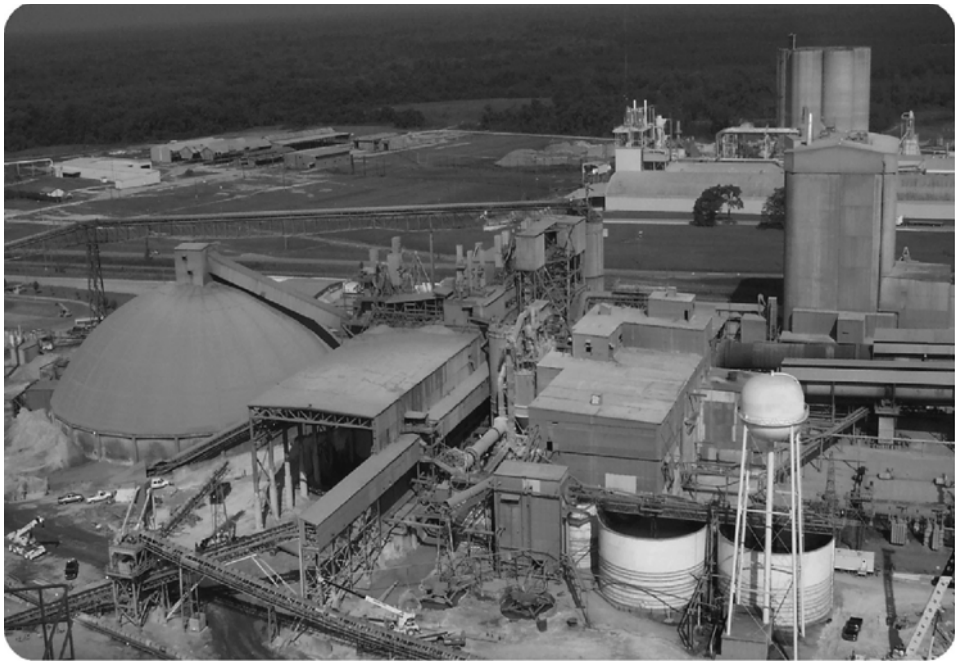
User Manual

Original Instructions

Allen-Bradley

Medium Voltage Contactor 800 A, 2400…7200V (Series F)

Bulletin 1502



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Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Summary of Changes

This table contains the changes made to this revision.

Topic	Page
Updated vacuum bottle replacement procedure	35

About This Publication

This manual pertains to the Allen-Bradley® Bulletin 1502, Series F version 800 A vacuum contactor. For earlier product series letters, contact your local Rockwell Automation representative.

Series F vacuum contactors are intended for use with electromechanical (relay) control circuits and with IntelliVAC™ and IntelliVAC™ Plus control modules. See publications 1503-UM053 and 1503-UM054 respectively.

This manual is intended for engineers or technicians that are directly involved in the installation, connection, energizing, and maintenance of the Medium Voltage 800 A Contactor.

What This Manual Contains

This user manual contains the following sections:

- Contactor description, including dropout times and specifications
- Information on how to receive, handle, and store the contactor
- How to mount the contactor, which includes typical electrical and wiring diagrams
- Tools that are required to maintain the contactor, recommended torque values, and how to perform routine maintenance tasks
- Troubleshooting section that outlines symptoms, possible causes, and how to remedy them
- Spare Parts list

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Medium Voltage Controllers, Bulletin 1512A 800A One-High Cabinet, Standard and Arc Resistant Enclosure User Manual, publication 1512A-UM102	Provides information on installation, maintenance, and spare parts for standard and arc resistant enclosures
IntelliVAC Contactor Control Module User Manual, publication 1503-UM053	Provides information on receiving and storage, installation, setup, monitoring, and spare parts for the IntelliVAC Contactor Control Module
IntelliVAC Plus Contactor Control Module User Manual, publication 1503-UM054	Provides information on receiving and storage, installation, wiring, programming, and troubleshooting for the IntelliVAC Plus Contactor Control Module
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Contactor Product Overview

Description

The vacuum contactors are designed for high horsepower applications in the 2400...7200V range. These contactors are suitable for all types of AC loads, for example: three-phase motors, transformers, power capacitors, and resistive heating loads. Mechanically latched contactors are used in situations that require the contactor to remain closed during a power failure.

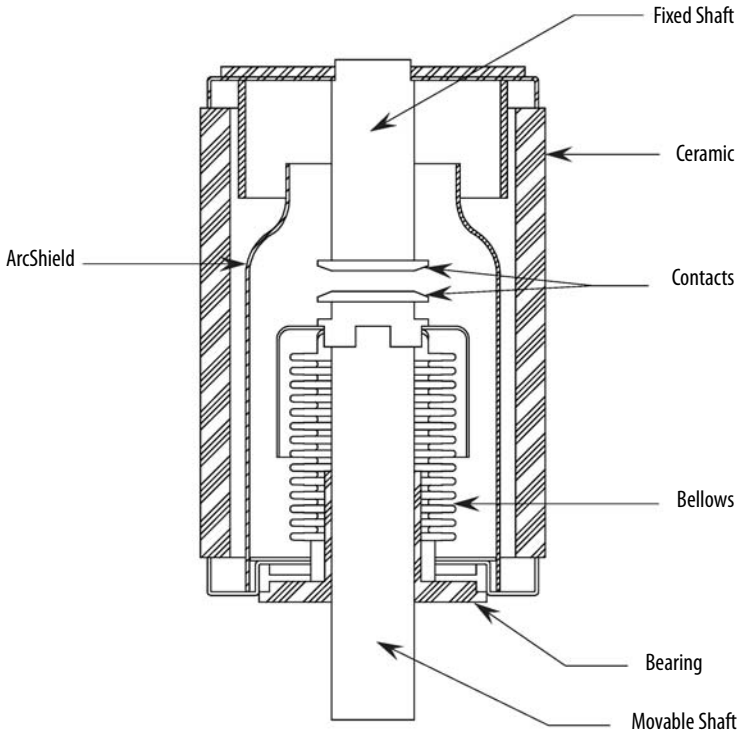
The contactor uses three interrupters (referred to as vacuum bottles) operated by an electromagnet assembly through a mechanical linkage. They are resistant to adverse atmospheric conditions and provide a long mechanical and electrical life.

The contactors are used in various starter and drive configurations. They are fixed-mounted in the structures and the line and load terminations are made at the rear of the device. In most configurations, the main contactor is mechanically interlocked with the external operating handle and isolation switch.

Vacuum Bottle Description

The vacuum bottle (Figure 1) consists of two contacts that are enclosed in a ceramic housing. One contact is mounted on a fixed shaft, and the other is attached to a movable shaft. The bearing and stainless steel bellows verify that the movable contact tracks accurately and maintains vacuum integrity within the bottle.

Figure 1 - Typical Vacuum Bottle Cross Section



Contactor Operation

The standard electrically held contactor consists of three vacuum bottles that are operated by an electromagnet assembly through a mechanical linkage (Figure 2 on page 10).

Electromechanical Relay Controlled

- When the control circuit is energized, current flows through both a closing coil and hold-in coil, which creates an electromagnet.
- This electromagnet pulls the armature plate towards the coil core, which also rotates the actuator shaft.
- The actuator plate, in turn, pushes the insulator and vacuum bottle movable shaft up, which closes the contacts inside the vacuum bottle.
- The control circuit economizing/auxiliary contacts, which are on the left side of the contactor, change state once the contactor fully closes.
- The current that is energizing the closing coil is then switched off. The contactor remains closed by the hold-in coil only.
- The contactor is opened by de-energizing the hold-in coil.

The mechanical latch version of the contactor operates similarly with the following exceptions:

- Both coils are de-energized upon closing of the contactor, and the armature plate is held in the closed position by a spring-loaded latching mechanism.
- The contactor is opened by energizing a trip coil that pulls the latch away from the armature, or by engaging a manual trip mechanism (see Figure 3 on page 10). The manual trip mechanism is operated by push button on the front of the medium voltage door.

External control relays and a rectification circuit are used to control the standard DC closing and hold-in coils on the contactor. Only use Rockwell Automation approved control components to achieve optimal performance.

IntelliVAC Controlled

The electrically held vacuum contactor operates as follows:

- When the IntelliVAC or IntelliVAC Plus control modules receive a close command, the contactor coil is energized, the current creates an electromagnet in the coil.
- The electromagnet pulls the armature plate towards the coil core, which rotates the shaft and causes the actuator plate to move upwards.
- As the actuator plate moves, it pushes the insulator and movable shaft up, which closes the contacts in the vacuum bottle.
- The IntelliVAC or IntelliVAC Plus control modules supply the close current to the coil for approximately 200 ms. Afterward, the coil current is reduced to a lower hold-in value.
- When the IntelliVAC and IntelliVAC Plus control modules remove the close command, the coil is de-energized, which opens the contactor.

The mechanical latch contactor operates similarly as the electrically held version with a few exceptions:

- Once the contactor is closed, a spring-loaded mechanism moves a roller against the armature plate to hold it against the electromagnetic core.
- The contactor can be opened electrically by energizing a trip coil (via IntelliVAC and IntelliVAC Plus open output) which pulls the latch away from the armature. The contactor can also be opened using a push button that is mounted on the power cell door that mechanically releases the contactor.

Figure 2 - Vacuum Contactor Operation

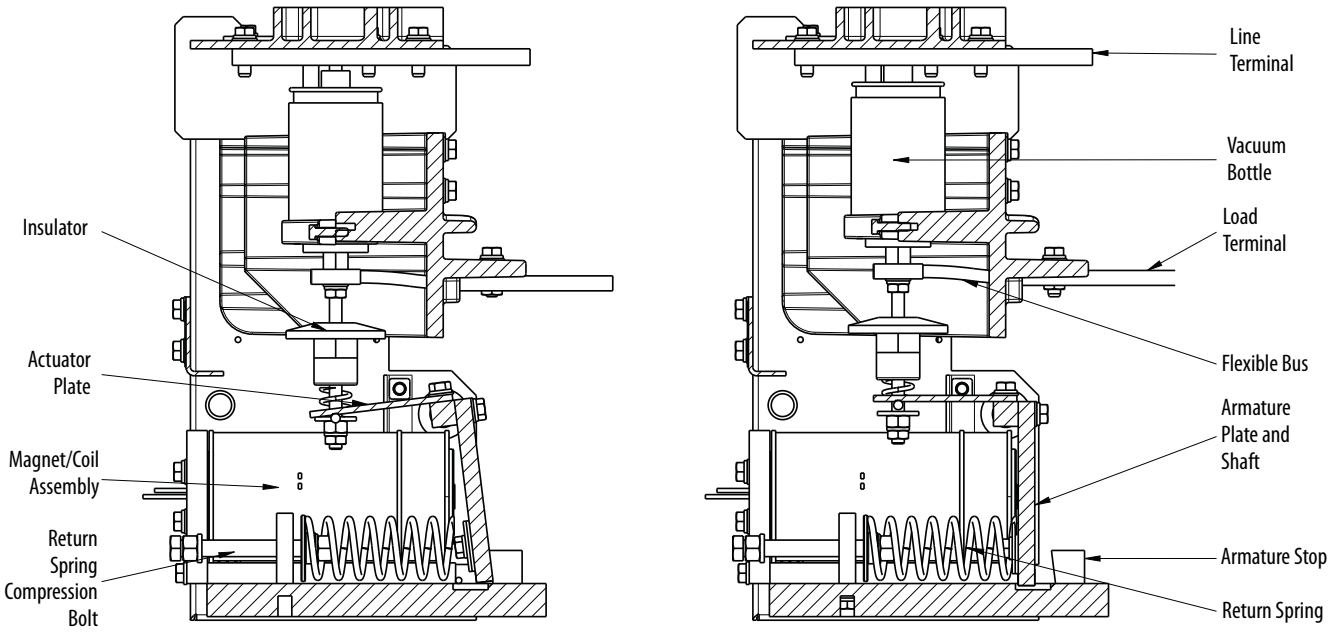
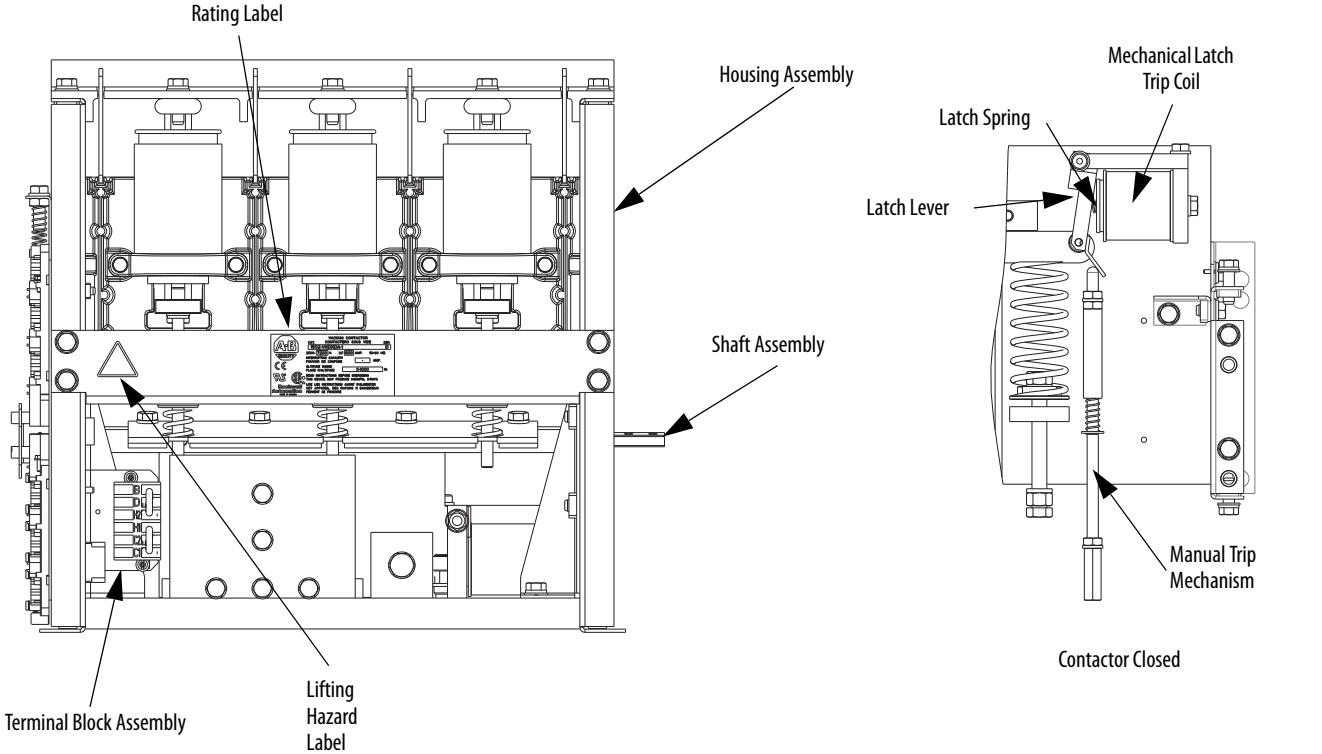


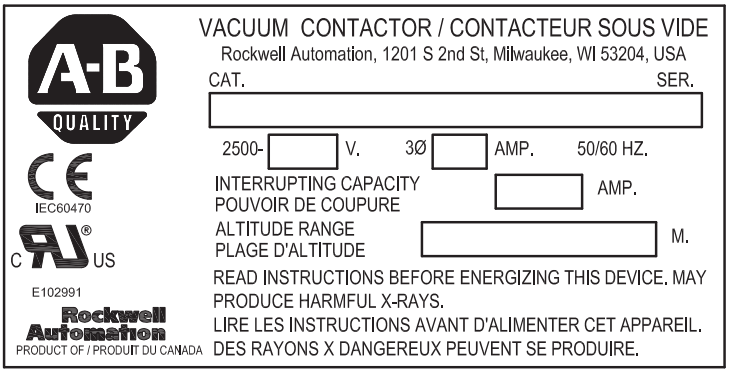
Figure 3 - Mechanical Latch Operation



Contactor Identification

Each contactor is identified with a nameplate (Figure 4) attached to the brace at the front of the contactor. The nameplate information includes the Catalog Number, Series Letter, Voltage Rating, Non-enclosed Current Rating, Interrupting Capacity, Altitude Range, and UL markings.

