



CLASS 8198 ISO-FLEX® MEDIUM VOLTAGE CONTROLLER — MODEL 3, SERIES B

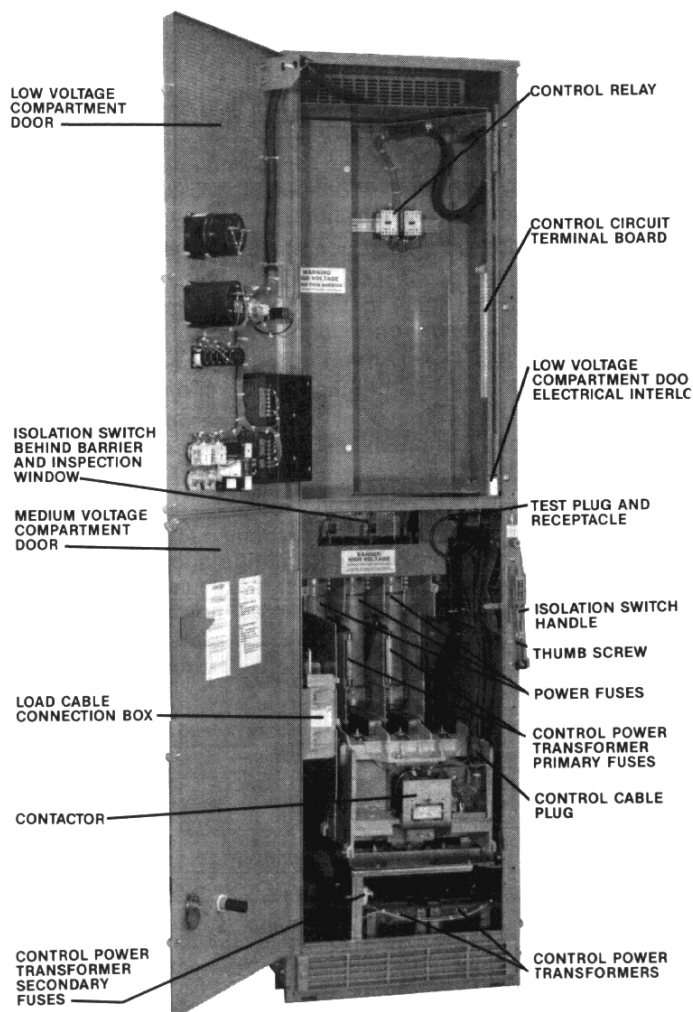
INSTALLATION AND MAINTENANCE

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6. Check operation of each interlock (electrical and mechanical) prior to connecting line power cables. Refer to INTERLOCK CHECK section (Page 8).
7. Only *authorized personnel* should be permitted to operate or service the contactor and controller.

LOCATION AND IDENTIFICATION OF CONTROLLER PARTS



PRECAUTIONS

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
INCOMING LINE POWER MUST BE DISCONNECTED FROM THE CONTROLLER AND CONTACTOR PRIOR TO PERFORMING ANY INSTALLATION OR MAINTENANCE. THE EQUIPMENT HAS BEEN DESIGNED TO PERMIT MAINTENANCE AND/OR TESTING ON THOSE COMPONENTS THAT ARE DISCONNECTED FROM THE MAIN POWER. WHEN PERFORMING THIS WORK, **EXTREME CAUTION** MUST BE EXERCISED IN VIEW OF THE PRESENCE OF HAZARDOUS VOLTAGE.

Medium voltage controllers are provided with many safety features. Nevertheless, they control power circuits with high voltage and high fault capacity which can result in a risk of severe electrical shock or burn. The following list of "PRECAUTIONS" must be studied and followed during installation, operation and servicing of the equipment.

1. Read this service bulletin in its entirety prior to installing or operating the equipment.
2. If motor controllers and/or contactors are to be stored prior to installation, they must be protected from the weather and be kept free of condensation and dust.
3. Use extreme care when moving or positioning controllers (even if crated) as they contain devices and mechanisms which may be damaged by rough handling.
4. Be sure all barriers, arc chutes (when applicable) and terminal covers are in place before operating controllers.
5. Be sure current transformer secondary circuit is complete. When thermal overload relays are supplied, be sure current setting/adjustment is properly selected.

GLOSSARY

VERTICAL SECTION is a free standing unit available in NEMA 1, NEMA 1 with gasketed doors, NEMA 3R or NEMA 12 enclosures with or without horizontal power bus.

CONTROLLER is a free standing unit consisting of one or more vertical sections. It contains medium voltage devices mounted in the medium voltage compartment and low voltage devices mounted in a separate isolated low voltage compartment.

LOW VOLTAGE COMPARTMENT (located in section containing isolation switch external handle) is the area behind the upper compartment door. It contains terminal blocks on the right side wall, control relays on the back panel, and door mounted equipment (overload relay, meters, push buttons etc.) on the low voltage compartment door.

MEDIUM VOLTAGE COMPARTMENT is the area behind the low voltage compartment and all controller doors other than the low voltage compartment door. It contains the isolation switch, power fuses, medium voltage contactor, current transformer assembly, control power transformer, line and load cables and other medium voltage equipment.

INTRODUCTION

This manual covers the installation and maintenance of Square D Class 8198 Model 3 Series B Medium Voltage Controllers. These instructions apply primarily to the controller less the contactor. The Class 8110 contactors are covered in detail in Service Bulletin 8110-10 (vacuum) and Service Bulletin 8110-11 (air break).

Controller operating instructions are covered in the following:

1. Service Bulletin 8198-7 for full voltage non-reversing and feeder disconnect controllers.
2. Service Bulletin 8198-8 for reduced voltage autotransformer and primary reactor controllers.
3. Service Bulletin 8198-9 for full voltage non-reversing synchronous and brushless synchronous controllers.

CONTROLLER RATINGS

Refer to the nameplate on the controller medium voltage compartment door for detailed ratings applicable to a specific controller. Basic controller maximum ratings are per NEMA Standard ICS No. 2-324 as indicated below.

	Contactor Rating		2300 Volt 60 Hertz	4000 Volt 60 Hertz	4600 Volt 60 Hertz
	NEMA Size	Amperes (Enclosed)			
Squirrel Cage Motors	H3	360	1500 HP	2500 HP	2500 HP
Wound Rotor Motors	H3	360	1500 HP	2500 HP	2500 HP
Synchronous Motors (0.8 pf) (1.0 pf)	H3	360	1500 HP	2500 HP	2500 HP
	H3	360	1750 HP	3000 HP	3000 HP
Interrupting Rating Class E2 (Fused)	H3	360	200 MVA	350 MVA	400 MVA
Basic Impulse Level	H3	360	60 KV	60 KV	60 KV

Above ratings apply to controllers in NEMA 1 enclosure when installed in maximum ambient temperature of 40 degrees Centigrade.

POWER FUSE COORDINATION

When a controller has a vacuum contactor used with either 18R or 24R fuses, proper coordination between the contactor and fuses is ensured by delaying contactor opening time. This is accomplished by factory installation of a 12 ohm, 1 watt resistor connected in the main contactor coil circuit. The resistor will be mounted on the control terminal board in the low voltage compartment.

Vacuum controllers used with 12R and smaller fuses do not have, or need, the resistor for proper coordination between the contactor and power fuses. If a vacuum controller is modified for higher horsepower drives requiring 18R or 24R fuses, the 12 ohm resistor must be added to the proper control terminal board connections (refer to label on inside of medium voltage compartment door for proper connection points).

If a 24R fuse is installed in a vacuum controller, the total clearing time of the fuse must not exceed 1/2 second at 6000 amperes. The following fuse types meet the requirements and could be used:

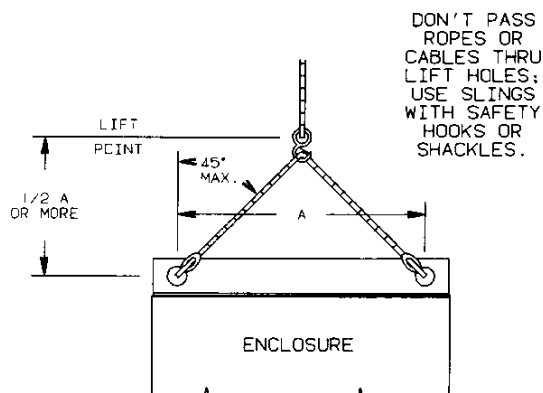
Buss JCL-24R
Gould Shawmut A480R-24R
GEC English Electric KDBX-24R
Carbone-Ferraz A48-24R

Air break controllers do not have, or need, the resistor for proper coordination between the contactor and power fuses.

