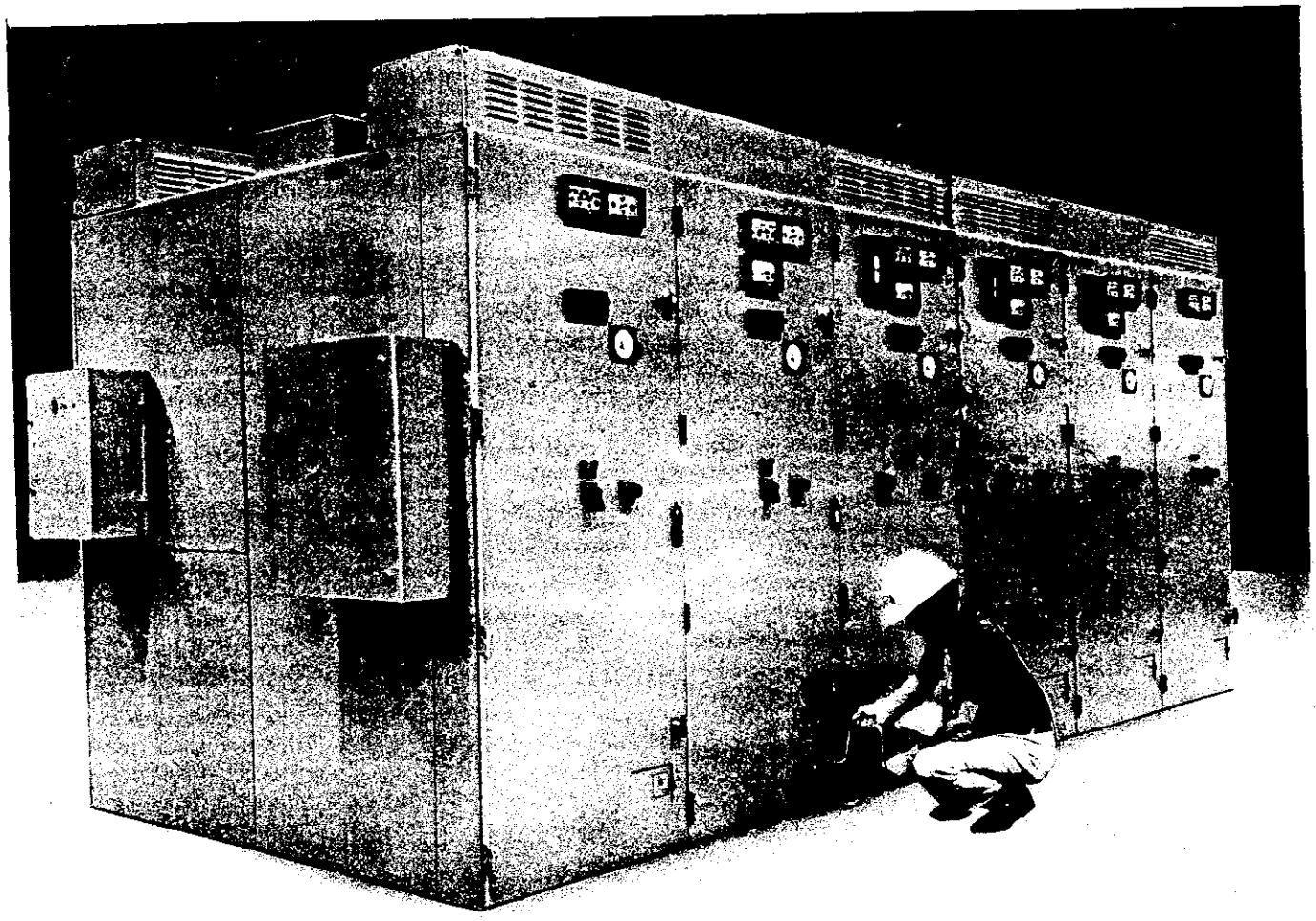
IB-8.2.7-1

ISSUE E

GOULD I-T-E METAL-CLAD SWITCHGEAR

INSTRUCTIONS

METAL-CLAD SWITCHGEAR
TYPE 5HK, 7.5HK, AND 15HK
5000, 7500, AND 15000 VOLT



GOULD

TABLE OF CONTENTS

Page

INTRODUCTION 1
SCOPE OF INSTRUCTIONS 1
IMPORTANT NOTES AND WARNINGS 1
TRANSPORTATION 1
UNLOADING AND HANDLING 1
Standard Unloading Procedure 2
Alternate Unloading Procedure 2
STORAGE 2
PREPARATION OF FLOOR 2
INDOOR INSTALLATION 3
Removal of Shipping Base 4
OUTDOOR INSTALLATION 5
ASSEMBLING THE HOUSING 5
INSTALLATION OF BUS BAR CONNECTION BETWEEN GROUPS 5
Covering Bus Joints 6
Connection of Primary Cables 7
GROUND SENSORS 7
Integral Bus-Mounted Ground Sensor 7
Cables Passing Through Ground Sensors or Zero Phase Sequence Current Txs 7
Metallic Sheathed Cable 8
ROOF BUSHINGS 8
CONNECTION TO GROUND BUS 8
CONNECTION TO CONTROL SOURCE 8
Secondary and Control Connections 8
TESTING AND INSPECTION 8
Final Inspection 9
STANDARD CONSTRUCTION 9
Shutters 9
Primary Disconnect Device 10
Secondary Disconnect Devices 10
Ground Bus and Contacts 10
Control Wires 10
CIRCUIT BREAKERS 10
General 10
HOW TO PUT THE SWITCHGEAR IN SERVICE 11
General 11
Safety Precautions 11
Procedure 11
MAINTENANCE 12
General 12
Annual Inspection 12
Care of Finish 12
Renewal Parts 13

TYPE 5HK, 7.5HK, AND 15HK METAL-CLAD SWITCHGEAR 5000, 7500, AND 15000 VOLT

INTRODUCTION

Instructions for installation, operation and maintenance of metal-clad switchgear are furnished with each shipment of equipment. These instructions are intended as a guide during installation and initial setup and operation.

File these instructions in a readily accessible place, together with pertinent drawings and other descriptive data of the switchgear. Use of these instructions will facilitate proper maintenance of the equipment and prolong its life and usefulness.

SCOPE OF INSTRUCTIONS

These instructions are general in nature, and cover requirements for installation, setup, checkout and maintenance as applied to all metal-clad switchgear. Specific information on particular applications are furnished in the form of general arrangement drawings. These may include:

a. Front view showing arrangement of relays and instruments.

b. Single line diagrams showing power connections.

c. Floor plan indicating available space for power and control conduits.

d. Special construction details.

e. Bill of Materials. The first sheet of the Bill of materials indicate the application of the drawings.

IMPORTANT NOTES AND WARNINGS

The successful and safe operation of switchgear is dependent upon proper handling installation, operation and maintenance, as well as upon proper design and manufacture. Neglecting certain fundamental installation and maintenance requirements may lead to personal injury, and the failure and loss of the switchgear as well as possible damage to other property.

