

Instructions for V200, V210 540 Ampere, 3 Pole Vacuum Motor Controller Nonreversing or Reversing

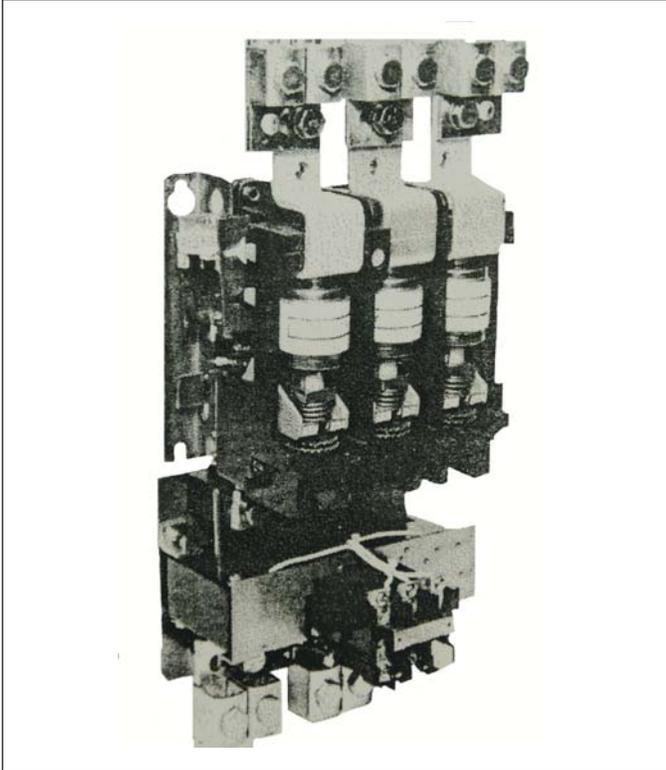


Fig. 1 V200 Motor Controller
(Type B Overload Relay shown)

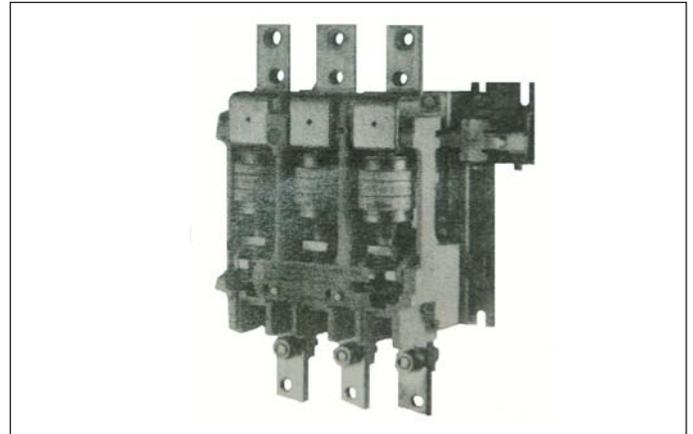


Fig. 2 Left Portion of V210 Reversing Contactor

THE CONTROLLER

The V200 or V210 motor controller, when wired as shown in Figure 5 or Figure 6, will operate as a full voltage starter and will give protection against overload, but not against short-circuit currents, when wired and provided with overload relay (OLR) heaters as listed in the heater selection table or when used with any means of inherent protection activated by motor temperature.

The controller should be protected against short circuits by providing branch circuit protection, in accordance with the National Electrical Code (NEC).

