INTRODUCTION

NERAL

These instructions cover the installation, operation and maintenance of Siemens-Allis vertical lift metal-clag switchgear. The equipment described in this manual consists of the indoor and *Shelter-Clad* outdoor designs in the 34.5 kV class. Fig. 1 shows a typical cubicle. All diagrams, descriptions and instructions apply to all the above classes and designs unless noted otherwise. Standard construction details of the switchgear, auxiliary equipment and accessories are given in the appropriate sections. Special mechanical and electrical devices, furnished in accordance with purchase order requirements, are covered by supplementary instructions submitted with this instruction book. Ratings described in this manual are in accordance with NEMA, IEEE and ANSI standard requirements.

WARRANTY

For specific warranty coverage, see the sales contract.

The equipment furnished has been designed to operate in a system having the circuit capacity specified by the customer. If for any reason the equipment is later used in a different system, or if the short-circuit capacity of the system is increased, the momentary rating of the switchgear, the interrupting capacity of the circuit breakers and the bus capacity must be checked. Failure on the part of the user to receive approval of the intended changes from Siemens-Allis may be cause for voiding the warranty.

GENERAL DESCRIPTION

The switchgear described in this manual is the metal-clad type. All parts are completely enclosed within grounded metal barriers. Secondary control devices and primary circuits are isolated from each other by shutters or barriers. Primary circuits of different potential are also separated by barriers. All primary bus work and joints are completely encased with insulation material to suit the voltage class of the equipment.

Siemens-Allis switchgear carries a latter designation as shown in Table 1. These designations may appear on drawings and familiarity with them will simplify communications with the factory.

Table 1. Switchgear Designation

Design	34.5 kV Designation
Indoor	IV
Shelter-Clad	SIV

Indoor equipment is arranged with the circuit breaker drawout compartment behind the right-hand panel. This hinged panel is opened to provide access to the circuit breaker. The left-hand hinged panel contains instruments, meters, relays, etc. and provides access to the secondary control wiring compartment. Either panel may be opened independently without disturbing the other panel.

Shelter-Clad outdoor equipment consists of indoor equipment enclosed in a weatherproof housing complete with an uminated, walk-in aisle. Circuit breakers can be rolled out into the aisle and control devices checked without exposure to the elements.

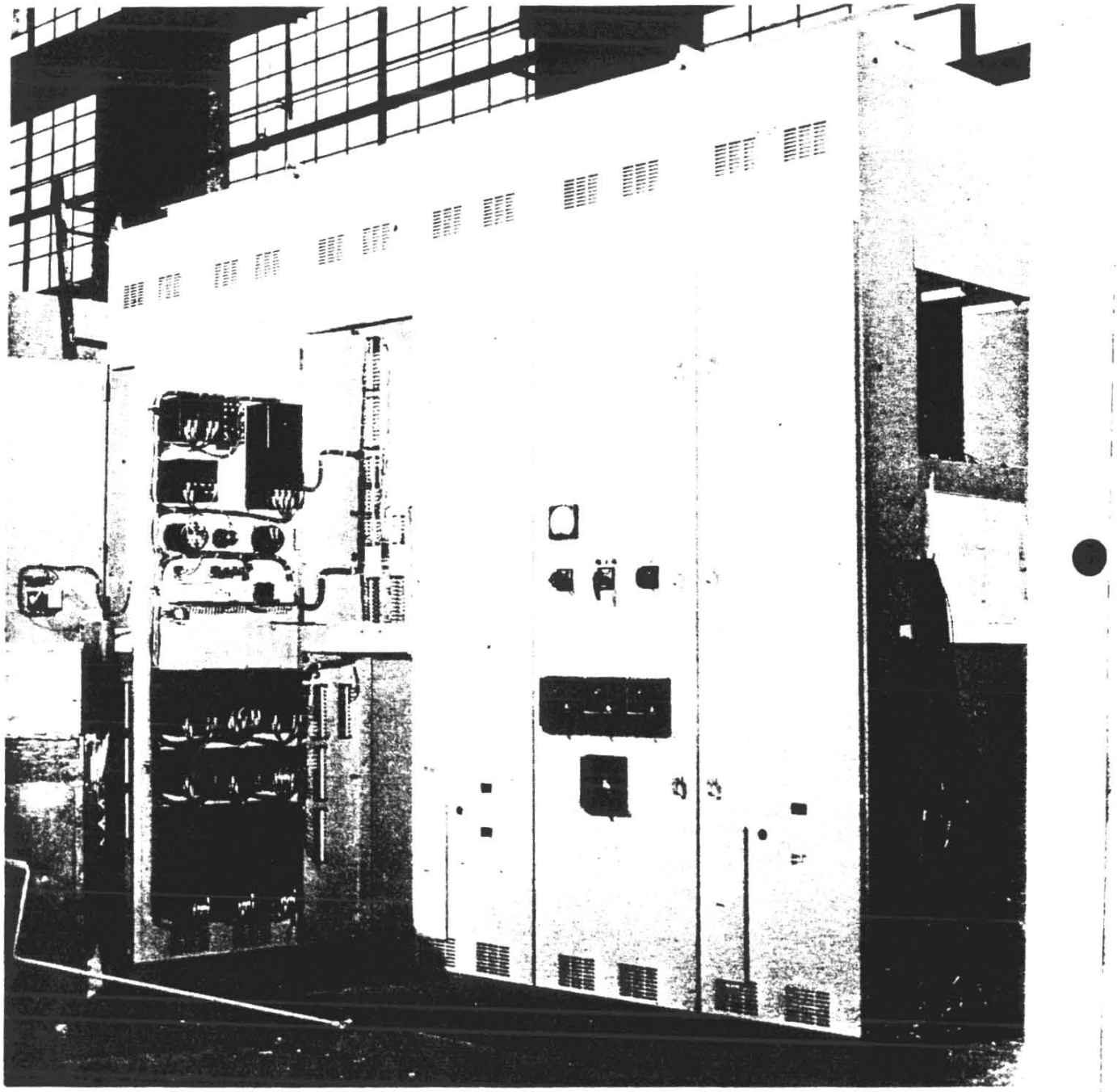


Figure 1. Typical 34.5 kV Indoor Cubicles

The cubicles described in this instruction book are for use with Siemens-Allis vacuum circuit breakers with available ratings as shown in Table 2. Installation, operation and maintenance of the vacuum breakers are covered in Instruction Book No. 18X 5763.

Table 2. VV-1500 Vacuum Circuit Breaker Ratings

RATED VALUES									RELATED REQUIRED CAPABILITIES			
Voltage			Insulation Level		Current					Current Values		
Nominal Voltage Class kV, rms	Rated Max. Voltage kV, rms	Rated Voltage Range Factor k	Rated Withstand Test Voltage		Rated Continuous Current at 60 Cycles amp rms	Rated Short Circuit Current (At Rated Max. kV) kA, rms	Rated Interrupting Time Cycles	Rated Permissible Tripping Delay Y Sec.	Rated Max. Voltage Divided by k kV, rms	Max. Sym. Interrupting Capability	3 Sec. Short Time Current Carrying Capability	Closing and Latching Capability 1.6K Times Rated Short Circuit Current kA, rms
			Low Frequency kV, rms	Impulse kV, rms						k times rated short circuit current values		
										kA, rms	kA, rms	
34.5	38.0	1.65	80	150	1200 2000 3000*	21	3	2	23.0	35	35	55

*3000 amp rating achieved by use of forced air fan cooling.

DRAWINGS AND WIRING DIAGRAMS

All drawings and wiring diagrams required during installation are furnished in advance to the customer. These include any and all changes originated by purchaser during manufacture. Any corrective changes by the supplier which are necessary to assure proper installation and operation of equipment are shown.

SHIPPING DAMAGE CLAIMS

F.O.B. DESTINATION/JOBSITE

IMPORTANT

The way visible shipping damage is treated by consignee prior to signing the delivery receipt can determine the outcome of the damage claim to be filed.

Notification to carrier within the 15 day limit on concealed damage is essential if loss resulting from unsettled claims is to be eliminated or minimized.

1. When shipment arrives note whether equipment is properly tarped and/or protected from the elements. Note trailer number equipment arrived on. Note blocking of equipment. During unloading make sure count agrees with delivery receipt.
2. Make immediate inspection upon arrival for visible damage. This should be done prior to unloading when possible. When total inspection cannot be made on vehicle prior to unloading, close inspection during unloading must be maintained and visible damage noted. Take pictures if possible.
3. Any visible damage must be noted on the delivery receipt and acknowledged with the driver's signature. The damage should be detailed as much as possible. It is essential that a notation "Possible Internal damage, subject to inspection" be included on delivery receipt. If driver will not sign the delivery receipt with damage noted, the shipment should not be signed for by the consignee or his agent.
4. Notify the Siemens-Allis Sales office immediately for any damage.
5. Arrange for a carrier inspection of damage immediately. IMPORTANT: Do not move equipment from point it was set when unloading. Equipment must be inspected by carrier prior to any handling after receipt. This eliminates loss due to claims by carrier that equipment was damaged or further damaged on site after unloading.
6. Be sure equipment is properly protected from any further damage by covering it properly after unloading.
7. If practical make further inspection for possible concealed damage while carrier inspector is on site. If inspection for concealed damage is not practical at the time the carrier inspector is present it must be done within 15 days of receipt of equipment in any event. If concealed damage is found, the carrier must again be notified and inspection made prior to taking any corrective action to repair. Also notify Siemens-Allis Sales office immediately.
8. Obtain the original of the carrier inspection report and forward it along with a copy of the noted delivery receipt to the Siemens-Allis Sales office. Approval must be obtained by Siemens-Allis from the carrier before any repair work can be performed. Before approval can be obtained the documents requested must be in our hands. The carrier inspection report and/or driver's signature on the delivery receipt does not constitute approval to repair.

IMPORTANT

Any adverse judgement as to whether the equipment was properly loaded or properly prepared by shipper for over-the-road travel cannot be made at the destination. We do not release shipments without a clear bill of lading. We use approved methods of preparation, loading, blocking and tarping of the equipment before it leaves our plant. Damage to the equipment had to occur while enroute due to conditions beyond our control. If the procedure outlined above is not followed by the consignee, customer or his agent, Siemens-Allis cannot be held liable for repairs. We will not be held liable for repairs in any case where the work was not authorized by us prior to being done.

SHIPPING DAMAGE CLAIMS

F.O.B. SHIPPING POINT/FACTORY

IMPORTANT

The way visible shipping damage is treated by consignee prior to signing the delivery receipt can determine the outcome of the damage claim to be filed.

Notification to carrier within the 15 day limit on concealed damage is essential if loss resulting from unsettled claims is to be eliminated or minimized.

1. When shipment arrives note whether equipment is properly tarped and/or protected from the elements. Note trailer number equipment arrived on. Note blocking of equipment. During unloading make sure count agrees with delivery receipt.
2. Make immediate inspection upon arrival for visible damage. This should be done prior to unloading when possible. When total inspection cannot be made on vehicle prior to unloading, close inspection during unloading must be maintained and visible damage noted. Take pictures if possible.
3. Any visible damage must be noted on the delivery receipt and acknowledged with the driver's signature. The damage should be detailed as much as possible. It is essential that a notation "Possible Internal damage, subject to inspection" be included on delivery receipt. If driver will not sign the delivery receipt with damage noted, the shipment should not be signed for by the consignee or his agent.
4. Arrange for a carrier inspection of damage immediately. IMPORTANT: Do not move equipment from point it was set when unloading. Equipment must be inspected by carrier prior to any handling after receipt. This eliminates loss due to claims by carrier that equipment was damaged or further damaged on site after unloading.
5. Be sure equipment is properly protected from any further damage by covering it properly after unloading.
6. If practical make further inspection for possible concealed damage while carrier inspector is on site. If inspection for concealed damage is not practical at the time the carrier inspector is present it must be done within 15 days of receipt of equipment in any event. If concealed damage is found, the carrier must again be notified and inspection made prior to taking any corrective action to repair.
7. If damage is such that it requires the service of Siemens-Allis serviceman to check the equipment, contact the Siemens-Allis Sales Office.

   Siemens-Allis will require a purchase order to cover cost of service and any parts which may subsequently be ordered for repairs.
8. Notify the carrier in writing of your intent to file a claim.
9. File claim when all costs accumulated.

IMPORTANT

Any adverse judgement as to whether the equipment was properly loaded or properly prepared by shipper for over-the-road travel cannot be made at the destination. We do not release shipments without a clear bill of lading. We use approved methods of preparation, loading, blocking and tarping of the equipment before it leaves our plant. Damage to the equipment ad to occur while enroute due to conditions beyond our control. If the procedure outlined above is not followed by the consignee, customer or his agent, Siemens-Allis cannot be held liable for repairs. We will not be held liable for repairs in any case where the work was not authorized by us prior to being done.

RECEIVING

Each group of switchgear is securely blocked and braced for shipment. It is crated, boxed, or covered as required by shipping conditions. Whatever method of shipment, every precaution is taken to insure its safe arrival. If special handling is required, it is so indicated. All moving parts are secured; however, relatively delicate instruments are included and must be handled carefully when unloading.

IDENTIFICATION

When shipment consists of more than one shipping group or more than one substation, each crate or package is identified by attached tag markings. The drawing number on the crate tag is also on the customer's copy of the shipping list. The shipping list describes the contents as "Unit 1-2-3." Refer to the general arrangement drawing for the location of each unit within the group line-up. Use this information to simplify the assembly operation and save unnecessary handling.

LIFTING

General

Each group of switchgear has provisions for attaching lifting equipment furnished by others. Though the lift points vary in location on indoor and *Shelter-Clad* outdoor designs, all are designed for use with a crane of adequate height and capacity. To determine the required crane capacity, multiply the number of cubicles to be lifted by 5,000 pounds (2273 kg) for indoor and 7,000 pounds (3182 kg) for *Shelter-Clad* outdoor.

34.5 kV Indoor Switchgear (See Fig. 2)

34.5 kV indoor equipment has lifting channels on the top of the switchgear. These channels have spreaders between the lift points for additional strength. The load angle on the lifting cables must be at least 45°; a lesser angle could damage the equipment.

CAUTION

Do not remove lifting channels on indoor switchgear under any circumstances until the switchgear is installed in its final location. These channels insure the true alignment of the switchgear group until it is leveled and anchored.

34.5 kV Shelter-Clad Switchgear (See Fig. 3)

Lift *Shelter-Clad* outdoor equipment by placing high strength pipes through holes provided in the supporting beams under the switchgear.

WARNING

All *Shelter-Clad* outdoor switchgear groups are to be lifted with 3.5" (88.9 mm) nominal xx-strong pipe. This extra heavy pipe has actual dimensions of 4.00 (101.6 mm) outside diameter with a .636 (16.2 mm) wall thickness. An alternate is 4.75 (120.7 mm) outside diameter mechanical tube with a .313 (8 mm) wall thickness.

It is extremely important that the correct size lifting pipe be used. Pipe of inadequate strength will bend, causing possible damage to the switchgear and injury to personnel.

Lift pipes, cables and spreaders are furnished by customer unless covered by contract. Cable spreaders are required above roof to protect the equipment. Wood cable spreaders, if used, must be timbers of sufficient strength to handle the compressive force of the cables and should have steel bands or studs to prevent splitting. Small groups of switchgear, up to three units, should be carefully checked for balance as distribution of equipment within the cubicles may place the center of gravity high or toward one end. If load is unbalanced, use a rope sling or other means to secure the top of the load to lifting cables to prevent tipping or rolling.

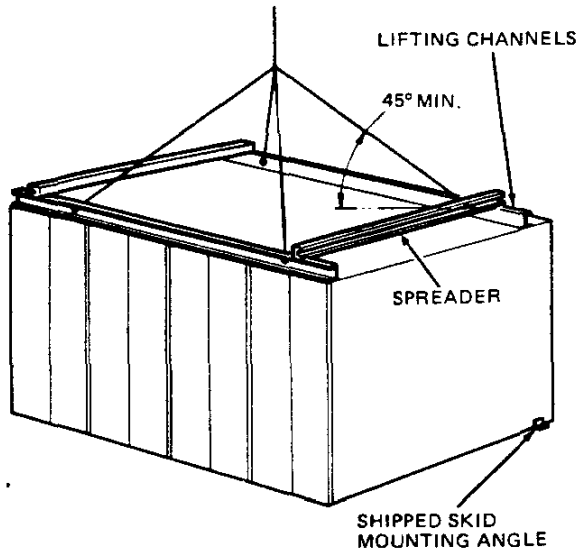


Figure 2. Lifting 34.5 kV Indoor Switchgear

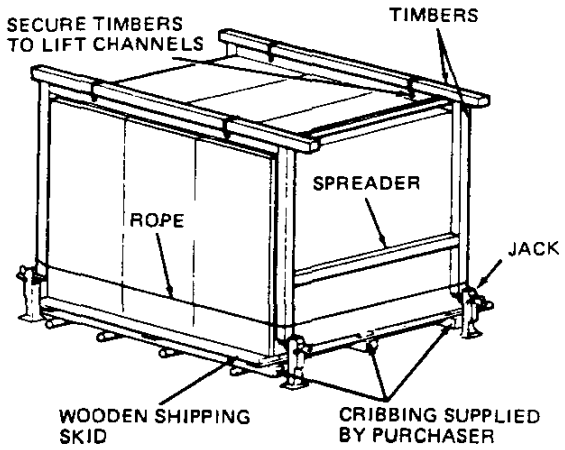


Figure 4. Jacking Indoor Switchgear

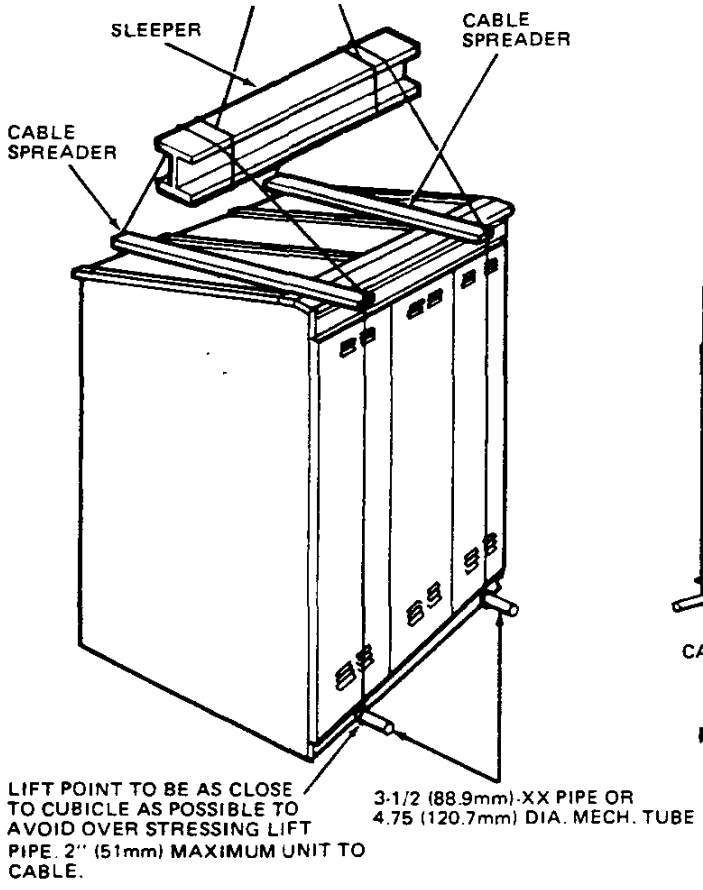


Figure 3. Lifting 34.5 kV Shelter-Clad Outdoor Switchgear

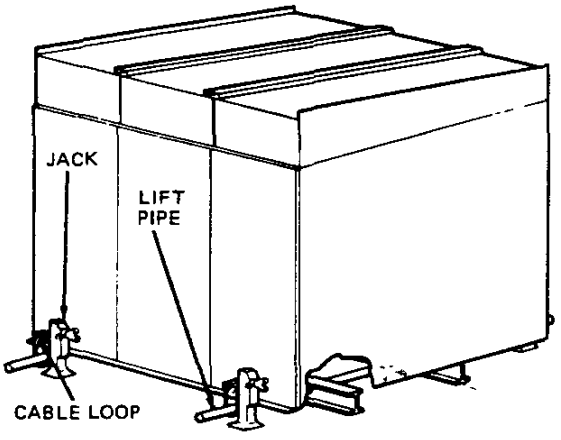


Figure 5. Jacking Shelter-Clad Outdoor Switchgear

MOVING SWITCHGEAR IN OBSTRUCTED AREAS WITHOUT A CRANE

Within buildings and obstructed areas, where a crane cannot be used, move switchgear with rollers, cribbing, jacks and other such equipment as may be required to meet the situation. To prevent distortion of the cubicles, rollers and cribbing of equal height must be used in sufficient number to evenly distribute the load. DO NOT USE ROLLERS DIRECTLY ON SHIPPING SKID; ADDITIONAL CRIBBING MUST BE USED. Remove rollers and lower switchgear carefully. Leave wooden skids (when provided) in place during moving operation until final location is reached. Fork-lift trucks should be used with discretion as improper lift points could cause extreme damage to equipment. Refer to Figs. 4 and 5 for the correct jacking methods.

INSPECTION AND UNCRATING

Inspect the equipment within 15 days after receiving for any damage that may have occurred in transit. Before uncrating, examine the crate itself; a splintered crate may indicate an area of damage within. Be careful when uncrating equipment. The use of sledge hammers and crowbars may damage the finish, if not the equipment itself. Use nail pullers. After uncrating, examine equipment for any possible damage. Check the shipping manifest to be certain that all items have been received. If there is a shortage, make certain it is noted on the freight bill and contact the carrier immediately. Notify the representing Siemens-Allis sales office of any shortage or damage.

Unusual circumstances may require partial shipments of switchgear. Should a case of this nature exist, provision is made for easy installation of these portions.

STORAGE

INDOOR SWITCHGEAR

When switchgear is not to be erected immediately, it should be uncrated, inspected within 15 days of receipt and stored in a clean dry location. Indoor cubicles are neither weatherproof nor drip-proof; therefore, they should be stored indoors. If they must be stored outdoors, or if they are to be kept in a humid, unheated area, provide an adequate covering, and place a heat source of approximately 500 watts output within each cubicle to prevent condensation. Space heaters are not standard equipment on indoor switchgear. Lubricate any moving parts such as hinges, shutter, etc., if storage is for an extensive period of time. When batteries are supplied, connect them to a charger; never leave batteries in dead storage.

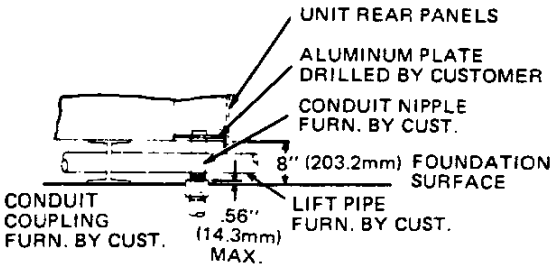
SHELTER-CLAD OUTDOOR SWITCHGEAR

When it is necessary to store *Shelter-Clad* outdoor equipment in a location exposing it to the weather or in a humid location, energize the space heaters provided within the cubicles and make certain that louvers and vents are uncovered to allow air to circulate. If at all possible, erect the aisle section and the switchgear at the permanent location even though it may be some time before the equipment is used. Regardless of what method of storage is used, break the shipping seal and remove the aisle wall (see Page 16) from in front of instrument panels. This is required to gain access to the space heater circuit so that heaters can be energized. Reseal the front or cover it for protection from the weather. Connect batteries (if provided) to a charger. Lubricate hinges, shutters, and other moving parts.

INSTALLATION

OUNDATION

Extreme care should be taken in layout of foundation or floor. Refer to general arrangement drawing for exact location of anchor bolts, area for secondary and primary conduits, other limitations and instructions. Should location of 3.5" (88.9 mm) nom. X-X strong lift pipe (furnished by customer) interfere with customer's primary conduit, it is suggested that a conduit coupling be installed in this location. The coupling should not project more than .56 (14.3 mm) above surface of foundation. After switchgear has been lowered to foundation and lift pipe has been removed, a conduit nipple may be screwed into coupling.



Floors, sills, piers or pilings, whichever type of foundation is used, must have a smooth level surface and be in the same plane. The surface of the foundation must not protrude above the grouted sills or bed plates at any point. Grouted sills or bed plates must be set true and level and be in the same plane to each other. Care and accuracy at this point will simplify or eliminate shimming when switchgear is installed. Foundations must be sufficiently strong to support the weight of the cubicles and breakers plus the impact loading of the circuit breakers (twice the weight of each circuit breaker). Outdoor switchgear groups which have been assembled on 4 x 8 (101.6 x 203.2 mm) beams must be supported along these beams with the maximum span between support points not exceeding eight (8) feet (2440 mm). If pilings are used, the diameter of these pilings is to be determined by the customer for proper loading. However, they must not be less than twelve (12) inches (305 mm) for sufficient contact with beam, allowing space for shipping split and space for grouting in of bed plate is used. All shipping splits must be supported and taken into consideration when foundation is constructed.

CAUTION

In the switchgear primary entrance area, steel reinforcing rods or mesh in concrete must not pass through space shown on general arrangement drawing even though cored or bored holes in concrete may miss rods or mesh. A single phase of a system may not be encircled by ferrous metals where current exceeds 600 amperes.

All sill channels, bed plates, shims and anchoring hardware are furnished by customer unless covered by contract.

Fig. 6 illustrated acceptable methods of setting sill channels for 34.5 kV indoor switchgear. Cubicles may be anchored to sills by use of nuts welded to bottom of channel. Before grouting channels in place, screws of sufficient length should be placed in anchor holes and coated with a heavy film of paraffin or other suitable coating which will allow the screws to be readily removed after the concrete has set.

Fig. 7 shows a suggested method of anchoring and leveling bed plates for outdoor switchgear of *Shelter-Clad* design. Outdoor switchgear, as received, is supported on 4" x 8" @ 18.4 lbs. (101.6 x 203.2 mm @ 27.4 kg/m) per foot beams. e maximum span between the support points on which these beams rest must not exceed eight feet. If pilings are used r foundation, their diameter may not be less than 12 inches (305 mm). Cubicles must be supported at shipping splits.

Before setting and erecting the cubicles, determine the correct locations of each shipping group and sequence of installation on the general arrangement drawing. Sweep the mounting surfaces to remove all dirt. Refer to Figs. 8 through 11 for additional installation instructions.

Secondary control conduits must be exceed 2-inch (50.8 mm) nominal pipe size (2.37 inch (60.2 mm) o.d.). If conduit extends above floor or slab to enter cubicle and exclude water, it should not exceed 1.50-inches (38 mm) on indoor equipment. On outdoor equipment, the secondary control conduit should extend to a maximum of 9.50 inches (241 mm)

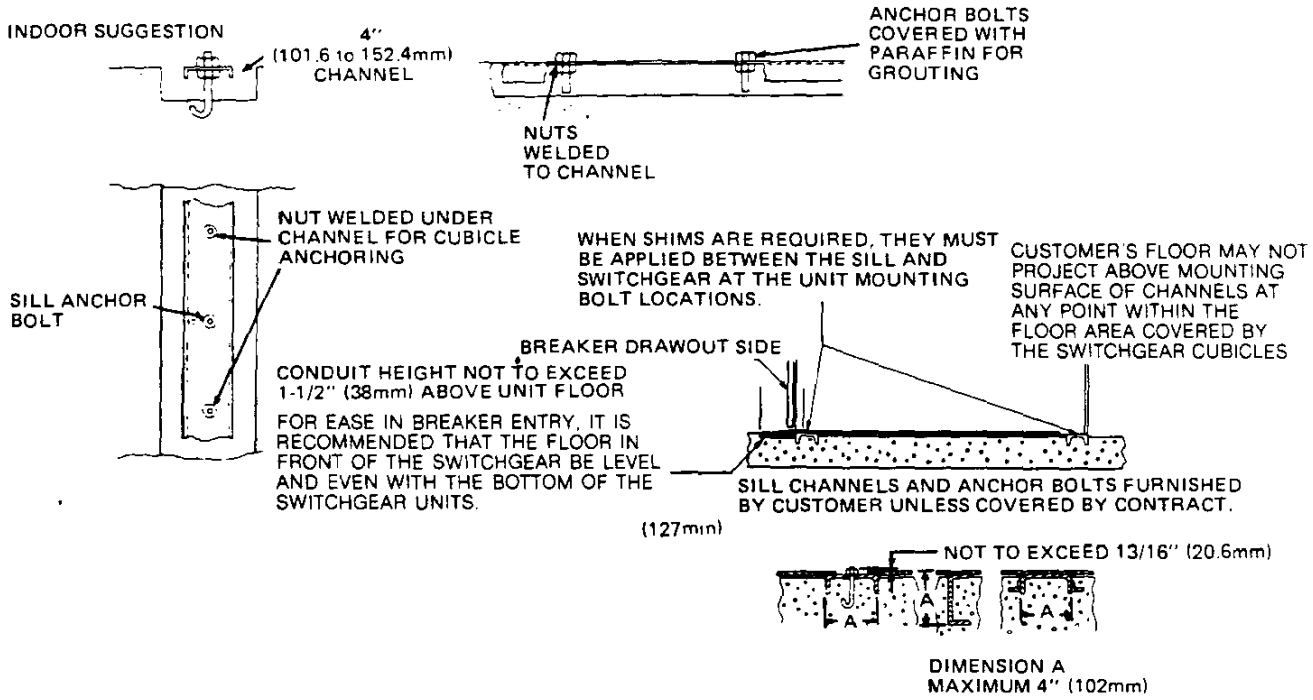


Figure 6. Setting Channel Sills for Indoor Switchgear

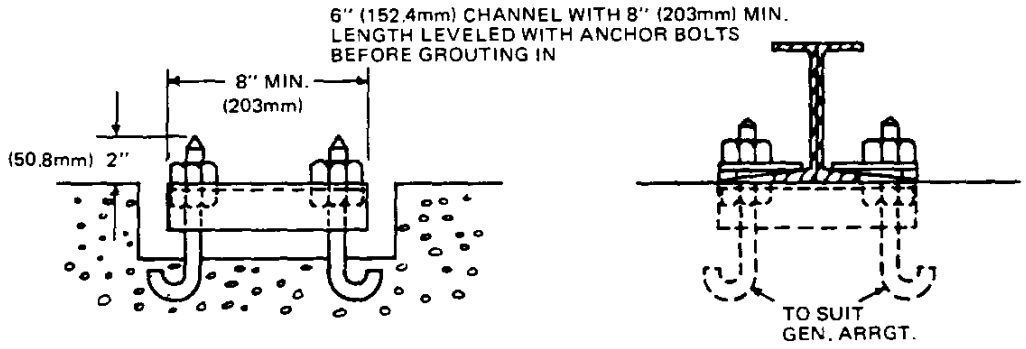


Figure 7. Securing Outdoor Cubicles

and a minimum of 8.75 inches (223 mm) above the slab or base plane. In cases where switchgear cannot be lowered over conduit because of headroom or other restrictions, conduit couplings can be grouted in flush with slab. Conduit nipples can then be added after switchgear is in place. Care should be taken during construction and at all times to keep conduit ends capped to prevent entry of dirt, moisture and vermin.

