



TYPE KP PLUGGING RELAYS

DESCRIPTION

Plugging relays are used on almost all dc reversing-plugging controllers. Type KP relays are rectifier type plugging relays with a rectifier diode assembly and an operating coil. These relays have a single contact block with one normally closed (1 NC) circuit.

INSTALLATION AND ADJUSTMENT

Mount the relay vertically on a rigid support. Allowances for arcing clearance are not required.

With the relay power off, operate the relay by hand. It should operate freely. If it does not, check for binding in the armature knife edge and where the spring rod passes through the magnet frame. Check that all electrical connections are tight. Adjustments are not required since all relays are factory set.

Relays used for single step plugging or second step in a two point plugging system are set to drop out when the motor approaches standstill. A relay used as the first step for a two point plugging system is set to drop out at approximately motor full load speed.

If the factory setting of a relay needs to be altered, the operating characteristic can be varied by changing the spring tension with the adjustment knob (13) on top of the relay. Increasing the spring tension (turn knob clockwise) will cause the relay to pick up and drop out at a higher voltage or current level. Decreasing the spring tension (turn adjustment knob counterclockwise) will cause the relay to pick up and drop out at a lower voltage level. After making any adjustment, tighten lock nut (12) against adjustment knob (13).

The armature stop is factory set with adjusting knob (18).

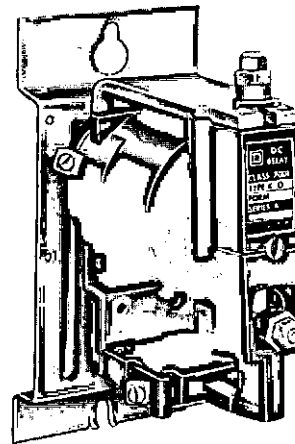
TROUBLESHOOTING

PROBLEM: Relay picks up immediately when the motor is energized.

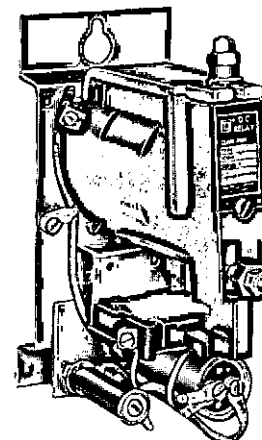
SOLUTION: Probable cause is polarity reversal at the plugging relay. Check power wiring to controller with controller wiring diagram. Incoming power to controller must have the polarity as shown on wiring diagram. Connections to plugging relay must be of the proper polarity. If the polarity is reversed at either point, the relay will not function properly. If necessary, change wiring to agree with that shown on controller wiring diagram.

PROBLEM: Relay does not pick up when plugging.

SOLUTION: Check the voltage at the operating coil terminals during plugging. An absence of voltage indicates a fault elsewhere in the circuitry. If the coil voltage is normal (voltage varies from zero at standstill to nearly double line voltage at the instant of plugging), disconnect the coil and external diode assembly leads and perform the following check on the coil: With an ohmmeter check the resistance of the coil.



Type KPO-2



Type KPO-5

The resistance of the coil should be as shown on coil data table (page 3). A defective coil would be indicated by an open circuit. If the coil is defective it must be replaced.

The diode assembly can be tested by using an ohmmeter. In the forward direction the ohmmeter should indicate the forward diode resistance. In the reverse direction the ohmmeter should indicate an open circuit. A defective diode assembly would be indicated by an open circuit in both directions. If the diode is shorted, an ohmmeter would indicate a short circuit in both directions. In either case a defective diode assembly must be replaced.

REPAIR AND MAINTENANCE

CONTACT REPLACEMENT

The relay contacts consist of a copper body with a silver facing. Contacts must be replaced when the silver has worn off. Note: Do not clean the silver facing as the oxides of silver are conductive and discoloration is normal.

To replace contacts, proceed as follows using a screwdriver:

1. Loosen the two mounting bracket screws and remove the assembled mounting bracket (20).
2. Turn bracket over and remove two screws (21).
3. Remove contact block and replace with a new block.
4. Mount new contact block on mounting bracket (20). Orient the open side of the contact so it faces down.
5. Replace assembled mounting bracket on relay base. Fasten with the two captive screws.

CAUTION: CONTACT BLOCK SHOULD FACE OPEN SIDE DOWN.

REPAIR AND MAINTENANCE (cont'd.)

