

Size 5A, 400 Amp, Single Pole DC Contactor, Normally Open Type MGAO1, Series A Class 7004

INTRODUCTION

This instruction bulletin illustrates and describes Class 7004 MGAO1 single pole DC contactors. The Class 7004 Type M Line-Arc[®] contactor is a DC magnetic, milltype clapper device designed to meet NEMA Standards. Table 1 lists the contactor ratings.

Contactors Ratings

Table 1 Maximum Contactor Ratings @ 600 VDC +40° C Ambient

Ratings	DC Motor Horsepower @ 230 VDC	DC Amperes
Open 8 hour	110	400
Enclosed	100	360
Crane	150	533

Operating Coils

The operating coils are designed in accordance with NEMA standards to continuously withstand 110% of rated voltage and to successfully operate the contactor at 80% of rated voltage. Standard coil voltages are 115/120 VDC and 230/240 VDC. Table 2 lists the ratings for standard operating coils. For other available coil voltages, refer to Class 9998 Coil Data Catalog Sheet.

Table 2 Operating Coil Ratings

Coil Part Number	DC Voltage Rating	Nominal Resistance @ +20° C (Ω)
D51019 - 243 - 53	230/240	1220
D51019 - 243 - 56	115/120	310

Electrical Interlocks

Electrical interlocks consist of stationary contacts mounted on the contactor arm support (item 23) and moving contacts attached to the bottom of the contact arm (item 22). A set of electrical interlocks contains one normally-open and one normally-closed double break contact. Make and break ratings apply for double-throw contacts only when both the normally-open and normally-closed contacts are connected to the same polarity. The electrical interlock ratings, listed in Table 3 and Table 4, are in accordance with NEMA standard ICS-2-125 (A600 and N600 table ratings).

Table 3 Electrical Interlock AC Ratings (A600)

Volts	Maximum Current (A)		Maximum Continuous Current (A)
	Make	Break	
120	60	6.0	10
240	30	3.0	10
480	15	1.5	10
600	12	1.2	10

Table 4 Electrical Interlock DC Ratings (N600)

Volts	Maximum Current (A)		Maximum Continuous Current (A)
	Make	Break	
125	2.2	2.2	10
250	1.1	1.1	10
480	0.4	0.4	10

Contact Tips

Copper power contact tips are standard. Silver-faced power contact tips are available and are recommended for applications where the contactors remain closed for long periods of time. Silver-faced contact tips are optional on DC starters.

INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE.

To prevent electric shock or burn, disconnect power to contactor before installation, adjustments, maintenance or troubleshooting. Metal parts of contactor may be at line voltage. Failure to observe this precaution will result in severe personal injury or death!

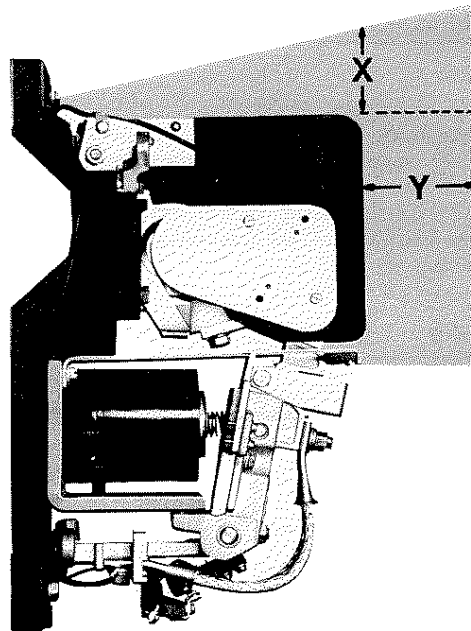
1. Unpack contactor carefully. Remove shipping tape if used.
2. Inspect nameplate data for correct equipment. Visually verify that the contactor operating coil (item 39) is the correct voltage. The operating coil circuit voltage may be different than the power circuit voltage.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD.