LIFTING

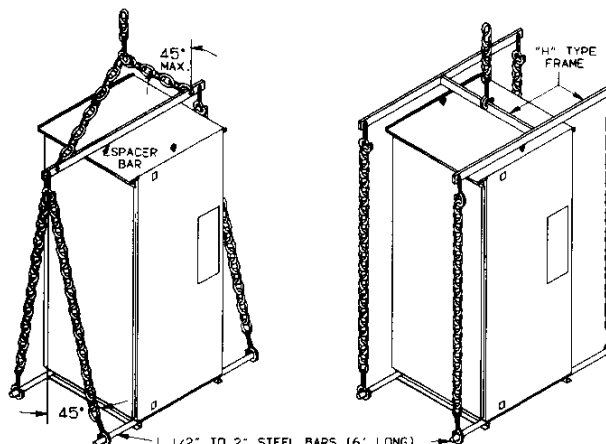
A. NEMA 1 and 12 VERTICAL SECTIONS

Lifting angles are provided on each controller for handling per illustration below.



PROPER USE OF SLING
TO LIFT CONTROLLER

B. NEMA 3R VERTICAL SECTIONS (for details see illustration below)



INSPECTION

UNCRATING

Examine the shipping crate before unpacking the controller to make sure it has not been damaged in transit. If the shipping crate is damaged, note the area and pay particular attention when unpacking to see if contents are also damaged. If damage is found, notify the carrier. Also notify the local Square D field office of the damage claim.

Contactor and all control devices are shipped installed in the controller. Check the packing list against the order to make sure shipment is complete and the correct components are received.

Take care when unpacking not to damage contents by inserting tools into crates. Use a nail puller and wire cutter. Do not insert pry bar in crate to force open.

Inspect components as follows:

1. Check visually for good condition. Inspect all parts for secure mounting and good electrical connections.
2. Check that the enclosure is not damaged.
3. Check all doors for free movement. To open doors, follow instructions on controller nameplate located on front of medium voltage compartment door. Swing doors to ensure free movement.
4. Contactor is shipped inside the enclosure. With medium voltage compartment door open, inspect contactor to ensure it was not damaged in shipment. The air break contactor has packing material around the arc chutes and armature for shipment. All tie straps and packing material must be removed prior to energization of controller. Review Service Bulletin 8110-10 (vacuum) or Service Bulletin 8110-11 (air break) for details on contactor inspection.
5. Close the medium voltage compartment door and secure per instructions on controller nameplate. Operate the isolation switch handle to check for free movement. If movement is not free, check for mechanical interference.
6. Check that wiring harnesses are securely fastened.

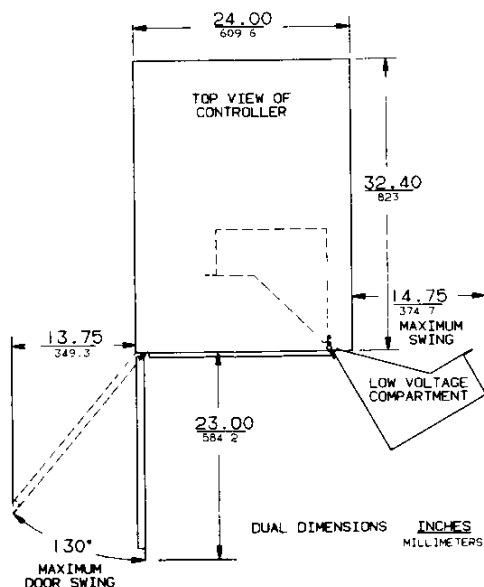


FIGURE 1

CONTROLLER INSTALLATION

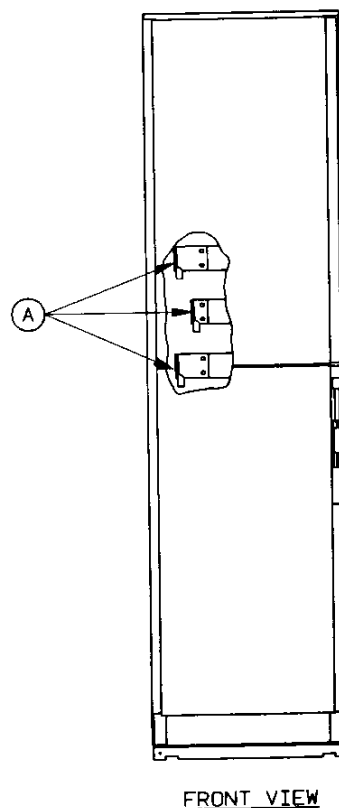
CONTROLLER MOUNTING

Class 8198 controllers are completely front accessible. Space is required in front of controller enclosure for contactor removal, on left side of controller enclosure for maximum door openings and on right side of controller enclosure for maximum swing out movement of the low voltage compartment. See Figure 1 for installation space requirements. Make sure enclosure is level and fully supported when mounted. Enclosure should be bolted in place. If enclosure is not securely supported and level, doors may not swing properly.

While the controller design allows controller installation without removing the contactor, the contactor may be removed per instructions given in CONTACTOR REMOVAL section of this bulletin.

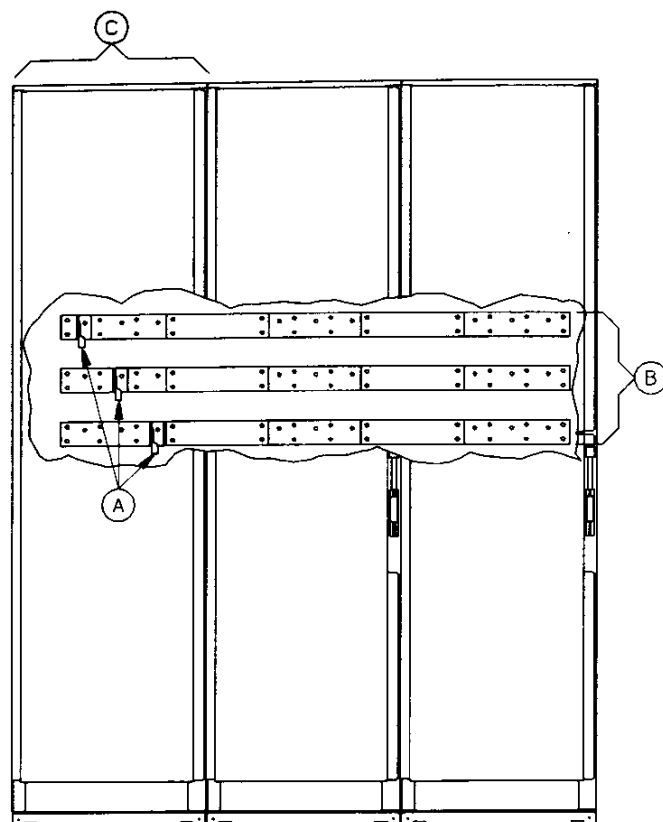
ARRANGEMENTS FOR TERMINATING LINE CABLES

The following arrangements are available for terminating line cables. When NEMA Type 3R enclosures are furnished, bottom cable entry only is recommended for line and load cables. Refer to drawings furnished with order to check the specific arrangement supplied for your equipment.



Single controller.

1. Line cable terminations on terminals (A) for top or bottom cable entry.
2. Maximum size cable, one 500 MCM or two 250 MCM cables per phase.



FRONT VIEW

Two or more controllers bused together by horizontal power bus (B).

1. Line cable terminations on terminals (A) in incoming line cable compartment (C).
2. Cable entry from top or bottom.
3. Maximum size cable:
 - A. Two 750 MCM cables per phase for 1200 ampere maximum bus.
 - B. Four 750 MCM cables per phase for 2400 ampere maximum bus.

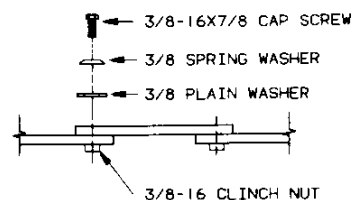
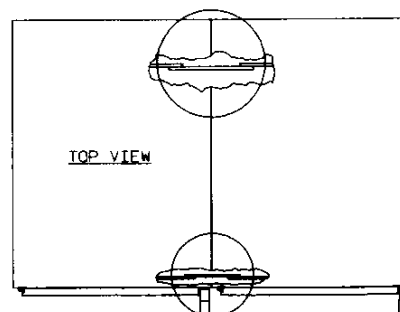
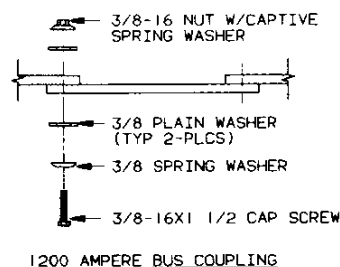
POWER AND GROUND BUS CONNECTIONS BETWEEN SHIPPING SECTIONS

If motor control center consists of two or more shipping sections, power bus and ground bus splice bars will be supplied and should be added after sections are firmly in place. Splice bus bars and necessary hardware will be mounted inside controller on back panel left of power fuses. Refer to the instructions included with splice bars for details.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE
POWER IS DE-ENERGIZED

Tighten each 5/16" bolt to 140 inch pounds.