Figure 4 - Contactor Label



Catalog Number Explanation

The following catalog number explanation is used to identify the contactor and must be used when contacting your Rockwell Automation sales office for assistance.

Position

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1502 –	**V**	**8**	**D**	**X**	**D**	**A**	**–__**
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*

a

Bulletin Number	
1502	Bulletin 1502

b

Contactor Type	
V	Vacuum (for electromechanical relay control)
VC	Vacuum (optimized for IntelliVAC control)

c

Contactor Size	
8	800 A

d

Nominal Line Voltage	
D	7200V

e

Control/Potential Transformer Primary Fuse Mounting Provisions	
X	None

f

Coil Voltage	
D	110V DC (120V AC)
E	207V DC (230V AC)

g

Function	
A	3 pole, electrically held contactor
B	3 pole, mechanically latched contactor with electrical and mechanical release
D	3 pole, electrically held contactor with fast dropout

h

Altitude Code (m)	
1	0…1000
2	1001…2000
3	2001…3000
4	3001…4000
5	4001…5000

Contactor Dropout Times

The IntelliVAC or IntelliVAC Plus contactor control module (publications 1503-UM053 and 1503-UM054) varies the time at which the electrically held vacuum contactor opens.

When electromechanical relays are used to control the electrically held contactor, there are two times available: normal dropout time and fast dropout time. Changes to the onboard contactor control circuitry control the opening speed (see Figure 7 through Figure 11).

Contactors that are configured for faster dropout times are used for specific applications if faster action is required.

The dropout time must be longer than the Total Clearing Time of the medium voltage power fuses being applied in combination with the vacuum contactor. Damage to the contactor can occur if this coordination is not addressed appropriately.

All mechanically latched contactors have fast dropout times, which correspond to the reaction time of the trip mechanism.

Contactor Specifications

Table 1 - Voltage Rating(1)

Maximum Rated Voltage		7200V
System Voltages		2400V, 3300V, 4160V, 4800V, 6600V, 6900V
Dielectric Voltage Withstand Rating	For 60 s	18.2 / 20 (IEC) kV
Basic Impulse Level (B.I.L.) Withstand	Phase to Ground, Phase to Phase	60 kV
Frequency Ratings		50/60 Hz

(1) The voltage ratings that are listed are valid up to 1000 m (3300 ft). See Table 9 for ratings above this altitude.

Table 2 - Current Ratings(1)

Rated Continuous Current		800 A
Maximum Interrupting Current Rating	2400V	12,500 RMS symmetrical amps
	5000V	12,500 RMS symmetrical amps
	7200V	12,500 RMS symmetrical amps
Maximum Interrupting MVA Rating	2400V	50 Sym MVA
	5000V	100 Sym MVA
	7200V	150 Sym MVA
Short-Circuit Withstand at Rated Voltage	Current Peak ½ cycle	85 kA
Short Time Current Rating Capability	For 1 s	12.0 kA
	For 30 s	4.8 kA
Make and Break Capability at Rated Voltage		8.0 kA
Ambient Temperature		40 °C (104 °F)

(1) The current ratings that are listed are valid up to 1000 m (3300 ft). See Table 9 for ratings above this altitude.

Table 3 - Contactor Coil Data, IntelliVAC Controlled

Description			Value
Control Voltage (V_{CTL})	Coil Voltage (V_{CL})		
110…240V AC or 110…250V DC[1]	VAC: $V_{CL} = \sqrt{2} \times V_{CTL}$ (Max.) VDC: $V_{CL} = C_{CTL}$	Close Current	12 A_{DC} (200 ms)
		Hold Current	0.7 A_{DC}
		Pick-up Voltage[1]	95V
		Dropout Voltage[1]	75V
		Trip Current	5.2 A_{DC} (200 ms)
		Trip Voltage[1]	70V

(1) Control voltage, as measured at the input of the IntelliVAC and IntelliVAC Plus control modules.

Table 4 - Contactor Coil Data, Electromechanical Relay Controlled

Description		Value
Control Voltage (V_{CTL}) 120V AC/ 230V AC	Coil Inrush Current – Electrically Held	13.1 A
	Coil Inrush Current – Mechanical Latch	13.1 A
	Coil Inrush Current – Mechanical Latch Trip	5.6 A
	Coil Continuous Current	0.24 A
	Coil Pick-up Voltage	102V AC
	Coil dropout Voltage	75V AC
	Trip Voltage	84V AC
Coil Voltage (V_{CL}), 110V DC/ 208V DC	Coil Inrush Current – Electrically Held	7.1 A
	Coil Continuous Current	0.13 A
	Coil Pick-up Voltage	196V AC
	Coil dropout Voltage	145V AC

Table 5 - Operational Characteristics

Mechanical Life[1]	Electrically Held	250,000 operations
	Mechanical Latch	100,000 operations
Electrical Life[1]		250,000 operations
Switching Frequency	Electrically Held	600 operations per hour
	Mechanical Latch	150 operations per hour

(1) If regular maintenance is performed, as detailed in this manual.

Table 6 - Opening and Closing Times

Electromechanical Relay Controlled		
Maximum Closing Time (120V AC)	50/60 Hz	200 ms
Maximum Opening Time (Normal Dropout)	50/60 Hz	250 ms
Maximum Opening Time (Fast Dropout and Mechanical Latch)	50/60 Hz	70 ms
IntelliVAC and IntelliVAC Plus Control		
Maximum Closing Time	120/240V AC	150 ms
Maximum Opening Time (without delay)(1)	120/240V AC	70 ms

(1) A contactor drop-out delay can be configured with the IntelliVAC or IntelliVAC Plus control module (refer to publications 1503-UM053 and 1503-UM054).

Table 7 - Capacitor Switching

System Voltage	2400V	2000 KVAR
	4160V	3000 KVAR
	6900V	4000 KVAR

Table 8 - General

Standard Altitude Capability (1) (2)	1000…5000 m (3300…16,500 ft)
Contactor Weight	53.5 kg (118 lb)
Auxiliary Contact Rating	A600
Auxiliary Contacts on the Vacuum Contactor (max.)(3)	3 N.O. / 3 N.C.

(1) The voltage and current ratings that are listed are valid up to 1000 m (3300 ft). See Table 9 for ratings above this altitude.

(2) Altitude adjustment is required.

(3) The number of contactor auxiliary contacts depends on the contactor type. Some of the contacts are used in the typical control schemes used.

Table 9 - Altitude Code/Derating

Altitude Range	Reduce Max. 800 A Continuous Current Rating By:	Reduce B.I.L. Withstand Rating By:
0…1000 m (0…3300 ft)	—	—
1001…2000 m (3301…6600 ft)	20 A	6.0 kV
2001…3000 m (6601…9900 ft)	40 A	12.0 kV
3001…4000 m (9901…13,200 ft)	60 A	18.0 kV
4001…5000 m (13,201…16,500 ft)	80 A	24.0 kV

Product Approvals

- UL347
- CSA 22.2 No. 253
- IEC 62271-106
- CE marking

Receiving and Handling

Receiving

Before leaving the factory, the contactors are tested mechanically and electrically. Immediately upon receiving the contactor, remove the packing material and check the contactor for possible shipping damage. If damage is found, do not discard any of the packaging materials and, if possible, note the damage on the Bill of Lading before accepting the receipt of the shipment. Report any damage immediately to the claims office of the common carrier. Provide a description of the damage and as much identification as possible.

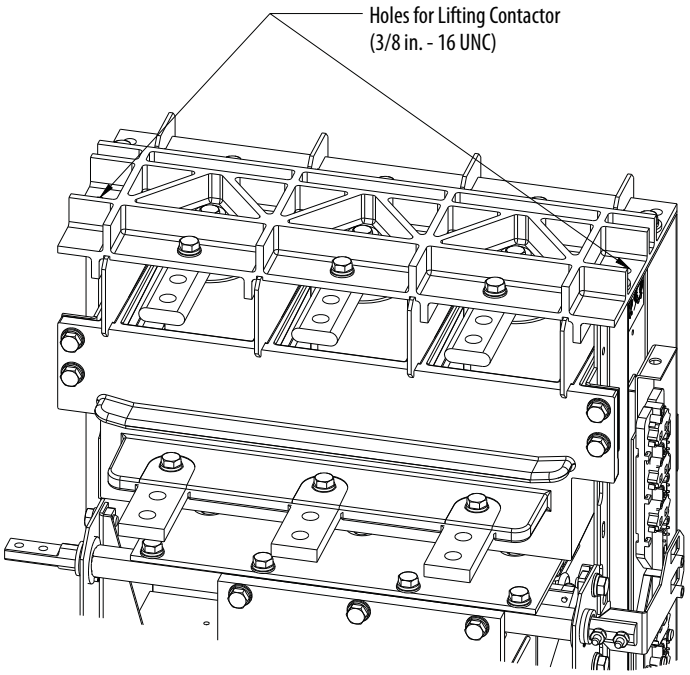
Preliminary Inspection

- Check for any cracks or breaks due to impact.
- Push the armature plate to verify that mechanisms are in good working order.
- Use a high potential testing instrument to verify vacuum bottle integrity (see Vacuum Bottle Integrity Test on page 32).

Handling

The contactor weighs approximately 53.5 kg (118 lb). Two people can safely handle the contactor for a short duration (injury can occur if one person attempts to handle the equipment). The following procedure can be used if a crane or hoist is used to handle the contactor.

1. Insert two 3/8 in.-16 UNC lifting bolts into the holes that are provided on the top of the contactor and attach the lifting means to the contactor with ropes or cables. Use rigging with safety hooks or shackles.



2. Select or adjust the rigging lengths to compensate for an unequal weight distribution of the load. Always maintain the contactor in an upright position.
3. To reduce the tension of the rigging and the compressive load on the lifting device, do not allow the angle between the lifting cables and vertical to exceed 45°.
4. Do not lift a contactor above an area where personnel are located.

When a forklift is used to handle the equipment, the following considerations must be taken:

- Keep the contactor in an upright position.
- Carefully balance the contactor on the forks.
- Use a safety strap when handling to steady the contactor and avoid shifting or tipping.
- Avoid excessive speeds and sudden starts, stops, and turns when handling the contactor.
- Do not lift a contactor above an area where personnel are located.

Pre-energization Inspection

Before placing the contactor in service, inspect it carefully for any damage that was sustained in transit or during maintenance:

- Check that all interphase barriers are correctly installed.
- Check housing for any cracks or breaks due to impact.
- Push the armature plate, rotating shaft to verify that the mechanism is in good working order.
- Inspect the contactor for dirt, stray loose hardware, tools, or metal chips and, if necessary, vacuum clean.

Storage

If it is necessary to store the contactor before it is put into service, store it in a clean, dry, dust, and condensation free area. Do not store the contactor outdoors.

Maintain a storage temperature between -20...+75 °C (-4...+149 °F). If the storage temperature fluctuates or if the humidity exceeds 85%, use space heaters to prevent condensation. Rockwell Automation recommends storing the contactor in a heated building with air conditioning.

Notes:

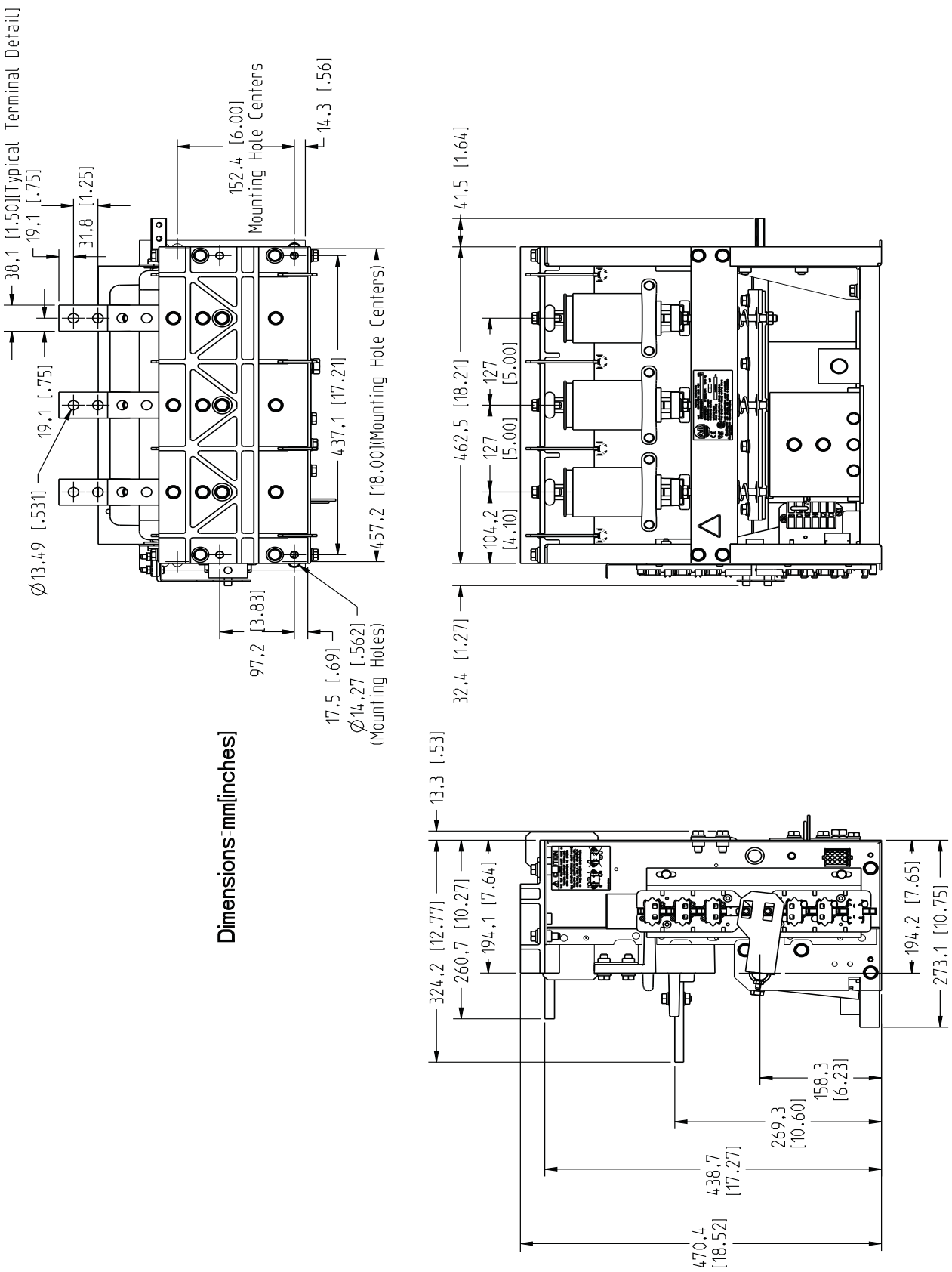
Installation

Mounting

The 800 A vacuum contactor is normally bolted to the controller enclosure. There are four mounting holes at the base of the contactor (Figure 5) to secure it to the enclosure. For reversing, autotransformer, and 2-speed controllers, one contactor can be mounted on top of the other. There are four threaded mounting holes at the top of the contactor to accommodate this configuration.

IMPORTANT The contactor is a bolted assembly and is therefore subject to being twisted if it is secured to an uneven surface. The contactor mounting plate has small stand-offs that permit the contactor to be fastened without twisting the frame. The contactor may not function correctly if it is forced onto an uneven mounting surface.

