Instructions for
Type DS
Metal-Enclosed Low-Voltage
Power Circuit Breaker Switchgear

Westinghouse Electric Corporation

Switchgear Division, East Pittsburgh, Pa. 15112

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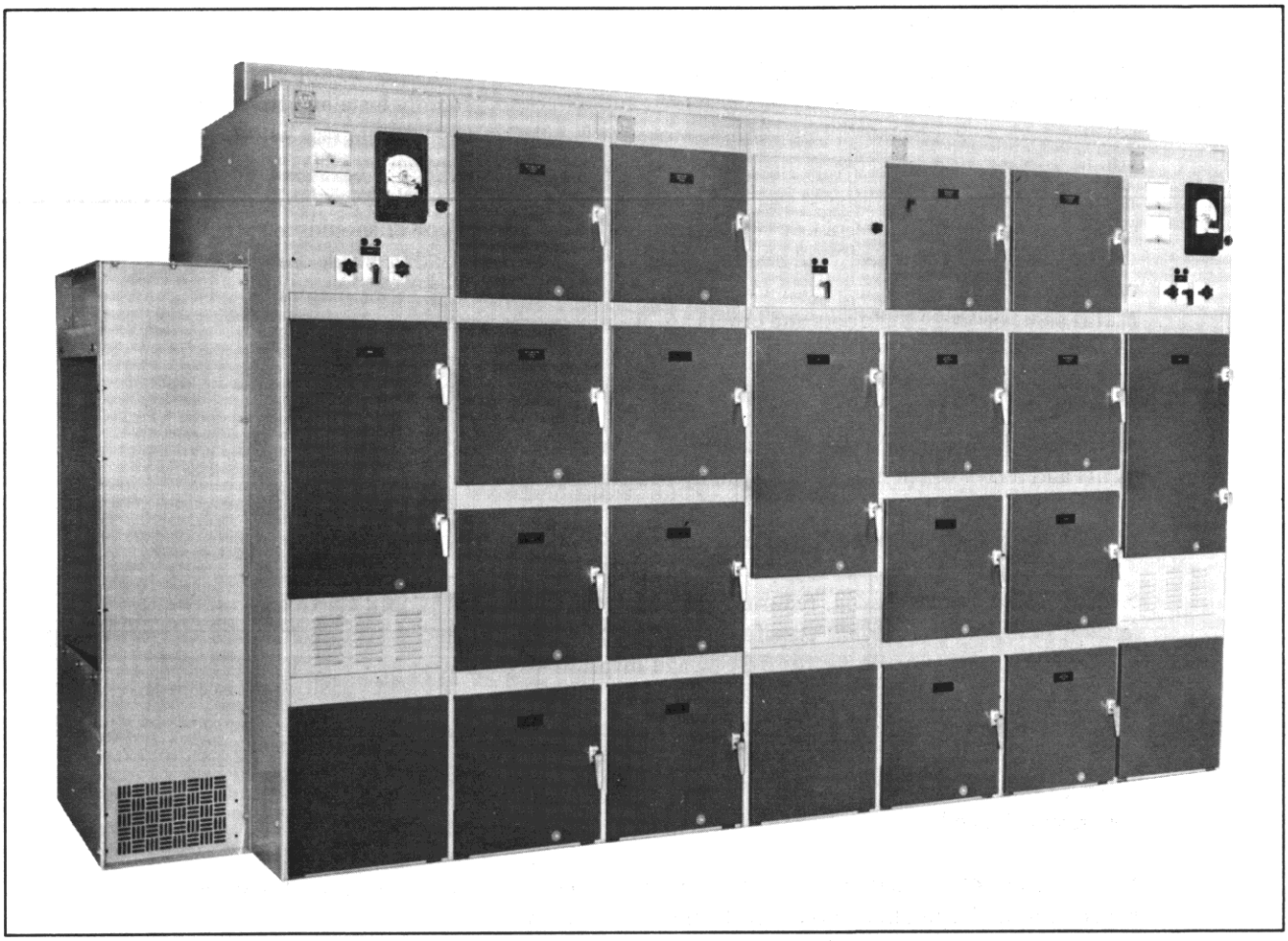

IMPORTANT

Low voltage metal-enclosed switchgear is strongly built and provided with many safety features. Nevertheless, it controls power circuits with high fault capacity which are dangerous. The list of recommended *PRECAUTIONS* should be studied and followed during handling, installation, and operation of the equipment.

1. WARNING

Metal-enclosed Low-voltage Power Circuit Breaker Switchgear assemblies do not present a hazard to personnel when all doors are closed and all covers properly installed. However when any door is opened or any cover removed it is possible to make contact with bare conductors or terminals which may be "live" when the assembly is energized or if a separate control power source is connected. The voltages and power levels available in this equipment make this type of contact extremely dangerous. All power should be turned off or adequate protective equipment should be used when working inside this equipment. Do not guess - be *sure* that the power is off and take the necessary steps to insure that it stays off until the doors and covers are again properly installed.

2. Only authorized personnel should be permitted to handle or operate the switchgear.

3. Handle all switchgear (even if crated) with extreme care as it contains delicate instruments and relays which may be damaged by rough handling.

4. When uncrating switchgear, exercise care not to scratch or mar the panel finish.

5. If any relays are included, remove blocking of relay armatures. Check control circuits (except potential and current transformer circuits) for grounds and short circuits before applying control power (Refer to "Testing and Inspection" page 10).

6. Connect the switchgear to the station ground before applying any power.

7. In case of fire do not use liquid fire extinguishers until all circuits have been made electrically "dead."

8. An ounce of prevention is worth a pound of cure. All personnel responsible for supervision and operation should be familiar with the switchgear and its functions. In time of emergency there is seldom time to consult the instruction material.

9. CAUTION. If outdoor switchgear is to be stored prior to installation, provision must be made for energizing the space heaters to control condensation of moisture inside the switchgear.

10. CAUTION. If indoor switchgear is to be stored prior to installation, it must be protected from the weather and be kept free of condensation.

INTRODUCTION

Metal-enclosed switchgear with type DS low voltage ac power circuit breakers controls and protects power circuits up through 600 volts. The switchgear assembly is composed of units that are arranged to suit the Customer's requirements. Each unit is divided into three or four compartments containing the type DS drawout air circuit breaker. An instrument compartment may be included that will contain potential transformers, instruments, meters, relays and secondary control devices. The rear of the unit will include busses and space for the main cables.

The metal-enclosed switchgear is designed, manufactured, and tested in accordance with industry standards. It is available for both indoor and outdoor installations. A typical indoor assembly is shown in Fig. 1. The types DS and DSL air circuit breakers are shown and described in I.B. 33-790-1.

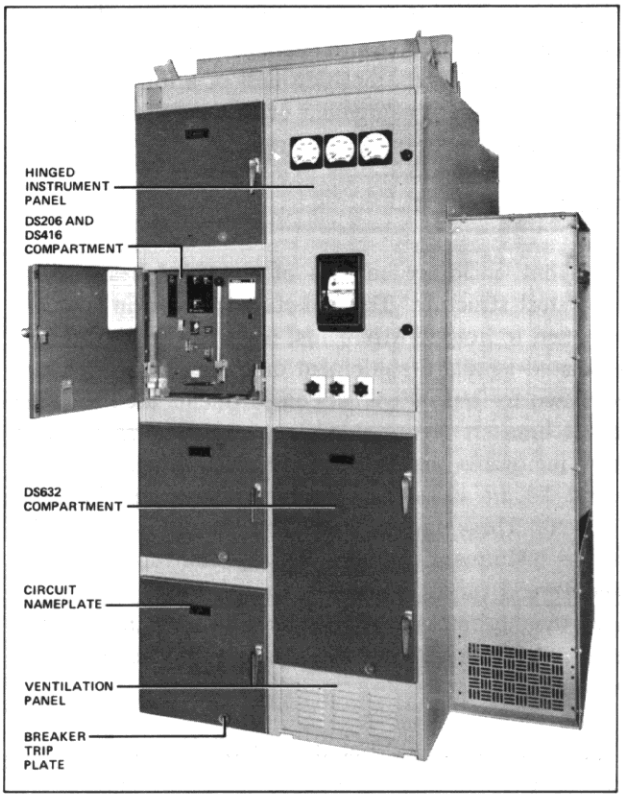

Fig. 1 *Indoor Metal Enclosed Units Front View*

This instruction book has been prepared to familiarize the Purchaser's engineering, installation, and operating staffs with the metal-enclosed switchgear supplied by Westinghouse. Personnel responsible for supervision, operation or maintenance should become well acquainted with the appearance and characteristics of each piece of equipment contained in or mounted on the switchgear.

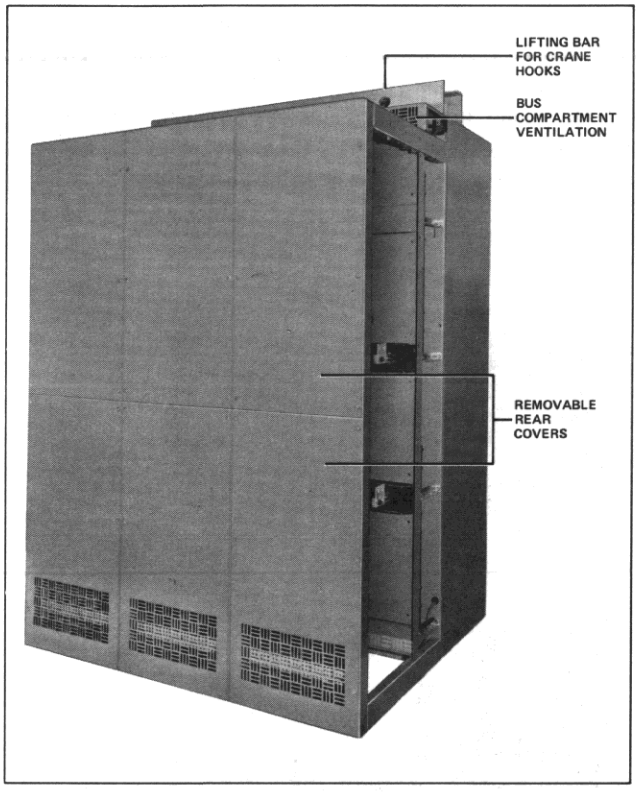

Fig. 2 *Indoor Metal Enclosed Units Rear View*

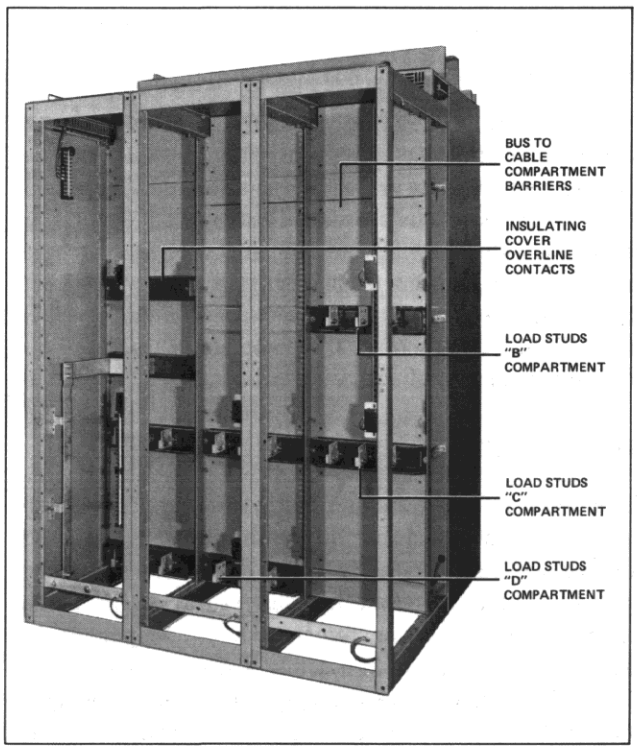

Fig. 3 *Rear View with Covers Removed*

Proper installation, operation, and maintenance are necessary to assure continued satisfactory service from the equipment. It should not be installed in places where it will be called upon to operate at voltages, currents, or fault capacities greater than those for which it was designed, or where the environment is unsuitable.

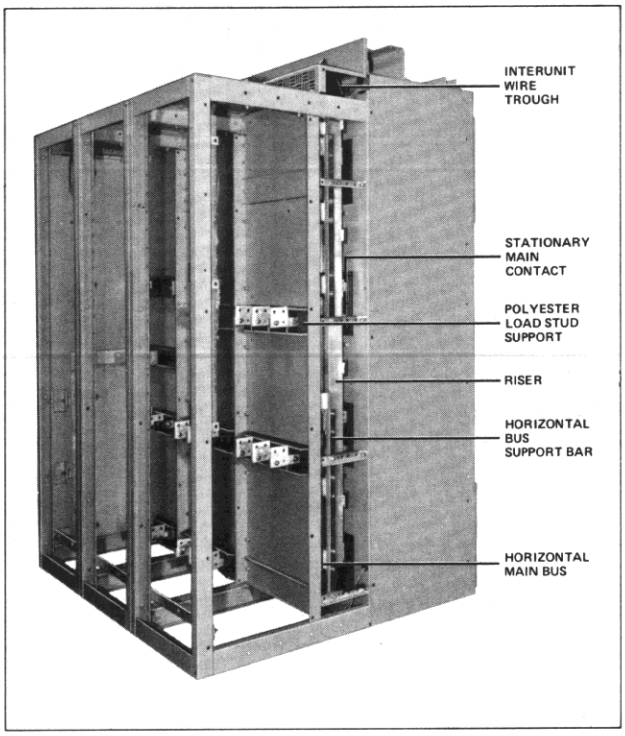

Fig. 4 *Side View with Covers Removed*

The following descriptions apply to standard metal-enclosed construction and wiring. Extra features and special control schemes are often incorporated when specified by the Purchaser's order. These special features are evident on the drawing and diagrams for the switchgear assembly. Instructions on standard apparatus such as relays, instruments, control switches, and circuit breakers are included elsewhere in the complete instruction book for a particular metal-enclosed assembly.

DESCRIPTION

Low voltage (600 volts and below) indoor and outdoor metal-enclosed switchgear having drawout mounted type DS and DSL (integrally fused) air circuit breakers is factory assembled and tested. It is designed to require a minimum amount of labor for installation. Shipments are made with the lineup completely assembled, or may be divided into one or more shipping groups, depending upon the number of units, total length and limitation of handling facilities at the point of installation.

The switchgear consists of a stationary structure that includes one or more free standing units mechanically and electrically joined to make a single coordinated installation. Each unit consists of three major parts - the Front Enclosure, the Bus Compartment, and the Cable and Terminal Compartment. See Fig. 5.

Type DS metal-enclosed switchgear is available for both indoor and outdoor applications. The circuit breakers and design features are similar whether the installation be indoor or outdoor. In general, outdoor metal-enclosed switchgear is constructed by assembling a weatherproof enclosure onto and around standard indoor housings. See Page 17.

In the majority of installations the line-up is close-coupled to a main transformer to form a coordinated secondary unit substation. These substations may be single-ended with only one transformer, or double ended with transformers on both ends. If the transformer is the liquid filled type, the bus transition connections will be made in either a reduced size transition unit or a full sized auxiliary unit on indoor equipment or in a standard transition throat in the case of outdoor equipment.

Front Enclosure

The front enclosure consists of a welded heavy gauge sheet steel structure. This structure may be an auxiliary unit used to house instruments, relays, switches and their associated auxiliary equipment or it may be divided into from two to four individual compartments used to house circuit breakers (removable elements). Figures 6 and 8 show removable elements in their compartments. Figures 9 and 10 are close-ups of compartments with breakers removed. These individual compartments may also be used as instrument compartments by omitting the circuit breaker and its associated stationary parts. The hinged door then becomes available for mounting instruments, relays, etc. This is shown in the upper right compartment in Fig. 1.

Between the compartments are bolted-in channels that may be blank or may be used for mounting small instruments, instrument switches, pushbuttons, lights or other devices within the space limitations. The compartment doors employ a piano type hinge to insure rigidity.

In compartments equipped for circuit breakers, a bolted in cradle supports the wheels of the removable element, provides the stationary engagement for the levering device and includes the stationary ground contact and trip linkage.

