Page

CONTENTS

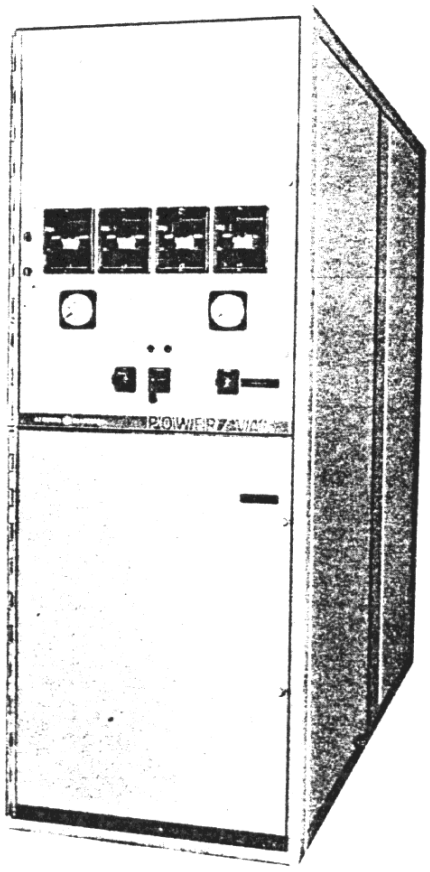
31

INSTRUCTIONS AND RECOMMENDED PARTS FOR MAINTENANCE

GEK-39672C
SUPERSEDES GEK-39672B

POWER/VAC* METAL-CLAD SWITCHGEAR
TYPES VM-4.16 AND VM-13.8

FOR VACUUM CIRCUIT BREAKER
TYPES VB-4.16, VB-7.2 AND VB-13.8



GENERAL ELECTRIC

30

LIST OF ILLUSTRATIONS

POWER/VAC* METAL-CLAD SWITCHGEAR
TYPES VM-4.16 AND VM-13.8

FOR VACUUM CIRCUIT BREAKERS
TYPES VB-4.16, VB-7.2 AND VB-13.8

INTRODUCTION

Metal-clad switchgear is equipment designed for the protection, instrumentation and control of various types of electrical apparatus and power circuits.

The switchgear consists of one or more vertical sections which are mounted side by side and connected mechanically and electrically together to form a complete switching equipment. Typical equipments are shown in Figs. 1, 2, 3 and 4.

The circuit breakers are easily removable to provide maximum accessibility for maintenance with minimum interruption of services. The switchgear is designed to provide a high degree of safety to the operator. All equipment is enclosed in grounded metal compartments.

The equipment is available in the ratings listed in the following table. The ratings of the equipment and devices are based on usual service conditions as covered in ANSI standards. Operation at currents above the equipment rating will result in temperature rises in excess of these standards, and is not recommended. For outdoor installation the same basic equipment is built into a weatherproof housing as in Figs. 2, 3 and 4. The equipment is not designed for exposure to dripping liquids as this condition is not a usual ANSI service condition. Dripping liquids can destroy the integrity of the insulation system and must be avoided.

TYPE EQUIPMENT	CIRCUIT BREAKER	MAXIMUM VOLTAGE KV	CONTINUOUS CURRENT AMPERES	NOMINAL INTERRUPTING CAPACITY MVA
VM-4.16	VB-4.16-250	4.76	1200-2000	250
VM-416	VB-4.16-350	4.76	1200-2000 3000	350
VM-13.8	VB-7.2-500	8.25	1200-2000	500
VM-13.8	VB-13.8-500	15.0	1200-2000	500
VM-13.8	VB-13.8-750	15.0	1200-2000	750
VM-13.8	VB-13.8-1000	15.0	1200-2000 3000	1000

RECEIVING, HANDLING AND STORAGE

RECEIVING

Every case or crate leaving the factory is plainly marked at convenient places with case number, requisition number, customer's order, front or rear, and when for size and other reasons it is necessary to divide the equipment for shipment, with the section numbers of the portion of equipment enclosed in each shipping case.

The contents of each package of the shipment are listed in the Packing Details. This list is forwarded with the shipment, packed in one of the cases. The case is especially marked and its number can also be obtained from the Memorandum of Shipment. To avoid the loss of small parts when unpacking, the contents of each case should be carefully checked against the Packing Details before discarding the packing material. Notify the nearest General Electric Company representative at once if any shortage of material is discovered.

Before leaving the factory all elements are carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Upon receipt of

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.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

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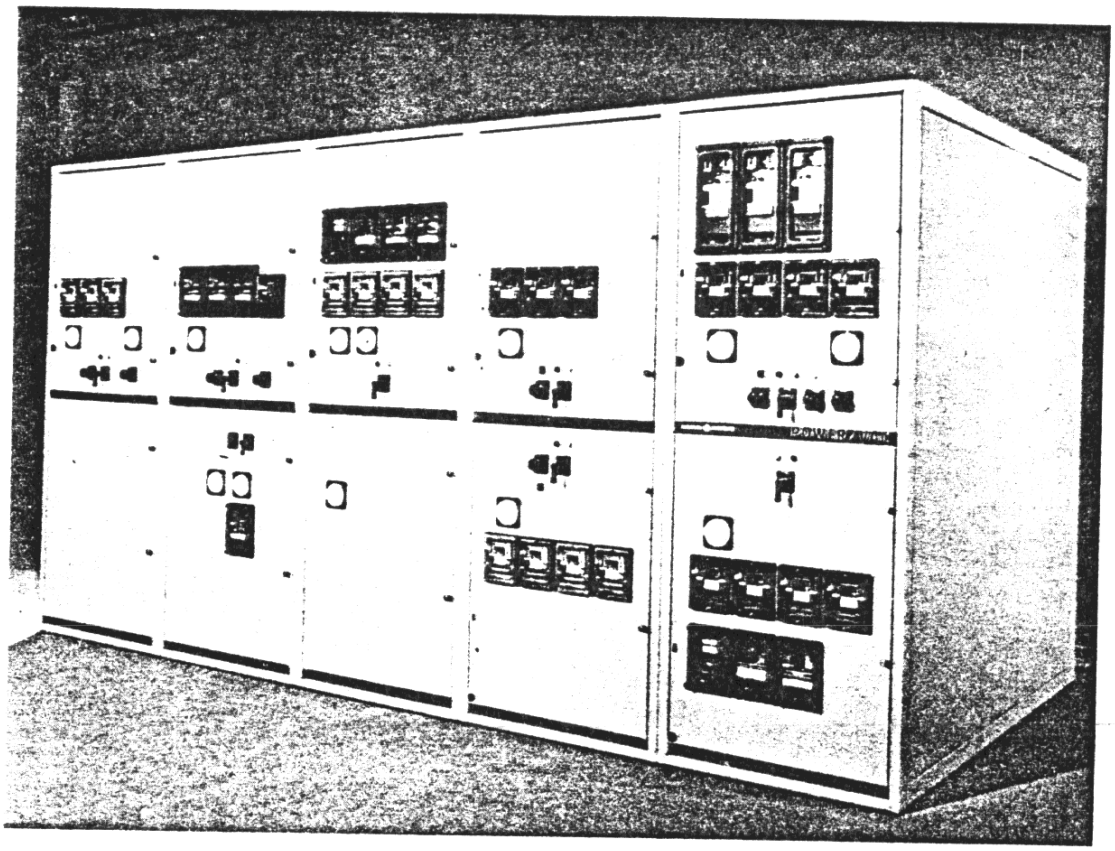


Fig. 1 (8918455D)

Fig. 1 Typical Indoor Power/Vac* Metal-Clad Switchgear Equipment

Fig. 2 Typical Outdoor Power/Vac* Metal-Clad Switchgear Equipment

Fig. 3 (89184386)

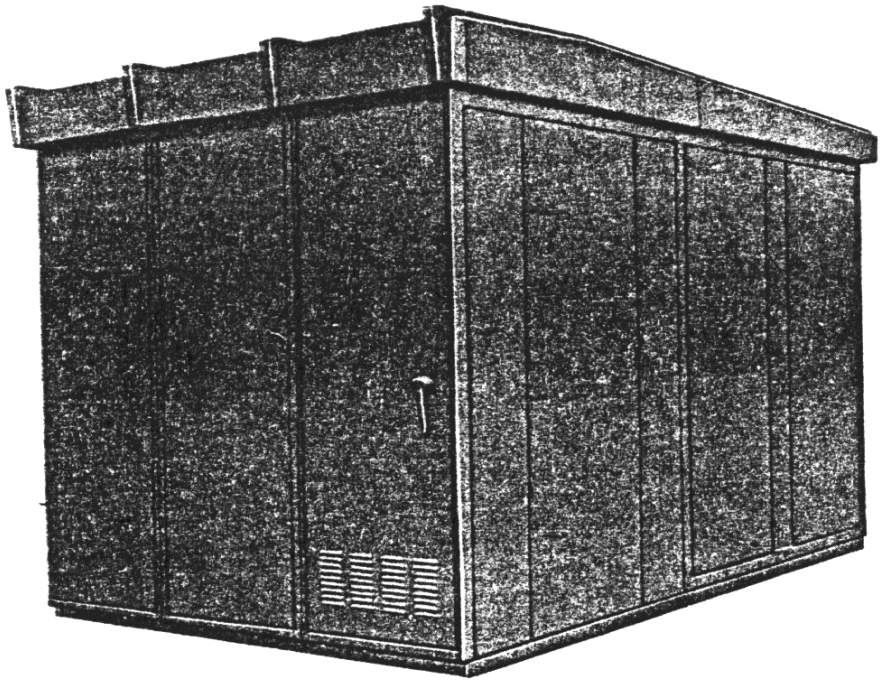


Fig. 3 Typical Outdoor Power/Vac* Metal-Clad Switchgear with Protected Aisle

Fig. 4 (

Fig. 4 Typical Outdoor Power/Vac* Metal-Clad Switchgear with Common Aisle

436

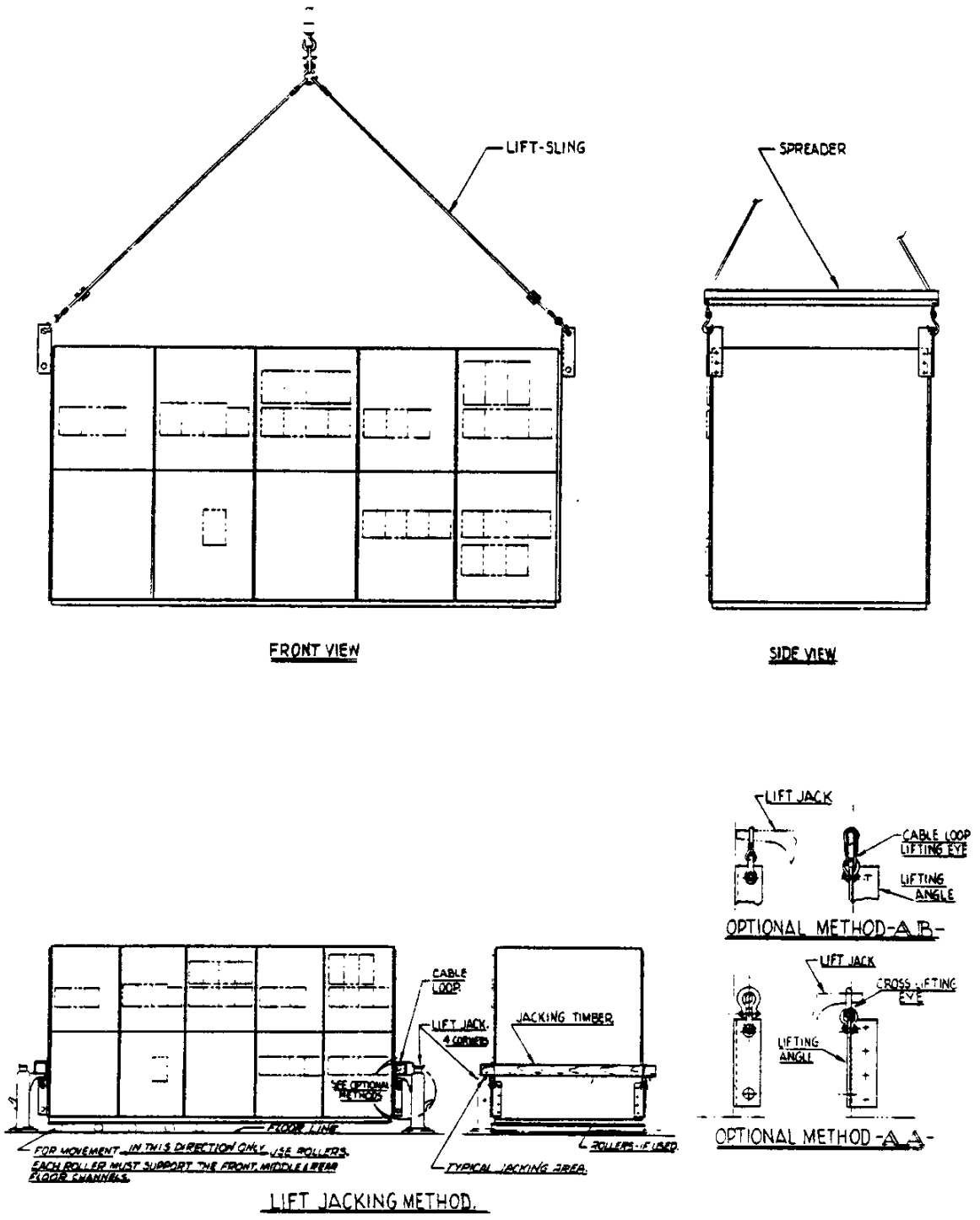


Fig. 5 (0209B4645 Rev. 0) – Fig. 5 (0209B4678 Rev 0)

Fig. 5 Installation Details for Indoor Power/Vac* Metal-Clad Switchgear

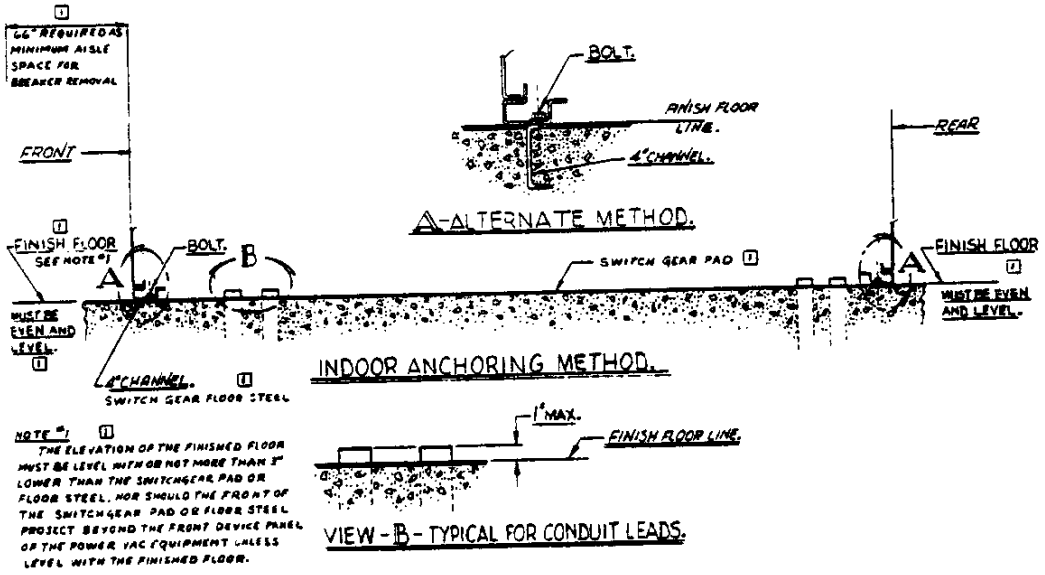


Fig. 5 Installation Details for Indoor Power/Vac* Metal-Clad Switchgear (Continued)

any apparatus an immediate inspection should be made for any damage sustained while enroute. If damage is evident or an indication of rough handling is visible, a claim for damage should be filed at once with the transportation company and the General Electric Company notified promptly. Information as to damaged parts, part number, case number, requisition number, etc., should accompany the claim.

HANDLING

Before uncrating, indoor equipment may be moved by crane with slings under the skids. Spreaders should be used to keep the cables from rubbing against the equipment. If crane facilities are unavailable, rollers under the skids may be used. Fig. 5 shows the suggested method of anchoring the switchgear after it is removed from the skids. After the equipment is in place the lifting brackets should be removed.

Methods of handling outdoor equipment are shown in Figs. 6, 7 and 8. After the equipment is in place the lifting brackets should be removed.

STORAGE OF INDOOR EQUIPMENT

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

1. Uncrate the equipment. Check it thoroughly for damage.
2. Cover important parts such as jack screws, gears and chain of racking mechanism, linkage and moving parts with a heavy oil or grease, such as D6B15 (Mobil 28).
3. Store in a clean, dry place with a moderate temperature (such as 40 - 100°F) and cover with a suitable cover to prevent deposits of dirt or other foreign substances upon movable parts and electrical contact surfaces.
4. Batteries should be uncrated and put on trickle charge immediately upon receipt.

5. If dampness or condensation may be encountered in the storage location, (can occur with rapid temperature changes) heaters should be placed inside the equipment to prevent moisture damage. Approximately 300 watts of heat per vertical stack will be required. The suggested arrangement is one 75-watt heat element in each breaker and primary cable compartment. Remove all cartons and other miscellaneous material packed inside units before energizing any heaters. If the equipment has been subjected to moisture it should be carefully dried out using forced warm air and then tested with a 1000 or 2500 volt megger. A reading of at least 200 megohms should be obtained.

6. Breakers should be prepared for storage separately. Refer to the breaker instruction book GEK-39671 for details.

STORAGE OF OUTDOOR EQUIPMENT

1. Uncrate the equipment. Check it thoroughly for damage.

2. Cover important parts such as jack scre chain of racking mechanism, linkage machine - finished parts with a heavy oil c as D6B15 (Mobil 28).

3. Batteries should be uncrated and put on immediately upon receipt.

4. Dampness or condensation can be prevent a temporary power supply connection t already installed in the equipment. If the e been subjected to moisture it should be dr same manner as with indoor equipment as d

Caution: Be sure that fuses to CPT second removed before energizing the temporary the heaters. This is to prevent a back feed o at CPT primary.