This industrial type control is designed to be installed,

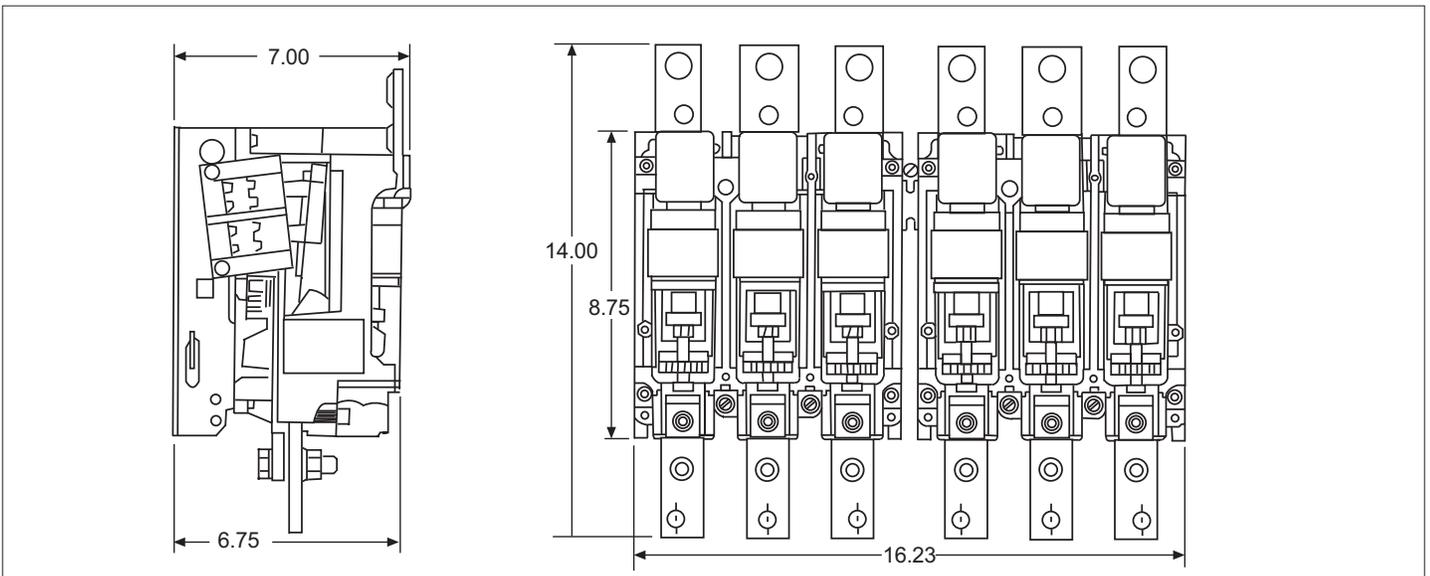


Fig. 3 Dimension Drawing (Dimensions in inches)

CONTROLLER RATINGS†						
THREE-PHASE HORSEPOWER AT						
200V	230V	380V	460V	575V	795V*	1500V*
150	200	300	400	500	700	1300

† For altitudes up to 3300 feet.
 * These ratings applicable only to controllers furnished with current transformers rated 1500 volts and with nameplates so marked.

operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state and national regulations, as well as safety practices, for this class of equipment.

MOUNTING

Mount each V200 controller with four 5/16" x 18 or 1/4" x 20 bolts. Flat washers should be used on bolts entering slotted holes or keyholes. See Table VII.

TYPE B OVERLOAD RELAY (See Figure 1)

This V200 motor controller is usually equipped with a Type B block type ambient compensated overload relay (with gray reset rod). The controller can also be supplied with a non-ambient compensated overload relay (with red reset rod). This relay is a bimetal actuated type equipped with a normally-closed control contact. An optional isolated normally-open control circuit is available for field mounting. When the overload relay trips, a yellow dot will appear flush with the molded surface below the reset rod. Resetting the relay returns this indicator to its normally concealed position.

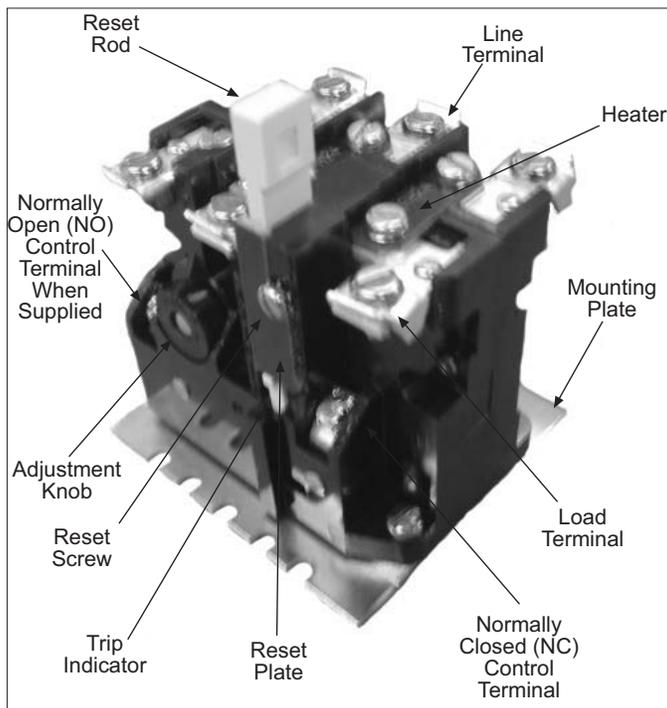


Fig. 4 Type A Block Overload Relay

TYPE A OVERLOAD RELAY (See Figure 4)

The V200 motor controller can be equipped with a Type A Block type non-ambient compensated overload relay (unmarked and with a red reset rod) or with a block type temperature compensated overload relay (marked "Ambient Compensated" and with a gray reset rod). The relay is of the bimetal actuated type equipped with trip indicator, trip adjustment covering ±15% of rating and a normally-closed control contact. It may be operated with either hand or automatic reset.

Reset operation is determined by the position of the plate on the load side of the overload base. Position the reset plate away from the panel to set the "hand" position. Loosen the locking screw, move the reset plate toward the panel, and tighten the screw to set the "auto" position.

Automatic reset should not be used with 2-wire control circuits where automatic starting of the motor may be hazardous.

OVERLOAD RELAY HEATERS

Overload relay (OLR) heaters are not included with the motor controller and must be ordered separately per the heater selection table and the information listed below. When installing heaters be sure that connecting surfaces are clean and heaters are attached securely to the relay in the proper location with the screws provided. The trip rating of a heater in a 40°C ambient is 125% of the minimum full load current shown in Table 1. When tested at 600 percent of its trip rating, the relay will trip in 20 seconds or less.

