April, 1985

Manual 6053-2

Installation & Maintenance Manual

VACARC™
Metal-Clad Switchgear
With Type VAD
Vacuum Circuit Breakers

• INSTALLATION • OPERATION • MAINTENANCE

SQUARE D COMPANY

METAL-CLAD SWITCHGEAR WITH TYPE VAD VACUUM CIRCUIT BREAKERS

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METAL-CLAD SWITCHGEAR WITH TYPE VAD VACUUM CIRCUIT BREAKERS

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 circuit (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 outdoors longer than one month before it is put into service, the space heaters should be energized to prevent condensation inside the switchgear.

13. CAUTION. If indoor switchgear is to be stored prior to being put into service, preferably it should be stored indoors in a warm, dry area. If it must be stored outdoors, it should be thoroughly tarped and protected from the weather, and temporary electric heaters (250W per bay) installed in the cable compartments to prevent condensation.

1.0 INTRODUCTION

VACARC switchgear is used to protect and switch 5 and 15kV high voltage distribution circuits. 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 is composed of individual components and units which are arranged to provide a structure in accordance with the purchase order.

1.1 Description (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 "VAD" 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. Inter-wiring between 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 thermostatically controlled space heaters 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 circuits become de-energized, all high voltage conductors should be tested for electrical insulating qualities prior to energization of the switchgear.

1.2 Enclosure Description

VACARC switchgear enclosure side panels are fabricated of 11 gauge hot rolled steel. These formed panels are 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 uniform and accurate in size. Removable exterior coverplates are fabricated of 14 gauge hot rolled steel.

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.

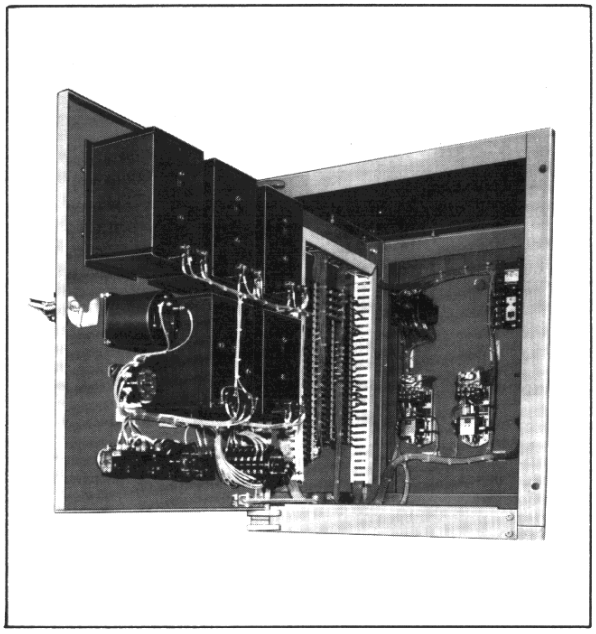
Metal barriers within the indoor enclosure may be removed for inspection and maintenance with standard tools.

1.2.1 Main Disconnecting Contacts (Figure 1-2)

The HV stationary main disconnecting contacts are located within porcelain tubes mounted directly behind the shutters at the rear of the breaker compartment.

The contacts and porcelain tubes are self-aligning upon installation, thus eliminating the need for any adjustments if the stationary contacts should need to be replaced.

METAL-CLAD SWITCHGEAR WITH TYPE VAD VACUUM CIRCUIT BREAKERS



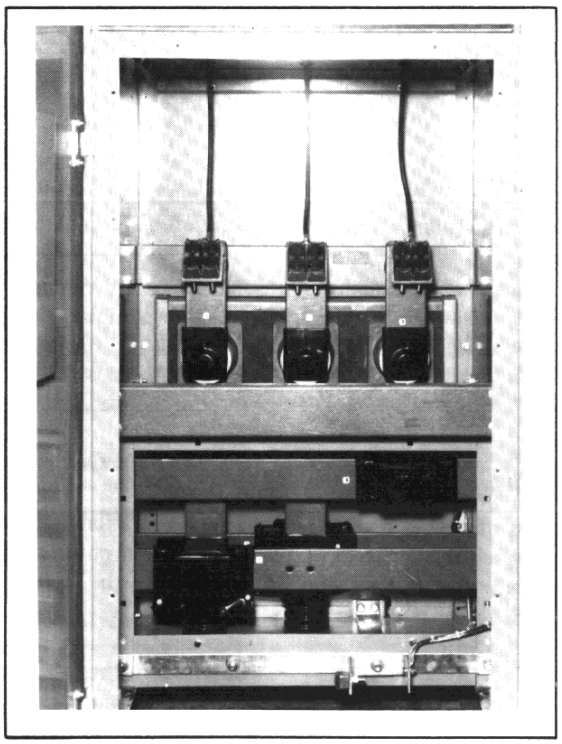


Figure 1-1

Figure 1-2

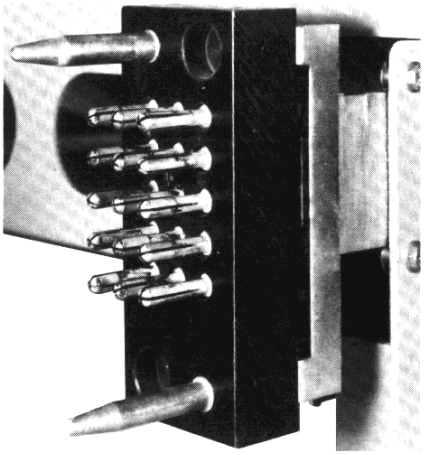


Figure 1-3

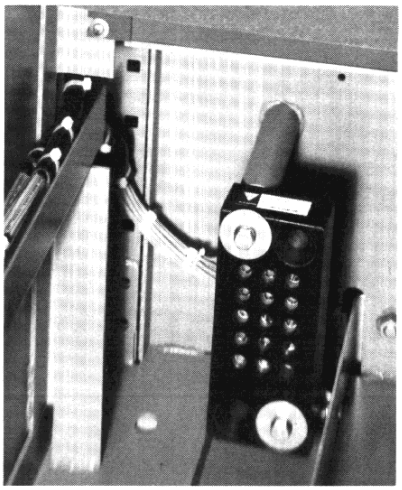


Figure 1-4

1.2.2 Control Power Connection To Breaker
(Figures 1-3 & 1-4)

Control power connections between the cubicle and the circuit breaker are accomplished with self-aligning, automatically engaging, pin/socket connectors.

With the circuit breaker in the test position, it is possible to manually engage the connector by raising the extension rod on the breaker, pushing the rod in until it is possible to use the racking lever and pushing down on the racking lever to fully seat the connector.

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

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 Figures 1-5 & 1-6. The shutters are part of the stationary housing and are raised by a shutter lifting arm which is actuated by a roller attached 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 lifting the shutter lifting arm.

1.2.4 Truck Operated Cell Switch (Figure 1-7)

The truck operated cell switch (TOC switch) is generally a 4 pole (2a & 2b) assembly with 8 poles (4a & 4b) as a maximum. Each switch pole is double-break. The TOC switch is accessible through the breaker compartment door with the breaker removed. It is operated by a plate mounted on the back of the circuit breaker. When the breaker is racked into the connected position, the plate depresses a spring loaded plunger which causes the switch to operate. This switch electrically indicates whether the breaker is in the connected or test position.

