SIEMENS

Series 81000™

5-7.2kV Medium Voltage Vacuum Contactors

Type 90H35 (5kV); Type 90H37 (7.2kV)

(Distribution Voltage 2400-6900VAC; Utilization Voltage 2300-6600VAC)

Instructions
Installation
Operation
Maintenance
MVC-9028

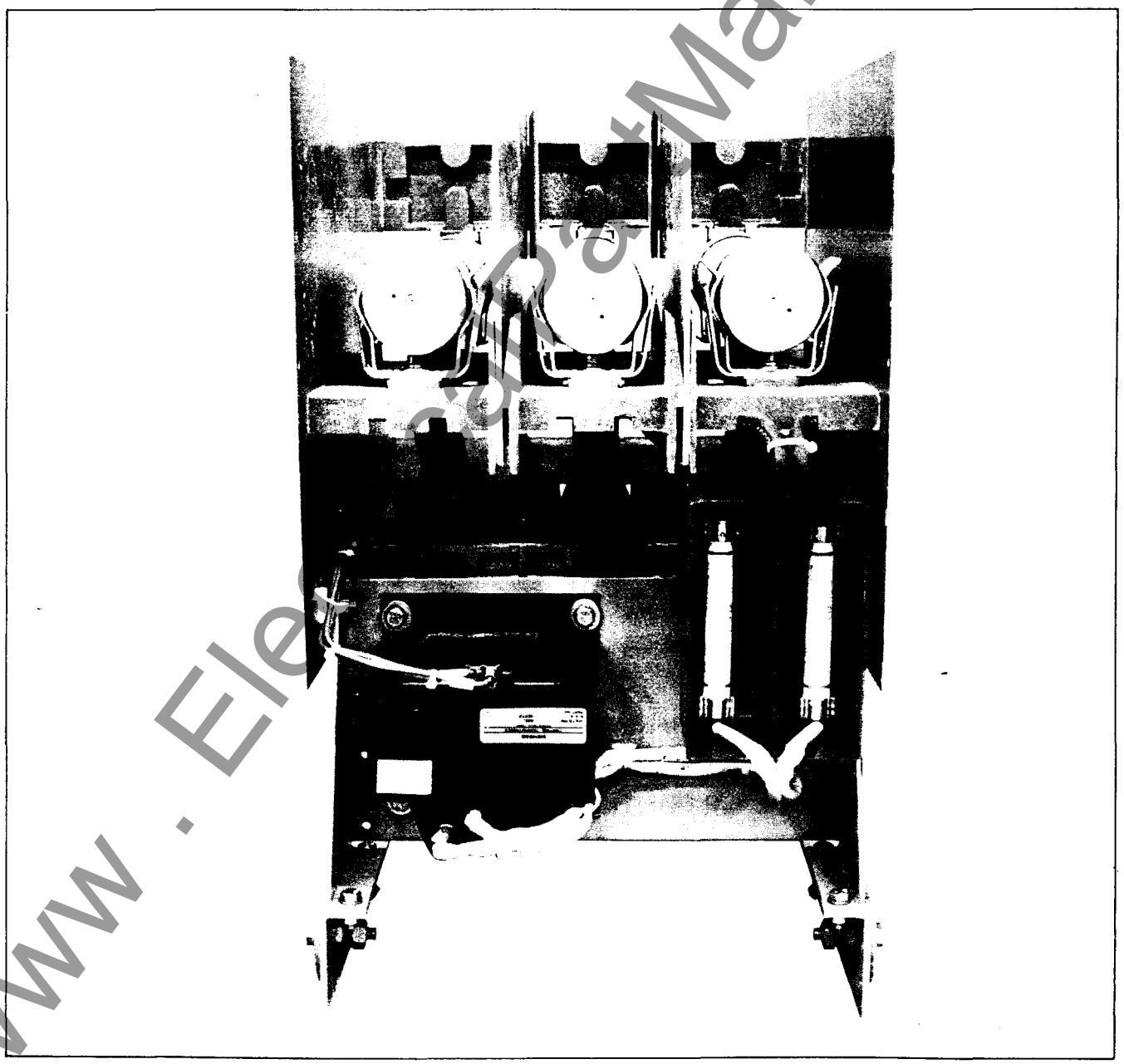


Table of Contents

NOTE

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statement contained herein do not create new warranties or modify the existing warranty.

⚠WARNING

Working in or around electrical equipment can cause shock, burn or electrocution if accidental contact is made with energized parts.

Turn off power supplying this equipment before any adjustments, servicing, wiring, parts replacement, or before any act requiring physical contact with electrical working components of this equipment is performed.

The successful and safe operation of motor control equipment is dependent upon proper handling, installation, operation and maintenance, as well as upon proper design and manufacture. Failure to follow certain fundamental installation and maintenance requirements may lead to personal injury and the failure and loss of control equipment, as well as damage to other property.

Qualified Person

For the purpose of this manual and product labels, a qualified person is one who is familiar with the installation, construction and operation of the equipment, and the hazards involved. In addition, he has the following qualifications:

(a) Is qualified and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.

(b) Is qualified in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices.

Danger

For the purpose of this manual and product labels, **DANGER,** indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

For the purpose of this manual and product labels, **WARNING**, indicates death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

For the purpose of this manual and product labels, **CAUTION** indicates minor personal injury or property damage can result if proper precautions are not taken.

Siemens medium voltage vacuum contactors are built in accordance with the latest applicable provisions of the National Electrical Code, Underwriters' Laboratories Standards and Procedures, NEMA, VDE and IEC Standards, and the National Electrical Safety Code. These publications and this instruction manual should be thoroughly read and understood prior to beginning any work on this equipment.

General

Siemens Type 90H3 vacuum contactors are provided for use in Series 81000™ medium voltage controllers. Type 90H3 contactors provide the advantage of long mechanical and electrical life with low maintenance and are essentially immune to adverse atmospheric environments. They are suitable for loads of all types, including three-phase motors, transformers, capacitors and resistive loads.

The overall dimensions of the vacuum contactor are 18 inches (457mm) wide by 27.5 inches (699mm) high by 23.87 inches (606mm) deep. The vacuum contactor with single or double barrel power fuses can be installed in Series 81000 Class E2 controllers of either one-, two- or three-high construction.

The Type 90H3 vacuum contactor consists of: (1) a low voltage section which contains the main coil drive and auxiliary contacts; (2) a medium voltage section which houses the vacuum interrupter bottles and (3) a support structure which provides mounting for the power fuses, control transformer and primary fuses, and drawout attachments.

Due to the fact that arc interruption is accomplished completely within the vacuum bottles, items such as arc chutes, blowout coils and pole plates are not required with vacuum contactors. Stationary and movable power contacts are located inside the vacuum bottles with corrugated stainless steel bellows attached to the movable contacts to ensure a complete seal and integrity of the vacuum bottle.

Voltage surge suppressors are sometimes furnished at the controller load terminals to limit transient overvoltages caused by multiple reignitions which may occur due to the use of vacuum interrupters. For application guidelines see the instruction manual for Series 81000™ Controllers—MVC-9018.

Contactor Ratings

Contactor Type	Maximum Voltage Rating	Enclosed Continuous Ampere Rating	Interrupting Capacity		kV Impulse Level (BIL)
			Unfused Contactor (kA)	Fused Class E2 Controller (MVA)	
90H35	5.0 kV	360	5 kV@ 2.3-4.6 kV	200 @ 2.3 kV 350 @ 4.0 kV 400 @ 4.6 kV	60
90H37	7.2 kV	310	5 kA @ 6.6 kV	5 kA @ 6.6 kV	60

Auxiliary Contacts: Each contactor is equipped with 3 N.O. and 4 N.C. auxiliary contacts for customer use. These contacts are rated 600V, 10A (NEMA Class A600).
NOTE: On drawout contactors, 2 N.O. and 2 N.C. contacts are available for customer use.

Contactor Type	3 Phase Horsepower Rating at Utilization Voltage									Maximum Motor Fuse Rating	Transformer Loads				Maximum Transf Fuse Rating
	2300V			4000-4600V			6600V				Maximum 3-Phase kVA at Distribution Voltage				
	Syn. Motors		Ind. Motors	Syn. Motors		Ind. Motors	Syn. Motors		Ind. Motors						
	0.8PF	1.0PF		0.8PF	1.0PF		0.8PF	1.0PF			2400V	4160V	4800V	6900V	
90H35	1500	1750	1500	2500	3000	2500	—	—	—	24R	1500	2500	2500	—	450E
90H37	—	—	—	—	—	—	3500	4500	3500	18R	—	—	—	1500	200E

Description of Operation (Refer to **Figure 1**.)

The drive lever (3.1) forms an angle, with point A as the fulcrum. When the magnet is not energized, the lever is held in the OFF position by the compression springs (9.3).

Thus point B of the drive lever is in its extreme left position. At this point the drive lever engages with the cup (3.3) and the nut (3.4) of the vacuum interrupter. This holds the contacts apart (in the OFF position) against the atmospheric pressure.

When the magnet coil (8.1) is energized, the armature (3.6) and with it the drive lever (3.1) are attracted towards the magnet core (8.2) against the reaction of the two compression springs (9.3).

Point B of the drive lever therefore moves to the far right position. The nut (3.4) of the vacuum interrupter (4.1) is thus released so that the atmospheric pressure can press the moving contact against the fixed contact.

The drive mechanism is constructed so that the nut (3.4) never comes into contact with the drive lever (3.1) when in the ON position. This ensures that the ON switching position is always reached, definitely and completely.

The clearance between the cup (3.3) and the nut (3.4) in the ON switching position allows the magnetic drive to accelerate during opening operations.

A compression spring (4.7) is positioned between the drive lever (3.1) and the vacuum interrupter (4.1).

Blown Fuse Trip Mechanism

Contactors can be supplied with an anti-single phase trip mechanism which offers protection from single phasing due to a blown power fuse. Fused contactors equipped with the blown fuse trip mechanism are pre-adjusted at the factory so that the opening of one or more power fuses results in de-energizing the contactor, thus interrupting current to the load. When a power fuse blows, a plunger extends from the load end of the fuse which rotates the spring-loaded trip bar and releases a pre-compressed micro-switch on the side of the contactor. A contact on the micro-switch opens at this time and de-energizes the contactor magnet coil.

