

# SQUARE D

## Instruction Bulletin

Reference No. 336AS  
Bulletin No. 30072-013-14  
Raleigh, NC, U.S.A., September, 1992  
Supersedes 8903-336 dated 10/85

### 400 and 600 Amp Electrically Held AC Magnetic Lighting Contactors Types SY and SZ, Series B Class 8903

#### INTRODUCTION

This instruction bulletin illustrates and describes Class 8903 two-and three- pole, 400 and 600 A, electrically held, AC magnetic lighting contactors. It also contains assembly, modification and parts ordering instructions. To identify parts, refer to Figure 1 on page 6.

**Note:** This bulletin contains significant changes throughout since last publication date. Please review all material carefully.

### DANGER

#### HAZARDOUS VOLTAGE.

**Disconnect all power before working on equipment. On contactors with Form S, also disconnect the separate control power source.**

Electrical shock will cause severe injury or death.

#### INSTALLATION

The following paragraphs contain procedures for installing 400 and 600 A lighting contactors.

##### Mounting

Mount the contactor on a vertical surface, with line terminals up. When mounting an open contactor, use three 1/2" bolts tightened to 500-550 in-lbs.


##### Terminals

Power terminals on standard contactors are suitable for use with either copper or aluminum conductors. Refer to instruction sheet for information on terminal wire sizes.


Provision for terminating power wiring with crimp lugs is provided on standard terminals by two clearance holes that accommodate 1/2" bolts spaced at the NEMA standard of 1-3/4".

Factory recommended tightening torques are listed in Table 3 on page 5 and the contactor instruction sheet. To insure proper device operation, these tightening torques must be followed when installing, assembling or adjusting device.

### Operation Rates

 <b>CAUTION</b>
<p><b>CONTROL MODULE BURNOUT.</b></p> <p><b>Do not exceed the contactor operation rates listed below:</b></p> <ul style="list-style-type: none"><li>• <b>Continuous operation rate: 3 operations/minute maximum.</b></li><li>• <b>Jogging or plugging duty: 15 operations/minute – 3 minutes maximum.</b></li></ul> <p>Failure to observe this precaution could damage the contactor, resulting in personal injury or equipment damage.</p>

### Manual Operation

 <b>WARNING</b>
<p><b>HAZARDOUS VOLTAGE.</b></p> <p><b>Disconnect all power before manually operating contactor.</b></p> <p>Manual operation with power on can cause contact arcing and unexpected energization of load, resulting in severe personal injury or equipment damage.</p>

Manual operation of contactors may be accomplished by pushing on the armature screws (item B).

### Short Circuit Protection

Provide branch circuit overcurrent protection for each contactor in accordance with the National Electrical Code and information supplied in the instruction sheet.

### Distant Control

Series impedance and shunt capacitance of control circuit wires must be considered to assure proper operation of contactor when controlled from remote operator station(s). A typical wire size and maximum conduit wire run is listed below in Table 1. Since the control voltage is usually 120 V, only the 120 V control distance is listed. For other wire sizes or special control schemes, contact your local Square D field office for Product Data Bulletin M379.

**Table 1      Maximum Control Distance**

<b>Voltage</b>	<b>Wire Size</b>	<b>Max. Control Distance</b>
120 V	#14 AWG	105 ft

## Control Circuit Transformer

The contactor is equipped with an integral transformer to provide an isolated 120 V @ 60 Hz/ 110 V @ 50 Hz supply for control circuits. It is factory-wired for use on the system voltage indicated on the label attached to the transformer.

### CAUTION

#### **TRANSFORMER BURNOUT.**

**Control circuit transformer must be reconnected or replaced for use at other system voltages (see instructions below), DO NOT change coil.**

Failure to observe this precaution could damage the contactor or prevent it from energizing, resulting in personal injury or equipment damage.

Use one of the following methods to convert the control circuit transformer for other system voltages:

1. If the contactor is factory-wired for 480 V @ 60 Hz/ 440 V @ 50 Hz, it may be converted to 240 V @ 60 Hz/ 220 V @ 50 Hz by reconnecting the control transformer as illustrated on the instruction sheet. The control transformer must be replaced for conversion to any other system voltages (e.g. 208, 380, 600 V). Select a new transformer with single voltage primary from Table 4 on page 7.
2. If the contactor is factory-wired for any voltage OTHER THAN 480 V @ 60 Hz/ 440 V @ 50 Hz, the control transformer must be replaced for conversion to any other voltage.