Heaters should be selected on the basis of the actual full load current and service factor as shown on the motor nameplate or in the manufacturer's published literature. When the service factor of the motor is 1.15 to 1.25, select heaters from the heater application table. If the service factor of the motor is 1.0, or there is no service factor shown, or a maximum of 115% protection is desired, select one size smaller heater than indicated. When motor and overload relay are in different ambient's and when using noncompensated overload relays,

TABLE I - HEATER SELECTION - A or B OLR			
Motor Full Load Current in Amperes for Use With 3 Heaters Only.			
Open Starter	Enclosed Starter		Heater
Compensated or Noncompensated OLR	Compensated OLR	Noncompensated OLR	Catalog (Code) Number
WITH 600/5 CURRENT TRANSFORMERS			
236-259	236-259	219-239	FH24
260-283	260-283	240-263	FH25
284-310	284-310	264-287	FH26
311-340	311-340	288-316	FH27
341-374	341-374	317-347	FH28
375-411	375-411	348-381	FH29
412-448	412-448	382-417	FH30
449-489	449-489	418-455	FH31
490-527	490-527	456-494	FH32
528-585	528-540	495-540	FH33
586-600	FH34

select heaters from the table using adjusted motor currents as follows: decrease rated motor current 1% for each °C motor ambient exceeds controller ambient. Increase rated motor current 1% for each °C controller ambient exceeds motor ambient.

WARNING: To provide continued protection against fire and shock hazard, the complete overload relay must be replaced if burnout of a current element occurs. See Table III.

TABLE III - OVERLOAD RELAY CONTROL CONTACT RATINGS				
AC Volts	Normally Closed		Normally Open	
	Make	Break	Make	Break
Type A 24 - 120 120 - 600	20A 2400VA	2A 240VA	5A 600VA	.5A 60VA
Type B 24 - 120 120 - 600	30A 3600VA	3A 360VA	30A 3600VA	3A 360VA

TABLE III - REPLACEMENT OVERLOAD RELAY	
OVERLOAD RELAY	CATALOG NUMBER
Type B Non-ambient compensated	BN13JP
Type B Ambient compensated	BA13JP
Type A Non-ambient compensated	AN13P
Type A Ambient compensated	AA13P

TYPE GCO CURRENT TRANSFORMERS

The Type GCO current transformers were specially designed to mount on A200 and V200 controllers and operate the Types A or B thermal overload relays.

The 600/5 ratio Type GCP transformers have a single turn primary winding, provided by the controller load connection straps. The secondary wires - one white, the other black - are color coded for polarity identification.

There are two versions of the Type GCO, 600/5 ratio, three-phase current transformers, one rated 1500 volts, the other 600 volts. Each has a label nameplate showing its maximum voltage rating. The 1500 volt version has a red nameplate and may be used at any voltage up to 1500, including voltages below 600.

These Type GCO current transformers are **not** to be used to power additional auxiliary devices and should never be energized with the secondary leads open circuited since the open circuit overvoltage can damage the transformer.

The combination of Type GCO 600/5 Ratio Current Transformers, Type A or B thermal overload relay, and V200 or V210 controller is intended to provide motor overload protection for motors with full load amperes (FLA) from 236 to 540 amperes up to the maximum voltage shown on the controller nameplate.

COIL

The operating coil has a “figure-eight” shape and is really two coils in series, with a connection to their

common point. Both coils are encapsulated in one environment-immune coil shell, which also contains a full-wave bridge. When AC is connected directly to terminals A and B on the coil shell, the magnet excitation is unfiltered DC. The magnet will not chatter as AC magnets sometimes do, but at less than rated voltage it may hum slightly. A normally-closed Type L63 auxiliary contact, set to open slightly before the armature fully closes, is connected to terminals C and D on the coil shell. When adjusted correctly, this contact allows a relatively high current through the pickup winding, and as the controller closes, the contact inserts the holding winding, which reduces the coil current to a low value sufficient to hold the magnet closed without overheating. No external resistors are required.

COIL DATA (TYPICAL VALUES)					
Coil Voltage	Freq.	Inrush VA	Sealed VA	Sealed Watts	Part Number
110-120	Any	1450	28	28	7874A24G01
220-240	Any	1450	28	28	7874A24G02
440-480	Any	1450	28	28	7874A24G03
550-600	Any	1450	28	28	7874A24G04

TABLE IV - OPERATING RANGES				
Rated Coil Voltage	Pick-Up-To-Seal Voltage		Drop-Out-To-Full Open Voltage	
	Above	Below	Above	Below
110-120 VAC	60	77	10	50
220-240 VAC	120	152	20	100
440-480 VAC	240	304	40	200
550-600 VAC	300	385	50	250

MAGNET OPERATING RANGE

When properly adjusted as described in previous sections, the controller should operate within the ranges shown in Table IV.

If the magnet chatters, look for mechanical interference that prevents the magnet from sealing. If there is no interference, then the magnet itself may be misaligned. The magnet gap can be seen from the left and right sides with the help of a flashlight. A screwdriver inserted into one of the long slots (Y-Figure 8) can be used as a lever to put a corrective set into the mounting plate around the magnet. It should not be necessary to do this unless the contactor has been damaged and it can be seen that the armature does not fit against the magnet. A poor magnet-to-armature fit usually produces a high dropout voltage and/or the chatter.

Mechanical interference can be produced by various incorrect adjustments. Two specific points to check are:

- A. Armature travel incorrect, causing the contact springs to be compressed into a solid, non-resilient “tube” that stops the crossbar rigidly. Refer to Eaton Service for assistance.
- B. The auxiliary contact mounting brackets are mis-adjusted, so that a contact plunger bottoms solidly

before the magnet seals. When the contactor is fully sealed closed, there should still be a small amount of travel remaining for the plungers. See **L63 Auxiliary Contact Adjustment**.