1	Housing
2	Drive Chamber
3.1	Drive Lever
3.3	Cup
3.4	Nut
3.5	Locknut
3.6	Magnet Armature
3.7	Thrust Plate
3.8	Stop
3.9	Guide
4.1	Vacuum Interrupter
4.7	Compression Spring
8.1	Main Coil
8.2	Magnet Core
8.3	Magnet Plate
9.1	Notch
9.2	Setting Plug
9.3	Compression Spring
9.4	Spring Retainer
10	Auxiliary Switch
11.1	Economy Resistor
12	Terminal Strip

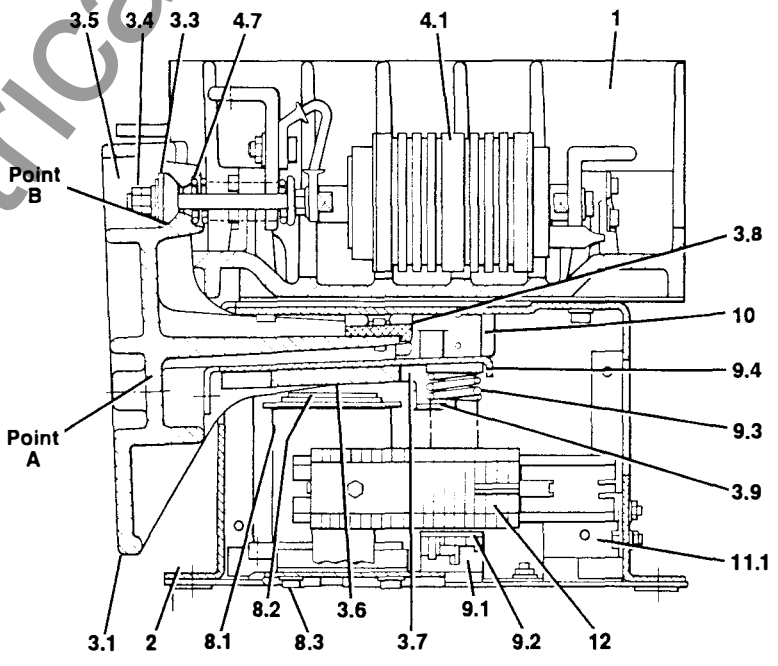


Figure 1. Operating Components of Vacuum Contactor

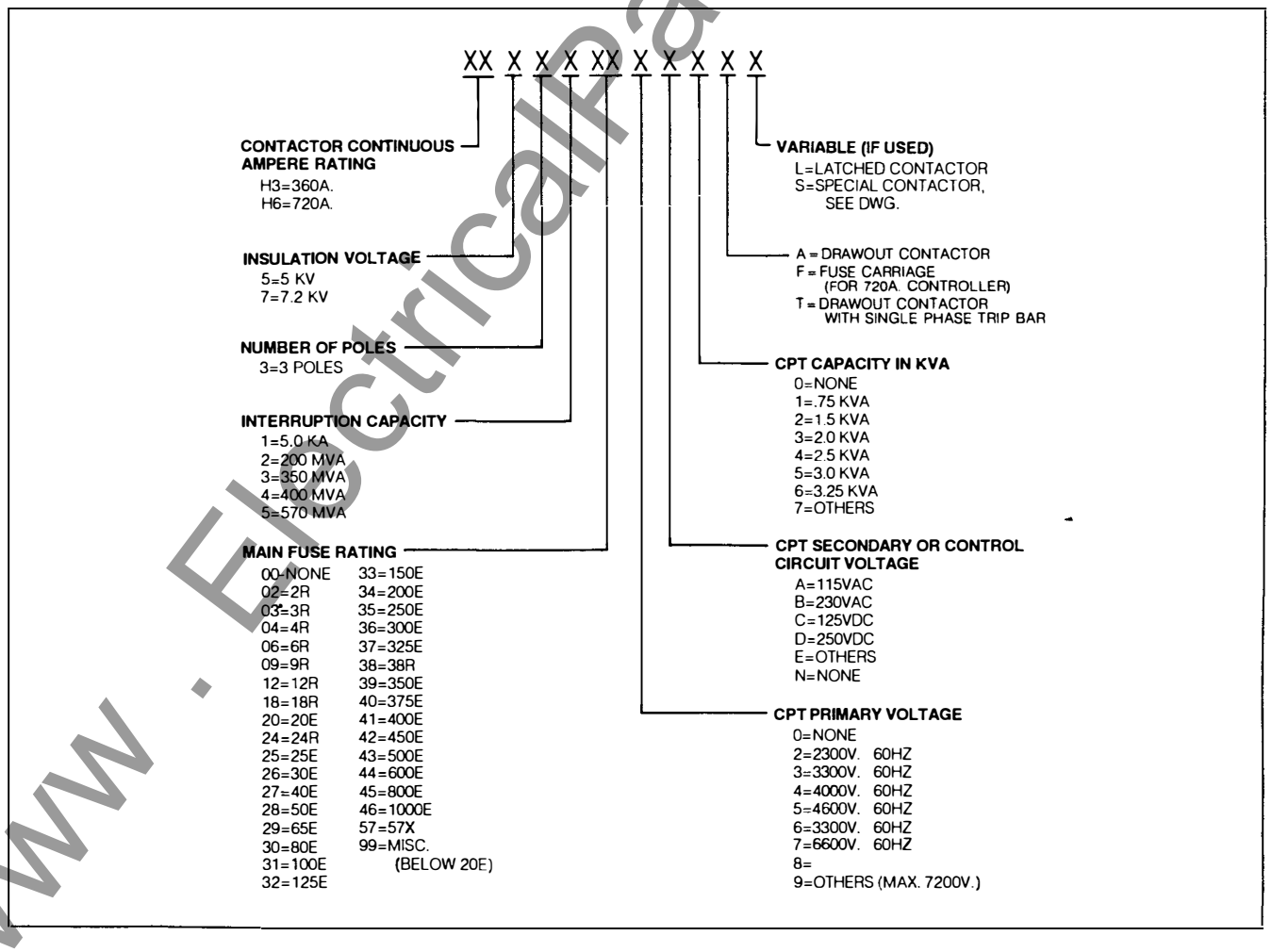
Mechanically Latched Contactors

Mechanically latched contactors are available which consist of a standard 90H3 contactor with the addition of a mechanically latch assembly. The mechanical latch holds the armature of the contactor closed against the magnet core after the contactor is energized (closed) and control power is removed. A pushbutton on the high voltage compartment door, when manually depressed, trips the contactor by releasing the mechanical latch. Electrical trip with an internal solenoid is optionally available from the normal control transformer source or from a stored energy (capacitor) source which is charged from the normal control source. The stored energy source provides reliable trip power for a maximum delay of 5 minutes after loss of control power. Special trip circuits energized from remote power sources can be provided. Standard control circuits are available for 115V and 230 VAC.

Refer to the contactor rating table for latched contactor ratings. Refer to specific drawings supplied with the equipment for details on connection and operation.

Nomenclature

The contactors can be identified through the nomenclature description shown below:



Receiving Inspection

An immediate inspection should be made for any damage which may have occurred during shipment upon receipt of this equipment. The inspection should include examination of the packaging material and the contactor. Be sure to look for concealed damage and do not discard the packaging material. If damage is found, note damage on "Bill of Lading" prior to accepting receipt of the shipment, if possible.

> NOTE
>
> The way visible shipping damage is treated by the consignee prior to signing the delivery receipt can determine the outcome of the damage claim to be filed. Notification to the carrier within the 15 day limit on concealed damage is essential if loss resulting from unsettled claims is to be eliminated or minimized.
>
> A claim should be immediately filed with the carrier, and the Siemens sales office should be notified if damage or loss is discovered. A description of the damage and as much identification information as possible should accompany the claim.

Handling

For convenience and safety in lifting or moving the contactor, the lifting device similar to that shown in **Figure 2** should be purchased.

> NOTE
>
> The lifting device is not intended to be used as a means of transporting the contactor in the raised position. The contactor should be transported with the lifting device in its lowered position.

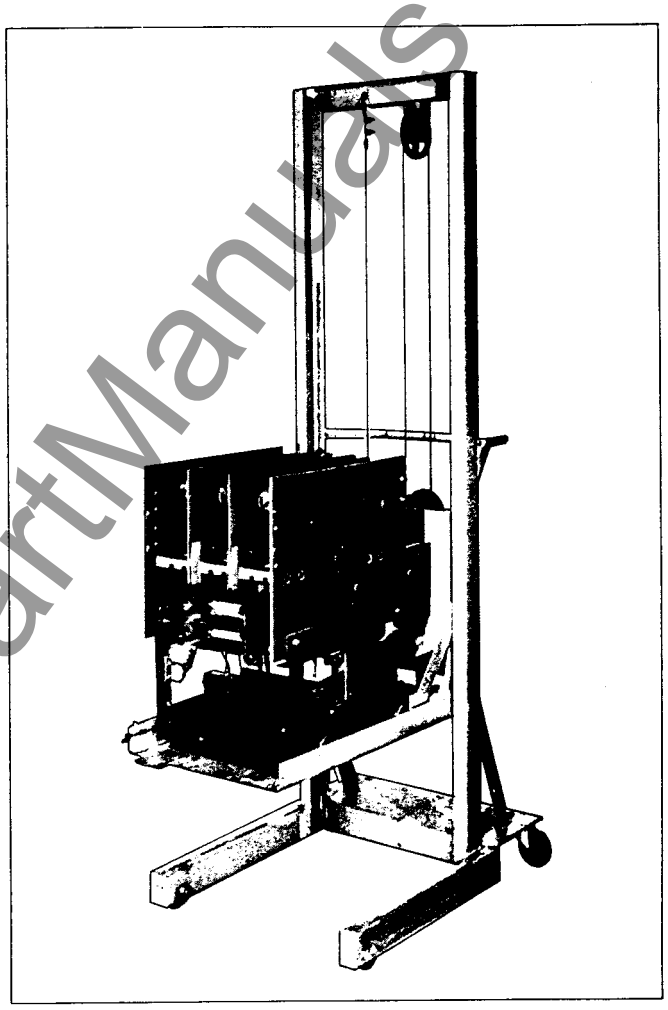


Figure 2. Lifting Device

A crane or hoist is also recommended to handle the contactor, if the lifting device is not available. Refer to **Figure 3** for recommended lifting method. A forklift truck can also be utilized:

Observe the following precautions prior to moving the contactor with a crane or hoist:

1. Keep the contactor in an upright position only.
2. Select rigging lengths to compensate for any unequal weight distribution.
3. Do not allow the angle between the lifting cables and vertical to exceed 45 degrees.
4. **Never lift a contactor above an area where personnel are located.**

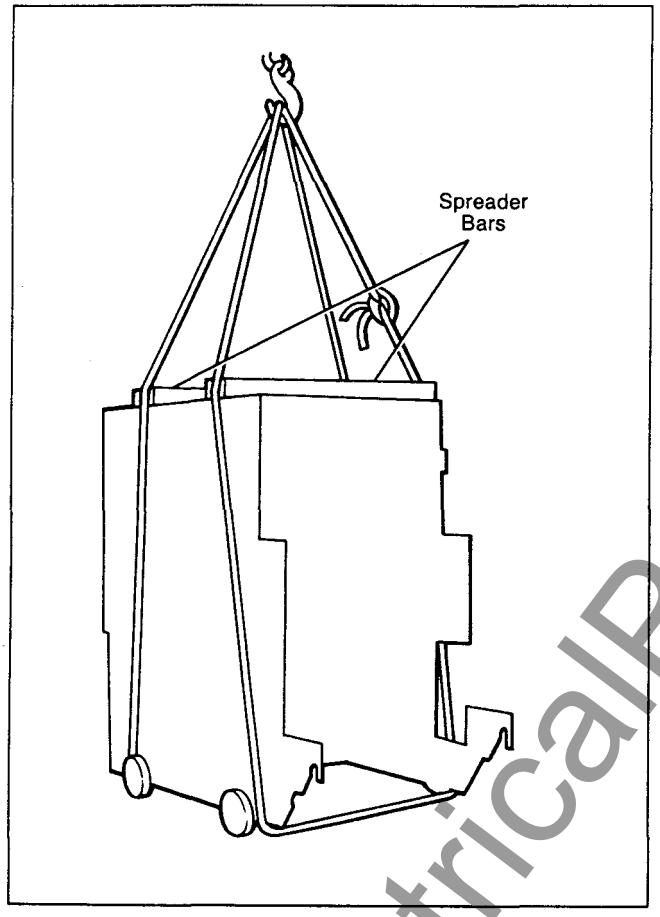


Figure 3. Recommended Lifting Method

If a forklift is utilized, the following precautions should be taken when moving contactors:

1. Keep the contactor in an upright position only.
2. Make sure the load is properly balanced on the forks.
3. Place protective material between the contactor and the forklift to prevent bending or scratching.
4. Securely strap the contactor to the forklift to prevent shifting or tipping.
5. Excessive speeds and sudden starts, stops, and turns must be avoided when handling the contactor.
6. Lift the contactor only high enough to clear obstructions on the floor.
7. Take care to avoid collisions with structures, other equipment, or personnel when moving the contactor.
8. **Never lift a contactor above an area where personnel are located.**

Storage

The contactor must be stored in a clean, dry, dust and condensation free environment if it cannot be placed into service reasonably soon after receipt. Do not store equipment outdoors. A standard 150 watt light bulb, connected to burn continuously should be placed within the contactor to prevent condensation.

⚠WARNING

Accidental contact with energized wiring or bus system can cause electric shock, burn or electrocution.

Disconnect and lock-out incoming power and control voltage sources before beginning work on this or any other electrical equipment.

Check all control circuit terminals with a voltmeter to make certain that the equipment is totally deenergized. Use only approved high voltage test equipment to check voltage on power terminals. Do not attempt to measure high voltage with a volt-ohm meter.

It is recommended that a safety ground be connected to the power bus after the system has been deenergized, and prior to working on the equipment. Follow the procedure outlined in the pre-energization check section of this manual before power is restored.

Site Preparation and Mounting

Installation shall be in accordance with the National Electrical Code, ANSI, and NFPA 70 Standards.

The contactor should be installed in a clean dry heated place with good ventilation. It should be readily accessible for cleaning and inspection and should be carefully set up and leveled on its supporting foundation and secured in place.

All adjustments have been made at the factory before shipping and generally no change is required. See that all contact surfaces are clean and smooth, and that current-carrying parts are not damaged.

⚠WARNING

Accidental contact with dielectric or megger test equipment can cause shock, burn or electrocution.

Dielectric or megger testing should only be conducted by qualified personnel. Refer to test device instructions for safety instructions.

Electrical Connections

Inspect all insulated wiring to see that no damage has resulted from installing the contactor. Test the high voltage wiring for possible grounds or short circuits.

A dielectric test at 2.25 times the nominal system voltage plus 2000 volts applied for one minute between phases and from all phases to ground is the preferred method. Be sure to disconnect any devices (control power transformer, etc.) from the circuit which could be damaged by the test voltage. If a hi-pot tester is not available, then a Megger test at 1000 volts is a suitable second choice.

⚠WARNING

Excessive dielectric test voltages can cause harmful x-radiation to be emitted from vacuum bottles.

Vacuum-type interrupters can produce x-rays if they are subjected to sufficiently high voltages. The vacuum bottles used in Siemens type 90H3 contactors will not produce harmful x-rays at applied voltages of 40 kV or less. High-potential dielectric tests should be limited to a maximum value of 13,250 volts RMS AC to allow an adequate safety margin for protection of personnel from x-radiation.

⚠WARNING

High peak voltages can result in erroneous test results and x-radiation emitted from vacuum bottles causing personal injury.

Do not exceed the recommended test voltages when performing dielectric tests.

DC high potential test voltage sources using half wave conversion will apply peak voltages 3 times greater than the measured DC voltage. Do not use DC high potential voltage sources which employ half wave conversion circuits.

Make sure that all current-carrying parts outside the contactor have adequate current-carrying capacity and are correctly insulated in accordance with the requirements of the National Electrical Code (NEC). All electrical connections should be made carefully per the wiring diagram furnished with the equipment. Tighten all lugs to recommended torque values. Use recommended crimping tools only if crimp lugs are supplied.

Altitude Setting

Vacuum contactors are sensitive, to a certain degree, to the altitude at the installation site. This is due to the fact that atmospheric pressure assists in closing the main contacts by exerting force on the bellows at the moveable end of the vacuum bottles. Since this force is proportional to the difference between internal bottle pressure and external atmospheric pressure, the contactor's main return springs must be adjusted slightly when the contact is to be located at extreme distances above or below sea level.

After suitable adjustment, the 90H3 vacuum contactors can be operated at the following site altitudes:

From 4100 ft. below S.L. to 650 ft. above S.L.
From 650 ft. below S.L. to 4100 ft. above S.L.
From 4100 ft. above S.L. to 8200 ft. above S.L.

The vacuum contactors are set at the factory for a site altitude from 650 ft. below sea level to 4100 ft. above sea level.

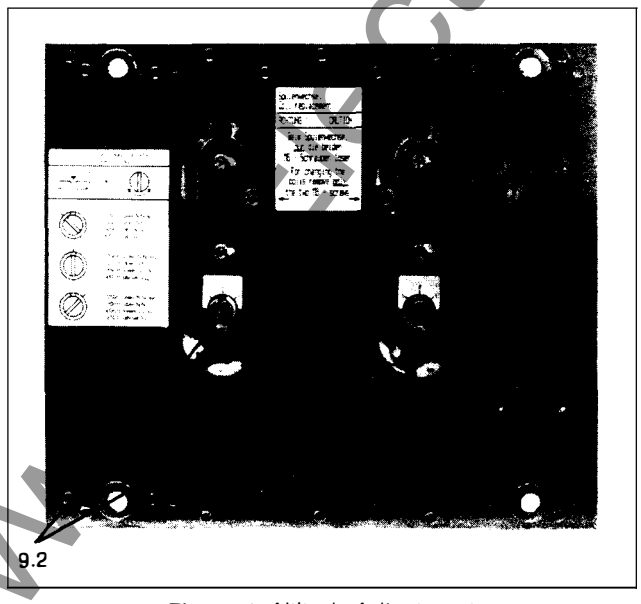


Figure 4. Altitude Adjustment

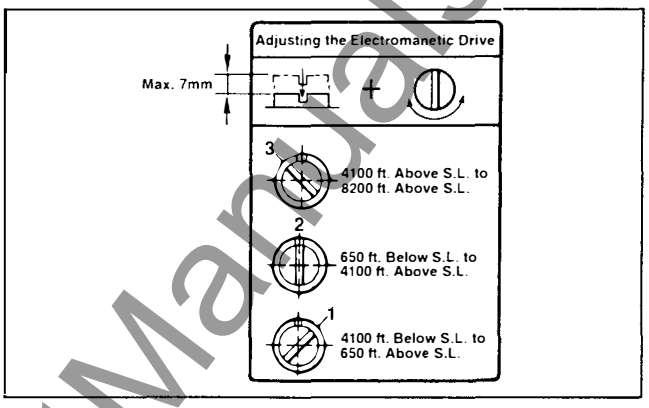


Figure 5. Altitude Adjustment Information Plate

Adjustment on the bottom of the vacuum contactor is necessary if the site altitude is different from that set at the factory. See **Figure 4.**

- Press in both setting plugs (9.2) using a screwdriver.
- Adjust each setting plug to the site altitude according to the instruction plate. See **Figure 5.**

Latched Contactors (Refer to **Figure 6**)

The trip rod on the latched contactor is locked in the shipping position by a wire tie as shown below. Remove this ty-rap before placing contactor in operation allowing the trip rod to extend fully.