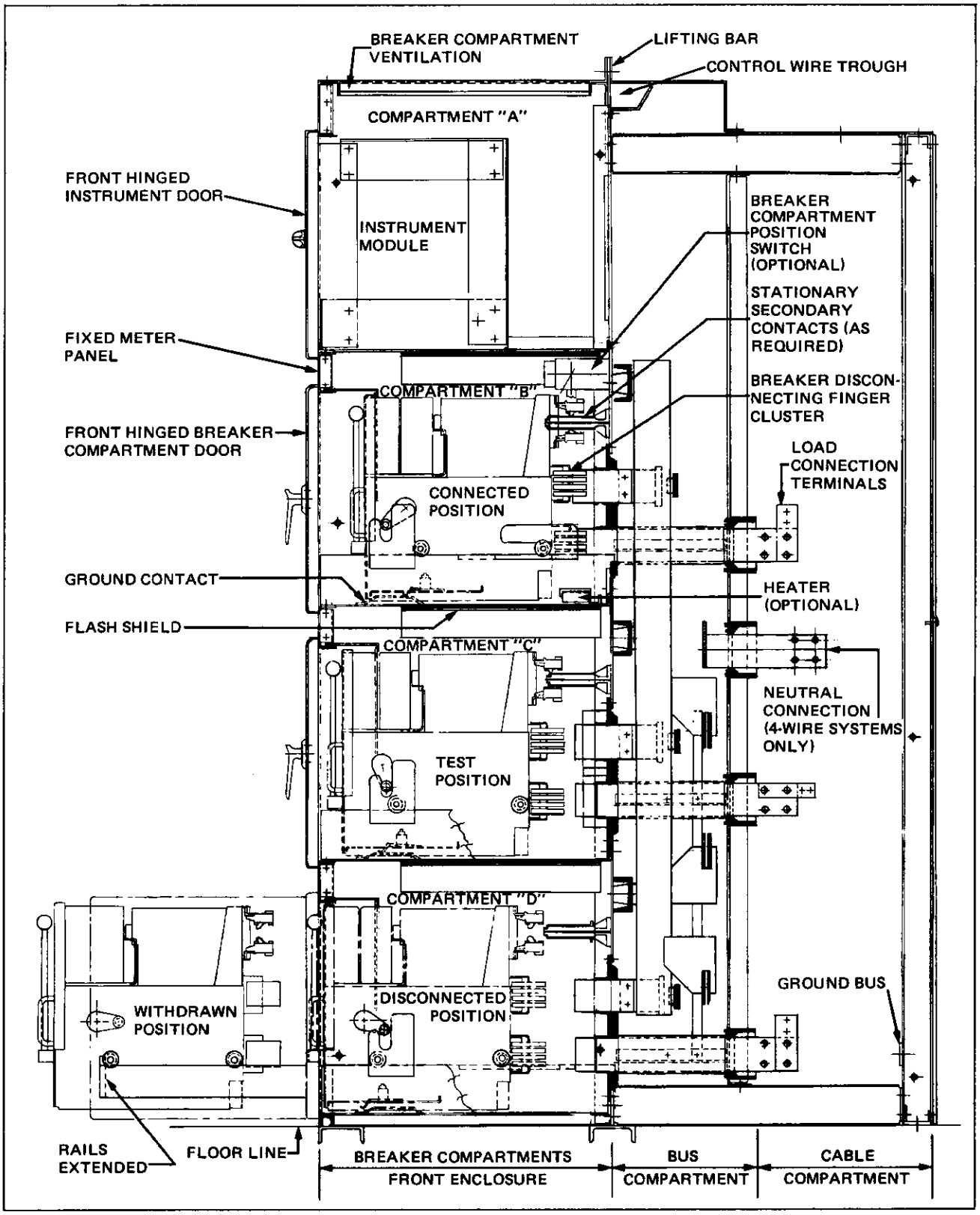

Fig. 5 *Side View 1600/2000 Amp Unit with Aluminum Bus*

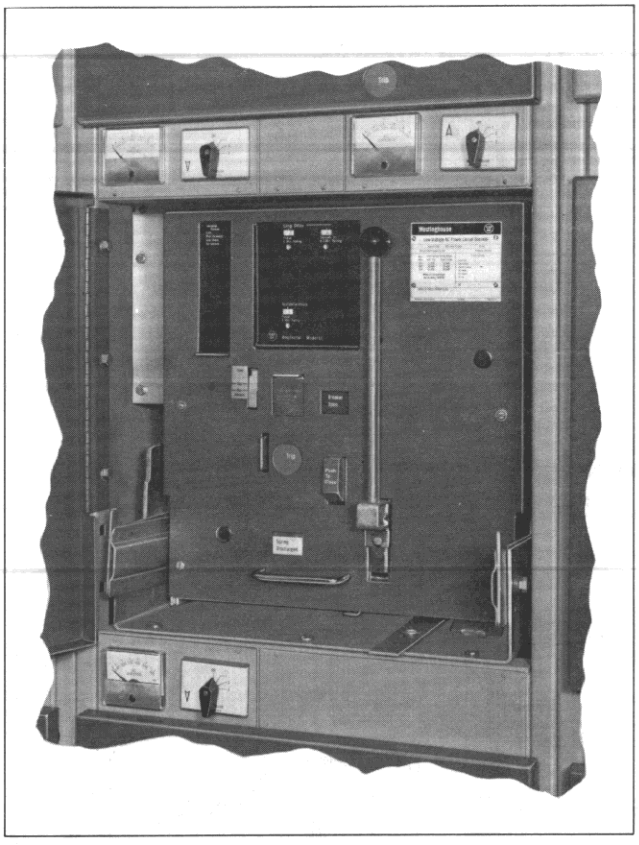

Fig. 6 *Type DS-416 Breaker in Connected Position*

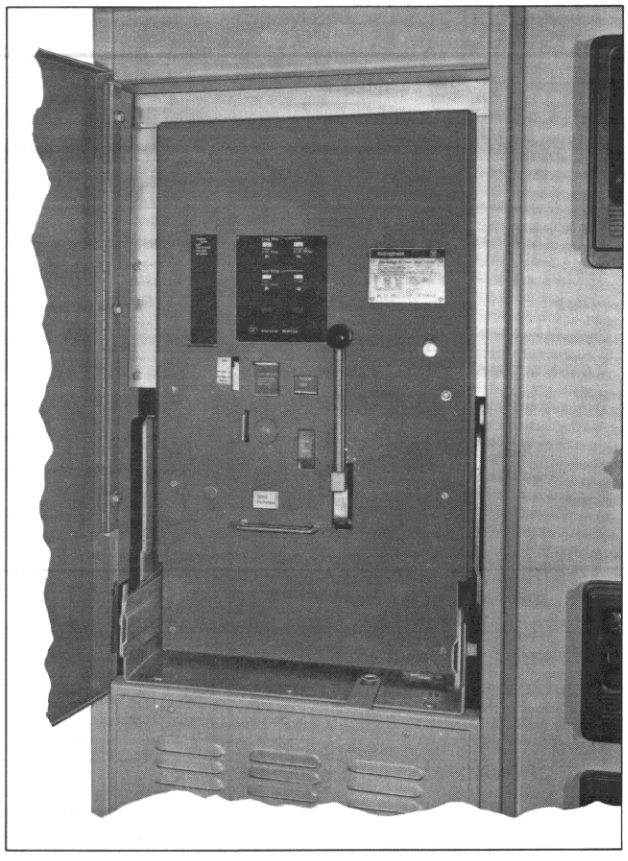

Fig. 8 *Type DS-632 Breaker in Connected Position*

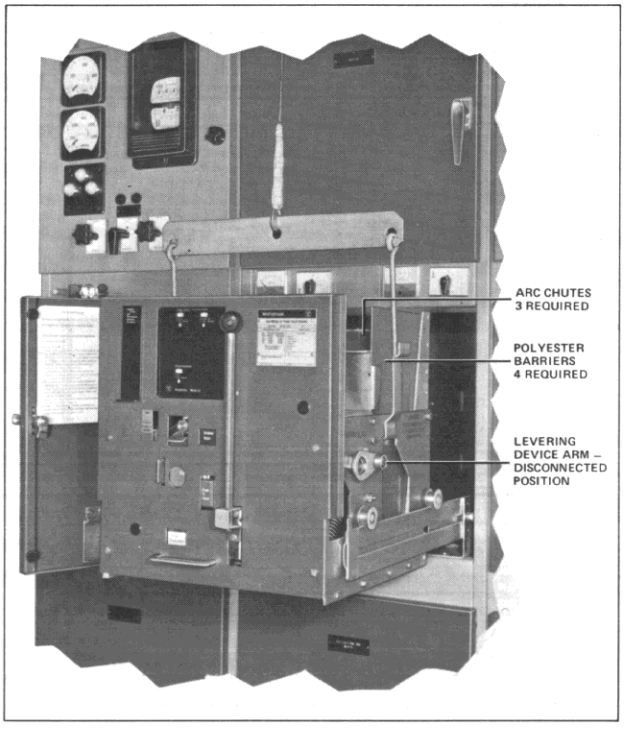

Fig. 7 *Type DS-416 Breaker on Extension Rails*

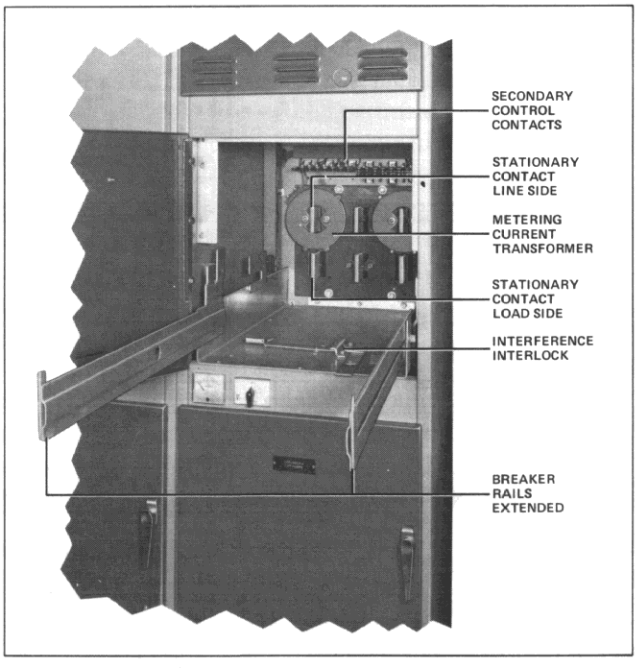

Fig. 9 *Type DSL-416 Breaker Compartment*

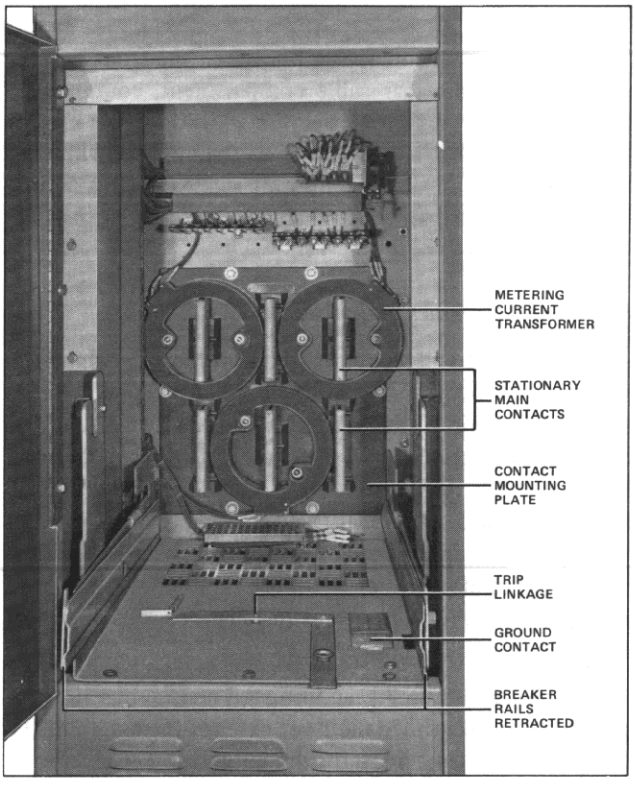

Fig. 10 *Type DS-632 Breaker Compartment*

A molded glass polyester plate at the rear of the compartment supports the six stationary disconnecting contacts and up to three metering current transformers, if required.

Secondary control disconnecting contacts when required are located on the rear wall above the stationary primary contacts and provide the control circuits to the drawout element.

The breaker compartment provides for four positions of the removable element, namely; "connected," "test," "disconnected," and "remove".

In the "connected" position, both the primary and secondary disconnecting devices are engaged, and the circuit breaker is ready for operation. See compartment "B" Fig. 5. In the "test" position, only the secondary disconnecting devices are engaged, and the circuit breaker can be operated without energizing the power circuit. See compartment "C" Fig. 5. In the "disconnected" position, both the primary and secondary disconnecting devices are disengaged, and the entire circuit breaker is isolated. The removable element is still held captive in the compartment in this position. See compartment "D", Fig. 5.

The levering device is moved to the "remove" position by one to three additional turns of the levering crank. The circuit breaker can then be freely rolled out of the compartment onto the extension rails (see compartment "D", Fig. 5. The compartment door may be closed and latched with the removable element in any one of the above positions.

The breakers are provided with finger clusters that engage the stationary main contact stabs at the rear of the compartment when in the connected position. Secondary disconnecting contacts connect the control circuits when in the test and connected positions. The positive interlock on the levering-in device insures proper operating sequence, and this is described in detail in the air circuit breaker Instruction Book, I.B. 33-790-1.

Since the type DS206, DS416, and DS420 breaker drawout elements units are contained in compartments having the same dimensions for non-current carrying parts, an interference-type interlock assembly is furnished between the stationary cradle and the bottom plate of the breaker unit. This prevents interchanging breaker frame ratings. If the incorrect drawout unit is placed upon the extended rails of a compartment, it will not be possible to move it far enough into the compartment to engage the levering device. Since the type DS416 and DS420 breakers have the same short-circuit current ratings and the current carrying parts in the compartment are identical, the same interlock is used on both of these breakers and they are physically interchangeable.

Figure 11 shows the positions of the interlock brackets for the two frame ratings. These brackets hold the drawout unit approximately 5.38 inches from the "connected" position.

Type DSL206 and DSL416 incorporate a similar interference type interlock, with the addition of one more piece located at the bottom of the main contact mounting frame which will interfere with the interlock brackets in standard DS breaker compartments to prevent insertion of DSL circuit breakers in DS compartments. See Figure 12. The engagement of the levering device will prevent insertion of a DS circuit breaker into a DSL compartment far enough to engage the disconnect contacts.

The type DS632 and DS840 circuit breakers do not require this type of interference interlock because they are not physically interchangeable with any other circuit breaker.

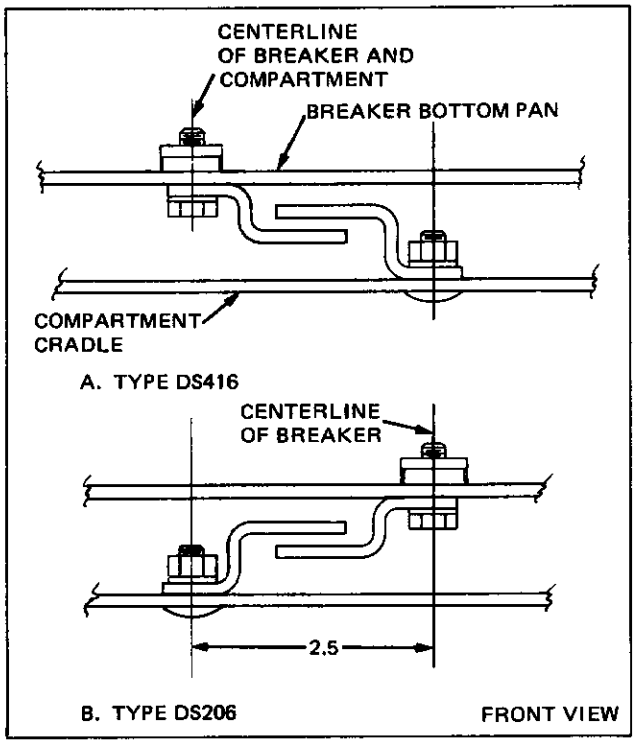

Fig. 11 *DS-206/416 Breaker Interference Interlock*

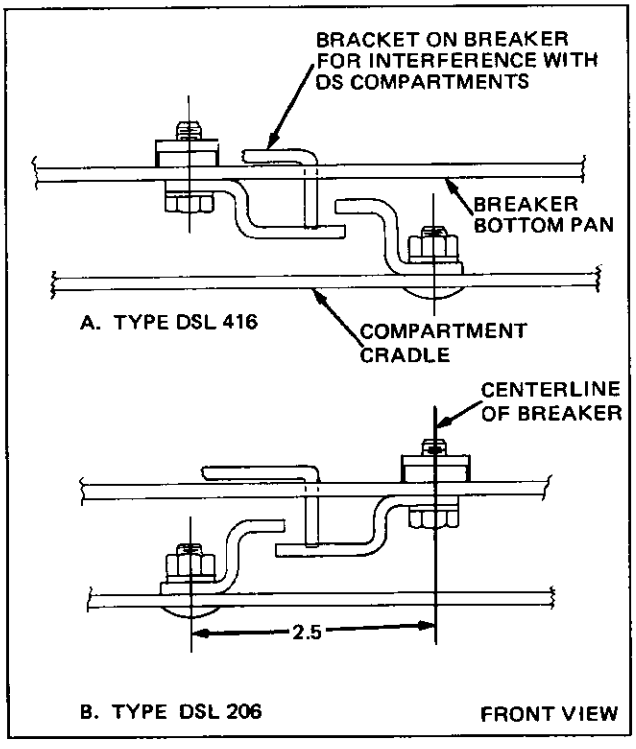

Fig. 12 *DSL-206/416 Breaker Interference Interlock*

Bus Compartment

The bus compartment, located between the front breaker enclosure and the rear cable compartment, contains the horizontal main bus that ties the units together electrically and the vertical bus that feeds the individual breaker compartments. It also includes all supporting insulators. The bus compartment is available in different depths depending upon bus rating.

Cable and Terminal Compartment

The cable and terminal compartment is located behind the bus compartment and provides adequate room for easy cable installation. Copper bars extend the load side of the stationary disconnecting contacts into the cable compartment. See Fig. 5. Standard NEMA drilling is provided on the silverplated ends for the outgoing cables for exit through either the top or bottom of the units. The drilling will accommodate either single or multiple terminals on each phase. On higher current installations, bus duct may be connected to the copper bars.

On four wire systems, an insulated neutral bus approximately 44 inches above the floor extends the length of the line-up and includes a tap for the outgoing neutral cable in each unit. See Fig. 5. A link to the ground bus may be furnished as optional equipment in one of the units for grounded four wire systems. Provision is made to locate a current transformer in this grounding connection if desired.

Ground Bus

Caution: **A permanent low resistance ground is essential for adequate protection.**

The ground bus consists of a .25 inch x 2 inch copper bus bar bolted to the rear frames of the units near the floor, and extending the length of the group. A clamp type terminal accommodating a cable range of 4/0 to 500 MCM is included for connection to the station ground. Where the line-up is split into several shipping groups, a splice plate and hardware will be furnished to bridge the shipping break at installation.

Indoor Ventilation

The front hinged doors have slots in the bottom flange to allow ventilating air to enter each compartment. The air passes upward at the sides of the breaker support cradles and is exhausted through the grillwork in the top compartment roof. A drip pan immediately below the grill prevents any foreign material from reaching the equipment. DS-632 and DS-840 compartments have a louvered pan below the breaker for ventilating air entrance.

