

KS-5639 DOUBLE COIL, MULTICONTACT CONTROL RELAY REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers the KS-5639, List 1 double-coil multicontact control relay.
- 1.02 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper applications of the requirements listed herein.
- 1.03 *Asterisk (*)*: Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of apparatus, or would affect the adjustment involved, or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.
- 1.04 For the purpose of this section, contacts are normally open (NO) or normally closed (NC) depending on their position when no operating current is flowing through the coil and not on their normal position for a particular application which may involve continuous operating current through the coil under normal circuit conditions. NO and NC contacts are sometimes referred to as front and back contacts, respectively.
- 1.05 *Operate*: A relay is said to operate if, when current is connected to its winding, the armature moves sufficiently to meet the following conditions.
- All normally open contacts close and all normally closed contacts open.
 - The armature rests against the core.
- 1.06 *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.

1.07 *Nonoperate*: A relay is said to nonoperate when, with current flowing through the coil, the armature has not moved sufficiently for NO contacts to close or to reduce the pressure of NC contacts enough to cause unreliable contact.

1.08 *Precautions Against High Voltage*: If this type relay is in a circuit where 150 volts or more are applied across terminals on the relay, the voltage should be removed from the terminals before performing any work on the relay or checking requirements other than electrical or temperature requirements. If the relay operates in an automatic control circuit, before work is started on the relay the automatic control should be made inoperative as described in the appropriate section covering the apparatus. In circuits where less than 150 volts are applied across terminals on the relay, service may be maintained while working on the relay by bridging and insulating the contacts as covered in 3.002. In some cases, it may be necessary to disconnect leads to maintain service.

1.09 Relays should not be handled by the contact springs.

2. REQUIREMENTS

2.01 *Cleaning Contacts and Removing Build-ups*: Contacts shall be clean and free from build-ups which might interfere with reliable contact.

Gauge by eye.

2.02 *Relay Mounting and Tightness of Component Parts*

- The relay shall be securely mounted.
- The component parts shall be held together securely.

Gauge by feel.

Caution: Do not touch or short-circuit live terminals or parts.

2.03 Contact Alignment: Contacts of the same diameter shall be so aligned that when the contacts are closed, the outer edge of one contact does not extend over the outer edge of the other more than

Max 1/32 inch

If contacts are of different diameters, the smaller contact shall not extend beyond the periphery of the larger.

Gauge by eye.

2.04 Contact Sequence

- (a) All NO contacts shall make at approximately the same time.
- (b) All NC contacts shall break at approximately the same time.

Gauge by eye.

2.05 Contact Separation: With the contacts at one end of the contact spring just closed and without flexing the contact spring or further compressing either contact pressure spring, separation between the contact at the other end of the spring and its mating contact shall be

Min 0.094 inch

Use the No. 161A gauge.

Before checking this requirement, disconnect the contacts from the power supply.

To check the requirement, move the armature manually as required with the KS-6320 orange stick.

2.06 Contact Pressure: The pressure between closed contacts shall be

	MINIMUM
NO contacts	50 grams
NC contacts	45 grams

with a gap between the contact spring and associated armature crossbar as shown Fig. 1(A).

Use the No. 79C gauge.

Before checking this requirement, disconnect the contacts from the power supply.

To check the requirement for NO contacts, hold the armature firmly against the pole face with the KS-6320 orange stick, taking care not to touch the contact springs. Apply the tip of the gauge to the movable contact spring as near to the contact as practicable and pull the gauge to

lift the spring. Read the gauge when the movable contact just leaves the stationary contact. Check the requirement for NC contacts similarly with the armature held in the unoperated position by the armature spring.

2.07 Freedom of Operation of Armature: The armature shall move freely throughout its travel.

Gauge by feel.

To check the requirement, slowly operate the armature manually with the KS-6320 orange stick.

2.08 Electrical Requirements

- (a) The relay shall meet the electrical requirements specified in the circuit requirement table or other job information.
- (b) Where electrical requirements are not specified in the circuit requirement table, operation of the relay shall be checked at any voltage available within the voltage range on the relay nameplate.