SHORT-CIRCUIT RATINGS

This motor controller is suitable for use on a circuit capable of delivering not more than the current (rms symmetrical amperes) shown below in circuits rated not more than the voltage shown in table below:

TABLE V - SHORT-CIRCUIT PROTECTION						
Short-Circuit Protective Device (SCPD)	Max. size SCPD	Current Breaker Interrupting Rating	Short-Circuit Rating		Typical Disconnect Device Cat No. Prefix	
			Current	Voltage		
Class L Fuse	800A	-	100,000A	600V	MCS (High Mag. Trip)	
Class R or J Fuse	600A	-	100,000A	600V	MCS (High Mag. Trip)	
Magnetic Only ¹ Type CB ²	600A	22,000A	18,000A	600V	LA	
		30,000A	25,000A	480V		
Thermal/Mag ³ Type CB ²	600A	25,000A	25,000A	480V	HLB, HLC, HMC	
		30,000A	30,000A	480V	LA, LC	
		35,000A	42,000A	600V	HLB, HLC, HMC	
Thermal/Mag ³ Type CB ²	600A	14,000A	25,000A	480V	HNAM	
		600A	22,000A	30,000A	1000V	HPBN
		800A	14,000A	42,000A	1000V	HNAM
		800A	22,000A	14,000A	1000V	HPBM

¹ Instantaneous Adjustable Trip
² Circuit Breaker
³ Inverse Time

AUXILIARY CONTACTS - TYPE J

Two mounting brackets for auxiliary contacts are provided for each contactor. Auxiliary contacts themselves must be ordered separately. An auxiliary contact with one or more normally-open poles may be used as the holding circuit auxiliary. A maximum of four auxiliary units can be installed in the brackets for each non-reversing contactor (three in each reversing contactor). They mount by means of a spring clip and retainer screw. To remove the auxiliary contacts, loosen the

TYPE J AUXILIARY CONTACTS		
Contact Type	Catalog No.	
2 Normally Closed	J02	
2 Normally Open	J20	
1 Normally Open and 1 Normally Closed	J11	
1 Normally Open and 1 Normally Closed, Delayed Breaker	J1C	
TYPE J CONTACT RATINGS (A600, R300)		
Voltage	Continuous	Make Break
120-600 VAC	10A	7200VA 720VA
72-120 VAC	10A	60A 720VA
28-72 VAC	10A	60A 10A
28-300 VDC	1.0A	28VA 28VA

TABLE VI - POWER CIRCUIT TERMINALS

Lugs (when used) **Wire Size** (2) 2/0 AWG - (2) 500 MCM

Wire with copper conductors only. Use 75°C wire.

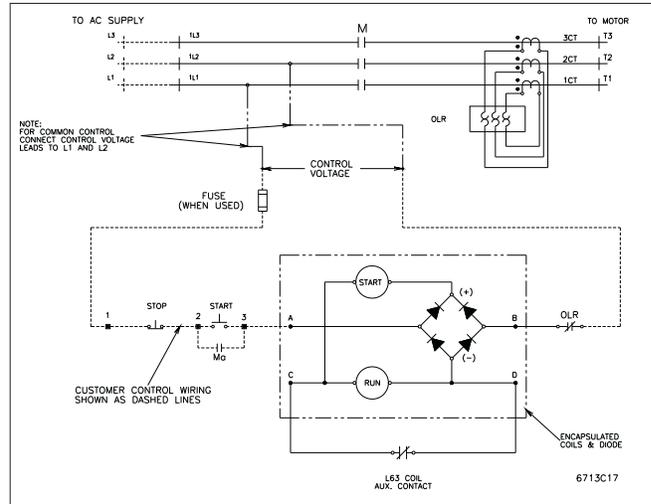


Fig. 5 Nonreversing Control Circuit

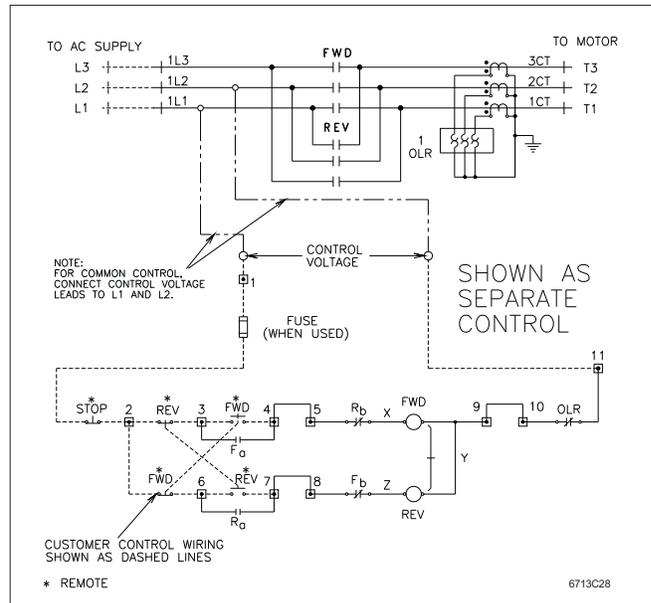


Fig. 6 Reversing Control Circuit

retainer screw several times (counterclockwise) and then slide the auxiliary contact unit out of the bracket.