All latched contactors are shipped with a threaded stud extending 3.62 inches (92mm) from the end of the trip rod. If the contactor is to be used in the bottom compartment of the controller cubicle, this stud should be left in place. If the contactor will be used in the middle or top compartments, the stud and associated nut and lockwasher must be removed.

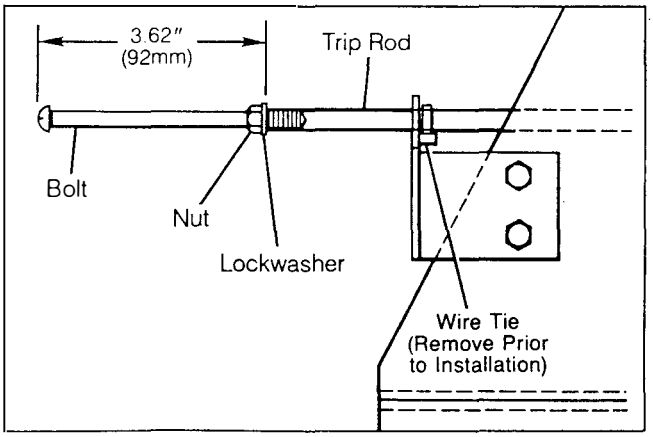


Figure 6. Latched Contactor

Pre-Energization Check

⚠WARNING

Failure to properly check out this equipment prior to energization can cause serious injury, burn or damage.

Perform the following checks before energizing equipment.

1. Be sure all phase barriers are correctly installed.
2. Clean any excessive amounts of dust and dirt that may have accumulated if the contactor has been in storage.
3. Connect only test power and operate the contactor electrically several times. The contactor should pick up and seal cleanly at 85% to 110% of rated control voltage (see Operating Data).

The contactor may now be placed in service by connecting main incoming power. The contactor must be appropriately guarded or isolated before energizing the medium voltage circuit. Refer to Series 81000 Controller Instruction Manual MVC-9018 for additional information. For typical control circuit diagrams see **Figures 7, 8** and **9.**

Operating Data

Description	230 Volt AC Supply*	115 Volt AC Supply*	220 Volt DC Supply	125 Volt DC Supply
Rated Control Voltage	240 Volts	120 Volts	220 Volts	125 Volts
Pick-Up Voltage	192 Volts	96 Volts	176 Volts	100 Volts
Drop-Out Voltage	84 Volts	42 Volts	77 Volts	44 Volts
Pick-Up Time (To Contact Make)	60-100 ms	60-100 ms	60-100 ms	60-100 ms
Drop-Out Time (To Contact Break)	200-240 ms	200-240 ms	200-240 ms	200-240 ms
Optional Fast Drop-Out Time (To Contact Break)	30-50 ms	30-50 ms	30-50 ms	30-50 ms
Inrush Current	2.3 Amps	4.7 Amps	2.3 Amps	4.0 Amps
Sealing Current	0.27 Amps	0.55 Amps	0.34 Amps	0.60 Amps

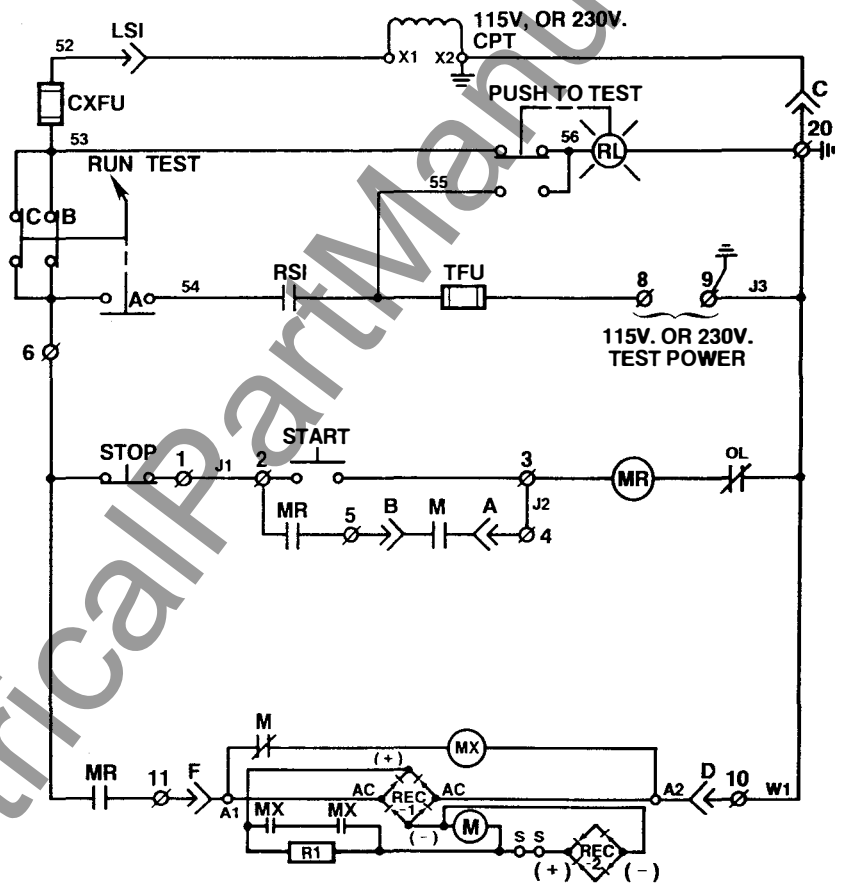
* Denotes Utilization Voltage.

Typical Control Circuit Diagrams

Test Switch Contact Development

	Run	Test
A		X
B	X	
C	X	

X = CONTACTS CLOSED



LEGEND

CPT . . . . Control Power Transf.
CXFU . . Fuse for CPT Sec.
LSI . . . . . Line Switch Interlock
M . . . . . Main Contactor
MR . . . . . Master Relay
MX . . . . . Auxiliary Relay
REC . . . . Rectifier
RL . . . . . Contactor Engagement Warning Light
R1 . . . . . Economy Resistor
RSI . . . . Racking Switch Interlock
TFU . . . . Fuse for Test Power

Additional Auxiliary Contacts

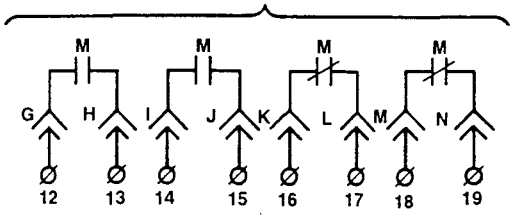


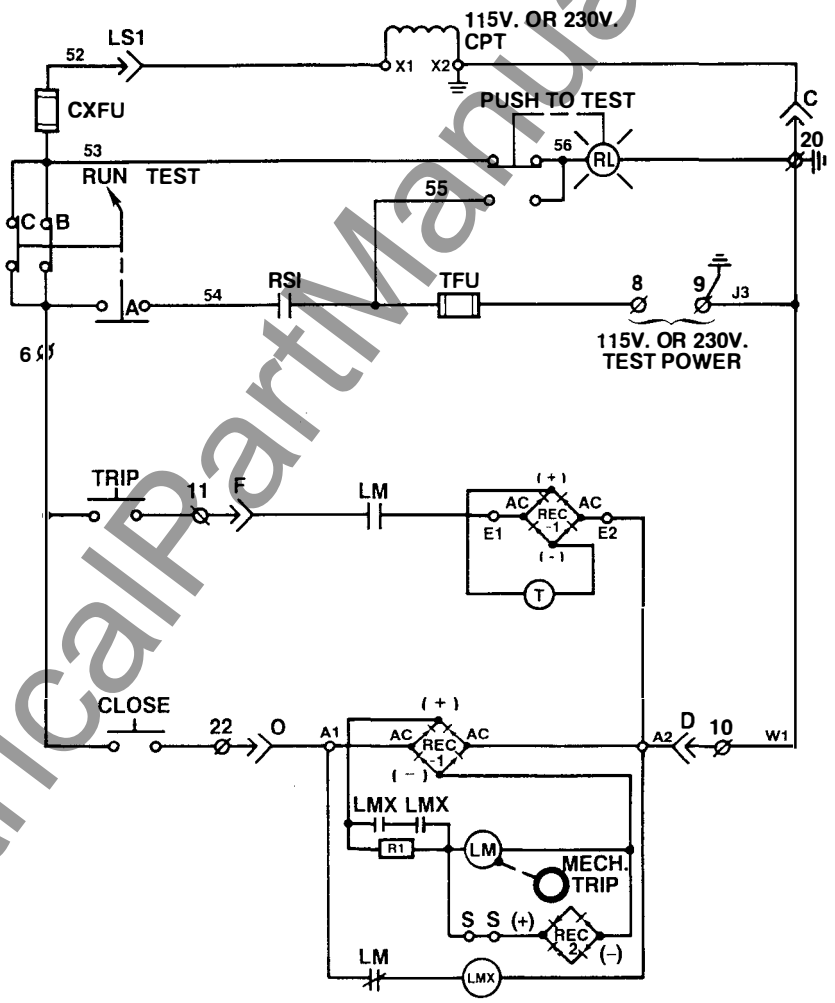
Figure 7. Series 81000 Controller with Type 90H3 Vacuum Contactor

Typical Control Circuit Diagrams

Test Switch Contact Development

	Run	Test
A		X
B	X	
C	X	

X = CONTACTS CLOSED



LEGEND

CPT . . . . Control Power Transf.
CXFU . . Fuse for CPT Sec.
LSI . . . . . Line Switch Interlock
LM . . . . . Main Contactor
MR . . . . . Master Relay
LMX . . . . Auxiliary Relay
REC . . . . Rectifier
RL . . . . . Contactor Engagement Warning Light
R1 . . . . . Economy Resistor
RSI . . . . Racking Switch Interlock
T . . . . . Trip Coil