Failure to connect operating coil to proper voltage may cause improper contactor operation or damage to coil. Failure to observe this precaution could result in personal injury or product damage.

3. Visually verify that all parts are undamaged and secure.
4. Mount the contactor vertically on a rigid support and fasten it down tightly using a plain washer against the contactor base. Provide the clearances shown in Figure 1 above the top of the contactor and in front of the arc chute.



Note: Shaded area for arcing clearances.

Dimension to grounded, uninsulated panel	600 VDC	240 VDC
X	2.5"	2.5"
Y	6.0"	3.2"

5. With all power removed, mount auxiliary devices such as electrical interlocks on contactor. Install and adjust these auxiliary devices according to procedures in the instruction sheets provided with the devices.
6. With all power removed, pivot the arc chute upwards and operate the contactor by hand. The contact tips (item 10) should meet squarely. If they do not meet squarely, align them by the procedure in "Contact Tip Alignment."
7. Pivot the arc chute down to its proper position.

 **CAUTION**

PRODUCT DAMAGE.

Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

8. Check the wiring diagram on the contactor instruction sheet before connecting the contactor coil leads, power contact leads and interlock leads. The operating coil circuit voltage may be different than the power circuit voltage. Wire the contactor according to the instruction sheet, making sure all connections are secure.

ADJUSTMENTS

Contactors may require contact alignment or adjustment of the electrical or mechanical interlocks. This section describes the adjustment procedures.

 **DANGER**

ELECTRICAL ARC.

Contactors operated under load expel an arc. Stay away from contactor operated under load.

HAZARDOUS VOLTAGE.

To prevent electric shock or burn, disconnect power to contactor before aligning contact tips or adjusting electrical interlock. Metal parts of contactor may be at line voltage.

Failure to observe these precautions will result in severe personal injury or death!

Contact Tip Alignment

Refer to Figure 2 when aligning the contact tip.

1. Remove all power. Pivot arc chute upward.
2. Visually verify that movable contact tip is against the ridge on the auxiliary arm (item 13).

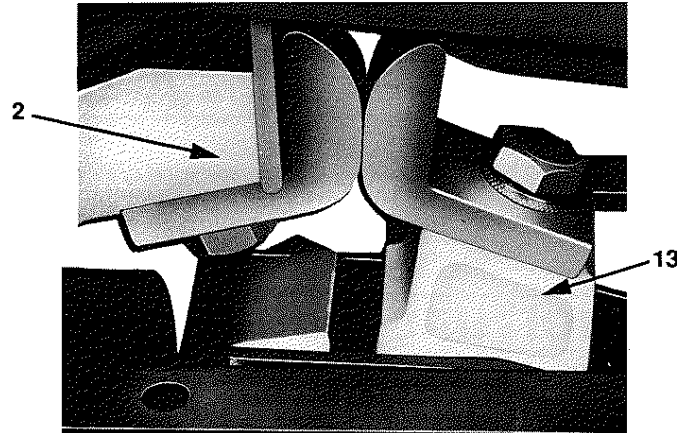


Figure 2 Contact Arm Assembly

3. Visually verify that stationary contact tip is seated against stationary contact support located on the blowout coil assembly (item 2).
4. Visually verify that contact tip surfaces are vertically and horizontally aligned.
5. Pivot arc chute down to its proper position.

CAUTION

PRODUCT DAMAGE.

Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

Electrical Interlock Adjustment

Refer to Figure 3 when adjusting the electrical interlock.

1. Remove all power. Visually verify that electrical interlock (item 49) has proper follow-up. With new electrical interlock contacts, moving contacts (item 52) should provide at least 1/16" follow-up on each stationary contact when contact arm reaches its limit of travel, either completely closed or completely opened (see Figure 3).
2. Visually verify that normally-closed electrical interlock contacts open before the power contact tips close.
3. Electrical interlock follow-up can be adjusted by bending stationary contacts (items 56 & 57).

