Instructions for V201, V211 320 Ampere Vacuum Contactor Non-reversing or Reversing

I.L. 16999A
Model A or B
Formerly Type SJM

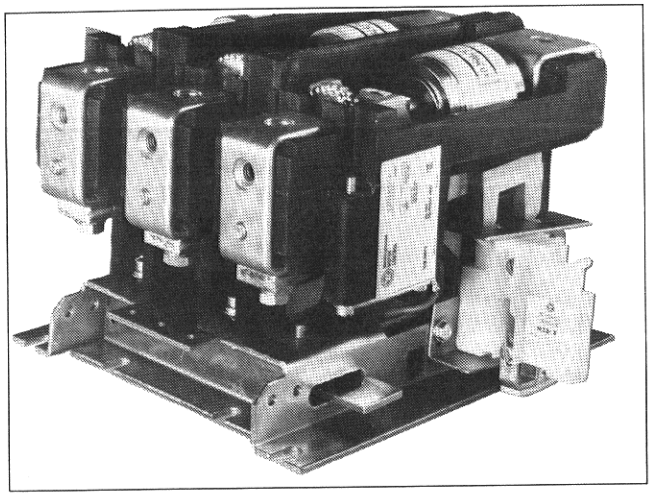

Fig. 1 V201 Non-reversing Contactor

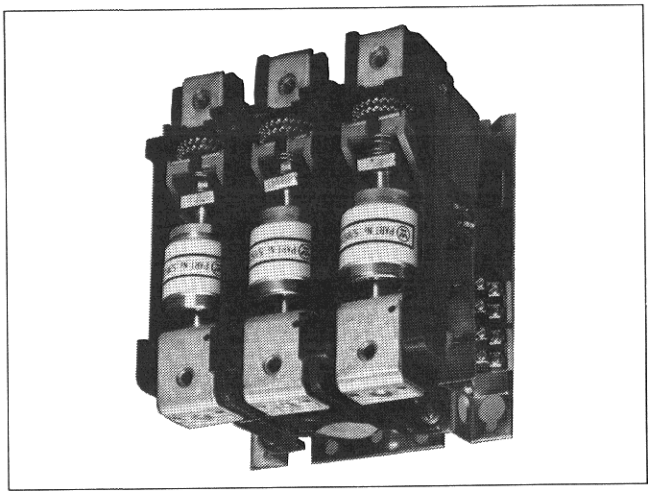

Fig. 2 Left hand portion of V211 Reversing Contactor

THE CONTACTOR

V201 contactors are designed for the control of inductive or non-inductive loads at voltages between 120 and 1500, AC. The units are suitable for mounting on either steel or insulated panels. All parts are front removable. Contactors should be protected against short circuits by branch circuit protective devices selected in accordance with the National Electrical Code.

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.

Mount each contactor with four 5/16 x 18 or 1/4 x 20 bolts or three 1/4 x 20 bolts if the V201 contactor is replacing the Type DPC air-break contactor. Flat washers should be used on bolts entering slotted holes or keyholes.

CONTROLLER RATINGS—3 POLE CONTACTORS						
3 Phase Horsepower At						
200V	230V	380V	460V	575V	795V	1500V
100	125	200	250	300	400	800

MAXIMUM CURRENT RATINGS (RMS)		
Continuous Carrying Open	Continuous Carrying Enclosed	Motor, transformer or Capacitor Make or Break
350A	320A	3000A

Two-pole contactors have the same current ratings as 3 pole devices but are not suitable for controlling 3 phase motors.

