Medium Voltage
450 A Contactor, Series G

Bulletin Number 1502

Allen-Bradley
by ROCKWELL AUTOMATION

User Manual Original Instructions

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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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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).

About This Publication

This manual pertains to the Allen-Bradley® Bulletin 1502, Series G version 450 A vacuum contactors. For earlier product series letters, contact your local Rockwell Automation representative.

Series G vacuum contactors are intended for use with electromechanical (relay) control circuits or with IntelliVAC™ control module. See publications 1503-UM060.

This manual is intended for engineers or technicians that are directly involved in the installation, connection, energizing, and maintenance of the medium voltage 450 A contactor.

Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Additional Resources

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

Resource	Description
Medium Voltage Controllers, 400A One-High Cabinet, Standard and Arc-Resistant Enclosure, publication 1512A-UM100	Provides information on installation, maintenance, and spare parts for standard and arc resistant enclosures
Medium Voltage Controllers, 200/400A Two-High Cabinet, Standard and Arc-Resistant Enclosure, publication 1500-UM055	Provides information on installation, maintenance, and spare parts for standard and arc resistant enclosures
IntelliVAC Contactor Control Module User Manual, publication 1503-UM060	Provides information on receiving and storage, installation, setup, monitoring, and spare parts for the IntelliVAC Contactor Control Module
EtherNet/IP Network Devices User Manual, ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
System Security Design Guidelines Reference Manual, SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Notes:

Product Description

Contactor Description

The Allen-Bradley® Bulletin 1502 450 A vacuum contactors are designed for applications in the 2400...7200V AC range. The contactor is suitable for all types of loads, for example: three-phase motors, transformers, power capacitors, and resistive heating loads.

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

The contactors are used in various motor control and adjustable speed drive configurations, such as full-voltage non-reversing, full-voltage reversing, two-speed, reduced voltage, synchronous, adjustable speed drive input/output, and bypass applications. They are fixed-mounted within the structures and the line and load terminations are made at the rear of the device. The main contactor should be mechanically interlocked with the external isolation switch operating handle and the isolation switch as well.

Bulletin 1502 vacuum contactors are optimized for use with the IntelliVAC™ control module (see publication 1503-UM060). Certain contactor models are available for use with electromechanical (relay) control panels. There are physical control wiring and component differences between contactors that are designed for IntelliVAC control versus those intended to be operated using electromechanical relay controls (see Catalog Number Explanation on page 12).

Series Letter Details

The series letter of the Bulletin 1502 contactor is shown on the label that is located on the front of the armature plate (Figure 4). The catalog number, along with the series letter, define the product's electrical and mechanical configuration. This information must be used to select the appropriate repair or replacement parts.

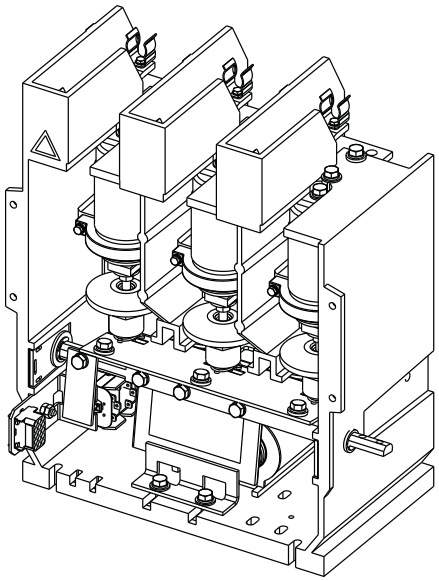
Electrically held, electromechanical relay controlled contactors moved from Series D to Series E with the inclusion of mechanical vacuum bottle braces.

Mechanically latched, electromechanical relay controlled contactors were moved from Series E to Series F with the inclusion of mechanical vacuum bottle braces.

Electrically held and mechanically latched IntelliVAC controlled contactors were moved from Series E to Series F with the inclusion of mechanical vacuum bottle braces.

All contactors were moved from series F to G with the change of current rating from 400 A to 450 A and the unification of altitude for relay controlled contactors

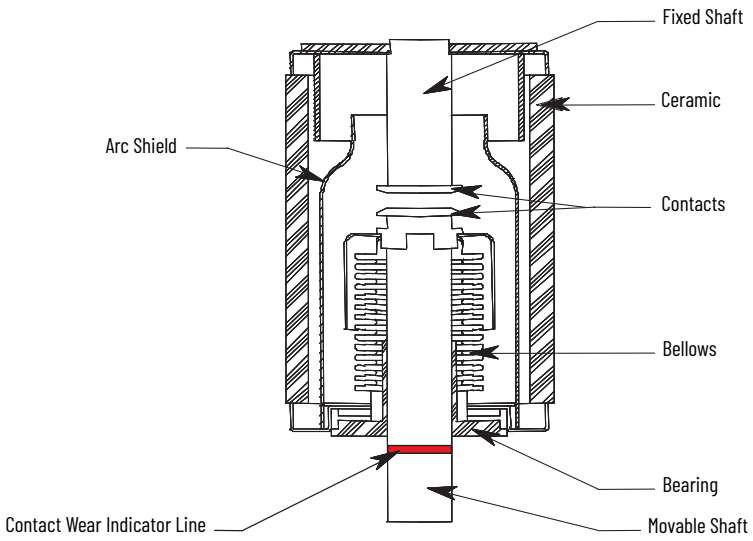
Figure 1 - 450 A Contactor



Vacuum Bottle Description

Each vacuum bottle (Figure 2) consists of two contacts that are enclosed in a ceramic housing: an upper contact that is mounted to a fixed shaft, and a lower contact that is mounted to a movable shaft. A stainless steel bellow helps the vacuum integrity of the bottle, while letting the lower contact move towards and away from the fixed contact.

Figure 2 - Vacuum Bottle Cross Section



Electrically Held Contactor Operation

IntelliVAC Controlled Contactors

The electrically held contactor consists of three vacuum bottles. An electromagnet assembly and a mechanical linkage are used to close the contacts (see Figure 3).

- When the IntelliVAC control module receives a close command, the contactor coils (two connected in series) are energized, and the current creates an electromagnet with the coils.
- The electromagnet pulls the armature plate towards the core of the coils, which rotates the shaft and causes the actuator plate to move upwards.
- As the actuator plate moves, it pushes the insulator and each vacuum interrupter's movable shaft up, which closes the contacts in the vacuum bottle.
- The IntelliVAC control module supplies the current required to close the coils for approximately 200 milliseconds. Afterward, the coil current is reduced to a much lower hold-in value.
- When the close command is removed from the IntelliVAC control module (Open), the coils are de-energized, which opens the contactor.

Electromechanical Relay Controlled Contactors

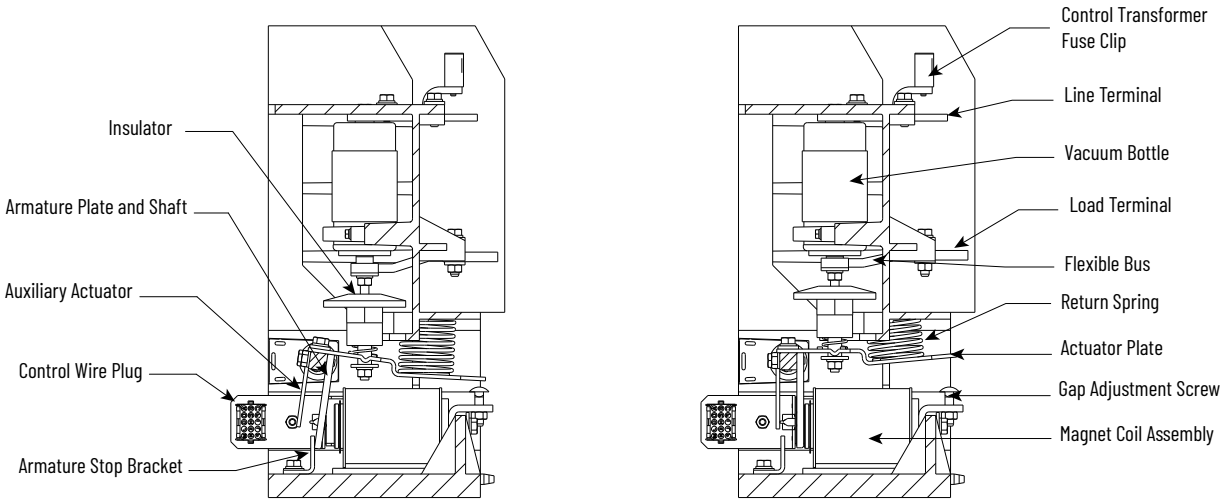
When the main pilot relay (CR1) in the control circuit is energized, the circuit energizes an electromagnet in the closing coil and in the hold-in coil (Figure 18). The electromagnet pulls the armature plate towards the core of the coils, which rotates the shaft and causes the actuator plate to move upwards.

As the actuator plate moves, it pushes the insulator and each vacuum interrupter's movable shaft up, which closes the contacts in the vacuum bottle (see Figure 3). The control circuit economizing auxiliary contacts, on the left side of the contactor, change from the normally closed state to the normally open state as the contactor closes, which de-energizes the closing coil.

The hold-in coil remains energized and keeps the contactor closed. De-energizing the hold-in coil opens the contactor.

IMPORTANT	The standard electrically held contactor requires an external 120V AC or 240V AC control relay and rectification circuit to control the standard DC closing and hold-in coils on the contactor (see Figure 19).

Figure 3 - Electrically Held Vacuum Contactor Operation



Mechanically Latched Contactor Operation

The mechanically latched contactor operates in much the same way as the electrically held (Figure 3) with only a few exceptions.

IntelliVAC Controlled Contactor

- Once the contactor is fully 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 'open' [TCO] output) which pulls the latch away from the armature, or by a push button that mechanically releases the contactor. The push button is mounted on the power cell door.

Electromechanical Relay Controlled Contactor

- Once the contactor is fully closed, a spring-loaded mechanism moves a roller against the armature plate to hold it against the electromagnetic core.
- The control circuit auxiliary contact, on the left side of the contactor, changes from the normally closed state to the normally open state as the contactor closes. This action de-energizes the relay that controls the closing coils (see Figure 18).
- The contactor can be opened electrically by energizing a trip coil that pulls the latch away from the armature, or by a push button that mechanically releases the contactor. The push button is mounted on the power cell door.

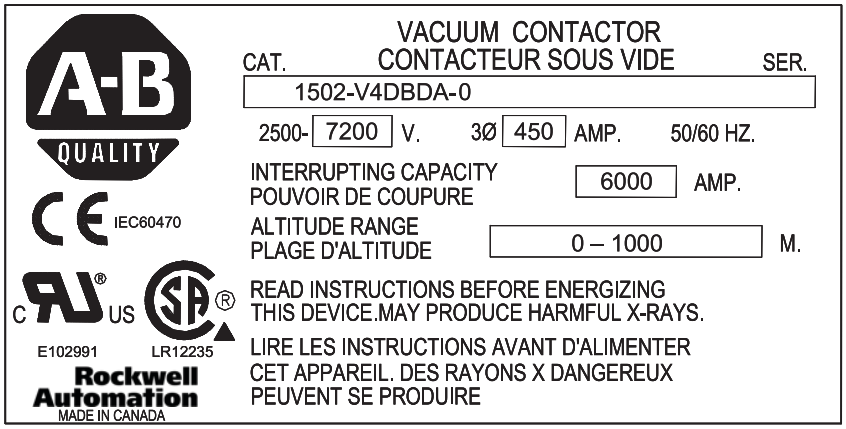
The electromechanical relay controlled mechanical latch contactor requires external 120V AC or 230V AC control relays and rectification circuit to control the standard DC closing and trip coils on the contactor (when IntelliVAC control module is not used). See Figure 19.

WARNING: The Rockwell Automation® relay control panel (1503C-XXX or 1503E-CXXX) is required for reliable operation of the contactor within its published specifications. The relays break the DC current that is drawn by the closing coil, holding coil, and trip coil. The relays make sure the pick-up and drop out voltages are coordinated with the pick-up and drop out voltages of the contactor. This provides reliable operation of the circuit in undervoltage conditions. The use of alternative control relays is not supported or recommended. Alternative relays do not provide the necessary control timings necessary to provide reliable operation and coordination with all power fuses used in combination with the contactors.

Contactor Identification

Each contactor is identified with a rating label (Figure 4) attached to the armature plate at the front of the contactor. The rating label information includes the Catalog Number (Cat.) Series Letter (Ser.) Voltage Rating, Non-Enclosed Current Rating, Interrupting Capacity, Altitude Range (in meters), CSA, UL, and CE markings.

Figure 4 - Contactor Rating Label (450 A)



Catalog Number Explanation

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

1502	-	V	4	-	D	-	B	-	D	-	A	-	0
		a	b		c		d		e		f		g

a	
Contactor Type and Interlock	
Code	Description
V	Vacuum, electromechanical relay controlled
VC	Vacuum, optimized for IntelliVAC control

b	
Contactor Size	
Code	Description
4	450 A

c	
Nominal Line Voltage	
Code	Description
D	7200V

d	
Control Circuit[1]	
Code	Description
B	5000V
C	7200V

(1) Or voltage transformer primary fuse mounting provisions.

b	
Coil Voltage	
Code	Description
D	110V DC
E	207V DC

c	
Function	
Code	Description
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 drop-out[1]

d	
Altitude Code (m)	
Code	Description
0	-1000...5000

(1) Controlled by electromechanical relay.

Contactor Dropout Times

The IntelliVAC contactor control module (publication 1503-UM060) varies the speed at which the electrically held vacuum contactor opens.

When electromechanical relays are used to control the electrically held contactor, there are two speeds available: normal dropout time and fast dropout time. The opening speed is controlled by changes to the onboard contactor control circuitry (see Figure 13 through Figure 16).

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

Contactors with normal dropout times are used in coordination with medium voltage power fuses. 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 are designed with the fast dropout time.

Specifications

Table 1 - Voltage Rating(1)

Maximum Rated Voltage	7200V
System Voltages	2400, 3300, 4160, 4800, 6600, 6900
Dielectric Voltage Withstand Rating(2)	18.2 kV 20 kV (IEC)
Basic Impulse Level (B.I.L.) Withstand(3)	60 kV
Frequency Ratings	50/60 Hz

(1) The voltage ratings listed are valid up to 1000 m (3300 ft). See Table 9 for ratings above this altitude.
(2) For 60 s.
(3) Phase to Ground, Phase to Phase

Table 2 - Current Ratings(1)

Rated Continuous Current		450 A
Maximum interrupting current rating	2400V	6000 RMS symmetrical amps
	5000V	
	7200V (2)	
Maximum interrupting MVA rating	2400V	25 Sym MVA
	5000V	50 Sym MVA
	7200V(2)	75 Sym MVA
Short circuit withstand at rated voltage	Current Peak ½ cycle	55 kA
Short time current rating capability	For 1 s	6.0 kA
	For 30 s	2.4 kA
Chop current (average rms amperes)		0.5
Make and Break Capability at Rated Voltage		4.0 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.
(2) The IEC rating at 7200V (RMS Sym.) is 5300 A / 66 MVA.