Tighten each 3/8" bolt to 250 inch pounds (power and ground bus).



GROUND BUS COUPLING

POWER CABLE CONNECTIONS

NOTE: Two-hole lugs must be used to prevent rotation of lugs. Use 3/8" bolts (maximum 1 1/2" long), nuts and spring washers for cable connections.

A. LINE CABLE CONNECTIONS: SINGLE VERTICAL SECTION

For top entry of line cables use 5 1/2" x 5 1/2" opening at top left rear (front view) of vertical section. For bottom entry use 5 1/2" x 5 1/2" opening located at left rear corner of bottom plate. Refer to outline drawing supplied with equipment for exact location of the openings. Incoming line terminals are located behind line isolation switch barrier. To gain access to terminals proceed as follows:

1. Remove screws (A) (See Figure 2).
2. Push front portion of horizontal barrier (B) down into medium voltage compartment. When barrier (B) is in a vertical position, remove barrier by disengaging it from slot in horizontal barrier (C).
3. Loosen nuts (D) and thumb screws (E).
4. Move vertical barrier (C) forward to allow slotted holes to clear nuts (D).
5. Remove barrier (C). Thumb screws (E) remain held captive to barrier.
6. Loosen low voltage compartment retaining nut (F) (See Figure 3).
7. Pull low voltage compartment (G) forward and swing it to the right.

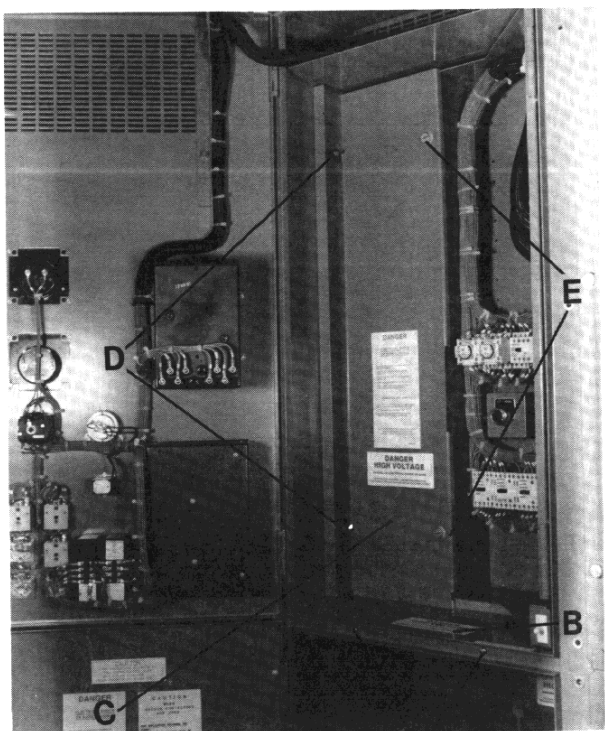


FIGURE 2

8. Remove screw (H) and bus access barrier (J) (See Figure 4).
9. Loosen bolts (K) and remove isolation switch barrier (L) (See Figure 4).

Connect incoming line cables to the terminals. Incoming line cable phase sequence from top to bottom is L1, L2, L3, as viewed from front of controller. Stress cones may be added in the space above or below incoming line terminals. Make sure cables are supported by cable clamps located on the left rear side of enclosure.

Reinstall all barriers and secure low voltage compartment.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE ENERGIZING, BE SURE TO REINSTALL
BARRIERS OVER INCOMING LINE TERMINALS.

B. LOAD CABLE CONNECTIONS

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE
POWER IS DE-ENERGIZED.

For top entry of load cables use 5½" x 5½" opening at top left middle (front view) of vertical section. For bottom entry use 5½" x 5½" opening located at bottom left middle of vertical section. Refer to outline drawing supplied with the equipment for exact location of the openings.

Load cables, entering controller from top, are routed behind low voltage compartment. This area is accessible after removing horizontal barrier (B) and vertical barrier (C) (See Figure 2). Refer to LINE CABLE CONNECTIONS section for barrier removal instructions.

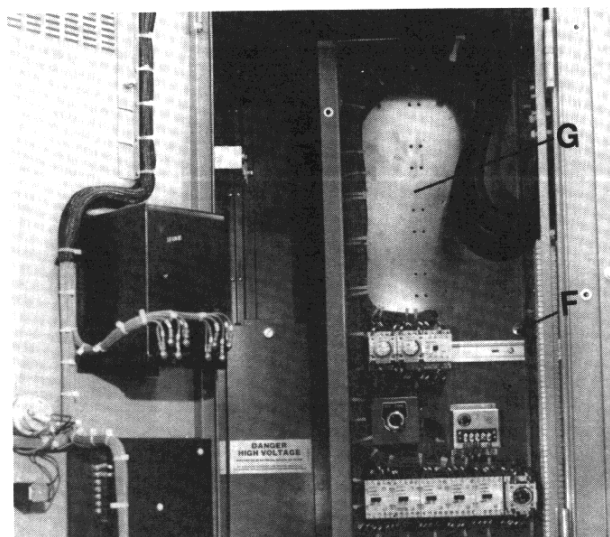


FIGURE 3

Load terminals are located in load cable connection box (A) mounted on left side wall of vertical section (See Figure 5).

NOTE: Load cable terminal pads (B) are shown in Figure 5 pointing upward for connection to load cables entering controller from top. If load cables enter from bottom, terminal pads (B) must be repositioned to point downward. Reposition terminal pads (B) by removing bolts (C), rotating pads 180 degrees clockwise and reinstalling bolts (C).

Connect outgoing load cables to proper load terminals. Load cable phase sequence from left to right (or front to rear) is T1, T2, T3 as viewed from front of controller.

Make sure top exit cables are supported by cable clamps mounted on left side wall of enclosure, and that cables are positioned to prevent interference with contactor.

CAUTION

BE SURE TO REINSTALL LOAD CABLE CONNECTION BOX BARRIER OVER LOAD TERMINALS.

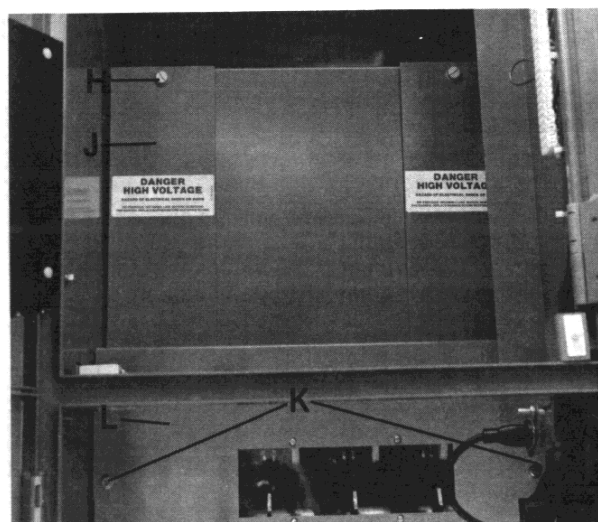


FIGURE 4

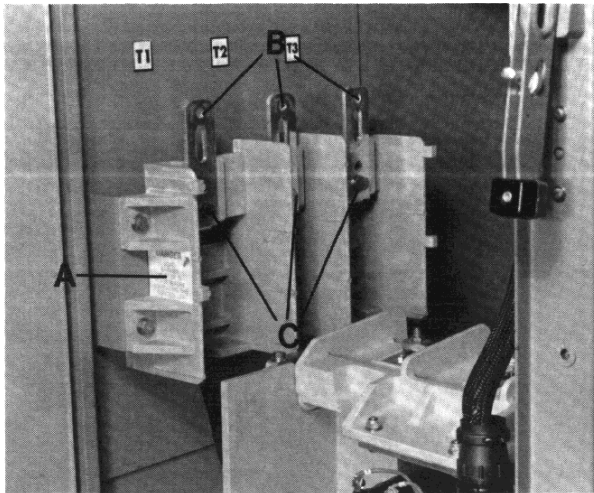


FIGURE 5

CONTACTOR REMOVAL

The controller design allows work to be performed on the controller without removing the contactor. When necessary, contactors can be removed per the following instructions:

DANGER

HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, MAKE CERTAIN THAT THE ISOLATION SWITCH IS IN THE OPENED POSITION.

DO SO BY OPENING THE MEDIUM VOLTAGE COMPARTMENT DOOR, CAREFULLY AVOID ANY LIVE PARTS, AND VIEW THE ISOLATION SWITCH BLADES THROUGH THE VIEWING WINDOW IN THE ISOLATION SWITCH BARRIER. IF BLADES ARE NOT IN THE OPENED POSITION, CLOSE THE DOOR AND DE-ENERGIZE INCOMING LINE POWER BEFORE PROCEEDING. ALSO VERIFY THAT THE CONTROLLER IS DE-ENERGIZED FROM EXTERNAL POWER FEEDBACK SOURCES THROUGH THE LOAD CONNECTIONS.