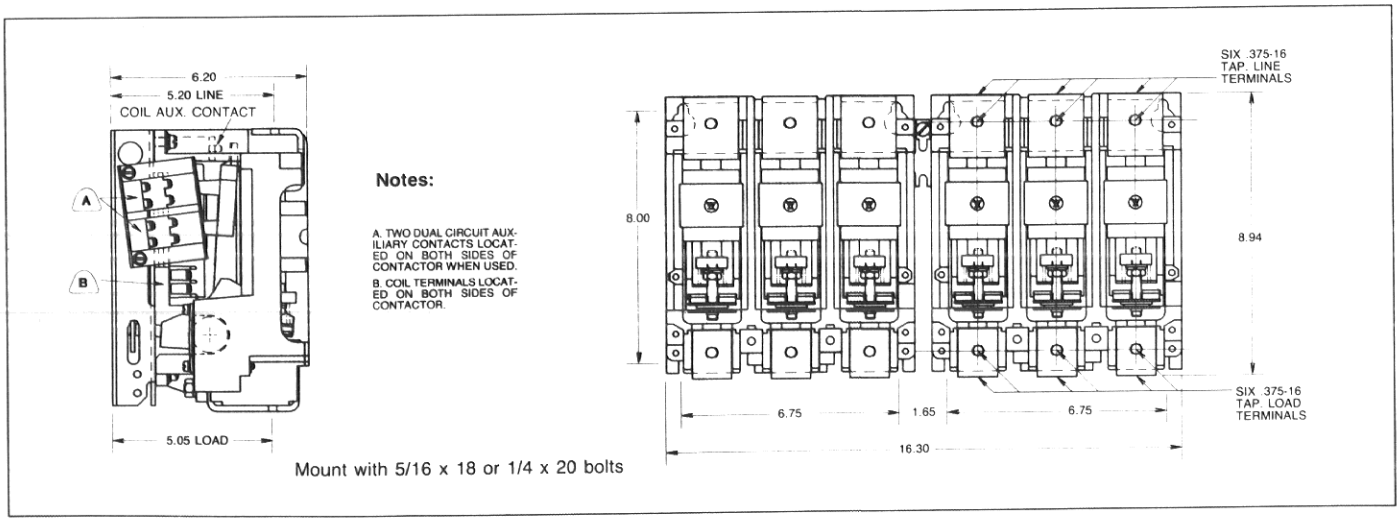

Fig. 3 Dimension Drawings (Dim. in inches)

AUXILIARY CONTACTS — L56 (RATED B600)

Two mounting brackets for L56 auxiliary contacts are provided on each contactor. Auxiliary contacts themselves must be ordered separately. An L56D with one normally open pole may be used as the holding circuit auxiliary. A maximum of four auxiliary units can be installed in the recesses of each non-reversing contactor (three in each reversing contactor). They mount by means of a spring clip which snaps into locations provided in the contactor. To remove the L56, disengage the top spring clip by pressing on the extended tab, and withdraw the unit.

L56 AUXILIARY CONTACTS

Contact Type	Catalog No.
1 Normally Closed	L56E
1 Normally Open	L56D
2 Normally Closed	L56C
2 Normally Open	L56B
1 Normally Open and 1 Normally Closed	L56

L56 CONTACT RATINGS (B600)

AC Volts	Make	Break
24-120	30A	3A
120-600	3600VA	360VA

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 silicon diode bridge. Although 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 volts 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 pick-up winding, and as the contactor 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.

AC COIL DATA (TYPICAL VALUES)

Volts	Inrush VA	Sealed VA	Sealed Watts
110-120	500	25	25
220-240	600	26	26

REPLACEMENT COIL: ORDER BY PART NUMBER VOLTAGE, AND FREQUENCY

AC OPERATING COILS

Voltage	Freq.	Part Number
110-120	Any	7874A09G02
220-240	Any	7874A09G04

MECHANICAL INTERLOCK

The Type M33-5 mechanical interlock is used when a pair of contactors must be mechanically protected against the closing of one when the other is already closed. The two contactors are mounted side-by-side (horizontal configuration). The Type M 33-5 mechanical interlock occupies one recess in each contactor.

TERMINATION MEANS

Lugs for power circuit conductors are not supplied with the V201 and V211 contactors. Regardless of the termination means used, maintain the minimum clearance shown in Table I for the application involved. Use adequate insulating material as needed. One recommended terminal for conductor size #0 through 500 MCM is Ilsco No. D-64.

TABLE I — MINIMUM CLEARANCES

Maintain minimum clearance between live parts and grounded parts and between live parts of opposite polarity.

System Voltage	Minimum Clearance
Not greater than 600 volts	.375 inches
Not greater than 1000 volts	.550 inches
Not greater than 1500 volts	.700 inches

TABLE II — ACCESSORIES

Fuse Block Kits — Meet requirements of National Electric Code (NEC) concerning common control fusing.

Order	Qty.	Description
F56	2	Contactor mounted Fuse Holder for one 600 volt Bussmann KTK Fuse
FKR	1	Panel mounted Fuse Holder for two Class CC (Bussmann KTKR) Fuses *

* Use when available fault current exceeds 10,000 amperes

GENERAL

The V201 contactor has its main contacts sealed inside ceramic tubes from which all air has been evacuated, i.e., the contacts are in vacuum. No arcboxes 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 frequency. 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 two-pole contactor has two vacuum bottles, and a three-pole contactor has three vacuum bottles. A metal bellows (like a small, circular accordian) 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 contacts 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 contactor 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 pick-up voltage on a bench before installation, with the contactor 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 pick-up voltage.