MECHANICAL INTERLOCKS

Mechanical interlocks are used when a pair of contactors must be mechanically protected against the closing of one when the other is already closed. For the horizontal reversing configuration, the Type M33-6VH mechanical interlock assembly is used. The M-33-6VH mechanical interlock can be adjusted for variations in contactor height. Mechanical interlocks which are

mounted on reversing contactors from the factory are adjusted at the factory. If the mechanical interlock is removed and reinstalled for any reason, its performance must be checked and readjusted if necessary. This is done by energizing the forward contactor at rated voltage and then momentarily energizing the reverse contactor with the electrical interlocks overridden. The electrical interlocks can be overridden by removing them from their recesses. With the reverse contactor locked out, the bottle stem farthest from the mechanical interlock on the reverse contactor should close about .040". If it closes more than .40", the mechanical interlock must be readjusted. Perform the same test locking out the other contactor. When adjusted correctly, the mechanical interlock arms should have room to pivot back and forth freely. If they do not, the mechanical interlock is adjusted too tightly and must be readjusted. After the mechanical interlock is correctly adjusted, be sure and tighten all screws.

CAUTION: Any work on the controller should be performed only with the power OFF. Remember to enable the electrical interlocks before returning the unit to service. Failure to do so may result in serious injury!

Note: The momentary energization of the locked out contactor should only last a few seconds or the contactor coil could be damaged. This lockout test should be performed with all of the busswork in place. Failure to do so could damage the mechanical interlock.

GENERAL

The contactor portion of a V200 or V210 controller (see Figure 7) has its main contacts sealed inside ceramic tubes from which all air has been evacuated, i.e., the contacts are in a vacuum. No arc boxes are required, because any arc formed between opening contacts in a vacuum has no ionized air to sustain it. The arc simply stops when the current goes through zero as it alternates at line frequently. The arc usually does not survive beyond the first half cycle after the contacts begin to separate. The ceramic tube with the moving and stationary contacts enclosed is called a **vacuum interrupter** or a **bottle**, and there is one such bottle for each pole of the contactor. A three-pole contactor has three vacuum bottles. A metal bellows (like a small, circular accordion) allows the moving contact to be closed and pulled open from the outside without letting air into the vacuum chamber of the bottle. Both the bellows and the metal-to-ceramic seals of modern bottles have been improved to the point that loss of vacuum is no longer cause for undue concern.

The moving contacts are driven by a molded plastic crossbar supported by two pre-lubricated ball bearings that are clamped in alignment for long life and free motion.

The contacts in an unmounted bottle (vacuum interrupter) are normally-closed, because the outside air pressure pushes against the flexible bellows. For

contactor duty, the contact must be "normally-open" when the operating magnet is not energized. Therefore, the contacts of the vacuum bottles must be held apart mechanically against the air pressure when used in a contactor. In the contactor, all of the bottles are held open by a single kickout spring in the rear of the contactor. The kickout spring pulls against the moving armature and crossbar and thereby forces the bottles into the open position. In the open position, the crossbar is pulling the moving contacts to hold them open.

The controller is intended to be mounted with its mounting plate vertical and the moving stem of the vacuum bottles aimed down. However, mounting position is not critical. If an unusual position is required, it is wise to check the pickup voltage on a bench before installation, with the controller oriented as it will ultimately be installed. The kickout spring can be adjusted as described under **Kickout Spring Adjustment**, if required to obtain the correct pickup voltage.

CONTACT FORCE AND ALTITUDE

A Vacuum motor controller is affected by atmospheric pressure on the bellows of the vacuum bottle. Up to an altitude of 2km (6600 feet), the contactor is designed to tolerate normal variations in barometric pressure. If the contactor is to be operated over 2km (6600 feet) above sea level, consult the factory.

CONTACT WEAR ALLOWANCE

Contact material vaporizes from the contact faces during every interruption and condenses inside the bottle. This is normal, and is provided for by **overtravel**, or wear allowance. When the contactor is fully closed, there is a gap underneath the lower bottle nut and the pivot plate. See Figure 8. As the contacts wear, this gap decreases. When any gap goes **below .020 in.**, the unit should be replaced. Use the .020 in. thick fork-shaped overtravel gauge supplied for this measurement. Part No. 7874A59H01.

CAUTION: The easiest way to close the contactor is to energize the coil. If the coil is energized for this or other maintenance, use adequate care to guard against electrical shock.

Do not re-adjust the bottle nuts to reset overtravel as the bottles wear. Once placed into service, overtravel should be checked but not adjusted. A star-wheel lock is included for locking the bottle nuts of each bottle to prevent tampering.

CHECK-OUT, VACUUM INTERRUPTERS

The dielectric strength of the interrupters should be checked before the contactor is energized for the first time and regularly thereafter to detect any deterioration

TABLE VII - RECOMMENDED DRIVING TORQUE

Location (Qty.)	Driving Torque (lb-in.)	Fig. 7 Item Refer.	Fig. 8 Item Refer.	Location (Qty.)	Driving Torque (lb-in.)	Fig. 7 Item Refer.	Fig. 8 Item Refer.
Coil Terminals (4)	7-9	1	-	Coil Mounting Screws (2)	10-15	5	M
OLR Bus Connections (6)	380-400	2	-	Lug Bolts (6)	380-400	6	-
V200 Base Mounting Screws (4)	60-65	4	S	Pressure Wire Connectors (6)	380-400	7	-
Mechanical Interlock Adjustment Screws (reverse only) - (4)	25-30	-	-				