1. Disconnect contactor control cable from contactor by turning control cable plug lock nut (A) counterclockwise and lifting plug (See Figure 6).
2. Remove air break contactor phase barriers and arc chutes. Refer to contactor Service Bulletin 8110-11 for instructions.
3. Disconnect line connections by removing nuts (A) and washers from contactor line bus (See Figure 7.)
4. Disconnect load cables by removing nuts and washers from threaded studs on contactor load terminals located at bottom rear of contactor. (Retain air break contactor load lug anti-rotation clamps).
5. Remove bolts (B) located on the contactor support plate (See Figure 7).

CAUTION

DO NOT USE CONTACTOR LINE OR LOAD BUS TO MOVE OR LIFT CONTACTOR. EACH BUS IS ALIGNED AT THE FACTORY. LIFTING BY BUS MAY CAUSE BREAKAGE OR MISALIGNMENT.

6. Slide contactor forward. Remove contactor from controller by lifting as shown in Figure 8.

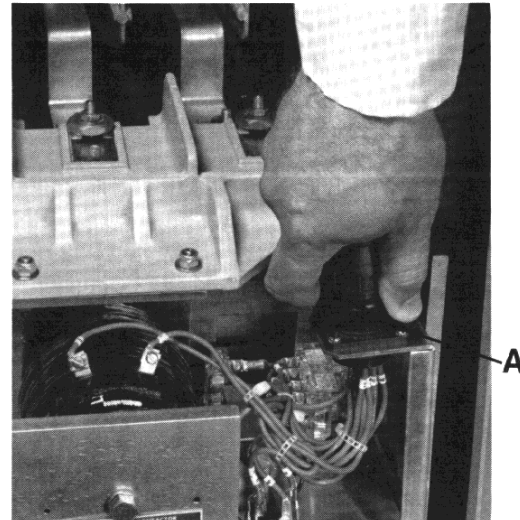


FIGURE 6

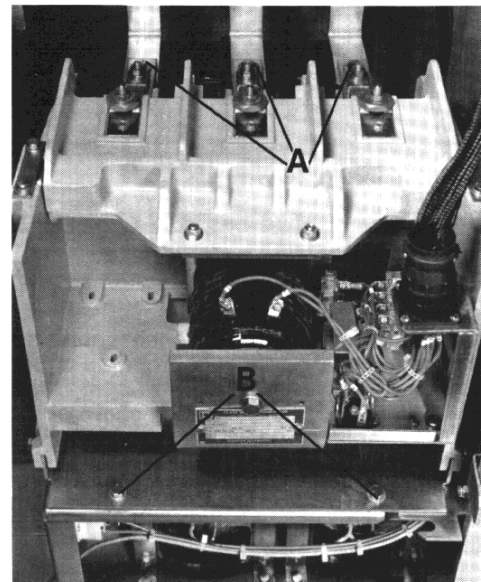


FIGURE 7



FIGURE 8

CONTACTOR INSTALLATION

Check that the contactor nameplate information (class, type and form) matches contactor information on label located on inside of controller medium voltage compartment door.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
TURN OFF POWER SUPPLYING THIS EQUIPMENT
BEFORE WORKING INSIDE. DO NOT ATTEMPT TO
WORK WHILE EQUIPMENT IS ENERGIZED.

1. Remove air break contactor phase barriers and arc chutes. See contactor Service Bulletin 8110-11 for instructions.
2. Lift contactor as shown in Figure 9.

CAUTION

DO NOT USE CONTACTOR LINE OR LOAD BUS TO MOVE OR LIFT CONTACTOR. EACH BUS IS ALIGNED AT THE FACTORY. LIFTING BY BUS MAY CAUSE BREAKAGE OR MISALIGNMENT.

3. Place contactor on pan inside controller section so that contactor coil is viewed from front of controller (See Figure 8).
4. Slide contactor into section until holes in contactor support plate line up with holes in pan.
5. Connect contactor support plate to pan by installing bolts (B) and washers (See Figure 7).
6. Connect load cables to contactor load terminals (ensure lug anti-rotation clamps are installed on air break contactor).
7. Connect line connections to contactor line bus by installing bolts (A) (See Figure 7).
8. Reinstall air break contactor arc chutes and phase barriers. See contactor Service Bulletin 8110-11 for instructions.
9. Connect contactor control cable to contactor by pushing cable plug into contactor plug receptacle and turning control cable plug lock nut (A) clockwise (See Figure 6).

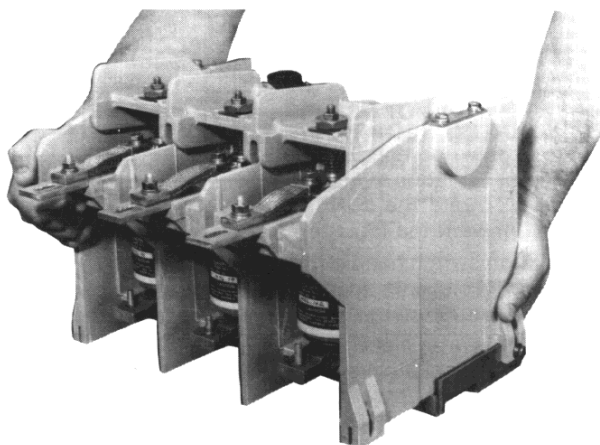


FIGURE 9

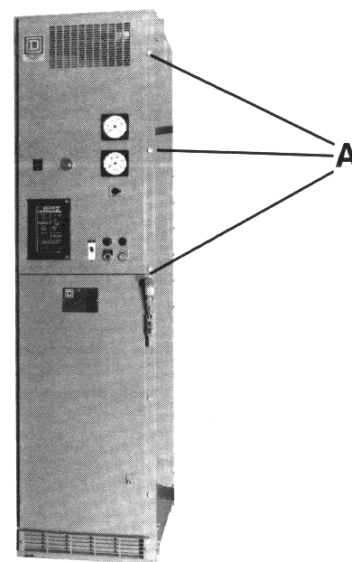


FIGURE 10

LOW VOLTAGE CONTROL

A. CONNECTION

Low voltage control wire conduit openings are provided for both top and bottom entry. For top entry of control wires use 2" x 2" opening at the right front corner (front view) of vertical section. For bottom entry use 2" x 2" opening located at the bottom right middle of vertical section. Refer to outline drawing supplied with the equipment for exact location of each opening.

B. COMPARTMENT

WARNING
HAZARD OF ELECTRICAL SHOCK OR BURN
SHOULD THIS CONTROLLER BE SUPPLIED WITH
SEPARATE OR MULTIPLE SOURCES OF CONTROL
POWER, CONTROL VOLTAGE MAY BE PRESENT
INSIDE THE LOW VOLTAGE COMPARTMENT AND
ON TERMINALS OF DOOR MOUNTED EQUIPMENT
EVEN THOUGH THE ISOLATION SWITCH IS OPEN.
EXTREME CAUTION IS REQUIRED WHEN WORK-
ING ON ENERGIZED EQUIPMENT.

Open low voltage compartment door by turning thumb screws (A) counter-clockwise (See Figure 10). Swing door to left and out of the way for access to devices and terminal blocks. If access to the low voltage compartment is attempted while the controller is energized, it will automatically de-energize because door interlock (B) opens (See Figure 11). Qualified personnel may bypass the door interlock by using the following procedure:

1. Insert a small tool through hole (A) below the isolation switch handle and depress defeat switch (See Figure 12).
2. While holding switch depressed, unlatch and open low voltage compartment door until interlock (B) can be operated by pulling plunger to fully extended position. After activating interlock, tool may be removed.
3. To close while energized, hold defeat switch depressed with small tool; close and latch door, then remove tool.

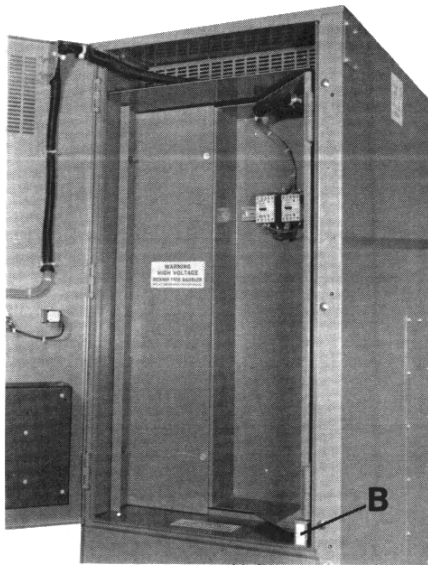


FIGURE 11
INTERLOCK CHECK

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE
POWER IS DE-ENERGIZED.