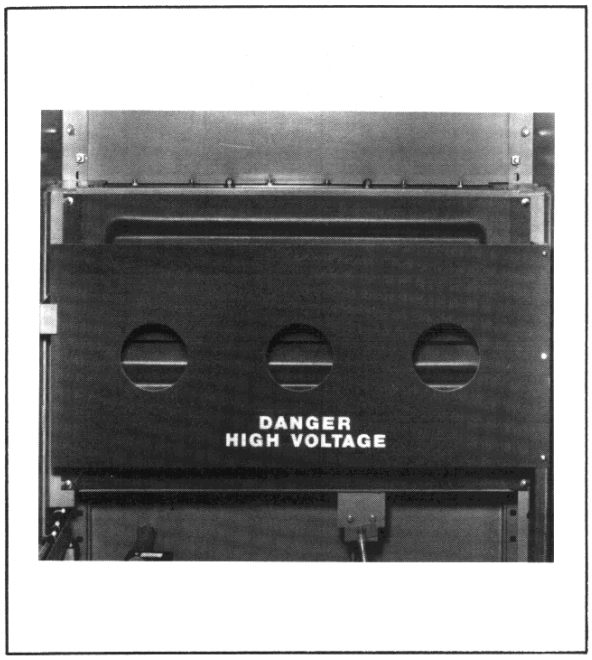


Figure 1-5

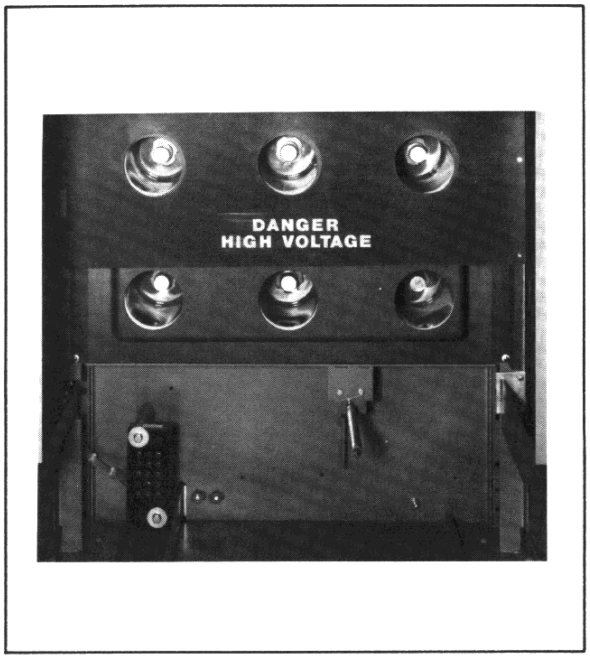


Figure 1-6

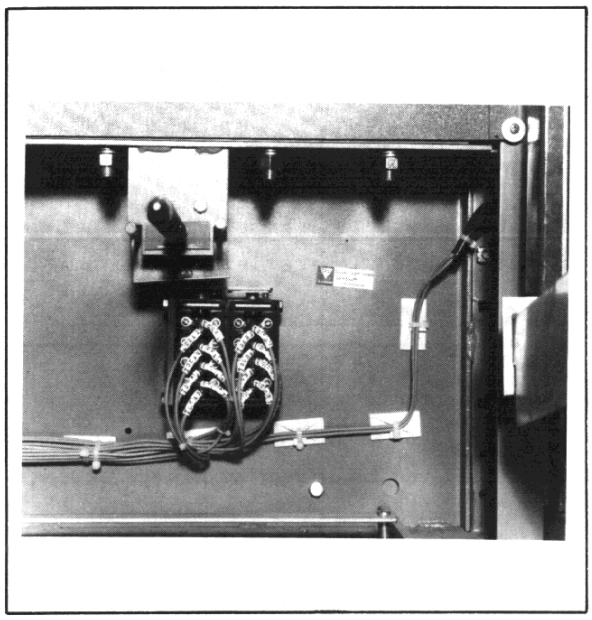


Figure 1-7

1.2.5 Circuit Breaker - Cubicle Rating Interlocking Scheme (Figures 1-8, 1-9)

All VACARC breaker compartments have an interlock scheme that prevents the insertion of an incorrectly rated circuit breaker into the compartment.

The interlocking is accomplished by a code plate mounted to the cell and a pin welded to the left side of the circuit breaker.

DO NOT INTERCHANGE VOLTAGE RATINGS.

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

1.2.6 Disconnecting Type Potential
(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 accessible 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 lefthand 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 accessible from the front of the switchgear when the breaker element is removed. A glass polyester molded barrier located behind the shutter assembly must be removed to gain access to these transformers.

It is possible to remove and/or replace the current transformers supplied with the equipment. The current transformers are mounted on porcelain bushings which allows the use of a standard 600V AC window type current transformer in the over-current protective circuits. Depending upon the current transformers selected, a maximum of two current transformers can be mounted on each bushing for a maximum total of four transformers per phase.

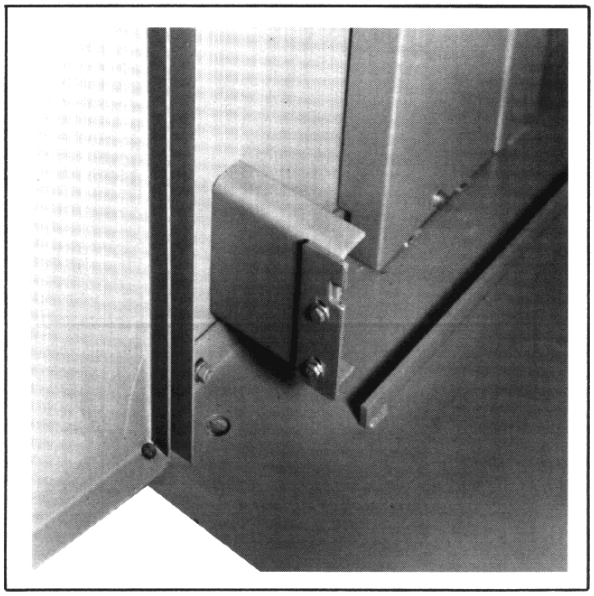


Figure 1-8

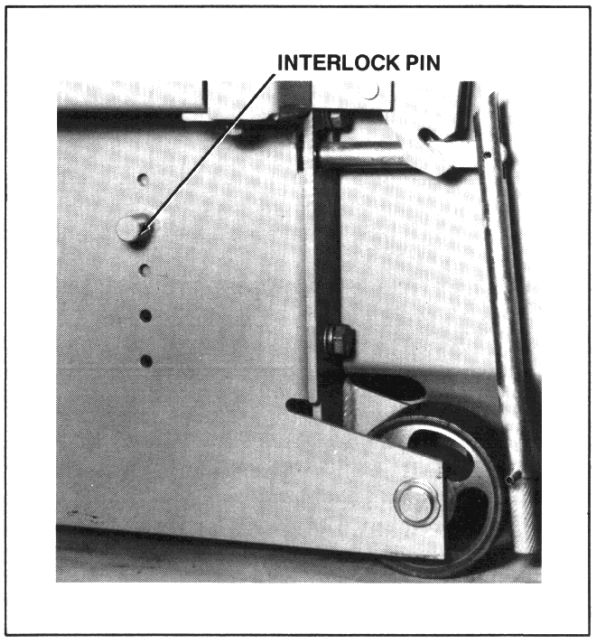


Figure 1-9

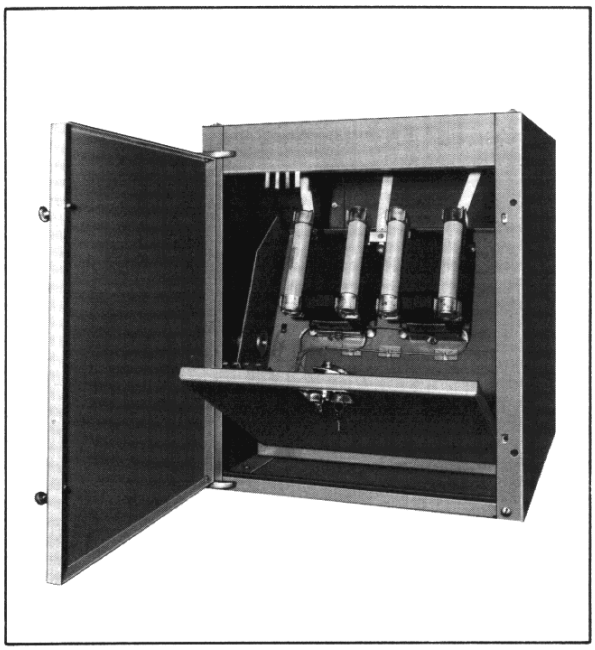


Figure 1-10

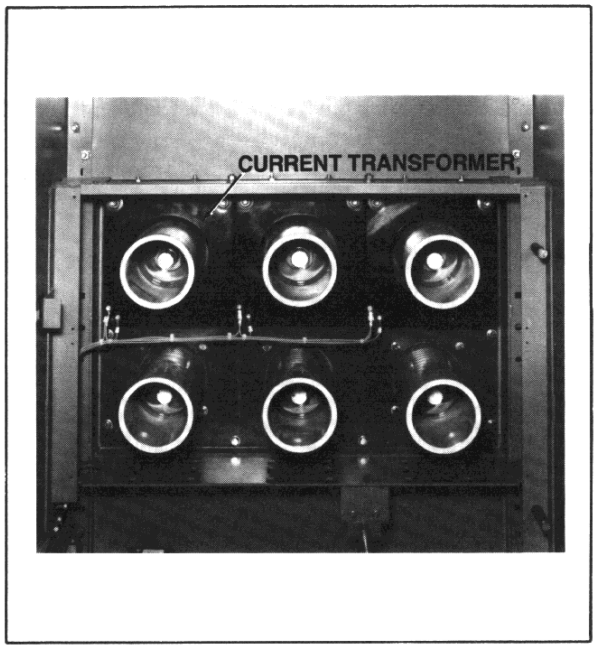


Figure 1-11

1.2.8 Control Power Transformers (Figure 1-12)

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.