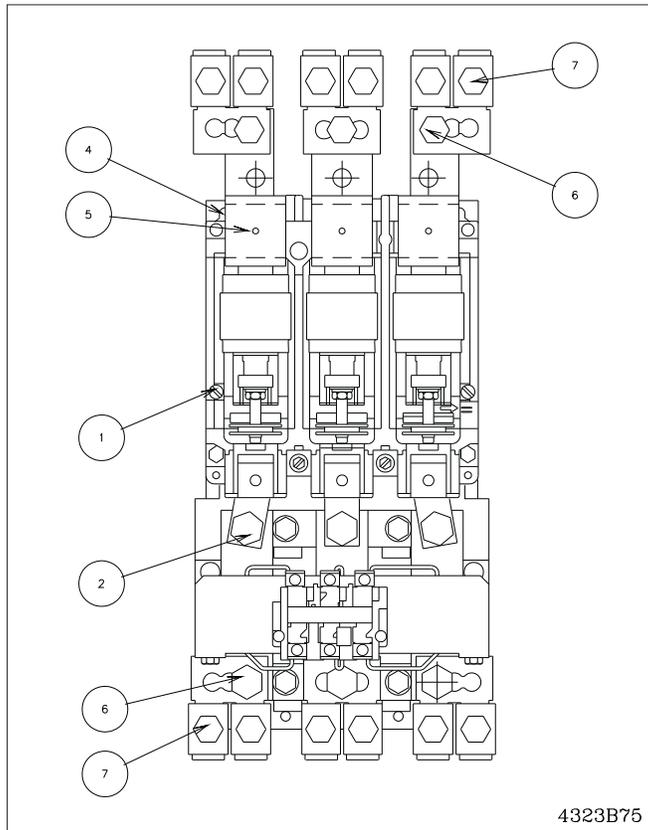


Fig. 7 Torquing Locations

CHECK-OUT, VACUUM INTERRUPTERS (cont.)

In the dielectric strength of the contact gap. A good interrupter will withstand a 5.5kV, 50 or 60 hertz voltage for one minute across a 0.090 inch contact gap with less than 1mA leakage. It will withstand a 7.8kV DC voltage for one minute across the gap with less than .1 micro-amperes leakage. Dielectric test using DC voltage should be performed with polarities in both directions.

When the vacuum bottle is tested with voltage over 5000 volts across its open gap, there is some possibility of generating X-rays. Test time should be minimized, and personnel should not be closer than 10 feet. This is a precaution until such time as the possible hazard is better understood and standards are published.

Periodic dielectric tests across open contacts are desirable since under certain operating conditions the contactor may perform satisfactorily even though one vacuum interrupter becomes defective. Dielectric tests should be made with the contactor in the same position it has when operating.

The interval between periodic tests depends on the number of operations per day, environmental factors, and experience. It is a matter of operator judgment, and philosophy of preventative maintenance.

CHECK-OUT, MECHANICAL

Make sure all power circuits are de-energized and isolated. The controller can be checked in its cabinet or outside.

If the controller is checked in its cabinet, make certain that the contactor coil is electrically isolated, to prevent feedback into a control transformer that could be hazardous.

Connect a separate power source of correct AC voltage to the coil of the contactor. Operate appropriate pushbuttons to close and open the contactor. If the contactor does not close fully or does not drop out fully refer to **Magnet Operating Range**.

While the contactor is closed, observe the overtravel gap between the pivot plates on the crossbar and the bottle nut on each pole. This overtravel gap should be not less than .045 inch when the contactor is new. If less refer to **Contact Wear Allowance**. Disconnect separate power source before proceeding.

While the contactor is open, attempt to pull the armature forward. The armature should not move because it should already be firmly against the plastic main frame. If it does move refer to **Kickout Spring Adjustment**.

CHECK-OUT, INSULATION LEVEL

After installation, and before energizing the controller for the first time, measure and record the insulation resistance between poles and from each pole to ground. It is not practical to specify an absolute value for this reading since it is dependent on other connected apparatus, and conditions of service. However, any unusually low reading or sudden reduction in this reading after the contactor has been in service indicates a possible source of trouble, and the cause should be determined and corrected before restoring power.

MAINTENANCE

Establish a maintenance program as soon as the controller is installed and put into operation. After the controller has been inspected a number of times at monthly intervals, and the condition noted, the frequency of inspections can be increased or decreased to suit the conditions found, depending upon the severity of the controller duty. It is a matter of operator judgment.

This industrial type control is designed to be installed, operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

All work on this controller should be done with the main circuit disconnect device open. Also, disconnect power from any other external circuits. Discharge any hazardous capacitors.

LOSS OF VACUUM

Gross loss of vacuum is highly unlikely, but it can be checked easily. With the contactor open, pull downward on the bottle nuts, one pole at a time, using an effort of about 20 pounds. If the bottle nuts (see Figure 8) move easily away from their pivot, the vacuum has probably failed and the bottle unit must be replaced.

It is also unlikely, but possible, to have a very slight

leak that does not change the bottle force appreciably, but which might seriously damage the ability of the bottle to interrupt. In this regard, it must be remembered that in a three-phase ungrounded circuit, it is possible for any two good interrupters to successfully interrupt the circuit even if the third interrupter is weak. But this condition should not be allowed to continue. It can be detected only by an electrical test. See **Check-out Vacuum Interrupters**.