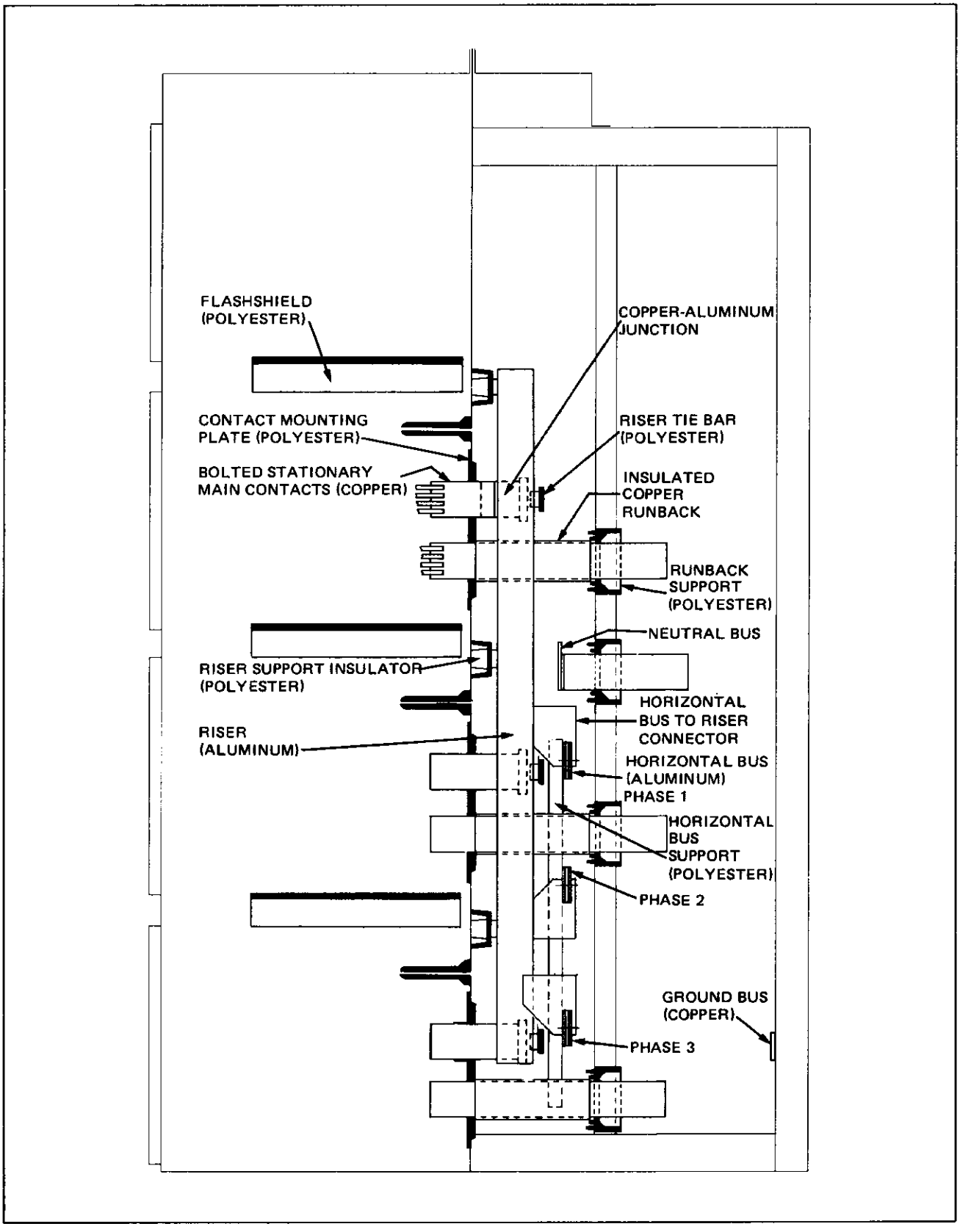

Fig. 13 *Bus and Insulation for 1600/2000 Amp Welded Aluminum Bus*

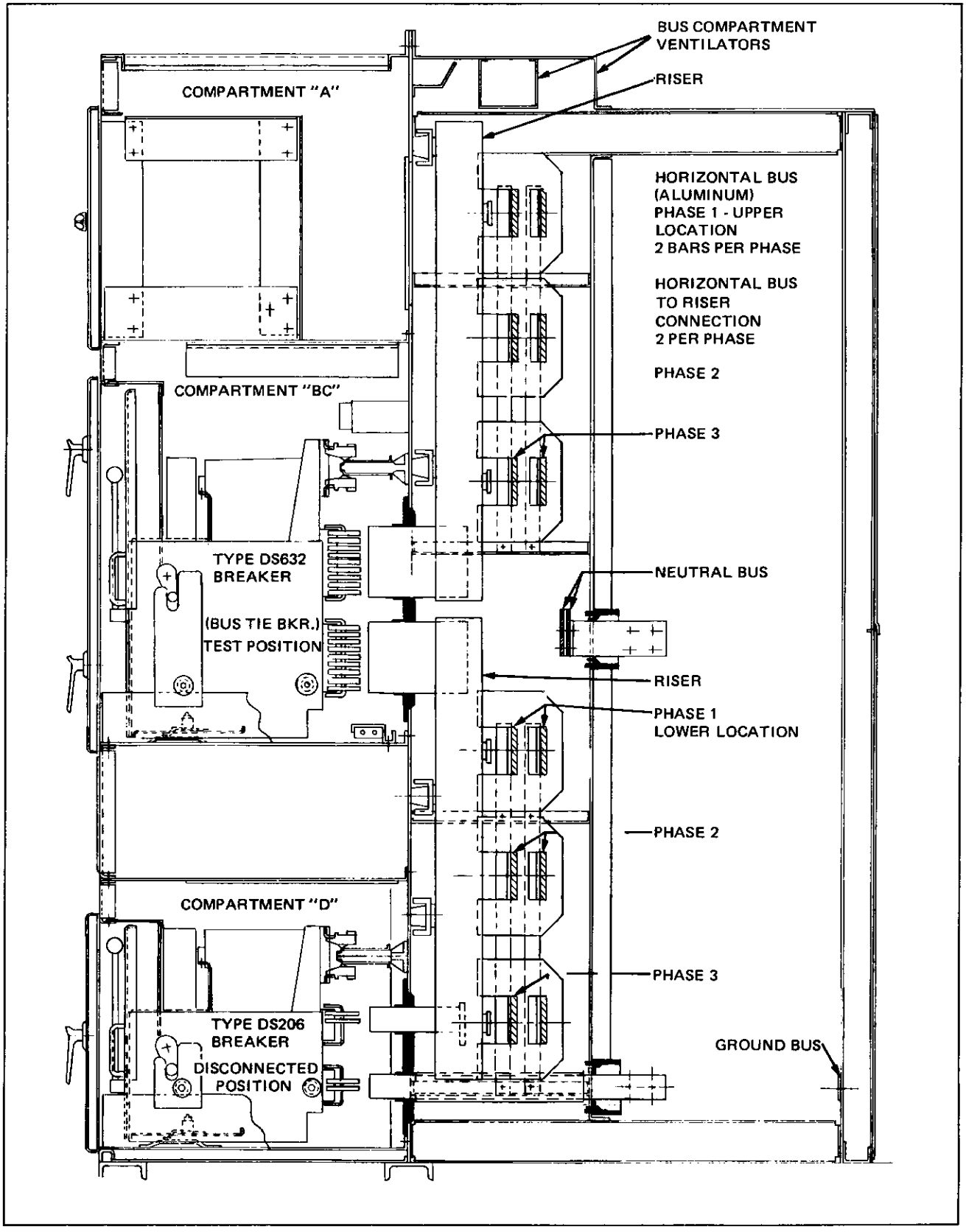

Fig. 14 *Side View 3200 Amp Unit with Welded Aluminum Bus Risers Arranged as a Bus Tie Unit*

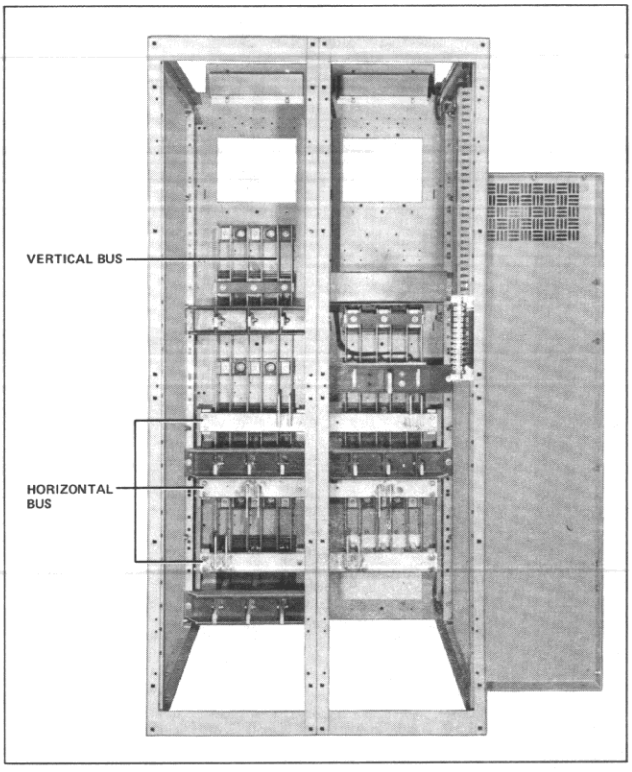

Fig. 15 *1600/2000 Amp Welded Aluminum Bus*

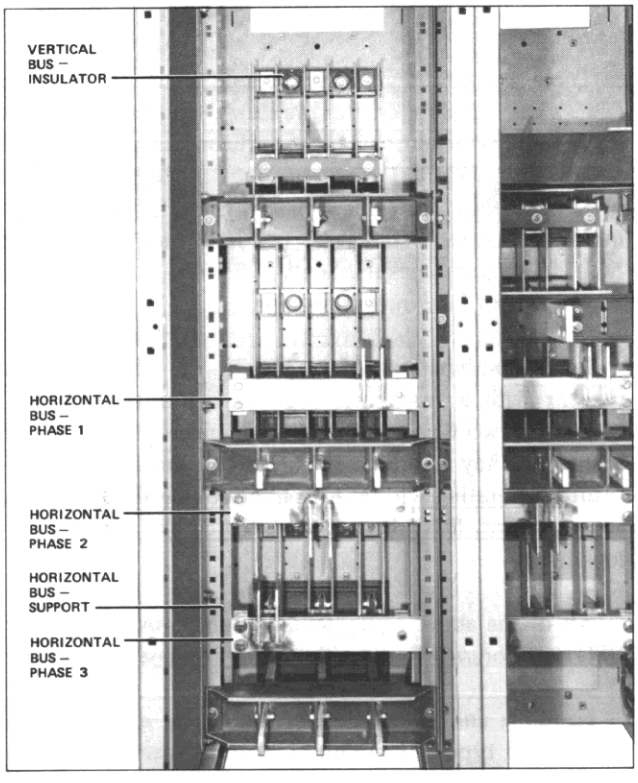

Fig. 16 *1600/2000 Amp Welded Aluminum Bus*

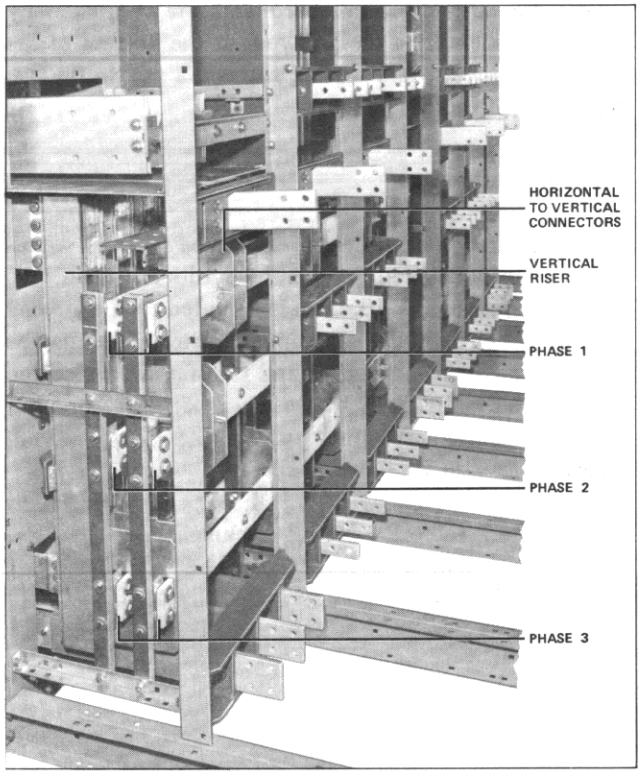

Fig. 17 *3200 Amp Welded Aluminum Bus*

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Fig. 18 *4000 Amp Welded Aluminum Bus*

The bus and cable compartments are ventilated by means of air entering the grillwork at the bottom of the bolted rear sheets, and leaving through a grill in the bus compartment roof.

Current Transformers

When required for metering, ring-type current transformers are positioned around the stationary main contacts as shown in Fig. 10. Each is mounted on the molded glass polyester main contact support plate. These may be used to feed a small ammeter and transfer switch located on the fixed meter panel between compartments or a meter on the hinged instrument panel. The metering accuracies are given in the following table:

Table 1 Metering Accuracies

Ratio	Accuracy Classification	
	B0.1*	B0.2*
100-5	1.2	–
150-5	1.2	–
200-5	1.2	1.2
300-5	0.6	0.6
400-5	0.6	0.6
600-5	0.6	0.6
800-5	0.3	0.3
1200-5	0.3	0.3
1600-5	0.3	0.3
2000-5	0.3	0.3
2500-5	0.3	0.3
3000-5	0.3	0.3
4000-5	0.3	0.3
5000-5	0.3	0.3
6000-5	0.3	0.3

*At 60 Hz Standard Burden

Switchgear with Type DSL Circuit Breakers

Type DSL circuit breakers are available in two frame sizes - DSL206 and DSL416 which include fuse type current limiters integrally mounted on the drawout element. The compartments for DSL circuit breakers are the same height and width as those for standard DS circuit breakers but are eight inches deeper. The indoor switchgear assembly is correspondingly eight inches deeper. See I.B. 33-790-1 for complete description of DSL circuit breakers.

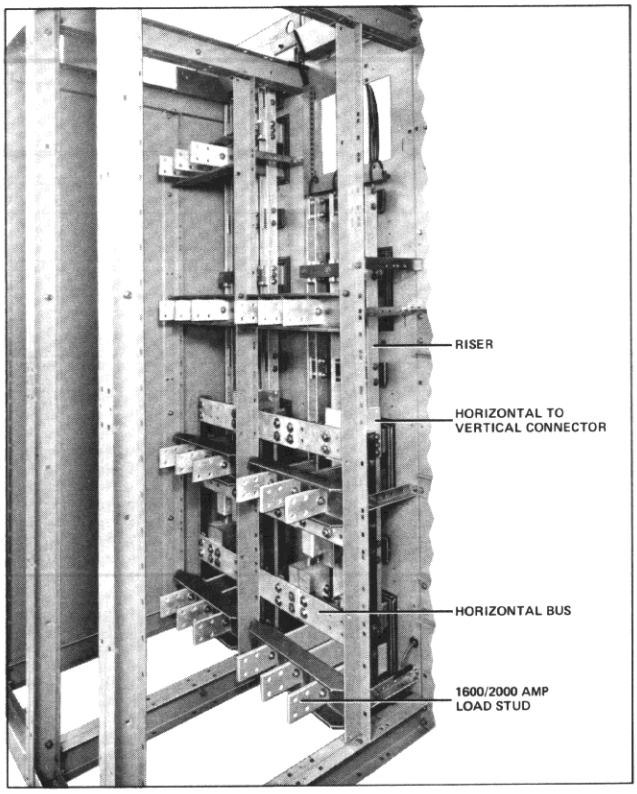

Fig. 19 *1600/2000 Amp Bolted Copper Bus*

There are no integrally fused equivalents of the type DS632 and DS840 circuit breakers, but these breakers may be used in combination with separately mounted DS3200 or DS4000 drawout fuse trucks. These fuse trucks are equipped with standard Class L fuses and fit into compartments the same depth as the DSL206 and DSL416 circuit breakers. See I.B. 33-790-1 for complete description of fuse trucks.

Each combination of a DS632 or DS840 circuit breaker with a fuse truck requires key interlocking between the two devices. This is accomplished by the use of a standard key interlock in the circuit breaker compartment cooperating with a door interlock on the fuse truck compartment. See I.B. 33-790-1 for details of this interlocking.

All of the above equipments may be provided in type DSO outdoor switchgear without any increase in depth.

Handling and installation of switchgear assemblies incorporating type DSL circuit breakers or fuse trucks is the same as for standard DS assemblies.