Figure 5 - Contactor Mounting Details

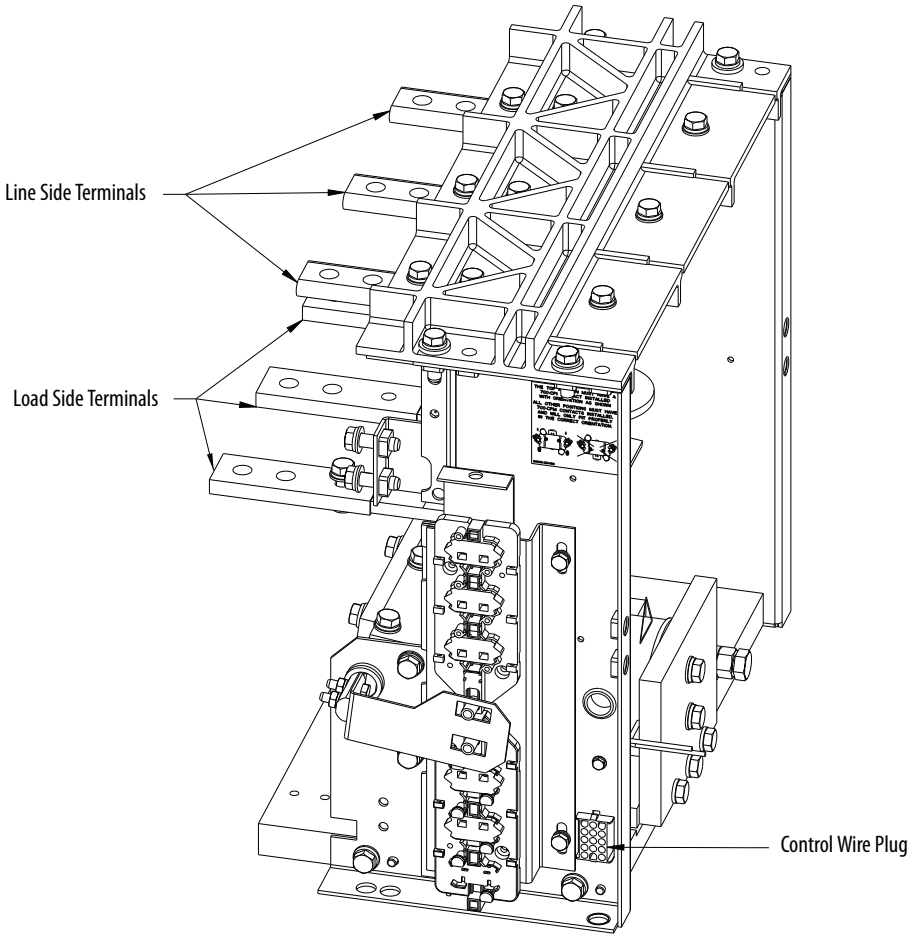


Electrical Connections

The control wiring from the low voltage panel to the contactor is made through a wire harness. The wiring connects to the left side of the contactor with a male and female configured wire plug.

The power wiring terminates on the rear side of the contactor to the line and load terminals. Holes are provided to accommodate 12 mm (1/2 in.) hardware (Figure 6).

Figure 6 - Electrical Connections



Wiring and Schematic Diagrams

Figure 7 - Electrically Held Electromechanical Relay Controlled Contactor (Normal Dropout Time)

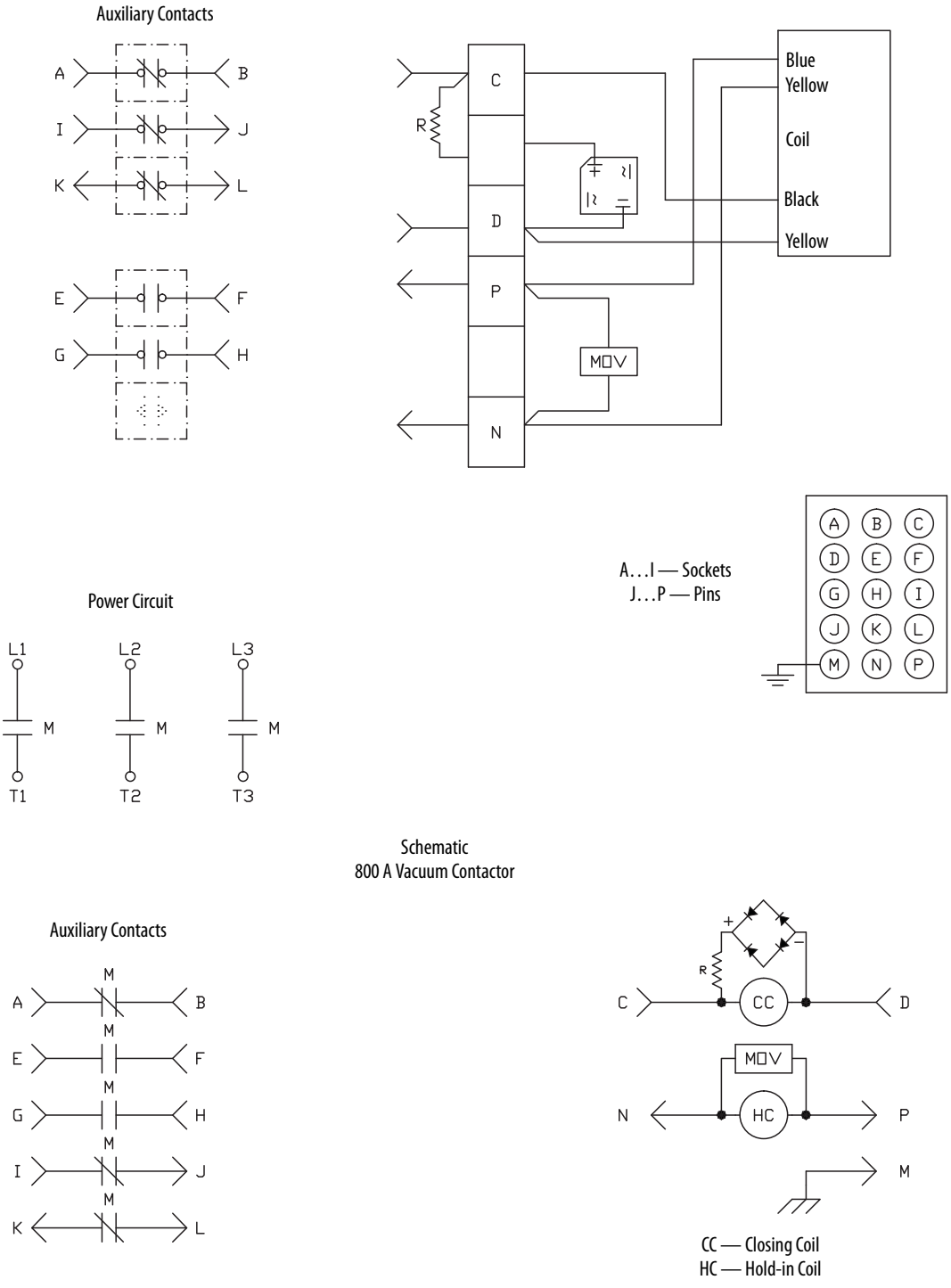


Figure 8 - Electrically Held Electromechanical Relay Controlled Contactor (Fast Dropout Time)