Table 3 - Contactor Coil Data, IntelliVAC Controlled

IntelliVAC Control (Electrically Held & Mechanical Latch)			
110...240V AC or 110...250V DC (1)	V AC: $V_{CL} = \sqrt{2} \times V_{CTL}$ (max.) V DC: $V_{CL} = V_{CTL}$	Close current	4.3 A_{DC}, 200 ms
		Hold current	0.48 A_{DC}
		Pick-up voltage(1)	95V
		Drop-out voltage(1)	75V
		Trip current	5.5 A_{DC}, 200 ms
		Trip voltage(1)	70V

(1) Control voltage, as measured at the input of the IntelliVAC control module or the primary voltage to the pilot relay control circuit.

Table 4 - Contactor Coil Data

Control Voltage (V_{CTL})	Coil Voltage (V_{CL})		
Electromechanical Relay Controlled (Electrically Held)			
120V AC	110V DC	Close current inrush	7.3 A_{DC}
		Economized holding current	0.13 A_{DC}
		Minimum CR1 coil pick-up voltage	102V AC
		CR1 coil drop-out voltage	75V AC
Electromechanical Relay Controlled (Electrically Held)			
230V AC	210V DC	Close current inrush	8.3 A_{DC}
		Economized holding current	0.11 A_{DC}
		Minimum CR1 coil pick-up voltage	190V AC
		CR1 coil drop-out voltage	140V AC
Electromechanical Relay Controlled (Mechanical Latch)			
120V AC	110V DC	Close current inrush (A_{DC})	5.6 A_{DC}
		Pilot Relay (CR1) pick-up voltage	102V AC
		Minimum trip coil voltage	84V AC
		Trip coil current	6 A
Electromechanical Relay Controlled (Mechanical Latch)			
230V AC	210V DC	Not available at this control voltage	

Table 5 - Operational Characteristics

Mechanical life [1]	Electrically held	2,500,000 operations
	Mechanical latch	100,000 operations
Electrical life [1]		1,000,000 operations
Switching frequency	Electrically held	600,000 operations per hour
	Mechanical latch	150,000 operations per hour

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

Table 6 - Opening and Closing Times

IntelliVAC Control (Electrically Held & Mechanical Latch)		
Maximum closing time (50...60 Hz)	120 / 240V AC	100/70 ms
Maximum opening time (without delay, for 50...60 Hz)[1]		60 ms
Electromechanical (Relay) Controlled		
Maximum closing time (120V AC)[2]	50/60 Hz	160 ms
Maximum opening time (120V AC)[3]		50 ms
Maximum opening time (120V AC)[4]		160 ms

(1) A contactor drop-out delay may be configured with the IntelliVAC control module, publication 1503-UM060.
(2) Control/Pilot relay, other than the standard Rockwell Automation Control Panel assembly (1503C-E4_ or 1503C-M4D), must provide a constant closing signal for at least this period of time. The use of control components other than Rockwell Automation products is not recommended and may pose reliability concerns.
(3) Mechanical latched.
(4) Electrically held, normal dropout.

Table 7 - Capacitor Switching

System Voltage	2400V	800 KVAR
	4160V	1400 KVAR
	6900V	2000 KVAR

Table 8 - General

Standard Altitude Capability [1][2]	1000…5000 m (3300…16,500 ft)
Contactor Weight	21.8 kg (48 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) The full altitude range is available with both relay and IntelliVAC control module. The IntelliVAC control module must be configured accordingly (see publication 1503-UM060).
(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 Derating

Altitude Rating	Max. Continuous Current Rating	Reduce B.I.L. Withstand Rating by:
-1000…0 m (-3300…0 ft)[1]	450 A	–
0…1000 m (0…3300 ft)		
1001…2000 m (3301…6600 ft)	440 A	6.0 kV
2001…3000 m (6601…9900 ft)	430 A	12.0 kV
3001…4000 m (9901…13,200 ft)	420 A	18.0 kV
4001…5000 m (13,201…16,500 ft)	410 A	24.0 kV

(1) Only supported with IntelliVAC controlled contactors.

Product Approvals

- UL347
- CSA22.2 No. 14 and T.I.L. D-21
- IEC 62271-106
- CE Marked

Notes:

Receiving and Handling

Receiving

The contactors have been tested both mechanically and electrically before leaving the factory. Immediately upon receiving the contactor, remove the packing material and check the contactor for possible damage from shipping. If damage is found, do not discard the packaging materials and, if possible, note the damage on the Bill of Lading before accepting 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 that were caused by impact.

Push armature plate to verify that the mechanisms are functional.

Use a HiPot tester to test vacuum bottle integrity (refer to Vacuum Bottle Integrity Test on page 18)

Handling

The contactor weighs approximately 21.8 kg (48 lb). When transporting the contactor over longer distances or for sustained lifting, use a forklift.

When a forklift is used to handle the equipment, adhere to the following precautions:

- Keep the contactor in an upright position.
- Carefully balance the contactor on the forks.
- Use a safety strap to steady the contactor and avoid shifting or being tipped.
- Avoid excessive speeds and sudden starts, stops, and turns.
- Never lift a contactor above an area where personnel are located.

Pre-energization Inspection

Before placing the contactor in service, inspect for possible damage sustained in transit or maintenance:.

- Check housing for any cracks or breaks.
- Push the armature plate and rotating shaft to verify that the mechanism is in good working order.
- Inspect the contactor for dirt, stray or loose hardware, tools, or metal chips. Vacuum if necessary.

Vacuum Bottle Integrity Test

The internal dielectric condition and vacuum integrity of the vacuum bottles is determined by this test.

ATTENTION: Do not apply a voltage higher than 25,000V across the open contacts of a vacuum bottle. Dangerous x-ray emissions can be produced.

ATTENTION: Vacuum bottles are thoroughly tested at the factory; however, damage during shipment can occur. It is important to perform the vacuum bottle integrity test before energizing the contactor for the first time, and before it is returned to service after maintenance or repair. The test may result in personal injury or damage to the equipment if the vacuum bottle integrity fails.

ATTENTION: A high-voltage test is potentially hazardous. Use caution when performing the Hi-pot test. Failure to do so may result in severe burns, injury, or death.

ATTENTION: Only AC high potential tests are recommended. Rockwell Automation does not recommend DC power frequency withstand voltage tests as they do not provide reliable results.

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. One of the following AC Hi-pot testers is recommended as a test instrument.

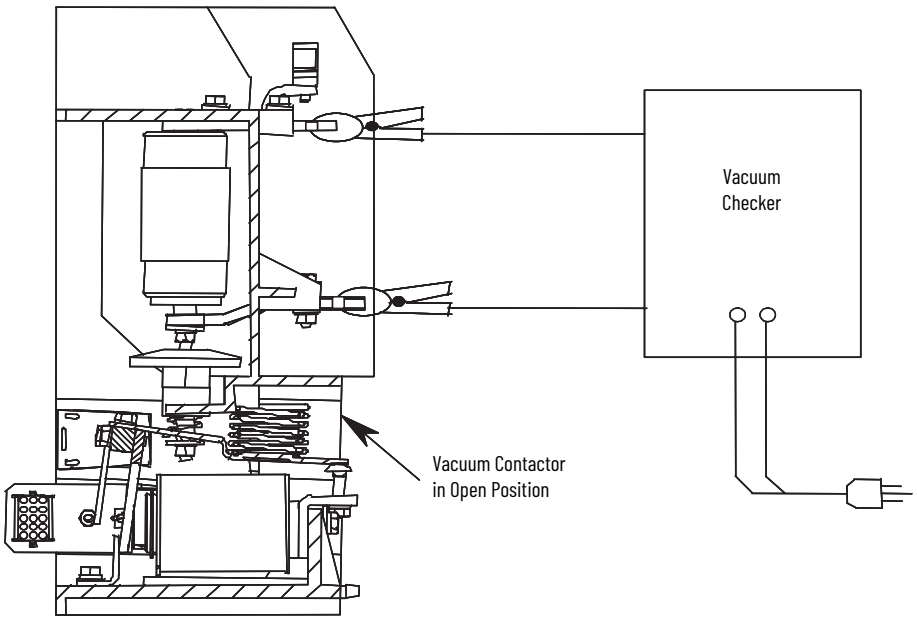
Manufacturer	Address
Vacuum Interrupters Inc. Model MAC-TS4 Vacuum Interrupter Tester	Farmers Branch, Texas 75244
Hipotronics Model 7BT60A	Brewster, NY, USA

1. Clean the outside of the vacuum bottles with a lint-free cloth or industrial wipe before performing the test.
2. 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 Hi-pot tester must be connected to the load side of the contactor. Any fuses in the top of the contactor must be removed.
3. With the contactor in the open position, connect the test leads to the contactor power terminals as shown in Figure 5. It is recommended that an AC Hi-pot tester be used. Apply 16 kV for 60 seconds and monitor the leakage current. It must not exceed 5 mA. Test each vacuum bottle individually.
4. If no breakdown occurs, the vacuum bottle is in an acceptable condition. If a breakdown occurs, repeat the test once more. If the vacuum bottle fails a second time, it must be replaced. If no breakdown occurs in the second test, the vacuum bottle is in an acceptable condition.

ATTENTION: If one vacuum bottle fails, Rockwell Automation recommends replacing all three vacuum bottles, if the unit has been in service.

5. After the high potential voltage is removed from the vacuum bottles, the metal end caps of the vacuum bottles must be discharged with a grounding rod.

Figure 5 - Vacuum Bottle Integrity Test Circuit



The allowable leakage current value of 5 mA 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 and noting the maximum leakage current. If this value is more than 2 mA, it must be added to the 5 mA limit when testing the vacuum bottles.

Rockwell Automation does not recommend a DC Hi-pot test. The values that are obtained during the test are not a reliable indication of vacuum bottle integrity. An AC test provides a reliable vacuum integrity indication. Additionally, 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.

Storage

To store the contactor before it is in service, store it in a clean, dry area, free from dust and condensation. Do not store contactor outdoors.

Storage temperature must be between -20...+65 °C (-4...+149 °F). If storage temperature fluctuates or if humidity exceeds 85%, use space heaters to prevent condensation.

Insulation Resistance Test

Use a 1000V insulation resistance tester to verify that the resistance from phase-to-phase or from phase-to-ground is greater than 500 megohms.

Notes:

Installation

Mounting

The electrically held and the mechanically latched contactors are fixed-mounted in the cabinet. Two retaining tabs at the rear of the molded base can be used for mounting. The two mounting slots at the front of the molded base secure the contactor with 1/4 in. bolts. The appropriate mounting configuration is provided inside the power cells of Allen-Bradley controllers. If the contactor is supplied as an OEM component for installation in a custom application, refer to the dimensional information in Figure 6. If the contactor is mounted in an enclosure designed by an OEM, there must be a minimum of 3 in. (76 mm) of air space between live parts (terminals and vacuum bottles) and the enclosure.

Figure 6 - Contactor Mounting Details (in. [mm])

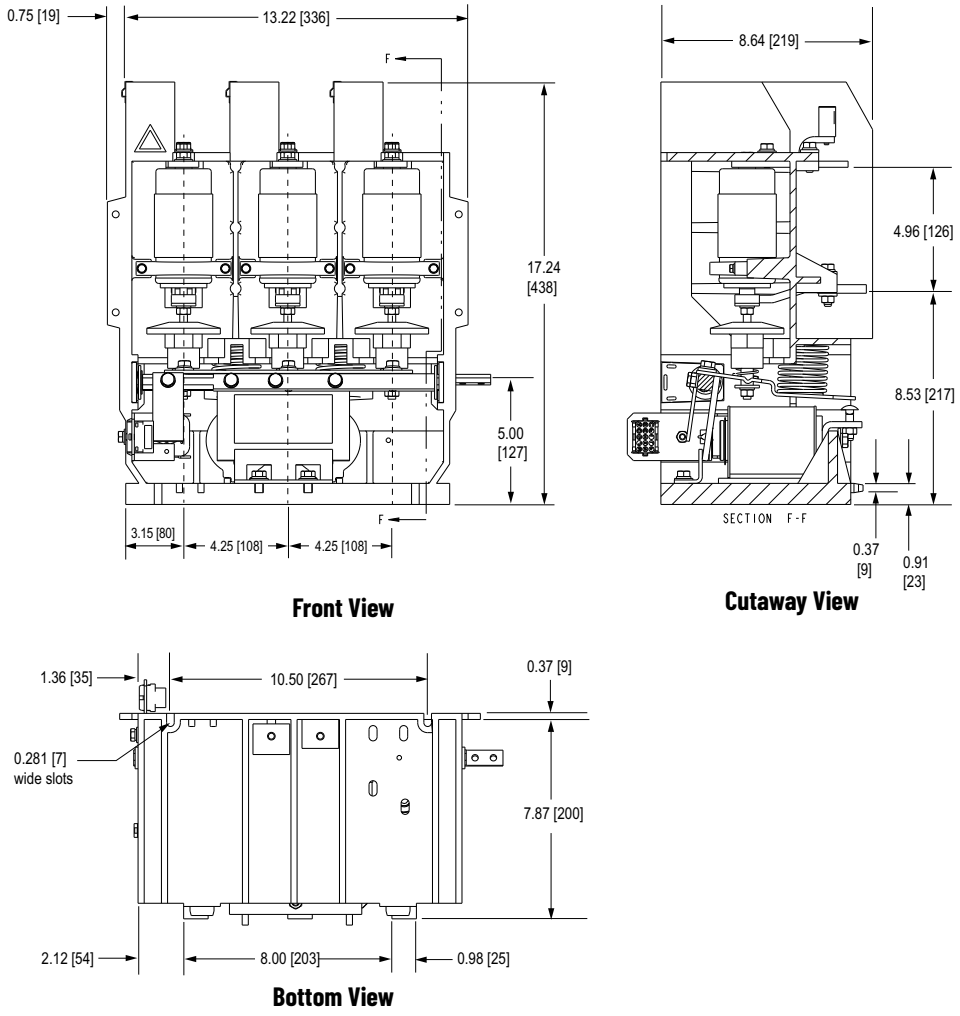
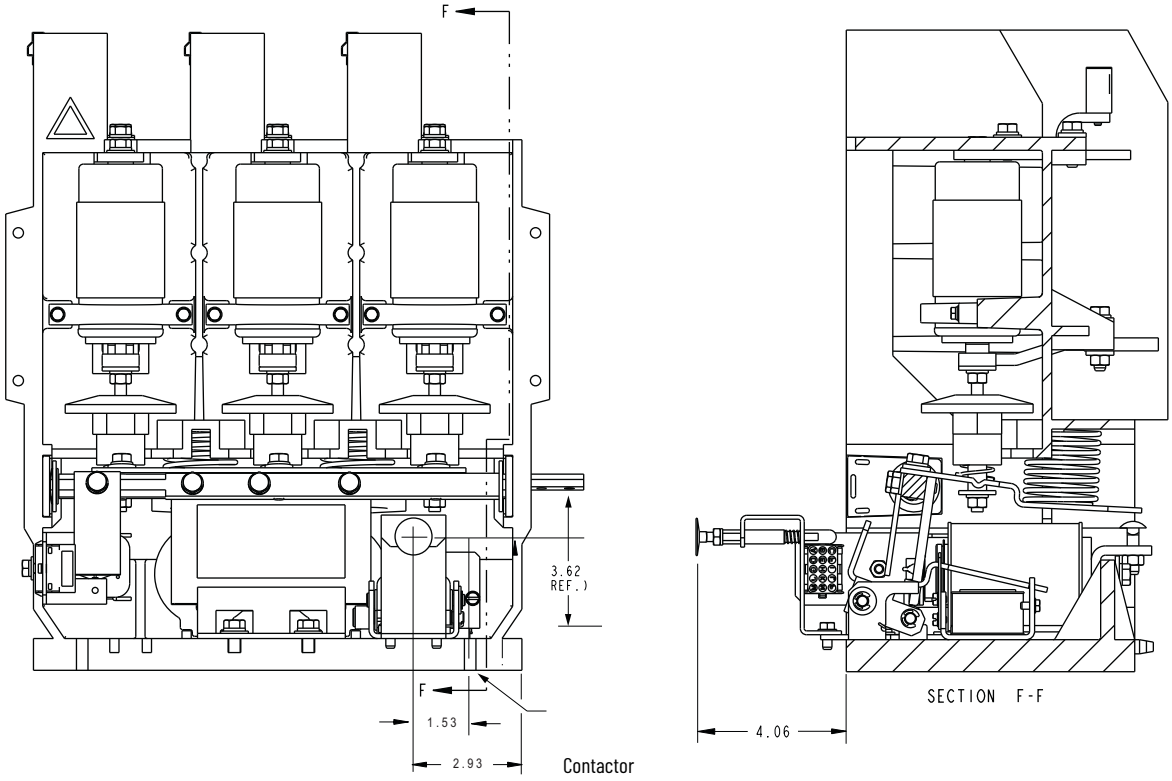


Figure 7 - Mechanical Latch Dimensions (Optional)



For mechanically latched contactors, the manual trip button in the cabinet door must be in line with the trip lever on the contactor.

