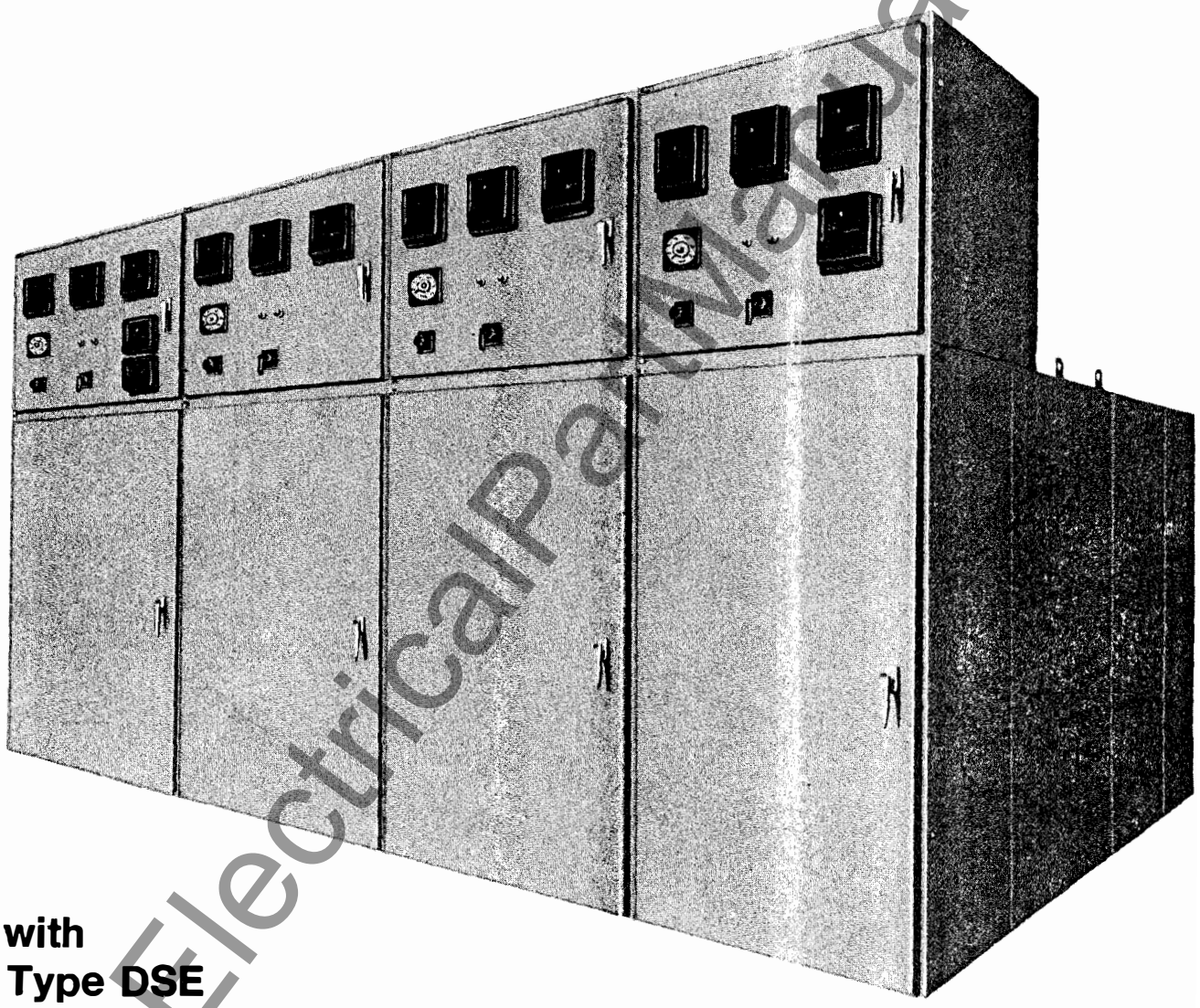
Instructions for SOLENARC® DSE Metal-Clad Switchgear

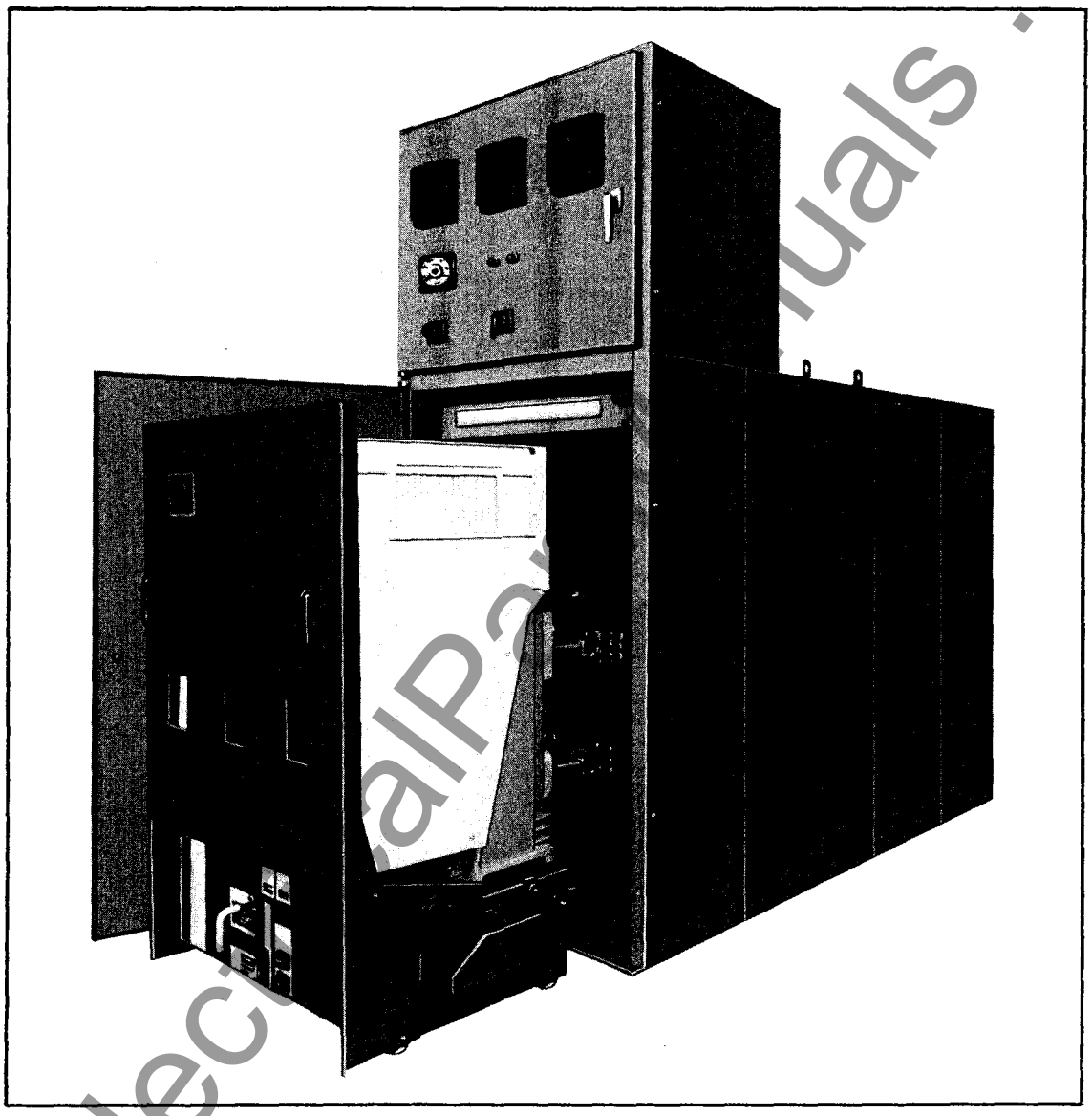


with Type DSE AC High-Voltage Circuit Breakers

SQUARE D COMPANY

P. O. BOX 558 • MIDDLETOWN, OHIO 45042

SU-6150-1



SOLENARC METAL-CLAD SWITCHGEAR SINGLE UNIT ASSEMBLY WITH DSE CIRCUIT BREAKER WITHDRAWN

Table of Contents

PRECAUTIONS

Metal-clad switchgear is heavy duty equipment and provided with many safety features. It controls high voltage circuits with high fault capacity which can be dangerous and the equipment contains many delicate devices. This list of recommended PRECAUTIONS should be studied and followed during handling, installation and operation of the metal-clad switchgear:

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

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

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

4. Remove blocking of relay armatures and check control circuits (except potential and current transformer circuits) for grounds and short circuits before applying control power.

5. Check proper phasing of all circuits and connect the switchgear to the station ground before applying high voltage power.

6. Do not work around "live" parts. The compartments of metal-clad switchgear are arranged so that, if a circuit has been de-energized, the compartment enclosing that circuit may be opened for maintenance without exposing any other circuit.

7. Any switches or breakers that have been opened to de-energize the equipment being serviced should be effectively locked, tagged, and even blocked open if possible to prevent accidental energization of the equipment.

8. Service current carrying parts only when these parts are disconnected from the system and grounded to the ground bus.

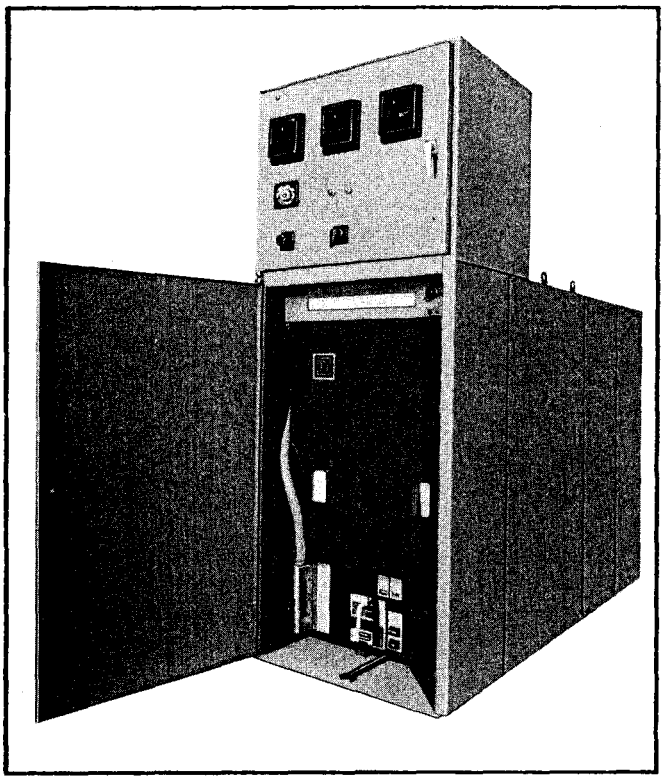
9. Never bring an exposed flame near a storage battery since the gasses given off during charging may form an explosive mixture.

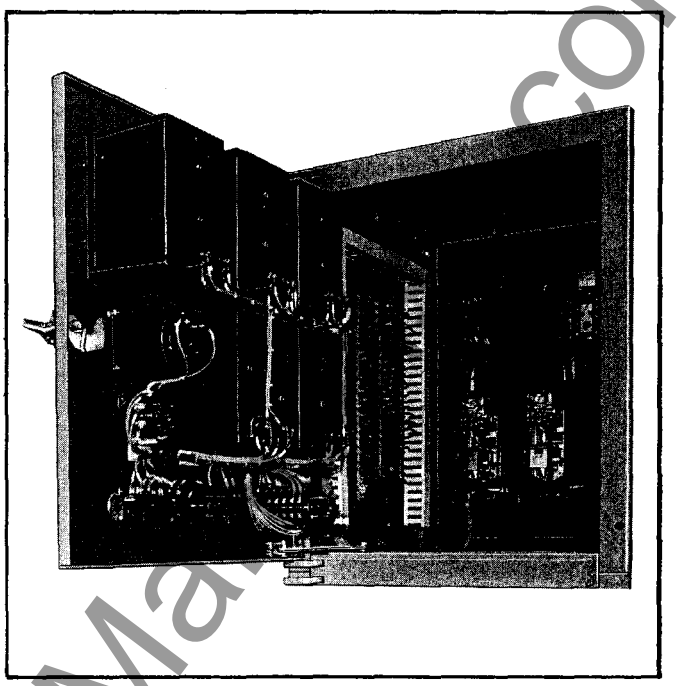
10. In case of fire do not use liquid fire extinguishers until all circuits have been made electrically "dead".

11. 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.

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

13. CAUTION. If indoor switchgear is to be stored prior to installation, it must be protected from the weather and be kept free of condensation. Whenever possible store the indoor switchgear where it will not be exposed to sunlight or sustained temperatures of 120° F. and higher. If the switchgear has been so exposed, the plastic coating supplied on the front panels must be removed within 30 days.





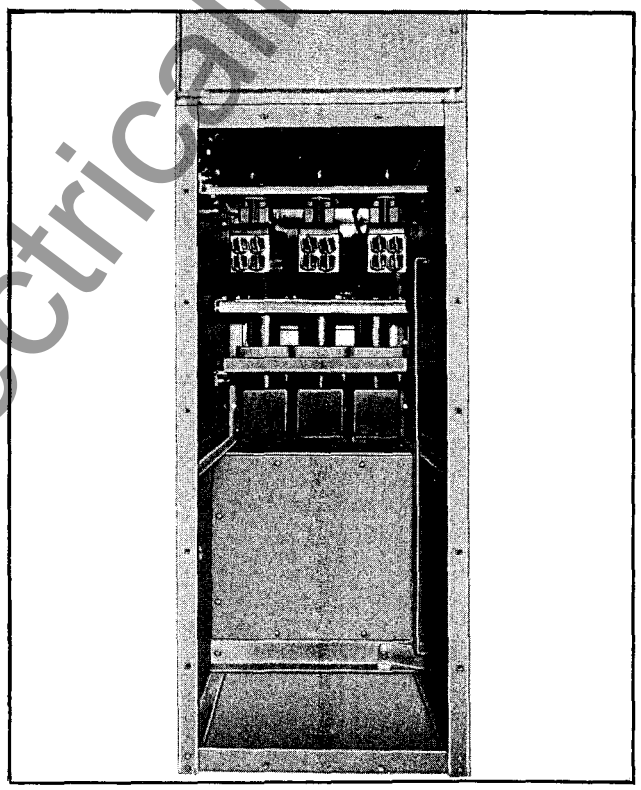


Figure 1-1.

SECTION 1

DESCRIPTION

1.0 INTRODUCTION

SOLENÂRC® DSE switchgear is designed to protect and control most of any type of high voltage distribution circuit. All circuit breakers, busses, current transformers, potential transformers and protective relays are included in the Metal-clad assembly. Secondary control devices interconnect all components to insure their proper operation in the sequence required by the user. The total assembly composed of individual components and units which are arranged to provide a structure in accordance with the purchase order.

1.1 DESCRIPTION (See figure 1-1).

The switchgear assembly will be in accordance with the drawings previously submitted to the user and represents a general picture of the complete assembly of the components in the equipment. Circuit designations, current and voltage ratings of bus, and circuit breakers should be in accordance with the drawings. A single Metal-clad unit consists of a stationary housing and removable breaker element. The breaker element is a type "DSE" circuit breaker mounted on a wheeled frame.

The Metal-clad switchgear is designed to provide maximum safety to the operator during normal service. There should be no danger of accidental contact with high voltage live parts because all live equipment and connections are enclosed in grounded steel compartments. The circuit breaker is designed to isolate the circuit it is controlling, when its contacts are in the open position.

1.1.1 Control Wiring

Normal access to control wiring is available only through hinged control panels. When these panels are opened, operating personnel are completely barriered from all high voltage (above 600 volts) circuits. All inter-wiring between high voltage compartments is isolated in conduit. Inter-wiring vertical sections is accomplished by a cable tray beneath the control compartment.

1.1.2 Power Connections

Access to high voltage circuits is generally available through removable steel panels unless otherwise specified by the purchase order. Removal of bolted steel panels will expose operating personnel to energized live parts and therefore extreme caution is required during these operations.