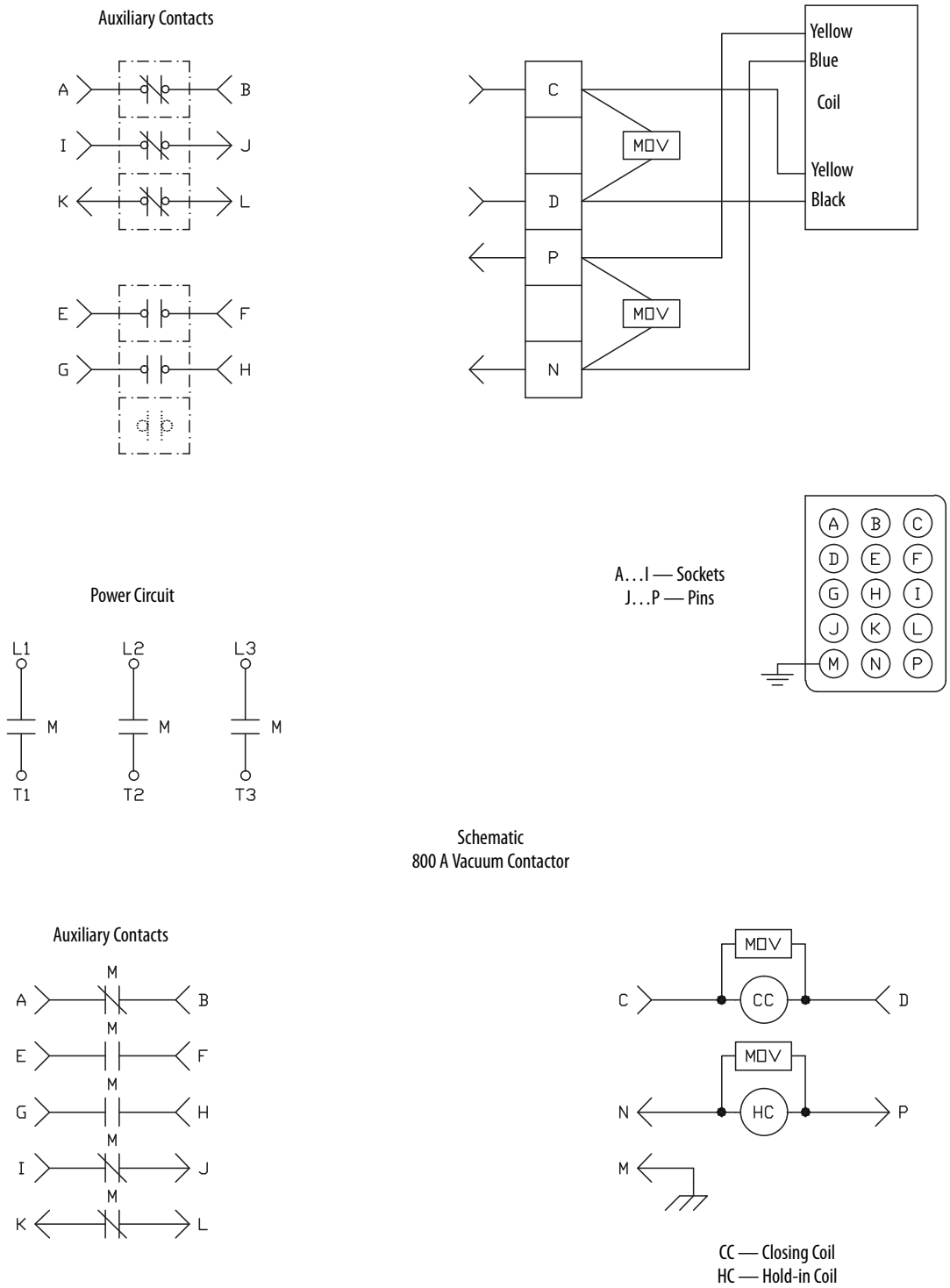


Figure 9 - Electrically Held IntelliVAC Controlled Contactor

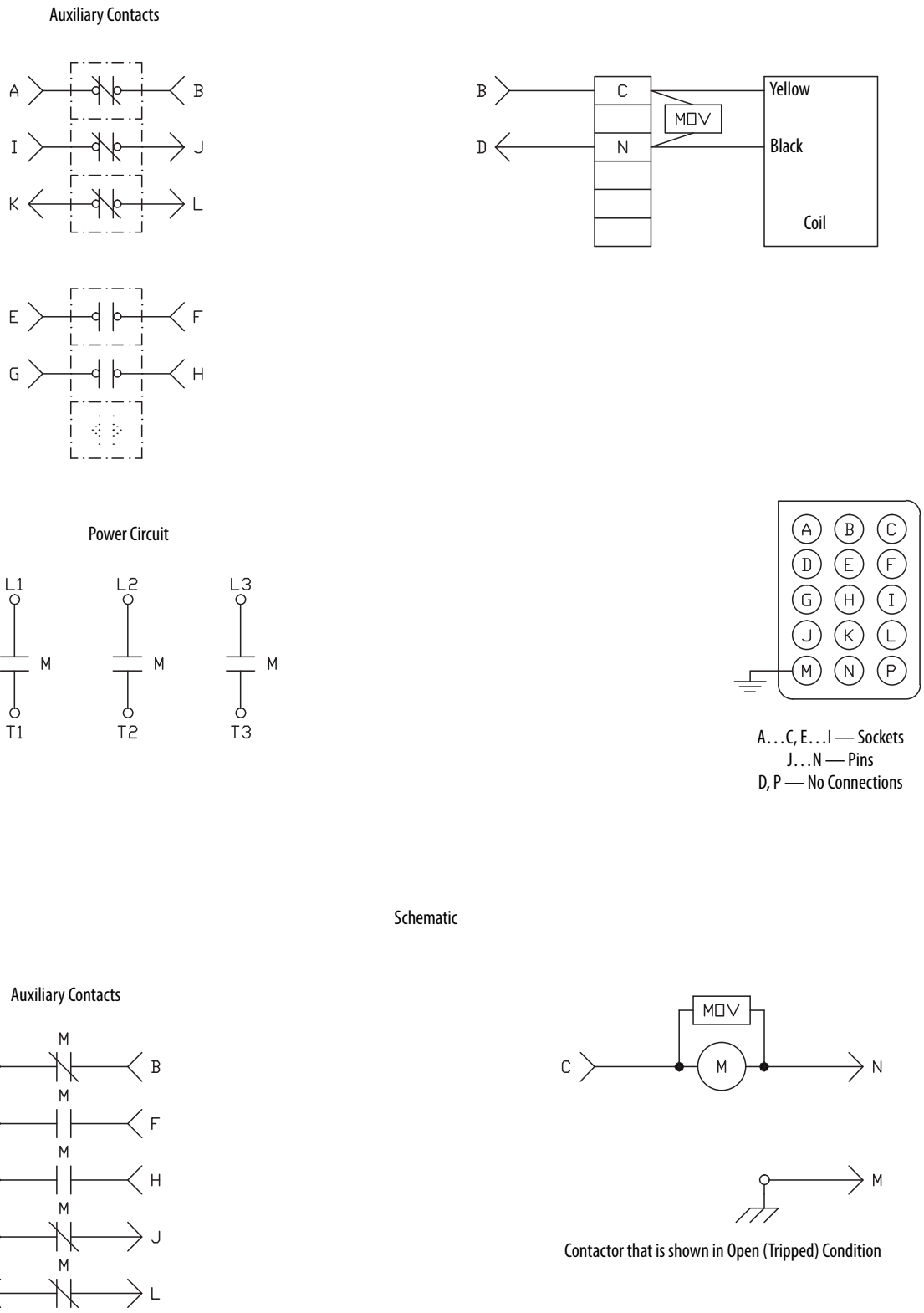


Figure 10 - Mechanical Latch Electromechanical Relay Controlled Contactor

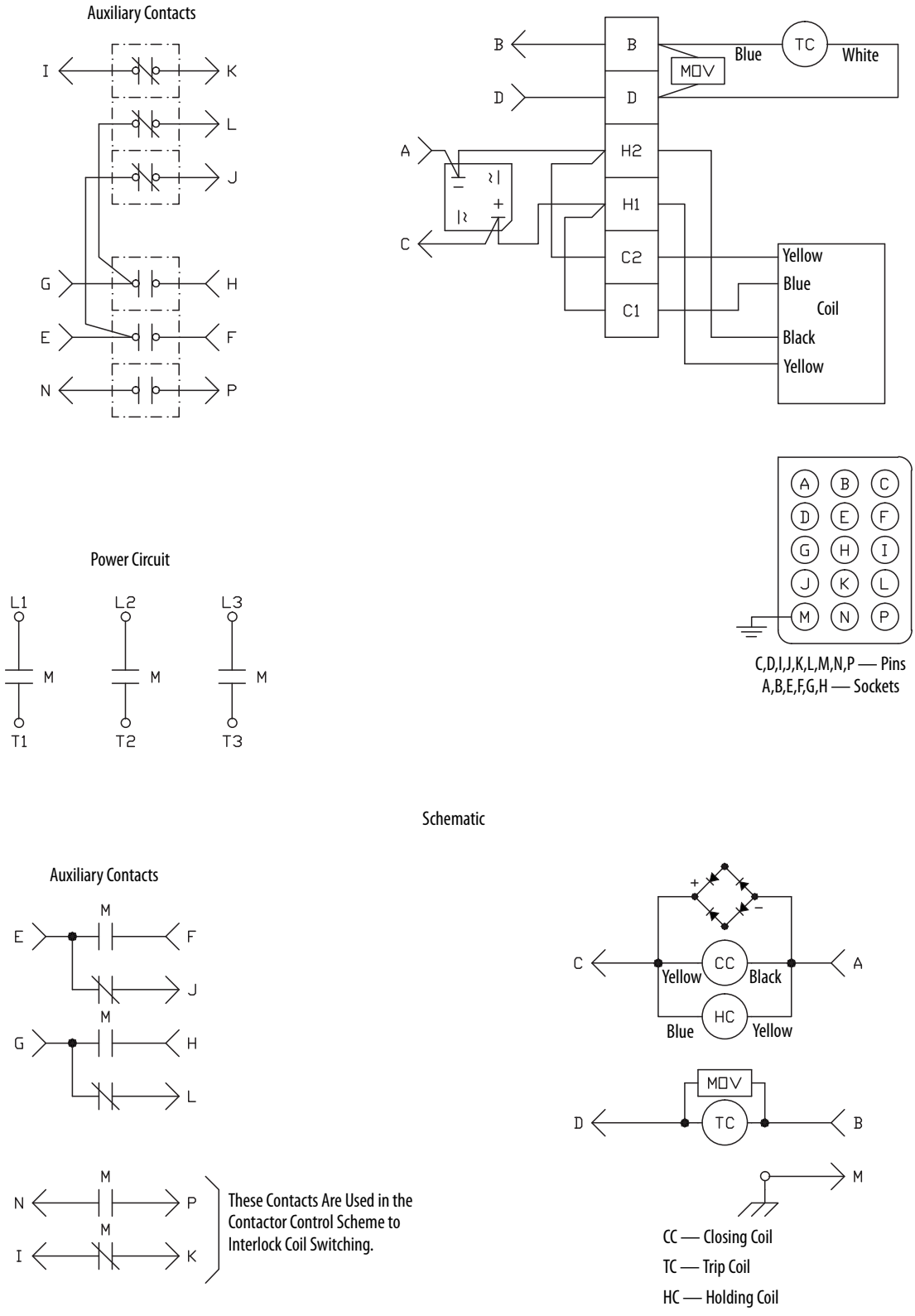
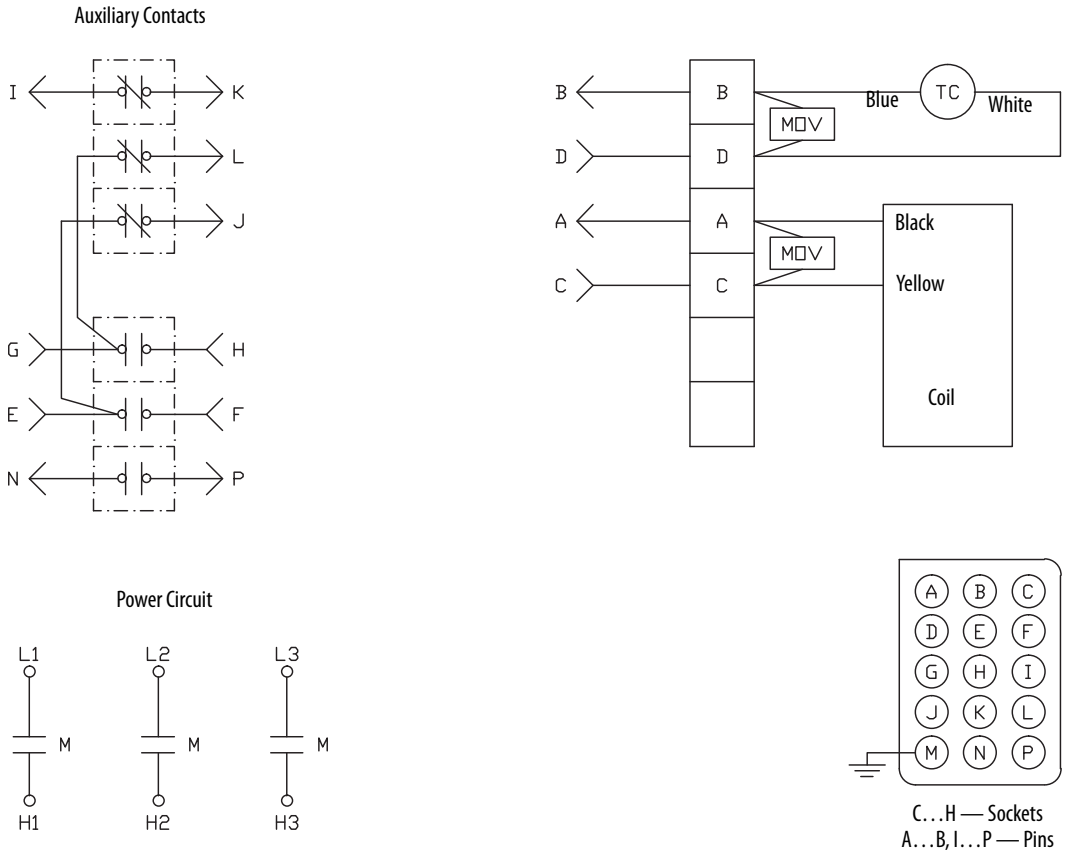


Figure 11 - Mechanical Latch IntelliVAC Controlled Contactor



Basic Electrical Diagrams

Figure 12 - FVNR Controller (Electrically Held Electromechanical Relay Controlled Contactor, 120V AC, Normal Dropout Time)

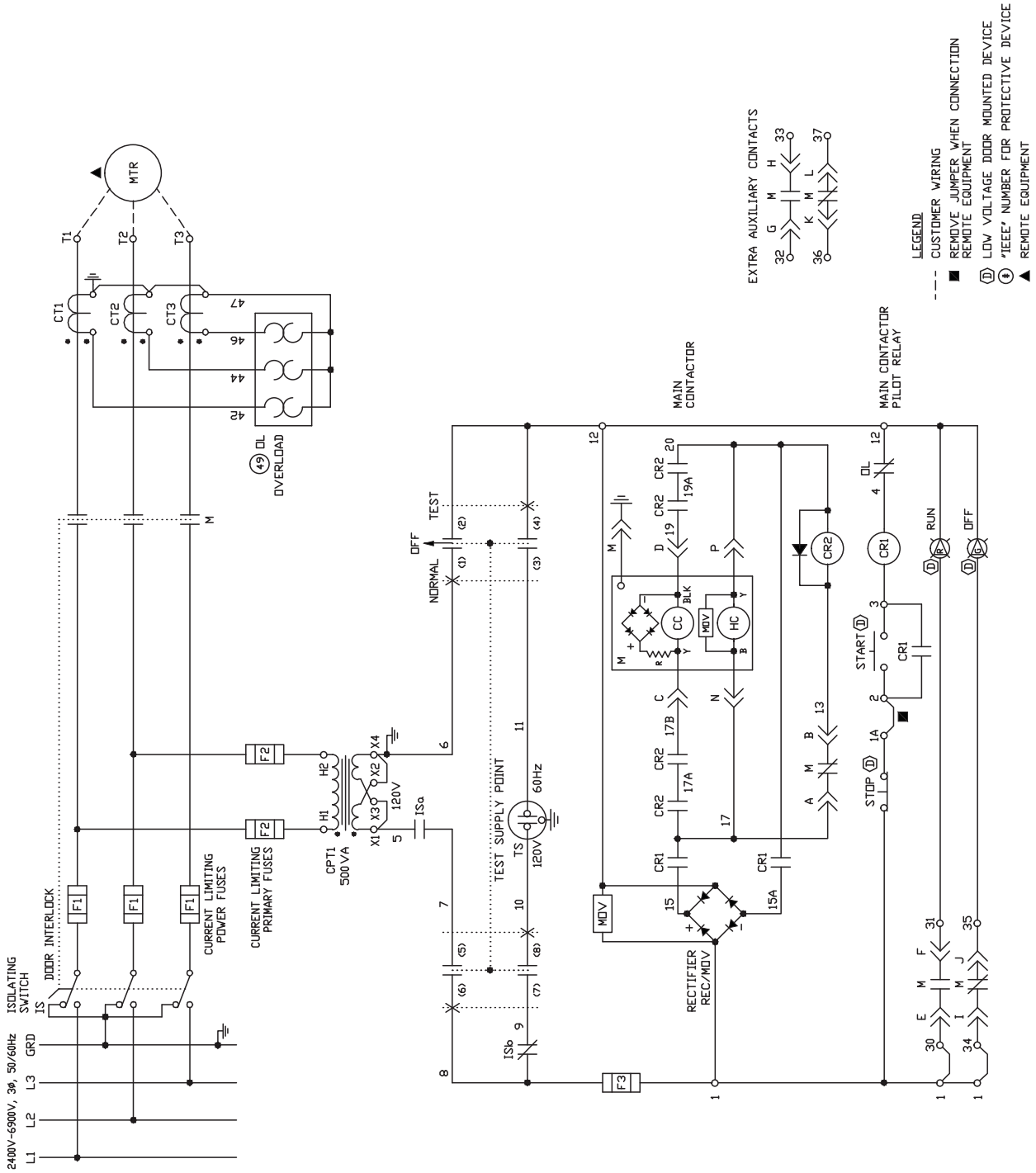


Figure 13 - FVNR Controller (Mechanical Latch Electromechanical Relay Controlled Contactor, 120V AC)

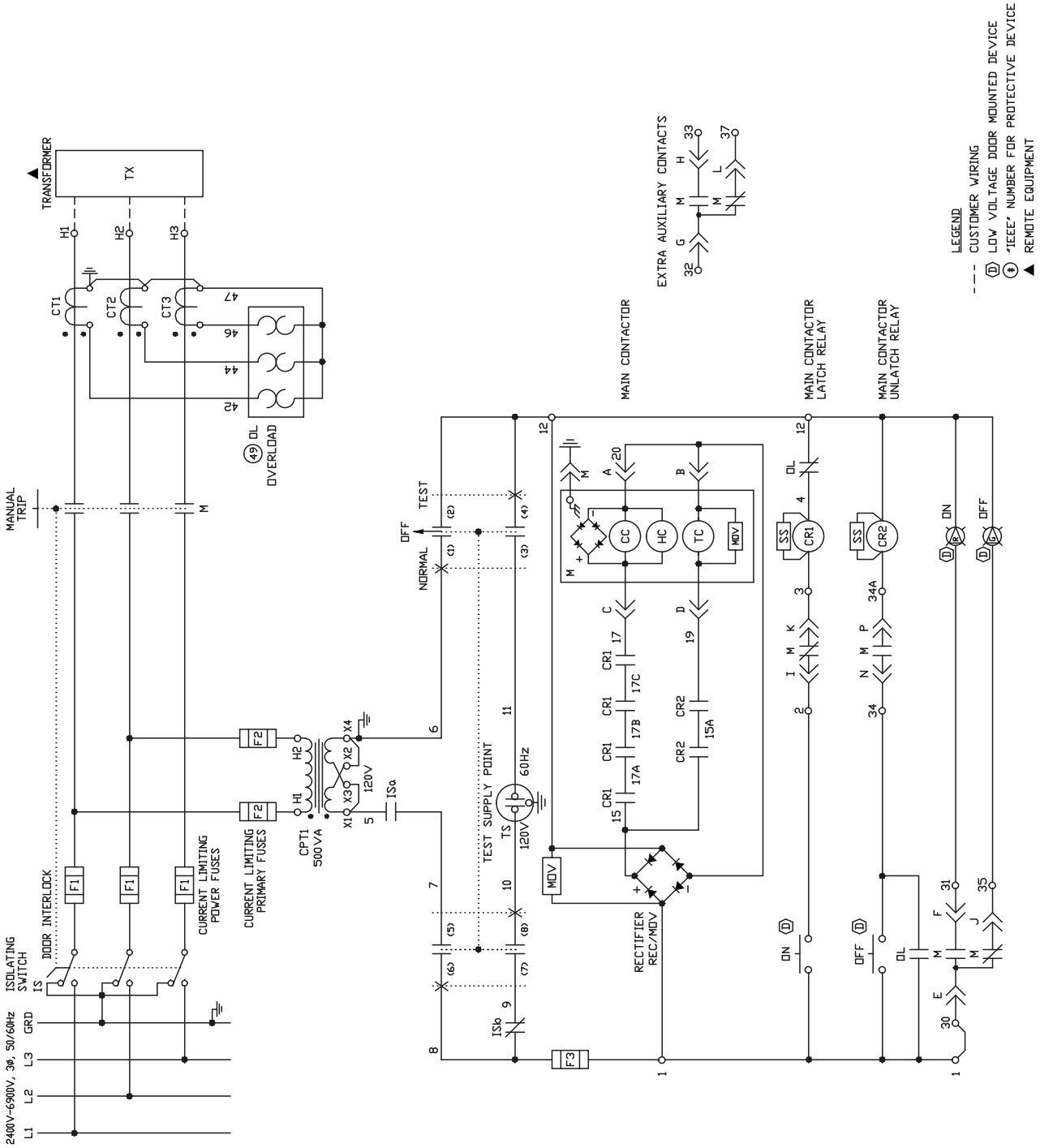


Figure 14 - FVNR Controller (Electrically Held IntelliVAC Controlled Contactor)