CHECK-OUT, MECHANICAL

Make sure all power circuits are deenergized and isolated. The contactor can be checked in its cabinet or outside. A mechanical interlock **must** be checked installed, to make certain that it functions properly.

If the contactor 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 underside of the lower bottle nut on each pole. This overtravel gap should be no less than .050 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 contactor 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 unusual 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.

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 in the dielectric strength of the contact gap. A good interrupter will withstand a 5.5KV, 50 or 60 hertz test across a 0.090 inch contact gap, which is the normal new gap.

When a vacuum bottle is tested with voltages 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 and should be replaced. 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 judgement, and philosophy of preventive maintenance.

CONTACT FORCE

A vacuum contactor is affected by atmospheric pressure on the bellows of the vacuum bottles. Up to an altitude of 3300 feet, the contactor is designed to tolerate normal variations in barometric pressure. If the contactor is to be operated over 3300 feet above sea level, the contact force should be increased by adding shims (Part No. 7874A17H01) to each bottle stud **between the shunt** and **hex nut holding the shunt.** The shims must **not be between the shunt and the stem of the bottle.** See center view of Fig.5 There are six shims attached to one flange of the mounting plate for possible use if required. Apply the shims per Table III.

TABLE III — ALTITUDE ADJUSTMENT SHIMS	
Altitude	**Quantity of Shims Required per Bottle**
0 to 3300 ft.	None
2800 to 4300 ft	One
3800 to 5300 ft.	Two
4800 to 6300 ft.	Use extra wide commercial washer (.060 thick)
Additional shims may be ordered as Part No. 7874A17H01	

MAINTENANCE

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

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

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 Fig. 5 and Fig. 6) move easily away from their pivot, the vacuum has probably failed and the bottle 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 a 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 power is off.

CHANGING OPERATING COIL

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

The coil contains its own rectifier to convert the applied AC into unfiltered full-wave rectified DC. When the coil is at rated voltage, the magnet will be silent. At reduced 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, refering to Fig. 5.

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 load leads from the contactor terminals.
4. Remove four ¼ x 20 screws 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 kickout 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 four 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 from the crossbar.
10. Reconnect line and load cables.

AUXILIARY CONTACT ADJUSTMENT

The nominal .34 gap show for the L63 auxiliary contact (normally-closed) in the left upper portion of Fig. 5 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 pick-up winding will burn out, because the pick-up 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 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.

The L56 auxiliary contacts are not as critical. In the open position, their plungers may rest lightly against the in operating arm, or may have a small clearance.

However, neither L63 nor L56 plungers 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 that hold the L63 mounting bracket, repositioning and tightenting. These bracket mounting screws are accessible from the top side of the contactor and are recognized by the slotted holes under their heads.

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 Fig. 5. As the contacts wear, this gap decreases. When any gap goes **below .020 in.**, all the bottles should be replaced. Use the .020 in. thick fork-shaped overtravel gauge supplied for this measurement, Part No. 5259C11H02.

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.

MAGNET OPERATING RANGE

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

TABLE IV — OPERATING RANGES

Rated Coil Voltage	Pick-Up-To-Seal Voltage		Drop-Out-To-Full Open Voltage	
	Above	Below	Above	Below
120	50	96	75	10
240	100	192	150	20

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-Fig. 5) 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 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 Westinghouse Service for assistance.

B. The auxiliary contact mounting brackets are misadjusted, 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 AUXILAIRY CONTACT ADJUSTMENT.

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. If it can be moved, the kickout spring must be stretched to hold the crossbar firmly against the frame. Refer to Figure 4. 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.