Note: Where electrical requirements are not specified in the circuit requirement table, (b) and (c) provide that normal operation of the relay is considered a satisfactory check and this would also apply where no nameplate range or other operate values are available.

(c) Check of electrical requirements may be at the temperature at which the relay is found, unless H (hot) or C (cold) is specified in the circuit requirement table.

(d) Where H is specified in the circuit requirement table without heating instructions, the relay shall be operated at nominal voltage for at least 1 hour prior to the test. See 3.002.

(e) Where C is specified in the circuit requirement table without cooling instructions, the relay shall be unoperated for at least 2 hours prior to the test. See 3.002.

To check the requirements, use a 35-type test set with voltmeter. If test set preparation has not been specified in the circuit requirement table, disconnect both relay coil terminals and furnish battery and ground through the test set using B/G or B/G/V preparation. See 3.002.

2.09 Temperature of Coils and Contacts: Under operating conditions, the temperature of the coils and contacts shall not exceed the following values.

Coils	95C (203F)
Contacts	115C (239F)

To check this requirement, hold the thermometer bulb against the part and cover the portion of the bulb not in contact with the part with a small asbestos pad or equivalent.

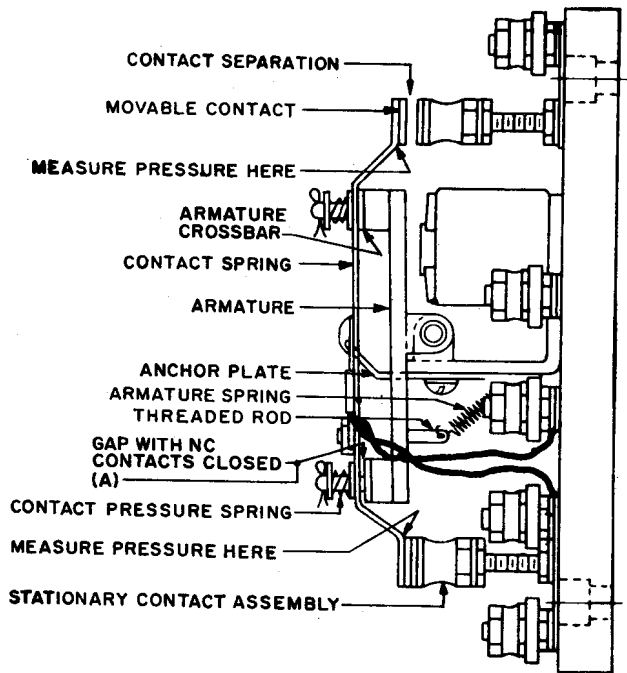


Fig. 1 - KS-5639, L1 Relay (Struthers-Dunn)

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
46	3/8-inch Hex. Single-end Socket Wrench
365 (As reqd)	Connecting Clip
373D	Contact Burnisher Holder
374A	Burnisher Blade

CODE OR SPEC NO.	DESCRIPTION
417A (2 reqd)	1/4- and 3/8-inch Hex. Open Double-end Flat Wrench
KS-2662	File
KS-6015	Duckbill Pliers
KS-6278 (As reqd)	Connecting Clip
KS-6320	Orange Stick
KS-6780 (As reqd)	Connecting Clip
KS-14208 (2 reqd)	Brush
—	4-inch Regular Screwdriver
GAUGES	
79C	0-200 Gram Push-Pull Tension Gauge
161A	0.050- and 0.094-inch Thickness Gauge
R1032 Detail 1 or 2	Thermometer
—	Voltmeter, DC, Weston Model No. 931, Ranges 300-150-75-30 (if available 35-type test set is not equipped with a voltmeter)
MATERIALS	
KS-2423	Cotton Twill Cloth
KS-7187	Bond Paper
KS-8372	Stabilized Trichloroethylene
—	Abrasive Cloth, 150 grade
—	Asbestos Pad
—	No. 14 Gauge, AM-14, Wire
—	1-ounce Bottle
TEST APPARATUS	
35 Type	Test Set
1W13A (As reqd)	Cord (each end equipped with a No. 365 connecting clip or KS-6278 connecting clip)
1W13B (As reqd)	Cord (each end equipped with a No. 365 connecting clip or KS-6278 connecting clip)

3.002 Maintaining Service While Working on Relay

(1) **General:** If less than 150 volts are applied across terminals and it is not practicable to disconnect the relay from the power supply (see 1.08), bridge the current-carrying contacts and insulate live parts as covered in (2) and (3), respectively.