1.1.3 Interlocking

A system of mechanical interlocking is provided to prevent moving the circuit breaker into or out of the operating position while it is closed. Safety features such as key interlocks, locked panels and electrical interlocking are also provided when specifically ordered. All interlocking must be confirmed and tested prior to putting the equipment into operation.

1.1.4 Space Heaters

Outdoor equipment will contain space heaters and ventilators which will prevent condensation from accumulating within the switchgear structures. Strip heater circuits must be energized at all times, even if the equipment is not in operation. Should the strip heaters become de-energized, all high voltage conductors should be tested for electrical insulating qualities prior to energization of the switchgear.

1.2 ENCLOSURE DESCRIPTION

SOLENARC DSE switchgear enclosures are fabricated of 11 gauge hot rolled steel sheet plates. These plates are formed, welded and bolted together to form a rigid self-supporting structure which is divided by metal barriers between the various compartments. All housings are assembled and jigged to insure all units are uniformed and accurate in size.

Each switchgear vertical section is divided into four basic compartments. These are: The breaker compartment, instrument compartment, main bus compartment and cable compartment. The side panels on these compartments are not removable except at the end of the main cross-bus compartment.

Metal barriers within the indoor enclosure may be removed for inspection and maintenance with standard tools, exterior covers of the indoor enclosure require a special "Torx" wrench. A Torx wrench is supplied with each switchgear line-up. The wrench is a size T 40 and is available from Square D, Middletown, Ohio, under Square D Part #A44050-099-10.

1.2.1 Main Disconnecting Contacts (Figure 1-2)

The HV stationary main disconnecting contacts (Fig. 1-2) are located within a cast epoxy bell mounted directly behind the steel shutters at the rear of the breaker compartment.

The stationary contacts are mounted in bells which are individually jig-aligned prior to installation in the housing, and again aligned once installed in the housing. The stationary contacts can be replaced without disturbing the alignment of the stationary bells. Special tools are not required for replacement of these contacts.

1.2.2 Control Power Plug (Figure 1-3 & -1-4)

Control power for secondary control circuit is accomplished by installing the control power plug on the front of the circuit breaker element. This multi-contact plug (Fig. 1-3 & 1-4) is a "Jones" type plug. Each individual plug consists of ten contacts. Four plugs are mounted in each assembly for a total of 40 contacts. The wiring to the individual plug terminals is accomplished by a slip-on (faston type) connector.

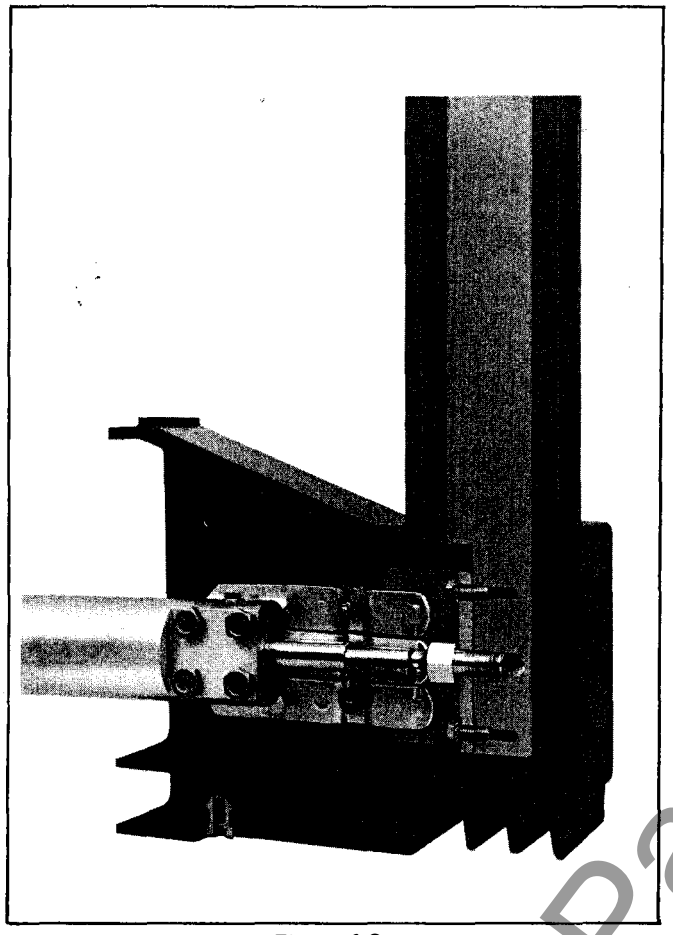


Figure 1-2.

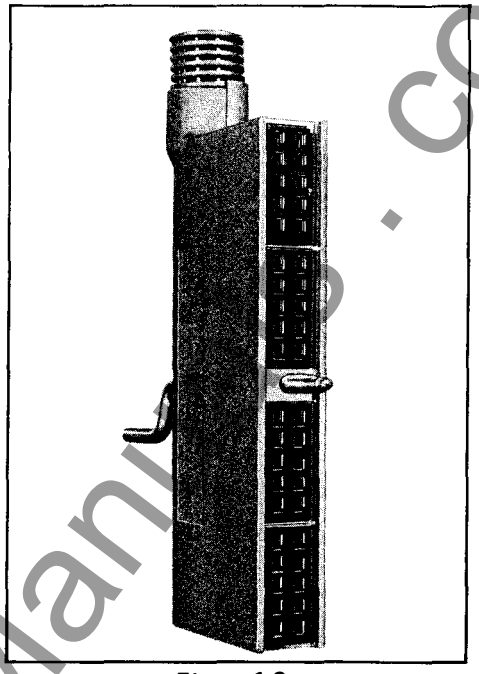


Figure 1-3.

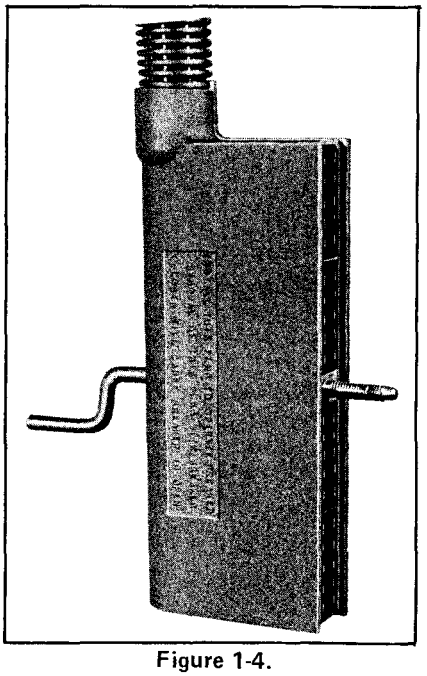


Figure 1-4.

The secondary control power plug is installed on the front of the breaker by cranking it into position. The circuit breaker cannot be closed unless the control power plug is fully installed. Any attempt to remove this plug, while the circuit breaker is closed, will trip the circuit breaker contacts to the open position. This is only one of several interlocks on the circuit breaker element. Section #4 of instruction manual SU-6150-2 fully describes the installation and operation of the DSE circuit breaker.

1.2.3 Shutters (Figure 1-5 & 1-6)

Grounded steel shutters are automatically operated by the circuit breaker element to cover the stationary main contacts when the breaker is removed from the enclosure. These shutters are shown in Figure 1-5 & 1-6. The shutters are part of the stationary housing and are raised by rollers which are actuated by a ramp permanently bolted to the circuit breaker element. The shutters are closed in the test/disconnect positions and are raised to expose the HV stationary contacts as the breaker is moved from the test to the connected position. The shutters can be hand operated by holding up two interlock cams and simultaneously lifting the shutter.

1.2.4 Truck Operated Cell Switch (Figure 1-7)

The truck operated cell switch (TOC switch) is generally a 5 pole assembly. This switch can be modified to supply additional poles when required. Each switch pole is double-break and field convertible. The TOC switch is accessible through the relay compartment door. It is operated by a

lever mounted on the left hand side of the circuit breaker cell when the circuit breaker is levered between the test position to the connected positions. This switch electrically indicates whether the breaker is in the connected or test position.

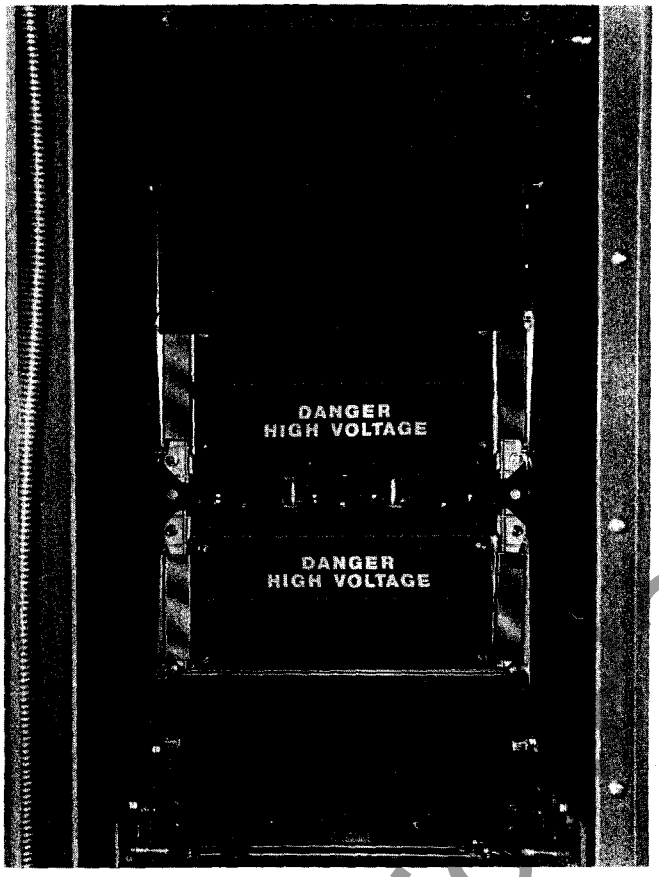


Figure 1-5.

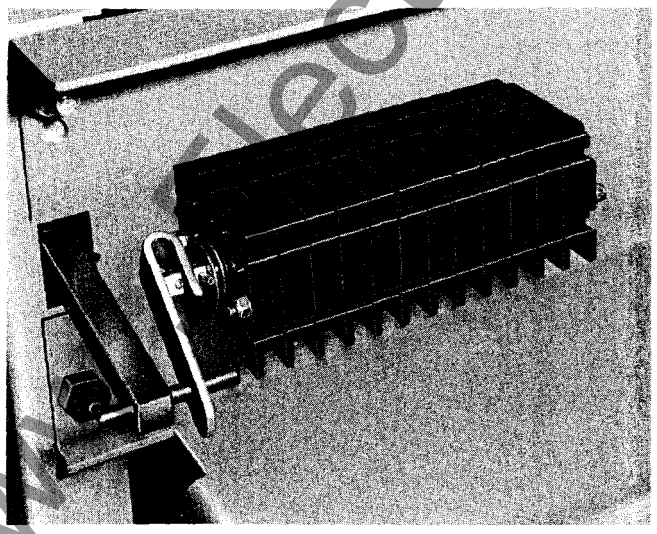


Figure 1-7.

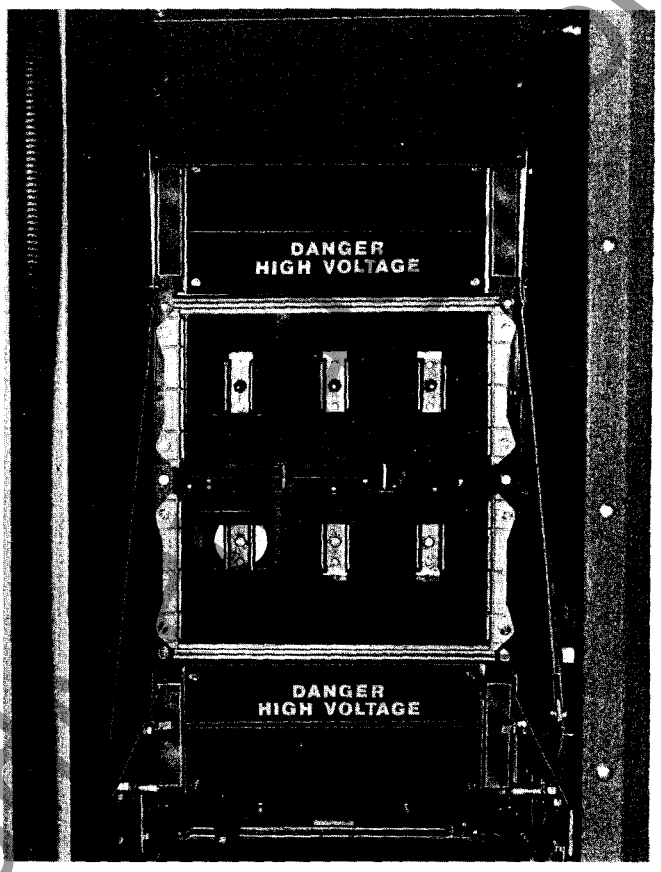


Figure 1-6.

1.2.5 Circuit Breaker - Cubicle Rating Interlocking Scheme

All DSE circuit breakers and their cubicles are provided with an interlock scheme that prevents the insertion of an under rated circuit breaker into a cubicle. This interlock scheme does permit a circuit breaker with a higher rating than the cubicle to be inserted into the cubicle, thus simplifying the selection of a spare breaker when required.

The ratings are based on both current and interrupting capacity. Units that may be used based on this scheme are:

1. A higher current, same interrupting capacity breaker may be used, or

2. A higher interrupting capacity, same current rating breaker may be used, or

3. A higher current and higher interrupting capacity rated breaker may be used, or

4. A breaker with identical ratings may be used.

The interlocking is accomplished by inserting one or more pins in a block welded to the floor of the cubicle and bolting one or more blocks to the bottom left rear of the circuit breaker truck. The pins and blocks are placed so the pins prevent all lower rated breakers being inserted into the cubicle and allowing all higher rated breakers to be inserted into the cubicle.

Whenever interchanging circuit breakers be sure the voltage rating of the breaker is the same as the voltage rating of the cubicle.

DO NOT INTERCHANGE VOLTAGE RATINGS.

Check all the control voltages to be sure they agree with the ratings of the cubicle.

Check the number and specification of the auxiliary switches to insure proper operation of the control circuits.

The overall scheme is shown in Fig. 1-8 & 1-9.

1.2.6 Disconnecting Type Potential Transformers (Figure 1-10)

Potential transformers generally supplied with metal-clad switchgear are of the disconnecting type and are designed to provide a maximum of safety for inspection and replacement of primary fuses. The transformers are mounted on a trunnion which is equipped with contacts to automatically engage the primary connections. The same contacts are used to ground the potential transformer when they are in the full disconnect position. The swing-out mounting is arranged so the potential transformers are a safe distance from energized parts and grounded when they are excessible for fuse replacement.

The trunnion mounted potential transformers are located behind a full door which must be opened to allow the carriage to be swung into view by turning a tee type handle and pulling down. The trunnion assembly will stop automatically when it is in the full down position. The secondary contacts are automatically engaged by a finger type disconnect located in the upper left hand corner of the assembly. This connection is made only when the transformers are swung to the full connected position.

1.2.7 Current Transformers (Figure 1-11)

The current transformers are excessible from the front of the switchgear when the breaker element is removed. A steel barrier located above the shutter assembly can be removed to gain access to these transformers.

CAUTION: DO NOT REMOVE THIS BARRIER UNLESS ALL "LIVE" POWER CIRCUITS ARE DE-ENERGIZED.