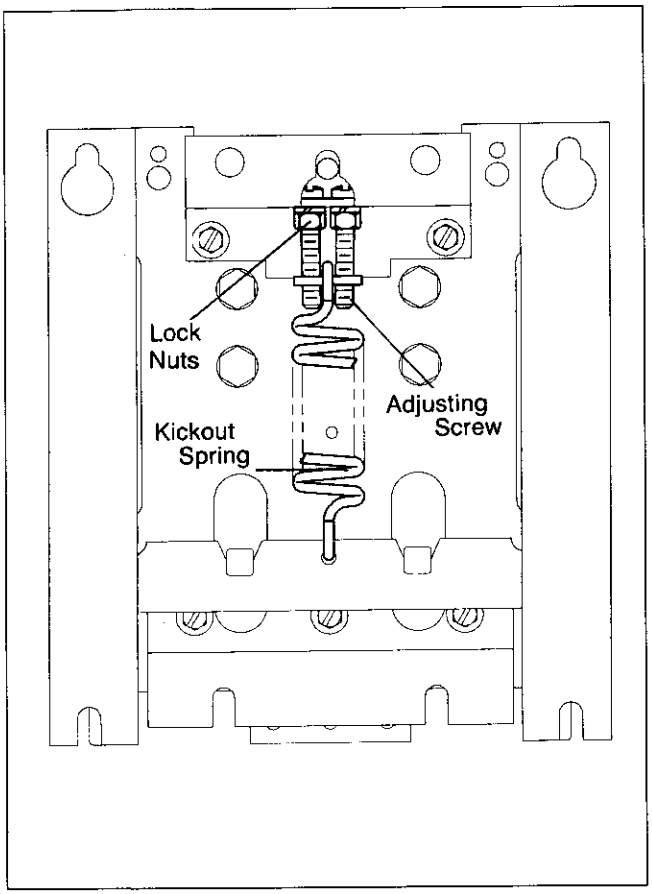

Fig. 4 Kickout Spring

VACUUM BOTTLE REPLACEMENT

If it becomes necessary to replace the vacuum bottles, proceed as follows:

O. Obtain replacement bottle sub-assemblies, keeping in mind that (1) all bottles on any contactor must be the identical part/style number, and (2) all bottles on any contactor must be replaced at the same time. See Table V.

1. **Deenergize the contactor circuits.** Remove the frame subassembly as described under CHANGING OPERATING COIL.

TABLE V — REPLACEMENT CONTACTS	
All vacuum interrupters (bottles) in any one contactor should be replaced as a set. Order appropriate quantity.	
Single Vacuum Interrupter Assembly	**Part No.**
Model A (w/ 5/16 x 18 x 1⅛ in. bolt)	9968D12G01
Model B (w/M8 1.25 x 30 mm bolt)	9968D12G02

VACUUM BOTTLE REPLACEMENT (CONT.)

2. Unbolt the rear shunt ends by removing fastener (N) behind the bottom terminal straps. Refer to Fig. 5.

   Note: On first production (N) is a bolt. Later units have a removable nut at (N), in which case, remove the nut and slide the shunt end off of the stud.

3. Loosen the bottle nuts on the moving stems, using a screwdriver, as shown in Fig. 6. Turn the blade clockwise from a notch in one nut across to a notch in the other nut, so that the nuts turn in opposite directions to each other. Once loose, back both nuts out until there is clearance to the pivot plate.

4. From this point, proceed with one bottle subassembly at a time, completely installing each new unit before removing the next old one, as follows.
5. Insert an Allen wrench through the two holes in each terminal (T) into the two ¼ x 20 hexsocket head screws (R). Loosen the screws until terminal (T) is free.

   Do not be concerned if the screws (R) fall into the cavity at this point.

6. Pull the terminal (T) from the structure. The bottle nuts and spring will slide out from the crossbar, the shunt will withdraw from the window it occupies, and the bottle subassembly is then out of the contactor.

7. Remove bottle clamp (P) and the two loose screws (R).

8. Replacement bottle subassemblies may look like either view in Fig. 7. Either style can be used, but all subassemblies on any one contactor must be identical. Although some **bottles** have metric threads there is no problem, since all hardware to mount the **bottle subassemblies** is English/American.

9. Adjust screws (R) in each bottle subassembly so that the dimension L (Fig. 7) between terminal (T) and bottle clamp (P) is greater than 0.7 inch. At the other end of the subassembly, run the bottle nuts to the extreme end of the bottle stud.

10. Bend the shunt by hand to the approximate shape to fit.

11. Insert the free end of the shunt into its window in the crossbar, sliding the bottle stud into its notch in the crossbar, with the bottle nuts under the pivot plate and the contact spring on the bottle side of the crossbar arm. At the same time, position terminal (T) into place so that the molded ledge is captured between clamp (P) and terminal (T). Make sure that the notches on each side of (P) are fitted over the corresponding projections on the molded ledge. Tighten two screws (R) with an Allen wrench inserted through the holes on top of terminal (T). There must be clearance between the bottle and the ends of the screws (R). If not, install spacer washers under the heads of screws (R).

