

RELAYS AND CONTACTORS

MAGNETIC TYPE

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1. GENERAL

1.1 Scope

1.11 This section covers requirements and methods for installing magnetically operated relays, contactors, transfer switches, certain emergency cell switches, and some motor starters all of which are used in power circuits. As differences in this apparatus cannot be clearly defined, all will be referred to as relays in this section.

1.12 The following relays are included in this section. Corresponding BSP numbers are also listed.

KS Number	BSP Number	KS Number	BSP Number
3067	A462.006	6724	A462.006
5013	A462.006	8854	A462.006
5264	A401.521	15072	A401.508
5350	A401.521	15503	A401.521
5381	A462.006	15516	A401.566
5422	A401.507	15517	A462.024
5451	A401.521	15528	A401.569
5483	A462.006	15598	A401.521
5635	A462.006	15601	A462.006
5639	A401.568	15602	A401.508
5694	A401.519 (Note)	15726	A462.024
5721	A462.018	15756	A401.569
5722	A401.574	15806	A401.521
5728	A401.521	15863	A401.584
6319	A462.006		

NOTE: KS-5694 Contactors, associated with KS-5323-01 and KS-15572 Reverse Current Switches are covered in Section 112.

1.2 Associated Information

1.21 For requirements refer to Circuit Requirement Tables on job drawings. If job drawings do not list requirements

relays should be tested and adjusted in accordance with this section. However, requirements on job drawings supersede those in this section.

1.3 Precautions

1.31 Before starting to test or adjust a relay which is in service, refer to the section in Handbook 0 covering: cooperation with the customer, prevention of service interruptions, and protection of personnel and equipment.

1.32 Use care when working in close quarters with live parts. Some relays will have in excess of 150 volts on their terminals. Do not touch at the same time, or short-circuit, live terminals or parts which may be at different potentials.

1.33 Handle relays carefully. In particular, do not pick up relays by the contact springs.

1.4 DS Inspection

1.41 Inspect each relay for damaged or missing parts, defects of finish, and freedom of movement. If replacements or corrections are required originate a J.I.M. in accordance with the Job Clerical Handbook.

1.5 Description

1.51 Figures 1 through 7 illustrate some typical magnetically operated relays and indicate various parts.

1.52 Some relays, such as KS-15726, have a capacitor and resistor in series with the coil. This is to make the relay sensitive to voltage and to cause it to pick up and drop out over a narrow voltage range.

This section includes material from BSP's A401.507, A401.508, A401.519, A401.521, A401.566, A401.568, A401.569, A401.574, A401.575, A401.584, A401.590, A401.591, A462.006, A462.017, A462.018, A462.024
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1.53 Some dc contactors may have arc chutes and blow-out coils to disperse arcs caused when a circuit carrying high current is opened.

1.54 Sometimes two relays, such as KS-5350, are mounted on a common base and the mechanism interlocked so that only one relay may be operated at a time.

1.55 Some relays have two coils which may be connected either in series or parallel. Relay armatures are mechanically joined in this case. Other relays, such as KS-15503, have one coil operating the armature which locks until the operation of the second coil releases the latching mechanism.

1.6 Definitions

1.61 Contacts: Whether contacts are normally open (NO) or normally closed (NC) depends on the position of these contacts when the relay coil is not energized and not on the position the contact may assume for a particular application. NO contacts are sometimes referred to as "front contacts" and NC contacts as "back contacts".

1.62 Operate: A relay is said to operate when the armature has moved sufficiently for NC contacts to open and NO contacts to close with reliable contact.

1.63 Release: A relay is said to release when the armature has moved sufficiently for NO contacts to open and NC contacts to close with reliable contact.

1.64 Nonoperate: A relay is said to be nonoperated when at the specified value of current through the coil or voltage across the coil the armature has not moved sufficiently for NO contacts to close or for NC contacts to break.

1.65 Main Contact: This term is usually applied to contacts that break a power circuit. These contacts are often specially designed to break high currents by being provided with arc chutes and blow-out coils.

1.66 Auxiliary Contact: These contacts are often smaller than the main current-carrying contacts and will be connected in the control circuit.