WARNING

THERE IS A HAZARD OF ELECTRIC SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. POWER MUST BE OFF BEFORE WORKING INSIDE SWITCHGEAR. TURN POWER OFF AHEAD OF THE SWITCHGEAR BEFORE PERFORMING ANY MAINTENANCE OPERATIONS. CHECK INCOMING LINE TERMINALS WITH A VOLTMETER TO ASCERTAIN POSITIVELY THAT THE EQUIPMENT IS TOTALLY DEENERGIZED.

TRANSPORTATION

Prior to shipment, the switchgear undergoes careful factory inspection. Each section is plainly marked at convenient places with its number and position. When size or other reasons make it necessary to divide the equipment for shipment, the unit number of the particular equipment is also marked on the section, along with its weight. The circuit breakers are shipped in individual cartons or crates.

Immediately upon receipt of the switchgear, examine the shipment for any evidence of damage or loss sustained during transportation. Check the contents against the packing list before discarding any packing material.

If there is any discrepancy, notify the nearest Gould representative at once. Gould Inc. is not responsible for damage after delivery of shipment to the carrier. However, if the company is notified of such claims, it will furnish forms to facilitate securing any adjustments. If damage to the shipment indicates rough handling, claim for damage should be filed at once with the carrier and Gould Inc. promptly notified.

Indoor switchgear housings are shipped in groups of one to five units. Each group is mounted on heavy steel shipping bases. To avoid distortion to the switchgear, any force to move the structures should be applied to the shipping bases only by means of crowbar, block and tackle, crane, etc.

UNLOADING AND HANDLING

The following is a recommended method for unloading and handling metal-clad switchgear. This method is based on availability of an unloading dock, and access to motorized material handling equipment of sufficient capacity for the weight of the switchgear.

Standard Unloading Procedure

Use chain with a rating ample for safe handling of the switchgear. Attach the chains to the cutout holes at the end of each shipping base, and secure to the towing equipment. Make sure that truck bed height and dock height are even, or provide heavy duty steel sheets to bridge between the truck and the dock. Make sure that towing force is evenly applied to prevent any lurching or rocking motion being imparted to the switchgear. Slowly pull the equipment until the shipping bases are completely resting on the dock.

If an unloading dock and motorized tow vehicle are not available, the following alternate unloading procedure is recommended.

Alternate Unloading Procedure

Where the switchgear must be lifted from its conveyance by an overhead device such as a crane, nylon slings of proper capacity should be used. Figure 1 illustrates the method of attaching the nylon sling to the base by means of shackles. If

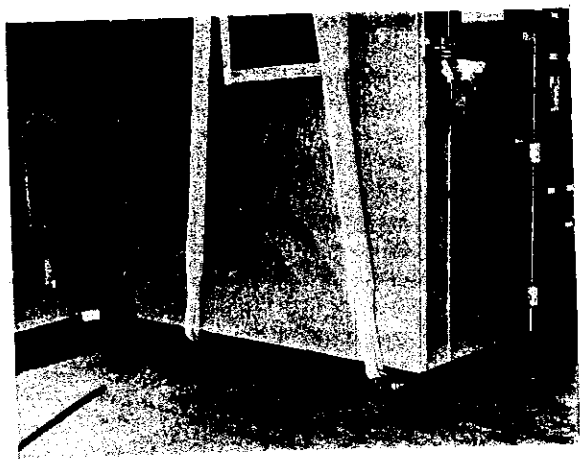


Fig. 1—Nylon Sling on Equipment

shackles are not available for use, insert one inch-diameter steel rods through the shipping base and end loops as illustrated in Figure 2. When using overhead lifting devices, it is recommended that spreaders be used. NEMA publication No. PB-2.1, Instructions for Safe Handling, Installation, Operation and Maintenance of Switchgear latest issue, should be consulted for proper application of spreaders. For the convenience of users of this publication, a copy of this NEMA publication is included with each shipment.

If it is necessary that steel cable, in lieu of nylon slings, be used with shackles or steel rods, a timber piece (such as a 4" x 4") should be placed between the side sheets of the switchgear and the cables.

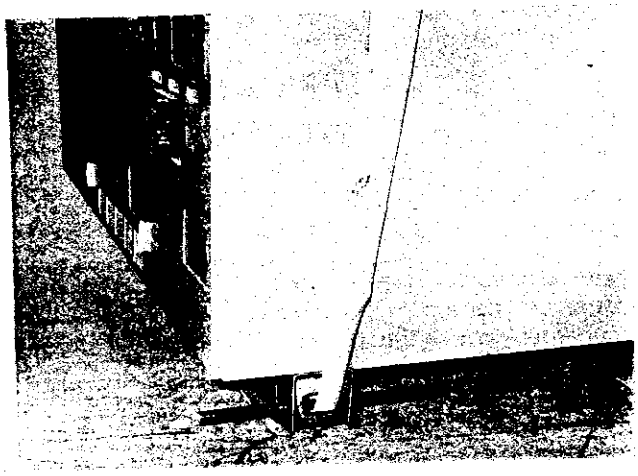


Fig. 2—Use of Steel Rod for Securing Sling

NEMA publication No. PB-2.1, latest issue, describes proper application of these timber pieces.

STORAGE

Leave each switchgear group on its shipping base until final installation. Remove circuit breakers and accessories from the shipping cartons or crates. Observe the following precautions and procedures:

Check for missing or damaged material.

Store in a clean, dry, well ventilated area.

Cover items susceptible to rust or corrosion with heavy oil or grease.

Cover the switchgear with heavy wrapping paper or other moisture barrier material to keep dirt and moisture from entering, as these contaminants may foul working parts and deteriorate contacts and insulation.

If the switchgear is to be stored to any length of time, or in any place where dampness may be present, heaters should be used to keep the switchgear dry until it is placed in service. When outdoor switchgears equipped with heaters are stored, the power source for the heaters should be brought to the load terminals of the thermal circuit breaker or cutout device which controls the heater circuits.

Before attempting any installation operation consult all drawings furnished by Gould Inc. for the particular order. These drawings are in the form of floor plans, front views, primary and secondary wiring and a bill of material of the equipment furnished.

PREPARATION OF FLOOR

Floor plan drawings are supplied for each installation.

The design of the floor may include channel iron sills embedded in the concrete. It is important that these sills be straight and level their full length, and

correctly spaced. To insure this condition, it is recommended that ties be bolted between the sills at various intervals after which the lower flange of the sill be shimmed to proper height.

Power and secondary (control) conduits should be installed before the installation of the housings, if the conduits bring the cabling from the floor. Available space is allocated for the conduits on the floor plan accompanying each order. These conduits should not extend more than one inch (1") above the station floor level. Make sure the conduits are plugged before pouring cement.