If primary power conduit is grouted into the foundation, follow instructions outlined above. (This conduit may often enter through trench or planned opening.)

ERECTING CUBICLES

The proper erection method depends on whether the units are shipped as one complete group or in two or more sections. In any case, the general arrangement drawing will indicate the shipping groups and their location within the lineup. Units are assembled and wired in accord with the arrangement as in the final installation

Before setting and erecting the cubicles determine the correct locations of each shipping group on the general arrangement drawing. Sweep the mounting surfaces to remove all dirt. Refer to Figs. 8 through 11 for additional installation instructions.

BOLT OR WELD
CUBICLE TO SILL

Carefully check that switchgear not furnished with supporting beams is in firm contact with the sills or floor. DO NOT FORCE CUBICLE INTO FIRM CONTACT BY DRAWING DOWN MOUNTING BOLTS. THIS MAY DISTORT CUBICLE. Place 4x4 inch (100 x 100mm) shims, if necessary, in the area of the mounting.

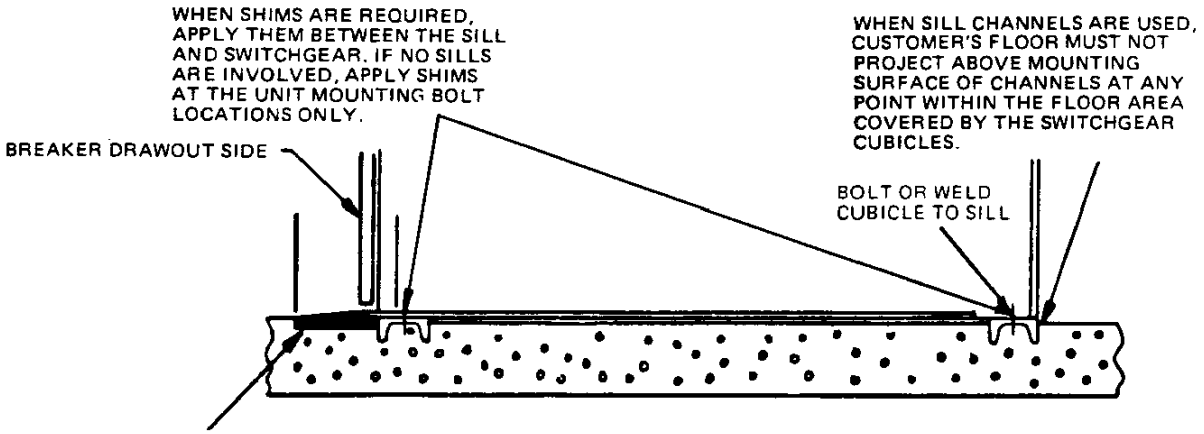


Figure 8. Setting Indoor Cubicles on Foundation

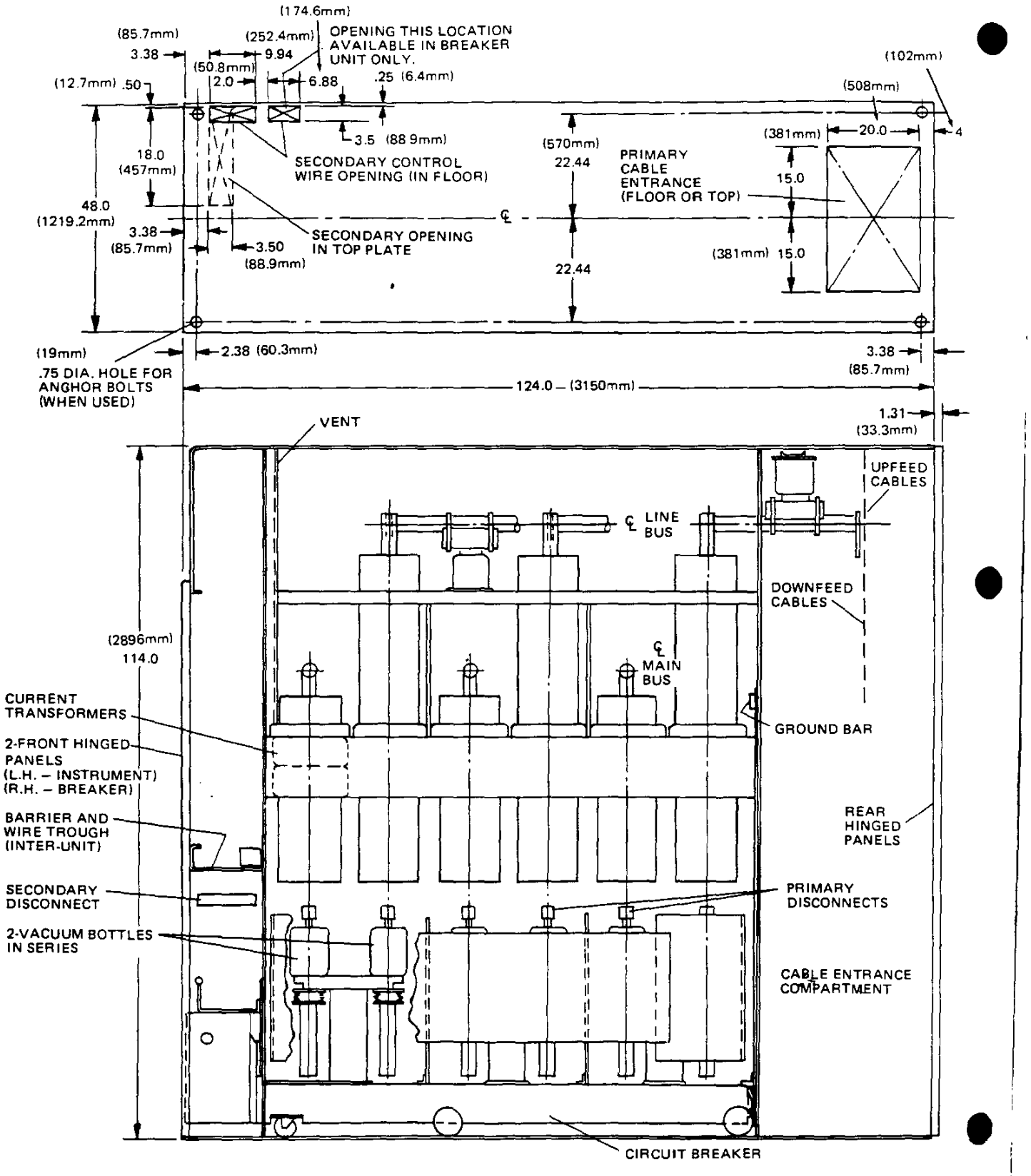


Figure 9. Floor Plan and Side View of Typical 34.5 kV Indoor Cubicle

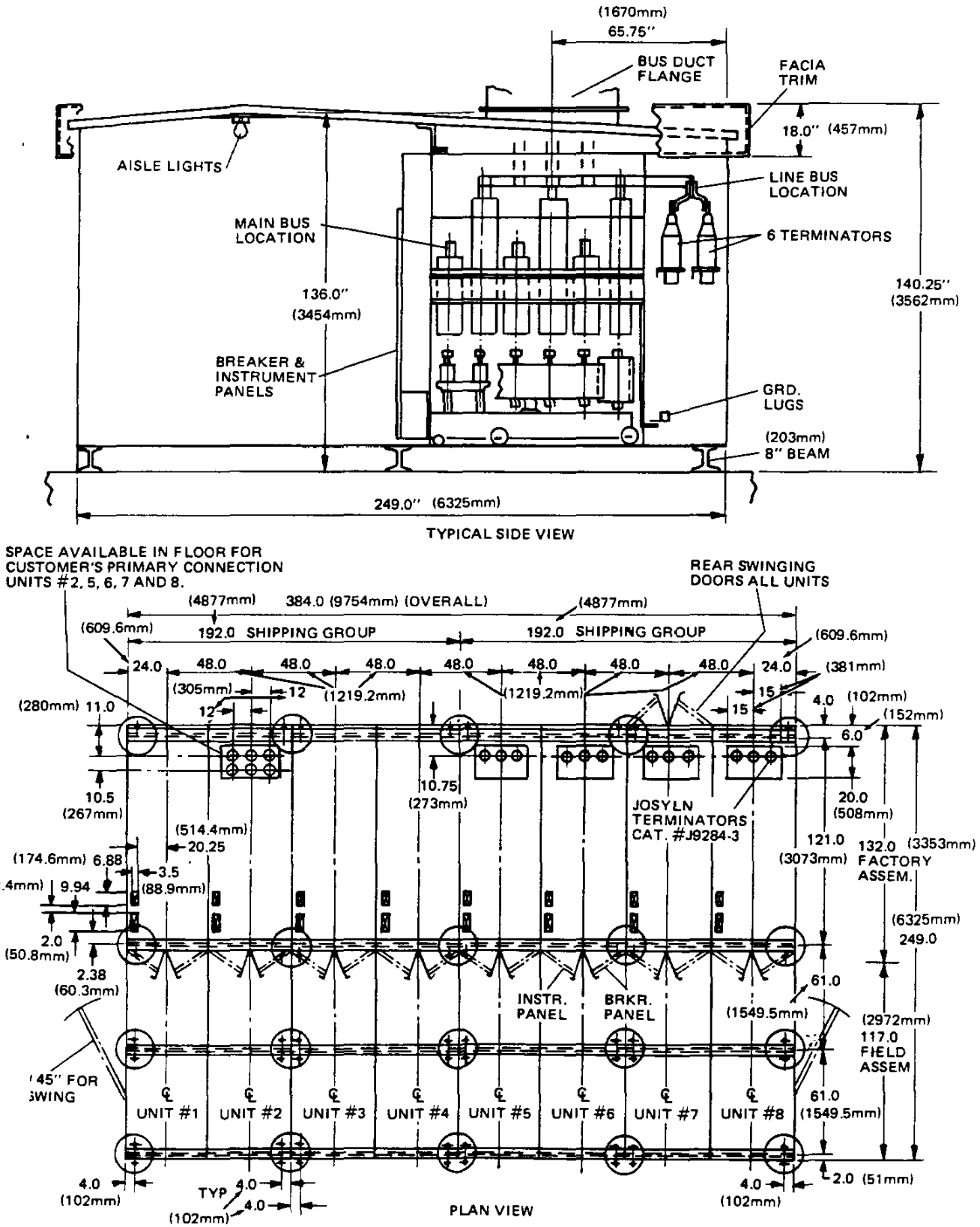


Figure 10. Floor Plan and Typical Side View of 34.5 kV Single Aisle Shelter-Clad Cubicle

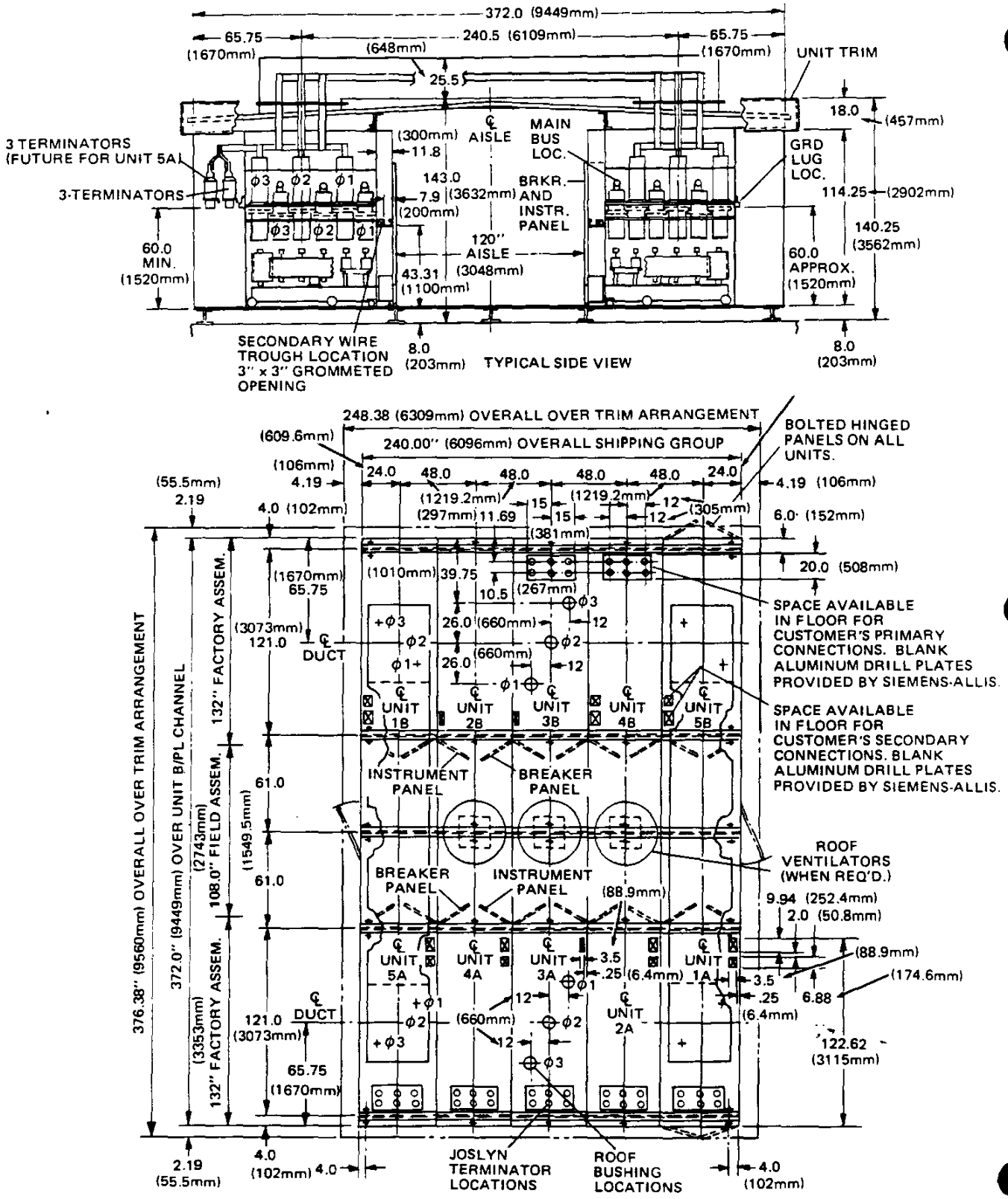


Figure 11. Floor Plan and Typical Side View of 34.5 kV Common Aisle Shelter-Clad Cubicle

ANCHORING AND LEVELING INDOOR SWITCHGEAR

Indoor switchgear shipping groups are held in true alignment by lifting channels across the top of the group and by bolts holding the cubicles to each other. The entire shipping group is to be anchored and leveled as a single element without loosening any hardware or removing lifting channel until entire shipping group is leveled and anchored.

Verify anchor bolt locations per general arrangement drawing and sweep area clean of any construction debris. Check general arrangement drawing for position of first shipping group and sequence of installation if arrangement consists of more than one shipping group.

Refer to Pages 6, 7 and 8 and move switchgear to its final location.

1. The switchgear equipment represented was accurately aligned on level steel bed plates at the factory. This care insures proper operation and fit of mating parts. Supporting surfaces for the switchgear at each mounting bolt location must be level and in the same plane. There must not be any projection above this plane within the area covered by the switchgear cubicles. If customer's floor or grouted sill channels do not meet this requirement it will be necessary to shim in the following manner. The four (4) anchor bolt locations in each cubicle must freely rest in firm contact with the mounting support surfaces. There must not be any projection or obstruction in other areas which may distort cubicle. Do not force cubicle into firm contact by drawing down mounting bolts as such drastic means will distort cubicles. Add 4 (100 mm) square shims adjacent to anchor bolts until firm contact is achieved. Check each bolt location, 4 per cubicle, and tighten bolts (see Fig. 9).
2. Tighten anchor bolts.
3. Check group for plumb. Use the first breaker cubicle in from the end of each shipping group. All plumb readings should be taken with anchor bolts tight. If it is not within .12" (3.2 mm), it could be due either to unlevel sills or the cubicles being damaged in shipment. Check first to insure that sills are level. If sills are not level, add 4" x 4" (100 x 100 mm) steel shims on top of sill, adjacent to the anchor bolts, as necessary to achieve a level floor in all cubicles and to insure that all cubicles are in form contact with the foundation at each anchor point. Tighten the anchor bolts.

   Do not loosen any hardware until *after* it has definitely been verified that floors are level and in firm contact with sills.

4. If lineup consists of multiple groups, move the next group into position, with the front of units in line and tight against the adjacent group. Do not bolt groups together at this time. Check for plumb as on previous group and bolt groups together with hardware provided. Repeat for any additional groups. Check that the cubicles are in firm contact with the foundation at each anchor point. Add 4" x 4" (100 x 100 mm) shims as necessary. Tighten the anchor bolts.

ANCHORING AND LEVELING OF SHELTER-CLAD SWITCHGEAR

In *Shelter-Clad* arrangements the switchgear, as received, is true and in correct position relative to its support beams. The beams are a permanent part of the switchgear, and are not to be loosened or moved from position.

Verify anchor bolt locations in concrete as shown in Fig. 7, and at all points shown on general arrangement plan view. Sweep foundation to make certain it is free of pebbles or other debris. Check general arrrangement drawing for positioning of switchgear and sequence of installation if arrangement consists of more than one shipping group.

Single aisle *Shelter-Clad* cubicles are shipped with the aisle wall covering the breaker drawout compartment. This wall may be removed before moving the switchgear into position on its foundation, if conduit clearance is in doubt, or if aisle is to be assembled immediately after leveling. See Fig. 13.

1. Remove seal material at top of wall (A).
2. Remove bolts at roof gable (C).
3. Support wall (A) with crane or other means (figure approximately 375 lb. (170 kg) per unit) and remove all the bolts (X) at each end of the group which hold the aisle wall in place. Carefully lay aisle wall aside until needed for aisle assembly.
4. Remove nuts from all anchor bolts, remove caps from all secondary conduit stubs, and remove covers from secondary openings in cubicle floor plates.

   Refer to Pages 6, 7 and 8 for Lifting and Handling *Shelter-Clad* switchgear. The arrangement may consist of a single complete shipping group, or may be broken down into a number of shipping sections as in a long line-up. Refer to general arrangement drawing for instructions as to which shipping group should be installed first, and in what sequence the remaining groups are to be installed. Using 3.50" (88.9 mm) nom. X-X strong (extra-heavy) pipe (do not substitute a member of less strength) move the first group into position as dimensioned on general arrangement drawing.

5. The switchgear equipment represented was accurately aligned on level steel bed plates at the factory. This care insures proper operation and fit of mating parts. Supporting surfaces for the switchgear's 4 x 8 (101.6 x 203.2 mm) beams must be level and in the same plane within .06" (1.6 mm). If concrete, grouted channels, pier support plates, etc. do not meet this requirement, or if there is any projection higher than the support points in line with beams, shims must be installed in the following manner to provide equivalent true surface of switchgear support. 34.5 kV outdoor switchgear groups which have been assembled on 4 x 8 (101.6 x 203.2 mm) beams must be supported along these beams with the maximum span between support points not exceeding eight (8) feet (2440 mm). If shims are required, use 4" (100 mm) square strips placed between bottom of beam and foundation, in the anchor bolt area where they will be clamped firmly in place.

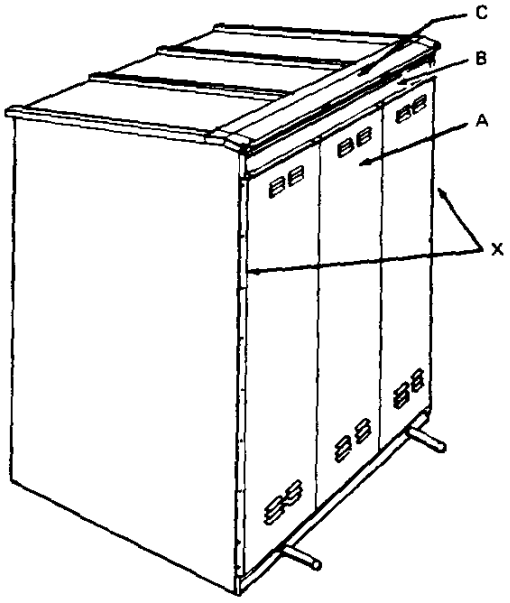


Figure 13. Aisle Wall Removal

6. Add clamp washers and nuts to anchor bolts and tighten securely.
7. Using the first breaker cubicle in from each end of every shipping group, check group for plumb. If the reading exceeds .12" (3.2 mm) out of plumb, does the position of the deviation in each end breaker cubicle read the same direction and approximately the same distance? If this condition exists it would normally indicate that the slab, piers or pilings, as the case may be, are not level and/or are not in the same plane. The addition of shims between foundation and the bottom of the beam should bring shipping group to level showing plumb reading within the .12" (3.2 mm) tolerance. Note all plumb readings are to be taken with anchor bolts tight.
8. A temporary plate is bolted to the end plate of each group at the shipping split. This plate was used to support the aisle wall during shipment. Remove and scrap these plates, and remove any hardware which would interfere with a tight fit when the next group is moved into position. Make sure that all anchor nuts of the first section installed are tight and have produced a true plumb reading before moving the next group into position.
9. Move the next group into position. The front edge of the cubicle floor plates should be in line with those of the previously installed group. This will insure a good fit with aisle floor plates.

   Make certain that the end of the group being installed is tightly against the previous installation. Repeat steps 5, 6 and 7 for each group. Replace covers for anchor bolt access at each end of line-up.
10. If there are additional groups in line-up, repeat steps 8 and then 5, 6 and 7 for each group.

ASSEMBLY OF SHELTER-CLAD OUTDOOR SWITCHGEAR

Single Aisle

Table 3 lists the standard components supplied for single aisle *Shelter-Clad* outdoor switchgear. The item numbers in the table are used in all instructions pertaining to this procedure. Assemble as follows (use hardware as indicated in Fig. 14):

1. Temporarily support the aisle wall assembly (removed for the plumb bob check) in its permanent position as shown in the exploded arrangement drawing (Fig. 14). Remove the aisle beam (B) from top of the wall assembly (A) and place the beam, with clip angles near the tip, in position as shown.
2. Put roof covers (510) in place to hold top of aisle wall in place. Do not tighten hardware. Remove and discard the buffer angles at the bottom of the unit. These angles are installed to prevent bending on the aisle wall during shipping. If not removed, they may interfere with installation of floor plates.
3. Align the ends of the aisle wall, aisle beam and switchgear. Place two sets of floor plates in position between the switchgear and the wall. Install each set next to the end position between the switchgear and the wall. (See Fig. 14 for location of floor plates.) With aisle floor plates set tightly against switchgear floor plates, check and adjust center beam and aisle wall beam location to provide a good fit with minimum size cracks between plates and a smooth surface. Check that aisle wall is square with switchgear by diagonal measurements at floor level – corner to corner distances should be equal. Tighten anchor bolts to secure beam locations.
4. With roof cover hardware loose, plumb front wall and tighten attaching hardware.
5. Install all floor plates using pattern as shown in Fig. 14. Each plate overlaps the supporting member of the next plate; therefore, determine sequence of installation accordingly. Place each set of aisle floor plates in line with cubicle floor plates to equalize the space between floor plates and prevent a wide crack at end of group.
6. Install sealant tape (310) at points "C" and "D". Place the tape so that one edge is on the vertical centerline of the holes and the other edge is toward the seam which will be exposed to the weather. See Section B-B of Fig. 14.
7. Install angles (316) to aisle beam at each end of line-up as shown in Fig. 14.
8. Install L.H. trim angle (524) and R.H. trim angle (526).
9. Set door assemblies (518) in place (Fig. 14). Bolt the doors to the aisle wall (A) and to side plate of the cubicle and to aisle beam.
10. Put all roof covers (510) in place and bolt to aisle wall assembly (A) and roof support.
11. Fasten roof covers together using bracket (318) at positions (two per joint) shown in Section A-A of Fig. 14.
12. Install trim angles (520) at each end of aisle.

13. Set roof channels (512 and 514) over roof cover joints. Slide the channel toward the roof peak until the clip inside the channel engages the bracket (318).
14. Install roof hoods (516).
15. Drill primary opening cover (360 or 362) to suit conduit installation and bolt in place.
16. Mount aisle conduit, switches, receptacle and wire to junction box at each end unit. See conduit arrangement in Fig. 14.
17. If equipment consists of more than one shipping group, caulk vertical shipping split at back of switchgear with metal filler (00-519-275-001) provided.
18. Bolt corner trim bracket assemblies (610) in place as shown in A-A and C-C of Fig. 15 (three per corner).
19. Install corner trim – (612) at breaker unit corners. These are installed by raising up until clips in corner trim engage brackets (610) and then pulling down sharply while pushing trim firmly against units.
20. Install bottom covers (614) on corner trim using tamperproof screws (246). See H-H of Fig. 16.
21. Install aisle wall vertical panel braces (618) as shown in Fig. 16 aisle wall view and Section G-G.
22. Install aisle end side braces (616) as shown in side view and Section B-B of Fig. 15 (2 per end).
23. Install roof trim supports (624) to roof decks as shown in Section K-K of Fig. 16 (4 per unit).
24. Install horizontal side trim parts (628, 630, 632 and 634) as shown in Fig. 15. Use bridge trim strips (636) where shown.
25. Install horizontal front and rear trim parts (638) along with bridge trim strips (636) and corner trim (626) as shown in Figs. 15 and 16.
26. After primary cables, terminators, LA's, etc. are mounted and primary entrances are ready for closing, the rear panels should be closed and bolted shut using four (4) tamperproof screws which were provided with these units as shipped. The rear trim is then completed by installing vertical trim channels (620) in same manner as described for corners under step 19. Install bottom covers (622) using tamperproof screws (246). See Fig. 16, rear view and Sections D-D, E-E and F-F.

Table 3. Standard Components – Single Aisle Switchgear

Item	Description	Part Number	Mk.
A	Aisle Wall Assembly		
B	Aisle Beam		
218*	Wiring Hardware (#8-32)	18-194-685-	801
	(#10-32)	18-194-685-	804
238*	Rd. Hd. Screw – #10-32 x .25 (6.4 mm)	00-615-485-	214
240*	Rd. Hd. Screw – #10-32 x .50 (12.7 mm)	00-615-485-	218
242*	Lockwasher – #10	00-655-017-	022
244*	Hex Nut – #10-32	00-631-123-	210
246*	Tamperproof Screw – .25-20 x .50 (12.7 mm)	15-171-404-	001
248*	Hex Hd. Cap Screw – .25-20 x .75 (19 mm)	00-611-315-	375
250*	Round Washer – .25	00-651-007-	160
252*	Lockwasher – .25	00-655-017-	026
254*	Hex Nut – .25-20	00-631-059-	104
256*	Tamperproof Screw – .31-18 x .75 (19 mm)	15-171-404-	006
258*	Round Washer – .31	00-651-007-	905
260*	Lockwasher – .31	00-655-017-	030
262*	Hex Hd. Cap Screw – .38-16 x 1.00 (25.4 mm)	00-611-315-	466
264*	Hex Hd. Cap Screw – .38-16 x 1.25 (31.8 mm)	00-611-315-	468
266*	Hex Hd. Cap Screw – .38-16 x 1.50 (38.1 mm)	00-611-315-	470
268*	Round Washer – .38	00-651-007-	230
270*	Lockwasher – .38	00-655-017-	032
272*	Hex Nut – .38-16	00-631-059-	106
274*	Hex Hd. Cap Screw – .50-13 x 1.50 (38.1 mm)	00-611-315-	548
276*	Round Washer – .50	00-615-007-	300
278*	Lockwasher – .50	00-655-017-	036

*Use material supplied – do not use metric hardware.