Electrical Connections

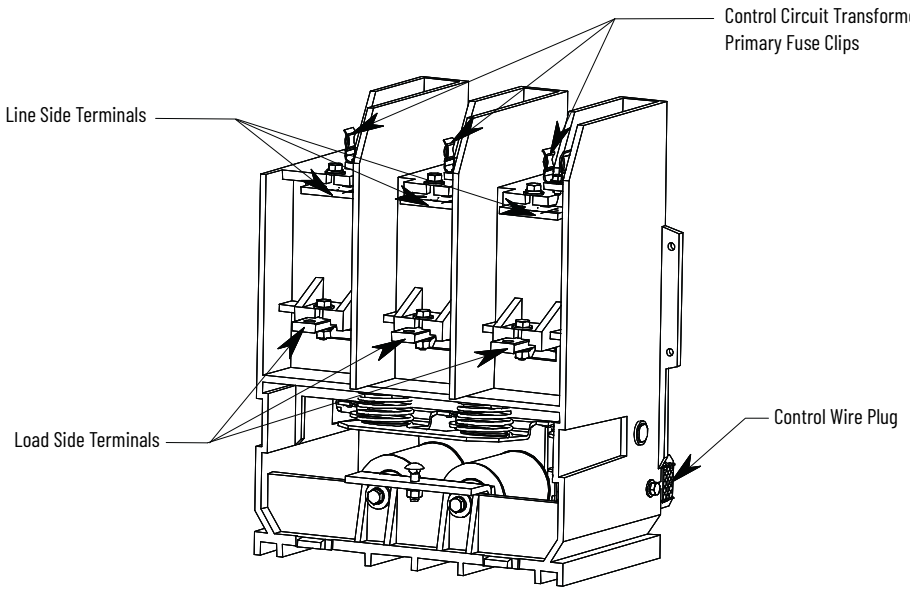
A wire harness connects the control wiring to the contactor from the low voltage control panel. The harness connects to a keyed wire plug on the lower left side of the contactor (plug configurations vary by contactor type). If the contactor is supplied as an OEM component for installation in a custom application, the following two control options and a connecting wire harness are available from Rockwell Automation.

- IntelliVAC control module
- Electromechanical control panel

Connect incoming medium voltage power to the line side terminals at the top, rear of the contactor near the control fuse clips. Use 3/8 in. (10 mm) bolts torqued to 20 lb•ft (292 N•m) to secure the connection.

Connect outgoing medium voltage power to the load side terminals halfway down the rear of the contactor. Use 3/8 in. (10 mm) bolts torqued to 20 lb•ft (292 N•m) to secure the connection.

Figure 8 - Electrical Connections (Rear View)



Wiring and Schematic Diagrams

Figure 9 - Wiring Diagram - Electrically Held Contactor (for use with IntelliVAC™ Control Modules Only)

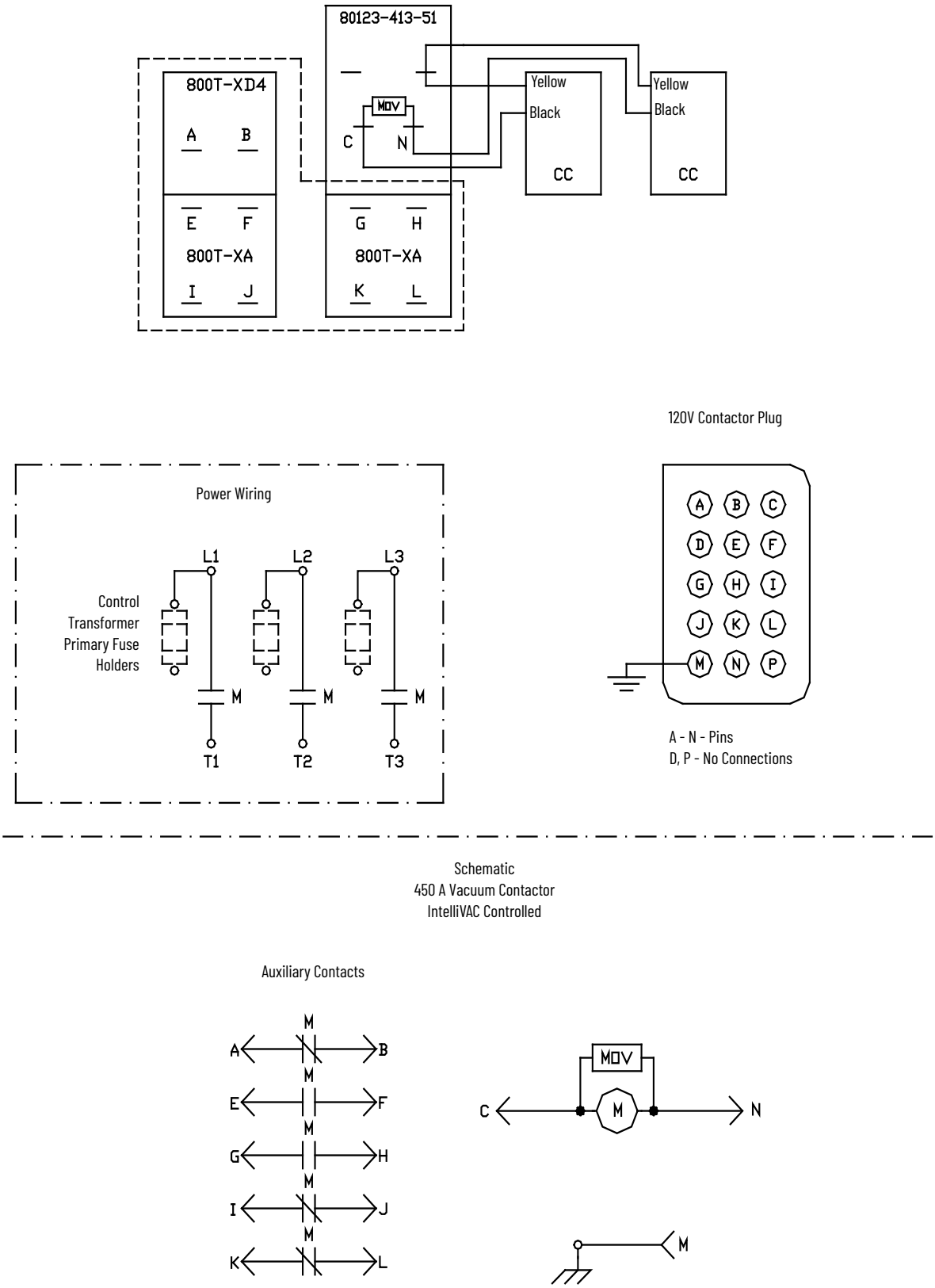


Figure 10 - Wiring Diagram - Mechanical Latch Contactor (for use with IntelliVAC Control Modules Only)

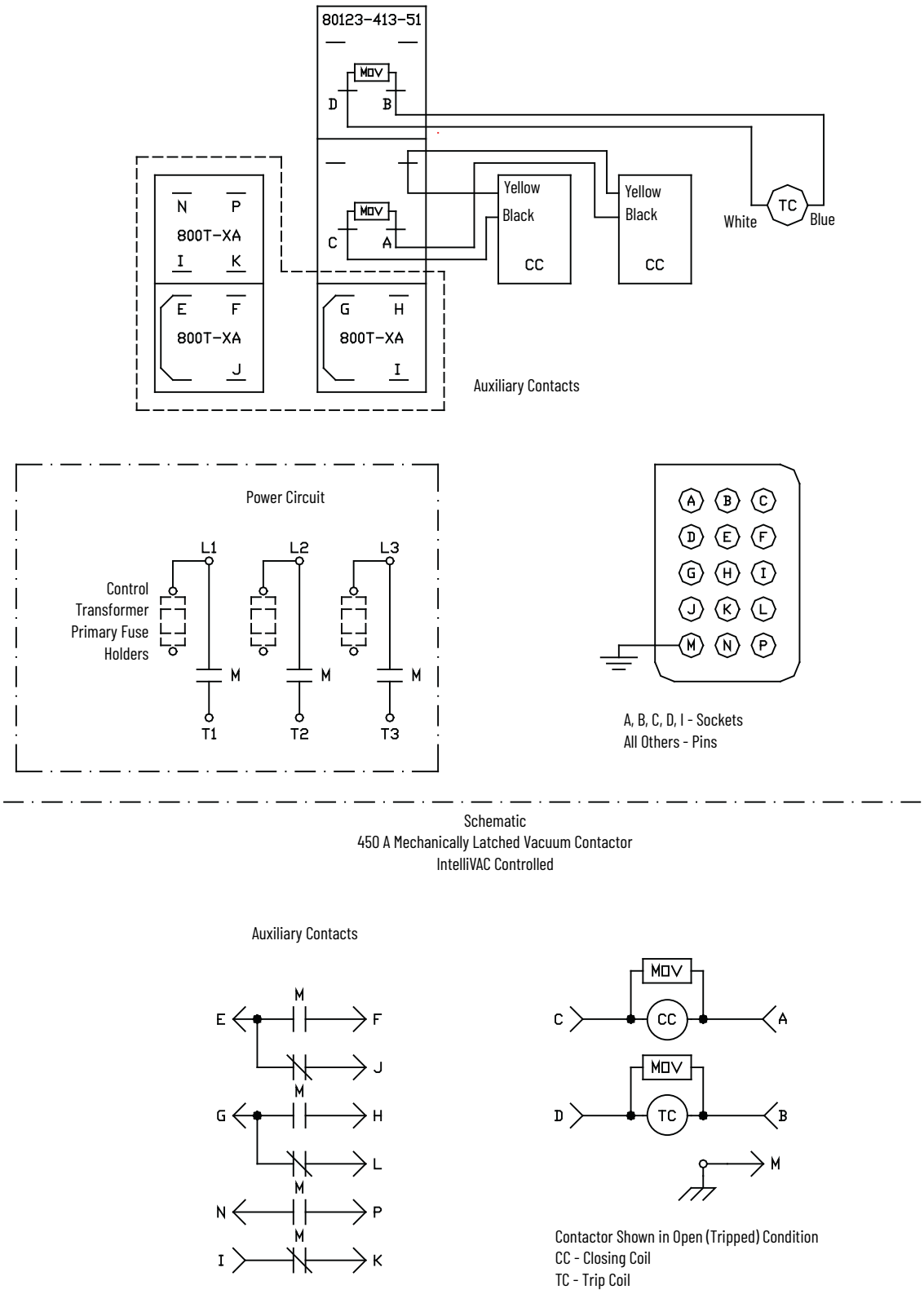
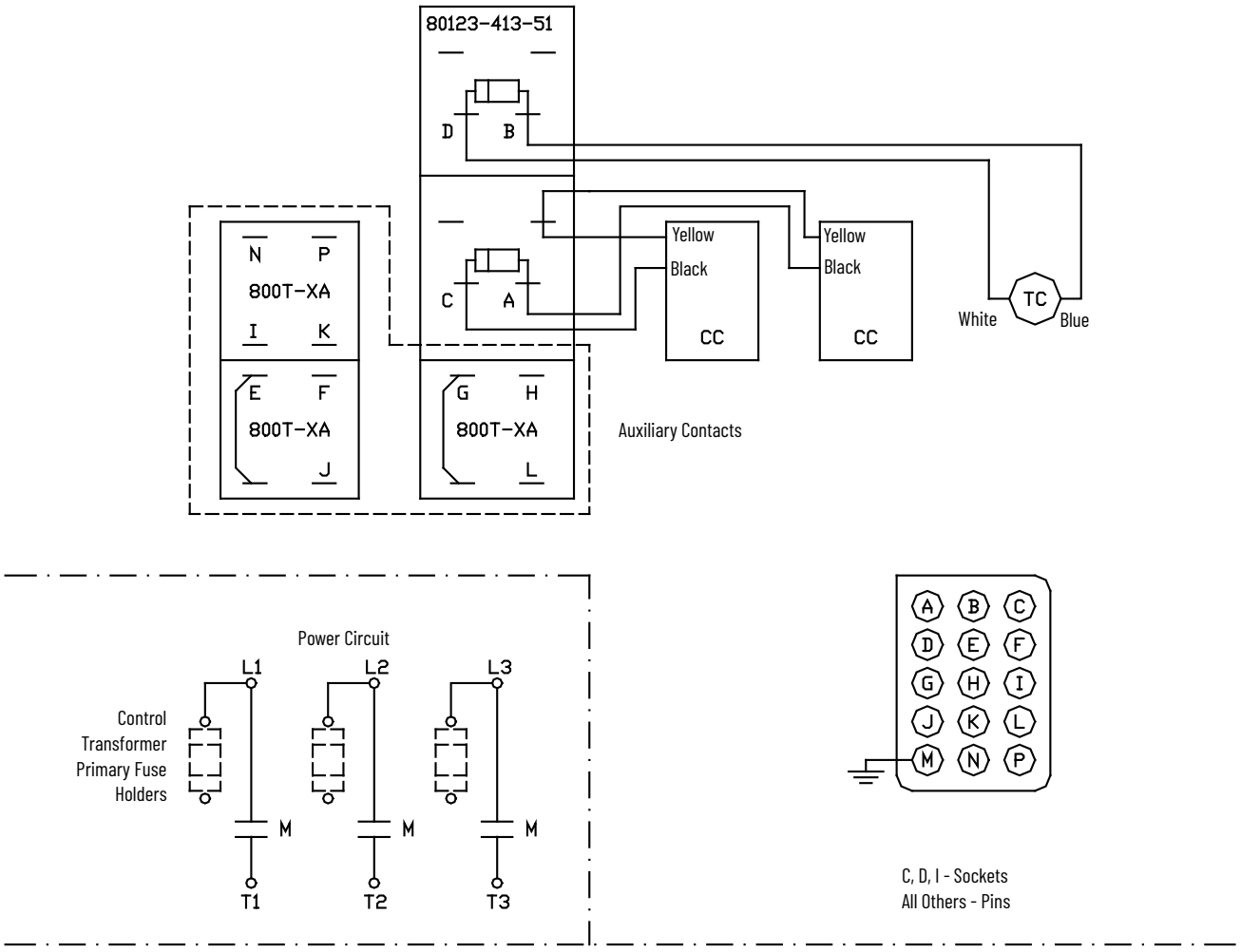
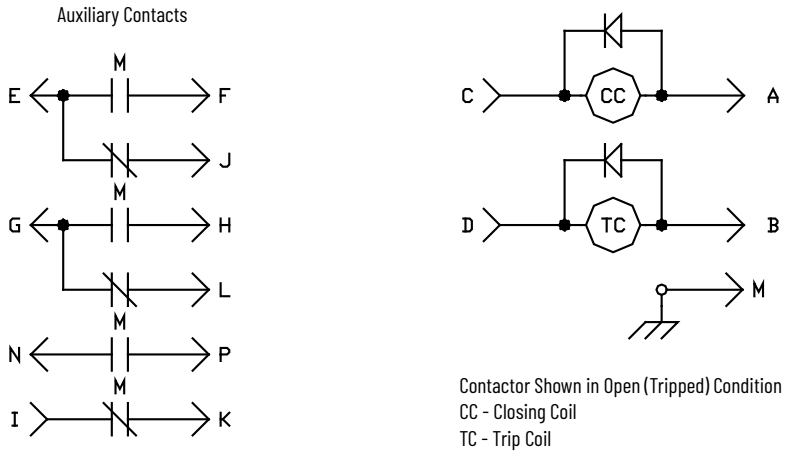