COIL REPLACEMENT

To replace the operating coil, proceed as follows:

1. Remove the coil leads. Grasp the operating arm (16) and also the adjustment knob (13) on top of the relay.
2. Pull down on the operator arm and lift the adjustment knob. Pull the entire assembly forward and it will snap free from the main part of the relay.
3. Remove screw (10) holding the core cap (8) and core cap spacer (9). Observe the number and order of core caps and core cap spacers.
4. Remove the core cap and core cap spacer. Note: Some relays use only a single core cap (8A) and no core cap spacer.

5. Remove the operating coil (7) and replace it with a new coil.
6. Replace the core cap (8) and core cap spacer (9). Fasten with screw (10). Connect coil leads.
7. To reassemble relay, grasp operating arm and lift the adjustment knob. Replace assembly on relay.
8. No adjustments are necessary since the adjustments were not disturbed during the coil change.

CAUTION: THE TWO PROJECTING POINTS ON THE BOTTOM OF THE ADJUSTING KNOB (13) MUST BE PROPERLY SEATED IN THE TWO SLOTS ON TOP OF MAGNET FRAME (4).

LUBRICATION

The Type KP relays require no lubrication.

PARTS LIST FOR TYPE KP PLUGGING RELAYS

Item No.	Part No.	Description	Types KPO-1,2,3,4,	Type KPO-5
1	A51152-024-50	Assembled Base	1	1
2		3/16" - 18 x 3/8" Steel Hex Cap Screw	1	1
3		3/16" Plain Lock Washer	1	1
4	A51152-007-01	Magnet Frame	1	1
5	A51152-025-50	Assembled Coil Core (Long)	1	—
	A51152-075-50	Assembled Coil Core (Short)	—	1
6	A51017-041-01	Spring Washer	1	1
7	▲	Assembled Operating Coil	1	1
8	A51152-023-01	Core Cap (Steel)	1	—
8A	A51152-038-01	Core Cap (Aluminum)	—	1
9	A51152-022-01	Core Cap Spacer (Stainless Steel)	1	—
10	21714-20240	1/4" - 20 x 3/4" Flat Hd. Brass Nylock Screw	1	1
11	A51152-008-01	Armature	1	1
12		3/4" - 28 Jam Nut	2	2
13	A51152-030-50	Assembled Adjusting Knob	1	1
14	B50502-601-42	Operating Spring (Blue)	1	1
15	A51152-013-50	Assembled Spring Adjustment Rod	1	1
16	C51152-009-01	Operator Arm	1	1
17		#10-24 x 1 1/4" Oval Head Screw	1	1
18	A51152-029-01	Adjusting knob.	1	1
19	A51139-108-01	Nameplate	1	1
20	A51152-014-50	Assem. Mtg. Bracket	1	1

Item No.	Part No.	Description	Types KPO-1,2,3,4,	Type KPO-5
*21		#10-24 x 3/8" Pan Head Screw Assem. (2 Req'd.)		
*22	Class 9999 Type KX-2 Kit	#10-24 Hex Nut (2 Req'd.)		1 or 1
*23		Assem. Contact Block, 1 N.C. Contact		
†24	A51152-080-01	Accessory Mtg. Plate	—	1
25		#8 Plain Lock Washer	—	2
26	B50512-001-19	Insulator	—	1
27		#8 - 32 x 1/4" Pan Head Screw	—	2
28	A52904-006-50	100 MFD, 450 V Capacitor	—	1
29	25052-03400	Lug	—	1
30	29903-08170	Resistor Mtg. Hardware	—	1
31	B50512-001-07	Insulator	—	2
32	A52906-011-66	Resistor 800 ohm, 25 watt	—	1
33		#10-32 Hex Nut	—	1
34		#10 Plain Lock Washer	—	2
35		#10-24 x 1/2" Pan Head Screw	—	1
36		#10-24 Hex Nut	—	1
37		#10-24 x 1/4" Pan Head Screw Assembly	—	2
*38	C51229-029-50	Diode Assembly		
39		#6-32 x 3/8" Pan Hd. Screw		
40		#6 Plain Washer		
41		#6 Lock Washer		
42		#6-32 Hex Nut		

* Essential Parts for General Maintenance

▲ See Coil Data for Selection

• Short Coil Core Used Only with Core Cap 8A.

† For KPO-5 and KPO-8, Add #8-32 hole up 1.0 and left 1.5 from corner #8-32 hole.