Table 3. Standard Components – Single Aisle Switchgear (Cont'd.)

Item	Description	Part Number	Mk.
280	Hex Nut – .50-13	00-631-059-	108
310	Sealant Tape	00-333-450-	005
312	Floor Plate	18-657-510-	530
316	Angle Assembly	18-657-848-	536
318	Bracket – Roof (Aisle)	18-184-206-	001
320*	Conduit – EMT – .50 x 52.8 (12.7 x 1341 mm) Formed	18-657-870-	308
322*	Conduit – EMT – .75 x 67.0 (19 x 1702 mm) Formed	14-657-870-	309
324*	Conduit – EMT – .75 x 33.0 (19 x 838 mm) Straight	14-239-690-	330
326*	Conduit – EMT – .75 x 84.8 (19 x 2154 mm) Straight	14-239-692-	068
328*	Conduit – EMT – .50 x 43.0 (12.7 x 1092 mm) Straight	18-199-658-	005
330*	Box Connector – . .75 (19 mm) EMT	00-855-051-	006
332*	Box Connector – . .50 (12.7 mm) EMT	00-855-051-	004
334*	Clamp – .75 (19 mm) EMT	00-691-259-	101
336*	Clamp – .50 (12.7 mm) EMT	00-691-259-	100
338*	Outlet Box – 4" (102 mm) Square	00-853-691-	106
340*	Cover – Blank	00-855-213-	101
342	Switch – 20A – 3 Way	00-871-505-	011
344	Duplex Outlet – 15A	00-857-215-	003
346	Cover – Switch and Receptacle	00-855-209-	375
348*	Outlet Box – 4" (102 mm) Octagon	00-853-713-	004
350	Lamp Receptacle – Porcelain	00-857-353-	204
352	Lamp – Incand. – 100W – 120 V	00-857-283-	213
354*	Wire – #14 Black – MTW	00-557-659-	355
356*	Wire – #14, White – MTW	00-557-659-	356
358*	Terminal – #14-10	00-851-078-	070
360	Primary Opening Cover (Breaker or Auxiliary Unit Without Cpt.)	18-657-521-	130
362	Primary Opening Cover (Auxiliary Unit With Cpt.)	18-657-853-	219
510	Aisle Roof Assembly	18-729-500-	501
512	Roof Channel – (Aisle)	18-730-190-	504
514	Roof Channel – (Unit)	18-392-988-	501
516	Hood	18-726-888-	001
518	Door Mounting – L.H. or R.H.	18-395-694-	508
520	Angle – Under Roof Channel (L.H. and R.H.)	18-730-190-	001
522	End Cap – Roof Channel	18-657-848-	535
524	L.H. Trim Angle	18-657-870-	282
526	R.H. Trim Angle	18-657-870-	283
610	Corner Bracket Assembly	18-657-830-	575
612	Corner Trim – Vertical – Unit	18-393-251-	502
614	Corner Cover – Bottom	18-657-510-	532
616	Side Brace – Vertical – Aisle Ends	18-730-190-	510
618	Panel Brace – Vertical – Aisle	18-726-884-	501
620	Rear Channel – Vertical – Units	18-392-987-	501
622	Rear Channel Cover – Bottom	18-657-817-	544
624	Trim Support – Roof	18-657-803-	033
626	Corner Trim	18-727-106-	001
628	Side Trim – Horizontal – 103" (2616 mm) Lg.	18-727-104-	501
630	Side Trim – Horizontal – 41" (1041 mm) Lg.	18-727-102-	501
632	Side Trim – Horizontal – 103" (2616 mm) Lg.	18-727-103-	501
634	Side Trim – Horizontal – 41" (1041 mm) Lg.	18-727-102-	502
636	Bridge Trim Strip	18-657-804-	076
638	Front – Rear Trim – Horizontal	18-727-100-	501

*Use material supplied – do not use metric hardware.

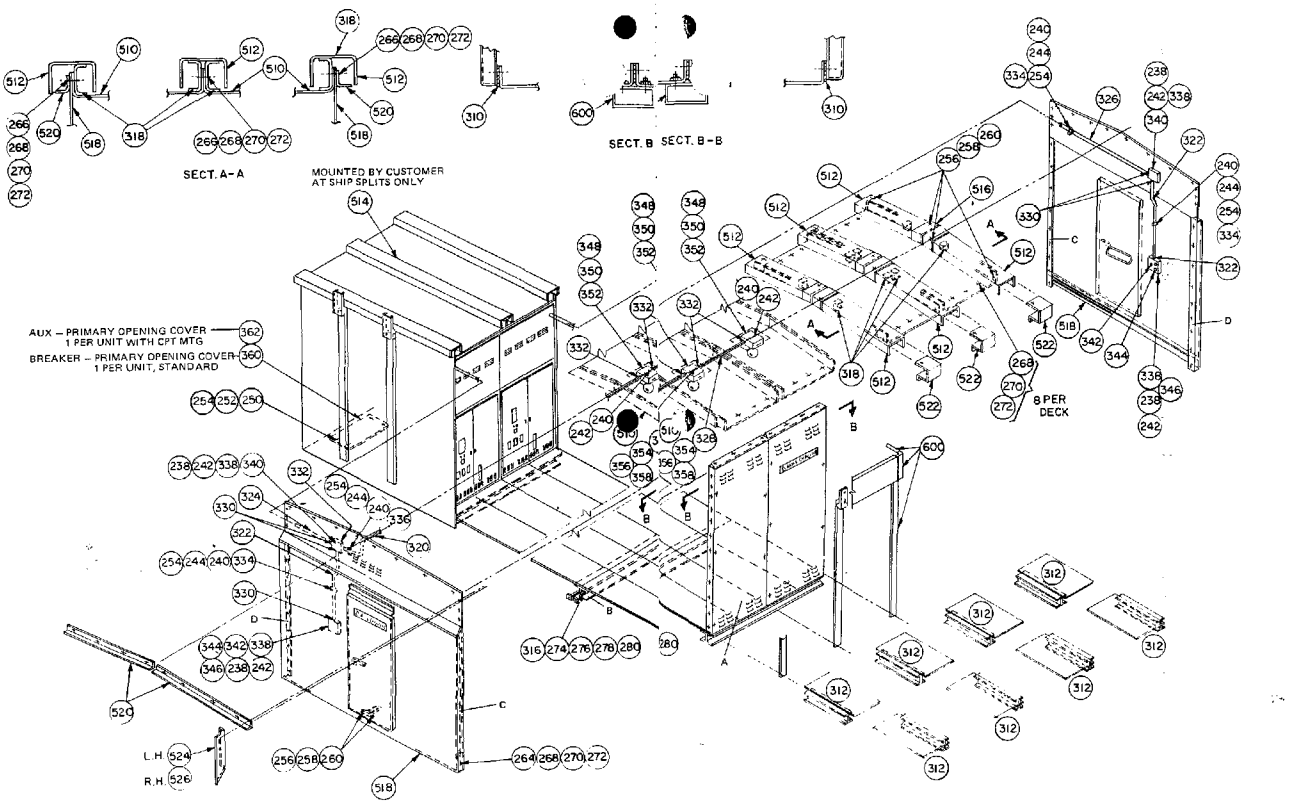


Figure 14. Aisle Assembly – Type "SIV" Single Aisle

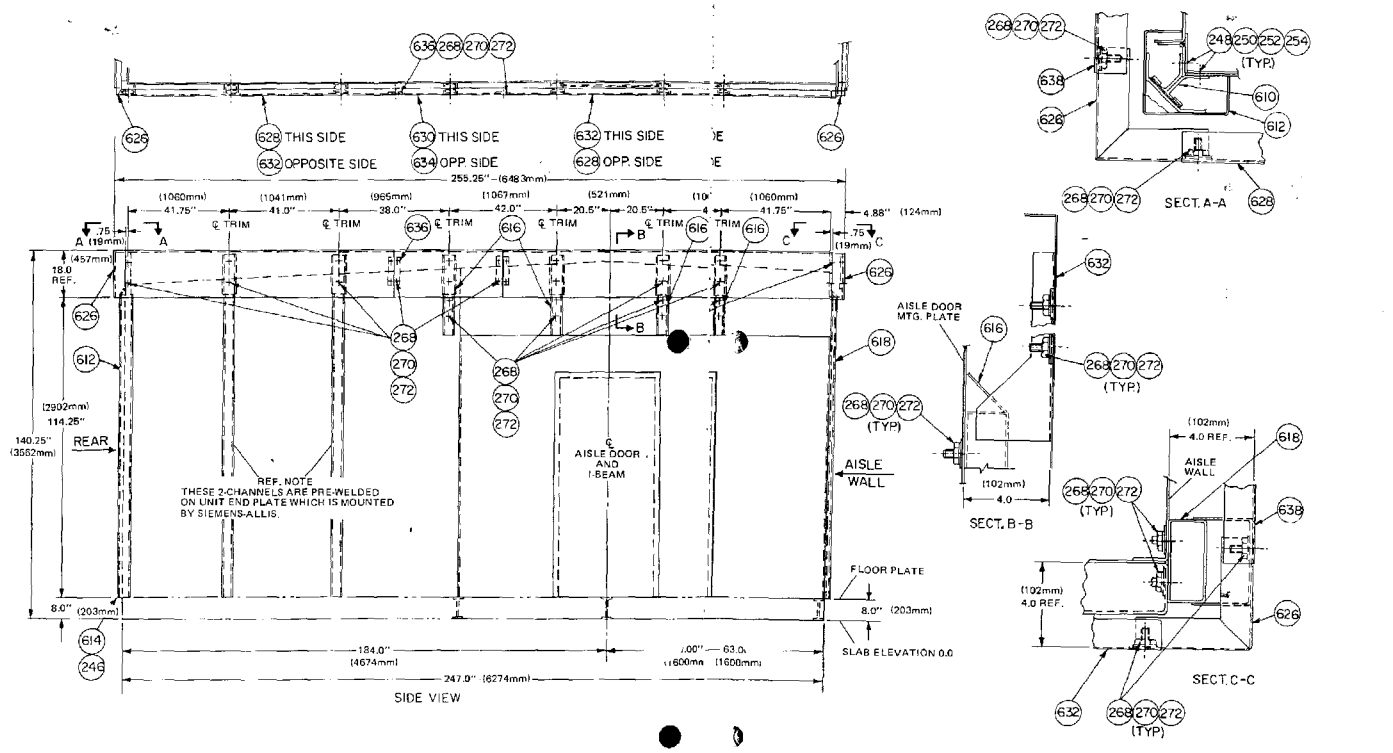


Figure 15. Trim Arrangement – Type "SIV" Single Aisle

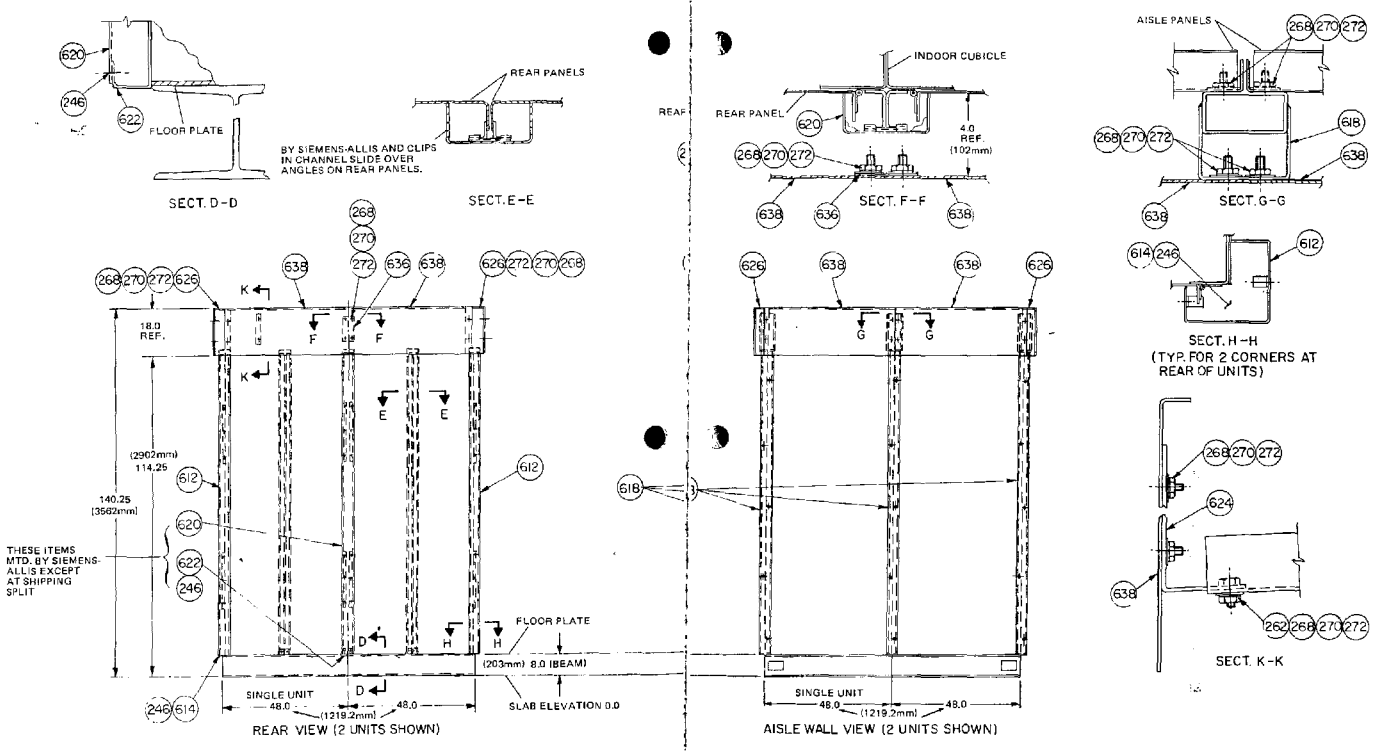


Figure 16. Trim Arrangement – Type "SIV" Single Aisle

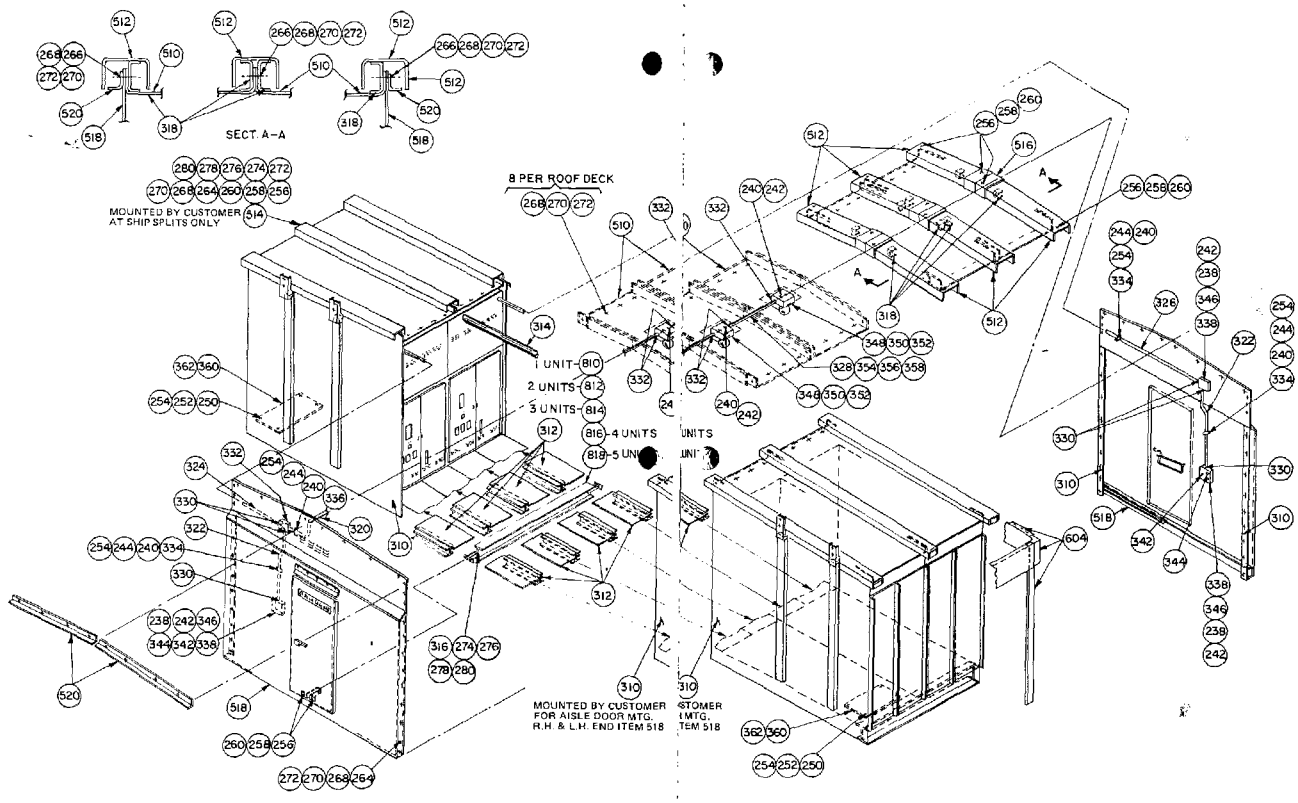


Figure 17. Aisle Assembly -- Type "SIV" Common Aisle

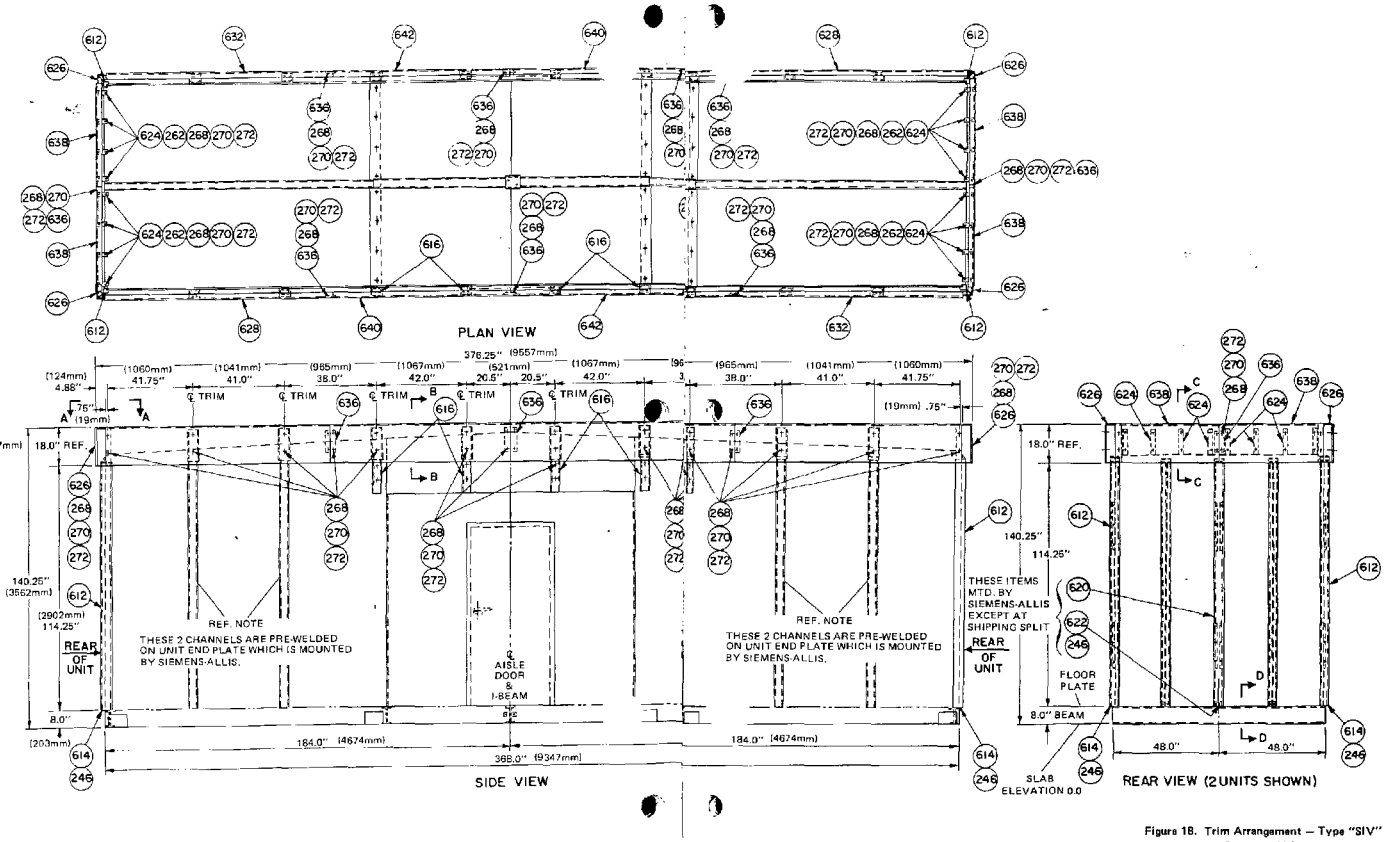


Figure 18. Trim Arrangement — Type "SIV" Common Aisle

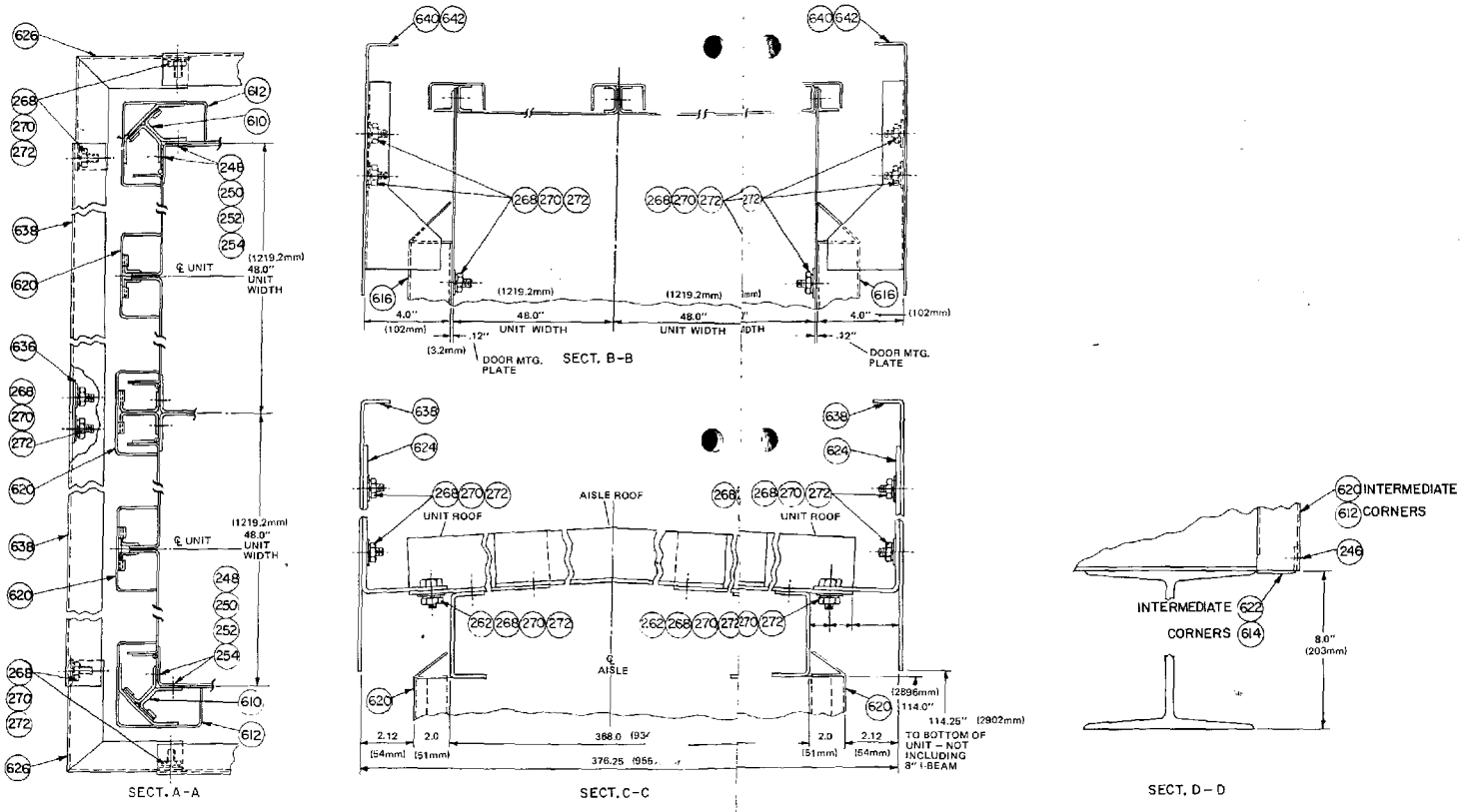


Figure 19. Trim Arrangement – Type "SIV" Common Aisle

Common Aisle

Table 4 lists the standard components supplied for common aisle *Shelter-Clad* outdoor switchgear. The item numbers in the table are used in all instructions pertaining to this procedure. Assemble as follows:

1. Place aisle beam in position (Fig. 17) and secure with anchor bolts.
2. Attach angles (316) to ends of aisle beam as shown.
3. See Fig. 17. Install all floor plates (312) using pattern shown. Each plate overlaps the supporting member of the next plate; determine sequence of installation. Place each set of aisle floor plates in line with cubicle floor plates to equalize the space between the floor plates and prevent a wide crack at end of group.

> **NOTE**
>
> Leave all bolts hand tight until shelter is completely assembled.

4. Install sealant tape (310) at points "C" and "D". Place the tape so that one edge is on the vertical centerline of the holes and the other edge is toward the seam which will be exposed to the weather.
5. See Fig. 17. Raise door assemblies (518) into place. Bolt doors to side plates of cubicles. Bolt to aisle sill using angles (316).
6. Mount aisle conduit, switches, receptacle and wire to junction boxes. See conduit arrangement, Fig. 17.
7. Place roof decks (510) in position and fasten with the bolts provided.
8. Fasten roof decks together using brackets (308). See view "A", Fig. 17.
9. Add trim angles (520) at each end of group.
10. Set channel-shaped covers (512) over the joints of roof decks and slide the covers up so the clips on the inner surface (Fig. 17) engage the brackets (318).
11. Bolt hoods (516) in place.
12. Tighten all bolts to complete the assembly.
13. Drill primary opening cover (360 or 362) to suit conduit. Bolt cover in place with hardware shown.
14. If equipment consists of more than one shipping group, caulk vertical shipping split at back of switchgear with metal filler (00-519-275-001) provided.
15. Bolt corner trim bracket assemblies (610) in place as shown in Section A-A, Fig. 19 (3 per corner).
16. Install corner trim (612) by raising up until clips in trim engage brackets (610) and then pulling down sharply while pushing trim firmly against units.
17. Install bottom covers (614) on corner trim using tamperproof screws (246). See Section D-D of Fig. 19.
18. Install aisle end side braces (616) as shown in side view Fig. 18 and Section B-B, Fig. 19 (2 per end).
19. Install roof trim supports (624) to roof decks as shown in Fig. 18 Section C-C of Fig. 19 (4 per unit).
20. Install horizontal side trim parts (628, 632, 640 and 642) using bridge trim strips (636) as shown in Fig. 18.
21. Install horizontal front and rear trim parts (638) along with bridge trim strips (636) and corner trim (612) as shown in Figs. 18 and 19.
22. After primary cables, terminators, LA's, etc. are mounted and primary entrances are ready for closing, the rear panels should be closed and bolted shut using four (4) tamperproof screws which were provided with these units as shipped. The unit rear trim is then completed by installing vertical trim channels (620) in same manner as described for corners under step 16. Install bottom covers (622) using tamperproof screws (246). See Figs. 18 and 19.