1.67 Follow: Movement of a contact spring after the contact on the spring touches the associated stationary contact.

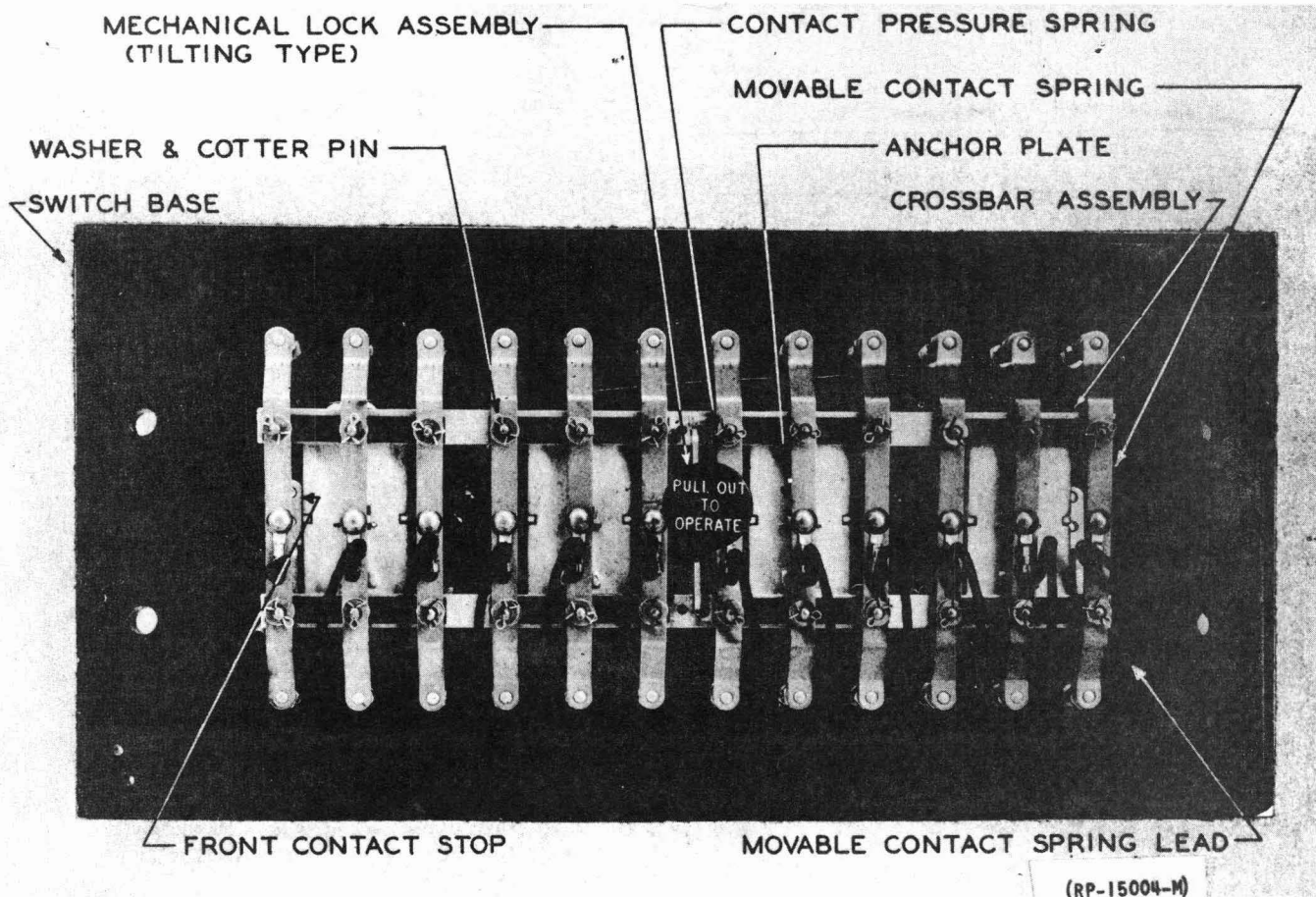


FIG. 1 TRANSFER SWITCH KS-5264
(PARS. 1.5, 10.34)

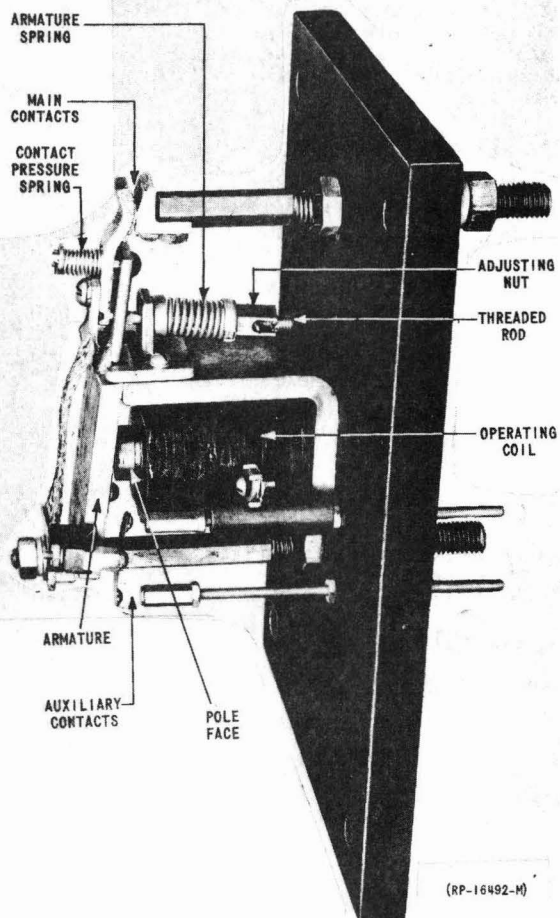


FIG. 2 KS-5422 LIST 07 AND LIST 17 CONTACTOR (150 AMPERES) (PARS.1.5,11.1)

2. INSTALLING EQUIPMENT

2.1 Tools

Code	Description
356	Adjuster
363	"
KS-2663	File
KS-6015	Pliers, Duckbill
R-2120	Pliers, Long Nose
R-2443	Screwdriver, Cabinet, 3"
R-2259	" " " 6"
KS-6854	" " " 3-1/2"
KS-6320	Stick, Orange
R-1542	Wrench, Adjustable, 6" - Open End
R-2512	Wrench, Adjustable, 8" - Open End
R-2478	Wrench, O.E., 7/16" - 9/16"
R-1770	" O.E., 1/2" - 9/16"
R-5850	" O.E., 5/8" - 3/4"
417A	" O.E., 1/4" - 3/8"
418A	" O.E., 7/32" - 5/16"
220	Socket, Hex, 3/16"
R-2185	" " 3/8"
R-2787	" " 5/16"
R-2788	" " 7/16"
R-8550	Scale, 6"

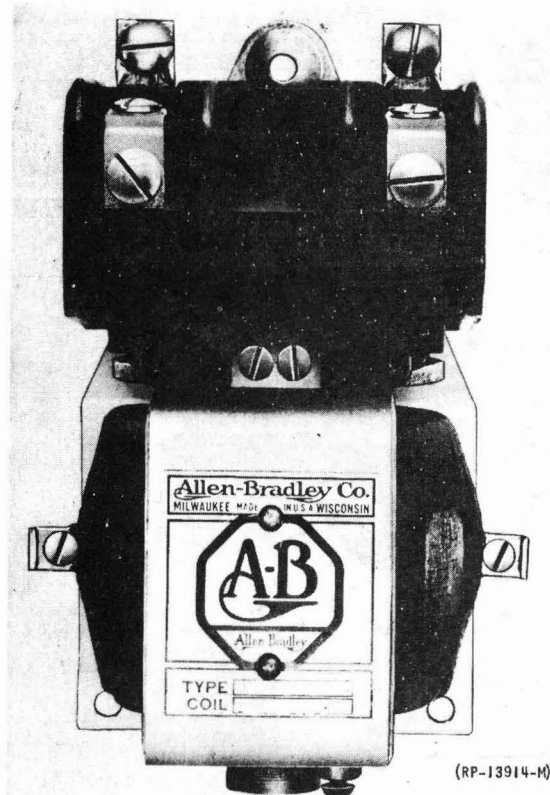


FIG. 3 KS-15072 CONTACTOR, 25 AMPERE SIZE (PARS. 1.5, 10.2)

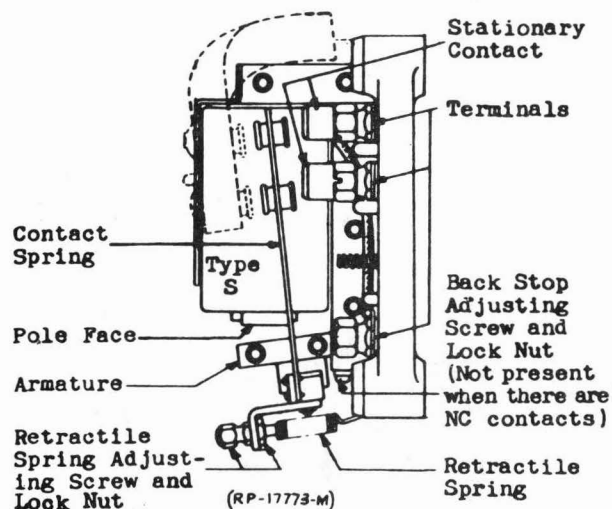


FIG. 4 KS-5483 RELAY (PAR. 1.5)

2.2 Gauges

Code	Description
R-2481	Balance, Spring, 30 Lbs.
70H	Gauge, Gram Ten., Fan Type, 0-30
70J	Gauge, Gram Ten., Fan Type, 0-150
79B	Gauge, Gram Ten., Barrel Type, 0-1000
79C	Gauge, Gram Ten., Barrel Type, 0-200
R-1032	Thermometer, Centigrade

2.3 Test Apparatus

ITE-4040 Adjusting Set, DC
 ITE-4297 Auto Transformer, Continuously Tapped
 ITE-4442 Volt-Ohmmeter

2.4 Supplies

→ KS-14208 Brush, Relay Contact
 KS-14666 Cloth, Cleaning
 KS-2423 Cloth, Twill Jean
 Obtain Pad, Felt
 Locally
 KS-7187 Paper, 1/2" x 1/2"
 → R-3163 Paper, Abrasive, 4/0 open coat
 → R-3250 Trichloroethylene

3. APPLICATION OF REQUIREMENTS

3.1 Mechanical Requirements

3.11 Security of mounting, freedom of operation, and all contact requirements shall be checked for all relays. Other mechanical requirements may be assumed met unless troubles develop during test. In this case, check and readjust, if necessary, any pertinent requirements in this section. All mechanical requirements are listed in Table A. If job drawings do not list any requirements refer to Table A. Non-KS relays are shown in Table B.