Figure 11 - Wiring Diagram - Mechanical Latch Contactor (for use with Electromechanical Control Panel Only)

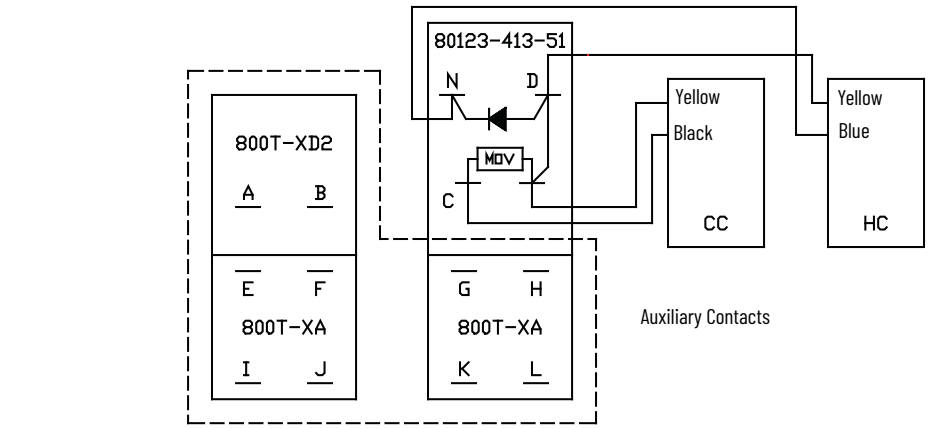


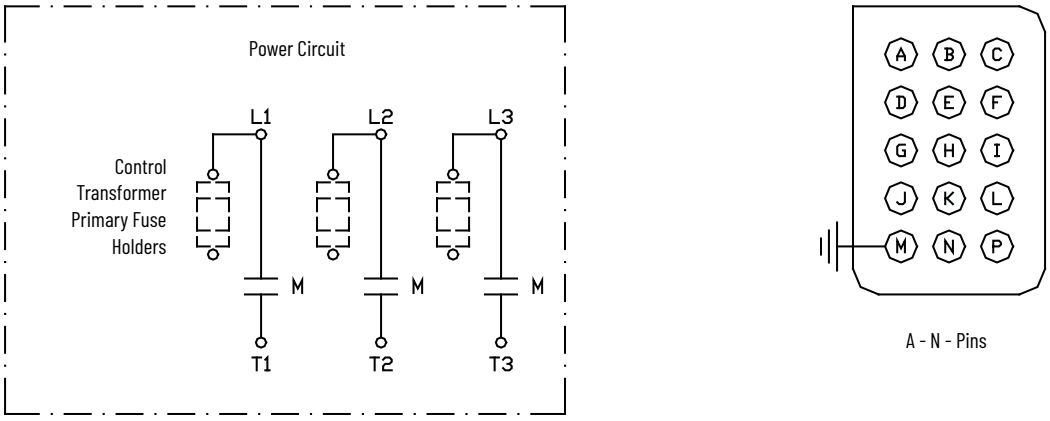
Schematic
450 A Mechanically Latched Vacuum Contactor
Relay Controlled



Contactor Shown in Open (Tripped) Condition
CC - Closing Coil
TC - Trip Coil

Figure 12 - Wiring Diagram - Electrically Held Contactor, 120V AC, Normal Dropout Time, (for use with Electromechanical Control Panel Only)





Schematic
450 A Vacuum Contactor
120V Coil, Normal Dropout

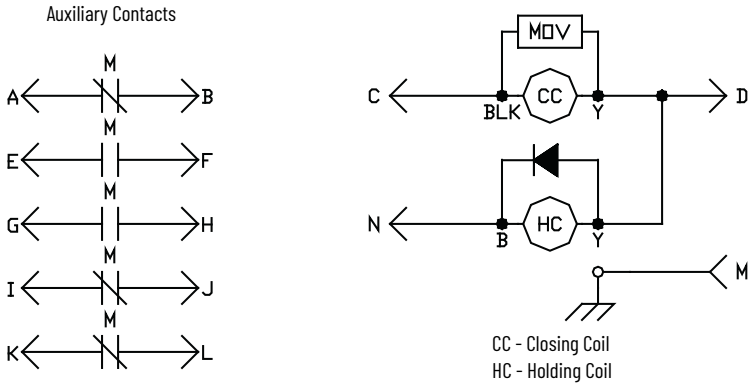
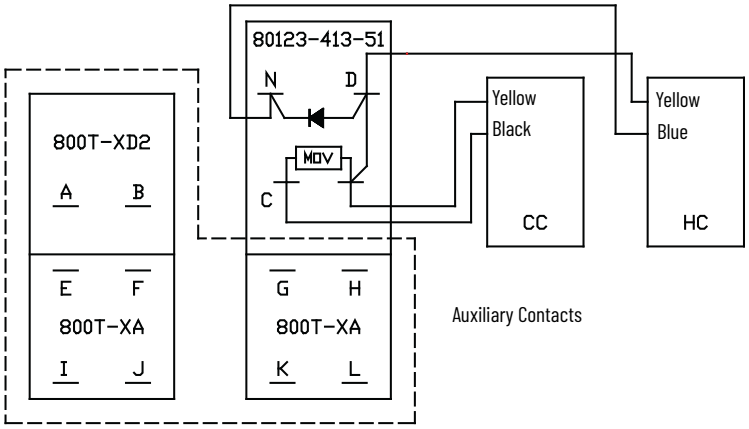
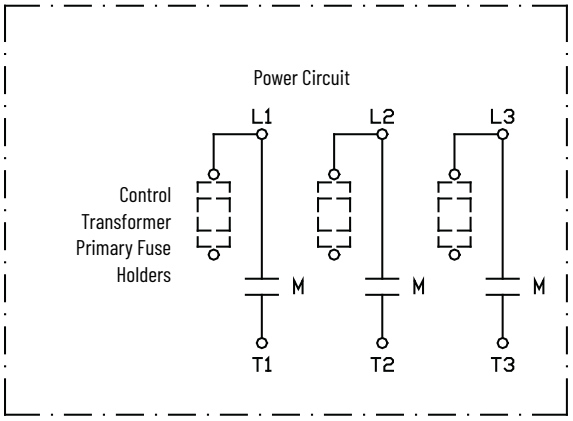
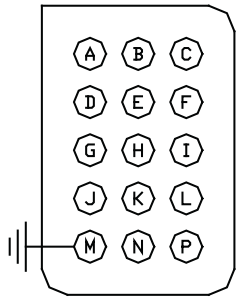


Figure 13 - Wiring Diagram - Electrically Held Contactor, 230V AC, Normal Dropout Time, (for use with Electromechanical Control Panel Only)

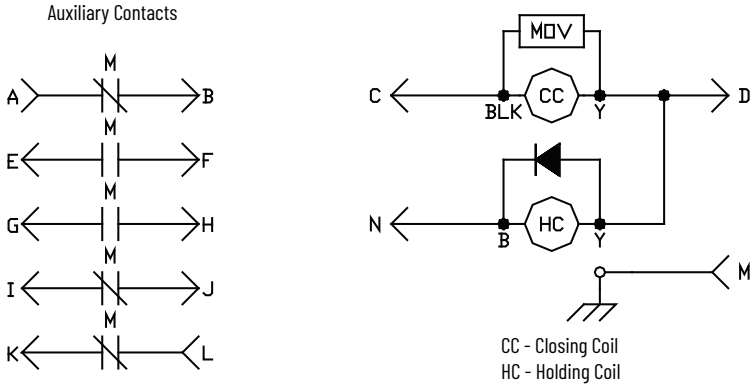






B, C, D, E, F, G, H, I, J, K, N - Pins
A, L, M - Sockets
P - Not used

Schematic
450 A Vacuum Contactor
230V Coil, Normal Dropout



CC - Closing Coil
HC - Holding Coil

Figure 14 - Wiring Diagram - Electrically Held Contactor, 120V AC, Fast Dropout Time, (for use with Electromechanical Control Panel Only)

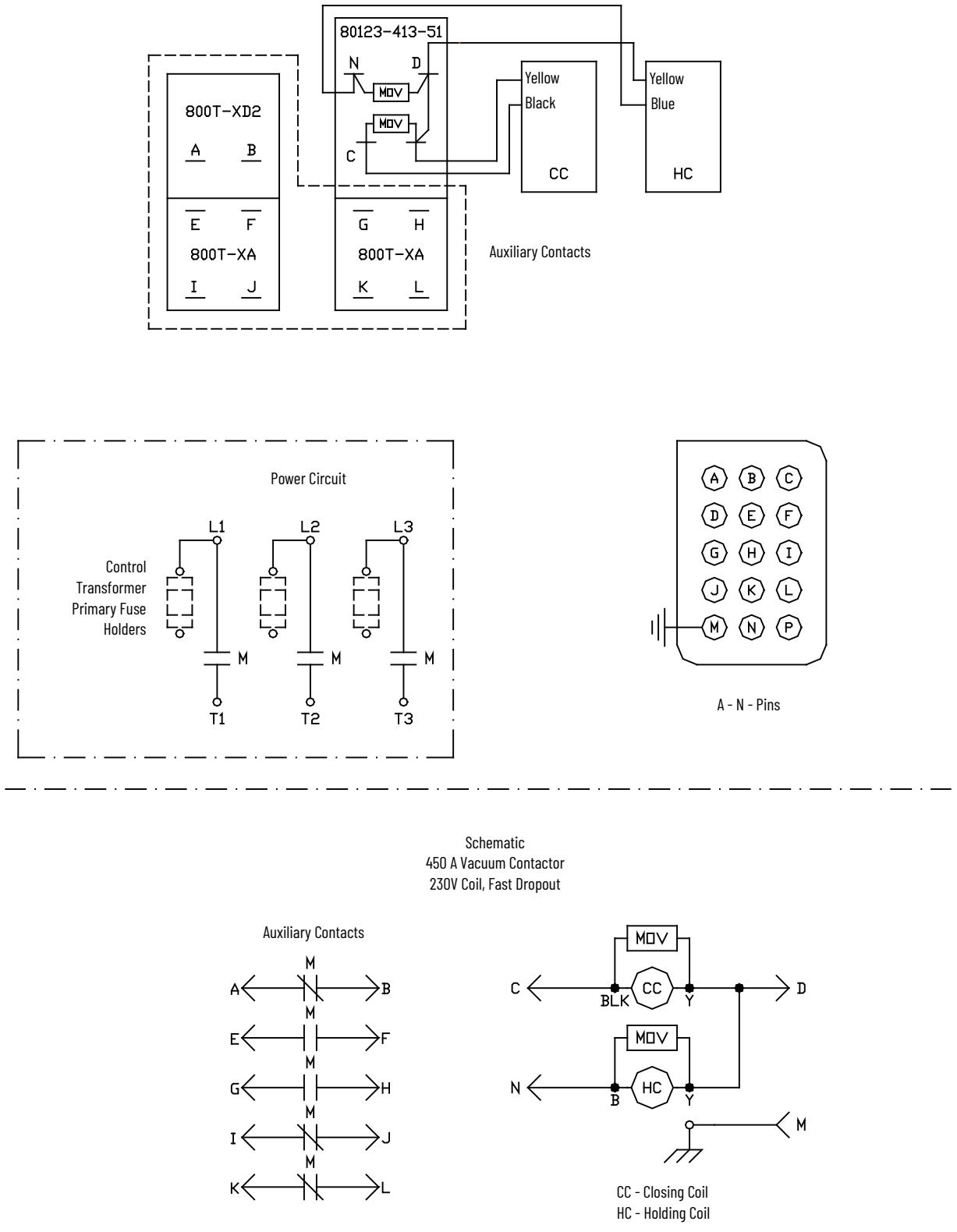


Figure 15 - Wiring Diagram - Electrically Held Contactor, 230V AC, Fast Dropout Time, (For Use with Electromechanical Control Panel Only)