The concrete floor in front of the housing should be smooth to facilitate the handling of the circuit breakers. The finished floor level should be flush with the top of the channel sills so that the circuit breaker will roll evenly into the housing. The cement should be prepared in accordance with instructions issued by the Portland Cement Association, available at their offices.

INDOOR INSTALLATION

The switchgear should be unloaded as near to the installation site as possible. The most practical method of raising the switchgear is by use of jacks. Raise the unit by inserting lifting jacks adjacent to the shipping base, as illustrated in Figure 3.

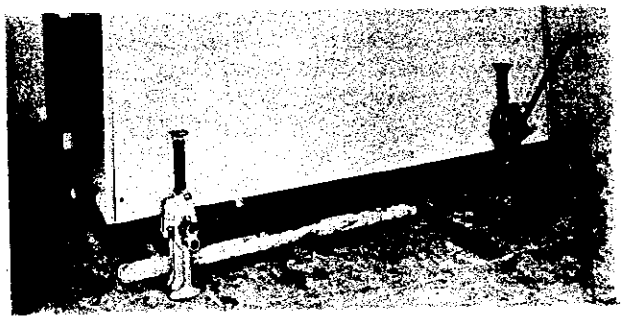


Fig. 3—Method of Raising Switchgear by Jacks

CAUTION

DO NOT APPLY JACKS TO THE HOUSING AT ANY OTHER POINTS AS STRESS DISTORTIONS MAY OCCUR.

After jacking unit evenly, place a roller on the floor so that the roller is across the shipping bases. Lower jacks until shipping bases are resting on the roller. Repeat jacking and roller placement on the opposite side. Raise units evenly to avoid stressing the housing, and place second roller as illustrated in Figure 4. A third roller should be placed along the route of travel so that the channels engage the third roller before the end roller is free. While the crew pushes the switchgear lengthwise towards its final position, one man should take the freed roller from the rear end to the forward end to continue roller engagement until the unit is in the desired position.

If it is necessary to move the unit in a lateral direction to position it directly over the installation site, additional channels will be required. Jack the unit up, remove the roller and reposition the roller so that motion in the desired direction will occur. Place a steel channel across the shipping base and on the roller, as illustrated in Figure 5. Lower the jacks, and jack the opposite side so that similar roller and channel placement can be performed. Move the units until they are directly over the the installation site. (Figure 6)

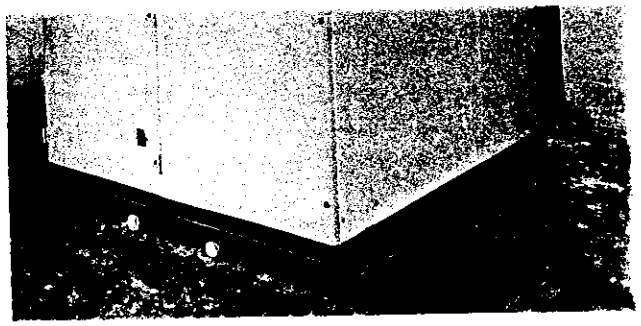


Fig. 4—Rollers in Place under Shipping Bases

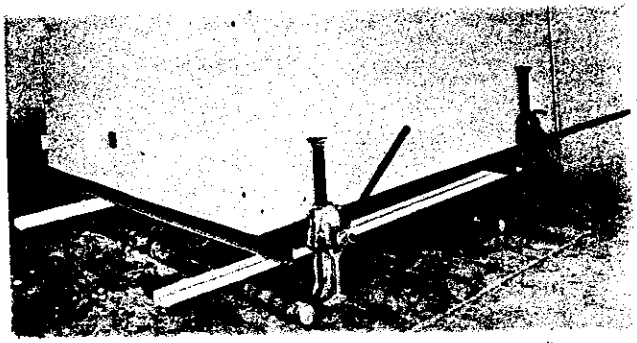


Fig. 5—Rollers and Channels in Place

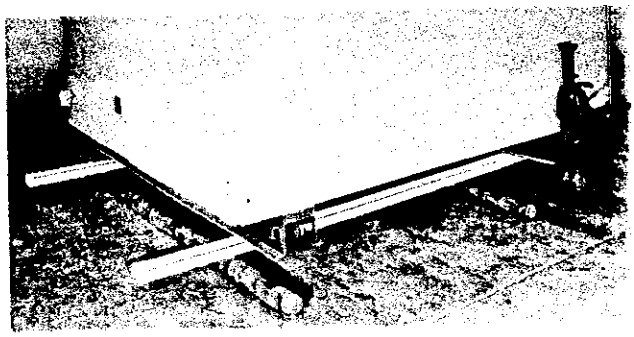


Fig. 6—Jacks Removed

When the units are in their final place, jack them up evenly and remove the channels and rollers. (Figure 7) Carefully lower the units to the floor so that they are resting on the shipping bases.

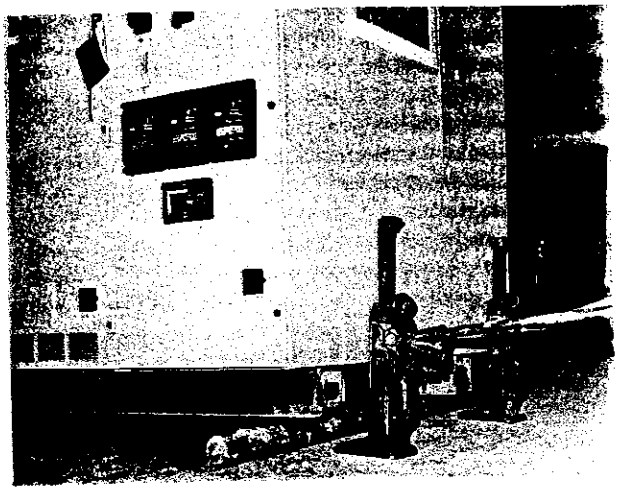


Fig. 7—Removing Channels and Rollers

Removal of Shipping Base — Open the switchgear doors and remove the bolts fastening the shipping bases to the switchgear, as illustrated in Figure 8. Make sure that all doors and panels are closed and secure before proceeding further.

Fig. 8—Removal of Shipping Base Bolts

Jack up the switchgear uniformly on both sides to a height where the bases can be removed. It is necessary that four jacks be used for this operation, and that housing can be uniformly level to prevent any undue stress with resultant housing distortion. Remove the base as illustrated in Figure 9.

Select four pieces of timber of sufficient thickness to permit toe of jack to be removed after lowering. Place a piece of timber at each corner, and then slowly lower one side of housing until it rests on the timber. Figure 10 demonstrates performance of this operation. Repeat this step on the other side, so that the unit now rests completely on the four lumber pieces. Use a crowbar and timber fulcrum, as illustrated in Figure 11, to raise the unit sufficiently to permit removal of a corner lumber piece.

CAUTION

USE THE CROWBAR ONLY AT THE SAME POSITIONS THAT WERE USED FOR JACKING SO SO THAT NO DISTORTION OR DAMAGE TO THE EQUIPMENT MAY RESULT.