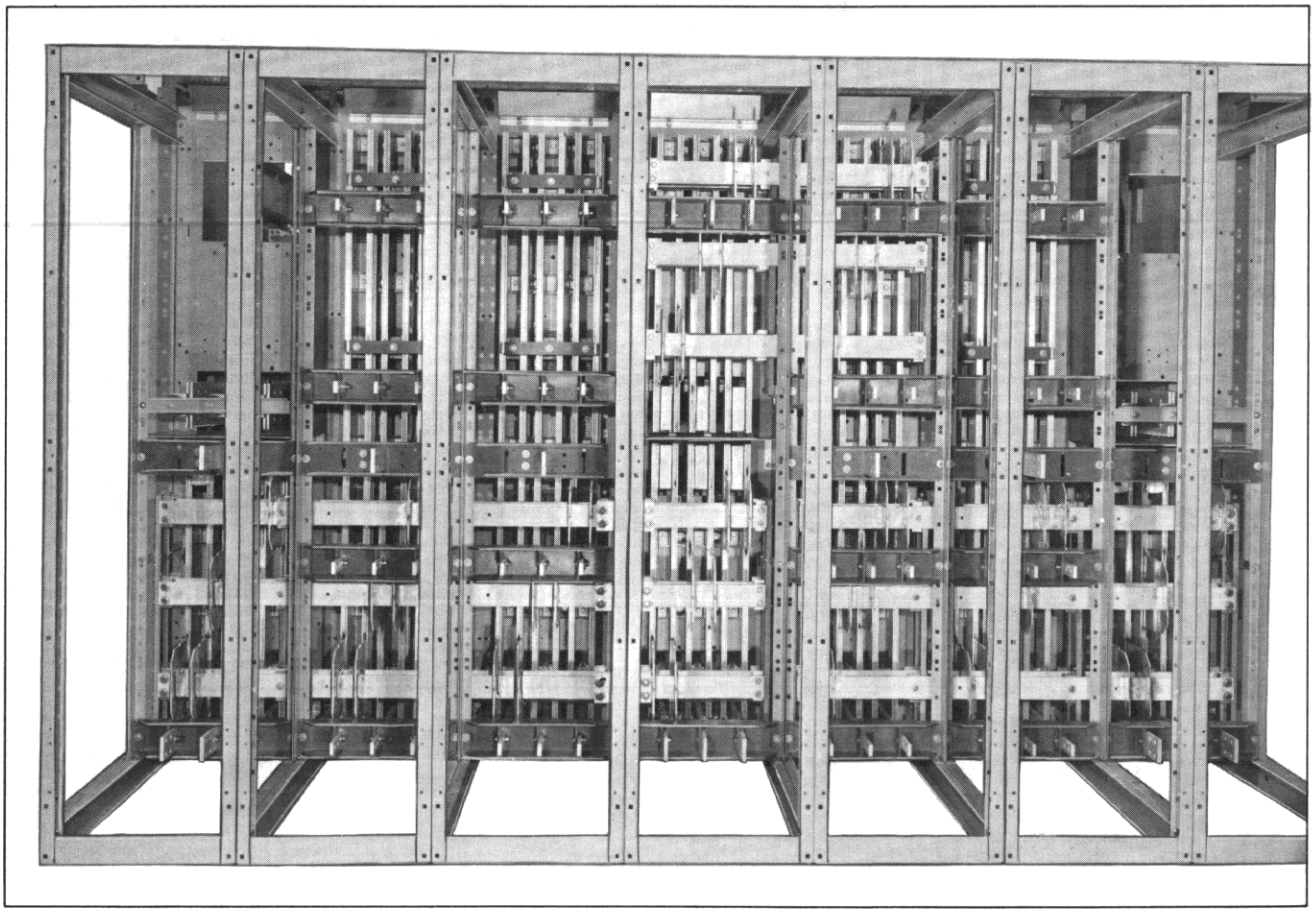

Fig. 20 *3200 Amp Welded Aluminum Bus*

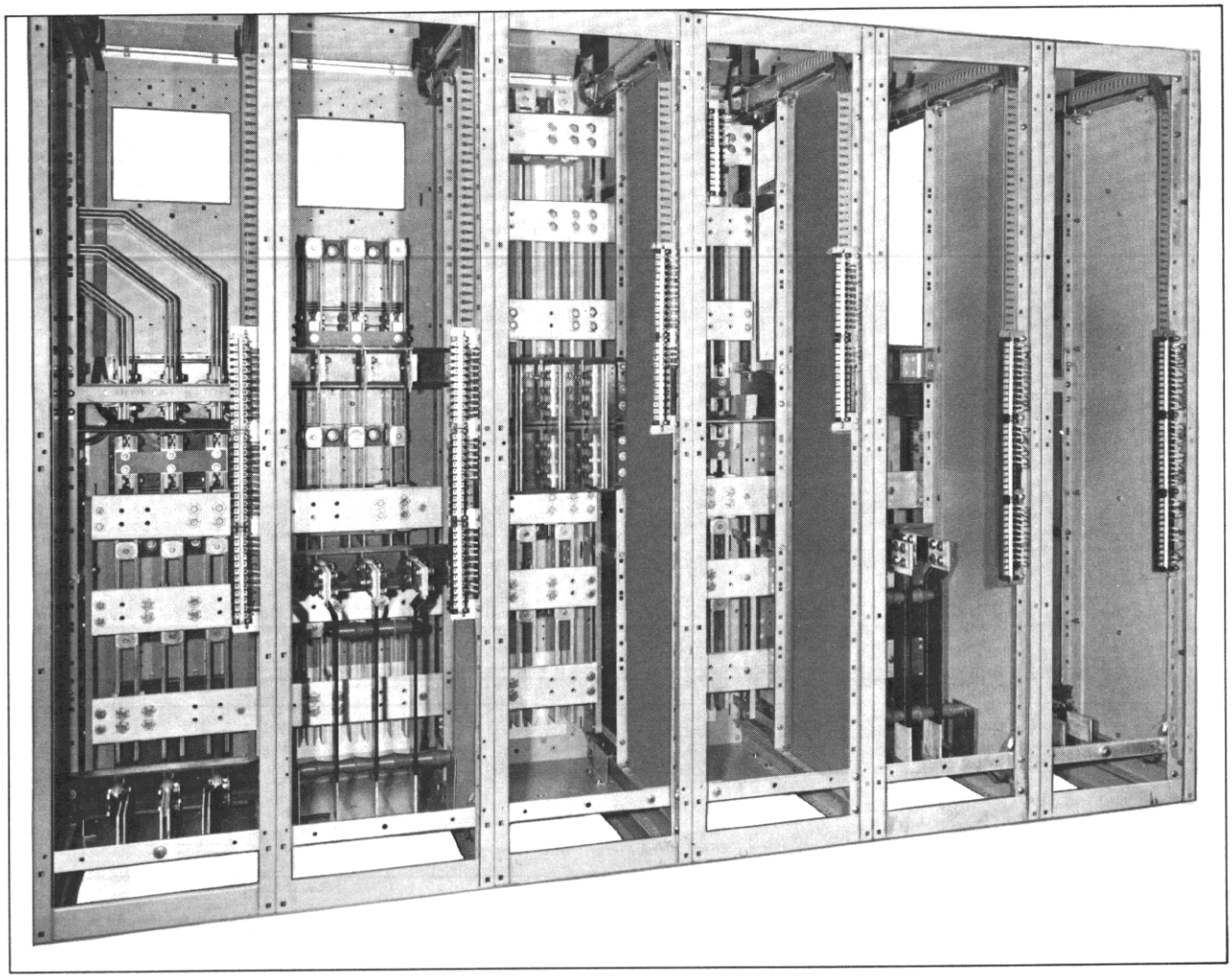

Fig. 21 *3200 Amp Bolted Copper Bus*

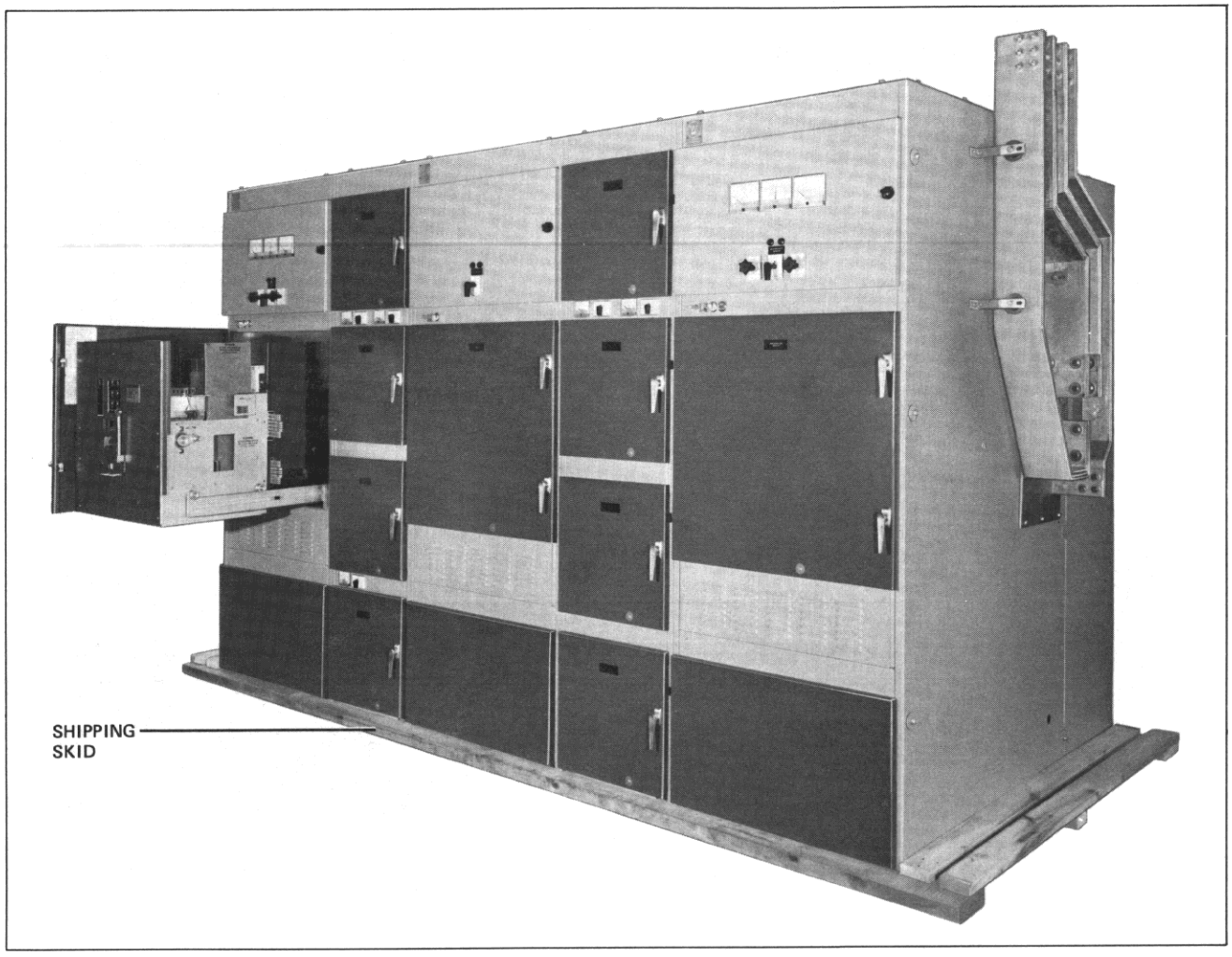

Fig. 22 *Front View Including DS-840 Compartment*

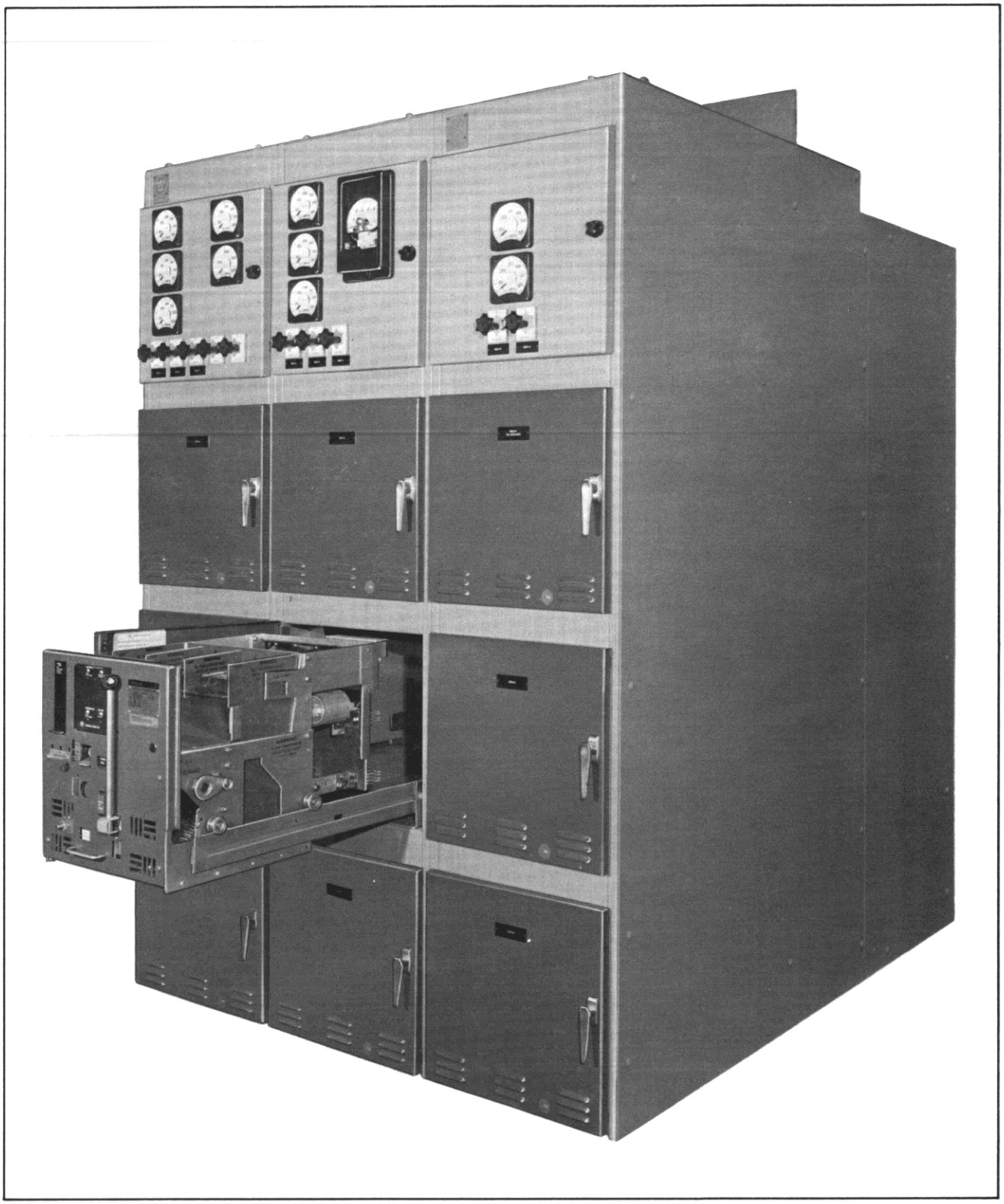

Fig. 23 *Front View Including DSL-206 Compartment*

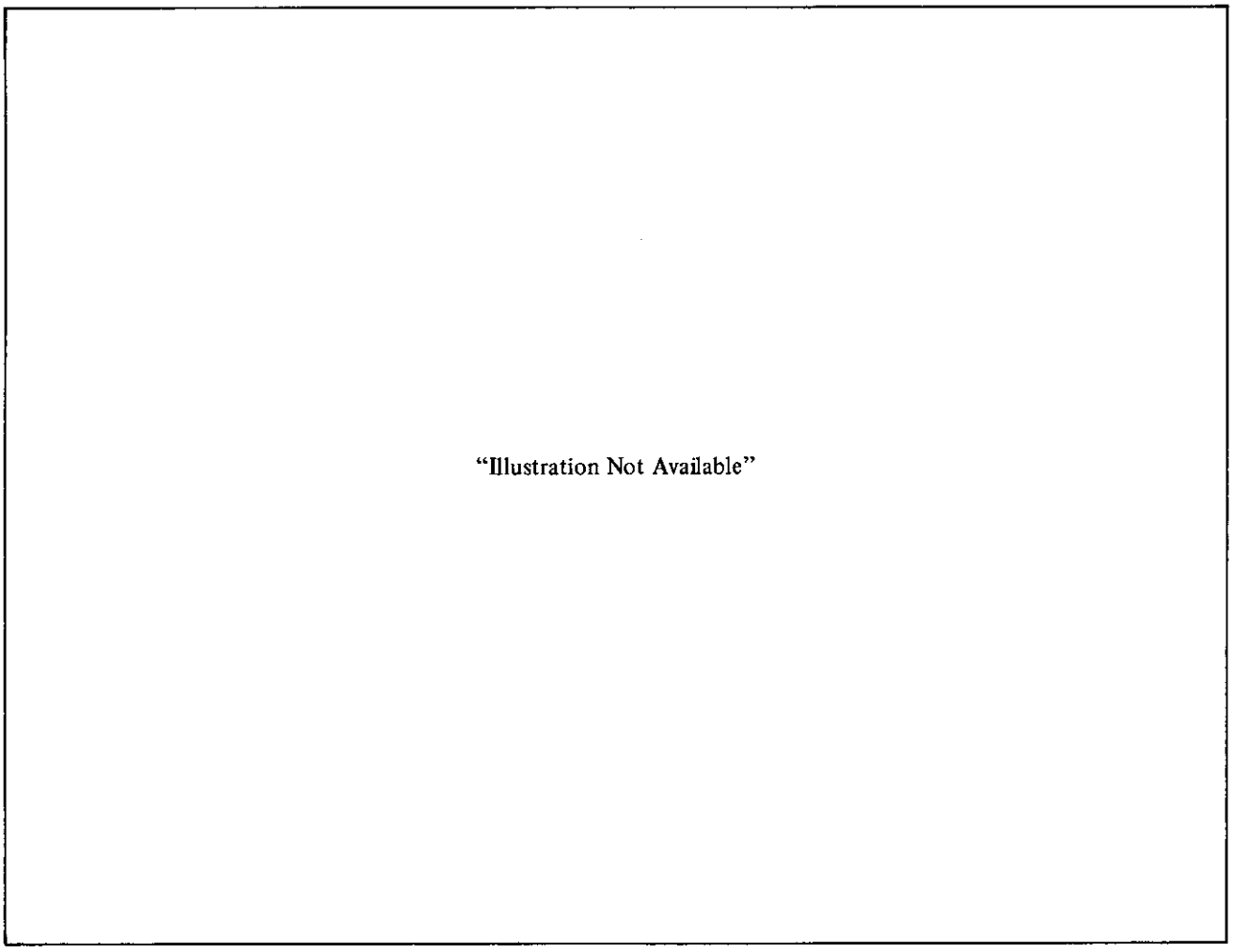

Fig. 24 *Front View Including DS-3200 Fuse Truck Compartment*

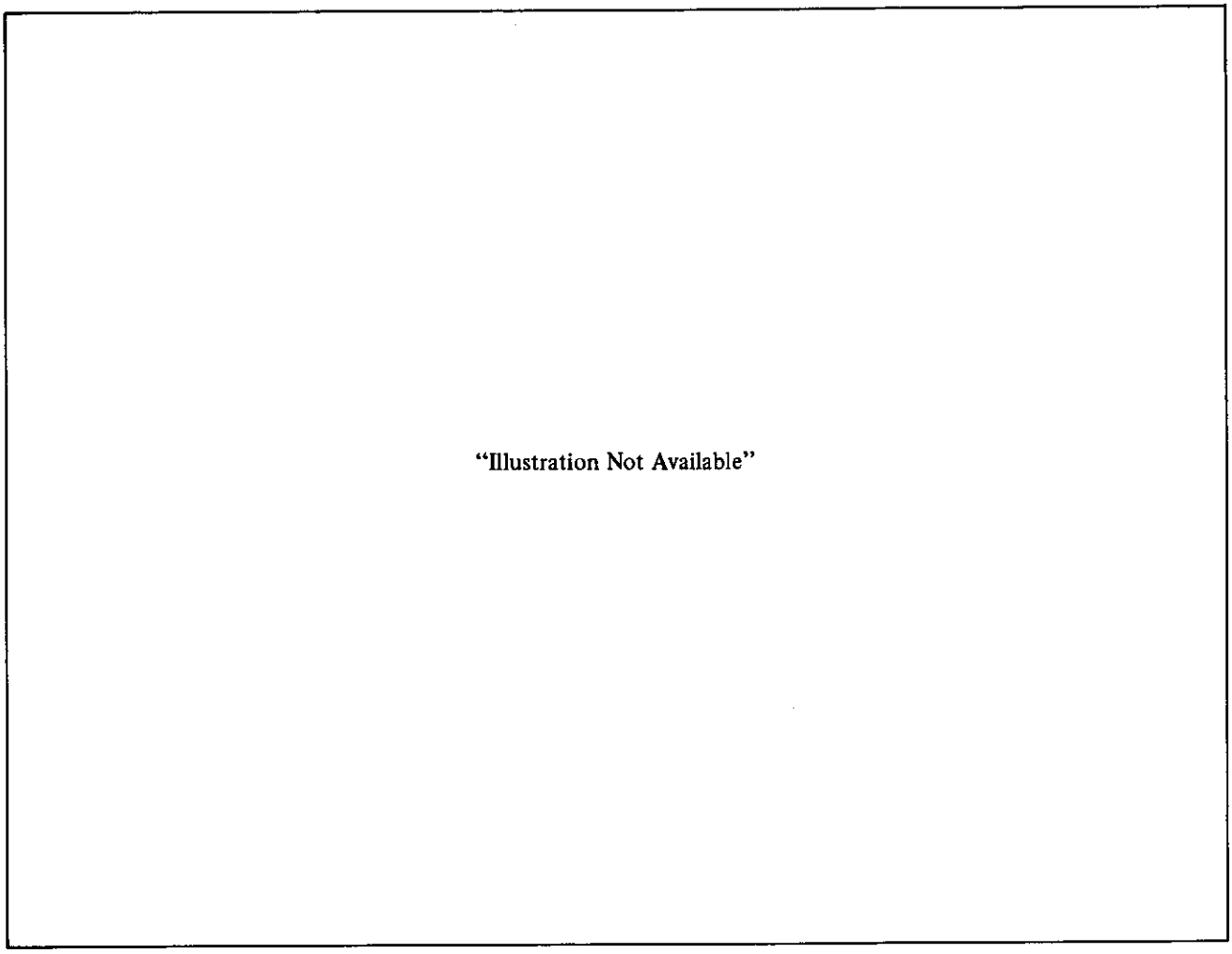

Fig. 25 *Front View Including DS-4000 Fuse Truck Compartment*

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Fig. 26 *4000 Amp Bolted Copper Bus*

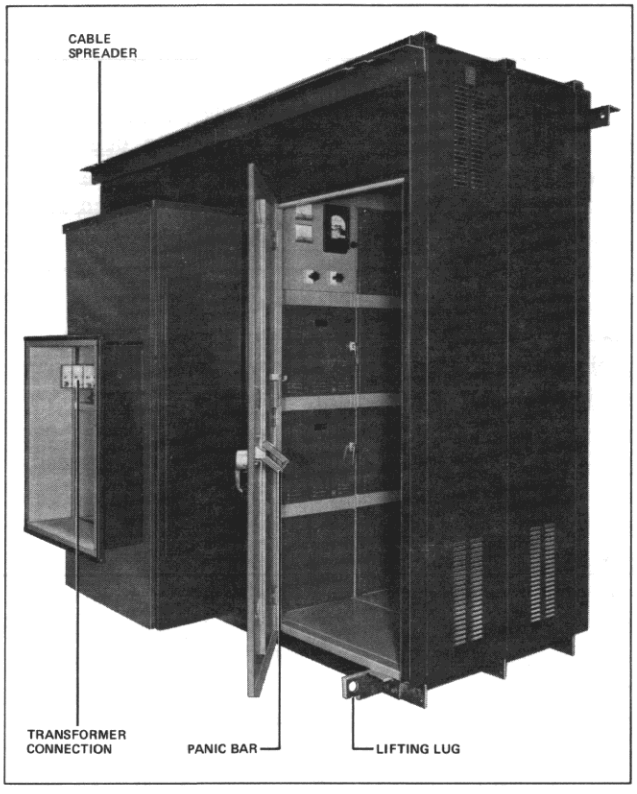


Fig. 27 *DSO Outdoor House*

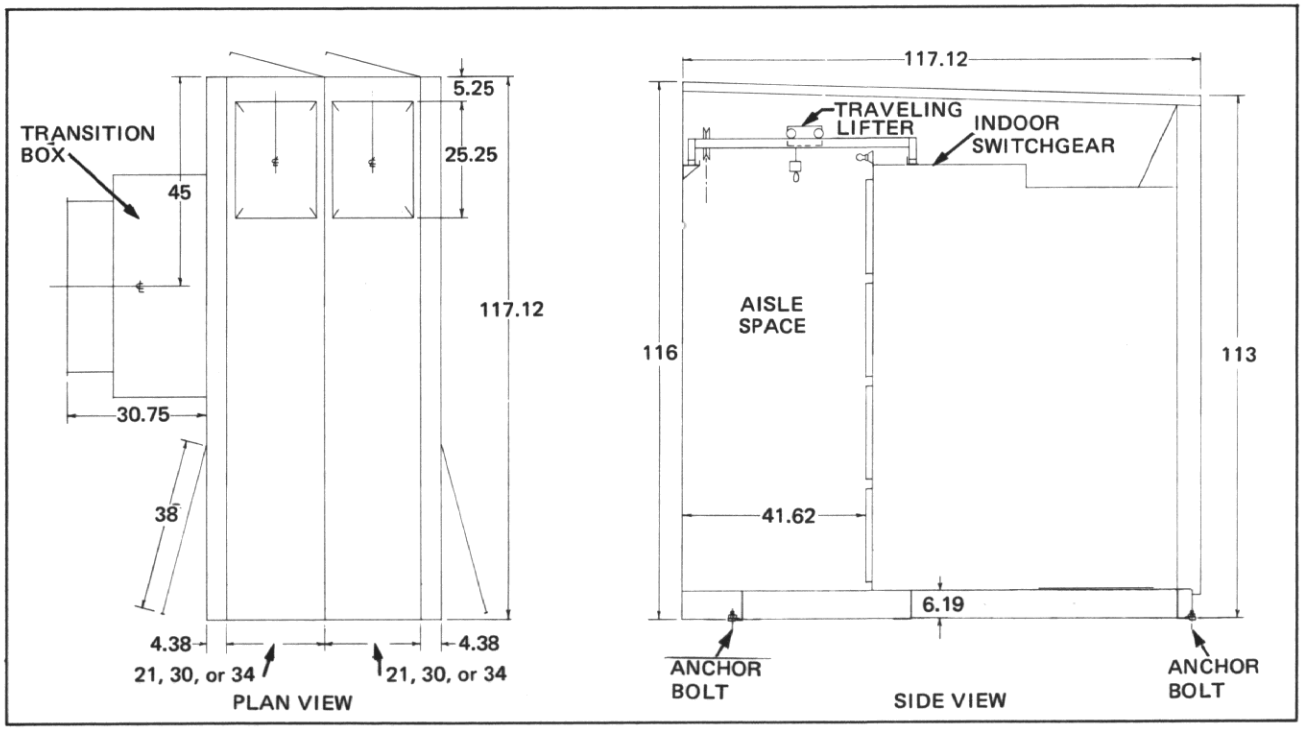


Fig. 28 *DSO Outdoor House Outline*

Type DSO Outdoor Switchgear

Type DSO switchgear consists of standard indoor switchgear structures assembled within a heavy gauge weatherproof enclosure. The enclosure provides a continuous "walk-in" operating and maintenance aisle in front of the indoor structure. This aisle has large reinforced entry doors equipped with "panic" hardware at each end. These doors can be opened from the inside even when the outside doors are padlocked. The rear of the enclosure is equipped with hinged covers for access to the bus and cable compartments. These covers are bolted closed, and equipped with a padlock hasp for locking.

