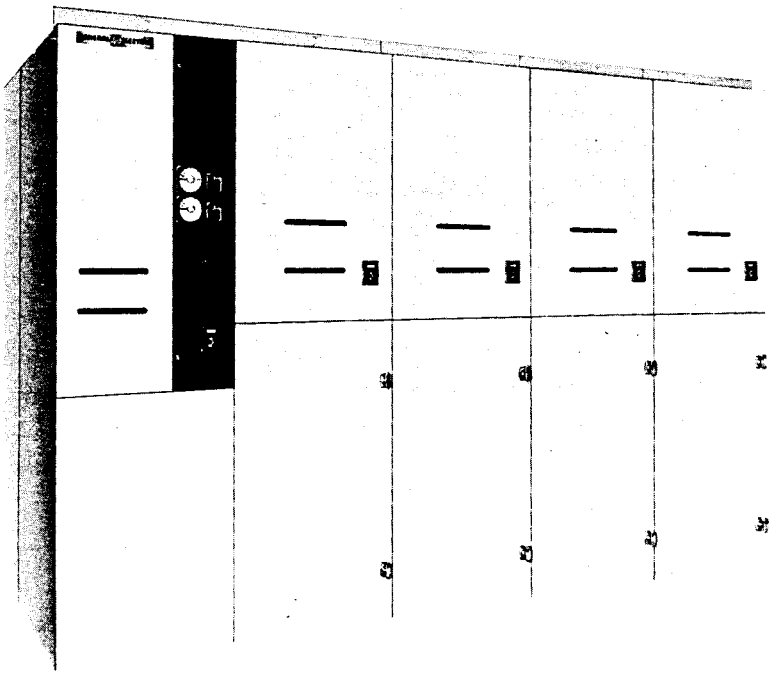
INSTRUCTIONS

GEI-90893B
Supersedes GEI-90893A

BREAKMASTER

Stationary Fusible Air Interrupter-Switch Equipment



SWITCHGEAR PRODUCTS DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

CONTENTS

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.

BREAKMASTER STATIONARY FUSIBLE AIR INTERRUPTER-SWITCHES

UNFUSED BREAKMASTER GENERAL RATINGS

System Voltage (Kv)	Nominal Voltage (Kv)	Max. Design Voltage (Kv)	60-cycle Withstand Voltage (Kv)	BIL BIL (Kv)	Continuous Current Rating (Amperes)	Contact[2] Interrupting Rating (Amperes)	Momentary* Rating (Amperes)	Fault-Close[1-2] Rating (Amperes**)	Field Test Volts 75% of Factory Test Volts (Kv) 60cy - 1 minute
2.4 4.16 4.8	4.8	5.5	19	60	600 1200	600 1200	40,000 60,000	40,000 60,000	15
6.9 7.2 12.0 13.2 13.8	13.8	15.5	36	95	600 1200	600 600	40,000 60,000	40,000 60,000	27

† Ten-cycle duration

* Applies to unfused switch units only. Values are expressed in RMS total amperes as defined in NEMA and ASA standards.

1 These ratings apply to breakmaster equipments with stored energy and electrically operated switches.

2 Manual units have contact interrupting rating of 100 amperes at 15KV, 400 amperes at 5KV. These units do not have fault close ability. Key interlocking is recommended to prevent operation under load.

INTRODUCTION

This supplement in conjunction with GEI-28838 and GEI-88767 contains instructions for installing, operating and maintaining breakmaster stationary fusible air-interrupter switch equipments. It should be carefully read before installation and initial operation of the equipment involved.

For application and specification information refer to GEA-3592N "Powermaster AKD-5 Low Voltage Switchgear" and GEA-8073 "Breakmaster Fusible Stationary Air Interrupter Switch Equipment".

Separate publications will be supplied for load break switches, lightning arresters, fuses or other devices not described in this publication.

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

1. Front view and floor plan drawings - These show the general arrangements, height, recommended aisle space, foundation cable area, unit numbers, etc. .

2. When required:

   a. Control wiring diagrams.
   b. Elementary and schematic wiring diagrams.
   c. Summary of switchgear equipment - This is a partial parts list, giving catalog numbers of switches, fuses, devices, etc. .