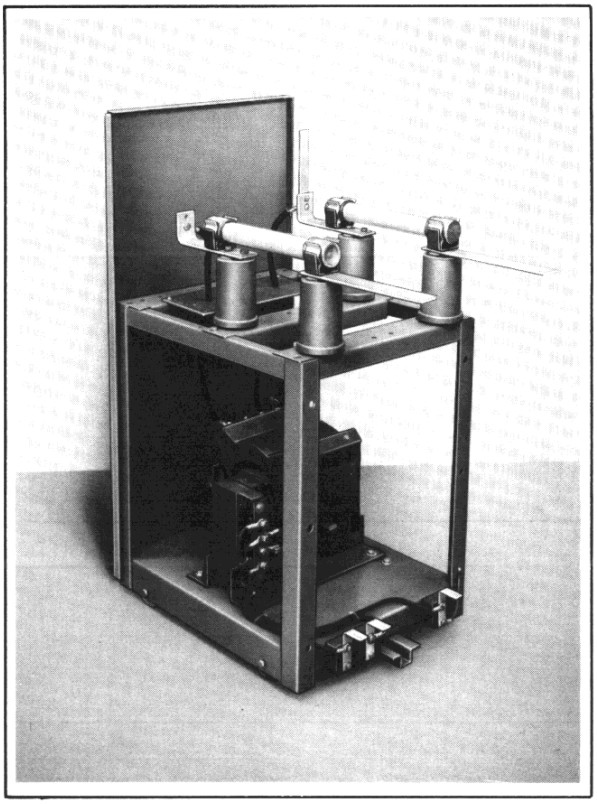


Figure 1-12

1.2.9 Ground Bus Connections

A ground bus is included with all VACARC switchgear assemblies. The normal ground bus is silver-plated copper. 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 1-13)

VAD vacuum 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. See Section 3.10 for installation of the VAD breaker. A typical circuit breaker element is shown in Figure 1-13. Additional descriptive information can be obtained from instruction manual 6080-1 for the breaker element itself. 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 VACARC metal-clad switchgear.

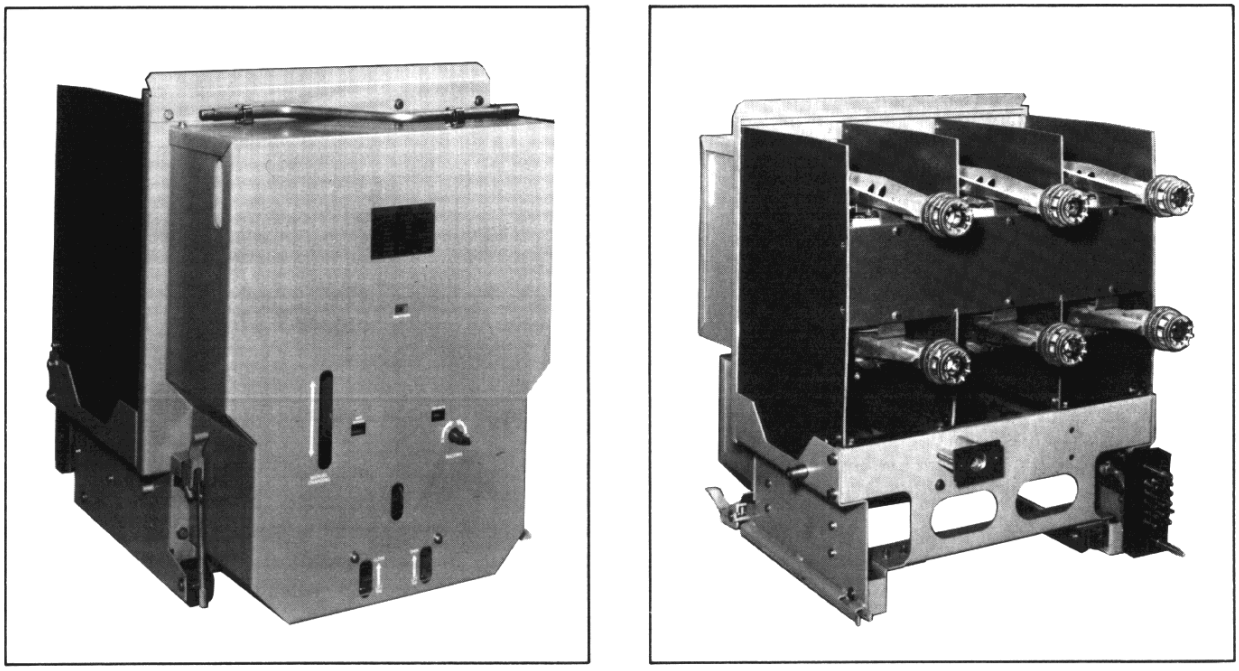


Figure 1-13

1.4.1 Racking Handle (Figures 1-14, 1-15, 1-16)

A combination racking, manual spring charging handle is provided for racking of the circuit breaker and for manually charging the closing springs if control power is not available.

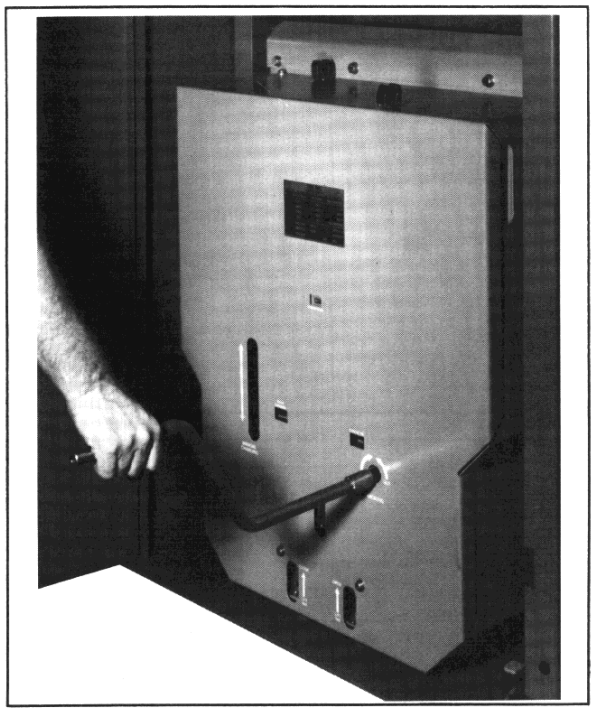


Figure 1-15

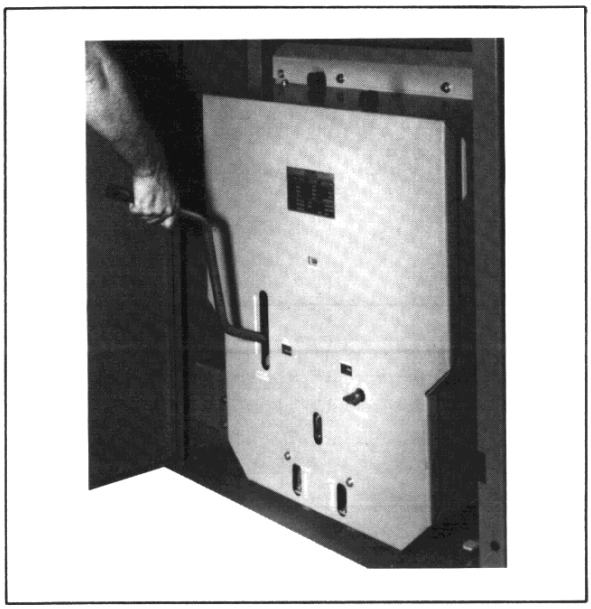


Figure 1-16

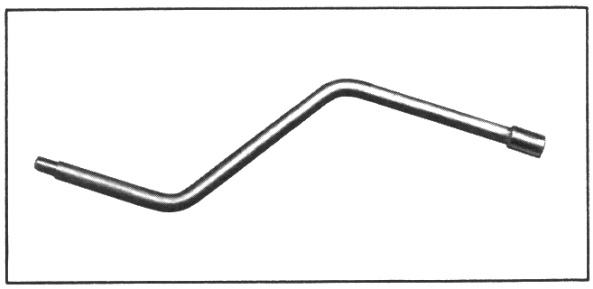


Figure 1-14

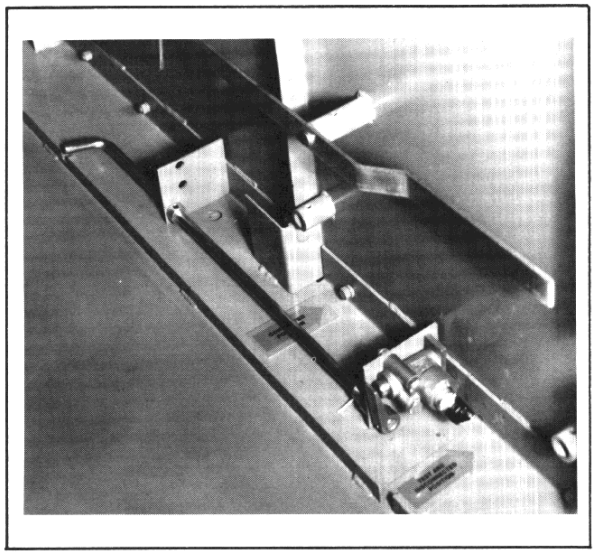


Figure 1-17

1.5 Key Interlock System (Figure 1-17)

As an option, key interlocks are often supplied with VACARC switchgear, either in conjunction with the circuit breaker elements or disconnecting switches, as required by the user's 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, in the lower righthand corner.

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.

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 enroute 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 VAC-ARC metal-clad switchgear indoor and outdoor are given in Tables 2-1 and 2-2A.

