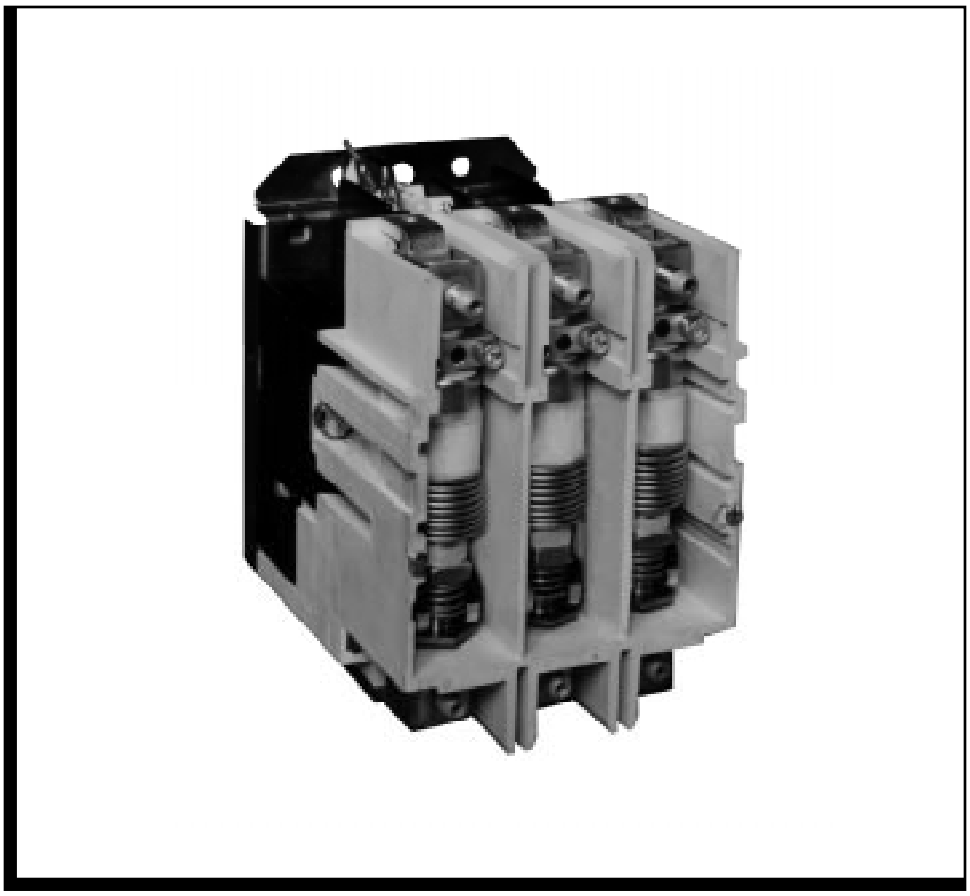
SQUARE D
Instruction Bulletin

Bulletin No. 30072-005-104A
October, 1992
Raleigh, NC, U.S.A.

Supersedes 30072-005-104 Dated 6/92

3-Pole AC Vacuum Contactors
Type WF, Series A
Class 8502 and 8702 — NEMA Size 4



Three-Pole AC Vacuum Contactor

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INTRODUCTION

This instruction bulletin illustrates and describes Class 8502 and Class 8702 three-pole vacuum contactors. It also contains assembly, modification and parts ordering instructions. This NEMA Size 4 vacuum contactor is designed for the control of inductive or non-inductive loads at voltages between 200 and 600 VAC.

⚠ DANGER

HAZARDOUS VOLTAGE.

Disconnect all power before working on equipment.

Electrical shock will cause severe injury or death.

MOUNTING

Mount contactor with three 1/4" - 20 bolts.

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.

The vacuum contactor is designed to tolerate normal variations in barometric pressure up to an altitude of 6600 feet. If the contactor is to be used at higher elevations, please consult the local Square D sales office.

TERMINALS

Class 8502/8702 Type WFO contactors are supplied with power terminals that are suitable for wire sizes #12 - 4/0 kcmil. **Use copper wire only**, 75° C minimum rating, on device power and control terminals. Maintain the minimum clearances listed in Table 1.