Standard features of Type DSO Switchgear include:

- Labyrinth type door openings - no gaskets required.
- Filtered ventilation openings.
- Traveling, geared breaker lifting device.
- Interior lighting and duplex receptacles.
- Rigid fabricated base structure for pad or foundation mounting.
- Walk in aisle is shipped assembled.
- Dark gray weather resistant exterior finish.
- Asphalt coating on underside of base.
- Space heaters for prevention of condensation.
- Removable covers in base for easy conduit installation.

For easy assembly into coordinated secondary unit substation, large transition throats with removable covers are provided. See Fig. 27 and 28.

Outdoor switchgear is also available as type DSOA. This switchgear is similar to type DSO except it does not have a "walk in aisle" or a "traveling geared lifting device" as described above. A removable geared lifting device is supplied.

RECEIVING, HANDLING AND STORAGE

Type DS or DSO metal-enclosed switchgear is shipped assembled in one or more groups depending on the number of units, total length or limitations of handling facilities at the installation site. Indoor shipping groups are bolted to longitudinal wooden skids located at the front and rear of the assembly. If shipment is made by rail or open truck the equipment is enclosed in a weather proof covering. When shipment is made in an enclosed or covered truck the weather proof covering is omitted. Each shipping group is plainly marked with or accompanied by an identification number, the General Order number and the shipping weight. A list of the contents of each shipment is included with the shipping papers.

Type DSO outdoor switchgear is inherently weatherproof, has a rigid fabricated base and requires no special covering or skids for shipment. If an assembly is separated into more than one group for shipping the matching ends are rigidly braced and provided with weatherproof covering as required.

All units are given commercial tests at the factory, after which they are carefully inspected and prepared for shipment by personnel experienced in the proper handling of electrical equipment.

Receiving

When the switchgear reaches its destination, the Purchaser should check the material actually received against the shipping list to be sure that all parts have been received. This should be done prior to discarding the packing material to avoid the loss of small parts. If damage is found or suspected, file claims as soon as possible with the transportation company and notify the nearest representative of the Westinghouse Electric Corporation. If the switchgear is to be installed as soon as received, it is recommended that the unpacking and handling be done as outlined in the paragraphs that follow. If the switchgear is to be stored or held for some time it is advisable to unpack sufficiently to check the shipment for completeness and condition; then reseal packing for protection until installation.

Handling

For ease of handling by a crane, each indoor shipping group is equipped with a lifting bar extending the length of the group. The bar has two 2 inch diameter holes to accept the crane hooks. On long lineups, a suitable spreader should be used with the crane sling to prevent any horizontal compressive load on the lifting bar. The bar is located approximately above the center of gravity, but variations in equipment may cause a slight tilt either forward or backward. The lifting bar may be removed and discarded after installation is complete.

Indoor switchgear shipping groups are provided with a dual purpose jack support and shipping brace at each end of the group when shipped by rail (not included for truck shipments). During shipment they are used for cross bracing to the freight car. During installation they can be removed and bolted in the lower set of tie bolt holes (as shown in Fig. 29) to make a handy jack support for removing skids and lowering the group to the floor. When the switchgear is not shipped by rail, a simple jack support can be fabricated by the purchaser from angle iron or wooden timbers.

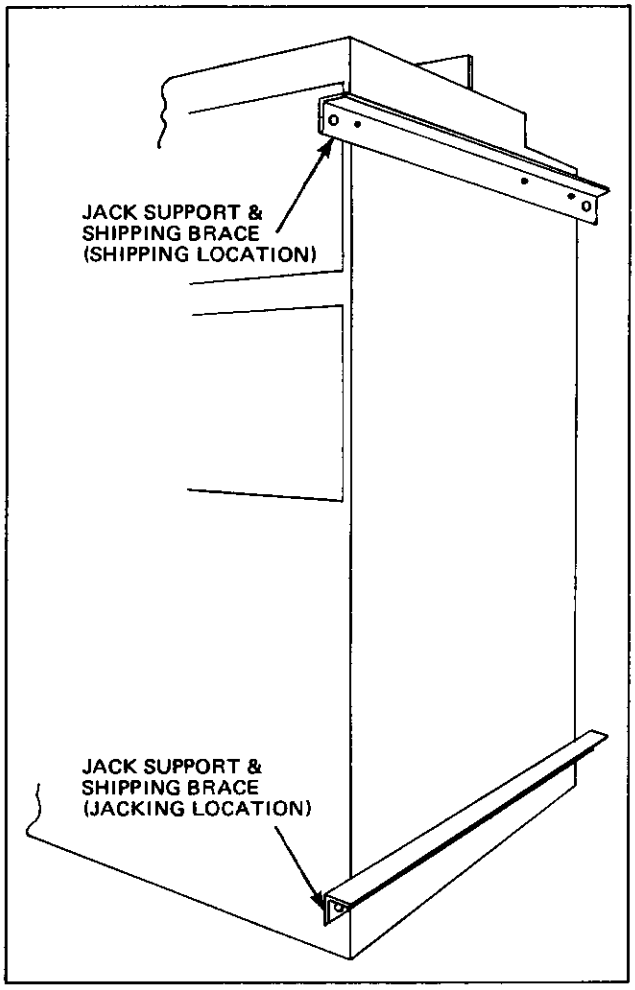


Fig. 29 *Shipping Brace Relocated to Form Jack Support*

It is preferable to lift the groups into position by a crane. However, if a crane is not available, they can be skidded into place on rollers. The longitudinal wooden skids provided at the front and rear for shipment may be used directly when rolling sideways, but for front-to-back rolling additional temporary skids must be provided in this direction. *Never let the rollers engage the switchgear directly - distortion and damage may result.*

For removing the rollers and skids and lowering the switchgear into place, jacks may be placed under the jack support (if provided) of the first group. However, in moving in subsequent groups, the jack support must be removed in order to place two groups next to one another. A method of lowering subsequent groups is the use of long wedges fabricated from 4 x 4's cut on the diagonal. With a large crowbar each corner may be lowered alternately a fraction of an inch. Two 2.0 x .50 inch slots are also provided in the front of the unit for this purpose as shown in Fig. 30.

Outdoor switchgear is equipped with lifting lugs attached to the base and cable spreaders attached to upper portion of the end walls to expedite lifting by crane. It may be placed directly on rollers for moving without additional skids.

Handle all crated or uncrated switchgear with extreme care since the drawout air circuit breakers may be shipped in their compartments and the front panels may contain delicate instruments, meters, or relays which may be damaged by rough handling. When handling the units, care should be exercised to avoid breakage and scratching or marring of the panel finish. Instructions for removing the shipping braces from the drawout breaker element are included later in this book.

If indoor switchgear is exposed to dust and dirt during construction, prior to being placed in service, it should be covered for protection. Removable elements should be stored in their compartments or covered separately.

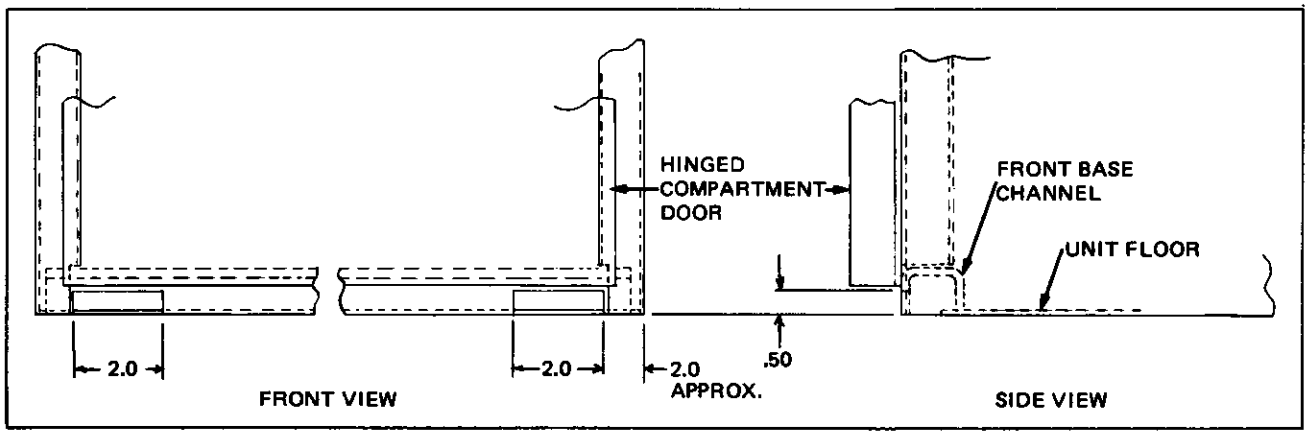


Fig. 30 *Location of Pry Slot at Front*

Storing

Indoor switchgear which cannot be installed and put into service immediately should be stored in a dry, clean place, preferably indoors, in a heated building. Trouble and delay will be avoided by having good storage facilities arranged so that the apparatus will be accessible only to authorized persons, and can be quickly located when required in the erection program. Conditions such as dampness, changes in temperature, cement dust, and corrosive atmosphere should be carefully guarded against. If necessary to store outdoors, special precautions will be required to keep it clean and warm enough to control condensation. It will be necessary to cover the switchgear and install temporary heating equipment. Approximately 250 watts per unit are required for average conditions. Outdoor storage of indoor switchgear, even for a brief period is not recommended and should be avoided if at all possible. The weatherproof covering which may have been provided during shipment is *not* adequate protection during outdoor storage.

Type DSO outdoor switchgear requires a minimum of care during outdoor storage. The area should be reasonably free from dust and corrosive gases and the space heaters which are a standard feature of this equipment should be energized to prevent condensation. Additional protection will be required for the exposed ends at shipping breaks if the equipment is shipped in more than one group.

During storage the switchgear shipping groups, either indoor or outdoor, should be placed on smooth and level surfaces to prevent unnecessary strain and possible distortion.

Weights

Weights listed in Table 2 are approximate. They will vary according to the actual complement of equipment supplied on the switchgear assemblies, depth of units, bus material and bus rating. Circuit breaker weights will vary slightly due to the differences in functional components on the individual breaker and the size of the current limiting elements supplied on DSL breakers. Fuse truck weights will vary due to the difference of available fuse sizes.

However, these weights are sufficiently accurate to be used in planning foundations and scheduling handling equipment at the point of installation.

Table 2 - Approximate Weights

Indoor Switchgear	Pounds
Circuit Breaker Units - less breakers	
21 inches wide	1400
34 inches wide	1500
Auxiliary Units	
21 inches wide	1100
30 or 34 inches wide	1200
Standard Transformer Transition Unit	300
Outdoor Switchgear	
End Trims - One Set per assembly	1300
Circuit Breaker Units - less breakers	
21 inches wide	2100
34 inches wide	2400
Auxiliary Units	
21 inches wide	1800
30 or 34 inches wide	2100
Standard Transformer Transition Throat	600
Drawout Elements	
DS-206 Circuit Breaker	150
DS-416 Circuit Breaker	195
DS-420 Circuit Breaker	200
DS-632 Circuit Breaker	300
DS-840 Circuit Breaker	400
DSL-206 Circuit Breaker	200
DSL-416 Circuit Breaker	260
DS-3200 Fuse Truck	325
DS-4000 Fuse Truck	430

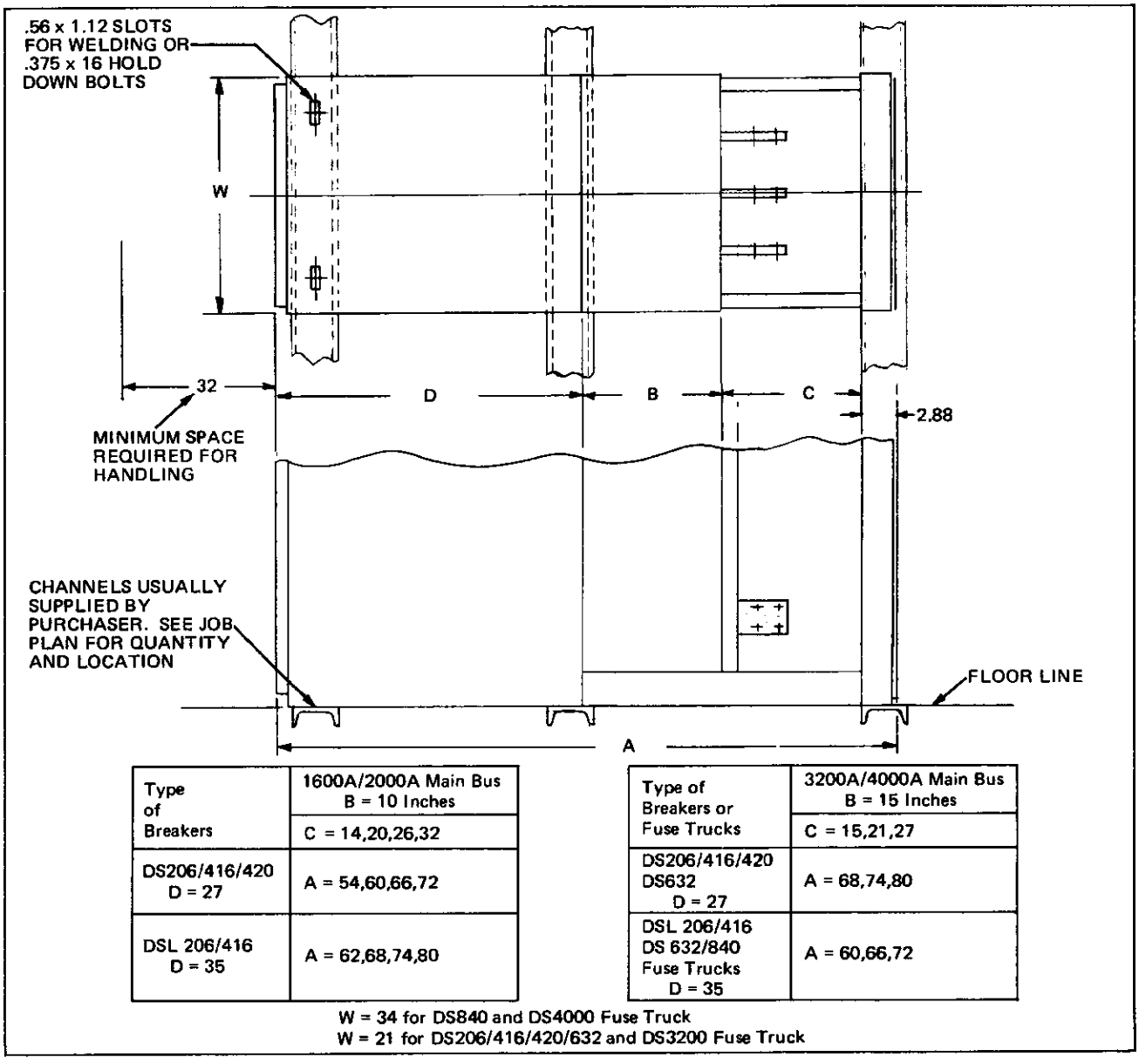
INSTALLATION

Prior to Installation

Proper installation of Westinghouse Type DS Low Voltage Metal Enclosed Switchgear is of prime importance. Too much emphasis cannot be placed upon this phase of the work. Study the associated instruction books and all drawings carefully. In most cases, all drawings will be sent to the Purchaser some time previous to the shipment of the gear to enable adequate advance planning. These drawings will include general assembly, front view, plan view, floor plan, schematic and connection diagrams.

Location

In locating Type DS indoor switchgear, consideration must be given to the aisle space required at the front and rear of the equipment as well as space at the ends of the



Type of Breakers	1600A/2000A Main Bus B = 10 Inches
	C = 14,20,26,32
DS206/416/420 D = 27	A = 54,60,66,72
DSL 206/416 D = 35	A = 62,68,74,80

Type of Breakers or Fuse Trucks	3200A/4000A Main Bus B = 15 Inches
	C = 15,21,27
DS206/416/420 DS632 D = 27	A = 68,74,80
DSL 206/416 DS 632/840 Fuse Trucks D = 35	A = 60,66,72

W = 34 for DS840 and DS4000 Fuse Truck
W = 21 for DS206/416/420/632 and DS3200 Fuse Truck

Fig. 31 *Typical Floor Plan*

lineup. The recommended minimum aisle space is shown on the floor plan drawing furnished with the order. Fig. ure 31 shows a typical floor plan and a table of dimensions for the various depth units. The space at the front must be sufficient to permit the opening of doors, the insertion and withdrawal of the breakers and their transfer to other compartments by means of the hoist. The space at the rear must be sufficient for installation of cables, inspection, and maintenance.

For type DSO outdoor switchgear, sufficient space must be provided for the side doors and hinged rear covers to be opened. The front covers are not removable but a front space of at least 24 inches is recommended for inspection and maintenance of the structure.

Foundation

Westinghouse Type DS metal-enclosed switchgear is fabricated in welding fixtures and assembled on true and level bedplates to insure ease or operation at all times. Since the tolerances and adjustments are kept to a minimum, it must be installed on a smooth level base.

Extra care by the Purchaser in laying out and preparing the foundation will result in reduced installation costs as well as good switchgear performance.