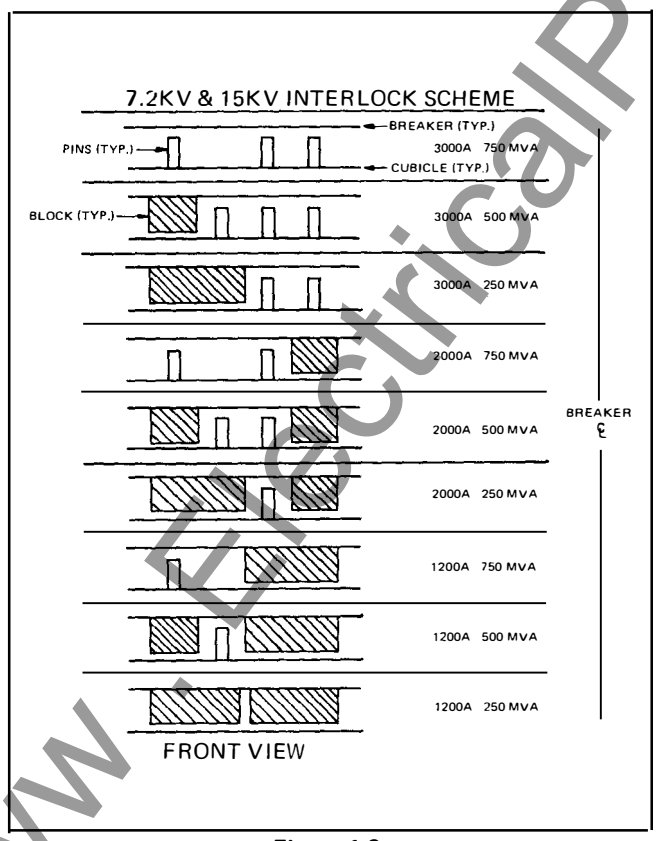


Figure 1-8.

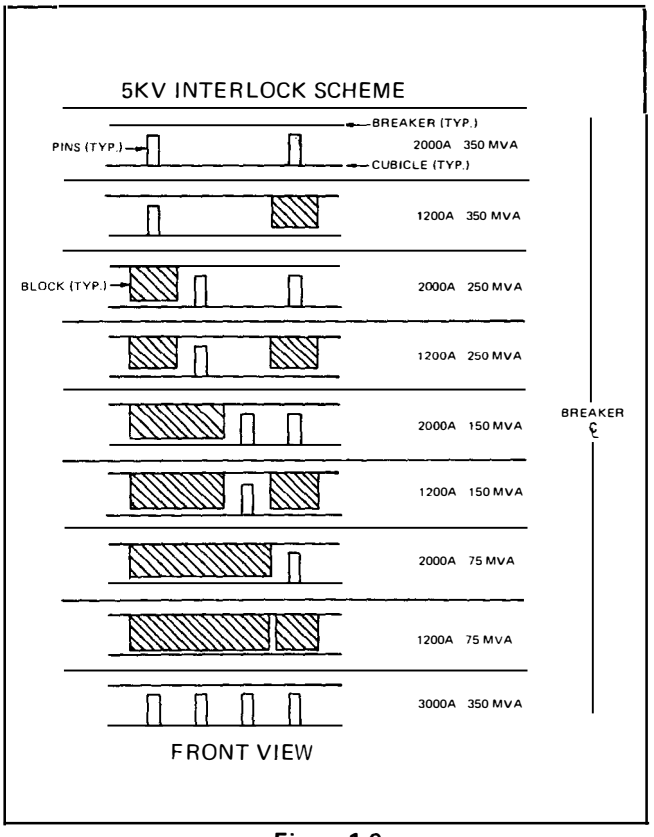


Figure 1-9.

It is possible to remove and/or replace the current transformers supplied with the equipment. The current transformers are mounted on a cast epoxy bushing which has a grounded electrostatic shield molded into the assembly. This allows the use of a standard 600 V AC window type current transformer in the over-current protective circuits. A maximum of three current transformers can be mounted to each bushing.

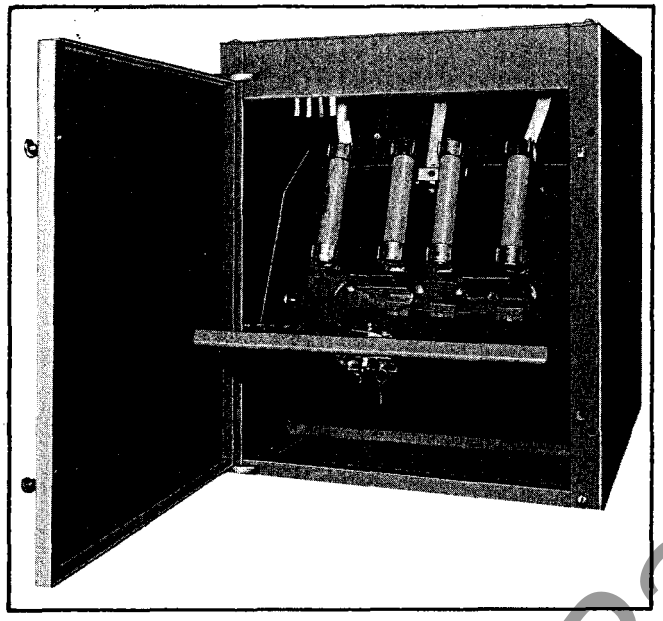


Figure 1-10.

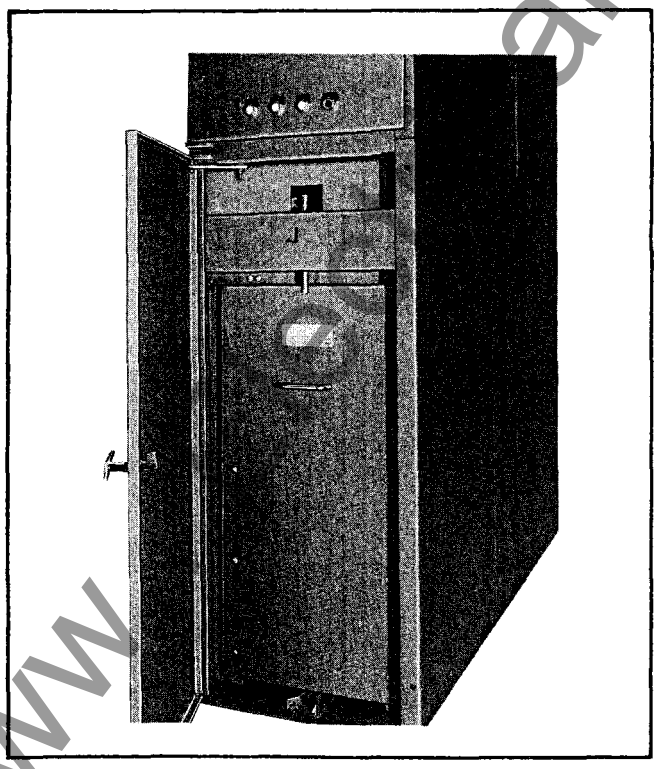


Figure 1-12.

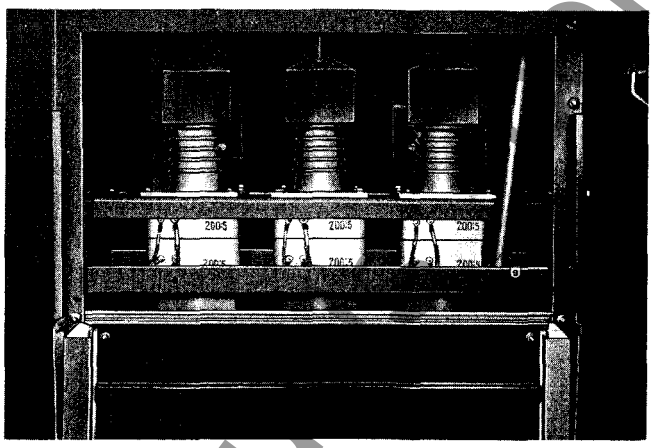


Figure 1-11.

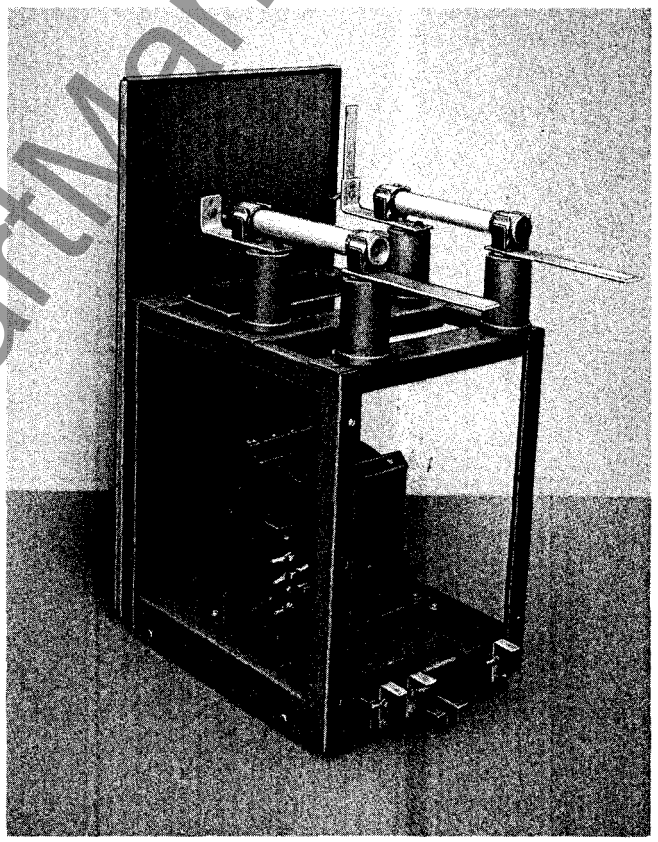


Figure 1-13.

1.2.8 Control Power Transformers (Figure 1-12 & 1-13)

The control power transformer with its associated primary fuses, is mounted on a welded steel truck which is installed in a separate auxiliary compartment in the switchgear assembly. The front door of this compartment is opened in the same manner as a circuit breaker compartment, to expose the front of the control power transformer truck. The truck is equipped with a steel protective barrier to isolate operating personnel from high voltage connections. When the truck is withdrawn from the cell, all high voltage connections remain barriered.

An interlock is provided to prevent the control power transformer truck from being withdrawn without disconnecting the secondary load. To withdraw the control power transformer truck, the main secondary circuit breaker is opened, the interlock rod raised, and the control power transformer can then be withdrawn from the cell. As the truck is rolled out of the cell, the high voltage terminals are automatically connected to a ground strap to discharge any capacitive voltage in the primary windings.

1.2.9 Ground Bus Connections

A ground bus is included with all SOLENARC switchgear assemblies. The normal ground bus is tin-plated aluminum. Ground lugs are provided on the ground bus at each end of the switchgear assembly. Each circuit breaker element frame is directly grounded to the ground bus in the test and connected positions. The breaker frame is grounded through a sliding ground shoe contact assembly.

1.3 REMOVABLE BREAKER ELEMENT (Figure 1-14)

DSE SOLENARC power circuit breakers are assembled on a wheeled frame or truck. The breaker can be installed, replaced or removed from the metal-clad switchgear housing as required. A typical circuit breaker element is shown in Figure 1-14. Additional descriptive information can be obtained from instruction manual SU-6150-2 for the breaker element itself. Section 4 of instruction manual SU-6150-2 describes the installation and operation of the DSE breaker. Study this instruction manual before operating the breaker in the enclosure.

1.4 ACCESSORIES

The following accessories will be supplied with and are required, to properly install and operate SOLENARC DSE metal-clad switchgear.

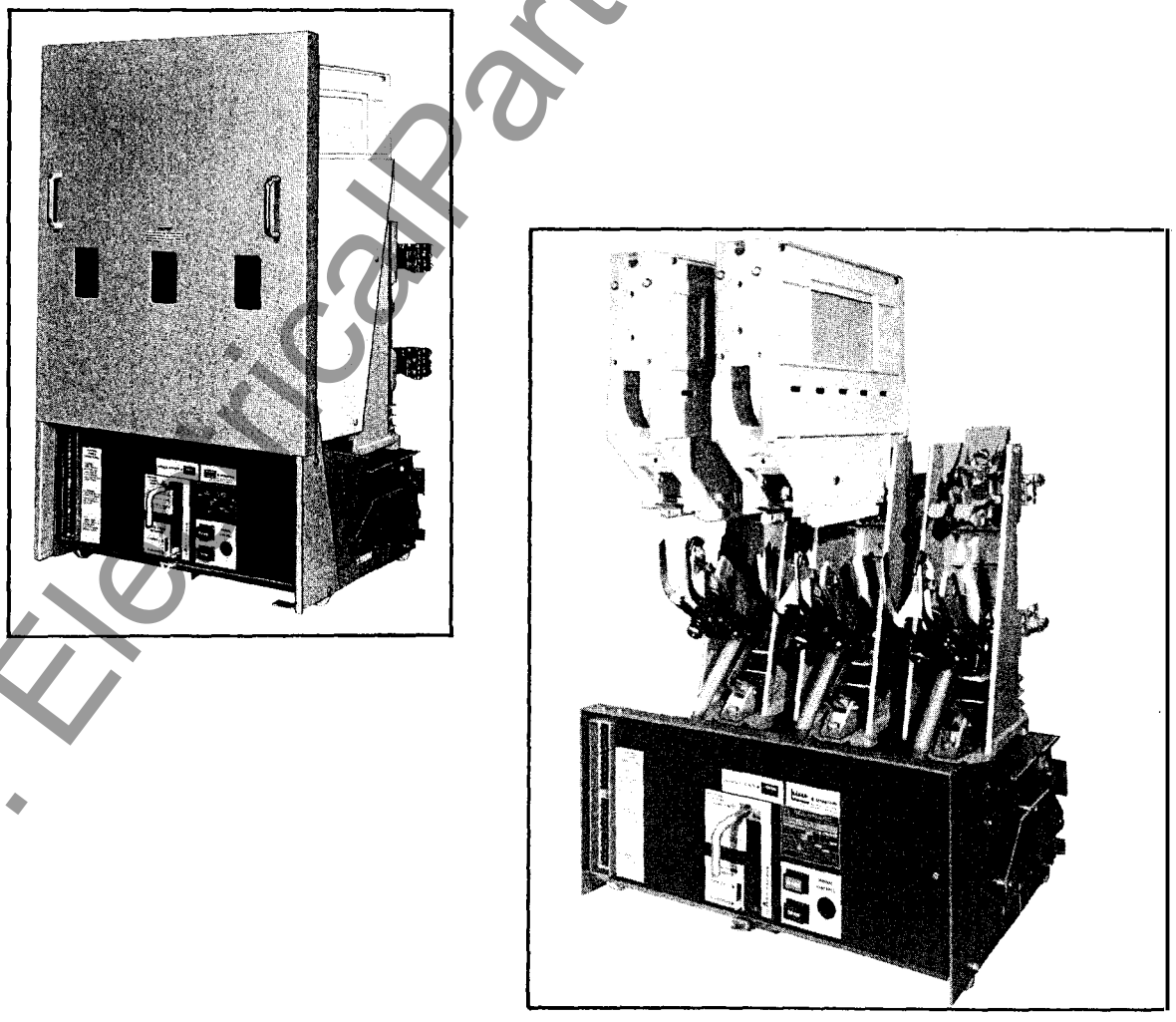


Figure 1-14.

1.4.1 Torx Wrench (Figure 1-15)

A "torx" wrench, Square D part #A44050-099-10, for the removal of bolted rear panels. All bolted panels are held in place by special tamper resistant screws which require this wrench for their removal.

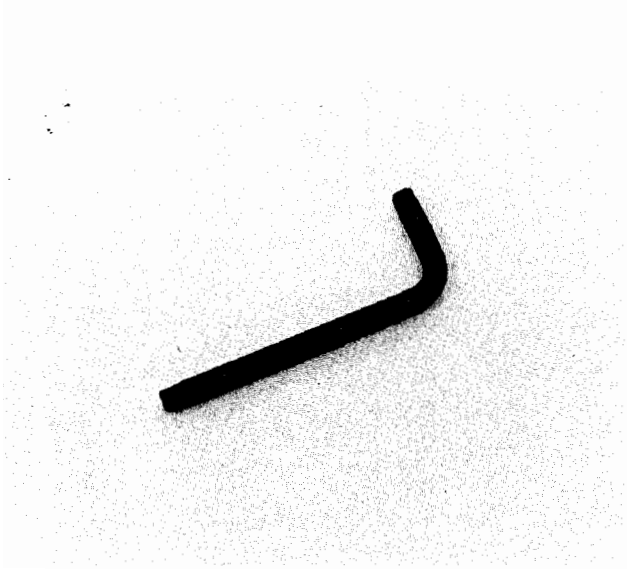


Figure 1-15.