Caution: Use care when working in close quarters with live parts.

(2) **Bridging Contacts:** To maintain service while work is being done affecting closed contacts carrying current in working circuits, bridge the contacts at the most convenient points in the circuit other than at the relay, if practicable. No. 1W13A cords (3 feet long) or No. 1W13B cords (6 feet long) with KS-6278 connecting clips (jaws insulated with No. 108 cord tips) are satisfactory for strapping purposes. Lengths of No. 14 gauge insulated wire or flexible cord such as is commonly used in lighting circuits, with KS-6780 connecting clips (jaws insulated with No. 108 cord tips), are equally satisfactory.

(3) **Insulating Contacts and Parts:** KS-7187 bond paper should be used for insulating live parts and should be shaped or bent as necessary to provide protection with minimum interference to the work being done. To prevent closure of open contacts in a live circuit, place bond paper, as required, around the fixed contact or disconnect the lead to the contact spring.

3.003 Closing Open Contacts: To close NO contacts, hold the armature against the pole face with the KS-6320 orange stick. To close NC contacts which are open and operating in a working circuit, open one connection to the coil, after first bridging or insulating the other contacts as necessary.

3.004 Removing Relay From Mounting: If it is necessary to remove the relay, patch the working circuit around the relay. Disconnect all power supply from the winding and contact circuits of the relay by opening switches, if provided, or by removing fuses. Then, disconnect the leads from the relay terminals using the 4-inch regular screwdriver or the No. 46 wrench. Remove the mounting screws with the screwdriver.

3.005 Preventing Concentration of Fumes: It is desirable to prevent concentration of fumes resulting from evaporation of the KS-8372 trichloroethylene during cleaning of contacts, armatures, or pole faces. To do this, locate an electric fan so that it will direct a current of air toward the freshly cleaned relay parts. In cases where the power room air is brought in through a central circulating system, it is advisable to temporarily set the air controls to provide a higher than normal percentage of outside air.

3.006 Caution: Unless otherwise stated in the procedures, do not make adjustments or perform work on live contacts or parts.

3.01 Cleaning Contacts and Removing Build-ups (Rq 2.01)

(1) **General:** Before cleaning contacts or removing build-ups, disconnect the power supply from the contacts, if practicable (refer to 1.08). If contacts are badly worn, replace the complete contact spring or stationary contact as covered in Section 040-641-801.

(2) **Cleaning Contacts:** To remove dirt and gummy substance, clean the contacts with KS-8372 trichloroethylene as covered in (a) and (b) and then brush them with a dry, clean KS-14208 brush as covered in (c).

(a) Pour a small quantity of the trichloroethylene into a 1-ounce bottle. It is important to avoid the use of contaminated trichloroethylene in cleaning the contacts. Therefore, discard the trichloroethylene as soon as it appears slightly dirty.

(b) Dip the hairs of a clean KS-14208 brush their full length in the trichloroethylene. Remove excess fluid by wiping the brush on the edge of the bottle. Then, with the pair of contacts open, brush the entire surface of the contact to be cleaned with the moist brush.

(c) Brush the contacts with a dry, clean KS-14208 brush. If necessary, burnish the contacts with the No. 374A burnisher blade as covered in (d).

(d) To burnish the contacts, insert the No. 374A burnisher blade held in the No. 373D contact burnisher holder between the contacts. Do not burnish live contacts. If the contacts are normally open, press

them together by holding the armature firmly against the pole face with the KS-6320 orange stick. Draw the burnisher blade back and forth until the contacts are clean as determined by visual inspection. After burnishing, brush the contacts with a dry, clean KS-14208 brush.