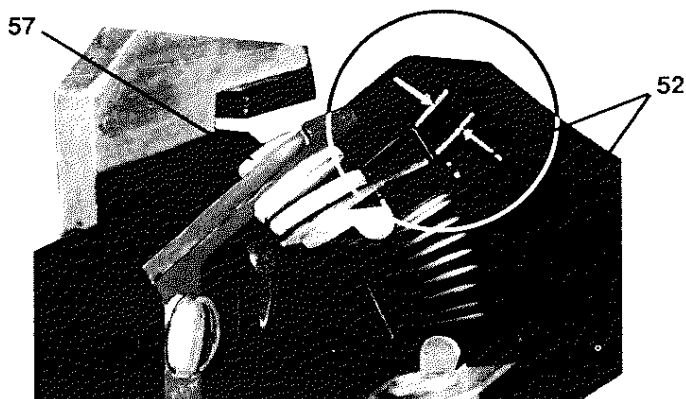


Figure 3 Electrical Interlock Contact Follow-Up

Mechanical Interlock Adjustment

Refer to Figure 4 when adjusting the mechanical interlock.

1. Remove all power. Visually verify that the mechanical interlock allows the contact arm (item 22) of either contactor to reach its limit of travel without binding, either completely open or completely closed.
2. Hold the contact arm of the left contactor fully closed and push closed the contact arm of the right contactor until it is stopped by the mechanical interlock. With new contact tips, check that there is a gap of at least $1/32$ " but not more than $1/16$ " between the inside edge of the stop bracket (item 44) and the back surface of the auxiliary arm (item 13) (see Figure 4).

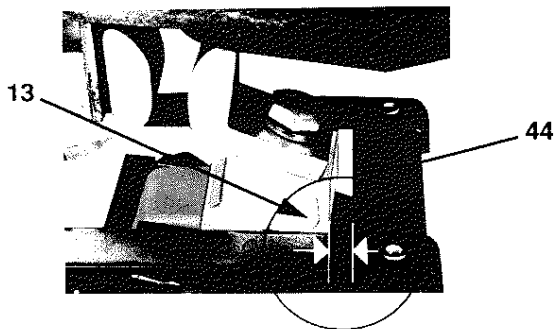


Figure 4 Contact Arm Gap

3. If the gap is not within the limits, adjust the mechanical interlock by loosening the two hex head screws holding the mechanical interlock to the contactor and moving the mechanical interlock until the desired gap is achieved.
4. Repeat steps 2 and 3 above while holding the right contactor in the fully closed position.
5. Push one contactor to the kiss position and check that the other contactor does not come to the kiss position at the same time.
6. If both contactors come to the kiss position at the same time, repeat steps 2 through 5, decreasing the gap but not decreasing it past $1/32$ ".
7. Visually verify that the mechanical interlock allows the contact arm of either contactor to reach its limit of travel without binding, either completely closed or completely open.

MAINTENANCE

This section describes some of the maintenance procedures that may be required for Class 7004 Type MGAO1 contactors. No lubrication is required since these contactors have permanently lubricated, oil impregnated bearings.

⚠ DANGER

HAZARDOUS VOLTAGE.

To prevent electric shock or burn, disconnect power to contactor before inspecting contact tips or replacing any parts. Metal parts of contactor may be at line voltage. Failure to observe this precaution will result in severe personal injury or death!

Contact Tip Inspection

Replace contact tips when the contact follow-up is less than 1/16" (see Figure 5).