3.2 Electrical Requirements

3.21 Electrical requirements listed in Circuit Requirement Tables shall be checked for all relays when measuring equipment is available. If measuring equipment is available but electrical requirements are not listed in Circuit Requirement

Tables, relay operation shall be checked at the minimum voltage or current listed on the relay nameplate. If measuring equipment is not available, the relay shall pick up and hold on normal plant voltage or current.

4. SECURITY OF MOUNTING

4.1 The relay and its component parts shall be securely mounted and fastened together.

Gauge by feel.

4.2 Tighten as necessary.

4.3 If parts on a relay cannot be readily fastened or secured, order a new relay.

5. FREEDOM OF OPERATION

5.1 The relay armature shall operate freely without binding.

Gauge by feel by operating the relay by hand. Disconnect relay from power service for this operation.

5.2 Remove dirt or other obstructions.

6. CONTACT SURFACES

6.1 Contact surfaces shall be free of gummy substances, oil, dirt, and buildups which might interfere with reliable contact. It is not necessary nor desirable to keep contacts polished or shining.

6.11 Clean surfaces with R-3250 Trichloroethylene. Pour about an ounce of liquid into a small container. Do not use dirty or contaminated trichloroethylene and discard it as soon as it appears dirty. Dip hairs of a clean KS-14208 brush full length into the liquid, wipe brush against edge of container, open the contacts and brush both surfaces of the contact pair with the moist brush. After surfaces dry, brush them with a clean dry KS-14208 brush.

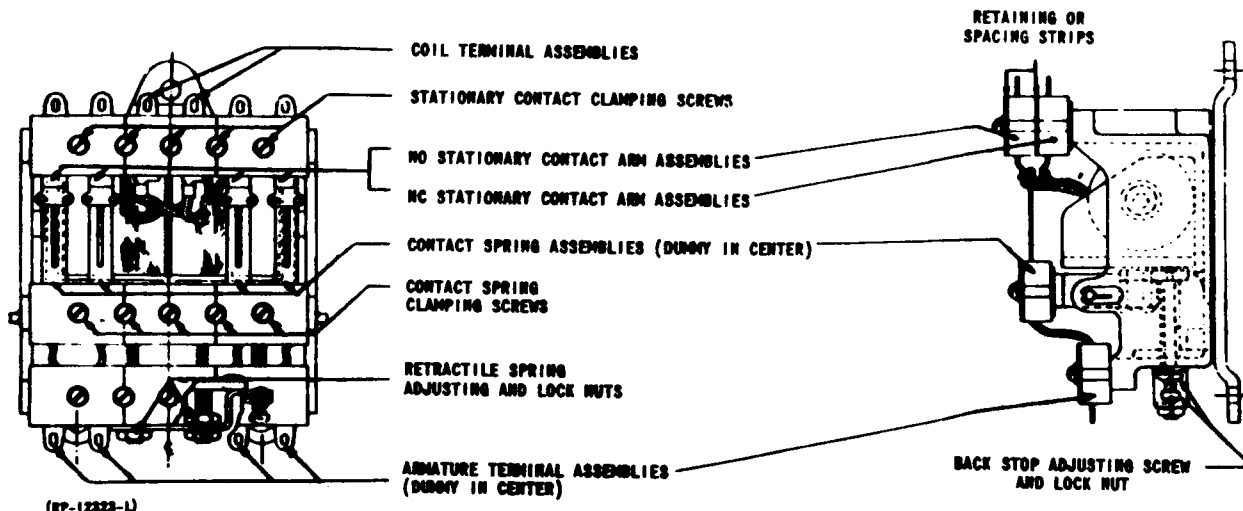


FIG. 5 KS-5635 RELAY (OPERATED) (PAR. 1.5)

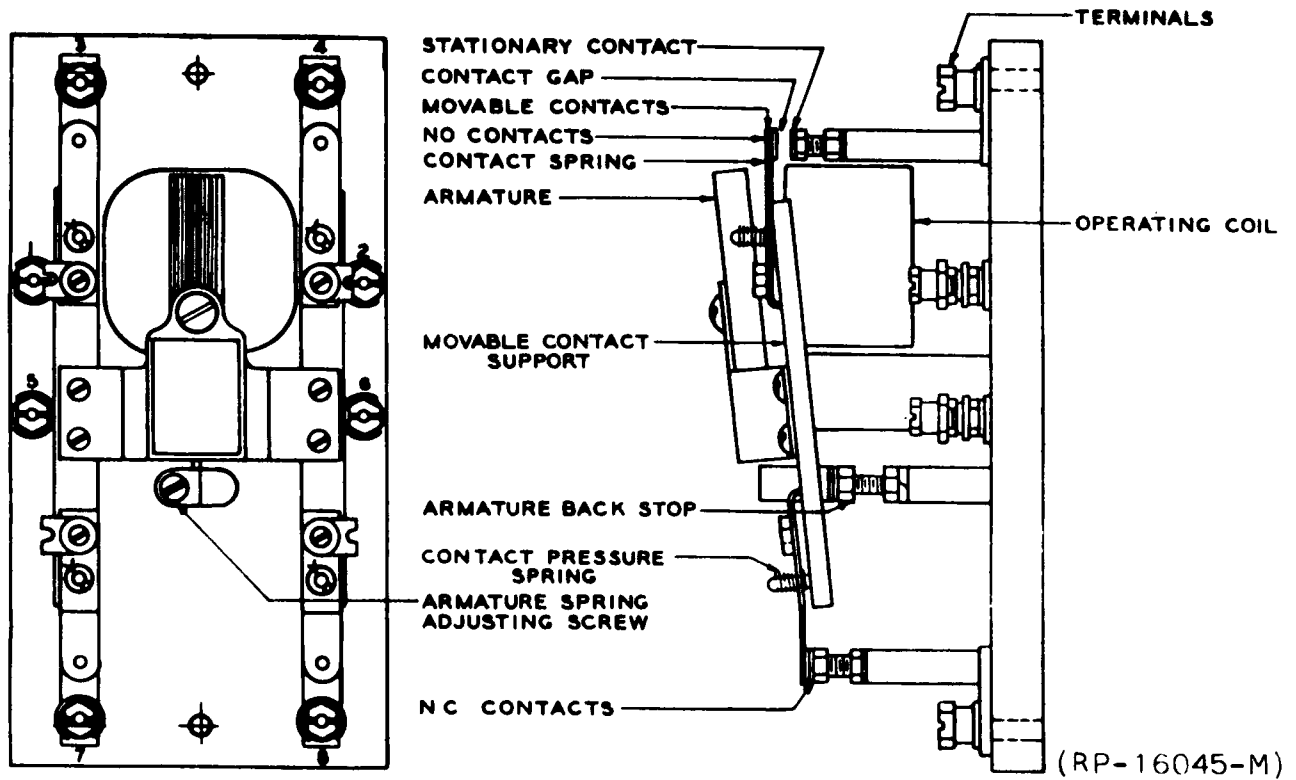


FIG. 6 RELAY, KS-15517, LIST 2 (PARS. 1.5, 10.33)