The standard transformer supplied may be used to power a maximum of five Class 9001, Type K illuminated operators incorporating transformer type light modules. Since the secondary of the control circuit transformer supplies an electronic circuit, highly inductive loads such as relays **MUST NOT** be placed in this secondary. All inductive loads and additional pilot lights must be supplied from a separate transformer. Extra capacity can be purchased as form F4T in 100 VA increments (see the Square D Digest).

**Standard contactors are wired for common control and are NOT CONVERTIBLE for operation of the control circuit from a separate source of supply voltage.**

Contactors wired for separate control (Form S) are furnished with an isolating transformer, usually equipped with a 120 V primary and 120 V secondary that must not be bypassed. **Form S contactors are NOT CONVERTIBLE for operation on common control.**

## Auxiliary Contacts

All contactors are supplied with a normally-closed auxiliary contact wired to the coil control unit. This contact is an integral part of the control circuit and must not be used with additional loads.

Up to four additional normally-open or normally-closed auxiliary contacts can be installed in the field. For class and type numbers, see Table 4 on page 7. For application information, refer to Instruction Bulletin 9999-287 or the Square D Digest.

**Cover Mounted  
Control Units**

NEMA 1, 4 and 12 enclosures are supplied with three punched holes with closing plates for field addition of Class 9001, Type K oiltight/watertight control units. Table 2 lists the parts kits needed to add control units in the field.

**Table 2 Field Modification Kits**

Kit	Class 9999 Type	Class 9001 Type	Form
Push Button, on-off	SA3 <sup>[1]</sup>		A12
Selector Switch, hand-off-auto	SC8		C
Selector Switch, on-off (selector switch) (on-off legend plate)		KS11BH1 KN245	C6
Red Pilot Light (120 V only)	SP28R <sup>[2]</sup>		P1

<sup>[1]</sup> Also requires normally-open auxiliary contact for holding circuit contact.

<sup>[2]</sup> For other voltages or colors, refer to the Class 9001 Type KP section of the Square D Digest.

**MAINTENANCE**

The following paragraphs contain maintenance instructions for 400 and 600 A lighting contactors:

**Inspecting and Replacing  
Contacts**

Contacts are not harmed by discoloration and slight pitting. **DO NOT FILE CONTACTS, as it wastes contact material.** Replacement is only necessary when the contact has worn thin. Replacement contacts for contactors are available as kits. Order from Table 4 on page 7.

It is unnecessary to remove any wiring to inspect or replace contacts. To inspect, loosen the two screws (item B) holding the armature to the movable contact carrier and loosen the four screws (item D) holding the contact actuator to the contact block. Lift the contact actuator to expose the contacts. To insure proper alignment of the contact actuator when the device is reassembled, the four screws (item D) holding the contact actuator to the contact block should be tightened in sequence. As you face the starter or contactor, mounted in the normal vertical position, the tightening sequence is: lower left, upper left, upper right and lower right. Follow tightening torques listed in Table 3 on page 5 when assembling the device. Manually operate the device after it is reassembled to insure all parts are functioning properly (see "Manual Operation" on page 2).

**Coil Replacement**

**Conversion for other system voltages is not accomplished by changing the coil.** See "Control Circuit Transformer" on page 3. To remove the coil, loosen the four screws (item A) and the two armature screws (item B). Remove cover and armature. Disconnect wires from coil terminals and remove coil.

When reassembling device, follow factory recommended tightening torques listed in Table 3. Manually operate the device after it is reassembled to insure all parts are functioning properly (see "Manual Operation" on page 2).

**Tightening Torques**

Factory recommended tightening torques are listed in Table 3 and the device instruction sheet. These tightening torques must be followed when reassembling or adjusting device during maintenance or assembly.

**Table 3 Factory Recommended Tightening Torques**

Item	Description	Tightening Torque (in-lb)
A	Cover screws, 1/4" - 20 x 1"	65 - 75
B	Armature screws, 1/4" - 20 x 1-5/8"	44 - 50
C	Coil terminal pressure wire connector	9 - 12
D	Power plant screws	65 - 75
E	Auxiliary contact pressure wire connector	9 - 12
F	Stationary contact fasteners, 1/2" - 13 x 1-1/4"	300 - 350
G	Lug assembly - Type SY Lug assembly - Type SZ	See device instruction sheet
H	Saddle-to-baseplate nuts, 5/16" - 18	145 - 160
J	Load terminal-to-standoff screws	65 - 75
K	Control transformer-to-saddle screws	24 - 35
L	Control transformer terminal screws	6 - 9
M	Transformer-to-saddle screws	24 - 35
N	Coil excitation module-to-saddle screws, #6 - 32 x 1-1/8"	9 - 12
P	Coil excitation module terminal screws	6 - 9
Q	Terminal block-to-mounting-plate screws, #8 - 32 x 5/16"	18 - 21
R	Terminal block pressure wire connectors	9 - 12
S	Lug retaining screw	Tighten until Belleville washer flattens