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

DESCRIPTION

Breakmaster stationary fusible air-interrupter switch equipments, rated at 4.8 and 13.8 KV nominally, provides an economical method of protecting and switching medium voltage circuits on systems rated 2.4 KV through 13.8 KV. An air-interrupter switch is utilized in series with high speed current limiting power fuses for short circuit detection and interruption. Breakmaster equipments are normally applied when duty cycle and other application requirements as well as economics dictate the use of a device less sophisticated than a power circuit breaker.

Breakmaster equipments consist of:

Line-up equipments - (Fig. 1)

Single unit equipment - (Fig. 2)

Load center incoming line equipments (LVP) - (Fig. 3, 4, 5)

All are designed for indoor and outdoor service with provisions for incoming line or feeder cables to enter the equipment from above or below with pothead or clamp type terminal connection.

1. Line-Up Equipment - Fig. 1

   Consists of two or more front accessible units containing a 600 or 1200 amp bus, connecting various combinations of incoming line units, tie units and feeder units together.

   Two windows, Fig. 6, are provided on the upper front cover of switch units so that a flashlight can be used to illuminate the switch

NOMENCLATURE OF BREAKMASTER EQUIPMENTS

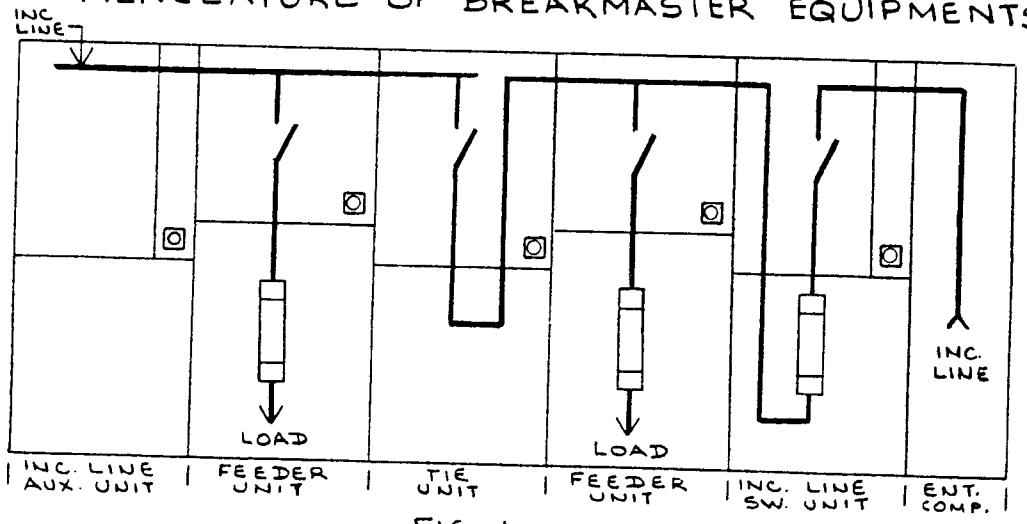


FIG. 1
LINE UP EQUIPMENT

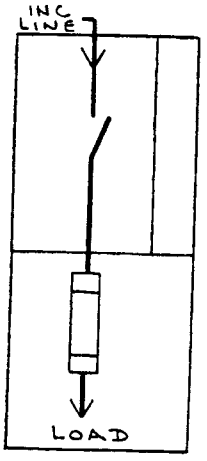


FIG. 2
IN & OUT UNIT

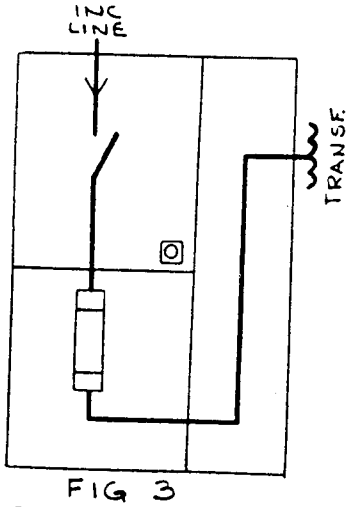


FIG 3
SINGLE UNIT LVP

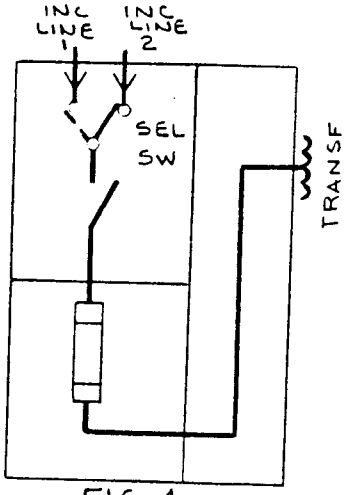


FIG 4
SINGLE UNIT WITH SELECTOR SW. LVPS

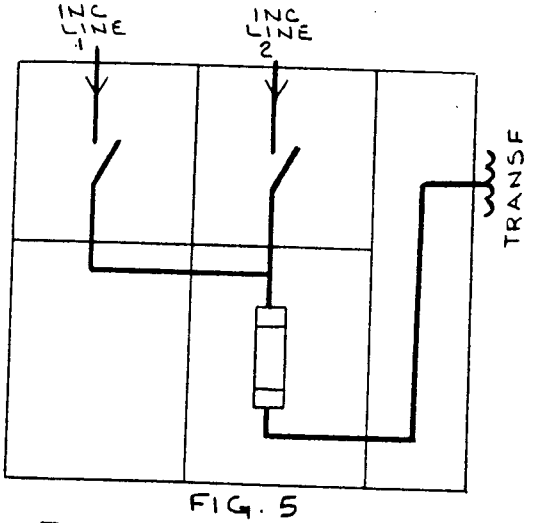


FIG. 5
DOUBLE UNIT LVPD

Fig. 6 (8035191)

without a reflected glare to the operator's eyes. This cover is bolted and hinged. A mechanical position indicator, Fig. 7, is also provided for switch position in the escutcheon over the switch operating shaft.