WARNING: All work on this contactor should be done with the main disconnect device open. As with any contactor of this voltage, there is danger of electrocution and/or severe burns. Make certain that the power is off.

Changing Operating Coil

The operating coil has a pickup winding which is intermittently rated. It may burn out in only minutes if continuously energized at the rated voltage because the L63 auxiliary contact does not open correctly.

Each AC coil contains its own rectifier to convert the applied AC into unfiltered full-wave rectified DC. DC coils do not contain a rectifier. When the coil is at rated voltage, the magnet will be silent. At reduced AC voltage, some slight hum may be heard. However the magnet must not chatter.

If for some reason a coil must be changed, proceed as outlined below, referring to Figure 8.

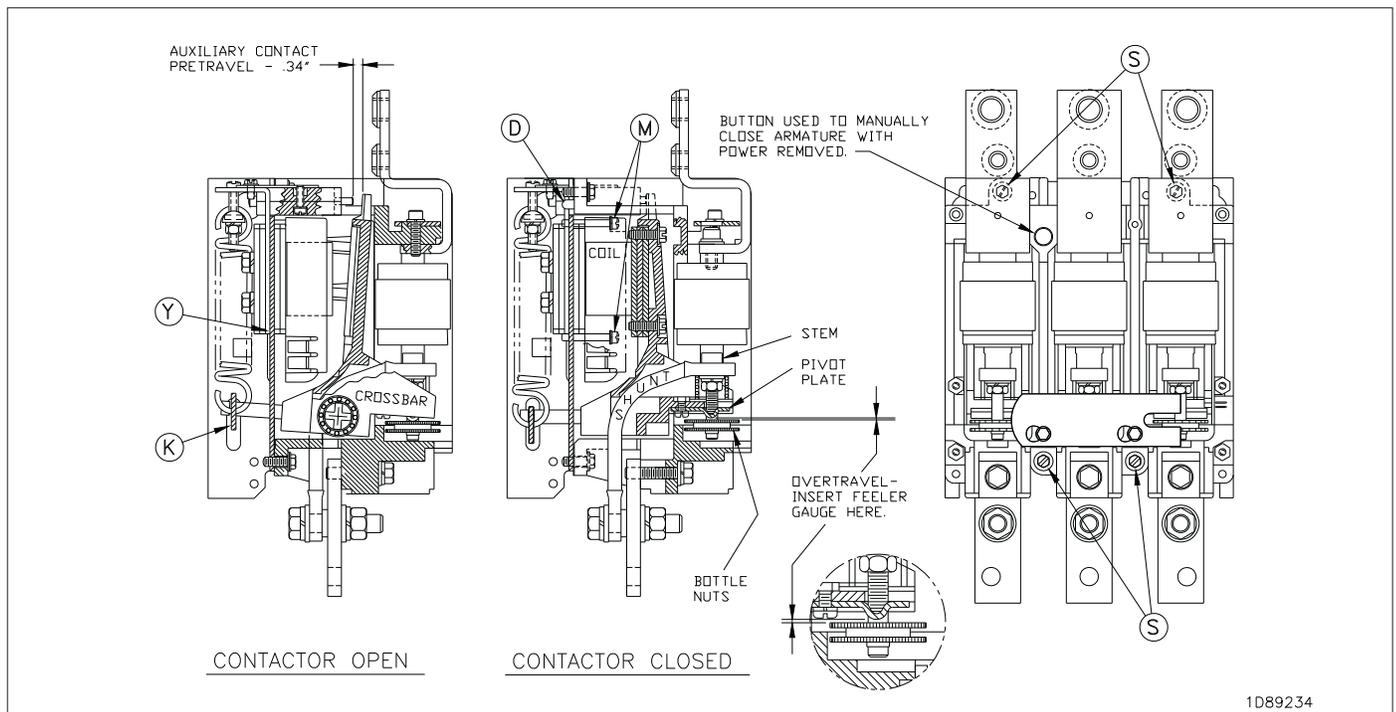
1. De-energize all circuits as previously specified.
2. Disconnect the leads to the coil terminals, noting their position for later reconnecting.
3. Disconnect the line and the load leads from the contactor terminals.
4. Remove for 1/4" x 20 screws (S) holding the frame subassembly to the mounting base.
5. Lift the line side of the frame subassembly away

from the mounting base until two dowels (D) are clear of their holes. The frame subassembly will automatically move under pressure from the kick-out system until the kickout bar reaches the end of its slots in the mounting base. The frame subassembly is then free to be moved outward away from the coil and put elsewhere.

6. The coil is then accessible. Remove the two mounting screws (M) to free the coil.
7. Install replacement coil and replace mounting screws.
8. Place the frame subassembly onto the mounting base so that the two posts extending from the crossbar go through the oblong slots in the base and into the notches in the kickout bar. Push the frame subassembly a short distance along the surface of the mounting plate toward the kickout bar until the dowels (D) slip into the dowel holes. Replace the mounting screws (S). **Make sure that the coil leads to the L63 auxiliary contact are not pinched under the frame feet.**
9. Reconnect coil and recheck contactor for correct adjustment per this leaflet. By hand jiggle the ends of the kickout bar(K) to make sure it is seated onto the posts of the crossbar.
10. Reconnect line and load cables.