**Test Procedure**

If the coil excitation control module (item 7) or sealed voltage transformer (item 5) must be replaced, follow this test procedure to verify that the parts and wiring are installed correctly and all components are functioning properly:

1. Open disconnect means ahead of contactor. On contactors with Form S (separate control), also disconnect the separate control power source.
2. Disconnect the wires from terminals F and G on the coil excitation control module (item 7).
3. Connect multimeter leads to terminals F and G; negative lead to F, positive lead to G. Set multimeter selector to read DC voltages between 0 and 150 V.

**NOTE**

**Contactor coil is not energized during the following test procedure. This is only a test of the voltages available.**

4. Close disconnect means ahead of contactor. On contactors with Form S, re-connect the separate control power source only.
5. Press and hold ON button or close contacts on pilot switch that controls the contactor. Voltmeter reading should be between 100 and 140 VDC. **DO NOT MAINTAIN THIS CONDITION FOR MORE THAN 15 SECONDS, otherwise the coil excitation control module may be damaged.**
6. With ON button depressed, manually open normally-closed auxiliary contact (item 2) by pushing the operating lever toward the panel. Voltmeter reading should be between 10 and 18 VDC.
7. Release the auxiliary contact. Voltmeter reading should remain between 10 and 18 VDC.
8. Open disconnect means. On contactors with Form S (separate control), also disconnect the separate control power source. Reconnect wires to terminals on the coil excitation control module from which they were removed. Wire labels should match the labels on the control module terminals.