Table 4. Standard Components – Common Aisle Switchgear

Item	Description	Part Number	Mk.
218*	Wiring Hardware (#8-32)	18-194-685-	801
	(#10-32)	18-194-685-	804
238*	Round Hd. Screw – #10-32 x .25 (6.4 mm)	00-615-485-	214
240*	Round Hd. Screw – #10-32 x .50 (12.7 mm)	00-615-485-	218
242*	Lockwasher – #10	00-655-017-	022
244*	Hex Nut – #10-32	00-631-123-	210
246*	Tamperproof Screw – .25-20 x .50 (12.7 mm)	15-171-404-	001
248*	Hex Hd. Cap Screw – .25-20 x .75 (19 mm)	00-611-315-	375
250*	Round Washer – .25	00-651-007-	160
252*	Lockwasher – .25	00-655-017-	026
254*	Hex Nut – .25-20	00-631-059-	104
256*	Tamperproof Screw – .31-18 x .75 (19 mm)	15-171-404-	006
258*	Round Washer – .31	00-651-007-	905
260*	Lockwasher – .31	00-655-017-	030
262*	Hex Hd. Cap Screw – .38-16 x 1.00 (25.4 mm)	00-611-315-	466
264*	Hex Hd. Cap Screw – .38-16 x 1.25 (31.8 mm)	00-611-315-	468
266*	Hex Hd. Cap Screw – .38-16 x 1.50 (38.1 mm)	00-611-315-	470
268*	Round Washer – .38	00-651-007-	230
270*	Lockwasher – .38	00-655-017-	032
272*	Hex Nut – .38-16	00-631-059-	106
274*	Hex Hd. Cap Screw – .50-13 x 1.50 (38.1 mm)	00-611-315-	548
276*	Round Washer – .50	00-615-007-	300
278*	Lockwasher – .50	00-655-017-	036
280*	Hex. Nut – .50-13	00-631-059-	108
310	Sealant Tape	00-333-450-	005
312	Floor Plate	18-657-510-	530
316	Angle Assembly	18-657-848-	536
318	Bracket – Roof (Aisle)	18-184-206-	001
320*	Conduit – EMT – .50 x 52.8 (12.7 x 1341 mm) Formed	18-657-870-	308
322*	Conduit – EMT – .75 x 67.0 (19 x 1702 mm) Formed	14-657-870-	309
324*	Conduit – EMT – .75 x 33.0 (19 x 838 mm) Straight	14-239-690-	330
326*	Conduit – EMT – .75 x 84.8 (19 x 2154 mm) Straight	14-239-692-	068
328*	Conduit – EMT – .50 x 43.0 (12.7 x 1092 mm) Straight	18-199-658-	005
330*	Box Connector – .75 (19 mm) EMT	00-855-051-	006
332*	Box Connector – .50 (12.7 mm) EMT	00-855-051-	004
334*	Clamp – .75 (19 mm) EMT	00-691-259-	101
336*	Clamp – .50 (12.7 mm) EMT	00-691-259-	100
338*	Outlet Box – 4" (102 mm) Square	00-853-691-	106
340	Cover – Blank	00-855-213-	101
342	Switch – 20A – 3 Way	00-871-505-	011
344	Duplex Outlet – 15A	00-857-215-	003
346	Cover – Switch and Receptacle	00-855-209-	375

*Use material supplied – do not use metric hardware.

Table 4. Standard Components – Common Aisle Switchgear (Cont'd.)

Item	Description	Part Number	Mk.
348*	Outlet Box – 4" (102 mm) Octagon	00-853-713-	004
350	Lamp Receptacle – Porcelain	00-857-353-	204
352	Lamp – Incand. – 100W – 120 V	00-857-283-	213
354*	Wire – #14 Black – MTW	00-557-659-	355
356*	Wire – #14 White – MTW	00-557-659-	356
358*	Terminal – #14-10	00-851-078-	070
360	Primary Opening Cover (Breaker or Auxiliary Unit Without Cpt.)	18-657-521-	130
362	Primary Opening Cover (Auxiliary Unit With Cpt.)	18-657-853-	219
510	Aisle Roof Assembly	18-729-500-	501
512	Roof Channel – (Aisle)	18-730-190-	504
516	Hood	18-726-888-	001
518	Door Mounting – L.H. or R.H.	18-395-694-	508
520	Angle – Under Roof Channel (L.H. and R.H.)	18-730-190-	001
610	Corner Bracket Assembly	18-657-830-	575
612	Corner Trim – Vertical – Unit	18-393-251-	502
614	Corner Cover – Bottom	18-657-510-	532
616	Side Brace – Vertical – Aisle Ends	18-730-190-	501
620	Rear Channel – Vertical – Units	18-392-987-	501
622	Rear Channel Cover – Bottom	18-657-817-	544
624	Trim Support – Roof	18-657-803-	033
626	Corner Trim	18-727-106-	001
628	Side Trim – Horizontal – 103" (2616 mm) Lg.	18-727-104-	501
632	Side Trim – Horizontal – 103" (2616 mm) Lg.	18-727-103-	501
636	Bridge Trim Strip	18-657-804-	076
638	Front – Rear Trim – Horizontal	18-727-100-	501
640	Side Trim – Horizontal – 81" (2057 mm) Lg.	18-727-109-	501
642	Side Trim – Horizontal – 81" (2057 mm) Lg.	18-727-109-	502
810	Aisle Beam – 1 Unit	18-726-873-	001
812	Aisle Beam – 2 Units	18-726-873-	002
814	Aisle Beam – 3 Units	18-726-873-	003
816	Aisle Beam – 4 Units	18-726-873-	004
818	Aisle Beam – 5 Units	18-726-873-	005

Expanding Single Aisle to Common Aisle

Table 5 lists standard components supplied to extend an existing single aisle line-up to a common aisle line-up. The item numbers in the table are used in all instructions pertaining to this procedure. Assemble as follows:

1. See Figs. 15 and 16. Remove horizontal and vertical trim (items 610, 612, 618, 622, 626, 628, 630, 632, 634, 636 and 638) from ends and front of aisle area. Discard items 612, 618, 630 and 634. Save all other items and associated hardware for reuse.
2. See Fig. 14. Remove floor plates (312) adjacent to aisle wall and set aside for reuse.
3. See Fig. 14. Remove hoods (516) and roof channels (512 and 514). Discard channels (514), but save all other items for reuse.
4. See Fig. 14. Loosen, but do not remove the hardware holding aisle roof decks (510) to front of unit roof decks.
5. See Fig. 14. Remove all hardware holding roof decks (510) to aisle wall assembly (A). Save hardware for reuse.
6. Remove angles (520) from under end roof channels and set aside for reuse along with associated hardware.

7. Using wood blocking under edge of roof decks adjacent to aisle wall, jack or otherwise elevate this edge of roof decks a sufficient amount to clear weld studs on top of aisle wall assembly. Block roof decks in this elevated position.
8. Remove aisle wall assembly (A) by unbolting from door frames (518) and by removing anchor bolt hardware from around aisle wall beam. Discard this aisle wall assembly, but save hardware.
9. Move new switchgear into position as shown on the general arrangement floor plan. Secure with anchor bolts after assuring new units are plumb.
10. Lower aisle roof decks over weld studs on front of new units and fasten with hardware saved from step 5.
11. Retighten hardware at roof deck edge over existing units.
12. Reinstall angles (520) using hardware saved under step 6.
13. Install roof channels (512) saved from step 3 and supplied with new units. See Fig. 17. Also reinstall hoods (516) saved from step 3.
14. Bolt door frames (518) to new units using hardware salvaged from step 8 after installing sealant tape (302) to door frame with one edge on vertical centerline of mounting holes and other edge toward point of exposure to weather.
15. Reinstall floor plates (312) as shown in Fig. 17.
16. Drill plates (360 or 362) to suit primary conduit layout and bolt in place with hardware provided.
17. See secondary conduit arrangement and revise conduit arrangement as required.
18. If new equipment consists of more than one shipping group, caulk vertical shipping split at back of switchgear with metal filler (00-519-275-001) provided.
19. Referring to Figs. 18 and 19, install roof trim supports (624) at rear of new units.
20. Install corner trim brackets (610) saved from step 1.
21. Install corner vertical trim pieces (612) and bottom cover plates (614) which were saved from step 1.
22. Install all horizontal trim parts (628, 632, 636 and 638 saved from step 1) and (640 and 642 supplied new) as per Figs. 18 and 19.
23. When primary entrance area is ready for closing, follow procedure outlined in step 22 on Page 36.

Table 5. Standard Components – Expanding Single Aisle to Common Aisle

Item	Description	Part Number	Mk.
262*	Hex Hd. Cap Screw – .38-16 x 1.00 (25.4 mm)	00-611-315-	466
268*	Round Washer – .38	00-651-007-	230
270*	Lockwasher – .38	00-655-017-	032
272*	Hex Nut – .38-16	00-631-059-	106
403	Roof Channel – Open Ends	18-726-883-	501
612	Corner Trim – Vertical – Units	18-393-251	502
620	Rear Channel – Vertical – Units	18-392-987	501
624	Trim Support – Roof	18-657-803	033
636	Bridge Trim Strip	18-657-804	076
640	Side Trim – Horizontal – 81" (2057 mm) Lg.	18-727-109	501
642	Side Trim – Horizontal – 81" (2057 mm) Lg.	18-727-109	502
310	Sealant Tape	00-333-450	005
360	Primary Opening Cover Plate	18-657-521	130
250*	Round Washer – .25	00-651-007	160
252*	Lockwasher – .25	00-655-017	026
254*	Hex Nut – .25-20	00-631-059	104

*Use material supplied – do not use metric hardware.

Expanding Length of Existing Shelter-Clad Switchgear by Addition of Units

The new extended foundation – be it slab, pier or pilings – must be constructed in the same careful manner as described nder "Installation".

The new foundation must be level and in the same plane as the existing foundation.

Certain items will be removed from the existing installation as described in the following instructions. Remove these items carefully and store them for re-mounting in the expanded set up.

> **CAUTION**
>
> Be certain switchgear is de-energized before removing covers to high voltage compartments.

Table 6 lists accessory items provided for addition of match and line units.

1. Referring to Fig. 15/16 or 18/19 depending upon whether switchgear is single or common aisle, remove all horizontal trim pieces (626, 628, 630, 632, 634, 640 and 642) from end to be expanded.
2. Remove vertical corner trim pieces (612 and 614) and corner brackets (610).
3. Remove hood (516) and roof channels (512 and 514) over aisle area as well as roof channels over breaker units.
4. Remove angles (520) under roof channels.
5. Disconnect aisle conduit.
6. Remove bolts located under aisle door which secure end plate to aisle beam.
7. Remove all hardware securing side plate to switchgear frame and hardware securing aisle end plate to aisle wall. It may be necessary to tap knife blade down verticle seam between aisle wall and end plate to cut sealant tape. Sealant tape is soluble in kerosene which may be used to clean surfaces after parting. Remove entire sections from both switchgear and aisle.
8. Remove aisle floor plates from in front of this end unit. These plates must be reinstalled in front of the new end unit.
9. The line-up is now ready for installation of the new unit or units. Follow the instructions outlined under "Installation", Page 9. If the foundation was carefully constructed, there should be no problems with line-up of beams or matching the level of existing equipment.

Table 6. Standard Components – Expanding Length of Existing Shelter-Clad Switchgear

Item	Description	Single Aisle		Common Aisle	
		Part Number	Mk.	Part Number	Mk.
360	Primary Opening Cover	18-657-521	130	18-657-521	130
510	Aisle Roof Assembly	18-729-500	501	18-729-500	501
512	Roof Channel – Aisle	18-730-190	504	18-730-190	504
514	Roof Channel – Units	18-392-988	501		
516	Hood	18-726-888	001	18-726-888	001
618	Panel Brace – Vertical – Aisle	18-726-884	501		
620	Rear Channel – Vertical – Unit	18-392-987	501	18-392-987	501
622	Rear Channel Cover – Bottom	18-657-817	544	18-657-817	544
624	Roof Trim Support	18-657-803	033	18-657-803	033
636	Bridge Trim Strip	18-657-804	076	18-657-804	076
638	Front/Rear Horizontal Trim	18-727-100	501	18-727-100	501
810	Aisle Beam – 1 Unit	18-726-873	001	18-726-873	001
812	Aisle Beam – 2 Units	18-726-873	002	18-726-873	002
814	Aisle Beam – 3 Units	18-726-873	003	18-726-873	003
816	Aisle Beam – 4 Units	18-726-873	004	18-726-873	004
818	Aisle Beam – 5 Units	18-726-873	005	18-726-873	005

10. With new units in true alignment with existing units and properly leveled, bolt units together with .50-inch (12.7 mm) hardware provided.
11. Run aisle wiring from terminal block in existing end unit, through barrier and header to junction box area.
12. Remount all parts removed from existing equipment and caulk all external seams with metal filler. Follow instructions in previous sections for single or common aisle units.
13. Make all electrical connections as instructed on Pages 37 through 67.
14. Caulk vertical split at back of switchgear between existing equipment and new addition with metal filler. Replace bus compartment barriers.

ELECTRICAL CONNECTIONS

Bus Bars

Siemens-Allis 34.5 kV vacuum switchgear utilizes all welded aluminum construction for main bus and line bus runbacks. Ground bus connections, however, are of bolted construction with either aluminum or copper conductors depending upon specific job requirements.

When making bus bar connections in the field, it is important to review and fully understand the configuration to be used; this is shown on the bus arrangement drawing provided with each contract.

For bolted bus bar joints (ground bars or external primary cable areas), the following procedure should be followed:

1. All surfaces must be free of dust, dirt or other foreign material.
2. Assemble all joints as shown in Fig. 20.

NOTE

All hardware furnished is plated high-strength, steel. Cap screws are .50-13 SAE Grade 5. Hexagon nuts are SAE Grade 2. Do not substitute with smaller or lower grade hardware than supplied.

3. Torque .50-13 steel hardware to 50 to 75-lb. ft. (68 to 102 N·m)

Notice in Fig. 20 heavy washers are used on both sides of the bus bar joint — under the cap screw head as well as under the nut and lockwasher. These washers insure an evenly distributed force around each screw, producing a low resistance joint. The torque value of approximately 75-lb. ft. (102 N·m) produces a joint of adequate pressure without cold flow.

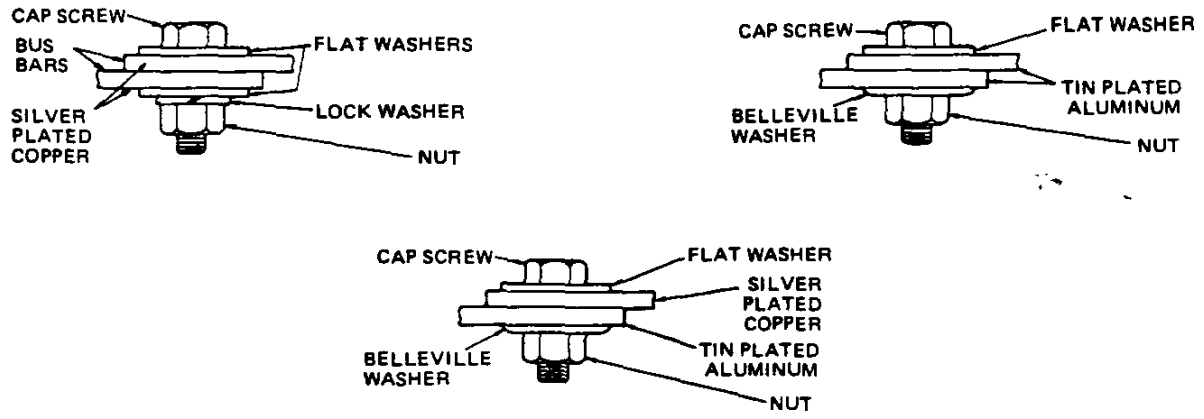


Figure 20. Bus Bar Joint Assembly (Bolted)

Bus Joints

When a switchgear group is split for shipping purposes, the primary bus and ground bus connections must be made when talling the switchgear.

For the ground bus, bolted connections as previously covered above are required.

For the primary bus, welding of aluminum conductors is required and this must be done with extreme care to obtain an adequate and trouble-free joint.

An ideal joint in a bus conductor would continue the cross sectional area of the parts joined in addition to providing mechanical strength.

FIELD WELDING PROCEDURE FOR ALUMINUM BUS

1.0 Scope

This welding procedure specification covers the welding of aluminum conductor components for 1200 ampere and 2000/3000 ampere rated designs of Siemens-Allis 34.5 kV switchgear.

2.0 Process

All welding shall be accomplished by the Gas Metal Arc Welding Process (GMAW) using #4043 aluminum alloy welding wire (AWS A5.10-69, classification ER-4043) or equivalent.

NOTE: A typical wire feeding system is shown in figure #21.

3.0 Joint Preparation

3.1 All joint edges and at least one inch of the adjacent base metal surfaces shall be degreased prior to welding using clean rags or paper towels and an acetone or alcohol solvent.

CAUTION: After cleaning, all solvents, rags and papers should be removed from the weld area to prevent fires.

3.2 After cleaning, all joint edges and at least one inch of the adjacent base metal surface shall be wire brushed prior to welding. Stainless steel brushes shall be used.

3.3 To prevent excessive heating of the bus insulation, dampened asbestos cloth or equivalent shall be used over the insulation adjacent to the joint to be welded. This protection should extend a minimum of 12 inches (305 mm) from the joint.

3.4 Precautions must be taken to prevent weld spatter or other foreign materials from entering the vertical connector procelains when welding the main bus joints, metal, asbestos or foil barriers shall be formed over the opening in the porcelain while welding, and carefully removed after welding. Shields shall also be used to protect all adjacent procelain insulators.

4.0 Preheat and Interpass Temperature

4.1 Preheating of base metals is not required and shall not be done.

4.2 The joint area shall be allowed to cool to below 150° F (65° C) between multiple weld passes and prior to welding opposite sides of conductors. A 150° F (65° C) crayon should be used for temperature indication.

NOTE: The above is necessary to prevent damage to the molded insulation.

5.0 Welding Parameters

5.1 Current type: DCRP (Electrode Positive)

5.2 Filler material: AWS A5. 10-69. Class ER-4043

5.3 Shielding gas: Argon @ 30-40 CFM (.014- .019 m^3/sec.

5.4 Welding technique:

5.4.1 The weld sizes, types of joint, welding conditions and typical number of passes are given in figure 22.

5.4.2 Weld metal shall be deposited using a stringer bead technique.

5.4.3 The gun shall be tilted in the forehand direction approximately 10° (from the vertical) for flat groove and flat and horizontal fillet welding. For horizontal and vertical groove or vertical fillet welding, the gun shall be tilted upward 5-10°.

5.4.4 The weld crater shall be filled by momentarily reversing the direction of the gun travel at the end of each pass.

5.4.5 Each weld pass must be wire brushed prior to the next pass in multiple-pass weld joints. All joints shall be wire brushed when welding is completed.

6.0 Workmanship & Cleanup

6.1 The cross-sectional area of the applied weld shall be as shown in figures (22 & 23).

6.2 Where the contour of parts being joined produces a deep crevice, small voids at the bottom of these crevices are acceptable, however, the dimensional thickness of the weld as shown on the weld symbol must be maintained.

6.3 The finished weld shall be carefully examined to make certain there are no sharp projections of spatter, "bee-bees" or pieces of electrode which would reduce the insulation integrity.

6.4 All molded insulation surfaces and other adjacent insulation materials shall be carefully examined for evidence of soot and other surface contamination. This shall be removed from insulating materials prior to installation of final insulating materials.

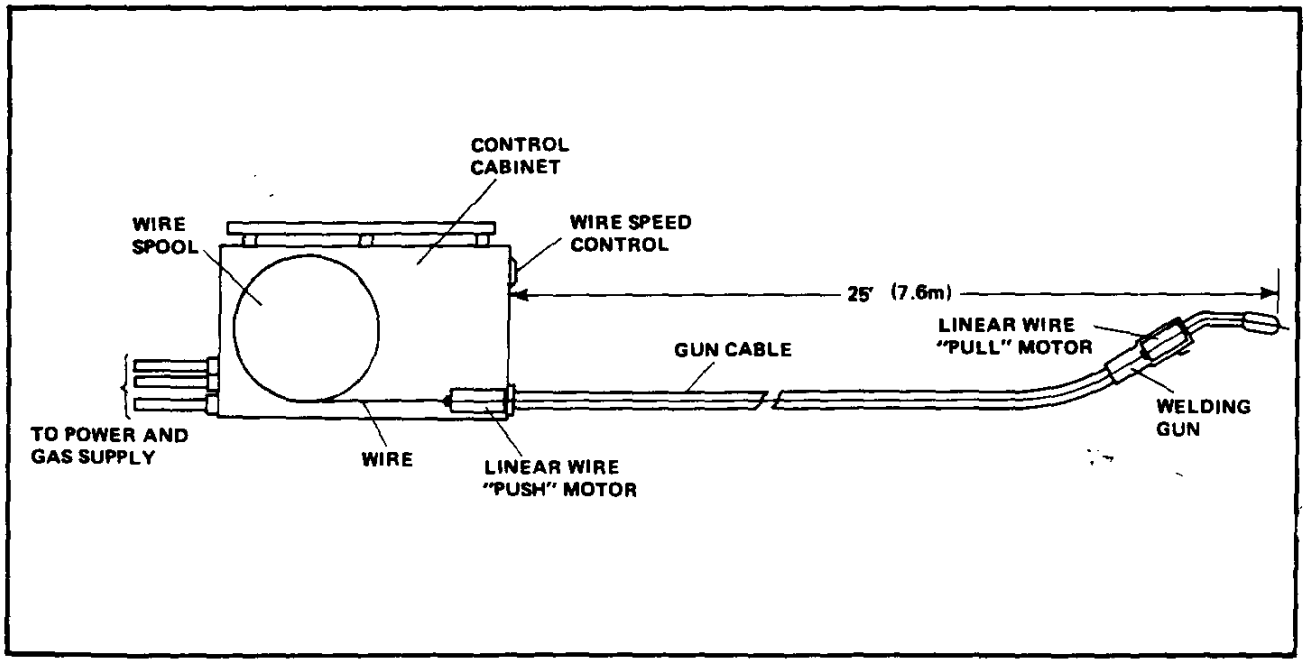
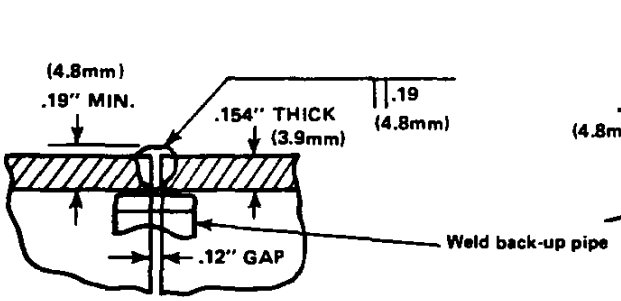


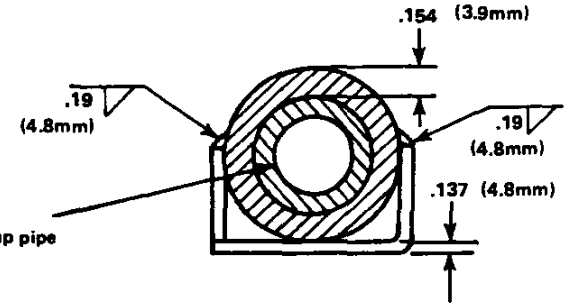
Figure 21. Schematic of Typical Wire Feeding System

WELD JOINT DESCRIPTION	FIGURE NO.	FILLET LEG OR WELD SIZE	BASE METAL THICKNESS	WELD PARAMETERS (DCRP)* AMPS	VOLTS	NUMBER* OF PASSES
B-6	3-1 (Plan) & 4	.19 (4.8 mm)	.154 to .154 w/plug (3.9 to 3.9 mm)	125/155	20.5/23.5	1
B-9	3-1 (Side) & 4	.19 (4.8 mm)	.187 to .154 (4.8 to 3.9 mm)	125/155	20.5/23.5	1 (AER side)
B-5B	3-2 (Side) & 4	.50 (12.7 mm)	.50 to .50 (12.7 to 12.7 mm)	190/230	21.5/24.5	3
B-4A	3-2 (Plan) & 4	.50 (12.7 mm)	.50 to .50 (12.7 to 12.7 mm)	190/230	21.5/24.5	2

*Parameters shown are typical for 3/64 inch (1.19 mm) diameter weld wire.

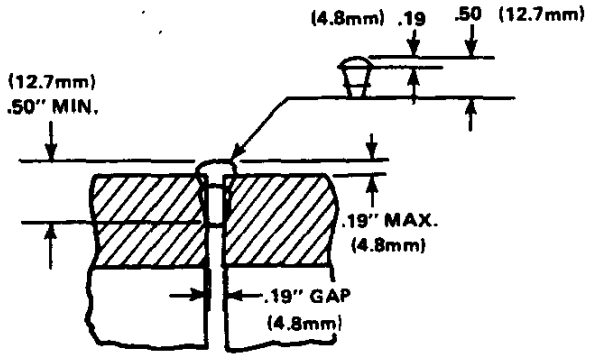


Joint B-6. 1200 Amp Round Conductor Butt Joint

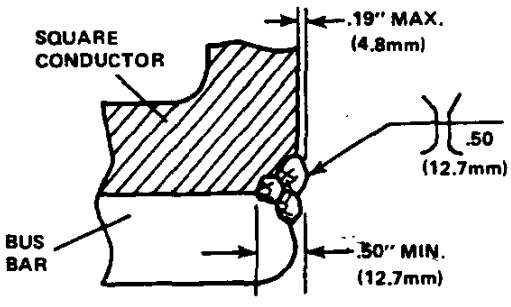


Joint B-9. 1200A Saddle Connection

1200A Main Bus Splice



Joint B-4A. 2000/3000 Amp Square Conductor Butt Joint



Joint B-5B. 2000/3000 Amp Conductor To Bus Bar

2000/3000A Main Bus Splice

Figure 22. GMAW Welding Parameters for Flat, Horizontal, Vertical Fillet and Partial Penetration Groove Welds

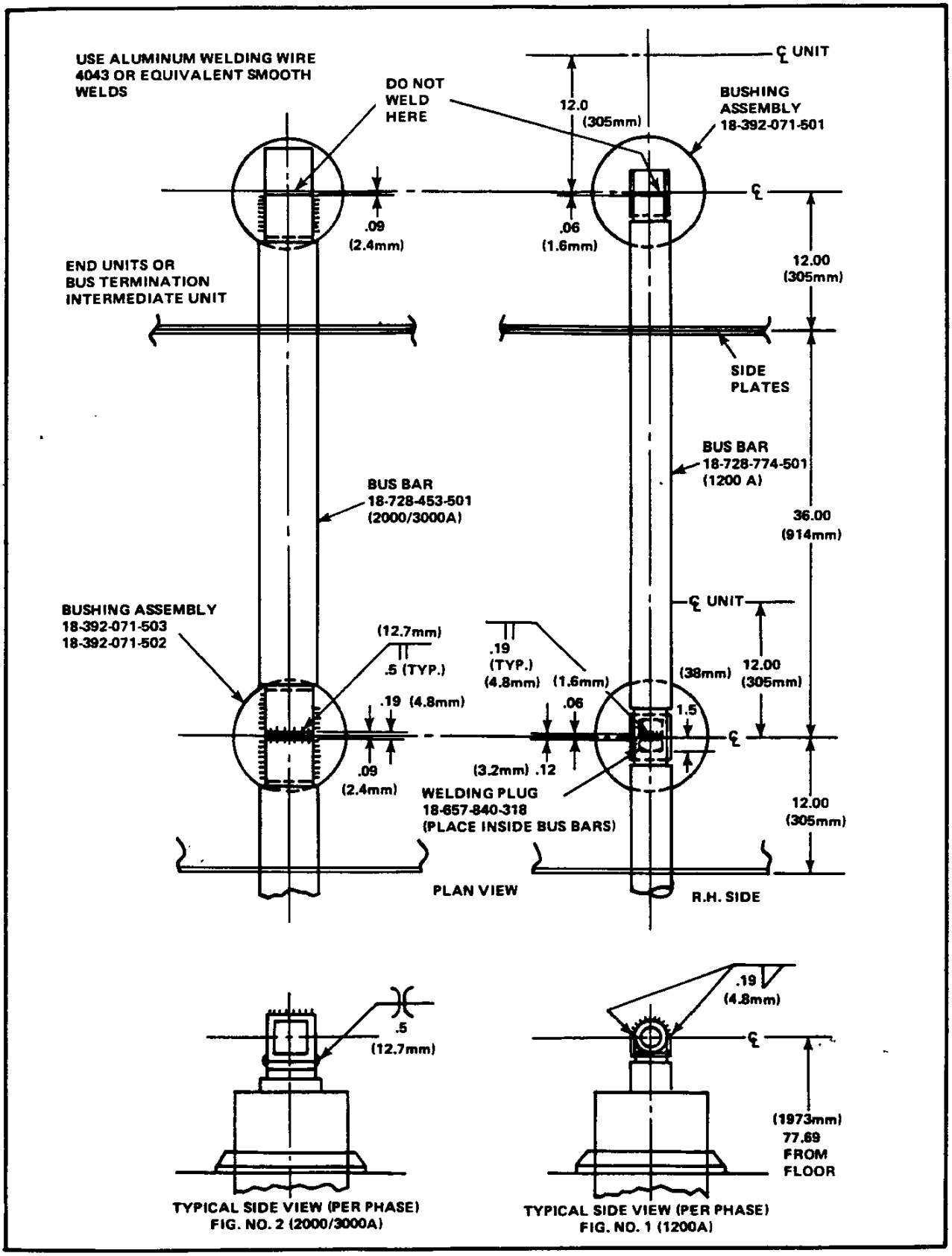


Figure 23. Shipping Split Drawing (Main Bus Welding)

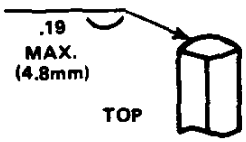
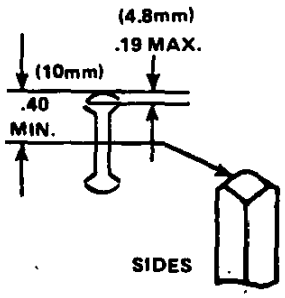
FIELD WELDING PROCEDURE FOR CONDUCTORS IN REAR EXTENSIONS

B1.0 All details of "Field Welding Procedure for Aluminum Bus" on the preceding pages are to be followed except as noted below. This will insure that no damage is done to the factory applied molded or taped insulation or to the tin plating on bolted contact surfaces.