Fig. 9—Removal of Shipping Base

Fig. 10—Placing of Lumber for Final Placement

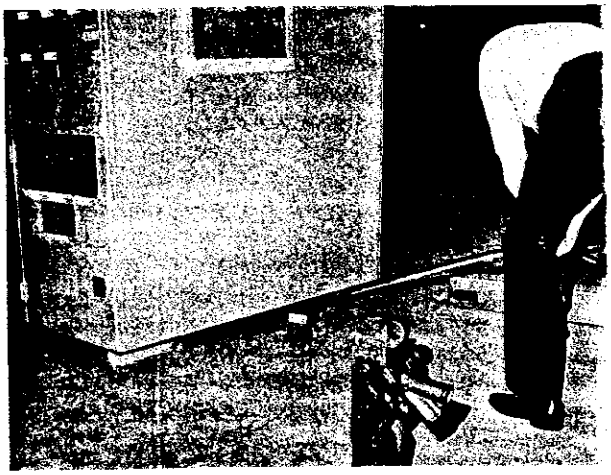


Fig. 11—Equipment with Lumber at all Four Corners

With the unit raised, remove the corner piece and slowly lower the housing until it touches the floor. Repeat this step for all four corners. Figure 12 is an illustration of corner piece removal.

Fig. 12—Removal of Lumber Piece

If the switchgear consists of more than one section, it will be necessary to set each section adjacent to the others. Place one section precisely in place, then move the next section as close as possible using the jack and roller technique. Final movement of the second section is accomplished by use of a crowbar. Greasing the floor prior to lowering the switchgear will facilitate close positioning of the sections.

OUTDOOR INSTALLATION

Outdoor installation is handled in a similar fashion to indoor installation, except that shipping bases are not removed. Outdoor switchgear is constructed with a permanent steel base that serves as a support for the internal housings, and functions as does the shipping bases of indoor switchgear for use of rollers, slings, etc. Floor preparation for outdoor installation is presented in the floor plan drawings for each order.

Before assembling a Walk-In structure, completely read the drawing "Erection Procedure" furnished with the equipment. Follow the instructions contained in the document. For proper assembly of Outdoor Non-Walk-In switchgear, follow the instructions contained in the drawing "Gasket Applications," furnished with the equipment.

ASSEMBLING THE HOUSING

Sections of housing for 5HK equipment consisting of five indoor units or less and four units or less in the case of 7.5 or 15HK housings, are shipped on a single base. Larger switchgear is divided in sections for shipment and each section is mounted on its own base. A removable angle is bolted across the front floor of each breaker housing to provide reinforcement while moving the housings on rollers. After final installation this angle should be discarded.

If the switchgear consists of a number of sections, the center section should be installed first, and the remaining sections added at each end. When the center section is in position, check for any distortion in shipping or handling. This may be done by dropping a plumb bob from the center of the front and rear doors. If the housings are not plumb and level, they must be straightened and aligned before proceeding any further.

As each section is added, it must be checked in the same manner. Any distortion must be corrected before installation, otherwise considerable pressure may be required to bring the sections into alignment, causing stress in adjoining structures.

Holes are provided in the floor for plug welding or bolting the housings to the channel sills. When shipment is made in sections, the main bus, control wiring, and interconnections are dismantled at the point where the switchgear is separated. These should now be reassembled and all bolts and screws tightened to established torque values.(P.6) Bus support bolts should be reinserted through both side sheets. Incoming and outgoing connections should be made for both the main power circuit and all the control circuits.

INSTALLATION OF BUS BAR CONNECTION BETWEEN GROUPS

The main bus in each group is assembled in the factory complete, ending at the tap connections located at either end of the group. Sections of main bus for connection between groups are provided for installation in the field.

All contact surfaces at all bolted joints in the bus are silver plated. These contact surfaces should be cleaned and then bolted together. Conductivity of a bolted or clamped joint depends upon the pressure applied. The contact surfaces may be cleaned by wiping with cloth saturated with an approved solvent. Take care not to remove silver plating. Use of solvents should be limited to removal of grease and contamination from primary conductors and insulation.

WARNING

DO NOT USE CARBON TETRACHLORIDE. USE ONLY OSHA APPROVED SOLVENTS. AVOID PROLONGED EXPOSURE TO SOLVENT VAPORS. USE SOLVENTS IN A WELL-VENTILATED AREA.

A non-flammable solvent with a Threshold Limit Value of 300 ppm or higher is recommended.

Figure 13 illustrates the proper hardware placement to insure good electrical contact. Tighten hardware to the following torque values:

1/2"-torque to 30-45 ft.lb dry threads

5/8"-torque to 50-75 ft.lb dry threads

After bolting the sections of the main bus together at shipping joints, insulate the connection by taping or installation of a molded boot over the joint.

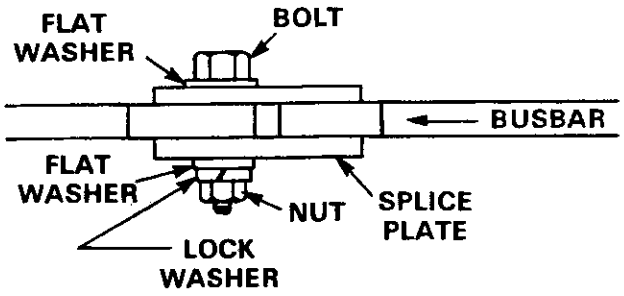


Fig. 13—Bolting of Conductors

Covering Bus Joints

Bus bars are covered with a flame retardant insulation having a sufficient thickness to stand full line voltage for the rating of the switchgear. Straight joints as well as connections to usual switchgear components are covered by a molded boot. After the bus has been reassembled at the junction point of shipment groups, the boot, which is flexible, should be spread apart, slipped over the joint and the flanges fastened together in the same manner as those previously applied in the factory. With this cover no wrapping or filling compound is required, since it fits tightly over the bus insulation.

CAUTION

ALL BOOTS COVERING JOINTS OR CONNECTIONS MUST BE REINSTALLED IMMEDIATELY AFTER ANY REMOVAL AND BEFORE SYSTEM IS REENERGIZED IN ORDER TO PRESERVE THE INSULATION INTEGRITY OF THE SYSTEM.

Where adherence of the mating flanges of the PVC bus joint covers (boots) is accomplished by Velcro (hook and loop type) fasteners, the adherence must be assured by applying "two finger" pressure along the entire joint of the mating flanges after installation.

