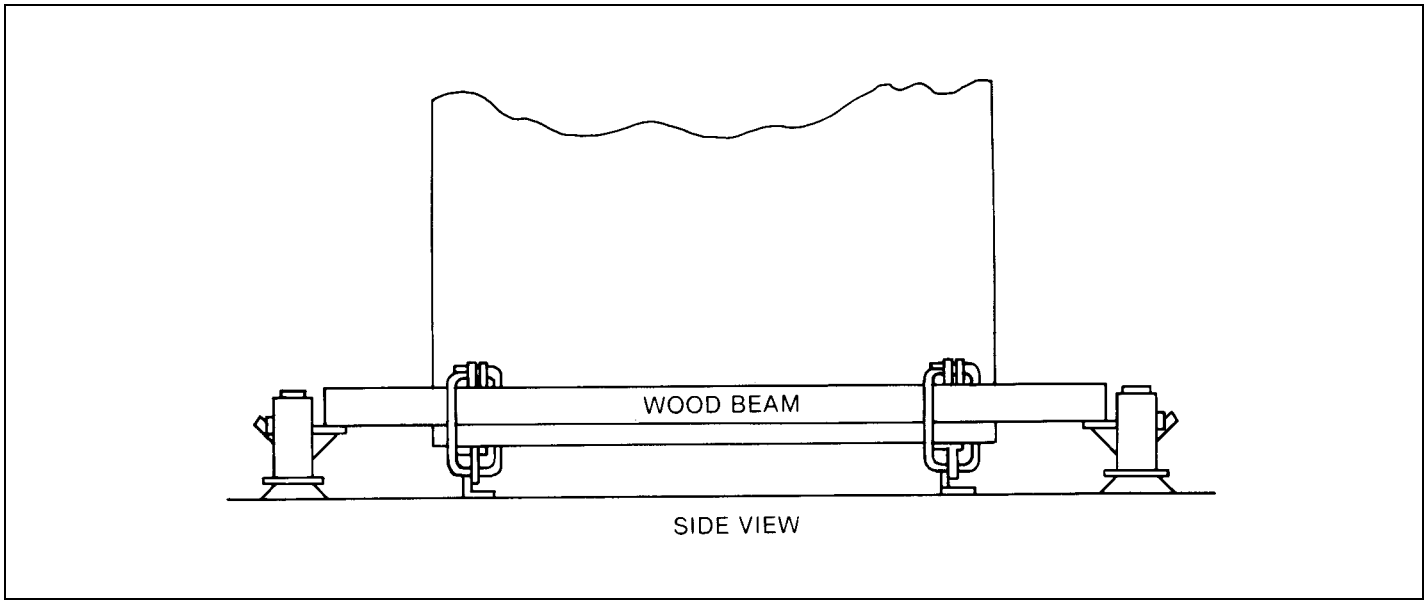


Fig. 2-9. Recommended method of jacking AKD-10 outdoor equipments

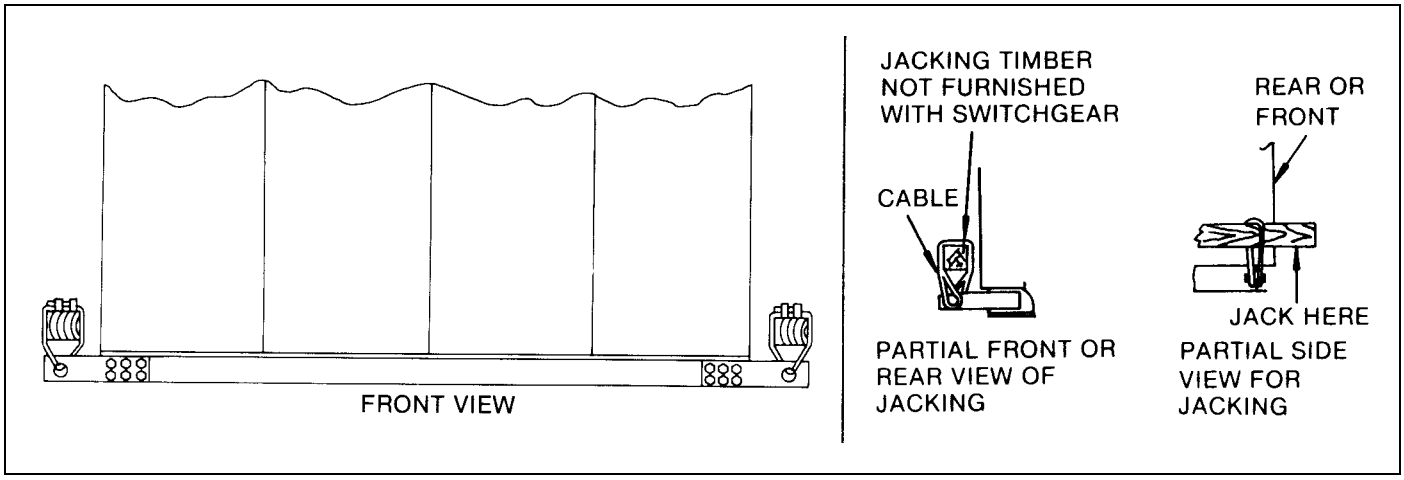


Fig. 2-10. Recommended method of jacking AKD-10 outdoor enclosure

6. Carefully lower the gear until it rests on the rollers (Fig. 2-7).

NOTE: If shipping skids are removed prior to final placement of equipment, rollers may only be used to move the equipment in a direction parallel to the front.

NOTE: Si l'emballage d'expédition a été enlevé avant que l'équipement ne soit rendu à son emplacement final, l'utilisation de rouleaux pour bouger l'équipement n'est permise qu'en direction parallèle à l'avant.

7. While carefully pushing the switchgear to its final site position, the rollers that are freed from the rear of the switchgear are then repositioned at the forward end. This procedure should be continued until the switchgear is in its final location. See Fig. 2-8.

8. When the switchgear is in its final position, remove all lug bolts holding the shipping skids to the switchgear line-up.

9. Insert the tines of the forklift at one end of the line-up, raise slightly, and remove the loose rollers.

10. Lower the end of the gear carefully to the floor.

11. Raise the other end of the line-up slightly and remove the remaining roller at that end.

Jacks

Jacks may be used in place of forklifts to raise and lower switchgear.

1. Place a jack under the front and rear corners of one end of the line-up. Figures 2-9 and 2-10 illustrate the use of jacks with outdoor equipment.

CAUTION: Do not place jacks in any other location other than the front and rear corners of the switchgear. Doing so may result in serious damage to the switchgear equipment.

ATTENTION: Il ne faut pas placer de vérins en aucun endroit autre que les coins avants et arrières du dispositif de commutation. L'équipement peut être sérieusement endommagé si l'on ne respecte pas cette directive.

2. Raise the switchgear evenly and just enough to position a roller beneath the equipment. Gently lower the switchgear onto the roller. Repeat the procedure at the opposite end of the switchgear, raising the gear far enough to place the appropriate number of rollers under the skids, spacing them evenly across the width of the line-up. Gently lower the gear onto the rollers.

3. While carefully pushing the switchgear to its final site position, the rollers that are freed from the rear of the switchgear are then repositioned at the forward end. This procedure should be continued until the switchgear is in its final location.

4. When the switchgear is in its final position, remove all lug bolts holding the shipping skids to the switchgear line-up.

5. Place one jack at each corner, front and rear, of the switchgear. Carefully raise the line-up evenly and remove the rollers and the shipping skids. Evenly lower the line-up to the floor and remove the jacks.

2-3 Storage

Switchgear

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

1. Remove protective covering. Check thoroughly for damage.

2. Store in a clean, dry, rodent-free location with moderate temperature and provide protective coverings to prevent dirt, water, or other foreign substances from entering the switchgear.

CAUTION: Remove all cartons, containers and any other miscellaneous packaging and packing material from inside the switchgear sections before energizing any internal heaters. To prevent fire, remove any plastic or poly-ethylene shrouding from the switchgear sections before energizing any internal heaters.

ATTENTION: Enlever tous les cartons, contenants et tout autre objet varié servant à l'emballage et au matériel d'emballage de l'intérieur des sections du dispositif de commutation avant de procéder à la mise sous tension de tout radiateur interne. Pour éviter un incendie, enlever tout résidu de plastique ou de polyéthylène des sections du dispositif de commutation avant de procéder à la mise sous tension de tous les radiateurs internes.

3. If dampness or condensation may be encountered in the storage location, heaters must be placed inside the switchgear sections to prevent moisture damage. Approximately 250 watts of heat in each section is required. Incandescent lamps may be used for this purpose. These lamps should be located in the bottom breaker compartment of each section and supported so the bulbs will not touch adjacent materials. On outdoor switchgear equipment, this may be accomplished by making a temporary power supply connection to the heaters already installed in the equipment.

CAUTION: If the space heaters are to be temporarily energized from external source, it is important to remove the fuses on the secondary side of the control power transformer. This precaution is to prevent a feed back of higher voltage to other portions of the equipment through the CPT primary.

ATTENTION: Il est important de retirer les fusibles du côté secondaire du contrôle du pouvoir du transformateur si les espaces des radiateurs doivent être temporairement mis sous tension par une source externe. Cette précaution prévient une rétroaction d'un voltage supérieur à d'autres portions de l'équipement par le contrôle de pouvoir du transformateur primaire.

Circuit Breakers

If circuit breakers are not to be placed into service at once, remove them from their shipping cartons and thoroughly inspect them for damage. If the breakers are in satisfactory condition, replace the breakers in their shipping cartons for storage. Do not remove the circuit breaker shipping members at this time.

Store the circuit breakers in a clean, dry location in an upright position. They 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 the circuit breakers are ready to be installed. A plastic or canvas-type cover should be provided to reduce the possibility of damage to the breakers due to dust and water.

3-1 General

This section contains a description of the General Electric AKD-10 Low Voltage Switchgear. It also describes the functions of the electrical and mechanical systems.

Figure 3-1 is a side view of a typical section showing compartmentation.

3-2 Summary Description

General Electric AKD-10 Low Voltage Switchgear is a freestanding assembly of metal-enclosed sections containing low-voltage power circuit breakers, bus bars, cable termination provisions, auxiliary power circuit protective devices, controls, and instrumentation. It may also be an integral part of a load center unit substation, either single-ended or double-ended.

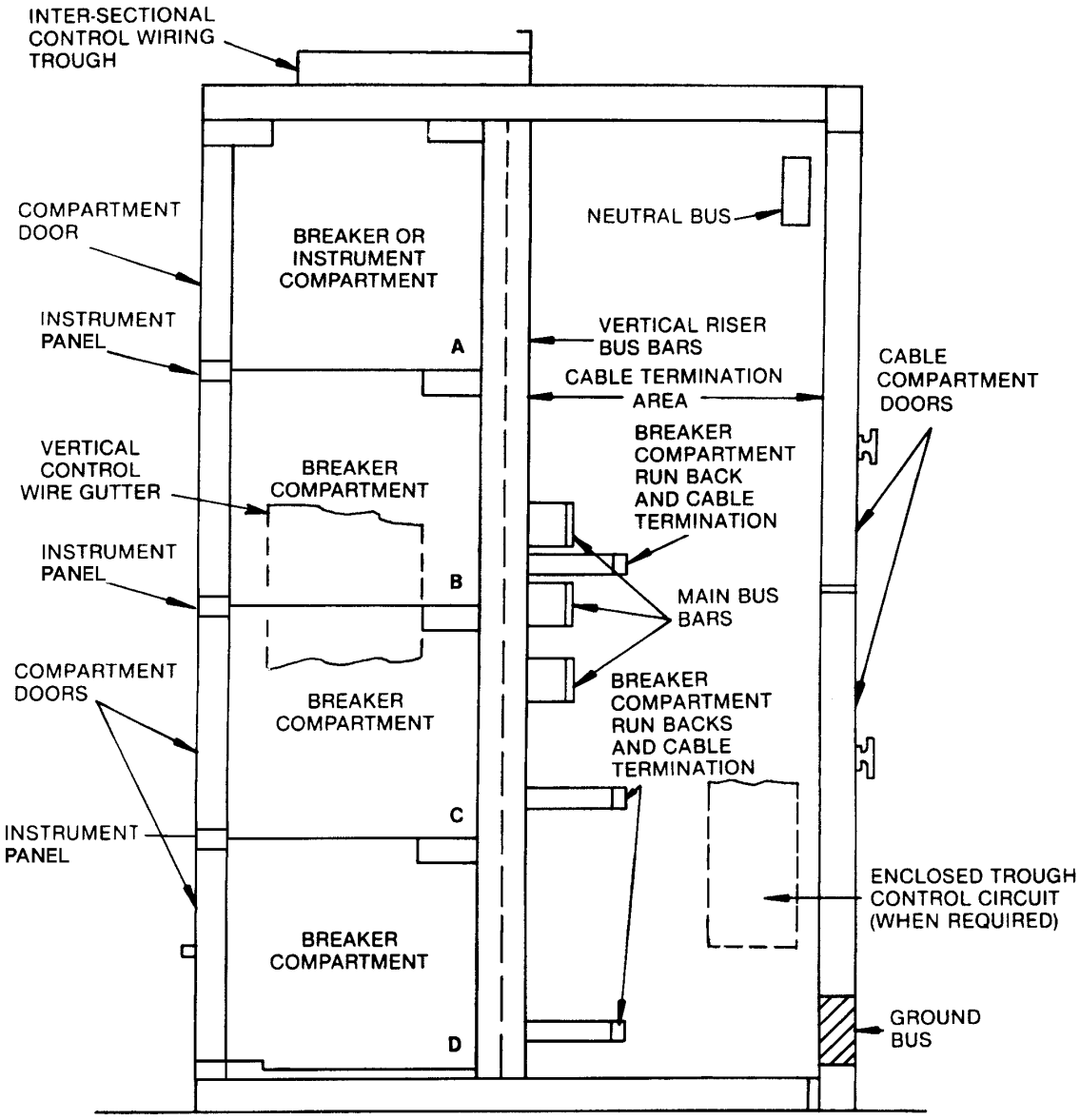


Fig. 3-1. Side-view section of AKD-10 Switchgear

All of the primary circuit switching and protective devices, secondary control and metering devices, control fuses, and instrument transformers are mounted in the enclosure. The breaker compartments include drawout rails, stationary breaker contacts, interlocks, and necessary control and indicating devices. The breakers are provided with self-aligning primary and secondary disconnecting contacts, breaker locking mechanism, and integral trip unit. The individual sections, compartments, and devices are described in the following paragraphs.

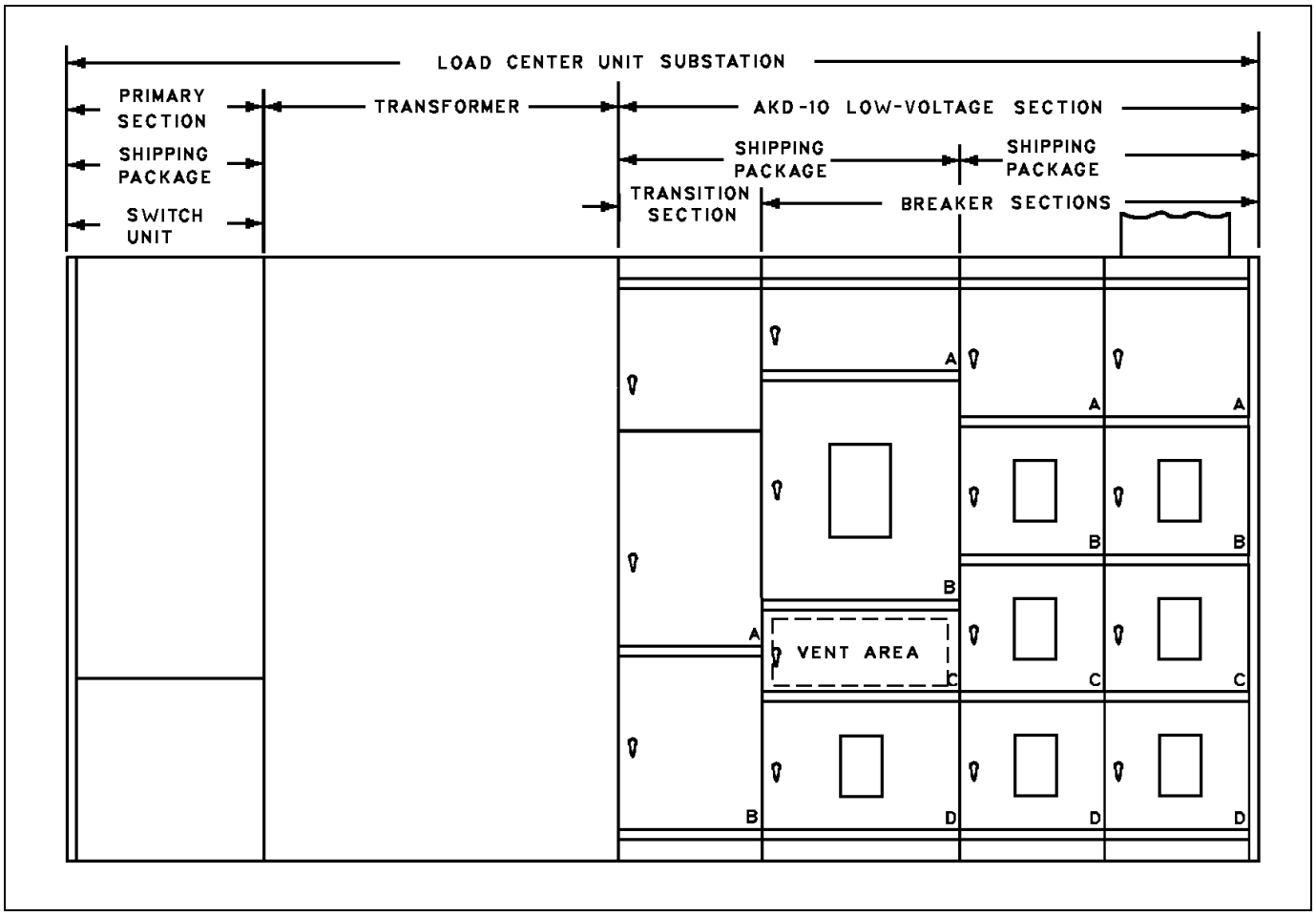


Fig. 3-2. Outline of a typical AKD-10 Load Center Unit Substation

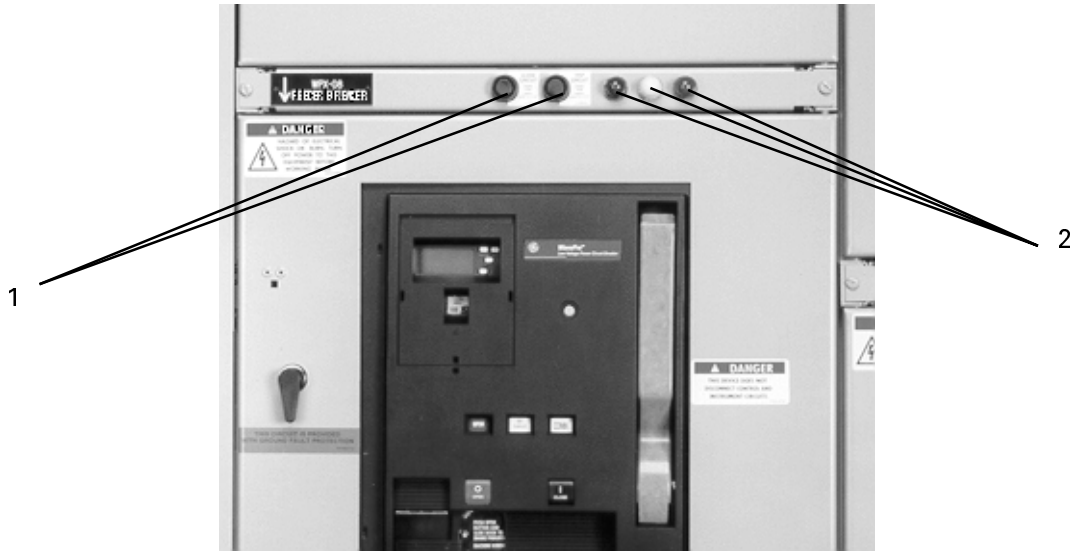
Figure 3-2 is an outline of a typical single-ended load center unit substation illustrating the nomenclature used for all equipment.

3-3 -Compartment Area

The front enclosure of each section is divided into individual compartments. These compartments house either a low-voltage power circuit breaker or are used to mount instruments, control components and other ancillary devices.

3-4 Instrument Panel

A standard instrument panel, Fig. 3-3, is located above each breaker compartment eliminating cross-hinge wiring. When required, optional devices may be included and mounted on the front face of the panel such as breaker control circuit fuses, pilot lights and test switches.



1. Control circuit fuses
2. Pilot lights

Fig. 3-3. Instrument panel

Fuses for the close and trip circuits of the electrically operated breakers are mounted on the panel. Routine wiring inspections and fuse checks or fuse replacements can be performed with the breaker compartment door in the closed position so that operators are protected from the energized primary circuits.

An instrument compartment with an internal hinged panel, Fig. 3-4, is available as a standard feature. These panels can be used to mount instruments and other devices associated with the switchgear metering, monitoring and control.

Relays, fuse cutouts and similar devices may be installed in the compartment behind the swing-out instrument panel or in adjacent compartments.

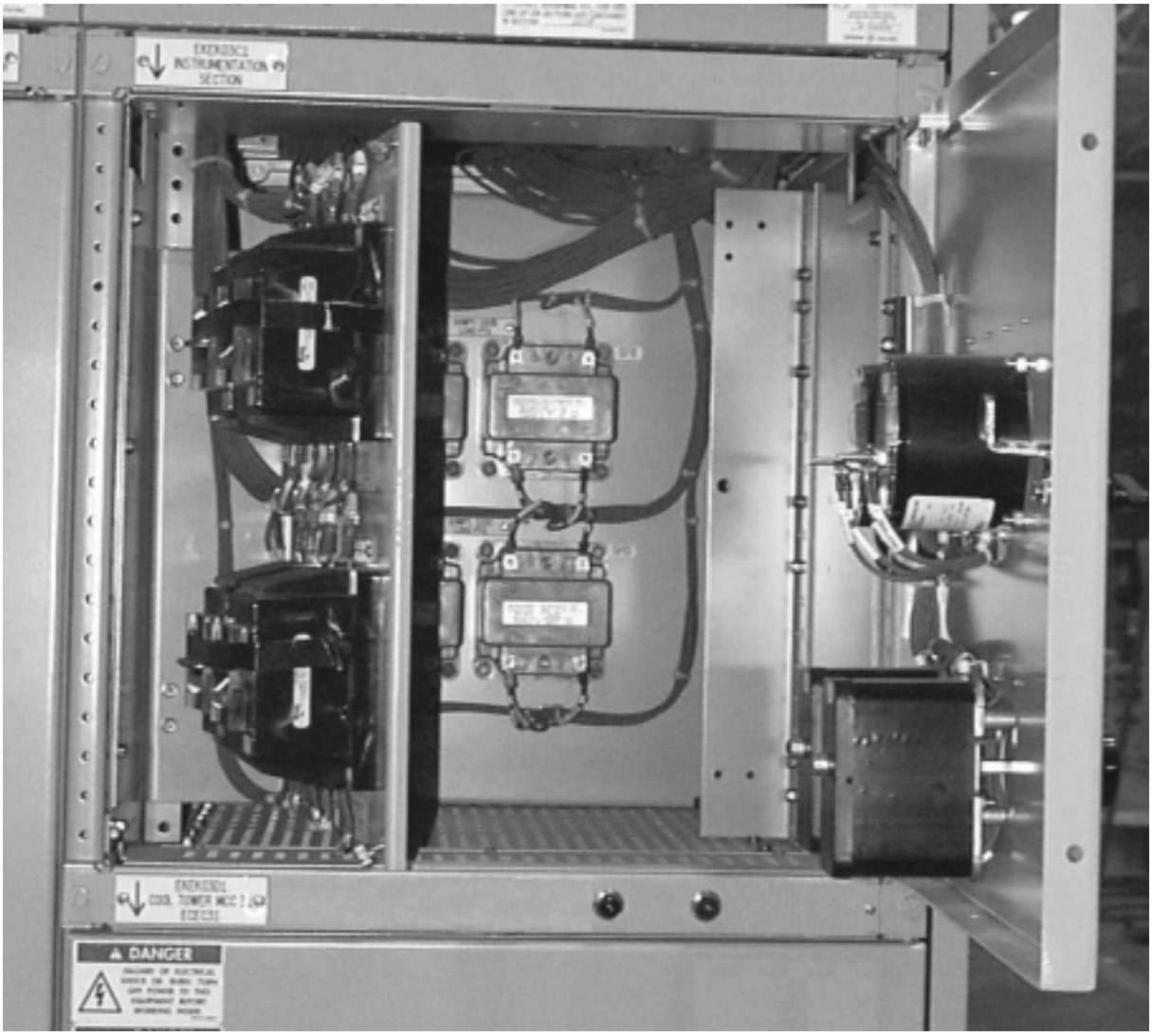
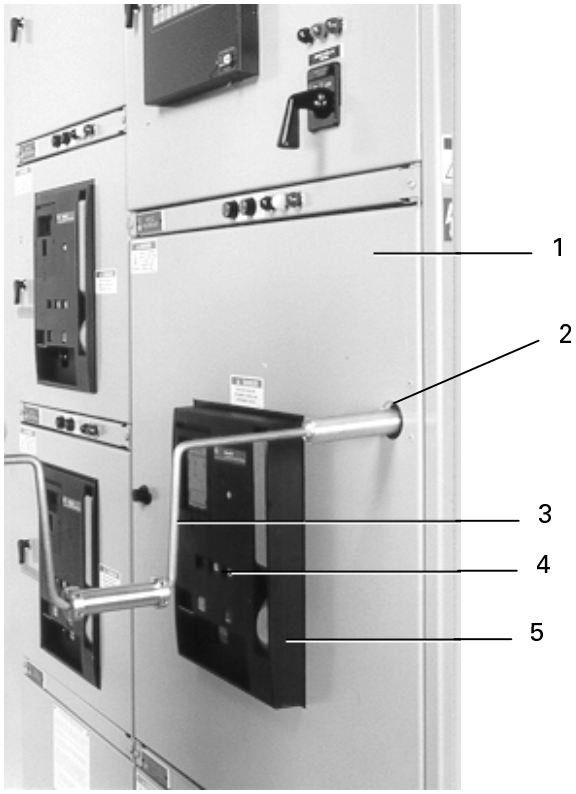


Fig. 3-4. Instrument compartment with internal hinged panel

3-5 Breaker Compartment

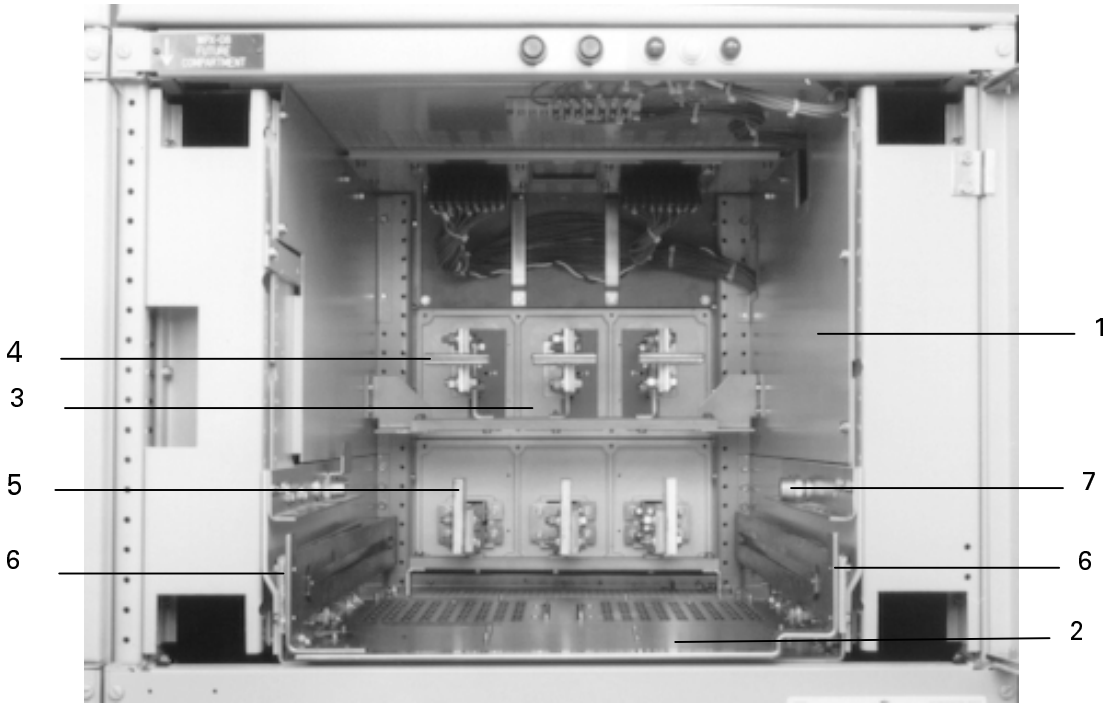
Closed-door drawout circuit breaker compartments, Fig. 3-5, are standard construction with all AKD-10 switchgear equipment. The circuit breaker compartment doors remain closed and latched while the breaker is racked out from the connected position, through test, to the disconnected position.

Breaker compartment doors do not have any ventilation slots, thus protecting operators from hot ionized gases which may be vented by the breaker during circuit interruption. Additionally, the breaker compartment, Fig. 3-6, is enclosed by grounded steel barriers on the top, sides, bottom, and front. In the back, a flame-retardant, track resistant, glass-filled polyester base minimizes the possibility of fault communication between compartments or to the bus.