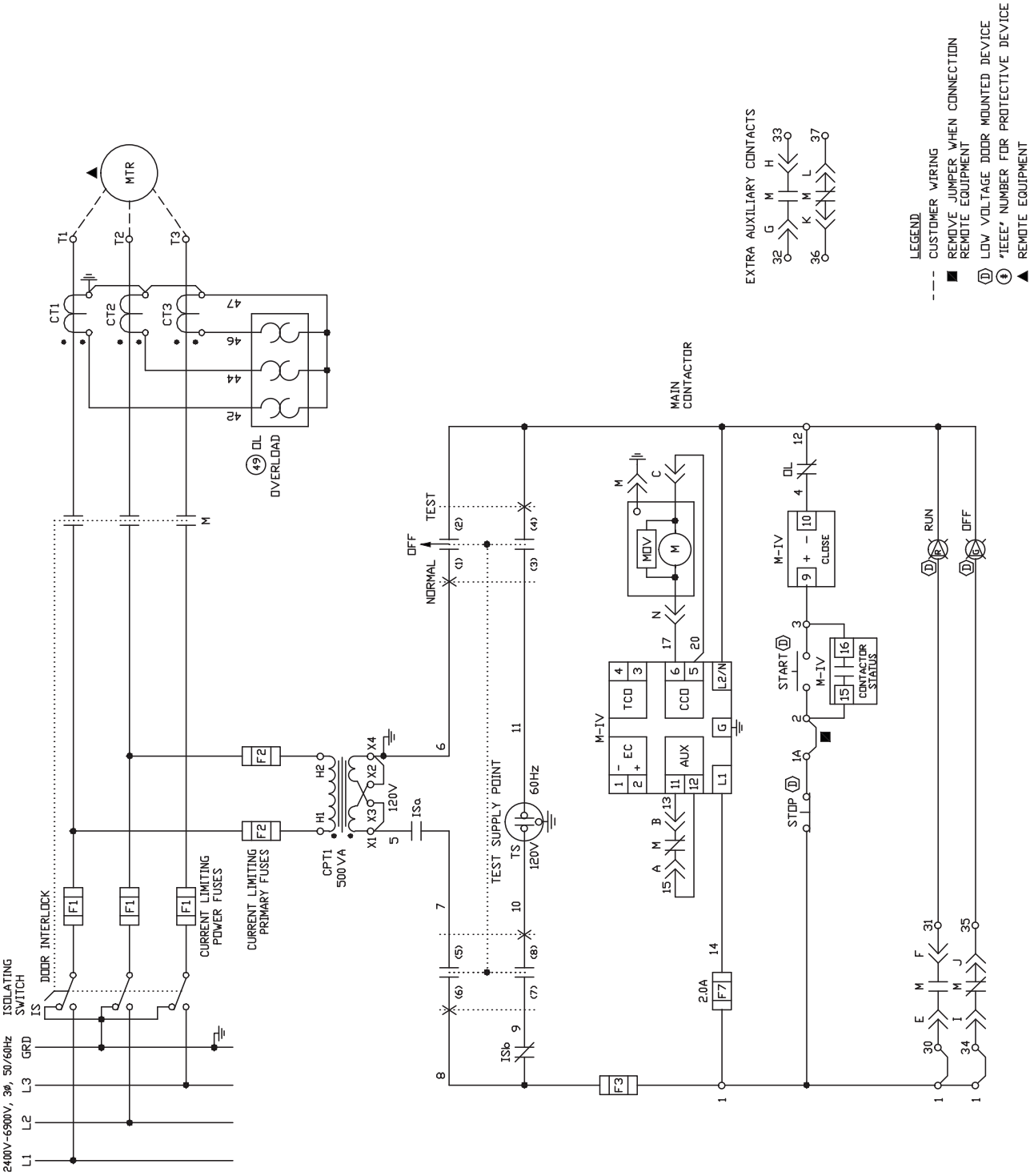
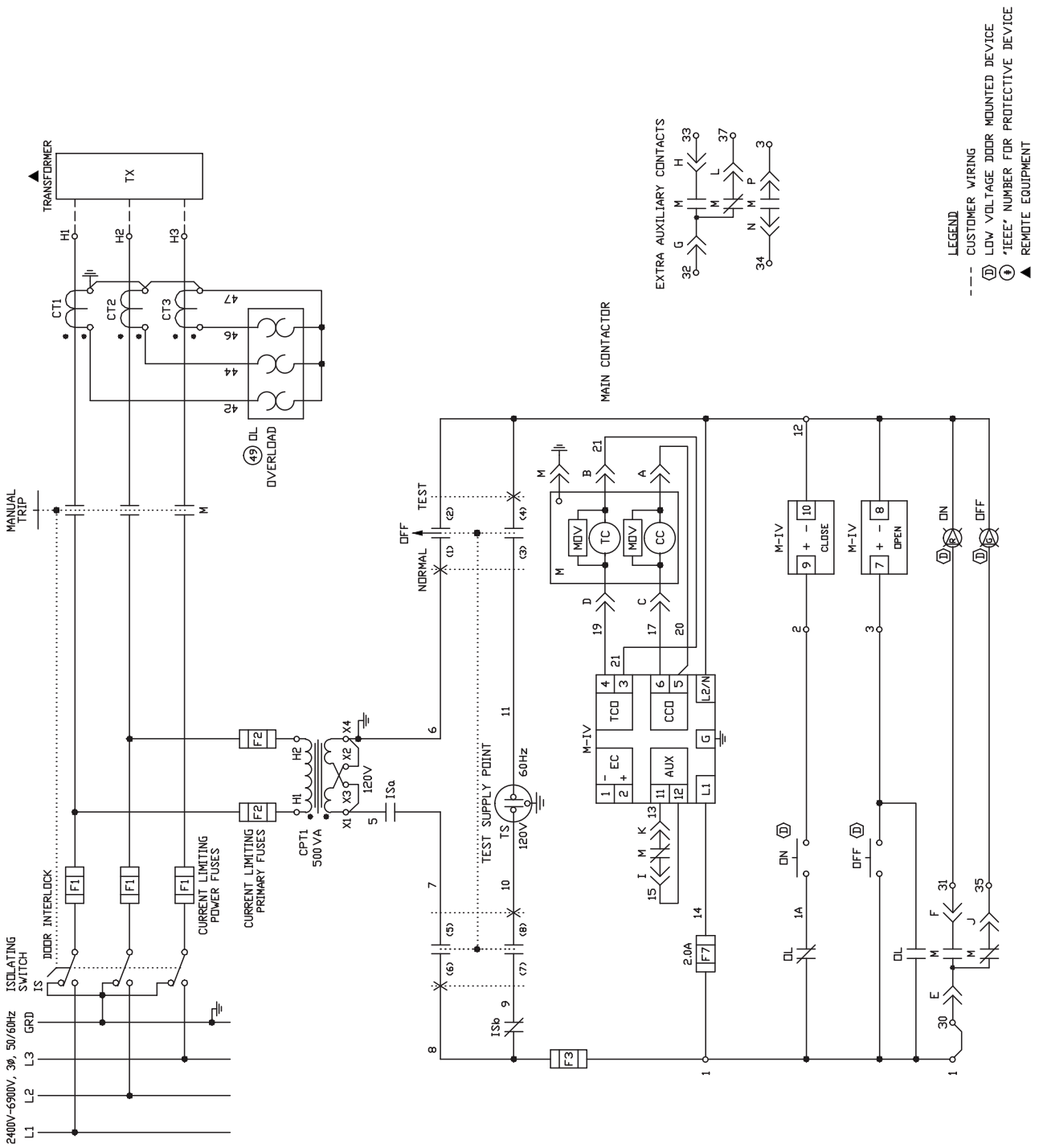


Figure 15 - FVNR Controller (Mechanical Latch IntelliVAC Controlled Contactor)



Maintenance

Required Tools

When maintenance is performed on the vacuum contactor, the following tools are required.

- 3/8 in. drive ratchet wrench with extension
- 3/8 in. drive torque wrench
- Standard 3/8 in. drive sockets; 7/16 in., 9/16 in., 3/4 in.
- Open-end wrenches: 7/16 in., 9/16 in., 11/16 in., 3/4 in., 7/8 in.
- 3/16 in. Allen key
- 3/16 in. dia. rod
- Slot head screwdrivers; 1/8 in. wide, 1/4 in. wide
- Feeler gauge set (0.125 in. and 0.300 in.)
- Digital caliper capable of depth measurement
- High potential tester

Recommended Torque Values

Part of the contactor may have to be disassembled for maintenance or replacement. There are appropriate torque requirements for particular bolt sizes when reassembling the contactor. Use these specified torque values.

Table 10 - Torque Values

Hardware	ft•lb	N•m	lb•in
1/4 in.	6	8	72
5/16 in	11	15	133
3/8 in.	20	27	240
1/2 in.	48	65	576

Routine Maintenance

Perform the following tasks on an annual basis or whenever a contactor is serviced.

Cleaning

- Remove any metal chips or filings from around the electromagnet assembly (coil core pole face and mating armature plate) as they may affect proper operation of the contactor. If necessary, use a vacuum cleaner.

IMPORTANT Do not use compressed air to clean or remove dirt from surfaces or the enclosure. Compressed air can redistribute the dirt.

- If dirty, clean the white ceramic area of vacuum bottles with a clean lint-free cloth.

Vacuum Main Contact Inspection

Inspect the wear of the main contacts with the contactor energized. When any part of the wear indicator line, which is on the front side of the hex shaft, moves up into the bearing, replace all three vacuum bottles. Under normal conditions, this replacement is not necessary until the contactor has gone beyond the 250,000 rated life (100,000 for mechanical latch contactors).

Vacuum Bottle Integrity Test

This test determines the internal dielectric condition and vacuum integrity of the vacuum bottles. Clean the outside of the vacuum bottles with a lint-free cloth or industrial type wiper before performing the test. Test each bottle individually during this test.

ATTENTION: Vacuum interrupters can emit X-radiation that can be hazardous. X-rays can be produced when high voltage withstand test levels are placed across open contacts. Keep at least 2 m (6 ft) distance from vacuum interrupter during tests.

The vacuum bottles are tested thoroughly at the factory before shipment. However, the bottles can be damaged by mishandling during shipment. This damage may not be visible, so perform this test before the contactor is energized for the first time and each time it is returned to service after maintenance, adjustment, or repair. Otherwise this test must be performed at least once per year, and after each 50,000 operations

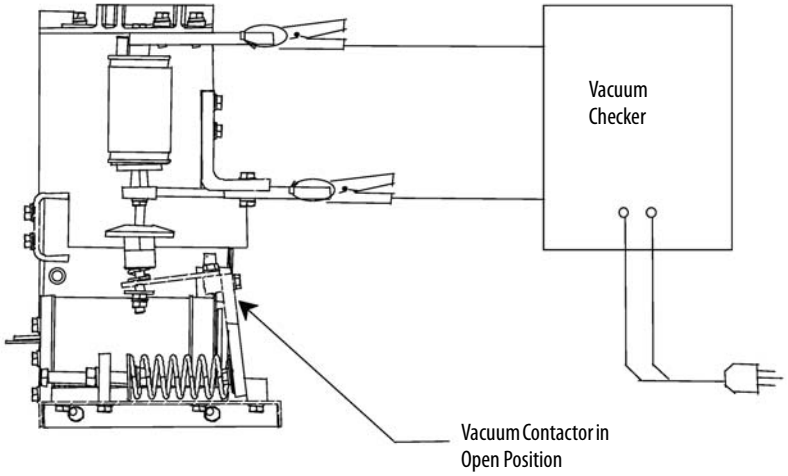
ATTENTION: High-potential test instruments can be purchased to perform the vacuum bottle integrity test. An insulation resistance tester cannot be used to measure vacuum integrity because the voltage is too low.

SHOCK HAZARD: High voltage is present during this test. Caution should be exercised during this test since high voltage testing is potentially hazardous.

ATTENTION: Before doing any work on the contactor, the controller isolation switch must be in the open position and locked out. If any control power is used from a separate source, it must be isolated. Verify that the equipment is voltage free by using a hot stick.

The contactor can be tested while it is in the power cell. The line connection of the contactor must be disconnected and the ground lead from the high potential testing instrument must be connected to the load side of the contactor.

1. With the contactor in the open position, connect the test leads to the contactor power terminals. It is recommended that an AC high potential testing instrument is used.
2. Apply 16 kV for 60 s and monitor the leakage current. It should not exceed 5 mA.



3. If no breakdown occurs, the bottle is in an acceptable condition. If a breakdown occurs, the bottle must be replaced.

   TIP Rockwell Automation recommends that, if the contactor has been in service, all three bottles be replaced simultaneously.

4. After the high potential voltage is removed from the bottles, discharge the metal end caps of the bottles with a grounding rod to remove any residual electrical charge.

The allowable leakage current of 5 mA is a maximum for new dry equipment, and is exclusive of leakage due to test equipment leads. The test setup leakage can be determined by running the dielectric test with test leads not connected to the contactor. Note the maximum leakage current. If this value is more than 2 milliamperes, it must be added to the 5 mA limit when testing the vacuum bottles.

IMPORTANT Rockwell Automation does not recommend DC high potential testing because the values that are obtained during the test are not a reliable indication of vacuum bottle integrity.

DC HiPot testing is unreliable due to the occurrence of a phenomenon known as Cathode Ray Tube Effect. This effect occurs when one contact of the vacuum bottle has a deformity, such as a burr or deposit, while the other contact remains flat and true. This deformity creates leakage currents that flow from a small surface to a large surface in one direction and vice versa when the polarity of the tester is changed. The resultant current is large in one direction that would incorrectly indicate a faulty vacuum bottle.

At best, DC testing verifies the vacuum integrity if both contact surfaces are perfectly smooth. It will not, however, give any indication of the degree of vacuum since the contact surface can feasibly change with each operation of the vacuum contactor. AC testing provides reliable vacuum integrity indication. As well, the degree of vacuum within the bottle can be determined by comparing initial test results to the present readings. Increases in leakage current indicate a reduction in vacuum within the vacuum bottle.

For these reasons, Rockwell Automation recommends AC testing as the only reliable method to test vacuum bottles.

Insulation Resistance Test

If using a 1000V insulation resistance tester, the resistance from phase to phase or phase to ground must be greater than 500 megohms.

Lubrication

Lubrication of the contactor is not necessary. Do not grease the armature shaft engineered resin bearings, nor the vacuum bottle resin bearings. The grease dries out and impedes the free motion of the contactor.

Mechanical Latch Mechanism Replacement

The mechanical latch mechanism must be replaced every 25,000 operations. Refer to Mechanical Latch Mechanism Refurbishing Kit Procedure on page 42.

SHOCK HAZARD: High voltage may be present, which can result in severe injury or death. It is suggested that a "Hot Stick" be used to verify that the equipment is dead. Lockout any incoming power and disconnect the control plug from the contactor before working on this equipment.

ATTENTION: Before performing any maintenance on the contactor that is installed inside a starter configuration, follow all procedures noted in the appropriate user manual.

Vacuum Bottle Replacement Procedure

Do not replace the vacuum bottles in the field. If the vacuum bottles need to be replaced, remove and return the vacuum contactor to Rockwell Automation for refurbishment.

Main Coil Replacement Procedure

ATTENTION: Before beginning work on the contactor, confirm that it is isolated from all power sources and locked out.

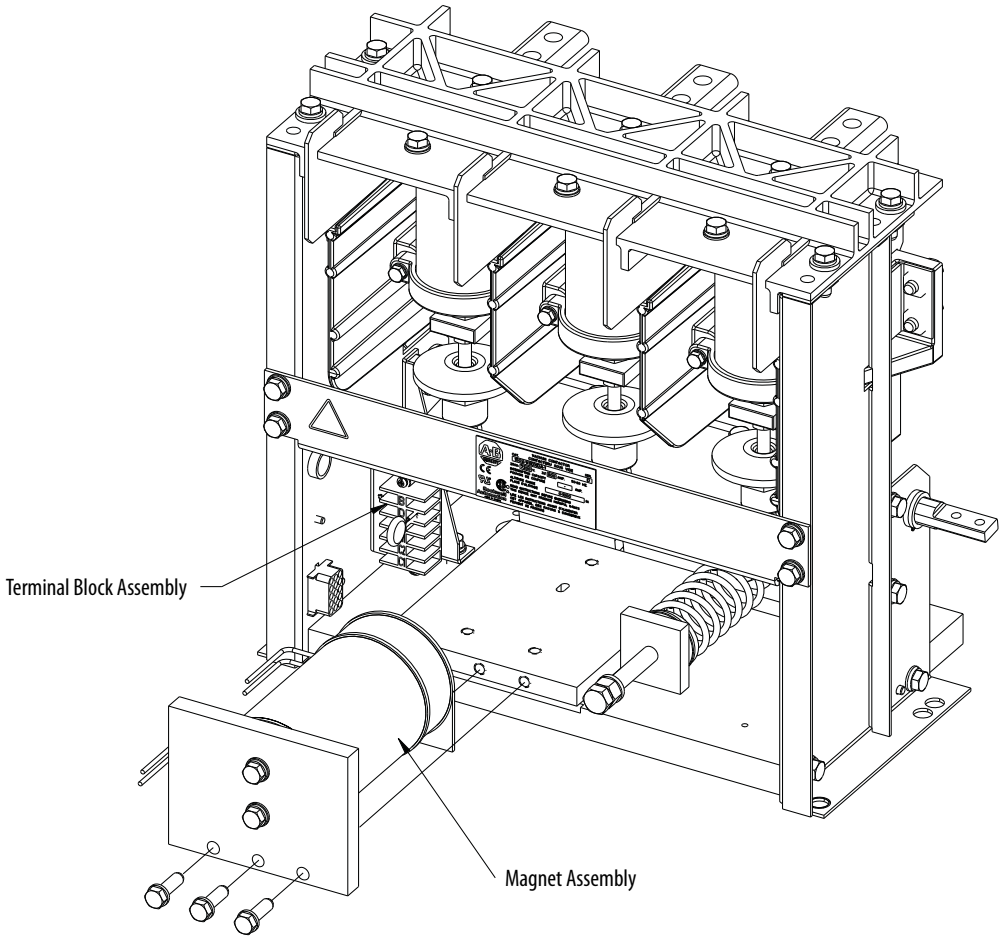
ATTENTION: Remove the control wiring from the contactor by disconnecting the control wire plug before starting any disassembly of the contactor.