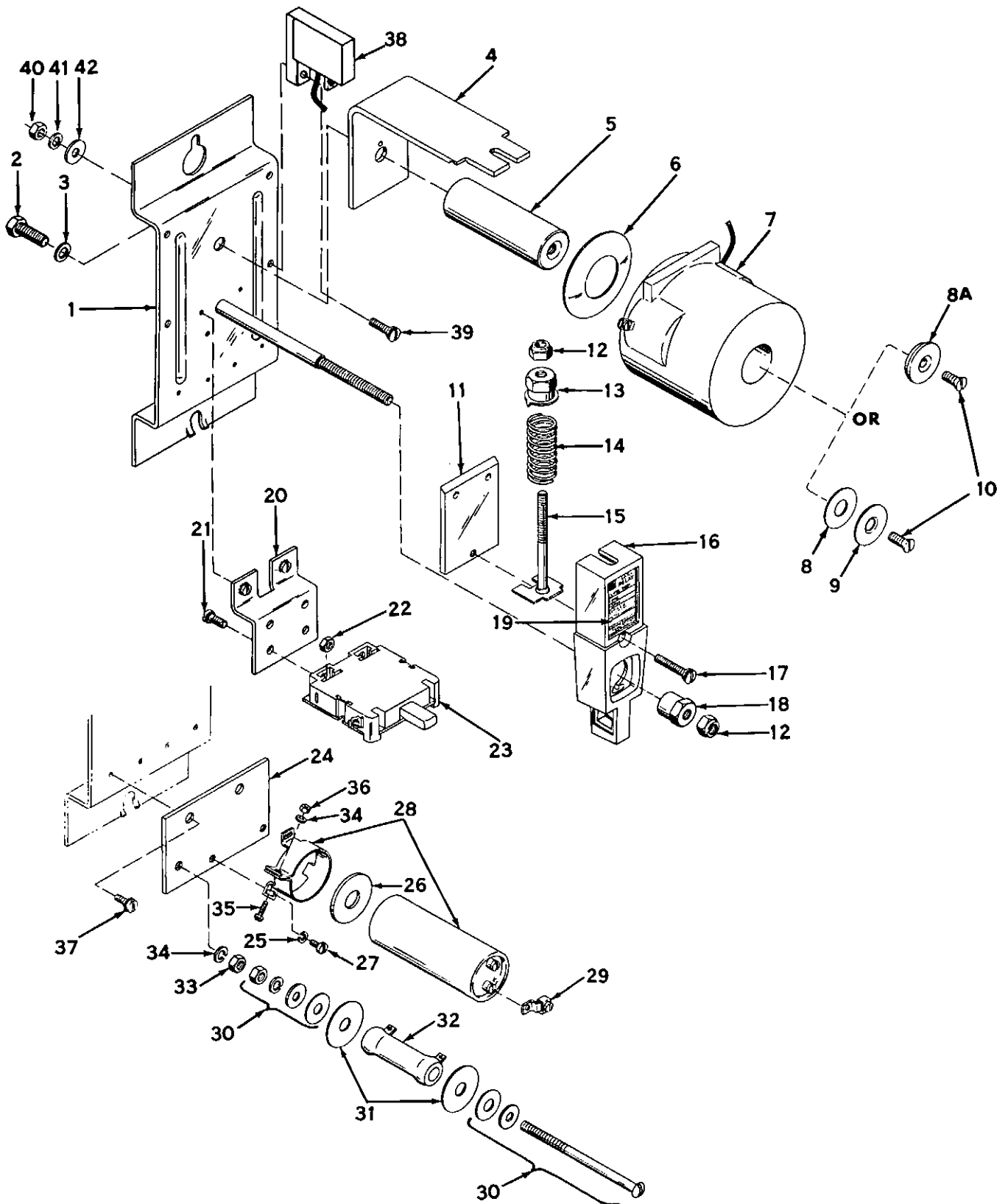
■ Standard hardware, listed without a Square D part number, should be obtained from a local hardware supplier.

COIL DATA

DEVICE USING COIL TYPE	COIL NUMBER	SYSTEM VOLTS	COIL VOLTS	COIL AMPERES @ 20°C +	COIL OHMS @ 20°C +	REVERSE* OHMS @ 20°C +
KP	D5-1017-056-51	240	120	.294	407	1 MEG
	D5-1017-056-59	120	60	.561	107	1 MEG

* Does not include external diode.