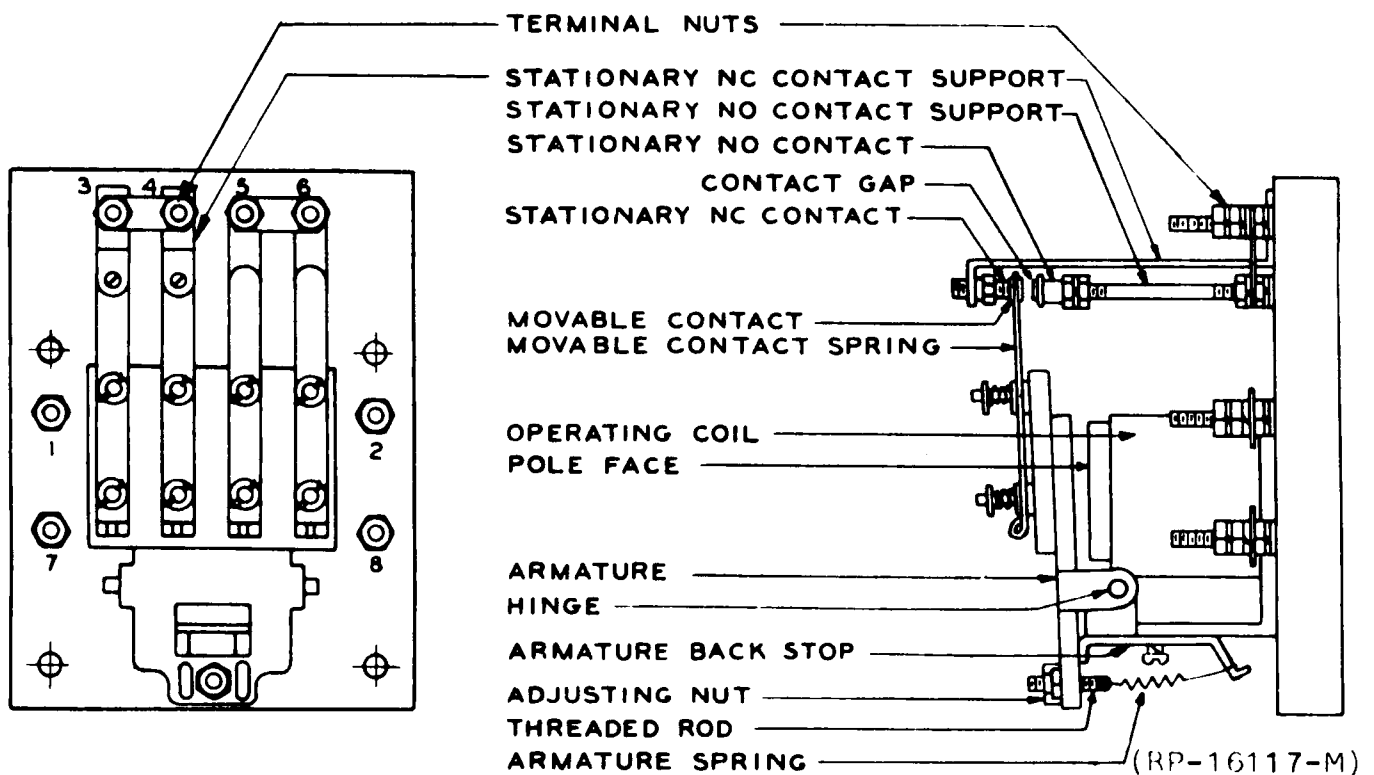


FIG. 7 RELAY KS-15516, LIST 3 (PARS. 1.5, 10.33)

TABLE A

KS NUMBER	LIST NUMBER	CON- TACT	CONTACT REQUIREMENTS				ALIGNMENT TOLERANCE (INCHES)	SEPARATION		SEQUENCE (PARA- GRAPH)	MAX. TEMPERATURE				ELECTRICAL REQUIRE- MENTS							
			PRESSURE (GRAMS)					MINIMUM (INCHES)	NOTE		COIL		CONTACTS									
			MIN.	NORM.	MAX.	NOTE					°C	°F	°C	°F								
3067		MAIN	80				1/16	3/32		9.32					Relays shall meet the requirements specified in the circuit requirements table. Where requirements are not specified on the circuit requirements table, operation of a relay shall be checked at the minimum coil voltage or current listed on the relay nameplate. If measuring equipment is not available the relay shall pick up and hold on normal plant voltage or current.							
		AUX.	50																			
5013		MAIN	80										50	122		55	131					
5264		AUX.	50							9.32												
		ALL	28					1/8	5	NONE	95	203	115	239								
5350	All Except Lists 12 & 20	NO	42				1/32	5/32		NONE	95	203	115	239								
		NC	28										95	203		115	239					
	Lists 12 & 20	NO	42					1/8		NONE												
		NC	28																			
5381	1,2,10(L),14(L)	NO	15	20								NONE	50	122		55	131					
		NC	6	7																		
	3,4,7	NO	60	70																		
		NC	15	20																		
	5,11,13,15	NO	18	35				3/32														
		NC	10	15																		
	6	ALL	10	12																		
	8,12	ALL	10	12			1/16															
	9,10(R),14(R)	NO	25	50			1/16	3/32														
		NC	25	35																		
5422	07,17	MAIN	2-1/4		3-1/4	1	-	-		9.2	105	122	115	239								
	08,18	MAIN	6		10-1/2	1					(Operating (Solid)											
	09,19	MAIN	13-1/2		17	1					70 158											
	All	AUX.	-		-	4					Blowout) (Laminated)											
5451	01-16, 18, 22	NO	20				1/16	1/16		NONE	95	203	115	239								
		NC	15																			
	17	NO	25																			
		NC	20																			
	21, 24	NO	25																			
		NC	25																			
	23	NO	12				1/32	5/64		NONE	65	149	55	131								
		NC	25																			
5483	02	NO	25	50																		
		NC	25	35												5/64						
	01,03,04,07-10, 12,14	NO	25	50												3/32						
		NC	25	35												3/16						
	05	NO	25	50												1/8						
	11	NO	15	20																		
		NC	6	7																		
	21-29,31,32	NO	18	35												3/32						
	34,36,37,40	NC	10	15																		
	41-43,92-95	ALL	10	12																		
	51-59,71-75	ALL	10	12												1/16						
		83,86	ALL	25	-			3/32														
	82,85	ALL	30	-																		
5635	01-03	ALL	60					3/32		NONE			65	149								
	04	NO	60			2		3/16		NONE	95	203	115	239								
5639		NO	50					3/32		NONE												
		NC	45																			
5694	See Section 11.2 of this Handbook																					
5721	Refer to Paragraph 11.2									NONE	105	221										
5722	2,4,5,6,10,11,12,13	NO	350																			
	7,8,9	NO	175							NONE	105	221	105	221								
	1,3	NO	3-1/4			1																