TIP See Table 14 on page 49 for coil resistance values.

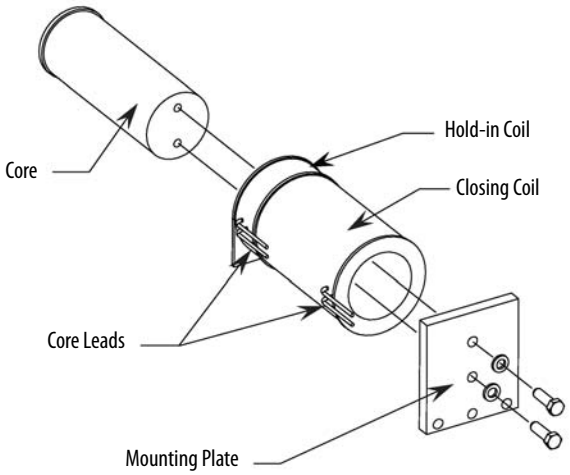
1. Disconnect the coil leads from the terminal block assembly.

   The closing and hold-in coils are both wound on one bobbin, therefore, all four coil leads (relay-controlled contactor, or two leads for IntelliVAC controlled contactor) must be removed (the MOVs and/or bridge diode leads may also become loose).

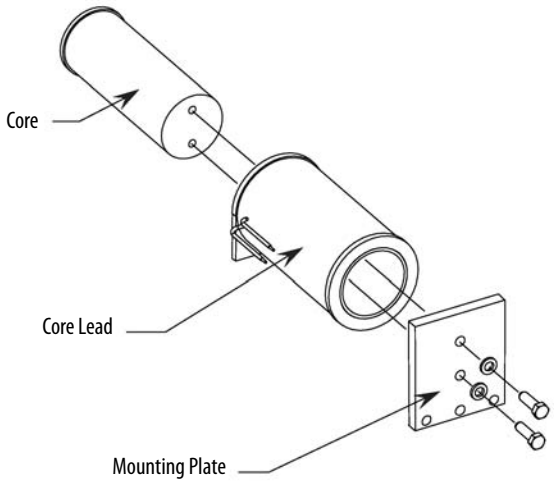
2. Remove three bolts from the bottom of the magnet assembly.
3. Withdraw the assembly from the contactor.



4. Remove the two bolts that connect the magnet core to the core mounting plate.



Electromechanical Control



IntelliVAC Control

5. Slide the core out of the coil.

   If there is a tight fit, tap out the core with a hammer.

6. Slide the core into the new coil with the mounting hole end that is located towards the closing coil.
7. Confirm that the coil leads are oriented properly with the core mounting holes.
8. Bolt the core to the mounting plate and position the magnet assembly in the contactor.
9. Install the three bolts that retain the assembly and torque all bolts to 20 lb•ft (27 N•m).
10. See Figure 16 for electromechanical relay controlled or Figure 17 for IntelliVAC controlled electrically held contactors, connect the leads from the coil to the terminal block assembly as follows:

Electromechanical Relay Controlled:	Closing coil (yellow lead) to “C”
	Closing coil (black lead) to “D”
	Hold-in coil (yellow lead) to “P”
	Hold-in coil (blue lead) to “N”
IntelliVAC Controlled:	Closing coil (yellow lead) to “C”
	Closing coil (black lead) to “N”

See Figure 18 for electromechanical relay controlled or Figure 19 for IntelliVAC controlled mechanically latched contactors. Connect the leads from the coil to the terminal block assembly as follows:

Electromechanical Relay Controlled:	Closing coil (yellow lead) to "H1"
	Closing coil (black lead) to "H2"
	Hold-in coil (blue lead) to "C1"
	Hold-in coil (yellow lead) to "C2"
	Trip Coil (white lead) to "D"
	Trip Coil (blue lead) to "B"
IntelliVAC Controlled:	Closing coil (yellow lead) to "C"
	Closing coil (black lead) to "A"
	Trip Coil (white lead) to "D"
	Trip Coil (blue lead) to "B"

The contactor has either a high density (1492-HC6) or a regular (1492-HJ86) terminal block. The wiring convention is the same for both types.

Figure 16 - Terminal Block Assembly (Electrically Held Relay Controlled Contactor, Regular Terminal Block)

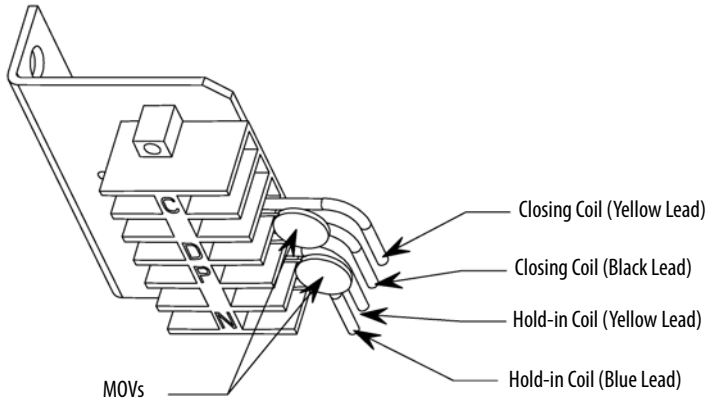


Figure 17 - Terminal Block Assembly (Electrically Held IntelliVAC Controlled Contactor)

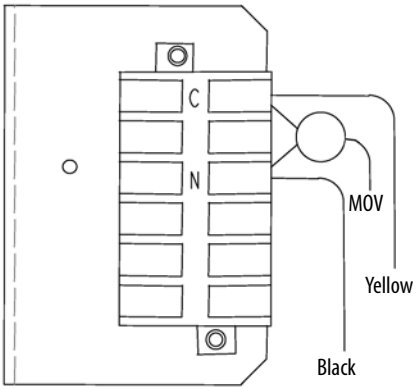


Figure 18 - Terminal Block Assembly (Mechanically Latched Electromechanical Relay Controlled Contactor)

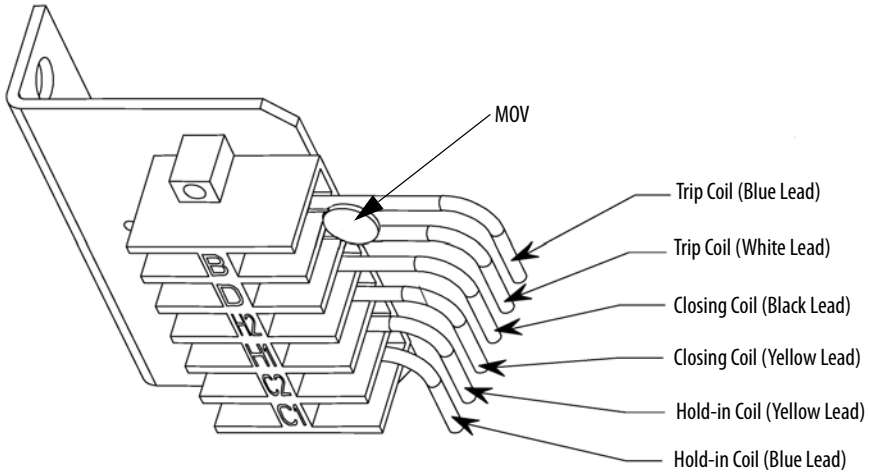
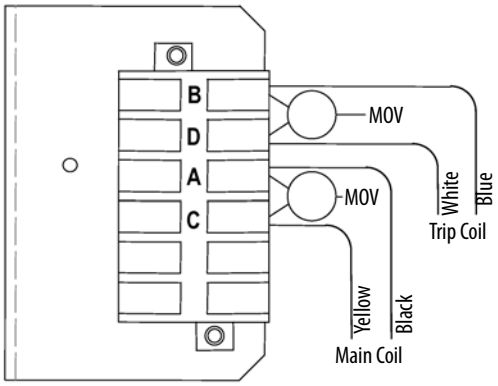


Figure 19 - Terminal Block Assembly (Mechanically Latched IntelliVAC Controlled Contactor)



11. Confirm that the bridge diode and/or MOV leads are properly connected. See the appropriate wiring diagram (Wiring and Schematic Diagrams on page 22).

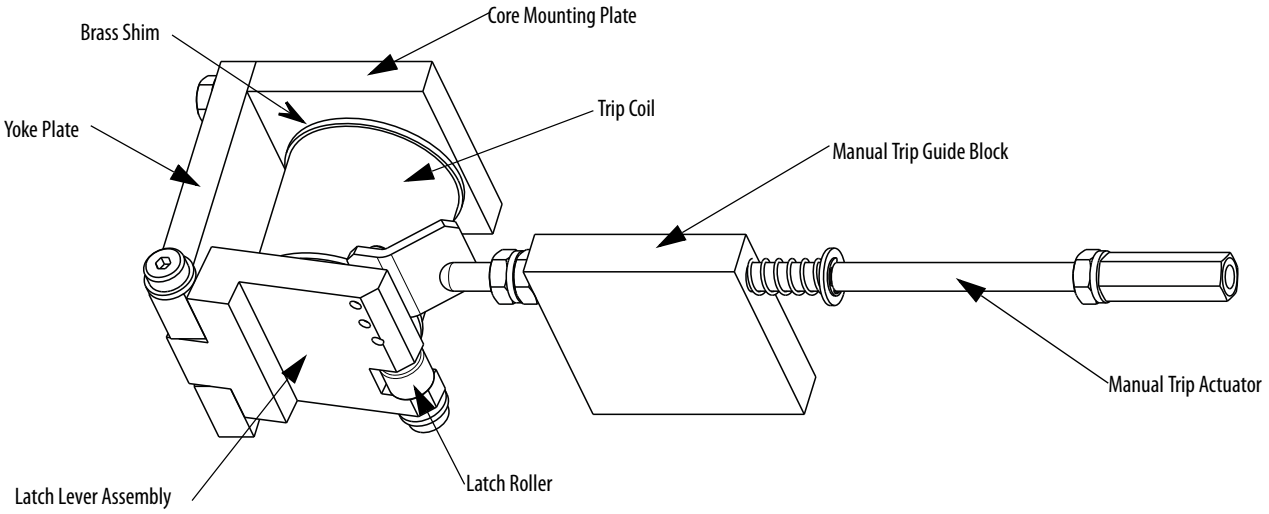
    TIP The closing coil is the larger of the two (electromechanical control only) and is located toward the front of the contactor.

12. Confirm that all leads, diodes, and MOVs are secured tightly.
13. Operate the contactor several times to verify that the core is located properly.

Mechanical Latch Trip Coil Replacement Procedure

ATTENTION: Before beginning work on the contactor, verify that it is isolated from all power sources and locked out. The contactor must be in the open (or tripped) state.

Figure 20 - Mechanical Latch Assembly



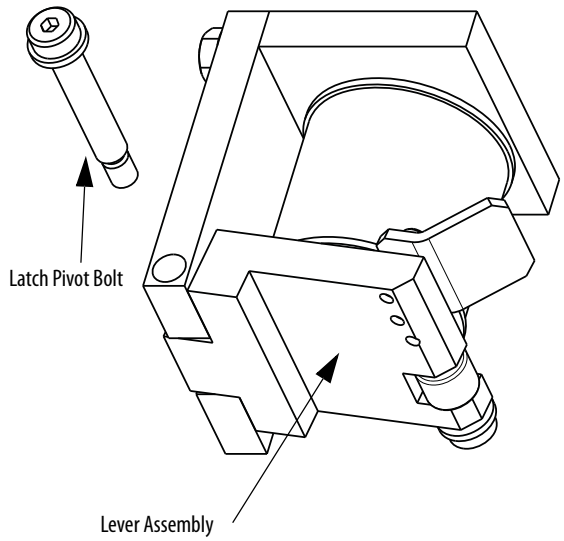
TIP See Table 14 on page 49 for coil resistance values.

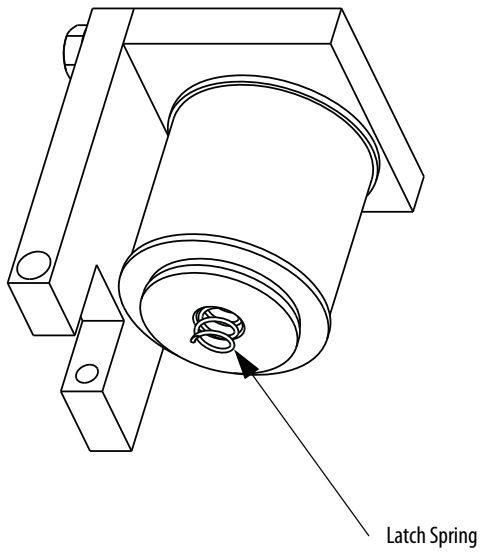
1. Disconnect the trip coil leads from the terminal block assembly.

   The trip coil leads are the blue and white wires that are connected to terminals "B" and "D" respectively (see Figure 18 or Figure 19).

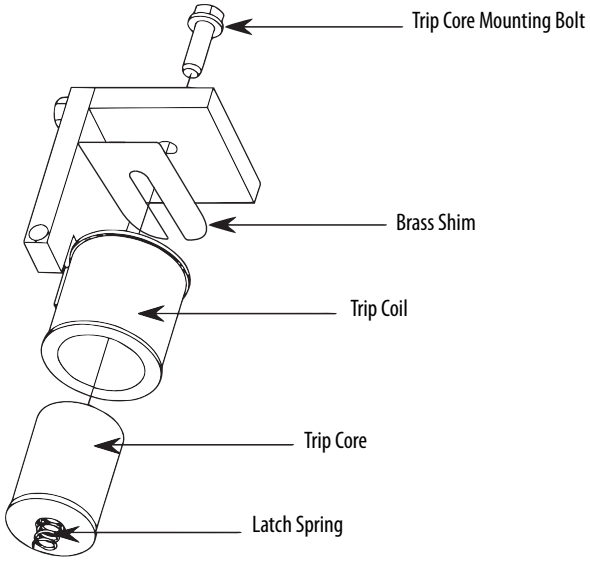
2. Remove latch pivot bolt with a 3/16 in. Allen key, and remove the lever assembly.

   The latch spring is no longer retained at this point and can fall out of the core—do not misplace this spring.





3. Remove the trip core mounting bolt and slide the core out of the coil allowing the coil to be removed.



4. Slide the core into the new coil and install the core mounting bolt.
5. Confirm that the latch spring is seated properly in the core, position the lever assembly and install the latch pivot bolt.