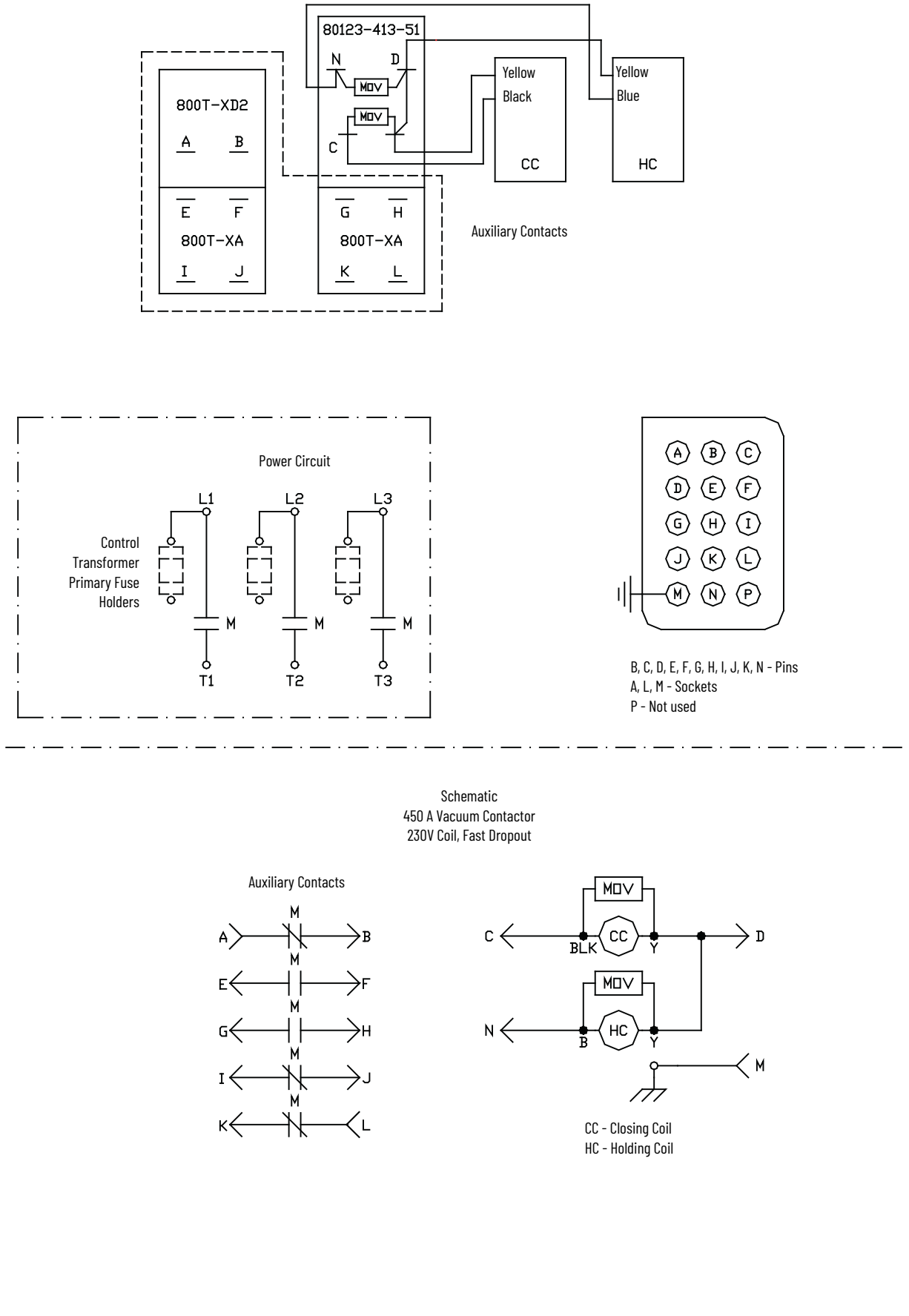


Figure 16 - Typical Schematic Diagram for 450 A Full-Voltage Non-Reversing (FVNR) Controller With IntelliVAC Control and Electrically Held Contactor

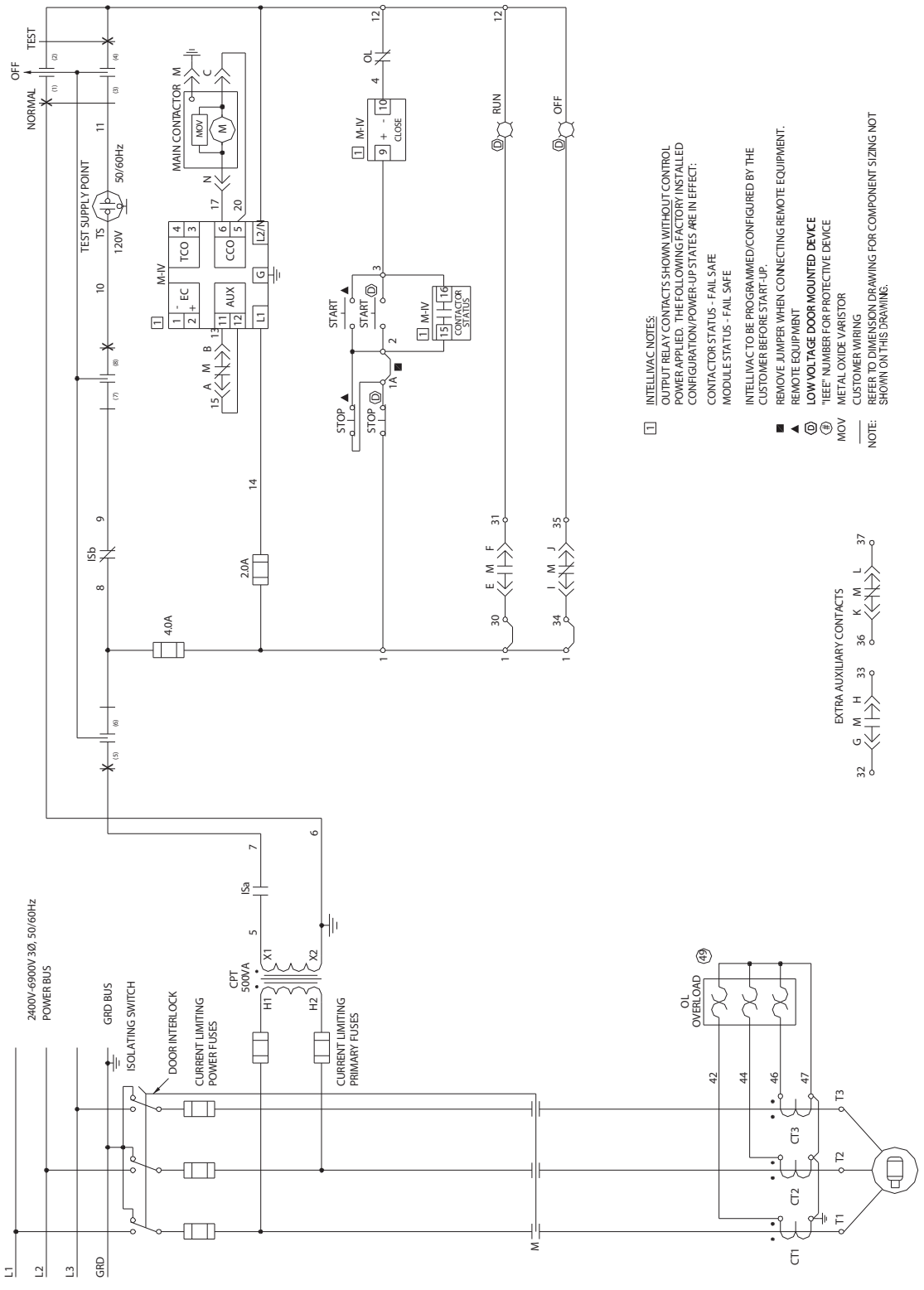


Figure 17 - Typical Schematic Diagram for 450 A Full-Voltage Non-Reversing (FVNR) Controller With IntelliVAC Control and Mechanical Latch Contactor

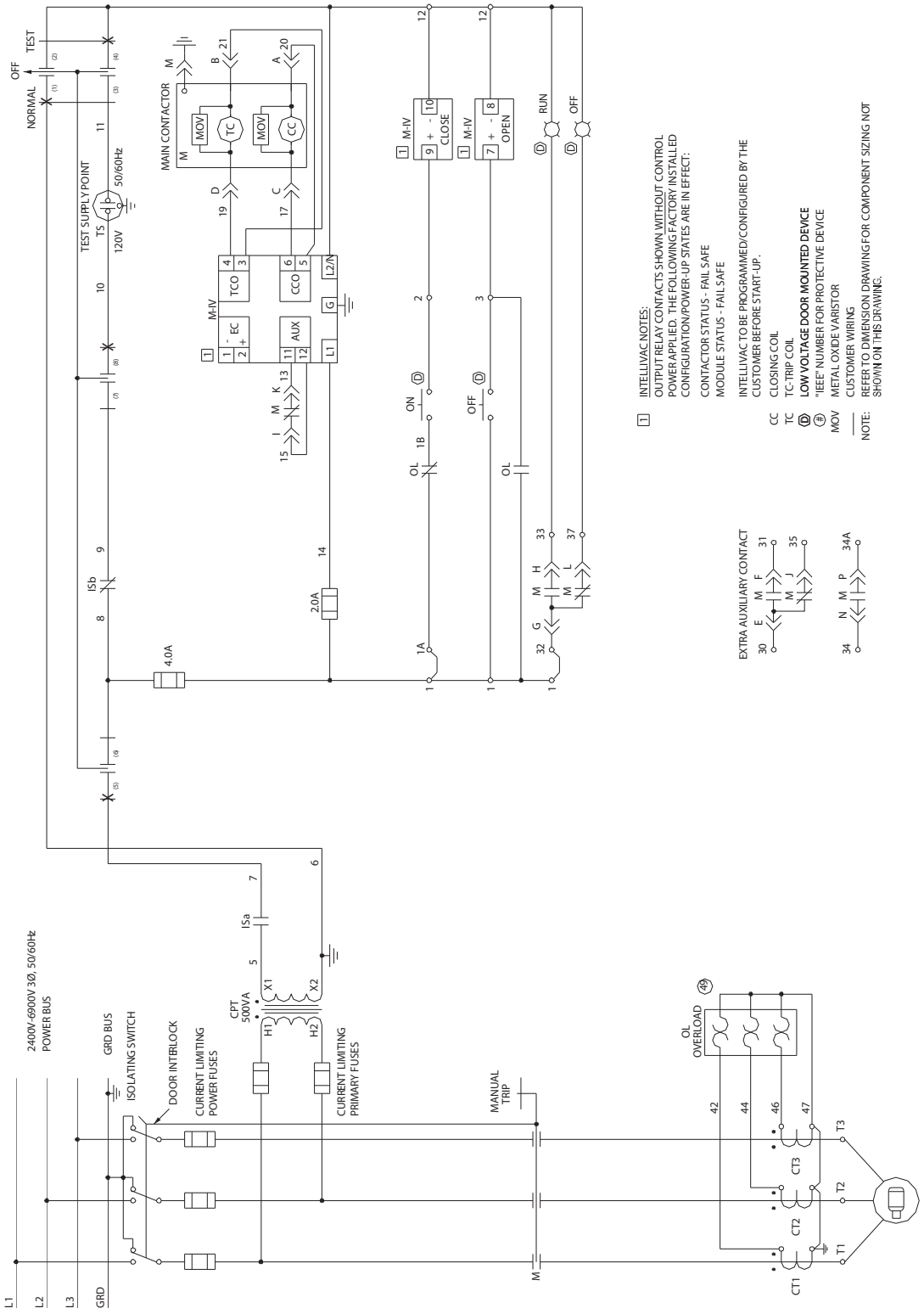
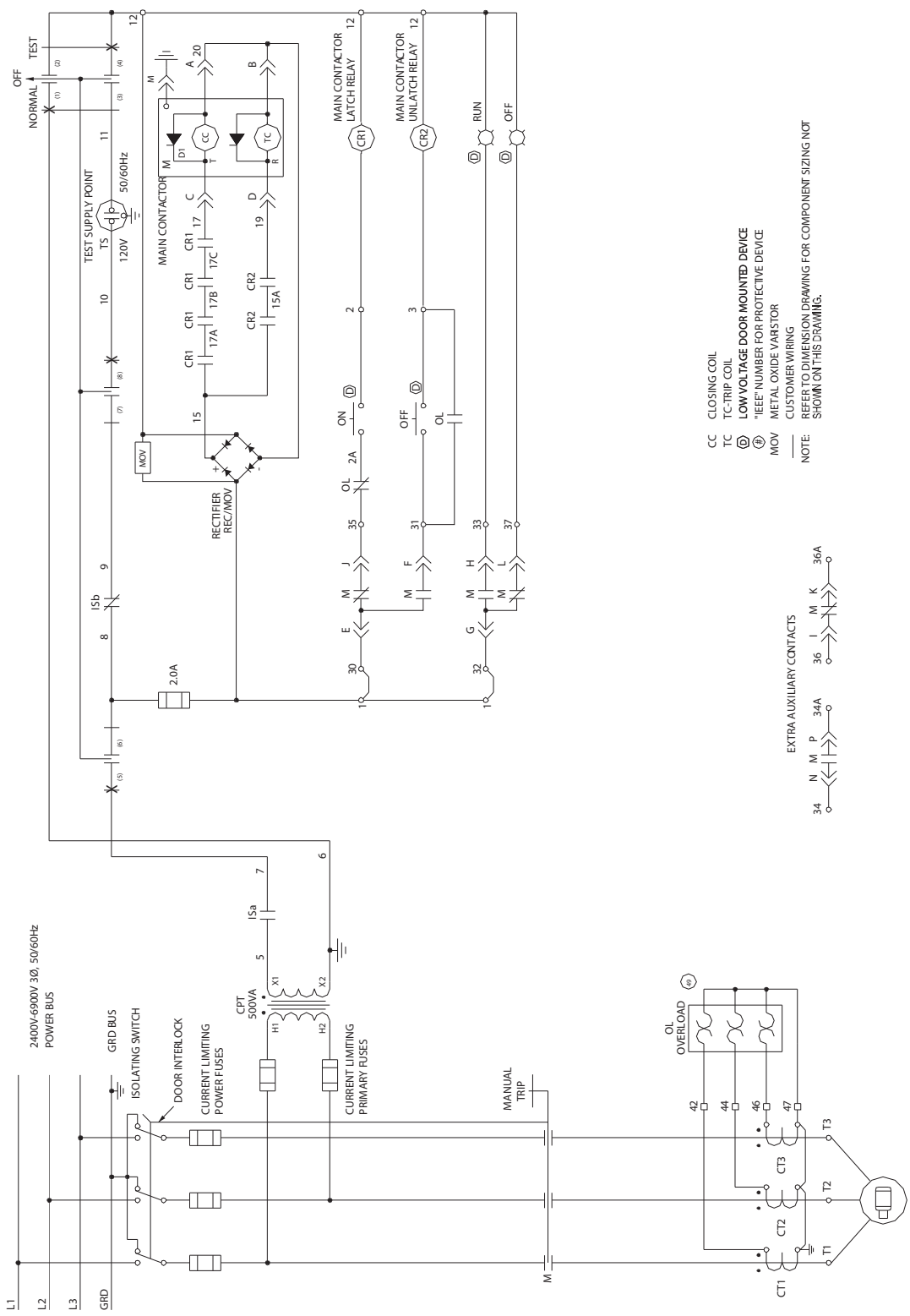
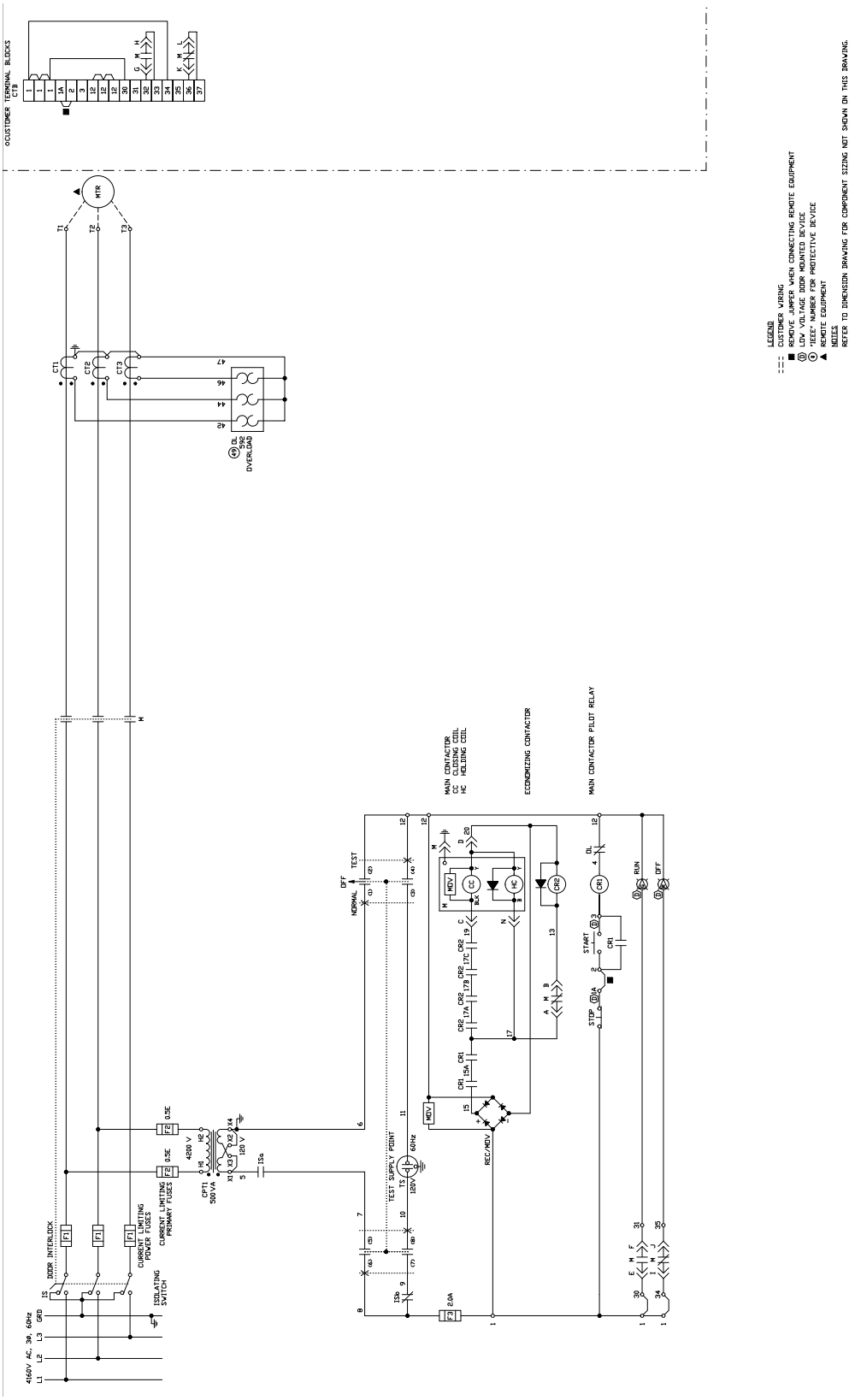