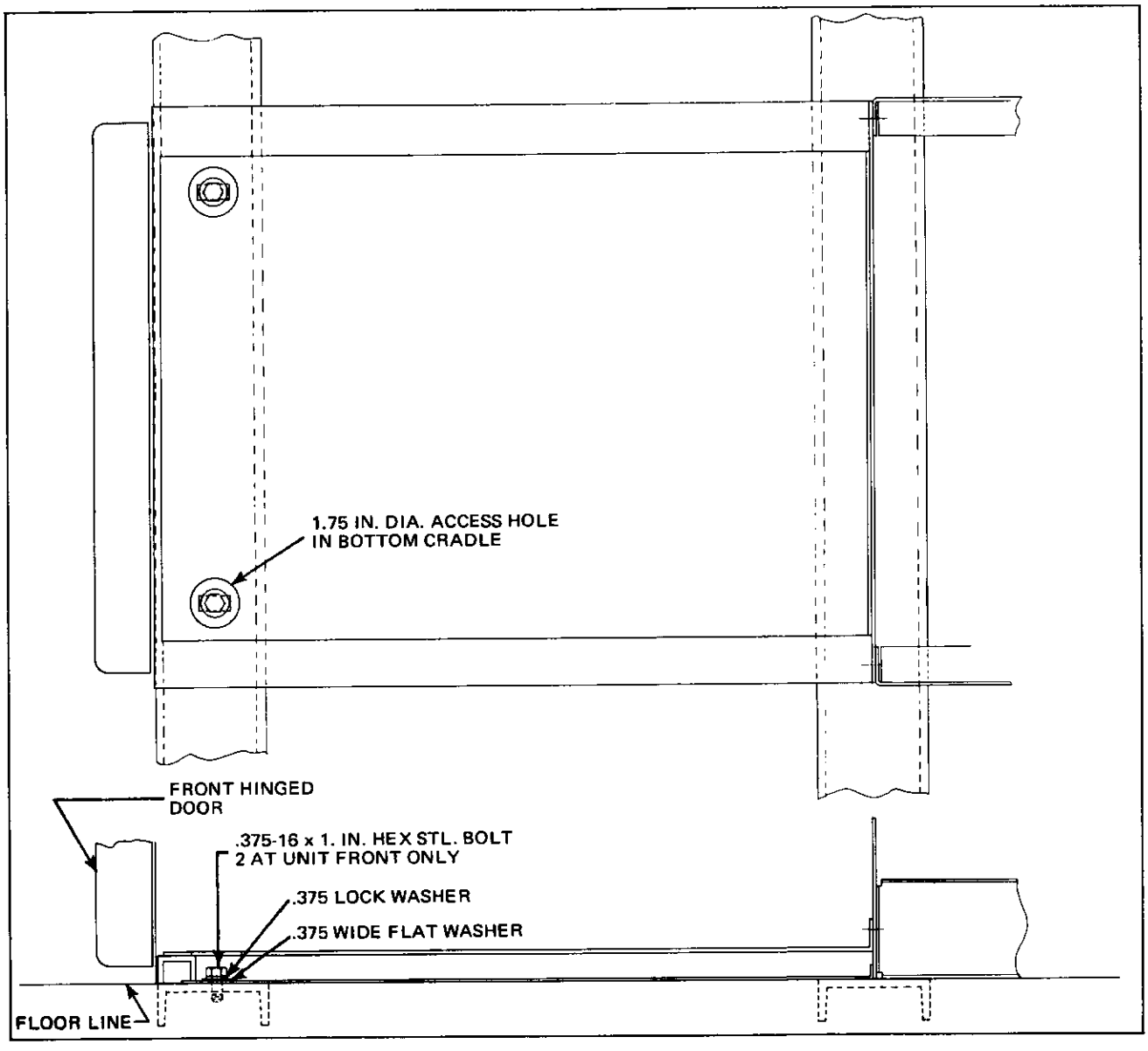


Fig. 32 *Anchor Bolt Detail*

The station floor or foundation must be strong enough to support the weight of the equipment without sagging. Table 2 - page 20 tabulates the approximate weights for the various ratings of indoor switchgear. Actual weights will vary depending upon the type and amount of equipment in the individual units. Adequate safety factors must be used. If the foundation is suqject to vibration, special mounting must be provided to prevent the transmission of vibration or shock to the equipment.

The preferred method of anchoring the indoor switchgear is by fastening it to steel channels which are properly embedded in the concrete floor. Figure 31 shows a typical indoor floor plan that may be used for estimating purposes. Detailed floor plans for drilling and locating this steel are supplied with each order.

Installations subject to seismic accelerations require special foundations. This is a common requirement in nuclear generating stations wherever they may be located.

Floor Steel

Anchor bolts, floor steel, and other foundation material are to be furnished by the Purchaser.

A 4 inch (5.4#/ft.) structural channel is recommended as a minimum size for the average lineup of indoor equipment, when large unit substation transformers are included in the installation, the floor steel under the transformer should be installed in accordance with the transformer manufacturer's recommendations.

Important: **The front and rear channels must be set level and aligned with each other and must be level over their entire length to avoid distortion of the switchgear structure. The finished floor may have a slight pitch away from the channels, but in no case should the finished floor be higher than the channels.**

Each unit is fastened to the floor channels by either bolting or welding as shown in Fig. 32. If bolting is to be used, the mounting bolts must be placed in the floor steel before the concrete is poured to assure that the tapped holes will not fill with concrete. Welding is a quick and easy method of securing the switchgear in place and eliminates the layout of the mounting holes in the channels.

Floor channels are not required for type DSO outdoor switchgear. See Figure 28 for anchor bolt details.

Conduits

Provisions must be made in the foundation for the conduits which carry the main cables, control wiring, and ground cable when such conduits enter the switchgear from below. The specific floor plan must be used for determining the final conduit layout, spacing of floor channels, and floor space required for each switchgear unit.

Encircling loops of reinforcing or building steel around single phase conductors should be avoided in the areas for main cables when these circuits are rated at 600 amperes or above.

Conduits should project above the finished floor approximately two inches for indoor switchgear. It will simplify moving the groups into place if the conduits are flush with the concrete surface and appropriate extension sleeves added after the units are in their final location. Otherwise it will be necessary to raise the units on timbers a sufficient height to clear the tops of the conduits.

Consideration should be given to installing conduits for future circuits at this time.

Shipping Skids

If possible, the shipping skid should remain on each group until it is at or near its final location. This will allow the use of pipe rollers for moving the group; and will also lessen any chance of distortion during final positioning.

Refer to Fig. 33. The front and rear wood sills of the skid are fastened to the bottom of the end units of the group by a total of four steel bolts - one in each corner. To remove the bolts, the skid must be raised a minimum of 6 inches above the floor; and a standard hex socket wrench used.

Although only one bolt is used at the corner of each shipping group, several captive nuts may be furnished in each unit. All should be removed prior to fastening the units to the floor steel. The nuts at the front of the unit are located below 1.75 inch diameter access holes in the front of the breaker support cradle-in the bottom compartment. If breakers are furnished in these compartments, they must be removed as the shipping braces cover the access holes. Refer to section on shipping braces following.

The rear captive nuts are located in the bottom channel of the unit rear frame. Remove the bolted rear covers for

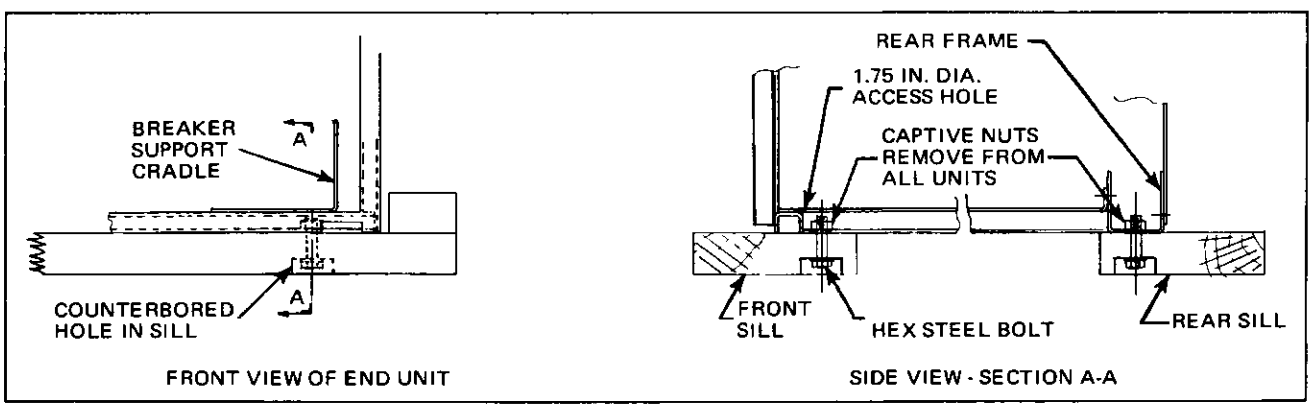


Fig. 33 *Removal of Shipping Skid*

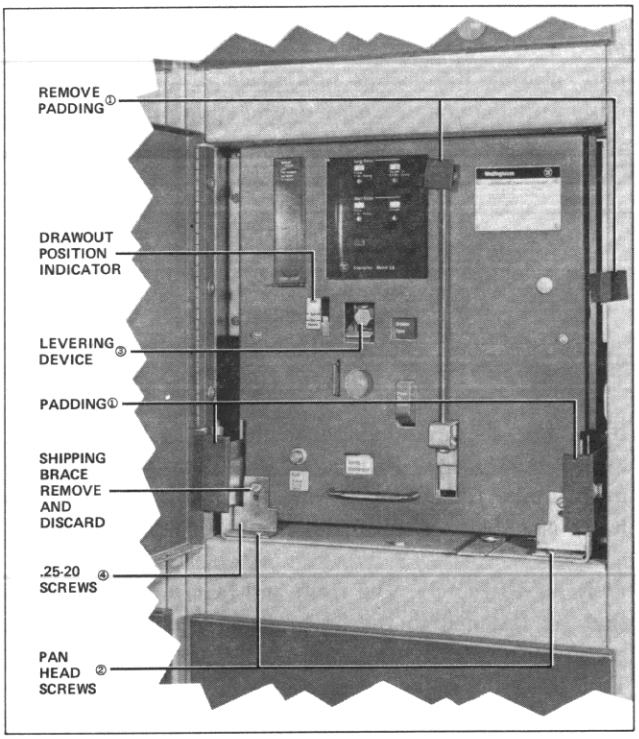


Fig. 34 *Front View of Breaker Shipped in Compartment*

access to these nuts. The clips holding these captive nuts may be pried out with a screwdriver.

Shipping Braces

Circuit breakers may be shipped either in separate cartons or secured in their own compartment. If the circuit breakers are shipped in separate cartons they should be unpacked carefully to avoid damage. If they are shipped in their own compartments the instructions in this section should be followed. SEE SECTION ON LIFTING THE BREAKER ON PAGE 34.

Before the circuit breaker element can be withdrawn from its compartment for the first time, the shipping braces must be removed from the lower part of the breaker front panel. Refer to Fig. 34. During shipment, the front wheels of the breaker are lifted approximately 1/16 inch above the compartment rails, and the unit is held part way between disconnected and test positions by means of its levering device.

Note: **Preliminary operation and inspection of the draw-out breaker unit are covered in detail in Instruction Book No. 33-790-1.**

Figure 35 is a drawing showing the side view of a typical breaker in its compartment as received. Study this figure and the following steps carefully before proceeding.

Note: **Step numbers below correspond to numbers on Fig. 35.**

1. Remove the sponge rubber padding and tape from the compartment rails and the knob on the top of the spring charging handle. (Shown in Fig. 34.)

2. With a screwdriver, remove the two (2) outside .25-20 pan head screws from the bottom leg of the shipping braces. Do not discard, as later they will be returned to their tapped holes. Do not remove the center screw.

3. Using the crank to operate the levering device, release the breaker from the shipping position. The crank will be shipped in a box of separate details. This procedure is covered in detail in the breaker Instruction Book No. 33-790-1. When the position indicator shows the levering device to be in the "remove" position, and the hand crank will no longer turn, remove the hand crank. Pull the breaker out onto the extended rails. This will require more effort than normal as the rear wheels are jammed by two lengths of plastic tubing used for shipping only.

4. Remove the two (2) .25-20 screws holding the shipping braces to the front panel of the breaker. Care must be exercised to prevent marring the front panel. Two or more flat washers are used between the braces and front panel for shipping. Discard the braces.

5. Immediately replace the two .25-20 screws in the front panel, discarding all washers.

6. With the breaker pulled completely to the end of the rails, remove the two (2) three inch long pieces of split plastic tubing that are on the top rear of the stationary rails immediately below the hold-down hooks. This tubing is for shipping purposes only and is to be discarded.

7. If secondary disconnecting contacts are supplied, a sheet of protective paper is inserted between the stationary and moving contacts during shipment. This must be removed and discarded.

8. Push the breaker back into its compartment, and replace the two (2) .25-20 pan head screws at the front edge of the cradle.

ASSEMBLY OF SHIPPING GROUPS

When correctly installed, the units for both indoor and outdoor metal-enclosed switchgear should conform to the following requirements:

1. Front panels form a straight true line: and when transformers and/or other gear are included, the fronts should line up or form parallel planes.

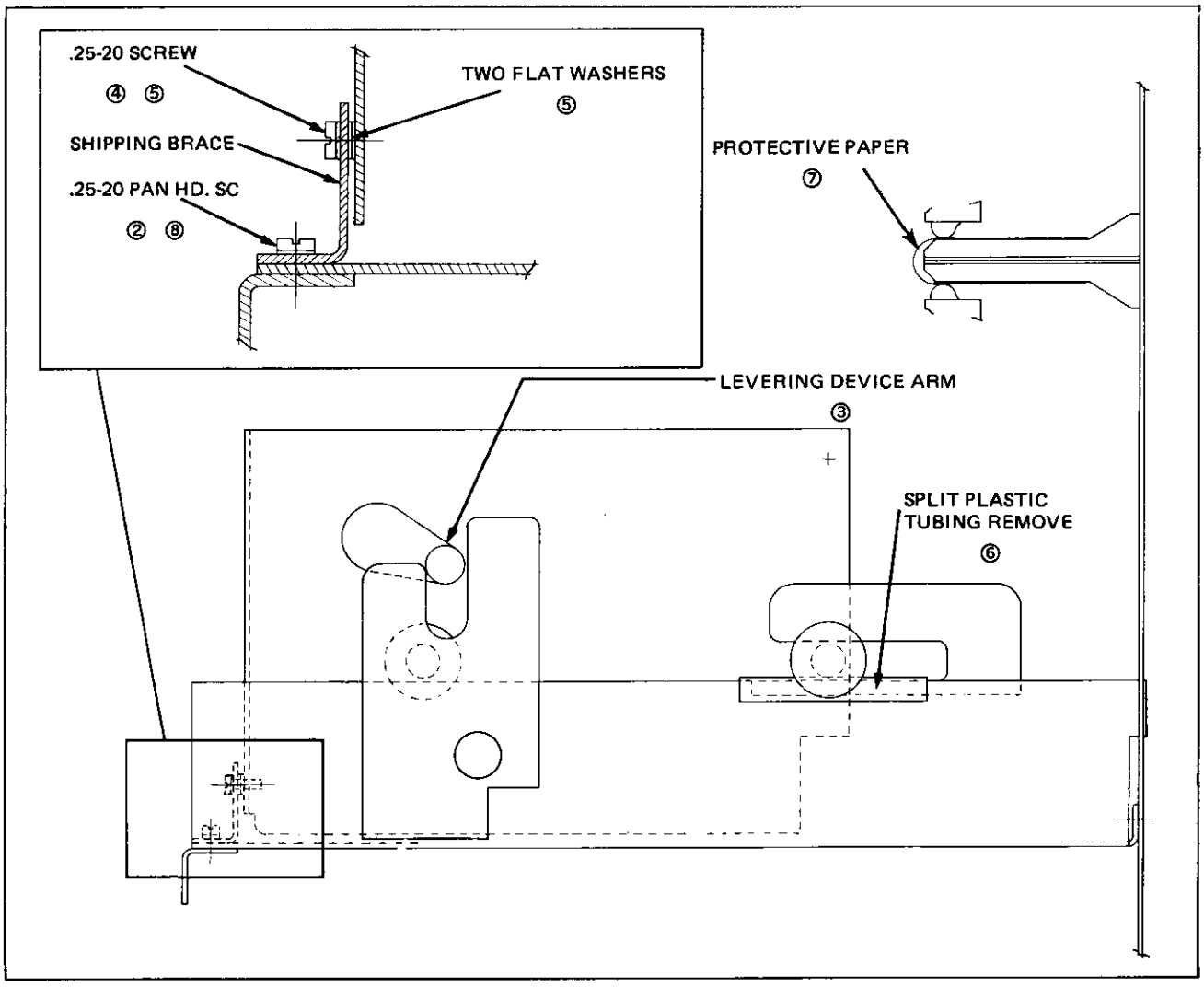


Fig. 35 *Section View of Breaker Shipping Details*

2. Units correctly spaced from center to center and plumb.

3. Entire assembly of housings securely fastened to floor channels or base pad.

4. Shipping groups must be securely bolted together, and all bus and control wiring connections properly made.

A suggestion for lining up the units is to establish a base line a few inches in front of the housings and parallel to the final location. Equalize the distances from the front of the housings to the base line, thus making the face of the group parallel to the base line.

Check the plumbness of the units by dropping a plumb line from the exact center or the horizontal steel member at the top front of the unit. It should align with the center of the bottom cross channel.

After the first group has been located, the second group should be moved into position and similarly checked. The steel housings are fastened together at eleven (11) locations which are shown in Fig. 36. Special short neck .38-16 x .75 steel carriage bolts are furnished for this purpose. It will facilitate assembly to locate the bolt head in the right hand unit with the nut and washers in the left hand unit. These should be tightened to the torque as shown in Table 3 page 29.

Bus Connections

All connections of the main and neutral busses and the ground bus at shipping breaks are made by means of bolted copper splice plates. These are always silverplated, bolted joints, and no field welding of aluminum is re-

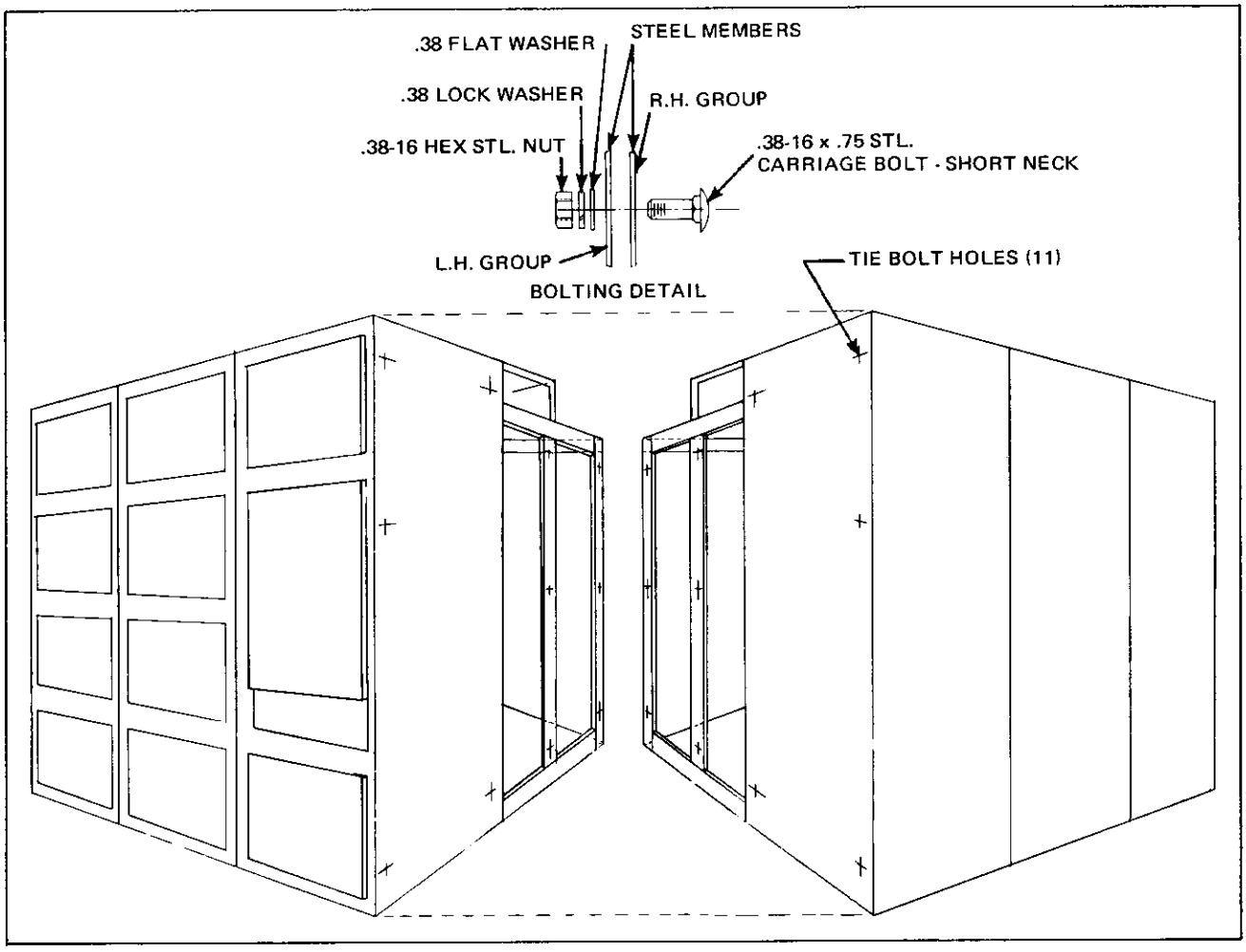


Fig. 36 *Tie Bolt Locations for Joining at Shipping Break*

quired. All necessary hardware and splice plates are included. Provision is made at the ends of the lineup not adjacent to transformers for future expansion by means of bolted joints.