2.1 Lifting Indoor Switchgear

Use the following procedure to lift a maximum of a 3 bay shipping section:

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

2. For hoisting, use a steel cable with a minimum diameter of 3/8 inches. Attached 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 and 2-5.

INDOOR SWITCHGEAR

TYPE OF BREAKER (VAD)	THREE PHASE MVA	VOLTAGE KV - RMS	RATED CONT. CURRENT 60 ~~HZ~~ AMPS - RMS	WEIGHT OF BREAKER	WEIGHT OF CUBICLE LESS BREAKER	TOTAL WEIGHT OF CUBICLE WITH BREAKER
05025-12	250	4.16	1200	570 / 259	1200 / 544	1770 / 803
05025-20	250	4.16	2000	590 / 268	1300 / 590	1890 / 858
15050-12	500	13.8	1200	570 / 259	1200 / 544	1770 / 803
15050-20	500	13.8	2000	590 / 268	1300 / 590	1890 / 858
15075-12	750	13.8	1200	570 / 259	1200 / 544	1770 / 803
15075-20	750	13.8	2000	590 / 268	1300 / 590	1890 / 858
						LB / KG

Table 2-1

Table 2-2A
OUTDOOR WALK-IN SWITCHGEAR

TYPE OF BREAKER (VAD)	THREE PHASE MVA	VOLTAGE KV - RMS	RATED CONT. CURRENT 60 HZ. AMPS - RMS	*WEIGHT OF BUILDING
05025-12	250	4.16	1200	2234 / 1013
05025-20	250	4.16	2000	2354 / 1068
15050-12	500	13.8	1200	2234 / 1013
15050-20	500	13.8	2000	2354 / 1068
15075-12	750	13.8	1200	2234 / 1013
15075-20	750	13.8	2000	2354 / 1068
				LB / KG

*1) Includes cubicle with breaker.
2) Multiply above weight times number of cubicles then add 1200 lbs. to get total weight.

Table 2-2B
OUTDOOR NON-WALK-IN SWITCHGEAR

TYPE OF BREAKER (VAD)	THREE PHASE MVA	VOLTAGE KV - RMS	RATED CONT. CURRENT 60 HZ. AMPS - RMS	*WEIGHT OF BUILDING
05025-12	250	4.16	1200	1859 / 843
05025-20	250	4.16	2000	1979 / 898
15050-12	500	13.8	1200	1859 / 843
15050-20	500	13.8	2000	1979 / 898
15075-12	750	13.8	1200	1859 / 843
15075-20	750	13.8	2000	1979 / 898
				LB / KG

*1) Includes cubicle with breaker.
2) Multiply above weight times number of cubicles then add 600 lbs. to get total weight.

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 above 120° F. During storage the switchgear housing

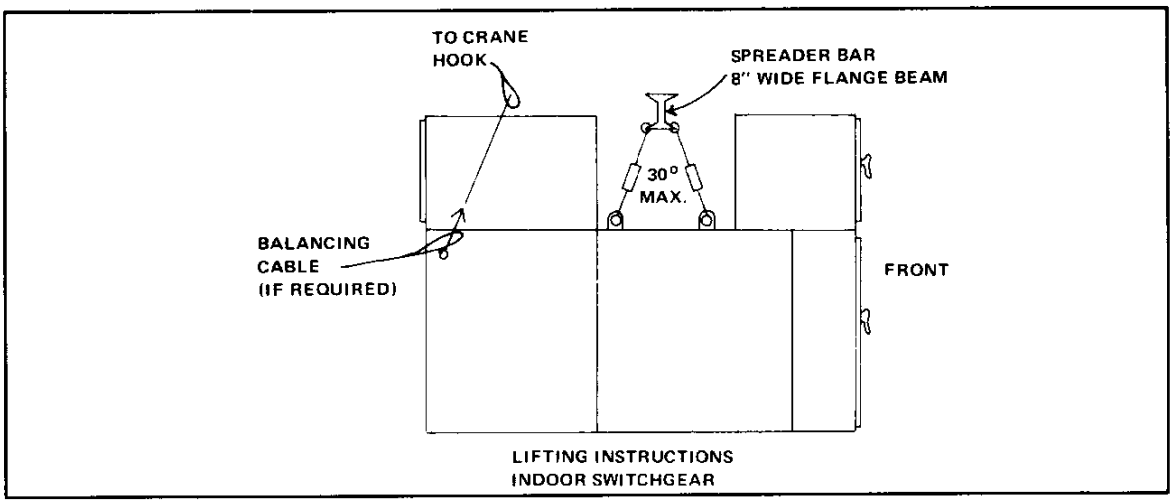


Figure 2-3

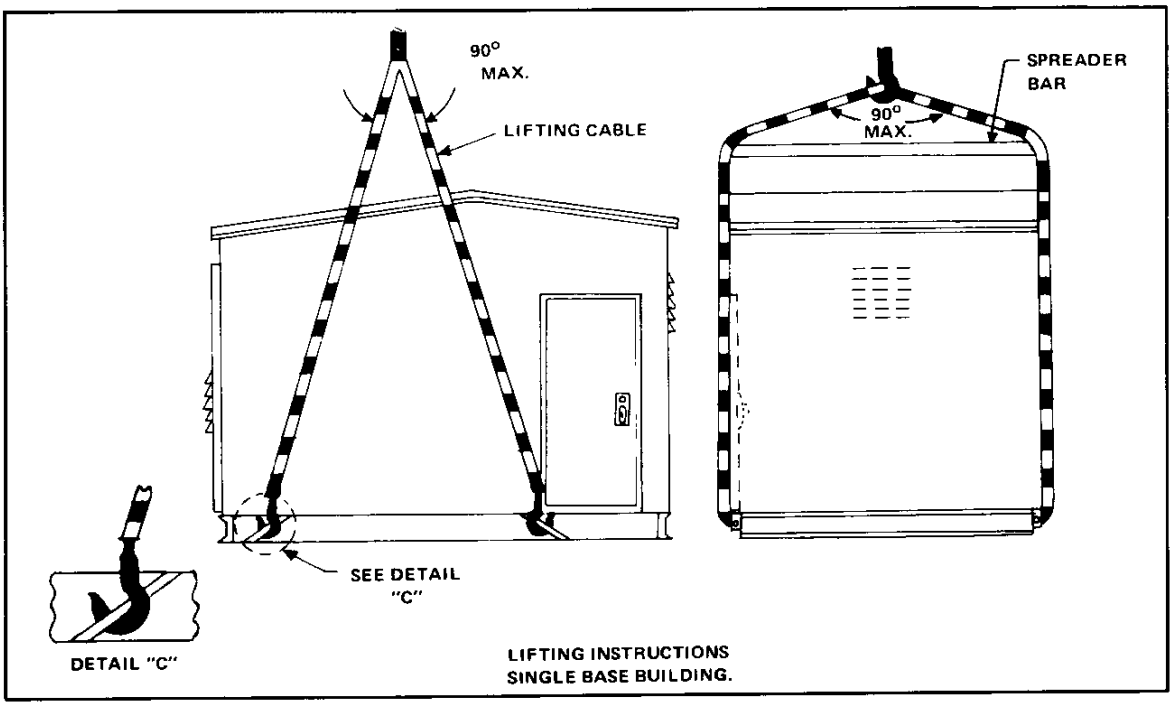


Figure 2-4

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.