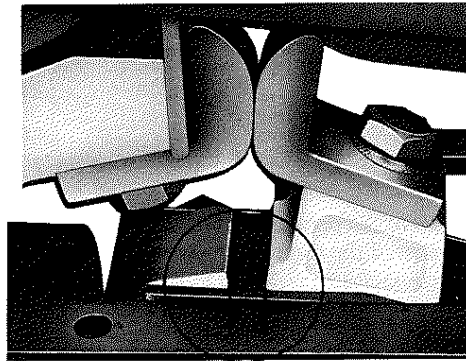


Figure 5 Contact Tip Follow-Up

Contact Tip Replacement

1. Remove all power. Pivot arc chute upward.
2. Remove the movable contact tip by removing the silicon bronze hex head cap screw and lock washer on auxiliary arm (item 13).
3. Remove stationary contact tip by removing the silicon bronze hex head cap screw and lock washer on blowout coil assembly (item 2).
4. Install new stationary contact tip, using the silicon bronze hex head cap screw and lock washer.
5. Install new movable contact tip using the silicon bronze hex head cap screw and lock washer.
6. Manually operate contactor and visually verify that contact tips are aligned. Contact tips must meet squarely, as described in "Contact Tip Alignment" on page 4.
7. Check the adjustment of the mechanical interlock, if used.
8. Pivot the arc chute down to its proper position.

⚠ CAUTION

PRODUCT DAMAGE.

Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

Coil Replacement

1. Remove all power. Disconnect coil leads.
2. Disconnect top end of shunt (item 21) by removing hex head nut, lock washer, washer and shunt.
3. Remove the contact arm pin (item 24) by removing the hex head nut, lock washer and set screw (item 26).
4. Remove contact arm assembly (item 22).
5. Remove the silicon bronze hex head cap screw (item 35) on the front of the magnet core and remove the lock washer (item 36), core cap spacer (item 37), core cap (item 38) and coil (item 39).
6. Install the new coil, using core cap, core cap spacer and lock washer. Tighten the silicon bronze hex head screw. The steel core cap, which is thicker than the non-magnetic phosphor bronze spacer, must be installed against the coil (see Figure 7 on page 12). Visually verify that the spring washer (item 40) is positioned so the outside edge is against the coil and not against the magnet frame (item 41).
7. Replace the contact arm. Visually verify that opening spring (item 29) is seated properly over hex head cap screw (item 35).
8. Replace contact arm pin. Tighten set screw and hex head nut.
9. Visually verify that contact arm pin (item 24) is centered and set screw (item 26) is tight.
10. Connect top end of shunt by replacing washer, lock washer and hex head nut.
11. Reconnect coil leads.
12. Check contact tip alignment and adjustment of the mechanical interlock, if used.

Arc Chute Replacement

1. Remove all power. Disconnect arc chute wires by removing the hex head cap screw (item 47), washer (item 19), lock washer (item 48), arc chute wires and shunt (item 21).
2. Disassemble arc chute wires from the contactor base.
3. Remove arc chute by removing hex head nut (item 17), lock washer (item 8) and hex head screw (item 45).
4. Install new arc chute, using hex head cap screw and lock washer. Secure with hex head nut.
5. Reposition arc chute wires along the contactor base.
6. Reconnect arc chute wires and shunt, using washer, lock washer and hex head cap screw (see Figure 6).

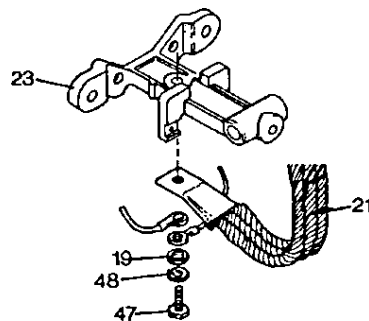


Figure 6 Assembling the Arc Chute Wires and Shunt

⚠ CAUTION

CONTACTOR OVERHEATING.
For proper connection, shunt must be seated directly against contact arm support. Failure to observe this precaution will result in contactor overheating.

7. Pivot arc chute down to its proper position.

⚠ CAUTION

PRODUCT DAMAGE.
Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

Shunt Replacement

Replace the shunt (item 21) when the flexible braided wires are broken or burned or if wires are loose in the terminal connectors on either end of the shunt.