Table 1 Minimum Clearances — 600V Maximum

Minimum clearance between any uninsulated live part and an uninsulated live part of opposite polarity, an uninsulated grounded part other than the enclosure, or exposed metal part.	Through Air	0.375"
	Over Surface	0.500"
Minimum clearance between any uninsulated live part and the metal enclosure.	Shortest Distance	0.500"

PRINCIPLE OF OPERATION

The Class 8502 Type WFO vacuum contactor has its main contacts sealed inside ceramic tubes (vacuum interrupters or bottles) in which a vacuum exists. No arc boxes are required because the vacuum has no ionized air to sustain the arc. The arc stops when the alternating current passes through zero at line frequency. The arc usually does not survive beyond the first half cycle after the contacts begin to separate. The metal bellows allow the contacts to open and close without letting air into the vacuum chamber.

The contacts in an unmounted bottle are normally-closed because the outside air pressure pushes against the flexible bellows. To keep the contacts in the normally-open position, a kickout spring is employed, and is located in the rear of the contactor. The kickout spring pushes against the moving crossbar, which in turn pulls the contacts open.

The contactor coil accepts AC control power connected directly to the coil terminals as shown in Figure 1 on page 5. However, the coil assembly uses a full wave rectifier to pass DC power through the coil winding. A capacitor and resistor are switched in series with the coil winding just before the armature fully closes to reduce the coil current and prevent overheating. All of the coil components are encapsulated.

AUXILIARY CONTACTS

Each Size 4 vacuum contactor is supplied with one normally-open and one normally-closed, delayed break auxiliary contact, Class 9999 Type WCX11. The normally closed pole is factory wired to switch a resistor and capacitor in series with the coil winding as shown in Figure 3 on page 9. The normally-open pole is available for customer use. The normally-closed pole **must** be located in the left center cavity of the four available auxiliary contact cavities in order to line up with a step in the crossbar. If this auxiliary contact is replaced, or if the upper frame of the contactor is removed for coil inspection or replacement, care must be taken to ensure that the auxiliary contact is positioned correctly in the left center cavity and that the contactor crossbar will operate the auxiliary contact actuator. **If the crossbar does not operate the actuator, the coil will overheat and burn out. Note:** Only replace a Class 9999 Type WCX11 with another Class 9999 Type WCX11 auxiliary contact.

On a reversing Size 4 vacuum contactor, one Class 9999 Type WCX11 auxiliary contact described in the previous paragraph and one Class 9999 Type WX11 auxiliary contact are supplied on both the forward and reverse contactors to switch the resistor and capacitor in the coil circuit, to provide electrical interlocking between the contactors and to provide the holding circuit contact. **Note:** There is one normally-open auxiliary contact on both the forward and reverse contactors that is available for customer use.

A maximum of three additional auxiliary contact units may be installed on each non-reversing contactor and one additional auxiliary unit may be installed on each contactor (forward or reverse) of a reversing contactor. The auxiliary units mount by means of a spring clip and retaining screw. To remove the auxiliary unit, loosen the retainer screw and then slide the auxiliary contact unit out of the recess.

For installation of auxiliary contact units, refer to Instruction Bulletin 30072-005-107 supplied with each kit.

Table 2 Auxiliary Contacts

Contact Type	Class 9999
1 Normally-Open and 1 Normally-Closed	WX11

Ratings (NEMA A600, R300)

Voltage	Make	Break
120-600 VAC	7200 VA	720 VA
72-120 VAC	60 A	720 VA
28-72 VAC	60 A	10 A
28-300 VDC	28 VA	28 VA

INSTALLATION INSPECTION

⚠ WARNING

HAZARDOUS VOLTAGE.

Disconnect all power before conducting Insulation Level Check and Vacuum Interrupter Check.

Electrical shock can cause injury or death.

Before energizing the contactor for the first time and on a continuing basis, the contactor should be inspected by qualified electrical personnel. See the following sections for Insulation Level Check and Vacuum Interrupter Check.

Insulation Level Check

After installation and before energizing the contactor for the first time, it is recommended that the insulation resistance between poles and from each pole to ground be measured and recorded. The reading will be dependent on other connected equipment and conditions of service. 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.

Vacuum Interrupter Check

⚠ CAUTION

POSSIBILITY OF X-RAY EXPOSURE AT VOLTAGES ABOVE 5000.