1. Compartment door
2. Access port to racking mechanism
3. Racking crank
4. Breaker position indicator
5. Circuit breaker escutcheon

Fig. 3-5. WavePro circuit breaker compartment



1. Side barrier
2. Bottom barrier
3. Rear base/barrier
4. Primary disconnects – line
5. Primary disconnects -- load
6. Drawout rails
7. Racking anchor pins

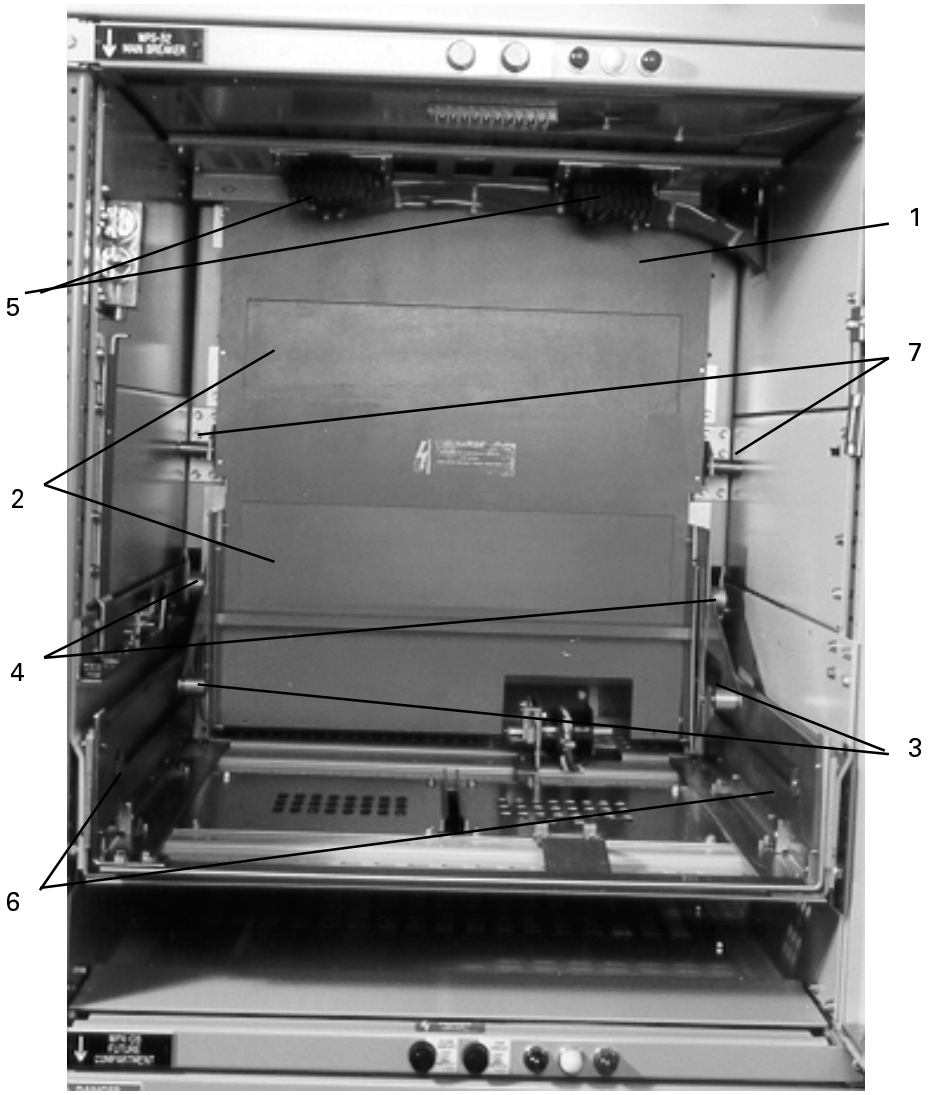
Fig. 3-6. Circuit breaker compartment (22-inch) showing drawout rails for WP-08/16/20 breakers (22-inch wide cubicle shown mounted in 30-inch wide frame)

Primary disconnect shutters, Figs. 3-7 and 3-8, are available as options to provide protection against contact with the energized stationary primary disconnects when the breaker is removed from its compartment. Shutters are supplied as standard components in the main and tie breaker compartments of double-ended substations. The shutters are constructed from glass-reinforced polyester insulating material.

NOTE: If a fuse rollout (FRE) carriage is used with a WPS-32/40/50 circuit breaker whose compartment is equipped with shutters, the FRE compartment will also be equipped with shutters.

NOTE: Si on utilise un chariot porte-fusibles à roulettes avec un disjoncteur WPS-32/40/50 dont les compartiments sont munis de volets, le compartiment du porte-fusible à roulettes sera aussimuni de volets.

Referring to Fig. 3-7, the combination of the stationary barrier (1) and the shutters (movable barriers) prevent frontal access to the primary disconnect line and load power stabs.



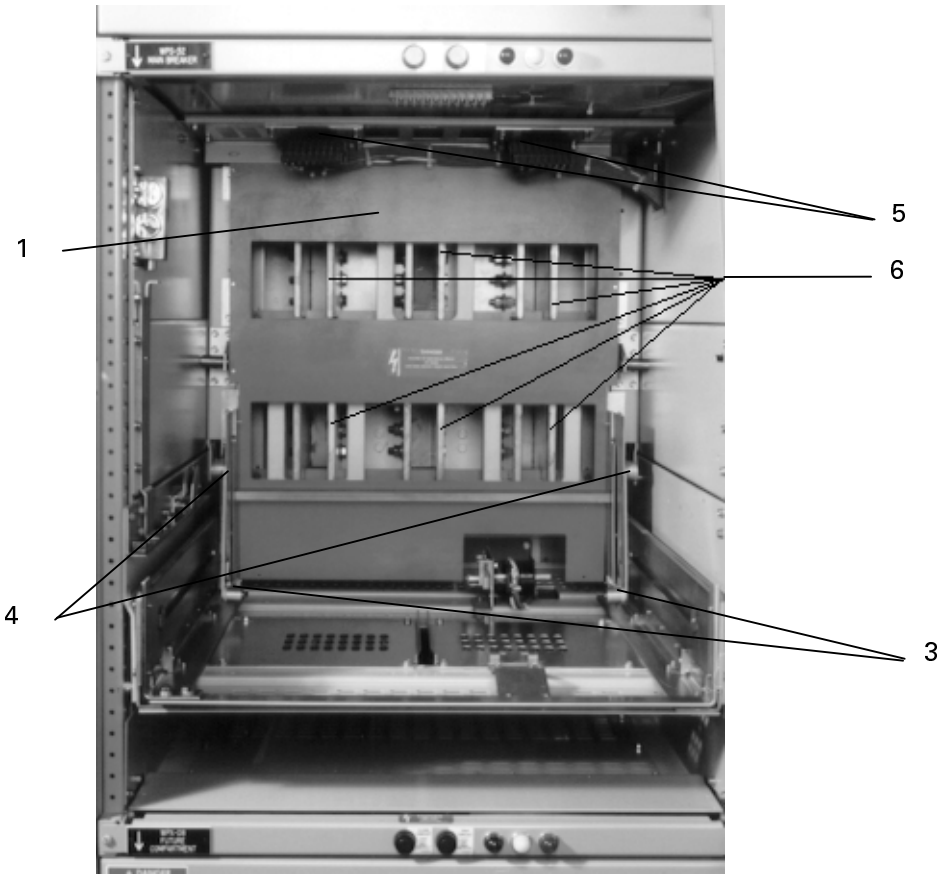
1. Stationary barrier
2. Shutters (retractable barrier)
3. Operating lever
4. Operating lever springs
5. Secondary disconnects
6. Drawout rails
7. Racking anchor pins

Fig. 3-7. AKD-10 primary disconnect shutter assembly (30-inch wide compartment) for WP-32/40 breakers and fuse carriages (30-inch wide compartment) - shutters manually retracted

The shutters are partially retracted when the breaker is in the Disconnect Position. As the circuit breaker is racked from the Disconnect Position to the Test Position the rear of the circuit breaker frame depresses the shutter operating lever (3) to cause the shutters to fully retract. The operating lever springs (4) cause the operating lever (3) to remain in contact with the circuit breaker frame during operation. As the breaker is racked from the Test Position to the Connected Position, the shutters remain fully retracted.

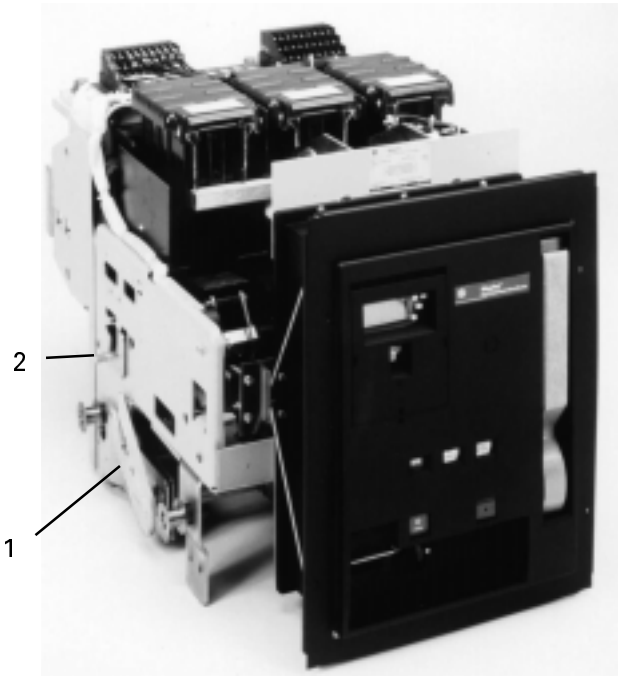
Figure 3-8 also shows the shutter assembly with the shutters manually retracted to show the location of the primary disconnect stabs (6) behind the shutter assembly.

Circuit breakers mounted in 22-inch wide compartments (WP-08, WP-16, WP-20.) are supported on drawout rails (6), Fig. 3-6. Larger WP-32 and WP-40 circuit breakers and fuse rollout carriages are installed in 30-inch wide compartments and are supported on drawout rails (6), Fig. 3-7. The WP-50 circuit breaker is installed in a 38-inch wide compartment and is supported on drawout rails.



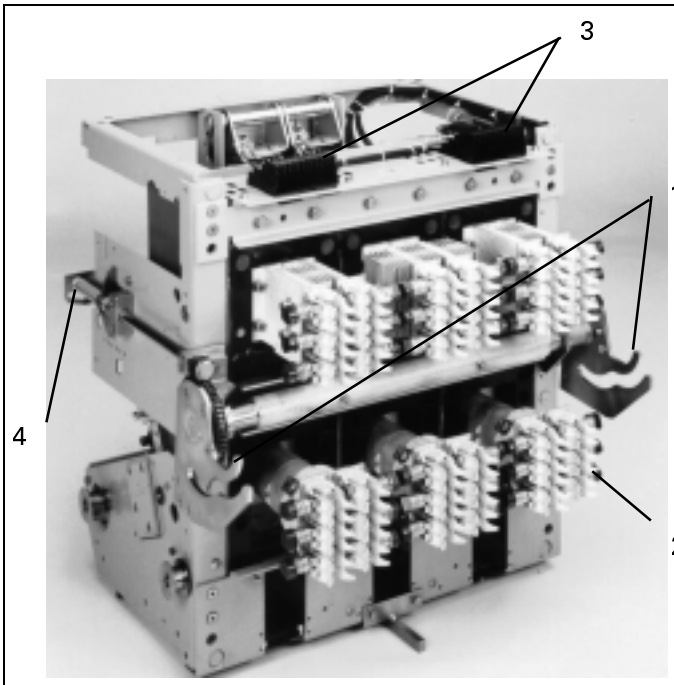
1. Stationary barrier
2. Shutters (not visible in retracted position)
3. Operating lever
4. Operating lever springs
5. Secondary disconnects
6. Primary disconnect stabs

Fig. 3-8. AKD-10 primary disconnect shutter assembly (30-inch wide compartment). Shutters manually retracted.



1. Racking arm
2. Drawout interlock

Fig. 3-9. WPX-08 circuit breaker



1. Racking arms
2. Primary disconnects
3. Secondary disconnects
4. Racking screw

Fig. 3-10. WPS-40 circuit breaker (rear view)

Note that extra items shown in Figs. 3-6, 3-7, and 3-8 (such as secondary disconnects, current transformers, position switches) may appear in any compartment or not be included at all, depending on the equipment specified. Primary disconnects are equipped with short-circuit braces when breakers are fused or when extra-deep breaker compartments are used.

The breaker racking arm slots engage fixed racking anchor pins (7), Fig. 3-7, mounted in the breaker compartment. As the racking arms are rotated by operation of the breaker racking crank, the breaker is pulled into the compartment, and locked in its final connected position.

A breaker should always be OPEN when it is moved into or out of the CONNECTED position. As a safeguard, drawout interlock (2), Fig. 3-9, will cause the breaker to open before the primary disconnects lose contact if a closed breaker is moved out of the CONNECTED position.

All WavePro circuit breakers of the same type and rating may be interchanged, provided the breaker accessories have the same ratings.

Each breaker compartment has four positions as described below:

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

2. TEST POSITION-The secondary contacts are made, but the primary contacts are not made. Any breaker test which requires control power may be made in this position.

3. DISCONNECTED POSITION-All primary power and secondary control electrical circuits between the breaker and the equipment are disconnected. The door may be closed. The breaker may be stored in this position with the door closed.

4. WITHDRAWN POSITION-The breaker is completely out of its compartment ready for removal from the equipment. The door must be open. The optional primary disconnect shutters, positioned in front of the primary stabs, would be closed with the breaker in the withdrawn position.

1. Racking crank
2. Breaker position indicator

Fig. 3-11. Racking crank for movement of WP-32, WP-40 and WP-50 breakers

Movement of the breaker between the connected, test, and disconnected positions is performed by the use of a racking crank which engages the racking mechanism mounted on the breaker. See Fig. 3-11. Movement to the withdrawn position is manually performed after opening the compartment door. These positions are illustrated and described more fully in Chapter 5 of this instruction book.

CAUTION: The door should not be opened when the circuit breaker is closed and in the connected position. Although the breaker compartment door may be opened in any position, it is recommended that the door only be opened when the breaker is in the disconnected or withdrawn position.

ATTENTION: Il ne faut pas que la porte soit ouverte lorsque le disjoncteur est fermé et branché. Bien que la porte du compartiment du disjoncteur puisse être ouverte lorsque le disjoncteur est en n'importe quelle position, il est préférable que la porte ne soit ouverte que lorsque le disjoncteur est en position débranchée ou retirée.

3-6 Circuit Breakers

The General Electric WavePro™ Low Voltage Power Circuit Breaker includes spring-operated, stored energy, close and trip mechanisms for either manual or electrical operation.

Six General Electric WavePro™ Circuit Breakers form the complete family of breakers used in the AKD-10 switchgear. These circuit breakers range from 800 to 5000 ampere frame size and are built with the following ratings and characteristics:

WPS/WPH/WPX-08 Circuit Breaker (Fig. 3-13)

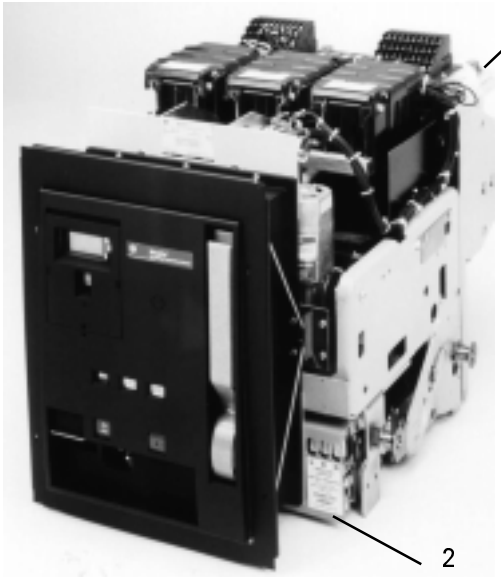
- 800-ampere frame size
- Standard 30,000-ampere interrupting and short-time capability (480 volts)
- Four-high stacking, 22-inch wide sections
- Increased IC and short-time rating 42,000 amperes (WPH-08) or 65,000 amperes (WPX-08) at 480 volts

WPF-08 Fused Circuit Breaker

- 800-ampere frame size
- 300- through 1600-ampere integral fusing
- 200,000-ampere interrupting rating
- Four-high stacking, 22-inch wide sections

Fig. 3-13. WPS-08 circuit breaker (electrically operated)

Fig. 3-12. WPS-08 circuit breaker (manually operated)



1. Fuses mounted on primary line stabs
2. Open fuse lockout device

Fig. 3-14. WPF-16 integrally fused circuit breaker

WPS/WPH-16 Circuit Breaker

- 1600-ampere frame size
- Standard 50,000-ampere interrupting and short-time capability at 480 volts
- Four-high stacking, 22-inch wide sections
- Increased IC and short time rating 65,000-ampere at 480 volts (WPH-16)

WPF-16 Fused Circuit Breaker (Fig. 3-14)

- 1600-ampere frame size
- 450- through 2500-ampere integral fusing
- 200,000-ampere interrupting rating
- Four-high stacking, 22-inch wide sections

WPS-20 Circuit Breaker

- 2000-ampere frame size
- Standard 65,000-ampere interrupting and short-time capability at 480 volts
- Three-high stacking, 22-inch wide sections (See DET-196)

WPS/WPH -32 Circuit Breaker (Fig. 3-15)

- 3200-ampere frame size
- Standard 65,000-ampere interrupting and short-time capability at 480 volts
- 30-inch wide sections, Two-high stacking in 38-inch wide sections
- Increased IC and short-time rating 85,000 amperes at 480 volts (WPH-32)

WPS-40 Circuit Breaker

- 4000-ampere frame size
- Standard 85,000-ampere interrupting and short-time capability at 480 volts
- 30-inch wide sections, Two-high stacking in 38-inch wide sections

Fig. 3-15. WPS-32 circuit breaker (manually operated)

WPS-50 Circuit Breaker

- 5000-ampere frame size, fan cooled
- Standard 85,000-ampere interrupting and short-time capability at 480 volts
- One-high stacking, 38-inch wide sections

3-7 Fuse Rollout Elements

When the system available short-circuit current exceeds the rating of a WPS-20, WPS-32 -40 or -50 breaker, current-limiting fuses can be used in series with the breaker to increase the short-circuit rating of the combination to 200,000 amps. When used, such fuses are housed in a separate drawout compartment located adjacent to the breaker compartment; they are mounted on a drawout carriage similar to a breaker frame and referred to as a fuse rollout element (FRE).

WPS-32 Rollout Carriage (Fig. 3-16)

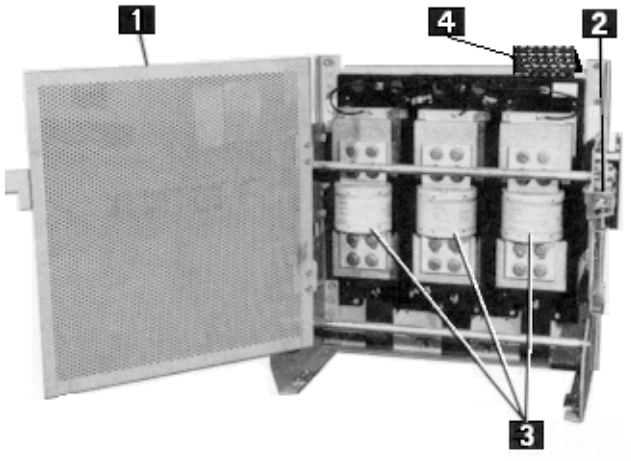
- 3200-ampere rating
- 200,000-ampere interrupting rating
- Accepts 2000- through 4000-ampere fusing
- Also used for WPS-20 breaker

WPS-40 Rollout Carriage

- 4000-ampere frame size
- 200,000-ampere interrupting rating
- Accepts 2000- through 5000-ampere fusing

WPS-50 Rollout Carriage

- 5000-ampere frame size
- 200,000-ampere interrupting rating
- Accepts 2000- through 5000-ampere fusing



1. Protective hinged screen
2. Racking mechanism
3. Fuses
4. Secondary disconnects

Fig. 3-16. Fuse roll-out carriage

3-8 Compartments for Future Breakers

When specified, compartments may be supplied for future addition of circuit breaker elements. These compartments are fully equipped with drawout rails, primary disconnects, and ancillary devices as required (i.e. secondary disconnects, accessory devices, etc.) The opening in the breaker compartment door (3), Fig. 3-17, is closed with a bolted-on steel plate (2) to deter accidental contact with energized electrical circuits.(i.e. primary disconnect stabs).

3-9 Auxiliary/Transition Sections

Sections may be provided for any one or more of several reasons including:

- Transition to a close-coupled transformer
- Transition to "match and line-up" with existing non AKD-8/AKD-10 switchgear
- Incoming cable or busway when a main breaker section is not provided
- Mounting and wiring of additional metering, relaying, and control devices requiring more space than available in a standard instrument panel or instrumentation compartment (transition or auxiliary)
- Mounting and wiring of purchaser specified and/or furnished devices (i.e. utility revenue metering equipment, etc.) (auxiliary)

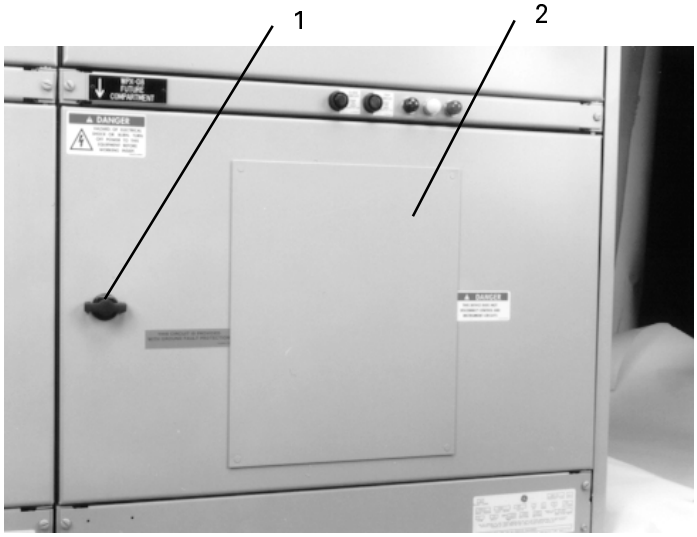
Auxiliary sections may be 22-inch, 30-inch, or 38-inch wide as required to accommodate the space requirements. The compartment doors on the front of the sections are hinged and latched in the same manner as breaker compartment doors.

Generally, transition sections will be 22-inches wide for close-coupling to transformers and "match and line-up" to non-GE equipments. Transition section width to an indoor AKD-5 or -6 equipment is usually twelve inches. No transition is required to indoor or outdoor AKD-8 equipments.

Power company metering requirements generally require either a 38-inch or 49-inch wide auxiliary section to accommodate the current transformers, kilowatt-hour meters, demand meters, etc. as required by their individual practices, tariff schedules, and/or regulatory commissions.

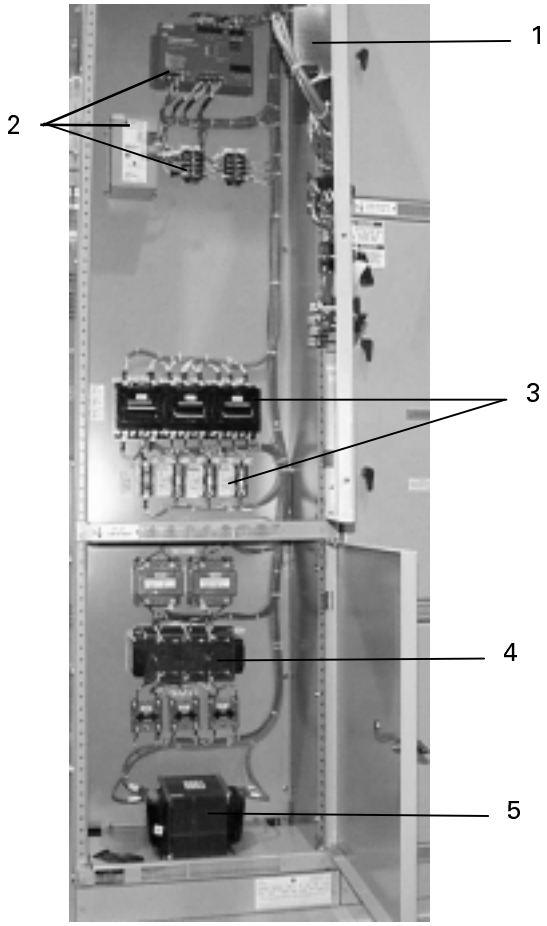
Figure 3-18 is a front view of a typical auxiliary/ transition section.

Protection, instrumentation and control devices are located in the top compartment (1), Fig. 3-18, and potential transformers (4) and a control power transformer (5) in the lower compartment.



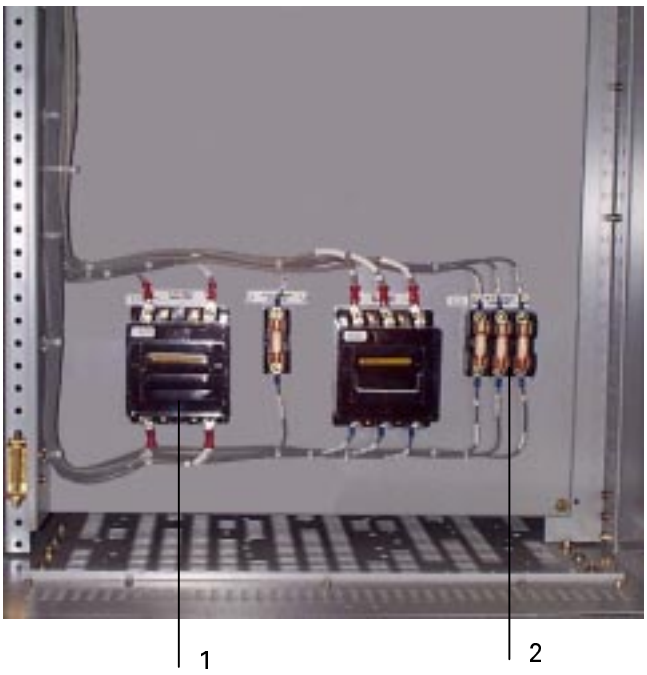
1. Quarter-turn latch
2. Steel plate (future breaker cubicle)
3. Compartment door

Fig. 3-17. Future breaker compartment



1. Instrument compartment
2. Power management equipment
3. Primary and secondary fuses
4. Potential transformer
5. Control power transformer

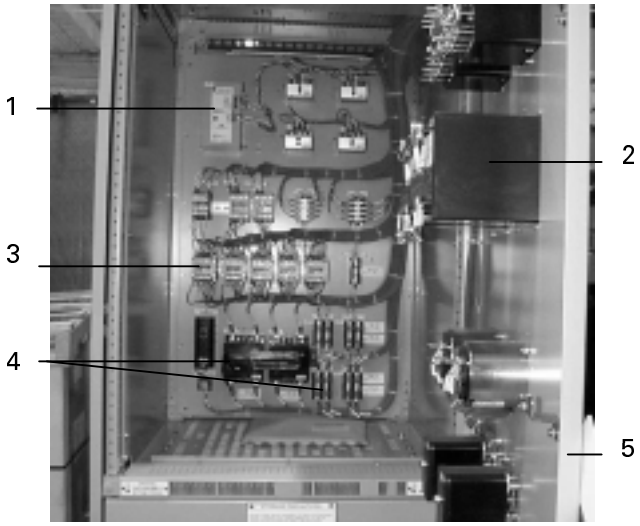
Fig. 3-18. Auxiliary/transition section - partial front view



1. Enclosed fuse block
2. Open fuse block

Fig. 3-19. Auxiliary/transition compartments - primary and secondary circuit fusing

Figure 3-20 illustrates an auxiliary/transition compartment with switchgear-type relays mounted in semi-flush draw-out cases (2) installed on the compartment door (1). Space in the compartment has been used for power management components and other control devices.

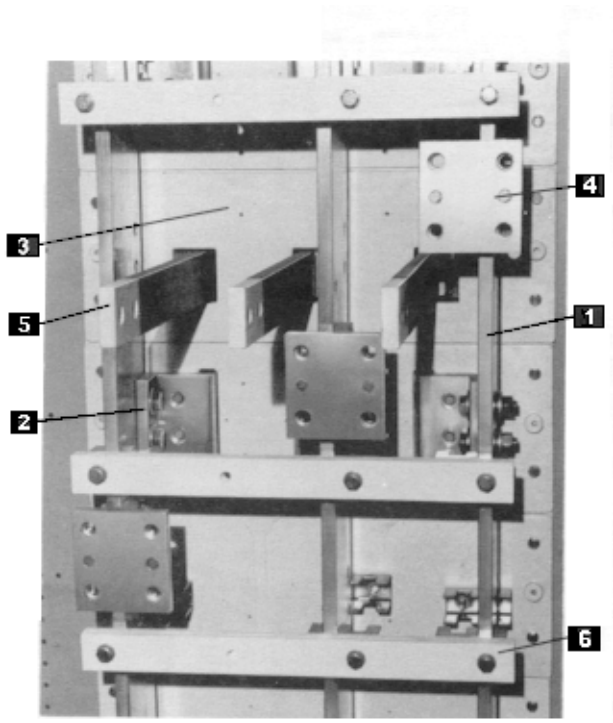


1. Power supply
2. Relays in draw-out cases
3. Auxiliary relays
4. Fuse blocks
5. Compartment door

Fig. 3-20. Auxiliary/transition compartments view of top section

3-10 Bus Area

The bus area, Fig. 3-21, contains the main horizontal bus and vertical riser bus bars (1) for the particular section. The vertical bus bars are supported at the breaker run-ins (2) which are bolted to the molded bases (3) that form the rear wall of the breaker compartment. The horizontal bus bars are supported by the power connectors (4) which are bolted to the vertical bus bars. All bolted supports and connections are accessible from the rear for maintenance. The bus area is fully isolated from the breaker, instrument and auxiliary compartments by the molded bases or glass polyester sheet.



1 Vertical riser bus
2. Run-ins to breaker compartment
3. Molded base
4. Power Connector
5. Run-backs from breaker compartment
6. Short-circuit brace

Fig. 3-21. Bus construction

Busing System

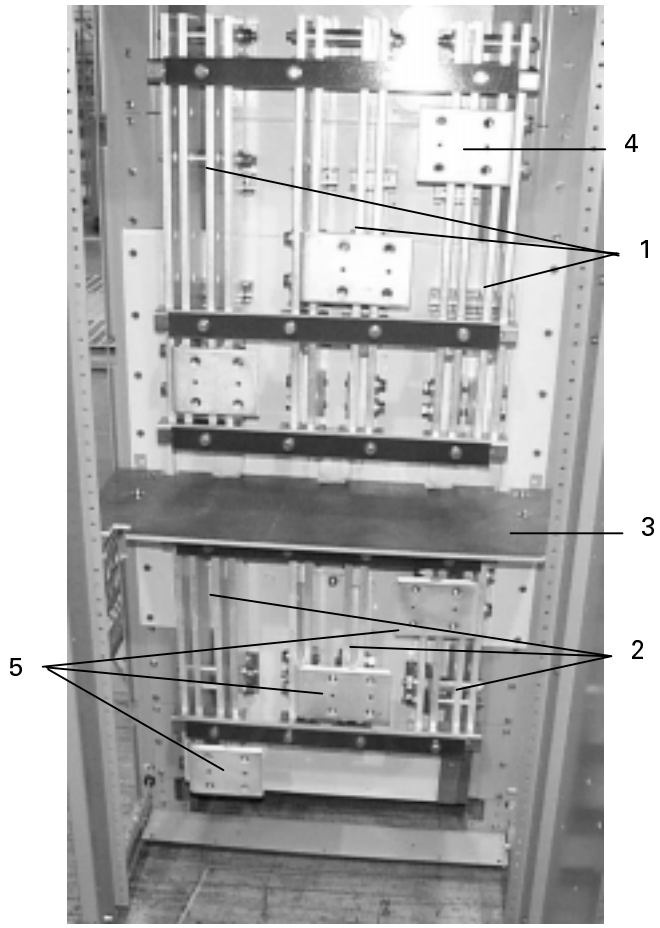
Bus bars are fully tin-plated copper with bolted joints. The standard construction is open bus. A barrier system (Bus compartmentation) that isolates the main and vertical bus bars from the cable area is available as an option. All run-backs (load-side power conductors) from the breaker compartment to the cable termination area are covered with non-PVC insulated tubing.