1. Remove all power. Disconnect bottom end of shunt by removing hex head cap screw, lock washer, washer, arc chute wires and shunt.
2. Disconnect top end of shunt by removing hex head nut, lock washer, washer and shunt.
3. Visually verify that auxiliary arm pin (item 27) is centered and set screw (item 18) is tight.
4. Install new shunt. Connect top end of shunt by replacing washer, lock washer and hex head nut.
5. Connect bottom end of shunt by replacing arc chute wires, washer, lock washer and hex head cap screw (see Figure 6 on page 7).

⚠ CAUTION

CONTACTOR OVERHEATING.
For proper connection, shunt must be seated directly against contact arm support. Failure to observe this precaution will result in contactor overheating.

6. Pivot the arc chute down to its proper position.

⚠ CAUTION

PRODUCT DAMAGE.
Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

Electrical Interlock Replacement

Replace the electrical interlock assembly when inspection of the contact tips shows that they are burned or badly pitted. It is recommended that the entire electrical interlock assembly be replaced from a kit. However, the contact tip assemblies can also be replaced.

Electrical Interlock
Assembly Replacement

1. Remove all power. Loosen terminal clamps and screws and remove terminal leads from the stationary contact assembly. Note the position of the leads so they can be properly replaced.

2. Remove the movable contact assembly by removing the slotted screw (item 50), lock washer (item 51) and washer (item 59).
3. Remove the stationary contact assembly by removing the slotted screw (item 58).
4. Install new stationary contact assembly and slotted screw, positioning the stationary contact assembly as shown in Figure 7 on page 12.
5. Install new movable contact assembly and replace washer, lock washer and slotted screw, positioning the movable contact assembly as shown in Figure 7 on page 12.
6. Manually operate the contactor and check the moving contacts for follow-up and sequencing according to "Electrical Interlock Adjustment" on page 4.
7. Replace the terminal leads.

Electrical Interlock Contact Tip Replacement

1. To replace the contact tips, the electrical interlock assembly must be removed from the contactor.
2. Remove both sets of movable contact tips (item 52) from movable contact assembly by compressing the spring (item 54) and retainers (item 53) and sliding out the movable contact tips.
3. Install both sets of new movable contact tips by compressing the spring and retainers and sliding in the movable contact tips.
4. Remove both top stationary contact tips (item 57) from stationary contact assembly by removing the screws and washers that hold them in place.
5. Remove terminal clamps and screws from top stationary contact tips.
6. Install both new top stationary contact tips and replace the terminal clamps and screws.
7. Remove both bottom stationary contact tips (item 56) from stationary contact assembly by removing screws and terminal clamps.
8. Install both new bottom stationary contact tips and replace the terminal clamps and screws.
9. Manually operate contactor and check moving contacts for follow-up and sequencing according to "Electrical Interlock Adjustment" on page 4.
10. Replace the terminal leads.

Opening Spring Replacement

1. Remove all power. Pivot arc chute upward.
2. Disconnect the top end of shunt (item 21) by removing hex head nut (item 20), lock washer (item 48) and washer (item 19).
3. Slide out the contact arm pin (item 24) after removing the hex head nut, lock washer and set screws (item 26).
4. Remove the contact arm (item 22).
5. Remove the opening spring (item 29) by removing the two hex head cap screws (item 31), lock washer, washers and armature plate (item 30).
6. Install new opening spring by inserting narrow end of spring through hole in armature plate so wide end of spring is between armature plate and contact arm.
7. Fasten armature plate to contact arm using washers, lock washers and hex head cap screws.
8. Visually verify that there is no gap between the armature plate and contact arm. This indicates that the opening spring is properly seated between the armature plate and contact arm.
9. Replace contact arm assembly. Check that opening spring is seated properly over hex head screw (item 35).
10. Replace contact arm pin and set screw, lock washer and hex head. Tighten set screw and hex head nut.
11. Connect top end of shunt by replacing washer, lock washer and hex head nut.

⚠ CAUTION

CONTACTOR OVERHEATING.
For proper connection, shunt must be seated directly against contact arm support. Failure to observe this precaution will result in contactor overheating.