B2.0 Wire Brushing. It is not necessary to wire brush the tin plated connectors prior to the first weld pass as mentioned in 3.2 of referenced supplement; however, where joints require multiple passes to achieve the required weld depth, wire brushing per 5.4.5 of supplement shall be done.

B3.0 Surface Protection. In addition to protecting the insulation as specified in 3.3 and 3.4 of supplement, the bolted contact areas shall also be shielded to protect the tin plating from weld spatter.

B4.0 Welding Parameters. Field weld requirements are shown on drawings supplied with the contract. The following parameters are typical for "GMAW" welding using a 3/64 inch (1.19 mm) diameter weld wire:

JOINT	WELD SIZE	BASE METAL THICKNESS	AMPS	VOLTS	NUMBER OF PASSES
	1.0" x .19 Max. (25.4 x 4.8mm)	.50 to .50 (12.7 to 12.7mm)	190/230	21.5/24.5	1
	.40 Min. (10mm)	.50 to .50 (12.7 to 12.7mm)	190/230	21.5/24.5	2 or 3

A shipping split drawing (18-738-937-401) provided on each contract gives specific details of joint welding (Fig. 23).

Access to the main bus joints for welding is through two hinged barriers in the left-hand side of the unit. To gain access to the hinged barriers, the lower left-hand front cover must be removed. Hinged barriers are then released and lowered against the side plates. This gives full access to the main bus compartment.

NOTE

For 3000A fan-cooled units, the three-phase fan assembly must be removed before hinged barriers can be lowered. This is accomplished as follows (Figs. 22 A and B).

a. Remove front barrier assembly.

b. Remove wires from right-hand side of block on front of fan assembly.

c. Remove top plate by removing four (4) bolts and washers in the corners.

d. Remove two (2) bolts and washers holding fan assembly to front barrier.

e. Slide assembly to the left so that fan baffle will clear opening and remove assembly by pulling straight out of unit.

BUS JOINT INSULATION-TAPING

Insulation covers are provided for repetitive or standard bus joint conditions, however, where covers are not provided, the bus joints must be carefully taped to the required insulation level.

The bus arrangement drawing will indicate the insulation required for ield joints and also the taping specification applicable for taped joints.

Fig. 24 illustrates various bus joint configurations which are completely insulated with insulation covers.

Fig. 25 illustrates various bus joints which are either a combination of taping and insulation covers or fully taped.

Fig. 23 details the steps for taping various joint or connector configurations. These steps must be followed to the letter to assure high integrity of the insulation system.

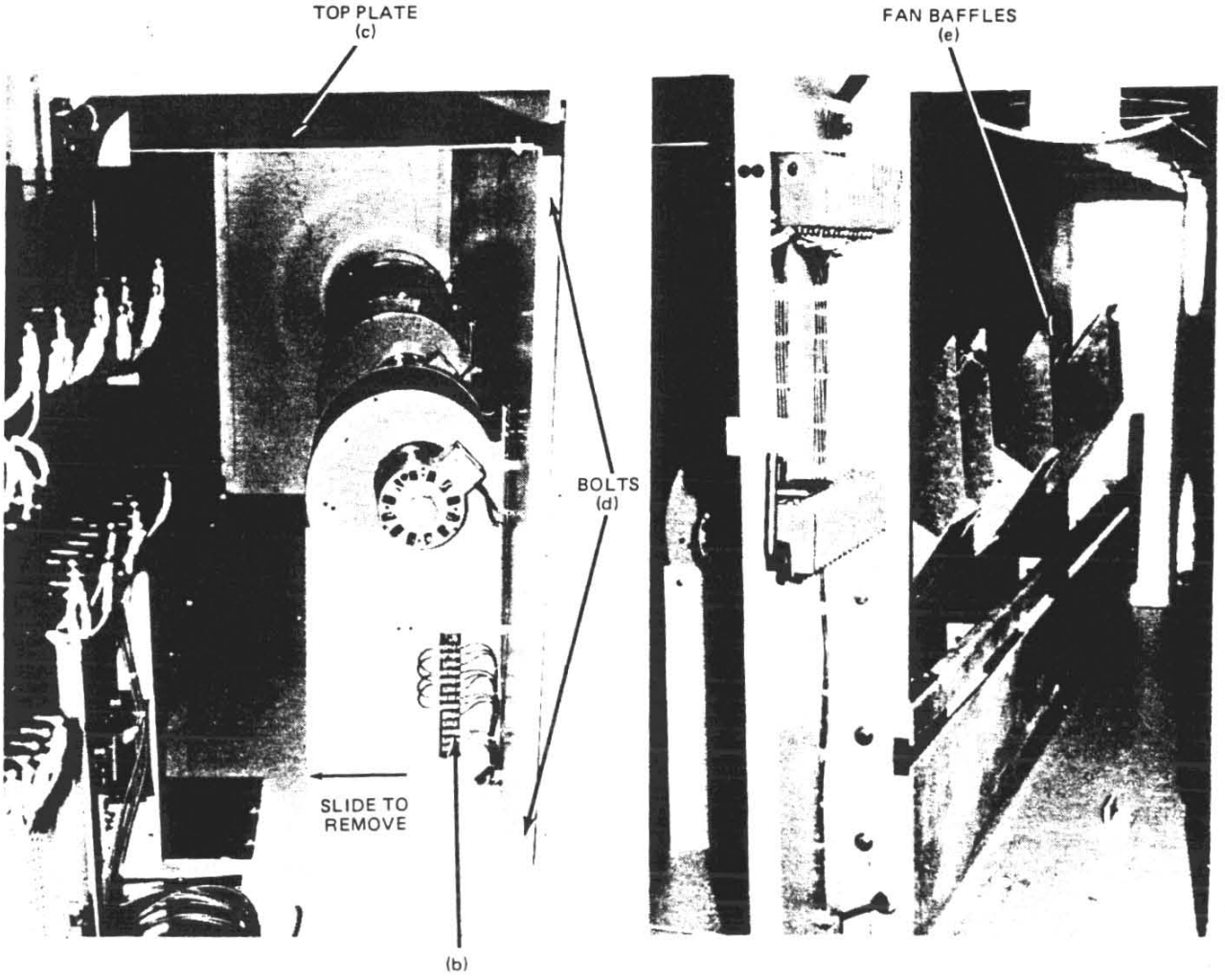


Figure 23A – Fan Duct Assembly Showing Blowers and Blower Outlets

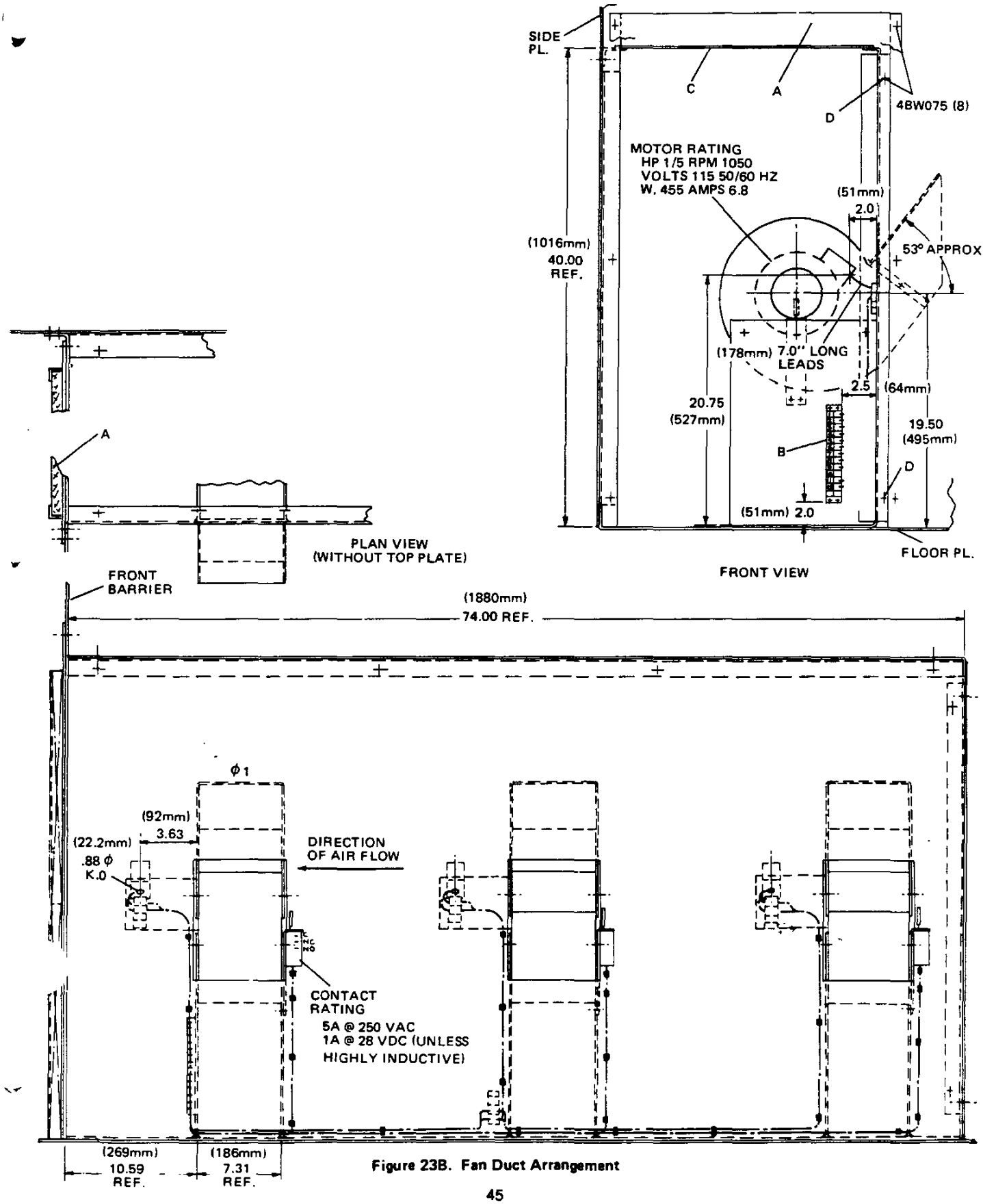


Figure 23B. Fan Duct Arrangement

Figure 23. Insulation Specification

INSULATION SPECIFICATION FOR BOLTED, WELDED OR BOLTED/WELDED JOINTS USED IN 34.5 kV (IV/SIV) METAL-CLAD SWITCHGEAR

Step No. 1: Inspect all welded joints to assure no sharp projections exist.

Step No. 2: Inspect all bolted joints to assure they are clamped tight without causing undue strain on component parts. Draw up all bolts and nuts tightly (25-40 ft-lb (34-54 N·m) for .38 (9.5 mm) hardware and 50-75 ft.-lb (68-102 N·m) for .50 (12.7 mm) hardware).

Step No. 3: Wrap joints with no-corona tape (15-171-164-001) using only as much as necessary to form a regular surface (not necessarily a straight surface) over bolts and/or welds. Air pockets under this tape need not be filled.

Step No. 4: Wrap joints with eight (8) layers of .010 x 18.0 (.25 x 457 mm) wide black polyester cloth (15-171-467-005) so that edges overlap adjoining insulation by 4.0 - 4.25 inches (102 - 108mm) and long enough so that ends overlap by 4.0 - 4.25 inches (102 - 108mm). Stagger the overlapping as much as possible and tie the layers firmly with yellow bias tape .010 x .75 (.25 x 19 mm) wire (00-413-431-100) wrap tightly so as to exclude as much air as possible between layers of cloth and between cloth and adjoining insulation.

Step No. 5: Repeat step no. 4 using a minimum of seven (7) layers of black polyester cloth.

Step No. 6: Complete by applying one layer of .010 x 75 (.25 x 19 mm) wide red flame retardant tape (00-479-441-107) half lapped and pulled tight. This tape to extend a minimum of 1.0 inch (25.4 mm) beyond black cloth.

Material: For joints having an open end 4" (102 mm) sq. tube – 18-657-834-856.

All other joints – 18-657-834-857, 18-471-852-805(T) or 18-395-154-806(T) as applicable.

GENERAL CLARIFICATION

The taping specification detailed on page 43 and the materials supplied by Siemens-Allis (Fig. 26 or job drawings for special configurations) are identical to these used on the design tests and for all factory taped joints; they are recommended for all new tapped joints also.

For some joint configurations, it may be difficult to use the 18" wire polyester cloth. In such cases, it will be permissible to cut the cloth to a narrower, more mangeable width for ease of taping. When this is done, it will be necessary to use a lesser number of layers than indicated in Steps 3 & 4 and repeat these steps a sufficient number of times to produce a minimum of 15 layers at any point along the insulation system. The overlap of these layers must be maintained at 4" to 4.25" (102 - 108 mm) whenever possible.

It is also permissable to use other insulation systems (such as 3M Electro-Products Division #E-2047B-76 "Method of Insulating Bus-Bar Connections").

Note that the taped insulation system has two basic requirements:

1) 60 Hz 1 minute withstand and impuise withstand values per ANSI C3720, Table 1.

2) 38 kV foil test are ANSI C37.20 Para. 5.2.1.4.

As a minimum, any alternate taping system must be tested for 60 kV a-c (85 kV d-c) for 1 minute. If assurance that the alternate system will withstand the 38 kV foil test is desired, this test should be conducted per ANSI C37.20 Para. 5.2.1.4 as follows:

1. Make a sample joint external to the switchgear with identical to the switchgear joint in question.
2. Tape sample joint with the proposed alternate system.
3. Wrap sample taped joint with aluminum foil.
4. Apply 38 kV a-c (54 kV d-c) between bus bar and foil (start at zero and raise gradually to final test value).

5. Joint must withstand voltage of Step 4 for 1 minute.

Siemens-Allis will not supply any materials for these alternate insulation systems.

PRIMARY CONNECTIONS TO SWITCHGEAR

All primary connections to 34.5 kV switchgear must be fully insulated. Because of considerable variations in customer requirements and available cables and potheads or terminators, Siemens-Allis will normally furnish double-bolt, double-clamp terminal lugs only unless contract specifically calls for other termination facilities. All insulating and terminating materials other than lugs and cable supports are also to be furnished by the customer unless otherwise specified in the contract.

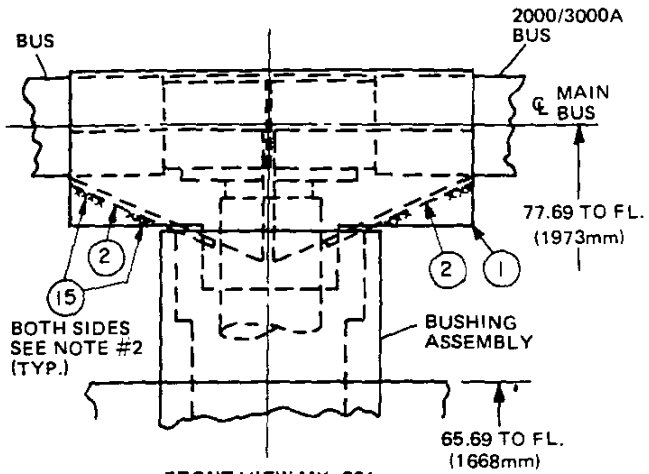
Phase rotation must be considered before primary cable connections are made. Standard phasing (1-2-3 left to right, top to bottom and front to back viewed from breaker drawout side) will be furnished unless otherwise marked on installation drawings prior to shipment of switchgear.

When terminating primary cables, instruction data supplied by the cable manufacturer and cable terminating device manufacturer should be followed. If cable terminators are supplied by Siemens-Allis, the instructions will be furnished with the devices when shipped.

Fig. 26 illustrates field insulation arrangements for connections to single or double terminators, roof bushings or bus duct. This figure together with the taping specification (Fig. 23) should be followed to insure insulation integrity.

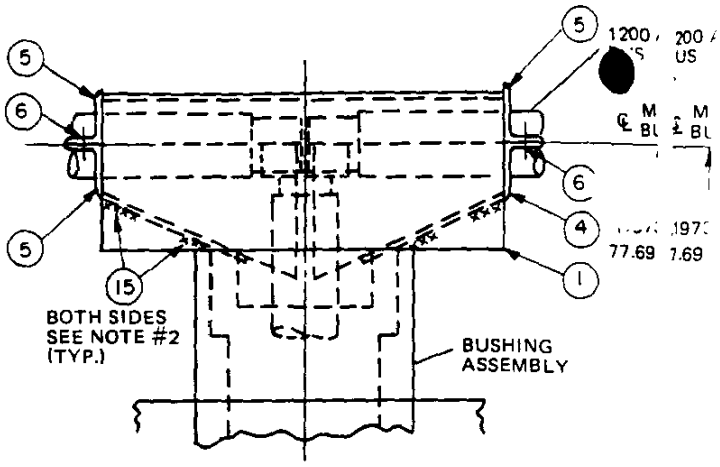
When lightning arresters are mounted in the same compartment as cable terminators, they must be porcelain top design and will be located as shown in Fig. 27. In this case, the connection from the line bus to the LA and terminators will be a flexible connection and will remain untaped. Insulation of these connections is achieved by a system of glass polyester barriers to assure adequate phase-phase and phase to ground clearance. A removable insulating barrier is also provided to prevent access to live connections when rear panels are opened. The barriers between phases 1 and 2 and phases 2 and 3 are removable to provide adequate working space for field installations of LA's and terminators.

If metal top arresters are required (above 27 kV), they require the entire 30" (762 mm) rear entrance section to maintain adequate electrical clearances. A typical mounting of metal top arresters is shown in Fig. 28.



FRONT VIEW MK. 801

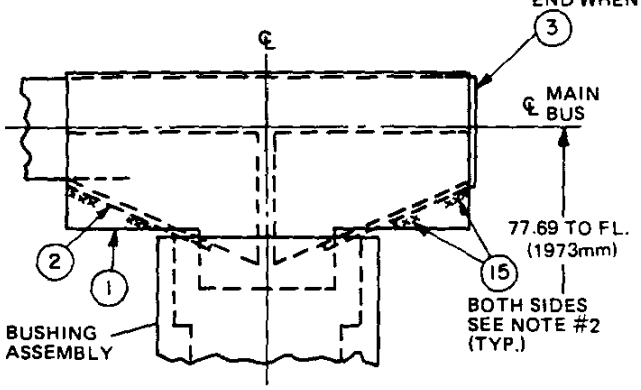
TYPICAL 2000/3000A INTERMEDIATE UNIT BUS INSULATION COVERS. (GOOD FOR A, B OR Cϕ)



FRONT VIEW MK. 803

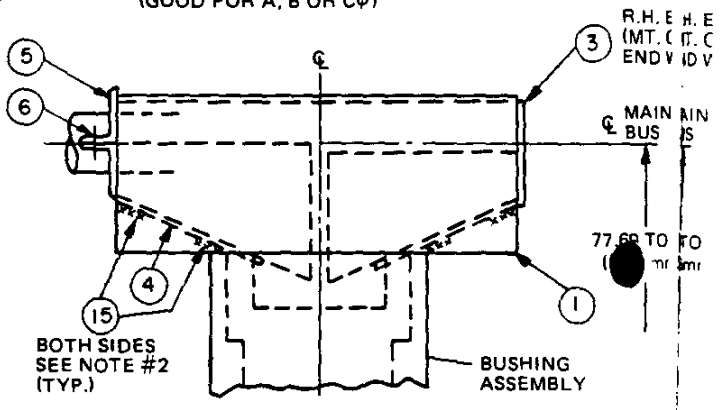
TYPICAL 1200A INTERMEDIATE UNIT BUS INSULATION COVERS. (GOOD FOR A, B OR Cϕ)

R.H. END SHOWN (MT. ON OPPOSITE END WHEN L.H.)



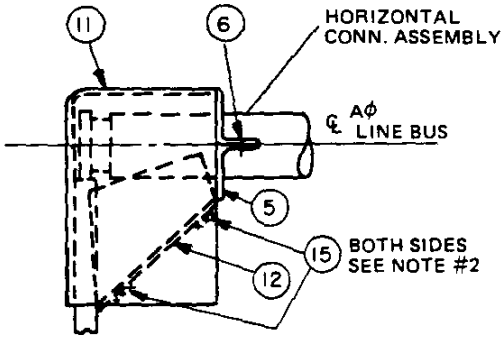
FRONT VIEW MK. 802

TYPICAL 2000/3000A END UNIT BUS INSULATION COVERS L.H. END OR R.H. END (GOOD FOR A, B OR Cϕ)



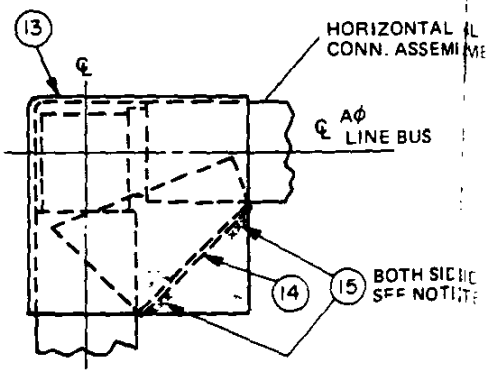
FRONT VIEW MK. 804

TYPICAL 1200A END UNIT BUS INSULATION COVERS L.H. END OR R.H. END (GOOD FOR A, B OR Cϕ)



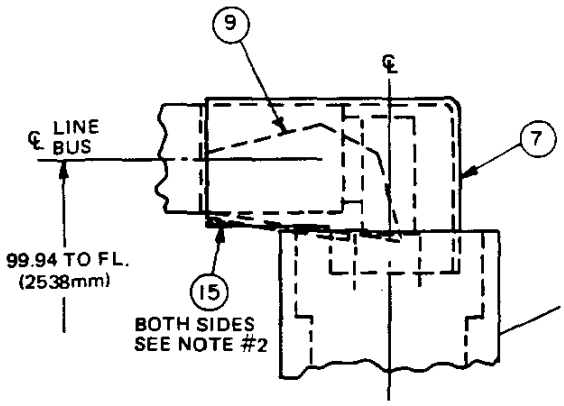
PLAN VIEW MK. 808

1200A

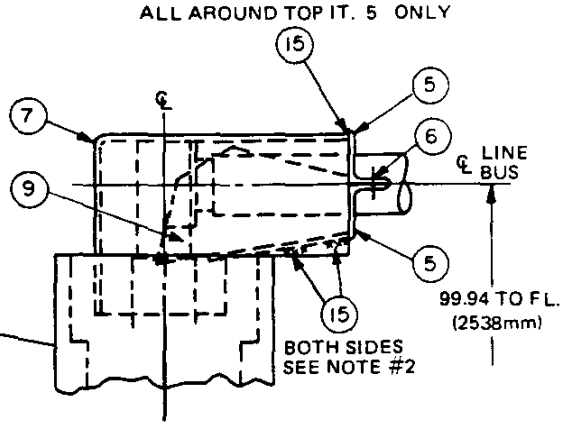


PLAN VIEW MK. 809

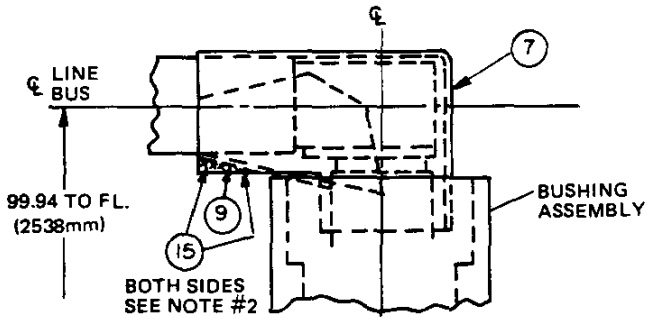
3000A



FRONT VIEW "A" & "B" ϕ MK. 805
1200A



SIDE VIEW "C" ϕ MK. 807
1200A

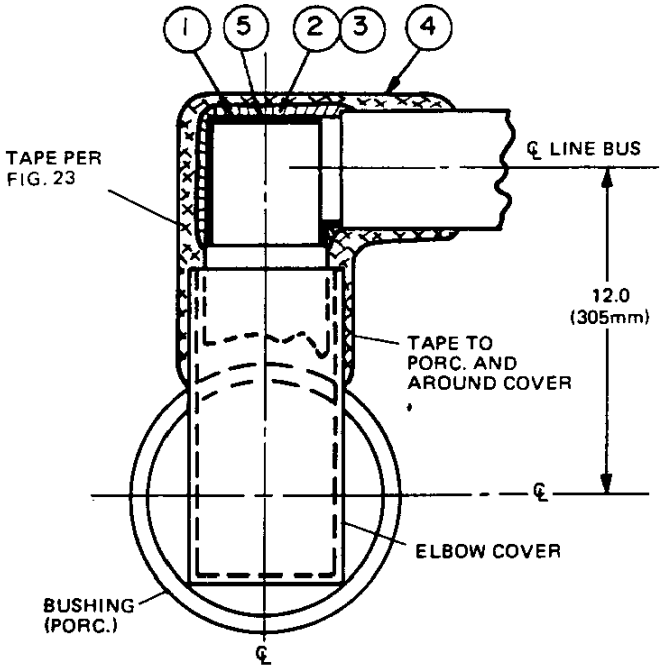


FRONT VIEW "A" & "B" ϕ 2000/3000A
SIDE VIEW "C" ϕ 2000/3000A
MK. 806

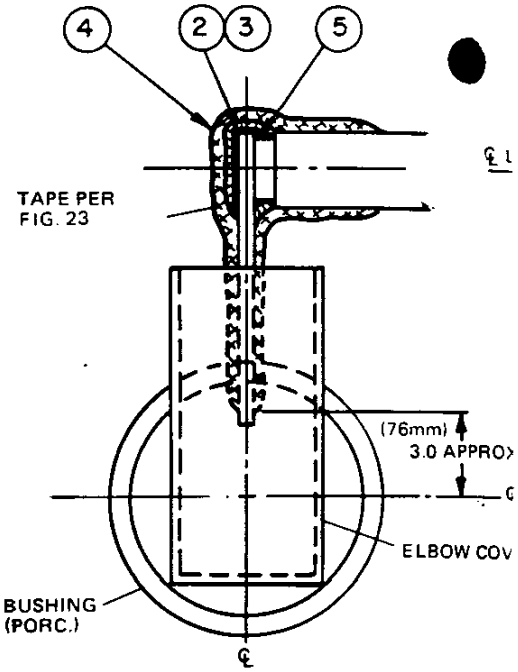
NOTE:
1) SLIDE BARRIERS INSIDE "T" OR "L" SHAPED COVERS TO SEAL OFF OPENINGS.
2) APPLY TO LOCATIONS INDICATED (XXX) TO INSIDE OF "T" OR ELBOW COVERS TO BOND BARRIERS, USE .25 (6.4mm) FILLET BY 1.0 LG. (RTV) IT.15.