5. Breakers should be prepared for storag Refer to the breaker instruction book GE details.

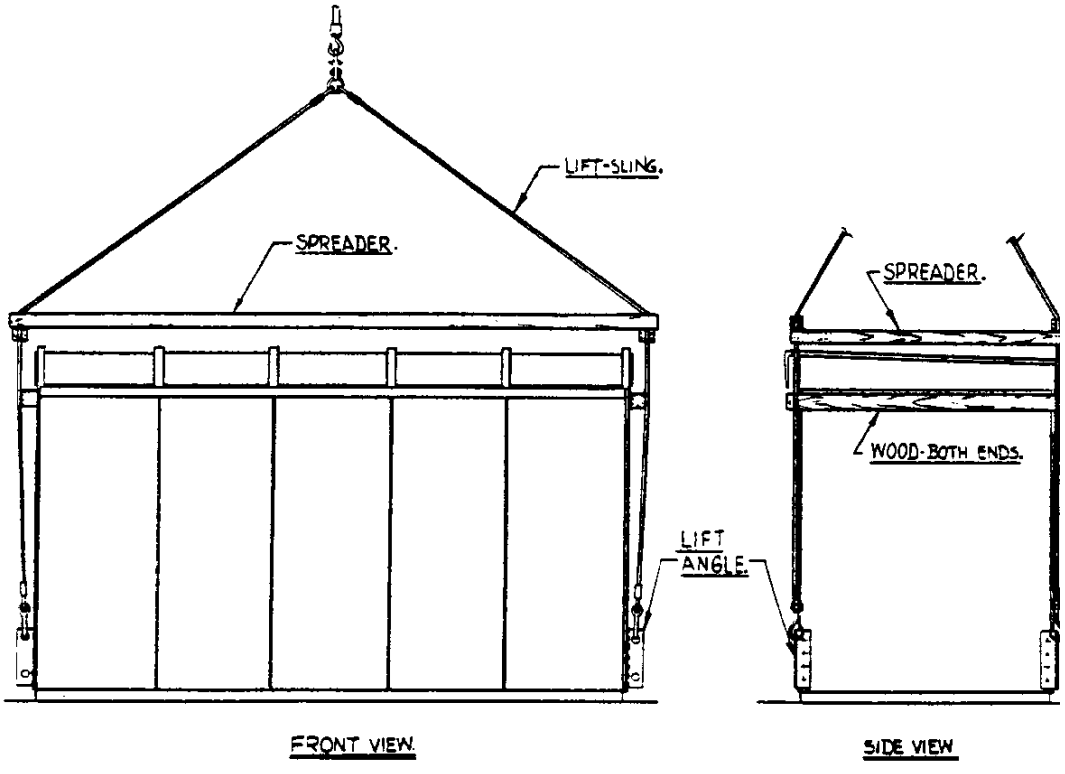


Fig. 6 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear

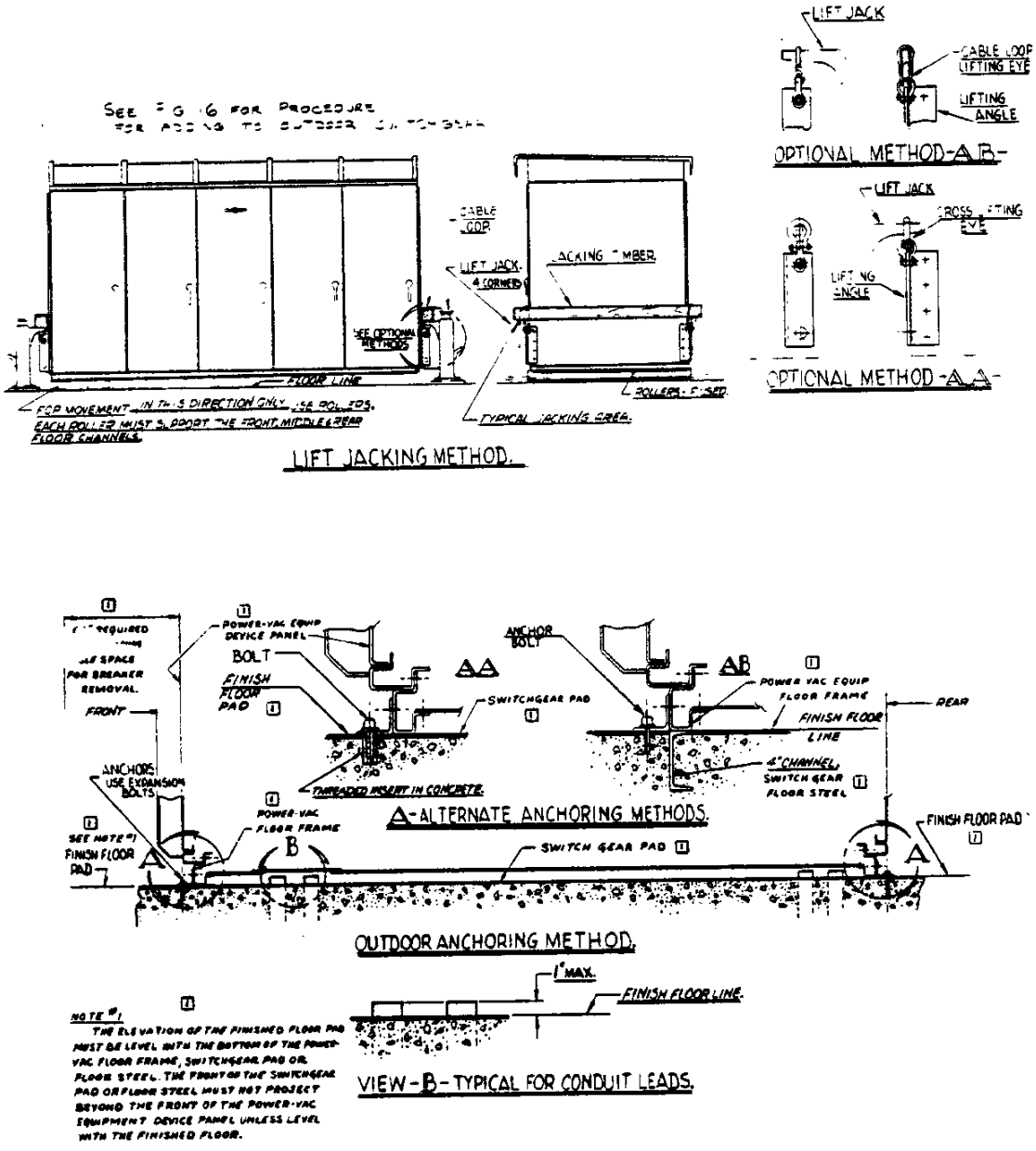
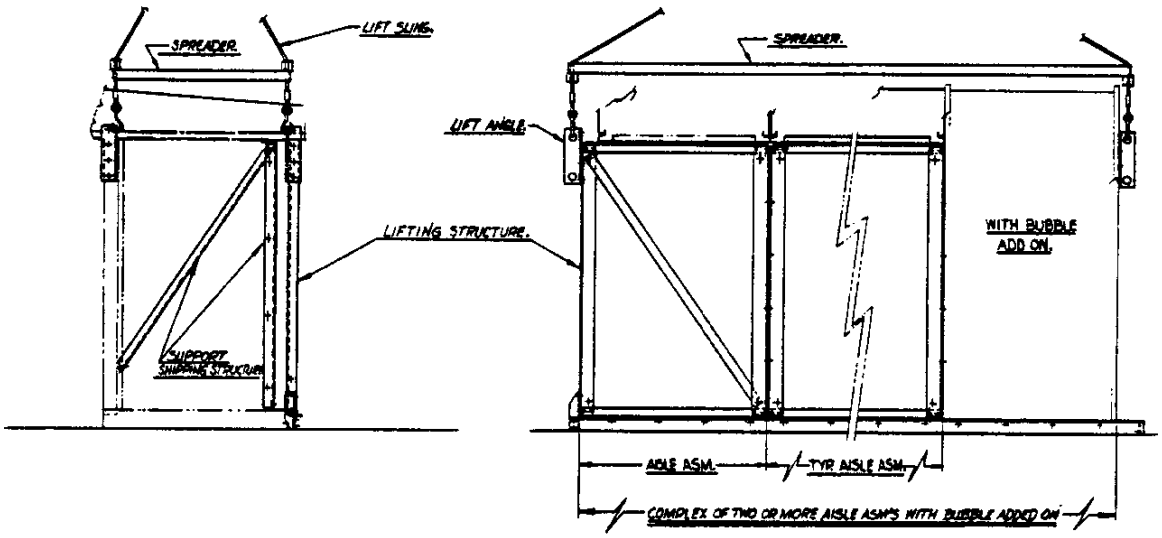


Fig. 6 (0209B4647 Rev. 0)

Fig. 6 (020

Fig. 6 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear (continued)



7 (0209B4652 Rev. 0)

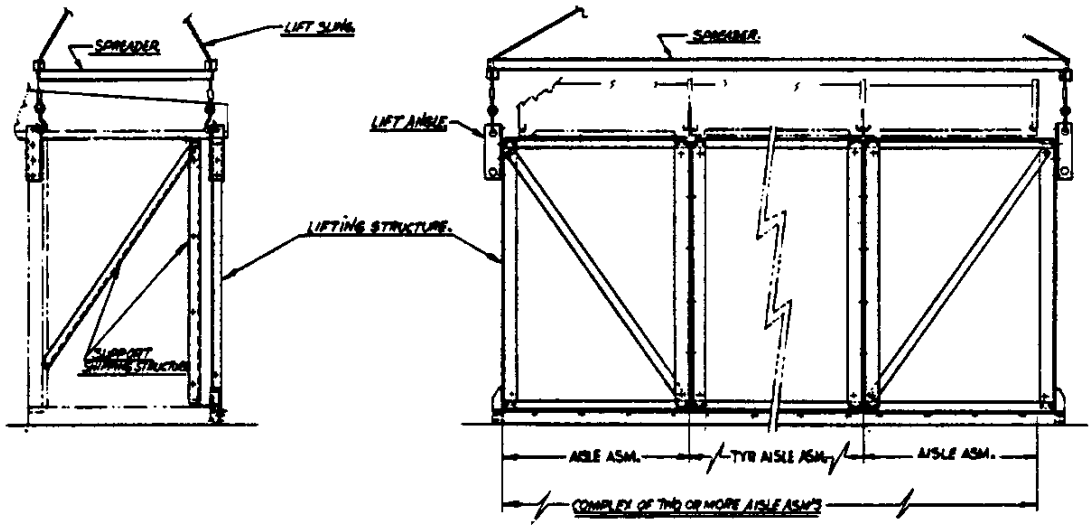


Fig. 7 (0209B4651 Rev. 0)

Fig. 7 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear with Protected Aisle

Fig. 7 (0209B4649-1 Rev. 0)

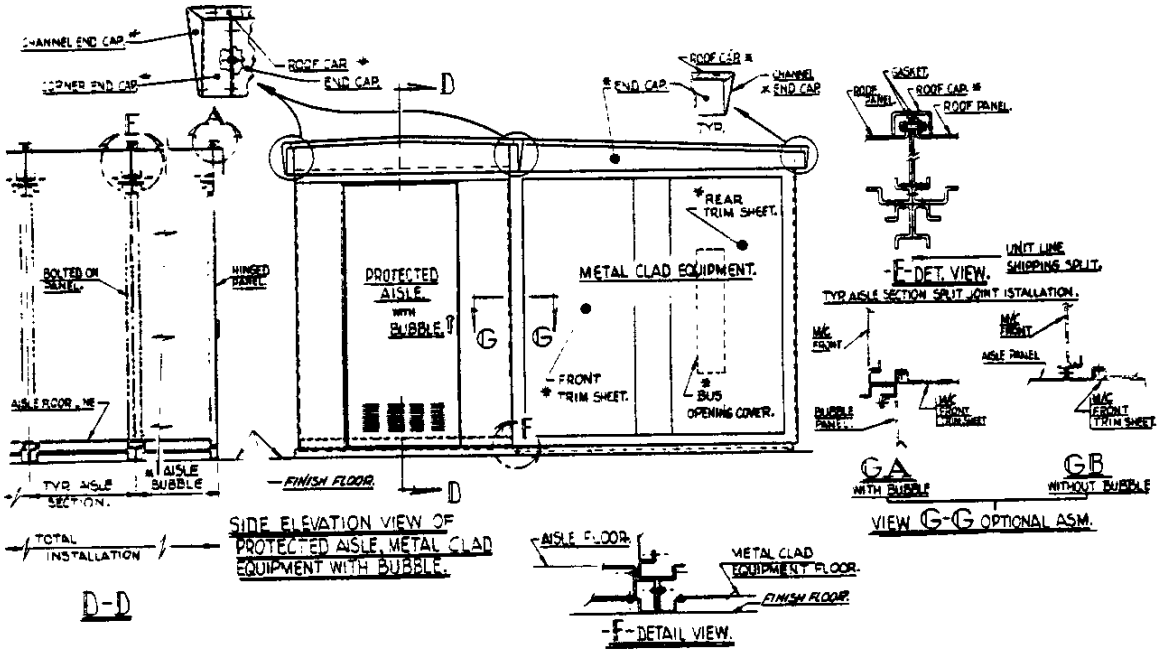


Fig. 7 (0209B4649-2 Rev. 0)

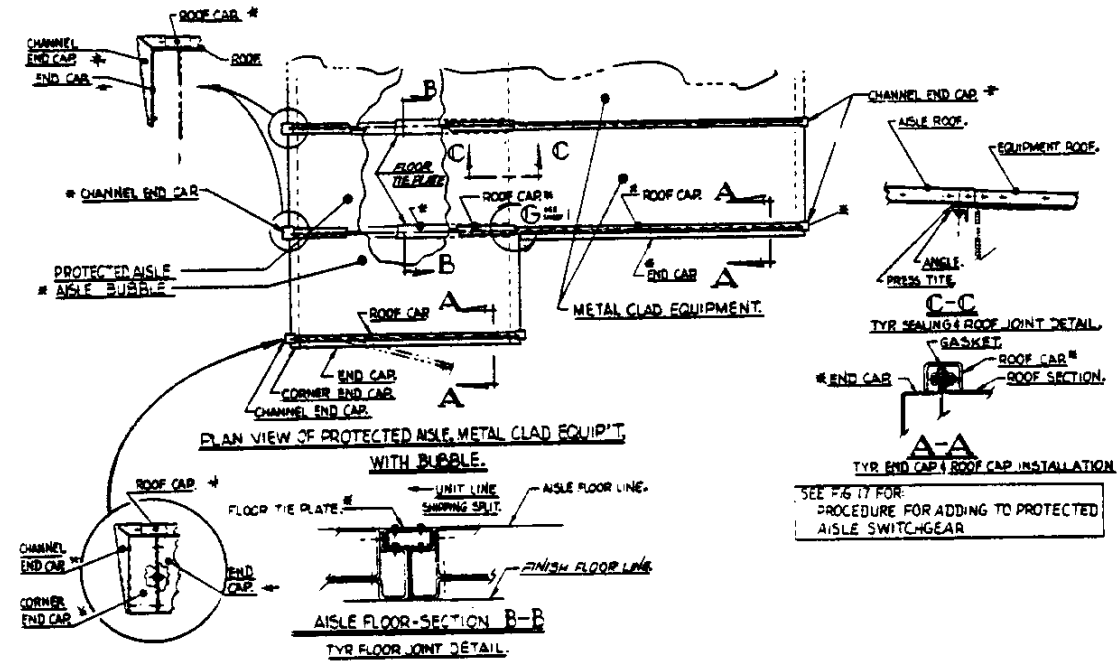


Fig. 7 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear with Protected Aisle (continued)

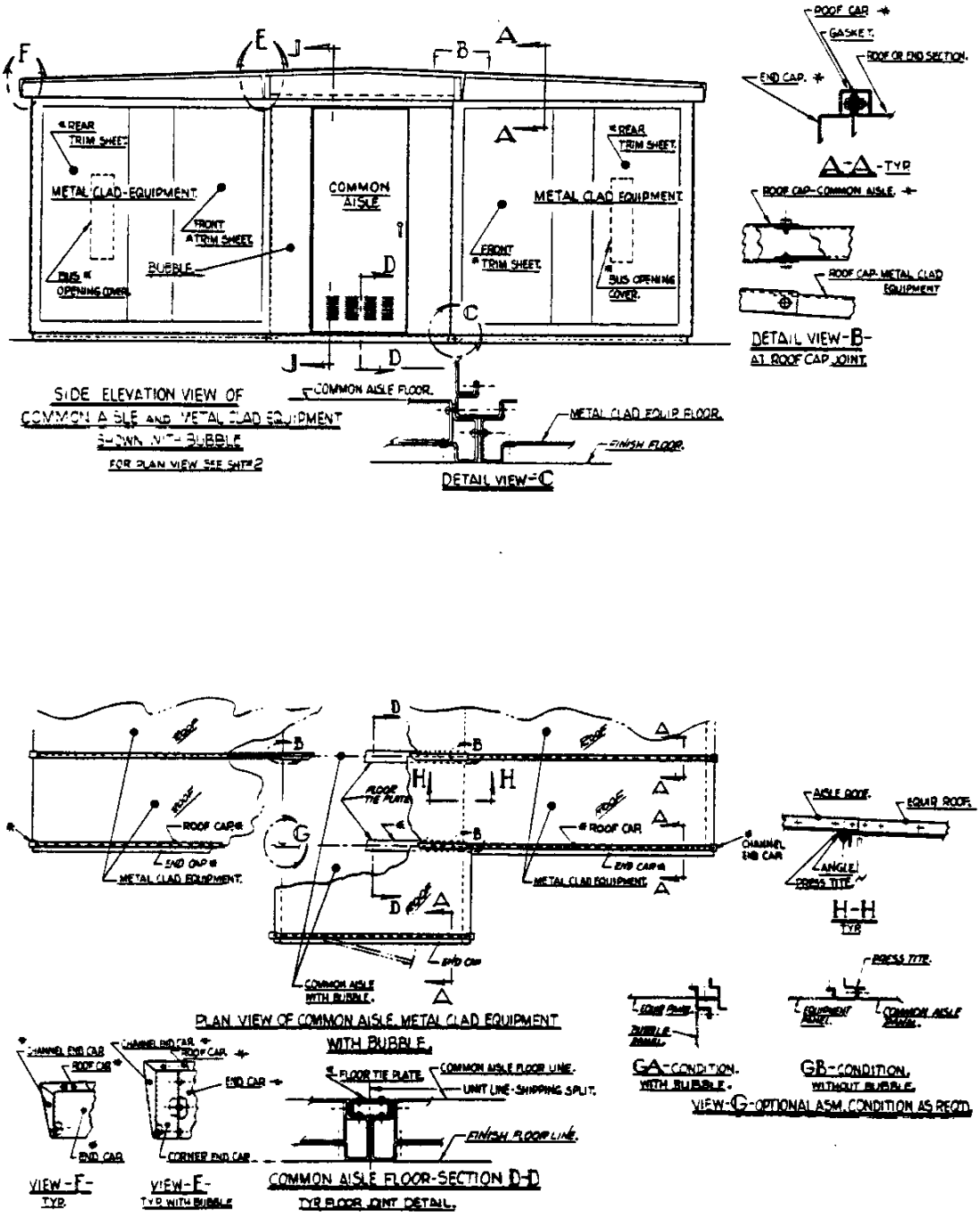


Fig. 8 (0209B4648-1 Rev. 0)