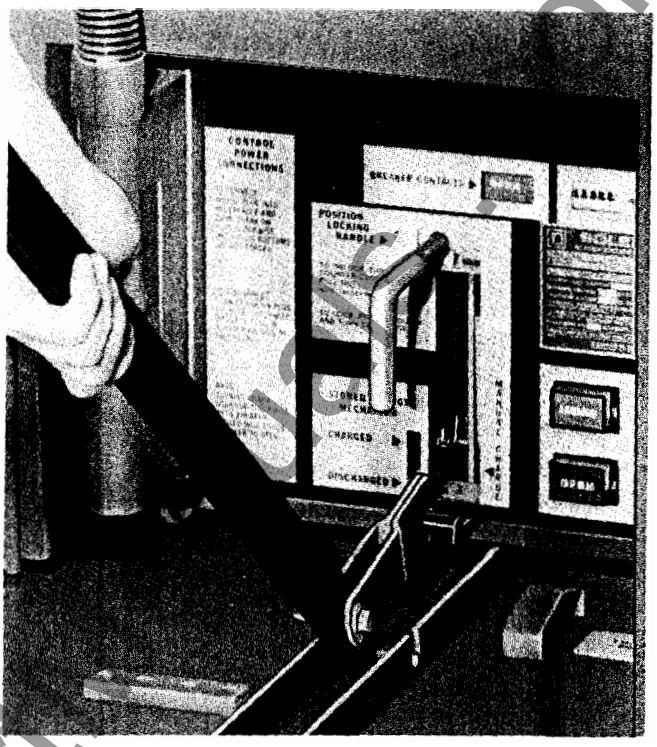


Figure 1-17.

1.4.2 Levering Tool (Figure 1-16, 1-17, 1-18)

A combination levering, manual spring charging and slow close handle, Square D part #B44065-076-50, is provided for levering of the circuit breaker and for manually charging the closing springs if control power is not available. This same handle can be used as a slow close tool.

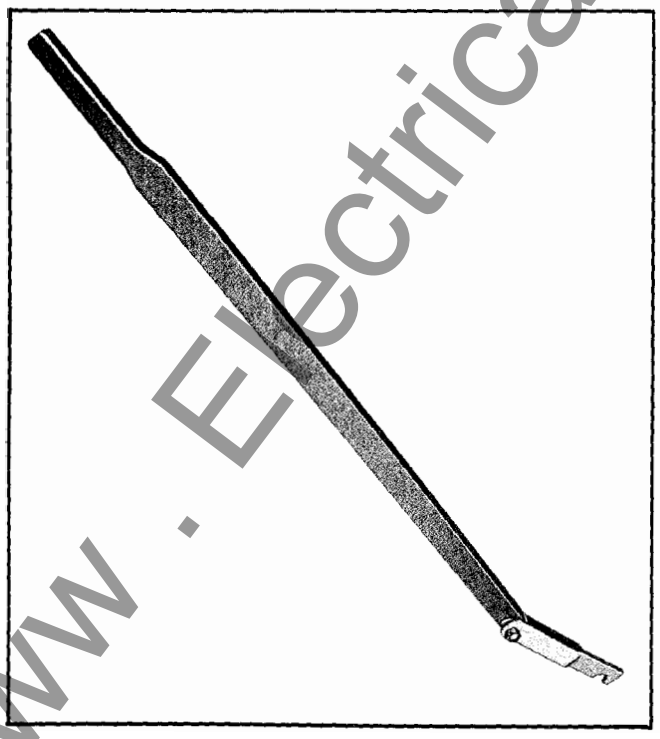


Figure 1-16.

Figure 1-18.

1.5 KEY INTERLOCK SYSTEM (Figure 1-19)

As an option, key interlocks are often supplied with SOLENARC switchgear, either in conjunction with the circuit breaker elements, disconnecting switches, or dummy circuit breakers as required by the users specifications. These interlocks are generally noted on the switchgear drawings along with their key interchange.

The key interlock cylinders are normally mounted behind the circuit breaker cell door, next to the cell interlock handle. The locks can be single or multiple cylinder type.

Extra keys are normally provided with each interlocking scheme which can be used to facilitate installation.

CAUTION: Prior to placing the switchgear in service, the entire interlocking scheme must be carefully checked and only the correct number of keys left in the lock scheme. All extra keys are to be removed and stored where they are not available to operating personnel.

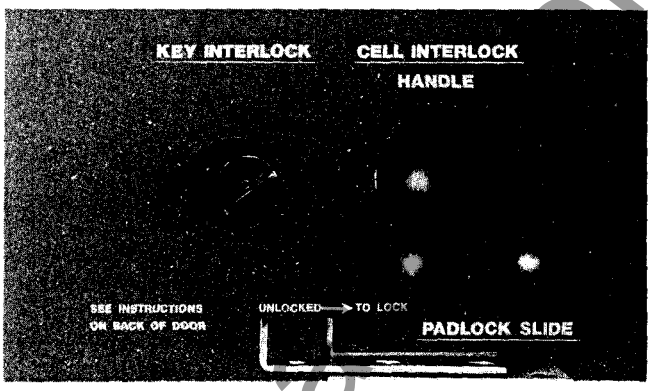


Figure 1-19.

SECTION 2

RECEIVING, HANDLING, STORAGE

2.0 RECEIVING, HANDLING

Upon receipt of the switchgear, remove it from the shipping container. All traces of packing, crating and foreign materials should be carefully removed. Equipment should be examined for damage made in route and all parts checked against the packing list. A claim for damage should be filed at once with the transportation company if the shipping container is damaged or if there is any indication of rough handling. Notify the local Square D Field Office of the damage claim and any shortages noted. See Paragraph 5 of Square D's Condition of Sale. The weights for SOLENARC DSE metal-clad switchgear indoor and outdoor are given in table #2-1 & 2-2.

TYPE OF BREAKER	THREE PHASE MVA	VOLTAGE KV-RMS	RATED CONT CURRENT 60 HZ AMPS-RMS	WEIGHT* OF BRKR. LESS ARC-CHUTES	WEIGHT* OF EACH ARC-CHUTE	WEIGHT* OF BRKR. WITH ARC-CHUTE ADDED	WEIGHT* OF CUBICLE LESS BREAKER	TOTAL WEIGHT* OF CUBICLE WITH BRKR.& ARC-CHUTES
DSE-21	75	4.16	1200	340 / 154	40 / 18	460 / 208	1600 / 726	2060 / 934
-23	150	4.16	1200	340 / 154	46 / 21	478 / 217	1600 / 726	2060 / 934
-23B	250	4.16	1200	340 / 154	57 / 26	511 / 238	1600 / 726	2111 / 964
-23B	250	4.16	2000	440 / 200	57 / 26	611 / 278	1600 / 726	2211 / 1004
-25C	350	4.16	1200	340 / 154	82 / 37	686 / 311	1600 / 726	2186 / 991
-25C	350	4.16	2000	440 / 200	82 / 37	686 / 311	1600 / 726	2286 / 1037
-25C	350	4.16	3000	490 / 222	82 / 37	736 / 333	1600 / 726	2336 / 1059
-23BU	250	7.2	1200	375 / 170	49 / 22	522 / 236	1800 / 817	2322 / 1053
-25CU	500	7.2	1200	375 / 170	82 / 37	621 / 281	1800 / 817	2421 / 1098
-25CU	500	7.2	2000	475 / 215	82 / 37	721 / 326	1800 / 817	2521 / 1143
-25CU	500	7.2	3000	525 / 238	82 / 37	771 / 349	1800 / 817	2571 / 1161
-62	250	13.8	1200	375 / 170	49 / 22	522 / 236	1800 / 817	2322 / 1053
-65	500	13.8	1200	375 / 170	80 / 36	615 / 278	1800 / 817	2415 / 1095
-65	500	13.8	2000	475 / 215	80 / 36	715 / 323	1800 / 817	2514 / 1140
-65	500	13.8	3000	525 / 238	80 / 36	765 / 346	1800 / 817	2565 / 1163
-57	750	13.8	1200	375 / 170	84 / 38	627 / 284	1800 / 817	2427 / 1101
-57	750	13.8	2000	475 / 215	84 / 38	727 / 329	1800 / 817	2527 / 1146
-57	750	13.8	3000	525 / 238	84 / 38	777 / 352	1800 / 817	2577 / 1169
							*	LB / Kg

INDOOR SWITCHGEAR

Table 2-1.

TYPE OF BREAKER	THREE PHASE MVA	VOLTAGE KV-RMS	RATED CONT. CURRENT 60 HZ AMPS-RMS	WEIGHT* OF BREAKER WITH ARC-CHUTE ADDED	WEIGHT* † OF ENCLOSURE LESS BREAKER	TOTAL † WEIGHT* OF ENCLOSURE WITH BRKR.& ARC-CHUTES
DSE-21	75	4.16	1200	460 / 208	2525 / 1136	2985 / 1343
23	150	4.16	1200	478 / 217	2525 / 1136	3003 / 1351
23B	250	4.16	1200	511 / 238	2525 / 1136	3036 / 1366
23B	250	4.16	2000	611 / 278	2525 / 1136	3136 / 1411
25C	350	4.16	1200	586 / 265	2525 / 1136	3111 / 1400
25C	350	4.16	2000	686 / 311	2525 / 1136	3211 / 1445
25C	350	4.16	3000	736 / 333	2525 / 1136	3261 / 1467
23BU	250	7.2	1200	522 / 236	2875 / 1294	3397 / 1529
25CU	500	7.2	1200	621 / 281	2875 / 1294	3496 / 1573
25CU	500	7.2	2000	721 / 326	2875 / 1294	3596 / 1618
25CU	500	7.2	3000	771 / 349	2875 / 1294	3646 / 1641
62	250	13.8	1200	522 / 236	2875 / 1294	3397 / 1529
65	500	13.8	1200	615 / 278	2875 / 1294	3490 / 1571
65	500	13.8	2000	715 / 323	2875 / 1294	3590 / 1616
65	500	13.8	3000	765 / 346	2875 / 1294	3640 / 1638
57	750	13.8	1200	627 / 284	2875 / 1294	3502 / 1576
57	750	13.8	2000	727 / 329	2875 / 1294	3602 / 1621
57	750	13.8	3000	777 / 352	2875 / 1294	3652 / 1643
					*	Lb. / Kg.

† Typical for standard circuit breaker bay, add 1450 lbs. or 653 kg. for end walls on each building.

OUTDOOR SWITCHGEAR WALK-IN CONSTRUCTION

Table 2-2.

2.1 LIFTING INDOOR SWITCHGEAR

Use the following procedure to lift a maximum of a 4 bay 5 KV or a 3 bay 15 KV shipping section.

1. An 8" - 24" lb./ft. I beam or larger is recommended for use as a spreader bar.

2. For hoisting, use a steel cable with a maximum diameter of 3/8". Attach cables between spreader bar and lifting eyes on switchgear. Installing a turn buckle in each cable will help balance the lifting load. All lifting eyes must be attached by cables to spreader bar.

3. Before lifting load completely off shipping skid, check load for balance. If necessary, add balance cables to ends to shipping section as shown in Figure 2-3.

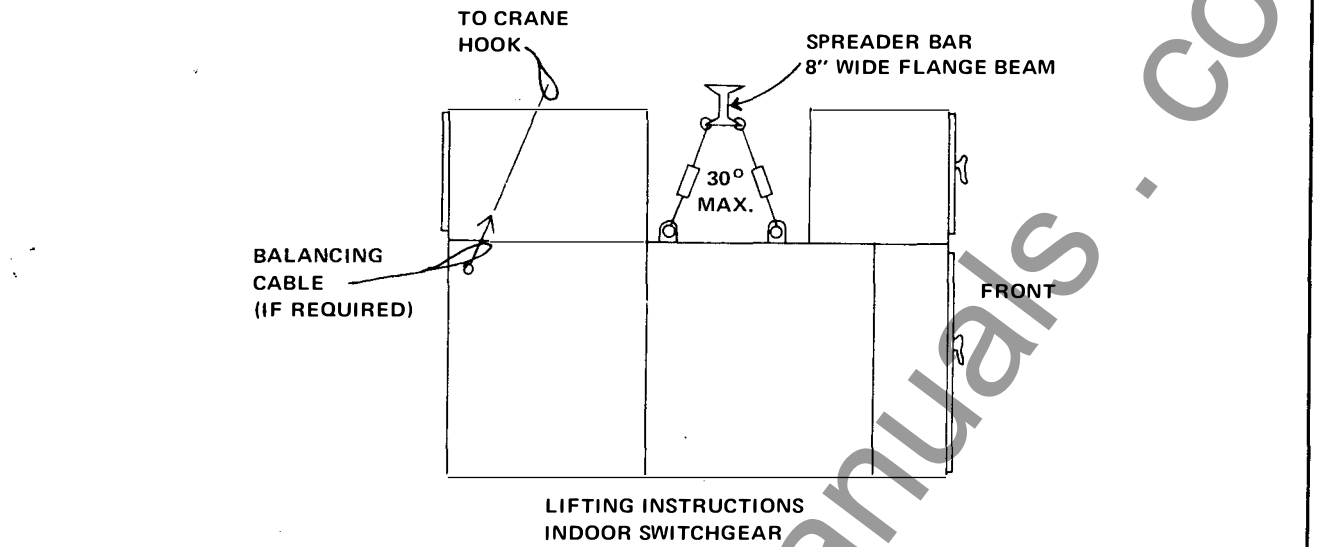
Instructions for lifting outdoor single base buildings and outdoor split base buildings are shown in Figures 2-4 & 2-5.

2.2 STORAGE

If it is necessary to store the equipment before installation, keep it in a clean dry location, protected from dirt and water and with ample air circulation and heat, if necessary, to prevent condensation. Like all electrical apparatus, these units contain insulation and although it is of the highest quality, it must be protected against dirt and moisture.