Additional Auxiliary Contacts

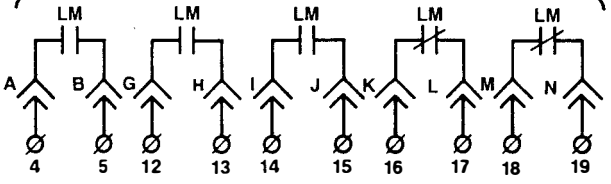


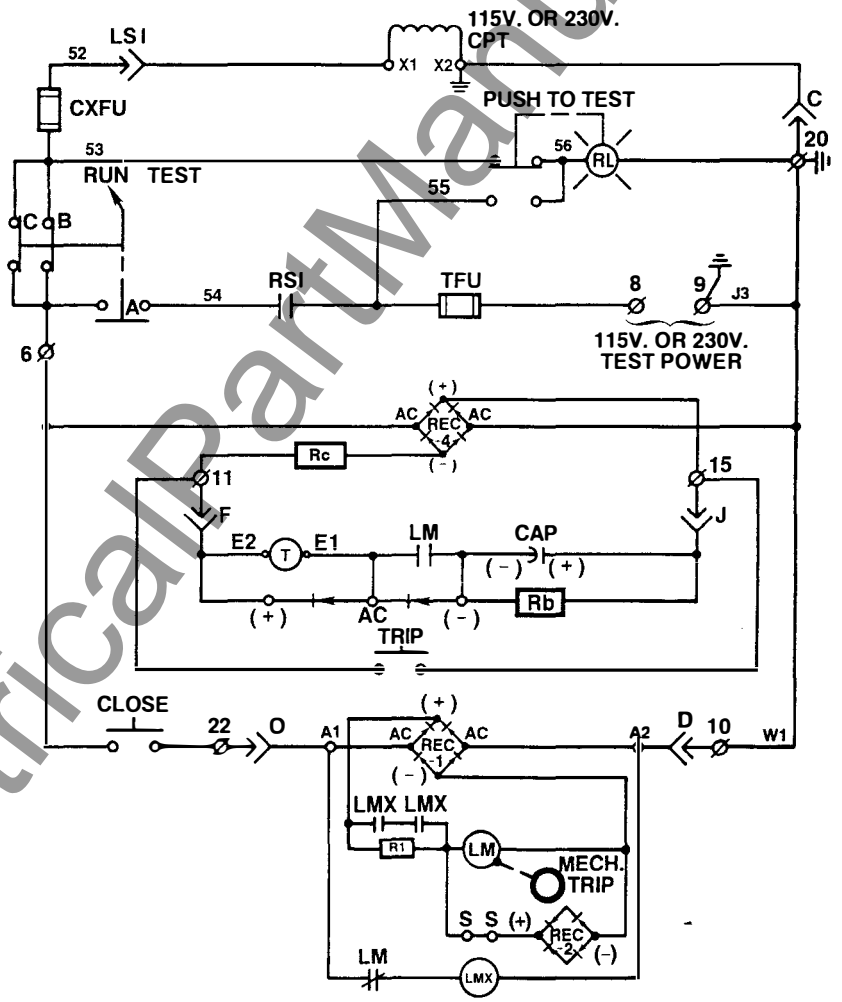
Figure 8. Series 81000 Controller with
with Type 90H3 Vacuum Contactor with Mechanical Latch and Electrical Trip from AC Source

Typical Control Circuit Diagrams

Test Switch Contact Development

	Run	Test
A		X
B	X	
C	X	

X = CONTACTS CLOSED



LEGEND

CAP . . . . Capacitor
CPT . . . . Control Power Transf.
CXFU . . Fuse for CPT Sec.
LSI . . . . . Line Switch Interlock
LM . . . . . Main Contactor
MR . . . . . Master Relay
LMX . . . . Auxiliary Relay
Rb . . . . . Bleeder Resistor
Rc . . . . . Charging Resistor
REC . . . . Rectifier
RL . . . . . Contactor Engagement Warning Light
R1 . . . . . Economy Resistor
RSI . . . . . Racking Switch Interlock
SP . . . . . Surge Suppressor (Molded into REC-4 Block)
T . . . . . Trip Coil
TFU . . . . Fuse for Test Power

Additional Auxiliary Contacts

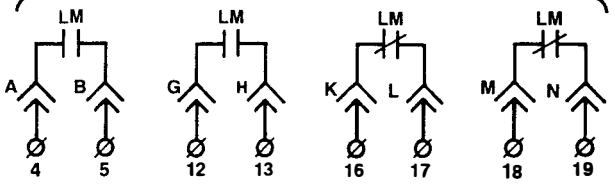


Figure 9. Series 81000 Controller with Type 90H3 Vacuum Contactor with Mechanical Latch and Electrical Trip from Stored Energy Capacitor Source

⚠WARNING

Accidental contact with energized wiring or bus system can cause electric shock, burn or electrocution.

Disconnect and lock-out incoming power and control voltage sources before beginning work on this or any other electrical equipment.

Check all control circuit terminals with a voltmeter to make certain that the equipment is totally deenergized. Use only approved high voltage test equipment to check voltage on power terminals. Do not attempt to measure high voltage with a volt-ohm meter.

It is recommended that a safety ground be connected to the power bus after the system has been deenergized, and proper to working on the equipment. Follow the procedure outlined in the pre-energization check section of this manual before power is restored.

Safety

For the safety of maintenance personnel as well as others who might be exposed to hazards associated with maintenance activities, the safety related to work practices of NFPA 70E, part II should always be followed when working on electrical equipment. Maintenance personnel should be trained in the safety practices, procedures and requirements that pertain to their respective job assignments.

The customer must establish a periodic program to ensure trouble-free and safe operation. The frequency of inspection, periodic cleaning, and preventive maintenance schedule will depend upon the operation conditions. NFPA Publication 70B "Electrical Equipment Maintenance" may be used as a guide to establish such a program. **A preventive maintenance program is not intended to cover reconditioning or major repair, but should be designed to reveal, if possible, the need to such actions in time to prevent malfunctions during operation.** The following items should be included in any maintenance checklist. For more details read the succeeding pages.

Proper installation of phase barriers
Vacuum Bottles
Blown Fuse Trip Mechanism
Main Coil
Auxiliary Contacts
Fuse Clips
Terminals and Joints
Cleaning
Tightening Torques
Mechanical and Electrical Operation of the Contactor
Mechanical Latch Mechanism

Maintenance of the vacuum contactor should be only be performed with the contactor deenergized and withdrawn from the controller compartment. In the case where a vacuum bottle must be replaced, control power is required to close the contactor.

Phase Barrier and Dust Cover Removal and Re-Installation

Type 90H3 vacuum contactors with drawout provisions are equipped with two glass polyester interphase barriers and one horizontal barrier located above the vacuum bottles which acts as a dust cover to prevent dust and other foreign material from accumulating inside the medium voltage section.

It is necessary to remove these barriers to perform maintenance on the vacuum contactor. First remove the interphase barriers, by sliding upward and out. A tab located on the rear of each interphase barrier engages a notch in the dust cover and locks it into the assembly. Once the interphase barriers are removed, the dust cover will slide out toward the rear (disconnect finger) end of the contactor.

Before placing the contactor back in service, both interphase barriers and the dust cover must be replaced in their proper locations.

Blown Fuse Trip Mechanism

NOTE

Use of the trip mechanism with fuses other than Siemens type FM motor fuses can result in failure of the trip bar to operate.

After the trip mechanism has operated, or if any of the power fuses have been removed or replaced, the following checks and adjustments must be performed.

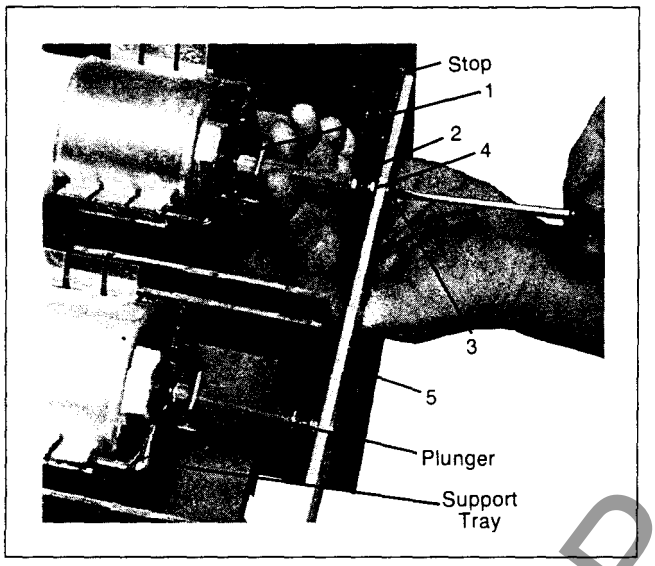


Figure 10. Adjustment of the Plunger

1. All fuses must be installed in clips with load side of fuse resting on support tray as shown in **Figure 10**. Plunger end of fuse must be facing forward, away from disconnect fingers on contactor.
2. With the trip bar in its normal spring return (deactivated position, the trip bar should rest against the stop screw on the right hand contactor side plate as shown in **Figure 10**. The trip bar must be held in this position while performing adjustments 3 and 4.
3. Adjust each of the three plunger assemblies shown in **Figure 10** to obtain a 1/16" (1.6mm) gap between the plunger (1) and the end of the corresponding fuse as follows: Insert a 1/16" (1.6mm) shim between the end of the fuse and the plunger (1). Loosen locknut (2) and turn adjusting screw (3) until there is no gap between stop nut (4) and trip bar (5). Retighten lock nut (2).
4. Referring to **Figure 11**, loosen the machine screw which threads into the pushrod and adjust outward (lengthen) until the micro-switch contacts just close. Then adjust outward one additional full turn and tighten the locknut.