Tape and sealer are used where bus work runs into apparatus mounted in the switchgear, such as flexible connectors, or equipment with irregularly shaped conditions. Sufficient quantities of tape and sealer are provided for covering connections to be made in the field. The procedure for applying is as follows (see Figure 14):

1. Torque hardware as given above
2. Clean the area to be covered by removing grease, oil or dust, using only OSHA approved solvents.
3. Prepare the bare joint for taping by first providing a smooth, tapered surface for the tape. Use the sealer, carefully eliminating voids and covering bare parts. In no case extend the sealer more than 3/8" onto the bus insulation.
4. Wrap the joint using the tape furnished for the purpose. On 7.5HK or 15HK switchgear wrap 13 half-lapped layers; on 5HK equipment wrap 5 half-lapper layers. Wherever possible have the tape overlap the bus insulation by at least 1-1/2". Half-lapped layers of tape should be pulled tight. Leave no voids between sealer and tape, or between layers of tape.
5. Taping should not cover more than 10% of porcelain bushings or insulators, nor should be carried beyond the first depression or petticoat.

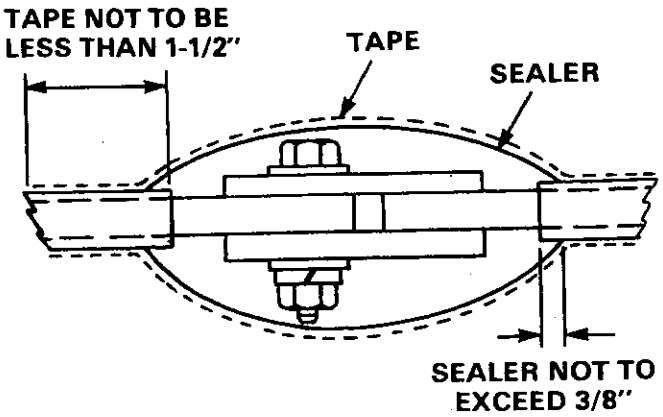


Fig. 14—Sealer and Taping of Conductor Joint

Connection of Primary Cables

In general, there are four common methods of making primary cable entrance connections.

1. Synthetic Covered Cable with Clamps — For this type of cable, prepare for entrance to connection lugs, and securely tighten lug clamps. The cable should be prepared as specified by the cable manufacturer.

2. Lead Covered Cable with Wiping Sleeve — When cable diameters are specified on order, the wiping sleeves are furnished cut off to fit the cables. Uncut wiping sleeves are fitted to the cables as follows:

Wrap a cord (or tape) around the cable to obtain the circumference. Then wrap the cord around the wiping sleeve cone and mark the cone slightly above the cord. Saw off cone. Ream sharp edges of cone with a round file.

Wiping sleeves are furnished untinned unless tinning is specified. Sleeves should be freshly tinned by applying flux and dipping in hot solder.

When installing the wiping sleeve, the lead sheath should extend into the sleeve fitting for one inch minimum. The end of the sheath should be belted over and if required by the type cable, a stress relief cone applied.

To wipe the joint, scrape the lead sheath clean approximately three inches beyond the end of the cone. Apply stearine flux to the cleaned sheath and to the cone. Then make the wiped joint in the usual manner. Fill wiping sleeve with the compound supplied.

3. Lead Covered Cable with Pothead — The same method of fitting as for wiping sleeves can be used to fit the pothead wiping sleeve to the cables in the case of the pothead with wiping sleeve, the lead sheath should extend into the pothead for one inch minimum, belt over the end of the sheath, and add a stress relief cone is required. Clean the sheath about three inches beyond the end of the cone and apply stearine flux to end of the cone and the sheath. Wipe the joint in the usual manner.

On inverted potheads, the lead sheath should be extended down into the pothead body beyond the wiping sleeve flange joint so that the sheath will terminate below the level of the compound. To vent the top end of the inverted pothead sleeve while compounding, wipe the joint with a greased wire inserted between the sleeve and the sheath. Pull out the wire to provide a small hole to vent the air. After the pothead has been filled with compound, seal the hole with solder.

4. Shielded Cable — When shielded cable is connected to any terminator, proper stress relief cones must be applied.

GROUND SENSORS

Integral Bus-Mounted Ground Sensor

The standard design for ground sensors is integrally mounted, encircling the three phases of bus. All wire connections are made to the ground fault relay, or in the case where the customer requires external relaying to a termination point. Thus, routing of customer cables through the sensor is eliminated, and maintenance is not necessary.

Cables Passing Through Ground Sensors or Zero Phase Sequence Current TXs

Figure 15 illustrates passing of cables through a sensor or zero phase sequence current transformer, either non-metallic or metallic sheathed cables.

When shielded or metallic sheathed cables pass through ground sensors or zero phase sequence current transformers, the shield/sheath grounding wires must be properly installed to cancel the effect of stray ground currents on the sensor/CT.

The cable shields should pass through the sensor/CT and terminate at stress relief devices in accordance with the cable manufacturer's recommendations. The shield grounding wire is usually

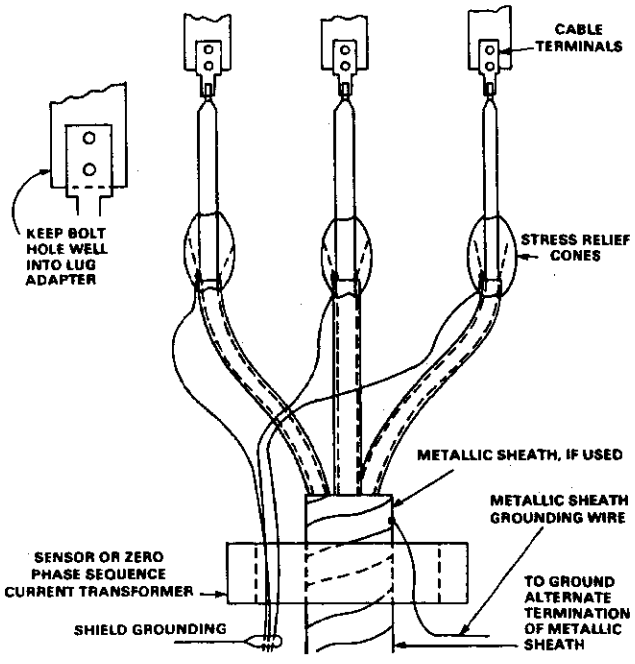


Fig. 15—Typical 3-Conductor Installation

attached to the shield within the stress "cone" and brought out at that point. These grounding wires must be trained back through the sensor/CT before being connected to ground. Should the shield grounding wires be connected

to the shield beyond the sensor/CT with respect to cable terminal, they should be run directly to ground.

Metallic Sheathed Cable

Metallic cable sheaths, when used, may be brought through the sensor/CT. In this case, if the grounding wire is attached to the sheath between the sensor/CT and the cable terminal, the grounding lead must be trained back through the sensor/CT. When the sheath grounding wire is attached to the sheath beyond the sensor/CT with respect to the cable terminal or when the sheath is not brought through the sensor/CT, the grounding wire should be run directly to ground. The illustration shows the installation of a typical three conductor shielded cable with metallic armor sheath. Other cable types are installed in a similar manner.