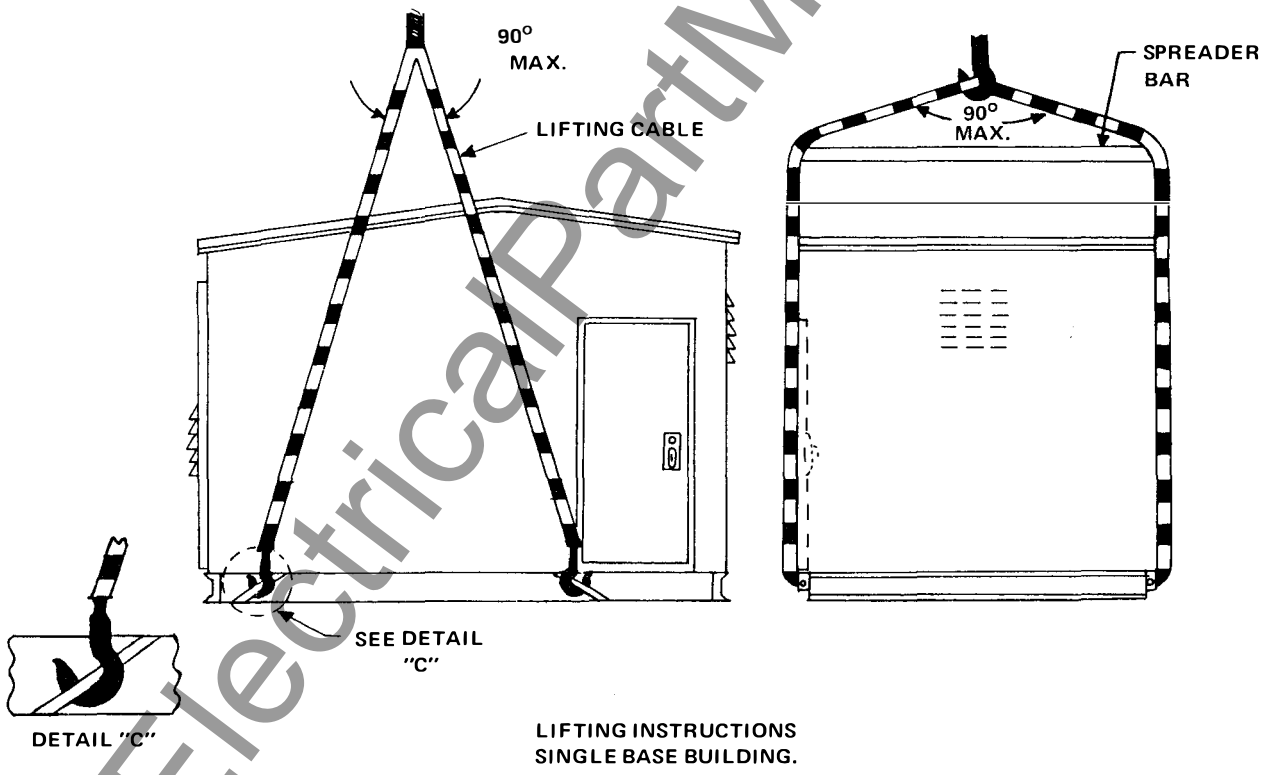
2.2.1 Storing Indoor Switchgear

It is preferred that all indoor metal-clad switchgear be stored indoors in a heated building. If this is not possible special precautions should be taken to keep the equipment warm enough to prevent condensation. It may be necessary to install temporary heating equipment in the switchgear and ventilate the packing crates to allow moisture to exit and for the free flow of dry clean air. The equipment should not be exposed to sunlight or temperatures



LIFTING INSTRUCTIONS INDOOR SWITCHGEAR

Figure 2-3.



LIFTING INSTRUCTIONS SINGLE BASE BUILDING.

Figure 2-4.

above 120° F. During storage the switchgear housing should be kept on a level surface to prevent strain and possible distortion of internal mechanisms. If the switchgear is exposed to sunlight or sustained temperatures of 120° F. or higher the plastic coating must be removed within 30 days. If the equipment is stored or located in a cool, dry and dark location, it is recommended the plastic packaging be removed within 18 months.

2.2.2 Storing Outdoor Switchgear

Outdoor metal-clad switchgear which is received and not immediately scheduled for installation must have temporary power available for operation of space heaters. This will prevent condensation and moisture from building up within the housing. Plastic covers should be ventilated to allow the condensation to escape.

2.3 CONTROL STORAGE BATTERIES

The Square D Company does not manufacture batteries or battery chargers and because of the large variety of suppliers for these items, it is not possible to cover receiving and handling instructions within the scope of this manual. When batteries and chargers are received for a specific installation, these shipments will contain instruction booklets on how to handle the equipment. We recommend these instructions be followed carefully.

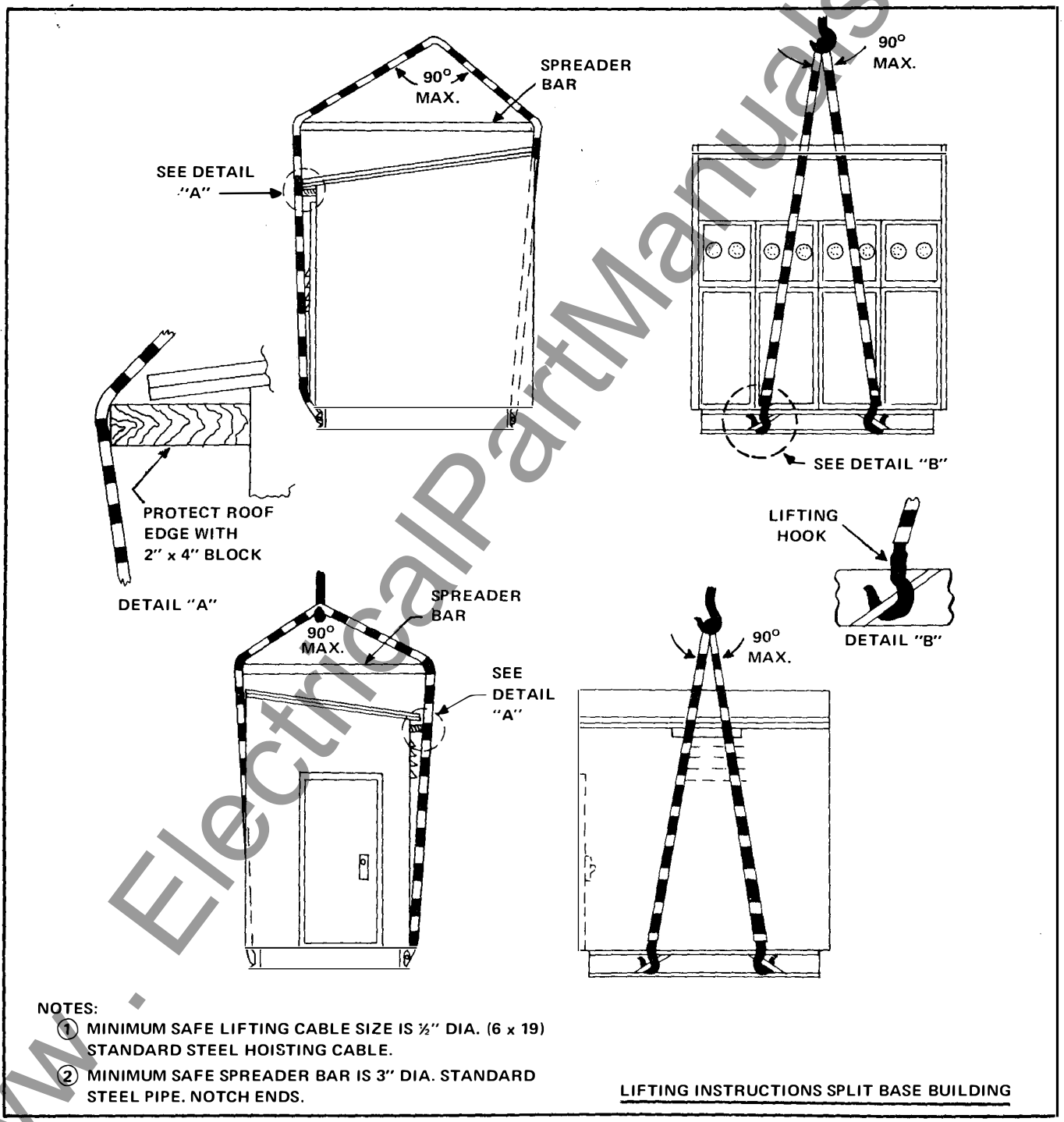


Figure 2-5.

SECTION 3

EXAMINATION AND PREPARATION FOR FIRST INSTALLATION

3.0 FOUNDATION

SOLENARC DSE metal-clad switchgear is assembled on a specially leveled floor to insure ease of operation and interchangeability of identical breaker frame sizes. Care should be taken in constructing the foundation at the job site to insure a true and level floor.

Actual weights of a specific installation will vary with individual devices depending upon the auxiliary equipment supplied. Adequate safety factors must be used in designing the floor or foundation. Impact from all circuit breakers opening simultaneously under short circuit conditions need not be considered when designing the foundation.

3.1 INDOOR SWITCHGEAR FOUNDATION

It is vitally important to be careful in preparing the concrete floor for the erection of indoor switchgear. Ease of installation and satisfactory operation depends on the accuracy and trueness of the concrete floor upon which the switchgear is installed. The accuracy of the concrete pads should vary no more than 1/8" in any square yard and MUST NOT PROTRUDE ABOVE THE LEVEL OF THE SUPPORTING MEMBERS.

Special consideration should also be made in leveling the floor adjacent to the housing on the drawout side for the circuit breakers. The ease and convenience of removing and installing the circuit breaker elements will be facilitated by a smooth true surface.

The recommended method for installing steel channels in the floor for an adequate foundation shown in Fig. 3-1. Examples # 1 and # 2 are generally the easiest since it eliminates the need for lining up bolt holes. Welding equipment will be required for these methods. The steel channels must be brought to the true plain of the floor finish, and held into position until the concrete is set.

To install metal-clad switchgear on an existing concrete floor, it is suggested a new pad be poured and channels be grouted as previously described. The new pad should be at least 4" high and extend in front of the switchgear by at least 5'.

Continuous loops of reinforcing or building steel around the single phase conductors of any incoming or outgoing cable should be avoided, particularly on circuits rated above 600 amperes.

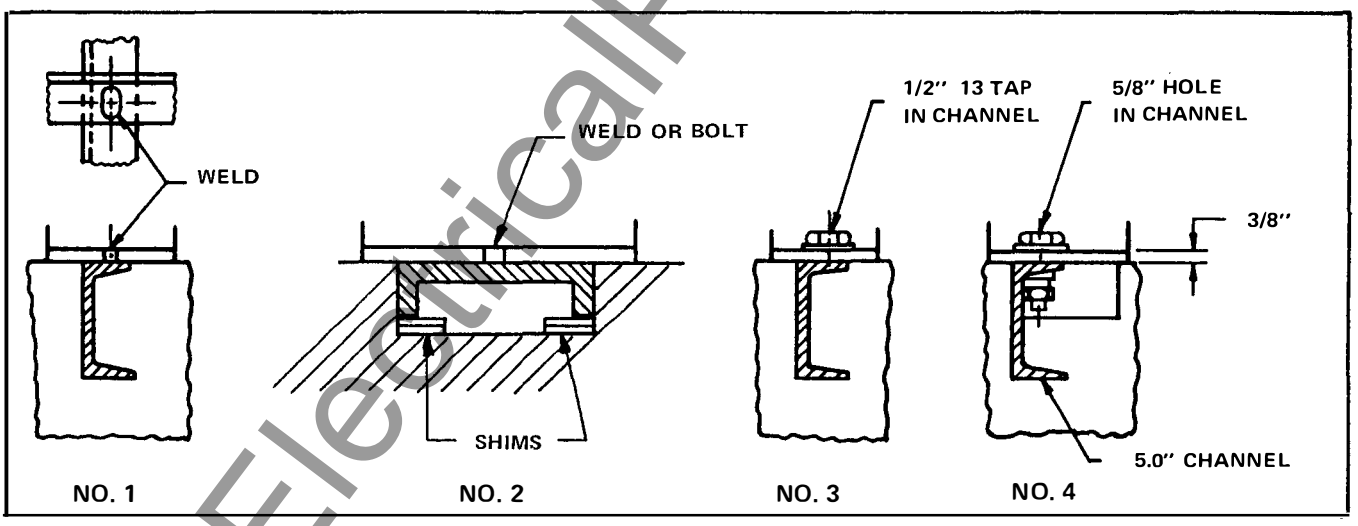


Figure 3-1.

3.2 OUTDOOR SWITCHGEAR FOUNDATION

There are three basic foundation types that may be used to support an outdoor switchgear building. These are the concrete pad, the footer and the pier. All three are effective supports and may be used to support the outdoor building but each must be properly designed to transmit the load of the building to the soil under the conditions of the soil at the jobsite. Generally accepted design and construction practices in the area of the installation should be used.

The design of the foundations and their construction details are left to the customer. Square D only specifies the magnitude and location of the loads that the foundations must support.

The specified loads take into account such things as a snow loading on the roof of the building of three feet of wet snow (30 lbs./ft.), the deflection of the base channels under the conditions of installation, and full equipment in each bay.

The top surface of all the foundations must be level to within one fourth of an inch over the entire top surface of the foundation to insure that the building is not twisted at installation. Use shims as necessary to bring building into as perfect a level as possible. Install anchor bolts where indicated. The anchor bolts are customer supplied. Square D will supply the toe clips required to clamp the building to the foundation.

The same basic principles apply to both walk-in and non-walk-in buildings.

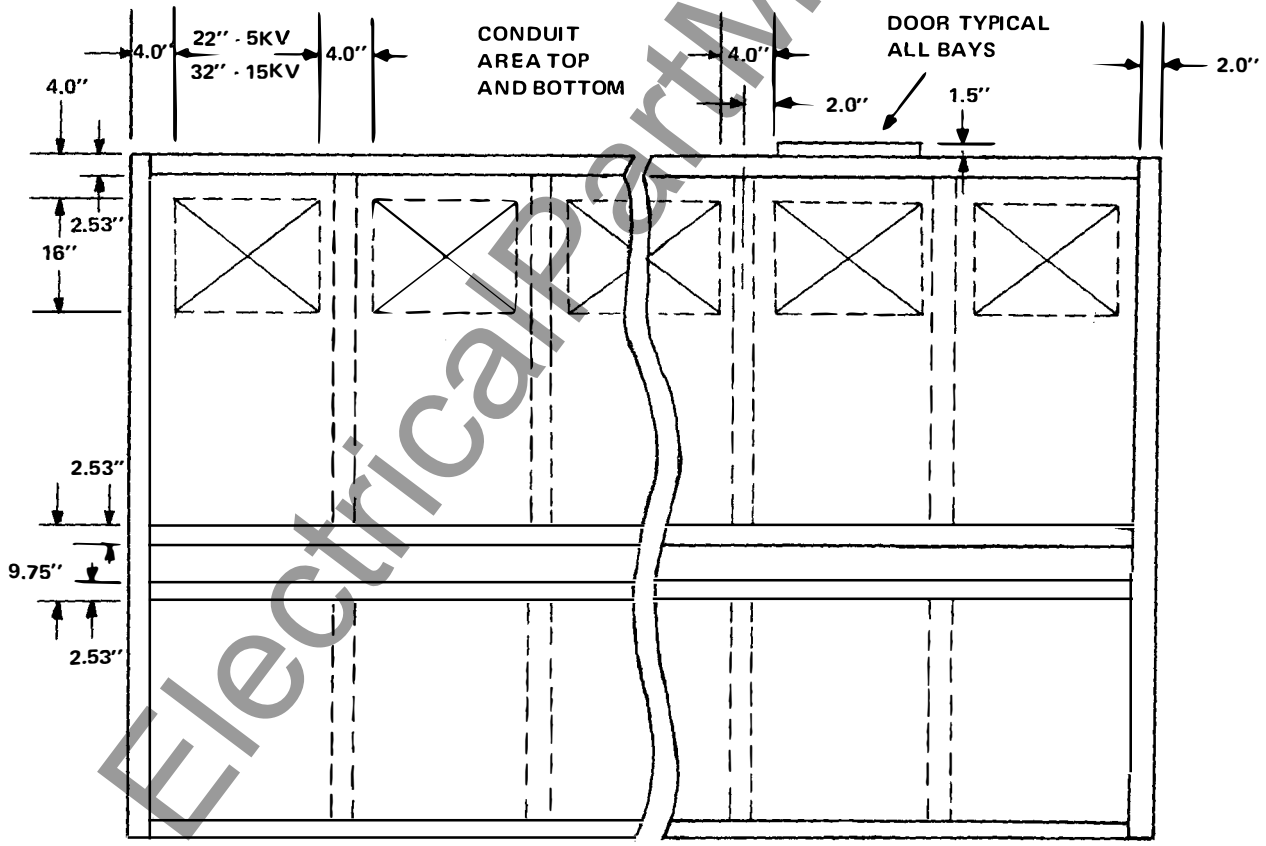
Each foundation type will be discussed individually.

The base channel of the building makes contact with the foundation only around the periphery of each shipping section and this should be kept in mind when designing the foundation.

3.2.1 Concrete Pad

Design the concrete pad to support the building around the periphery of the shipping sections since these are the primary load bearing channels. The building exerts a force of 1,500 pounds per linear foot of contact of the base channel with the concrete pad.

Make provisions for conduit entrance in the areas indicated on job drawings similar to that shown in Figure 3-2 and Figure 3-3. The base channel contact area is also indicated in these figures.



Typical drawing – Use project job drawings supplied by Square D Co. for specific foundation recommendation.