Fig. 8 (0209B4648-2 Rev. 0)

Fig. 8 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear with Common Aisle

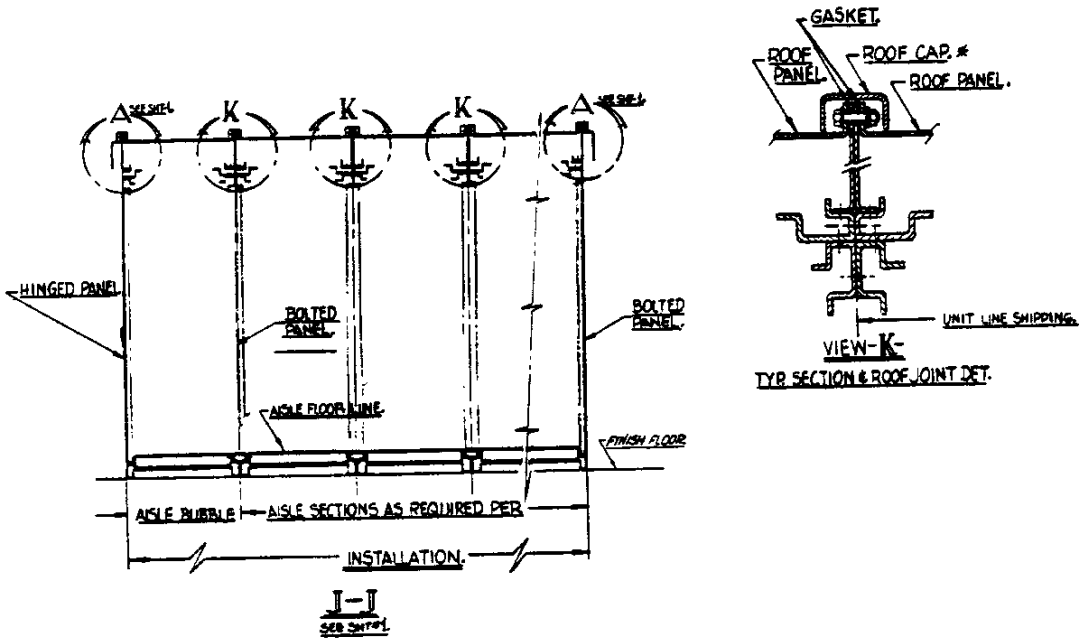


Fig. 8 (0209B4644B-3 Rev. 0)

Fig. 8 Installation Details for Outdoor Power/Vac* Metal-clad Switchgear with Common Aisle (continued)

DESCRIPTION

Each unit is made up of a secondary enclosure and a primary enclosure as shown in Fig. 9.

SECONDARY ENCLOSURE

The secondary enclosure is located at the front of the unit where the breaker is withdrawn. This enclosure consists of a compartment with a hinged panel upon which are mounted the necessary instruments, control and protective devices. The terminal blocks, fuse blocks, and some control devices are mounted inside the enclosure on the side sheets and on the internal device panel. A wiring space is provided across the top of the unit to run wires between vertical sections.

PRIMARY ENCLOSURE

The primary enclosure contains the high voltage equipment and connections. It consists of the breaker compartments, the bus compartment, the cable termination compartment, and auxiliary compartments for potential and control power transformers. Each of these compartments is separated from the others by metal barriers for reliability and safety.

Interference Interlocks (Fig. 34) are provided on the metal-clad unit to permit only the circuit breaker with the correct voltage, continuous current, mva and momentary rating to be inserted.

BREAKER REMOVABLE ELEMENT

The removable element consists of a Power/Vac* circuit breaker which includes an operating mechanism, interlocks, primary and secondary disconnecting devices. The Power/Vac* breakers are equipped with wheels for easy movement along the floor.

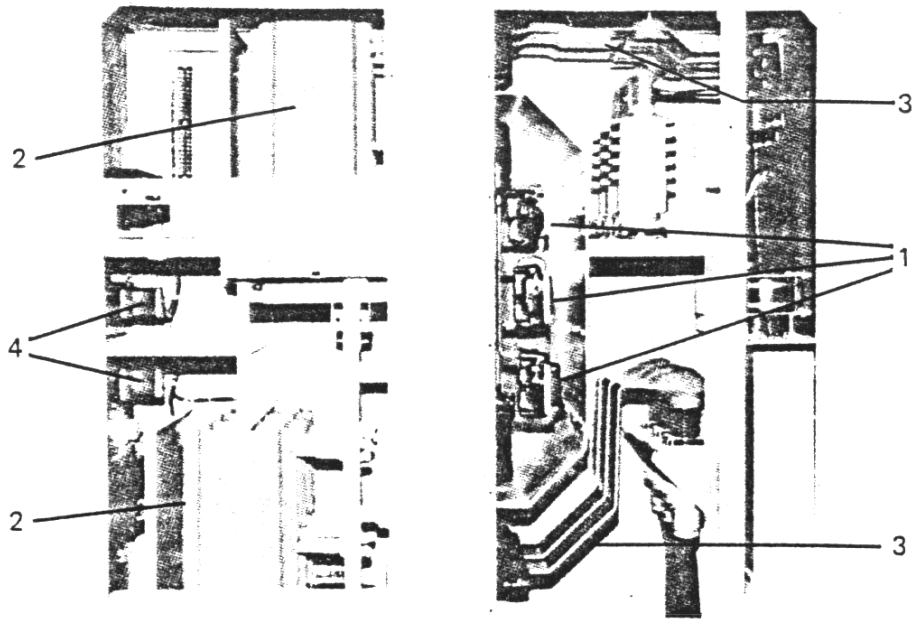
A lift truck (Fig. 10) is provided for insertion and removal of the circuit breaker from the metal-clad unit.

Power/Vac* circuit breakers of the same rating are interchangeable in their corresponding metal-clad units. An interference interlock is provided on the rear of each circuit breaker to insure that the properly rated breaker is used with in the proper metal-clad unit. (See OPERATION – INTERFERENCE INTERLOCK).

For a detailed description of the Power/Vac* breaker and its operation the breaker instruction book GEK 39671 should be consulted.

BREAKER LIFT TRUCK

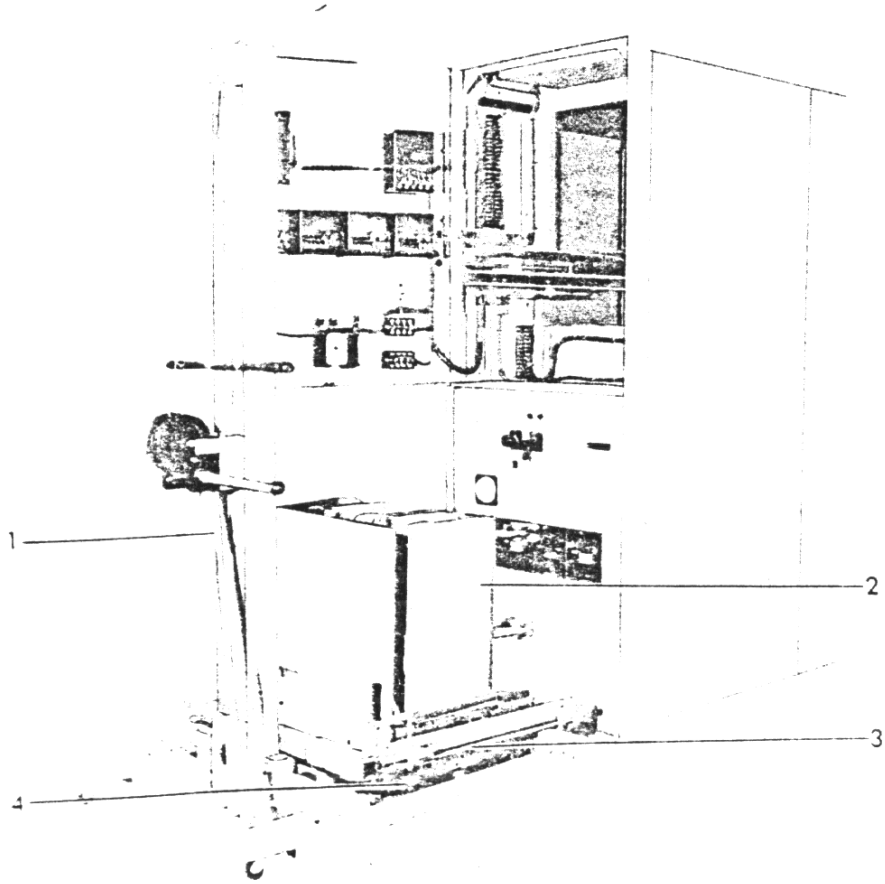
For ease of breaker handling during installation and removal, a breaker lift truck is furnished as a standard



1 – Primary Bus
2 – Breaker Compartment
3 – Load Take-Offs
4 – Secondary Compartment

Fig. 9 (8918455A)

Fig. 9 Side Section View Power/Vac* Metal-clad Switchgear



1 – Lift Truck
2 – Breaker
3 – Rails
4 – Interlock

Fig. 10 (8918438C)

Fig. 10 Power/Vac* Breaker and Lift Truck

Fig. 11 (8918455B)

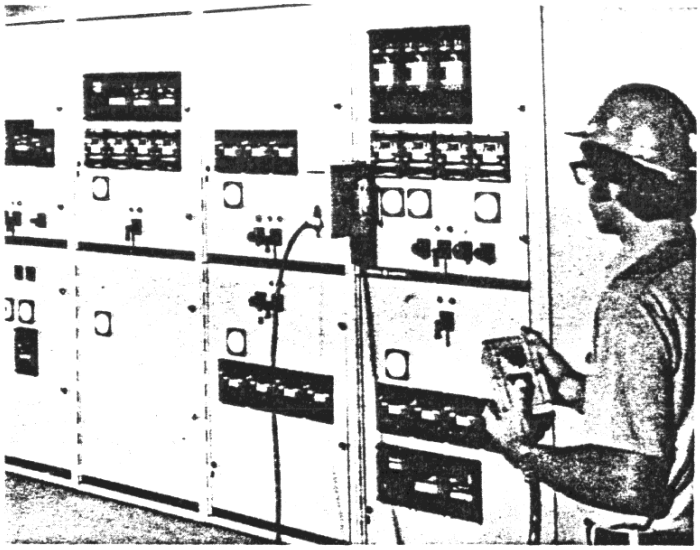


Fig. 11 Remote Racking Operator

accessory with each Power/Vac* switchgear order (Fig. 10). This accessory device is used to elevate the breaker from the floor or working platform to the level of the tracks in the switchgear cubicle. Docking of the lifting device rails to the switchgear tracks is provided for maximum safety. (See OPERATION - BREAKER INSTALLATION).

BREAKER RACKING MECHANISM

When installed in the switchgear cubicle the removable element is supported by two horizontal steel tracks, one on each side of the cubicle. The racking mechanism moves the breaker element along these tracks between the connected and test positions. This mechanism consists of heavy-duty steel jack screws which carry nuts that engage the sides of the removable element. The racking mechanism may be manually operated with the racking handle which is furnished with each equipment.

The breaker cannot be moved between the connected and test positions unless it has been tripped. The breaker cannot be closed unless it is in the connected or test position.

For a detailed explanation of the racking mechanism refer to description under OPERATION - CLOSED DOOR BREAKER RACKING.

REMOTE RACKING OPERATOR

The electrically operated racking device (see Fig. 11) provides a convenient means for racking a breaker between the connected and test positions from a remote location. It is easily mounted to the breaker unit front door and is designed for quick transfer between units.

The remote racking operator is furnished in two operating voltage versions. The 115 VAC, 50/60 hertz model has a six foot electrical cord with standard three prong plug to fit a grounded receptacle or extension cord. The 230 VAC, 50/60 hertz model has a three wire six foot cord to which the purchaser applies his standard plug.

The remote racking operator is provided with a two position directional switch, an "On-Off" circuit breaker and a push button control box attached with a 30 foot extension cord.

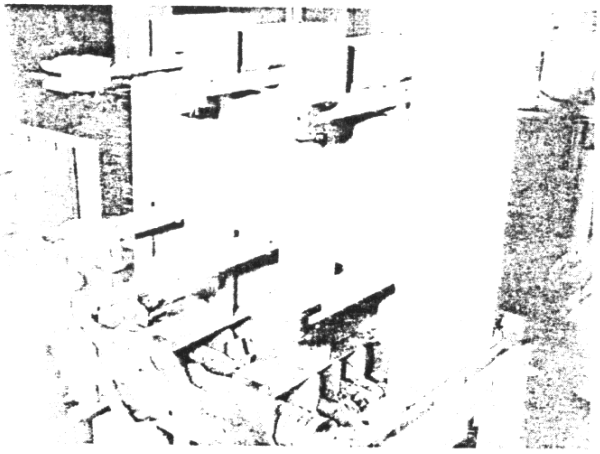
Instructions for the remote racking operator are found in GEK-39683.

PRIMARY DISCONNECTS

The 1200 and 2000 ampere primary disconnects consist of two rows of silver-plated copper fingers mounted on either side of the circuit breaker studs. These fingers are held in place with a spider which positions the fingers and fastens them to the breaker. Wipe pressure is obtained by tension springs between the rows of fingers which pull them together. When the circuit breaker is connected to the metal-clad studs, the spring force on the fingers is divided between the breaker stud and metal-clad studs. See Fig. 12.

On 3000 ampere primary disconnects silver-plated copper fingers are positioned in a circular configuration and are supported by a non-magnetic spider. This spider spaces the fingers equally around the breaker stud and fastens them to

1 – 1200 AMP



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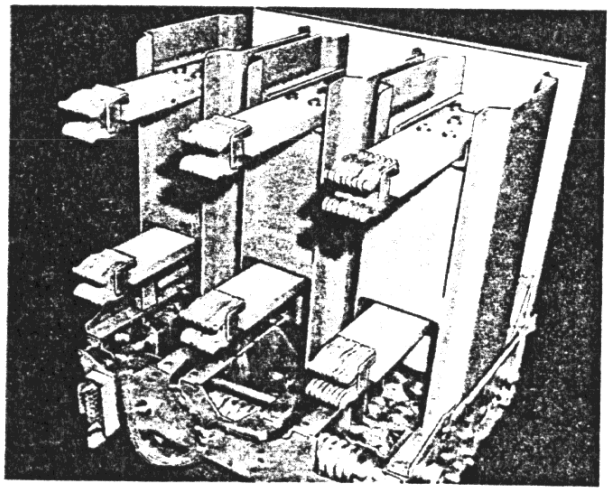
2 – 2000 AMP



(89184311)

3 – 3000 AMP

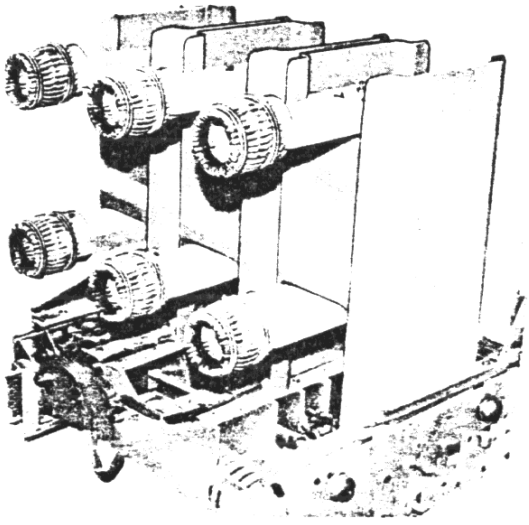


Fig. 12 Primary Disconnects

the end of the stud. The fingers are held in contact with the breaker stud by a stainless steel garter spring. A second garter spring on the outer end of the finger provides contact pressure when the finger assembly is connected to the tube in the metal-clad unit. See Fig. 12.

BUS COMPARTMENT

The main buses are enclosed in a metal compartment with removable front covers to provide accessibility. The bus is supported and insulated by molded glass-reinforced-polyester barriers which are flame retardant and track resistant. In 15 kV equipments polyester supports with porcelain sleeves are provided.

Bus bars are insulated with high dielectric thermosetting epoxy insulation applied using the fluidized bed process. This insulation is suitable for a total temperature of 105°C. All bolted joints have silver-to-silver connections for low contact resistance. The joints are insulated with a molded polyvinyl-chloride boot.

CURRENT TRANSFORMER COMPARTMENT

The current transformers are mounted over the primary bushings in the rear of the breaker compartment and are isolated from the breaker by the shutter barrier. Current transformers are front accessible by removal of the shutter barrier. The equipment must be deenergized, before any component is touched or serious injury could result.

PRIMARY TERMINATION SPACE

The primary termination space of each breaker unit is isolated from the other equipment by metal barriers. Space is provided in this compartment for connecting the purchaser's primary cable by means of potheads or clamp-type terminals. Two hole NEMA drilling for two cables per phase is provided at all cable connection points.

In double breaker vertical sections a steel duct serves as a pull-box and barrier to separate the two outgoing cable circuits.

The primary termination space of a unit is accessible by removal of the bolted rear cover.