12. Check that the bottle stud (Fig. 5) does not rub on the sides or back of its slot in the crossbar arm. If the stud rubs on the rear, it may be necessary to remove the subassembly and reshape the shunt. If the stud rubs on the side of the slot, loosen bolt (H) with an Allen wrench inserted through the terminal hole, position the bottle to suit, then retighten bolt (H).

13. Install the other two bottle subassemblies using the same procedure.

14. Remount the frame subassembly onto the mounting base as described in CHANGING OPERATING COIL.

15. Close the contactor by energizing coil. Set the overtravel gap on the center pole at .050 ± .005 inch by turning the bottle nuts by hand. Once the gap is achieved, the bottle nuts should be finger-tight, one against the other. Lock the bottle nuts with a screwdriver inserted from the front, turning the screwdriver counterclockwise with the blade fitted from a notch in one bottle nut across to a notch of the other bottle nut, so that the nuts turn in opposite directions to each other. Refer to Fig. 6.

16. Adjust the bottle nuts on the two outer poles to make-circuit (touch) simultaneously with the center pole, using volt-ohmmeters or test lamp circuits. Lock the bottle nuts with a screwdriver per Fig. 6.

17. The overtravel on the two outer poles may not be the same as the center pole when the contacts are set to touch simultaneously. This is a normal variation. However, as the contacts wear, the overtravel on any pole must not be allowed to go below .020 inch.

18. When the contactor is open, pull the armature forward. The armature should not move because it should already be firmly against the plastic main frame. If it does move, the kickout spring must be adjusted. See KICKOUT SPRING ADJUSTMENT.

19. Reconnect line and load cables.

20. Because it is difficult to detect a damaged vacuum bottle, promptly destroy bottles removed from service.

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.