The typical arrangement is shown in Fig. 3-22.

The standard bracing is 65,000 amperes, RMS symmetrical. Bracing for 100,000, 150,000 and 200,000 amperes, RMS symmetrical is available as an option.

In general, when the switchgear equipment has no more than four sections or does not exceed 10 feet in length, it will be shipped as one complete lineup. In such cases, the only field assembly would be to a close-coupled transformer if, the switchgear were part of a Load Center Unit Substation. If, because of shipping and/or handling considerations, the equipment cannot be handled in one piece, it can be split into two or more shipping sections at the factory. The individual shipping splits require both mechanical and electrical connections between sections to be made in the field. At these shipping splits, provisions are made for bolting all buses and making the necessary electrical and mechanical connections. These are described in Chapter 4 of this publication.

On main and tie breakers, the bus area, Fig. 3-22, is divided into an upper (1) and lower (2) section by a glass reinforced polyester isolation barrier (3). For typical unit substation main circuit breakers, the upper section contains the incoming line bus (4). The lower section of the bus area contains the load side main bus (5) (protected by the main breaker) which feeds all sections of the switchgear equipment. Similarly, barriers at tie breakers isolate the two main bus sections from each other.



1. Upper section vertical bus-incoming line
2. Lower section vertical bus-load side
3. Barrier between upper and lower vertical bus sections
4. Incoming bus connections
5. Main horizontal bus connections

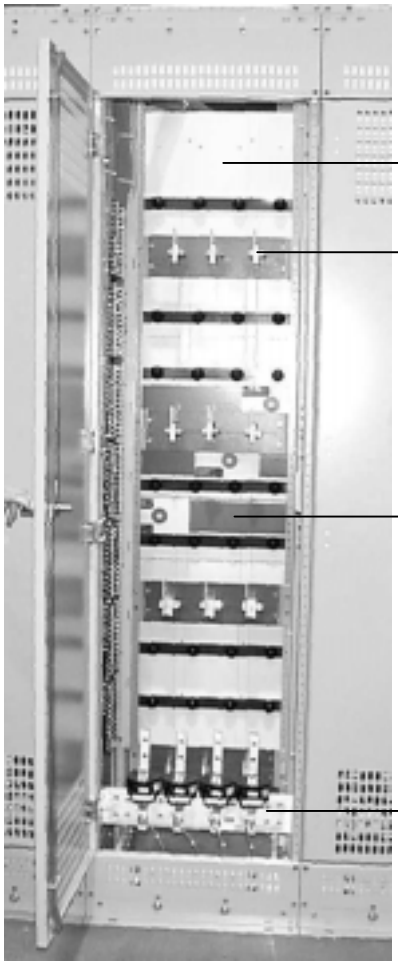
Fig. 3-22. Main breaker bus arrangement

Insulated/Isolated Bus System

A bus insulation system, Fig. 3-23, that fully insulates and isolates each phase of the horizontal main bus and isolates each phase of the vertical bus, is optionally available for AKD-10 switchgear when specified. With the INSULATED/-ISOLATED BUS system, there are no live connections accessible in the rear of each section except the cable lugs.

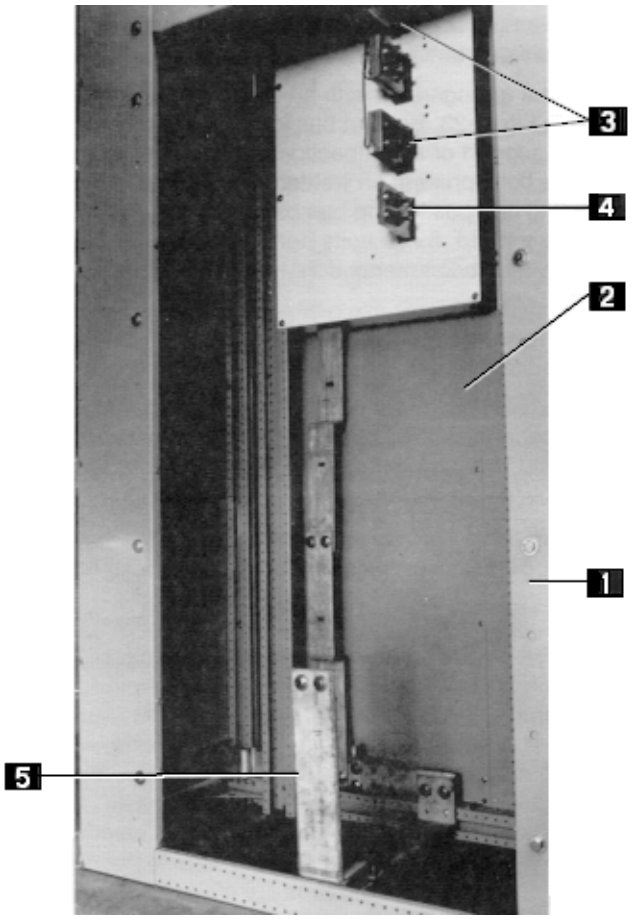
A vertical barrier (2), Fig. 3-24, between the transition section (1) and the first breaker section is always furnished.

The buswork in the device/auxiliary/transition sections is not insulated at the termination points to the other connected equipments such as transformers, busway, or existing equipments.



1. Vertical riser bus covers
2. Run-backs to feeder cables
3. Horizontal main bus
4. Lower neutral bus with 4th wire sensors

Fig. 3-23. Insulated/Isolated-Bus system

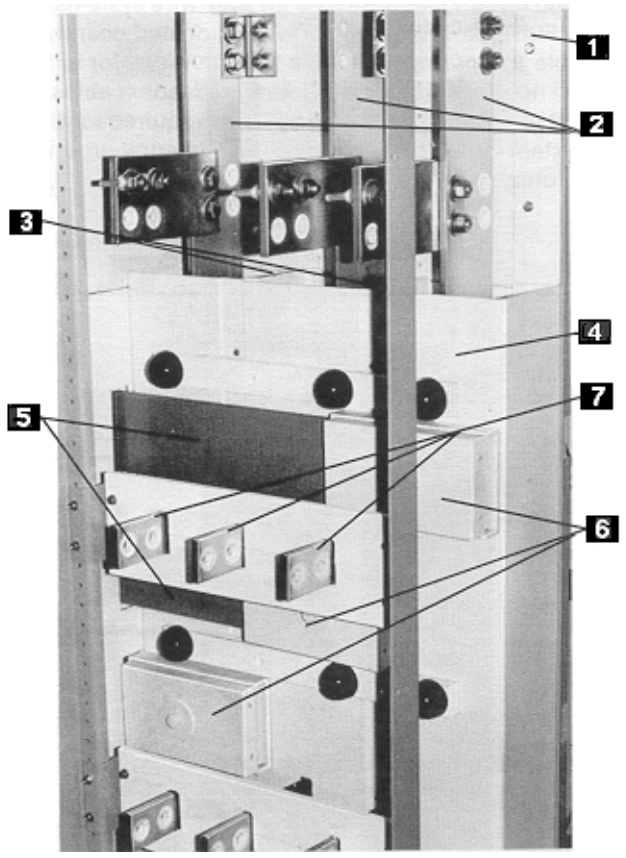


1. Transition compartment
2. Barrier
3. Main incoming bus
4. Neutral bus
5. Ground bus

Fig. 3-24. Transition section

Insulation and isolation of the vertical riser bus bars (2), Fig. 3-25, is provided by installing phase isolation barriers (3) between the bus bars and by mounting covers (4) over the bus bars. (The top portion of the vertical bus is shown with the cover removed.)

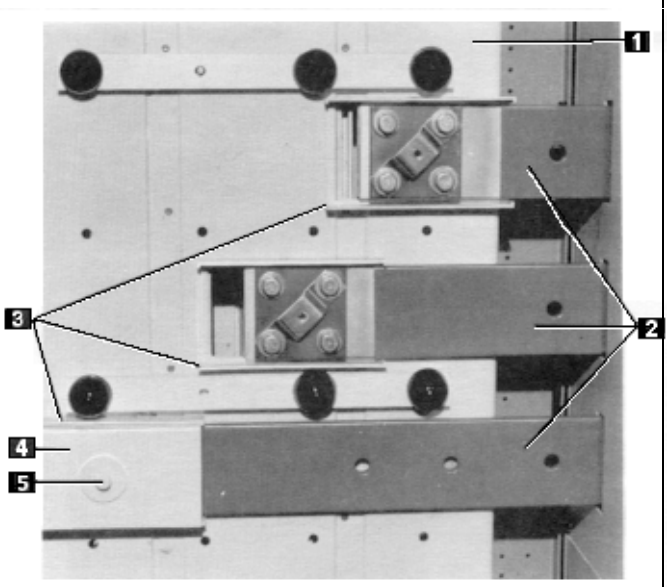
The phase isolation barriers and riser bus covers are constructed from insulating material. Insulation of the horizontal main bus bars (5) is achieved by an oven cured coating of epoxy.



1. Molded base
2. Vertical riser buses (cover removed to show bus location)
3. Phase isolation barriers (See Figure 3-23, Item 6)
4. Covers over riser bus
5. Insulated horizontal main buses
6. Covers for vertical/horizontal bus joints
7. Insulated run backs

Fig. 3-25. Insul-Bar insulation/isolation bus system

Figure 3-26 illustrates the various components comprising the insulation/isolation system for the horizontal main bus bars. The horizontal bus bars (2) are insulated with an epoxy coating applied by a fluidized bed process. The vertical/ horizontal bus bar joints are covered with collars (3) and caps (4) held in place with nylon thumb screws (5). The collars and caps are constructed from insulating material.



1. Vertical bus barrier
2. Insulated bus bar (powder coated)
3. Joint collars
4. Joint caps
5. Nylon thumb screws

Fig. 3-26. Insul-bar horizontal bus insulation system

3-11 Feeder Cable and Busway Compartment

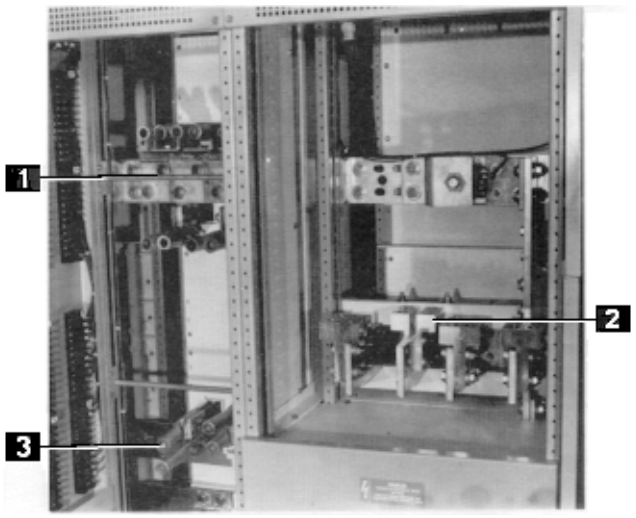
The rear cable and terminal compartment, Fig. 3-27, provides for cable installation and terminations. The cable bending space meets the requirements of the 1996 National Electric Code. Various arrangements of single or double cable terminals are provided, depending upon the purchaser's requirements.

When specified, racks (1), Fig. 3-27, for the support of feeder cables are located in the cable compartment. The actual support of the cables is provided by lashing them to these racks.

Also located in the cable compartments are provisions for terminating control wires between external devices and control circuits within the switchgear equipments.

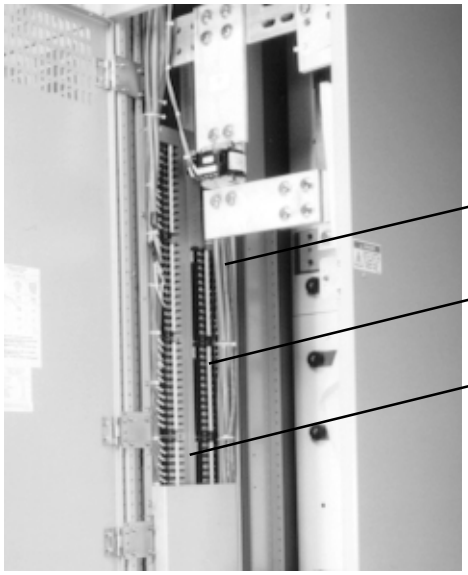
See Fig. 3-28. When furnished, the terminal boards (2), Fig. 3-28, for such connections are located in an enclosed vertical wiring trough mounted on the side of the cable compartment. The trough is of steel construction with bolted covers to provide an isolation barrier between the control wiring (1) and the adjacent power cables.

A neutral bus, insulated from ground, is provided in the bus area on switchgear designed for four-wire systems. As shown in Fig. 3-29, the neutral bus (1) is located near the top of the cable compartment. It includes provisions for terminating the neutral conductor of four-wire feeder cables and also direct mounting of the neutral CT as required for those feeder system circuit breakers having an integral groundfault trip function.



1. Support rack for customer's feeder cables
2. Cable lugs - mechanical type
3. Cable lugs - compression type

Fig. 3-27. Cable termination provisions

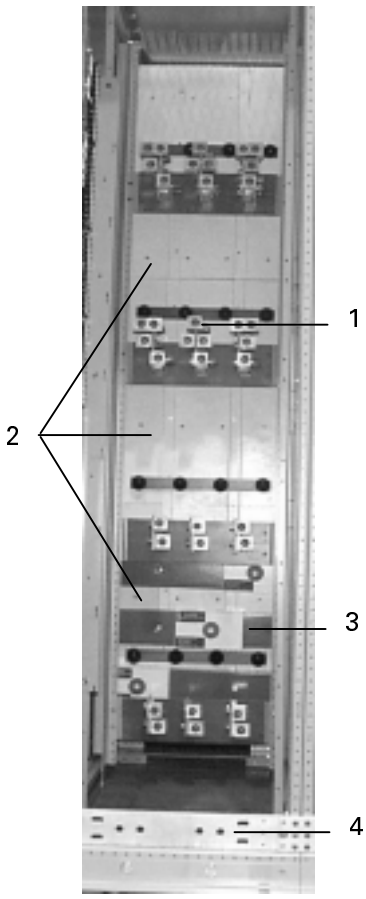


1. Internal equipment control wiring
2. Terminal boards
3. Space for purchaser's field control wiring

Fig. 3-28. Control wiring termination trough

3-12 Ground Bus

All General Electric AKD-10 switchgear sections are grounded to the internal equipment ground bus (4), Fig. 3-29, located at the bottom of the cable compartment.



1. Feeder runbacks
2. Vertical riser bus covers
3. Horizontal main bus
4. Ground bus

Fig. 3-29. Cable termination compartment

3-13 AKD-10 Outdoor Switchgear

AKD-10 switchgear designed for outdoor installations is fully weatherproofed. See Fig. 3-30 and 3-31. A weather-proof housing completely encloses the switchgear and may be provided with a walk-in front aisle for easy access to all controls and instruments.

Aisle lighting with wall switch (2), Fig. 3-31 and a 115-volt GFCI convenience outlet (4) are standard devices supplied with front aisle, outdoor switchgear equipments. Also included in the walk-in front aisle area are the breaker lifting device and storage provision for the hoist operating crank (2) Fig. 3-30. A double-wide door with panic latch (1) is provided for breaker loading.

1. Panic latch
2. Hoist operating crank
3. Walk-in aisle - 46 inches deep (approx.)

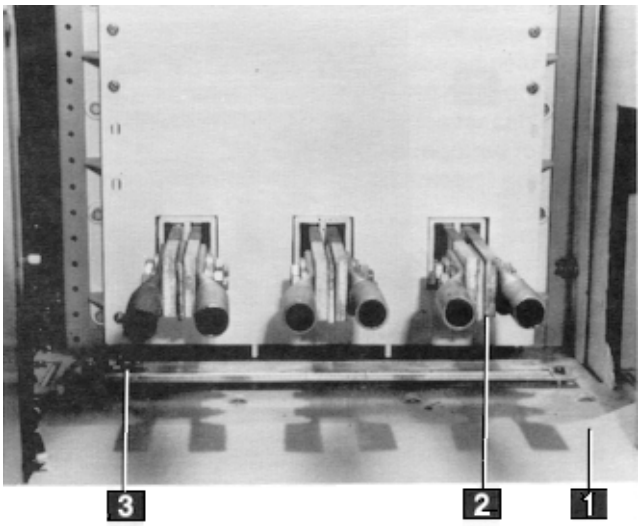
Fig. 3-30. AKD-10 Switchgear outdoor enclosure

Space heaters (3), Fig. 3-32 are provided as standard equipment. They provide protection against condensation of moisture that could, in combination with air-borne contaminants, deteriorate insulation or cause corrosion. One 1000-watt, 240-volt, operating at 120V (250-watts) ac heater is located on the floor of the bus compartment of each outdoor switchgear section. The heaters should be energized at all times to prevent condensation within the switchgear.

1. Interior lighting switch
2. GFCI convenience outlet
3. Breaker lifting device crank

Fig. 3-31. Outdoor enclosure accessories

Heaters are fed by the control power transformer. The on-off control switch (3), Fig. 3-31, is located in the walk-in front aisle.



1. Rear cable compartment floor (Standard on outdoor - Optional on indoor)
2. Runbacks and cable lugs
3. Space heater

Fig. 3-32. Location of space heater

AKD-10 outdoor switchgear may also be provided without the walk-in front aisle. Non-walk-in outdoor equipment is not equipped with an overhead breaker lifting hoist. A portable hoist, available as an optional accessory, is used for lifting the WavePro breakers.

4-1 General

This chapter contains complete instructions for installing General Electric AKD-10 Low-voltage Switchgear.

CAUTION: Personnel installing this equipment must be thoroughly familiar with this instruction manual and all articles of the National Electrical Code applicable to the installation of this switchgear. In addition, all drawings, both mechanical installation and electrical, must be understood and strictly followed to prevent damage to the switchgear or equipment being protected by the switchgear.

ATTENTION: La ou les personnes procédant à l'installation de cet équipement doivent être tout à fait familier avec ce livre d'instruction ainsi que tous les articles du Code national d'électricité s'appliquant à l'installation de ce dispositif de commutation. De plus, tous les dessins se rapportant tant à l'installation mécanique qu'électrique doivent être compris et suivis à la lettre afin de prévenir des dommages au dispositif de commutation ou à l'équipement protégé par celui-ci.

NOTE: Before installation work is started, it is important to review all of the drawings provided, including the General Electric equipment arrangement drawings, site installation drawings, elementary and remote connection drawings, mechanical connection drawings, and the summary of equipment list.

NOTE: Il est important de reviser tous les dessins fournis, incluant les dessins de disposition de l'équipement de General Electric, les dessins d'installation du site, les dessins de raccords élémentaires et à distance, les dessins de raccords mécaniques et le sommaire de la liste d'équipement avant que ne débutent les travaux d'installation.

All expendable hardware for shipping purposes only, is painted yellow or tagged with yellow adhesive tape (as shown in Fig. 2-4) and may be discarded at completion of the installation phase.

Site Location

In general, the location of the switchgear equipment will have been predetermined during the specification and/or procurement of equipment phases. Indoor locations within buildings impose certain requirements which must be met so that the switchgear may operate efficiently with a minimum of maintenance.

In locating the AKD-10 Switchgear, adequate aisle space must be provided at the front and rear of the equipment to ensure proper ventilation of the equipment and to allow service and maintenance of the equipment with the front and rear doors open. The recommended aisle space is shown on the floor plan supplied with the equipment drawings.

The switchgear equipment should be placed in an area where clean, dry air is free to circulate around and above it. Since air is taken into the equipment at the bottom of each section and exhausted at the top, a location with good air flow must be provided for efficient operation. A minimum of 30 inches of clear space above the equipment is recommended.

Foundation Requirements

For optimum performance of your General Electric switchgear equipment, the foundation requirements expressed in this chapter should be strictly adhered to.

NOTE: The foundation for the outdoor switchgear must provide proper drainage of ground and/or surface water accumulations away from the equipment.

NOTE: La fondation du dispositif de commutation situé à l'intérieur doit être en mesure de drainer correctement les accumulations d'eau du sol et de surface loin de l'équipement.

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

The foundation must be flat and level in all planes. Refer to Figure 4-1 for definition of flat and level.

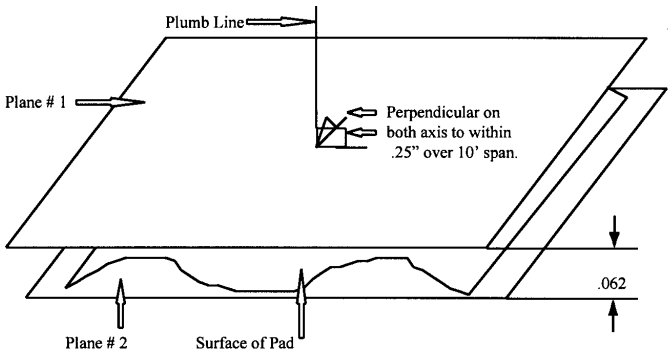


Fig. 4-1. Definition of flat and level

Foundation Preparation

Indoor Equipment

Refer to Fig. 4-2 along with the owner's foundation construction drawings, and the General Electric supplemental installation drawings. Although the indoor switchgear equipment can be mounted directly on a smooth, level floor, it is recommended that recessed steel channels be installed for supporting the equipment. Anchor bolts and channels are to be provided by the purchaser.

NOTE: When the equipment is installed on a surface subject to impact (shock) loads due to operating conditions or environmental seismic (earthquake) conditions, the anchor bolts should be fabricated of medium carbon steel (grade 5 load rating).

NOTE: Lorsque l'équipement est installé sur une surface sujette à des charges d'impact (choc) causées par les conditions d'opération ou des séismes environnementaux (tremblements de terre), les boulons d'ancrage devraient être fabriqués d'acier à moyenne teneur en carbone (spécification de charge classe 5).

The floor channels under the front and rear switchgear anchor points (see Fig. 4-2) should be embedded in a level concrete slab with their top surfaces flush with the finished floor. It is essential that these steel channels be level and aligned with each other prior to final anchoring, to prevent distortion of the switchgear structure, to assure proper mechanical and electrical connections between shipping splits, and to assure proper interfacing to other close-coupled equipments.

AKD-10 Switchgear and Load Center Substations are frequently mounted on steel floors and/or structural steel in industrial installations (such as a mezzanine) to minimize usage of production floor space. Regardless of the type of mounting surface, the requirements for a smooth level surface remain.

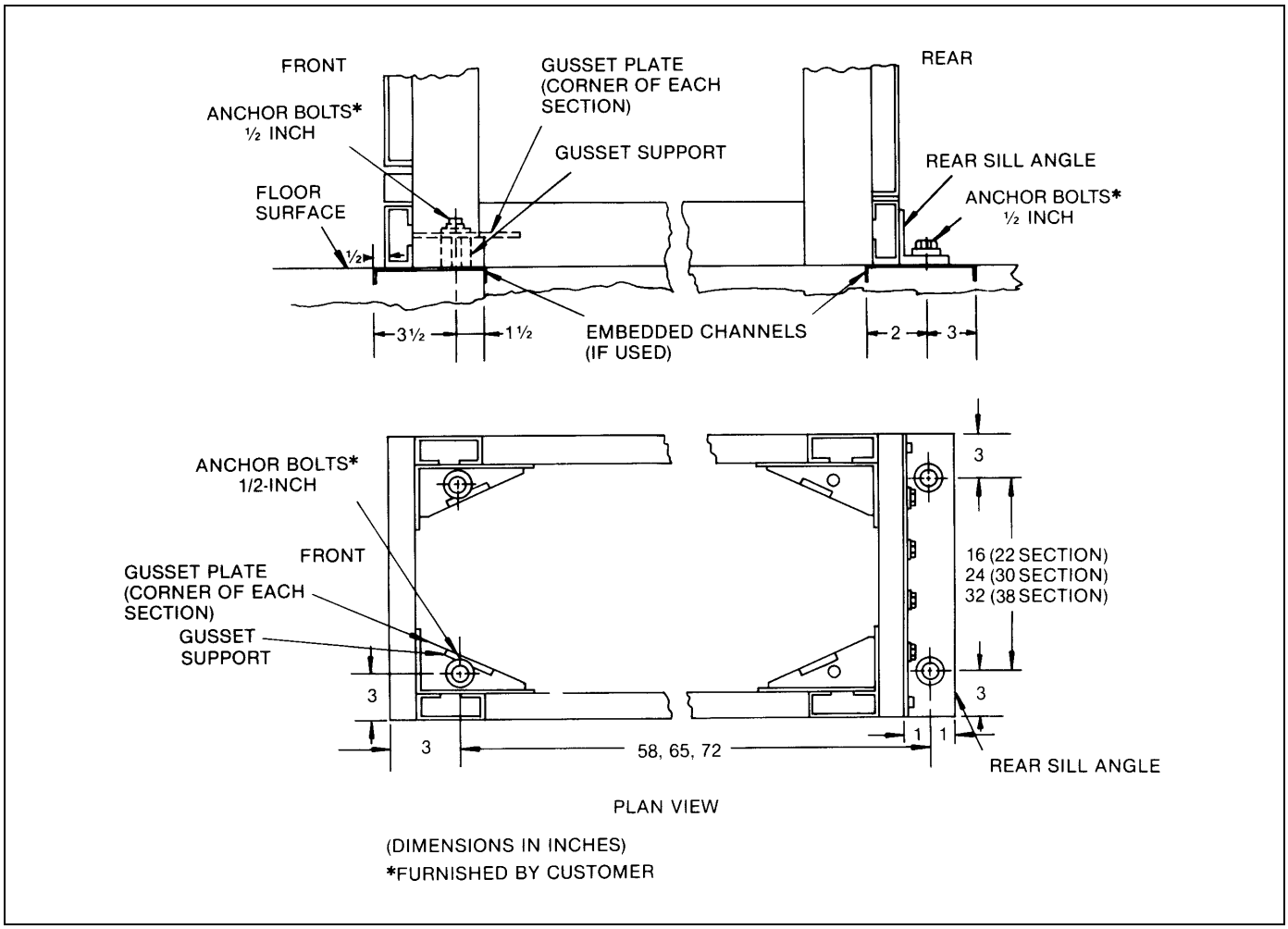
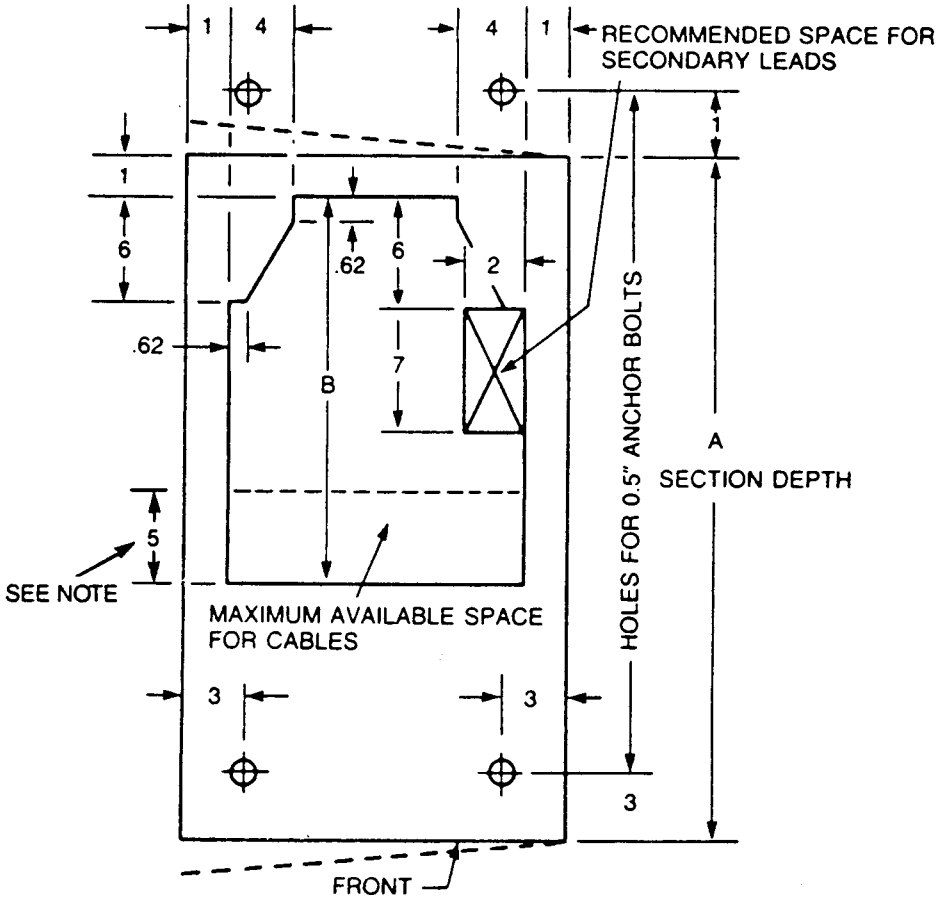


Fig 4-2. Indoor enclosure - location of equipment anchor points

If studs or anchor bolts are to be used, they should be installed in the foundation as it is poured. It is important that the studs or bolts are spaced to agree with dimensions given on the General Electric job drawings. The dimensions between anchor bolts for a particular installation are dependent upon the configuration of equipment ordered. The dimensions shown on Fig. 4-2 cover all of the standard enclosures available for AKD-10 Switchgear.

Figure 4-3 illustrates the space available for conduit and/or cable entrance through the bottom or top of each equipment section. The space required for control wiring entry to the optional wiring trough is also shown.