POTENTIAL TRANSFORMERS

Potential transformers are located in an auxiliary unit. Up to three transformers can be mounted on a movable carriage equipped with primary and secondary disconnecting devices. When the potential transformers are disconnected, they are at a safe striking distance from all live parts of the switchgear. In addition a grounding device is provided which contacts the fuses when the potential transformers are disconnected, effectively discharging the transformers. In this position the transformer fuses may be safely removed and replaced. A barrier mounted at the rear of the carriage moves with the carriage to a position in front of the stationary part of the primary disconnect device, providing a safe striking distance from all live parts. See Fig. 13.

CURRENT LIMITING FUSES AND CONTROL POWER TRANSFORMER

Current limiting fuses with high interrupting rating are sometimes used in metal-clad switchgear to protect small transformers or circuits where circuit breakers cannot be economically or functionally justified.

Fig. 13 (8918432D)

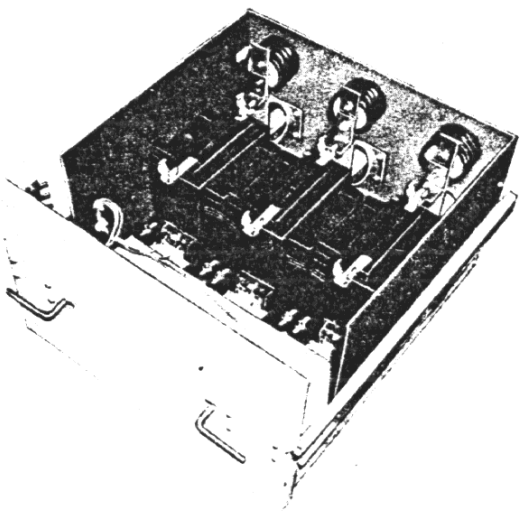


Fig. 13 Potential Transformer Drawout Carriage

Fig. 14 (8919432B)

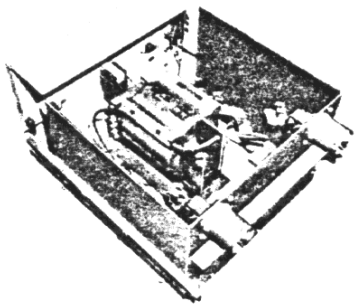


Fig. 14 Control Power Transformer Drawout Carriage

The fuses are mounted on a movable carriage equipped with primary and secondary disconnecting devices. Single phase control power transformers of 15 kva and smaller and their secondary breaker are mounted on the carriage with the fuses. See Fig. 14. Larger control power transformers up to 37.5 kva single phase or 45 kva 3 phase are located in the cable compartment behind their associated fuse carriage and their secondary breaker is located behind a hinged cover on the upper cable compartment.

When the fuses are disconnected, they are at a safe striking distance from all live parts of the switchgear. In addition a grounding device is provided which contacts the fuses after they are disconnected, effectively removing any static charge from the fuses. In this position the fuses may be safely removed and replaced. The disconnecting devices are capable of interrupting transformer magnetizing current, but should not be used to interrupt load current. Mechanical or key interlocks are applied to prevent operating the disconnecting device while the load is connected. This is generally accomplished by interlocking so that the transformer secondary breaker must be locked in the open position before the disconnecting device can be connected or disconnected.

Current limiting fuse and control power transformer roll-outs are located in auxiliary units.

DUMMY REMOVABLE ELEMENT

Dummy removable elements, are used as a means of isolating circuits or bus sections, where operation is infrequent and a circuit breaker cannot be economically justified. The device consists of a circuit breaker mechanism frame and primary insulator supports with six primary studs including disconnecting devices. Copper rods are bolted in the location normally occupied by vacuum interrupters. The stationary structure is the same as for a circuit breaker. When the device is fully racked in, it connects the top set of metal-clad primary disconnects to the bottom set.

An interlock system is provided to insure that the dummy element cannot be racked in or out, unless all sources to which it may connect are de-energized. The dummy element includes an extension from the side which is an exact duplicate of the positive interlock extension on a standard circuit breaker when that breaker is closed. Hence, insofar as the racking mechanism is concerned the dummy element locks exactly like a closed circuit breaker, and the positive interlock prevents it from being racked in or out.

A key lock is provided on the dummy element. It takes a key which becomes available only when all sources, to which the dummy might connect, are de-energized. When the key is available the key interlock can be operated to withdraw the positive interlock extension. The dummy element now looks like an open breaker, and it can be racked in or out. As long as the positive interlock extension is withdrawn, the key is captured and it cannot be released unless the dummy element is in the CONNECTED or TEST position or completely withdrawn. Hence, the sources to which the dummy may connect cannot be re-energized until the dummy is in one of these three positions.

The key for the dummy element interlock will usually be obtained from a transfer lock at which all the source keys are accumulated and captured before the dummy element key can be obtained.

GROUND AND TEST DEVICE

This device is designed to make either the upper or lower primary conductors in the breaker unit readily accessible. The type PVV ground and test device, provides a convenient means of grounding the cables or the bus in order to safeguard personnel who may be working on the cables or the equipment. The device can be used for applying power for high potential tests or for fault location. It can be used to measure insulation resistance (megger). By using potential transformers, it can also be used for phasing out cables. Refer to the instruction book provided for this device. If "hot sticks" are used they should be insulated.

CAUTION – NOTE THAT THE MAIN SWITCHGEAR BUS IS CONNECTED TO THE LOWER STUDS WHEN THE DEVICE IS INSTALLED IN AN UPPER COMPARTMENT AND TO THE UPPER STUDS WHEN THE DEVICE IS INSTALLED IN A LOWER COMPARTMENT Refer to Fig. 9, which shows a side section view of the switchgear, for clarification.

In addition to the device described above, there is available the deluxe power-operated type PMV device which has a self-contained bus or line selector switch and a separately controlled, power operated, three-phase grounding switch. The PMV device is a dead-front design with mechanical and electrical interlocks, provision for remote control and plug-type cable testing and phasing. The primary conductors required for grounding are self-contained, with no external cable connections required.

The PMV device is designed for maximum safety to personnel while accomplishing all the basic required grounding and testing functions. Refer to the instruction book provided for this device.

INSTALLATION

Before any installation work is done, consult and study all drawings furnished by the General Electric Company for the particular requisition. These drawings include arrangement and floor plan drawings, elementary, connection and interconnection diagrams and a device summary.

Occasionally additional shipping members are installed in the primary area to protect against shipping damage.

CAUTION – Shipping braces must be removed prior to energizing. Shipping braces are painted yellow and may be found in any unit with a red "Caution" label attached to the front of the unit. Shipping braces may be applied to devices as well as to current-carrying conductors.

After the shipping braces have been removed all joints must be properly tightened and insulated before energizing the bus.

Mats, screens, railings, etc. which are external to the switchgear, but which may be required to meet any local codes, must be furnished by the purchaser.

LOCATION

The recommended aisle space required at the front and at the rear of the equipment is shown on the floor plan drawing furnished for the particular requisition. The space at the front must be sufficient to permit the insertion and withdrawal of the circuit breakers, and their transfer to other units. No part of a foundation "PAD" or "SILL" may extend more than 3 inches beyond the front of the equipment.

The space at the rear must be sufficient for installation of cables, inspection and maintenance.

ANCHORING

INDOOR EQUIPMENT – FLOOR PREPARATION

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

Suitable means must be provided by the purchaser for anchoring the equipment to the floor. It is essential that the floor be level to avoid distortion of the switchgear structure and the equipment be completely aligned prior to final anchoring. The recommended floor construction is shown in Fig. 5. The floor channels must be level and straight with respect to each other. Steel shims should be used for final leveling of the switchgear if necessary. Care should be taken to provide a smooth, hard, and level floor under and in front of the units to facilitate installation and removal of the breaker. If the floor is not level and flush with the floor channels, it will be difficult to handle the breaker because it will not be level with respect to the stationary element.

The switchgear structure can be secured by bolting it to the floor channels using at least 5/8 inch bolts at locations shown in Fig. 5. Plug welding can also be used at the same locations if desired.

Provision should be made in the floor for conduits for primary and secondary cables, located as shown on the floor plan drawing furnished for the particular requisition. If desired, the conduits may be installed before the switchgear. Consideration should be given to conduits which might be required for future connections. Conduits must extend no more than one inch above the finished floor prior to the installation of the switchgear. If shipped in more than one section, shipping sections must be assembled in the proper sequence due to the location of conduits. The left hand section of a switchgear line-up must be positioned in its final location first. Then the section located immediately to the right must be positioned as close as the lifting members permit with the front in alignment with the first section. Remove the lifting members and then push or jack the unit to the left until it is flush with the first section. Be sure to distribute the forces over the side frame using appropriate timgers so as not to deform or damage the surface of the structure.

OUTDOOR EQUIPMENT

Switchgear support should be concrete or reinforced concrete with depth, fill, drainage, etc., according to recommended foundation design for the loading, type of construction, and local conditions involved. The base furnished with the switchgear should be supported on a level surface over the full area of the switchgear. Steel supporting members should be furnished if required for leveling the foundation and supporting the switchgear. Refer to Fig. 6 for recommended foundation and anchoring.

Primary and secondary conduits should be installed in accordance with the requisition drawings, before the equipment is put into place. Conduits must extend no more than one inch above the finished floor prior to the installation of the switchgear.

When outdoor equipments are shipped in more than one section, the roof joint between the sections must be assembled as shown in Fig. 7. Shipping sections must be assembled in the proper sequence due to the location of conduits. The left hand section of a switchgear line-up must be positioned in its final location first. Then the section located immediately to the right must be positioned as close as the lifting members permit with the front in alignment with the first section. Remove the lifting members and then push or jack the unit to the left until it is flush with the first section. Be sure to distribute the forces over the side frame using appropriate timbers so as not to deform or damage the surface of the structure.

OUTDOOR EQUIPMENT WITH PROTECTED AISLE

When specified by the purchaser, outdoor equipment is furnished with an enclosed, weatherproof operating aisle. See Fig. 3. The aisle enclosure is shipped separately from the switchgear.

The following procedure outlines the steps necessary to install outdoor equipment with a protected aisle:

(1) Install the switchgear in accordance with the procedure given above for outdoor equipment.

(2) Remove the shipping covers from the control panels. Since the relay and instrument cases are not weatherproof, the control panels should be protected from inclement weather until the installation of the aisle enclosure is completed.

(3) Install gasketing material and aisle assembly into position taking care to align the lap joint between the aisle and switchgear roof assemblies as shown in Fig. 7. Note that aisle sections are provided with lifting members which must be removed before joining the aisle to the switchgear. The aisle should be positioned about 4 inches away from the switchgear, the lifting members removed and then the aisle slid into its final position. Care should be taken to distribute the pushing forces over the aisle frame with suitable timber.

(4) Bolt the aisle enclosure in place at the top and on both ends as shown. After bolting the aisle in place, the yellow shipping braces along the open side of the aisle should be removed.

(5) If the aisle enclosure was shipped in more than one section, bolt the sections together and assemble the roof caps in the manner described above for roof joints in outdoor switchgear..

(6) Anchor the base of the protected aisle assembly to the concrete pad using the anchor clips provided. Install anchor bolts in accordance with the requisition drawing. See Fig. 7.

(7) Connect secondary wiring to lights, convenience outlets, etc., in accordance with the wiring diagrams furnished for the equipment.

OUTDOOR EQUIPMENT WITH COMMON AISLE

A typical outdoor common aisle equipment is shown in Fig. 4. The aisle enclosure sections are shipped separately from the switchgear.

The following procedure outlines the steps necessary to install outdoor equipment with a common aisle:

(1) Install one of the switchgear lineups in accordance with the procedure given above for outdoor equipment.

(2) Remove the shipping covers from the control panels. Since the relay and instrument cases are not weatherproof, the control panels should be protected from inclement weather until the installation of the aisle enclosure is completed.

(3) Install the aisle floor assembly and bolt into place as shown in Fig. 8.

(4) Move the second switchgear lineup into position and bolt to the aisle floor assembly in the same fashion. After the switchgear is secured to the aisle floor, it should be anchored to the concrete pad using the anchor clips provided. Install anchor bolts in accordance with the requisition drawing.

(5) Install gasketing material and lower aisle roof assembly into place taking care to align the lap joint between the aisle and switchgear roof assemblies. Bolt into place as shown in Fig. 8.

(6) If the aisle roof assembly was shipped in more than one section, bolt the sections together in the manner described above for roof joints in outdoor switchgear.

(7) Install aisle end panels and/or aisle bubble section as shown in the requisition drawings. Install gasketing material as shown in Fig. 8.

(8) Connect secondary wiring to lights, convenience outlets, etc., in accordance with the wiring diagrams furnished for the equipment.

BREAKER REMOVABLE ELEMENT

Before installing or operating the removable element, consult the circuit breaker instruction book GEK 39671 for directions on installation and inspection.

The operation of the racking mechanism, positive and negative interlocks and associated features are described under OPERATION OF EQUIPMENT and should be reviewed before installing removable element.

Fig. 15 (8043125)

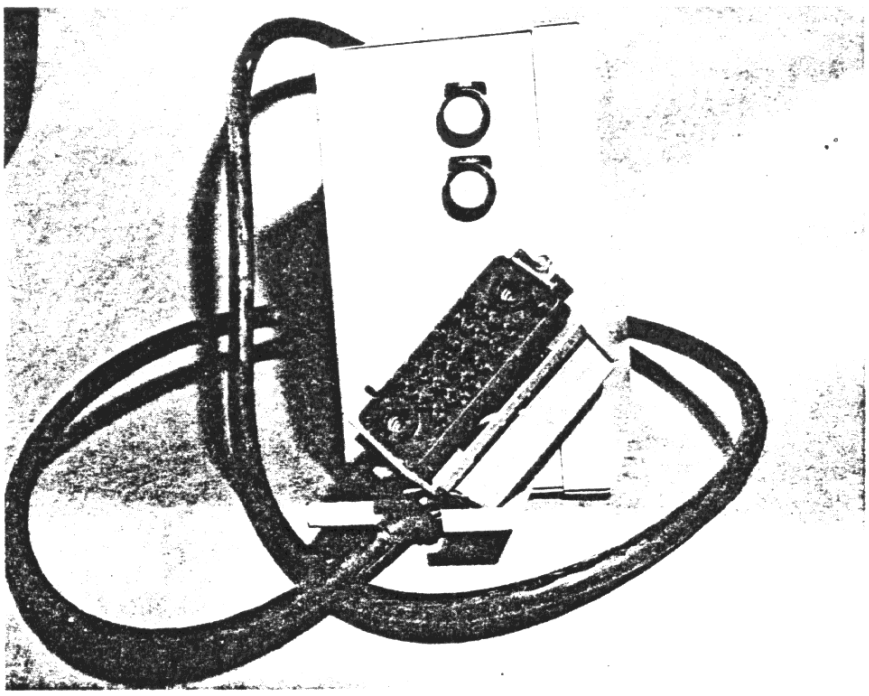


Fig. 15 Test Cabinet

TEST CABINET

The test cabinet, Fig. 15 is used to operate a breaker that has been removed from the metal-clad equipment. It should be installed on the wall at a location where maintenance and testing of the breaker can be conveniently done. Conduits must be installed for cables to supply control power for testing. Make certain that the green ground conductor is connected to the electrical ground.

ADDITION OF UNITS TO EXISTING EQUIPMENT

Before adding units to existing equipment, consult and study all drawings furnished with the equipment. In addition to the usual drawings furnished with new equipment special drawings may be furnished covering complicated or special assembly work. Also, check to make sure all necessary parts are on hand.

BEFORE ANY COVERS ARE REMOVED OR ANY DOORS OPENED WHICH PERMIT ACCESS TO THE PRIMARY CIRCUITS' IT IS ESSENTIAL THAT THE CIRCUIT OR CIRCUITS BE DE-ENERGIZED AND BREAKERS BE WITHDRAWN TO THE TEST POSITION AND TAGGED.

Fig. 16 indicates the special procedures required to add new metal-clad units to outdoor equipment without a protected aisle, and Fig. 17 indicates the special procedures required to add new metal-clad units to outdoor equipment with a protected aisle. For indoor equipment, it is usually necessary only to remove the end trim sheets and to reassemble them on the new units after these are located and bolted to the existing units. Otherwise, the installation procedure is the same as described above.

When the units are in place and bolted together, assemble the main bus and other primary connections per the instructions below.

Secondary wiring and control bus connections should be made in accordance with the wiring diagrams furnished with the equipment.

CONNECTIONS

The main bus bars and other connection bars will be either copper or aluminum. In either case, the contact surfaces will be silver surfaced or equivalent. Do not use unplated copper or aluminum bars. All field assembled joints in primary conductors, regardless of material or method of insulation, should be made as described below:

(1) Wipe silver clean. Do not use steel wool, sandpaper or any abrasive on the silvered surface. Avoid handling of cleaned surface as much as possible.

(2) After cleaning, apply D50H47 contact compound to the silvered surfaces in sufficient quantity so that the contact area will be thoroughly sealed with excess compound squeezed out of the joint when tightened. The bolts should be tightened to the torque values, shown in Fig. 18. After the bolts have been securely tightened, the joints are insulated using the molded polyvinyl-chloride boots which are furnished. These boots are placed over the bolted joints and the boot flaps are secured with nylon rivets.