FLOOR PLAN – OUTDOOR WALK-IN CONSTRUCTION

Figure 3-2.

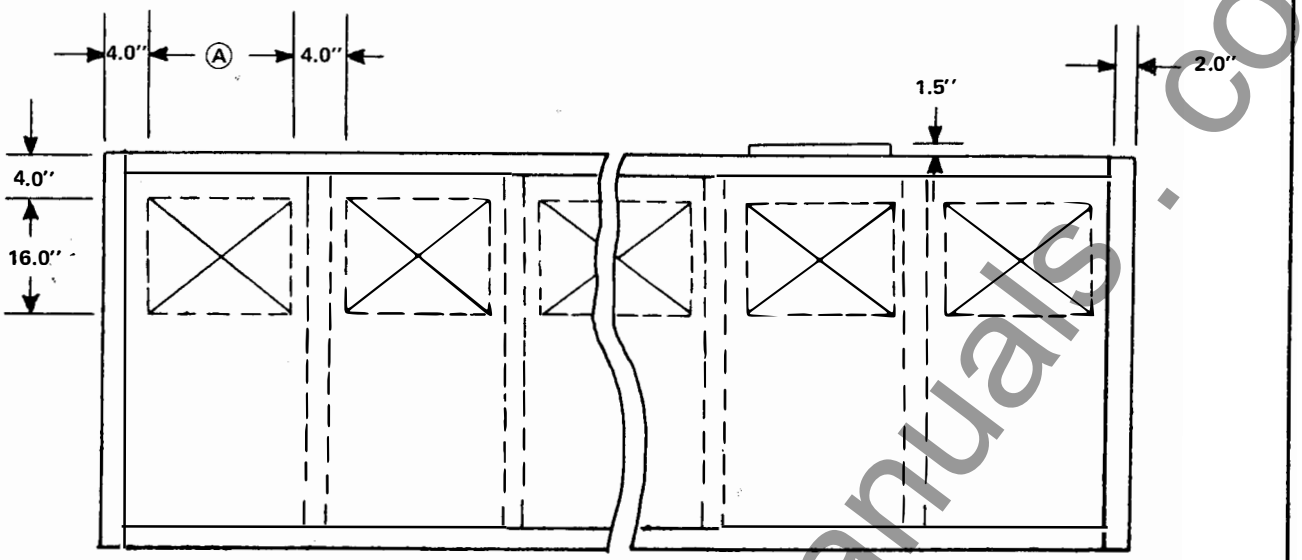


Figure 3-3.

3.2.2 Footers

Footers may run the length or width of the outdoor building. Each type of footer requires different design considerations.

Footers that are run the length of the building should be designed to support the main channels that run the length of the outdoor building. The location of these is indicated in Figures 3-2 & 3-3. Note that there are three main channel areas that require support.

The footers should be a minimum of ten inches wide for the side channels and a minimum of fourteen inches wide for the center channels. Provide room for the entrance of conduits as indicated in Figures 3-2 & 3-3. Design the footer to support a load of 1,500 pounds per linear foot of contact of the base channel with the footer. Buildings shipped in one section do not require the center footer.

Footers that run the width of the building are located in the same locations as defined under "Piers". Design each footer to carry 20,000 pounds at the contact point of the base channel. The footer should be as wide as necessary to support the building but must be fourteen inches wide along shipping splits that involve the width of the building. Anchor bolts should be located where indicated under the "Piers" section along the footers.

3.2.3 Piers

Piers used to support the outdoor building can be located up to eleven feet apart along the length of the building. This figure limits the maximum deflection of the base channel to a safe distance and provides a safety factor for the stress in the base channels. They are to be located along the length of the building in sets of three across the width of the building. Refer to Figures 3-4, 3-5, & 3-6 for the recommended locations of the piers for the outdoor buildings. The middle pier is not required for buildings which are not split along the length of the building.

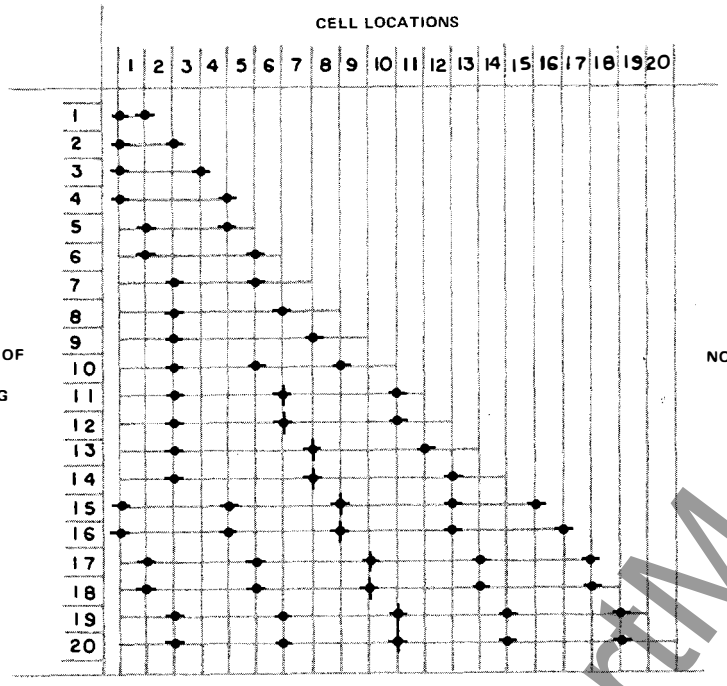
Figures 3-4 & 3-5 show the recommended locations for the minimum number of piers for each size building. These piers are always placed between the cells to minimize blocking of the conduit entrance area. Other pier spacing may be used provided the distance between the piers does not exceed the recommended eleven feet.

Piers under the outer channels should be a minimum of ten inches in diameter or ten inches square at the contact surface with the building. Piers located along a shipping split should be a minimum of fourteen inches in diameter or fourteen inches square at the contact surface with the building. Anchor bolts are to be placed where indicated in Figure 3-6.

Design each pier to support a load of 20,000 pounds and match this load to the soil conditions at the jobsite.

3.3 INDOOR SWITCHGEAR STRUCTURES

Suggestions for a properly installed metal-clad switchgear structure:



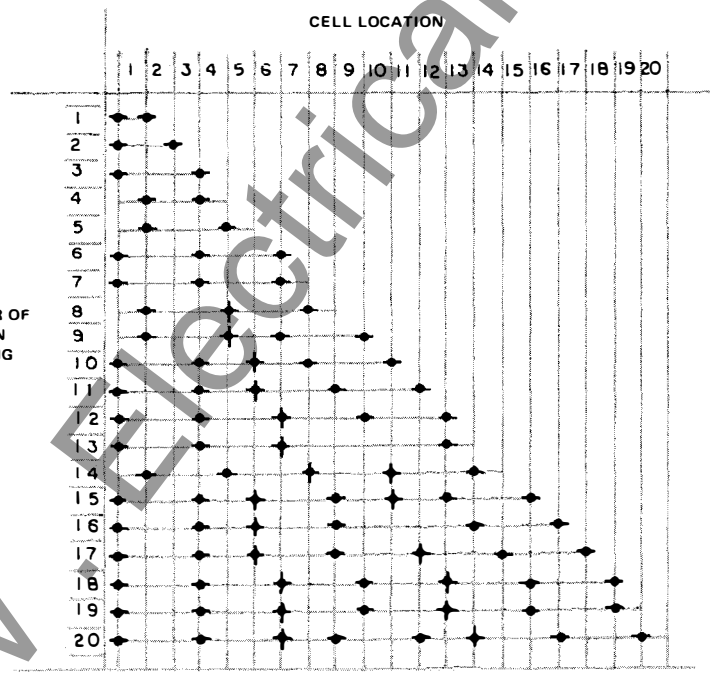
RECOMMENDED PIER LOCATIONS FOR THE SQUARE D OUTDOOR BUILDING FOR THE 26" CELL WIDTH (5KV)

NOTES ① ✦ INDICATES A SHIPPING SPLIT ALONG THE WIDTH OF THE BUILDING AND A PIER LOCATION.

② ⊸ INDICATES A PIER LOCATION.

PIER LOCATION FOR OUTDOOR BUILDINGS – 26" CELL WIDTH (5KV)

Figure 3-4.



RECOMMENDED PIER LOCATIONS FOR THE SQUARE D OUTDOOR BUILDINGS FOR THE 36" CELL WIDTH (15KV).

NOTES: ① ✦ INDICATES A SHIPPING SPLIT ALONG THE WIDTH OF THE BUILDING AND A PIER LOCATION.

② ⊸ INDICATES A PIER LOCATION.

PIER LOCATION FOR OUTDOOR BUILDINGS – 36" CELL WIDTH (15KV)

Figure 3-5.

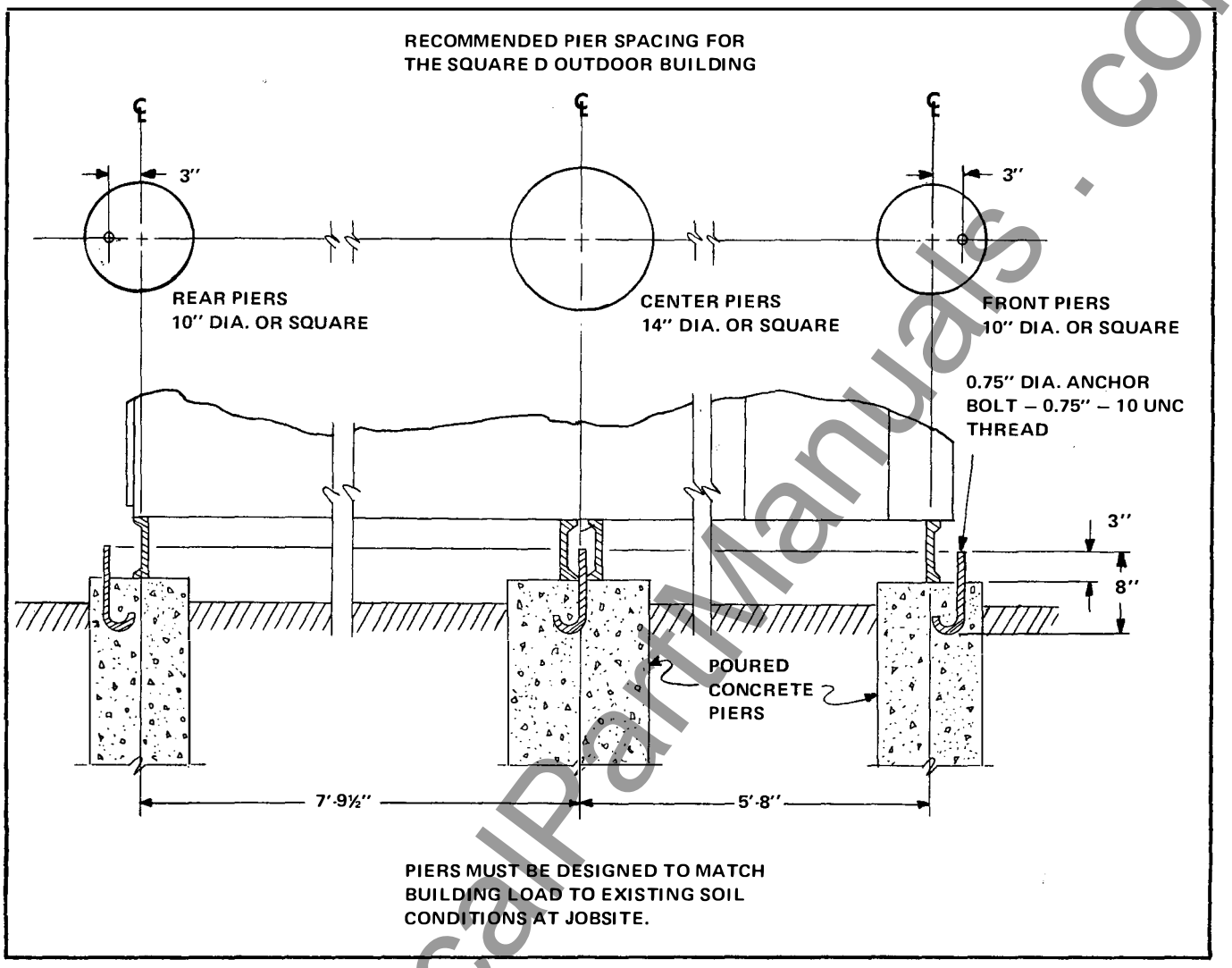


Figure 3-6.

1. When three or more switchgear enclosures are arranged in a line-up. Install the first structure at either end of the equipment room. All other structures and/or switchgear should be installed in successive order in one direction.

2. Remove all crating and packing material except for the skids from the first group to be installed. Be careful not to damage delicate instruments and relays mounted on the front of the switchgear when removing the packaging.

3. Move the first switchgear assembly into position by use of either a crane or pipe rollers. The rollers used should be high enough to allow the switchgear to pass over the conduits projecting above the floor.

4. A 64" min. clearance aisle is required in front of the switchgear, and a 24" min. clearance aisle is required in the rear. From the back wall of the switchgear room measure 24". The back of the switchgear will set at this point. Do this to each bay to assure that the switchgear will be square to the building.

5. Check the base channels which have been grouted into the concrete floor for levelness diagonally, lengthwise and front to rear. There are three locations in which the flatness of the floor should be checked. These are: front, rear and middle. All should be within 1/8" tolerance.

6. To check for levelness of the switchgear place 4 - 2" X 2" spacers on the floor of the cubicle as shown in Fig. 3-7. All spacers must be square. Place a piece of wood 2" X 4" on the spacers as shown in Fig. 3-7. This 2" X 4" must have square sides. Check for levelness by placing a 2' level on this 2" X 4". Check at points A to B, B to C, C to D, D to A, B to D and A to C. Refer to Figure 3-7.

Corrections should be made by the use of metal shims inserted between the base channel and the steel floor. It is important to shim both sides and the center wherever necessary. Distorted frames will cause binding of shutters, cams, doors, and the breaker element.

7. Once the switchgear structure is properly aligned, it can be fastened to the floor channels.

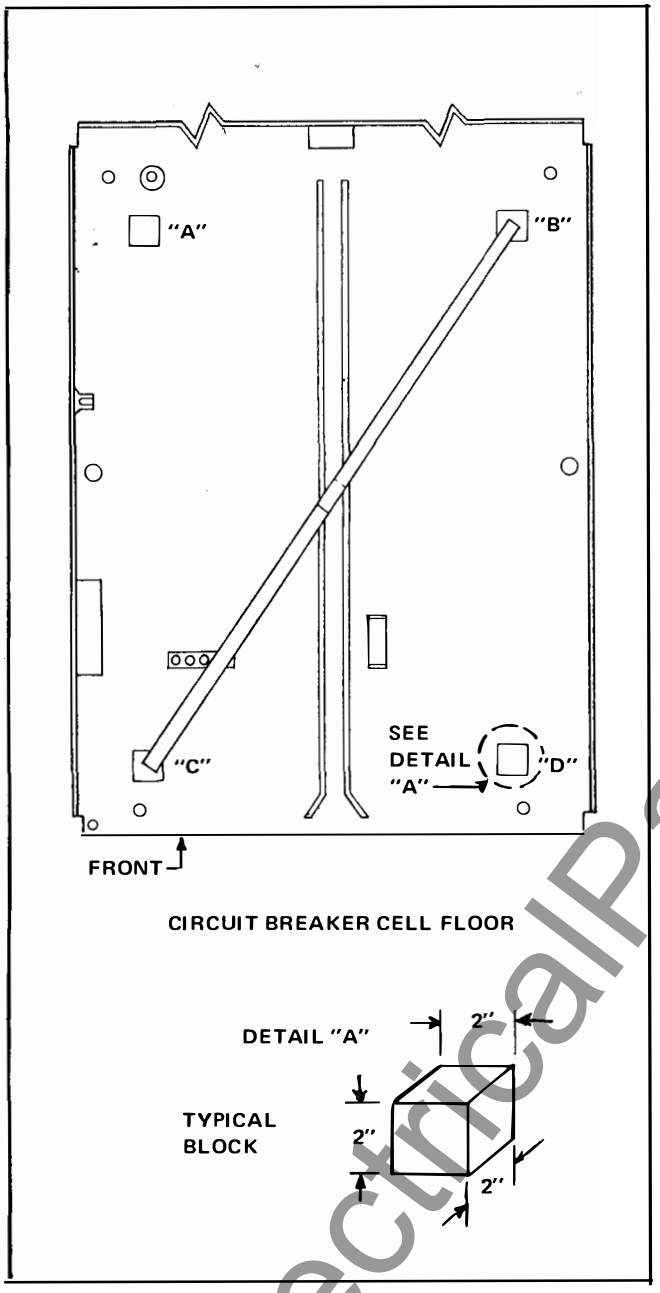


Figure 3-7.