During dielectric test, stay at least 10 feet away from contactor, preferably behind a metal barrier.

Exposure to x-rays can cause injury. This precaution must be observed until this possible hazard is better identified and standards are published.

The dielectric strength of each vacuum interrupter should be checked. A good interrupter will withstand a 5.5 kV, 50 or 60 Hz test across a 0.075" contact gap, which is the normal new gap.

It is unlikely, but possible to have some loss of vacuum which might seriously damage the ability of the bottle to interrupt the circuit. This condition may go unnoticed in a three-phase, ungrounded circuit, since it is possible for any two good interrupters to successfully interrupt the circuit. To guard against this condition, periodic dielectric tests across open contacts are desirable. The interval between periodic tests depends on the number of operations per day, environmental factors and experience.

CONTACT WEAR

DANGER

HAZARDOUS VOLTAGE.

Disconnect all power before beginning the contact wear measurement procedure.
Read the instructions below carefully before attempting to measure contact wear.

Failure to observe these precautions can cause electrical shock and unexpected energization of load, resulting in injury or death.

When the contactor is fully closed, there is a gap between the pivot plate and the bottle stem as shown in Figure 1 on page 5. This gap is a measurement of the contact overtravel and is equivalent to the contact wear allowance provided on a new contactor. During the life of the contactor, contact material continually vaporizes from the contact faces and condenses inside the bottle, reducing the overtravel. Periodic measurement of this overtravel provides an indication of contact wear. **Do not readjust bottle position, which is set at the factory.**

Use the following procedure to measure contact wear:

1. Disconnect all power. Test to make sure there is no voltage present at the main power terminals or at the coil terminals. Coil terminal location is shown in Figure 1 on page 5.
2. Trace the wires connected to the coil terminals to determine the source of coil power. If power to the coil is supplied from a source that is separate from the main power circuit, proceed to step 3 below. If power to the coil is supplied from the main power circuit, either directly or through a control transformer, remove all wiring from the coil terminals. Then connect the coil terminals to a separate source of AC voltage that matches the rating marked on the coil.
3. Apply coil power to energize the contactor.
4. **NOTE: Be aware that the coil terminals are now energized. Keep body parts and tools away from the coil terminals to avoid danger of electrical shock.**
5. Use the 0.010" thick fork-shaped overtravel gauge supplied to measure the gap between the pivot plate and the bottle stem as shown in Figure 1 on page 5. If the gap is more than 0.010" on all bottles, the contacts are suitable for further use. If the overtravel gauge will not fit into the gap on any bottle, the contactor must be replaced.
6. Remove power to the coil. Reconnect, if necessary, to original circuit configuration.