Mk. 809 Req.	Mk. 808 Req.	Mk. 807 Req.	Mk. 806 Req.	Mk. 805 Req.	Mk. 804 Req.	Mk. 803 Req.	Mk. 802 Req.	Mk. 801 Req.	Item	Description	Drawing No.	Mk. No.
–	–	–	–	–	1	1	1	1	001	"T" Insulation	18-728-164	001
–	–	–	–	–	–	–	1	2	002	Barrier	18-728-164	005
–	–	–	–	–	1	–	1	–	003	End Barrier Assembly	18-729-009	501
–	–	–	–	–	1	2	–	–	004	Barrier Assembly	18-729-011	501
–	1	2	–	–	1	2	–	–	005	Angle Barrier	18-657-840	092
–	2	2	–	–	2	4	–	–	006	Rivet (Plastic .25)	00-671-501	070
–	–	1	1	1	–	–	–	–	007	Cut Elbow Insulation	18-728-164	003
–	–	–	–	–	–	–	–	–	008	Barrier Assembly	18-729-012	501
–	–	1	1	1	–	–	–	–	009	Barrier	18-728-164	007
–	–	–	–	–	–	–	–	–	010	Barrier Assembly	18-729-010	501
–	1	–	–	–	–	–	–	–	011	Barrier Assembly	18-729-008	501
–	1	–	–	–	–	–	–	–	012	Barrier Assembly	18-728-164	008
1	–	–	–	–	–	–	–	–	013	Elbow Insulation	18-728-164	002
1	–	–	–	–	–	–	–	–	014	Barrier	18-728-164	006
.1	.1	.1	.1	.1	.1	.1	.1	.1	015	RTV Silicone Rubber	00-333-031	025

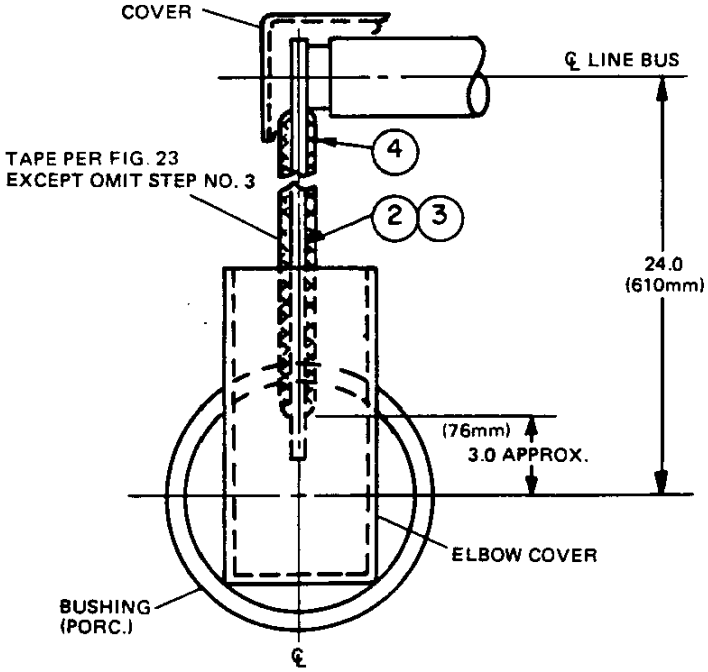
Figure 24. Factory Insulation Arrangement



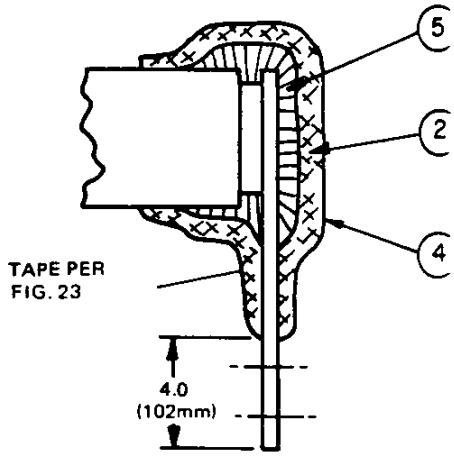
PLAN VIEW – ϕ2 2000/3000A.
MK. 801



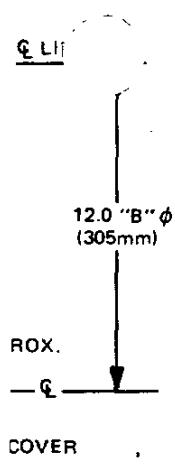
PLAN VIEW – ϕ2 1200A.
MK. 802

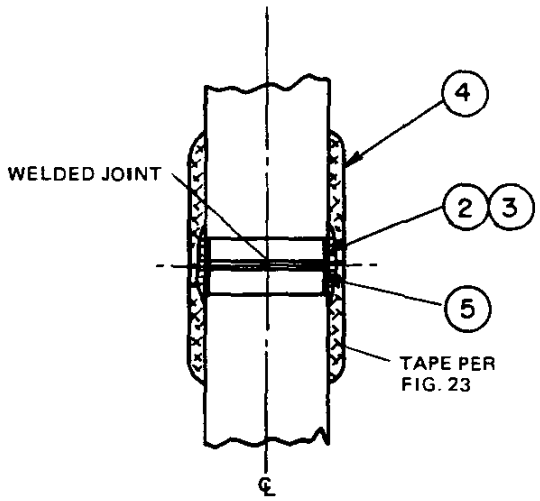


PLAN VIEW – ϕ1 – 1200A.
MK. 805

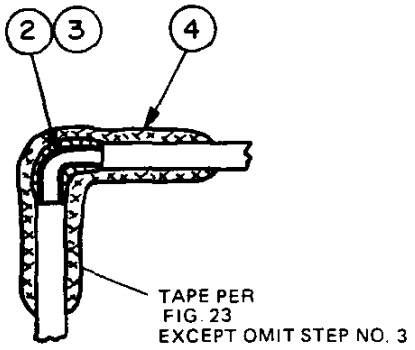


LINE BUS INSULATION
MARK 806
1200/2000/3000

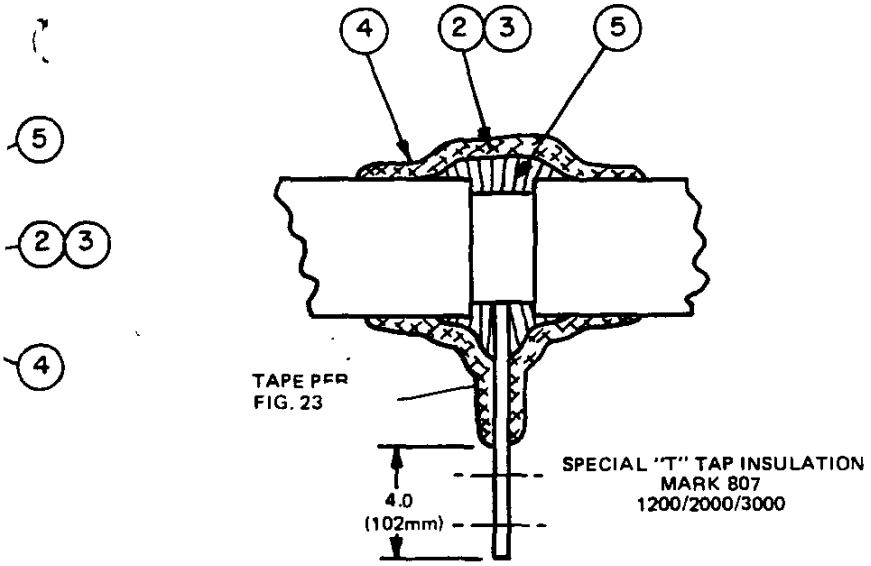




PLAN VIEW – ϕ1, ϕ2, ϕ3 1200/3000A
(STRAIGHT THRU WELDED BUS JOINT)
MK. 803

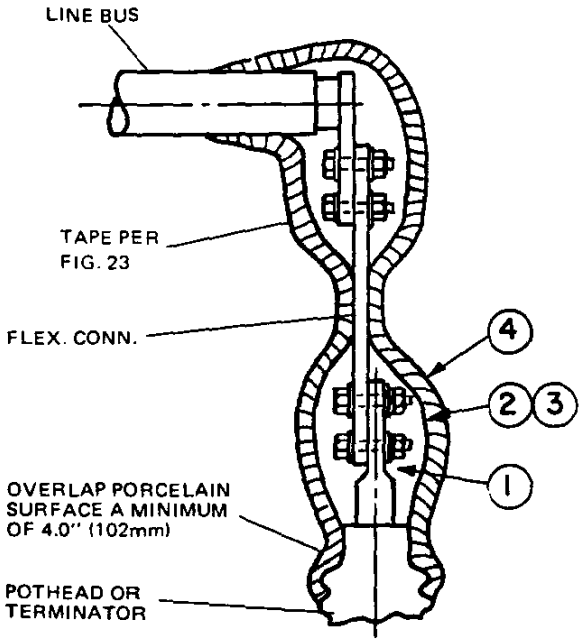


AUX. UNIT CONN. – ϕ1, ϕ2, ϕ3
MK. 804



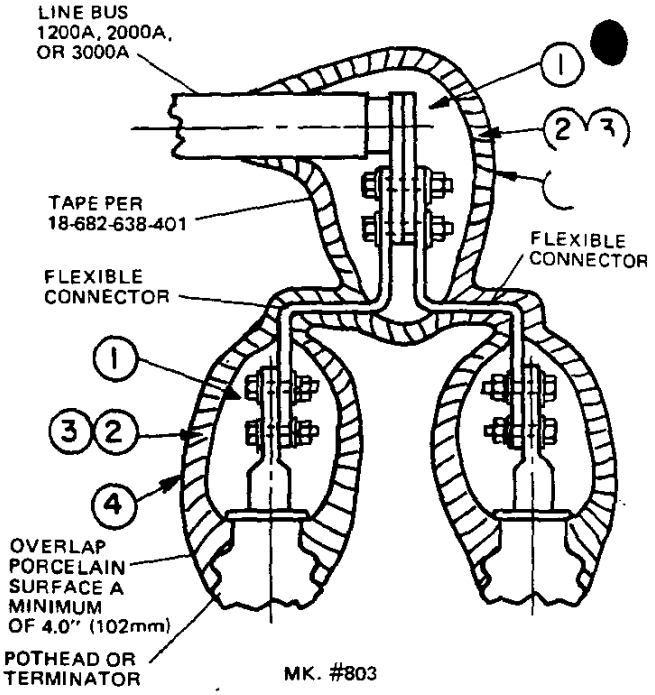
M 80. Req.	Mk. 806 Req.	Mk. 805 Req.	Mk. 804 Req.	Mk. 803 Req.	Mk. 802 Req.	Mk. 801 Req.	Item	Description	Drawing No.	Mk. No.
–	–	–	–	–	–	1	1	Insulation Cover	18-657-840	317
.25 Roll	.25 Roll	.2 Roll	.1 Roll	.1 Roll	.2 Roll	.3 Roll	2	.010 x 18.0 (.25 x 457mm) Black Polyester Cloth	15-171-467	005
.5 Roll	.5 Roll	.5 Roll	.3 Roll	.3 Roll	.5 Roll	.5 Roll	3	.010 x .75 (.25 x 19mm) Yellow Bias Tape	00-413-431	100
[illegible]	.5 Roll	.5 Roll	.3 Roll	.3 Roll	.5 Roll	.5 Roll	4	.010 x .75 (.25 x 19mm) Fl. Ret. Tape (Red)	00-479-441	107
[illegible]	.5 Lb.	–	–	.3 Lb.	.3 Lb.	.5 Lb.	5	Nocorona Tape (Alum.)	15-171-164	001

Figure 25. Insulation Material



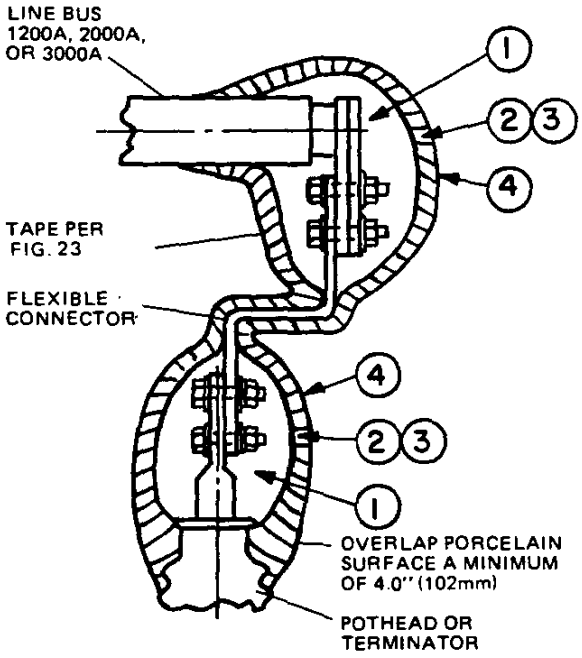
MK. #801

CONNECTION FROM 1200A LINE BUS TO ONE POTHEAD OR TERMINATOR BUSHING



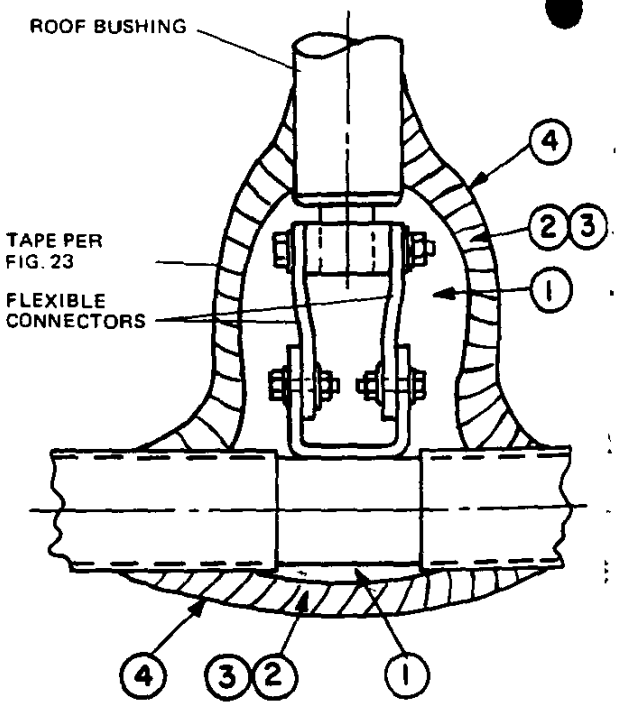
MK. #803

CONNECTION FROM 1200A, 2000A OR 3000A. LINE BUS TO TWO POTHEAD OR TERMINATOR BUSHINGS.



MK. #802

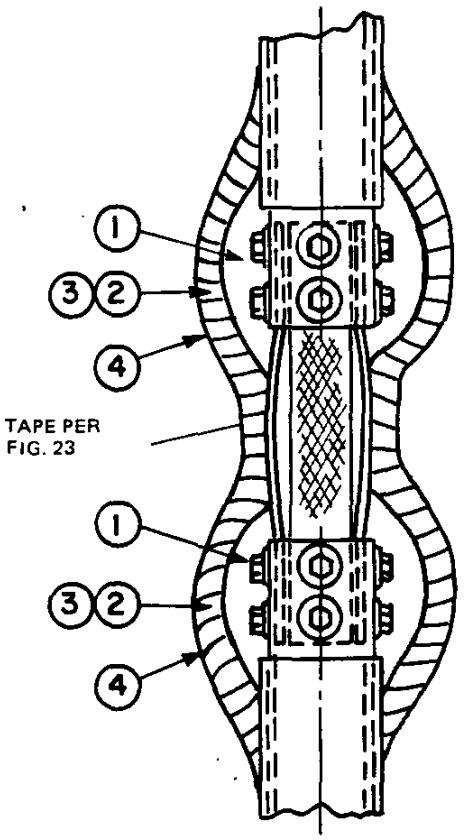
CONNECTION FROM 1200, 2000 OR 3000A. LINE BUS TO ONE POTHEAD OR TERMINATOR BUSHING.



MK. #804

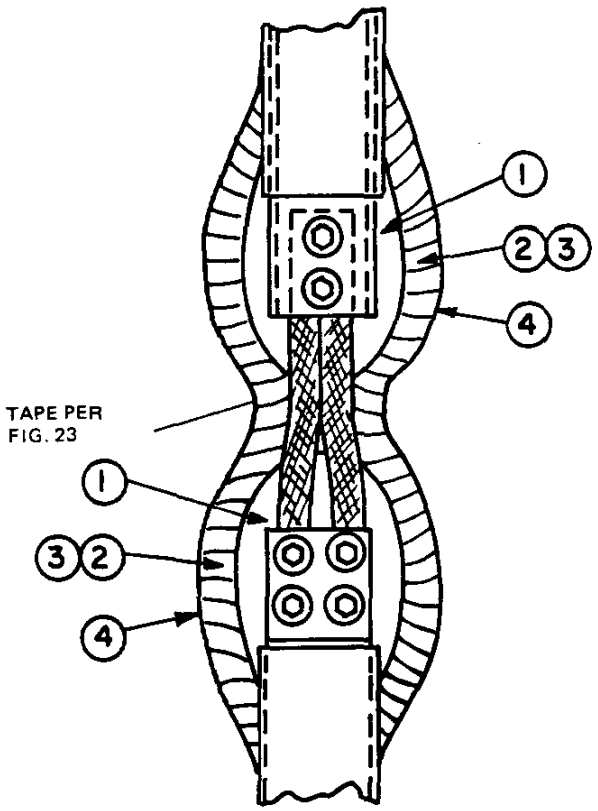
CONNECTION FROM 2000A OR 3000A. LINE BUS TO ONE ROOF BUSHING.

Mk. 806 Req.	Mk. 805 Req.	Mk. 804 Req.	Mk. 803 Req.	Mk. 802 Req.	Mk. 801 Req.	U/M	Item	Part Name	Part Number
1.5	2.0	2.0	1.5	1.0	1.0	lbs	001	Nocorona Tape (Alum.)	15-171-164-001
.5	.8	.8	.8	.5	.5	rol	002	.010 x 18.0 (.25 x 457mm) Black Polyester Cloth	15-171-467-005
2.0	2.0	2.0	2.0	1.0	1.0	rol	003	.010 x .75 (.25 x 19mm) Yellow Bias Tape	00-413-431-100
2.0	2.0	2.0	2.0	1.0	1.0	rol	004	Red Flame Ret. Tape (.010 x .75 Wide) (.25 x 19mm)	00-479-441-107



MK. #805

CONNECTION FROM 2000A OR 3000A. RISER BAR TO 2000A OR 3000A BUS DUCT.



MK. #806

CONNECTION FROM 1200A RISER BAR TO 1200A BUS DUCT

Figure 26. Field Insulation Arrangement

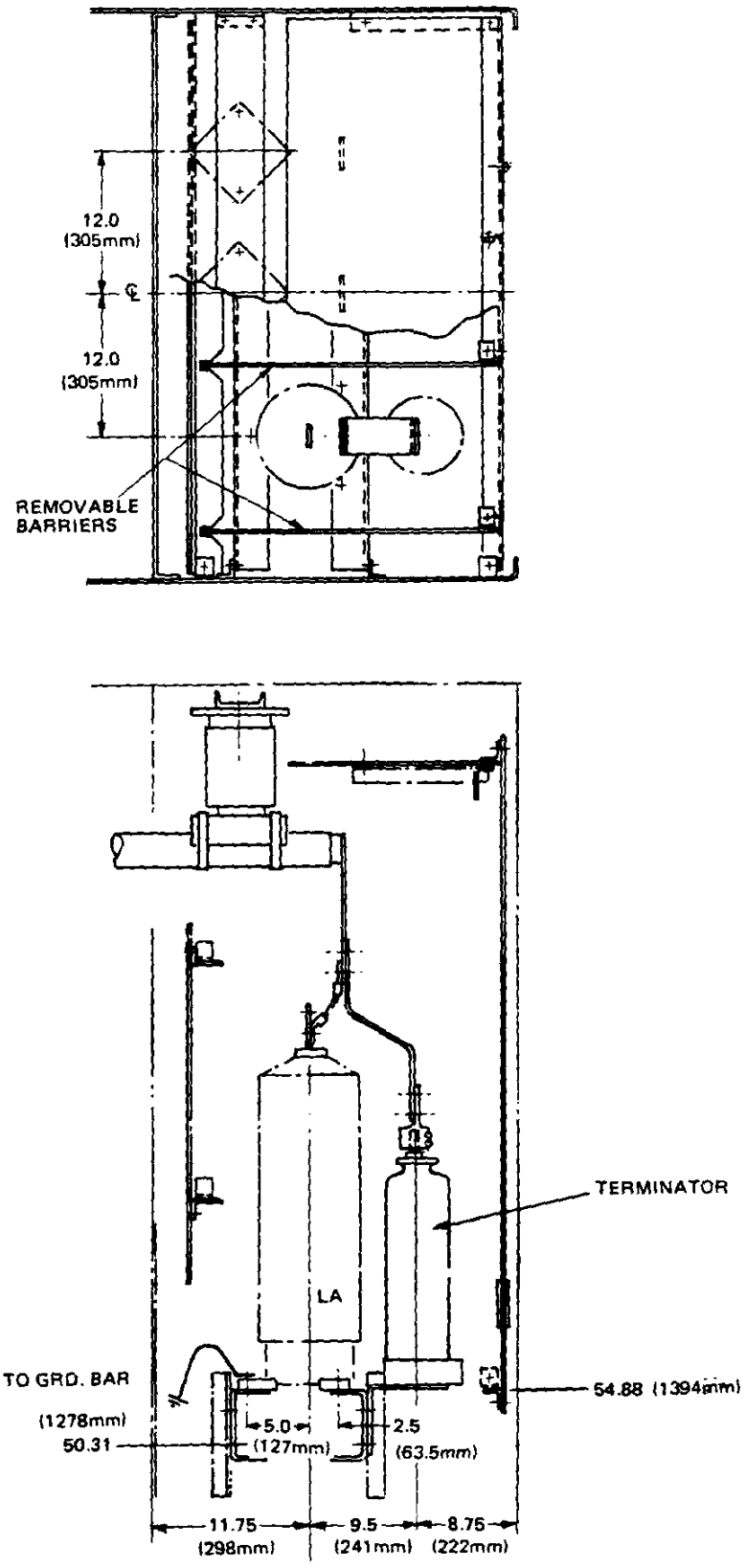


Figure 27. Porcelain Top Lightning Arrester and Terminator Mounting

Wire No.	Panel Wire Chart
C31	TC10-F6
C32	TC11-F12
C33	TC12-F18
C41	TB1-M3
C42	TB2-M9
C43	TB3-M15
C1	TB4-M2
C2	TB5-M8
C3	TB6-M14
CO	TB7-M4-M10-M16
IC1	TB8-L4
IC2	TB9-L6
IC3	TB10-L8
IC0	TB11-L2
C11	D1-M1
C12	D3-M7
C13	D5-M13
C21	D2-F4
C22	D4-F10
C23	D6-F16
AM2	E1-F8-F20
AM1	E2-F2-F14
IC21	G5-N4
IC22	H5-N6
IC23	J5-N8
IC20	J6-H6-G6-K5
IC11	L5-N3
IC12	L7-N5
IC13	L9-N7
IC10	L3-K6
SC1	TC1-A6
SC2	TC2-A5
ST1	TC3-C6
ST2	TC4-C5
V11	TC6-M6
V12	TC7-M12
V13	TC8-M18
V0	TC9-M20
5	TA1-A4-CS1
5A	TA2-A8-CS2
9	TA4-C8-CS4-G2-G3 -H2-H3-J2-J3-K2-K3 -L10-N2
9	CS4-LR2
11	TA5-C4-LR1-LG1-CS3 -G1-H1-J1-K1-N1
12	TA6-B8
13	TA7-LG2
21	TA8-B10
21A	TA8-B1-B7
9A	B9-L1
62-3	TA10-B8
62-4	TA11-B4
RP	TD10-P1
RN	TD11-P3
GB	TD12-P3

NO. 14 WIRE, 00-557-286-341 (SIS) WIRE UNLESS OTHERWISE STATED.

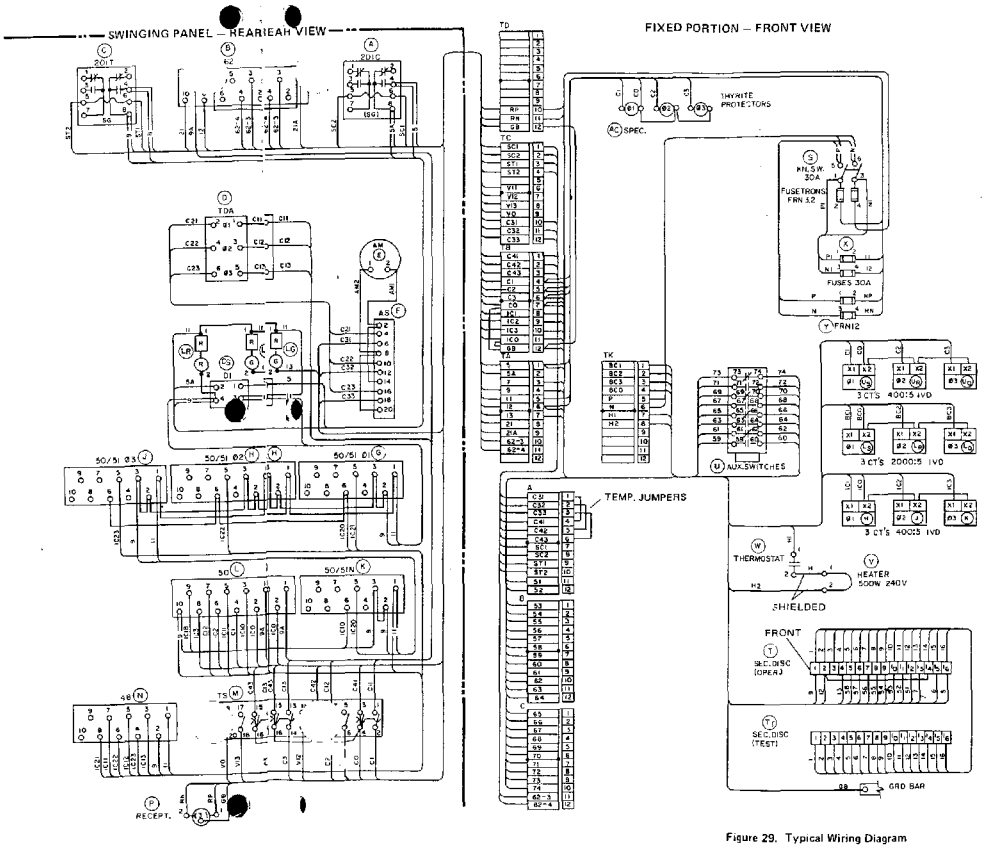


Figure 29. Typical Wiring Diagram

SECONDARY CONTROL WIRING

Secondary control wiring is carefully installed and tested at the Factory. Inter-group wiring at shipping splits can be ly connected by referring to wire markings. All wiring charts needed for installation are furnished in advance. These rts show both the changes originated by purchaser during manufacture and the changes made by the supplier to incorporate the purchaser's changes.

Wires can be traced easily on a wire chart similar to those shown in Fig. 29. Each device is illustrated and identified with a letter. Each terminal on each device is identified by a number. The table on the chart indicates the device and terminal number to which each wire is connected and the next connection point. For example, the designations TC10-F6 appear opposite wire No. C31 in the table in Fig. 29. This indicates that wire No. C31 is connected to terminal 10 of TC, a terminal block and to terminal 6 of F, the ammeter switch.

Wires may be connected to a series of devices. For example, wire No. CO is connected to terminal 7 on TB, the terminal block; then to terminals 4, 10 and 16 on M, the test switch.

All secondary control wiring installed by the Factory is neatly bundled and cleated to the cubicle side plate. Make all field connections in a similar manner. Check that the circuit breaker, its components and panel clear any additional wiring installed. Fig. 30 shows a typical secondary control cable installation. Fig. 31 shows the physical location of maximum number of terminal blocks located above secondary cable entrance to guide customer in designing conduit entrance layouts or control cable locations.

GROUND CONNECTION

A common ground bus is incorporated in all units for properly grounding the equipment after installation. The ground bus is accessible in the primary cable area.

Provision for connecting this ground bus must be made in such a manner that a reliable ground connection is obtained. Consult latest National Electrical Code for ground connection standards.

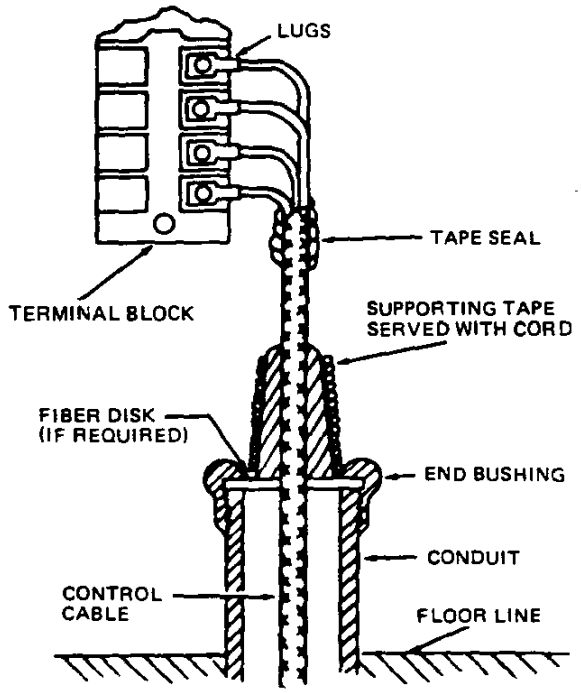


Figure 30. Secondary Control Cable Connections

TEMPORARY GROUND CONNECTIONS

It is recommended that no work be done on current carrying parts until these parts have been disconnected from the system and solidly grounded. One method of solidly grounding the high voltage circuit is by use of a grounding device. This device is placed in a cubicle in the same manner as a breaker and provides a path to ground. It is furnished only when specified in the contract.

POTENTIAL AND CONTROL POWER TRANSFORMERS

Potential and control power transformers are mounted in auxiliary units in a fixed position; the primary fuses are mounted on a removable fuse truck. Fig. 32 illustrates the location of these devices – note that one auxiliary unit can accommodate up to three (3) potential transformers or one (1) control power transformer. PT's are of molded type; CPT is non-inflammable liquid-filled type. When the fuse truck is moved from the connected to the disconnected position, spring loaded grounding fingers automatically ground the PT or CPT primary to remove any charge from the transformers. Truck operated shutters provide a protective barrier between the stationary primary contacts and the operator when the fuse truck is withdrawn from the cubicle.

To remove and replace PT fuses, proceed as follows:

1. Rotate front panel latches 1/4 turn and open panels.
2. Lift cubicle interlock rod (located at lower front of truck) to release truck.
3. Using the two handles near top of truck, pull truck out of unit. This disconnects and grounds transformers. Fuses are now accessible for removal and replacement.

CAUTION

When opening or closing any type of disconnect always perform the action in one complete, continuous motion.

For CPT applications, an interlock circuit breaker is furnished on the secondary side of the control power transformer to prevent disconnecting the transformer unless the circuit breaker is open. This breaker is located in the center of the front barrier directly over the fuse truck. Only when this breaker is opened (disconnecting the load from the transformer) can the fuse truck be moved from the connected position (Fig. 32).