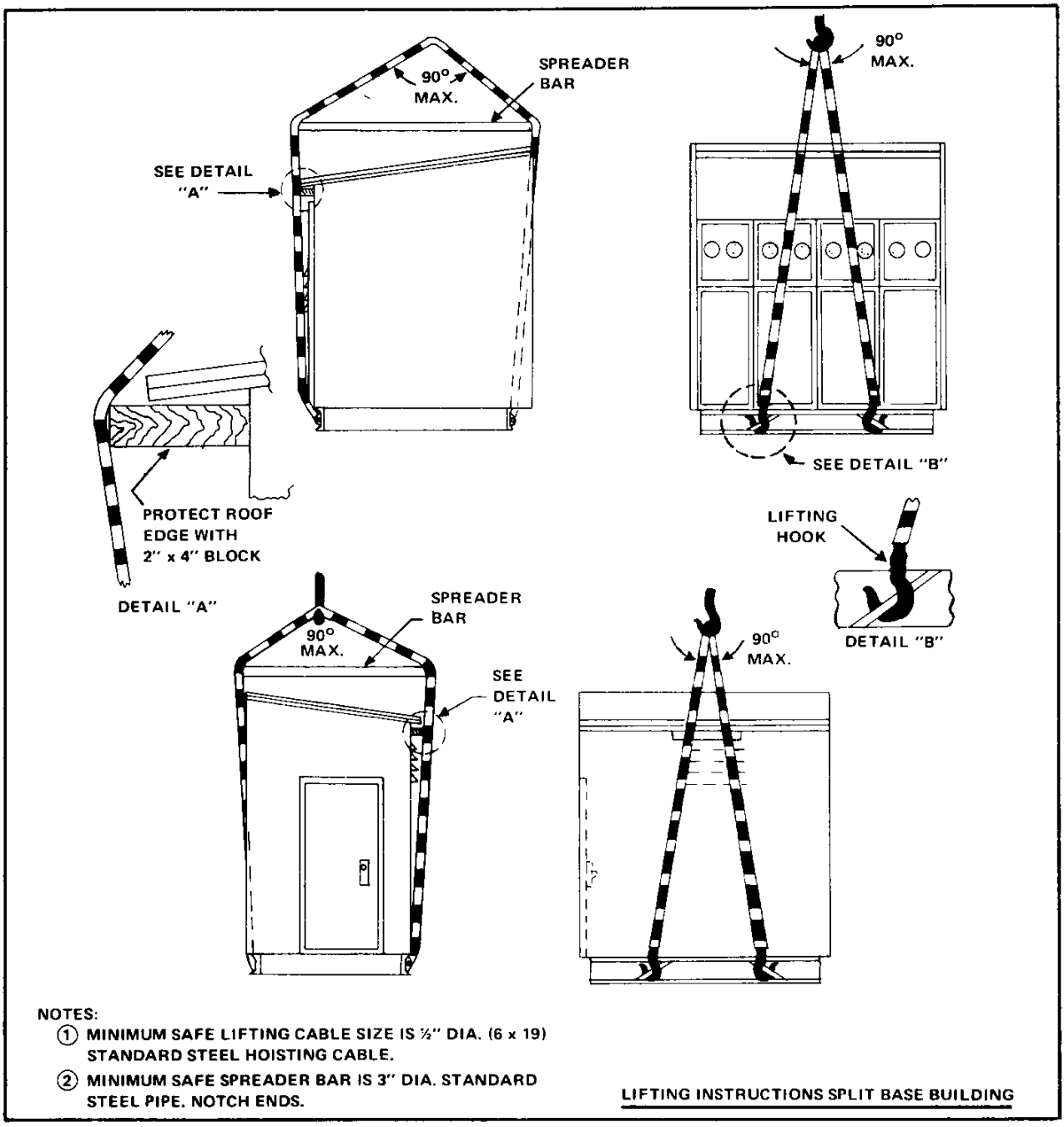


Figure 2-5

3.0 FOUNDATION

VACARC 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 is shown in Figure 3-1. Examples No. 1 and No. 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 inches high and extend in front of the switchgear by at least 5 feet.

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.

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 job site. 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.

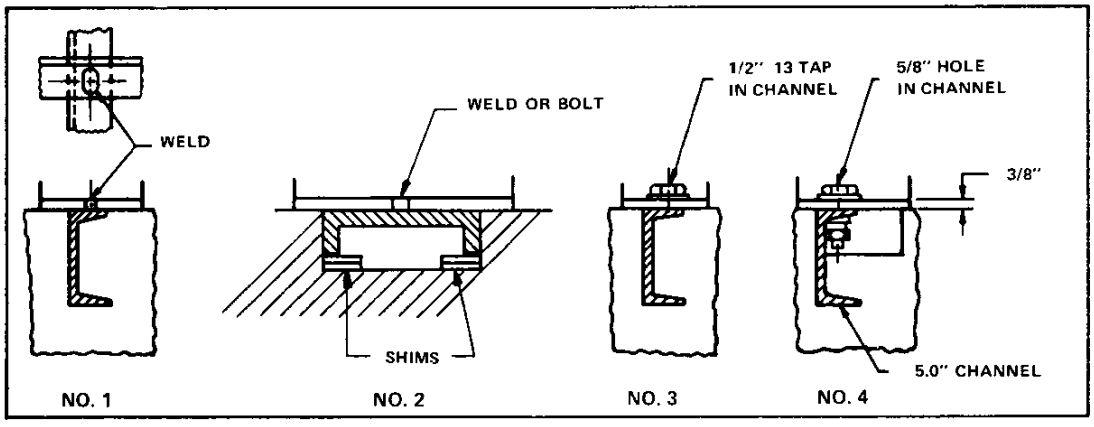


Figure 3-1

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.

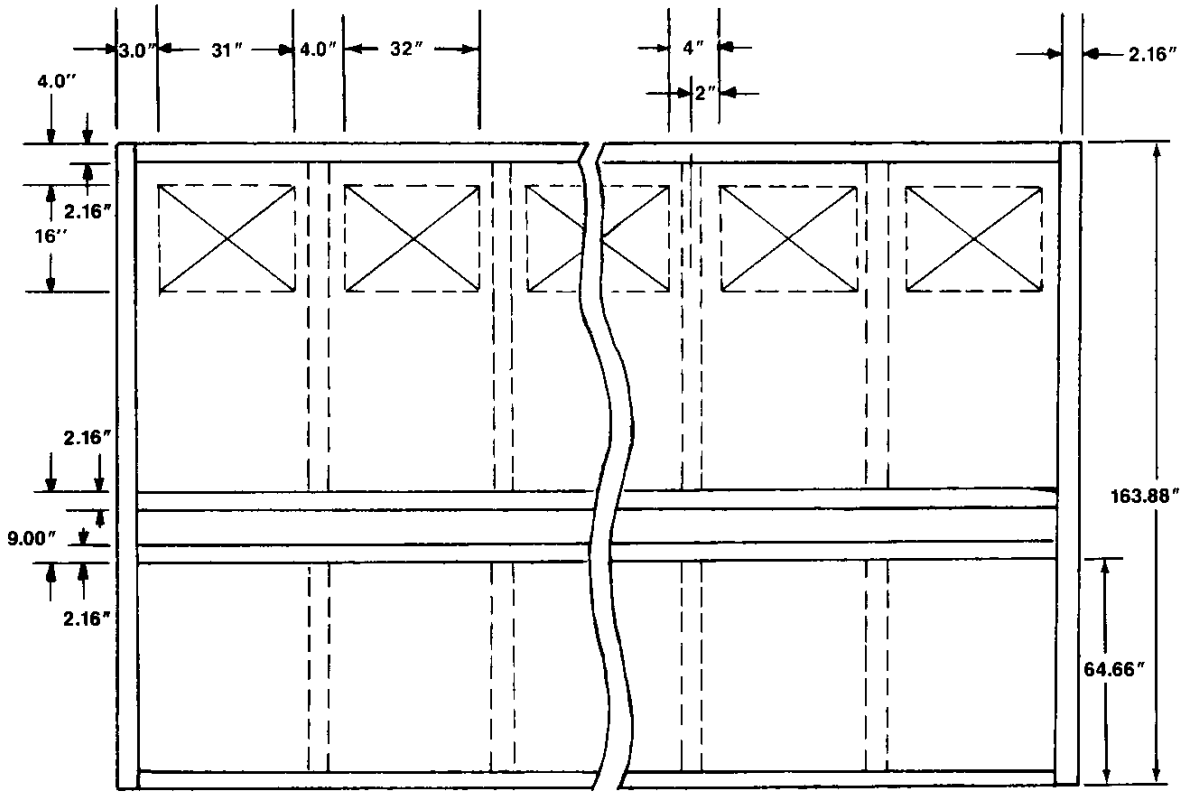
Each foundation type will be discussed individually.

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.

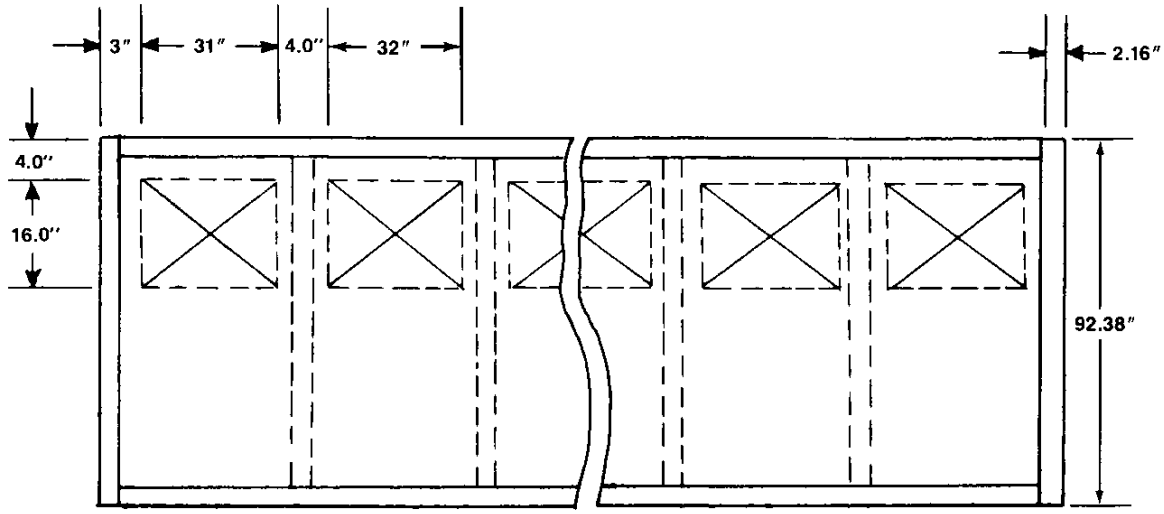
Make provisions for conduit entrance in the areas indicated on job drawings similar to that shown in Figure 3-2 and Figure 3-3. The base channel contact area is also indicated in these figures.