ALSO VERIFY THAT THE CONTROLLER IS DE-
ENERGIZED FROM EXTERNAL POWER FEED-
BACK SOURCES THROUGH THE LOAD CON-
NECTIONS.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
DO NOT ENERGIZE CONTROLLER IF ANY OF THE
MECHANICAL OR ELECTRICAL INTERLOCKS ARE
INOPERATIVE. CONSULT LOCAL SQUARE D
SALES OFFICE IMMEDIATELY.

A combination of five electrical and mechanical interlocks provide personnel and equipment protection. It is important to check operation of these safety interlocks.

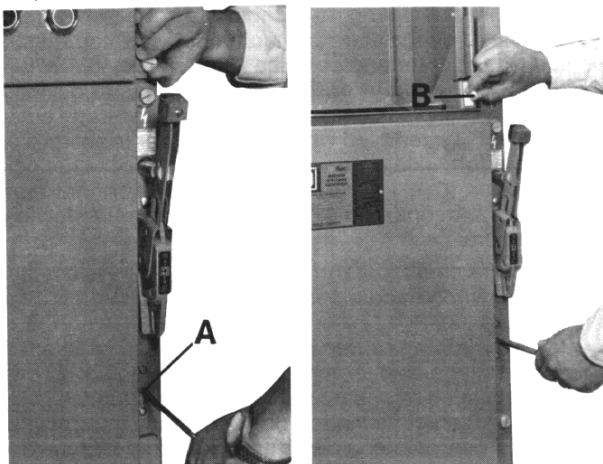


FIGURE 12

1. Low voltage compartment door interlock (B) de-energizes controller when low voltage door is opened. (See Figure 11).

Proper operation of electrical interlock is checked by performing a continuity test at terminal blocks located inside low voltage compartment. Refer to wiring diagram supplied with equipment.

There should be circuit continuity when the electrical interlock plunger is either held in the depressed position or pulled to the fully extended position.

2. Handle interlock lever (A) prevents opening medium voltage compartment door when the isolation switch is closed (See Figure 13).

Check interlock (A) by first closing the medium voltage compartment door and then the isolation switch. Make an attempt to open the door. The door must not open.

Open isolation switch and then open medium voltage compartment door.

3. Door interlock (B) combined with handle interlock (A) prevents closing the isolation switch when the medium voltage compartment door is open (See Figure 13).

Check interlock (B) as follows:



FIGURE 13

CAUTION
DO NOT USE EXCESSIVE FORCE

Press down on handle interlock lever (A) and attempt to close isolation switch by moving the switch handle slowly toward the "ON" position. The door interlock must prevent the isolation switch from being closed.

4. Isolation switch handle thumb screw interlock (A) (See Figure 14) prevents opening isolation switch when control circuit is energized.

Since this is an electrical interlock, use continuity test at the terminal blocks inside the low voltage compartment to check operation. Refer to wiring diagram supplied with equipment. When the thumb screw interlock is fully engaged, there should be circuit continuity. With thumb screw interlock disengaged, the circuit should be open.

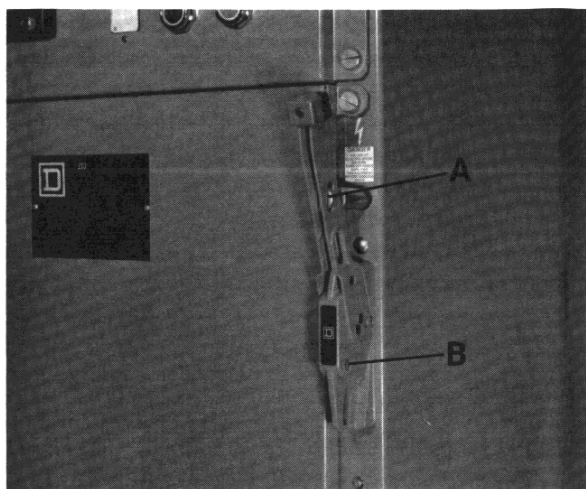


FIGURE 14

5. Contactor interlock slider prevents opening or closing the isolation switch when the contactor power contacts are closed.

Check interlock as follows:

Manually close the contactor after referring to vacuum contactor Service Bulletin 8110-10 or air break contactor Service Bulletin 8110-11 for details on manual contactor operation. For air break contactor tie one pair of contact tips together before proceeding. Close and secure the medium voltage compartment door. Attempt to close the isolation switch and verify that the contactor interlock slider prevents operation of isolation switch when contactor is closed. This interference need only be checked with the isolation switch in the "OFF" position.

Reassemble contactor to operational mode.

ISOLATION SWITCH

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE POWER IS DE-ENERGIZED.
ALSO VERIFY THAT THE CONTROLLER IS DE-ENERGIZED FROM EXTERNAL POWER FEEDBACK SOURCES THROUGH THE LOAD CONNECTIONS.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
DO NOT ENERGIZE CONTROLLER IF ANY OF THE MECHANICAL OR ELECTRICAL INTERLOCKS ARE INOPERATIVE. CONSULT LOCAL SQUARE D SALES OFFICE IMMEDIATELY.

Check isolation switch mechanism with the medium voltage door open using the following procedure.

CAUTION

DO NOT FORCE ISOLATION SWITCH HANDLE. EXCESSIVE FORCE CAN DAMAGE INTERLOCK MECHANISMS.

1. Press down on handle interlock lever (A) and hold while moving isolation switch handle (B) towards the "ON" position until it stops (See Figure 15).

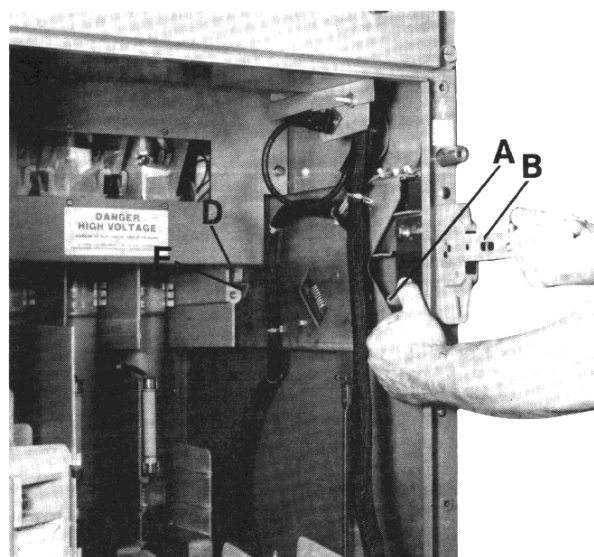


FIGURE 15

2. While maintaining the handle in this position using minimum amount of pressure, press in on the door interlock connecting rod (C) (See Figure 16) and...
3. Simultaneously continue moving the operating handle until it is in the "ON" position. The isolation switch should now be closed.
4. Pull handle down to open isolation switch. The switch is fully open when the bail arm (D) is against its stop (E) (See Figure 15) and the switch blades are about an inch from inside face of viewing window in isolation switch barrier.
5. Repeat steps 1 through 4 to insure that mechanisms operate freely.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
DO NOT ENERGIZE CONTROLLER IF ANY OF THE MECHANICAL OR ELECTRICAL INTERLOCKS ARE INOPERATIVE. CONSULT LOCAL SQUARE D SALES OFFICE IMMEDIATELY.

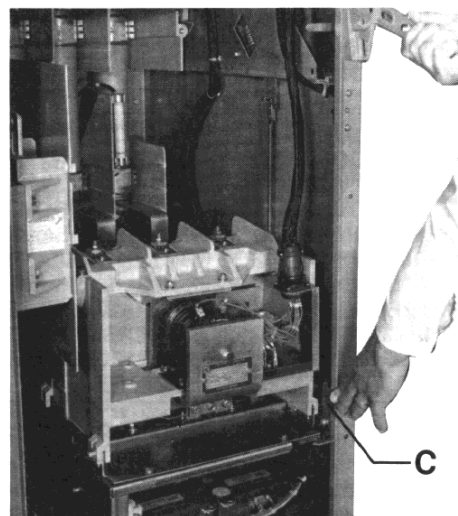


FIGURE 16

START-UP PROCEDURE

CONTROLLER TEST CIRCUIT

To test the control circuit and contactor.

1. Open the isolation switch before test voltage is applied.
2. Access to the test cord can be gained by opening the medium voltage controller door. Unplug the test cord (A) from receptacle (B) located in front right corner of medium voltage contactor compartment (See Figure 17).
3. Plug test cord into a grounded (3-wire) extension cord (C) (See Figure 17).
4. Plug the other end of the extension cord into a grounded 120 volt circuit.
5. Ensure low voltage compartment door is closed.
6. Check that control cord is securely fastened to contactor.
7. Refer to elementary wiring diagram supplied with the controller and check the control circuit sequence.

NOTE: For energizing and testing of contactor only (in or out of enclosure), use optional contactor portable test cord (Square D part number 51034-241-50).