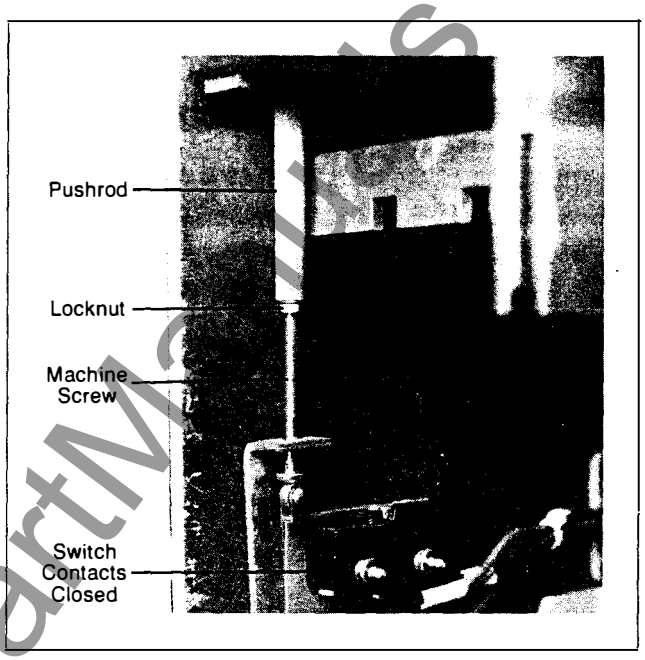


Figure 11. Adjustment of Trip Mechanism in Deactivated Position

5. Referring to **Figure 12**, insert a 3/16" (4.8mm) thick shim between one of the three plungers and the adjacent fuse, rotating the trip bar in the direction shown. The micro-switch contacts should open at this point. If they do not, loosen the locknut and adjust the machine screw to shorten dimension "A" slightly until the switch contacts open, then retighten the locknut.

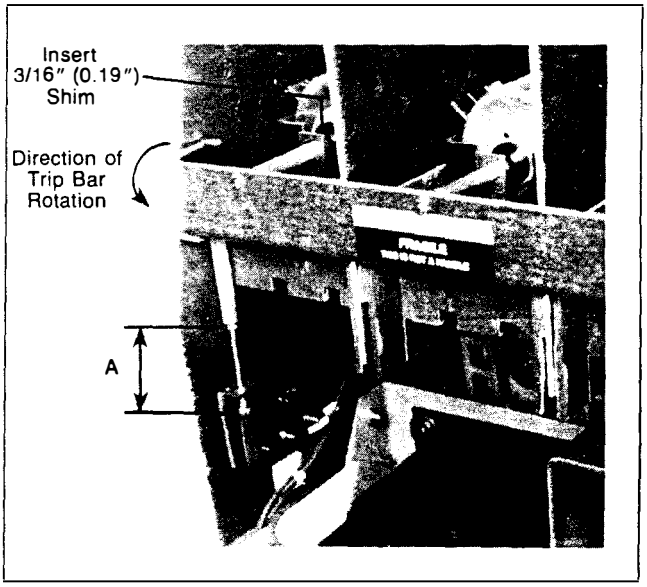


Figure 12. Operational Check of Trip Mechanism

Main Contacts Wear Check

The recommended method of determining main contact wear is to keep records as accurately as possible of the number of daily switching cycles along with the amount of current being interrupted. By using this data and the graph of electrical life, **Figure 13**, it can be determined with sufficient accuracy when the contacts in the vacuum bottles have reached the end of their service life. At this point, the vacuum bottles should be replaced by following the instructions under "Vacuum Bottle Replacement."

It should be noted that probability of replacing a vacuum bottle due to contact wear is **very** low, due to the exceptionally long mechanical and electrical switching life of the Siemens VS-6602 vacuum bottle.

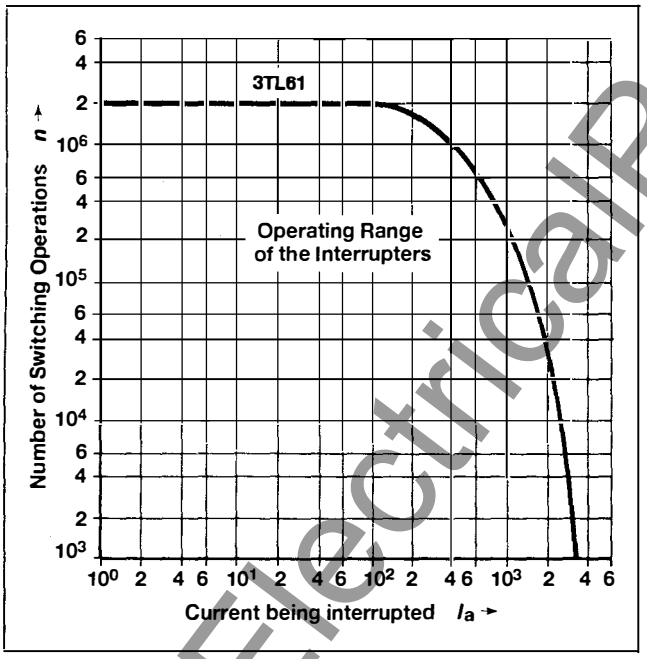


FIGURE 13. Electrical Life Curve

Vacuum Loss Check

It is highly unlikely that a vacuum bottle will ever suffer loss of vacuum. The vacuum bottle has been designed and tested to maintain the level of internal pressure necessary to proper operation for at least 20 years of shelf life. Since switching under load tends to increase the level of vacuum, due to a phenomenon known as "gettering", the life of bottles which have been placed in operation will be extended even further.

Since loss of vacuum is accompanied by loss of dielectric strength, bottles may be tested for sufficient vacuum level by performing a high potential dielectric test across the contacts with the contactor in the open position.

⚠WARNING

Excessive dielectric test voltages can cause harmful x-radiation to be emitted from vacuum bottles.

Do not exceed 13,250 volts RMS AC or 19 kV DC when performing dielectric tests.

⚠WARNING

Accidental contact with dielectric test equipment can cause shock, burn or electrocution.

Dielectric testing should only be conducted by qualified personnel. Refer to test device instructions for safety instructions.

With the vacuum contactor withdrawn from the controller and in the open position, apply 13.25 kV RMS AC across the open contacts of each bottle for one minute. No breakdown should occur. If breakdown occurs on any vacuum bottle, it must be replaced.

If a DC hi-pot tester is used, a test voltage of 19 kV DC should be applied.

⚠WARNING

High peak voltages can result in erroneous test results and x-radiation causing personal injury.

DC high potential test voltage sources using half-wave conversion will apply peak voltages 3 times greater than the measured average DC voltage. Repetitive application of high peak voltage can result in erroneous test results and x-radiation causing personal injury.

Do not use DC high potential voltage sources which employ half-wave conversion circuits.

Vacuum Bottle Replacement

⚠WARNING

Accidental contact with energized components can cause shock, burn or electrocution.

Before replacing vacuum bottles, withdraw the contactor from the controller compartment to ensure that all high voltage sources are disconnected.

Low voltage test power is required during the re-installation of new vacuum interrupters, so exercise caution.

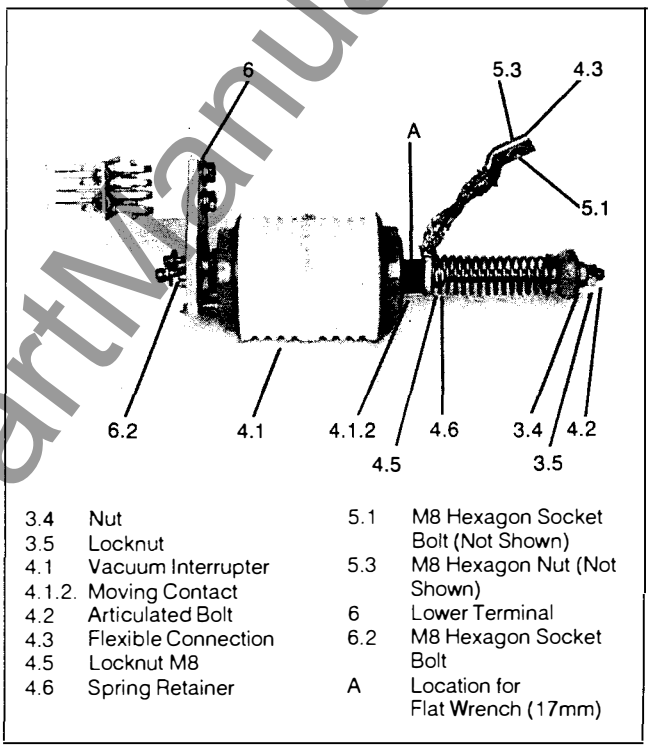
To gain access to the vacuum bottles, first remove the power fuses, the two interphase barriers and the horizontal dust barrier.

The interrupters can be replaced when the vacuum contactor is in the "Off" position.

The replacement instructions should be adhered to, otherwise correct operation of the vacuum contactor cannot be ensured.

Removing Vacuum Bottle

An adjusting handle is required for installing the interrupters. It is supplied with every replacement interrupter.



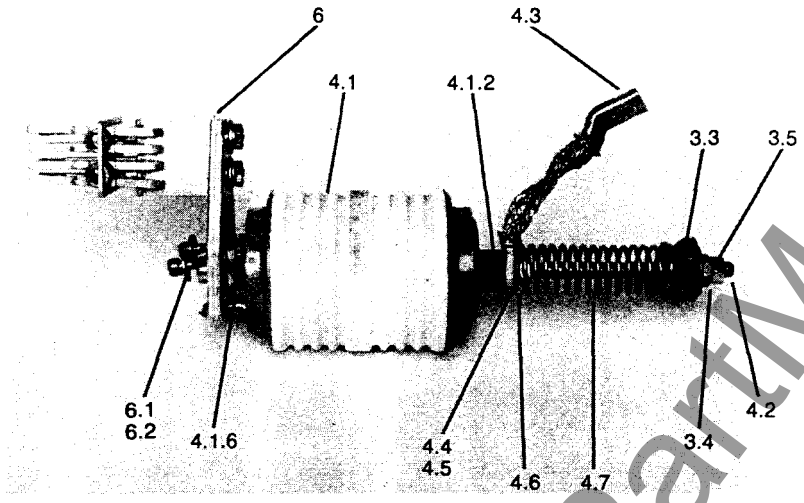
3.4	Nut	5.1	M8 Hexagon Socket Bolt (Not Shown)
3.5	Locknut		
4.1	Vacuum Interrupter	5.3	M8 Hexagon Nut (Not Shown)
4.1.2.	Moving Contact		
4.2	Articulated Bolt	6	Lower Terminal
4.3	Flexible Connection	6.2	M8 Hexagon Socket Bolt
4.5	Locknut M8		
4.6	Spring Retainer	A	Location for Flat Wrench (17mm)

Figure 14. Removing an Interrupter

Refer to **Figure 14**.