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

FLOOR PLAN – OUTDOOR WALK-IN CONSTRUCTION

Figure 3-2



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

FLOOR PLAN

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 and 3-3. Note that there are three main channel areas that require support on the walk-in building.

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 and 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

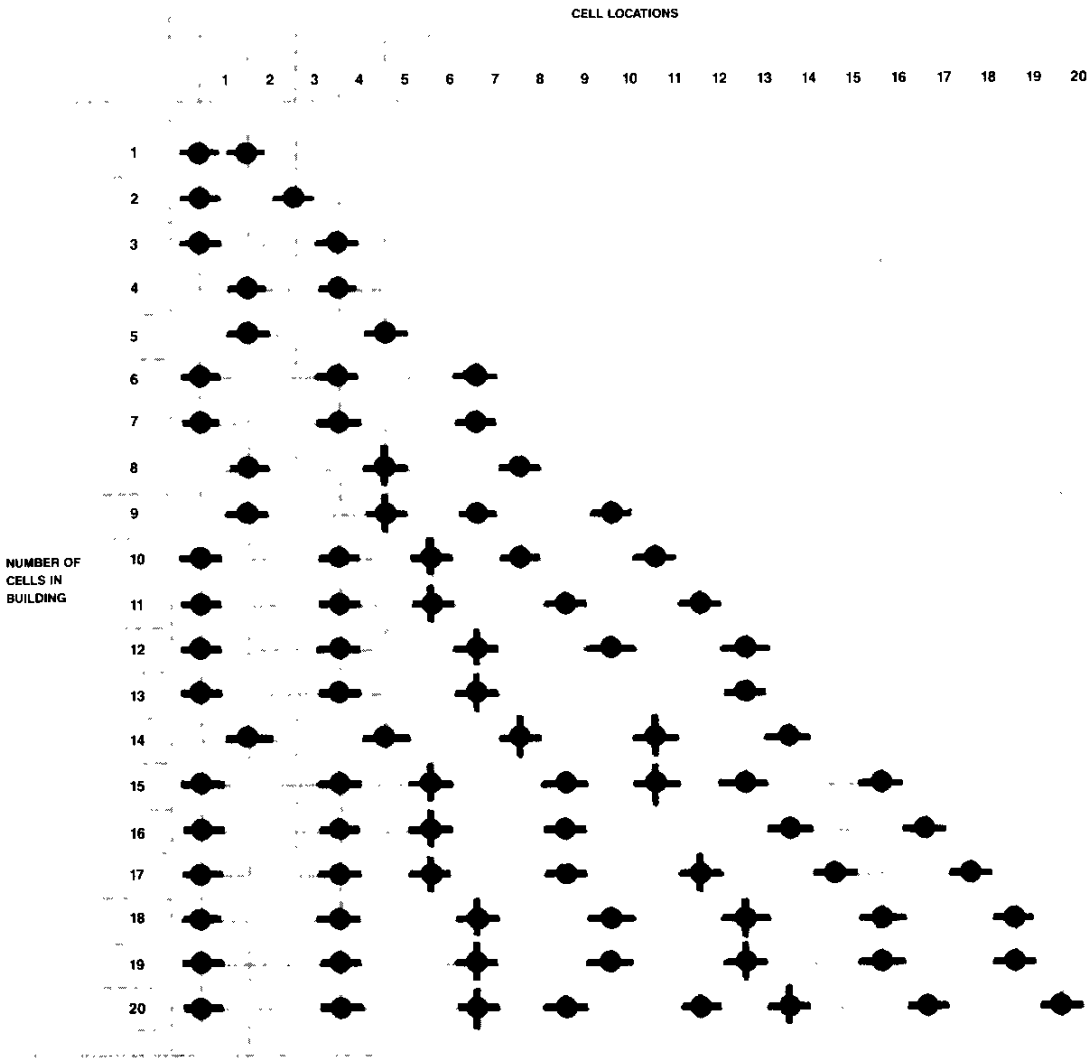
Piers used to support the outdoor building can be located up to eleven feet apart along the length of the building. This figure limits the maximum deflection of the base channel to a safe distance and provides a safety factor for the stress in the base channels. They are to be located along the length of the building in sets of three across the width of the building. Refer to Figures 3-5 and 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.

Figure 3-5 shows 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 job site.

RECOMMENDED PIER LOCATIONS FOR THE SQUARE D OUTDOOR BUILDINGS FOR THE 36" CELL WIDTH.



PIER LOCATIONS FOR OUTDOOR BUILDINGS—36" CELL WIDTH

Figure 3-5

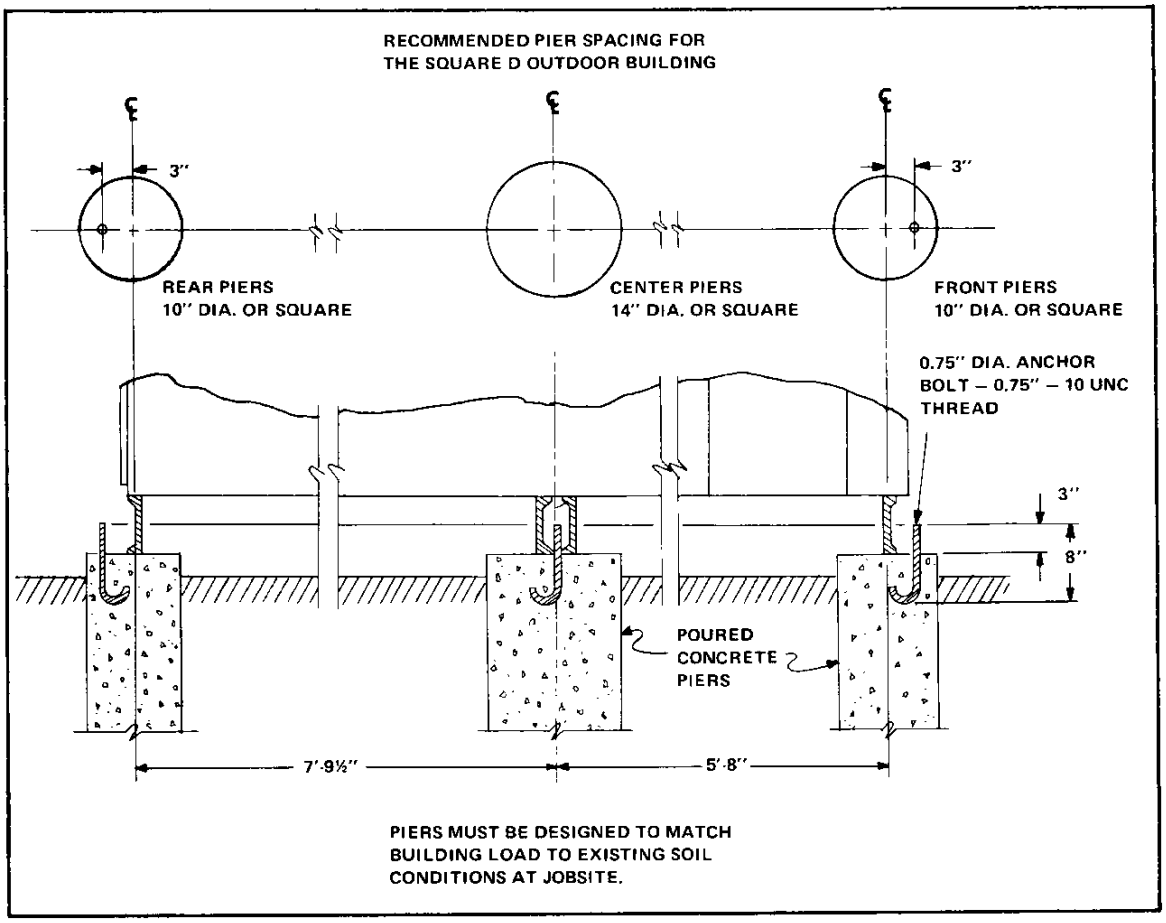


Figure 3-6

3.3 INDOOR SWITCHGEAR STRUCTURES

Suggestions for a properly installed metal-clad switchgear structure:

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 inch minimum clearance aisle is required in front of the switchgear, and a 36 inch minimum clearance aisle is required in the rear. From the back wall of the switchgear room measure 36 inches. 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 four 2 inch x 2 inch spacers on the floor of the cubicle as shown in Figure 3-7. All spacers must be square. Place a piece of wood 2 inches x 4 inches on the spacers as shown