OPERATION

Be sure that test cord is removed and its plug is replaced in receptacle. Close and secure medium voltage and low voltage compartment doors. Apply medium voltage power to incoming line. Raise the isolating switch handle to the "ON" position and tighten handle interlock thumb screw.

Depress START button. Sequence should be as per the elementary wiring diagram supplied with the controller.

NOTE: If controller fails to operate, refer to TROUBLE-SHOOTING section.

MAINTENANCE AND REPAIRS

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, MAKE CERTAIN THAT THE ISOLATION SWITCH IS IN THE OPENED POSITION.

DO SO BY OPENING THE MEDIUM VOLTAGE COMPARTMENT DOOR, CAREFULLY AVOID ANY LIVE PARTS, AND VIEW THE ISOLATION SWITCH BLADES THROUGH THE VIEWING WINDOW IN THE ISOLATION SWITCH BARRIER. IF BLADES ARE NOT IN THE OPENED POSITION, CLOSE THE DOOR AND DE-ENERGIZE INCOMING LINE POWER BEFORE PROCEEDING. ALSO VERIFY THAT THE CONTROLLER IS DE-ENERGIZED FROM EXTERNAL POWER FEEDBACK SOURCES THROUGH THE LOAD CONNECTIONS.

Most routine maintenance can be performed while contactor is installed in the controller section. For details on contactor maintenance and repair, refer to Service Bulletin 8110-10 for vacuum contactor and Service Bulletin 8110-11 for air break contactor.

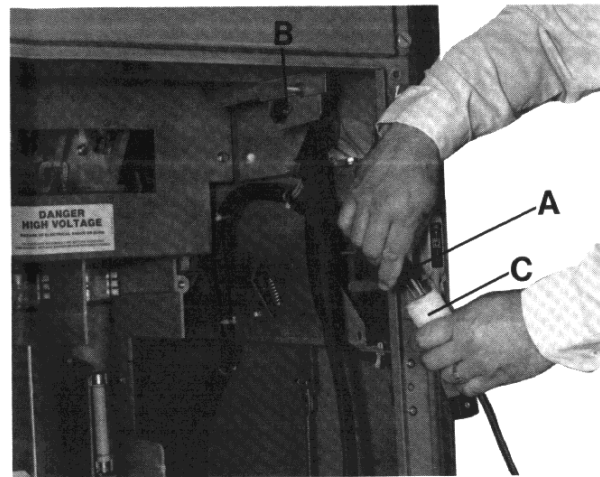


FIGURE 17

POWER FUSE REPLACEMENT

Fuse size and rating are determined by motor full load and locked rotor currents. Information on size of the fuse is given on the nameplate of the controller located on the medium voltage door. Make sure replacement fuse is identical to original fuse. If a 24R fuse is used with a vacuum contactor, only the following fuses should be used: Buss JCL-24R, Gould Shawmut A480R-24R, GEC English Electric KDBX-24R, and Carbone-Ferraz A48-24R. (Refer to POWER FUSE COORDINATION section for details.) Pull fuse from top fuse clip first and then from lower clip. When installing new fuse, make sure it is centered between the fuse clips and is firmly held by the fuse clips at top and bottom.

CONTROL TRANSFORMER PRIMARY FUSE REPLACEMENT

Control transformer primary fuses are located between the current limiting power fuses (See Parts Identification Photo on page 1). Control transformer primary fuses are selected on basis of transformer rating. Make sure replacement fuse is identical to original fuse. Pull fuse from top fuse clip first and then from lower fuse clip. When installing new fuse, make sure it is centered between fuse clips and is firmly held by the fuse clips at top and bottom.

CONTROL TRANSFORMER REPLACEMENT

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE POWER IS DE-ENERGIZED. ALSO VERIFY THAT THE CONTROLLER IS DE-ENERGIZED FROM EXTERNAL POWER FEEDBACK SOURCES THROUGH THE LOAD CONNECTIONS.

The control transformer(s) is located on bottom plate of the medium voltage section, directly below the contactor. Replace a control transformer as follows:

1. Disconnect secondary (low voltage) wires at transformer terminals.
2. Disconnect primary leads at the transformer primary fuse clips.

3. Remove the four bolts and washers holding transformer mounting feet to bottom plate.
4. Replace control transformer.
5. Reinstall bolts and washers holding transformer mounting feet to bottom plate.
6. Ensure that the transformer primary leads are routed as shown in Figure 18.
7. Reconnect the primary leads at the transformer primary fuse clips.
8. Reconnect the secondary wires to the transformer terminals.

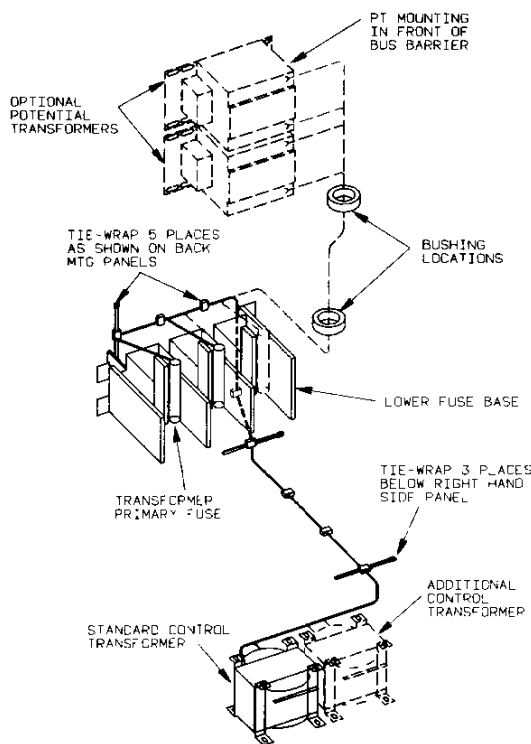


FIGURE 18

ISOLATION SWITCH MAINTENANCE

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
DE-ENERGIZE INCOMING LINE POWER

Contacting surfaces of the isolation switch blades are coated with a special deoxidizing lubricant (Square D part number PJC 7201) prior to shipping. The switch blades must be coated with this deoxidizing lubricant at all times. Under no circumstances should any other lubricant be used on these surfaces.

Periodically, open the isolation switch. Remove switch barrier and apply the special deoxidizing lubricant to entire contact area of switch blades.

Lubricate pivot points of switch handle mechanism with Cosmolube (Square D part number 1615-100120).

Reinstall switch barrier, close medium voltage door and re-energize incoming line.

ROUTINE MAINTENANCE

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
TURN OFF POWER SUPPLYING THIS EQUIPMENT
AND ASSOCIATED APPARATUS BEFORE WORK-
ING INSIDE. DO NOT ATTEMPT TO WORK WHILE
EXISTING EQUIPMENT IS ENERGIZED.

1. Be sure all connections are tight.
2. Be sure all molded parts and insulating surfaces are clean and free of foreign materials.
3. Lubricate isolation switch per ISOLATION SWITCH MAINTENANCE section.

REPAIRS

Major repairs should not be attempted with the contactor in the enclosure. Refer to CONTACTOR sections for contactor removal and installation procedures. Remove contactor and refer to Service Bulletin 8110-10 (vacuum) or Service Bulletin 8110-11 (air break) for details on contactor and for contactor parts list. Reinstall contactor after performing necessary repairs.

TROUBLESHOOTING

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
ALL POWER SHOULD BE DISCONNECTED FROM
CONTROLLER PRIOR TO PERFORMING ANY
TROUBLESHOOTING OR MAINTENANCE WORK.
DO NOT UNDER ANY CIRCUMSTANCES REMOVE
THE ISOLATION SWITCH BARRIER UNLESS ALL
POWER IS DISCONNECTED FROM THE
CONTROLLER.

While operating the controller from the main power, ensure that all doors are closed and properly secured.

Access to the low voltage compartment, with the medium voltage compartment door closed and the isolation switch in the closed position, may be gained for checking control devices and circuitry. (See LOW VOLTAGE CONTROL section.) However, extreme care must be exercised due to the presence of live terminals.

Access to the medium voltage compartment must always be gained with the isolation switch in the opened position, except for the situation covered in the EMERGENCY ACCESS TO MEDIUM VOLTAGE COMPARTMENT section.

EMERGENCY ACCESS TO MEDIUM VOLTAGE COMPARTMENT

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE PROCEEDING, BE SURE INCOMING LINE
POWER IS DE-ENERGIZED. ALSO VERIFY THAT
THE CONTROLLER IS DE-ENERGIZED FROM
EXTERNAL POWER FEEDBACK SOURCES
THROUGH THE LOAD CONNECTIONS.

In the event that it becomes necessary to open the medium voltage compartment door of the controller with the isolation switch closed (i.e., welded contact tips on the contactor), access may be obtained as follows:

1. Follow instructions on controller nameplate located on front of controller medium voltage compartment door.
2. Bypass interlock by turning screw (B) clockwise and open door (See Figure 14).