TABLE A (Cont'd)

KS NUMBER	LIST NUMBER	CON- TACT	CONTACT REQUIREMENTS				ALIGNMENT TOLERANCE (INCHES)	SEPARATION		SEQUENCE (PARA- GRAPH)	MAX. TEMPERATURE				ELECTRICAL REQUIRE- MENTS	
			PRESSURE (GRAMS)					MINIMUM	NOTE		COIL		CONTACTS			
			MIN.	NORM.	MAX.	NOTE					°C	°F	°C	°F		
5728		NO	50				1/32	5/32		NONE	95	203	115	239	Relays shall meet the requirements specified in the circuit require- ments table. Where requirements are not specified on the circuit re- quirements table, operation of a relay shall be checked at the minimum voltage or current listed on the relay nameplate. If measuring equip- ment is not available the relay shall pick up and hold on normal plant voltage or current.	
6319		NC	45				1/16	3/32		9.32	107	225				
6724		MAIN	50							NONE						
		AUX.	80													
8854		MAIN	50				1/32			NONE						
15072		AUX.	50							NONE						
15503		NO	50							9.32	100	212	105	221		
15516		Refer to Paragraph 10.2					1/8	5/64			NONE	95	203	115		239
	1,4,5,9,10	NC	20													
		NO	30													
	3,8,13	NC	40				1/32	3/32		NONE	105	221	115	239		
	2,6,12	ALL	40													
		NO	40													
		NC	20													
	7,11	NO	35													
		NC	40													
15517	1,3,6,7	ALL	40				1/8			NONE	105	221	115	239		
	2,4,5	ALL	40				1/16									
15528		ALL	35				1/32			NONE	95	203	115	239		
15598	1,2,3,4	NO	40				5/32-7/32	3.5		NONE	105	221	115	239		
		NC	30													
		NC	30													
15601		NO	30 Each				1/32			NONE	65	149	55	131		
		NC	30 Contact													
15602	1,2,3	Not Adjustable - Refer to Paragraph 11.3						-			NONE	115	239	95		103
														(Frame)		
15726	1,2	NO	40				1/32	1/8			Resistor Temp 140C					
	3	ALL	40					1/16			NONE	105	221	115		239
15756		ALL	35					1/32			NONE	95	203	115		239
15806		ALL	42					5/32-7/32			NONE	95	203	115		239
15848		Refer to Paragraph 10.2					1/8	-			NONE	105	221	115	239	
15863		ALL	35					1/32		NONE	95	203	115	239		
15925		NO	48			3	1/32	5/32-7/32			105	221	115	239		
		NC	28													
15933		NO	48													
		NC	28													
NOTE 1: Pressure in pounds.																
NOTE 2: Contact pressure, values are for both contacts of a split spring. Measure on the split spring just below the two con- tacts.																
NOTE 3: In addition, the height of each stationary contact shall be measured to provide a minimum clearance of 0.020" between the movable contact arm and the crossbar shoulder or molded support member.																
NOTE 4: The interlock (NO) contacts have no specific contact pressure values but there shall be additional movement of the oper- ating mechanism after the contacts touch.																
NOTE 5: Measure separation of contacts with the contact at the other end of the spring just making with its stationary contact with no flexing of the spring.																

TABLE B
(NON KS RELAYS)

MANUFACTURER	CATALOG NO. OR TYPE	CONTACT REQUIREMENTS				MAX. TEMPERATURE				ELECTRICAL REQUIRE- MENTS
		CONTACT	PRESSURE (GRAMS)	ALIGNMENT TOLERANCE (INCHES)	SEPARATION MINIMUM (INCHES)	COIL		CONTACTS		
			MIN.			°C	°F	°C	°F	
STRUTHERS- DUNN, INC. (DUNCO)	2 NXM 102	NO	40	1/32	3/32					Relays shall meet the requirements specified in the circuit requirements table. Where requirements are not specified on the circuit requirements table, operation of a relay shall be checked at the minimum voltage or current listed on the relay nameplate. If measuring equipment is not available the relay shall pick up and hold on normal plant voltage or current.
		NC	30							
	2 NXX 100	ALL	30							
	2 NXX 101	ALL	40							
	2 PXX 101	ALL	40							
	2 XXP 100	ALL	30							
	89 MXM 100	ALL	40							
	89 XXM 100	ALL	40							
	106 CXX 100	ALL	40							
	106 PXM 103	NO	40							
		NC	30							
	106 QXX 100	ALL	40							
219 BBXP 106			NOTE 1	1/16	105	221	115	239		
1054-207-S	ALL	40	NOTE 2	1/8						
101 S 74	ALL	40	1/32							
101 S 75	ALL	60								
101 S 78	ALL	40								
SIGMA INSTRUMENTS, INC.	101 S 94	ALL	40	NOTE 1						
	42 RO 150 S S1L									
NOTE 1: Not adjustable, replace when necessary. NOTE 2: Refer to Section 231 in this handbook for adjusting procedures.										

6.12 If the trichloroethylene does not clean satisfactorily, insert a piece of R-3163 Abrasive Paper between contacts, hold contacts closed and draw the abrasive paper back and forth to remove any foreign material.

6.13 Replace contacts that have pits or buildups preventing reliable contact.

NOTE: Do not dress carbon contacts.

7. CONTACT ALIGNMENT

7.1 Each pair of contacts, if each contact is the same size, shall not overlap more than the alignment tolerance indicated in Table A when the contacts are closed. (See Figure 8). If contacts are of different sizes the smaller contact shall not extend beyond the outer edge of the larger when the contacts are closed.

Gauge by eye.

7.2 If both contact surfaces are flat, they shall rest flat against each other when the contacts are closed.

Gauge by eye.

7.3 Contact alignment may be corrected on some relays by loosening and moving stationary contacts. If this cannot be done bend contact springs with long nose pliers to correct alignment.