3.4 OUTDOOR SWITCHGEAR STRUCTURE

Outdoor switchgear includes a structural steel frame as part of the total switchgear housing. It is only necessary to install a suitable foundation which the switchgear can be set upon. It is recommended the structural steel base be shimmed and leveled after the switchgear is set in place.

The building base is a welded frame made from 8" high structural steel channels (18.75 lb/foot) and formed 7 ga. steel channels. Primary load bearing members are 8" structural steel. Base design limits the deflection of the longest base during lifting to 1/16" maximum. Aisle floors are 7 ga. hot roll steel.

Exterior walls and roof are formed from 11 ga. Galvaneal steel sheet. Walls and roof are designed to support a dead load of 3 ft. of wet snow (30 lbs./ft density). Roof seams are capped. Vertical wall seams are caulked with silicon rubber – Dow Corning Type 781 – formulated for exterior use. Exterior surfaces of building have two coats of ASA # 49 gray paint, interior surfaces one coat of ASA # 49 paint.

Buildings are shipped as a single shipping section if they are not larger than:

3 bays for 5 KV &
2 bays for 15 KV

The building is split lengthwise for lineups exceeding the above. A maximum of 10 bays, 5 KV or 7 bays, 15 KV can be shipped as a single shipping section. The M/C equipment portion is shipped separately from the aisle portion of the building. The M/C NEMA I equipment is shipped completely assembled, including main bus.

Each shipping section can be moved into place with a crane without interferring with other shipping sections.

The following procedures are for outdoor walk-in control house assembly:

1. Remove all exterior protective shielding and wooden framework before lining up of shipping sections. Do not remove any interior roof bracing or guy wires located in each shipping section behind protective shielding.

2. Rigger shall move equipment section into position first. Level with steel shims (shims not supplied) if necessary.

3. Move aisle sections into position for alignment with equipment sections. Correct alignment is achieved when all holes in side panels of aisle section align with corresponding holes in equipment section.

4. Bolt section together using hardware supplied.

5. Install all gusset plates.

6. Interior roof bracing and guy wires can now be removed and discarded.

7. Place floor filler plates into position. Drill and tap using holes in plates as locators for 3/8" – 16 flathead screws (supplied).

8. Install roof caps (see figure # 3-8).

9. After all structural joining parts have been assembled, all seams to be caulked with Dow Corning type # 781 silicon rubber.

Buildings are fan ventilated as standard. A 12" dia. fan – 740 CFM free air – is standard for buildings up to and including 10 bays. Two 12" diameter fans for buildings 11 thru 20 bays. Fans are thermostatically controlled.

40 watt fluorescent lights are supplied every 3 bays or closer. Three-way light switches are mounted at door on buildings exceeding 5 bays.

120 volt outlets are supplied 1 per every 3 bays on the aisle exterior wall.

Two steel doors equipped with crash bars, thumb latch and lock set are supplied as standard on aisle portion of building. Door key is identical.

Hinged coverplates are standard at rear of each equipment bay. Plates are held by tamperproof hardware and a tamperproof wrench is supplied with the building.

As standard, buildings are equipped with strip heaters in each equipment bay to prevent condensation. Each bay has 3 strip heaters installed for a total wattage of 500 watts. The strip heaters in each cell are controlled by a thermostat in that cell.

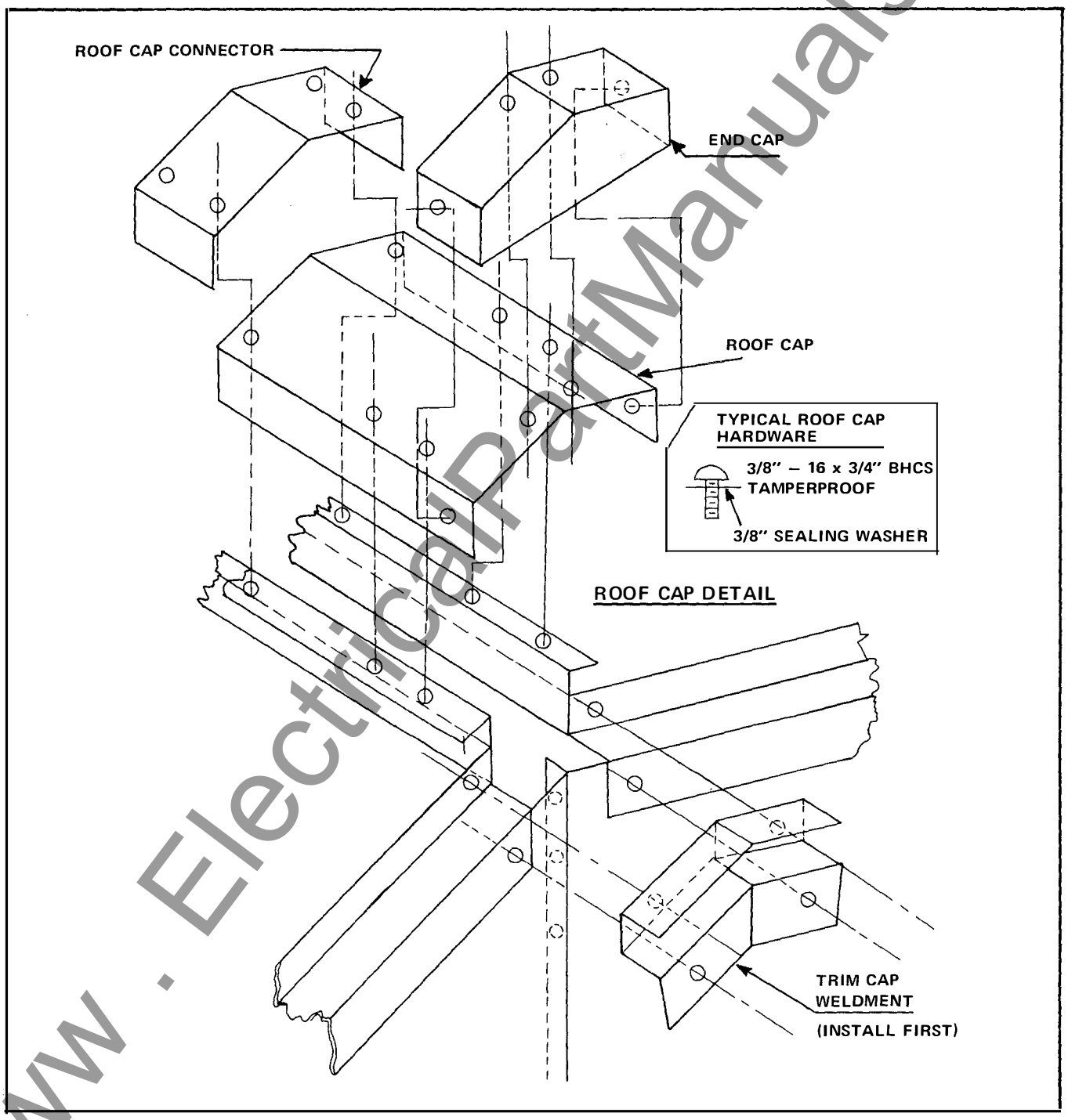


Figure 3-8.

3.5 FLOOR PLAN AND CONDUIT ENTRANCE AREA

A floor plan drawing is made for each Metal-clad switchgear order. The floor should be laid out in accordance with this drawing. This drawing will show the available conduit entrance area for the main incoming cables and the available conduit entrance area for control wiring. The ground cable should enter the switchgear in the same general area as the main power cables. A typical floor plan for indoor SOLENARC Metal-clad switchgear can be seen in Fig. 3-9 & 3-10.

Conduits should project approximately four inches above the floor for indoor switchgear and twelve inches above the foundation for outdoor switchgear. If more than one control conduit is required per unit on indoor switchgear, align the conduits in the space allotted for them on the floor plan.

A typical floor plan for both indoor and outdoor switchgear can be seen in Fig. 3-9 and Fig. 3-10. The figures shown are for standard units and can be used for preliminary planning or for future additions to existing switchgear. Final detail layouts will be provided by the factory on each individual order.

It is suggested a secondary control wire trough to be provided in the floor for the control wires. Space available for conduits is limited and can be seen in Fig. 3-9. Minor bending of the conduits may be necessary to correct for errors in locating conduits in the pads.

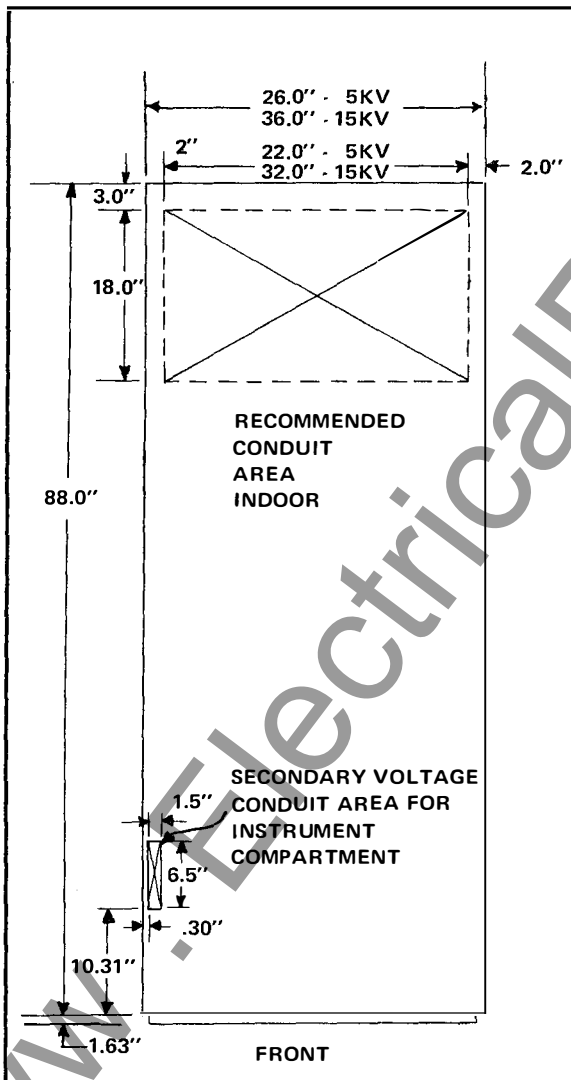


Figure 3-9.

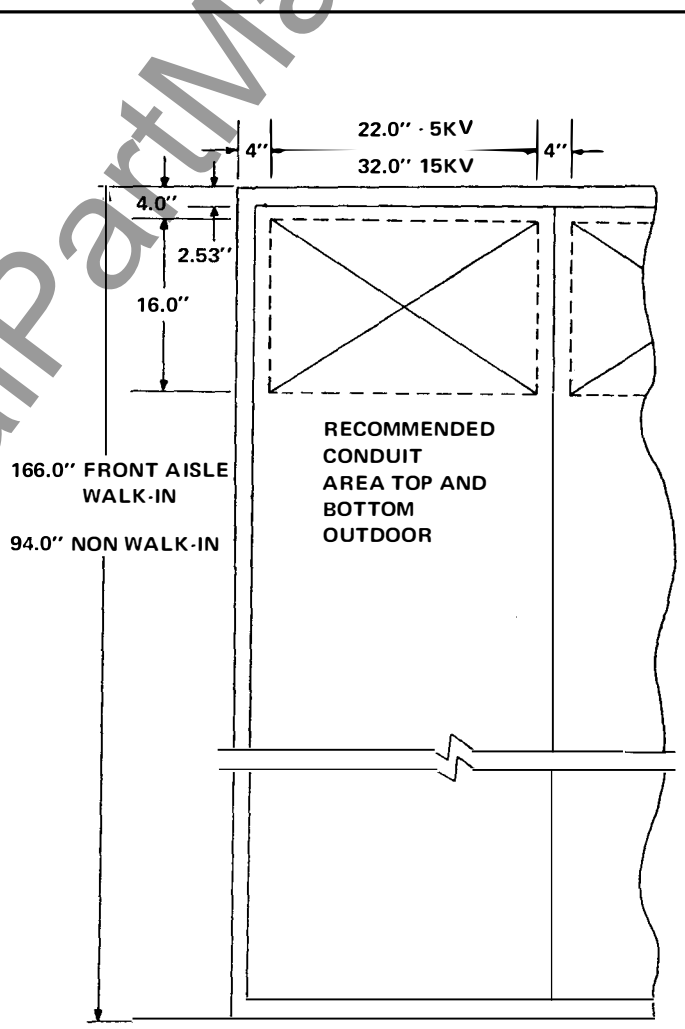
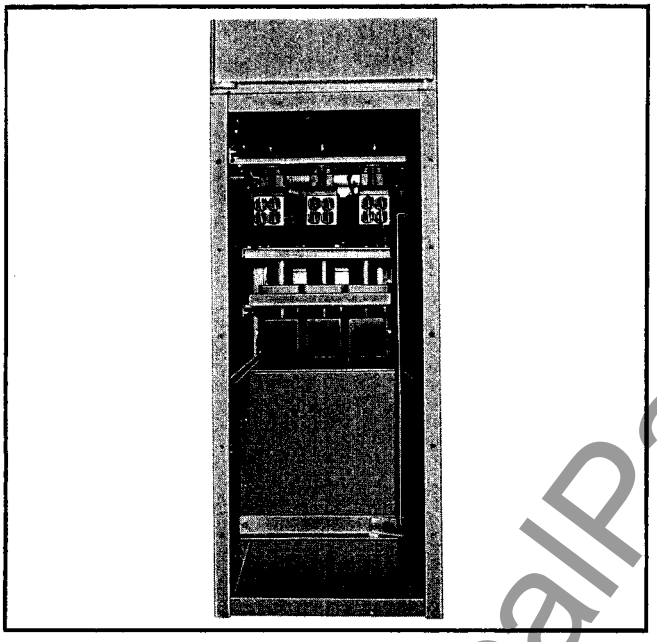


Figure 3-10.

3.6 MAIN POWER CONNECTIONS

Solenarc Metal-clad switchgear is generally supplied with solderless cable connectors or potheads for connecting to the power cables. Typical installations of this type can be seen in Figure # 3-11 & 3-12.

The phase locations of each cable should be determined in accordance with the plans and specifications before making up the connections. Each cable should be tagged accordingly. ANSI standard C37.20 requires switchgear to be phase A,B,C left to right, top to bottom, and front to rear. Square D switchgear is bussed in accordance with this, standard unless otherwise specified.



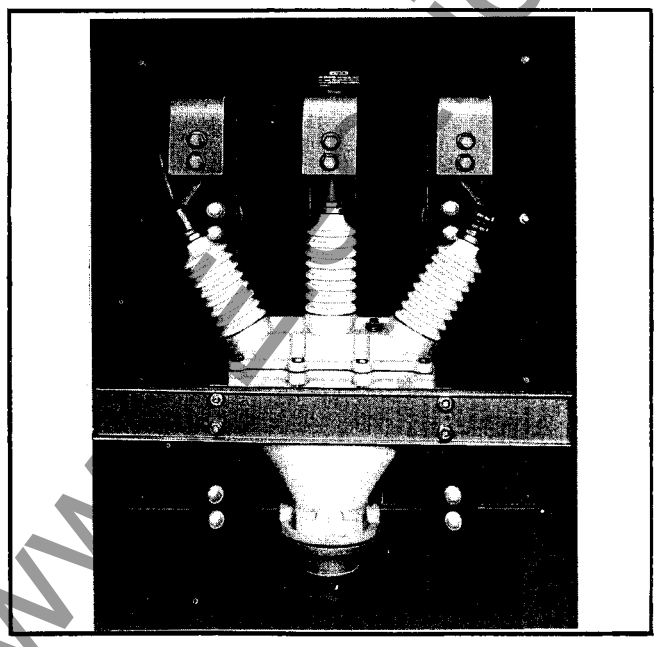


Figure 3-12.