The following figures show in detail the methods employed for joining the various types and ratings of main bus.

1. 1600/2000 Amp Aluminum Bus - Fig. 37.

Two (2) .25 x 3.0 inch aluminum bars per phase are used, with a single .25 x 4.0 copper splice plate at bolted connections.

A total of four (4) .50-13 high strength steel bolts and "Pyramidal" lock washers are used in each plate. The heads of the bolts face toward the rear of the units. They must be tightened to the torque shown in Table 3 page 29.

2. 3200 Amp Aluminum Bus - Fig. 38.

This rating employes two (2) .50 x 3.0 inch aluminum bars per phase. Each bar is joined by means of two (2) .25 x 4.0 inch copper splice plates at bolted connections. Each pair of splice plates uses four (4) .50-13 high strength steel bolts and "Pyramidal" lock washers. It will be easiest to join the bus bar that is nearest to the front of the switchgear first.

3. 4000 Amp Aluminum Bus - Fig. 38.

This rating employes two (2) .50 x 4.0 inch aluminum bars per phase. Each bar is joined by means of two (2) .25 x 4.0 inch copper splice plates at bolted connections. Each pair of splice plates uses four (4) .50-13 high strength steel bolts and "Pyramidal" lock washers. It will be easiest to join the bus bar that is nearest to the front of the switchgear first.

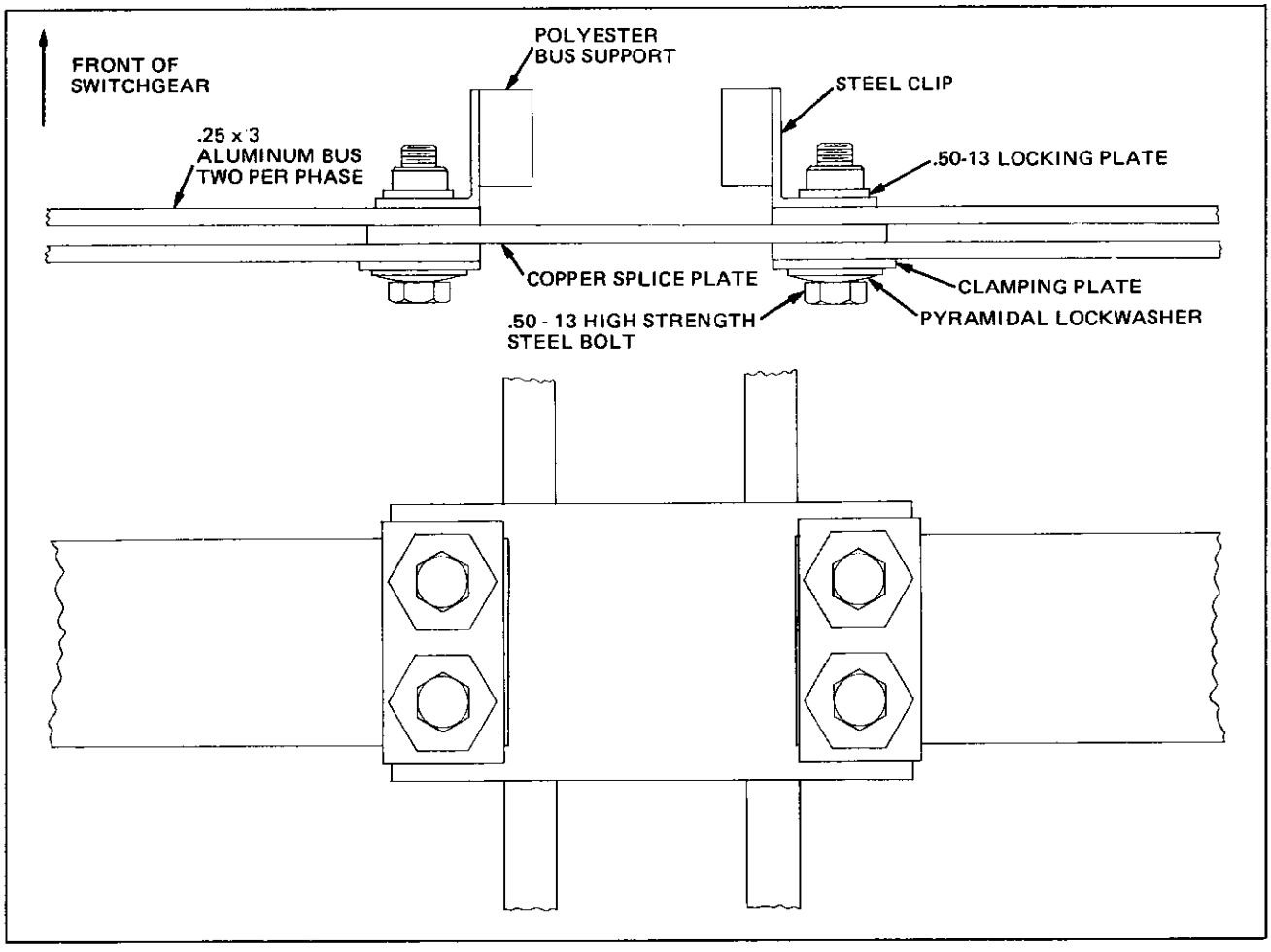


Fig. 37 *Field Assembly of Joints in 1600/2000 Amp Aluminum Bus*

4. 1600/2000 Amp Copper Bus - Fig. 39.

One (1) .25 x 4 copper bar is used per phase with one (1) .25 x 4 copper splice plate used at each bolted connection. A total of eight (8) .50-13 high strength steel bolts and "Pyramidal" washers are used at each bolted connection.

5. 3200 Amp Copper Bus - Fig. 40.

This rating employs two (2) .25 x 5.0 inch copper bars per phase and two (2) .25 x 5.0 inch copper splice plates per phase at each bolted joint. A total of eight (8) .50 - 13 high strength steel bolts and "Pyramidal" washers are used at each bolted connection.

6. 4000 Amp Copper Bus - Fig. 40.

This rating employes three (3) .25 x 5.0 inch copper bars per phase and three (3) .25 x 5.0 inch copper splice plates per phase at each bolted joint. Otherwise the assembly is the same as the 3200 ampere rating.

Neutral Bus

When required on a four wire system an insulated neutral bus is supplied, located in the bus compartment approximately 44 inches above the floor. The neutral bus is always copper, regardless of the main bus material. See Fig. 40. Available neutral bus sizes are listed in the following table.

Neutral Bus Sizes

Main Bus Rating	Minimum Neutral Bars	Maximum Neutral Bars
1600 or 2000 Amp	1 - .25 x 2.0 in	1 - .25 x 4.0 in
3200 Amp	1 - .25 x 4.0 in	2 - .25 x 4.0 in
4000 Amp	2 - .25 x 4.0 in	3 - .25 x 4.0 in

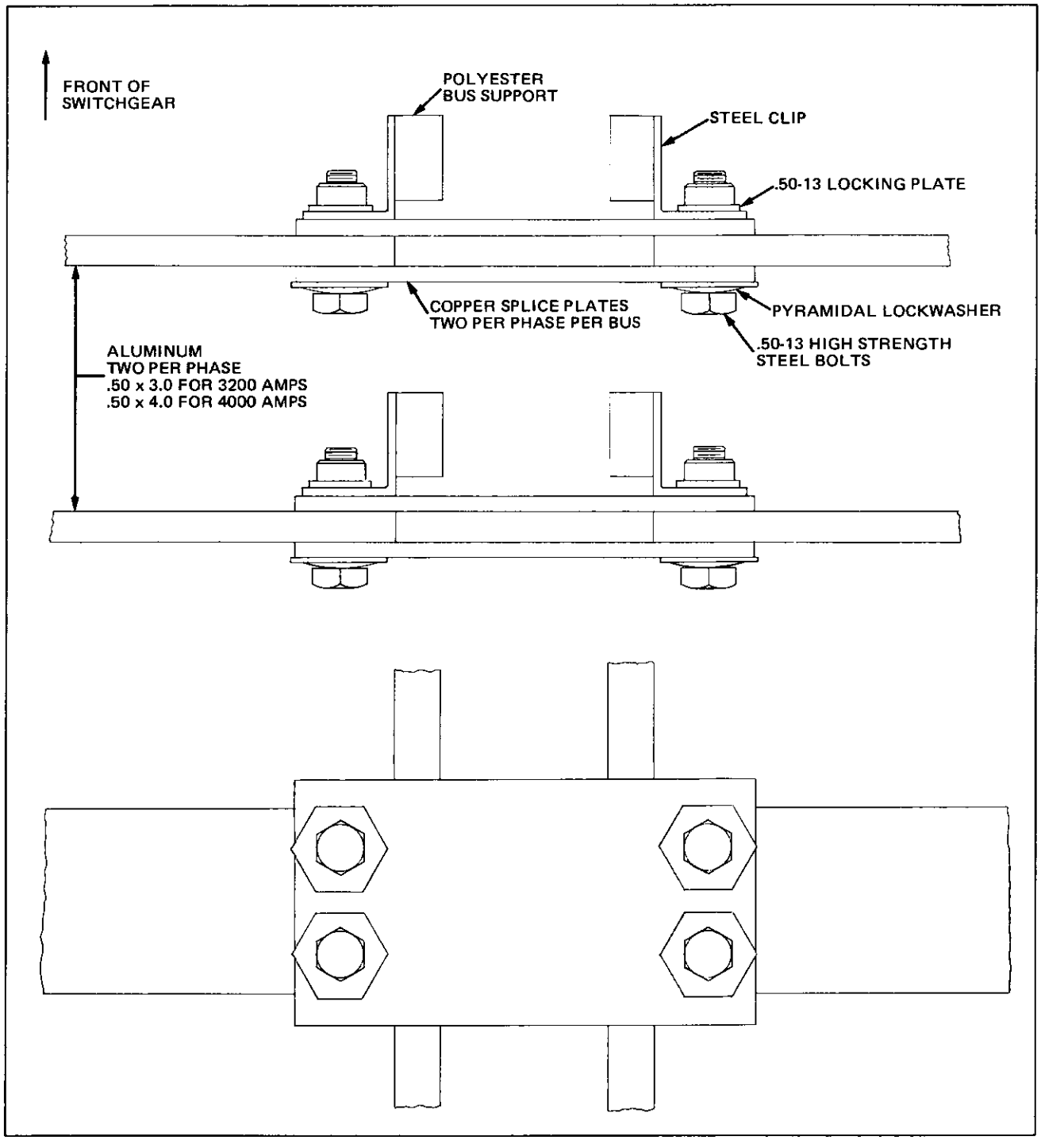


Fig. 38 *Field Assembly of Joints in 3200/4000 Amp Aluminum Bus*

Copper Ground Bus - Fig. 41

The joint in the .25 x 2.0 inch copper ground bus is made by means of a single copper splice plate bolted directly to the inside of the rear steel frame.

Preparation of Bus Joints

The bolting areas of all bus materials are silver-plated to provide the optimum joint. In some atmospheres the silver will become tarnished, but this does not reduce its effec-

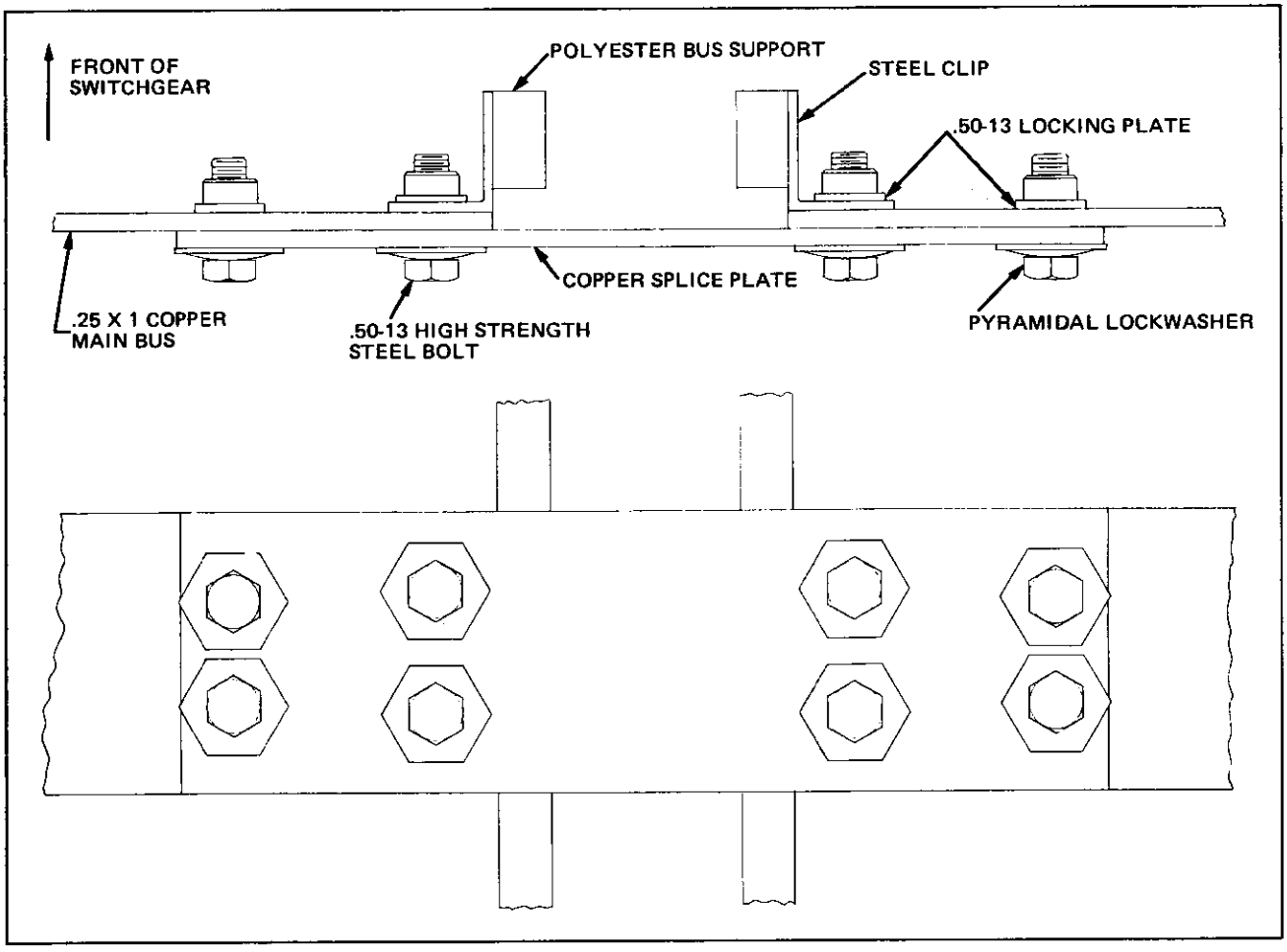


Fig. 39 *Field Assembly of Joints in 1600/2000 Amp Copper Bus*

tiveness. However, dirt, grease, and other foreign material must be removed from the surfaces before they are joined. Clean the silver-plated contact surfaces carefully by rubbing with a clean cloth, and wipe with a cleaning solvent such as Stoddard's Solvent (or Westinghouse #55812CA) if required.

Caution: **This is a flammable liquid. Keep sparks and flames away. Do not breathe large quantities of vapor. Avoid excess contact with skin.**

Bolt Tightness

All bolts holding structural members, barriers and covers are installed in the factory tightly enough to insure rigidity of the assembly and to prevent rattling of the covers after the equipment is energized. When covers or barriers are removed during installation care should be taken to solidly tighten all bolts after replacing.

Bolts installed in bus joints and connections are normally high strength steel. Silicon bronze hardware is sometimes supplied, if specified by the customer. The reliability of current conducting joints is dependent upon the tightness of the joint. Therefore, extreme care must be taken when making or remaking bus joints in the field to insure their tightness. Bolts in bus connections should be tightened according to Table 3.

Table 3 - Bolt Tightness for Bus Connections

Bolt Material	Torque in Foot-Pounds for Bolt Size				
	.25-20	.31-18	.38-16	.50-13	.62-11
High Strength Steel	5	12	20	50	95
Silicon Bronze	5	10	15	40	55

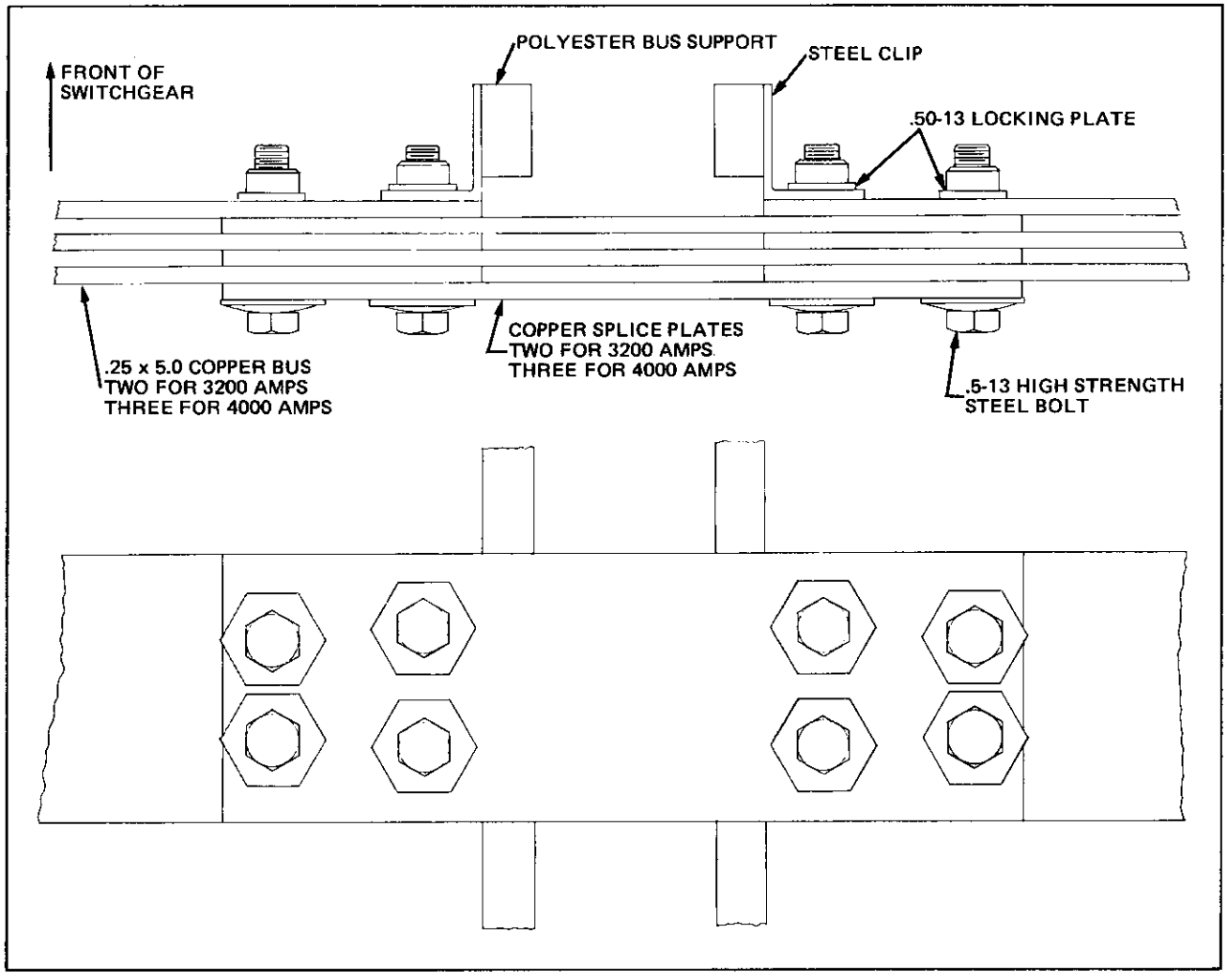


Fig. 40 *Field Assembly of Joints in 3200/4000 Amp Copper Bus*

Barriers

Steel barriers separating the bus and cable compartments are optional items. When barriers have qeen provided on a switchgear assembly, they should be in place before feeder cables are installed. Those barriers located between the runbacks from the feeder compartments will be fastened by means of four .38-16 hex head steel bolts and lock-washers. A few of the larger barriers may have six bolts. These should be securely tightened to the prescribed torque to prevent vibration during operation.