52

PROCEDURE FOR ADDING TO OUTDOOR (NO AISLE)

A. REMOVE THE FOLLOWING ITEMS, MARKED WITH ASTERISK(*) FROM THE EXISTING METALCLAD SECTION AND MOVE TO THE END OF THE NEW ADDITION.
   1. CHANNEL END CAPS
   2. ROOF CAPS
   3. METALCLAD END AND CORNER CAP
   4. METALCLAD FRONT TRIM SHEET
   5. METALCLAD REAR TRIM SHEET
   6. BUS OPENING COVER

B. TO INSTALL NEW METALCLAD UNITS.
   1. SET NEW UNITS IN PLACE AND BOLT TOGETHER
   2. ASSEMBLE BUS OPENING COVER, FRONT AND REAR TRIM SHEETS.
   3. ASSEMBLE NEW ROOF CAPS AND FRONT AND REAR CHANNEL END CAPS.
   4. ASSEMBLE GROUND BUS SPLICE BETWEEN EXISTING AND NEW GROUND BUS.
   5. ASSEMBLE BUS BARS AND INSULATING BOOTS.
   6. REASSEMBLE A-1 THROUGH A-3

Fig. 16 (0282A3019)

Fig. 16 Outdoor Metal-Clad Switchgear Addition of Units to a Line-up (Refer to Fig. 6 and 7)

PROCEDURE FOR ADDING TO PROTECTED / COMMON AISLE

A. REMOVE THE FOLLOWING ITEMS, MARKED WITH ASTERISK(*), FROM THE EXISTING PROTECTED/COMMON AISLE AND METALCLAD SECTION AND MOVE TO THE END OF THE NEW ADDITION.
   1. CHANNEL END CAP
   2. ROOF CAPS
   3. METALCLAD END CAP(S)
   4. FLOOR TIE PLATE
   5. AISLE END BUBBLE ENCLOSURE
   6. METALCLAD FRONT TRIM SHEET
   7. METALCLAD REAR TRIM SHEET
   8. BUS OPENING COVER

B. TO INSTALL NEW METALCLAD UNITS.
   1. SET NEW UNITS IN PLACE & BOLT TOGETHER.
   2. ASSEMBLE BUS OPENING COVER, FRONT & REAR TRIM SHEETS.
   3. ASSEMBLE NEW ROOF CAPS & REAR CHANNEL END CAP.
   4. ASSEMBLE GROUND BUS SPLICE BETWEEN EXISTING & NEW GROUND BUS.
   5. ASSEMBLE BUS BARS & INSULATING BOOTS.

C. TO INSTALL NEW PROTECTED AISLE UNITS
   1. APPLY PRESSTITE SEALER TO METALCLAD ROOF.
   2. INSTALL NEW AISLE ASSEMBLY, BOLT IN PLACE.
   3. ASSEMBLE NEW ROOF CAP & CHANNEL END CAP.
   4. ASSEMBLE NEW FLOOR TIE PLATE.
   5. REASSEMBLE ITEMS (A-1) THROUGH (A-5).

Fig. 17 (0209B4650 Rev. 0)

Fig. 17 Outdoor Metal-Clad Switchgear with Protected Common Aisle – Addition of Units to Line-up (Refer to Fig. 7 and 8)

Bolt Size	Torque Foot Pounds
3/8 - 16	20 - 25
1/2 - 13	30 - 35
5/8 - 11	43 - 47
The material may be aluminum or copper	

Fig. 18 Bolt Torque Values for Metal-Clad Switchgear

(3) All field assembled primary joints and terminations must be insulated. There are two methods of insulating joints, boots where applicable and taped joints for all others.

MAIN BUS ASSEMBLY

The procedure shown below should be followed when assembling the main bus at shipping splits or when adding new units to existing equipment.

(1) Unbolt and remove the inter-unit horizontal barriers from the vertical sections to be joined. Do not remove the small trays on which the position switch, auxiliary switch and ground shoe are mounted. See Fig. 35.

(2) Unbolt and remove first the lower and then the upper unit bus cover from the vertical sections to be joined. The bus compartments of the two sections will now be exposed. It is not necessary to remove the secondary coupler or the racking mechanism chain in order to assemble the bus bars.

(3) Install the lower (phase 3) bus bar(s) from the right-hand section. If the main bus uses porcelain inserts, take extreme care not to chip the porcelain when installing the bus bars. Position the rubber bushings furnished on the bus bars that assemble through the porcelain in the middle of the porcelain. Bolt splice plates and bus bars together, following assembly instructions as given under CONNECTIONS. The sequence of parts from rear to front is: (1) splice plate with press nuts, (2) main bus bar (with spacers if 2 bar bus) (3) riser bars to breakers or roll outs. Next, install the middle phase 2 bus bar(s) in the same fashion.

(4) From the left-hand section install the upper (phase 1) bus bar(s) as described above.

(5) Place the PVC bus insulating boots over the joints as shown in Fig. 19 and secure with furnished nylon rivets. Joint insulation is now complete.

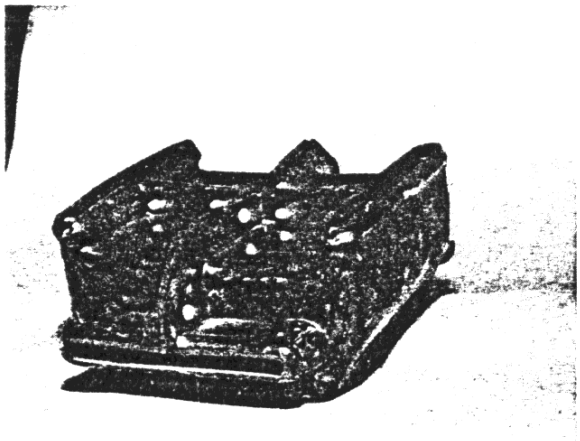


Fig. 19 Bus Insulating Boot

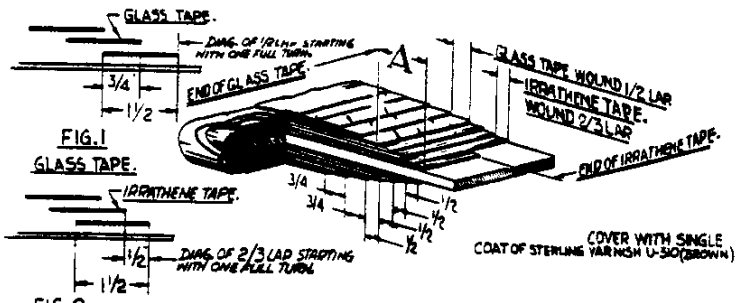
(6) Replace all barriers and cover plates previously removed.

TAPED JOINTS FOR 13.8 KV EQUIPMENT

(1) Prepare all joints as outlined under CONNECTIONS. Clean off any grease on the outside of the joint.

(2) Fill all cavities around bolts and nuts with A50H119 compound to form a smooth surface for taping. This compound is not an insulating medium and should not be used for that purpose.

Fig. 19 (8918432E)



APPROXIMATE AMOUNT OF INSULATION REQUIRED TO TAPE ONE LINEAR FOOT

BAR APPLICATION	FIG	INSULATION VOLTS RANGING		LAYERS IRRA.	LAYERS GLASS	A	SIZE OF BAR .25X2.0	.25X6.0	.38 OR 6.0	.50 OR 6.0	.38X6.0
							LENGTH OF TAPE IN FEET				
ST'D	1 #	600	5000	1	X	2	10.0	27.0	27.5	28.0	31.0
				X	1		6.5	17.5	18.0	19.0	20.5
	2	5001	15000	2	X	3	20.0	54.0	55.0	56.0	61.5
				X	1		6.5	17.5	18.0	19.0	31.0

IRRATHENE 202 TAPE: WIDTH-1½", THICKNESS-.010, LAYERS AS TABULATED WOUND 2/3 LAP.
ONE LAYER OF IRRATHENE TAPE (WOUND 2/3 LAP) REQUIRES 3 TURNS AROUND THE BAR IN ONE WIDTH OF THE TAPE. THE THICKNESS OF ONE LAYER IS 3 TIMES THE THICKNESS OF THE TAPE. WHEN BARS ARE TAPED ON THE BENCH AS A SUB-ASSEMBLY, THE BOTTOM OF THE GLASS TAPE SHOULD STOP AT "A" TAB FROM THE END OF THE IRRATHENE 202 TAPE AS SHOWN ABOVE.

Δ WHITE GLASS TAPE (A2L12B):
WIDTH-1½"x.004 THICK.
(1) ONE LAYER WOUND 1/2 LAP.
PAINT AS NOTED ABOVE.

Fig. 20 Insulation of Connection Bars

(3) Wrap with the provided insulating tape 4 layers, 2/3 lapped maintaining tension on the tape while wrapping, as shown in Fig. 20. Where there are sharp angles apply additional layers to obtain equivalent of the simulation on tile flat surfaces.

(4) Over the insulating tape, apply one layer of glass tape, half lapped as a protective covering as shown in Fig. 20.

(5) Over the glass tape, brush a heavy coat of U310 (brown) varnish. Varnish may be thinned, if necessary, with Xylene D5B9.

TAPED JOINTS FOR 4.16 KV EQUIPMENT

(1) The instructions for the bolted joint and application of the tape insulation is the same as outlined for the 13.8 kV equipment except use 2 layers 2/3 lapped of insulating tape and use the U310 (brown) varnish. Refer to Table in Fig. 20.

BUS DUCT

Bus ducts connecting between groups of metal-clad switchgear, or between metal-clad switchgear and other apparatus, should be installed as shown on the arrangement drawings furnished with the ducts. Supports should be provided as indicated on the drawings.

All joints in the bus, including adjustable joints, should be assembled and insulated as described above for main buses except that only yellow joint compound should be used. This grease should also be used at the switchgear riser bars. Adjustable joints are provided in long runs of bus duct to allow for variations in building construction, etc. These joints should be loosened before installation of the duct, then tightened after being set in the position required by the fixed points at the ends of the duct.

Outdoor bus ducts must be gasketed at the joints between shipping sections. Coat both sides of the flat gasket and the flanges of both duct sections with Sterling U310 varnish before assembly. Bolt the two duct sections together. Remove the top cover from one duct section and place 3/8 inch elastic compound bead along top of joint slightly overlapping the sides. Bolt top cover in place and fasten roof cap in place over the joint. See Fig. 21. When top covers are removed after installation for inspection the 3/8 inch elastic compound bead must be replaced to insure a tight seal.

Removable front and rear covers of vertical sections of bus duct must also be gasketed. Coat both sides of the gasket, the flange of the duct, and the edges of the inside surface of the cover with Sterling U310 varnish before assembly. Do not bolt these covers in place until all interior assembly work on the duct is completed and access will no longer be required.

Fig. 20 (A3926)

Fig. 22 (0121A6285 Rev. 4)

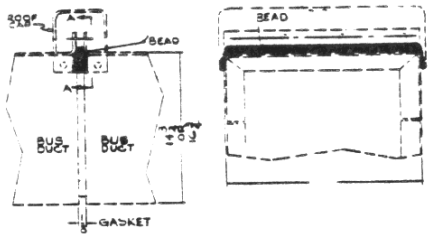


Fig. 21 Bus Duct Gaskets

Outdoor bus ducts of the 13.8 kV class are provided with heaters. Connect these heaters in accordance with the wiring diagrams furnished with the equipment before energizing the bus duct.

PRIMARY CABLES

The primary cable connections are reached by removing the rear bolted covers.

When circuit breakers are stacked two high and primary cable terminations must be made in both upper and lower units, the procedure described below should be followed. (Refer to Fig. 22.)

1. Remove rear bolted covers
2. Remove batten (1), Fig. 22.
3. Remove cable trough cover and pull-box cover.
4. Remove cable trough(2), Fig. 22.
5. If primary cables enter switchgear from below, terminate cables for lower unit first. If primary cables enter from above, terminate cables for upper unit first.
6. Replace cable trough.
7. Terminate primary cables in remaining unit. (Pulling cables thru cable trough.)
8. Replace pull-box cover, cable trough cover, batten and rear bolted covers.

Fig. 22 (0282A3015)

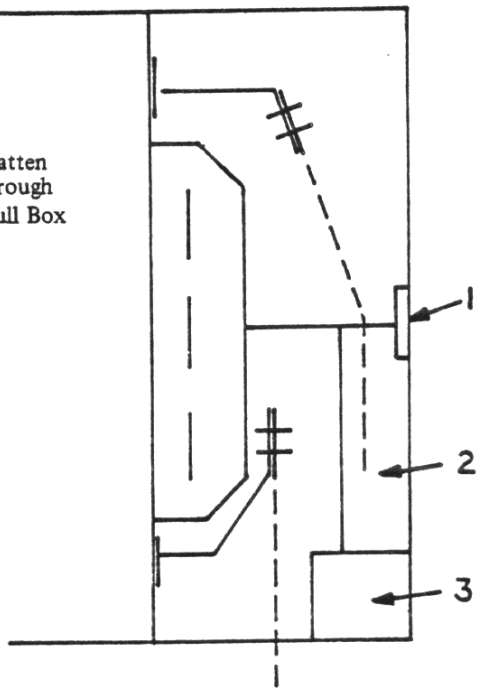


Fig. 22 Installation of Primary Cables

Before any primary cable connections are made, the cables should be identified to indicate their phase relationship with the switchgear connections. This is necessary to assure that motors will rotate in the proper direction and that the phase rotation is the same when interconnecting two different sources of power.

There are two common methods of making primary cable connections:

(a) Potheads

Potheads are used when it is desired to hermetically seal the end of the cable to make a moisture-proof connection between the cable and switchgear bus. A pothead also prevents seeping of oil from the end of oil unpregnated varnish cambric or paper insulated cable.

(b) Clamp type terminals and stress cones.

No insulation materials are furnished for cable terminations. When potheads are supplied as part of switchgear, insulation materials are furnished for the bar terminations to the pothead studs.

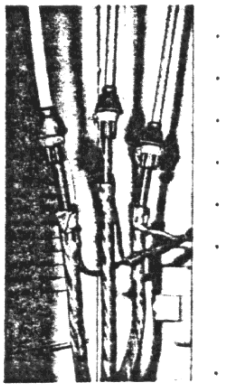


Fig. 23 (8918431C)

Fig. 23 Cable Termination without Pothead, Single Conductor

In all cases carefully follow the cable manufacturer's recommendations for installation of the type of cable being used. A typical example of terminating a shielded cable is shown in Fig. 23. If the cable is aluminum, the conductor surface must be carefully abraided and the cable covered liberally with a joint compound recommended by the cable manufacturer.

INSULATING PRIMARY CABLE TERMINATIONS

All field assembled joints for primary cable terminations should be prepared as outlined under CONNECTIONS. Upon completion of the cable termination, care must be exercised when taping the exposed joint.

1. Check to see that a sufficient area of insulating tape extends beyond the fluid bed insulation furnished on the terminal bars (2 inches for 5 kV, 3 inches for 15 kV). Refer to Fig. 20.

2. All terminations should be insulated as outlined in table, Fig. 20, for correct layers of insulating and glass tape.

3. The instructions for application of the tape insulation is the same as outlined for TAPED JOINTS.

POTHEADS

Installation procedures for a three-conductor lead-sheathed cable with a wiping sleeve cable entrance fitting on the pothead are outlined in Russgreen Cat. No. P66. This is the type most generally used. The factory does not furnish insulating materials for completing stress cones and cable terminations. In all cases carefully follow the cable manufacturer's recommendation for installation of the type cable being used.

TERMINATION WITHOUT POTHEAD

The factory does not furnish insulating materials for completing the termination of primary cables, nor does it furnish stress cone material. The cable manufacturer's recommendations should be followed for the type of cable being used.

When stress cones are required, packaged stress cone kits such as the GE Termi-Matic^T Cable Termination System are frequently used. Information and ordering data can be found in GEA-1017. Since the termination is inside the metal-clad enclosure, the Indoor type A system is generally applicable. If excessive contamination is a problem, the padmount type G system may be desirable. No matter which system is used, step by step pictorial instructions will be furnished as part of the kit.

The space provided for primary cable terminations in the standard Power-Vac arrangements is more than sufficient for the Termi-Matic^T system. Hand taped stress cones require more space. However,the cable termination space provided in Power/Vac* is never less than the minimum recommended for a hand taped stress cone.

In making up stress cone terminations, ground clamps and ground leads are installed. Care must be taken to assure that these grounded elements are installed such that the required clearances to energized parts are maintained. For insulated bars or unshielded cables, these are

For 5kv equipments – at least 2 inches
For 15 kV equipments – at least 3 inches

When terminating three conductor cables which flare out to single conductor terminations, the crotch at the root of the flare out should be adequately sealed to prevent possible entrance of moisture into the three conductor jackets.

For long cable runs within the equipment, a support to restrain lateral movement of the cables under short circuit conditions will be provided approximately 20 inches from the termination point. The customer's incoming cables should be lashed securely to this support.

There is no provision in the Power-Vac* equipment to support the weight of primary cables.

GROUND FAULT CURRENT TRANSFORMERS (THROUGH-TYPE)

Through-type current transformers (see Fig. 24) are furnished where specified for sensitive protection against ground faults. These transformers are normally installed in a horizontal position directly above or below the primary cable terminals so that the primary cable or cables can pass through them. One transformer is required for each three-phase circuit.

Where armored cable is used, the armor must be terminated and grounded before the cable passes through the transformer. Armor clamps are furnished for this purpose when specified.

When lead or other conducting sheath cable, or cable with shielding tape or braid is used, it is recommended that the sheath or shield be grounded solidly to the switchgear ground bus. The ground lead should be bonded to the sheath or shield on the side of the current transformer away from the primary terminals. In cases where the ground cannot be applied before the cable passes through the transformer, bond the lead to the sheath or shield between the transformer and the primary terminals. The ground conductor must then be passed back along the cable path through the current transformer before being connected to the ground bus.

Where potheads are used in units provided with ground fault current transformers, the pothead mountings must be insulated from ground.

Fig. 24 (8043127)

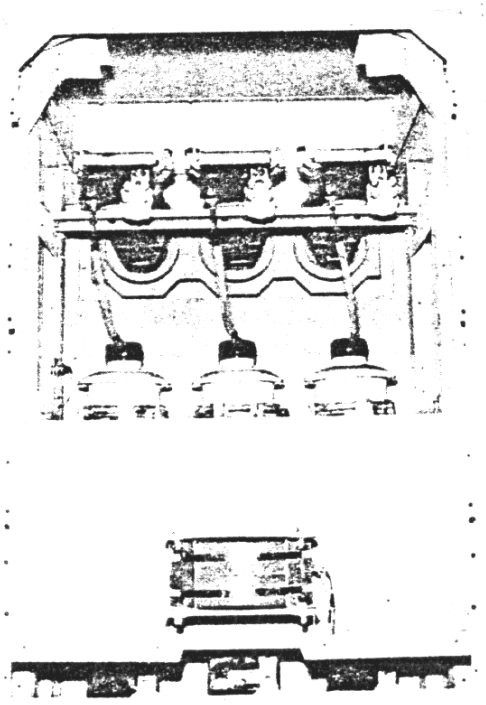


Fig. 24 Rear View of Unit
Showing Through-Type Current Transformers

CONTROL CABLES

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

Control cables should be guided toward the side sheet and run behind the track assembly as shown in Fig. 25. This will prevent the circuit breaker or roll-out carriage from interfering.