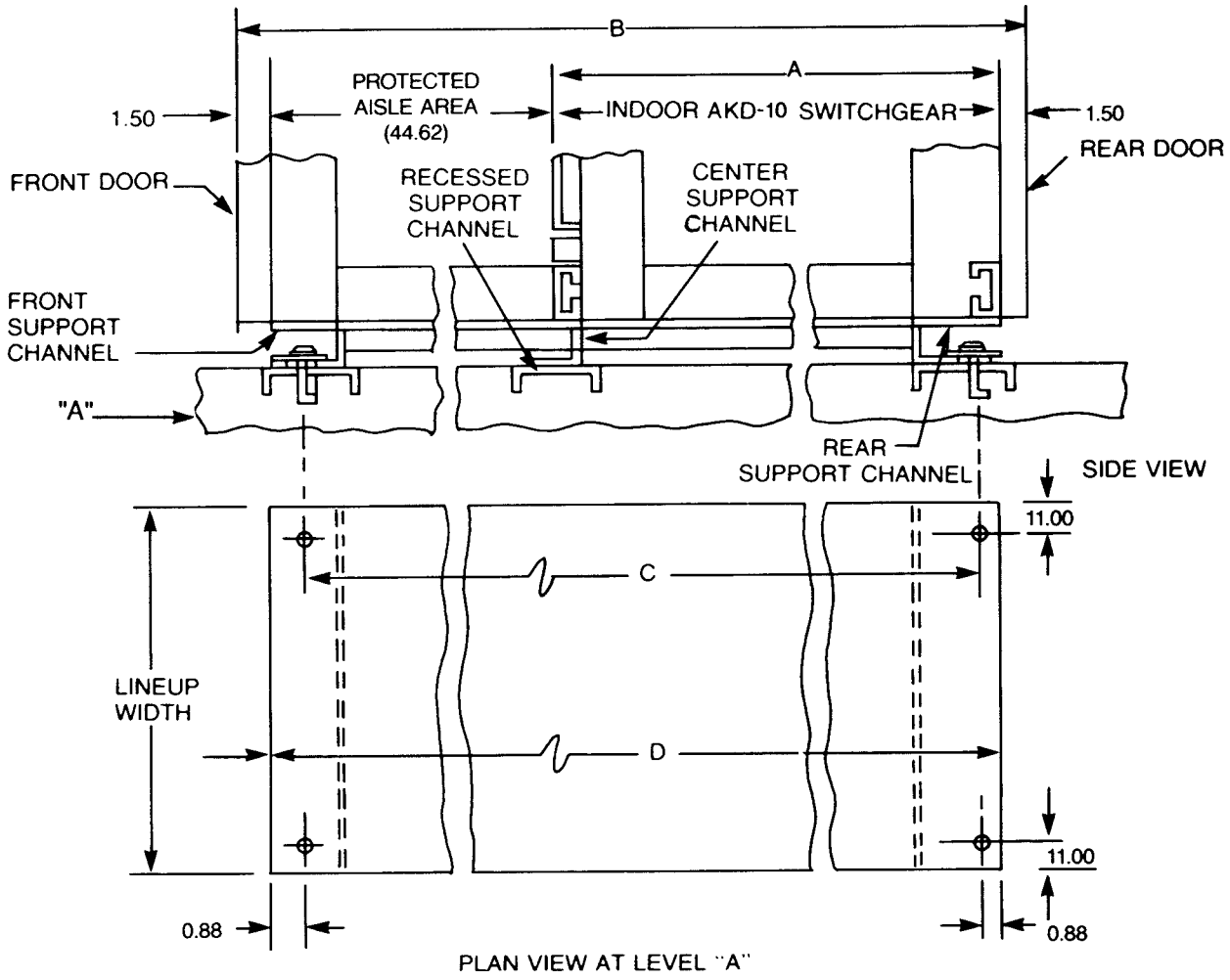
NOTE: BUS COMPARTMENT BARRIER LOCATION - WHEN THIS OPTION IS PROVIDED, IT REDUCES AVAILABLE SPACE FOR CABLES **ABOVE** BY (5) INCHES

Equipment Depth "A"	Direction of Leads	B
60" non-fused or	Below	19
67" with fused WPF-08/16	Above	24
67" non-fused or	Below	26
74" with fused WPF-08/16	Above	31
74" non-fused or	Below	33
81" with fused WPF-08/16	Above	38

Fig 4-3. Floor plan and cable entry space - indoor AKD-10

Outdoor Equipment

Refer to Fig. 4-4 along with the owner's foundation construction drawings and the General Electric supplemental installation drawings. The outdoor switchgear equipment is supplied with three built-in structural support channels in the base of the switchgear as shown in Fig. 4-4. The front and rear structural support channels are designed to be clamped to the foundation. The center channel is a structural stabilization channel. Although the equipment can be mounted directly on a smooth, level surface, it is recommended that



(DIMENSIONS IN INCHES)

NOTE: Four (4) clamp plates are required for each outdoor lineup. One at each corner.

A Depth of Indoor Switchgear	B Depth of Outdoor Switchgear	C Anchor Bolt Spacing	D Sub Base Depth
60	107.62	106.00	104.62
74	121.62	120.00	118.62

Fig 4-4. Outdoor enclosure mounting details and anchor bolt location

recessed steel channels be installed to support the switchgear. The floor channel sills under the front, center, and rear of the switchgear base should be embedded in a level concrete slab with their top surfaces flush with the finished floor.

While the equipment base center channel is not anchored to the foundation, it is still required that the center channel sill (see Fig. 4-4) be level with the foundation and also with the front and rear channel sills to prevent structural distortion of the switchgear equipment.

Only four anchor bolts are normally used for outdoor enclosures.

NOTE: The factory must be consulted for anchoring recommendations for equipment subject to operational and/or environmental (seismic) shock loading.

NOTE: Si l'équipement doit être assujetti à une charge de choc opérationnelle ou environnementale (sismique), il faut consulter le manufacturier afin d'obtenir des recommandations d'ancrage.

Anchor bolts and channels are to be provided by the purchaser; the clamp plates (Fig. 4-5) are supplied with the equipment.

It is recommended that the anchor bolts be 5/8-inch diameter.

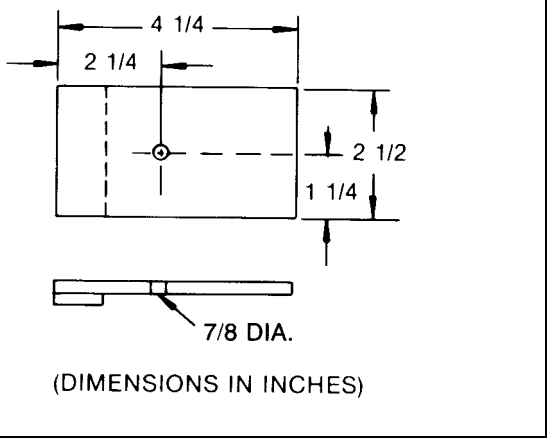


Fig. 4-5. Outdoor enclosure clamp plate

4-2 Assembly and Installation of Switchgear Equipment

General Requirements

Before assembling or installing the switchgear equipment, all components should be available at the site location. This will facilitate switchgear component identification as well as installation. The foundation should be prepared in accordance with the instructions in Sections 4-1 and 4-2, and all embedded conduits installed and capped.

NOTE: If rollers are to be used for movement of the equipment to its permanent installation, it is recommended that the shipping skid not be removed until the equipment is placed in position over the anchor bolts.

NOTE: Au cas où l'utilisation de rouleaux s'avérerait nécessaire afin d'apporter l'équipement à son emplacement permanent, nous recommandons que l'emballage d'expédition ne soit pas enlevé tant que l'équipement n'est pas positionné au dessus des boulons d'ancrage.

If a transformer is not part of the installation, and/or the equipment has been split for shipment, place the center section on the foundation first. Assemble the remaining sections outward from the center section, in each direction.

If the switchgear equipment is part of a Load Center Unit Substation, the transformer section should be set on its pad first in accordance with the instructions furnished with the transformer. All remaining sections of the switchgear should then be installed.

NOTE: Before assembling and installing the switchgear equipment, the foundation must be absolutely level and clear of debris to prevent damage and possible misoperation of the switchgear equipment.

NOTE: Il faut avant de procéder à l'assemblage et à l'installation s'assurer que la fondation soit absolument au niveau et exempte de débris afin de prévenir des dommages à l'équipement du dispositif de commutation.

Detailed Assembly and Installation Instructions

Indoor Equipment

The recommended procedure for installation of an indoor switchgear or Load Center Unit Substation is as follows:

1. POSITION THE EQUIPMENT-Position the equipment or sections of the complete equipment in their final location.

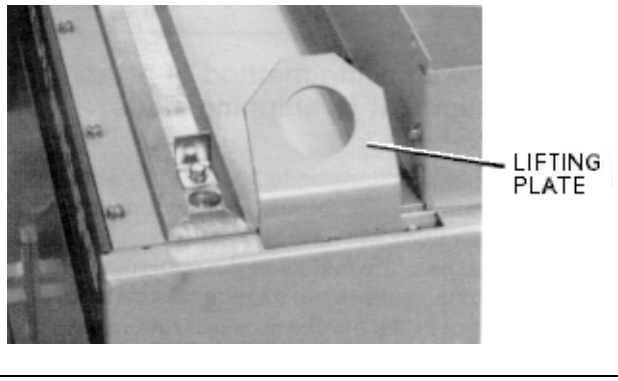


Fig. 4-6. Lifting plate location

NOTE: If the equipment line-up was split into shipping sections, the lifting plates on corners of adjacent sections shown in Fig. 4-6 must be removed. Failure to remove these plates will interfere with mating adjacent sections and prevent installation of bus splice plates, structure tie plates, etc.

NOTE: Si l'ensemble de l'équipement a été séparé en sections pour l'expédition, il faut que les plaques de soulèvement aux coins des sections adjacentes montrées à la Figure 4–6 soient enlevées. L'omission d'enlever ces plaques viendra en interférence avec les sections barres omnibus, de l'attache de la structure des plaques, etc.

Once the lifting plates have been removed, they may be discarded.

NOTE: In the event the lifting plates must be reassembled on the equipment for lifting purposes, they must be moved to locations where unused screw holes are available, generally achieved by shifting the plate horizontally on the mounting surface one bolt-hole from its previous location. When remounting the lifting plates, torque the mounting bolts to 7-9 ft-lbs.

NOTE: Dans l'éventualité où les plaques de levage doivent être réassemblées sur l'équipement à des fins de levage, elles doivent être déménagées aux endroits où il y a des trous de boulons inutilisés, on y arrive habituellement en décalant la plaque horizontalement sur la surface de montage d'un trou de boulon de son emplacement précédent. Lors du remontage des plaques de levage, serrer les boulons d'assemblage à un couple de 7–9 livres-pied.

NOTE: All mating sections of the equipment line-up (including transformer, if applicable) must be securely fastened together prior to tightening anchor bolts fastening the equipment to the mounting surface.

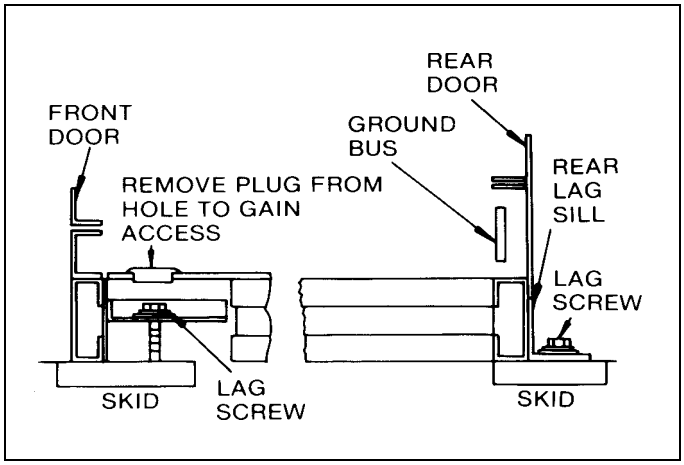


Fig. 4-7. View showing method of attaching equipment to shipping skids

NOTE: Toutes les sections se rapportant à la disposition de l'équipement (incluant le transformateur si tel est le cas) doivent être retenues ensembles solidement avant de resserrer les boulons d'ancrage qui retiennent l'équipement à la surface de montage.

2. REMOVE THE SHIPPING SKIDS-The equipment is fastened to the shipping skids with 3/8-3 lag screws through the equipment anchoring holes. See Fig. 4-7.

Equipment shipping sections up to 10 feet long will be fastened to the skids with four lag screws, one in each corner. Longer sections will have two additional lag screws which are located near the middle of the equipment. The shipping skid and lag screws are expendable material and may be disposed of at the purchaser's discretion.

3. FASTEN SECTIONS TOGETHER-After placement of the equipment and installing the anchor bolts loosely, the various shipping sections must be rigidly fastened together. Through-bolts fasten each section of the switchgear equipment to the adjacent section. Figure 4-8 shows the location of the through-bolts.

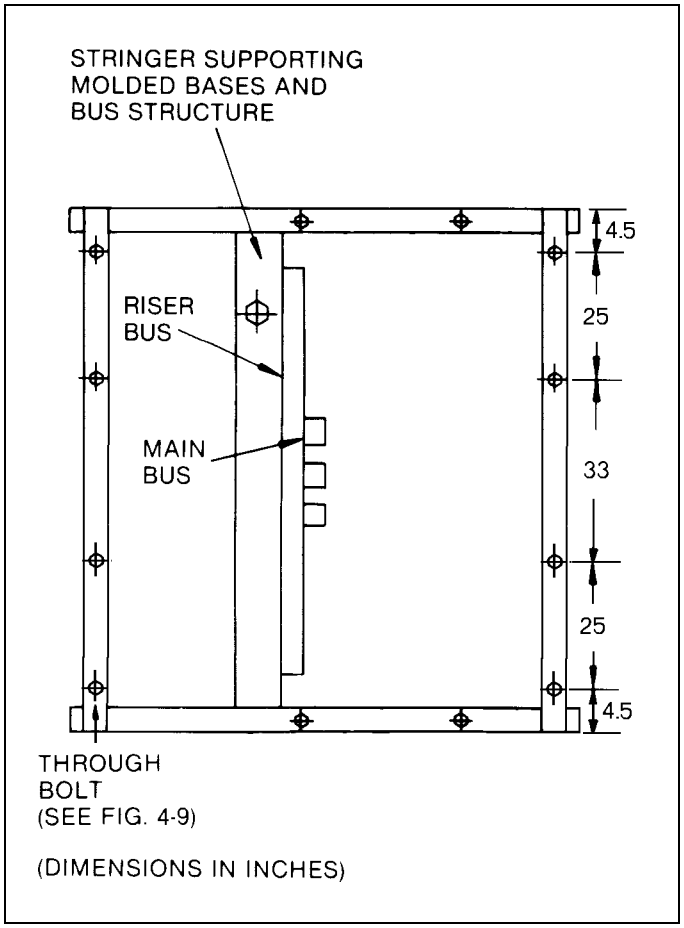


Fig. 4-8. Location of through-bolts

Figure 4-9 illustrates the installation of the through-bolts. The through-bolts are in the front and rear compartments. The nut and bolt assembly should be tightened with a torque of 25-30 ft-lbs.

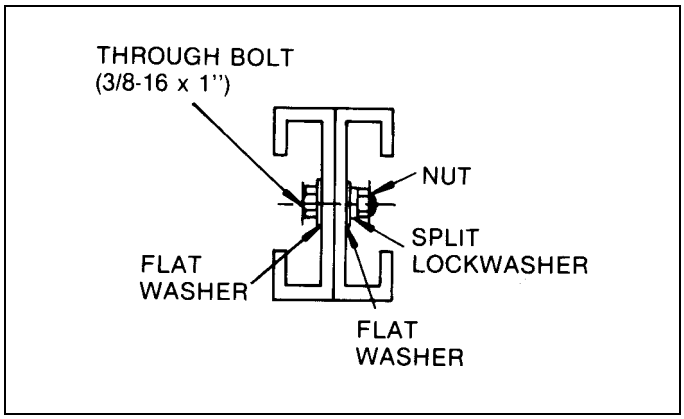


Fig. 4-9. Through-bolt installation

All of the hardware required for assembling the equipment across the shipping splits is furnished with the equipment. If a transformer is included in the line-up of equipment, the transformer flange should be aligned with the opening in the side of the transition compartment and fastened together using the 3/8-16 bolts, nuts and washers supplied with switchgear. The fastener assembly should be tightened with a torque of 25-30 ft-lbs.

4. COMPLETE THE ELECTRICAL INTERCONNECTIONS - After completing the mechanical connections between the several sections of equipment, the electrical interconnections should be completed. This includes the installation of splice plates for the main bus bars, the neutral bus, and the ground bus in addition to the control and metering circuits.

WARNING: All switchgear equipment must be adequately grounded for safety. Failure to ground equipment properly may result in serious injury.

ADVERTISSEMENT: Tout l'équipement du dispositif de commutation doit être mis à la terre adéquatement de manière sécutaire. Des blessures sérieuses peuvent survenir si l'on omet de mettre l'équipement à la terre correctement.

Figure 4-10 illustrates the general location of the buses that must be spliced across the shipping splits.

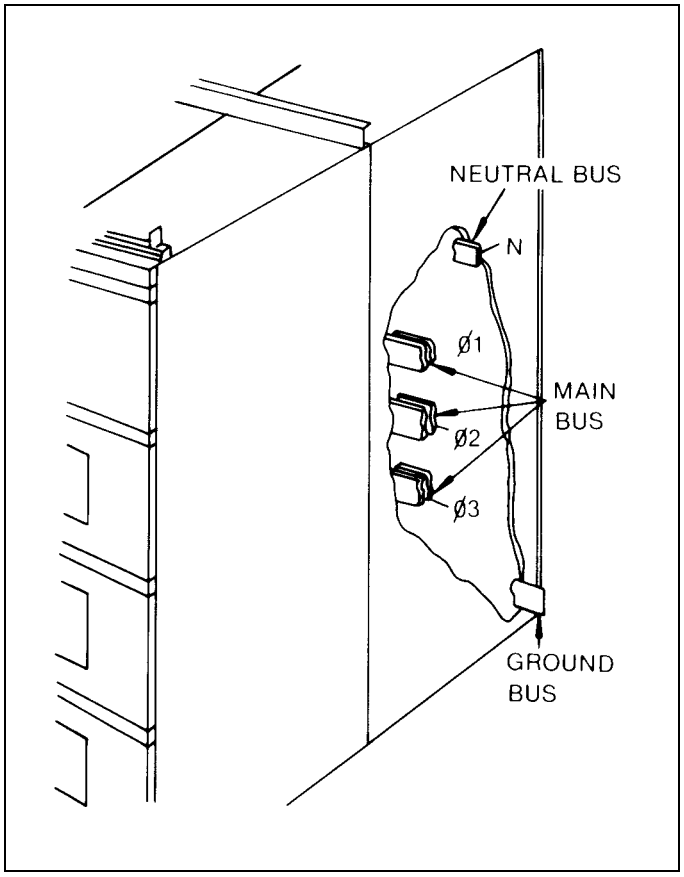


Fig. 4-10. Typical location of buses at shipping split

The ground bus is mounted directly on the rear upright channels.

NOTE: It is particularly important that the ground bus be connected first since it provides an integral ground for all the equipment. It must also be connected to the station ground prior to proceeding with the installation.

NOTE: Il est particulièrement important que la barre omnibus de mise à la terre soit branchée en premier, étant donné qu'elle fournit une mise à la terre intégrale à tout l'équipement. Elle doit aussi être branchée à la mise à la terre du poste avant de procéder à la installation.

A 4/0 AWG cable connector is located in the bottom of the transition section (or in the incoming line compartment if a transition section is not included) for terminating the purchaser's cable connection to ground. The specific location of the station ground connection is shown on the site floor plan drawing and in the electrical drawings supplied with the equipment. All grounding of the switchgear should be in accordance with National Electrical Code.

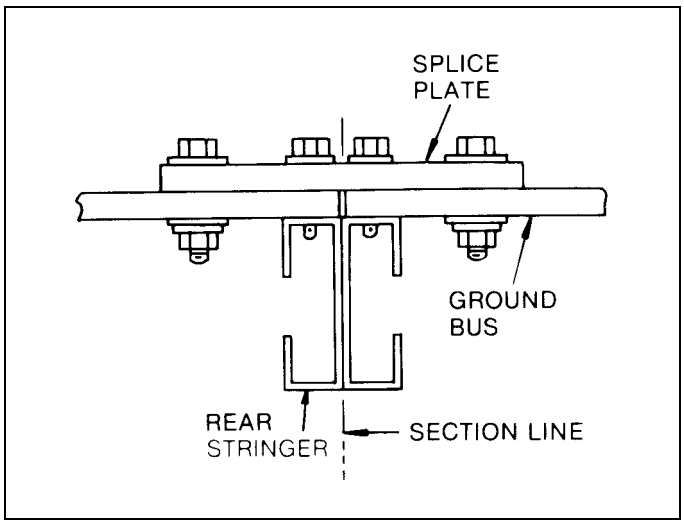


Fig. 4-11. Plan view of ground bus splice installation

Figure 4-11 illustrates the installation of the ground bus splice plate across a shipping split. In addition to the bolted fastening of the splice plate to the two ends of the ground bus, self-tapping 1/4-20 bolts pass through the splice plate and ground bus stubs, and thread into the equipment frame. These bolts should be fastened with a torque of 7-9 ft-lbs.

If a GE transformer (rated above 750 kVA) is present in the line-up, a ground bar located in the transition compartment, Fig. 4-12, is provided for connection of the transformer ground pad to the equipment ground termination point.

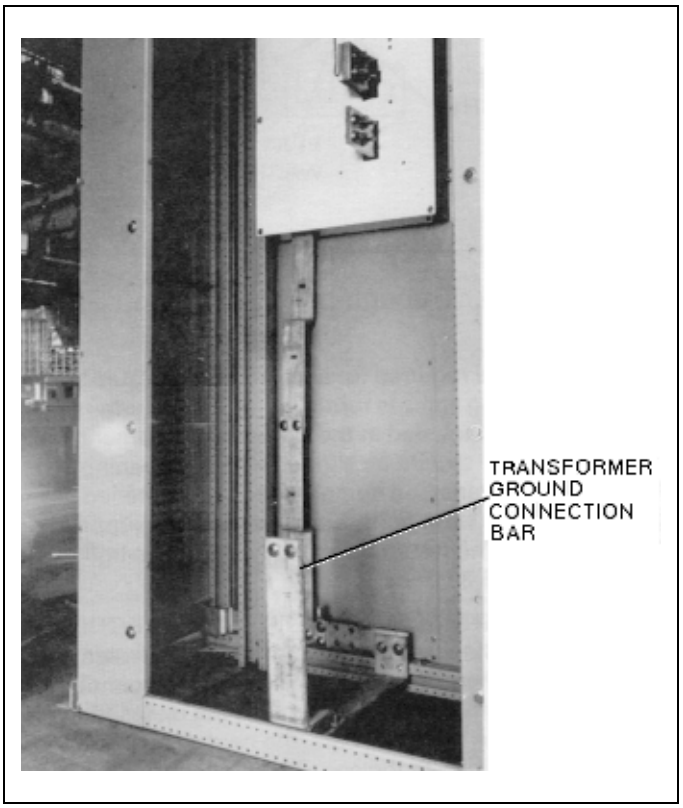


Fig. 4-12. Flange opening on a transition section to a GE transformer (above 750 kVA)

As shipped, the ground bar is mounted so it does not protrude beyond the outer surface of the equipment. When the equipment is installed in its final location, the ground bar must be reassembled using the outer bolt holes in the horizontal ground bus spanning the width of the transition compartment. In this mounting location, the offset portion of the ground bar will permit connection to the transformer ground pad with the 1/2-13 bolt assembly supplied with the switchgear equipment. If an optional floor plate is supplied for the transition compartment, it will be necessary to remove the floor plate to permit relocation of the ground connection bar.

All bolted bus joints should be made using the proper torque as shown in Table A-1 in Appendix A of this manual.

Transformers not manufactured by General Electric may require special mounting and bus connection hardware.

The neutral bus may be insulated from the grounded frame of the switchgear equipment; thus, it is mounted on insulators throughout the equipment. Installation of the neutral bus splice plate across a shipping split is similar to the ground bar splice except that the splice plate is not bolted to the equipment frame. Figure 4-13 illustrates the installation of the neutral splice plate.

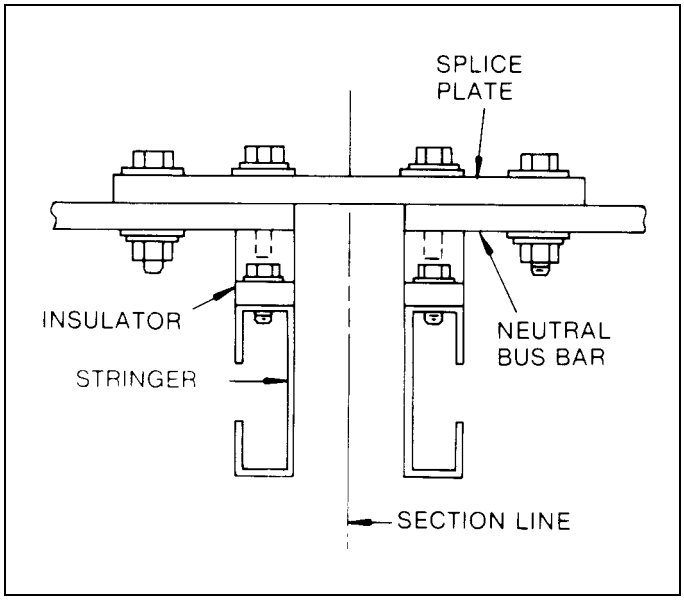


Fig. 4-13. Plan view of neutral bus splice installation

The installation of the horizontal bus splice bars is with bolted joints.

Figures 4-14 and 4-15 illustrate the assembly of the main bus splice plates on the bolted bus system. Copper bus systems are normally supplied with flat washers and lockwashers.

Figure 4-14 shows the rear view of the main bus area with the installed splice plates indicated with cross-hatching.

Figure 4-15 shows that a spacer is used both between the bus bars when more than one bar is used per phase (normally the 2500 ampere and larger main bus ratings) and over the outer bars of a single or multiple bar joint.

After assembly of the splice bars and spacers, the 1/2-13 bolts should be tightened to a torque of 35-40 ft-lbs.

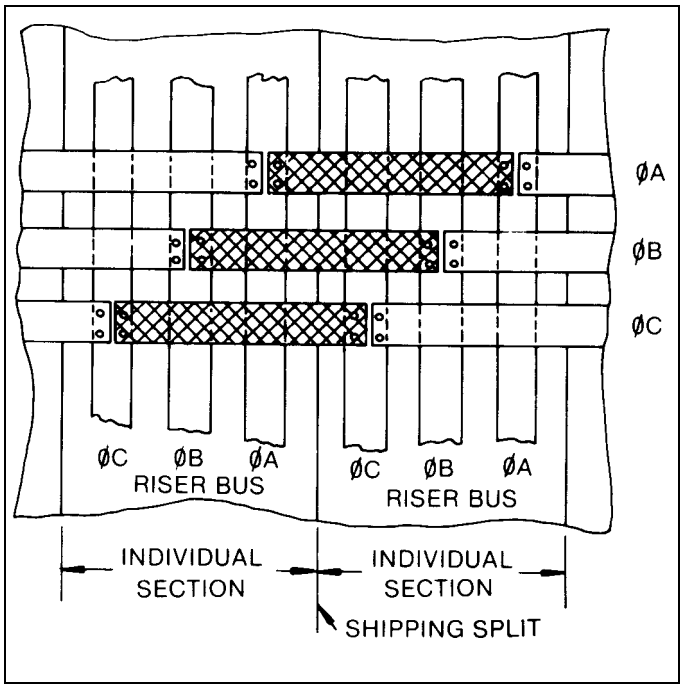


Fig. 4-14. Rear view of main bus at a shipping split

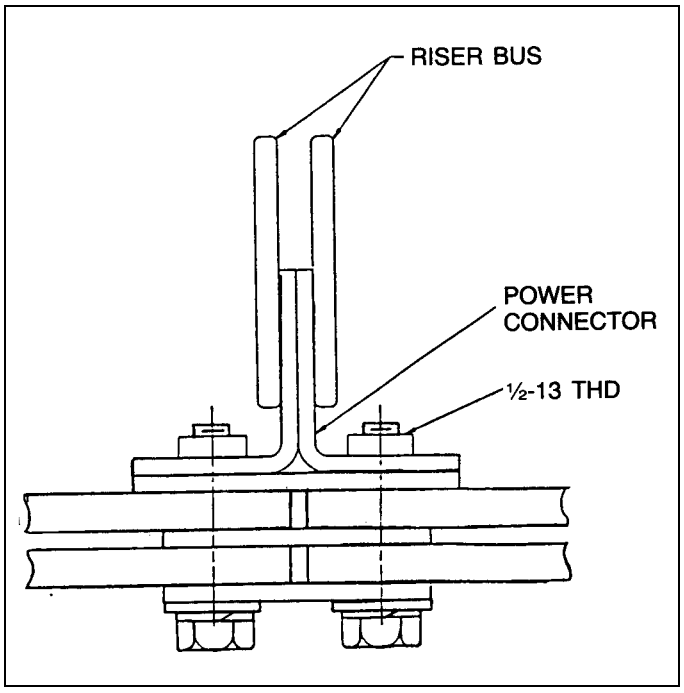


Fig. 4-15. Plan view of a two bar main bus connection

After completing the installation of the main bus splice bars, the joint covers may be mounted and secured by a 3/8-16 nylon bolt and polyester flat washer if the bus insulation option has been supplied with the equipment.

5. CONNECT THE TRANSFORMER SECONDARY - The connection of the transformer secondary to the incoming bus bars in the transition is made using the flexible connection straps supplied with the transformer. These connections are always bolted joints.

The recommended torque for tightening the ½-13 bolts fastening the transformer connection straps to the incoming bus bars is 35-40 ft-lbs.

6. INTERCONNECT CONTROL WIRING - Interconnection of control wiring across shipping splits is accomplished by connecting to terminal blocks located in the cross-section wiring trough on top of the equipment shown in Fig. 4-16.

If terminal blocks are provided, each wire must be attached to the correct point on the terminal block, following the circuit identification number attached to each wire.

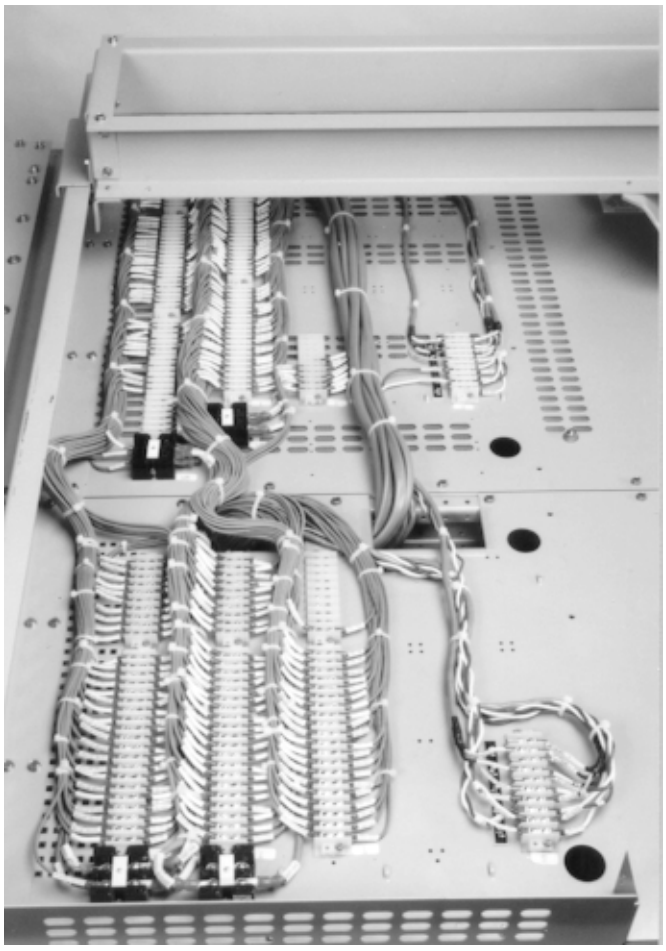


Fig. 4-16. Interconnect control wiring is located in the wiring trough on top of the equipment

Outdoor Equipment

The recommended procedure for installing a switchgear equipment supplied in an outdoor enclosure is as follows:

1. POSITION THE EQUIPMENT-Position the equipment or sections of equipment in their final location. If the equipment line-up was split into two or more shipping sections, it is necessary to first match, line up, and reassemble the multiple sections into one integrated equipment.