At the pole whose interrupter is to be replaced:

- Loosen the M8 hexagon socket bolt (5.1) of the flexible connection (4.3) and hold the nut (5.3) with a flat wrench (13mm), as shown in the **Figure 14.**
- Loosen the M8 locknut (4.5) of the articulated bolt (4.2), holding the moving contact (4.1.2) of the vacuum interrupter with a flat wrench at location A (17mm).
- Unscrew the articulated bolt (4.2) from the moving contact by the locknut (3.5) using a 13mm box wrench.
- Unscrew the M8 hexagon socket bolt (6.2) at the lower terminal (6).
- Take hold of the interrupter and lift it out of the housing.



3.3	Cup
3.4	Nut
3.5	Locknut
4.1	Vacuum Interrupter
4.1.2	Moving Contact
4.1.6	Pumping Port
5.1	M8 Hexagon Socket Bolt (Not Shown)
4.2	Articulated Bolt
4.3	Flexible Connection
4.4	Contact Washer
4.5	Locknut
4.6	Spring Retainer
4.7	Compression Spring
6	Lower Terminal
6.1	Contact Washer
6.2	M8 Hexagon Socket Bolt

Figure 15. Vacuum Interrupter

Refer to **Figure 15**.

Re-use the following parts of the old interrupter:

Compression spring (4.7), spring retainer (4.6), locknut (4.5), flexible connection (4.3) and articulated bolt (4.2) with nut (3.4) and locknut (3.5).

The articulated bolt (4.2), which is screwed into the moving contact of the interrupter, is fixed by means of contact washer (4.4) and locknut (4.5), in the same way as the flexible connection (4.3). The parts (4.6) and (4.7) are only slipped on.

> NOTE
>
> Replace the contact washers (4.4), (6.1) at the interrupter end of the flexible connection, and at the line and load terminals, with the new contact washers supplied.

Installing the Replacement Vacuum Interrupter:

- Place the interrupter (4.1) on the lower terminal (6) and fix it in position using a new contact washer (6.1) and the hexagon socket bolt (6.2).

> NOTE
>
> When positioning the interrupter take care to see that the pumping port (4.1.6) locates in the rear cutout of the lower terminal (6), see **Figure 16** and **17**.

- Slip cup (3.3) onto the articulated bolt (4.2) fitted with locknut (3.5) and nut (3.4).
- Pass the bolt through the drive lever (3).
- Slip compression spring (4.7) and spring retainer (4.6) into position and lock with nut (4.5).
- Slip contact washer (4.4) and flexible connection (4.3) onto the articulated bolt.
- Screw the bolt into the moving contact (4.1.2) of the vacuum interrupter.
- Screw the articulated bolt into the moving contact until it comes up against the bottom of the contact thread or the locknut comes up against the cup (3.3).
- Tighten the locknut (4.5), at the same time holding the moving contact (4.1.2) in order to prevent the bellows from becoming damaged.
- Attach the flexible connection (4.3) to the line terminal using the hexagon socket bolt (5.1), contact washer (5.2) and nut (5.3), see **Figure 16**.
- Undo the locknut holding nut (3.4).

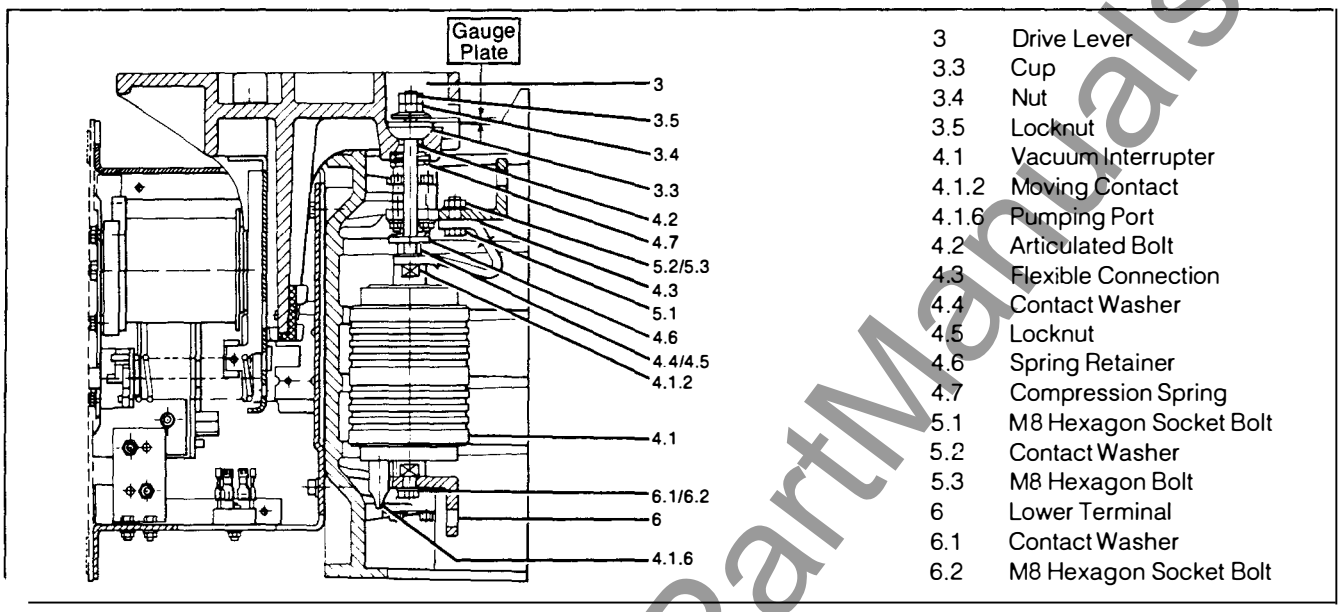


Figure 16. Installing the Replacement Vacuum Interrupter

- Insert the gauge plate (supplied) between the cup (3.3) and nut (3.4).
- Adjust this nut to size and lock it with the locknut.
- Remove the gauge plate.
- Now carry out a few test operations.

Main Coil Replacement

There are two main coils. To gain access to the main coils, first remove the two side plates from the low voltage section. The main coil leads are connected to the control circuit with push-on terminals and can be removed by pulling off.

The main coils may be removed by removing the two M8 hexagon socket head bolts from the underside of the contactor. See label on underside of contactor which identifies these two bolts.

To install a new coil, reverse the above disassembly procedure.

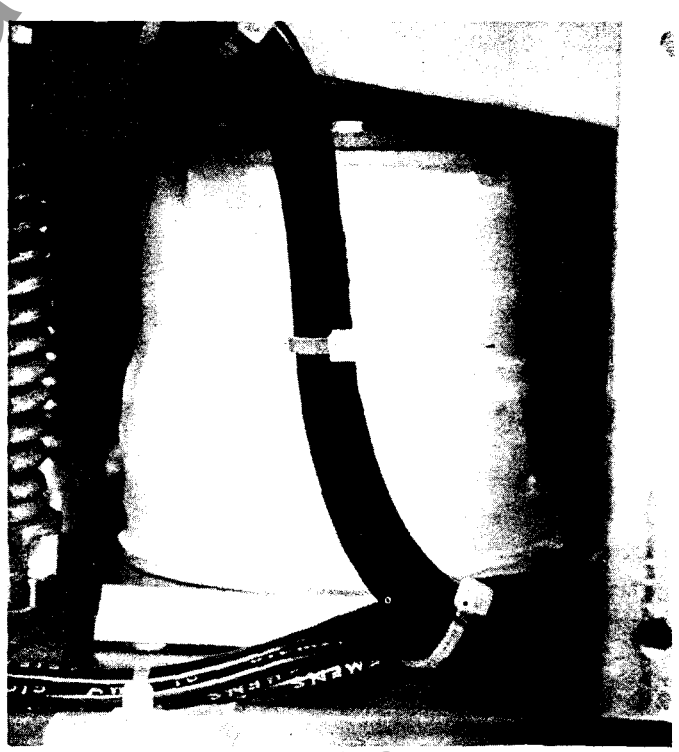


Figure 17. Main Coil Replacement

Auxiliary Contact Block Replacement

Located in the drive chamber on both sides of the electromagnetic drive is an auxiliary contact block, consisting of two auxiliary contacts. These are actuated by the drive lever via their own drive pins.

To replace an auxiliary contact block remove the particular side plate of the drive chamber. Remove existing auxiliary contact block.

Wire up the new auxiliary contact, turn it so that it locks in the mounting angle and screw it tight.

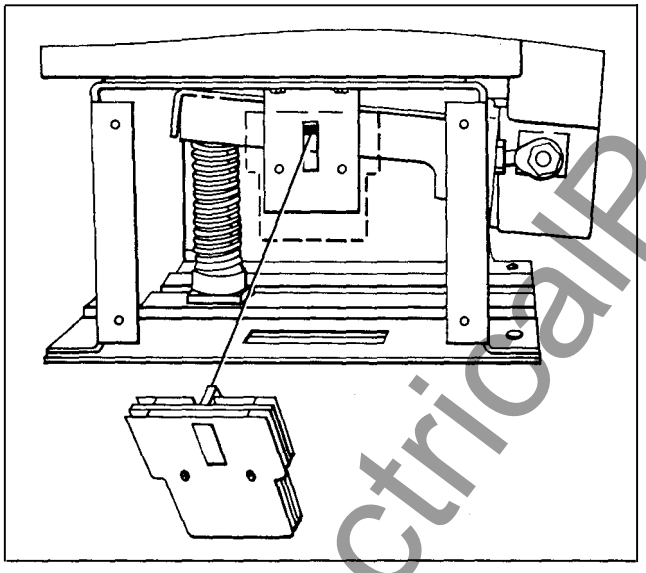


Figure 18. Auxiliary Contact Block Replacement

Fuse Clip Inspection

Closely examine fuse clips. If there is any sign of overheating or looseness check the spring pressure or tightness of clamps. Replace the fuse clips if the spring pressure compares unfavorably with that of other similar fuse clips. Make sure that fuses are completely inserted.