ROOF BUSHINGS

Roof bushings, for cable entrance, are shipped detached from the housing, and must be mounted in place when the switchgear is installed. Each bushing is furnished with a gasket that must be properly inserted between the roof and the bushing flange, using the adhesive as a binder between each of the parts. Cement the gasket to the roof using one layer of adhesive, then spread cement on the remaining flat surface of the gasket. Now put the bushing in place and bolt to the structure. Apply a bead of sealer around the bushing flange at the roof line and around the bushing mounting hardware.

CONNECTION TO GROUND BUS

Ground bus bars are bolted to the frames of the housings at the factory before shipment. When housings are shipped separately, it is necessary to bolt the ground bus to the framing. Ground bus bars should be solidly and permanently connected to the station ground by means of a cable or bus of cross section not less than that of the housing ground bus. Cable or bus should not be in conduit, and should take the most direct path.

CONNECTION TO CONTROL SOURCE

The control source wiring to the switchgear should be of larger cross section than the balance of the control wiring in order to reduce the voltage drop, particularly when this source is some distance from the switchgear. Provision is made in the switchgear, in the form of heavy duty terminal blocks, for the connection of these control source leads. The leads should first be checked for proper electrical sequence and polarity if applicable, before the connection is made.

Secondary and Control Connections

All secondary and control connections on metal-clad switchgear are factory wired in connection diagrams applying to the installation. The secondary and control connections for all outgoing connections are wired to terminal blocks accessible to the system wiring. Control connections between housings are provided through openings in the side sheets of the switchgear. When shipment is made in groups of several units each, the cross connections between groups are installed at the factory, one end of each of the group connectors is then disconnected and tagged. Care should be taken to ensure that all these connectors between groups are securely and correctly remade when the groups are placed together.

TESTING AND INSPECTION

With the housing erected, assembled, and connected, observe the following precautions:

1. Remove all extraneous matter and see that all internal parts are free of dirt, grease, and moisture. If moisture has penetrated, dry out with air or heat.
2. Remove all blocks in relays used for protection in shipment.
3. Apply potential tests to check for any damaged insulation.

60 HERTZ, RMS, WITHSTAND VOLTAGES (1 MINUTE)

Related	Factory Test	Field Test	DC* Field Test
60 volts	500 volts	375 volts	
61 to 220 volts	1,500 volts	1,100 volts	
221 to 600 volts	2,200 volts	1,650 volts	
4,800 volts	19,000 volts	14,250 volts	20,000
7,200 volts	36,000 volts	27,000 volts	37,500
13,800 volts	36,000 volts	27,000 volts	37,500

**Per ANSI 37.20, the following precautionary notes apply for DC testing:*

CAUTION

IF PHASE TO PHASE TESTS ARE MADE IN ADDITION TO PHASE TO GROUND TEST, CARE MUST BE TAKEN THAT NO SHUNT CONNECTED COILS SUCH AS POTENTIAL TRANSFORMERS ARE CONNECTED DURING THE TESTS. ALSO, DO NOT TEST SOLID STATE RELAYS WITH HIGH VOLTAGE, INSTEAD, DISCONNECT SOLID STATE RELAYS PRIOR TO APPLYING ANY VOLTAGE TESTS.

1. Field tests are recommended when new units are added to an existing installation or after major field modifications. The equipment should be put in good condition prior to the field test. It is not expected that equipment shall be subjected to these tests after it has been stored for long periods of time or has accumulated a large amount of dust, dirt, moisture, or other contaminants without first being restored to good condition.

2. The table headed "Withstand Voltages"(P.8) is given as a reference only for those using dc tests and represents values believed to be appropriate and approximately equivalent to the corresponding power frequency withstand test values specified for each voltage class of switchgear. The presence of this column in no way implies any requirement for a dc withstand test on ac equipment. When making dc tests, the voltage should be raised to the test value in discrete steps and held for a period of one minute.

3. Check continuity of all circuits. A great deal of this work can be done after the circuit breakers are installed by energizing the control source and operating the equipment with the primary circuit de-energized. Indicating instruments check the continuity of current transformer and potential transformer circuits after the primary circuit is energized.

4. Set all relays, regulators, and other devices for proper operation of loads. No relays are set at the factory. Remove screws from short circuiting strip on terminal blocks in current transformer circuits. Screws should be stored in tapped holes in corners of the blocks. See SAFETY PRECAUTIONS.

IMPORTANT: PROPER PHASING OF ALL MAIN CIRCUITS SHOULD BE CHECKED ACCORDING TO DIAGRAM.

Final Inspection

WARNING

THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. POWER, BOTH PRIMARY AND CONTROL VOLTAGES, MUST BE TURNED OFF BEFORE WORKING INSIDE THE EQUIPMENT.

After the switchgear together with the apparatus which it is to control has been installed and all interconnections made, it should be given a final check and test before being put into service. This is necessary to insure that the equipment has been correctly installed and that all connections are completed. Extreme care must be exercised to prevent the equipment to be controlled from being connected to the system while the preliminary tests are being conducted. If disconnecting switches are not part of the apparatus or switchgear, the line leads should be disconnected to accomplish this. The testing equipment required will depend entirely on the type of installation. Portable voltmeters both a-c and d-c with a wide range of scales will usually be required. If the equipment to be put into service is quite extensive and complicated, both a-c and d-c ammeters should be available in case unexpected trouble develops.

Some simple portable device for ringing or lighting out circuits should be included in the testing equipment.

STANDARD CONSTRUCTION

Shutters

Shutter arrangement (Figure 16) is the means of covering the primary terminals in the switchgear compartment when the circuit breaker is moved

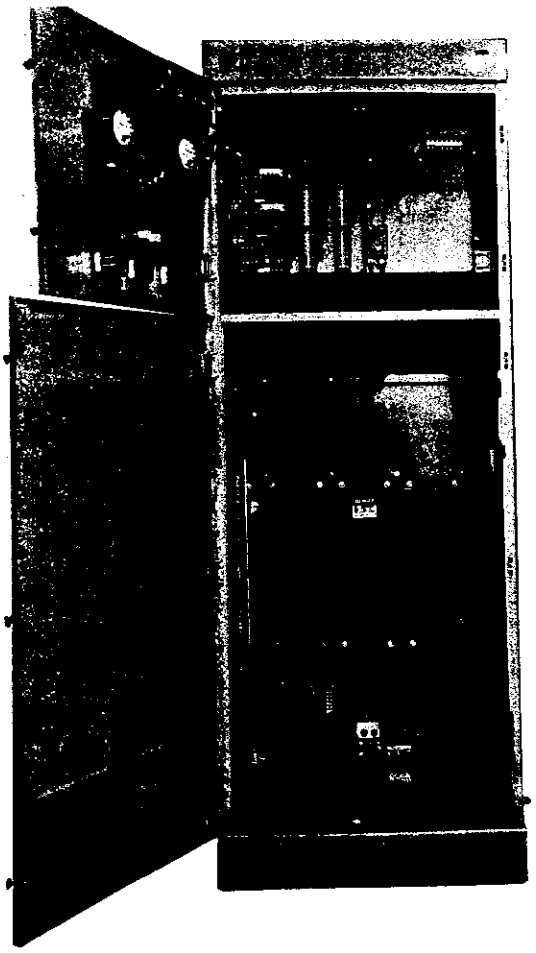


Fig. 16—Shutter and Control Wire Configuration

from the "CONNECTED" position. When the breaker is moved from the "TEST" position toward "CONNECTED," the breaker engages the arm connected to the shutter assembly and actuates it, opening the shutters as the breaker continues to the "CONNECTED" position. For the 15HK1000, the shutter arm actuates when the breaker leaves the "DISCONNECT" position.