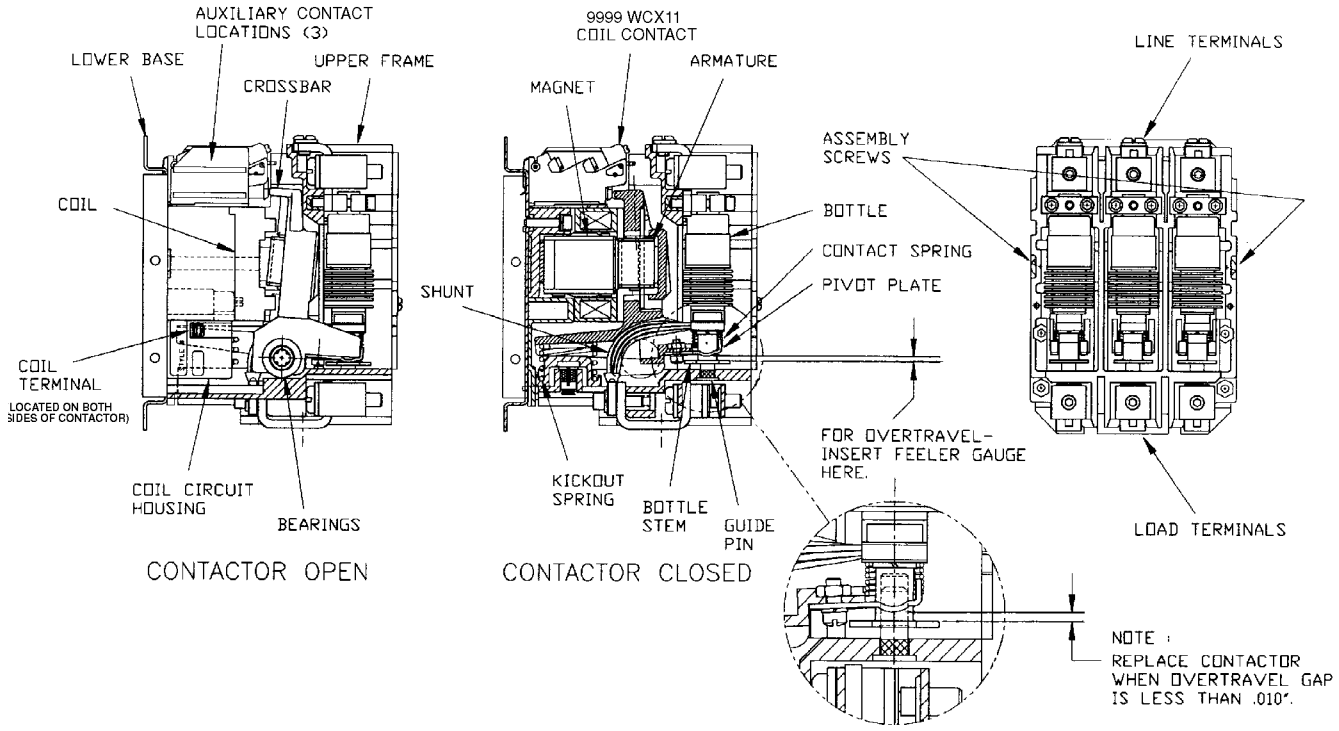


Figure 1 Size 4 Vacuum Contactor, Class 8502 Type WFO

INSPECTION AFTER SHORT CIRCUIT

Class 8502/8702 Type WFO vacuum contactors must be protected against overcurrent in accordance with applicable electrical codes and the maximum device ratings listed in Table 5 on page 8. However, the magnitude of a short circuit may exceed the damage threshold of the vacuum bottles. After a short circuit, the effects of physical stress on the contactor should be checked along with the overtravel, dielectric strength and insulation level. Physical damage or deformation of conductor bars and cables would indicate severe stress. The overtravel should not have changed significantly and should still exceed the 0.010 inch minimum. Refer to CONTACT WEAR on page 4. The Insulation Level Check and Vacuum Interrupter Check described on page 3 **must** be conducted. If there is no evidence of physical stress and if overtravel, dielectric strength and insulation level are satisfactory, the contactor may be returned to service. Otherwise replace the unit.

COIL REPLACEMENT

Each replacement coil kit consists of an encapsulated coil and a coil circuit assembly, which contains a rectifier, capacitor and resistor as shown in Figure 2 on page 7. These two units plug together in the assembled contactor. If there is a coil failure, both units must be replaced because they are properly matched according to rated control voltage and frequency.

Table 3 Replacement Coil Kits

Voltage (AC)	Frequency (Hz)	Class/Type
120/110	60/50	9998WF120
240/220	60/50	9998WF240
480/440	60/50	9998WF480
600/550	60/50	9998WF600

⚠ DANGER

HAZARDOUS VOLTAGE.

Disconnect all power before replacing coil.

Electrical shock will cause severe injury or death.

To replace the coil and coil circuit assembly (Refer to Figure 2 on page 7 for item locations):

1. Disconnect all power from the contactor and remove the contactor from the panel.
2. To remove the old coil, loosen the two assembly screws located at the sides of the contactor.
3. Remove the loosened upper frame, and pull the coil away from the magnet.
4. Remove the two #10-32 screws that hold the coil circuit assembly to the baseplate.
5. Loosen the two terminal screws on the delayed break, normally closed 9999WCX11 auxiliary contact (mounted in the left center recess), and remove the two wires that connect to the coil circuit assembly.
6. Pull the coil circuit assembly away from the lower base, feeding the two wires on the bottom through the holes in the baseplate, refer to Figure 5 on page 10.
7. Reverse the above procedure to mount the new coil circuit assembly, taking care to guide the wires back through the holes in the baseplate and connect them to the 9999WCX11 auxiliary contact terminals.
8. Plug the new coil into the coil circuit assembly, lining up the two pins in the bottom of the coil with the mating receptacles on the coil circuit assembly.
9. Replace the upper frame. Slide the assembly screws into their respective holes and let the screws hang from the upper frame to facilitate re-assembly. This step accommodates the beveled slot in each side of the upper frame and allows each screw to be perpendicular to the baseplate.
10. While the upper frame assembly is being installed on the lower frame, make certain that the 9999WCX11 and any other auxiliary contacts are pushed completely back into their cavities and secured. **It is essential that the 9999WCX11 be mounted correctly and that the crossbar engage the contact actuator or a coil failure will result.**
11. Tighten the assembly screws to the recommended driving torque.