Assembly Drawing

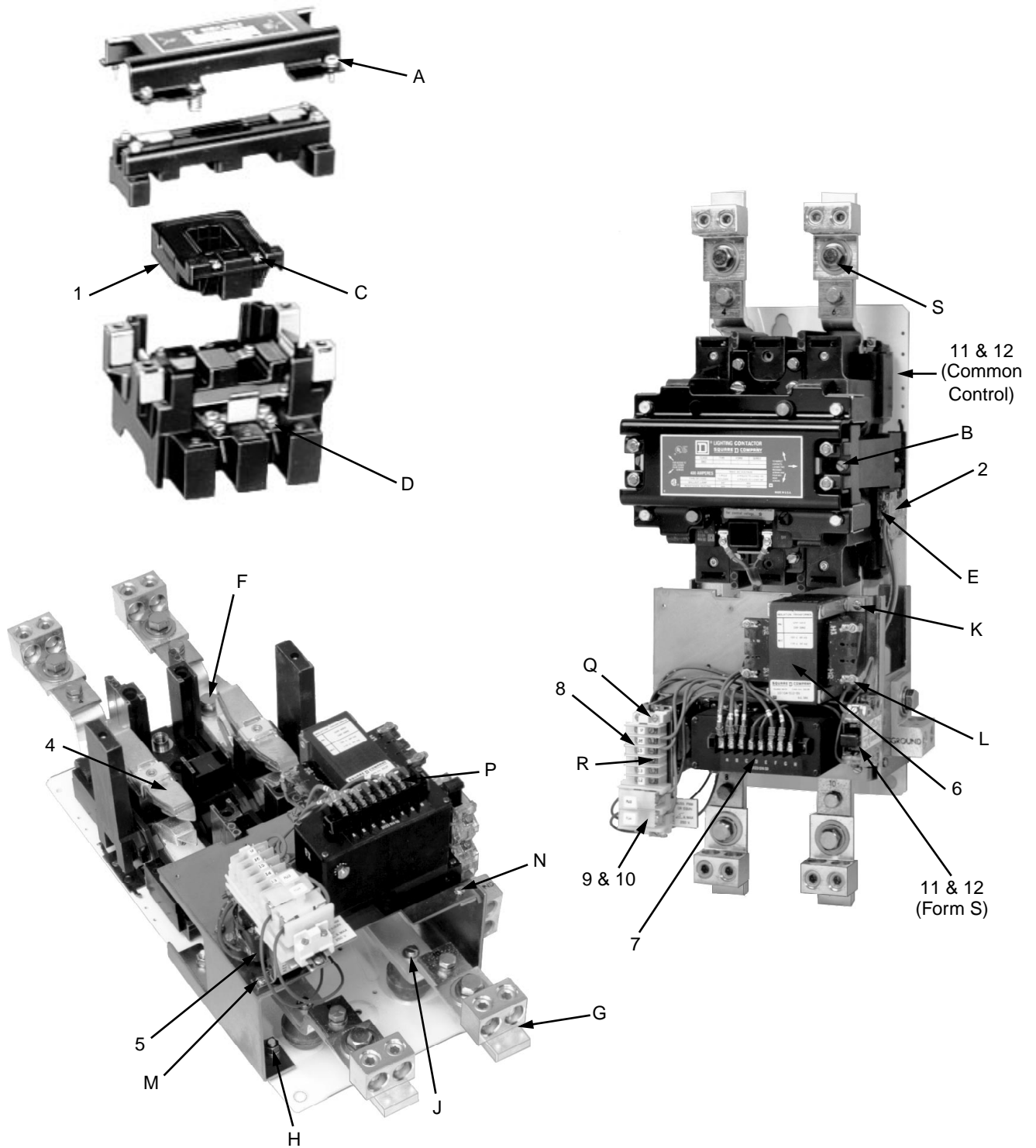


Figure 1 Contactor Assembly Drawing

**Ordering Instructions**

Specify quantity, part number and description of part, giving complete nameplate data of the device. For example, one control circuit auxiliary contact, Class 9999, Type SX7 for a Class 8903, Type SYO2, Series B lighting contactor. To identify parts, refer to Figure 1 on page 6.

**Table 4 Parts List**

Item	Description	Part Number	Quantity			
			Type SY		Type SZ	
			2-Pole	3-Pole	2-Pole	3-Pole
1	Coil (all system voltages)	31104-400-50	1	1	1	1
2	Coil excitation control circuit auxiliary contact, N.C.	Class 9999 Type SX7	1	1	1	1
3 [1]	Auxiliary contact	Class 9999:				
	1 N.O.	Type SX6	...	...	...	...
	1 N.C.	Type SX7	...	...	...	...
4	Contact kit	Class 9998:				
		Type SL25	1			
		Type SL26		1		
		Type SL32			1	
		Type SL33				1
5 [2]	Transformer	30023-514-50	1	1	1	1
6	Control transformer (see "Control Circuit Transformer" on page 3). Order info. must include Class, Type and voltage code, (e.g. Class 9070, Type EO3S2A) 240/480 - 120 (standard)	Class 9070 Type EO3S2_	1	1	1	1
		A				
		B				
		C				
		D				
		E				
		F				
		G				
	Other voltages - consult field office					
7 [2]	Coil excitation control module	31123-514-50	1	1	1	1
8	Terminal block	Class 9080 Type GP6	6	6	6	6
9	Fuse holder (white)	Class 9080 Type GF6	2	2	2	2
10	Fuse (for item 9) - Bussman FNM 1/2 or equivalent.	25419-20050	2	2	2	2
11	Fuse holder (clear)	30015-130-54	1	1	1	1
12	Fuse (for item 11) - Littlefuse KLDR time delay fuse only, do not substitute	See Table 6 on page 10	2	2	2	2
G	Lug assembly					
	Type SY	25085-24604	4	6		
	Type SZ	25085-24902			4	6
S	Lug mounting hardware					
	Lock washer, 1/2"	23606-00282	4	6	4	6
	Belleville washer, 1/2"	23903-33204	4	6	4	6
	Nut 1/2" - 13	23002-00280	4	6	4	6
	Cap screw, 1/2" - 13 x 1-3/4"	21401-28560	4	6	4	6

[1] Not shown.

[2] When replacing this item, see "Test Procedure" on page 5.