To remove and replace CPT fuses, proceed as follows:

1. Open cubicle doors.
2. Open secondary breaker.
3. Follow steps 2 and 3 under PT instructions.

CURRENT TRANSFORMERS

Current transformers are of the toroidal type and are mounted in the circuit breaker compartment between the channels which support the high voltage disconnects (Fig. 33).

The primary bushings of the circuit breaker serve as the primary bar of the current transformer. Therefore, removing the circuit breaker actually removes the primary bar. It is possible to test the current transformers without removing them from the unit while maintaining maximum operator safety.

This testing should be done at the terminal blocks located in the secondary control compartment accessible through the left-hand front door of the unit.

Current transformers are built to NEMA and IEEE standards. Each current transformer has a nameplate with the following information: type, serial number and rating. When contacting the Factory about transformers, include the nameplate information and identify the cubicle in which the transformer is mounted.

CAUTION

Do not operate any current transformer with secondaries open-circuited.

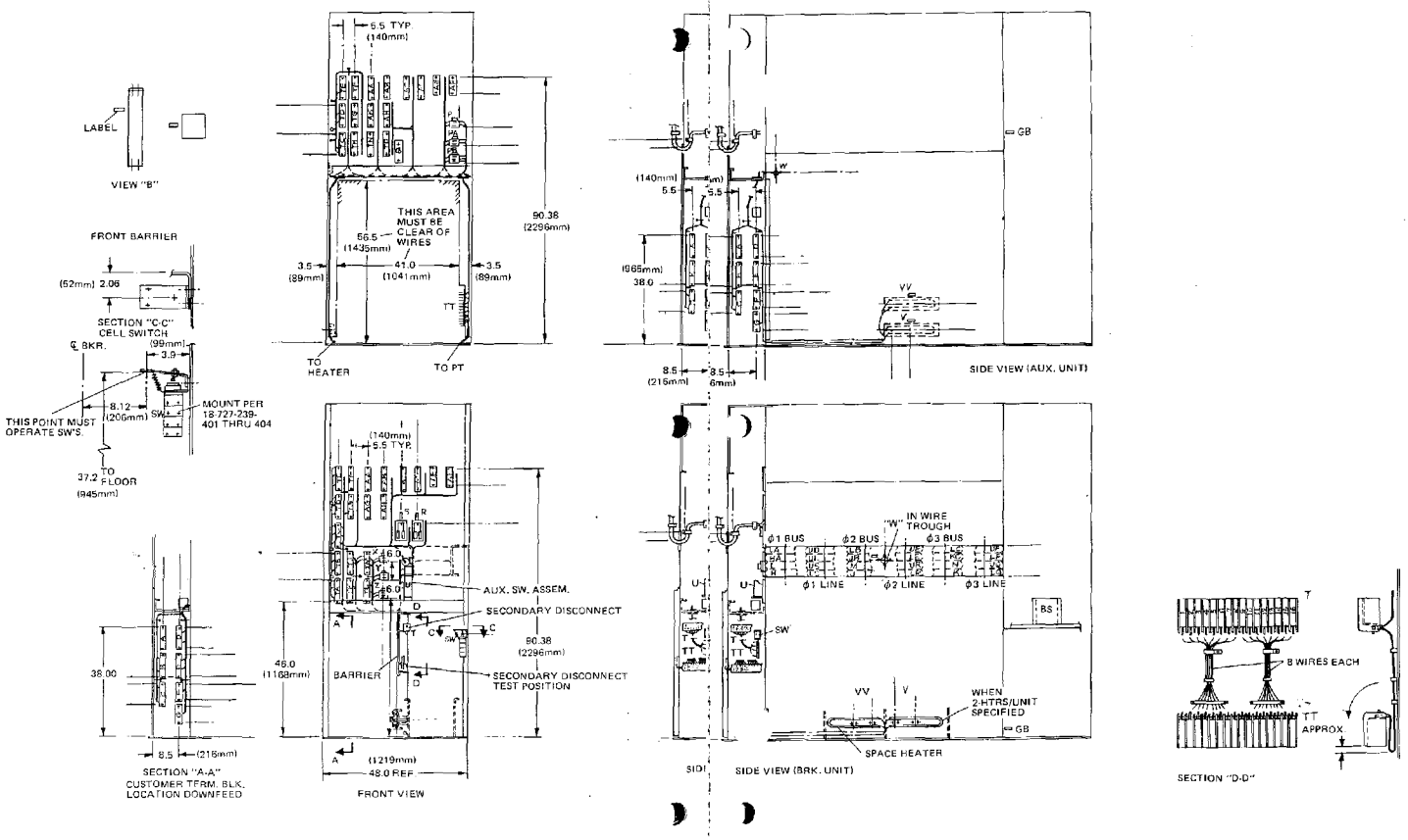


Figure 31. Miscellaneous Auxiliary Equipment

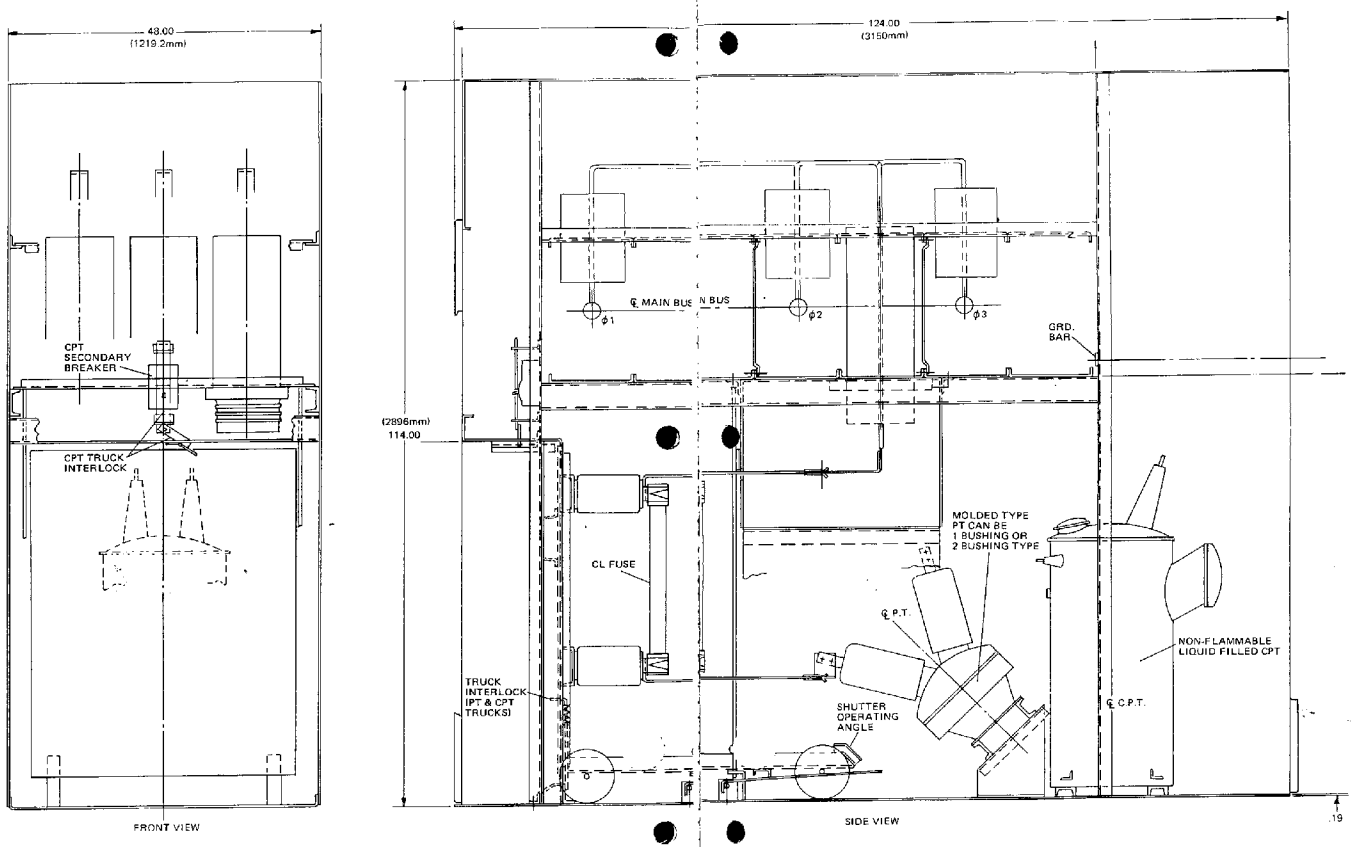


Figure 32. Auxiliary Unit Assembly (Typ.)

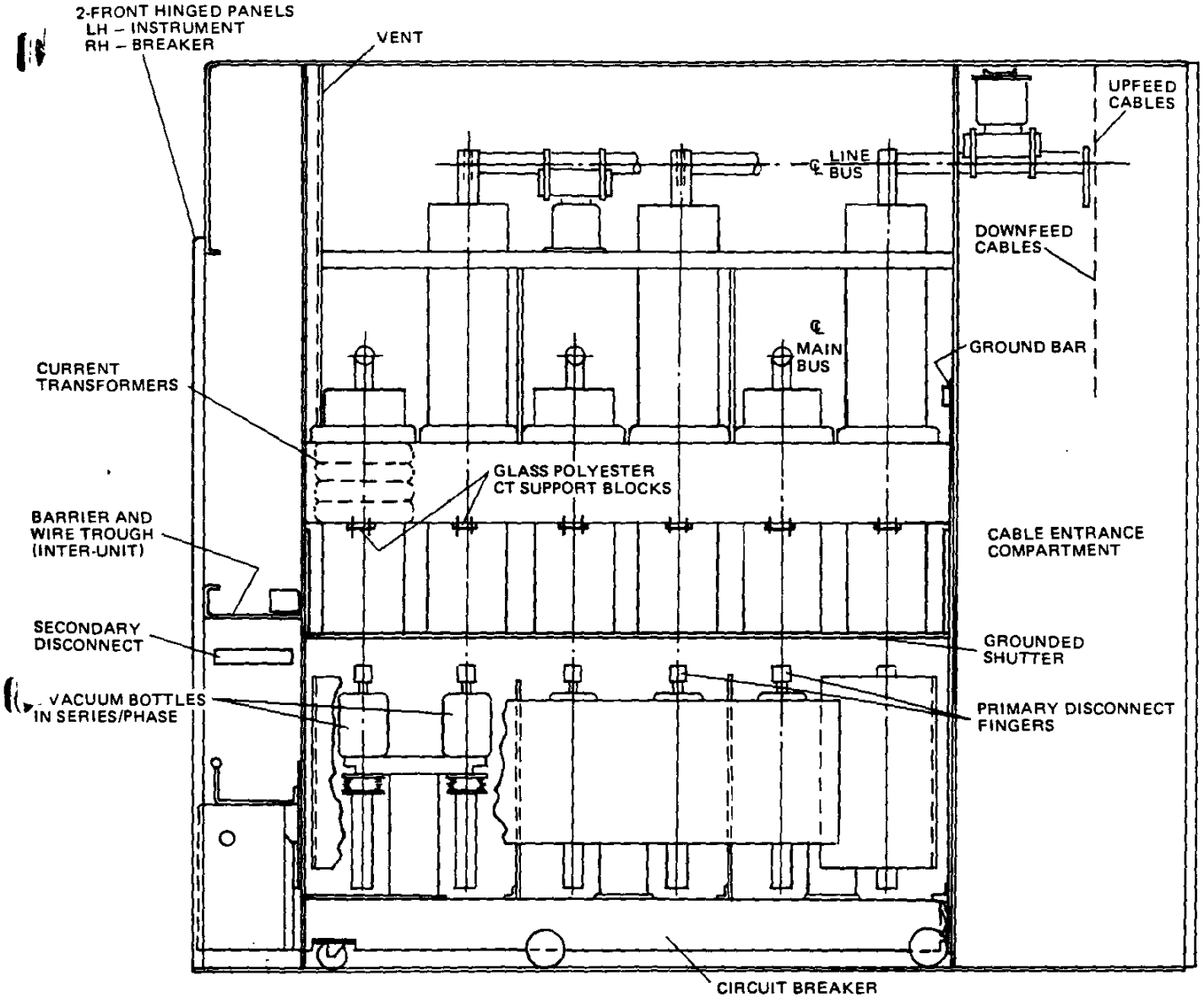


Figure 33. Side View Typical 1200A Breaker Cubicle Showing CT Location

The toroidal current transformers shown in Fig. 34 are the type used in 34.5 kV switchgear equipment. The circuit breaker primary bushings pass through the transformers when in the connected position. Nameplates are located on the outer diameter of the transformer. These CT's are supplied in either single ratio or multi-ratio design.

An elliptical shaped toroidal current transformer, Fig. 35, is furnished for ground sensing circuits. This transformer is mounted in the primary cable area at a convenient height for receiving customer's cables. If shielded cables are used it is important that the ground lead be brought back down through the ground sensing CT and grounded ahead of this CT to insure proper relay operation.

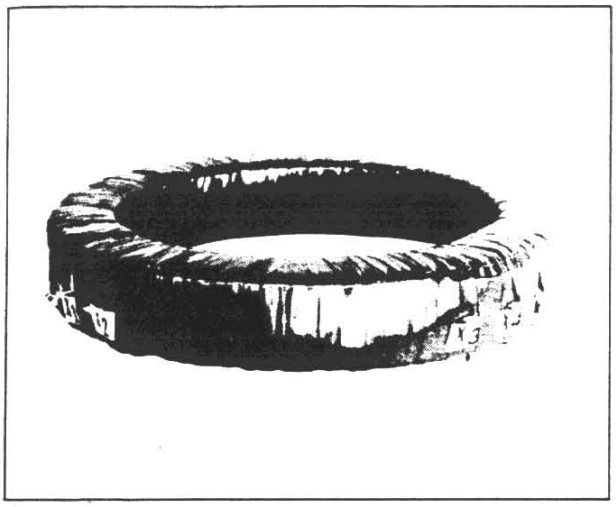


Figure 34. Typical IVD Current Transformer

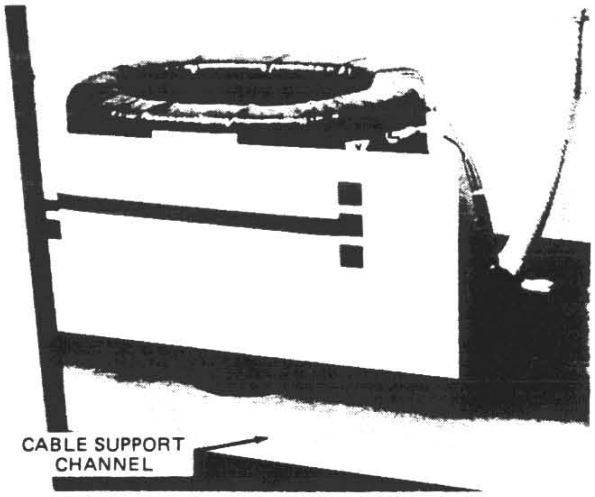


Figure 35. Elliptical Toroidal Current Transformer (Ground Sensor)

CIRCUIT BREAKER INSTALLATION

CUBICLE PREPARATION

The cubicle contains the positioning, interlocking and operating devices described below and shown in Figure 36. These devices must be checked for placement and freedom of operation.

GUIDE RAILS, RACKING SUPPORTS AND MAIN INTERLOCK BRACKET

The funnel-shaped guide rails on the cubicle floor together with slots in the L.H. and R.H. racking supports will align the breaker and assure proper entry into the cubicle. The main interlock bracket is located at the lower right front of the cubicle and contains notches at top and bottom plus an offset angle in front of the bottom notch; These, in conjunction with interlock bars on the breaker, latch the breaker in one of two definite positions. These two positions are disconnect/test (breaker lowered to floor) and operate (breaker raised to full elevation). The circuit breaker is made trip-free (main contacts cannot be held closed, electrically or mechanically) at all times except when the interlock bar on the circuit breaker engages either the disconnect test or operate position as shown in Figure 37.

The main interlock bracket (Figs. 36 and 37) provides three types of interlocking functions.

1. The lower notch which also has a cam face prevents a closed breaker from being rolled into the test position. The racking interlock on the breaker is a sliding bar which extends outward to the right of the breaker. If the breaker is in the open mode, the racking interlock bar will be allowed to slide to the left as it rides up over the cam face of the interlock bracket. This permits rolling the breaker to the test position after which the racking interlock bar springs into the notch behind the cam face. If the breaker is in the closed mode, the racking interlock on the breaker cannot slide to the left, therefore it cannot ride up over the cam face and breaker is held outside of cubicle.
2. The lower notch prevents a closed breaker from being withdrawn from the cubicle in much the same manner as in #1 above. In place of a cam face on the interlock bracket on withdrawal, the front edge of the racking interlock on the breaker is beveled.

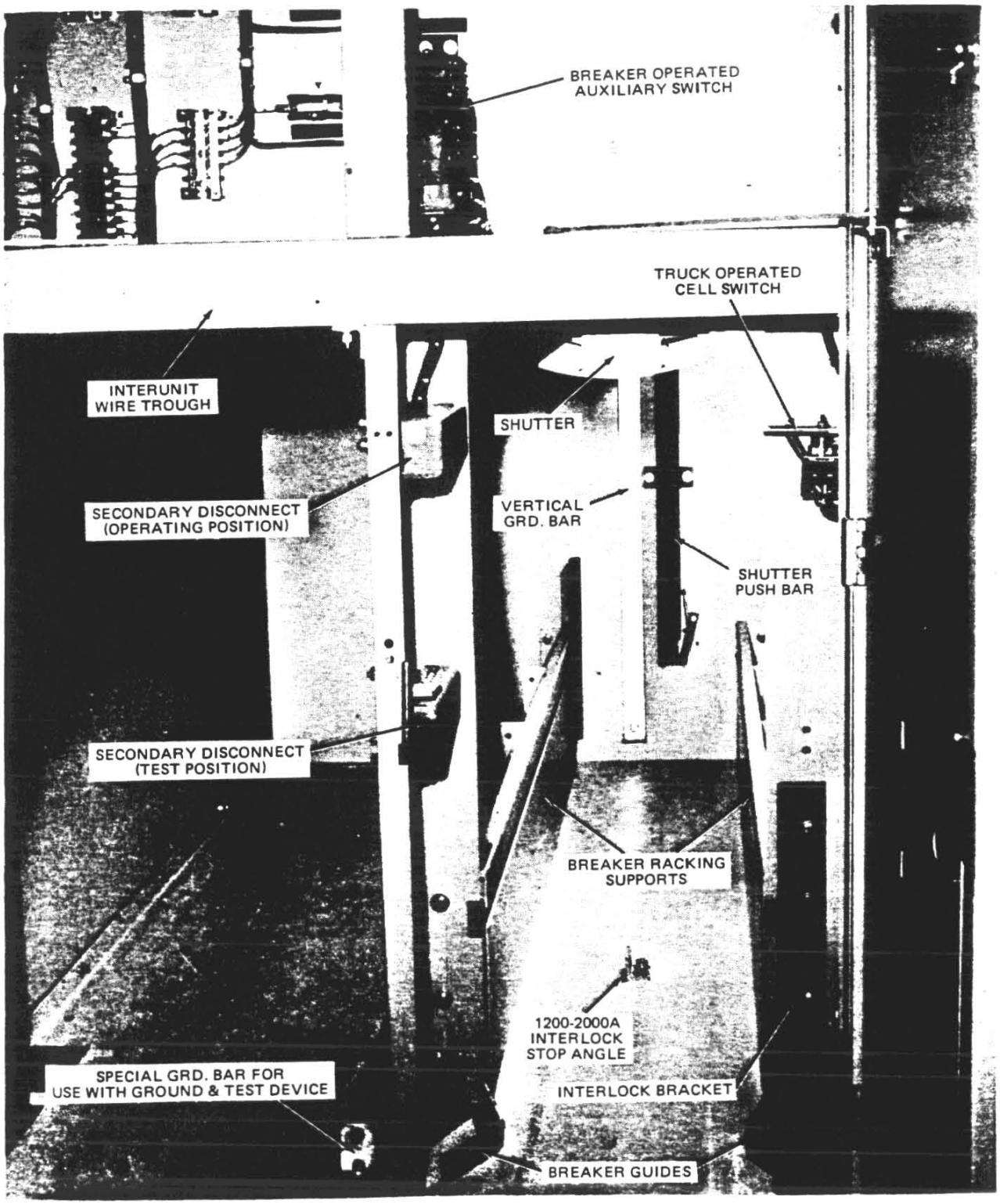


Figure 36. Positioning Interlocking and Operating Devices

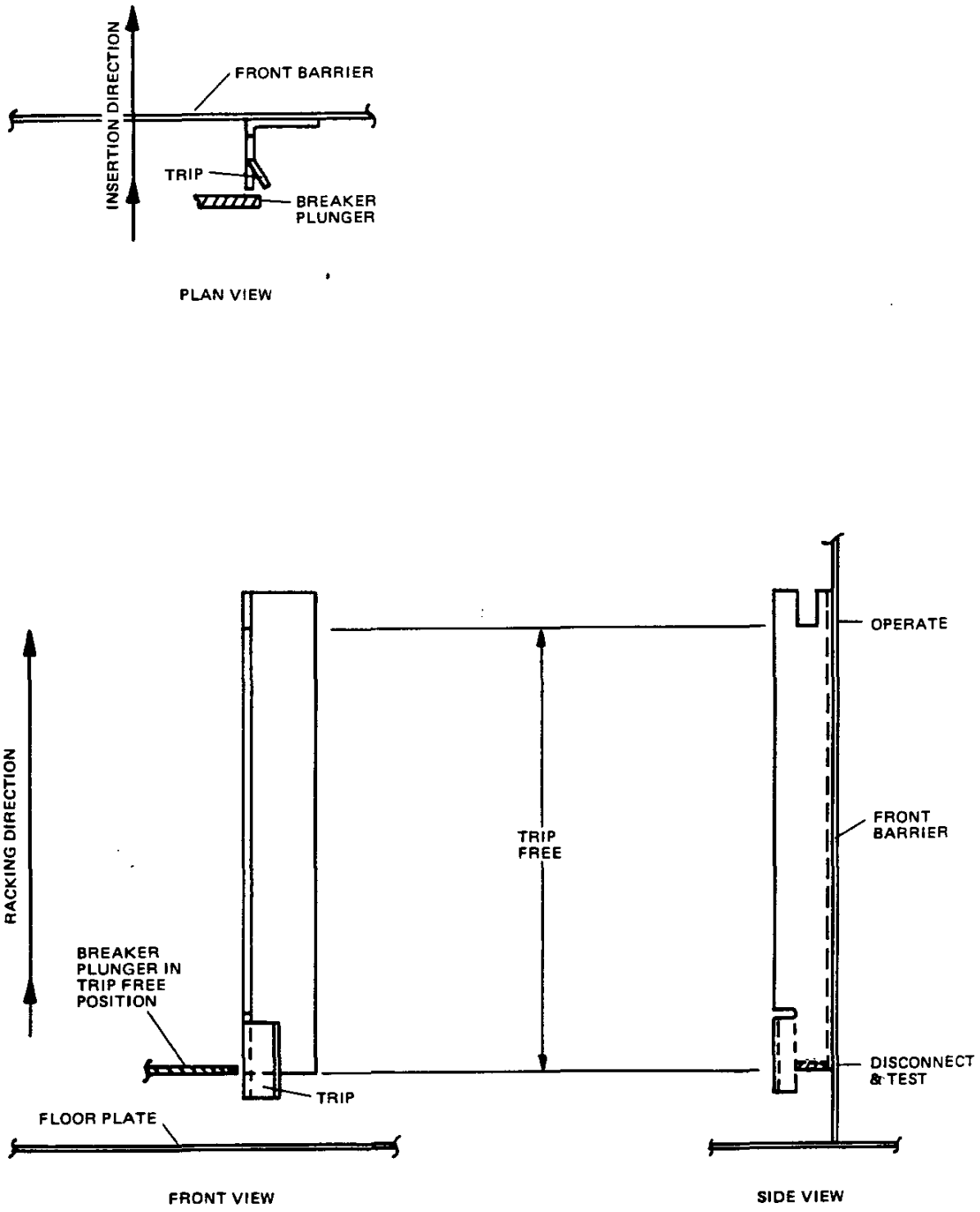


Figure 37. Circuit Breaker Interlock Bracket

3. The upper notch in the interlock bracket allows the closing springs to be charged while the breaker is in he disconnect/ test position. The face of the interlock bracket depresses the spring release interlock on the breaker as it is being rolled into the cubicle. This unloads the springs if they were charged and springs cannot be recharged until the spring release interlock either drops into the upper notch or breaker has been withdrawn beyond the interlock bracket. To withdraw the breaker from the cubicle the spring release lever on the breaker must be moved to the right, which will then cause the spring release interlock to withdraw from the notch in the interlock bracket. This will discharge the springs if they were charged and it will also close the breaker. The breaker must now be tripped to the open mode, hold the spring release lever to the right and withdraw the breaker.

   The face of the interlock bracket also serves to keep the breaker in a trip free state during racking as it holds the racking interlock in a depressed position (Fig. 37).

Interlock Stop Angle

The angle is mounted on the cubicle floor so as to allow only a 1200-ampere circuit breaker to enter a 1200-ampere cubicle and a 2000-ampere circuit breaker to enter a 2000-ampere cubicle. When other special devices restrict a circuit breaker to a specific cubicle, it will be indicated on the circuit breaker rating plate. Normally cubicle and circuit breaker rating plates will be identical. Figure 36 illustrates the placement of the interlock stop angle for a 1200-ampere breaker.

Secondary Disconnect

The secondary disconnect contains all the electrical control circuit connections for the circuit breaker. It mates with the secondary disconnect block on the circuit breaker. The sliding fingers of the secondary disconnect block on the circuit breaker engage the contact strips on the secondary disconnects in both the test and connected (operate) positions. In the test position, the secondary disconnect is engaged by rotating the lower stationary contacts 90° with the handle provided.

Auxiliary Switch

This switch is operated by a cam bar on the circuit breaker. The breaker engages the auxiliary switch in the connected (operating) position and test position. Switch contacts should be lubricated regularly with Siemens-Allis electrical contact lubricant supplied by Siemens-Allis.

Circuit Breaker Ground Connection

A sliding contact finger for grounding the circuit breaker frame is mounted at rear of the breaker. This finger engages a vertical ground bar mounted at rear of the cubicle and maintains a solid ground contact with a continuous wipe through the test and connected positions. The contact is broken when the breaker is being removed from the cubicle.

Shutter Operation

Through the engagement of a cam on the shutter push bar with a cam follower on the breaker, the shutter opens as the circuit breaker is raised into the connected (operate) position, and closes as the breaker is lowered. Shutter is fully closed with the breaker at the test position and is opened when the breaker is just above the test position.

CIRCUIT BREAKER PREPARATION

CAUTION

Remove Packaging. Breakers are shipped in closed position. Do not trip breaker open until reading the breaker instruction manual 18X5763.

Refer to the circuit breaker manual 18X5763 for instructions on handling and preparing the circuit breaker.

CIRCUIT BREAKER INSERTION

After the circuit breaker has been prepared in accordance with instructions in the breaker manual, check to see that control power is off and primary system is de-energized. Visually inspect the cubicles and remove any foreign material that might hinder or prevent smooth insertion of the breaker. Proceed as follows:

1. Line up the circuit breakers in front of their respective cubicles.

2. Check that circuit breaker interlock will pass interlock stop angle on floor of cubicle.

3. Apply a .03 to .06 (1 to 2 mm) layer of electrical contact grease inside primary finger clusters at contact point area. Siemens-Allis electrical contact lubricant, No. 15-171-370-002.)

NOTE

The finger clusters are lubricated in preparation for the check of the primary contact engagement which is made when circuit breaker is removed, (see step 6) and also to protect contact surfaces (see step 7).

4. Move breaker into disconnect/test position. See Racking Instruction (page 66). The funnel-shaped guide rails on the cubicle floor and guide slots on the racking supports will align the breaker with the cubicle on entry. When the disconnect position is reached, the interlocks on the circuit breaker will drop into the interlock bracket notches. In this position, check the following items:

   a. That secondary contacts have good contact alignment. This can be done by rotating the test position secondary block (lower of two blocks) see Fig. 25, Book 18X5763, until it engages the secondary fingers on the breaker; leave in test position for steps e, f, g and h.

   b. That ground contact is made (rear of breaker)

   c. That shutter operating pin has engaged mating hole on circuit breaker and shutter interlock latch has released.

   d. If manual charging crank has been used, remove it. Then energize control power and proceed with the checks outlined in steps f, g and h.

NOTE

Breaker is a stored-energy type: spring-charging motor will start immediately. Wait until springs are completely charged (motor stops) before proceeding.

   f. Close and trip breaker electrically two or three times using panel-mounted control switch.

   g. Close breaker mechanically by pulling the manual close pull rod and tripping mechanically by operating trip button.

   h. Close breaker and attempt to rack. Racking handle cannot be turned while breaker is closed.