Main Power Connections

Low voltage metal-enclosed switchgear is usually provided with solderless cable connectors for terminating the main power cables.

Before making up the connections, the phase of each cable must be determined. Normally, switchgear is supplied with connections for phase sequence 1-2-3 unless otherwise required on the particular order.

When forming cables for termination within switchgear assemblies, avoid sharp turns, corners, and edges in order to prevent damage to, or weakening of the cable insulation. The cable manufacturer's instructions should be followed closely in determining the minimum bending radii of cables. This will vary with the type and size of cable involved. Cable supports as required may be attached to the frame of the switchgear assembly.

Adequate electrical and mechanical clearances must be provided between cables, conduits, and bus in this compartment. Where the cables enter the unit, they must be

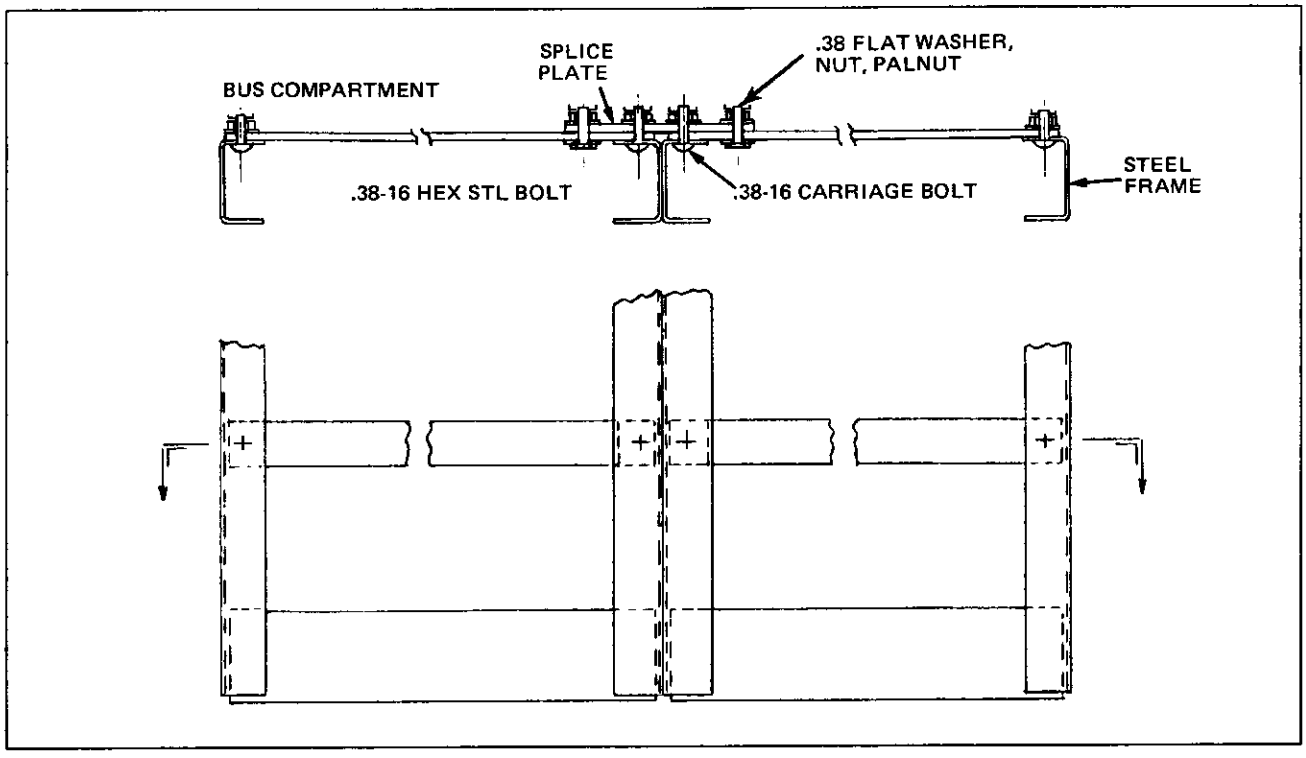


Fig. 41 *Field Assembly of Joints in Ground Bus*

securely lashed and supported to withstand any short circuit forces, and to prevent any strain or load on the terminals.

Ground Bus Connections

Terminals of the solderless type are provided on the copper ground bus in one or more of the units, depending upon the number in the lineup. These are shown on the floor plan drawing, and are for the connections to the station ground which should be as direct a connection as possible, and should not be run in metal conduit. The grounding conductor should be capable of carrying the maximum line-to-ground current for the duration of the fault.

Caution: **A permanent low resistance ground is essential for adequate protection. A poor ground may be worse than none since it gives a false feeling of safety to those working around the equipment.**

Control Connections

All interunit control wires that cross a shipping break must be reconnected to their correct points on the terminal blocks provided for this purpose. These have been properly tagged at the factory and will be shown on the connection diagrams for the order.

Any control connections to remote mounted relays, control switches, instruments, etc. will be brought to a set of terminal blocks located on the rear frame of the unit.

Control wiring should be checked with the connection diagram to make certain that all connections have been properly made, all fuses installed, current transformer circuits completed, and loose connections tightened. Before applying control energy, check all control circuits, except current and potential transformer secondary circuits for grounds; and make sure that all circuits are clear.

If the control power source is other than a self-contained control power transformer, the cables from the source to the switchgear must be of adequate size to avoid excessive voltage drop during operation.

Key Interlocks

Key interlocks are often supplied when it is necessary to insure the proper sequence of operation between two or more circuit breakers or between a circuit breaker and fuse truck or disconnect switch. The interlock mechanism provided in a circuit breaker compartment functions by preventing a circuit breaker from being levered into the compartment. This insures that before the interlock key

can be removed to be used in another location, the circuit breaker must be opened and withdrawn from the compartment. After this is done the blocking mechanism is moved into place, the key lock can be turned and the key removed. Detailed operating instructions are located on the inside of the compartment door whenever an interlock is provided.

A special version of this blocking type key interlock makes use of a pull-out padlock hasp for use with the customer's padlock instead of the key lock mechanism normally supplied.

Key interlock mechanisms used with DS3200 and DS4000 fuse trucks are mounted on the compartment door. This arrangement is intended to insure that a circuit breaker connected in series with the fuse truck has been locked out before the key is available to open the fuse truck compartment door. It is also necessary to close the fuse truck compartment door before the door lock can be operated and the key withdrawn to return it to the circuit breaker compartment.

The operation of key interlock systems may be complex and is generally described by a note or keying chart on the order assembly drawings.

Caution: **To facilitate manufacture and installation procedures, a key is supplied with each lock. Before placing switchgear with key interlocks in operation, the key scheme must be carefully checked; and only the proper keys left in the locks. All extra keys must be removed and destroyed or stored where not available to operating personnel. This procedure is necessary since improper use of spare keys will defeat the interlocking scheme.**

Moving Parts

There are few moving parts in the stationary structures of metal enclosed switchgear; and in general, they do not require installation as they are factory-installed. However, it is recommended that all moving parts be carefully operated by hand (even if normally operated automatically) to assure that no binding or damage has occurred during shipment or handling. In some cases, accessories may be blocked or braced for shipment; or foreign matter may have accumulated or lodged in the equipment during long periods of storage under unfavorable conditions.

Some apparatus, such as meters and relays, must be thoroughly checked for forms of blocking or bracing which must be removed.

PRE-OPERATION CHECK

After the switchgear equipment and apparatus to be controlled have been installed and all interconnections made, the equipment should be tested and given a final check before being placed in service. This is necessary to assure that the equipment has been correctly installed and that all connections are complete and have been properly made.

Caution: **Extreme care must be exercised to prevent the equipment from being connected to the power system while the preliminary tests are being conducted. If disconnecting switches are not available, line leads should be disconnected to accomplish this.**

The testing equipment will depend on the size and type of installation. Portable voltmeters, of the multi-scale type if available, will be required. For large and complicated installations, ammeters should be available in case unexpected trouble develops. Although insulation resistance will vary greatly due to the multiplicity of parallel paths in equipment of this type, an ohmmeter and "megger" will be valuable to insure that there is no breakdown of insulation. Initial insulation values may be recorded for comparison to values determined at a later date during inspection and maintenance. A continuing comparative record is valuable to help detect any progressive deterioration of insulation. A simple portable device for "ringing" or "lighting-out" circuits may be used for making continuity checks.

Wire connections, accessible bolted bus connections, and insulated joints should be examined to make sure that they have not been loosened or damaged during shipment or installation.

The connections to the equipment apart from the switchgear such as remote control and interlock circuits, and auxiliary switches should be "lighted-out" to make sure that they are also correct. The extent to which this will have to be done depends on the thoroughness of the installation work. There must be definite assurance that connections are correct before an attempt is made to operate the equipment.

Any relays included on the hinged instrument panel have been checked at the factory and are normally set at "minimum" for shipment. The final settings of the relays should be coordinated with other parts of the system in accordance with the Purchaser's standards or operating practice. If it becomes necessary to modify these relay settings, the instruction leaflet for the relay involved should be carefully studied. These instruction leaflets

show typical connection diagrams only and may not necessarily agree with the connections furnished. The schematic diagrams furnished for the order should be referred to for the actual connections.

The covers for meters, relays, and other devices which have to be removed during the course of installation and test should be carefully handled when removed. The covers should be put back in place promptly to keep dust and dirt from collecting on the vital relay parts.

Drawout Element

The trip settings of the Amptector trip devices should be checked to be sure that they are in accordance with the requirements of the circuits. For information on complete testing and maintenance of the circuit breakers see I.B. 33-790-1.

INSPECTION AND MAINTENANCE

Inspection and Maintenance Schedule

To assure high quality service, a definite maintenance schedule, systematically followed, is essential. Plant, operating, and local conditions vary to such an extent that the schedule must be prepared to suit the conditions. However, the following general requirements should be helpful in setting up the program.

Individual Devices

The maintenance schedule for individual devices such as circuit breakers, relays, meters, etc. should be based upon recommendations contained in the individual instruction book for the device. These operations should be coordinated with the overall program to result in the least operating inconvenience and circuit shutdown.

Overall Installation

The switchgear installation should be given a thorough overall maintenance check at least annually, when plant, operating, and local conditions are normal. Where conditions are abnormal, more frequent inspection and maintenance is necessary. The following items require attention:

1. Buses and Connections – De-energize primary circuits and remove rear cover from the primary compartment. Before cleaning, take "megger" readings between phases and to ground. Inspect for symptoms which might indicate overheating or weakened insulation. Remove dust from buses, connections, supports, and enclosure surfaces. A vacuum cleaner with a long nozzle will be of assistance. Wipe clean with a solvent such as Stoddard's Solvent (or Westinghouse #55812CA). If bolts need tightening, see Table 3.

Caution: **Keep sparks and flames away. Do not breath large quantities of vapor. Avoid excess contact with skin.**

After buses have been dusted and wiped clean, take "megger" readings again between the buses and ground and between phases. Keep a record of these readings for future reference in determining when trends occur that would indicate a lowering of the insulation resistance.

2. Main Disconnecting Contacts and Supports – Remove each breaker from its housing. De-energize all circuits and expose primary contacts and their supports. Wipe clean with a cloth moistened in Stoddard's Solvent. (See preceding paragraph.) Inspect for abnormal wear or overheating. Discoloration of the surfaces is not harmful unless corrosion due to atmospheric conditions is severe, leaving deposits on the surface. Any deposits must be removed by rubbing with a clean cloth, or a new contact installed. Check each breaker while it is out of the housing for all items recommended in the instruction book applying to that particular type of breaker.

3. Other Disconnecting Contacts – Inspect all secondary disconnecting contacts for abnormal wear, fatigue, or overheating. Replace if necessary; otherwise treat the same as Main Disconnecting Contacts above.

4. Instruments, Relays and Other Panel Mounted Devices – Individual devices should be maintained according to the specific instructions supplied for each device. Remove all relay covers and inspect the interiors for dust or dirt. This operation can most readily be performed by relay test personnel during periodic relay tests. Control switches, transfer switches, and instrument switches should have their contacts inspected.

5. Secondary Wiring – Check all wiring connections for tightness including those at the current and potential transformers and at the terminal blocks where circuits leave the switchgear. Make sure that all secondary wiring connections are properly connected to the switchgear ground bus where so indicated.

6. Mechanical Parts – Visually check and manually operate mechanical moving parts such as truck operated switch assemblies, the position interlock, emergency trip linkage, and hinged doors. Examine mechanical parts such as the levering-in arms, and the rail extensions.

7. Ventilation – Check all labyrinths, grillwork, and air passages for obstructions and accumulations of dirt. When filters are used, check and replace when dirty.

8. Records – The condition of each switchgear unit at the time of inspection should be listed in a permanent record to become a guide for anticipating the need for replacements or for special attention between the regular maintenance periods.

9. Abnormal Conditions – Local conditions such as high humidity, salt-laden atmosphere, corrosive gases, heavy dust, or severe circuit operating conditions, are considered to be abnormal; and will require more frequent inspections.

It should be emphasized that a series of inspections should be made at quarterly intervals until the progressive facts of the local conditions can be analyzed to determine a schedule which will maintain the equipment in satisfactory condition.

In some locations local conditions may be so bad that the frequency of maintenance will interfere with operating and production schedules. In such cases, consideration should be given to the possibility of enclosing the switchgear equipment in a relatively tight room and to supplying a sufficient quantity of clean air so as to maintain a positive pressure in the room. Under such conditions maintenance schedules may then be established on a more normal basis. Such an arrangement might also provide for cooling the air where the ambient temperature is relatively high, thus further improving operating conditions.

Lubrication

The lubrication of the drawout breaker is covered in its I.B. In general, there is nothing that will require any lubrication in the stationary housings.

The main disconnecting finger clusters and stationary contacts should be cleaned periodically but KEPT DRY. Vaseline or grease should NOT be applied to these contact surfaces as it will hold dirt and particles of plating which will cause an increase in the levering-in force required.

LIFTING THE BREAKER

When it is necessary to lift the breaker off the rails, all lifting should be done only with the accessory lifting adapter. DO NOT ATTEMPT TO LIFT BREAKER WITH ORDINARY CRANE HOOKS, ROPES, CHAINS ETC., AS VITAL PARTS SUCH AS WIRING, BARRIERS AND ARC CHUTE PARTS MIGHT BE DAMAGED. Fig. 4 shows a view of the breaker with the lifting adapter in place. The lifter consists essentially of two sheet steel hooks specially shaped to hook under the top edges of the large openings on each circuit breaker side sheet, or in the specially provided lifting lugs on some breakers, and a spreader. Actual lifting may be with a crane, chain block or with the optional lifting mechanisms which can be supplied with the switchgear. The breaker must be pulled completely to the end of the rails.

There are two different lifting devices which may be supplied as options with an indoor assembly. One is a simple transport truck which can be rolled up in front of a circuit breaker compartment. The integral lifting adapter is then attached to the circuit breaker and the breaker is lifted from the rails using the crank operated geared hoist mechanism. The truck can then be rolled away from the

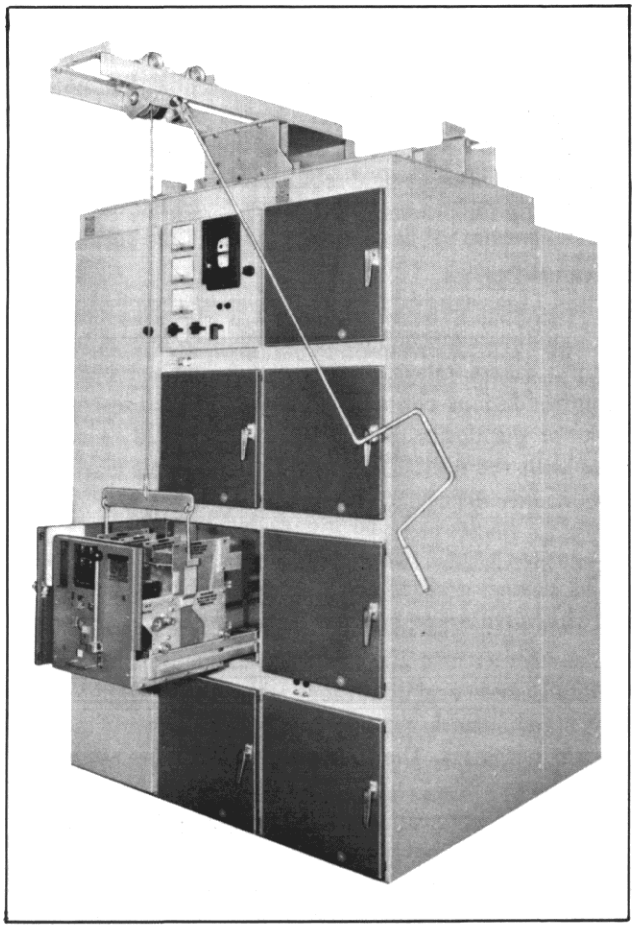


Fig. 42 *Breaker Showing Traveling Lifter*

compartment and the circuit breaker lowered to the floor level platform for movement to another location. DO NOT ATTEMPT TO TRANSPORT THE CIRCUIT BREAKER WHILE IT IS STILL SUSPENDED IN MID AIR.

The more common accessory is the Traveling Lifter which is mounted permanently on the top of the assembly. See Fig. 42. The boom of the lifter is equipped with rollers so it can be positioned in front of any compartment. With the integral lifting adapter attached to the circuit breaker, the breaker can be lifted from the rails using the crank operated geared hoist mechanism and either moved to any other location in the assembly or lowered to the floor. This device does not provide transport means to move the breaker to or from the assembly.

Type DS Outdoor Switchgear Assemblies are provided with a traveling lifter as standard equipment. This lifter is similar to the one described above for indoor equipment with the exception that due to space limitations the geared hoist mechanism is driven by a chain fall type operator instead of by a crank.

RENEWAL PARTS

When ordering renewal or spare parts include as much information as possible. In many cases the style number of the new part can be obtained from identification on the old part. Always include a description of the part. Specify the rating, unit number, and shop order number of the metal enclosed housing in which the part is to be used.