3.7 SOLDERLESS CABLE LUGS

The most common method for connecting power cables to metal-clad switchgear is by the use of solderless or compression type cable lugs. The standard lugs are the Anderson Type TLS clamp type for copper cable and Type VCAL compression lugs for aluminum cable. Follow the cable manufacturers instructions for making the terminations for each type of power cable. After the cable connections have been made and securely bolted in place, insulate the completed assembly. This is accomplished by using insulating putty such as SCOTCHFIL® to provide a smooth installation build-up around the lug and bolts to reduce the concentrated field created by an irregularly shape joint, see figure # 3-13. A layer of # 13 semi-conducting tape should be used over the SCOTCHFIL. This tape is to be half-lapped and extend up over the insulated bus. Apply Scotch Brand # 130C tape over the # 13 tape. This tape is to be half-lapped for two layers on 5KV installations and four layers for 15KV installations. The tape is to extend one inch past the cable lugs on the main power connections. Two layers of Scotch Brand # 22 tape are to be applied next and extend up over the # 130C tape in all directions. The tape and other insulating materials for completing these field connections are not normally supplied with the switchgear.

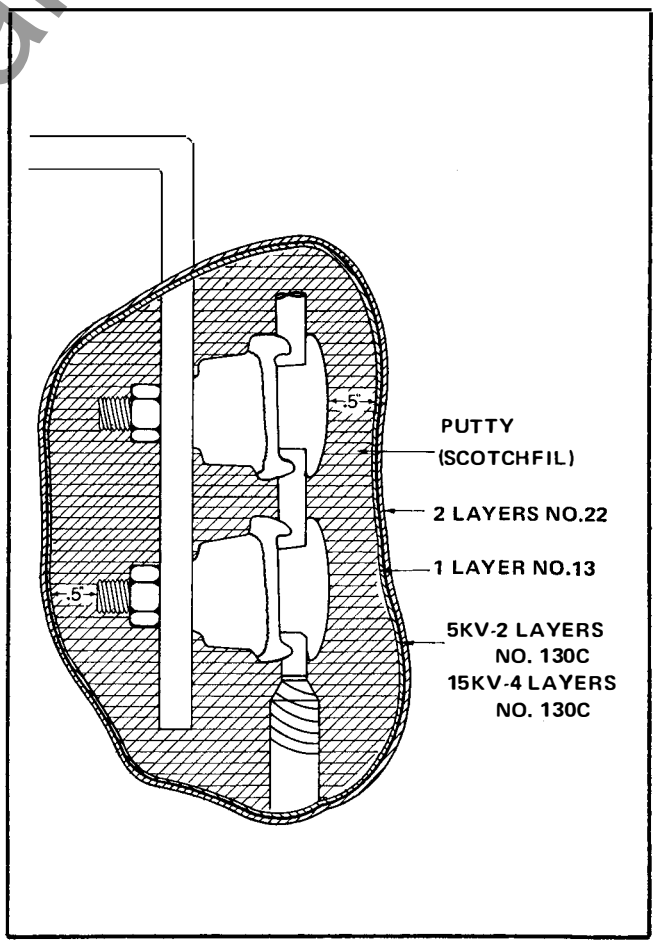


Figure 3-13.

3.8 POTHEAD

Some installations will utilize potheads or cable terminators to armor and hermetically seal the ends of the power cable connections. The cable manufacturer's recommendations should be followed for terminating the cables in these devices. The bus side is not taped to facilitate installation of the power cables. After the cables have been made up, insulate the external connections similar to that previously described for the cable lugs. The tape and other insulating materials for completing these field connections are not normally supplied with the switchgear.

3.9 FLEXIBLE CONNECTORS

Occasionally, flexible connectors are provided for relieving the strain on insulators when the switchgear is connected to a transformer. These connectors also facilitate the connections between equipment supplied from various facilities. Flexible connectors used for these applications must be taped to provide adequate insulation. The taping instructions discussed in Section 3.8 under "Solderless Cable Lug" should be used.

GENERAL

Extreme care should be taken when making up all types of cable terminations as the successful operation of the electrical distribution system will depend on successful terminations. Avoid sharp turns, edges or corners in order to prevent damage to the cable installation. Follow the cable manufacturers recommendations for minimum bending radius and for properly taping the installation to establish voltage gradients. These instructions will vary from manufacturer to manufacturer.

BOLT TIGHTNESS FOR BUS CONNECTIONS AND CLAMP TYPE LUGS

BOLT MATERIAL	TORQUE IN FOOT-POUNDS FOR BOLT DIAMETER				
	.25-20	.31-18	.38-16	.50-13	.62-11
GRADE 5 HEAT TREATED STEEL	7	16	27	70	140
TLS LUGS	–	–	20	40	55

Table 3-1.

SECTION 4

PREVENTIVE MAINTENANCE

4.0 MAINTENANCE

A systematic maintenance schedule is necessary to insure the switchgear will deliver the high quality service it was designed to provide. In determining the maintenance schedule, all operating conditions to which the equipment is subjected must be taken into account. These conditions include operating cycles, plant conditions and local atmospheric conditions. The possible effect of these conditions make it difficult to specify a specific maintenance schedule. The following guidelines are suggested:

1. The maintenance of individual components such as relays, meters and instruments should be based on the individual manufacturers recommendations. These should be coordinated as much as possible with the overall maintenance schedule to minimize operating inconvenience and circuit shutdown.

2. The installation should be given a thorough overall maintenance check and inspection annually. Initially more frequent inspections should be made to determine an accurate maintenance schedule.

4.1 CIRCUIT BREAKER CELL

Remove the circuit breaker from its compartment and service as instructed in Section 5.1 entitled "Preventative Maintenance" in Square D Manual SU-6150-2.

4.1.1 Control Power Interlock

Check the operation of the control power interlock. This interlock trips the circuit breaker when the control power plug is removed from the breaker element. With the plug fully connected; crank rotated fully clockwise; and the breaker in the test position, close the breaker by depressing the close button. Note the position of the plug crank. Start turning the crank counterclockwise slowly. At approximately 2-1/2 to 4 turns, the circuit breaker should trip to the open position, if the interlock is functioning properly. If the interlock does not function in this range, adjust it according to Instruction Manual 6150-2.

4.2 ELECTRICAL INTERLOCK

An electrical interlock switch is mounted in the control receptical to electrically prevent the circuit breaker from closing. It is a switch that closes as the plug crank is screwed in. To check for proper operation, turn the screw to its full-in position. Note the position of the handle. Slowly turn the handle in a counterclockwise direction until the switch operates as evidenced by an audible click. This should occur approximately 1-1/2 turns out from the full-in position. If it occurs early or late, adjust according to Instruction Manual 6150-2.

4.2.1 Spring Discharge Mechanism

When the circuit breaker is removed from the breaker compartment, a spring discharge ramp located on the floor will discharge the closing spring and the breaker is rolled out beyond the disconnect/test position. As the springs are discharged, the moving contacts will physically cycle through a closing operation. This insures the breaker springs are not charged when the breaker element is first removed from the compartment. This action will occur approximately 1 inch out from the disconnect/test position.

4.2.2 Disconnect Contacts

Inspect the self-aligning disconnecting contact figures and the stationary high voltage contacts for sign of excessive wear or overheating. These contacts are to be cleaned with a denatured alcohol solvent.* Wear is excessive when the silver is worn away from the contact point on the fingers exposing the copper. Replacement self-aligning are shown in Instruction Manual SU-6150-2, Section 5.3.7. Overheating is evidenced by a color change on the surface of the metal. If overheating was excessive, replace the self-aligning disconnect contact fingers and the stationary high voltage contact.

4.2.3 Cell Interlock Mechanism

The cell interlock mechanism should be checked for proper operation. When the cell interlock knob is in the "Lock-Out" position (pushed-in) the breaker should enter the compartment until it lines up with the "Test/Disconnect" position in the compartment. The circuit breaker should advance no further. The interlocking handle of the breaker can lock the breaker element in this position by pushing in and rotating in a clockwise direction.

Pull the cell interlock handle out with the breaker in this position. With the locking handle in the unlocked position, the breaker will move freely toward the "Connected" position. The levering bar should be used to lever the circuit breaker in final inches into the compartment. The locking handle should operate easily to lock the breaker into the "Connected" position. If the above functions do not operate properly, check the cell interlock mechanism to be sure it is not deformed.

CAUTION

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

4.2.4 Shutter Mechanism

The shutter mechanism must operate freely without binding through its travel. Clean the old grease from the shutter track and lubricate lightly with moly grease. The spacing between the edges of shutters should be approximately 5-3/8 inches with the shutters in the closed position.

4.2.5 Cell Switch

The cell switch (when used) is located in the lower part of the instrument compartment and is excessible through the instrument compartment door. The operating mechanism is located in the breaker compartment. A lever located on the left side of the breaker compartment is lifted by a ramp mounted on the left hand side of the breaker base.

As the breaker is moved from the "Test/Disconnected" position toward the "Connected" position, the cell will rotate 90°. Lubricate the linkages with machine oil and check for free movement of the mechanism.

4.2.6

Clean all bus bars and insulators with denatured alcohol solvent.* Use of other solvents may damage the insulating system. Inspect the bussing structure and all connection for evidence of overheating. This would be indicated by charred insulation on the bus or deformed bus joints insulating boots. Should a bus joint show evidence of overheating, take steps to eliminate the problem.

When reworking a bus bar joint, DO NOT USE ABRASIVE COMPOUNDS OR SAND PAPERS to clean the joint, as this will remove the plating. Clean the contact area with a coarse cloth such as canvas and denatured alcohol solvent.* Reconnect the joint and tighten until the Bellville spring washer in accordance with table # 3-1. When the overheating condition is excessive, it may be necessary to replace parts. Contact you local Square D Sales Office for recommendations.

After cleaning and inspecting the bus assemblies, measure the entire bussing system and record the reading in a log book. Record anv other unusual observation.

4.2.7 Trunnion Mounted Potential Transformers

On trunnion mounted potential transformers, check all bolted connections to be sure they are tight. Clean the primary fuse connections and the fuse surface with denatured alcohol solvent.* Lubricate the latch mechanism lightly. Clean the primary contact surface.

4.2.8 Control Power Transformers

Remove the control power transformer from the cell and clean all contacts, fuse connections and fuses with denatured alcohol solvent.* Inspect the transformer for cracks in the insulation or any other condition which may be abnormal. Check all connections to be sure they are tight.

4.2.9 Control Wiring

Inspect all wiring connections to be sure they are secure. Be especially observant of connections to current transformers and the current transformer circuit.

4.2.10 Air Filters

On the walk in outdoor buildings, check the air filter for excessive dirt accumulation. Replace if necessary. Oil the fan motor as recommended by the motor manufacturer.

4.2.11 Capacitor Trip Units

Some installations require capacitor trip units. After the control voltage has been re-established, the output from this trip unit can be checked. The normal voltage across its output terminal should be between 150 and 165 volts dc, with an input voltage to the unit of 120 volts ac.

If the output dc voltage is low, replace the trip unit before placing the equipment back in service. There is one capacitor trip unit provided with each circuit breaker.

4.2.12

After completion of the preventative maintenance work, it is recommended that all circuit breakers be placed in a "Test/Disconnected" position and tested for proper operation. Including the tripping function.

The importance of maintaining a log book for a scheduled maintenance program cannot be over emphasized. If the book is kept up to date and maintenance observations entered, it will provide important information when parts should be replaced and will avoid costly unscheduled shutdowns. The log book should contain all maintenance performed, measure readings and corrective actions.

4.3 ADJUSTING AND TESTING

After the switchgear has been installed and connections to downstream devices completed, the power and control circuits should be tested prior to energization. This will insure the equipment and all connections are properly made. Take care to prevent the equipment being protected or controlled from being connected to the system during the initial testing stages. The amount of testing equipment required, for any switchgear assembly, will depend upon the complexity of the system. Portable voltmeters and ammeters will be required to confirm readings on the switchgear instruments. A portable battery-operated device to ring out circuits should be part of the testing equipment.

CAUTION

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The switchgear was completely inspected and tested in its entirety for all control functions prior to leaving the factory. Control wire connections are to be checked at the job site to insure they were not loosened or damaged during installation or shipment. Bolted connections for bus joints are to be tightened to insure adequate contact pressure. Inspect and check all remote circuits, integral interlocks, external interlocks, transformers and auxiliary switches to be sure they are correct and proper.

The control relays were checked at the factory to assure proper operation. Contacts on electromechanical current relays are blocked at the factory to prevent damage during shipment. This blocking must be removed to allow proper operation of the relays.

The relays must be set in the field in accordance with the purchaser's standards. Carefully study the instruction manual for the relays involved before attempting to adjust them. These instruction manuals show the typical connections furnished in a particular switchgear assembly. The schematic and wiring diagrams furnished with the equipment should be referred to for actual connections which apply to this installation.

The covers for meters, relays and other devices, which are removed during the course of modification and/or installation and testing, should be handled carefully. These covers must be replaced as soon as possible to prevent dust and dirt from contaminating the meter movement or the relay contacts.

After the switchgear has been installed and placed in service, the drawings and diagrams supplied with the equipment should be noted for changes made during installation. A set of these drawings should be returned to the Square D Company, Middletown Plant, so changes can be made on the original tracings for a permanent record. Copies of these drawings will be returned to the customer for his file. This is necessary in order to prevent confusion in handling future orders or changes or extensions.

4.4 ADDITIONS TO EXISTING SWITCHGEAR ASSEMBLIES

The standard SOLENARC Switchgear design allows for the addition of future switchgear vertical sections in both directions. If future expansion is anticipated, this feature should be specified on the customer's inquiry. When the additional switchgear units are added to the existing installation, it can be accomplished in the following ways:

1. DE-ENERGIZE THE ENTIRE SWITCHGEAR ASSEMBLY.

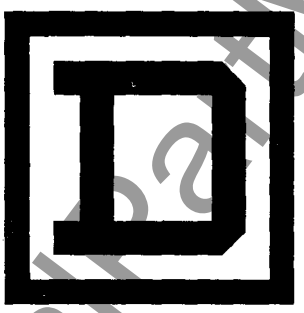
2. REMOVE THE REAR PLATES, INTERNAL MAIN CROSS BUS BARRIERS, AND END COVER PLATE FOR THE MAIN CROSS BUS.

4. REMOVE ALL INSULATING BOOTS OVER BUS JOINTS.

3. REMOVE THE CIRCUIT BREAKER FROM THE END SWITCHGEAR CUBICLE AND REMOVE THE BARRIER AT THE BOTTOM REAR OF THE CIRCUIT BREAKER CELL TO GIVE FRONT ACCESS TO THE MAIN BUS.

5. UNBOLT THE MAIN CROSS BUS FROM THE INNER-CONNECTING SUPPORT AT EACH INSULATED BUS SUPPORT. INSTALL THE NEW BUS BARS EXTENDING INTO THE ADDITIONAL SECTIONS ON THE TOP OF THE EXISTING BUS AND SECURE BARS WITH THE NEW BOLTS AND WASHERS SUPPLIED WITH THE NEW SWITCHGEAR ASSEMBLY. BE SURE TO TORQUE ALL BOLTS PROPERLY.

6. RE-INSTALL INSULATING COVERS AND BARRIERS. DO A COMPLETE ELECTRICAL CHECK ON THE NEW SWITCHGEAR ASSEMBLY ONLY AFTER IT HAS BEEN PROPERLY INSTALLED AS PART OF THE TOTAL LINE-UP.



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