12. Check contact tip alignment and adjustment of mechanical interlock, if used.
13. Pivot the arc chute back to its proper position.

⚠ CAUTION

PRODUCT DAMAGE.
Operating contactor with arc chute up may decrease contact tip life or cause product damage. Failure to observe this precaution could result in product damage and shortened product life.

TROUBLESHOOTING

When troubleshooting, refer to Table 1 on page 1 for contactor ratings and Table 2 on page 1 for coil ratings.

⚠ DANGER

HAZARDOUS VOLTAGE.
Troubleshooting procedures marked with an asterisk (*) require application of power. To prevent electric shock or burn, do not touch contactor with power applied. Failure to observe this precaution will result in severe personal injury or death!

Table 5 Troubleshooting Procedure

Problem	Possible Causes	Corrective Action
Contacts will not close or operation is sluggish.	Improper or inoperative operating coil. *Low control circuit voltage.	Visually verify coil part number. Measure resistance to determine if coil is inoperative. Measure control circuit voltage. It must be at least 80% of rated coil voltage. If it is zero, the problem is elsewhere in the circuit.
	Loose connection in control circuit.	Inspect connections and tighten if loose.
	Mechanical interference or binding.	Manually close armature plate and check that cap screw head on core of magnet frame assembly clears the hole in the armature plate. Manually close armature plate and check that auxiliary arm bearings are not binding. Manually close contact arm and check that cap screw head on core of magnet frame assembly clears the hole in the armature plate. Manually close the contact arm. Verify that the auxiliary arm bearings are not binding.
Contact tips overheat, short tip life.	Loose connections.	Inspect contact tips and shunt connections and tighten if loose.
	Movable or stationary contact tip not properly aligned.	Align contact tips according to "Contact Tip Alignment" on page 4.
	Foreign matter on contact surfaces.	Remove foreign matter.
	Contact tips worn beyond recommended limits.	Inspect for contact wear according to "Contact Tip Inspection" on page 6.
	Contact surfaces severely scored or burned.	Inspect contact surfaces and file as required.
	Arc chute not properly installed.	Visually verify that arc chute is pivoted to the fully down position.
	Inoperative opening spring.	Replace the spring.
Operating coil overhauls.	*Normal load currents below 5% of rated contact current.	Use a smaller size contactor.
	Improper or inoperative coil.	Visually verify coil part number. Measure resistance to determine if coil is inoperative.
	*High voltage condition on coil.	Measure control circuit voltage. It must not exceed 110% of rated coil voltage.
	Loose connection at coil terminals.	Check connection and tighten if loose.

*See danger statement above.

**ORDERING
INSTRUCTIONS**

When ordering parts, specify quantity, part number and description of part, giving complete nameplate data of the device. To identify parts, see Figure 7 on page 12.