TIGHTENING TORQUES

Factory recommended tightening torques are listed in the Table 4. To ensure proper device operation, these tightening torques must be followed when installing, assembling or adjusting the device. Refer to Figure 2.

Table 4 Recommended Driving Torque

Item	Description	Driving Torque
A	Assembly Screw (2)	50-60 lb-in.
B	Coil Terminal Screw (2)	8-9 lb-in.
C	Main Power Terminal Screw (2 per pole)	90-100 lb-in.
D	Coil Circuit Mounting Screw (2)	30 lb-in.

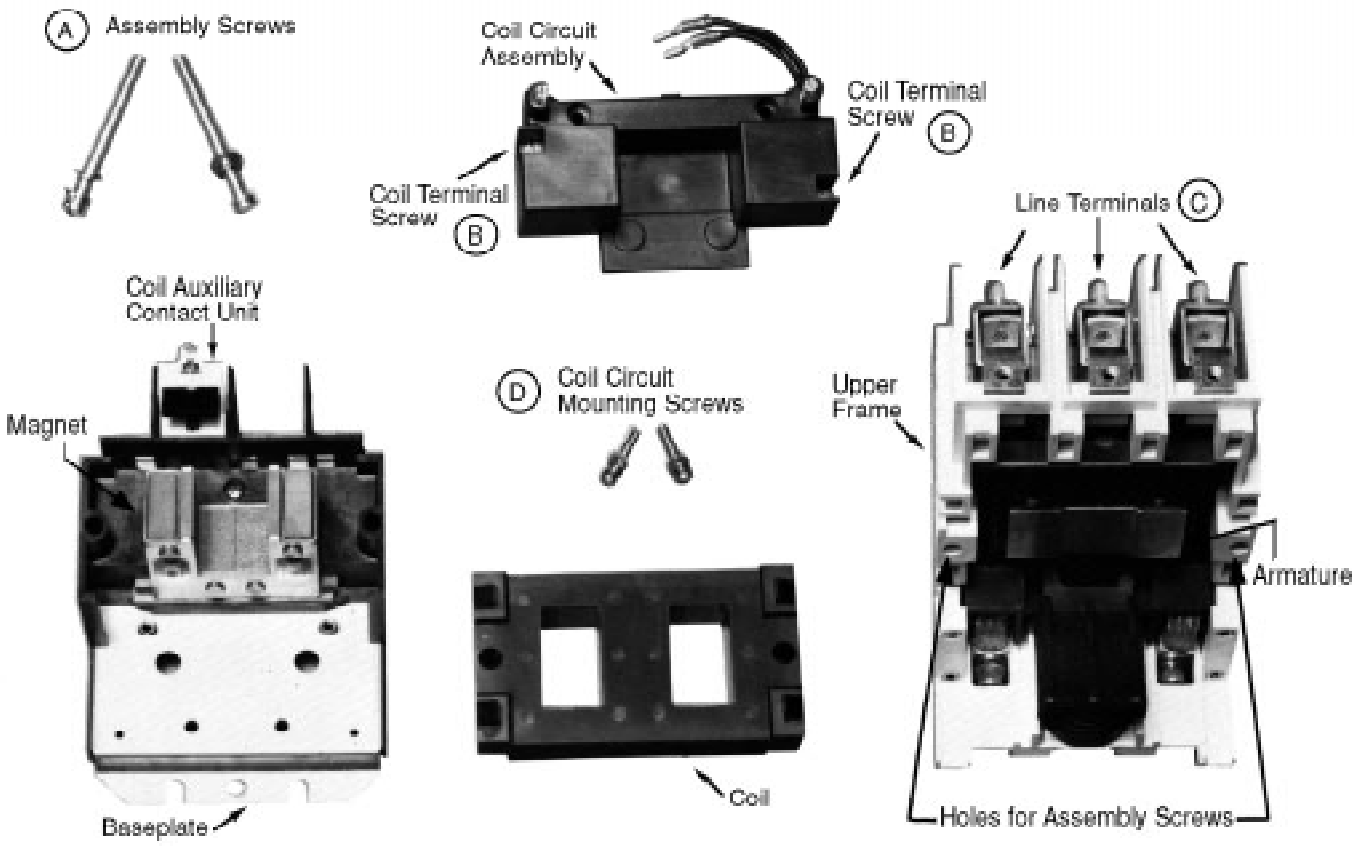


Figure 2 Assembly Drawing, Class 8502 Type WFO

SHORT CIRCUIT PROTECTION