The blue instrument panel, standard equipment for all incoming line units, is hinged for access to the operating handle storage area. This area also provides storage for instruction books, reference drawings, summaries and installation drawings. Barriers behind this panel separate this storage and secondary control area from primary line parts.

When fuses are located in the lower compartment, Fig. 8, its door will be hinged and provided with two door handles for easy access. This door is mechanically interlocked, Fig. 7, with the air interrupter switch to prevent access to energized fuses. When fuses are not present in the lower compartment its door will be hinged and bolted.

The welded aluminum 600 or 1200 amp main bus, Fig. 9, is located in the rear upper area of the unit. Access is obtained by removing the rear top covers or rear end sheets. Provisions for future bus extension is provided at each end of the equipment. Flash welded and silver plated copper connection stubs are provided at shipping splits and where bolted connections are required at devices. (Current transformers, switch and fuse tangs, etc.)

In addition to the basic description of this equipment, the units may contain, as standard accessories, potential transformers, current transformers, lightning arresters, instrumentation, etc. in combinations too numerous to describe. Refer to the front view and summary of equipment for catalog numbers, arrangement and location.

2. Single Unit Equipment - Fig. 2

Consists of a single unit which permits front side, and top access to the incoming line and load cables entering the unit, in any combination, from above and below.

Constructional features are similar to those of line up equipments except for omission of main bus.

3. LVP Two-Position Air-Interrupter Switch Fig. 3

The Type LVP air interrupter switches are three pole, two position (open-closed) switches with all three poles operated simultaneously by a removable handle on the front of the switch compartment. The LVP switch provides a visible air break in the primary circuit when the substation is disconnected.