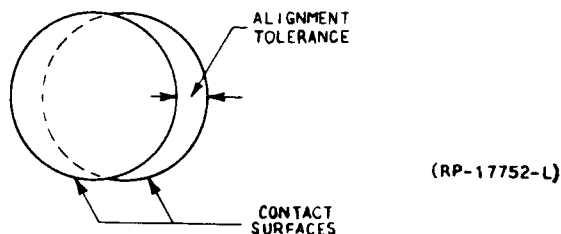


FIG. 8 CONTACT ALIGNMENT (PAR. 7.1)

8. CONTACT SEPARATION

8.1 Each pair of contacts shall have at least the separation indicated in Circuit Requirement Tables or in Table A of this section.

Gauge by eye or with R-8550 scale.

8.2 Measure separation of NO contacts with the relay in the normal or de-energized position. Measure separation of NC contacts after moving relay armature to its operated position either by hand or electrically.

8.3 If there are contacts on both ends of the same spring (double-throw transfer contact) gauge separation of contacts at one end of the spring as the contact on the other end of the spring just makes with its associated fixed contact, without any follow or flexing of the contact spring.

8.4 Readjustment of contact separation may be done as follows:

8.41 Stationary Contact: Adjust the stationary contact to provide more separation wherever possible. This has minimum effect on electrical operation but changes contact pressures and sequence.

8.42 Armature Stop: Adjust the armature stops, if they are provided and are adjustable. Contact pressures and electrical operation will be changed.

8.43 Spring Bending: If adjustments in Paragraphs 8.41 and 8.42 cannot be made, separation may be increased by bending the movable contact spring. This changes contact pressures, sequence, and alignment and electrical operation. Springs may be bent with long nose pliers or a 363 Spring Adjuster.

9. CONTACT SEQUENCE

9.1 Contact sequence shall be in accordance with Circuit Requirement Tables, Table A of this section, or Paragraph 9.3.

Judge contact sequence by eye as the relay is slowly operated by hand.

9.2 For KS-5422, normally open auxiliary, or interlock contacts, shall close immediately after main contacts open.

9.3 If no special contact sequence is indicated in Table A or Circuit Requirement Tables the following general requirements apply:

9.31 All contacts of a similar type on the relay (NO, NC, main or auxiliary) shall make or break simultaneously.

9.32 Auxiliary contacts shall make before main contacts make.

9.4 Readjust contact sequence as follows:

9.41 Stationary Contact: Adjust height of stationary contact where possible. Loosen locknuts on the contact, turn contact up or down, as required, and tighten locknuts. This will affect contact pressure and separation and electrical operation.

9.42 Movable Contact Spring: Bend movable contact spring if stationary contact cannot be adjusted. This will affect contact pressure, separation and alignment and electrical operation.

Use R-2120 Long Nose Pliers or 356 or 363 Adjusters.

10. CONTACT PRESSURE

10.1 Contact pressures shall be in accordance with Circuit Requirement Tables or Table A of this section.

Use a gram gauge or pound gauge, as required.

10.11 Pressure requirements are usually minimum values. For some relays both maximum and minimum values of pressure

are given and the test value must fall in this range. In some cases a normal value of pressure is also listed for the relay.

10.12 Readjust if pressures are below minimum or above maximum pressure requirements. Try to readjust near minimum value or midway between minimum and maximum values if both are given. If normal pressures are given try to readjust near this value.

10.13 Measure contact pressures with the contacts closed. For NC contacts the relay must be in the normal or deenergized position. For NO contacts hold the relay armature manually in the operated position. Apply the hook or lip of the gram gauge as close as possible to the movable contact at the point of contact and lift the movable contact in its normal direction of travel. The contact pressure is the indication on the gauge as the contacts separate.

10.14 Similar contacts on multicontact relays shall have about the same contact pressure except in special cases.

10.2 Due to the construction of some relays such as KS-15072 (Figure 3) and KS-15848 it may not be possible to check contact pressures. Pressure may be assumed to be satisfactory for these relays if contact follow is at least the amount listed after the contacts first make:

KS Relay	Follow (Inches)
KS-15072	1/16
KS-15848	3/32

10.3 Readjust contact pressure in one of the following ways:

10.31 Stationary Contacts: This is the preferred method. Decrease contact separation of a NO contact to increase contact pressure and vice versa. This will have little effect on NC contacts. Recheck contact sequence and separation and electrical requirements after this adjustment.

10.32 Armature Spring: Increasing tension of the armature spring, if the spring is below the armature hinge, increases pressure of all NC contacts on the relay. Recheck electrical requirements after this adjustment.

10.33 Armature Stops: Moving the stop which limits travel away from the coil to increase the travel will increase pressure on all NC contacts on the relay. Recheck electrical requirements after this adjustment. (Refer to Figures 6 and 7).

10.34 Contact Pressure Spring: Increasing tension of a contact pressure spring on a NO contact increases the pressure of that contact. (Refer to Figure 1). Remove cotter pin, washer, and contact pressure spring. Pull out the spring slightly. Replace spring, washer, and cotter pin. This will have little effect on a NC contact. Recheck electrical requirements after this adjustment.

10.35 Contact Spring Bending: If other methods of adjustment cannot be used, a contact spring may be bent slightly to increase or decrease pressure. Pressure can be increased by bowing the spring in the direction toward which it moves when closing the contact; decreased by bowing the spring in the opposite direction. This has little effect on NC contacts. Recheck contact separation, sequence, and alignment and electrical requirements after this adjustment.

11. MISCELLANEOUS RELAY ADJUSTMENTS

11.1 KS-5422 Contact Arm Initial Pressure

11.11 This is the pressure of the spring holding the pivoted part of the contact arm on large relays used as dc switches. These relays have rigid arms with a pivoted piece near the end which carries the contact and provides contact follow.

11.12 Contact arm initial pressures for KS-5422 relay shall be as follows:

List No.	Min. (Lbs)	Max. (Lbs)
07,17	2	3
09,19	3	4-3/4
08,18	6-3/4	9

11.13 To check this requirement attach a short loop of cord around the movable contact and insert a piece of paper in the contact assembly between contact finger and support. (See Figure 9). Hook the R-2481 gauge in the loop and pull in the direction away from the stationary contact. Pull gently on the paper and observe the reading of the gauge at the instant the paper can be moved.

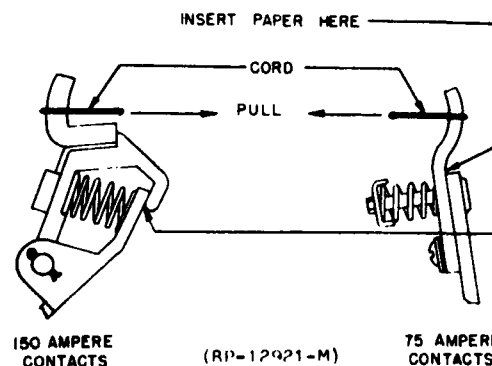


FIG. 9 MEASUREMENT OF INITIAL CONTACT PRESSURE (PAR. 11.1)

11.2 KS-5721 Mercury Relay

11.21 This relay shall be mounted so that the glass tube is vertical. The horizontal black line appearing on the front of the tube shall register with the upper edge of the clamp which holds it in place.

Gauge by eye.