Suitable for use on a circuit capable of delivering not more that 10,000 rms symmetrical amperes - 600 Volts maximum. Ratings of branch-circuit protective device must comply with applicable electrical codes and the maximum protective device ratings listed in Table 5.

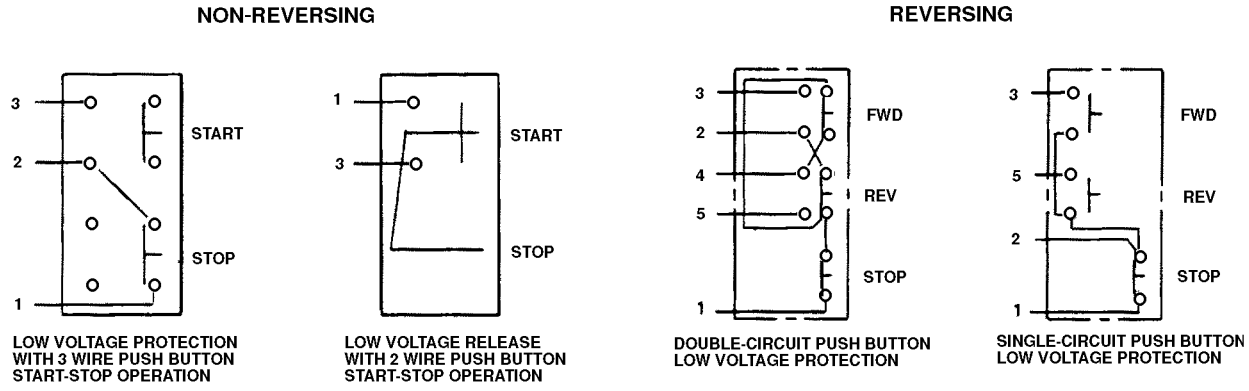
Table 5 Maximum Ampere Ratings

Maximum Voltage	Class K5, RK5 or RK1 Fuse*	Class J Fuse	Inverse-Time Circuit Breaker
600	200	400	225

*** Time Delay fuse may be required**

CONTROL WIRING

Control circuit conductors must be protected against overcurrent in accordance with applicable electrical codes. This may require installation of protective devices not shown in the control circuit connection diagrams. Fuse holder kits Class 9999SF4 and 9999SFR4 are available to allow compliance.