LVPS Air-Interrupter Selector Switch - Fig. 4

Where there are two separate incoming lines, the three-position (Line 1/Open/Line 2) Type

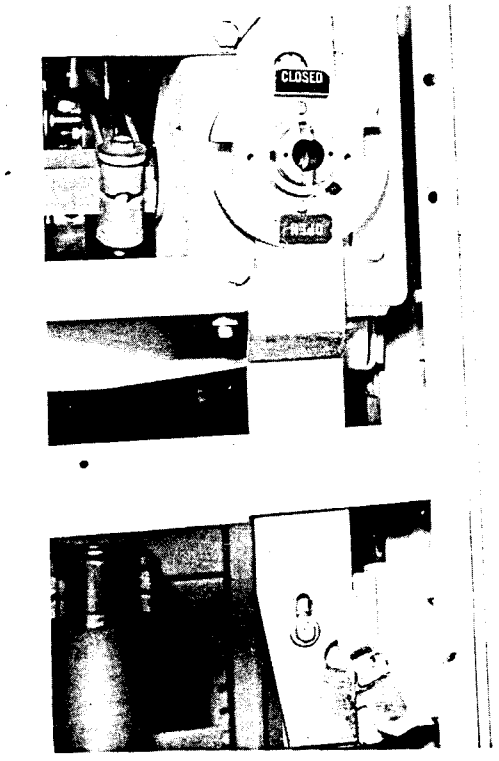


Fig. 7 (8035198)

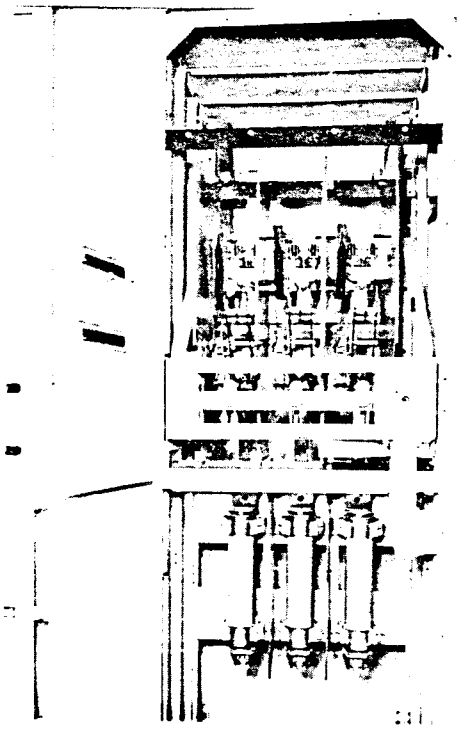


Fig. 8 (8035205)

Fig. 9 (8035207)

LVPS air-interrupter selector switch provides maximum service continuity by allowing the operator to switch from one incoming line to the other incase of failure of the primary feed, or to OPEN for planned maintenance.

The switch consists of a two-position (open closed) air-interrupter switch in series with a two-position (Line 1/Line 2) selector switch. The selector switch is a dead-break device mechanically interlocked so it cannot be operated unless the interrupter switch is OPEN.

LVPD Double Break Air-Interrupter Switch - Fig. 5

As an alternate to the LVPS, where there are two separate incoming lines, the three-position (Line 1/ Open/ Line 2) Type LVPD double interrupting switch provides maximum service continuity by allowing the operator to switch from one incoming line to the other in case of failure of a primary feeder, or to OPEN for planned maintenance.

The switch consists of two two-position (open-closed) air-interrupter switches connected in parallel on the load side, key-interlocked so both incoming line switches cannot be closed at the same time. The LVPD double break interrupter switch has the advantage of isolating two lines permitting maintenance of one while the other is energized and reducing the probability of transfer of a fault on one cable to the other.

RECEIVING, HANDLING AND STORAGE

RECEIVING

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

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

The package containing miscellaneous parts is normally located within the equipment for shipment. The envelope containing instruction books and drawings is taped to the inside of the equipment door.

To avoid the loss of small parts, the contents of each case should be carefully checked before discarding the packing material.

Some of the miscellaneous parts that are furnished when required are listed below.

For Breakmaster lineups:

Power Fuses
Tube of Contact Lubricant D50H47
Can of Sand Gray Paint
Can of Blue Paint
Hardware for Shipping Splits
Pothead Compound
Can of Thinner
Rubber Seal
Cement
Floor Clamps
} Outdoor Only
Switch Operating Handle
Switch Maintenance Handle
Insulating material consisting of sufficient quantities of
- I-202 Tape
- Varnish A50H77
- Glass Tape A2L12B
- Filler A50H 119

is furnished for insulating the connection bars to potheads. Since these bars cannot be insulated until purchaser's cables are installed they must be insulated in the field.