Terminals and Joints

If joints or terminations appear too badly discolored, corroded or pitted, or show evidence of having been subjected to high temperature, the parts should be disassembled and replaced or cleaned.

Examine all wire or cable connections for evidence of looseness or overheating. Re-torque if necessary. If major discoloration or cable damage is apparent, replace the damaged parts.

Recommended Torque

When making bolted assemblies, the following considerations should be generally followed. The recommended torque is determined by the size of hardware used.

1. Metal-to-Metal—Apply standard torque as listed:
2. Metal-to-Insert molded in compound part—Apply approximately 2/3 of standard torque.
3. Compound-to-Insert molded in compound part—Apply approximately 1/2 of standard torque.
4. Compound-to-Compound—Apply approximately 1/2 of standard torque.

Periodic Cleaning

Accumulation of dust and foreign material such as coal dust, cement dust, or lamp black must be removed from the contactor and all surfaces must be wiped clean at regular intervals. Dirty, wet or contaminated parts should be replaced unless they can be cleaned effectively. Dust can collect moisture, causing voltage breakdown. Do not use compressed air as it will only redistribute contaminants on other surfaces, and may damage delicate parts.

Thread Size	Standard Torque Metal-to-Metal (in.-lbs.)	2/3 Standard Torque Metal-to-Insert (in.-lbs.)	1/2 Standard Torque Compound-to-Insert (in.-lbs.)	1/2 Standard Torque Compound-to-Compound (in.-lbs.)
8-32	14-20	10-14	7-10	7-10
10-32	20-30	13-20	10-15	10-15
1/4-20	40-60	26-40	20-30	20-30
5/16-18	168-228	110-150	84-114	84-114
3/8-16	240-360	160-240	120-180	120-180
1/2-13	480-600	320-400	240-300	240-300

⚠WARNING

Accidental contact with energized wiring or bus system can cause electric shock, burn or electrocution.

Disconnect and lock-out incoming power and control voltage sources before beginning work on this or any other electrical equipment.

Only qualified personnel should be involved in the inspection and repair procedure and all plant safety procedures must be observed.

Check all control circuit terminals with a voltmeter to make certain that the equipment is totally deenergized. Use only approved high voltage test equipment to check voltage on power terminals. Do not attempt to measure high voltage with a volt-ohm meter.

It is recommended that a safety ground be connected to the power bus after the system has been deenergized, and prior to working on the equipment. Follow the procedure outlined in the pre-energization check section of this manual before power is restored.

General

The excessive currents occurring during a fault may result in structure, component and/or conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. After a fault, repair the cause of the fault, inspect all equipment per NEMA Standards Publication No. ICS2-302 and make any necessary repairs or replacements prior to placing the equipment into service again. Be sure that all replacements (if any) are of the proper rating and are suitable for the application. If in doubt, consult your field sales representative.

Inspection

The following areas should be inspected after a fault has occurred.

Enclosures

External evidence of enclosure deformation usually is indicative of damage within. Extensive damage will require replacement of the enclosure parts and the enclosed equipment. Insure that door mounted equipment and safety interlocks function properly. Verify that hinge and latch integrity is maintained.

Terminals and Internal Conductors

Replace all damaged parts which show evidence of discoloration, melting or arcing damage. Special attention should be paid to the stab fingers.

Overload Relays

The complete overload relay must be replaced if burnout of the heater element has occurred. Any indication of an arc striking or burning the overload relay also requires replacement.

If there is no visual indication of damage that would require replacement, contact operation must be verified by electrically or mechanically tripping and resetting the overload relay.

Fuse Holders

Replace fuse holders if the insulation mounts, barriers, or fuse clips show signs of damage, deterioration, heating, distortion or looseness.

Fuses

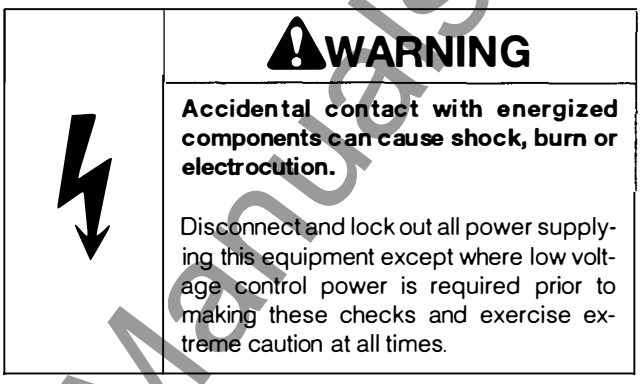
Always replace all three fuses in a three phase circuit even though only one or two are open circuited since internal damage suffered by fuses not replaced could result in nuisance shut-down later.

Perform the "Pre-Energization Check" procedures detailed in this manual before restoring the equipment to service.

In the unlikely event that operating problems are encountered, use the following troubleshooting chart to isolate the cause of the malfunction and find the remedy. If the corrective action given in the chart fails to correct the difficulty, consult your field sales representative.

The following information is required if it is necessary to write to Siemens relative to the equipment problems.

1. Manufacturer's serial number and part number, if available.
2. Nameplate data on contactor.
3. Duty cycle and any details of operation.
4. Length of time in service and approximate total number of operations.
5. Voltage, current and frequency.
6. Description of problem.
7. Any other pertinent information.



⚠WARNING

Accidental contact with energized components can cause shock, burn or electrocution.

Disconnect and lock out all power supplying this equipment except where low voltage control power is required prior to making these checks and exercise extreme caution at all times.

Trouble	Cause	Remedy
Contactor chatter or pumping	Poor contact in control circuit	Check all connections in control circuit for tightness
	Fluttering control relay such as pressure or temperature switch	Properly adjust switch and replace
	Abnormally low control voltage	Measure control voltage. Voltage must be at least minimum pick-up value shown in OPERATING DATA
	Faulty economizing resistor	Check continuity of economizing resistor
	Faulty economizing relay	Check operation of economizing relay MX
	Improper number or wrong size shims installed under magnet assembly	If the magnet assembly has been removed for coil replacement, check that the flat washers (shims) that were beneath it have been reinstalled in the original locations.
	High Altitude	Adjust altitude setting as required.
Coil/Rectifier Burnout	Fluttering control relay such as pressure or temperature switch	Properly adjust switch or replace
	Faulty economizing relay	Check operation of economizing relay MX
	Control voltage too high	Measure control voltage. Voltage must not exceed rated voltage by more than 10%.
	Ambient temperature too high	Ambient temperature outside contactor enclosure should not exceed 40°C (104°F)

Type 90H35 (5 kV) Contactor (Refer to **Figures 19** and **20**)

Item	Description	Part Number	Contactor Quantities	
			Drawout	Stationary
1	L.H. Side Rail	25-154-301-509	1	—
2	R.H. Side Rail	25-154-301-510	1	—
3	Side Angle	25-154-301-504	2	—
4	L.H. Side Plate	25-154-301-069	1	—
5	R.H. Side Plate	25-154-301-070	1	—
6	Insulator Molding	25-407-783-005	1	—
7	CPT Mounting Plate	25-154-301-513	1	—
8	CPT Fuse Block Assembly	25-154-301-508	1	—
9	Wheel	18-658-134-345	4	—
10	Wheel Shaft	25-154-301-034	4	—
11	Insulator Molding	25-407-783-001	3	—
12	Copper Spacer	25-131-570-001	3	—
13	Copper Spacer	25-135-186-072	3	—
14	LSI Mounting Bracket	25-154-301-074	1	—
15	Barrier	25-154-301-071	1	—
16	Interphase Barrier	25-154-301-072	2	—
17	Striker Bar	25-154-247-075	1	—
18	Guide	25-154-247-099	1	—
19	LSI Finger	25-135-753-001	1	—
20	LSI Support	25-154-301-073	1	—
21	Finger Assembly Line	25-131-570-527	3	—
22	Finger Assembly Load	71-240-055-501	3	—
23	CPT Fuse Clip	25-127-244-001	2	—
24	Fuse Clip Assembly Line	25-135-186-517	1	—
25	Fuse Clip Assembly Load	25-135-186-528	1	—
26	Terminal Block Bracket	25-154-301-068	1	—
27	Interlock Lever Assembly	25-213-070-502	1	—
28	Magnet Coil 120VAC	25-154-158-001	1	1
29	Magnet Coil 240VAC	25-154-158-002	1	1
30	Magnet Coil 125VDC	25-154-158-003	1	1
31	Magnet Coil 220VDC	25-154-158-004	1	1
32	Vacuum Bottle VS6602	25-154-158-005	3	3
33	Aux. Cont. 1 N.O.-1 N.C. (Left)	25-154-158-006	2	2
34	Aux. Cont. 1 N.O.-1 N.C. (Right)	25-154-158-007	2	2
35	Flexible Lead	25-154-158-017	3	3
36	Econ. Relay 120VAC	25-154-158-008	1	1
37	Econ. Relay 240VAC	25-154-158-009	1	1
38	Econ. Relay 125VDC	25-154-158-010	1	1
39	Econ. Relay 220VDC	25-154-158-011	1	1
40	Econ. Resistor 120VAC	25-154-158-013	1	1
41	Econ. Resistor 240VAC	25-154-158-014	1	1
42	Econ. Resistor 125VDC	25-154-158-015	1	1
43	Econ. Resistor 220VDC	25-154-158-016	1	1
44	Rectifier	25-154-158-012	2	2

SIEMENS

Siemens Energy
& Automation, Inc.
Electrical Apparatus Division

P.O. Box 29503
Raleigh, NC 27626
(919) 365-6660

MVC-9028 10/91

PRINTED IN U.S.A.