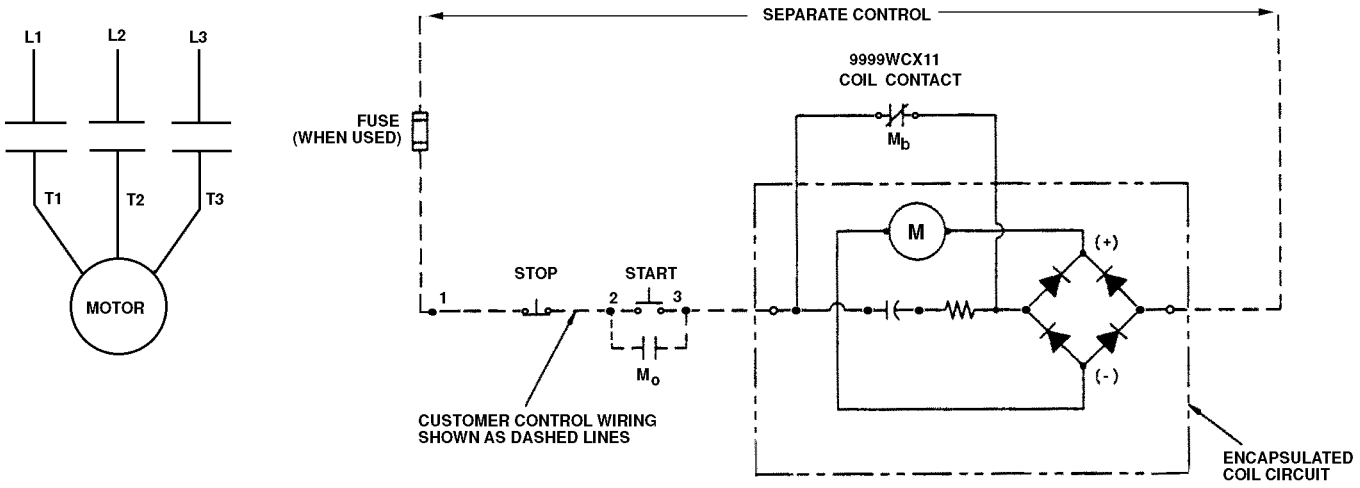


Figure 3 Connection Diagram, Class 8502 Type WFO

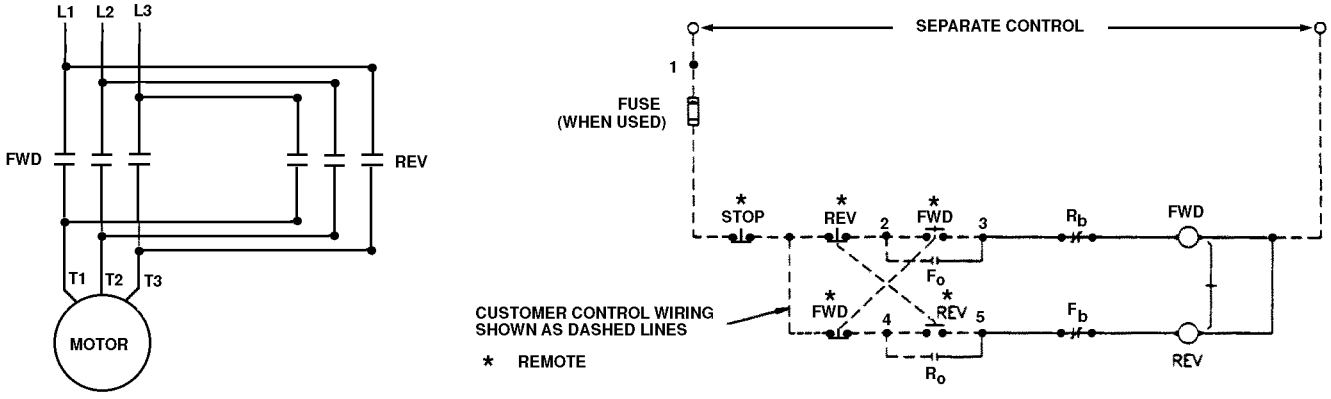


Figure 4 Connection Diagram, Class 8702 Type WFO

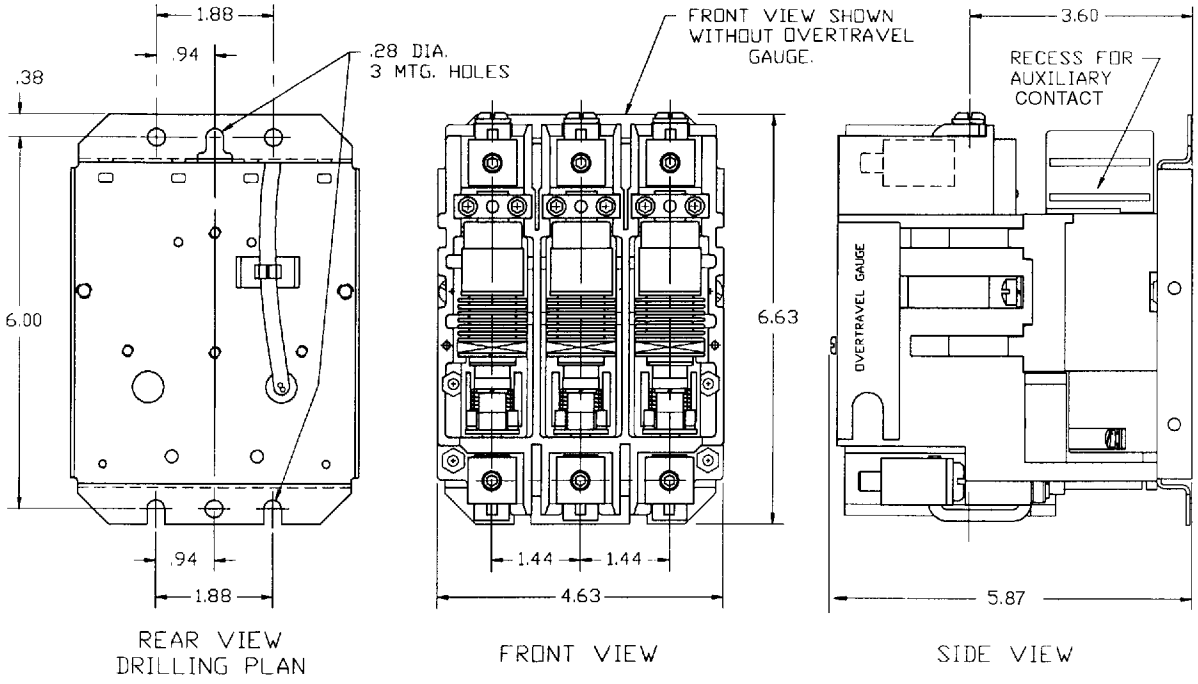


Figure 5 Dimensional Drawing (Inches), Class 8502 Type WFO

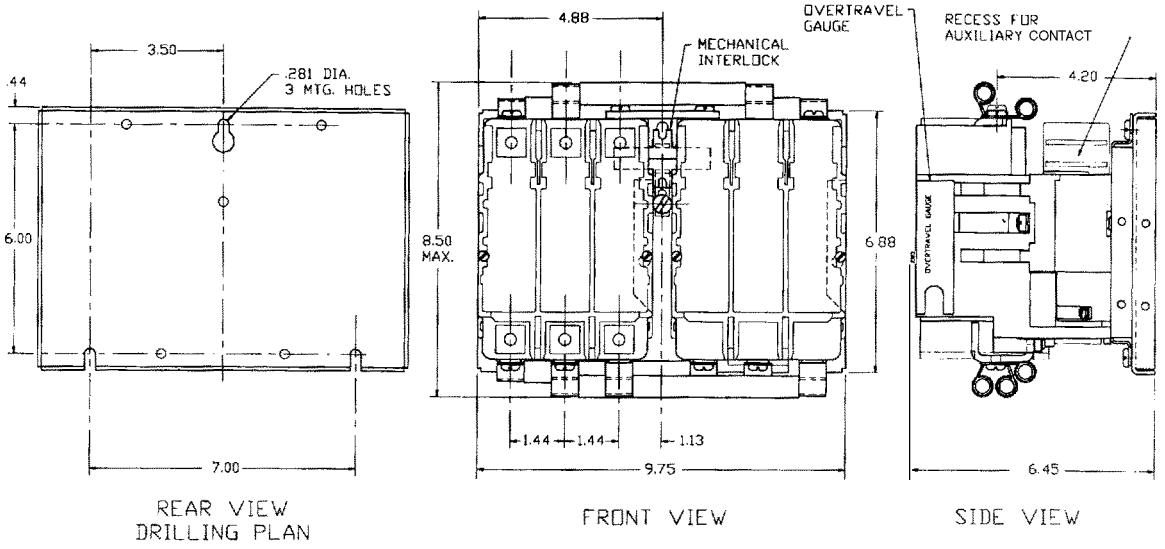


Figure 6 Dimensional Drawing (Inches), Class 8702 Type WFO

PLEASE NOTE:

Electrical equipment should be serviced only by qualified electrical maintenance personnel, and this document should not be viewed as sufficient instruction for those who are not otherwise qualified to operate, service or maintain the equipment discussed. Although reasonable care has been taken to provide accurate and authoritative information in this document, no responsibility is assumed by Square D for any consequences arising out of the use of this material.