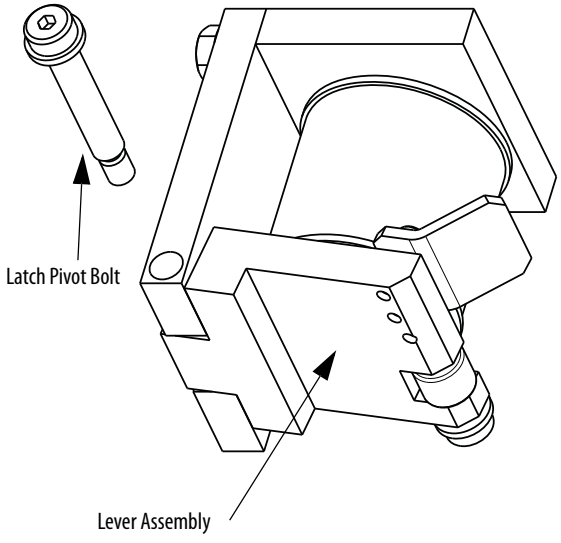
   The spring must be seated properly in the retaining holes in both the core and the lever.
6. Route the trip coil leads as they were and connect to the terminal block assembly as shown in Figure 18 or Figure 19.

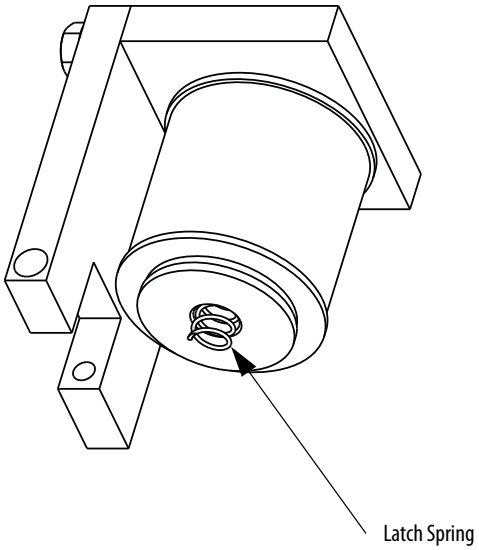
Mechanical Latch Mechanism Refurbishing Kit Procedure

The latch mechanism must be refurbished every 25,000 operations by replacing the lever assembly, latch spring, and the armature plate.

To replace the lever assembly, latch spring, and the armature plate, follow these steps.

1. Remove latch pivot bolt with a 3/16 in. Allen key

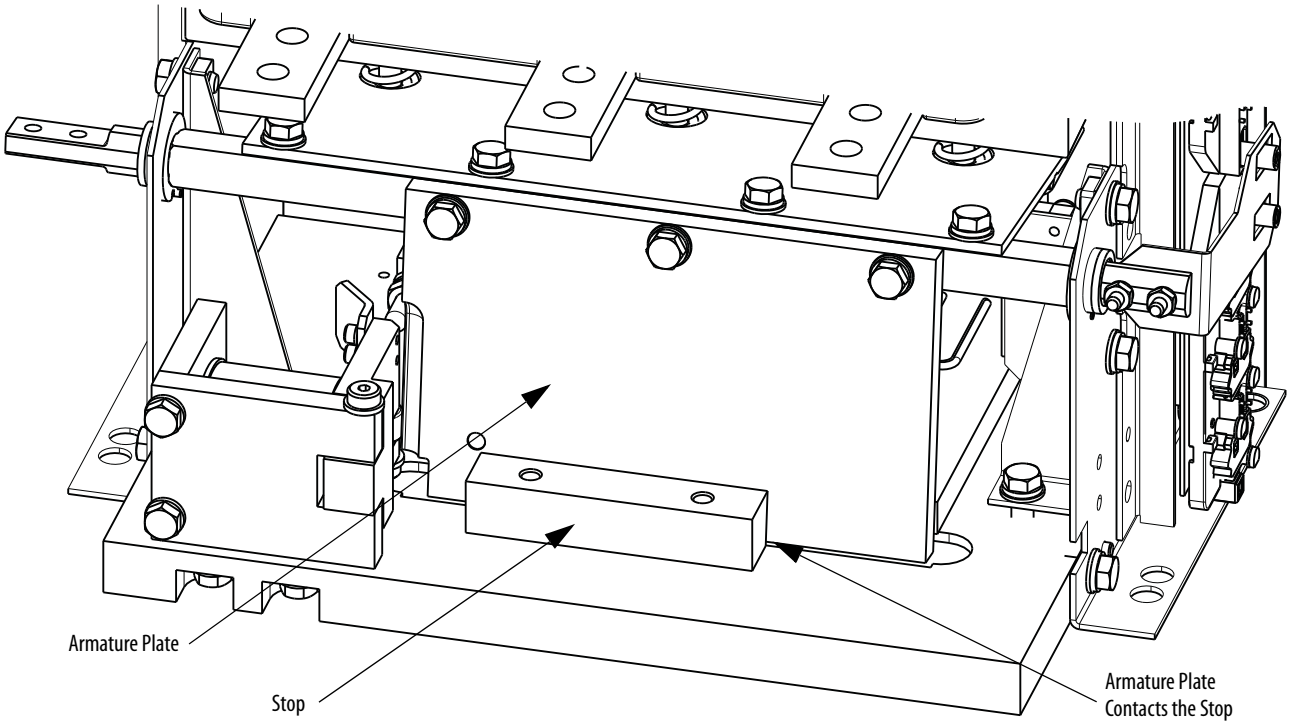




2. Remove the lever assembly.
3. Remove and discard the latch spring.
4. Install the new latch spring so that it is seated properly in the core.
5. Position the new lever assembly.
6. Install the latch pivot bolt, and torque hardware to 11 ft•lb (15 N•m).

   The spring must be seated properly in the retaining holes in both the core and the lever.
7. Loosen the locking nut on the return spring compression bolt and withdraw the compression bolt until the return spring is relaxed.
8. Remove the return spring.
9. Remove the armature plate mounting bolts.
10. Discard the armature plate.
11. Install the new armature plate.
12. Push the armature plate against the mechanical latch roller with a 0.033 in. (0.75 mm) feeler gage.
13. Tighten the armature plate bolts.
14. Reinstall the return spring.

15. Advance the compression bolt until the armature plate contacts the stop as shown.



16. Advance the bolt one additional full turn to confirm that the contactor opens fully.
17. Hold the compression bolt in position with a wrench and tighten the compression bolt locking nut.

Altitude Adjustment

Vacuum contactors are sensitive to the altitude at the installation site. Atmospheric pressure helps to close the main contacts by exerting force on the bellows at the movable end of the vacuum bottles. Since this force is proportional to the difference between internal bottle pressure and external atmospheric pressure, the return spring must be adjusted for the appropriate altitudes. Contactors are factory set for the altitude that is specified by the catalog number when the order is placed. If a contactor is used at another altitude range (see Table 11 on page 44), a spring adjustment is necessary for proper operation.

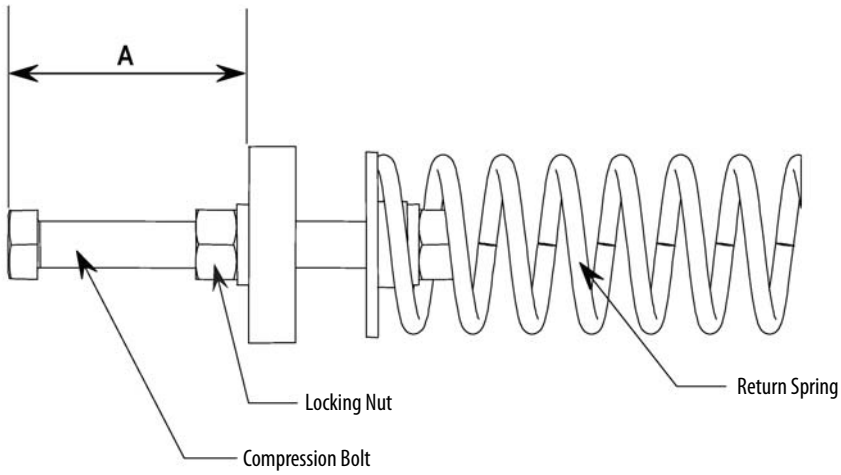
The following procedure must be used to make the correct settings.

IMPORTANT If the contactor return spring has been adjusted using any of the procedures in Chapter 4, use the altitude range at which the adjustments were performed (not the range on the rating label) as the basis for determining if adjustments are required for application at another altitude.

1. Determine which altitude range the contactor is configured for by checking the rating label (see Catalog Number Explanation on page 11).
2. Measure and record dimension "A" as shown per Figure 21.

IMPORTANT Dimension "A" varies from contactor to contactor, there is no predetermined value.

Figure 21 - Return Spring Assembly



3. Loosen the compression bolt locking nut and adjust the position of the compression bolt according to Table 11.

EXAMPLE Dimension "A" is changed by the amount that is shown in Table 11. For example, if the existing range is 0…1000 m and the desired range is 3000…4000 m, increase dimension "A" by 4.93 mm (0.194 in.).

If the existing range is 4000…5000 m and the desired range is 2000…3000 m, decrease dimension "A" by 2.69 mm (0.106 in.). After dimension "A" has been set for the desired altitude range, retighten the locking nut.

Table 11 - Dimension "A" Settings

Existing Altitude Range	New Altitude Range Increase or Decrease Dimension "A" by:				
	0…1000 m	**1000…2000 m**	**2000…3000 m**	**3000…4000 m**	**4000…5000 m**
0…1000 m	N/A	+0.073 in. (1.85 mm)	+0.140 in. (3.56 mm)	+0.194 in. (4.93 mm)	+0.246 in. (6.25 mm)
1000…2000 m	-0.073 in. (-1.85 mm)	N/A	+0.067 in. (1.70 mm)	+0.121 in. (3.07 mm)	+0.173 in. (4.39 mm)
2000…3000 m	-0.140 in. (-3.56 mm)	-0.067 in. (-1.70 mm)	N/A	+0.054 in. (1.37 mm)	+0.106 in. (2.69 mm)
3000…4000 m	-0.194 in. (-4.93 mm)	-0.121 in. (-3.07 mm)	-0.054 in. (-1.37 mm)	N/A	+0.052 in. (1.32 mm)
4000…5000 m	-0.246 in. (-6.25 mm)	-0.173 in. (-4.39 mm)	-0.106 in. (-2.69 mm)	-0.052 in. (-1.32 mm)	N/A

4. On the rating label, change the catalog number (altitude suffix), the stated altitude range, and the current rating.

   See Table 12 for the derated continuous current and B.I.L. withstand ratings for each altitude range.

ATTENTION: A contactor only functions properly in the altitude range for which it is configured. If functional tests are required, they must be performed at the proper altitude or in a pressure chamber that simulates the proper altitude.

Table 12 - Contactor Deratings

Altitude Range	Continuous Current Rating	B.I.L. Withstand Rating
0…1000 m	800 A	60 kV
1000…2000 m	780 A	54 kV
2000…3000 m	760 A	48 kV
3000…4000 m	740 A	42 kV
4000…5000 m	720 A	36 kV

Dropout Time Conversion

Electromechanical Relay Controlled Contactors

The average normal dropout time for the contactor is 200 ms. The "fast dropout" contactor has a dropout time less than 70 ms. Conversion from "normal" to "fast" or vice versa is easily achieved by changing the control component wired in parallel with the closing coil. The required components can be ordered from Rockwell Automation and installed per the appropriate schematic.

Dropout Parts	Description	Part Number	Quantity
Normal	Rectifier bridge	24808-451-01	1
	Mounting screw	M-8765	1
	Wire assembly	80018-457-32	1
	Wire assembly	80018-457-33	1
Fast	MOV assembly	80145-581-03	1

The rectifier bridge for the normal dropout mounts on the outside of the left side plate above the auxiliary assembly (mounting hole provided). The MOV for the fast drop-out or the resistor for normal drop-out mounts directly on the terminal blocks.

IntelliVAC Controlled Contactors

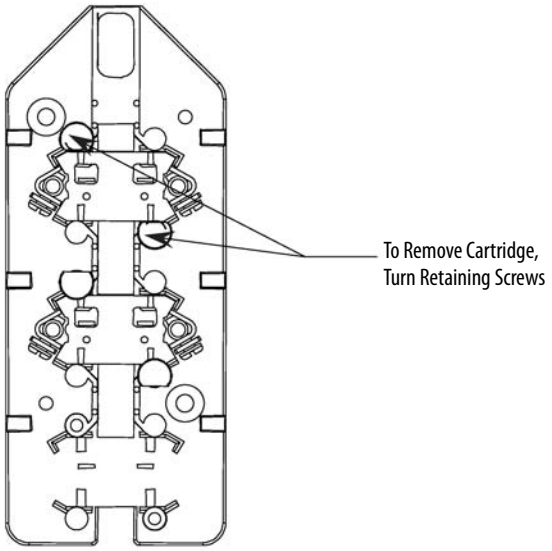
Contactor dropout times are adjustable within and controlled by the IntelliVAC or IntelliVAC Plus control modules (see publications 1503-UM053 or 1503-UM054).

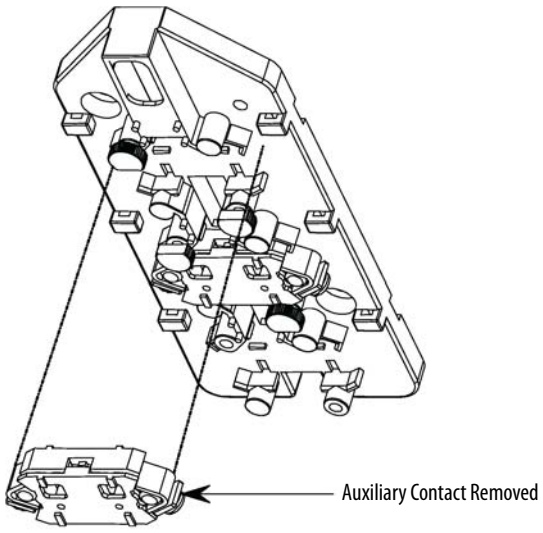
Auxiliary Contact Replacement and Set-up Procedure

To replace one contact cartridge, follow these steps.

TIP Before removing any contacts, note the specific orientation of the contact block and the terminal screws. Be certain that the replacement block is installed in the same orientation.

1. Remove the appropriate leads and turn the plastic retaining screws to allow removal of the cartridge.





2. Insert the new cartridge and position the retaining screws to hold it in place.
3. Reconnect the leads to the cartridge.

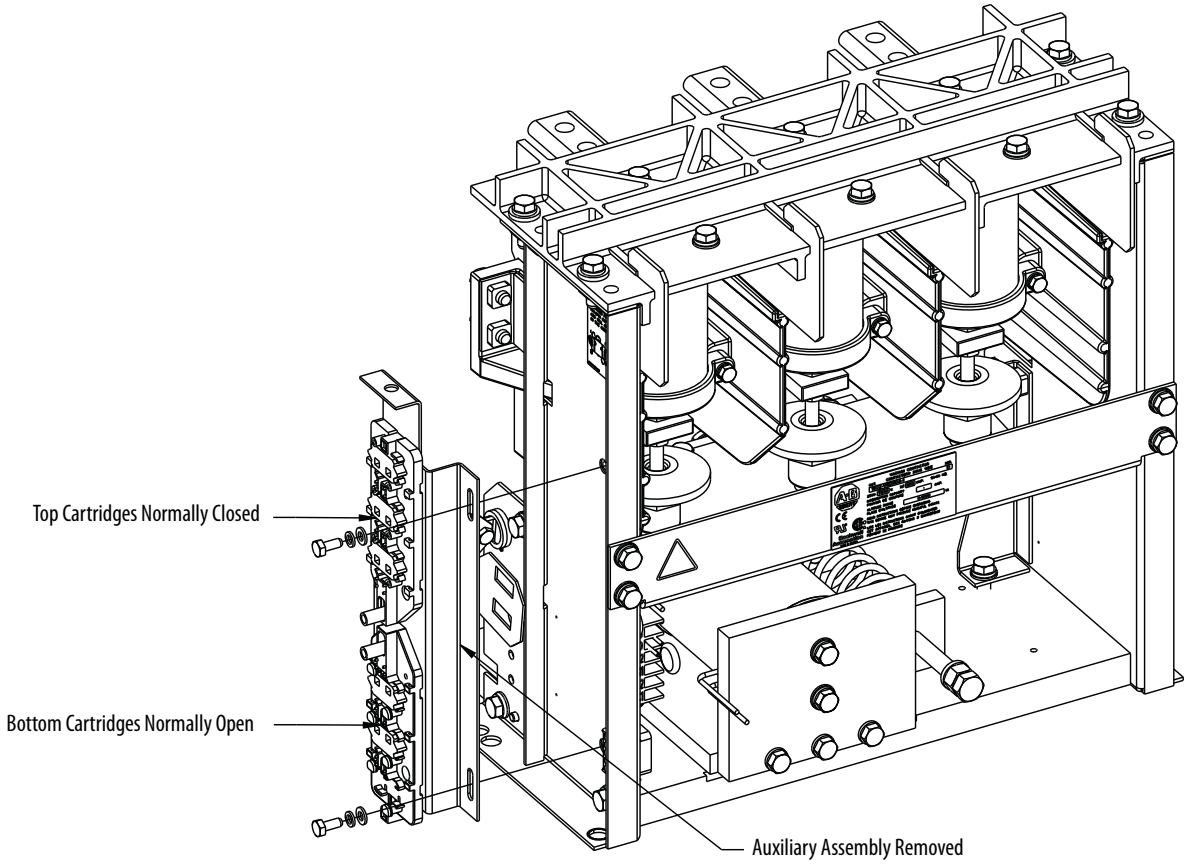
> **ATTENTION:** The cartridge must be in the proper configuration (the top cartridges are normally closed, the bottom cartridges are normally open).