For LVP Switch Units:

The same as above plus sufficient quantities of insulating materials same as listed above for insulating the primary bushings of the transformer.

Insulating material is never furnished for purchaser's connections to incoming or outgoing leads unless specifically ordered.

HANDLING

Refer to Installation Drawings 931D100 Sh. 2 for line-up equipments, Sh. 3 for in and out units and Sh. 4 for LVP units.

The equipment may be most conveniently handled by a crane. Removable lifting angles are provided on top of the equipment. If the installer uses a crane for lifting, a cable spreader must be used to obtain a vertical pull on the lifting angles.

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

CAUTION: Be sure the rollers used are spaced such that the three channels rest on top of the rollers, as a direct application of the rollers between the channels may tear or distort the equipment. Jacks may also be applied to handle the equipment when a crane is not available. Fork lift trucks must never be used to handle equipment.

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

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

STORAGE

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

1. Uncrate the equipment. Check thoroughly for damage.

2. Store in a clean, dry, rodent free location with moderate temperature and cover with a suitable canvas to prevent dust, dirt, water, or other foreign substances from entering the switchgear.

3. If dampness or condensation is encountered in the storage location, heaters must be placed inside the units to prevent moisture damage. Approximately 250 watts of heaters per unit are required. On outdoor switchgear this may readily be accomplished in making a temporary power supply connection to the heaters already installed in the equipment.

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

EQUIPMENT INSTALLATION

PRIOR TO INSTALLATION

Before any installation work is performed, study all drawings furnished by the General Electric Company for the particular installation. These include arrangement drawings, installation drawings, and when required, connection diagrams, elementary and summary. When requesting information from the factory on any specific item furnished with the equipment, refer to the requisition and summary number. Any material external to the equipment which may be required to meet any local codes, such as mats, screens, railings, warning signs, etc., are not furnished.

LOCATION

In locating the Breakmaster Equipment, consideration should be given to the aisle space required at the front and, when required, rear of the equipment. The recommended aisle space is shown on the floor plan drawing furnished for the particular installation. The space at the front must be sufficient to permit the opening of doors. The space at the rear must be sufficient for opening of doors, removing covers, installation of cables, inspection, and maintenance. Check local codes for special aisle space requirements.

FOUNDATION REQUIREMENTS

Indoor Equipment

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

Suitable means must be provided by the purchaser for mounting and anchoring the switchgear to the floor. The equipment is furnished with built in channels, eliminating the need for floor steel when mounting on a smooth level floor. When embedded channels are desired, they shouldbe in a level concrete slab with the top surface of the channels extending above the concrete sub floor (about 3/4 inch). It is imperative that floor steel be even with finished floor and that both be level prior to the final anchoring to avoid distortion of the switchgear structure. The recommended foundation construction and method of mounting the switchgear to the foundation is shown on installation drawings. At the time the foundation channels are being installed, any conduits or sleeves required for power and control cables that are to enter the equipment from underneath should be located and installed within the available space shown on the floor plan drawings. Consideration should be given to installing conduits or sleeves which might be required for future connections. The conduits should terminate at the switchgear with the appropriate conduit connectors.

Outdoor Equipment

Foundation recommendations for outdoor equipment also are given in installation drawings.

REMOVING SHIPPING SKID - Indoor Equipment Only

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

The skid is bolted to the equipment through the anchor bolt holes used for final installation. The bolts in the equipment may be removed by opening the front doors.

ANCHORING

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

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

Suggested methods for anchoring outdoor equipment are also illustrated in installation drawings. All of these methods use an anchor bolt and floor clamp to secure the supporting channel to the foundation.

ASSEMBLY OF EQUIPMENT

Indoor Equipment

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

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

2. The switchgear and Breakmaster packages should then be placed on their foundations with the aid of crane or jacks as previously described.