Connect the cables to the terminal blocks in accordance with the wiring diagrams furnished for the requisition.

The cables from the control power source to the switchgear should be large enough to avoid excessive voltage drop when the circuit breakers are operated. See testing instructions.

Where units have been split for shipment, any control or other secondary leads which must connect across the split will be arranged with terminal blocks at the top or on the side sheet so that the wires can be reconnected. The wires will be cut to length and formed before being folded back so that a minimum of time will be required for reconnecting them.

GROUND BUS

Where the equipment is shipped in more than one section, the ground bus must be connected by using the splice plates furnished with the equipment. Assemble the ground bus joints as outlined under CONNECTIONS.

The ground bus is bolted to the rear of the frame near the bottom. It is arranged so that connections to the station ground can be made in any vertical section. Ground bus risers are provided in each cable compartment to provide a convenient place to ground cable armor, cable sheath, shields or ground wires. The switchgear ground bus must be connected to the station ground bus by a conductor having a current-carrying capacity equal to that of the switchgear ground bus. It is very important that the equipment be properly grounded to protect the operator from injury when short circuits or other abnormal occurrences take place and to ensure that all parts of the equipment, other than live parts, are at ground potential.

LIGHTNING PROTECTION

It will be the responsibility of the purchaser to specify suitable lightning arresters to protect the switchgear from damage due to lightning. The General Electric Company's recommendations as to the types of circuits requiring lightning protection, and a list of recommended lightning arresters; are contained in Bulletin GER-141, copies of which are available upon request.

When lightning arresters are furnished the primary cable terminal will be insulated at the factory unless it must be disconnected for shipment. When this connection is completed in the field it will be necessary to insulate the primary connection before the switchgear is energized.

SURGE SUPPRESSORS

General Electric surge suppressors are provided on each feeder circuit. These are self contained units which require no maintenance.

ROOF ENTRANCE BUSHING

When assembling the connection bar end of roof entrance bushings-inside the switchgear and other terminations where porcelain insulators are used, insulation should be applied as follows:

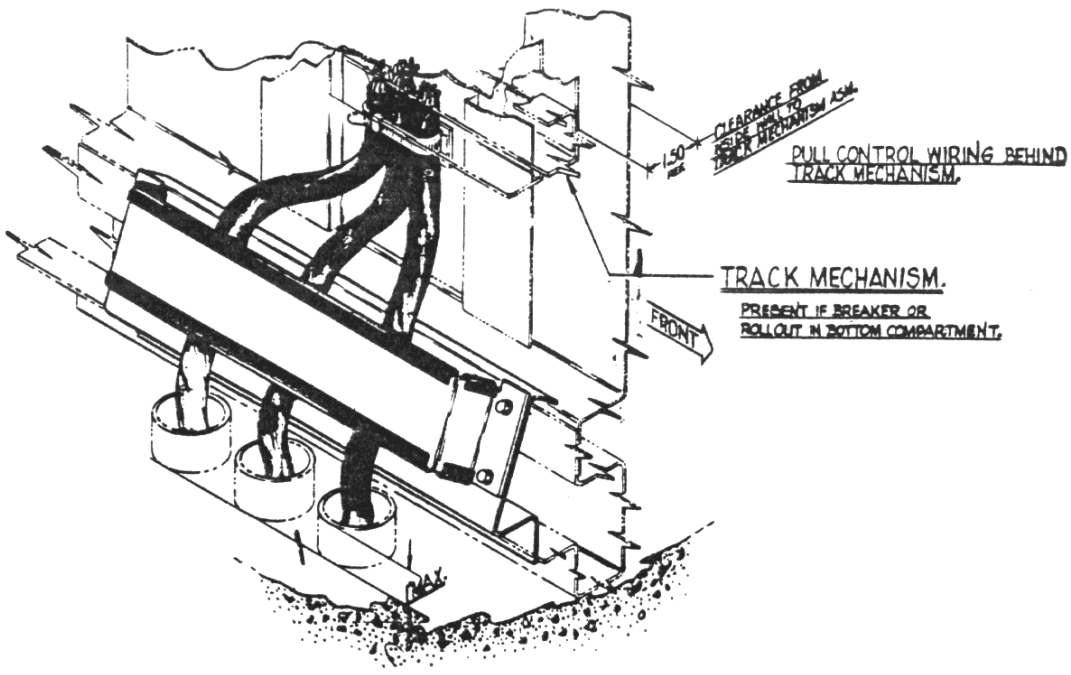


Fig. 25 (0209B4653)

Fig. 25 Control Cable Guide

(1) Prepare the connection bars as outlined under CONNECTIONS.

(2) Fill all cavities around the contact nuts and connection bars with A50H119 compound. Form a smooth surface for taping. The compound is not an insulating medium and should not be used for that purpose.

(3) Wrap joint with insulating tape provided, maintaining tension on the tape while wrapping as shown in Fig. 20. Where there are sharp angles apply additional layers to obtain equivalent of the insulation on the flat surfaces.

(4) Over the insulating tape, apply one layer of glass tape, half LAP as a protective covering as shown in Fig. 20.

(5) Over the glass tape, brush a heavy coat of U310 brown (for 15kV) or U311 black (for 5kV) varnish. See Fig. 26.

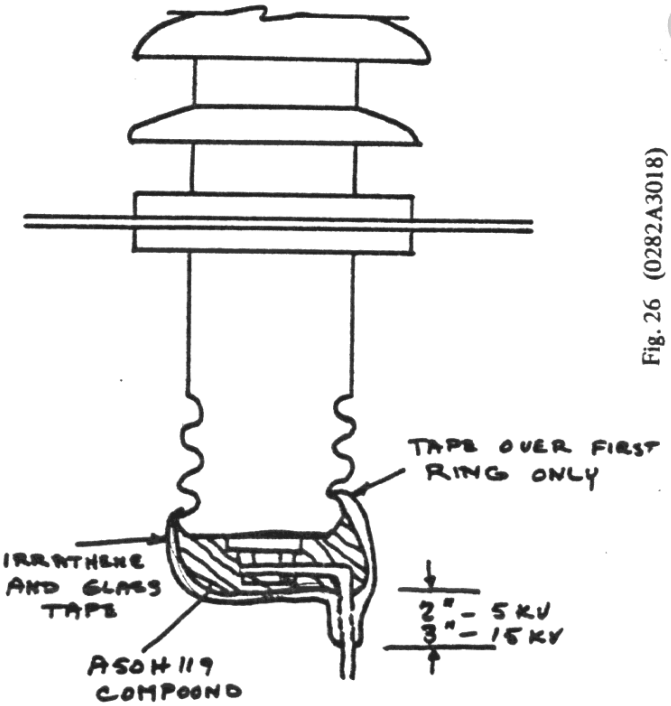
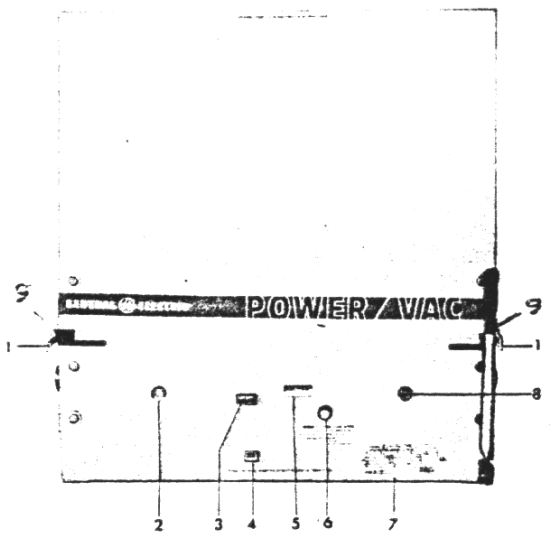


Fig. 26 (0282A3018)

Fig. 26 Taping of Roof Entrance Termination

59

.29 (891438M)



1 – Indicator
2 – Push to Trip Open
3 – Open-Close Indicator
4 – Counter
5 – Charge Indicator
6 – Manual Charge
7 – Nameplate
8 – Manual Close
9 – Breaker Racking Lever

Fig. 29 Racking Arm Position Indicator Level

To remove the breaker from the metal-clad unit reverse the above procedure. Check the circuit breaker to be sure that it is in the "open" position. Rack the breaker from the "Connect" position to "Disconnect/Test". Disengage the racking mechanism by raising both racking arms and roll the breaker forward. Move the lift truck into position to engage the rails and connect the docking hooks. After disengaging the safety catch on the right hand rail the breaker can now be rolled forward onto the lift truck for transporting away.

After the breaker has been racked fully into the connected position and then is removed from the unit, the engagement and alignment of the primary disconnect fingers on the breaker studs may be checked with respect to the stationary conductor in the unit. (THE SWITCHGEAR MUST BE DEENERGIZED FOR THIS CHECK.)

Use the racking handle to turn the jackscrew several turns toward the connected position, until the shutters are opened to uncover the opening to the insulation tube and stationary conductor in the unit. Inspect the impression made in the coating of contact lubricant D50H47 on the stationary conductor surface by the breaker primary disconnect fingers:

On 1200 and 2000 ampere ratings, there must be heavy impressions of all the fingers on both the top and bottom of the stationary conductor bar. The impressions should extend back from the front end of the bar a minimum of 1/2 inch and should be no closer than 3/16 inch to either side of the bar.

On 3000 ampere ratings, there must be heavy impressions of all the fingers on the cylindrical conductor. The impressions should extend back from the front end a minimum of 1/2 inch.

If the contact wipe is not proper, adjustments will be necessary.

DO NOT MAKE ANY ADJUSTMENT. COMMUNICATE WITH THE NEAREST GENERAL ELECTRIC COMPANY INSTALLATION AND SERVICE ENGINEERING OFFICE FOR INSTRUCTIONS.

BREAKER RACKING WITH FRONT DOOR CLOSED

The circuit breaker can be racked in and out of the "Connect" position with the front door of the metal-clad closed. For maximum safety the breaker must always be racked with the front door closed when primary power is connected to the metal-clad. Make sure the breaker is open before attempting to rack the breaker. The breaker is installed in the metal-clad unit as described in BREAKER INSTALLATION. Engage the racking arms and then close the front door of the unit and secure it with the knurled knobs. Insert the racking handle into the hole in the left side of the front door and engage the racking mechanism by pushing it in fully. Rack the breaker by rotating the handle clockwide (60 turns are required) until a positive stop is felt. The breaker is now in the fully connected position and the tape indicator should read "Conn".

To rack the circuit breaker from the "Connected" to the "Disconnect/Test" position be sure that the breaker is open then turn the handle counterclockwise.

REMOTE RACKING ATTACHMENT

The breaker may be racked between the "Disconnect/Test" and "Connected" positions electrically using the remote racking device. See DESCRIPTION – REMOTE RACKING ATTACHMENT.

POSITIVE INTERLOCK

The positive interlock functions to prevent racking a breaker between the "Connect" and the "Disconnect/Test" positions except when the primary contacts are open.

The positive interlock consists of a bar which protrudes from the left side of a closed breaker to engage a slot in the left-side-racking mechanism when the breaker is in either the "Disconnect/Test" or "Connected" position. When the interlock is engaged the racking mechanism cannot be operated. (See Fig. 30.)

To test the function of the positive interlock install a circuit breaker following the instructions given under BREAKER INSTALLATION. For the test the control power circuits in the metal-clad must be energized.

Place the breaker in the "Disconnect/Test" position and connect the secondary disconnect device by pulling down on the breaker handle and horizontally inserting the lever arm fully into the breaker to engage the secondary disconnects. This will actuate the spring-charging motor and charge the breaker-closing springs. Close the front door of the unit and secure it with the knurled knobs. BEFORE PROCEEDING WITH THIS CHECK IT IS NECESSARY THAT THE PRIMARY CIRCUITS BE DE-ENERGIZED. Close the breaker with the control switch on the front of the door then insert the racking handle into the hole in the unit door. When attempting to insert the racking handle a definite stop should be encountered preventing the socket on the racking handle from engaging the racking mechanism.

TESTING AND INSPECTION

After the equipment has been installed and all connections made, it should be tested and inspected before putting it in service. Although the equipment and devices have been completely tested at the factory, a final field test should be made to be sure that the equipment has been properly installed and that all connections are correct and have not become loose in transportation. The primary equipment should be completely de-energized while the tests are in progress.

Directions for testing devices such as relays, instruments and meters are given in the instruction book furnished for each device. The settings of the protective relays must be coordinated with the other relays on the system and therefore these relays must be set by the purchaser. General instructions on setting the relays are given in the relay instruction books. Special instruction books are furnished for complicated automatic equipments, describing the sequence of operation of the devices required to perform the desired function.

When transformers are furnished to supply the control power, the primary taps should be selected so that the control voltage indicated on the wiring diagram is obtained on the secondary of the transformer. When a battery is used to supply the control power, the cables from the battery to the switchgear should be large enough to avoid excessive voltage drop. The voltage at the terminals of the breaker closing coils, when the breaker is being closed, should not be less than 112.5 volts for 125-volt coils and 225 volts for 250-volt coils.

The operation of the breaker with its associated devices may be tested in the unit while the equipment is energized by racking the breaker into the test position and engaging the secondary coupler. This is accomplished by lowering the handle on the right-hand side of the breaker mechanism and pushing forward until the coupler engages.

High potential tests to check the integrity of the insulation are not necessary if the insulation instructions in this book are carefully followed. Should the purchaser desire to make high potential tests, the test voltage should not exceed 14 kV alternating current for 4.16 kV and 27 kV alternating current for 13.8 equipments. These voltages are 75 percent of factory test voltages and are in accordance with ANSI standards.

Potential transformers, control power transformers, lightning arresters and surge suppressors must be disconnected during high voltage testing. When bus ground studs and caps are furnished, the caps are removed in order to attach grounding cables. The purchaser must replace the ground stud caps after testing and/or maintenance is complete.

OPERATION

The metal-clad switchgear provides safe operation and easy removal and replacement of the circuit breaker. Circuit breakers of the same type, rating and duplicate wiring may be interchanged. Various interlocks are provided between the metal-clad and breaker to insure safe operation. The following instructions explain how these interlocks should function. If the breaker and metal-clad do not function in the manner called for in these instructions, do not force, modify, adjust or remove any interlocks. Consult your local General Electric Installation and Service representative. Failure to follow the following instructions could result in serious injury.

BREAKER INSTALLATION AND REMOVAL

With all primary and control power circuits deenergized and before installing the breaker clean the mating surfaces of the metal-clad and circuit breaker primary disconnects, secondary disconnects and ground shoe and apply a thin coating of D50H47 contact grease. This will prevent galling of the silvered-contact surfaces.

Check the racking mechanism to make certain that it is in the disconnect position, see Fig. 27. The tape indicator should read "Disc/Test" and the drive nuts on the jack screws should be in the forward position against their respective stops. The racking mechanism is accurately leveled and checked at the factory and should need no adjustment.

Check the circuit breaker to ensure that it is in the "OPEN" and "DISCHARGED" condition.

Pick up the breaker with the lift truck by moving them in such a position that the channel type rails on the lift truck slide over the wheels on the side of the breaker.

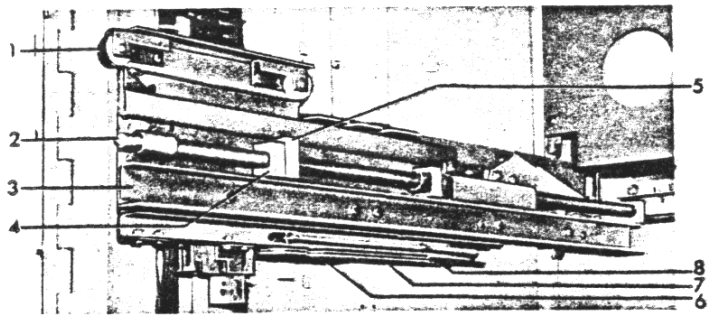
Lock the breaker on the truck by pulling the wheel locking handles (3) Fig. 28 out to the side and secure the wheel lock by pulling the truck locking handles (2) Fig. 28 forward until the wheel locking handle engages a notch. Operate both handles first on one side and then on the other.

Operate the lift truck crank to raise the breaker until the truck rails are slightly higher than the rails in the metal-clad unit into which the breaker is to be inserted. Move the lift truck toward the metal-clad unit and lower the lift truck slightly, if necessary, to engage the docking hooks and check that the lift truck rails are approximately level.

Move the truck locking handles (2) forward. This action releases the breaker wheel locking handles (3) and locks the lift truck and metal-clad rails together.

Push the breaker into the metal-clad unit until the racking arms are engaged as indicated by the label on the front cover of the breaker. (1) Fig. 29. A safety catch on the right hand metal-clad rail will prevent the breaker from rolling back out in case the racking arms are not engaged, see Fig. 44.

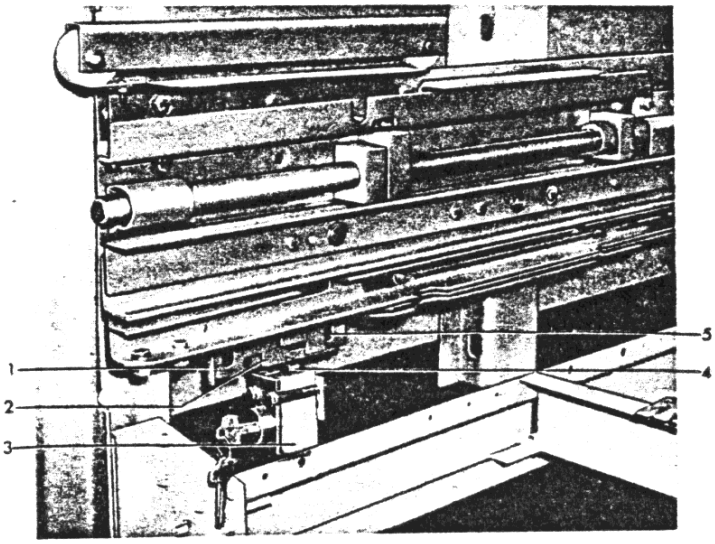
The lift truck may now be released by moving the breaker wheel lock handle (3) out and the truck locking handle forward.