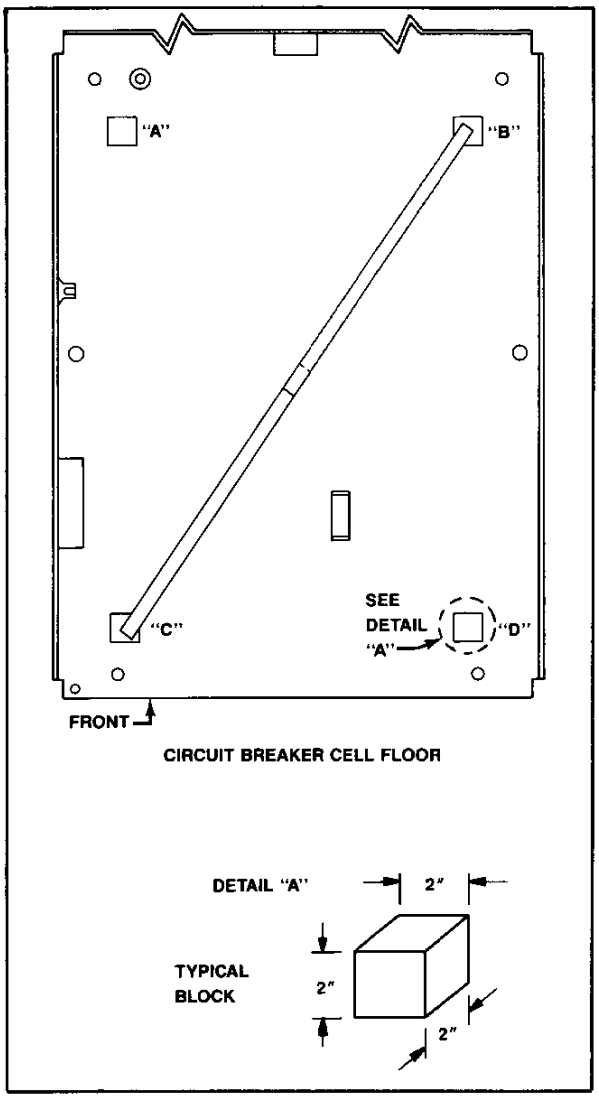


Figure 3-7

in Figure 3-7. This 2 inches x 4 inches must have square sides. Check for levelness by placing a 2 foot level on this 2 inches x 4 inches. 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.

3.4 OUTDOOR SWITCHGEAR STRUCTURES

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 6 inch high structural steel channels (13.00 lb./ft.) and formed 7 gauge steel channels. Primary load bearing members are 6 inch structural steel. Base design limits the deflection of the longest base during lifting to 1/16 inch maximum. Aisle floors are 7 gauge hot rolled steel.

Exterior walls and roof are formed from 14 gauge Galvaneal steel sheet. Walls and roof are designed to support a dead load of 3 feet of wet snow (30 lbs./ft. density). Roof seams are capped. Vertical wall seams are caulked with silicon rubber 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 2 bays.

The building is split lengthwise for line-ups exceeding the above. A maximum of 7 bays 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 in each shipping section 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 inch – 16 flathead screws (supplied).

8. Install roof caps (see Figure 3-8).

9. After all structural joining parts have been assembled, all seams are to be caulked with silicon rubber formulated for exterior use.

Buildings are fan ventilated as standard. A 12 inch diameter fan – 740 CFM free air – is standard for buildings up to and including 10 bays; two 12 inch diameter fans for buildings 11 through 20 bays. Fans are thermostatically controlled. Fluorescent lights are supplied as required. Three-way light switches are mounted at door on buildings exceeding 2 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 keys are identical.

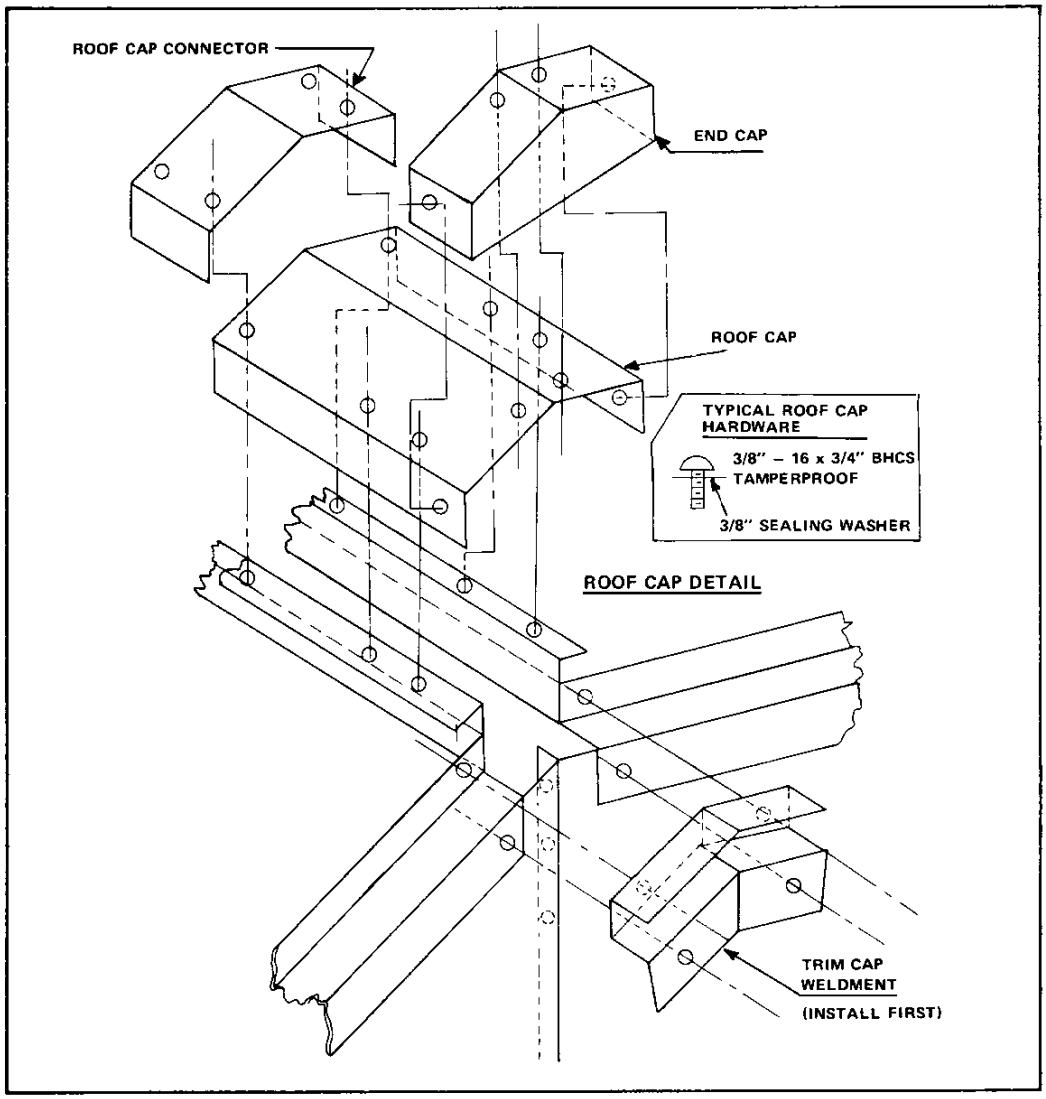


Figure 3-8

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 375 watts. The strip heaters in each cell are thermostatically controlled.

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 VACARC metal-clad switchgear can be seen in Figures 3-9 and 3-10.

Conduits should project approximately four inches above the floor for indoor switchgear and ten 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 Figure 3-9 and Figure 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 be provided in the floor for the control wires. Space available for conduits is limited as can be seen in Figure 3-9. Minor bending of the conduits may be necessary to correct for errors in locating conduits in the pads.

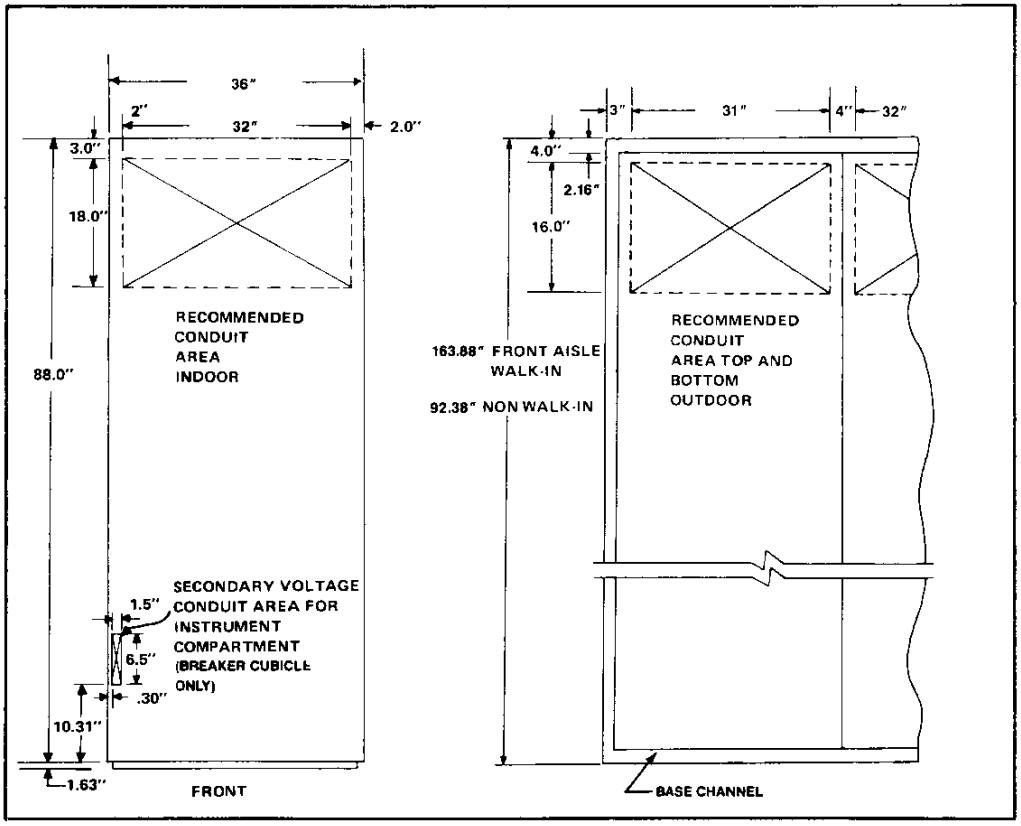


Figure 3-9

Figure 3-10

3.6 MAIN POWER CONNECTIONS

VACARC metal-clad switchgear is generally supplied with solderless cable connectors for connecting to the power cables. Typical installations of this type can be seen in Figure 3-11.