**Troubleshooting**

**Table 5 Troubleshooting Procedure**

<b>Problem</b>	<b>Possible Causes</b>	<b>Corrective Action</b>
Contactor will not turn on.	Control circuit fuse(s) (item 12) open.	Replace open fuse(s). <sup>[1]</sup> If repeated burnout occurs, see "Open Control Circuit Fuse" in "Problem" column.
	Contacts on normally-closed auxiliary contact (item 2) not making contact.	Disconnect <sup>[1]</sup> leads from auxiliary contact and check continuity between its terminals. If no continuity, replace contact.
	Pilot switch (thermostat, float switch, etc.) not making contact.	Disconnect <sup>[1]</sup> leads from pilot switch. Check continuity <sup>[1]</sup> between its terminals with switch contacts closed. If no continuity, replace pilot switch.
	Coil (item 1) not operating.	Disconnect <sup>[1]</sup> one of the coil leads and measure resistance between coil terminals. If resistance is less than 3.4 ohms or more than 4.2 ohms, replace coil.
	Control transformer (item 6) connected for wrong voltage or wrong transformer is being used.	Determine voltage rating of control transformer on contactor by consulting transformer label. Check connection of transformer primary if it is a 4-terminal primary (see instruction sheet furnished with contactor).
	System voltage too low or excessive voltage drop in control circuit. (Common control only.)	<b>Power circuit:</b> Measure system voltage at control transformer (item 6) primary terminals. If it measures less than 90% of the transformer's marked rating, increase system voltage. <b>Control circuit:</b> Measure control voltage between terminals 15 and 16 with ON button depressed. If it measures less than 102 VAC, increase control circuit conductor size or shorten length of conductor run. Refer to "Distant Control" on page 2.
	Separate control power source voltage too low or excessive voltage drop in control circuit. (Separate control only.)	<b>Separate control power source:</b> Measure separate control voltage between terminals 12 and 16 with ON button depressed. If it measures less than 90% of the control transformer's (item 6) marked primary voltage rating, increase separate control power source voltage and/or capacity. <b>Control circuit:</b> Measure control voltage between terminals 15 and 16 with ON button depressed. If it measures less than 90% of the control transformer's (item 6) marked primary voltage rating, increase control circuit conductor size or shorten length of conductor run. Refer to "Distant Control" on page 2.
	Control transformer (item 6) inoperative.	Disconnect <sup>[1]</sup> the lead from terminal X1 of the control transformer. Measure AC voltage between terminals X1 and X2 on control transformer (with primary of transformer energized). If it measures less than 100 V and voltage at the primary terminals has been checked as described in step above and is satisfactory, replace control transformer.
Control module (item 7) inoperative.	If all of the procedures above have been performed and the contactor still will not turn on, replace <sup>[1]</sup> the control module (item 7). When replacing coil excitation control module (item 7), see "Test Procedure" on page 5.	
Open (blown) control circuit fuse(s).	Incorrect fuse(s).	Replace <sup>[1]</sup> fuse(s) (item 10 or 12) with proper fuse shown in Table 4 on page 7.
	Contactor operating rate is too high.	Reduce operating rate to: <b>Continuous Duty:</b> 3 operations/minute maximum <b>Intermittent Duty:</b> 15 operations/minute - 3 minutes maximum
	Coil (item 1) is shorted.	Disconnect <sup>[1]</sup> one of the coil leads and measure the resistance between coil terminals. If resistance is less than 3.4 ohms or more than 4.2 ohms, replace coil.
	Control transformer (item 6) incorrectly connected.	Disconnect <sup>[1]</sup> the lead from terminal X1 of the control transformer. Measure AC voltage between terminals X1 and X2 of control transformer with pilot switch turned on (contacts closed). If voltage exceeds 132 V, verify transformer primary connections using diagram on contactor instruction sheet. If connections are correct, see next step.

<sup>[1]</sup> Always open disconnect switch on line side of contactor before making continuity or resistance checks, removing or making any connections and replacing fuses. On Form S (separate control) contactors, also disconnect the separate control power source.