2. APPLY GASKET MATERIAL-After removal of the lifting plates (see Fig. 4-5), it is necessary to apply the self adhesive gasket material (6), Fig. 4-17, to the mounting surface of the roof flange (5). The gasket material is supplied with the equipment.

3. ALIGN SECTIONS-Align the two sections with the mating surfaces butted together.

4. FASTEN SECTIONS TOGETHER-Referring to Fig. 4-17, the mating sections of the outdoor enclosure should be immediately bolted together including the front (3) and rear (4) vertical posts and the roof flange (5). Each vertical post will require ten 3/8-16 x 1-inch bolt assemblies; the roof flange will require either eleven or twelve 3/8-16 x 1/2-inch bolt assemblies. The bolts should be tightened with a torque of 25-30 ft-lbs. Figure 4-18 is a cross-sectional view of the assembled roof joint.

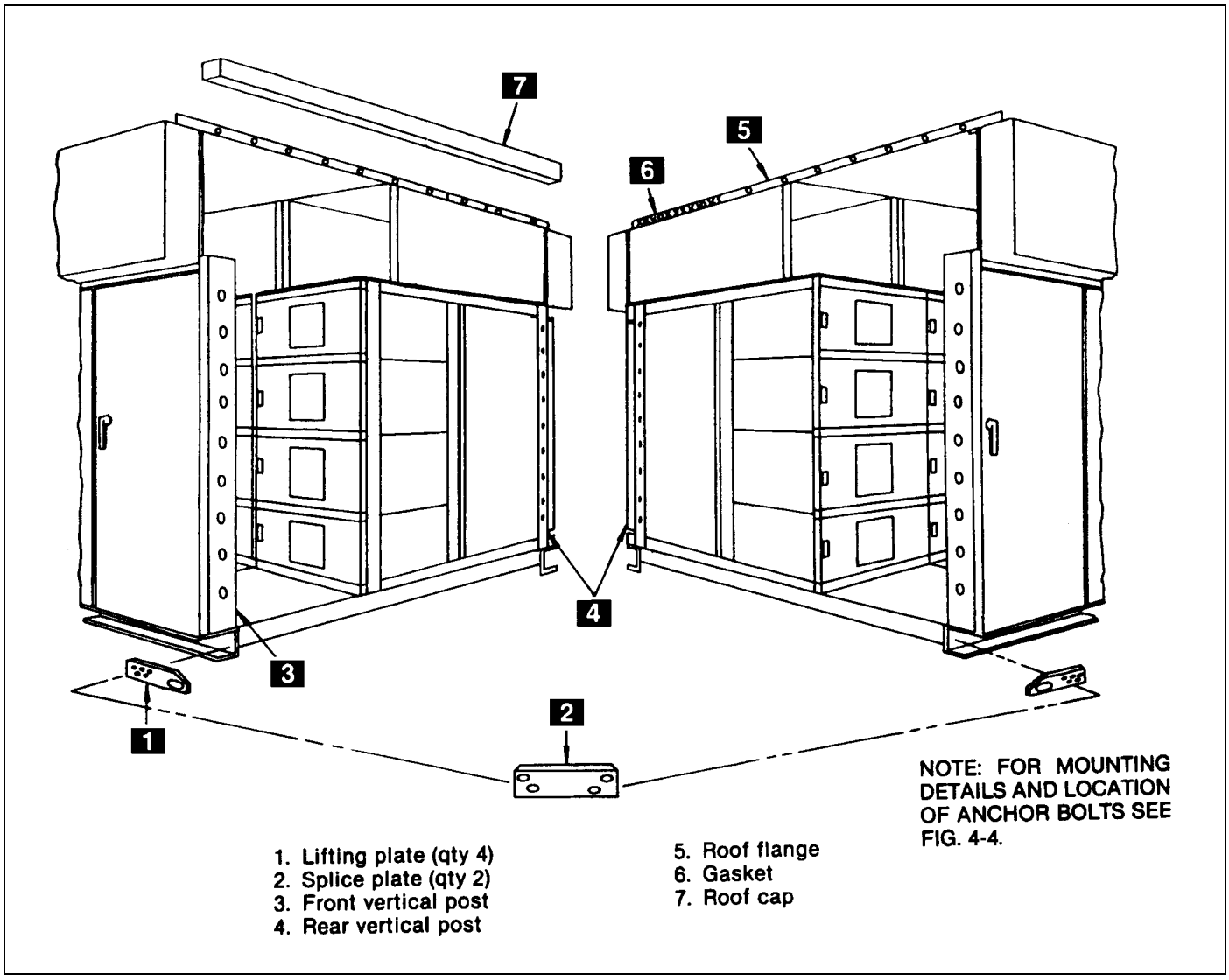


Fig. 4-17. Outdoor enclosure shipping split assembly

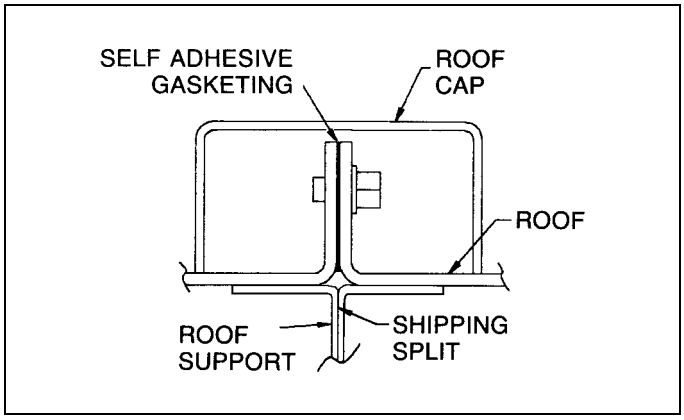


Fig. 4-18. Cross-section view of assembled roof joint

5. TIE HOUSING BASES TOGETHER - Referring to Fig. 4-17, tie the bases of the outdoor housing together using the splice plate (2) supplied with the equipment and the bolts which previously secured the lifting plates (1) removed after emplacement of the equipment. The nuts are welded to the rear surface of the base. The bolts should be tightened with a torque of 45 ft-lbs.

NOTE: There are two splice plates required, front and rear of the assembly.

NOTE: Deux plaques à épissures sont nécessaires à l'avant et à l'arrière de l'assemblage

6. INSTALL THE ROOFCAP - The roofcap (7), Fig. 4-17, should be installed over the sealed and fastened roof flange assembly (5). The roofcap is secured in place with two 1/4-20 NC x 1/2-inch thread forming bolts, each at the front and the rear ends of the roof cap. These bolts should be tightened with a torque of 7-9 ft-lbs.

7. CONNECT TRANSFORMER FLANGE - If a transformer is included in the equipment line-up, the flange should be connected to the switchgear opening using the gasket and fastening material supplied with the switchgear equipment.

8. JOIN SECTIONS TOGETHER - The switchgear equipment within the outdoor enclosure should be joined to its mating sections in the manner described for indoor equipment in Chapter 4, Step 3, Page 39.

9. MAKE ELECTRICAL INTERCONNECTIONS - The installation of bus splice plates for the main horizontal, neutral and ground buses should be done in accordance with the instructions for indoor equipment, Chapter 4, Step 4, Page 40.

10. CONNECT THE TRANSFORMER SECONDARY-The installation of the transformer connection straps to the incoming bus should be done in accordance with the instructions for indoor equipment, Chapter 4, Step 5, Page 43.

11. INTERCONNECT CONTROL WIRING-The interconnection of control wiring across shipping splits should be done in accordance with the instructions for indoor equipment, Chapter 4, Step 6, Page 43.

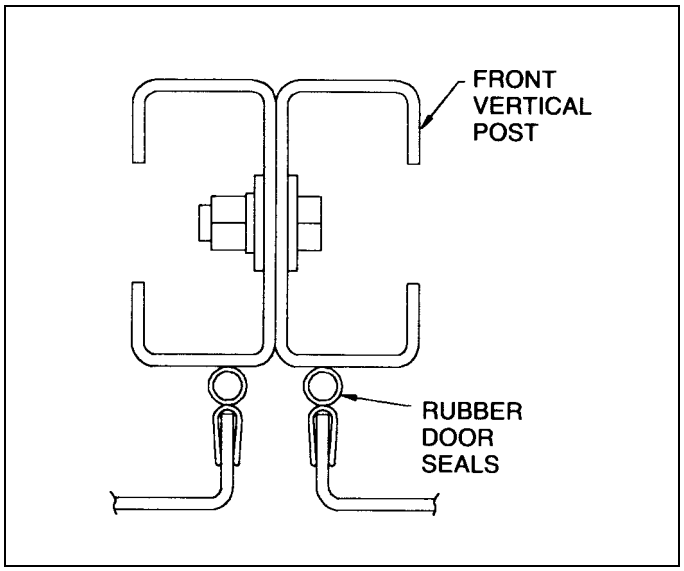


Fig. 4-19. Door seals

12. SEAL SMALL OPENINGS - After completion of the shipping split assembly, any small openings should be sealed with GE Clear Silicone Caulking Cement.

Anchoring Switchgear Equipment

Correct anchoring of the switchgear equipment to the foundation is very important. After completion of re-assembly of the equipment at the shipping splits, the equipment anchoring procedure should be completed.

Indoor Equipment.

1. ANCHORING BY ANCHOR BOLTS - Indoor equipments are normally secured to their final mounting surface by anchor bolts threaded into the embedded channel sills. The bolts were loosely threaded into place before reassembling the equipment shipping splits and connecting to the close-coupled transformer, if appropriate.

The anchor bolts should now be tightened with a torque of 35-40 ft-lbs.

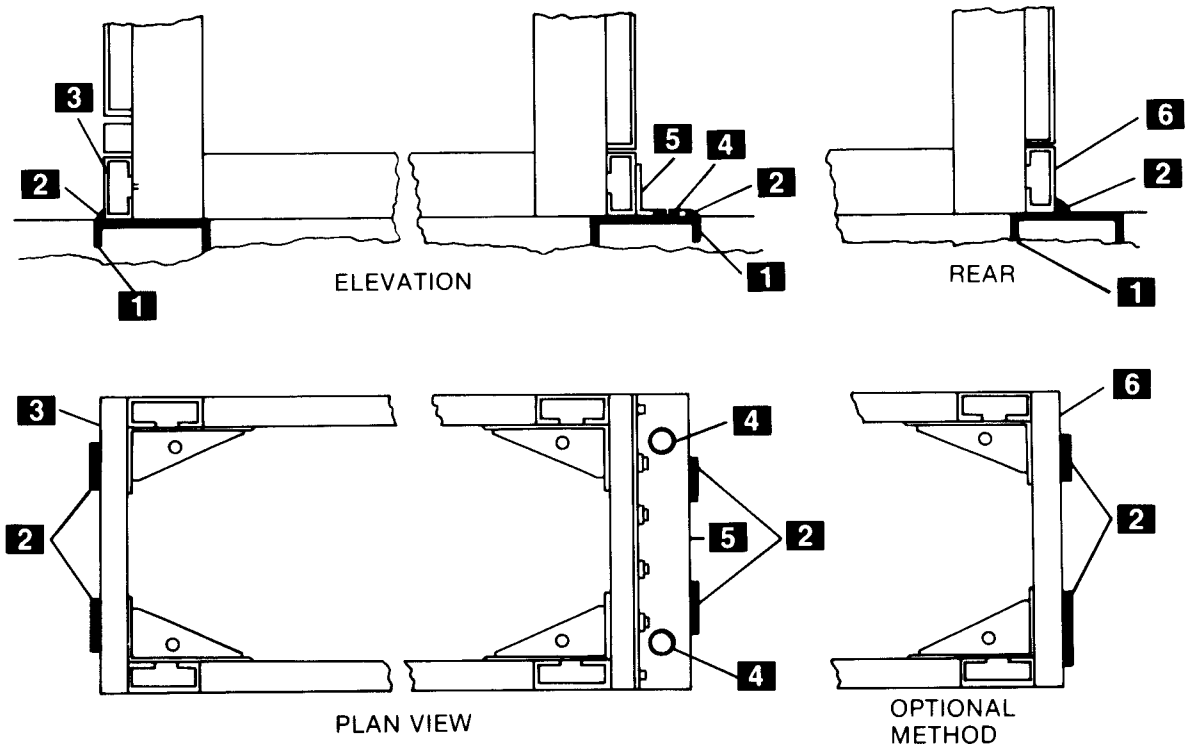
2. ANCHORING BY WELD - An alternate method of anchoring the equipment to its foundation is to weld the equipment to floor sills (or the floor itself if constructed of steel). Several methods, shown on Fig. 4-20, are available to the purchaser for welding the equipment to the channel sills.

   a. *The front of the equipment* is attached to the embedded channel sills (1), Fig. 4-20, by two 3/16-inch fillet welds (2). It is recommended that two welds, each 2-1/2 inches long (min.), be used for each section to firmly tie the bottom width post (3) to the channel sill.

   b. *The rear of the equipment* may be anchored by one of three procedures:

- The first method is by plug welds (4), Fig. 4-20, using the anchor bolt holes in the rear sill angle (5). The plug weld should receive a minimum 1/2-inch bead around the entire circumference of the anchor bolt hole.

- A second method of securing the rear sill angle (5) to the channel sill (1) is the use of two linear fillet welds (2) for each section. It is recommended that each weld be 2-1/2 inches long (min.) with a 3/16-inch fillet (min.).



1. Channel sill
2. 3/16-inch fillet weld
3. Front width post
4. Plug weld in anchor bolt hole
5. Rear sill angle
6. Rear width post

Fig. 4-20. Indoor equipment weld anchoring

- A third method for anchoring the rear of the equipment is to remove the rear sill angle (5) from the switchgear and weld the rear bottom width post (6) to the channel sill (1). These welds (2) should, like the front welds, have a 3/16-inch (min.) fillet and each have a minimum length of 2-1/2 inches.

Outdoor Equipment

Outdoor equipments are anchored after re-assembly of the separately shipped sections. The four anchor bolts should be tightened with a torque of 45-55 ft-lbs.

CAUTION: If the equipment is to be subjected to operational or environmental (seismic) shock loading, the factory must be consulted for anchoring recommendations.

ATTENTION: Si l'équipement doit être assujetti à une charge de choc opérationnelle ou environnementale (sismique), il faut consulter le manufacturier afin d'obtenir des recommandations d'ancrage.

Busway Connections

Busway runs must be aligned with openings in the equipment and connected to the mating components electrically and mechanically. A collar is mounted on the top of the equipment cable compartment to which is bolted the busway housing. See Fig. 4-21. The 1/4-20 NC bolts, washers, and nuts for this mechanical connection are supplied with the busway stub. The bolts should be tightened with a torque of 7-9 ft-lbs.

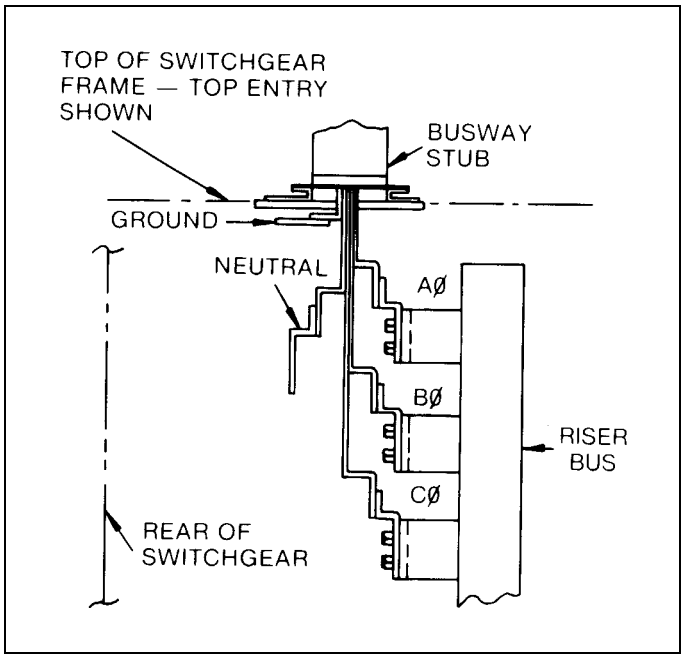


Fig. 4-21. Spectra Series™ Busway mounting (front-entry)

The power conductors in the busway stub are designed to bolt directly to power connector blocks mounted on the switchgear riser bus bars. These connections are made with 1/2-13 NC bolts supplied with the switchgear equipment.

NOTE: To maintain the minimum contact resistance across bolted bus joints, it is recommended that the joint contact surfaces be coated with a film of GE lubricating grease D6A15A2. A can of this grease is supplied with the equipment. Do not put grease on the bolt threads as this will affect the clamping force exerted by the bolt.

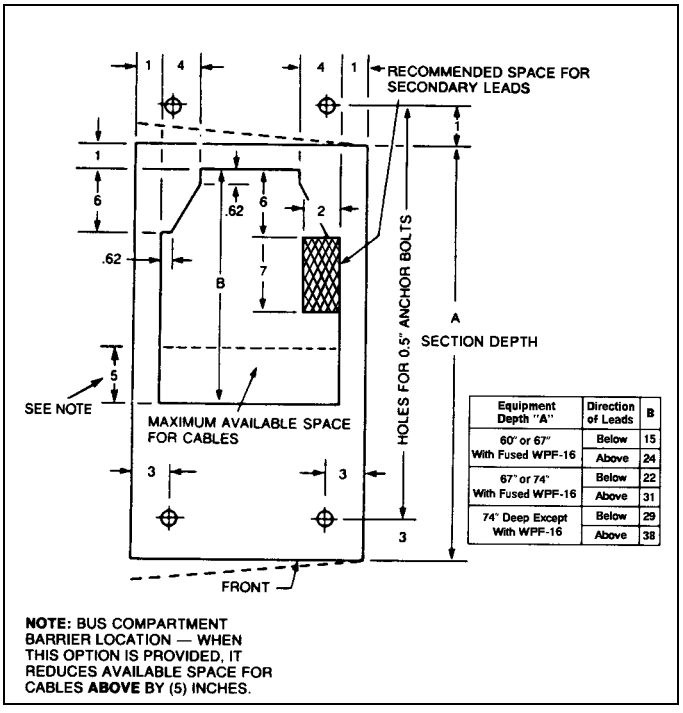
NOTE: Afin de maintenir une résistance de contact minimale à travers les joints vissés des barres omnibus, nous recommandons que les surfaces du joint de contact soient unduites d'une pellicule de graisse lubrifiante GE D6A15A2. L'équipement est fourni avec une boîte de cette graisse. Il ne faut pas graisser les fils des boulons car la force de serrage exercée par le boulon en sera affectée.

The recommended torque for tightening the 1/2-13 NC bolts connecting the busway stub conductions to the riser bus power connectors is 35-40 ft-lbs.

Control Wire Connections

For external control wiring, refer to Fig. 4-22 for switchgear cable area dimensions, and connect the control wires to the switchgear section as follows:

1. When control conduits enter the switchgear from below, they should not extend more than one inch above the



Equipment Depth "A"	Direction of Leads	B
60" or 67" With Fused WPF-16	Below	15
	Above	24
67" or 74" With Fused WPF-16	Below	22
	Above	31
74" Deep Except With WPF-16	Below	29
	Above	38

Fig. 4-22. Floor plan and cable entry space - indoor AKD-10

floor. The control wires may be pulled through the conduits before or after the switchgear is installed.

2. Route the control wires from the conduits through the wiring trough (cross-hatched area- 2" x 7"-shown on Fig. 4-22) at the side of the cable compartment. Connect the cables to the terminal blocks in accordance with the connection diagrams for the equipment.

3. If the control conduits enter from above, drill the top cover within the available space indicated. See Fig. 4-22. Control wires should be routed to the wiring trough and connected to the terminal blocks as described previously.

Power Cable Connections

Connect the main cables to the main lugs. Before any main cable connections are made, the cables should be identified to indicate their phase relationship with the equipment. Adequate electrical and mechanical clearances must be provided between conduit, cables, and bus. Where the cables enter the section, they can be lashed to optional cable supports at the rear of the cable compartment as required. (See Fig. 3-29.)

Mechanical cable terminals are normally included with the switchgear (compression terminals are supplied when ordered) and are mounted at the ends of the breaker runbacks in the cable compartment. Carefully follow the cable manufacturer's recommendations for installation of cable.

Install the cables in the proper path to the terminals, using temporary lashing if required. Cut the cables to the proper length. Strip the insulation to the desired dimension, being careful not to damage any strands.

For copper cables, coat the wires with GE lubricating grease D6A15A2, insert the cables into the terminals, and tighten the set screws in accordance with torque values shown in the torque value table for cable terminals in the addendum of this manual. See Appendix A, Table A-3.

For aluminum cables, wire brush the wire strands thoroughly. Immediately after wire brushing, coat the cable strands with a quality oxide inhibiting compound such as Penetrox A. Insert exposed wires into the terminals and tighten the set screws in accordance with values shown in the torque Table A-3 in Appendix A of this Instruction Book.

CAUTION: The torque values shown in the table are for dry threads only. Do not grease or otherwise lubricate the threads on the cable terminals as this will permit over-tightening of the screw and possible damage to the terminal or cable.

ATTENTION: Les valeurs de couple indiquées dans le tableau ne sont valables que pour des filets secs uniquement. Il ne faut pas graisser ou librifier autrement les filets des câbles terminaux, car cela produira un serrage excessif de la vis et possiblement des dommages au terminal ou au câble.

This should result in the oozing of compound material from between individual strands. Wipe off any excess compound.

Bolt the cable terminal connectors to the ends of the bars in the cable compartment. A non-oxidizing grease, such as GE lubricating grease D6A15A2 furnished with each equipment, should be used at these connection surfaces. The bolts should be tightened with a torque of 35-40 ft-lbs.

Lash the cables securely to the cable support, if present, to take their weight off the runbacks and to brace them against short circuit forces in the event of a fault.

Relays and Control Devices

Remove all blocking on relays and devices as shown in the instructions accompanying the devices.

Breaker Hoist

Indoor Equipment

Figure 4-23 shows the breaker hoist assembled on an indoor switchgear equipment. When supplied with indoor equipment, the hoist is shipped in a separate carton completely assembled, Fig. 4-24.

Before attempting to install the hoist assembly on the switchgear equipment, it is necessary to remove the runner guide from the hoist carriage as shown in Fig. 4-25. Do not dispose of this guide since it must be reinstalled after mounting the hoist on the equipment.

NOTE: Maximum recommended lifting capacity is 700 lbs.

NOTE: La capacité maximale recommandée de soulèvement est de 700 livres.

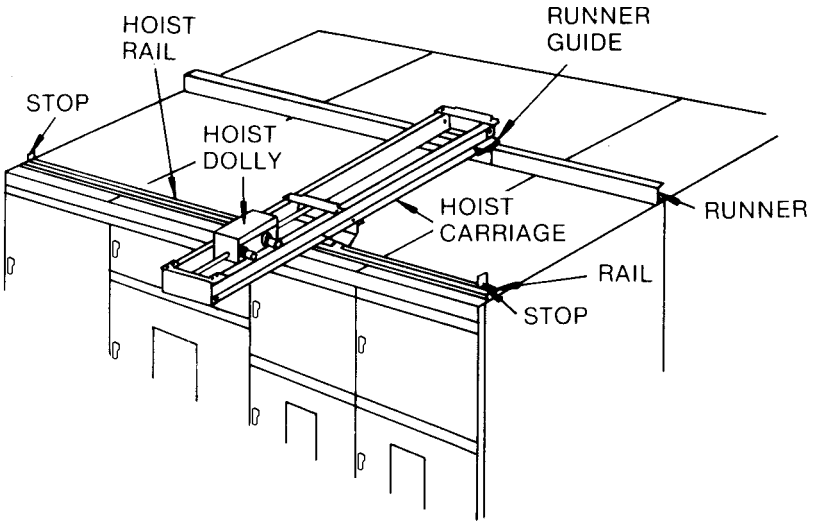


Fig. 4-23. Breaker hoist assembly on indoor switchgear

Fig. 4-24. Carton containing breaker lifting device

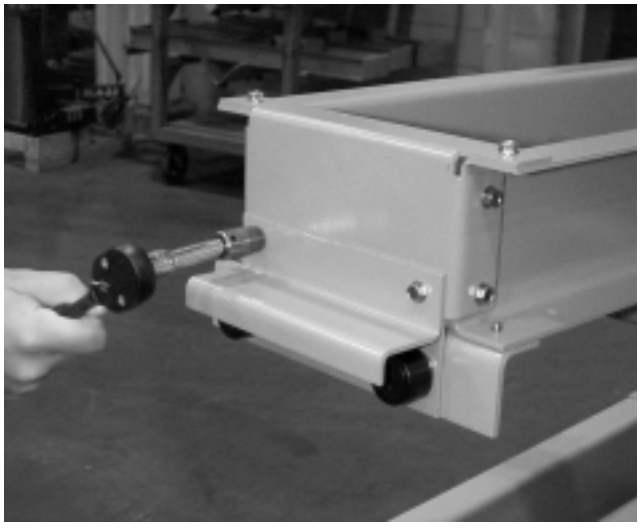


Fig. 4-25. Removal of hoist runner guide

The hoist should be lifted into position on top of the switchgear so that the end with two rollers is toward the rear of the equipment, Fig. 4-26.

Fig. 4-26. Location of hoist rear rollers

The rear wheels can then be hooked under the channel and the front wheels can be positioned on the front track. See Fig. 4-27. The runner guide at the rear should then be reassembled, Fig. 4-28. Stop clips are provided at each end of the front track to prevent the hoist from rolling off the ends of the track.

Fig. 4-27. Front rollers positioned on front track

Fig. 4-28. Replacing the runner guide after completion of hoist installation

Fig. 4-29. Removing the bracket locking the hoist dolly

If the equipment has been shipped in sections, run the hoist carriage over the assembled shipping split to check the alignment of the hoist rail and runner. If necessary, adjust the rail and/or runner for smooth operation of the rollers on the hoist carriage.

On seismic rated equipment, it is necessary to remove the bracket locking the hoist dolly on the carriage before the hoist can be used, Fig. 4-29. Replace the bracket after breaker installation or removal is complete.

Outdoor Equipment

When the hoist is provided with outdoor equipment, it is shipped mounted and secured in place. The shipping supports at either end of the hoist movable track must be removed. To free the hoist dolly, remove the retaining clip used to keep it in place during shipment, as shown in Fig. 4-30.

Final Inspection

Make a final inspection to see that no tools, construction materials, or other foreign matter have been left in the switchgear equipment.

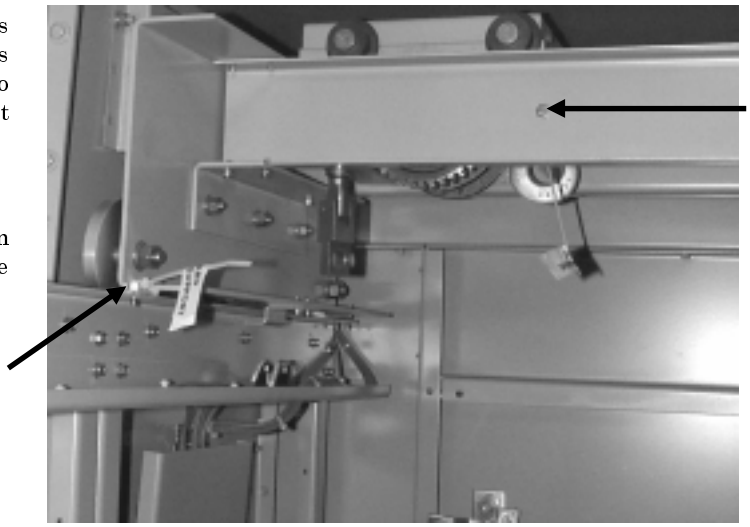


Fig. 4-30. Retaining clips used for shipment

5-1 General

Inspection and Preparation of Circuit Breakers

Before installing, operating, or removing a circuit breaker, refer to the breaker instruction manual for preparation, inspection, and test. Check thoroughly for damaged or loose parts and for any dirt or foreign matter which may be in the breaker. Be sure that a thin film of GE lubricating grease D6A15A2 is present on primary disconnects of the switchgear before installing the breaker.

Circuit Breaker Installation

To install a circuit breaker, proceed as follows:

1. Before installing a breaker, check the tightness of the bolted joints in the primary disconnect bars. Refer to torque value table, Appendix A, Table A-1, in this manual for the proper torque values. Also check the contact areas on each primary disconnect bar or cluster of fingers for foreign matter that may have accumulated. Clean these areas if necessary. Be sure that a thin film of GE lubricating grease D6A15A2 covers the contact areas before putting a breaker in the compartment.

2. Check to see that the breakers match their respective compartments. 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. The breaker may also be identified using the 15 digit catalog number.

3. 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 carton or the mark number on the breaker nameplate. All identical breakers will have the same mark and catalog number.

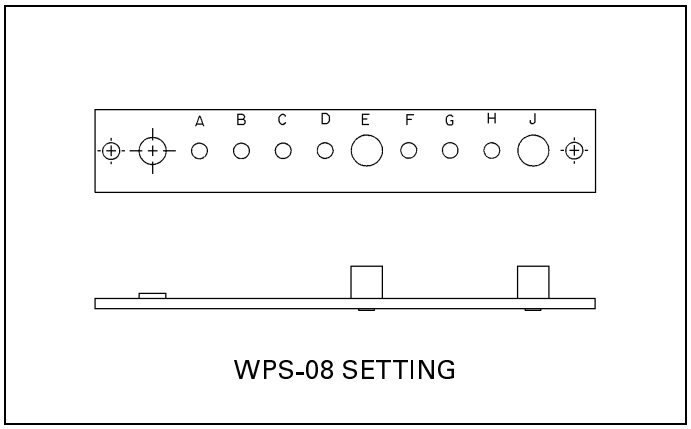


Fig. 5-1. Rejection pin mounting used in WP-08/16/20 compartments

Rejection Feature

Drawout breakers of the same type and rating are interchangeable in their equipment compartments. Drawout breakers of different frame size, type, or short-circuit rating are intentionally made non-interchangeable to prevent inserting the wrong type breaker into a drawout compartment; unique "rejection hardware" is affixed to each breaker and its compartment. When the wrong type breaker is inserted into a cell, the pins on the breaker and the pins in the cell interfere, thus preventing the wrong breaker from being racked onto the primary stabs.