Figure 18 - Typical Schematic Diagram for 450 A Full-Voltage Non-Reversing (FVNR) Controller With Electro-Mechanical Control and Mechanical Latch Contactor[(a)]



(a) CR1, CR2, and the wiring of their contacts into the control circuit are part of the Rockwell Automation relay control panel (1503C-XXX or 1503E-CXXX). This control panel provides reliable operation of the contactor within its published specification.

Figure 19 - Typical Electrical Diagram for 450 A Full-voltage Non-reversing (FVNR) Controller with Electrically Held Contactor, 120V AC (Normal Drop-out Time)[a]



(a) CR1, CR2, and the wiring of their contacts into the control circuit are part of the Rockwell Automation relay control panel (1503C-XXX or 1503E-CXXX). This control panel provides reliable operation of the contactor within its published specification.

Maintenance

Tool Requirements

IMPORTANT	Some components of this product incorporate imperial hardware. Rockwell Automation recommends the use of the appropriate tools to complete the maintenance procedure on these components. If you cannot obtain such tools, contact your Rockwell Automation sales office.

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., 1/2 in.
- Open-end wrenches; 7/16 in., 1/2 in., 5/8 in.
- Slot head screwdrivers; 1/8 in. wide, 1/4 in. wide
- External retaining ring pliers (STANLEY-PROTO #393 or equivalent)
- Feeler gauge set (0.030 in. [0.76 mm] and 0.075 in. [1.91 mm])
- Feeler gauge set (0.010 in. [0.25 mm]) Mechanical Latch
- 2 in. C-Clamp
- Armature clamping fixture (Allen-Bradley PN-195987)
- 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 the torque values that are specified in Table 10.

Table 10 - Torque Values

#10 in. hardware	2.7 lb•ft (3.6 N•m)
1/4 in. hardware	6 lb•ft (8 N•m)
5/16 in. hardware (Grade 2)(1)	11 lb•ft (15 N•m)
5/16 in. hardware (Grade 5)(2)	18 lb•ft (24 N•m)
3/8 in. hardware	20 lb•ft (27 N•m)

(1) All 5/16 hardware is Grade 2 unless otherwise specified.
(2) See Figure 22.

Routine Maintenance

ATTENTION: Before performing any maintenance on the contactor, refer to the User Manual of the starter configuration. Failure to do so can result in injury to personnel or damage to the controller or contactor.

ATTENTION: To avoid shock hazards, lockout incoming power and disconnect the control plug from the contactor before working on the unit. Verify with a hot stick or meter that all circuits are voltage free. Failure to do so can result in severe burns, injury, or death.

The following must be performed annually or whenever a contactor is serviced:

Cleaning

1. Clean all metal chips or filings from around the electromagnet assembly (coil core pole face and mating armature plate) as they can affect proper operation of the contactor. Vacuum clean if necessary.

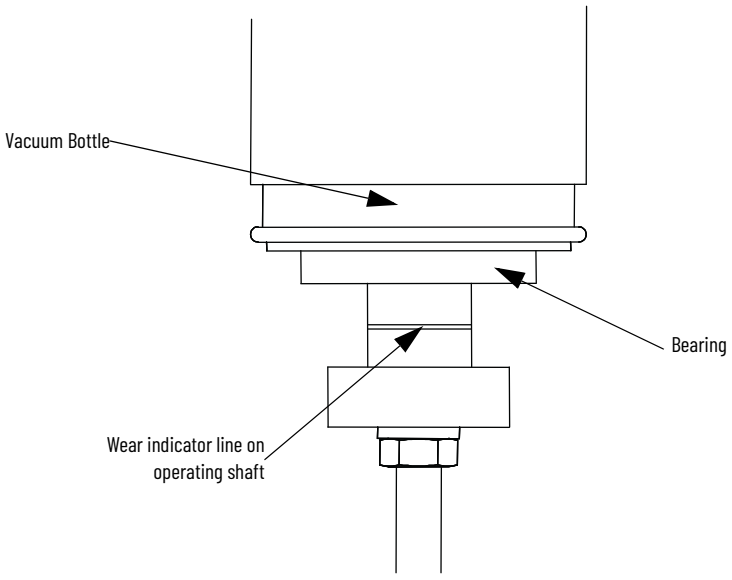
IMPORTANT Do not use compressed air to clean or remove dirt from surfaces or the enclosure.

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

Main Contact Inspection

Visually inspect the wear of the main contacts with the contactor energized. When any part of the wear indicator line, located on the front side of the shaft, moves up into the bearing, replace all three vacuum bottles (Figure 20).

Figure 20 - Vacuum Bottle Wear Indicator



High Potential Voltage (HiPot) and Insulation Resistance Test

The internal dielectric condition and vacuum integrity of the vacuum bottles is determined by this test.

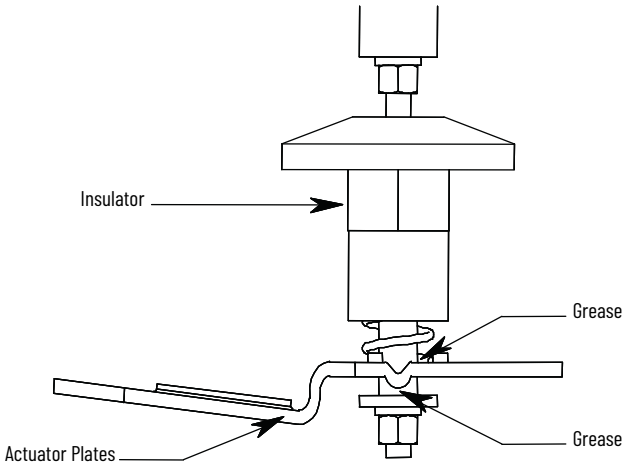
See page 18 to check the vacuum bottle integrity.

See page 20 to check the insulation resistance.

Lubrication

Using AeroShell No. 7 (1 oz tube, Part No. 40025-198-01), grease the actuator plate where the overtravel springs and washers make contact (Figure 21).

Figure 21 - Grease Locations



IMPORTANT Do not grease the armature shaft plastic bearings. These bearings are self-lubricating and do not require grease.

Vacuum Bottle Replacement

Rockwell Automation does not recommend that the vacuum bottles be replaced in the field. If the vacuum bottles need to be replaced, remove and return the entire vacuum contactor to Rockwell Automation for refurbishment.

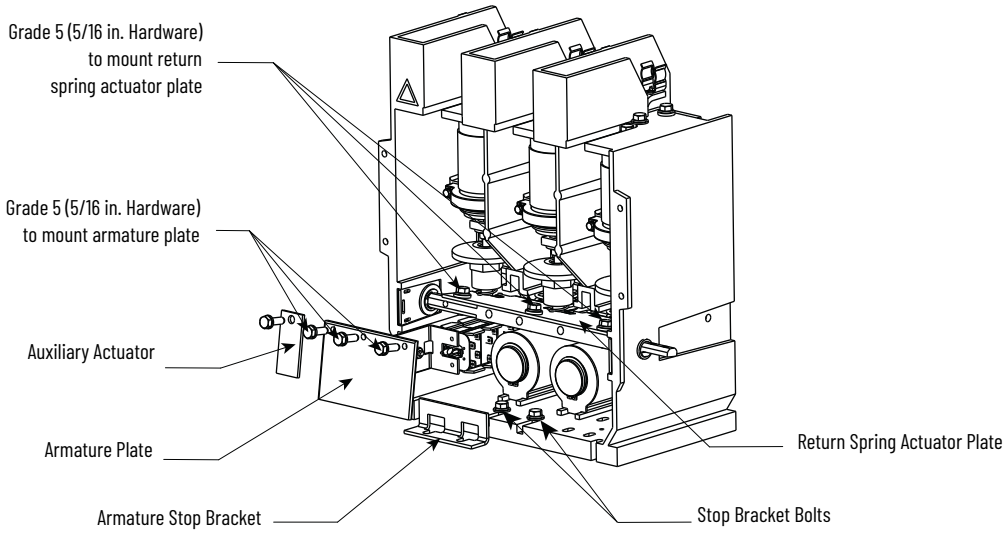
Coil Replacement Procedure

See Spare Parts on page 54 for the part numbers that are required for this procedure.

1. Remove the auxiliary actuator, front stop bracket, and armature plate as shown in Figure 22.

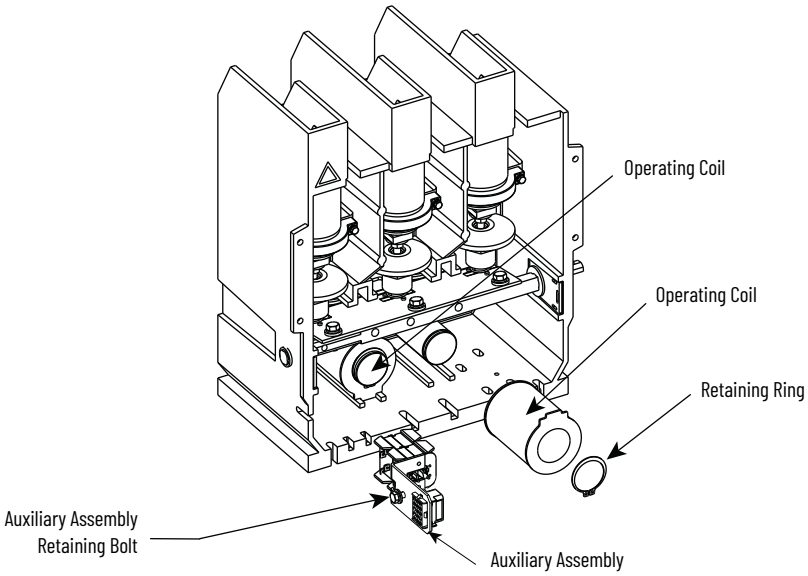
   Do not remove the bolts that secure the stop bracket. Loosen them and slide out the bracket.

Figure 22 - Access to Coils



2. Remove the retaining ring from the core of the coil you wish to replace as shown in Figure 23.
3. Loosen the auxiliary assembly retaining bolt and slide the assembly and the coils forward and out of the contactor as shown in Figure 23.

Figure 23 - Coil Removal



4. Disconnect the coil leads (take note of their location). Connect the leads of the new coil making sure that all metal-oxide varistors (MOVs) and/or diodes are secure. See the appropriate wiring diagram in this manual for further control wiring details (page 24).
5. Slide the new coil into position and install the retaining ring on the core. Install the auxiliary assembly leaving the retaining bolt loose for adjustment later. See the Auxiliary Contact Setup Procedure (page 39) for determining the position of the auxiliary assembly.

6. Install the armature plate, auxiliary actuator and stop bracket. Position the stop bracket by resting it lightly against the armature plate.

IMPORTANT This procedure applies to adjustment of existing auxiliaries and installation of new auxiliaries. Under normal conditions, auxiliaries last at least 1,000,000 operations. If auxiliary contacts must be replaced, discard the entire assembly and install a new assembly. Discarding the entire assembly is easier than replacing one contact block.

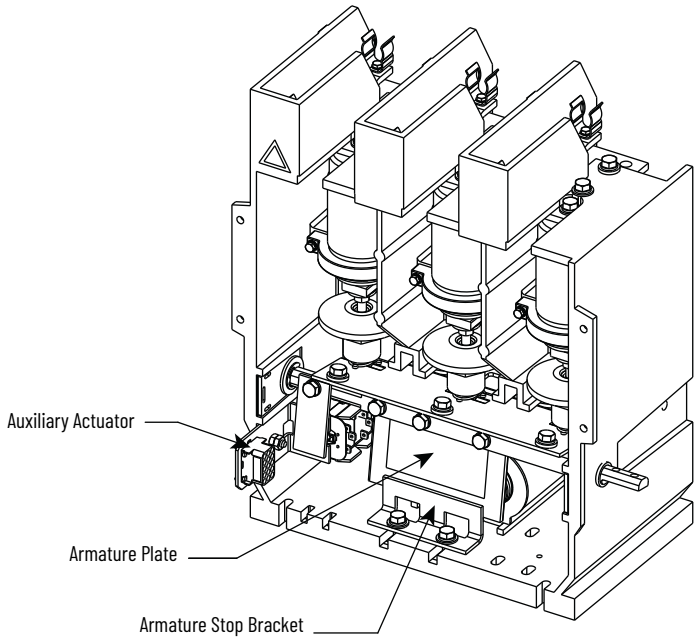
Auxiliary Contact Setup Procedure

See Spare Parts on page 54 for part numbers required for this procedure.