* Reverse ohms can only be measured when externally mounted diode is in series with coil.



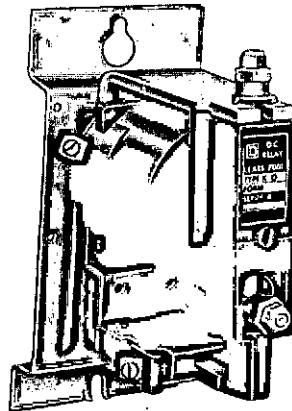


Type KP Plugging Relay

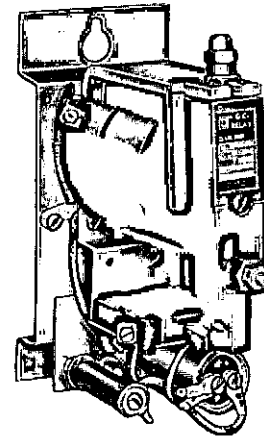
Class 7001

Introduction

This instruction bulletin illustrates and describes Type KP plugging relays, shown in Figure 1. Plugging relays are used on most DC reversing plugging controllers. Type KP relays are rectifier type plugging relays with a rectifier diode assembly and an operating coil. These relays have a single contact block with one normally-closed circuit.



Type KPO2



Type KPO5

Figure 1 Type KP Plugging Relays

Installation and Adjustment



HAZARD OF ELECTRICAL SHOCK OR BURN

To prevent electric shock, disconnect power to relay before installation, adjustment, maintenance or parts replacement. Failure to observe this precaution will result in severe personal injury or death!

Mount the relay vertically on a rigid support. Allowances for arcing clearance are not required. With the relay power off, operate the relay by hand. It should operate freely. If it does not, check for binding in armature knife edge and where spring rod (item 15) passes through magnet frame (item 4). All electrical connections must be tight. Adjustments are not required since all relays are factory set.

Relays used for single step plugging or second step in a two point plugging system are set to drop out when the motor approaches standstill. A relay used as the first step for a two-point plugging system is set to drop out at approximately motor full load speed.

If the relay factory setting needs to be altered, the operating characteristic can be varied by changing the spring tension with the adjustment knob (item 13) on top of the relay. Increasing the spring tension (turning knob clockwise) causes the relay to pick up and drop out at a higher voltage level. Decreasing the spring tension (turning adjustment knob counter-clockwise) causes the relay to pick up and drop out at a lower voltage level. After making any adjustment, tighten lock nut (item 12) against adjustment knob (item 13).

The armature stop is factory set with the armature adjustment knob (item 18).

Repair and Maintenance

This section describes how to replace and maintain the relay contacts and coils. Type KP relays do not require lubrication.



Contact Replacement

The relay contacts consist of a copper body with a silver facing. Contacts must be replaced when the silver has worn off.

NOTE

Do not clean the silver facing as the oxides of silver are conductive and discoloration is normal.

To replace contacts, proceed as follows:

1. **Disconnect power to relay.** Loosen the two mounting bracket screws and remove the assembled mounting bracket (item 20).
2. Turn bracket over and remove two screws (item 21).
3. Remove contact block and replace with a new block.
4. Mount new contact block on mounting bracket (item 20). Orient the open side of contact so it faces down.

CAUTION**Equipment Damage Hazard**

Contact block must face open side down. Failure to observe this precaution could result in personal injury or product damage.

5. Replace assembled mounting bracket on relay base. Fasten with the two captive screws.

Coil Replacement

To replace the operating coil, proceed as follows:

1. **Disconnect power to relay.** Remove coil leads. Grasp operating arm (item 16) and adjustment knob (item 13) on top of relay.
2. Pull down on operator arm and lift adjustment knob. Pull entire assembly forward and it will snap free from part of relay.
3. Remove screw (item 10) holding the core cap (item 8) and core cap spacer (item 9). Observe the number and order of core cap spacers.
4. Remove core cap and core cap spacer.

NOTE

Some relays use only a single core cap (8A) and no core cap spacer.

5. Remove operating coil (item 7) and replace it with new coil.
6. Replace core cap (item 8) and core cap spacer (item 9). Fasten with screw (item 10). Connect coil leads.
7. To reassemble relay, grasp operating arm and lift adjustment knob. Replace assembly on relay.
8. No adjustments are necessary as long as no adjustments are made during coil change.