CAUTION

DO NOT ACTUATE THE SHUTTER UNTIL YOU ARE ABSOLUTELY CERTAIN ALL EQUIPMENT HAS BEEN COMPLETELY DE-ENERGIZED. SEVERE ELECTRICAL BURNS AND SHOCK CAN BE CAUSED BY CONTACT WITH ENERGIZED CONDUCTORS.

Primary Disconnect Device

Each primary terminal of a drawout circuit breaker is equipped with a disconnect device consisting of a circle of fingers compressed by a garter spring (see Figure 17). The mounting of these fingers on the circuit breaker permits inspection of them when the circuit breaker is withdrawn. This is a high pressure, self-aligning device, whose parts are silver plated to reduce the resistance to a minimum. The springs are outside the current path. The tubular stationary element is rigidly mounted in an insulating molding located in the primary housing of 5HK switchgear and in a porcelain insulator in that of the 7.5 and 15HK switchgear.

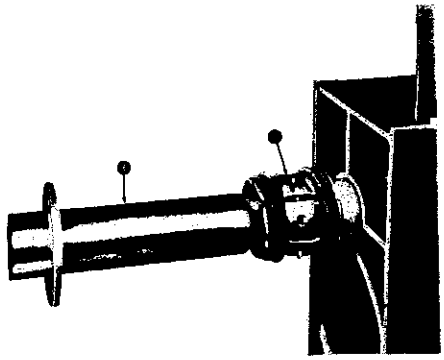


Fig. 17—Primary Disconnect

Secondary Disconnecting Devices

All circuit breakers are provided with separable disconnecting devices of the self-aligning pressure-type as shown in Figure 18. These devices are amply proportioned for carrying the required amount of current. The flexible member of the device is mounted on the breaker frame to facilitate inspection and maintenance. These devices make contact in the fully connected and test position, and no test jumper is needed.

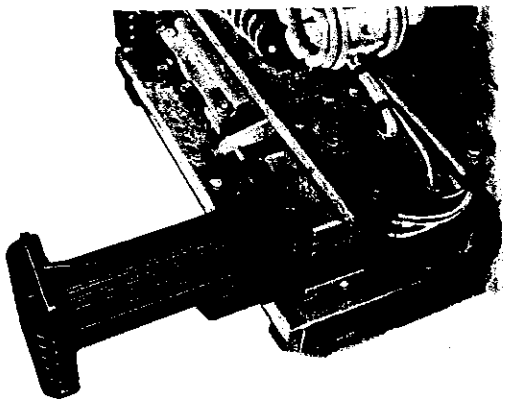


Fig. 18—Secondary Disconnect

Ground Bus and Contacts

The extension of the ground bus projecting toward the front of the housing, between the floor guides, is shown in Figure 16. The ground bus contacts are located on the bottom of the rear structure of the circuit breaker and engage the ground bus extension when the breaker is in the connected, test, and any intermediate position. The circuit breaker grounding devices are coordinated with the momentary short circuit current rating.

Control Wires

The main control leads are mounted in the rear of the metering compartment. All electrically operated equipment is connected to these control wires through a suitable control circuit protective device. See Figure 16.

CIRCUIT BREAKERS

General

Circuit breakers are shipped separately.

On each switchgear all circuit breakers of like rating are interchangeable unless the secondary (control) circuit requires otherwise. In these cases interlocking will be used to prevent interchangeability.

Circuit breakers and housing are each set in an alignment fixture at the factory.

Circuit breakers have three positions in the housing. In the "DISCONNECT" position the main disconnecting devices on the breaker are disengaged and separated a safe distance from the stationary part of the devices located on the housings. A shutter covers the openings to the stationary part. In this position, all control contacts are disengaged. In the "TEST" position, also, the main disconnecting devices are disengaged, but certain of the control contacts are connected so that the circuit breaker may be operated.

In the third or "CONNECTED" position, the main disconnecting devices are engaged, the shutters are open and all control contacts, except those

connected to the test push buttons on the breaker, are connected.

Interlocks prevent moving a circuit breaker from one position to another unless the breaker is open, and prevent closing the breaker between positions.

For handling of circuit breakers, for the procedure of inserting them into the switchgear compartment and removing them, refer to the separate bulletin covering the breakers.

Circuit breakers should be installed in their permanent location as soon as possible. If the breakers are not to be placed in service for some time, it is required that adequate means of protection be provided. This may be done by keeping the breaker in its original shipping carton and storing in a warm (approximately 15°C) dry (50% maximum humidity) and uncontaminated atmosphere. If the circuit breaker cannot be stored properly due to abnormal circumstances, it must be checked before going into service to insure that it is without damage and it has not become generally contaminated in any way.

HOW TO PUT THE SWITCHGEAR IN SERVICE

General

Before energizing the switchgear observe that:

1. The switchgear is completely assembled with all barriers in place, all joints covered with boots or taped and all extraneous material and tools have been removed.
2. Potential tests have been made to determine that all insulation is in good condition.
3. All outgoing cables are either permanently connected or thoroughly insulated so as not to cause a fault, especially at end remote from switchgear.
4. All current circuits are complete beyond the current transformer short circuiting terminal blocks and that protective relays are set properly and are operable. Refer to safety precautions for removal of short circuiting devices.
5. All circuits are properly phased.
6. There is a backup circuit breaker which is in operating condition and set so as to clear any fault that inadvertently may occur.

Safety Precautions

WARNING

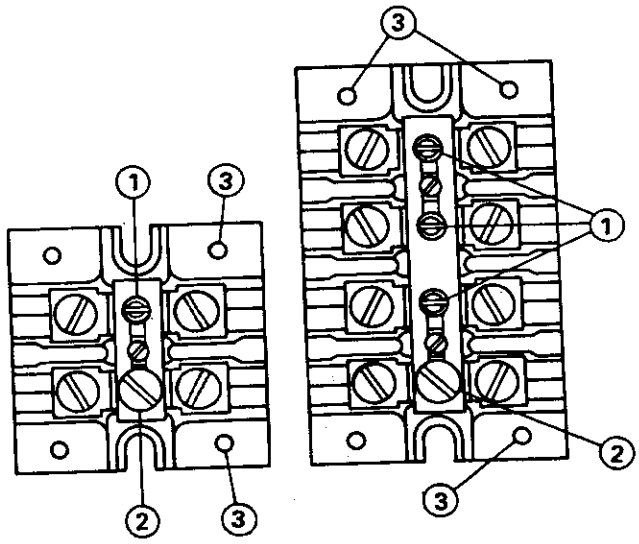
THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. POWER, BOTH PRIMARY AND CONTROL VOLTAGES, MUST BE TURNED OFF BEFORE WORKING INSIDE THE EQUIPMENT.