CONTROLLER CONTROL CIRCUIT SEQUENCE

Refer to elementary wiring diagram supplied with controller and check control circuit sequence. Following literature explains basic control circuit sequence using standard elementary wiring diagrams:

1. Service Bulletin 8198-7 for full voltage non-reversing and feeder disconnect controllers.
2. Service Bulletin 8198-8 for reduced voltage auto-transformer and primary reactor controllers.
3. Service Bulletin 8198-8 for full voltage non-reversing synchronous and brushless synchronous controllers.

EXTERNAL TEST VOLTAGE

The controller test cord (A) (See Figure 17) must be used when testing the contactor and control circuit from an external 120 Volt ac power source. This disconnects the

control transformer and prevents generation of hazardous voltage at transformer primary.

INOPERATIVE CONTROLLER

Before troubleshooting an inoperative controller ensure that the following conditions exist:

1. Medium voltage compartment door is closed and secured.
2. Isolation switch handle is in the "ON" position.
3. Isolation switch handle thumb screw is tightened clockwise and fully engages the isolation switch electrical interlock "ISHI".
4. All devices such as overload, ground fault and motor protective relays are reset.
5. Low voltage compartment door is closed and secured.

If the controller still does not operate, identify the problem and follow the instructions given in TROUBLESHOOTING CHART. Actions identified "LV" require access to low voltage control compartment and actions identified "MV" require access to medium voltage compartment.

TROUBLESHOOTING CHART

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
ALL POWER SHOULD BE DISCONNECTED FROM CONTROLLER PRIOR TO PERFORMING ANY TROUBLESHOOTING OR MAINTENANCE WORK.
DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE ISOLATION SWITCH BARRIER UNLESS ALL POWER IS DISCONNECTED FROM THE CONTROLLER.

TROUBLE	POSSIBLE CAUSE	ACTION
Isolation switch handle cannot be placed in "ON" position.	1. Medium voltage compartment door not fully closed or latched.	1. MV - Close door and engage latch.
Load does not energize even though contactor and pilot light(s) operate.	1. Power connections not complete.	1. MV - Check to ensure that all power connections are tight.
Contactor does not operate properly even though control relay operates.	1. Control cable plug defective or disengaged from contactor plug receptacle. 2. Low control voltage. 3. Contactor service required.	1. MV - Refer to CONTACTOR INSTALLATION section and check plug cable and receptacle. 2. LV - Check that control voltage is 102 to 120V ac. 3. MV — Refer to TROUBLESHOOTING section in contactor service bulletin.
Control relay does not operate.	1. Control circuit fuse open. 2. Inoperative low voltage compartment door interlock. 3. Control transformer primary or secondary fuse(s) open. 4. Test plug defective or disengaged from receptacle. 5. Power fuse(s) open*. 6. Inoperative isolation switch handle thumb screw interlock 7. Control sequence incomplete. 8. Defective or incorrect coil in control relay.	1. LV - Check control fuse mounted above terminal board and replace if open. 2. LV — Refer to INTERLOCK CHECK section, item 1, and check interlock. 3. MV — Check fuses and replace if open. 4. MV — Refer to START-UP PROCEDURE section and check plug cable and receptacle. 5. MV - Check fuses and replace if open. 6. MV-Refer to INTERLOCK CHECK section, item 4, and check interlock. 7. LV-Refer to wiring diagram supplied with controller and check control sequence. Check to ensure that all external or remote control devices operate properly. 8. LV - Check coil and replace if defective or wrong coil is installed.
Isolation switch handle can not be moved to the "OFF" position.	Isolation switch blades or contactor contact tips welded together.	<p style="text-align: center;">DANGER BEFORE PROCEEDING, BE SURE INCOMING LINE POWER IS DE-ENERGIZED</p> <p>MV — Refer to TROUBLESHOOTING section for instructions on emergency access to medium voltage compartment.</p> <p>On air break contactor either break free or replace the welded contact(s). Welded contacts on vacuum contactor require replacement of the vacuum bottle assembly(s). Refer to contactor Service Bulletin 8110-10 for replacement procedures.</p> <p>Check for open power fuses and inspect controller for damage as result of possible overcurrent condition.</p>

* Open power fuses may indicate other problems. A complete check of the controller and cabling should be made for possible damage from short circuit/overcurrent condition.

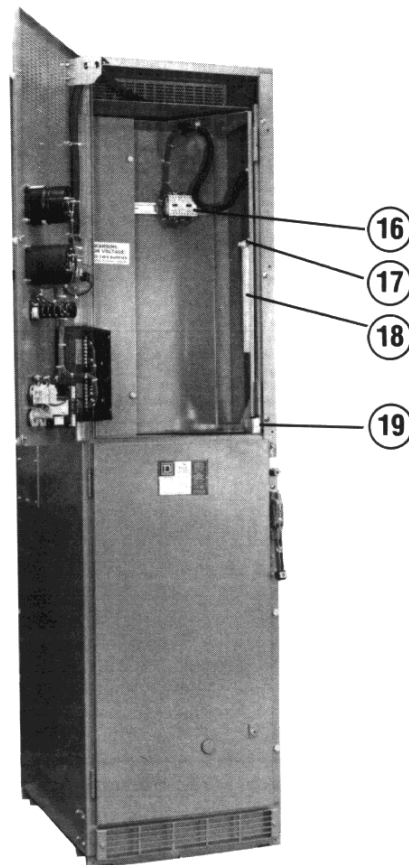
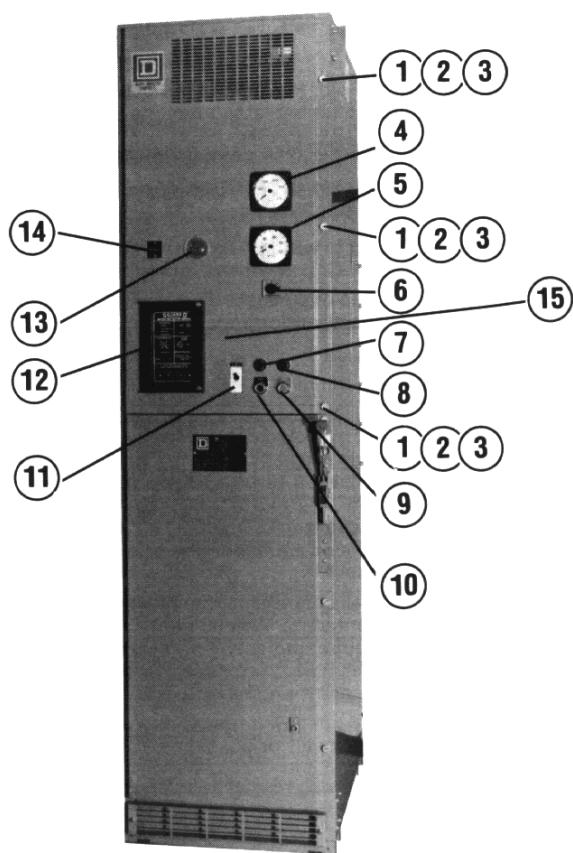
PARTS LIST FOR LOW VOLTAGE COMPARTMENT

Item No.	Part Number	Description	Item No.	Part Number	Description
1	22906-10040	Low Voltage Compartment Door Thumb Screw	15		Overload Relay Reset Push Button Assembly (Device Not Shown — Only Location Identified)
2	23615-00220	Nylon Washer	30019-117-02		Reset Push Button
3	29929-00002	"X" Washer	30019-115-01		Reset Push Button Housing
* 4	(X)	Voltmeter	29206-30700		Reset Push Button Gasket — NEMA 12 Enclosure Only
* 5	(X)	Ammeter	30019-121-01		Reset Push Button Housing Nut
* 6	(X)	Meter Selector Switch	3023-L1-X1		Reset Push Button Spring
7	9001 KP1R9	Indicating Light (Red)	31132-056-01		Reset Push Button Plunger
* 8	9001 KP1G9	Indicating Light (Green)	†		8 - 32 x 3/8 Screw
9	9001 KR1R	Stop Push Button (Red)	†		#8 Lock Washer
	9001 KA3	Normally Closed Contact Block	16	8501 PH40E	Control Relay (120 Volt, 60 Hertz Coil)
10	9001 KR1B	Start Push Button (Black)	17	9080 GF6	Control Circuit Fuse Block and Fuse Puller
	9001 KA2	Normally Open Contact Block	18	9080 GR6	Control Circuit Terminal Block
*11	52905-014-50	Ground-Censor® Relay, Type GA	19	26202-02010	Low Voltage Compartment Door Electrical Interlock Switch
*12	9065 SSR0-200	Multi-function Motor Protector Module			
*13	(X)	Elapsed Time Meter			
*14	(X)	Operations Counter			

* Optional equipment, not supplied unless specified on factory order.

(X) Refer to device identification table supplied with factory order.

† Standard hardware, listed without a Square D part number, should be obtained from a local hardware supplier.