CAUTION**Equipment Damage Hazard**

The two projecting points on bottom of adjusting knob (item 13) must be properly seated in the two slots on top of magnet frame (item 4). Failure to observe this precaution could result in personal injury or product damage.



Troubleshooting

! DANGER

HAZARD OF ELECTRICAL SHOCK OR BURN

Troubleshooting procedures require application of power. Do not touch relay or wiring with power applied. Failure to observe this precaution will result in severe personal injury or death!

Table 1 Troubleshooting Procedure

Problem	Possible Causes	Corrective Action
Relay picks up immediately when motor is energized.	Polarity reversal at plugging relay.	Using controller diagram, check power wiring to controller. Incoming power to controller and connections to plugging relay must have polarity shown on diagram or relay will not function properly.
Relay does not pick up when plugging.	Inoperative coil or diode assembly.	Check voltage at operating coil terminals during plugging. An absence of voltage indicates a fault elsewhere in the circuitry. If coil voltage is normal (varies from zero at standstill to nearly double line voltage at instant of plugging), remove power, disconnect coil and external diode assembly leads and perform following coil check: 1. With ohmmeter, measure coil resistance. Coil resistance must be as shown in Table 3. Inoperative coil is indicated by an open circuit. Replace coil if inoperative. 2. With ohmmeter, test diode assembly. In forward direction, ohmmeter should indicate forward diode resistance. In reverse direction, ohmmeter should indicate an open circuit. Inoperative diode assembly is indicated by an open circuit in both directions. If diode is shorted, ohmmeter indicates short circuit in both directions. In either case, replace inoperative diode assembly.

Exploded Assembly Drawing

Figure 2 identifies items in the parts list and in the maintenance and adjustment procedures.

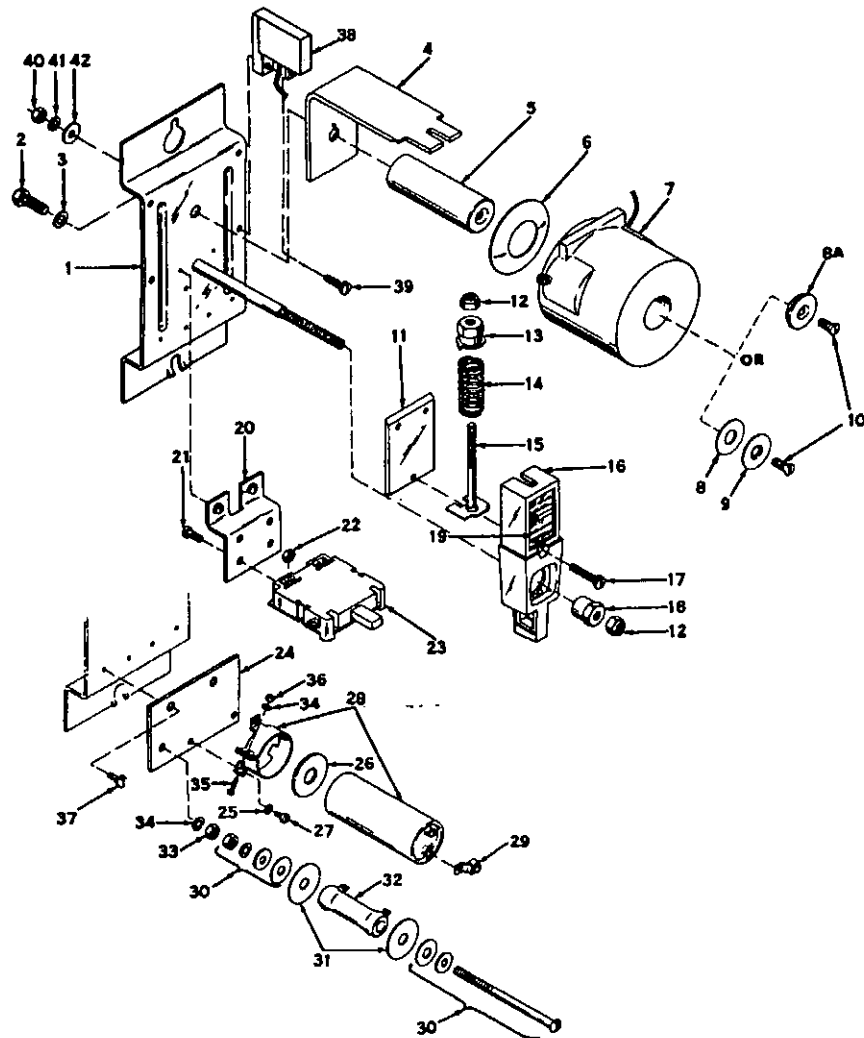


Figure 2 Exploded Assembly Drawing

Ordering Instructions

When ordering parts, specify quantity, part number and description of part, giving complete nameplate data of the device. For example: one magnet frame A51152-007-01 for a Class 7001 Type KPO5 plugging relay. To identify parts, refer to Figure 2 on page 3.