WHEN A THOROUGH INSPECTION OR WORK IS REQUIRED ON A BREAKER, IT MUST BE REMOVED FROM THE HOUSING. THE BUS SHOULD BE DE-ENERGIZED AND GROUNDED WHEN WORK IS TO BE DONE ON SWITCHGEAR.

The secondary circuits of energized current transformers SHOULD NEVER BE OPEN CIRCUITED. Current transformer secondaries are short circuited when shipped from the factory.

To open the short circuiting device:

1. Check current transformer secondary circuits to assure that they are complete.
2. Remove the special short circuiting screws from the short circuiting strip. Do not remove the grounding screw.
3. Store the screws in the holes provided at the corners of the moulding. See Figure 19.



1. Special short circuiting screws in short circuiting position.
2. Grounding screw - DO NOT REMOVE.
3. Holes for storing short circuiting screws.

Fig. 19—Short Circuiting Device

See Connection Diagram for location.

(Symbol ⫩)

Procedure

Circuit breaker identification tags and indicating lamps should be carefully observed before operating the control switch.

All circuit breakers should be in the disconnect position initially. Then first energize the control circuit with the main power circuit de-energized. Rack one circuit breaker into the test position. The charging of the closing springs will indicate that the control power is connected. Then rack the remaining circuit breakers into test position, one at a time.

With the circuit breaker in the test and connected position, open and close the breaker by push buttons when provided on the breaker, or from the control switch, or any remote operating point that may be provided. The breaker may be tripped by manually manipulating electro-mechanical relays and protective devices. The I-T-E solid state power shield has an auxiliary test device available for complete testing. See IB-9.1.7-22. Interlocks and special controls may be checked for proper operation.

The main power may now be applied to the switchgear after all circuit breakers have been placed in the test position. Close all doors to the switchgear as a safety measure with all panel thumb screws completely engaged. Those breakers necessary to energize the main bus should be moved to the connected position and closed. Observe undervoltage relays or other devices that should function properly when the main bus is energized. Next move each circuit breaker in turn to the connected position and close. Observe that all relays and instruments are functioning properly. Improper readings of wattmeters, power factor meters, and watthour meters usually indicate improper phasing of meter wiring.

When a switchgear installation is fed from one or more generators, it is usual to bring each generator up to speed and connect it to the bus so as to make adjustments on it for speed and voltage. The generators are then synchronized and adjusted for load division.

When a switchgear installation controls synchronous or induction motors, there may be special adjustments of relays and control devices that must be made for the proper operation of the motors.

MAINTENANCE

General

WARNING

THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. POWER, BOTH PRIMARY AND CONTROL VOLTAGES, MUST BE TURNED OFF BEFORE WORKING INSIDE THE EQUIPMENT.

CAUTION

WHEN FIELD ASSEMBLY IS REQUIRED SUCH AS AT SHIPPING SPLITS, OR PERIODIC MAINTENANCE REQUIRES DISASSEMBLY, OR PARTS ARE BEING REPLACED FOR SOME REASON; IT IS IMPERATIVE THAT THE HARDWARE CALLED FOR AND FURNISHED BY THE MANUFACTURER BE INSTALLED EXACTLY AS THE DRAWINGS SHOW. IF NO DRAWING IS AVAILABLE, AND THERE IS NO SIMILAR ASSEMBLY NEAR TO USE AS AN EXAMPLE, THE MANUFACTURER SHOULD BE CONSULTED. THERE CAN BE SITUATIONS WHERE HARDWARE CLEARANCES, HARDWARE TORQUE VALUES, AND EVEN THE MATERIALS FROM WHICH THE HARDWARE IS MADE ARE CRITICAL TO THE SAFE OPERATION OF THE SWITCHGEAR.

All switchgear installations should be given a general inspection at frequent intervals. Perform a visual inspection, front and rear, to see that there is no evidence of loose parts, warping or undue vibration. Take steps to remedy any deficiencies of this nature that may appear. Keep the assembly dry at all times. If leaks from overhead pipes and dripping from condensation or other sources cannot be eliminated, prevent the moisture from falling on the gear.

Annual Inspection

At least yearly, a thorough inspection of the gear must be performed. Prior to this inspection, deenergize all circuits. The following checks in particular are emphasized.

1. Inspect all bolted connections, nuts and screws for tightness.
2. Inspect all cables for tight connections and ample support.
3. Inspect control wiring for signs of wear and damage. Replace wires wherever doubtful.
4. Examine resistors and other devices prone to overheating.
5. Open all hinged panels and remove all bolted panels.
6. Clean all insulation thoroughly.
7. Withdraw all drawout components and clean. (Refer to Circuit Breaker Instruction Bulletin before cleaning circuit breakers.)
8. Clean the stationary portion of the switchgear by wiping with a clean cloth. A compressed air hose will be useful in the relatively inaccessible areas.
9. Replace or clean dirty filters. Periodically remove air filters from the doors and/or roof eaves and examine for dust content. The time intervals for this examination is dependent on the environment of the installation. If required, clean filters by flushing with a stream of water. After draining, recoat with R.P. Super Coat Adhesive, or equivalent, and replace.
10. Remove covers of all panel devices where practicable. Check wiring for secure connections. Clean contacts on relays and switches wherever necessary. Replace covers.
11. If Forced Air Cooling is utilized, roof exhauster fan belts must be examined for proper tension and adjusted if necessary.
12. Replace all panels and components. All panel screws must be secured in place.

Care of Finish

The exterior finish used on Gould Switchgear is of the highest grade baked synthetic enamel. The interior frame work is also phosphatized and finished with oven baked enamel. The switchgear should be kept clean at all times. Wiping with a clean dry cloth will usually suffice. To remove oil and grease marks, use warm water and soap, wiping dry with a soft cloth.

To touch up the exterior or interior finish after final erection, use PPG DZL-3200 light gray primer surfacer and PPG air dry acrylic enamel of the corresponding color. The color finish furnished on the exterior varies, and this information is stated on the front sheet of the Switchgear Bill of Material.

Renewal Parts

The quantity of renewal parts to be stocked varies with the installation. Previous experience and the number of units in service are the best guides available. To order replacement parts, contact the nearest Sales Office of Gould, Inc. Give a complete description of the parts and the nameplate data of the device requiring these parts. Specify the quantity required.

Gould, Inc., Switchgear Division
501 Office Center Drive
Fort Washington, PA 19034

Issue E, 7-78, Supersedes Issue D dated 11-7

GOULD