EXCEPTION: A breaker with a higher short-circuit rating will fit into a compartment keyed for a lower short-circuit rating. For example, a WPH-08 breaker can be inserted into an WPS-08 compartment. A WPS-08 breaker, however, will be rejected by a WPH-08 compartment.

EXCEPTION: Un disjoncteur ayant un calibrage éléve de court-circuit accomodera un compartiment classifié d'un calibrage moindre de court-circuit. Par exemple, un disjoncteur WPH-08 peut être inséré dans un comparitment WPS-08. Cependant un disjoncteur WPS-08 sera rejeté d'un compartiment WPH-08.

Figures 5-1 and 5-2 illustrate the rejection pin mounting used in WPS-08, WPH-08, WPF-08, WPX-08, WPS-16, WPH-16, WPF-16 and WPS-20 compartments.

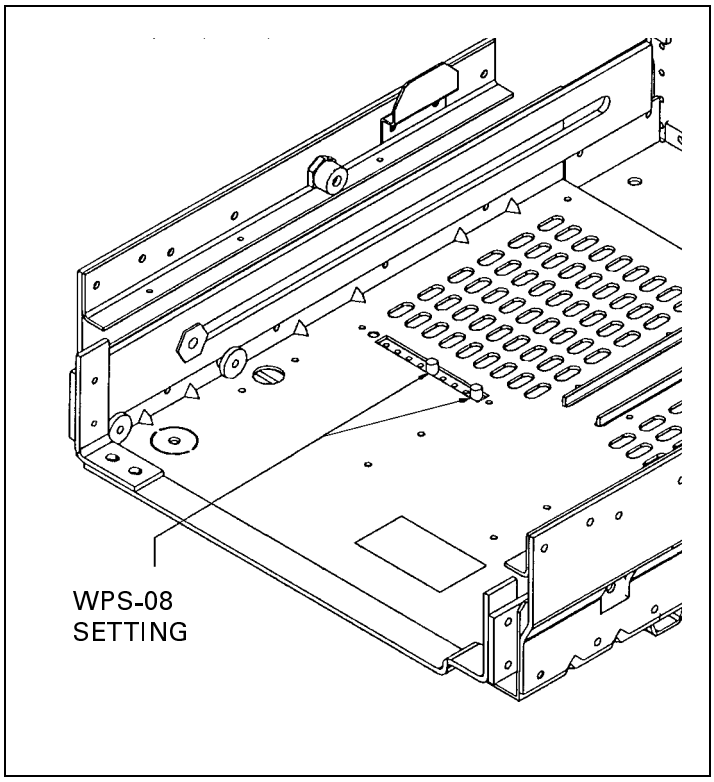


Fig. 5-2. Rejection pins used in WP-08/16/20 compartments

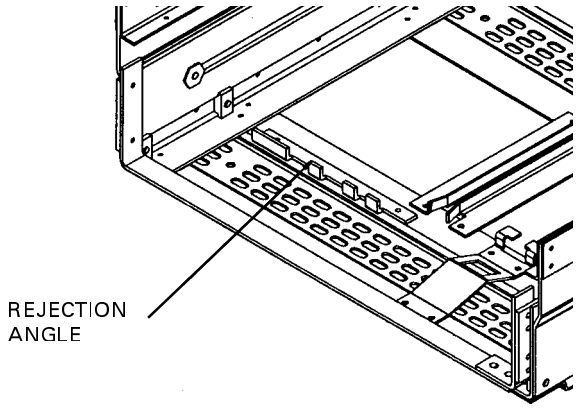


Fig. 5-3. Isometric view of rejection angle used in WP-32/40/50 compartments

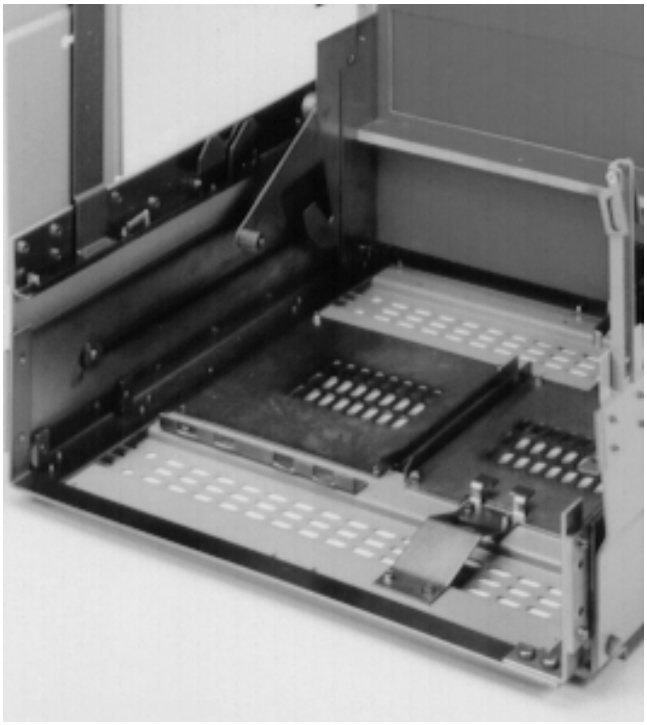


Fig. 5-4. Photograph of rejection angle used in WP-32/40/50 compartments

NOTE: If a breaker is rejected by the rejection pins, check the breaker type and rating against the job drawing.

NOTE: Si un disjoncteur est rejeté par les pins coulissants, vérifier de quel type est le disjoncteur ainsi que le calibrage en rapport avec le plan de la tâche.

The complete rejection pin pattern code is included in Appendix B.

5-2 Installing WP-08/16/20 Circuit Breakers

Prior to Installation

Prior to lifting a breaker to its intended compartment location, observe the following precautions:

Precautions:

1. Check the compartment to ensure that it is free of foreign objects.
2. Verify that the breaker is the correct type for that compartment.
3. Ensure that the breaker is OPEN.
4. Apply a thin fresh coat of GE lubricating grease D6A15A2 to the breakers primary disconnects.
5. Ensure that the racking forks on the breaker are correctly positioned for initial engagement with the pins in the compartment. To do this, insert the racking handle and rotate it fully counterclockwise.

Précautions:

- Vérifier le compartiment afin de s'assurer qui'il est libre d'objets étrangers.
- Vérifier que le disjoncteur est du genre correct pour ce compartiment.
- Assurez-vous que le disjoncteur est en position OPEN.
- Appliquer une mince couche fraîche de graisse lubrifiante GE D6A15A2 aux débranchements primaires du disjoncteur.
- Assurez-vous que les cames de montage du disjoncteur soient positionnées correctement en vue de l'engagment initial avec les goujons du compartiment. Pour ce faire, insérer la poignée de montage et lui faire effectuer une rotation complète dans le sens des aiguilles d'une montre.

Installation Procedures

To install the WavePro circuit breaker, proceed as follows:

1. Carefully place the breaker in front of the section in which it is to be installed. See Fig. 5-5.
2. Open the breaker compartment door by rotating the door latch assembly ¼ turn clockwise.
3. Using the switchgear hoist or a suitable lifting mechanism and the appropriate spreader, raise the breaker above the elevation of the rails. See Fig. 5-6. The lifting spreader for 800A, 1600A & 2000A AKR breakers cannot be used with 800A, 1600A & 2000A WavePro breakers.

WARNING: Do not stand under the circuit breaker during the hoisting operation.

ADVERTISSEMENT: Il est interdit de se tenir sous le disjoncteur durant l'opération de levage.

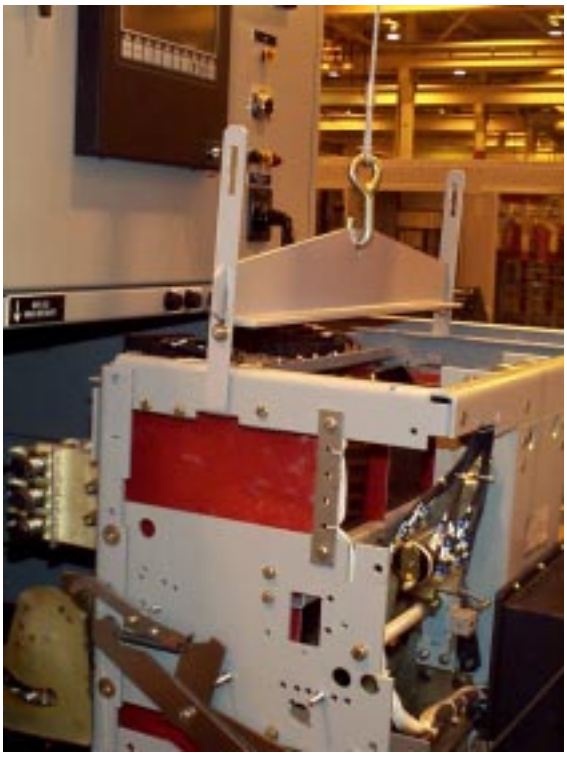


Fig. 5-5. Reel out hoist cable. Attach spreader bar assembly to circuit breaker

Fig. 5-6. Hoist breaker above rails

Fig. 5-7. Pull rails out completely from the circuit breaker compartment

Fig. 5-8. Lower the breaker onto the rails of the cell. Remove the spreader bar assembly

CAUTION: When using the switchgear hoist, do not unwind the cable completely from the drum. To lift the breaker, turn the hoist operating crank clockwise. To lower the breaker, turn the hoist operating crank counterclockwise.

ATTENTION: Il ne faut pas dérouler complètement le câble du cylindre lorsque l'on utilisse le treuil du dispositif de commutation. Tourner la manivelle opérant le treuil dans le sens des aiguilles d'une montre pour soulever le disjoncteur. Tourner la manivelle opérant le treuil dans le sens contraire des aiguilles d'une montre pour abaisser le disjoncteur.

4. Fully withdraw rails to stops.

5. Slowly lower and guide the breaker to allow the 4 breaker wheels to align with the rails. See Fig. 5-8. Remove the lifting device. The breaker is now positioned on the drawout rails.

6. Roll the breaker into the compartment until the racking forks meet the racking pin, this is the DISCONNECT position. If an incorrect breaker has been installed, the interference pins on the breaker will interfere with the rejection pins in the compartment prior to reaching the disconnect position. See Fig. 5-9. At this point, the racking forks are contacting the fixed racking pins in the compartment.

7. Slide rails back into compartment. Close the compartment door and rotate latch ¼ turn counterclockwise.

8. Engage the racking handle by pushing and holding the trip button in the breaker escutcheon, sliding the cover just below it to the right, releasing the trip button, and inserting the handle on the jackshaft. See Fig. 5-10.

9. Rotate the handle clockwise as far as it will go. As you rotate the handle clockwise, the breaker will travel from the disconnect, through the test position (you will notice an audible click), and then into the connect position. The breaker position can be seen on the indicator, located on the breaker escutcheon.

Fig. 5-9. Push the breaker in completely. Close the door.

Fig. 5-10. Engage the racking screw with the racking handle (WP-08/16/20)

5-3 Installing the WPH-32, WPS-32/40/50 Circuit Breaker

WARNING: Do not stand under the circuit breaker during the hoisting operation.

ADVERTISSEMENT: Il est interdit de se tenir sous le disjoncteur durant l'opération de levage.

CAUTION: When using the switchgear hoist, do not unwind the cable completely from the drum. To lift the breaker, turn the hoist operating crank clockwise, To lower the breaker, turn the hoist operating crank counterclockwise.

ATTENTION: Il ne faut pas dérouler complètement le câble du cylindre lorsque l'on utilisse le treuil du dispositif de commutation. Tourner la manivelle opérant le treuil dans le sens des aiguilles d'une montre pour soulever le disjoncteur. Tourner la manivelle opérant le treuil dans le sens contraire des aiguilles d'une montre pour abaisser le disjoncteur.

Installation Procedure

To position the WPH-32, WPS-32/40/50 circuit breaker on the drawout rails, proceed as follows:

1. Carefully place the breaker in front of the section in which it is to be installed, See fig. 5-5.
2. Open the breaker compartment door by rotating the door latch assembly ¼ turn clockwise.
3. Using the switchgear hoist or a suitable lifting mechanism and the appropriate spreader for WP-32/40/50, raise the breaker above the elevation of the rails. See Fig. 5-6.
4. Pull the drawout rails all the way out to its WITHDRAWN limit. The rail pin will be positioned at the back of the rail slot.
5. Slowly lower and guide the breaker to allow the 4 breaker wheels to align with the rails. See Fig. 5-8. Remove the lifting device. The breaker is now positioned on the drawout rails.
6. Roll the breaker into the compartment until the racking cams touch the racking pin and the spring discharge stop engages. this is the DISCONNECT position. At this point, the racking cams are positioned to engage the fixed racking pins in the compartment, ready to begin the racking motion. If the incorrect breaker has been installed, the interference pins on the breaker will interfere with the rejection teeth in the compartment prior to reaching the disconnect position (Fig. 5-11).
7. Slide rails back into compartment. Close the compartment door and rotate latch ¼ turn counterclockwise.
8. With the WP-32/40/50 breakers rotate the racking access cover in the door and engage the racking handle
9. Rotate the handle clockwise as far as it will go. As you rotate the handle clockwise, the breaker will travel from the disconnect, through the test position (you will notice an audible click as the secondary disconnects engage), and then into the connect position. The breaker position can be seen on the indicator, located on the breaker escutcheon.

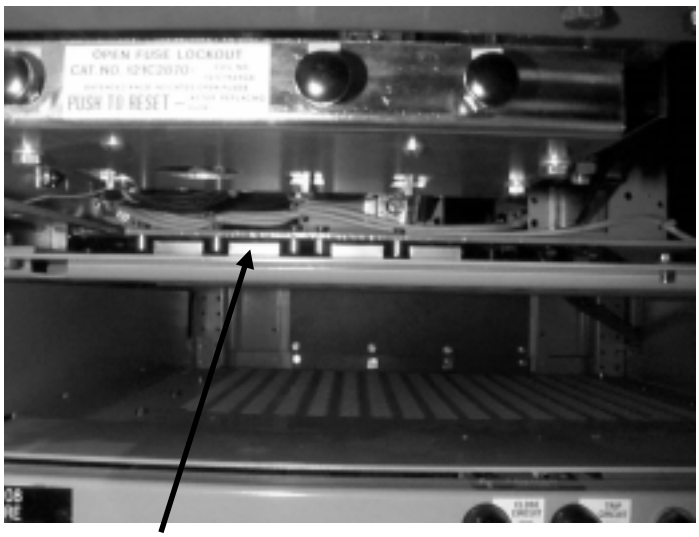


Fig. 5-11. Rating rejection bracket on WP-32/40/50

Fig. 5-12. Spring discharge interlock used on manually and electrically operated breakers

5-4 Removing the WP-08/16/20 Circuit Breakers

WARNING: Do not stand under the circuit breaker during the lowering operation.

ADVERTISSEMENT: Il est interdit de se tenir sous le disjoncteur durant l'opération de levage.

CAUTION: When using the switchgear hoist, do not unwind the cable completely from the drum. To lift the breaker, turn the hoist operating crank clockwise. To lower the breaker, turn the hoist operating crank counterclockwise.

ATTENTION: Il ne faut pas dérouler complètement le câble du cylindre lorsque l'on utilisse le treuil du dispositif de commutation. Tourner la manivelle opérant le treuil dans le sens des aiguilles d'une montre pour soulever le disjoncteur. Tourner la manivelle opérant le treuil dans le sens contraire des aiguilles d'une montre pour abaisser le disjoncteur.

To remove the WP-08/16/20 circuit breaker, proceed as follows:

1. With the door closed and latched, press and hold the trip button while sliding the racking cover open. Now release the trip button.
2. Insert the racking handle and rotate it counterclockwise until the breaker travels from CONNECT through TEST to the DISCONNECT position, as shown by the position indicator. This operation should be per-formed with the door closed. If the breaker closing spring is fully charged, it will be automatically discharged a few turns before the end of racking action.
3. Open the compartment door and fully extend the drawout rails. Roll breaker out to rail stops. This is the WITHDRAWN position.
4. Before proceeding, visually check the breaker's spring charge and close indicators to verify that breaker is open and the springs are discharged.
5. Attach the lifting device and raise breaker off drawout rails.
6. Push the drawout rails back into the compartment.
7. Pull the breaker forward until the primary disconnects clear the compartment.
8. Lower the breaker onto a flat surface free of protrusions that could damage the breaker's internal parts. The back of breaker will be resting on the interference pins and guide.

5-5 Removing the WPH-32, WPS-32/40/50 Circuit Breakers

WARNING: Do not stand under the circuit breaker during the lowering operation.

ADVERTISSEMENT: Il est interdit de se tenir sous le disjoncteur durant l'opération de levage.

CAUTION: When using the switchgear hoist, do not unwind cable completely from the drum. To lift the breaker, turn the hoist operating crank clockwise. To lower the breaker, turn the hoist operating crank counter-clockwise.

ATTENTION: Il ne faut pas dérouler complètement le câble du cylindre lorsque l'on utilisse le treuil du dispositif de commutation. Tourner la manivelle opérant le treuil dans le sens des aiguilles d'une montre pour soulever le disjoncteur. Tourner la manivelle opérant le treuil dans le sens contraire des aiguilles d'une montre pour abaisser le disjoncteur.

To remove WPH-32 or WPS-32/40/50 breakers, proceed as follows:

1. With the door closed and latched, trip the breaker.
2. Rotate the racking access cover in the door, insert the racking handle and rotate it counterclockwise until the breaker travels from CONNECT through TEST to the DISCONNECT position, as shown by the position indicator. This operation should be performed with the door closed.
3. Open the door, depress the spring discharge lever (Fig. 5-12) to discharge breaker's closing springs and then fully extend the rails. While holding this lever depressed, pull the breaker all the way out to its WITHDRAWN position.
4. Before proceeding, visually check the breaker's spring charge and close indicators to verify that the breaker is open and the springs are discharged.
5. Attach lifting device to cutout notches in top wraparound frame of the breaker, using care to prevent damage to the wiring.
6. Lift the breaker off the rails. Push the rails back into the compartment.
7. Pull breaker forward until primary disconnects clear the compartment. Lower breaker onto a flat surface free of protrusions that could damage the breaker's internal parts.

5-6 Installing and Removing WPF-08/16 Fused Circuit Breakers

Except for the open fuse lockout device and the integrally mounted fuses on the upper studs, the WPF-08 and -16 breakers are identical to the non-fused WPS-08 and -16 models. The procedural steps for installing and removing the WPF-08/16 breakers from the AKD-10 switchgear equipment are the same as that described in paragraph 5-2 and 5-4 for non-fused WPS-08/16 breakers.

5-7. Installing Fuses on WPF-08/16 Circuit Breakers

The fuses on WPF-08/16 breakers are mounted on the line side primary disconnect conductors. The Class L fuses are mounted as shown in Fig. 5-13. Other than the 800A size, which has a single mounting hole per tang, each Class L fuse tang has two holes sized for one-half inch bolts.

Appendix G includes a tabulation of the range of fuse sizes available for these breakers including catalog numbers of Gould Shawmut Fuses.

Class J fuses rated 300 through 600A have one mounting hole per tang. The 300, 350 and 400A sizes require copper adapter bars as shown in Fig. 5-14.

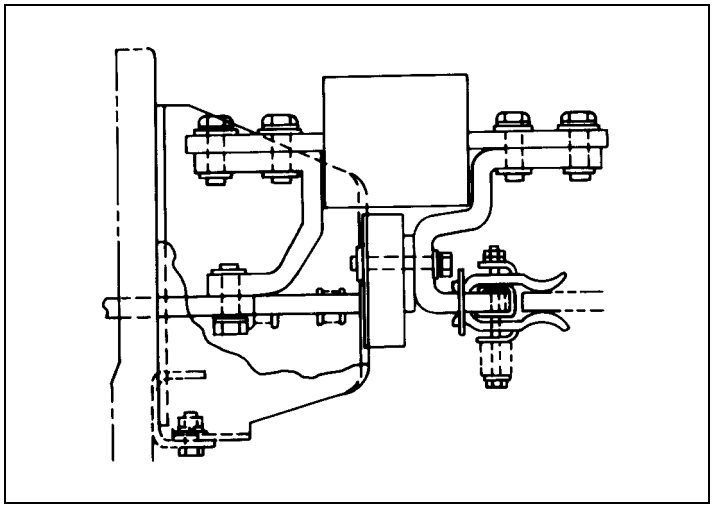


Fig. 5-13. Typical mounting for Class "L" fuse on WPF-08/16 breakers

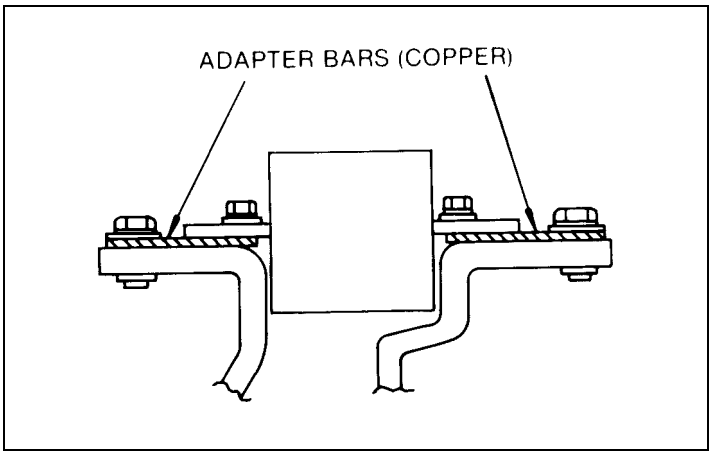


Fig. 5-14. Mounting for 300, 350, and 400-ampere Class "J" fuses on WPF-08 breakers

A special fuse is available for use with WPF-16 breakers. This fuse provides a melting time-current characteristic that coordinates with 1600A trip devices. Compared physically with a 2500A, NEMA Class L fuse, the special fuse is more compact (shorter) and its tangs are specially configured and offset to achieve the required pole-to-pole fuse spacing. A special primary disconnect assembly mounts directly on the outboard tang of the fuse. Because of their unique mounting provisions, the following procedure should be adhered to when replacing these fuses (Fig. 5-15):

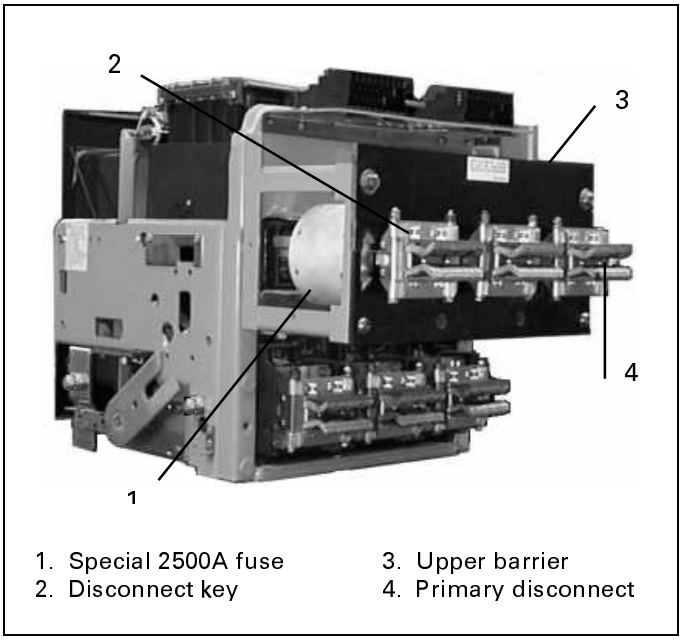


Fig. 5-15. WPF-16 breaker with special 2500-ampere fuse

1. Remove the primary disconnect assembly from the fuse tang. This is accomplished by first loosening the two keys (2), Fig. 5-15, via their holding screw and pulling them upward and out. After the keys are removed, pull the disconnect assembly off the end of the fuse tang.

NOTE: This removal does not disturb the disconnect's clamping force adjustment.

NOTE: Ce retrait n'affecte pas l'ajustement de la force de serrage du sectionneur.

2. Remove the upper barrier (3).

3. Detach the inboard end of the fuse by removing the two ½-13 NC bolts. A ratchet and socket with a short extension will be required.

4. Remove the fuse.

5. Install the new fuse by reversing the disassembly procedure. Ensure that the mating face of the fuse is clean.

CAUTION: When replacing the fuse in the right pole (plan view) of the breaker, note particularly that this fuse is mounted differently from the other two fuses. As shown in Fig. 5-16, for this phase the fuse is rotated 180 degrees about its axis so that its inboard tang is positioned beneath the breaker stud. This tang is offset with respect to the opposite end, (Fig. 5-17), so that rotating the fuse does not alter the position of the primary disconnect.

ATTENTION: Lorsqu'on procède au remplacement d'un fusible dans le pôle droit (vue de plan) du disjoncteur, prendre note que ce fusible en particulier est monté différemment des deux autres fusibles. Tel que montré à la Figure 5–16 pour cette phase le fusible est tourné de 180° autour de son axe de façon à ce que son axe intérieur soit positionné sous le plot du disjoncteur. Cette queue est déplacée en tenant compte du bout opposé (figure 5–17), pour que le fusible en rotation n'altère pas la position du débranchement primaire.

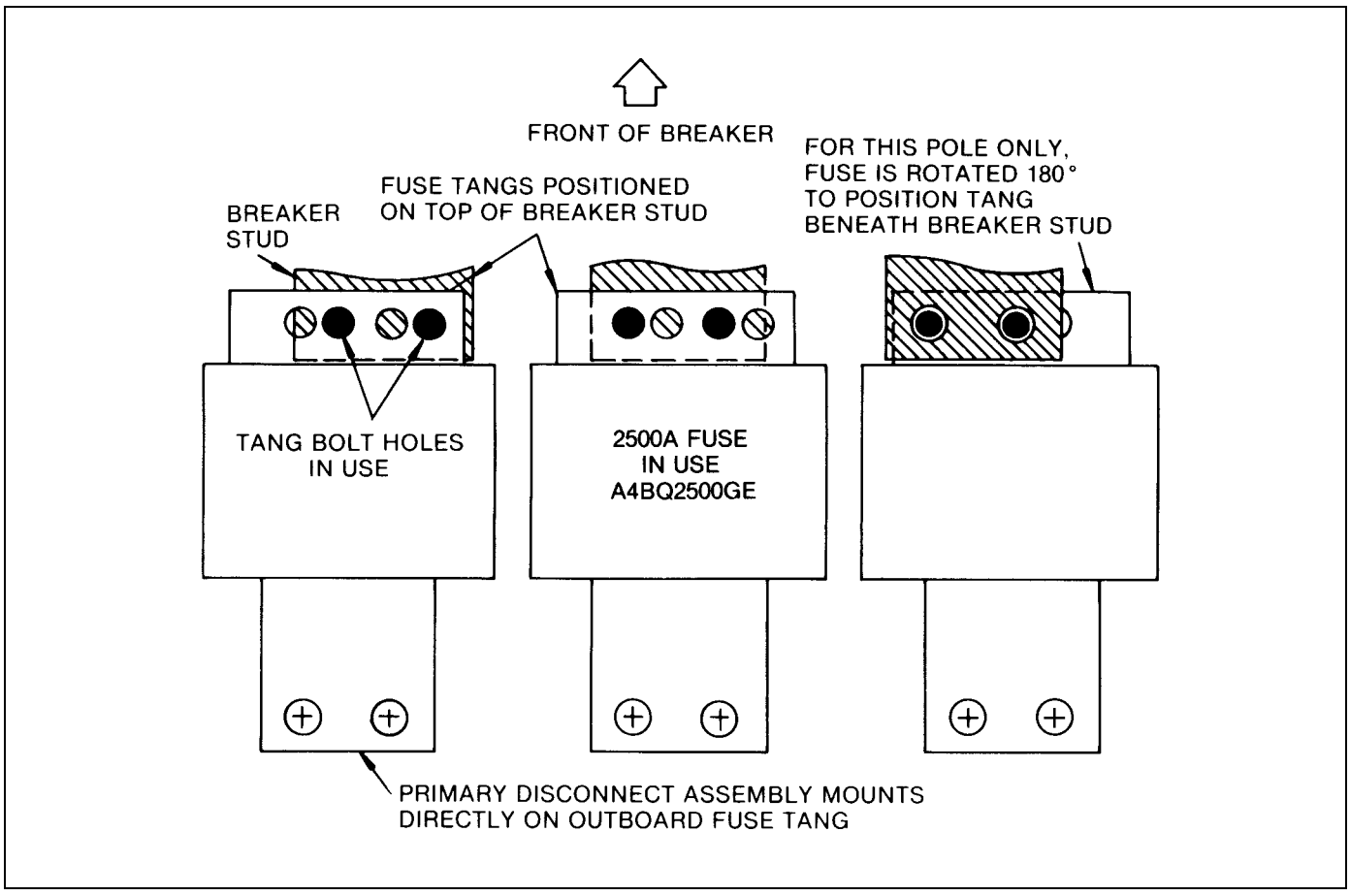


Fig. 5-16. Plan view of WPF-16 breaker showing 2500-ampere fuse tang positions

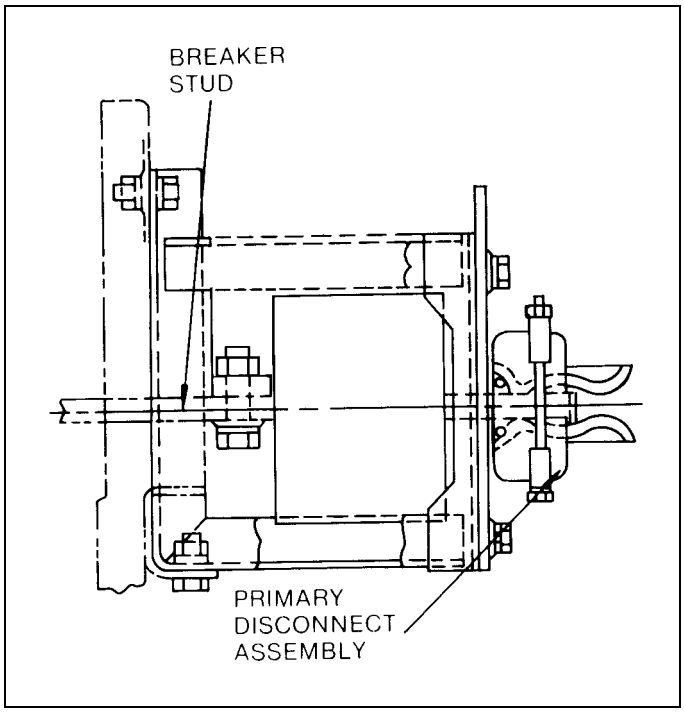


Fig. 5-17. Mounting for special 2500-ampere fuse on WPF-16 breaker

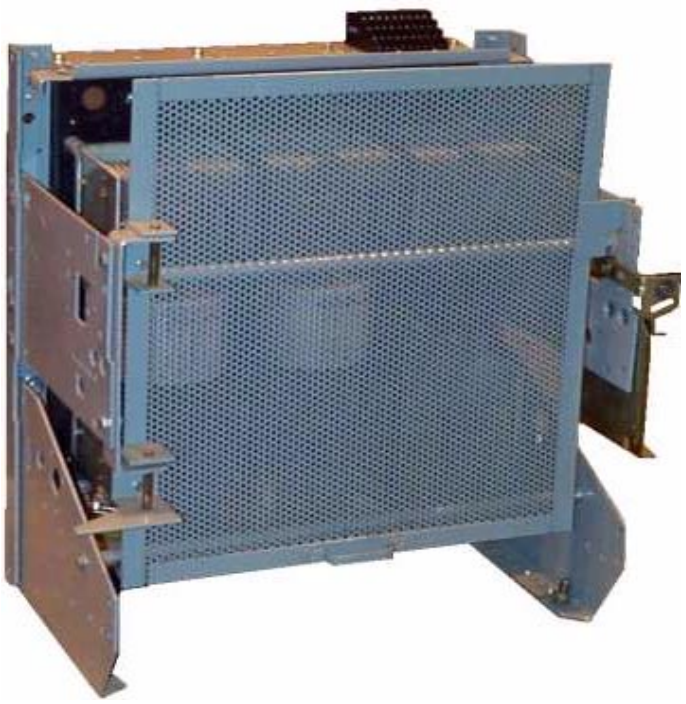


Fig. 5-18. Fuse rollout carriage (FRE) showing hinged, perforated steel screen panel

5-8 Installing and Removing Fuse Rollout Elements (FRE)–30-38-inch Wide Compartments

The FRE is racked into and out of its compartment just like a breaker. However, the fuse and breaker compartments each are equipped with keylocks to prevent racking the FRE when its associated breaker is closed. The FRE also utilizes a rejection pin scheme similar to that used on WPS-32/40/50 breakers, to prevent installation of an incorrect FRE.