The “normal” state is when the contactor is “off” (open position).

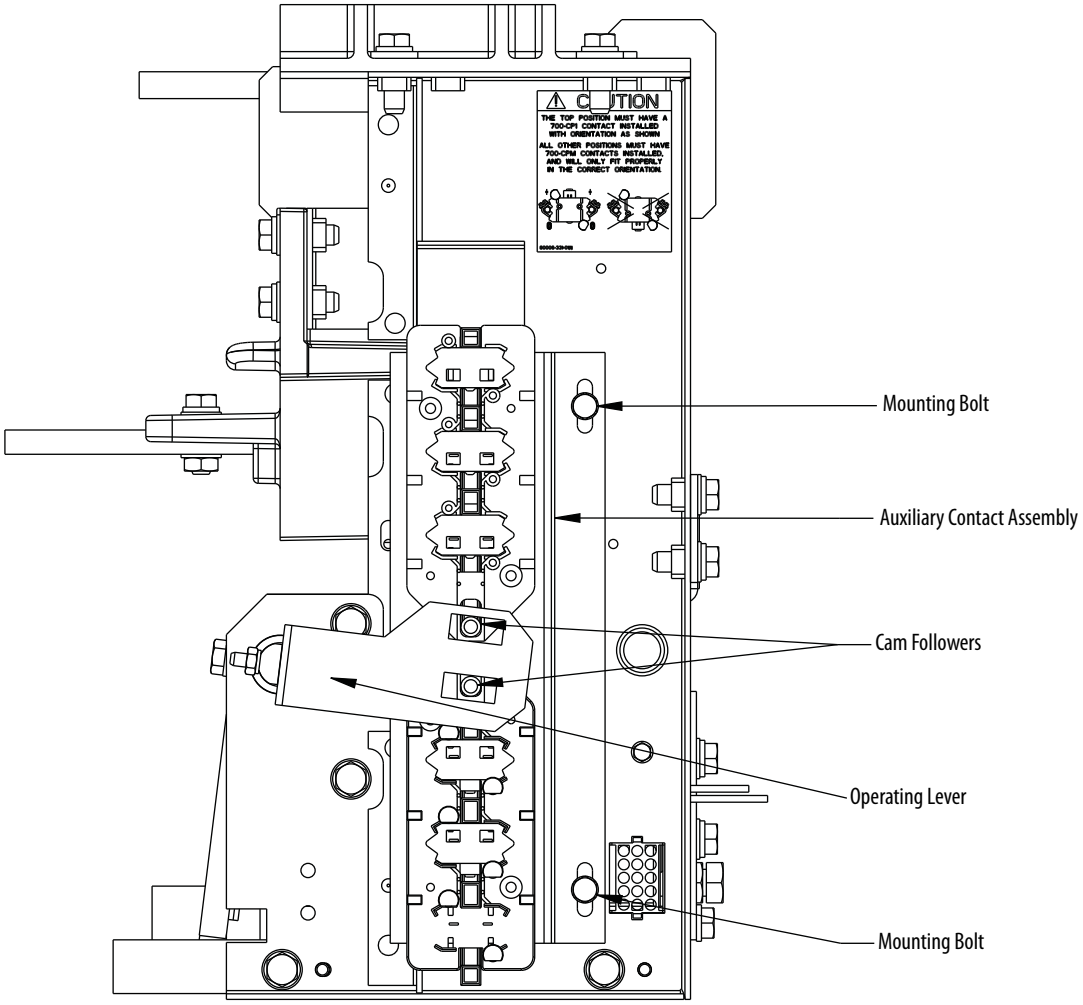
For IntelliVAC controlled contactors, the top auxiliary contact position must use a 700-CP1 cartridge. All other positions must use 700-CPM cartridges.

To replace the entire auxiliary assembly, follow these steps.

1. Remove the leads from all cartridges.
2. Remove the assembly complete with mounting plate by removing the mounting bolts.



3. Position the new assembly on the left side plate of the contactor with the cam followers protruding through the rectangular holes in the operating lever.



4. Install and allow the mounting bolts to remain loose so that the assembly can slide vertically on its mounting slots.
5. With the contactor off, push the entire auxiliary assembly up until the cam followers bottom out against the top of the rectangular holes in the operating lever as shown in step 2.

   Verify that the armature plate is against the stop such that the contactor is fully open. At this point, the top set of auxiliary contacts are closed and the bottom set of auxiliary contacts is open.
6. Tighten and torque (6 lb•ft) the mounting bolts to fix the position of the auxiliary assembly.
7. Connect all control wire leads to the appropriate cartridge terminals per the appropriate electrical diagram (see Installation on page 19), or per the specific electrical drawing supplied with the starter unit.
8. Operate the contactor several times to confirm proper positioning of the auxiliary assembly and proper connection of the control wires.

Troubleshooting

If an operating problem occurs, use the following troubleshooting chart to isolate the cause of the failure and find the corrective action. If the corrective action fails to resolve the problem, consult your Rockwell Automation field support representative.

Table 13 - Troubleshooting

Symptom	Possible Cause	Actions
Contactor Chatters[1]	• Loose connections in control circuit • Coil leads reversed • Control voltage too low • Foreign material on contactor magnet pole face • Improper set-up of contactor auxiliary contact assembly • Faulty auxiliary contacts • Faulty CR1 or CR2 interposing relay (mechanical latch only) • Faulty IntelliVAC or IntelliVAC Plus • Latch does not engage • Incorrect style of CR1 and/or CR2 used with relay controlled contactor	• Check all connections in control circuit for tightness • Check wiring from the coil to the terminal block assembly • Measure control voltage. See Contactor Specifications for minimum pick-up voltage • Clean magnet cores and armature • Check set-up of contactor auxiliary contact assembly. • Check master contact cartridges on contactor • The N.C. contact from contactor auxiliary assembly must be wired to auxiliary input on IntelliVAC or IntelliVAC Plus • Replace IntelliVAC or IntelliVAC Plus control module • Check adjustment of mechanical latch • Only use approved Rockwell Automation control relay panels on relay-controlled contactors.
Coil Burnout	• Coil leads improperly wired • Faulty IntelliVAC or IntelliVAC Plus control module[2] • Improper set-up of contactor auxiliary contact assembly[1] • Control voltage too high[2]	• Check wiring from the coil to the terminal block assembly • Replace IntelliVAC or IntelliVAC Plus control module[2] • Check set-up of contactor auxiliary contact assembly[1] • Check for correct control voltage[1]
Contactor does not energize	• Loose connections in control circuit • Damaged contactor auxiliary contacts • Control voltage too low • Improper set-up of contactor auxiliary contact assembly • Faulty CR1 or CR2 interposing relay[1] • Faulty IntelliVAC or IntelliVAC Plus control module[2]	• Check all connections in control circuit for tightness. Check wiring from the coil to the terminal block assembly • Replace contactor auxiliary contact assembly • Measure control voltage. See Contactor specifications for minimum pick-up voltage • Check set-up of contactor auxiliary contact assembly • Check CR1 and CR2 relay[1] • Check IntelliVAC or IntelliVAC Plus status LEDs[2]

(1) Valid if mechanical latch contactors are controlled with electromechanical circuit only.

(2) Valid if IntelliVAC or IntelliVAC Plus control module is used (see 1503-UM053 and 1503-UM054).

Table 14 - Typical Contactor Coil Resistance Values

Coil Part Number	Description	Resistance[2]
80025-697-01	Closing and Hold-in Coil Assembly (Electromechanical Relay Controlled)	8.4 Ω (Close), 4.55 Ω (Hold)
80026-231-02	Closing and Hold-in Coil Assembly (Series F IntelliVAC Control)	7.0 Ω
80025-853-01[1]	Mechanical Latch Trip Coil (Series F Electromechanical and IntelliVAC Control)	19.4 Ω

(1) Supplied only with mechanical latch option.

(2) Resistance values that are listed have a tolerance ±10% at 20 °C (68 °F). See Chapter 3 for measurement point at the contactor receptacle.

Notes:

Renewal Parts

Views and Parts Numbers

Figure 22 - Electrically Held Vacuum Contactor

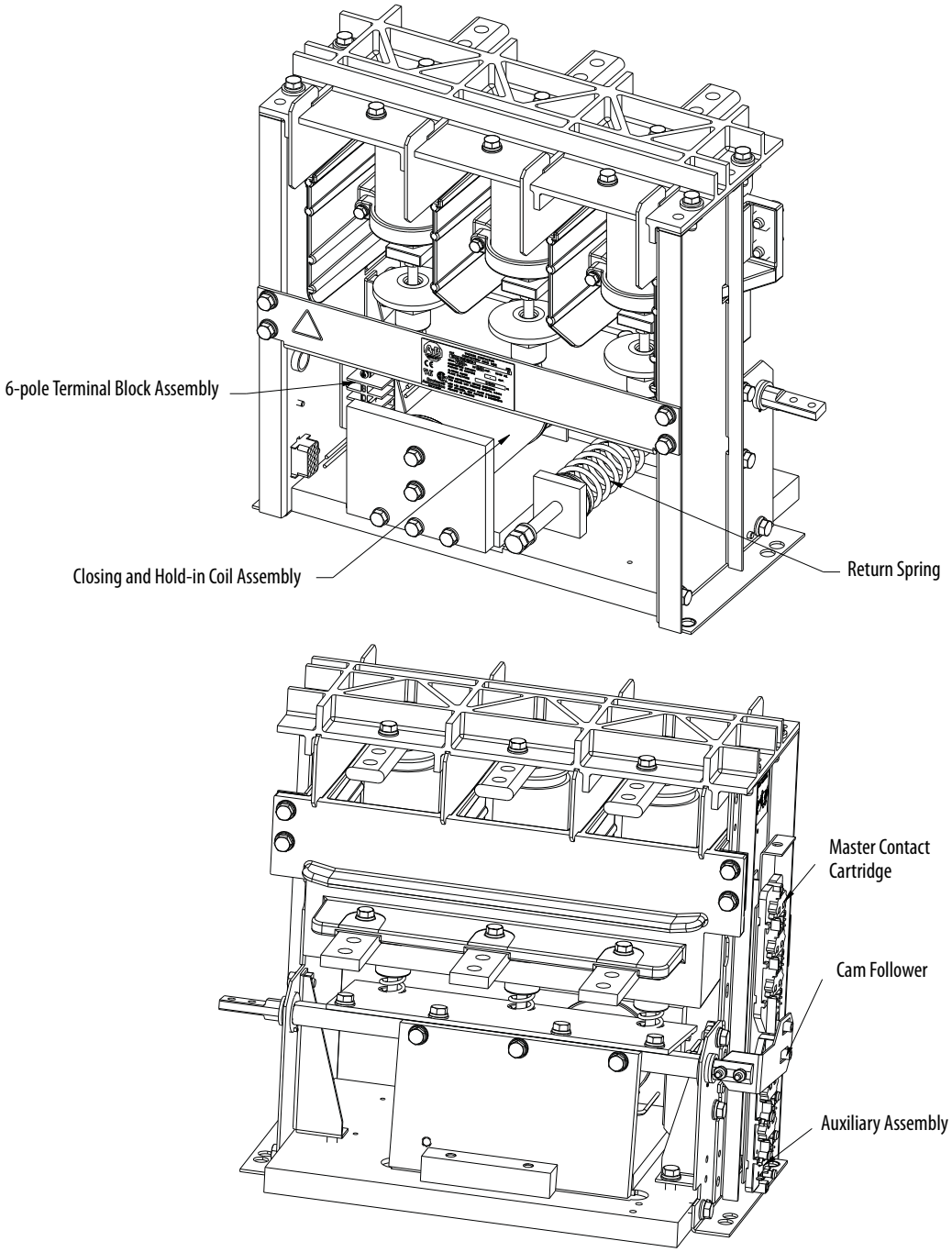


Figure 23 - Mechanical Latch Assembly

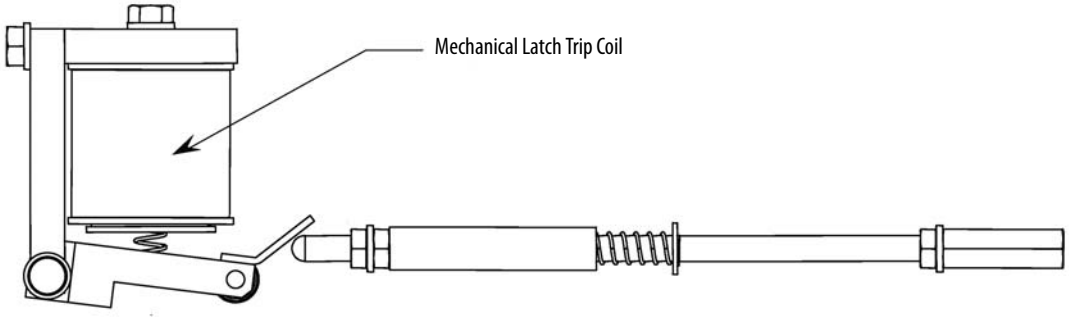


Table 15 - Renewal Parts

Item	Description of Parts			Part Number
1	Closing and Hold-in Coil Assembly	Electromechanical Relay Controlled		80025-697-01-R
		IntelliVAC Controlled		80026-231-02-R
2	Master Contact Cartridge	General		700-CPM A
		IntelliVAC or IntelliVAC Plus feedback		700-CP1 B
3	Auxiliary Assembly	Electrically Held	Electromechanical Control	80157-305-51-R
			IntelliVAC Control	80158-870-51-R
		Mechanical Latch	Electromechanical Control	80157-305-52-R
			IntelliVAC Control	80158-870-52-R
4	6-pole Terminal Block Assembly (high density)(1)			1492-HC6 C
4A	6-pole Terminal Block Assembly (regular)(1)			1492-HJ86 B
5	Return Spring			80026-011-02-R
6	Cam Follower			80154-422-01-R
7	MOV (1)			80145-581-08-R
8	Rectifier Bridge (not shown)			W2480845101
9	Mechanical Latch Trip Coil(2)			80025-853-01-R
10	Mechanical Latch Refurbishing Kit(3)			PN-415384

(1) Refer to Figure 16 . . . Figure 19.

(2) See Figure 20 on page 40.

(3) Includes new lever assembly, latch spring, and armature plate.

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Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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