L63 Auxiliary Contact Adjustment

The nominal .34" pretravel gap shown for the L63 auxiliary contact (normally-closed) in the left upper portion of Figure 8 is important. If the gap is too big, the "hold" winding of the operator coil will not be inserted as the contactor closes, and the pickup winding will burn out, because the pickup winding is only intermittently rated. If the gap is too small, the hold winding will be inserted too soon, reducing the force to "hold" before the



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Fig. 8 Contactor Portion of a V200 Motor Controller

contactor is closed, and producing an oscillation like a doorbell. In a particular contactor, the .34" gap may need slight adjustment to avoid these problems. The key is not the measurement, but the performance of the magnet. Replacement L63 auxiliary contacts are available as Part No. 578D461G03.

The other auxiliary contacts are not as critical. In the open position, their plungers may rest lightly against the operating arm, or may have a small clearance.

However, neither L63, Type J nor L56 plunger should bottom solidly in the closed contactor position, as discussed under **Magnet Operating Range**. If required, the auxiliaries can be adjusted by resetting their mounting brackets in their slotted holes. Adjust the L63 by loosening the two slotted hexagonal washer head screws the hold the L63 mounting bracket, repositioning and tightening. These bracket mounting screws are visible from the top side of the contactor and are recognized by the slotted holes under their heads.

Kickout Spring Adjustment

The kickout spring is not disturbed by any maintenance described in this leaflet, and it should not need to be adjusted. However, when the contactor is in the de-energized, open position, the crossbar should be solidly against the frame, so that it cannot move any further open even when pulled. It can removed, the kickout spring must be stretched to hold the crossbar firmly against the frame. Refer to figure 9. Loosen the lock nuts and tighten the adjusting screws alternately (to keep the spring on centerline) until the force from the spring holds the crossbar properly open. Lock the two lock nuts again.

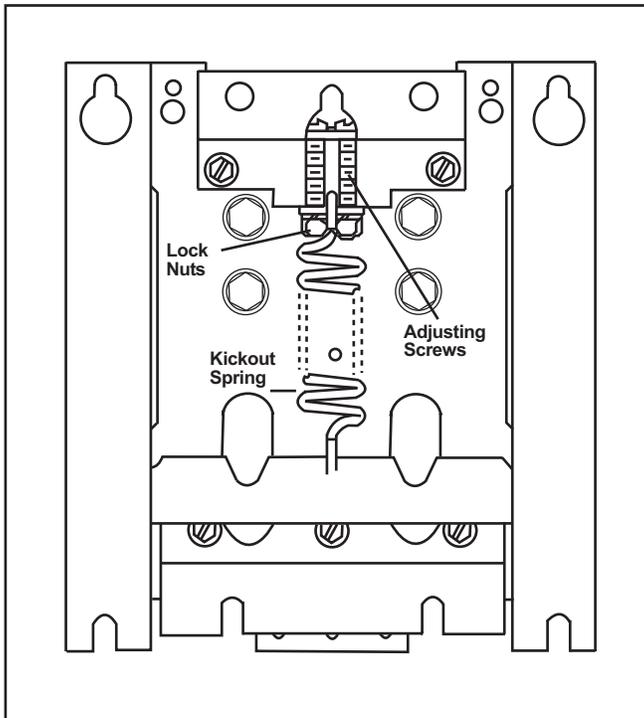


Fig. 9 Kickout Spring

Inspection After Short Circuit

The V200 or V210 motor controller is intended to be protected by power fuses and/or a circuit breaker in accordance with the NEC. However, the magnitude of a short circuit may exceed the damage threshold of the vacuum bottles. After a short circuit, the unit should be examined for any apparent physical damage, or deformation of conductor bars and cables. If there is any evidence of severe stress, it is recommended that the unit be replaced. If the overtravel has changed significantly (from the last inspection) on one or more bottles, the unit should be replaced.

A dielectric test would not by itself confirm that the unit should be returned to service after a fault. However, if there is no physical evidence of stress, and if the overtravel exceeds the .020 in. minimum, the bottles can then be dielectrically tested as outlined previously. If physical stress, overtravel, and dielectric are O.K., it is reasonable to return the unit to service after a fault.

Insulation Level

Refer to the insulation resistance measurements between poles and from each pole to ground that were recorded at start-up and subsequent intervals. Measure the same points in the same manner and record. Investigate any sudden reduction in resistance or any unusually low reading.

Dust and moisture are detrimental to electrical equipment. Industrial equipment is designed to tolerate a less-than-perfect environment. However, excessive dust can cause trouble, and should be wiped or blown off at appropriate intervals. If the contactor is wet for any reason, it must be dried until insulation resistance between poles and from each pole to ground has returned to normal.

TABLE VIII - ACCESSORIES		
Fuse Block Kits - Meet requirements of NEC concerning common control fusing.		
Order Cat No.	Qty.	Description
F56	2	Contactor mounted Fuse Holder for 1 600 volt Buss KTK Fuse
FKR	1	Panel mounted Fuse Holder for 2 Class CC (Bussman KTKR) Fuses*
*Use when available fault current exceeds 10,000 amperes		
Order Fuses Separately By Ampere Rating.		
Controller Size	Minimum Wire Size in Control Circuit	Suggested Fuse Size†
540A	#16 AWG	10 AMP
† When using a control transformer, select fuse size per the National Electrical Code.		