11.22 Vertical alignment of the tube can be corrected by bending the contact leads with the fingers. To line up the upper edge of the clamp with the line on the tube, loosen the clamp screw with a screwdriver, raise or lower the tube as required, and tighten the clamp.

11.3 KS-15602 Overcurrent Relay

11.31 Adjust this relay to the following settings:

List No.	Trip Current (Amps)
1	65
2	105
3	135

11.32 To adjust the relay loosen the locknut (see Figure 10) and screw the plunger core until the line corresponding to the required trip current rating is flush with the inside edge of the cup washer. Tighten the locknut to lock the plunger in position.

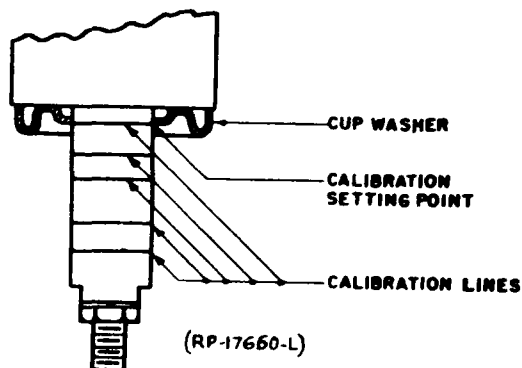


FIG. 10 KS-15602 RELAY (PAR. 11.3)

11.4 Overcurrent or Overload Relays

11.41 These relays, other than KS-15602, shall be adjusted to values of current given in Circuit Requirements Tables. If current values are not given, adjust relays to a value of current not exceeding 115% of the full load running current given on the motor nameplate.

12. NOISE

12.1 AC relays may hum or chatter due to excessive NO contact pressure. If noise is objectionable reducing NO contact pressure will reduce noise, but pressures must not be reduced below the minimum requirement. Hum or chatter may also be caused by excessive pull on the armature spring, in which case reduce spring tension but not to the extent that NC contact pressures (which will be affected by this adjustment) are reduced below the minimum values:

13. ELECTRICAL TEST

13.1 Temperature Requirements

13.11 Relays shall meet the requirements in Circuit Requirements Tables. This electrical test may be at

the temperature at which the relay is found, unless H (hot) or C (cold) is specified in the Circuit Requirements Table. If H is specified, without heating instructions, the relay coil shall be energized for at least one hour prior to the test. If C is specified, without cooling instructions, the relay shall be deenergized for at least 2 hours prior to the test.

13.2 DC Current Test

13.21 To check this requirement connect the relay to an ITE-4040 as shown in Figure 11 (a), (b) or (c) depending on whether battery, ground or both battery and ground are to be supplied to the relay thru the test set. Operate SETUP switch on ITE-4040 to position indicated to arrange the internal circuit of the test set as shown. Detailed instructions for operating ITE-4040 will be found in Section TMO-4040 of Handbook 100. If test set preparation is not specified on the Circuit Requirements Table, analyze the schematic drawing to determine whether battery or ground potential is normally applied to the relay to operate it. If no parallel circuits interfere, apply this potential through the ITE-4040 to the relay terminals. If there are parallel circuits disconnect both relay coil terminals and furnish both battery and ground through the test set with the B/G test setup.

NOTE: The current in the relay coil cannot exceed 3/4 ampere for the above test setup. If it is suspected that the coil may draw more than 3/4 ampere, measure coil resistance with an ohmmeter and calculate operating current. (Current = voltage divided by resistance.)

13.3 DC Voltage Test

13.31 To check this requirement prepare ITE-4040 test circuit as described in Paragraph 13.21. Connect an ITE-4442 across the relay coil to read voltages. Place red and black sliders on the ITE-4040 initially to the extreme right as when making current adjustments and then regulate with the correspondingly numbered key operated, until the desired voltage is impressed across the coil.

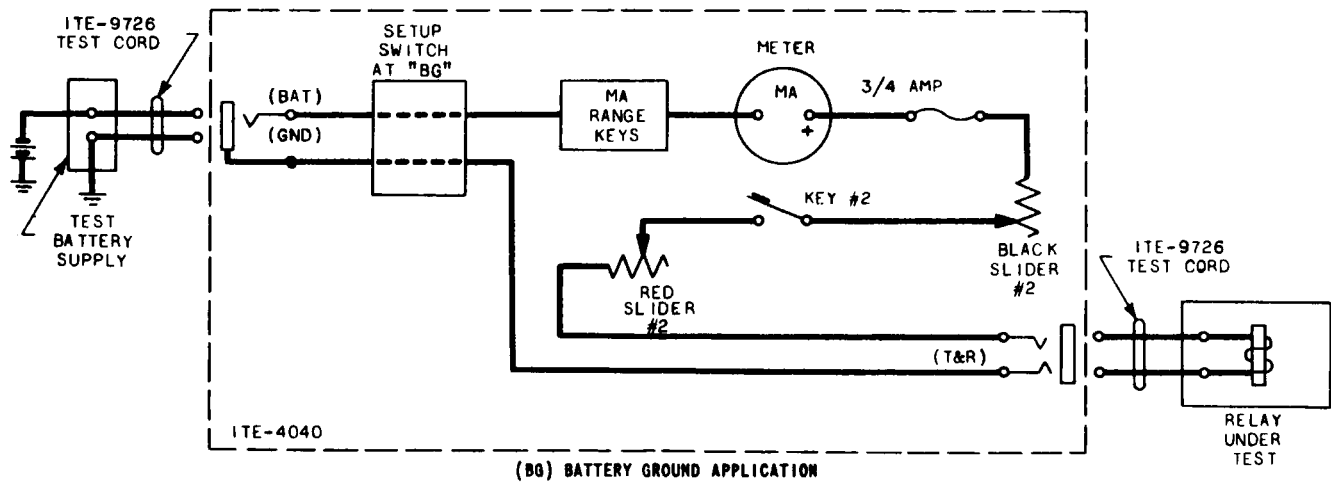
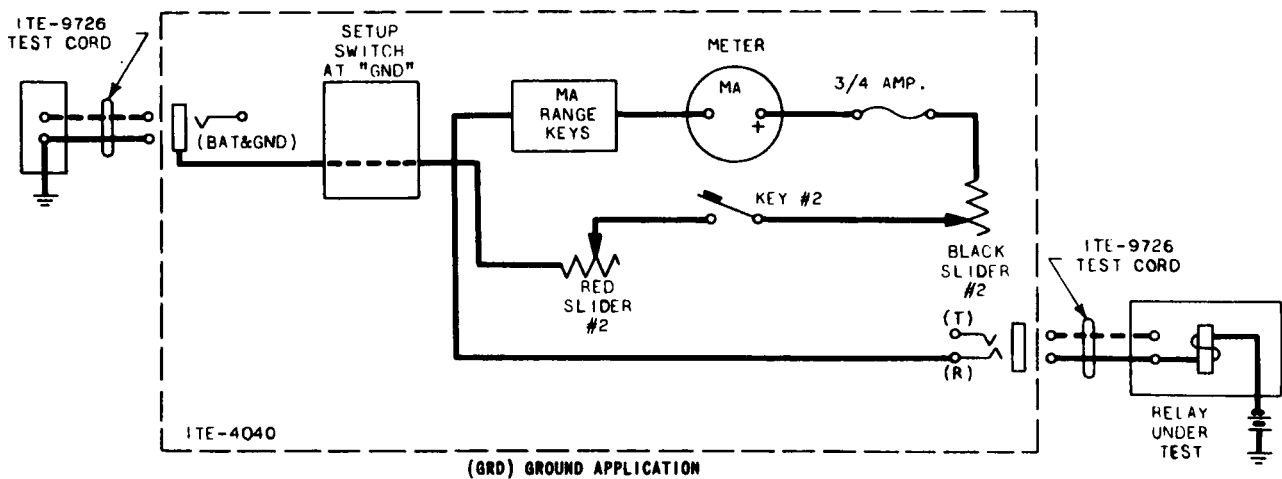
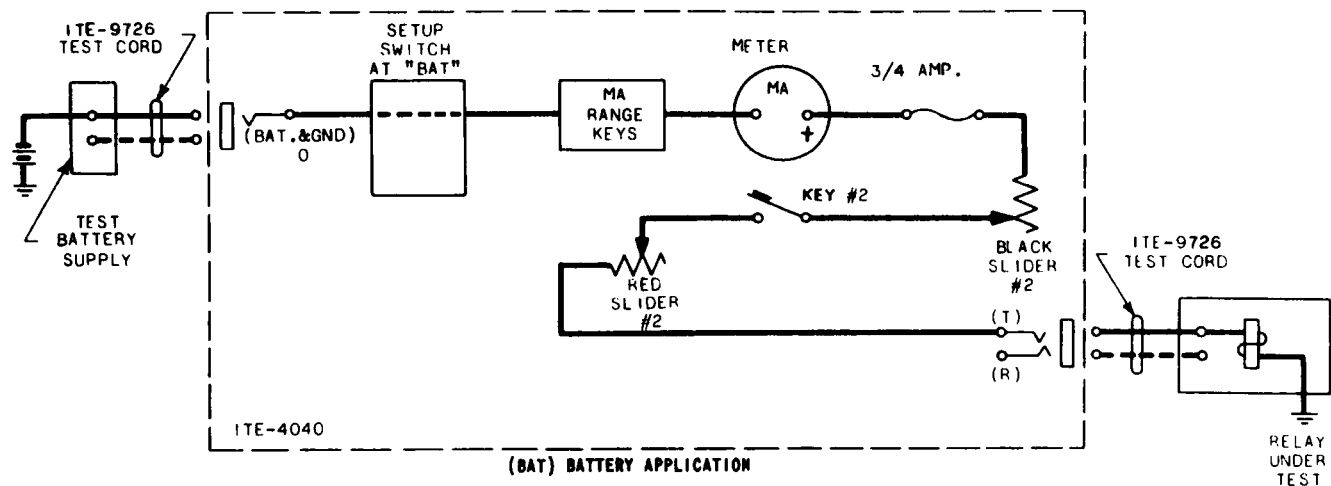
13.4 AC Voltage Test