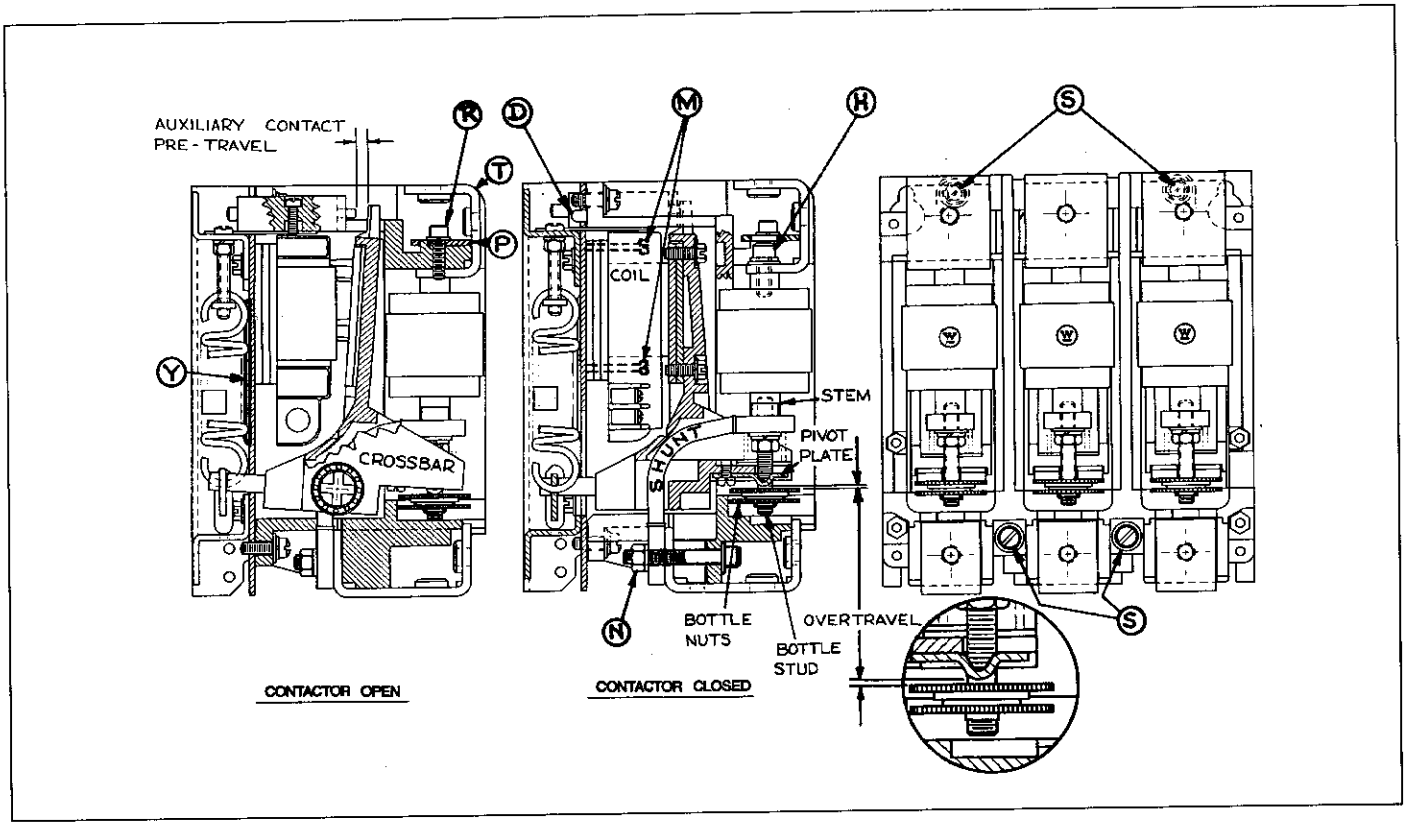

Fig. 5 V201 Contactor

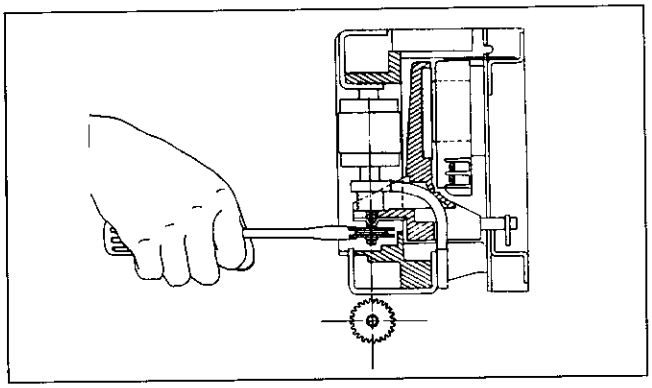

Fig. 6 Adjusting Bottle Nuts

INSPECTION AFTER SHORT CIRCUIT

The V201 contactor 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 all bottles be replaced. If the overtravel has changed significantly (from the last inspection) on one or more bottles, all three bottles should be replaced.

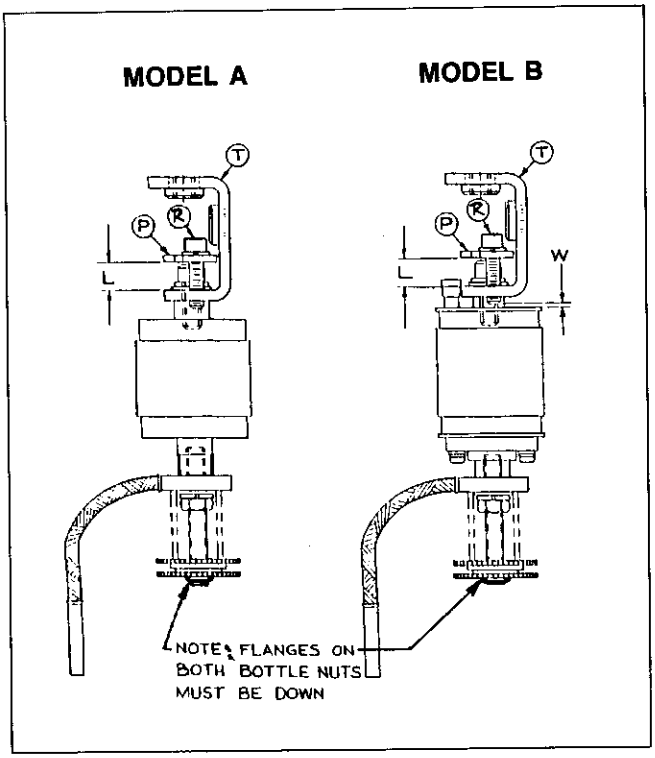

Fig. 7 Vacuum Bottles and Shunts

A dielectric test would not by itself confirm that the bottles 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 bottles 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.