**Table 5 Troubleshooting Procedure (cont'd)**

<b>Problem</b>	<b>Possible Causes</b>	<b>Corrective Action</b>
Open (blown) control circuit fuse(s). (cont'd)	Control transformer (item 6) primary voltage too high or too low.	Determine primary voltage rating of control transformer (item 6) from transformer's label. Measure system voltage on standard (common control) contactor or separate control power source voltage on Form S (separate control) contactor. Voltage measured at primary terminals of control transformer must be between 90-110% of rated primary voltage.
	Normally-closed auxiliary contact (item 2) at lower-right corner of power-contact block is not opening.	Disconnect <sup>[1]</sup> one lead from the auxiliary contact and check continuity between contact terminals. Verify there is continuity when contact operator is in normal position. There should be no continuity when contact operator is rotated clockwise towards the baseplate. Replace contact if these requirements are not met.
	Small transformer (item 5) or control module (item 7) shorted.	If all above procedures have been performed and fuse(s) FU1 and/or FU2 (item 12) still open when the ON button is depressed, replace <sup>[1]</sup> the control module (item 7). When replacing coil excitation control module, see "Test Procedure" on page 5.  If fuse(s) FU3 and/or FU4 (item 10) open when the ON button is depressed, disconnect <sup>[1]</sup> the 3 leads from terminal A on the control module. Determine which one of these 3 leads is connected to the normally-closed auxiliary contact (item 2) and isolate it. Temporarily connect the remaining 2 leads together. Also disconnect the leads from terminals D, E and H on the control module. Keep all loose leads insulated. With new fuses installed at FU3 and FU4, reconnect the power supply and depress the ON button. If FU3 and/or FU4 opens, replace <sup>[1]</sup> the small transformer (item 5). When replacing small transformer, see "Test Procedure" on page 5.  If neither FU3 nor FU4 opens, replace <sup>[1]</sup> the control module (item 7). When replacing coil excitation control module, see "Test Procedure" on page 5. Return disconnected leads to their original locations.
Contactor turns on once momentarily then stays off, or cycles on and off.	"Telegraphing" pilot device.	If controlled by 2-wire pilot device (pressure switch, thermostat, etc.), observe operation of pilot device to make sure it switches on and off when intended without observable bounce. Replace if necessary.
	Small transformer (item 5) or control module (item 7) inoperative.	Disconnect <sup>[1]</sup> leads from C, D and E on control module and keep leads separated. Close disconnect means on standard (common control) contactor or reconnect separate control power source on Form S (separate control) contactor. Measure AC voltage between lead D and terminal H and between lead E and terminal H.  If either measurement is below 8 V, replace <sup>[1]</sup> transformer (item 5). When replacing small transformer, see "Test Procedure" on page 5.  If both measurements are between 8 and 13 V, replace <sup>[1]</sup> control module (item 7). When replacing coil excitation control module, see "Test Procedure" on page 5.  Reconnect <sup>[1]</sup> leads C, D and E to control module.
Contactor does not stay off when OFF button is released.	Holding circuit contact not opening.	Remove <sup>[1]</sup> one lead connected to the holding circuit contact (located at upper-right corner of contactor) and check continuity between contact terminals. If continuity exists, replace contact. If it does not, see next step.
	Short circuit in control circuit wiring.	If no switches show continuity in check described in step above, probable cause of problem is short circuit in wiring. Locate <sup>[1]</sup> short circuit and correct.

<sup>[1]</sup> Always open disconnect switch on line side of contactor before making continuity or resistance checks, removing or making any connections and replacing fuses. On Form S (separate control) contactors, also disconnect the separate control power source.

**Table 5 Troubleshooting Procedure (cont'd)**

<b>Problem</b>	<b>Possible Causes</b>	<b>Corrective Action</b>
Contactor will not turn off.	OFF switch or pilot switch (thermostat, float switch, etc.) not opening circuit.	Disconnect <sup>[1]</sup> wires from one terminal of switch. Check continuity between terminals of switch while it is in off position (contacts open). If continuity exists, replace switch.
	Short circuit in wiring between contactor and ON switch or pilot switch (thermostat, float switch, etc.).	<ol style="list-style-type: none"> <li>1. If contactor is equipped with ON and OFF buttons, either remote or enclosure-mounted, disconnect<sup>[1]</sup> lead from terminal X1 of the control transformer on standard (common control) contactor or remove<sup>[1]</sup> fuse FU1 (item 12) on Form S (separate control) contactor, and check for continuity between terminals 12 and 13. If continuity remains when any OFF button is depressed, a short circuit is present in the wiring and must be corrected.</li> <li>2. If contactor is connected to remote pilot switch (thermostat, float switch, etc.), disconnect<sup>[1]</sup> lead from terminal X1 of the control transformer on standard (common control) contactor or remove<sup>[1]</sup> fuse FU1 (item 12) on Form S (separate control) contactor, and disconnect<sup>[1]</sup> wires from one terminal of pilot switch. Check continuity between terminals 12 and 15 on terminal block. If continuity exists, a short circuit is present in the wiring, which must be corrected.</li> </ol>

<sup>[1]</sup> Always open disconnect switch on line side of contactor before making continuity or resistance checks, removing or making any connections and replacing fuses. On Form S (separate control) contactors, also disconnect the separate control power source.

**Table 6 Fuse Selection**

<b>Primary Voltage</b>	<b>Max. Fuse Rating</b>
600 V	3/4 A
480 V	8/10 A
415 V	1 A
380 V	1-1/8 A
277 V	1-6/10 A
240 V	1-8/10 A
208 V	2 A
120 V	3-1/2 A

Use Class CC Type KLDR Time delay fuses only.

NOTES:

**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.