To facilitate the set-up procedure, the contactor is held closed mechanically with a clamping fixture (Figure 24). It is important that the contactor is held closed tightly with the armature plate against the magnet cores when gauging the overtravel and auxiliary positioning.

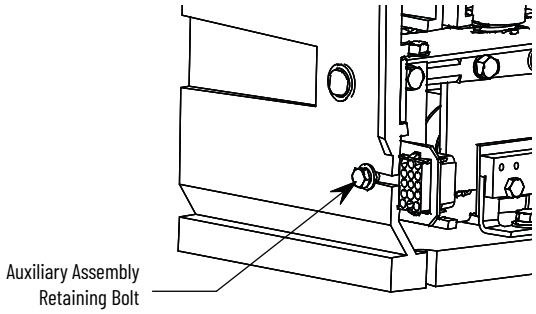
To aid in closing the contactor mechanically, a clamping fixture is recommended (PN-195987).

Figure 24 - Contactor Components



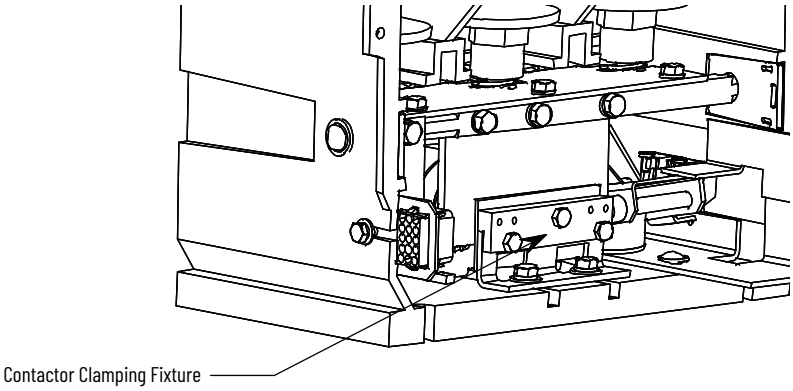
1. Loosen the nuts on auxiliary assembly retaining bolt. This requires loosening and removal of the first nut that secures a ground wire at this location. Leave the nut loosened enough to permit the assembly to slide along the adjustment slot as shown in Figure 25.

Figure 25 - Auxiliary Contact Adjustment



2. Slide the clamping fixture (PN-195987) over the top of the armature stop bracket (Figure 26). Finger-tighten the two outside fixture mounting bolts against the armature stop bracket. You might have to push the armature plate a little to the rear to put the clamp in place.

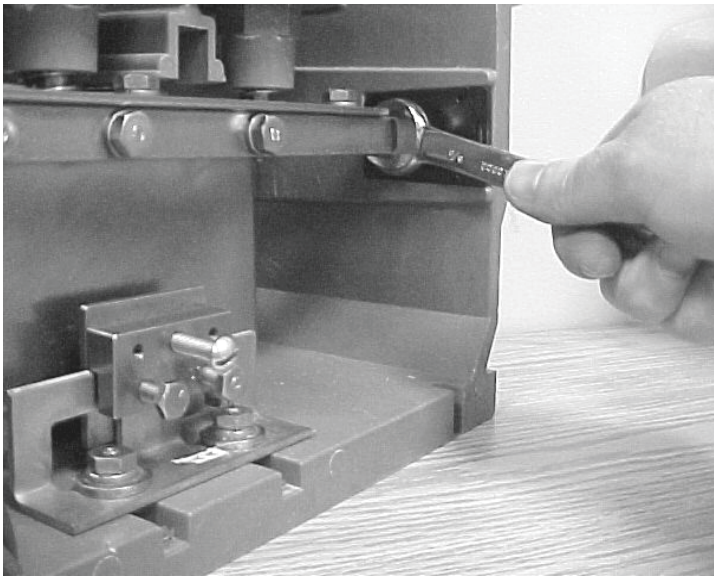
Figure 26 - Clamping Contactor Closed



3. Place a 5/8 in. wrench on the main shaft of the contactor, pull-down and close the contactor (Figure 27) while finger-tightening the top middle screw on the clamping fixture (PN-195987).

ATTENTION: Do not bend the actuator stop plate.

Figure 27 - Closing the Contactor



4. After the top screw is finger tight, continue to tighten this screw with a hand tool. The armature stop bracket flexes a little, which is acceptable, but do not overtighten and bend the armature stop plate. It is important that the armature plate is held tightly against the magnet cores. The contactor must be fully closed.
5. Place a wide blade 0.030 in. (0.76 mm) feeler gauge between the plastic auxiliary actuator tips and the steel actuator plate. To aid the installation of the feeler gauge, the gauge can be put in place as the clamping block screw is being finger-tightened (Step 3). See Figure 28 and Figure 29.

Figure 28 - Gauging the Contacts

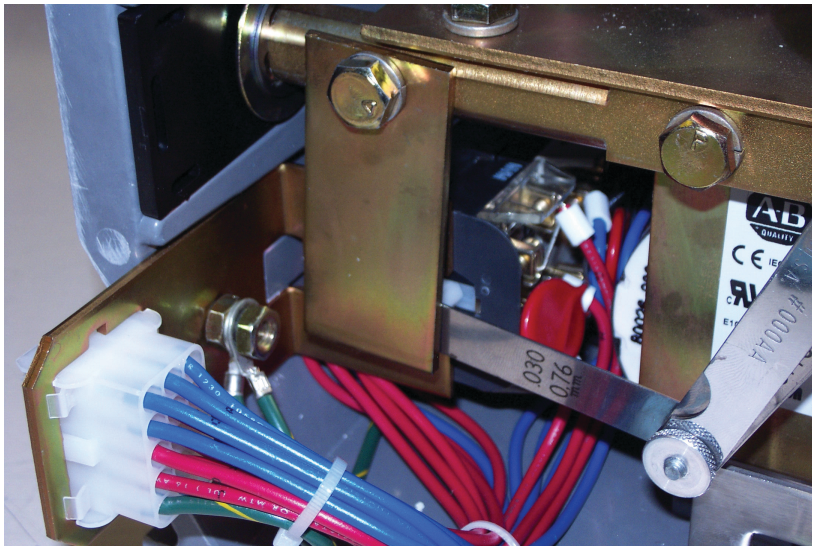
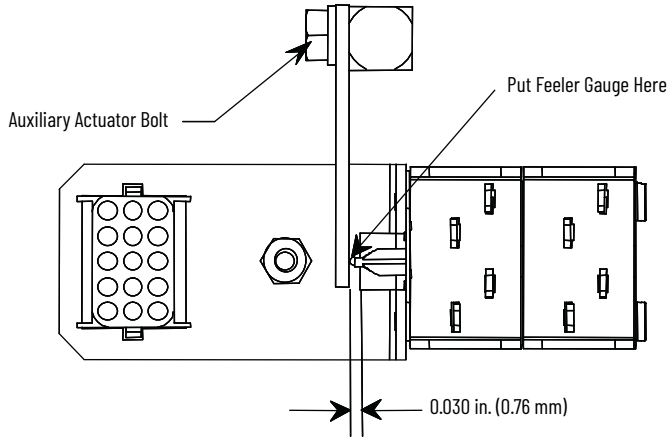


Figure 29 - Gauging Auxiliary Contact Location



6. With the gauge in place, slide the assembly forward until the contact actuator bottoms out. With the gauge still in place, carefully tighten the auxiliary assembly retaining nut.

IMPORTANT Hold the bolt head using a wrench when you tighten the nut. Make sure that the auxiliary assembly does not move as you tighten the nut.

7. When the first nut is tightened, slide out and remove the feeler gauge.
8. Reinstall the green ground wire on the auxiliary assembly retaining bolt. Install and carefully tighten the second nut.
9. Slowly loosen the top screw of the contactor clamping fixture to remove the pressure on the armature plate. Loosen the two mounting screws on the contactor clamping fixture. Remove the fixture.
10. Energize the control circuit in "TEST" mode and exercise the contactor to verify set-up. Contactor must open and close smoothly and solidly.

Mechanically Latched Contactor Trip Coil Replacement Procedure

Parts

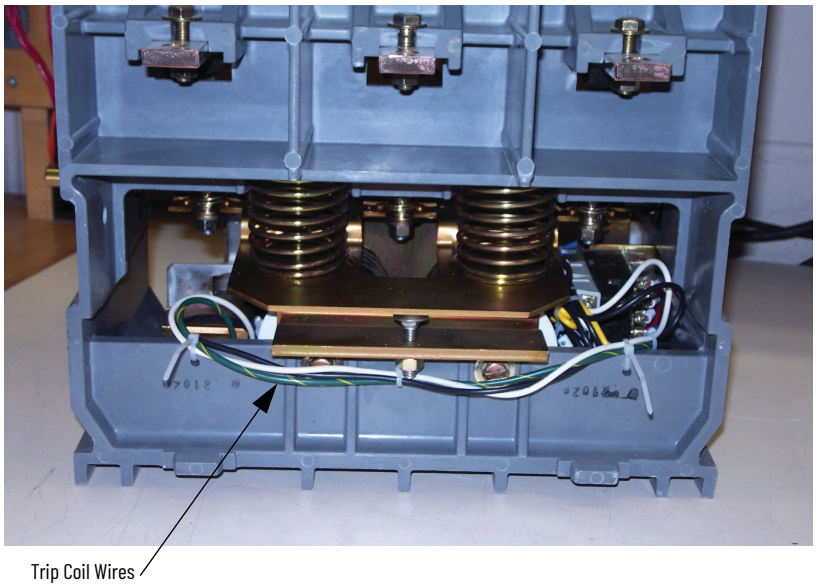
See Spare Parts on page 54 for the part numbers required for this procedure.

- Required Tools
- Two 7/16 in. Wrenches
- 3/8 socket and ratchet
- 5/16 socket and ratchet
- Phillips Screwdriver
- 3/32 in. Right Angle Allen Key
- Feeler gauges
- Side Cutting Pliers
- Wire Ties
- Armature Clamping Fixture, PN-195987

Follow this procedure to replace the contactor trip coil.

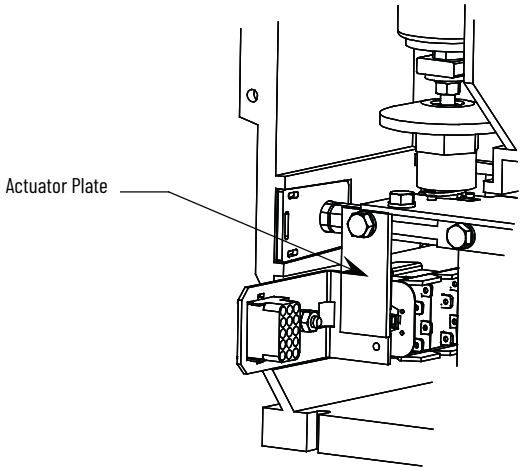
1. Cut wire ties at the rear of the contactor holding the mechanical latch coil wires in place (Figure 30).

Figure 30 - Rear View of Mechanical Latch Contactor (showing wires to trip coil)



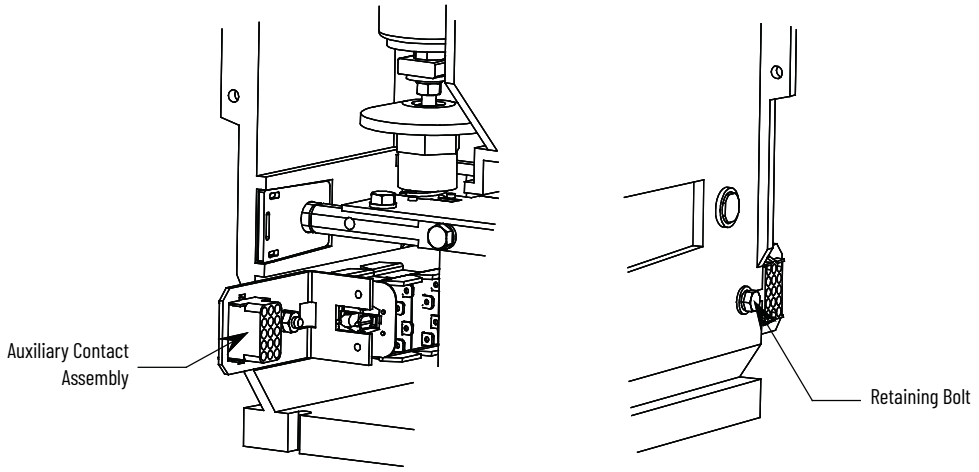
2. Using ½ in. wrench, remove the auxiliary contact actuator plate from the main shaft assembly (Figure 31).

Figure 31 - Auxiliary Actuator Plate Removal



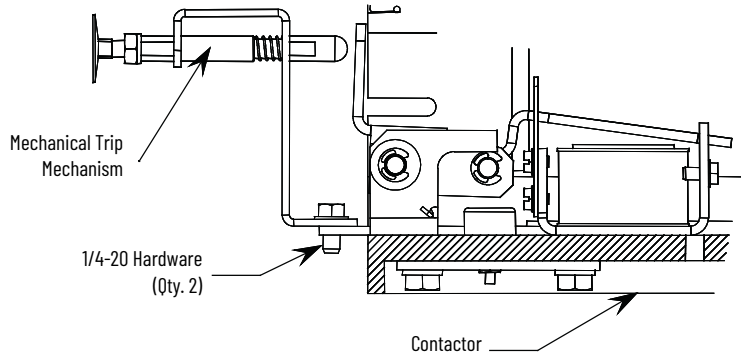
3. Using two 7/16 in. wrenches, loosen the auxiliary contact assembly retaining bolt and slide the auxiliary contact assembly out of the front of the contactor (Figure 32).

Figure 32 - Auxiliary Contact Assembly Removal



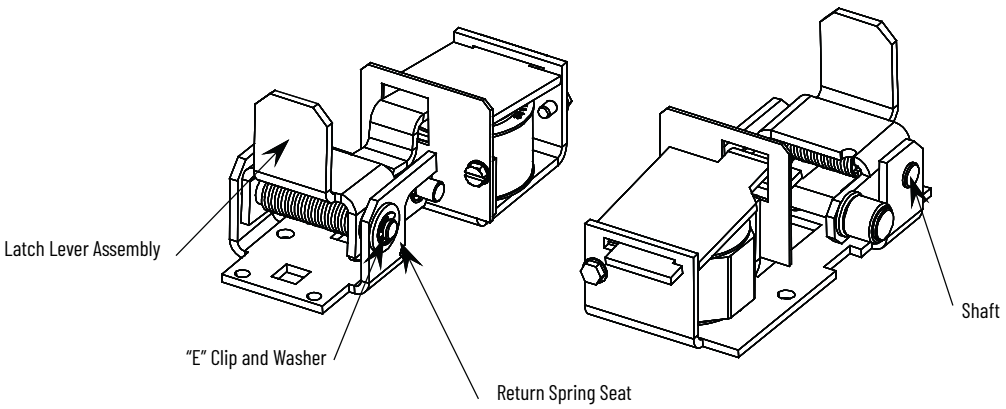
4. Disconnect the mechanical latch trip coil leads form the auxiliary contact assembly using a Phillips screwdriver.
5. Using a 3/8 in. socket, remove the ¼-20 hardware holding the mechanical trip mechanism in place, and then remove the mechanical trip mechanism (Figure 33).