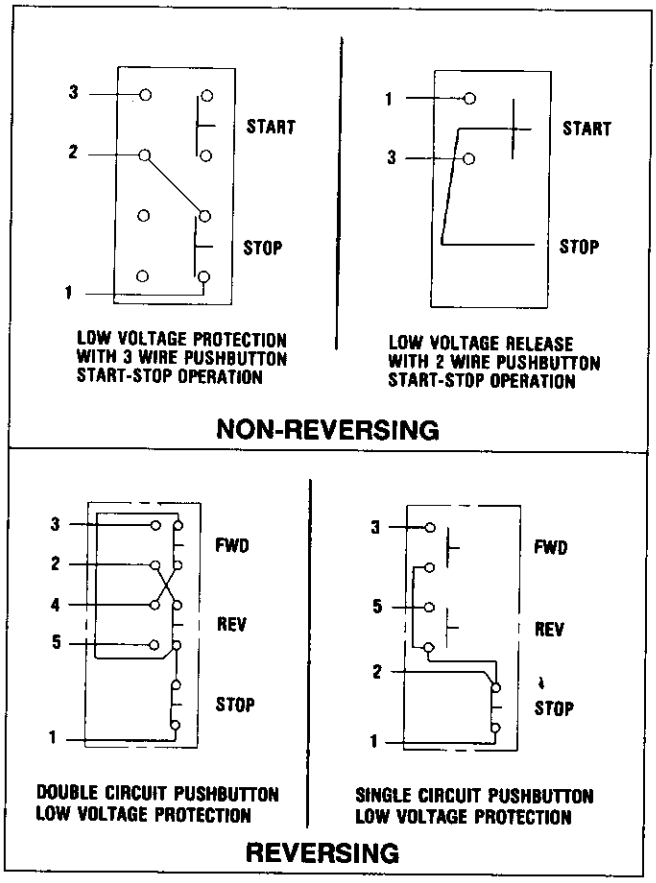

Fig. 8 Control Circuit Diagrams

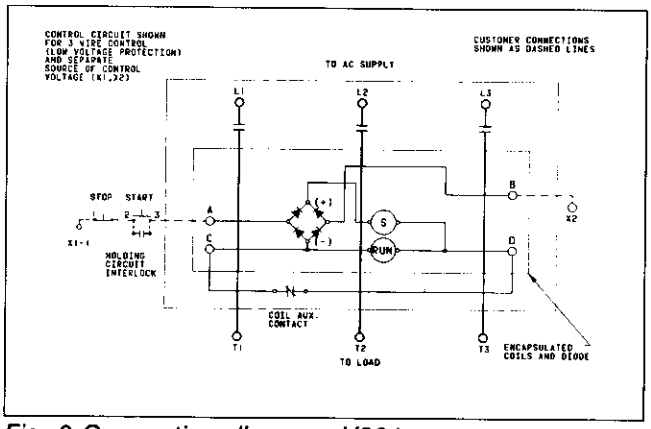

Fig. 9 Connection diagram, V201

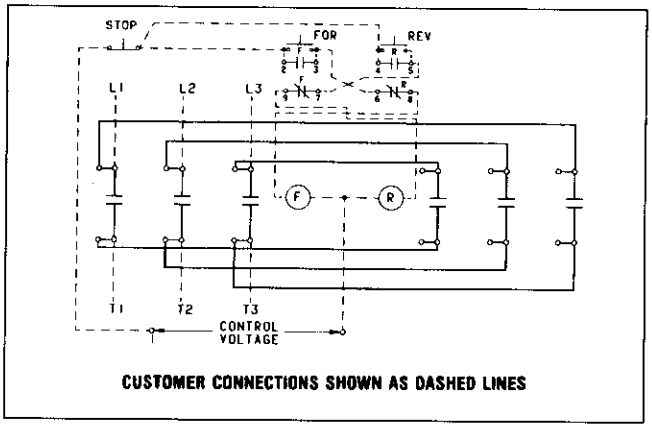

Fig. 10 Connection Diagram, V211

TABLE VI — RECOMMENDED DRIVING TORQUE

Location (Qty.)	Driving Torque (lb.-in.)	Fig. 5 Item Refer.
Coil Terminals (4)	7-9	—
Shunt Nut (Bolt) (1 per pole)	90-95	N
Clamp Screws (2 per pole)	40-45	R
Base Mounting Screws (4)	60-65	S
Coil Mounting Screws (2)	10-15	M
Bottle Stud Mounting Bolt (1 per pole)	90-95	H