All FRE models feature a hinged, perforated steel screen panel in front of the fuses as shown in Fig. 5-18. This panel can be opened to allow access to the fuses, Fig. 5-19, only when the FRE is in the WITHDRAWN position. In all other positions, an interference plate attached to the right side of the panel prevents it from being opened. Operation of the breaker compartment keylock is the same for all models. With the breaker open, the key can be removed; this extends the lock bolt, thereby maintaining the breaker in a trip-free state while in the CONNECT position Fig. 5-21. The breaker can be racked at will regardless of the keylock position.

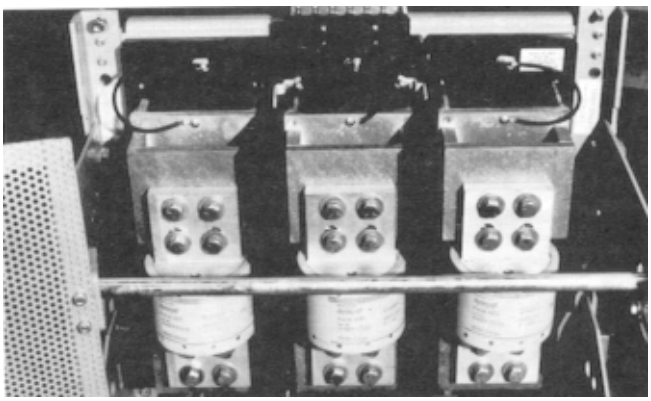


Fig. 5-19. View showing perforated panel open to allow easy access to fuses

The FRE compartment is KEY INTERLOCKED with the associated breaker. The FRE is locked in the connect position until a key is inserted in the FRE key interlock, Fig. 5-20, at this time the FRE can be racked out.

The breaker is prevented from being closed until the key is reinserted and captured in the breaker compartment key interlock mechanism.

Secondary disconnects on the FRE provide the voltage signals across each fuse to the OPEN FUSE LOCKOUT DEVICE on the associated circuit breaker, Fig. 5-22.

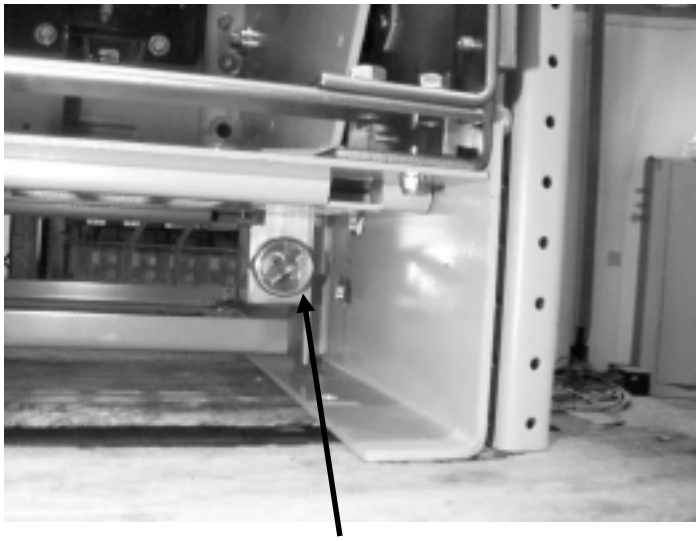


Fig. 5-20. View showing FRE key interlock locking FRE in connect position

Fig. 5-21. Key is captured in key interlock until breaker is opened

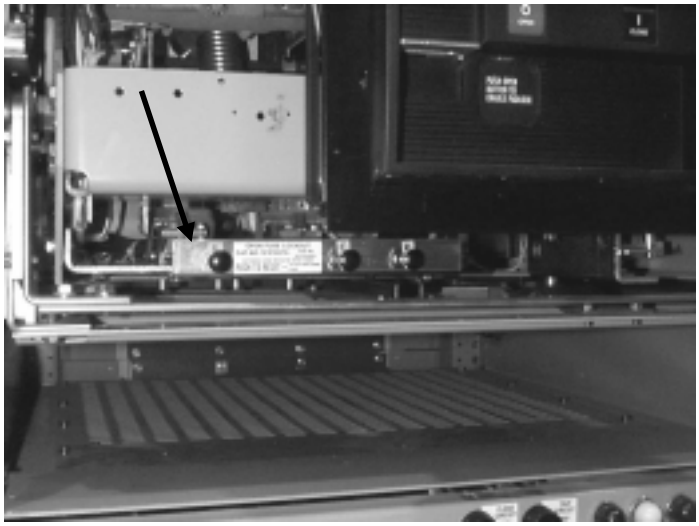


Fig. 5-22. View showing Open Fuse Lockout Device on the associated breaker

6-1 General

After the equipment has been installed and all connections made, it must be tested and inspected before it is put 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.

WARNING: The equipment must be completely de-energized while the tests are in progress.

ADVERTISSEMENT: L'équipement doit être complètement désamorcé lorsque l'on procède à des tests.

Directions for testing relays, instruments, and meters are given in the instruction book furnished for each device. The proper settings of the protective relays and circuit breaker trip units are normally determined from a complete power system coordination study performed by the purchaser or their consultant; therefore, the settings of these devices must be made by the purchaser. When the equipment is shipped from the factory, the time dial of all inverse-time induction disc relays (i.e., IFC types) is set to zero to prevent contact bounce during transportation.

NOTE: The trip setting adjustments of the trip unit for each circuit breakers may be in any position when shipped from the factory and must be correctly positioned prior to energization of the equipment.

NOTE: Les ajustements des réglages du disjoncteur peuvent être en n'importe quelle position lorsque celui-ci est expédié de l'usine et ils doivent être positionnés correctement avant que l'équipement ne soit mis sous tension.

General instructions for setting the relays are given in the applicable Relay or Trip Unit 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 meggering, 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 percent of the IEEE factory test voltage.

For the power circuit, the IEEE factory test voltage is two times switchgear rating plus 1,000 volts. See Table 5-1. Potential and control power transformers must be disconnected during high-voltage testing.

Switchgear Voltage Rating	ANSI Test Voltage, ac RMS	Field Test Voltage, ac RMS
600V	2200V	1650V
480V	1960V	1470V
240V	1480V	1110V

Table 5-1

6-2 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 stored in a location in accordance with the owner's established procedures.

CAUTION: 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 the improper use of spare keys will defeat the interlocking scheme.

ATTENTION: Référez-vous au schéma des clés de verrouillage inclus au sommaire fourni avec l'équipement pour déterminer les séquences d'opération et le nombre correct de clés d'opération requises. Cette précaution est nécessaire étant donné qu'un mauvais usage des clés de réserve rendra inopérant le programme de verrouillage.

6-3 Breaker Operation Test

All compartments housing WavePro 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. See DEH-134 or DEH-135.

6-4 Power+ and MicroVersaTrip™ Trip Units

The calibration of the Power+ and MicroVersaTrip™ trip unit should be checked with the Type TVRMS2 test kit, a portable instrument designed for the field testing of MicroVersaTrip solid-state trip units. The complete trip system is comprised of the following components:

1. Solid-state Trip Unit with rating plug
2. Phase Current Sensors
3. Flux Shift Magnetic Trip Device
4. When applicable, a Neutral Sensor for units containing a Ground Fault Trip element.

All components, except the Neutral Sensor, are integrally mounted in the circuit breaker. When used, the Neutral Sensor is separately mounted in the bus or cable compartment of the switchgear. In drawout construction, it is automatically connected to the trip unit in the breaker via a drawout secondary disconnect block.

CAUTION: Never disengage the trip unit on a breaker that is energized and carrying load current. This will open-circuit the current sensors, allowing dangerous and damaging voltages to develop.

ATTENTION: Il ne faut jamais désengager le déclencheur d'un disjoncteur qui est sous tension et transporte un courant de charge. Cela ouvrira les circuits des détecteurs de courant, permettant le développement de voltages dangereux et dommageables.

Complete Instructions for testing the trip units are included with the test set. The trip unit users manuals are DEH-178 (MicroVersaTrip Plus/PM) and DEH-179 (Power+).

6-5 Final Steps to Be Taken Before Energizing Equipment

The following steps should be taken before energizing the equipment:

1. Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they are properly aligned and operate freely.

2. Conduct an electrical insulation resistance test to make sure the switchgear is free from short circuits and grounds. This should be done both phase-to-ground and phase-to-phase with the switches or circuit breakers both opened and closed. This test should be performed with a 1000 volt meggar. Disconnect all control circuits before checking resistance.

3. Check any electrical relays, meters, or instrumentation to determine that connections are made properly and the devices function properly.

4. Electrically exercise all electrically operated circuit breakers, and other mechanisms (but not under load), to determine that the devices operate properly. An auxiliary source of control power may be necessary to provide power to the electrical operators.

5. Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions.

6. Set the adjustable current and voltage trip mechanisms to the proper values. Experience has indicated that damage from faults can be reduced if the devices used for overload and short circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7. Make certain that field wiring is clear of live bus and, where necessary, physically secured to withstand the effects of fault currents.

8. Check to determine that all grounding connections are made properly.

9. Remove all debris, scrap wire, etc., from the switchgear interior before closing the enclosure.

10. Install covers, close doors, and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.

7-1 Circuit Breaker Operation

General

Included below are abbreviated operating instructions for WavePro circuit breakers. Before activation of the circuit breakers or operation of the switchgear equipment, thoroughly read, and be familiar with, the circuit breaker manuals which will be supplied as supplementary information to this manual. Publication numbers are: DEH-134 and DEH-135.

Manually Operated Breakers

Closing Manually Operated WavePro Circuit Breakers

Manually operated WavePro breakers are equipped with a integral charging handle and a push button marked CLOSE on the front of the escutcheon. The spring must be charged first.

1. FOR WP-08/16/20 BREAKERS - A complete charge is accomplished by pulling the handle down about 90° (until it stops) five-six times to fully charge the closing springs. *This will not close the breaker contacts*. The charge indicator will show CHARGED on a yellow background.

2. FOR WP-32/40/50 BREAKERS - These breakers require the handle to be pulled down eight times to fully charge the springs. The charge indicator will show CHARGED on a yellow background.

Tripping Manually Operated WavePro Breakers

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

Electrically Operated Breakers

Electrically operated breakers may be closed by ac control power, or dc (normally station or standby battery) control power. Refer to the provided elementary diagrams for information on control circuitry.

The breakers may be controlled by a mechanically operated, double insulated 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 installed in a remote location. Fuses are located on the instrument panel just above the breaker compartment.

Electrical Tripping on WavePro Breakers

A shunt trip device is used for electrical tripping. A normally open auxiliary switch "a" contact opens the control circuit after the breaker opens, preventing damage to the shunt trip coil.

7-2 Circuit Breaker Drawout Operation

Breaker Positions

Refer to Fig. 7-1. The drawout operation features four positions:

1. CONNECT - In the CONNECT position, the primary and secondary disconnects are fully engaged. The breaker must be tripped before it can be racked out of this position.

2. TEST - When in the TEST position, the primary contacts are disconnected, but the secondary contacts remain engaged. This allows complete breaker operation without energizing the primary circuit.

3. DISCONNECT - In the DISCONNECT position, neither primary or secondary contacts are made. Breakers may be racked between these three positions with the compartment door closed and latched.

4. WITHDRAWN - With the door open, the breaker can be rolled out manually from the DISCONNECT to the WITHDRAWN position. Here, the breaker is completely out of its compartment, ready for removal.

Fig. 7-1. WavePro switchgear circuit breaker shown in DISCONNECT position

Drawout Operation

All breakers are supported on the drawout rails mounted on the side walls of the breaker compartments. On WavePro breakers, two wheels on each side of the breaker rest on each drawout rail.

Motion is provided by a mechanism mounted on the breaker. This mechanism drives racking cams which engage pins anchored to each side of the compartment.

The cams are driven by a removable racking handle which engages the mechanism. On small frame breakers, the handle is inserted through an opening in the breaker escutcheon; on large frame breakers, the handle is inserted in an opening in the upper right side of the door.

Turning the handle in a clockwise direction drives the breaker into the compartment. As the breaker disconnect fingers engage the stationary studs, a high force will be felt. Turn the racking handle as far as it will go to be sure the disconnect fingers are completely engaged.

The position of the breaker is given by the position indicator in the breaker escutcheon as it moves through the door cutout.

7-3 Front Doors

Operation

The front access doors on all standard AKD-10 Switchgear are hinged and equipped with a ¼-turn latch, Fig. 7-3. To open the door, rotate the knob clockwise ¼ turn.

Removal and Installation

Refer to Fig. 7-3 and remove/install switchgear front doors.

Door Removal

To remove the AKD-10 Switchgear door, proceed as follows:

1. Open door.
2. Loosen the two screws holding the top hinge pin plate and allow the pin to drop out of the hinge block. See Fig. 7-3.
3. Move the top of the door away from the switchgear, avoiding the door stop and lift the door out of the lower hinge pin socket. Retain the washer.

Door Installation

To install the AKD-10 Switchgear door, proceed as follows:

1. Insert washer, then place lower hinge pin into hinge pin socket on switchgear. See Fig. 7-3.
2. Swing door open, position behind door stop and align hinge pin socket.
3. Insert the hinge pin into the hinge block and tighten two screws.
4. Close door.

Fig. 7-2. AKD-10 switchgear front access doors are hinged with a rotary-type latch

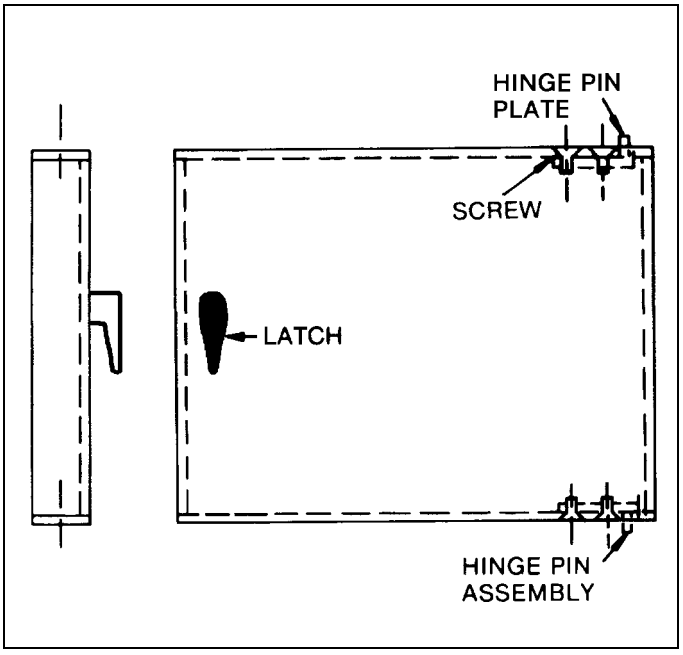


Fig. 7-3. Drawing showing front access details

7-4 AKD-10 Switchgear Accessories

Future Circuit Breaker Compartments

Breaker compartments designed for future use are complete and ready to use. These breaker compartments have a steel panel to cover the door cutout, Fig. 7-4. To prepare the circuit breaker compartment for use, remove the steel outer cover.

WARNING: Terminals behind the steel barrier may be electrically hot.

AVERTISSEMENT: Il se peut que les bornes à l'arrière de la barrière d'acier soient sous haute tension.

Fig. 7-4. Future-use breaker compartments

Circuit Breaker Key Interlock

General

A circuit breaker key interlock is available to provide protection against unauthorized operation. See Fig. 7-5. The key interlock is mounted with two one-way screws and lockwashers on the left side of the breaker compartment.

The interlock system is designed so that the key may be removed from the lock only when the breaker is tripped and the lock bolt is extended. With the bolt extended, the breaker is rendered trip free only in the CONNECT position in this compartment.

The breaker may be operated (closed and tripped) in the TEST or DISCONNECT positions even when the lock bolt is extended and the key removed.

Key Interlock Operation Check

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

1. With the breaker in the CONNECT position, manually trip the breaker. This then allows the interlock trip slide to be pushed in. When the trip slide is in, the lock bolt may be extended and the key removed. The breaker will remain trip free in the CONNECT position until the key is returned and the lock bolt is retracted.

Fig. 7-5. View showing circuit breaker key interlock to provide protection against unauthorized operation

2. If desired, the breaker may be moved to either the TEST or DISCONNECT position while the key is removed from the lock. In these positions, the breaker can be operated for checking or maintenance.

Test and Disconnect Padlock Device

General

WARNING: This padlock lockout does <u>not</u> provide equipment de-energization, isolation and grounding required for maintenance personnel safety. See instruction book DEH-134 or DEH-135 for details.

AVERTISSEMENT: Le mécanisme de verrouillage à cadenas ne fournit pas la mise hors tension adéquate de l'équipement, l'isolation et las mise à la terre requis pour assurer la sécurité du personnel de maintenance. Voir les instructions DEH–134 ou DEH–135 pour les details.

A test and disconnect mechanism padlock device is available to prevent unauthorized racking of the breaker. The rackout mechanism for circuit breakers and FRE may be locked in either the DISCONNECT or TEST position.

Fig. 7-6. Test & disconnect position padlock device (WP-08/16/20 and WPF-08/16 breakers)

Padlocking the WP-08/16/20 Breakers. (See Fig. 7-6.)

To padlock these breakers, proceed as follows:

1. The circuit breaker compartment door must be opened to put the padlock on; however, there is no interference with the door after the padlock has been placed in position.
2. With breaker moved to the appropriate position, push down on the sliding lock plate until its holes are aligned with those in the stationary plate. Insert and lock the padlocks.

Fig. 7-7. Racking mechanism padlock device (WPS-32/40/50 breakers)

Padlocking the WP-32/40/50 Breakers & WP-32/40/50 FRE Fuse Rollout Element (See Fig. 7-7.)

1. The circuit breaker compartment door must be opened to put the padlock on; however, there is no interference with the door after the padlock has been placed in position.
2. The device will permit locking the breaker in the DISCONNECT or TEST position. Hasps, which pivot on the corner post in combination with the circuit breaker crank interlock, prevent movement of the breaker from its locked position.
3. Align the appropriate hasp (front hasp for DISCONNECT position or rear hasp for the TEST position), insert, and lock the padlock.

Fig. 7-8. Compartment padlock device (WP-08/16/20, WP-32/40/50 WP-32/40/50 FRE compartments)

Padlocking the WP-08/16/20, WP-32/40/50, WP-32/40/50 FRE Compartments (See Fig. 7-8.)

1. The circuit breaker compartment door must be opened to put the padlock on; however, there is no interference with the door after the padlock has been placed in position.
2. Padlocks will prevent the acceptance of breakers or FRE in the compartment

Installing and Removing Metering Current Transformers

WARNING: Do not operate any current transformer with secondaries open-circuited. Be sure to short-circuit secondary before moving a current transformer.

AVERTISSEMENT: Tout transformateur de courant ne doit pas être opéré avec les secondaires dans un état de circuits ouverts. Assurez-vous de court-circuiter les secondaires avant de bouger un transformateur de courant.

Current transformers (CT's) for metering are generally mounted on the stationary primary disconnect studs in the breaker compartment and are readily accessible for inspection and replacement. In some applications they are located in the bus compartment or in the transition section.

When current transformers are mounted in device compartments, care must be exercised when installing or removing transformer mounting screws so as not to strip the holes in the plastic base. Do not torque screws over five in/lbs.

Removing Shutter Units

Visual inspection of primary disconnects and CT's can be made by first removing the breaker and opening the shutters manually. This is done by pressing the left and right hand actuating rollers toward the rear of the compartment simultaneously. This is a two-handed operation.
If it is necessary to perform work on the primary disconnects or CT's, it will be necessary to remove the entire shutter unit.

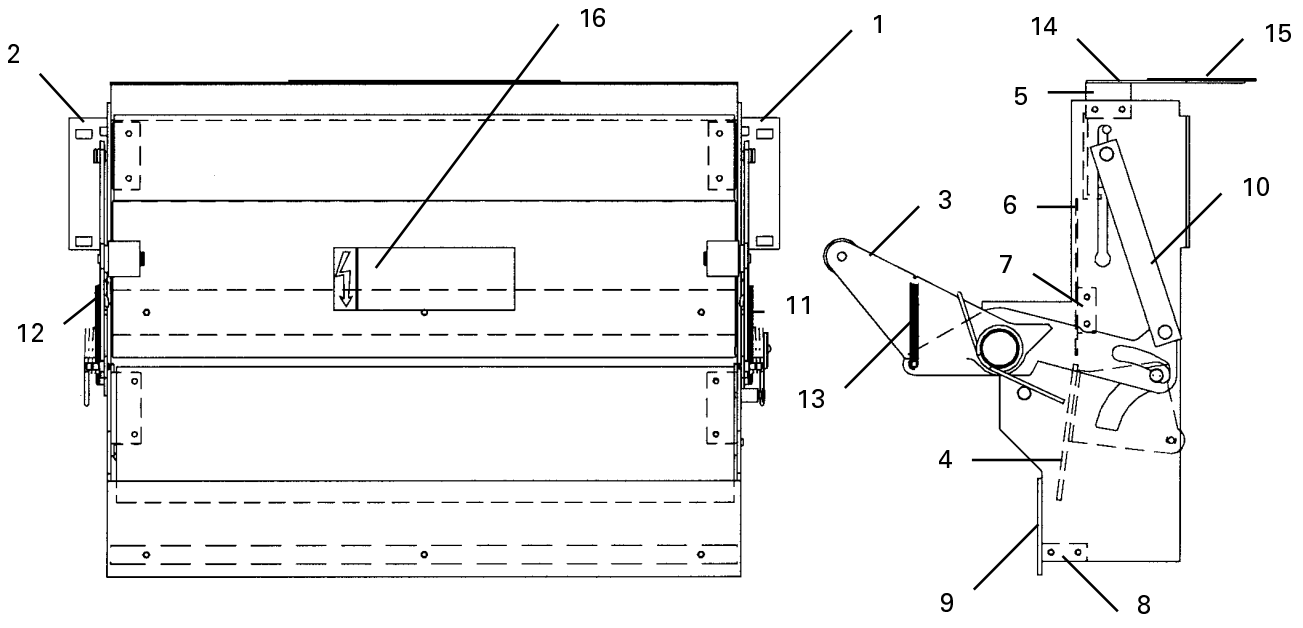
WARNING: Unless the proper precautions are taken, the removal of a shutter unit presents the hazard of electrical shock and burn. Do not remove the shutter unit unless the equipment has been de-energized. Failure to do this can result in serious injury.

ADVERTISSEMENT: A moins que les précautions nécessaires ne soient prises, l'installation d'une unité à volet présente des risques de choc électrique ou de brûlure. Il ne faut pas installer l'unité à volet à moins que l'équipement ait été désamorcé. L'omission de ce faire peut résulter en blessures sérieuses.

Removing a WP-08/16/20-Shutter Unit

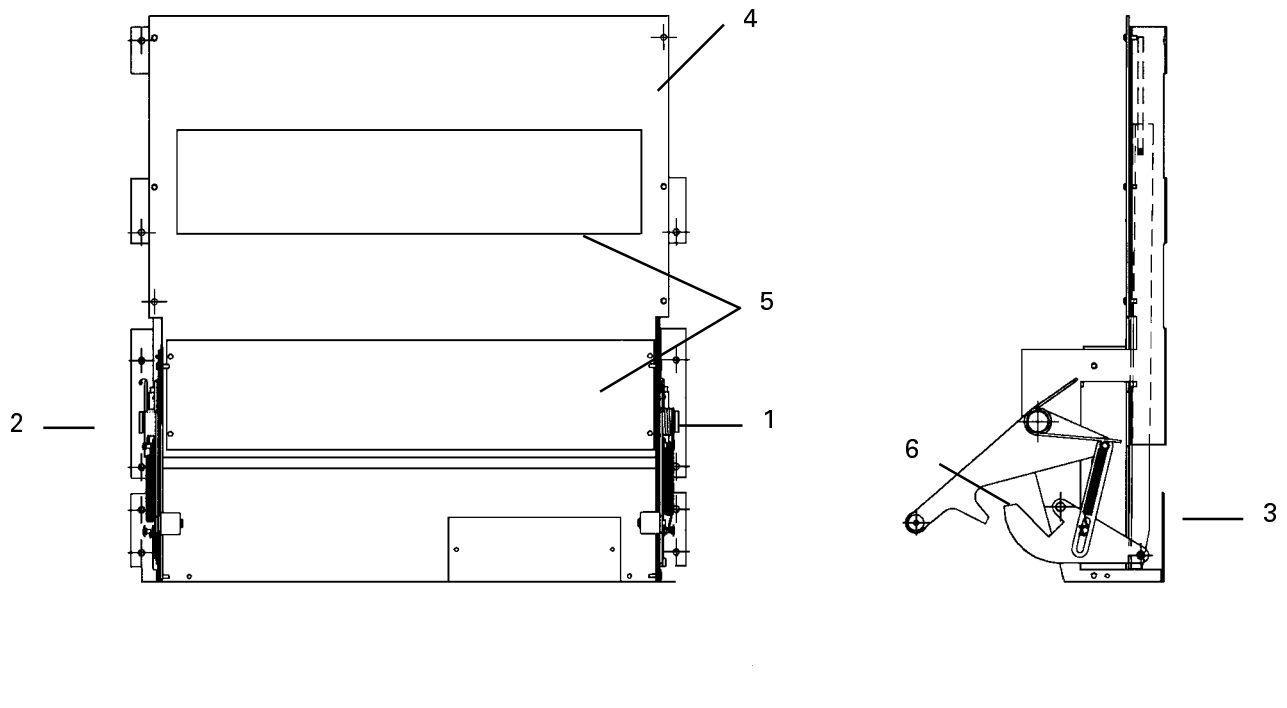
To remove these shutter units, proceed as follows:

1. The shutter unit frame is mounted on the vertical stringers located at each side of the rear of the breaker compartment. See Fig. 7-9. In extended compartments, the shutter is mounted to extension brackets.
2. Take out two 1/4-inch hex head screws on each side of the frame. A socket wrench with a 3/8-inch driving head with 4-inch extension will be needed.



1. Frame assembly
2. Frame assembly
3. Shutter Actuator
4. Bottom shutter
5. Support Block
6. Center shield
7. Support block
8. Support block
9. Bottom shield
10. Connector link
11. Spring
12. Spring
13. Spring
14. Complete upper shield assembly
15. Shield cover
16. Label

Fig. 7-9. AKD-10 circuit breaker shutter unit (WPS-08/16 breakers)



1. Side frame assembly (right)
2. Side frame assembly (left)
3. Movable shield assembly
4. Front shield
5. Shutters
6. Shutter actuator

Fig. 7-10. AKD-10 circuit breaker shutter unit (WPS-32/40/50 & WPH-32 breakers)

3. Carefully remove the entire shutter frame.

4. The frame is then maneuvered forward past the cam plates on each side, then upward and forward over the cam pins.

Removing a WPS-32/40/50 or Fuse Roll Out Shutter Unit

To remove these shutter units, proceed as follows:

1. The shutter unit frame is mounted to the vertical stringers located at each side of the rear of the breaker compartment. See Fig. 7-10.

2. Take out 11 ¼-inch hex head screws from the frame. A socket wrench with a 3/8-inch driving head with an 8-inch extension will be needed. See Fig. 7-10.

3. Carefully remove the entire shutter frame.

Installing a Shutter Unit

WARNING: Unless the proper precautions are taken, the installation of a shutter unit presents the hazard of electrical shock and burn. Do not install the shutter unit unless the equipment has been de-energized. Failure to do this can result in serious injury.

ADVERTISSEMENT: A moins que les précautions nécessaires ne soient prises, l'installation d'une unité à volet présente des risques de choc électrique ou de brûlure. Il ne faut pas installer l'unité à volet à moins que l'équipement ait été désamorcé. L'omission de ce faire peut résulter en blessures sérieuses.

Installing a WP-08/16/20 Shutter Unit

To install these shutter units, proceed as follows:

1. Carefully maneuver the shutter frame into the compartment, first lifting it over the cam pins on each side wall and past the cam plates.
2. Position the rear flanges of the shutter frame against the vertical stringers at the rear corners of the compartment.
3. Align the holes in the flange and drive in four 1/4-inch hex head screws using a 3/8-inch driver and a socket wrench with a 4-inch extension.
4. Check the operation of the moveable shutters by pressing the left and right hand actuating rollers toward the rear of the compartment.

Installing a WP-32/40/50 or Fuse Rollout Shutter Unit

To install these shutter units, proceed as follows:

1. Carefully maneuver the shutter frame into the compartment.
2. Position the rear flanges of the shutter frame against the vertical stringers at the rear corners of the compartment.
3. Align the holes in the flange and drive in 1/4-inch hex head screws using a 3/8-inch driver and a socket wrench with 8-inch extension.
4. Check the operation of the moveable shutters by pressing the left and right hand actuating rollers toward the rear of the compartment.

Chapter 8. Energizing the Switchgear

8-1 Before Energizing

Before switchgear is energized, a thorough final check should be made using the following checklist: Refer to section 6-5 for additional information.