3. These packages should be connected and bolted together in the following manner:

   a. Bolt the packages together using 3/8-16 bolts, lockwashers and nuts at the points shown on the installation drawings.

   b. Connect together the main buses and ground buses, of adjacent shipping packages using the splice bars furnished with the equipment (See Table A required torque values for various seze bolts).

TABLE A

TORQUE VALUES FOR BREAKMASTER EQUIPMENT HARDWARE

Insulation-Copper-Steel

BOLT SIZE	FOOT-POUNDS
1/4 - 20	5 - 8
3/8 - 16	15 - 20
1/2 - 13	30 - 40
5/8 - 11	35 - 45

   c. Route and connect control cables between units at the shipping splits. Make the necessary connections by referring to the connection diagram to determine what leads and how many are to be connected.

4. The equipment should be anchored to the foundation by anchor bolts, or tack welds as specified under the paragraph headed "Anchoring".

5. All shipping supports must be removed from the switchgear.

6. Make a final inspection to see that there are no tools, construction materials, or other foreign matter left in the switchgear.

INTERLOCKS

(a) After initial installation of the switchgear equipment, all necessary interlock keys should be inserted into the appropriate locks and all spare keys should be placed in the hands of a responsible person. This precaution is necessary since improper use of spare keys will defeat the interlocking scheme.

(b) All fused switches are equipped with a mechanical interlock that prevents opening the fuse door until the switch is first opened. The switch cannot be reclosed as long as the fuse door is open. This interlock must be examined before energization of the equipment to insure that it did not get out of adjustment during shipment.

(c) In those instances where control power is furnished with the equipment, a key interlock with auxiliary switch is furnished on the access door to the primary fuses of the control power transformer. The auxiliary switch contacts are wired in series with the secondary of the control power transformer and disconnect the load automatically when the access door is opened. This prevents inadvertent pulling of primary fuses with a secondary load.

Operation Test-Load Break Switch

Refer to GEI-88767 instruction manual for preoperational checks on the load break switch.

BUS BARS

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

(a) Clean the silver plated contacting surfaces with a clean cloth or solvent, if required. Sandpaper or other abrasives must not be used. Apply lubricant, D50H47, furnished with each equipment to the contact surface.

(b) Bolt the splice bar to the bus using a bolt, washer, and lockwasher for each bus connection. Refer to Table A for the proper torque values.

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

(a) Check alignment of doors on outdoor equipment to insure that the weatherproof seal has not beed disturbed.

(b) When joining shipping packages, special procedures for weatherproofing must be followed as indicated in installation drawings. The joint in the roof between units and shipping splits must be weatherproofed. This is done by placing a rubber seal between roof flanges. Bolt this joint together, using 3/18-16 hex head bolts, lockwashers and hex nuts. A roof cap is placed over this seam and held in place by the roof trim. Joints between transformer throat and switchgear, and between shipping splits, must also be weatherproofed. Install a front and rear rubber seal at the shipping split joints.

Removable patch plates and pull boxes shipped excess have gaskets cemented thereto by the factory. At installation apply cement Goodrich A57ST to the other face of the gasket which meets the roof.

Remove the lifting plates from front and rear of the switchgear base at both ends of the shipping split joint.

The gasket for outdoor transformers are furnished with the transformer, the hardware for connecting transformer flange to the switchgear is supplied with the switchgear.

PRIMARY CABLE

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

There are two common methods of making primary cable connections:

(a) 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 the switchgear bus. A pothead also prevents seeping of oil from the end of oil impregnated varnished cambric or paper insulated cable.

(b) Clamp type terminals with mechanical entrance device.

In all cases carefully follow the cable manufacturer's recommendations for installation of the type of cable being used, as well as the instructions contained in GEI-28838.

For system voltage above 7500 volts it is recommended that stress relief cones be built up when single-conductor or three-conductor shielded cable is used. Construct stress relief cones in accordance with the recommendations of the cable manufacturer. See GEI-28838 for one recommended method. On lower voltage cables, belling out the end of the lead sheath ordinarily provides sufficient stress relief. (Stress cone material will not be furnished with pothead).

TESTING AND INSPECTION

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

Directions for testing instruments and meters are given in the instruction book furnished for each device.