Table 2 Parts List

Item	Description	Part Number	Quantity	
			KPO1,2,3,4	KPO5
1	Assembled base	A51152 - 024 - 50	1	1
2	5/16" - 18 x 7/8" steel hex cap screw	■	1	1
3	5/16" plain lock washer	■	1	1
4	Magnet frame	A51152 - 007 - 01	1	1
5	Assembled coil core (long)	A51152 - 025 - 50	1	N/A
●	Assembled coil core (short)	A51152 - 075 - 50	N/A	1
6	Spring washer	A51017 - 041 - 01	1	1
* 7	Assembled operating coil	▼	1	1
8	Core cap (steel)	A51152 - 023 - 01	1	N/A
8A	Core cap (aluminum)	A51152 - 038 - 01	N/A	1
9	Core cap spacer (stainless steel)	A51152 - 022 - 01	1	N/A
10	1/4" - 20 x 3/4" flat head brass nylock screw	21714 - 20240	1	1
11	Armature	A51152 - 008 - 01	1	1
12	1/4" - 28 jam nut	■	2	2
13	Assembled adjusting knob	A51152 - 030 - 50	1	1
14	Operating spring (blue)	B50502 - 601 - 42	1	1
15	Assembled spring adjustment rod	A51152 - 013 - 50	1	1
16	Operator arm	C51152 - 009 - 01	1	1
17	#10 - 24 x 1-1/4" oval head screw	■	1	1
18	Adjusting knob	A51152 - 029 - 01	1	1
19	Nameplate	A51139 - 108 - 01	1	1
20	Mounting bracket assembly	A51152 - 014 - 50	1	1
*21	#10 - 24 x 5/8" pan head screw assembly (2 req'd)	} Class 9999 Type KX2 kit		1
*22	#10 - 24 hex nut (2 req'd)			
*23	Assembly contact block, 1 normally-closed contact			
†24	Accessory mounting plate	A51152 - 080 - 01	N/A	1
25	#8 plain lock washer	■	N/A	2
26	Insulator	B50512 - 001 - 19	N/A	1
27	#8 - 32 x 1/4" pan head screw	■	N/A	2
28	100 µf, 450 V capacitor	A52904 - 006 - 50	N/A	1
29	Lug	25052 - 03400	N/A	1
30	Resistor mounting hardware	29903 - 08170	N/A	1
31	Insulator	B50512 - 001 - 07	N/A	2
32	Resistor, 500 ohm, 25 watt	26160 - 26520	N/A	1
33	#10 - 32" hex nut	■	N/A	1
34	#10 plain lock washer	■	N/A	2
35	#10 - 24 x 1/2" pan head screw	■	N/A	1
36	#10 - 24 hex nut	■	N/A	1
37	#10 - 24 x 1/4" pan head screw assembly	■	N/A	2
*38	Diode assembly	C51229 - 029 - 50		
39	#6 - 32 x 7/8" pan head screw	■		
40	#6 plain washer	■		
41	#6 lock washer	■		
42	#6 - 32 hex nut	■		

- * Essential parts for general maintenance.
- ▼ See coil data in Table 3 for selection.
- Short coil core used only with core cap 8A.
- † For KPO5 and KPO8, add #8 - 32 hole up 1.0" and left 1.5" from corner #8 - 32 hole.
- Obtain standard hardware, listed without a Square D part number, from a local hardware supplier.

Table 3 Coil Data

Coil Part No. ▲	System Voltage (V)	Coil Ratings @ +20° C			
		Voltage (V)	Current (A)	Resistance (Ω)	Reverse Resistance (Ω)*
D5 - 1017 - 056 - 51	240	120	.294	407	1 Meg
D5 - 1017 - 056 - 59	120	60	.561	107	1 Meg

- ▲ Does not include external diode.
- * Reverse ohms can only be measured when externally mounted diode is in series with coil.

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.