Figure 33 - Removal of Mechanical Trip Mechanism



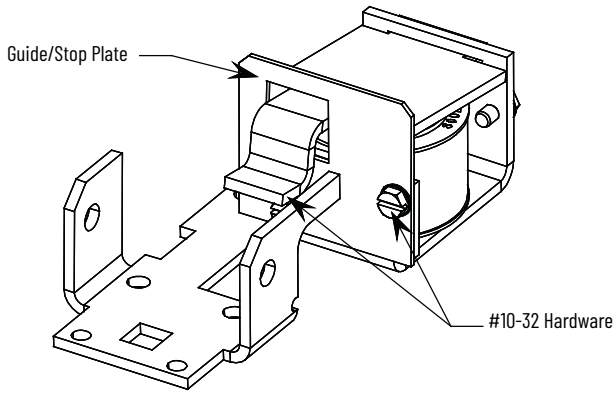
6. Remove the "E" clip and washer from the latch lever assembly shaft and then remove the shaft (Figure 34). Remove the latch lever assembly from the mechanical latch base. The return spring is "seated" on the right side of the mechanical latch base (the contactor is not shown for clarity).

Figure 34 - Removal of Latch Lever Assembly



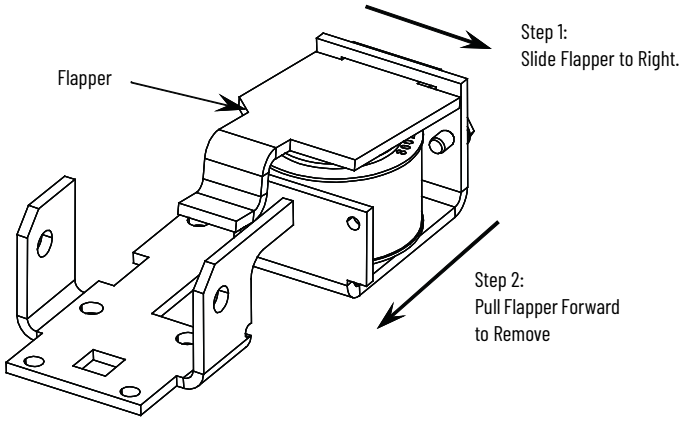
7. Using a 5/16 in. socket, remove the #10-32 hardware holding the stainless steel guide/stop plate in place, and then remove the guide/stop plate (Figure 35). The contactor not shown for clarity.

Figure 35 - Removal of Guide/Stop Plate



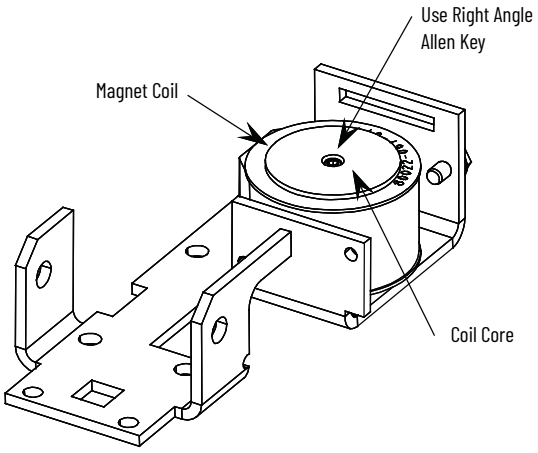
8. Remove the flapper by sliding it to the right until it stops and then pulling it towards the front of the contact (Figure 36). The trip (magnet) coil and coil core are now exposed (The contactor not shown for clarity).

Figure 36 - Removal of Flapper



9. Remove the coil core (Figure 37) and trip (magnet) coil using a right angle Allen key. The contactor is not shown for clarity.

Figure 37 - Trip Coil and Core Removal



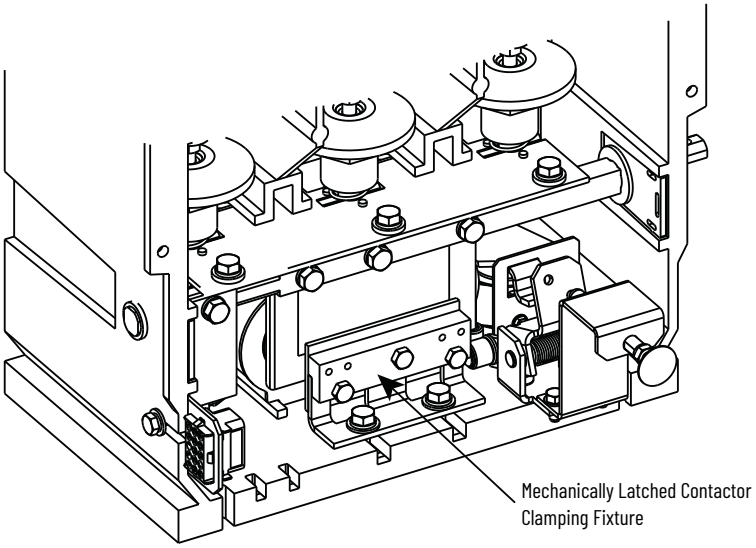
10. Slide the coil core from the trip (magnet) coil and then place the replacement coil onto the coil core.

11. Connect the new trip (magnet) coil leads to the auxiliary contact assembly.
12. Reassemble the mechanical latch and auxiliary assembly in reverse order of this procedure.
13. Perform the auxiliary contact assembly adjustment procedure (see page 39). The contactor will not function correctly if this step is not performed.
14. Verify that the replacement trip coil functions by using Test Power to close (latch) the contactor. Complete the cycle by opening (tripping) the contactor. Perform this sequence 2...3 times to verify that the contactor closes (latches and opens (trips) properly.

Mechanically Latched Contactor Setup Procedure

1. The overtravel, contact gap, and auxiliary set up procedures are the same for mechanically latched contactors as they are for electrically held contactors except that instead of energizing the contactor with the "TEST" circuit, the contactor must be held closed mechanically with a clamp or special fixture as shown in Figure 38. It is important that the contactor is held closed tightly with the armature against the magnet cores when gauging the overtravel, contact gap, and auxiliary positioning. Allen-Bradley PN-195987 is recommended, however, a C-clamp can be used at the rear of the contactor to pull up the actuator plate (do not overtighten the C-clamp and bend the actuator plate).

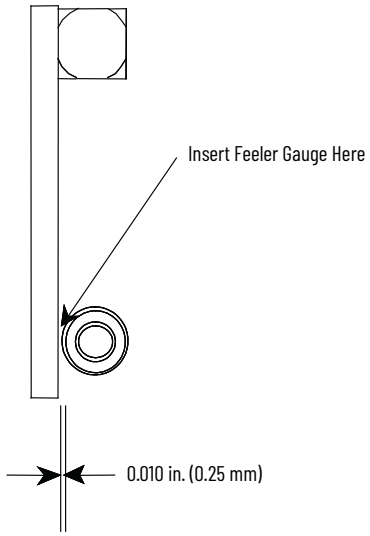
Figure 38 - Clamping a Mechanically Latched Contactor Closed



2. Clamp the contactor closed as detailed in Step 1. The latch mechanism must be in place with the mounting bolts loose enough to allow sliding along the adjustment slots.

3. With the contactor lying on its back, insert a 0.015 in. (0.38 mm) feeler gauge between the latch roller and the armature plate as shown in Figure 39. Tighten the mounting blots (do not overtorque 1/4 in. nuts or 5/16 in. bolts).

Figure 39 - Gauging Mechanical Latch Location



4. With the contactor still clamped, depress the latch lever and release allowing it to spring up. Verify there is smooth, unimpeded motion.
5. Remove the clamp and allow the armature to move out against the roller such that the contactor is in the "latched" condition.

ATTENTION: The return springs exert a significant force on the armature plate. To avoid injury, do not place fingers between the armature plate and the stop bracket at any time.

6. Using the manual trip lever, trip (drop out) the contactor. Apply 2...3 lb of force to trip the contactor.
   a. If too little force is required, the mechanism must be moved away from the armature slightly (toward the front of the contactor).
   b. If too great a force is required, the mechanism must be moved toward the armature slightly (toward the back of the contactor).

   If adjustment is required, the contactor must be clamped closed and repeat the set-up procedure with thicker or thinner feeler gauges, as required.

IMPORTANT This setup is sensitive and critical. A few thousandths of an inch makes a noticeable difference in the function of the latch. A mechanism that trips too easily can result in nuisance tripping. A mechanism that requires too much force can result in failure of the coil to trip the latch.

Notes:

Troubleshooting

Troubleshooting and Contactor Coil Resistance

If an operating problem occurs, use the following troubleshooting chart to isolate the cause of the failure and find corrective action. If the corrective action fails to resolve the problem, consult your Rockwell Automation field support representative. Verify all vacuum contactor components every 5 years to check the integrity of the parts.

Table 11 - 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™ control module • 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 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 the IntelliVAC control module • Replace IntelliVAC 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 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 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 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 Specifications for minimum pick-up voltage • Check set-up of contactor auxiliary contact assembly • Check CR1 and CR2 relay(1) • Check IntelliVAC status LEDs(2)

(1) Valid if mechanical latch contactors are controlled with electromechanical circuit only.
(2) Valid if IntelliVAC control module is used (see 1503-UM060).

If faulty contactor coils are the suspected cause of malfunction, see Table 12 for typical coil resistance values and check the contactor coils.

Table 12 - Typical Contactor Coil Resistance Values

Coil Part Number	Description	DC resistance(1)
80026-230-01	Operating Coil (each)	19.2 (9.6 x 2) Ω
80022-067-01(2)	Mechanical Latch Trip Coil	17.6 Ω

(1) Resistance values that are listed have a tolerance of ±10%. See page 21 for measurement points at the contactor receptacle.
(2) Supplied only with mechanical latch option.

Notes:

Spare Parts

Bulletin 1502 Spare Parts Diagrams and Chart

Figure 40 - Bulletin 1502, 450 A Electrically Held Vacuum Contactor

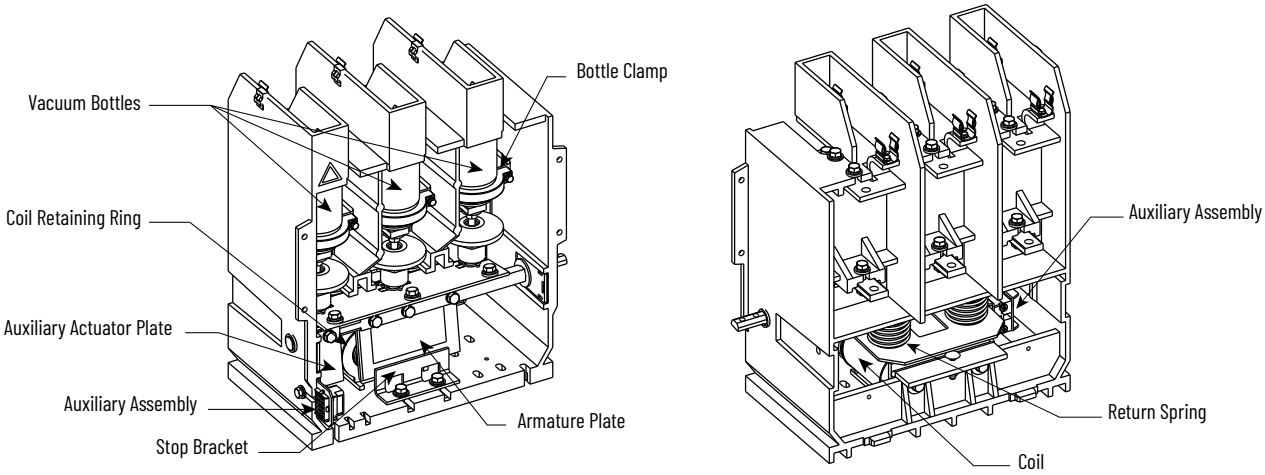


Figure 41 - Bulletin 1502, 450 A Mechanical Latch Assembly

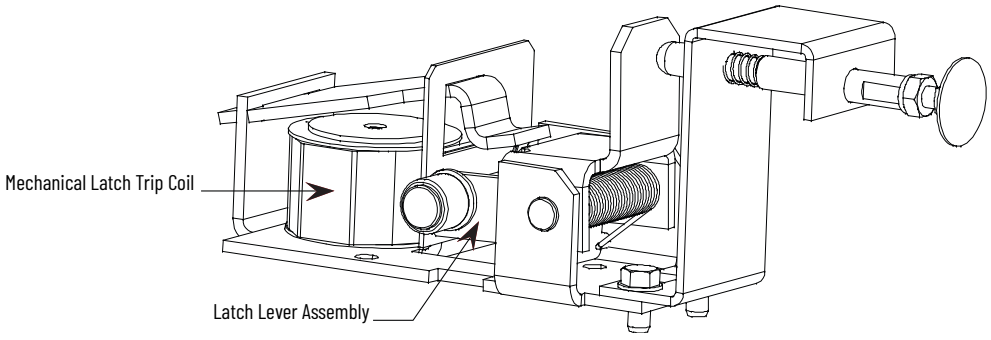


Table 13 - Spare Parts

Item	Description of Parts (Based on control voltage of 120V, unless noted otherwise)			Part Number	Recommended Quantity
1	Main pull-in and hold-in coils, two required[1]			80026-230-01	2
2	Pull-in coil[2]			80154-134-51	1
3	Pull-in coil, 230V[3]			80153-576-52	1
4	Hold-in coil[3]			80153-575-51	1
5	Hold-in coil, 230V[3]			80153-575-52	1
6	Coil retaining ring			28325-042-01	2
7	Trip coil (120V AC), mechanically latched contractor			80022-067-01	1
8	Auxiliary contact assemblies[3]	120V relay controlled	Electrically held contactor[4][4]	80153-554-52	1
9			Electrically held contactor[4][5]	80153-554-56	1
10	Auxiliary contact assemblies[5]	230V relay controlled	Electrically held contactor[4][6]	80153-554-59	1
11			Electrically held contactor[4][7]	80153-554-60	1
12	Auxiliary contact assemblies[5]	120V relay controlled	Mechanically latched contactor[4]	80158-744-54	1
13			Not available	—	—
14	Auxiliary contact assemblies[5]	IntelliVAC controlled	Electrically held contactor[2]	80158-743-52	1
15			Mechanically latched contactor[2]	80158-744-52	1
16	Auxiliary contact plastic actuator tip			40274-084-01	2
17	Return spring			80153-567-01	2
18	Roller flapper latch lever assembly			80158-768-51	1
19	Armature clamping fixture			PN-195987	1

(1) For contactors controlled by IntelliVAC™ module.
(2) For contactors controlled by electromechanical relay control panel.
(3) For contactors controlled by electromechanical relay control panel.
(4) For Normal drop-out time ("A" or "B" in the sixth position of the Catalog Number Explanation on page 12).
(5) For Fast drop-out time ("C" in the sixth position of the Catalog Number Explanation on page 12).

Numerics

A

B

C

D

E

F

G

H

I

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

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