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.

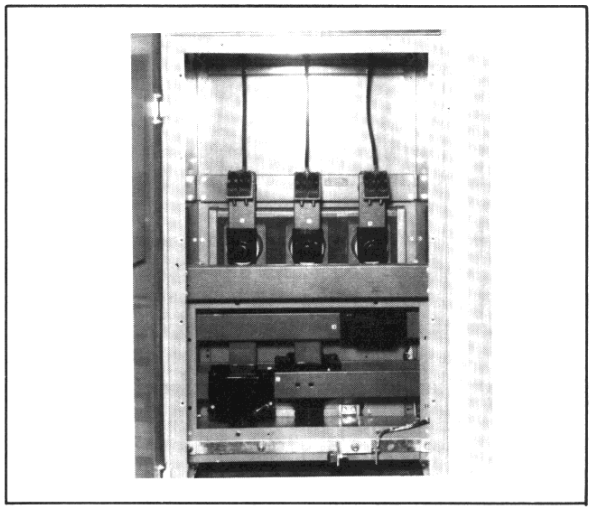


Figure 3-11

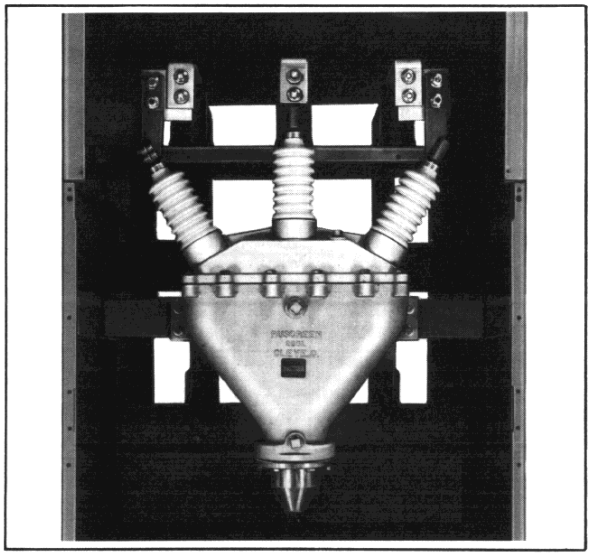


Figure 3-12

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 TLD clamp type for copper cable and Type VACL compression lugs for aluminum cable. Follow the cable manufacturer's 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 shaped 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 bare 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 1½" onto the bus bar and cable insulation. 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.

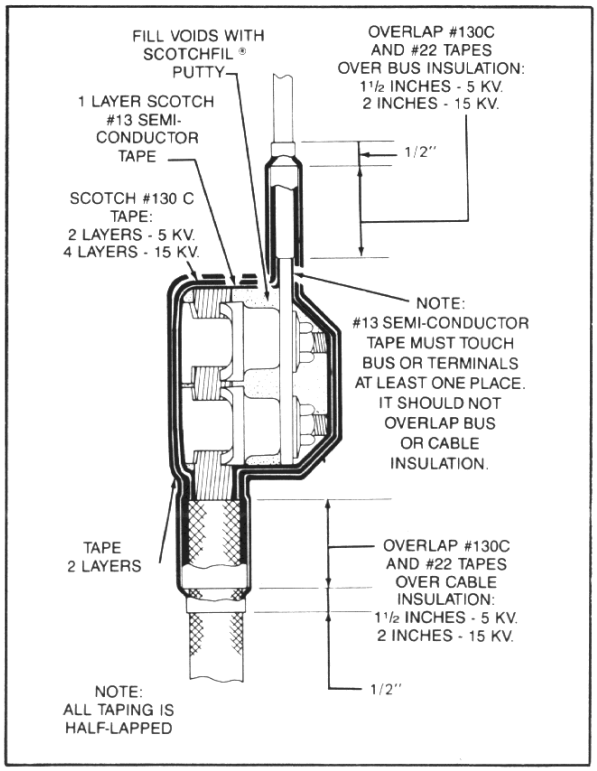


Figure 3-13

3.8 POTHEAD (Figure 3-12)

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 Lugs" should be used.

3.10 BREAKER INSTALLATION

WARNING: THE FOLLOWING CHECKOUT PROCEDURE MUST BE COMPLETED BEFORE ANY HIGH VOLTAGE CONNECTIONS ARE MADE ON THE SWITCHGEAR. DONE OTHERWISE, CHECKOUT PERSONNEL ARE WORKING UNDER POTENTIALLY LETHAL CIRCUMSTANCES.

NOTE: The following procedure should be performed on each breaker in its respective cubicle. All shipping blocks should be removed from all relays before performing these tests.

1. Roll breaker into the cubicle until the "test/disconnect" latch located on the lower right side of breaker engages with the notch in the guide rail located on the cubicle floor. The breaker is now in the "test/disconnect" position.

2. While the breaker is in this position, manually charge the breaker closing springs using the racking handle. Close the breaker by lifting the closing lever on front of breaker. Then open the breaker by lifting the trip lever.

3. Turn control power on. Lift control connector extension rod and push in until connector is seated into mating block. The charging motor should begin charging the closing springs. Close the breaker by using the breaker control switch. Open the breaker by using the same.

4. Disconnect the breaker from the control power, lift the "test/disconnect" latch and push the breaker into the cubicle until it stops. Insert the racking handle and rotate clockwise until the racking shaft turns freely and breaker motion has stopped. (This action should cause the breaker springs to automatically discharge, if the springs were charged at the beginning of this step.)

5. With the high voltage power off, cycle the breaker several times using the protective relays and breaker control switch to trip the breaker.

6. The breaker is now ready for normal operation.

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 manufacturer's 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	.75-10
GRADE 5 HEAT TREATED STEEL	7	16	27	70	125
TSL LUGS	–	–	20	40	–

Table 3-1

4.0 MAINTENANCE

(All Maintenance should be performed only after the switchgear is rendered electrically dead.)

A systematic maintenance schedule is necessary to insure the switchgear will deliver the high 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 manufacturer's 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 Square D Manual 6080-1.

4.1.1 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 as the breaker is rolled out beyond the "disconnect/test position." This insures the breaker springs are not charged when the breaker element is first removed from the compartment.

4.1.2 Disconnect Contacts (Low & High Voltage)

Inspect the self-aligning disconnecting contacts and the stationary 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 exposing the copper. 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 contact.

4.1.3 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.

4.1.4 Cell Switch (TOC)

The cell switch (when used) is located in the lower part of the breaker compartment and is accessible through the compartment door. Lubricate the linkages with machine oil and check for free movement of the mechanism.

4.1.5 Bus Bars and Insulators

Clean all bus bars and insulators with denatured alchohol solvent.* Use of other solvents may damage the insulating system. Inspect the bussing structure and all connections 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 in accordance with Table 3-1. When the overheating condition is excessive, it may be necessary to replace parts. Contact your 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 any other unusual observation.

4.1.6 Trunnion Mounted Potential

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.

4.1.7 Control Power Transformers

Remove the control power transformer from the cell and clean all contacts, fuse connections and fuses with dena-

tured 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.

CAUTION

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

4.1.8 Mechanism Operated Contacts (MOC)

The MOC linkage must operate freely without binding. Lubricate the linkages with moly grease.

4.1.9 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.

4.1.10 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.

4.1.11 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. When required, there is one capacitor trip unit provided with each circuit breaker.

4.1.12

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.

4.2 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.

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.

4.3 ADDITIONS TO EXISTING SWITCHGEAR ASSEMBLIES

The standard VACARC 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.

3. REMOVE ALL INSULATING BOOTS OVER BUS JOINTS.

4. 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 PROPERLY TORQUE ALL BOLTS.

5. 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.

SQUARE D COMPANY

330 Weakley Rd., Smyrna, Tennessee 37167

Manual 6053-2

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