      Manually trip the breaker and again attempt to rack. One or two clockwise turns of the racking handle will cam out the racking interlock if the circuit breaker is open and will allow the breaker to move toward the connected position. Note that the shutter moves away from the disconnects with the first few turns of the crank.

      It is normal for the first one or two turns of the racking crank (in either direction) to require higher than normal torque to cam out the interlock; if the high resistance to turning is encountered after two turns, check to see that the breaker is in the open position.

5. Raise the breaker to the connected position. (See Racking Instructions, below). The breaker will travel 15 inches (381 mm) to reach this location at which time the interlock bar will drop into the connected position notch.

   If the springs are discharged, the charging motor will start immediately upon reaching this position. However, with control power on, if breaker stopped in test position, the mechanism would have charged and retained its charge between positions. Perform the following checks in this position:

   a. Electrically close and trip breaker to check operation in the connected position.

   b. Check ground contact.

6. Lower breaker and remove it from cubicle to check the length of engagement of the primary contact fingers over the straight portion of the stationary contact surface. The contact point of the fingers must have a minimum wipe of .12 inch over this portion. This can be observed by opening the shutter and with a flashlight noting the polish marks on the stionary contact surface. Remove excess grease from the contact fingers.

WARNING

STATIONARY PRIMARY DISCONNECTS MUST NOT BE ENERGIZED WHEN OPENING SHUTTERS.

7. Before final installation of circuit breakers, check that all primary disconnect studs and contact fingers and secondary disconnect strips and fingers are lubricated with a film of the Siemens-Allis electrical contact lubricant provided. This lubricant will insure a long service life for the contacts and will protect them against corrosion. Lubricant Siemens-Allis No. 15-171-370-002.

RACKING INSTRUCTIONS

A crank for raising or lowering the breakers is provided as a standard accessory. Racking can be accomplished with the circuit breaker front panel open or thru a small door in the front panel, with this panel closed. (See Figure 38).

Insert crank into opening at front of breaker operator panel until it engages the end of the racking screw.

Rotate crank clockwise to raise breaker or counterclockwise to lower breaker.

As an optional extra, an electrical racking package can be supplied for operation from a 120 VAC source. It consists of a motor on the breaker plus a control package and limit switches installed on the fixed portion. A portable electrical racking device is also available for operation from either a 120 VAC source or a 125 VDC source.

Figure 38. Breaker Racking, Manual

INSPECTION AND TESTING

INSTALLATION, INSPECTION AND TESTING

Before the equipment is put in service, it must be thoroughly inspected and tested. Correct any defects immediately.

Check the following points:

1. High voltage connections properly insulated.
2. Electrical disconnecting contacts, machine parts, shutter, etc., checked for lubrication and operation.
3. Blockings, supports and other temporary ties removed from breakers, instruments, relays, etc.
4. Proper fuses correctly placed.
5. Temporary wiring jumpers (used on the secondaries of current transformers tied to external devices, as shown on wiring diagrams) removed.
6. Ground connections properly made.
7. Incoming primary and secondary connections properly made and checked for shorts or undesired grounds as well as proper phasing.
8. All equipment, removed during assembly, replaced.
9. Relays coordinated with other relays, etc., on the system. Refer to relay instruction book before making any adjustments. Consult local power company before making any connections to the power supply.
10. Storage battery fully charged and provided with recharging facilities.
11. Interlocks performing properly.
12. Circuit breakers checked and prepared per instruction books.
13. All filters in vent areas are clean and free of shipping or construction material.

FINAL TESTING

1. A megger test is made on the high voltage circuit to be sure that all connections made in the field are properly insulated. A megger test is also advisable on the control circuit.
2. A dielectric test, if possible, should be made on the high voltage circuit for one minute at one of the following voltages. (Potential transformers, control transformers, lightning arresters, surge capacitors must be disconnected during this test.)

Rated kV	Test kV	
	AC	DC
34.5	60.0	85.0

A dielectric test on secondary and control circuits should be made at 1200 volts.

The above voltages are in accord with NEMA Standards.

3. With breaker in the test position make the following tests on each unit.
   a. Trip and close the circuit breaker with the control switch.
   b. Trip the breaker by passing sufficient amps (or volts) through the coils of protective relays.
      b1. Caution "certain control devices (motors, motor circuits, etc.) 75% of 900 volts or 675 volts."
   c. Trip and close the breaker from any remote control positions.
   d. Operate auxiliary devices.
   e. Test the phase sequence of polyphase high voltage circuits, particularly those used for motor starting.

OPERATION

To place equipment in service for the first time proceed as follows:

1. Check that all circuit breakers are open and all control circuits energized.
2. Connect primary incoming power source to equipment.

> **NOTE**
>
> The primary incoming power source should be at the lowest voltage possible and gradually brought up to normal.

3. Check all instruments, relays, meters, etc., during this time.
4. Connect as small a load as possible and observe instruments.

> **NOTE**
>
> Allow several minutes before connecting additional load.

5. Gradually connect more load to the equipment while observing instruments until full load is connected.
6. Check for overheating of primary and secondary circuits and satisfactory operation of all instruments during the first week of operation.

MAINTENANCE

> **WARNING**
>
> Before any maintenance work is performed within primary compartments, make certain that the equipment is completely de-energized, tested, grounded, tagged or properly identified, and released for work in an authorized manner.

Thorough inspections at periodic intervals are important for satisfactory operation. The frequency of inspection depends on installation conditions and is determined by experience and practice. Make inspections at least once a year – more frequently if local conditions require. Conditions affecting inspection and maintenance scheduling are weather and atmosphere, unusual number of operations, experience of operating and maintenance personnel and special operating requirements.

After the frequency of inspection has been established, include the following items in your inspection procedure.

1. Inspect switchgear interior for accumulation of dust, dirt or any foreign matter. Remove dust from all insulators.
2. Clean air filters by washing in any mild household detergent.
3. Check instrument and control switches and inspect their contacts.
4. Examine indicating lamps and replace as required.
5. Check terminal block contacts for loose connections.
6. Inspect bus bars and connections for proper condition. If bus bars are overheating, check for poor or loose connections or for overload.
7. Check for proper condition of instrument transformers. Replace burned out fuses, if any. Check primary and secondary connections.
8. Examine automatic shutters for proper operation.
9. Examine all safety interlocks.
10. Perform maintenance of circuit breakers as outlined in circuit breaker instruction manual.
11. Check space heaters and thermostat (if equipped) for proper operation.

CUBICLE LUBRICATION

It is essential that switchgear be lubricated carefully and properly to guard against corrosion and to insure that all operating parts work freely.

A tube of Siemens-Allis electrical contact lubricant is furnished by Siemens-Allis packed with accessories, for this purpose. Old grease should be removed annually and current carrying parts relubricated. Relubricate at more frequent intervals if required. Lubricant Part No. 15-171-370-002.

ELECTRICAL CONTACTS

Lubricate stationary silver-surfaced contacts and auxiliary switch contacts with contact lubricant furnished by Siemens-Allis, prior to use, as follows:

1. Wipe contacts clean.
2. Apply lubricant to contact surfaces.
3. Wipe off excess lubricant, leaving a film.

CAUTION

Avoid getting lubricant on insulation.

Do not use Siemens-Allis electrical contact lubricant on non-current carrying parts. Non-current carrying parts which may require lubrication are to be lubricated with Beacon P-290 grease.

CORROSIVE ATMOSPHERES

This switchgear is designed to give top performance when installed in normal indoor or outdoor locations. Where abnormal conditions, such as corrosive atmospheres, are encountered, special precautions must be taken to minimize their effect. Exposed metallic surfaces – non-insulated bus bars, disconnect switches, primary and secondary disconnecting contacts, wire ends, instrument terminals, etc., – must be protected. At each maintenance inspection all of the old grease should be wiped off of the contacts and new lubricant applied to all sliding surfaces. Apply the material in a layer between .03" and .06" (1 - 2mm) thick. Use only Siemens-Allis Electrical Contact Lubricant, part no. 15-171-370-002, available in 8 oz. (.23 kg) tubes. Other exposed members can be protected with a coat of glyptol lacquer or any other corrosion-resisting paint.

When old grease becomes dirty, wipe the parts clean and apply new grease immediately.

RELAYS AND INSTRUMENTS

To insure satisfactory operation of relays and instruments do not leave device covers off longer than necessary. When a cover has been broken, cover the device temporarily and replace broken glass as soon as possible.

EQUIPMENT SURFACES

Matching paint, one pint per three units, thinned and ready for use, is supplied with each order for touching up any scratches, etc., made during installation. Inspect the surface and retouch where necessary. Paint is furnished in one pint spray cans.

Inspect the cubicle surfaces and touch up scratches as necessary. Use the paint furnished with the unit. This paint matches the cubicle, is thinned and ready for use in spray-on pint cans.

ACCESSORIES

KEY INTERLOCK

When specified, a key interlock can be supplied to prohibit closing a breaker. The interlock bar is attached to the guide bar. In the locked position, the lock bolt is extended, locking the breaker in the trip-free position. Then the key can be removed to release disconnects or associated equipment for operation.

This interlock is cleared for normal breaker operation by returning disconnects, etc., to normal operating position and inserting the key into its lock, permitting withdrawal of the bolt and releasing of the cam follower bar.

TESTING DEVICE

When specified, a plug jumper is supplied so that a breaker can be operated (tested) outside its compartment with the control switches on the instrument panel. This plug jumper is used to bridge – with a flexible cable – the secondary disconnects so that the breaker can be electrically closed and tripped, see Figures 39 and 40. Refer to Figures 41 and 42 for plug jumper connection instructions.

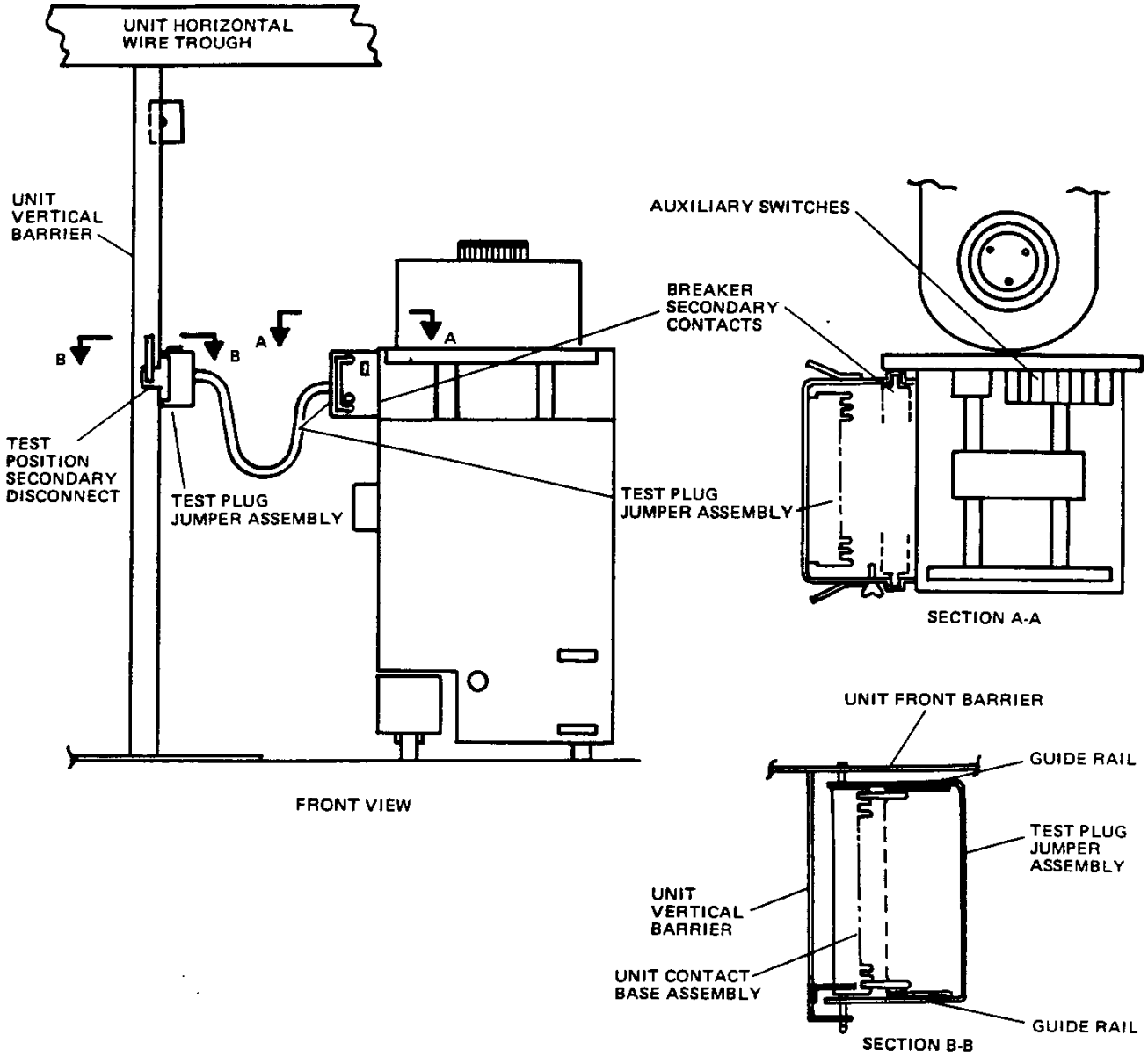


Figure 42. Connecting Breaker Secondary to Cubicle

GROUND AND TEST DEVICE

A ground and test device (Fig. 43) is available for use in phasing out and potential testing of line and bus circuits. The device is furnished with six studs which terminate within the unit. Access to stud terminals is through insulating doors which are clearly marked to indicate stud position.

When this device is furnished, a special ground bar (see Fig. 36) is provided in the breaker cubicle to allow connection of ground ties for grounding dead bus of feeder circuits for maintenance protection

Fig. 44 shows a ground and test device in the disconnected position while Fig. 45 shows the device in the connected position within a breaker cubicle.

PORTABLE RACKING MOTOR

A portable racking motor for elevating or lowering a breaker in its unit is also available. This motor can be supplied for either 120 VAC or 125 VDC operation at customer's option.

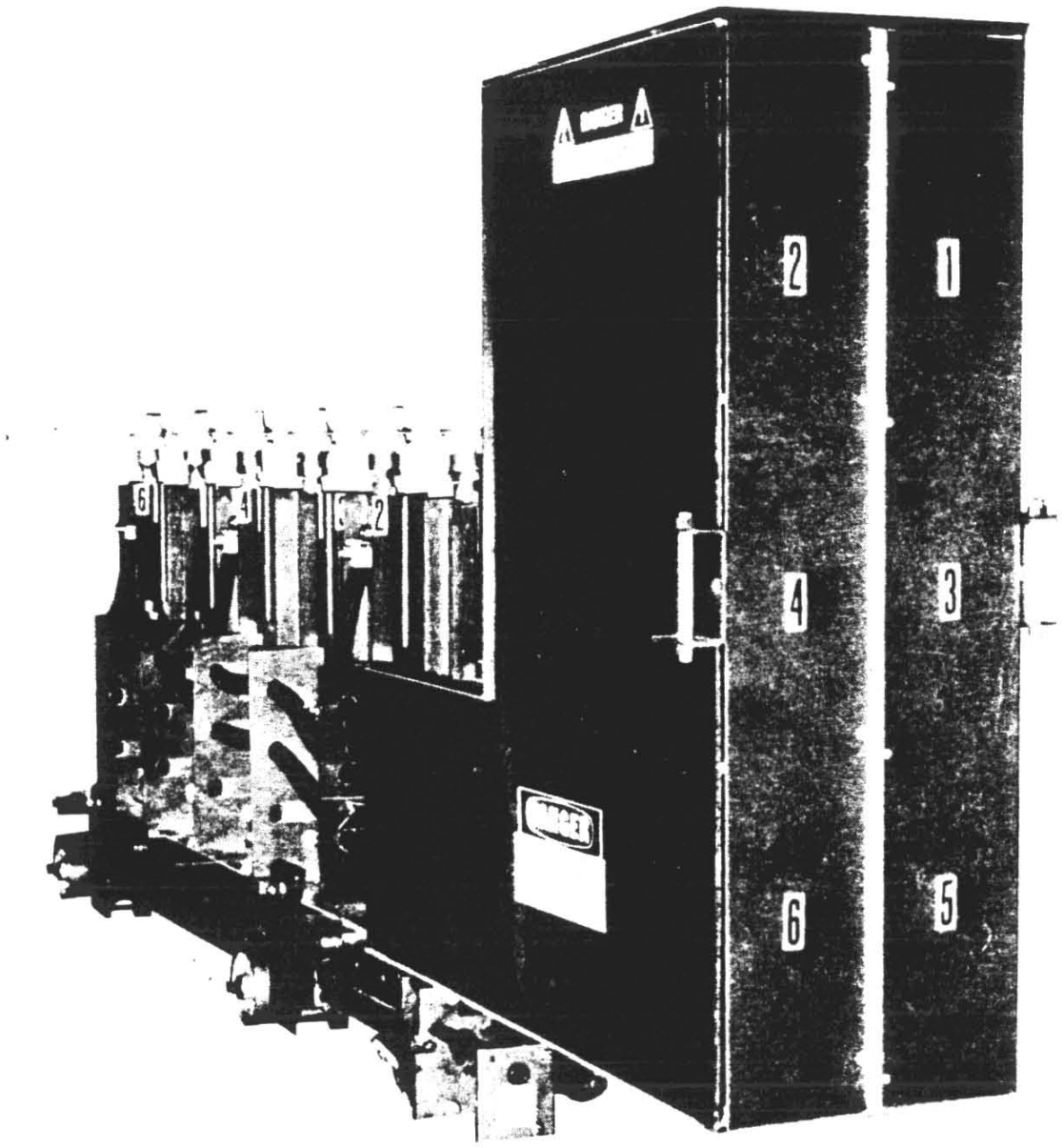


Figure 43. Typical 34.5 kV Ground and Test Device

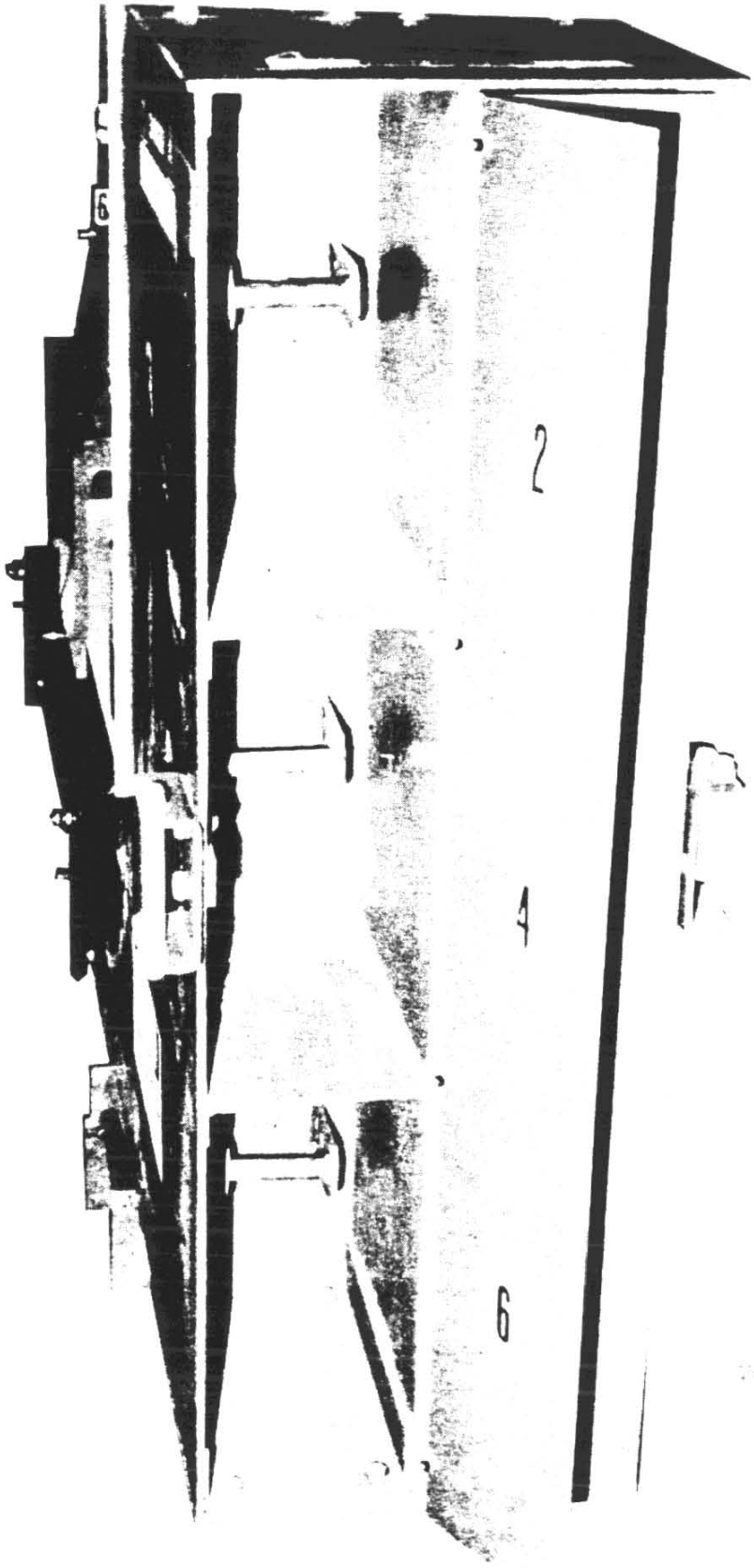


Figure 43A. 34.5 kV Ground and Test Device with One Door Open to Show Ground Stirrups

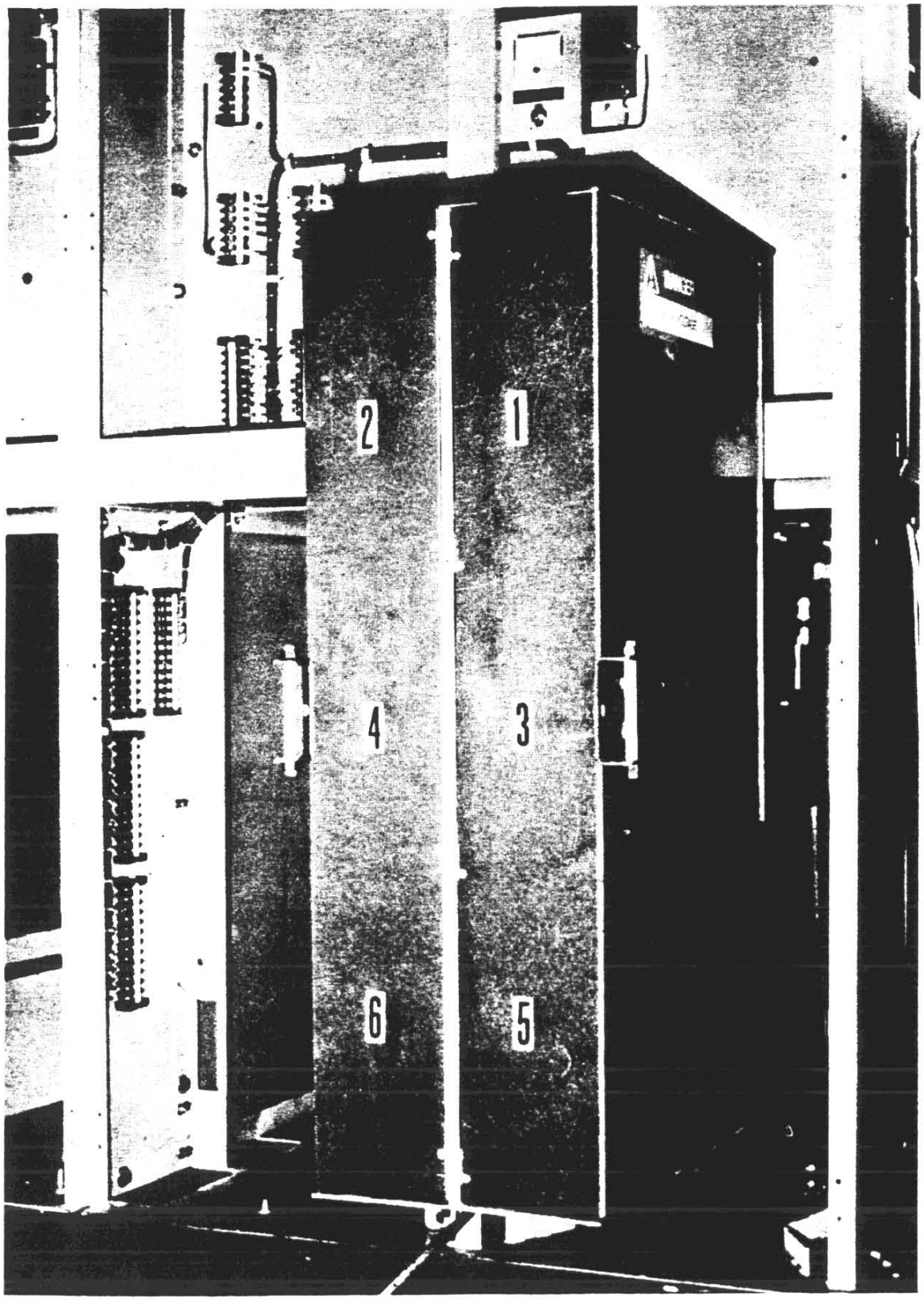


Figure 44. Ground and Test Device in Disconnected Position

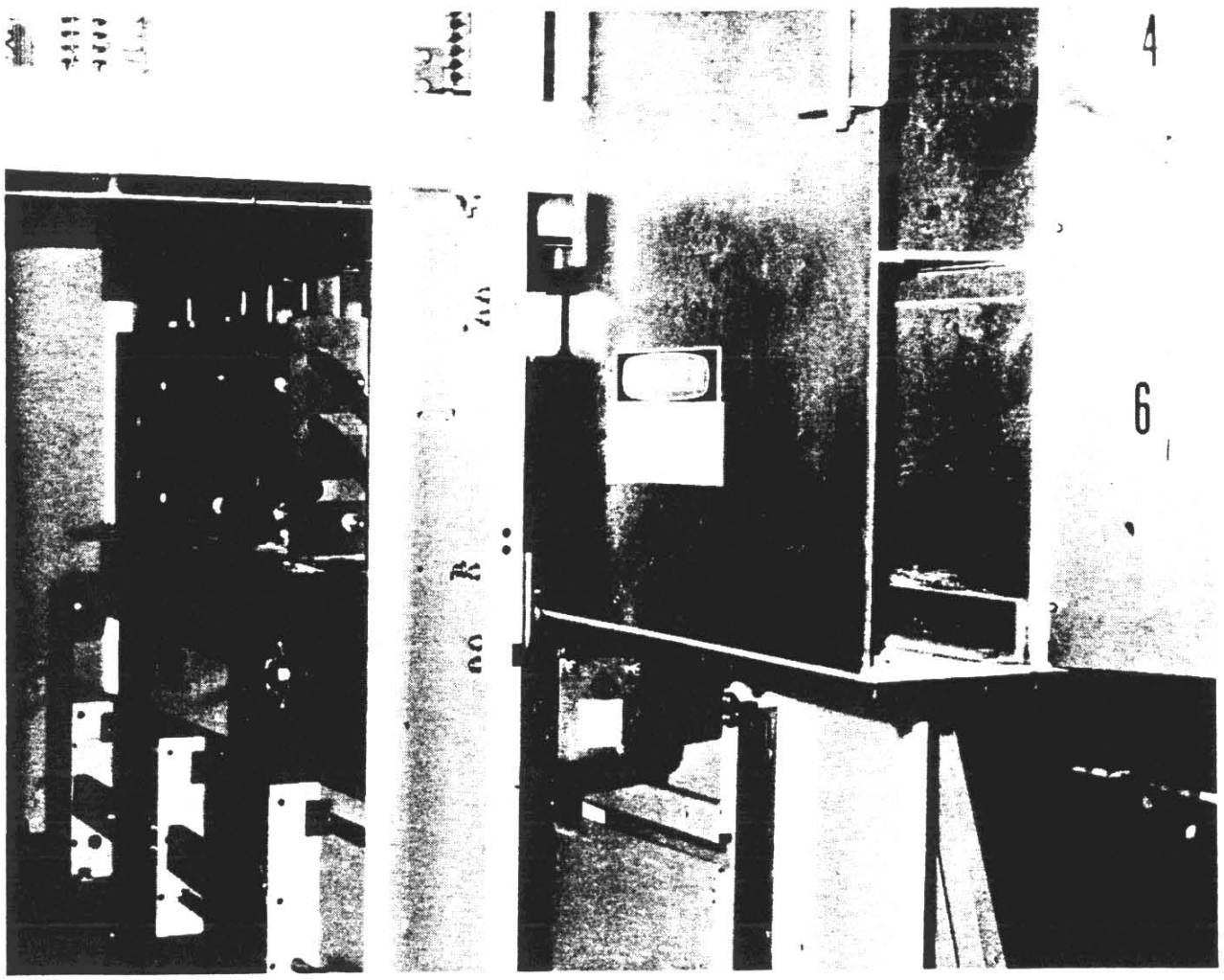


Figure 45. Ground and Test Device in Connected Position