Table 6 Parts List

Item	Description	Part Number	Quantity
1	Arc chute.....	C51019 - 217 - 50	1
2	Blowout coil assembly	C51019 - 157 - 50	1
3	Blowout coil guard	C51019 - 237 - 01	1
4	1/4" - 20 x 1/2" pan head screw with captive lock washer	■	5
5	1/4" - 20 x 7/8" slotted hex head cap screw	■	2
6	1/4" lock washer.....	■	2
7	5/16" - 18 x 1" slotted hex head cap screw.....	■	2
8	5/16" lock washer.....	■	10
9	1/4" - 20 x 3/8" flat head brass screw	21203 - 20120	1
†10	Contact tip kit (copper) consisting of 2 sets of tips and hardware	Class 9998 Type MG1 or	
	Contact tip kit (silver) consisting of 2 sets of tips and hardware.....	Class 9998 Type MG2	1
11	3/8" - 16 x 7/8" silicon bronze hex head cap screw	21407 - 24280	2
12	3/8" silicon bronze lock washer.....	23711 - 22400	2
13	Auxiliary arm	B51019 - 255 - 50	1
14	Auxiliary arm spring	B50502 - 602 - 44	1
15	Auxiliary arm spring retainer.....	B51019 - 239 - 01	1
16	5/16" - 18 x 2" hex head cap screw	■	1
17	5/16" - 18 hex head nut	■	2
18	3/8" - 16 x 2" headless slotted half dog point set screw.....	21802 - 24640	1
19	3/8" plain washer	■	2
20	3/8" - 16 hex head nut.....	■	2
21	Shunt	B51019 - 204 - 51	1
22	Contact arm	B51019 - 214 - 50	1
23	Contact arm support	C51019 - 230 - 01	1
24	Contact arm pin	A51019 - 251 - 06	1
25	Bearing	29005 - 32220	2
26	3/8" - 16 x 1" headless slotted half dog point set screw.....	21802 - 24320	1
27	Auxiliary arm pin	A51019 - 251 - 05	1
28	Bearing	29005 - 24161	2
29	Opening Spring.....	B50502 - 602 - 13	1
30	Armature plate	A51019 - 234 - 01	1
31	5/16" - 18 x 5/8" hex head cap screw	■	2
32	5/16" plain washer	■	2
33	Nameplate (copper tips)	B51139 - 242 - 41 or	
	Nameplate (silver tips).....	B51139 - 242 - 42	1
34	6" - 32 x 1/4" pan head screw	■	2
35	5/16" - 18 x 3/4" silicon bronze hex head cap screw	■	1
36	5/16" silicon bronze lock washer.....	■	1
37	Core cap spacer (phosphor bronze).....	B50502 - 006 - 11	1
38	Core cap (steel)	B50502 - 006 - 10	1
†39	Operating coil 230/240 V	D51019 - 243 - 53 or	
	Operating coil 115/120 V	D51019 - 243 - 56	1
40	Spring washer.....	A51019 - 041 - 01	1
41	Magnet frame.....	B51019 - 223 - 50	1
42	Contact base	E51019 - 238 - 50	1
43	5/16" - 18 x 1/2" slotted hex head cap screw.....	■	2
44	Stop bracket.....	B51019 - 256 - 50	1
45	5/16" - 18 x 2-1/2" hex head cap screw	■	1
46	5/16" - 18 x 3/4" slotted hex head cap screw.....	■	2
47	3/8" - 16 x 7/8" hex head cap screw	21401 - 24280	1
48	3/8" lock washer.....	23701 - 00240	3
†49	Electrical interlock kit	Class 9999 Type MX11 or	
	Bulk package of replacement electrical interlock includes:.....	C51075 - 038 - 54	1
	10 - movable contact tip (item 52)	■	
	10 - bottom stationary contact tip (item 56)	■	
	10 - top stationary contact tip (item 57)	■	
	4 - spring retainer (item 53)	■	
	2 - spring (item 54).....	■	
50	#10 - 24 x 1" pan head screw	■	2
51	#10 lock washer	■	2
52	Movable contact tip.....	■	2
53	Spring retainer	■	2
54	Spring	21802 - 24640	1
55	#10 - 24 x 1/2" pan head screw with captive lock washer	■	1
56	Bottom stationary contact tip	■	2
57	Top stationary contact tip.....	■	2
58	#10 - 24 x 1/2" captive screw assembly with long shank and captive lock washer.....	■	1
59	#10 plain washer.....	■	3

■ Obtain standard hardware, listed without Square D part number, from a local hardware supplier.

† Parts recommended for general maintenance.

● The following user modification kits are also available for this contactor:

Class 9999 Type MM3 mechanical interlock kit for 2 SPNO or 2 DPNO contactors

Class 9999 Type MT3 tie bar kit for 2 SPNO contactors

Class 9999 Type MK2 pneumatic timer kit

Class 9999 Type ML4 power lug kit consisting of 4 dam shell lugs

**EXPLODED
ASSEMBLY DRAWING**

Figure 7 identifies items in the parts list and in the maintenance and adjustment procedures.