1 – Position Indicator
2 – Racking Shaft
3 – Rail
4 – Bearing
5 – Racking Nut
6 – Forward Slot
7 – Cam
8 – Rear Slot

Fig. 31 (8918431F)

Fig. 31 Negative Interlock



1 – Notched Sliding Link
2 – Detent
3 – Keylock
4 – Bolt
5 – Slot

Fig. 32 (8918438D-2)

Fig. 32 Key Lock and Padlocks

To test the function of the spring-discharge interlock install a circuit breaker following the instructions given under BREAKER INSTALLATION. For this test the control power circuits in the metal-clad must be energized.

Place the breaker in the "Disconnect/Test" position and connect the secondary disconnect device by pulling down on the breaker handle and inserting the level arm fully in the breaker. This will actuate the spring-charging motor and charge the breaker-closing springs.

Rack the breaker toward the connected position using the manual racking handle. The spring-discharge interlock should discharge the breaker springs in three to five turns.

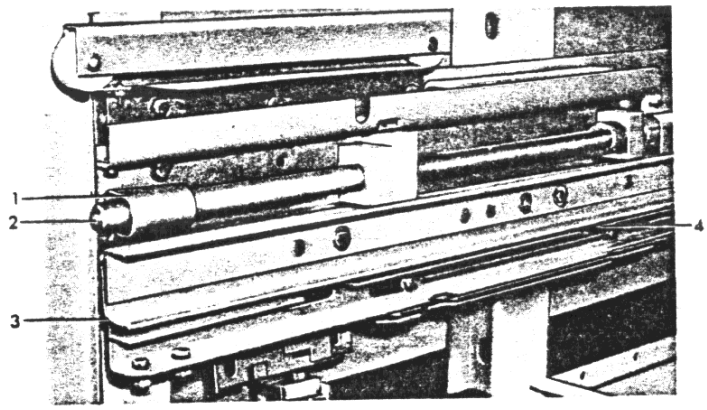
Continue to rack the breaker to the connected position. Just before reaching the connected position, the spring charging motor will be reenergized and charge the closing springs. Rack the breaker toward the disconnected position. The spring discharge interlock should discharge the breaker closing springs in 3 to 5 turns. Continue to rack the breaker to the disconnect position. Reenergize the secondary disconnect device as before and this will cause the spring charging motor to charge the breaker closing springs. Raise the racking arms to the release position and roll the breaker forward. The spring discharge interlock should discharge the breaker closing springs before traveling 1/2 inch.

If the interlock does not function as indicated DO NOT MAKE ANY ADJUSTMENT. COMMUNICATE WITH THE NEAREST GENERAL ELECTRIC COMPANY INSTALLATION AND SERVICE ENGINEERING OFFICE FOR INSTRUCTIONS'

INTERFERENCE INTERLOCK

The function of the mechanical interference interlock is to permit only breakers with the same ratings to be inserted in any specific compartment.

This interlock consists of two comb-like plates, one on the equipment and a mating plate on the breaker. The equipment interference plate is permanently fastened to a cross member located just below the breaker mechanism frame device panel. (See Fig. 34.)



1 – Interlock
2 – Racking Shaft
3 – Rail
4 – Slot

30 (8918438D-1)

Fig. 30 Positive Interlock

Trip the breaker and rack it into the connected position. AGAIN IT IS EMPHASIZED THAT THE PRIMARY CIRCUITS MUST BE DE-ENERGIZED BEFORE MAKING THIS CHECK OF THE POSITIVE INTERLOCK. Close the breaker and insert the racking handle into the hole in the unit door. When attempting to insert the racking handle a definite stop should be encountered preventing the socket on the racking handle from engaging the racking mechanism.

If the interlock does not function as indicated in either of the above cases DO NOT MAKE ANY ADJUSTMENT. COMMUNICATE WITH THE NEAREST GENERAL ELECTRIC COMPANY INSTALLATION AND SERVICE ENGINEERING OFFICE FOR INSTRUCTIONS.

NEGATIVE INTERLOCK

The negative interlock functions to hold the breaker in a mechanical and electrical trip-free mode when it is being racked between the "Disconnect/Test" and "Connect" positions. As an added precaution the negative interlock will trip the breaker and hold it trip-free if an attempt is made to operate the racking mechanism when the breaker is closed and in either the "Disconnect/Test" or "Connect" position, and the positive interlock fails to function.

The negative interlock consists of two notched members in the left-side-track assembly which operate the negative (trip latch) interlock roller on the left side of the breaker. Refer to Fig. 31. On the metal-clad one members is stationary and the other is a spring-loaded slide attached to the racking mechanism. A third member, a notched sliding link, provides the key lock functions and is described under KEY LOCKS. See Fig. 32.

To test the function of the negative interlock install a circuit breaker following the instructions given under BREAKER INSTALLATION. For this test the control power circuits in the metal-clad must be energized.

Place the breaker in the "Disconnect/Test" position and connect the secondary disconnect device by pulling down on the breaker handle and inserting the level arm fully into the breaker. This will actuate the spring-charging motor and charge the breaker-closing springs. Close the breaker using either the control switch or the manual close button. Push the sliding link located on the front of the left track rearward. Refer to Fig. 32. This will cause the negative interlock roller on the breaker to depress and trip the breaker. Leave the sliding link in the rearward position and attempt to close the breaker using the control switch. Nothing should happen. Now attempt to close the breaker by depressing the manual close button. The closing springs will discharge but the breaker should remain open. Return the sliding link to the forward position.

Rack the circuit breaker into the connected position and close it either manually or electrically. Push the sliding link rearward and verify that the breaker trips. With the sliding link in the rearward position attempt to close the breaker using the control switch. Again, nothing should happen. Now attempt to close the breaker by depressing the manual close button. Again, the closing springs will discharge but the breaker should remain open.

If the interlock does not function as indicated in either of the above cases DO NOT MAKE ANY ADJUSTMENT. COMMUNICATE WITH THE NEAREST GENERAL ELECTRIC COMPANY INSTALLATION AND SERVICE ENGINEERING OFFICE FOR ADDITIONAL INSTRUCTIONS.

SPRING DISCHARGE INTERLOCK

The spring discharge interlock consists of a notched member in the right-side-track assembly which activates the spring discharge roller on the right side of the breaker. Refer to Fig. 33.

The function of the spring discharge interlock is to prevent the breaker closing spring from being charged unless the breaker is in the "Connect" or "Disconnect/Test" position or removed from the cubicle. In addition, it will mechanically discharge the breaker springs when the breaker is moved between any of the above mentioned positions and prevent recharging by opening the close-latch-monitoring switch in the breaker spring-charging circuit.

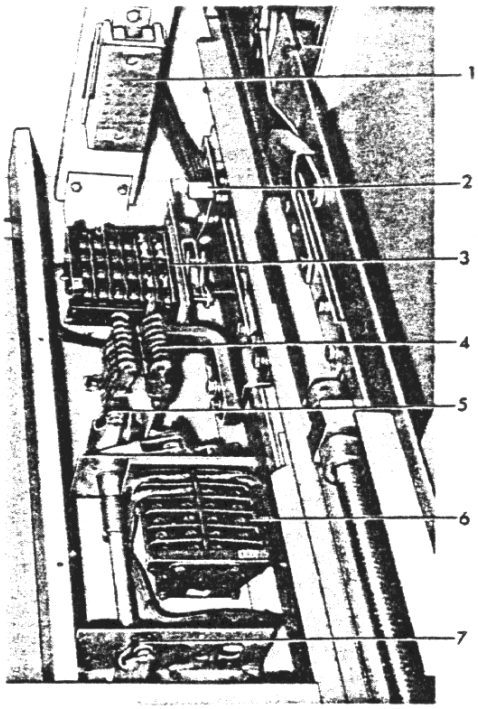


Fig. 35 (8918438H)

1 – Secondary Coupler
2 – Position Switch Actuator
3 – Position Switch
4 – Ground Shoe
5 – Stationary Auxiliary Switch Connect Position Actuator
6 – Stationary Auxiliary Switch
7 – Stationary Auxiliary Switch Test Position Actuator

Fig. 35
Stationary Auxiliary Switch and Breaker Position Switch

order to keep the inside temperature several degrees higher than the outside. Heaters are also furnished for indoor equipment with it is known that abnormal atmospheric conditions exist at the installation, or when specified by the purchaser.

By maintaining a slight temperature differential, the heaters help facilitate drying and prevent condensation and the resulting corrosion and insulation deterioration which might occur.

Four 75-watt heaters are provided in each vertical section. One heater is located in each breaker or auxiliary compartment on the bottom at the rear. One heater is also located at the bottom of each cable compartment when breakers are stacked two high. When there is only one breaker per section both heaters are located in the cable compartment at the bottom of the section. Heaters may also be located in transition compartments and in bus ducts if the operating conditions require them.

Before energizing the heaters, be sure the power source is of the proper voltage, frequency, and phase arrangement, and is connected in accordance with the wiring diagrams furnished with the equipment. Also, be sure to remove all cartons and miscellaneous material packed inside the units before energizing the heaters.

The heater circuit should be inspected several times a year to make sure that it is energized.

It is recommended that the heaters be energized at all times and that thermostatic control not be used. If thermostatic control is used, the contacts of the thermostat should be set to close between 95°F and 100°F on falling temperature, de-energizing the heaters only when strong sunlight beats on the switchgear. Under no condition should a differential thermostat be used to control the heaters because under conditions of extremely high humidity this type of thermostat will not operate at all times to keep the heaters on enough to prevent condensation in the switchgear.

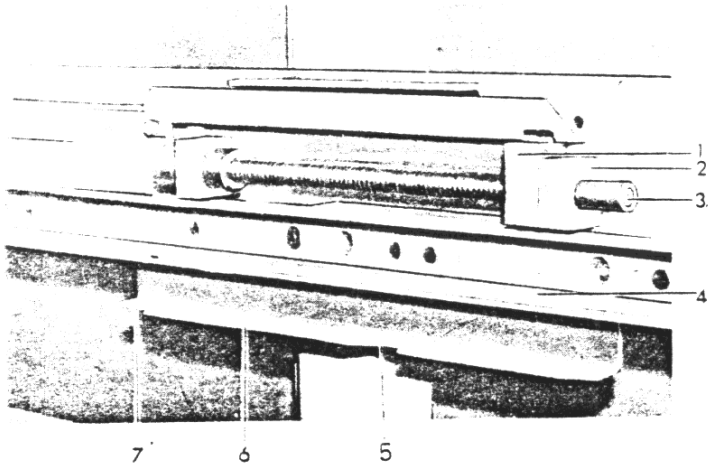
MAINTENANCE

A regular maintenance schedule should be established to obtain the best service and reliability from the switchgear. Plant operating and local conditions will dictate the frequency of inspection required. 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. The test cabinet, which is furnished, provides a convenient means for maintaining the circuit breakers. Under normal conditions the protective relays do not operate, therefore, it is important to check the operation of these devices regularly.

A permanent record of all maintenance work should be kept, the degree of detail depending on the operating conditions. In any event, it will be a valuable reference for subsequent maintenance work and for station operation. It is recommended that the record include reports of tests made, the condition of equipment and repairs and adjustments that were made.

BEFORE ANY COVERS ARE REMOVED OR ANY DOORS OPENED WHICH PERMIT ACCESS TO THE PRIMARY CIRCUITS, IT IS ESSENTIAL THAT THE CIRCUIT OR CIRCUITS BE DE-ENERGIZED AND BREAKERS BE WITHDRAWN TO THE TEST POSITION AND TAGGED.

The primary circuits of metal-clad switchgear are insulated



1 – Racking Nut
2 – Bearing
3 – Jack Screw
4 – Rail
5 – Disconnect/Test Slot
6 – Operating CAM
7 – Connect Slot

Fig. 33 (8918438O)

Fig. 33 Closing Spring Discharge Interlock

TO PREVENT DAMAGE DO NOT REMOVE REPLACE OR READJUST THE RATING INTERFERENCE PLATES ON EITHER THE METAL-CLAD UNIT OR THE POWER VAC* CIRCUIT BREAKER. IN CASE OF A PROBLEM CONSULT YOUR NEAREST GENERAL ELECTRIC COMPANY INSTALLATION AND SERVICE ENGINEERING OFFICE.

CLOSING SPRING GAG INTERLOCK

An interlock is provided at the rear left side of the breaker to prevent racking in a breaker which has the spring blocking pin in the gagged position. The spring blocking pin must be removed from the gag position and repositioned to hold this interlock in the ungagged position before the breaker will enter the metal-clad unit. See breaker instruction book GEK 39671 for the use of the closing spring blocking pin.

CAUTION: Gagging closing springs when they are in the discharged position can damage the breaker. The breaker side frame may be deformed and/or the gear motor may be damaged.

KEY LOCK

On the lefthand breaker racking mechanism track is a provision for a key lock. The purpose of this lock is to keep the breaker from closing in the "Test" and "Connect" positions by operating the negative interlock see Fig. 32. To operate the key lock (3) in order to remove the key, push slide (1) to the rear and extend the bolt (4) of the lock into slot. This allows the key to be removed and prevents the breaker from closing. The key lock does not prevent motion of the racking mechanism.

PADLOCKS

Two positions for a possible 3 padlocks each are provided on the racking mechanism. See Fig. 32. The front position keeps the breaker from closing in the "Test" and "Connect" position. To obtain this position push slide (1) Fig. 32 to the rear and insert the padlock in the slotted opening just forward of the keylock (3). This gives the same interlocking function as

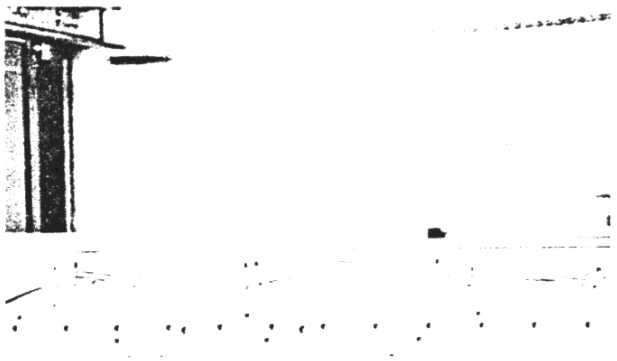


Fig. 34 (8043071)

Fig. 34 Interference Interlock

the keylock and does not block the motion of the racking mechanism.

The second position for padlocks (5) is behind the key lock. A padlock in this slot will prevent any motion of the racking mechanism by keeping the hexagon turning shaft covered.

STATIONARY AUXILIARY SWITCH

An auxiliary switch can be provided at the bottom of the breaker compartment so that additional contacts can be actuated by the operation of the breaker. The breaker will operate this switch when it is in the "Test" or "Connect" position. See Fig. 35.

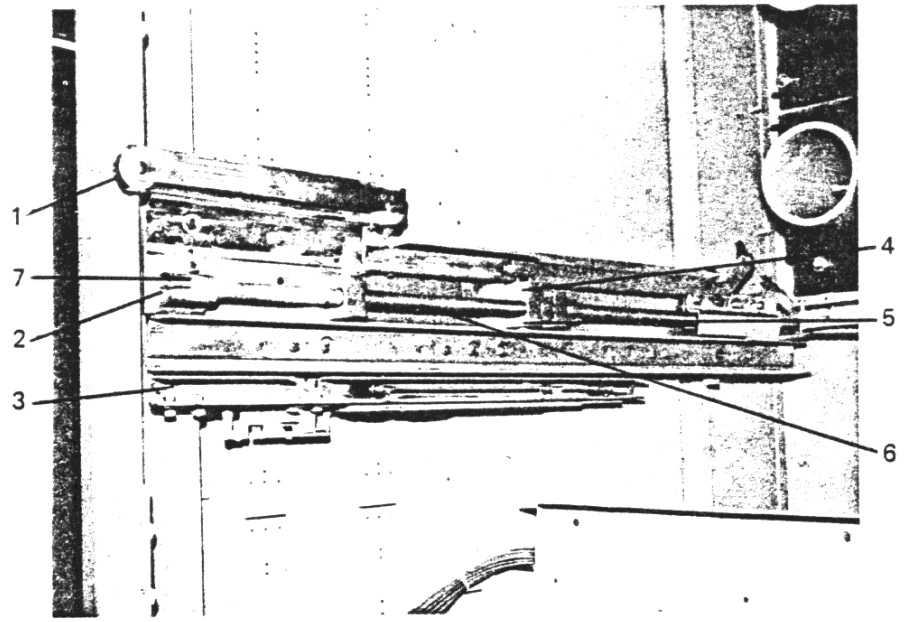
BREAKER POSITION SWITCH

A position switch can be provided at the bottom of a breaker compartment so that it will be operated by a bracket on the breaker frame when the breaker is in the "Connect" position. When the breaker is withdrawn, a spring will return the switch to its normal position. See Fig. 35.