- Breakers and other operating mechanisms exercised
- Electrical insulation resistance tested phase-to- phase and phase-to-ground
- Relays, meters and instruments properly connected
- Electrically operated breakers and operating mechanisms exercised
- Ground fault protection system tested
- Adjustable trips properly set
- Field wiring secured and free of live bus
- Grounding connections made
- All debris, scrap wire, etc. removed
- All covers installed, doors closed and latched

8-2 Energizing Procedures

CAUTION: Energizing switchgear for the first time is potentially dangerous. Therefore, qualified electrical personnel should be present when the equipment is energized. If problems caused by damage or poor installation practices have not been detected in the checkout procedure described previously, serious damage can result when power is turned on.

ATTENTION: La mise sous tension pour la première fois d'un dispositif de commutation est un acte potentiellement dangereux. Il faut donc que du personnel qualifié en électricité soit présent lorsque l'équipement est mis sous tension. Si lors de la procédure de vérification décrite précédemment des problèmes causés par des dommages ou de mauvaises pratiques d'installation n'ont pas été détectés, il peut en résulter des dommages sérieux lorsque le contact est établi.

1. There should be no load on the switchgear when it is energized.
2. Turn off all of the downstream loads, including those such as motor control centers and other devices which are remote from the switchgear.
3. The equipment should be energized in sequence by starting at the source end of the system and working toward the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices.
4. Turn the devices on with a firm positive motion.

9-1 Maintenance Requirements

General

A periodic maintenance schedule must be established to obtain the best service from the switchgear. An annual check of the switchgear devices and all connections should be made as a minimum requirement. Equipment subject to highly repetitive operation may require more frequent maintenance. A permanent record of all maintenance work should 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 Electric Safety Code, ANSI C2-1981 and in company or other safety regulations.

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

ADVERTISSEMENT: Il ne faut pas se fier à une isolation solide entourant un conducteur mis sous tension et à la puissance de l'appareillage pour fournir une protection aux membres du 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.

9-2 Breaker and Instrument Compartments

Periodic inspection of the circuit breaker is recommended at least once a year. More frequent inspections are recommended where severe load conditions, dust, moisture or other unfavorable conditions exist, or if the vital nature of the load warrants it. Always inspect the breaker after a short-circuit current has been interrupted.

Breakers

Test for Proper Operation

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

1. 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: Primary equipment must be completely de-energized while tests on control circuits, etc. are being conducted. Be sure that all areas of feedback from secondary circuits, as well as outside sources, are disconnected.

ADVERTISSEMENT: Il faut que l'équipement primaire soit complètement désamorcé lorsque des tests sont effectués sur des circuits de contrôle, etc. Assurez-vous que toutes les aires de rétroaction des circuits secondaires de même que les sources extérieures soient débranchées.

2. Remove the breakers from their compartments to a clean maintenance area. Close compartment door and cover the breaker cutout to prevent access to live parts.

WARNING: De-energize equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

ADVERTISSEMENT: Désamorcer complètement l'équipement avant d'effectuer du travail de maintenance dans les compartiments. Cela inclut le désamorçage de toute connexion aux sources primaires et secondaires, telles que les transformateurs et les interconnexions.

Checks After Breaker Is De-energized

At the time of inspection, the following checks should be made after the breaker has been de-energized.

1. Manually operate the breaker several times, checking for obstructions or excessive friction. Manual closing of an electrically operated breaker may be performed by the following two steps:

   a. To charge the mechanism springs, pull the operating handle down until it stops (about 90°) five-six times for the WP-08/16/20 and eight times for the WP-32/40/50 frame. The charge indicator will show CHARGED on a yellow background.

   b. Depress the CLOSE button on the front of the breaker. The springs should discharge and, if the latch is properly reset, the breaker will close.

2. Electrically operate the breaker several times to check performance of the electrical accessories.

3. Visually check the breaker for loose hardware on the breaker; also, check the bottom of the compartment for any hardware that has fallen from the breaker.

4. Remove and inspect the arc quenchers and contacts for breakage or excessive burning.

5. The performance of the solid-state current trip devices may be checked with a suitable test set. Check electro-mechanical devices for positive trip in accordance with the instructions in the proper Maintenance Manual.

6. Check insulating parts for evidence of overheating and for cracks that indicate excessive thermal aging.

Refer to circuit breaker instruction manuals for detailed maintenance instructions and information for replacement of parts. See DEH-136, DEH-137, DEF-004 or DEF-005.

Lubrication

In general, the circuit breaker requires moderate lubrication. Bearing points and sliding surfaces should be lubricated at the regular inspection periods with a thin film of GE lubricant D6A15A2. Before lubricating, remove any hardened grease and dirt from latch and bearing surfaces with mineral spirits then wipe with a clean rag.

CAUTION: All excess lubricant should be removed with a clean cloth to avoid accumulation of dirt or dust.

ATTENTION: Il faut enlever complètement tout excès de lubrifiant avec un linge propre afin d'éviter l'accumulation de saletés ou de poussières.

On drawout breakers, the contact surface of the disconnect fingers should be cleaned and greased with GE lubricant 0282A2048P009.

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.

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

Breaker Compartment Interiors

WARNING: De-energize equipment completely before doing maintenance work in compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

ADVERTISSEMENT: Mettre l'équipement complètement hors tension avant d'entreprendre tout travail de maintenance sur tout dispositif, raccordement, barres omnibus ou les compartiments des câbles d'alimentation. Cela inclut la mise hors tension des raccordements aux sources primaires et secondaires tels que les transformateurs et les interconnexions.

1. Thoroughly clean the 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.
2. Check indicating devices, mechanical and key interlocks.
3. 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.
4. Clean the racking mechanism and lubricate with GE lubricant D6A15A2.
5. Before replacing the breaker, wipe off the primary disconnecting device contacts. Apply a thin coat of GE lubricant D6A15A2 to the stationary studs and to the primary disconnects on the breaker.

9-3 Bus Area

WARNING: De-energize equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

ADVERTISSEMENT: Désamorcer complètement l'équipement avant d'effectuer du travail de maintenance dans les compartiments. Cela inclut le désamorçage de toute connexion aux sources primaires et secondaires, telles que les transformateurs et les interconnexions.

Inspect and check the bus area as follows:

1. Inspect the buses and connections carefully for evidence of overheating or weakening of the insulating supports. If bus insulation is present, remove the molded covers over the main bus connection to expose joints for inspection.
2. Check all connection bolts in the bus compartment and all bracing bolts for tightness. See the Torque Table A-1 in Appendix A.
3. Vacuum and, with a clean rag, wipe the buses and supports.
4. Visually inspect the insulation on the bars that run from the breaker studs through the bus structure to the cable area.
5. After cleaning, megger and record the resistance to ground and between phases of all insulated bars and all buses 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 ambient temperature and humidity.

9-4 Cable and Busway Compartment

Inspect and check the cable and busway compartment as follows:

1. Inspect all power cable connections for signs of overheating and tighten all connections. If severe discoloration or if damage is apparent, remove the damaged portion of the cable.

CAUTION: Be sure the condition which caused the overheating has been corrected before energizing.

ATTENTION: Assurez-vous que la condition ayant causé le surchauffement a été corrigée avant de mettre sous tension.

2. Check all bolts that hold cable terminals to the connection bars for tightness.
3. Check the neutral bus and ground bus connection and mounting bolts for tightness.
4. Check that all secondary control wiring connections are tight and that all control cabling is intact.

9-5 Over-all Switchgear

Make the following checks on the complete switchgear equipment.

1. Clean and inspect all painted surfaces and retouch where necessary.

2. Check to see that all anchor bolts and other structural bolts are tight.

3. Check that all breaker and instrument compartment door latches operate properly.

4. If the switchgear is equipped with heaters, check to see that all heaters are energized and operating.

5. For exterior vent openings in equipment furnished with air filters, the foam filter elements should be removed and washed in warm soapy water, rinsed, and reassembled at least annually. Elements should be inspected before re-assembly and replaced if any signs of deterioration are evident.

9-6 Paint Refinishing

Indoor switchgear is finished with ANSI-61 gray acrylic enamel paint (PPG W42713, GE part number 21525032650). To refinish damaged areas, remove all loose paint, rust, scale, oil or grease. Sand any scratches smooth using 220 grit paper or finer.

—Apply a coat of good acrylic enamel primer (Sherman-Williams E61 A 60,-GE part number 21525025200) with a viscosity of approximately 24-32 seconds using a #2 Zahn cup. Reduce with D5B9 Xylol (GE part number 21525038000) if needed. Air dry the primer for a minimum of 30 minutes, then apply the finish color coat of acrylic enamel. The top coat should be applied within 24 hours for best adhesion.

—If the area is to be spray-coated, thin the acrylic enamel with D5B9 Xylol (GE part number 21525038000). This thinning should only be necessary if the paint was received in a five gallon drum or more. The recommended viscosity for the W42713 topcoat should be 24-32 seconds with a #2 Zahn cup. The curing schedule for PPG W42713 is dust free in 5 minutes, touch in 30 minutes, handle in 60 minutes, full cure in 7 days. Both the primer (Sherwin-Williams E61 A 60) and paint (PPG W42713) should be applied only when temperature is above 55 degrees Fahrenheit.

—Application of special paint will be per the manufacturer's Product Data Sheet which includes instructions on thinning and application.

9-7 Circuit Breaker Lifting Mechanism

Under normal conditions, no special maintenance procedures or lubrication is required for this device. If the cable is abraided under any condition, it should be inspected for broken strands or other damage and replaced if necessary.

Hardware Size	Torque* (ft/lbs) Standard Nut with Conical Spring Washer or Lockwasher
¼-20	7-10
3/8-16	25-30
½-13	35-40
5/8-11	45-55

*These torque values are for non-lubricated threads

Table A-1—Torque Values for Low- voltage Equipment Electrical Joint Hardware other than Cable Terminals (Copper, Tin or Silver Plated)

Caution should be exercised when installing parts or components to the compartment molded base. Torque 1/4-inch screws slowly and do not exceed nine ft/lbs.

Table A-2—Torque Values for Self-threading Screws in Plastic

Wire Size	Torque* (in/lbs)
6 5 4 3	100
3 2 1	125
0 00	150
000 0000 200,000	200
250,000 300,000 350,000 400,000	250
500,000 600,000 700,000 750,000	300
800,000 900,000 1,000,000	400
1,250,000 1,500,000 1,750,000 2,000,000	500

*These torque values are for non-lubricated threads.

Table A-3—Torque Values for Cable Terminals

Appendix B. Circuit Breaker Rejection Features

General

In general, drawout breakers of the same type and rating are interchangeable in their equipment compartments; drawout breakers of different frame sizes or short circuit ratings are intentionally made non-interchangeable. To prevent inserting the wrong type breaker into a drawout compartment, unique "rejection hardware" is affixed to each breaker and its compartment. The rejection is accomplished by teeth or pins on the bottom of the breaker backframe and teeth or pins on the top of the pan in the equipment compartment.

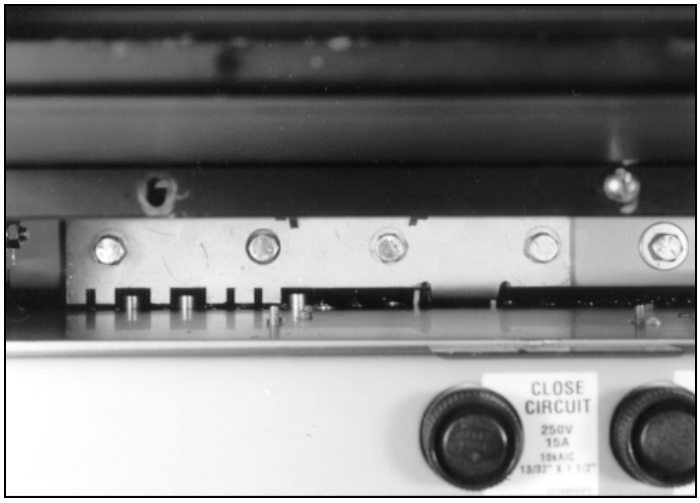


Fig. B-1. Breaker-mounted rejection plate

22-inch Wide Compartment

Figure B-1 (WPS-08/16/20, WPH-08/16, WPF-08/16, WPX-08 breaker family) shows the breaker-mounted rejection teeth located on the bottom left side of the backframe.

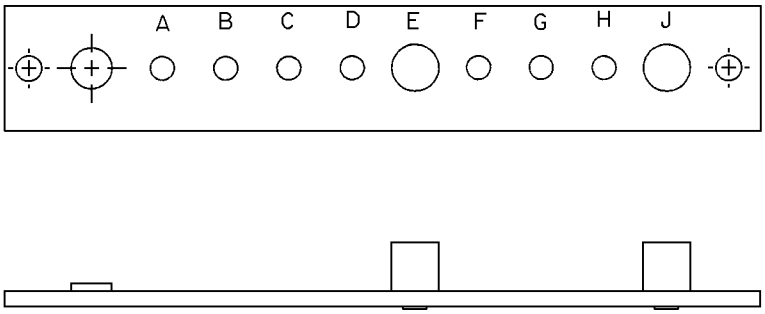
When a wrong type breaker is inserted into a compartment, the breaker teeth and equipment pins interfere, preventing the breaker from rolling into the disconnect position.

There is one exception to the above rule. Breakers of the same frame size, having different short circuit ratings, may be interchanged in one direction only. Specifically:

1. A WPH-08 or WPX-08 can be inserted into a WPS-08 compartment.
2. A WPX-08 can be inserted into a WPH-08 compartment.
3. A WPH-16 can be inserted into a WPS-16 compartment.

The rejection hardware prevents the converse of 1, 2. and 3.

Figure B-2 shows the rejection teeth combinations employed for the various breaker models and frame sizes.



WPF-08 shown

Circuit Breaker	Rejection Pin Position								
Type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**
WPS-08	○	○	○		●	○	○	○	
WPH-08	●	○	○		●	○	○	○	
WPF-08	○	○	○		●	○	○	○	
WPX-08	○	○	●		●	○	○	○	
WPS-16	○	○	○		○	○	●	○	
WPF-16 <2500A	○	○	○	○	○	○	●	○	●
WPF-16 2500A	○	○	○			●			
WPH-16	○	○	●		○	●	●	○	
WPS-20*	○	●	○		○	●	●	○	
WPS-20	○	●	○		○	●	○	○	

● Pin
○ No Pin
*With OFLO

Fig. B-2. Rejection pin pattern code for WP 08/16/20 breakers

The rejection teeth logic shown above is for AKD-10 equipment breakers only. Equipment breaker catalog numbers start with WE and have a green nameplate located on the breaker escutcheon.

OEM breaker catalog numbers start with WS and are identified with a yellow nameplate located on the breaker escutcheon.

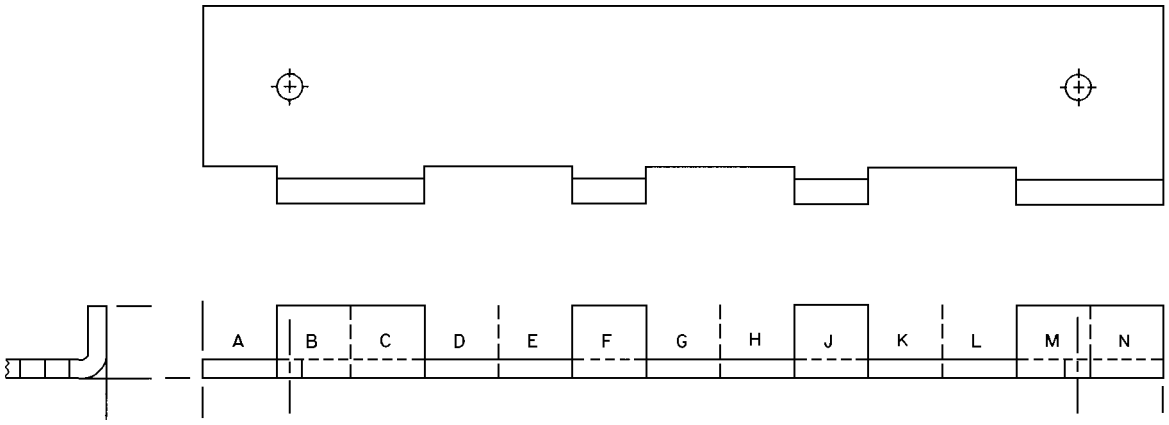
30 & 38-inch Wide Compartment

WPS-32/40/50 and WPH-32 breakers and fuse rollouts for AKD-10 switchgear include means to prevent inadvertent interchange of these 3200, 4000, and 5000 ampere sizes. Interference hardware on each breaker and in its compartment, cause the compartment to accept the correct breaker type and reject all others.

Interchangeability within and between frame sizes is prevented by the rejection system of Fig. B-3. When the wrong type breaker is inserted into a compartment, the breaker pins and the equipment teeth interfere.

Exception: A WPH-32 can be inserted into a WPS-32 compartment, but rejection hardware prevents a WPS-32 from being inserted into a WPH-32 compartment.

Figure B-3 shows the rejection pin combinations for 3200A, 4000A and 5000A breakers and fuse rollout elements.



WPS-32 shown

Circuit Breaker			Rejection Tab Position												
Type	OFLO	Volts	A	B	C	D	E	F	G	H	J	K	L	M	N
WPS-32	Y	600Vac		T	T			T			T			T	T
WPS-40	Y	600Vac	T			T			T	T				T	T
WPS-50	Y	600Vac		T	T			T			T			T	T
WPS-32	N	600Vac		T	T			T			T			T	
WPH-32	N	600Vac	T	T	T			T			T			T	
WPS-40	N	600Vac	T			T			T	T				T	
WPS-50	N	600Vac		T	T			T			T			T	
WP-32 FRE		600Vac	T			T					T			T	T
WP-40 FRE		600Vac		T	T						T			T	T
WP-50 FRE		600Vac		T	T						T			T	T

T = Tab Location

Fig. B-3. Rejection tab pattern code for WPS-32/40/50 & WPH-32 breakers and FRE

The rejection logic shown above is for AKD-10 equipment breakers only. Equipment breaker catalog numbers start with WE and have a green nameplate located on the breaker escutcheon.

OEM breaker catalog numbers start with WS and have a yellow nameplate located on the breaker escutcheon.

Figure B-4 shows the WP-32/40/50 rejection system.

Fuse Rollout Elements

Fuse rollout (FRE) elements used in conjunction with either the WPS-32 (3200 ampere), WPS-40 (4000 ampere), or WPS-50 (5000 ampere) breakers employ the same type drawout mechanism as their companion breakers and utilize the same type rejection system. Only a 3200-ampere fuse rollout element may be installed in a 3200-ampere fuse rollout compartment; Only a 4000-ampere fuse rollout element may be installed in a 4000-ampere fuse rollout compartment; Only a 5000-ampere fuse rollout element may be installed in a 5000-ampere fuse rollout compartment. The rejection pin pattern is shown on Fig. B-3.

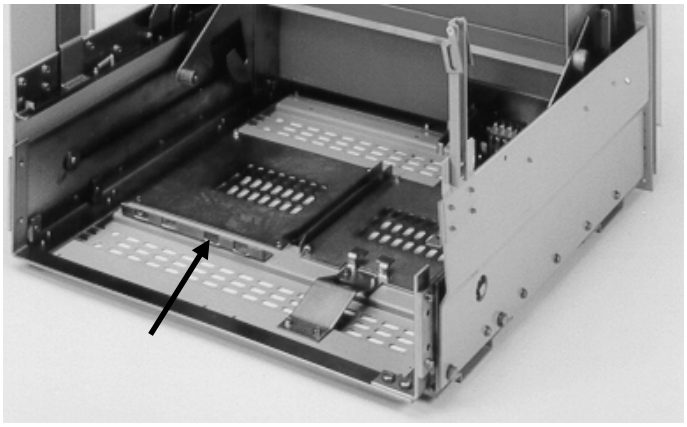


Fig. B-4. View showing WP-32/40/50 rejection angles

Appendix C. Circuit Breaker Ratings

Frame Size (Amperes)	Breaker Type	System Nominal Voltage (60 HZ AC)	Three-phase Short Circuit Rating RMS Symmetrical kA		
			Short Time Withstand	With Instantaneous Trip	Without Instantaneous Trip
800	WPS-08	600	30	30	30
		480	30	30	30
		240	30	42	30
800	WPH-08	600	42	42	42
		480	42	42	42
		240	42	50	42
800	WPX-08	600	50	50	50
		480	65	65	65
		240	65	65	65
1600	WPS-16	600	42	42	42
		480	50	50	50
		240	50	65	50
1600	WPH-16	600	65	65	65
		480	65	65	65
		240	65	65	65
2000	WPS-20	600	65	65	65
		480	65	65	65
		240	65	65	65
3200	WPS-32	600	65	65	65
		480	65	65	65
		240	65	85	65
3200	WPH-32	600	85	85	85
		480	85	85	85
		240	85	130	85
4000	WPS-40	600	85	85	85
		480	85	85	85
		240	85	130	85
5000	WPS-50	600	85	85	85
		480	85	85	85
		240	85	130	85

Table C-1-General Circuit Breaker Ratings

Appendix C. Circuit Breaker Ratings

Frame Size (Amperes)	Breaker Type	Rated Maximum Voltage ac (60 Hz)	CLF Fuse Rating (Amperes)		Interrupting Rating RMS Symmetrical kA
			Min	Max	
800	WPF-08	600	300	1600	200
1600	WPF-16	600	450	2500	200

Table C-2—Integrally Fused Circuit Breaker Ratings

Mode	Rated Voltage		Voltage Range	Amperes Inrush/Sustained	
				WP-08/16/20	WP-32/40/50
Spring Charging	Ac (60 Hz)	120	104–127	25/5	25/8.1
		240	208–254	12/3	11.7/3.5
	Dc	110	88–123	30/7	30/7
		125	100–140	27/5	25/7
		250	200–280	13/3	13/3.2
Tripping	Ac (60 Hz)	120	95–127	12.3/10.8	
		240	190–254	3.9/3.4	
	Dc	110	62–123	2.3/2.3	
		125	70–140	2.0/2.0	
		250	140–280	1.0/1.0	

Table C-3. Circuit Breaker Control-operating Currents

Appendix D. Circuit Breaker Accessory Device Ratings

Shunt Trip

The shunt trip offers remote electrical tripping of breakers. Usually controlled by a switch or push button, it may also be used in conjunction with protective relays for automatic tripping.

The shunt trip coil is rated for intermittent duty. When ordered factory installed, it is supplied with a cutoff switch which automatically removes control power following a breaker trip. See Table D-1.

Control Voltage		Shunt Trip Amperes		
Nominal		Operating Range	Inrush	Sustained
Dc	48	28-60	4.5	4.5
	110	62–123	2.3	2.3
	125	70–140	2.0	2.0
	250	140–290	1.0	1.0
Ac (60 Hz)	120	95–127	12.3	10.8
	208	165–220	3.2	2.6
	240	190–254	3.9	3.4

Table D-1

Undervoltage Trip (UV)

The undervoltage trip device protects against harmful drops in line voltage by automatically tripping the breaker. This device is set to pick up at approximately 85 percent of bus voltage and drop out between 30 percent and 60 percent (non-adjustable). See Table D-2.

Control Voltage		UV Coil Amperes Holding Current
Dc	48	0.32
	110	0.15
	125	0.15
	250	0.07
Ac (50/60 Hz)	120	0.15
	240	0.07

Table D-2

The UV device is also available with an optional static time-delay unit. This offers a field adjustable 2- to 6-second delay between undervoltage and breaker trip to prevent potential nuisance tripping due to momentary loss of voltage.

The time-delay unit is mounted external to the breaker. It is rated 125 or 250 volts dc or 208/240 volts ac, 50 or 60 hertz. For any other ac source voltage, a control power transformer with a 240-volt secondary rated at least 100 Va is required. See DET-196 for additional information.

Auxiliary Switch

The auxiliary switch is used for remote indication of breaker main contact position and is available in groupings of six contacts or twelve contacts. All contacts feature rugged double break construction. See Tables D-3 and 4.

CB Main Contacts	Auxiliary Switch Position	
	"A" Contact	"B" Contact
Open or Tripped	Open	Closed
Closed	Closed	Open

Table D-3

Control Voltage		Auxiliary Switch* Interrupting Ratings (Amperes)	
		Non-Inductive	Inductive
Dc	125	10	6.3
	250	5	1.8
Ac (60 Hz)	115	15	15
	240	10	10

*20 ampere continuous rating of switch limited to 15-ampere continuous rating of No. 16 wire on drawout breakers.

Table D-4

Remote Close Accessory

This accessory provides a means to electrically close all WavePro breakers from a remote location. It may be controlled by a switch or push button for five-cycle closing.

The breaker must be charged locally. The available ratings are shown in Table D-5.

Control Voltage		Amperes Inrush
Dc	48	15.0
	110	4.0
	125	4.0
	250	3.0
Ac (50/60 Hz)	120	16.0
	240	7.0

Table D-5

Bell Alarm With Lockout

The bell alarm is provided with two c-form contacts - each c-form contact is 1 NO and 1 NC contact with a common connection. It is activated when the breaker is tripped by the trip unit. The manual trip button, UV, OFLO or the shunt trip device do not activate the bell alarm. The ratings are shown in Table D-6.

The contacts may be used for remote indication of an automatic trip or disable electrical operation of breakers that may have automatic control.

The lockout feature is available to mechanically lock the breaker "open" when the device is activated. "Reset" is accomplished through operation of reset button on the breaker escutcheon.

The bell alarm is available without the lockout feature when so specified.

Control Voltage		Bell Alarm Contact Ratings (Amperes)
		Continuous
Dc	125	0.5
	250	0.25
Ac	240	6

Table D-6

Electric Lockout

The electric lockout device provides a means to electrically enable or disable manual closing of a circuit breaker. This device must be energized prior to attempting to manually close the breaker. Once the breaker is closed, loss of voltage will not trip the breaker. A manual bypass interlock is provided for initial startup. Refer to the undervoltage device for ratings and coil characteristics. (Note: Interlocking of electrically operated breakers does not require an electrical lockout device.)

Appendix E. Circuit Breaker Weights

Device	Net Weight, lb. (kg)	
	Manual	Electrical
WPS/WPH/WPX-08	200 (91)	205 (93)
WPF-08	245 (112)	250 (114)
WPS/WPH-16	210 (96)	215 (98)
WPF-16	255 (116)	260 (118)
WPS-20	220 (100)	225 (102)
WPS/WPH-32	475 (216)	485 (221)
WPS-40	535 (243)	545 (248)
WPS-50	575 (262)	585 (266)
2000 Ampere Fuse Rollout	250 (114)	–
3200-Ampere Fuse Rollout	350 (159)	–
4000-Ampere Fuse Rollout	400 (182)	–
5000-Ampere Fuse Rollout	450 (205)	–

Table E-1. Circuit Breaker/Fuse Rollout Element Weights

Appendix F. Circuit Breaker Repetitive Duty Data

General

Circuit breakers are designed primarily to perform the function of circuit interruption under short-circuit conditions. Nevertheless modern circuit breaker mechanisms are capable of many operations under full-load operation and in-rush conditions such as encountered in motor starting applications. Industry standards have been established for the minimum performance which is indicated in Table F-1. With adequate maintenance, GE breakers can be expected to exceed the standards.

Circuit Breaker Frame Size (Amperes)	Number of Operations Between Servicing	Number of Operations Rated Continuous Current Switching* (1) (2) (3) (4) (5) (6) (7) (8) and (10)	Number of Operations No-Load Closing and Opening* (1) (2) (3) (4) (5) (6) and (7)	Number of Operations In-Rush Current Switching* (3) (4) (5) (6)) (7) (9) and (10)
800	1750	2800	9700	1400
1600	500	800	3200	400
2000	500	800	3200	400
3000	250	400	1100	—
4000	250	400	1100	—
5000	250	400	1100	—

*Refer to lettered paragraphs under NOTES.

Table F-1. Repetitive Duty and Normal Maintenance

Notes

Power operated circuit breakers, when operating under usual service conditions, shall be capable of operating the number of times specified in Table F-1. The operating conditions and the permissible effect of such operations upon the breaker are given in the following lettered paragraphs. For each column, all paragraphs listed in the column heading must be given consideration.

This standard applies to all parts of a circuit breaker that function during normal operation. It does not apply to other parts, such as overcurrent tripping devices, that function only during infrequent abnormal circuit conditions.

1. Servicing consists of adjusting, cleaning, lubricating, tightening, etc., as recommended by the manufacturer. When current is interrupted, dressing of contacts may be required as well. The operations listed are on the basis of servicing at intervals of 6 months or less.

2. When closing and opening no-load.

3. With rated control voltage applied.

4. Frequency of operation not to exceed 20 in 10 minutes or 30 in an hour. Rectifiers or other auxiliary devices may further limit the frequency of operation.

5. Servicing at no greater intervals than shown in Column 2 of Table F-1.

6. No functional parts should have been replaced during the listed operations.

7. The circuit breaker should be in a condition to carry its rated continuous current at rated maximum voltage and perform at least one opening operation at rated short-circuit current. After completion of this series of operations, functional part replacement and general servicing may be necessary.

8. When closing and opening current up to the continuous current rating of the circuit breaker at voltages up to the rated maximum voltage and at 85% power factor or higher.

9. When closing currents up to 600% and opening currents up to 100% (80% power factor or higher) of the continuous current rating of the circuit breaker at voltages up to the rated maximum voltage.

   When closing currents up to 600% and opening currents up to 600% (50% power factor or less) of the continuous current rating of the circuit breaker at voltages up to rated maximum voltage, the number of operations shown shall be reduced to 10% of the number listed.

10. If a fault operation occurs before the completion of the listed operations, servicing is recommended and possible functional part replacements may be necessary, depending on previous accumulated duty, fault magnitude, and expected future operations.

Appendix G. Fuses for WPF-08/16 and FRE Elements

NEMA Fuse Class 600V, 60 Hz	Breaker Type WPF 08	Breaker Type WPF 16	Ampere Rating	Gould Shawmut Fuse Cat. No.
"J"	x	—	300*	A4J300
	x	—	400*	A4J400
	x	x	450	A4J450
	x	x	500	A4J500
	x	x	600	A4J600
"L"	x	x	800	A4BY800
	x	x	1000	A4BY1000BG
	x	x	1200	A4BY1200BG
	x	x	1600	A4BY1600BG
	—	x	2000	A4BY2000
Special	—	x	2500	A4BQ2500GE

*Mounting adapter required.

Table G-1. Fuses for Integrally Fused WavePro Breakers

Ampere Rating	Fuse Size Min.	Fuse Size Max.	Fuse Cat. No's Gould Shawmut
3200	2000A	4000A	A4BY2000-55BA
4000	2000A	5000A	A4BQ2500-55BA
5000	2000A	5000A	A4BY3000-55BA
			A4BY4000-55BA
			A4BY5000-55BA

Table G-2. Fuses for Roll-out Fuse Carriages

GE Electrical Distribution & Control

General Electric Company
Switchgear Business Department
Burlington, Iowa 52601

DEH194 R01 0698