13.41 Prepare a test circuit using an ITE-4442 volt-ohmmeter and ITE-4297 continuously tapped auto-transformer as shown in Figure 12. This circuit cannot be used for testing relays which draw more than 2 amperes at 130 volts and below, or more than 1 ampere at 230 volts.

13.42 Adjust ITE-4297 to provide specified voltage and observe that relay operates.

13.5 Readjustments for Electrical Requirements

13.51 **Armature Spring:** The amount of current required to operate the relay may be changed by changing the tension of the armature retractile spring. Increasing the tension increases the amount of current required to operate the relay.



(RP-17:53-0)

FIG. 11 ITE-4040 TEST CIRCUIT FOR DC RELAYS
(PARS. 13.21 & 13.31)

If the armature throw is unchanged, an increase in spring tension also increases the hold and release current values. This requires a recheck of NC contact pressure.

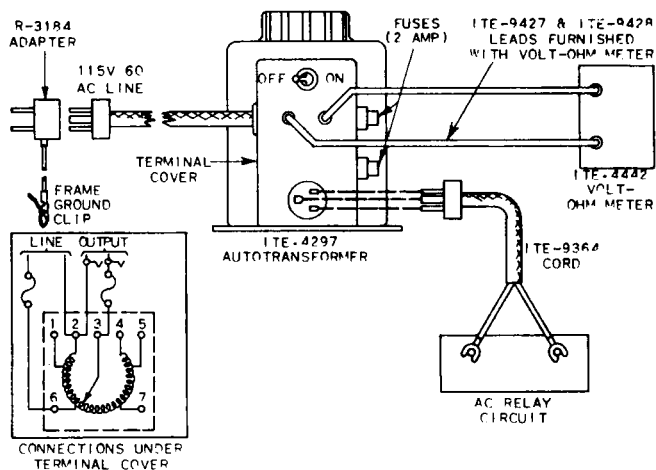


FIG. 12 SCHEMATIC SHOWING USE OF ITE-4297 (PAR. 13.4)

13.52 Armature Stops: The armature stop, which limits the clearance between the armature and the pole face when the relay is released, is frequently adjustable. Adjustment of this stop to increase this clearance increases the amount of current required to operate the relay. This adjustment, unlike the adjustment in Paragraph 13.51, will not increase the hold

and release current values. On relays provided with a stop to limit the approach of the armature to the pole face, adjustment of this stop to allow the armature to pull up closer to the pole face decreases the hold and release current values. Contact separation and pressure must be rechecked.

13.53 Contact Pressure: Decreasing pressures of NO contacts decreases the hold current. In no case, however, should the pressure be less than the specified minimum value. Increasing pressure of NC contacts causes a slight decrease in the current required to operate the relay if this operation decreases clearance between the armature and the pole face. Recheck contact pressure and separation.

14. TEMPERATURE

14.1 The temperature shall not exceed the values given in Table A.

14.2 While standing on a dry insulating surface with one hand in pocket, hold the other hand close to the hot area to determine whether it is too hot to touch. If not, touch hot area. If fingers cannot be held on hot area, the temperature may be excessive and should be measured by thermometer.

14.3 To measure the temperature, hold the bulb of the thermometer against the spot in question. Cover that part of the bulb, not in contact with the relay, with a piece of felt or the equivalent.

14.4 If the temperature exceeds the specified limit, replace the relay.

→ Arrowed lines indicate new or changed information.

[Vertical line at side of paragraphs indicates requirements.

R. W. HILLEGAS

Engineer of Installation

Reason for Reissue:

- (1) To replace petroleum spirits with R-3250 trichloroethylene.
- (2) To add information for cleaning contact surfaces (Paragraph 6.)
- (3) To add KS-5722 List 13 Relay in Table A.
- (4) To add list numbers for KS-5451 relays in Table A.
- (5) To add Table B for Non KS Relays.

Replaces Section 101 dated 9-18-58.