SPACE HEATERS

Space heaters are provided in all outdoor equipment in

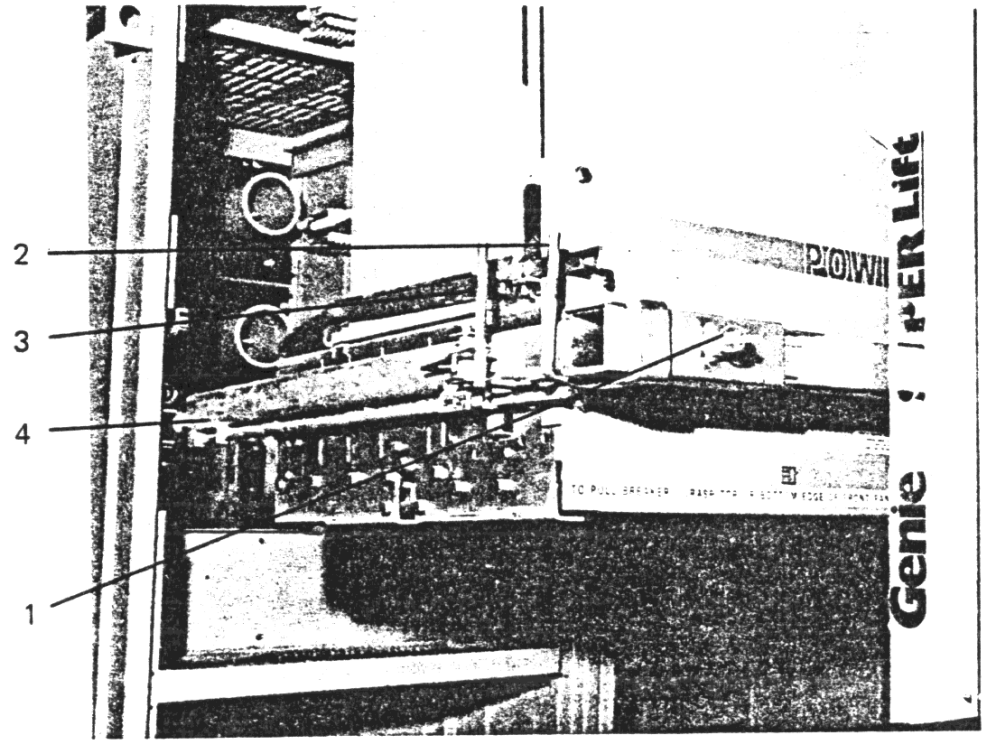
Fig. 27 (8043123)



1 – Position Indicator
2 – Racking Shaft
3 – Rail
4 – Shaft Bearing
5 – Racking Nut
6 – Jack Screw
7 – Interlock

Fig. 27 Racking Mechanism

Fig. 28 (8043121)



1 – Lift Truck
2 – Truck Locking Handle
3 – Wheel Locking Handle
4 – Docking Hooks

Fig. 28 Lift Truck Connection to Rails

in order to reduce the size of the equipment. However, this insulation, except in one or two instances, requires a certain amount of air gap between phases and to ground to complete the insulation. Inserting any object in this air space, when equipment is energized, whether it be a tool or a part of the body, may under certain conditions, in effect, short circuit this air gap and may cause a breakdown in the primary circuit to ground and cause serious damage or injury or both.

Care should be exercised in the maintenance and checking procedures that accidental tripping or operation is not initiated.

RECOMMENDED ANNUAL MAINTENANCE

The switchgear structure and connections should be given the following overall maintenance at least annually. All maintenance work must be done with both the primary and control power circuits deenergized.

1. Thoroughly clean the equipment, preferably using a heavy duty vacuum cleaner to remove all dust and other accumulations. Wipe clean the buses and supports. Inspect the buses and connections carefully for evidence of overheating or weakening of the insulation.

2. Measure the resistance to ground and between phases of the insulation of buses and connections with a 1000 or 2500 volt megger. Since definite limits cannot be given for satisfactory insulation resistance values, a record must be kept of the reading. Weakening of the insulation from one maintenance period to the next can be recognized from the recorded readings. The readings should be taken under similar conditions each time if possible, and the record should include the temperature and humidity.

   High potential tests are not required, but if it seems advisable, based on the insulation resistance tests or after repairs, the test voltage should not exceed 14 kV alternating current for 4.16 kV and 27 kV alternating current for 13.8 equipments. These voltages are 75 percent of factory test voltages and are in accordance with ANSI standards.

   Potential transformers and control power transformers, lighting arrestors and surge suppressors must be disconnected during high voltage testing.

3. Clean racking mechanism and lubricate jack screws and gears with lubricant D6B15 (Mobil 28).

4. Check primary disconnecting device contacts for signs of abnormal wear or overheating. Discoloration of the silvered surfaces is not ordinarily harmful unless atmospheric conditions cause deposits such as sulphides on the contacts. If necessary the deposits can be removed with a good grade of silver polish.

   Sandpaper, steel wool or abrasive cleaners should never be used on silver-plated parts.

   Before replacing breaker, apply a thin coat of contact lubricant D50H47 to breaker studs for lubrication.

5. Check to see that all anchor bolts and bolts in the structure are tight. Check tightness and continuity of all control connections and wiring.

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

   Inspect individual heater elements and replace any which have failed.

7. All louvered exterior openings in outdoor equipment are 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 reassembly and replaced if any signs of deterioration are evident.

OUTDOOR ACRYLIC PAINT FINISH

The outside of outdoor switchgear has acrylic paint finish providing improved resistance to all atmospheric conditions, longer life and less maintenance than with ordinary paint finishes.

If it is desired to refinish acrylic painted switchgear, it is necessary to use one of the following procedures in order to secure the best adhesion of the paint to the original finish.

A. Refinishing with Acrylic Paint. It is recommended that refinishing be done with DuPont acrylic paint of the desired color. Obtain materials and instructions for application from the DuPont Company.

B. Refinishing with Alkyd or Oil Base Paints. Two metho are recommended:

   1. Spray one sealer coat of DuPont 233E75300 or equivalent which has been reduced to spraying viscosity with DuPont 37692 or 37666 thinner. Air dry for one hour. Apply alkyd or oil base paint.

   2. Spray one sealer coat of Arco 214-806 primer which has been reduced to spraying viscosity with Xylol. Air dry for one hour. Apply alkyd or oil base paint.

Fig. 39 (8042973)

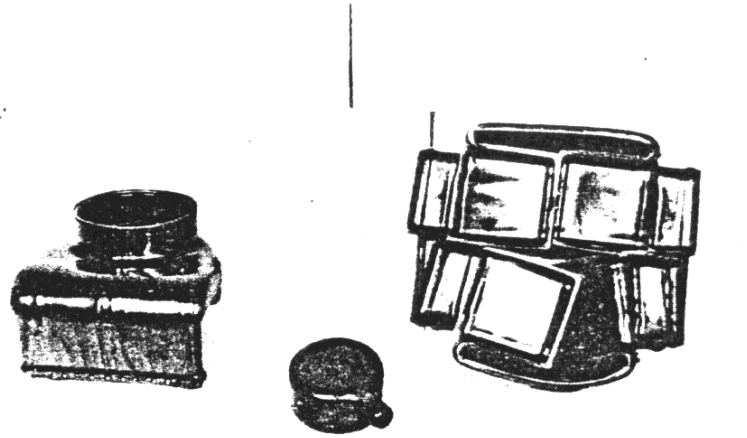


Fig. 39 Connection Boots for Primary Disconnects, Surge Suppressors, and Bus

Fig. 40 (8043070)

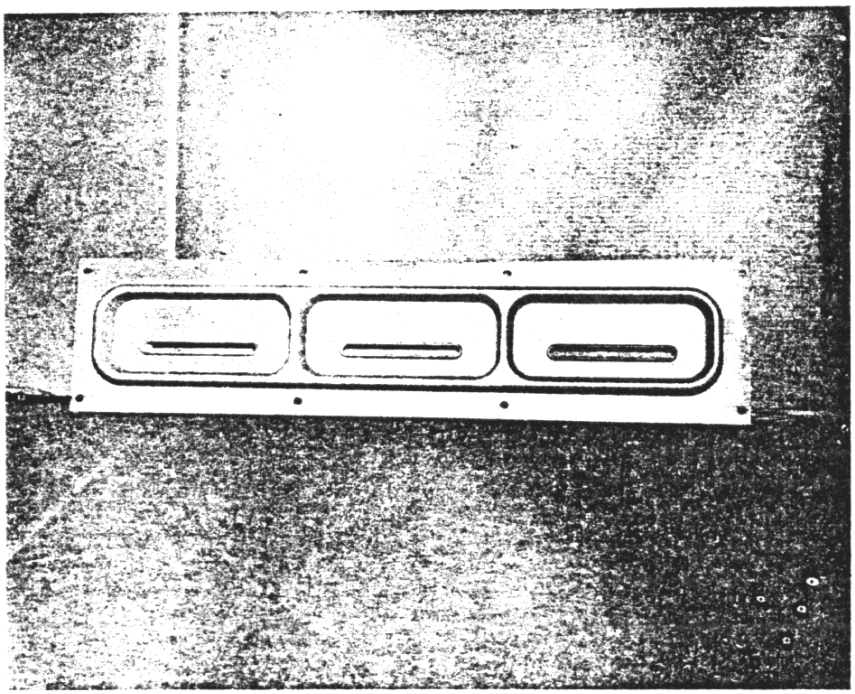


Fig. 40 4.16 kV Inter Unit Barrier

RENEWAL PARTS

ORDERING INSTRUCTIONS

Renewal parts should be ordered from the Switchgear Business Department.

Always specify the requisition number on which the equipment was originally furnished.

Specify the quantity, reference number, description and this bulletin number.

tandard hardware, such as screws, bolts, nuts, washers, , is not listed. Such items should be purchased locally.

For prices, refer to the nearest office of the General Electric Company.

If insulating material, such as tape, varnish, compound, etc., is required, it must be specified separately.

If parts listed separately are to be assembled at the factory, order must so state.

Not all parts shown herein will be used on any one equipment. Parts not used in original equipment should not be ordered as renewal parts.

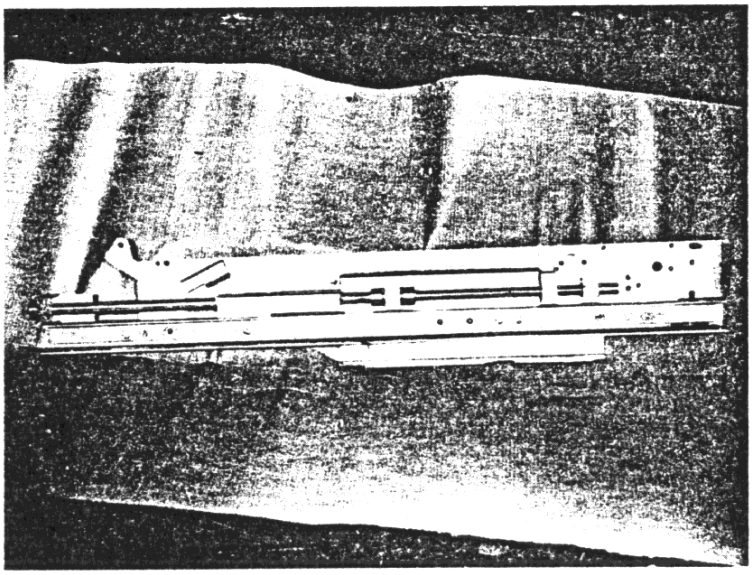


Fig. 36 (8042976)

Fig. 36 Right Hand Track Assembly for Vacuum Metal Clad

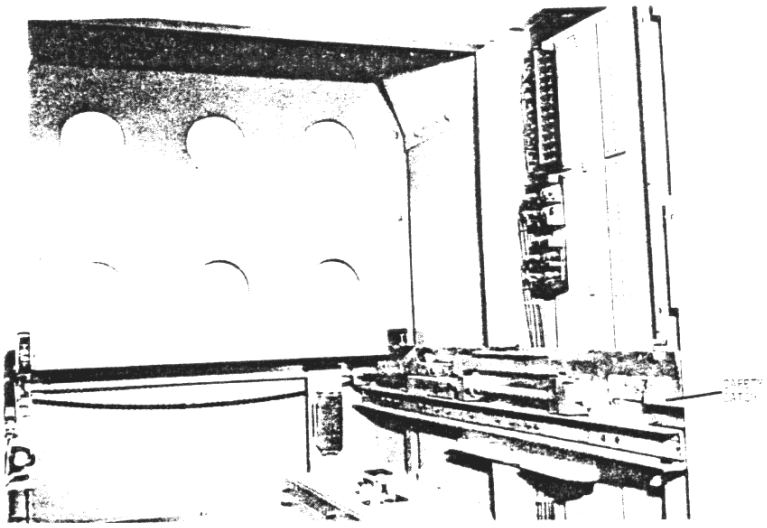


Fig. 44 Vacuum Metal-Clad Breaker Unit

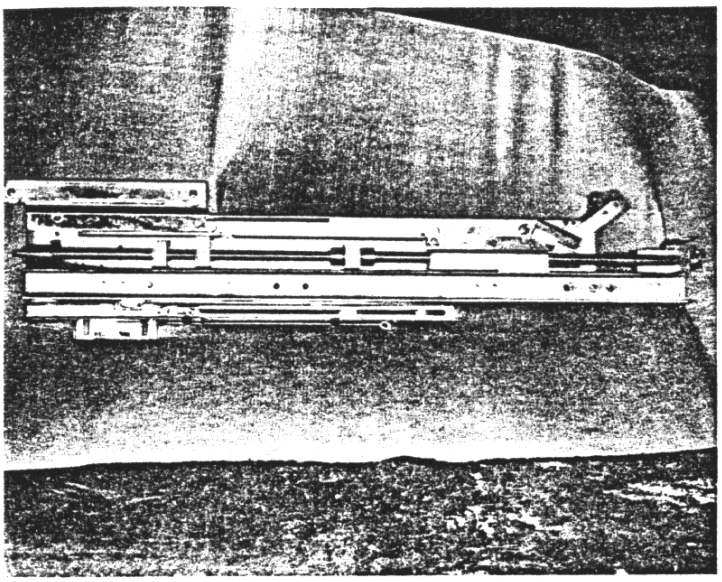


Fig. 37 Left Hand Track Assembly for Vacuum Metal Clad

37 (8042974)

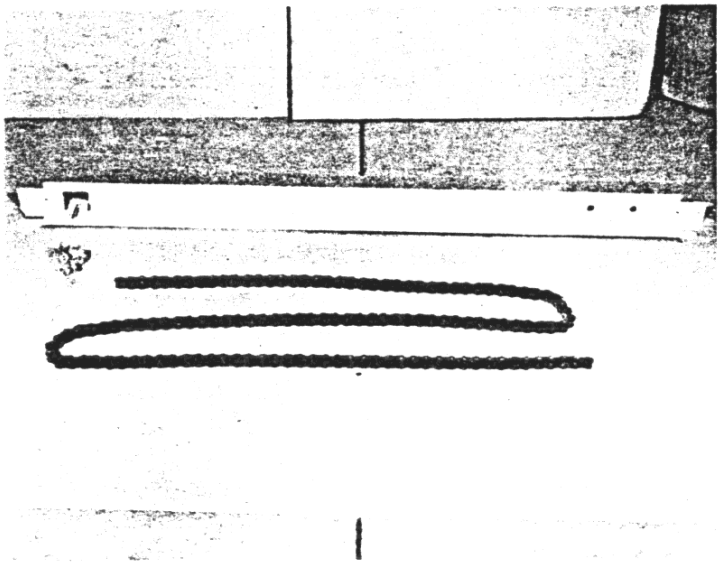


Fig. 38 Spreader Bar, Chain and Idler Sprocket for Vacuum Metal Clad

Fig. 38 (8042972)

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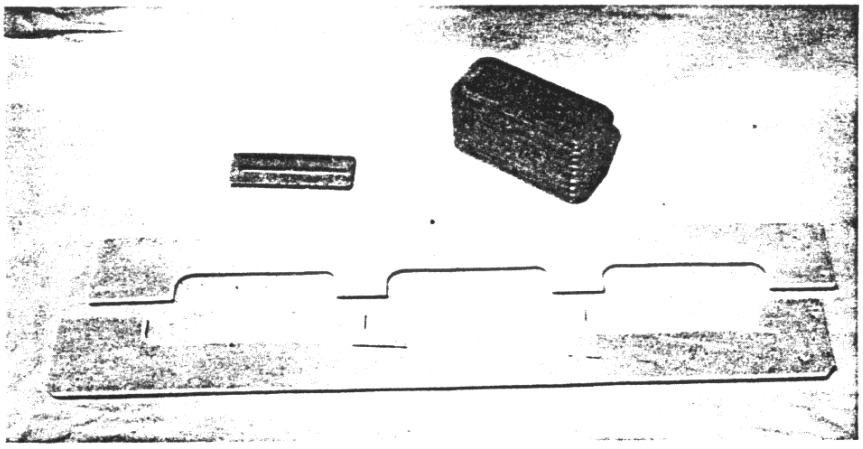

Fig. 41 13.8 kV Inter Unit Barrier

41 (8043114)

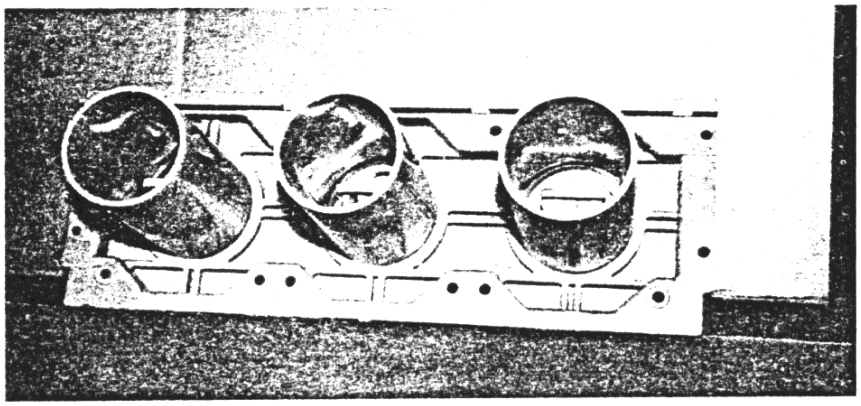

Fig. 42 4.16 kV Primary Disconnect

Fig. 42 (8043057)

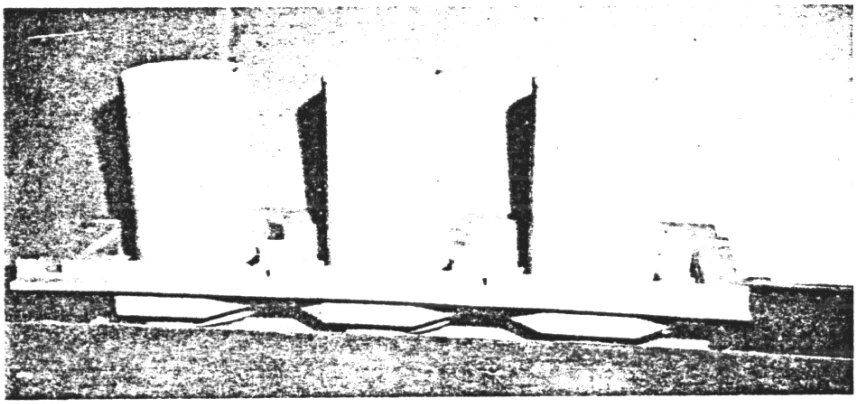

Fig. 43 13.8 kV Primary Disconnect

Fig. 43 (8043056)