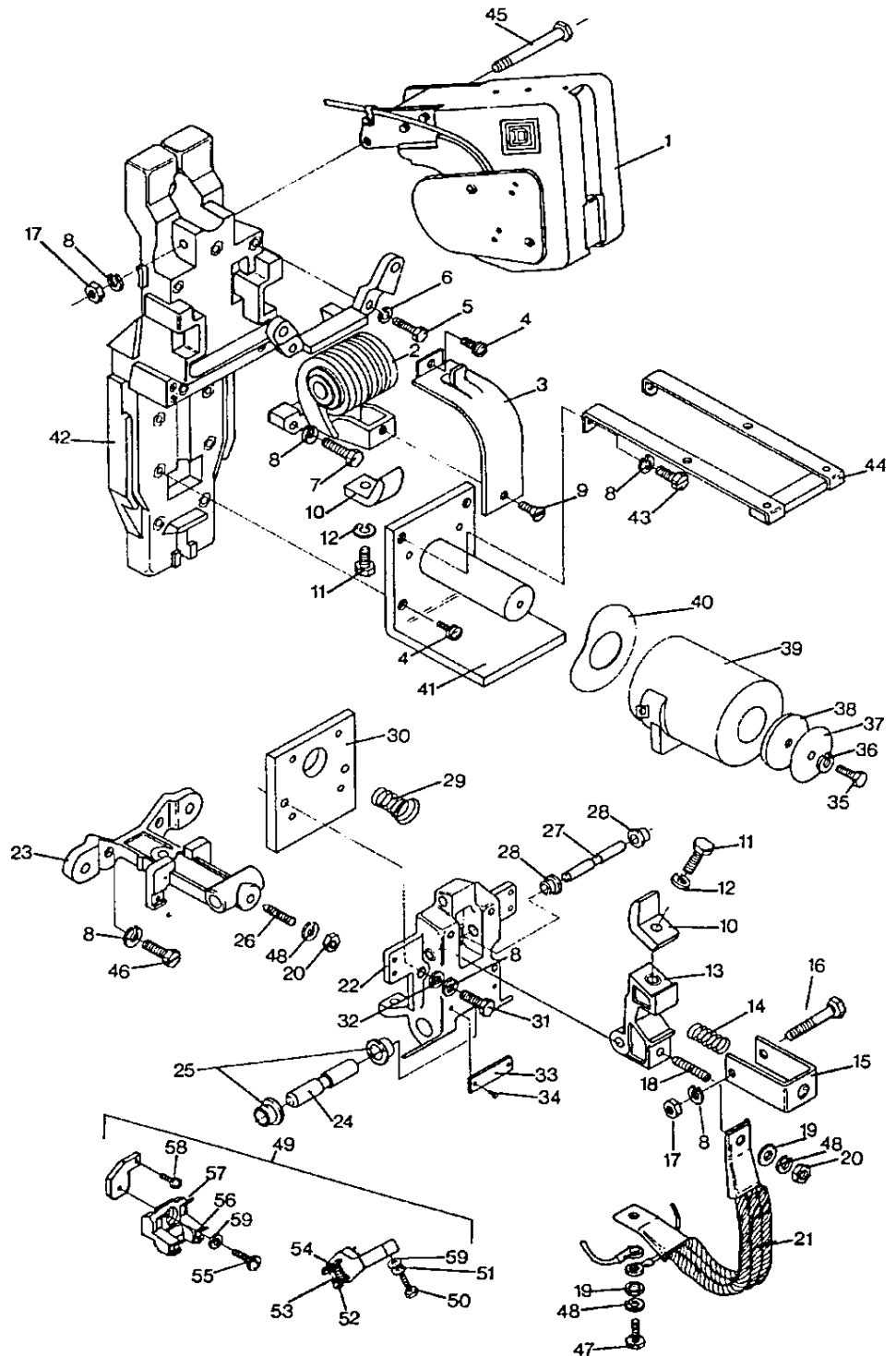


Figure 7 Contactor Assembly Drawing

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.