The General Electric Company will not be responsible for defects in devices not manufactured by the Company when such devices are specified by the purchaser. All questions relative to such devices should be referred to the manufacturer.

The extent of the tests on the equipment as a whole will depend on the type and function of the equipment. Tests which should be performed, however, include air-interrupter switch operation, phasing, and grounding checks.

High potential tests to check the integrity of the insulation are not necessary if the installation instructions in this book are carefully followed. If the purchaser wishes to make high potential tests the voltage should not exceed 75% of the factory test voltages.

Potential transformers must be disconnected during high voltage testing.

MAINTENANCE

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

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

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

For specific information regarding the maintenance of devices, such as load break switch, lightning arresters, meters, etc. , refer to the separate instruction book furnished for each device.

DEVICES & COMPARTMENTS

Switches-Test and inspect all switches for proper operation as described in GEI-88767 "Load Break Switch".

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

Compartment Interiors

(a) Thoroughly clean interior of compartments. Use a vacuum cleaner and clean rags only. Do not use steel wool, or oxide papers. Blowing with compressed air is not recommended.

(b) Check indicating devices, mechanical and key interlocks.

BUS COMPARTMENT

To perform the following remove the steel top, rear and end sheets.

(a) Before any covers are removed or any doors opened which permit access to the primary circuits, it is essential that the circuits be de-energized.

(b) Check that all bus mounting bolts and splice connection bolts are tight.

(c) Wipe and vacuum clean the busses and supports.

Feeder Cable & Primary Cable Terminations

(a) Inspect all main cable connections for signs of overheating, and tighten all connections.

(b) Check that all secondary control wiring connections are tight and all control cabling is intact.

(c) Check all bolts that secure the terminals for tightness.

(d) Check the ground bus connection and mounting bolts for tightness, and clean the ground bus.

Overall Switchgear

(a) Clean and inspect all painted surfaces and retouch where necessary.

(b) Check to see that all anchor bolts and other structural bolts are tight.

(c) Check that all door latches operate properly.

PAINT REFINISHING

Indoor and Outdoor Primer

1. Remove all loose paint, rust, scale, oil or grease. Sand scratches smooth before priming.
2. Materials
   a. Synthetic phenolic, alkyd paint 214-488 Sand Gray as made by Arco Co.
   b. Thinner Xylol made by Standard Oil Co.
   c. Viscosity 30 seconds Zahn #2 cup.

3. Application

   a. Primer is preheated to 185° F and sprayed with DeVilbiss type hot spray unit.

   b. Air dry 30 minutes.

   c. Thickness of paint coating 0.45 to 0.65 mils.

Indoor Finish Coat

1. Materials

   a. Sand Gray lacquer 246-84296 as made by DuPont Co.

   b. Blue lacquer 254-84299 as made by DuPont Co.

   c. Lacquer thinner.

   d. Viscosity Sand Gray 25 seconds Zahn #2 cup. Blue 27 seconds Zahn #2 cup.

2. Application

   a. Spray one wet coat.

   b. Air dry 30 minutes.

   c. Thickness 1.00 mil.

Outdoor Finish

1. This finish is applied to surfaces previously cleaned and primed.

2. Materials

   a. Acrylic Sealer 881-007 as made by DuPont Co.

   b. Acrylic Lacquer ASA-24 as made by G.E. Co. #200.

   c. Acrylic thinner E-615 as made by Geo. Senn Co.

3. Application - Sealer Coat

   a. Reduce sealer to spraying viscosity using 5 parts 881-007 to 6 parts E-615.

   b. Spray one coat of sealer.

   c. Air dry one hour.

4. Application - Finish Coat

   a. Reduce G.E. 200 with E-615 to spraying viscosity of 17 seconds Zahn #2 cup.

   b. Apply one coat of finish.

   c. Air dry 30 minutes.

   d. Thickness of finish coat 1.00 mil.

RENEWAL PARTS

Ordering Instructions

1. Renewal parts should be ordered from the nearest Sales Office of the General Electric Co.

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

3. Specify the quantity, reference number, description and this Bulletin number.

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

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

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

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