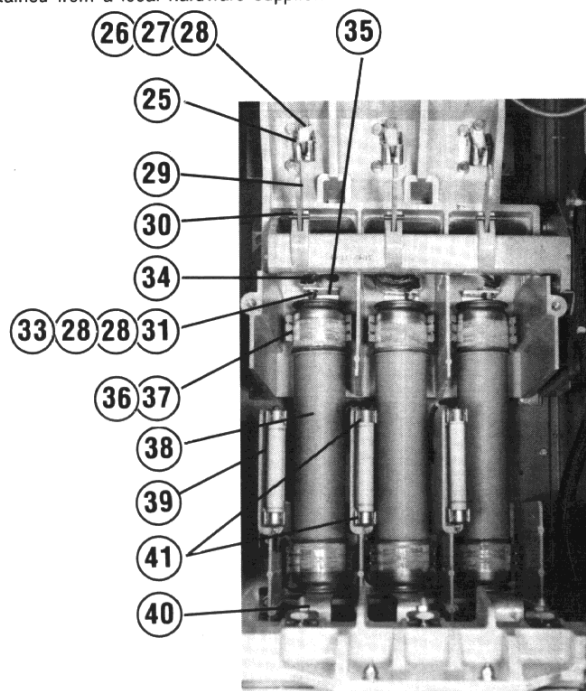
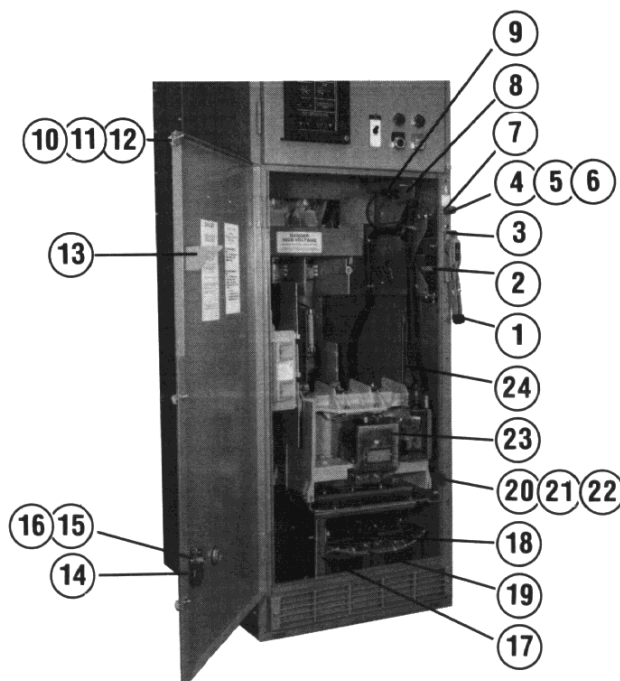


PARTS LIST FOR MEDIUM VOLTAGE COMPARTMENT

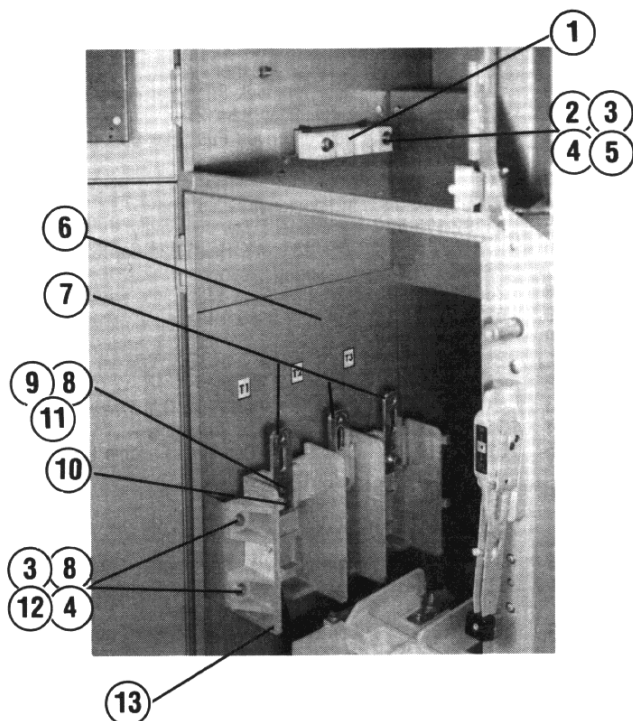
Item No.	Part Number	Description	Item No.	Part Number	Description
1	51190-074-50	Isolation Switch Handle			$\frac{5}{16}$ - 18 x $1\frac{1}{4}$ Cap Screw
2	31008-467-01	Isolation Switch Handle Interlock Lever			$\frac{5}{16}$ Lock Washer
3	31008-004-01	Isolation Switch Handle Gasket for NEMA 3R and NEMA 12 Enclosures			$\frac{5}{16}$ Plain Washer
4	51192-135-50	Thumb Screw Interlock Actuator Guide and Isolation Switch Handle Mounting Bracket Assembly	20	51192-044-50	Door Interlock Push Bar Assembly (Includes Item 21)
5	51192-134-01	Thumb Screw Interlock Actuator	21	50502-602-09	Door Interlock Push Bar Spring
6	9007 A02	Interlock Snap Switch	22	31004-261-01	Drive Pin
7	29206-00395	Sealing Ring for NEMA 3R and NEMA 12 Enclosures	23	(X)	Contact
8	25410-02908	Test Receptacle	24	31055-164-04	Interlock Threaded Rod
9	25410-01235	Test Plug	25	51192-115-50	Disconnect Jaw Assembly
10	22906-10040	Medium Voltage Compartment Door	†26		$\frac{5}{16}$ - 18 x $1\frac{1}{4}$ Hex Head Cap Screw
11	23615-00220	Nylon Washer	27	23903-32003	$\frac{5}{16}$ Spring Washer
12	29929-00002	"X" Washer	28	23601-00222	$\frac{5}{16}$ Large Plain Washer
13	51192-141-01	Medium Voltage Compartment Door Interlock Hook	29	51192-112-01	Isolation Switch Blade
14		Medium Voltage Compartment Door Interlock Assembly	30	24209-16240	Spring Pin
	30007-080-01	Release Plate	31	23427-00220	$\frac{5}{16}$ Hex Nut with Lock Washer
	30017-163-01	Torsion Spring	32	23903-32003	$\frac{5}{16}$ Spring Washer
	31008-061-01	Release Pin	†33		$\frac{5}{16}$ - 18 x 1 Hex Head Cap Screw
	29206-00160	"O" Ring	34	51192-118-50	Flexible Shunt Assembly
	31008-118-01	Bushing	35	51192-119-01	Shunt Bus (Connects Flexible Shunt to Power Fuse Clip)
	30007-079-01	Gasket	36	51033-506-01	Power Fuse Clip
	30007-076-50	Plate Assembly	37	51033-507-01	Power Fuse Clip Back Up Spring
†15		$\frac{3}{8}$ Hex Jam Nut	38	(X)	Power Fuse
†16		$\frac{3}{8}$ Lock Washer	39	(X)	Control Power Transformer Primary Fuse
17	51192-130-50	Contact Mounting Shelf	40	51192-138-50	Lower Fuse Base Bus (Connects Power Fuse Clip to Contact)
18	9080 6F6	Control Power Transformer Secondary Fuse Block and Fuse Puller	41	K153010	Control Power Transformer Primary Fuse Clip
19	(X)	Control Power Transformer			10 - 24 x $\frac{1}{2}$ Pan Head Screw
			†		#10 Lock Washer
			†		#10 Plain Washer

(X) Refer to device identification table supplied with factory order.

† Standard hardware, listed without a Square D part number, should be obtained from a local hardware supplier.



PARTS LIST FOR LEFT WALL OF MEDIUM VOLTAGE COMPARTMENT



Item No.	Part Number	Description
1	51203-849-01	Cable Clap Half (two required)
† 2		$\frac{5}{16}$ - 18 x $2\frac{3}{4}$ Hex Head Screw
† 3		$\frac{5}{16}$ Lock Washer
† 4		$\frac{5}{16}$ Plain Washer
5	23502-22002	$\frac{5}{16}$ - 18 Retained Nut
6	51192-147-01	Load Cable Connection Box Sidewall Barrier
7	51192-146-01	Connection Box Load Cable Bus Tap
† 8		$\frac{5}{16}$ -18 x 1 Cap Screw
9	23903-32003	$\frac{5}{16}$ Spring Washer
10	51192-145-01	Load Connection Box Bus
11	23601-00222	$\frac{5}{16}$ Large Plain Washer
12	23502-22001	$\frac{5}{16}$ - 18 Cage Nut
13	51190-116-50	Load Cable Connection Box
14	51190-111-01	Load Cable Connection Box Cover (Not Shown)

† Standard hardware, listed without a Square D part number, should be obtained from a local hardware supplier.