(3) **Removing Build-ups:** To remove build-ups in dead circuits, use a strip of 150 grade abrasive cloth, the KS-2662 file, or the No. 374A burnisher blade held in the No. 373D contact burnisher holder. For contacts in live circuits of less than 150 volts to ground, use abrasive cloth only. For contacts in live circuits of 150 volts or more to ground, remove the voltage from the terminals as outlined in 1.08 before removing build-ups. Insert the abrasive cloth, file, or blade between the contacts. If the contacts are normally open, hold the armature firmly against the pole face with the KS-6320 orange stick, taking care not to touch the contact springs. Draw the cloth, file, or blade back and forth until the build-ups are removed. Exercise care to avoid reducing the height of the contact. After burnishing, brush the contacts with a dry KS-14208 brush.

3.02 **Relay Mounting and Tightness of Component Parts** (Rq 2.02)

- (1) Tighten loose mounting screws and other screws with the 4-inch regular screwdriver.
- (2) Tighten loose terminal nuts with the No. 417A wrench.

3.03 **Contact Alignment** (Rq 2.03)

- (1) Adjust slightly misaligned contact springs with the KS-6015 pliers. Badly bent contact springs should be removed and reshaped if practicable or otherwise replaced as covered in Section 040-641-801.
- (2) If satisfactory contact alignment cannot be obtained, replace the relay.

3.04 **Contact Sequence** (Rq 2.04)

- (1) If the requirement is not met, check the stationary and movable contacts in the group of NO or NC contacts. Adjust misaligned movable springs with the KS-6015 pliers (see 3.006). Adjust the height of stationary contacts using one or two No. 417A wrenches, as required. Recheck the requirement and also check requirements 2.03, 2.05, 2.06, and 2.08.

3.05 **Contact Separation** (Rq 2.05)

- (1) To adjust contact separation, loosen the locknut of the stationary contact using one or two No. 417A wrenches, as required. Turn the stationary contact assembly as required, and tighten the locknut. Do not bend the movable contact spring. Recheck the requirement and also check requirements 2.03, 2.04, 2.06, and 2.08.

3.06 **Contact Pressure** (Rq 2.06)

- (1) Contact pressures are specified on a minimum basis and have a direct bearing on the electrical requirements. If the pressure is greatly in excess of the specified minimum limit, the relay may fail to meet its electrical requirements. After changing contact pressure, check requirement 2.04.
- (2) To change the contact pressure of NO contacts, adjust the height of the stationary contacts using one or two No. 417A wrenches, as required.
- (3) To change the contact pressure of NC contacts, adjust the armature spring tension as covered in (4) or (5) depending on which relay is being adjusted, and then adjust the height of the stationary contacts if necessary.
- (4) **Struthers-Dunn Relays:** To change the armature spring tension, raise the threaded rod to permit turning the nut. Turn the nut clockwise to increase and counterclockwise to decrease the tension. Further adjustment may be obtained by moving the anchor plate down to increase and up to increase the spring tension. Use the 4-inch regular screwdriver to loosen and tighten the anchor plate mounting screw.
- (5) **Ward Leonard Relays:** To change the armature spring tension, loosen the nuts on the threaded rod to which the end of the spring is attached, using two No. 417A wrenches. Manually turn the nuts toward the spring to increase and away from the spring to decrease the tension. Tighten the nuts.

3.07 **Freedom of Operation of Armature** (Rq 2.07)

- (1) Remove any foreign matter which may have lodged between the armature and pole face of the coil with the KS-6320 orange

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stick. In some cases, the armature or pole face may require cleaning with KS-8372 trichloroethylene on a KS-2423 cloth wrapped around the orange stick.

(2) If the armature is binding on the armature pin, remove the pin by removing the cotter pin at the inner end and withdrawing the armature pin. Clean the armature pin and the armature bearings with a KS-2423 cloth moistened with trichloroethylene and wipe the parts with a dry cloth. Remount the armature pin and insert the cotter pin.

(3) If the trouble cannot be corrected as covered above, replace the armature or armature pin as covered in Section 040-641-801.

3.08 *Electrical Requirements* (Rq 2.08)

(1) If the relay fails to operate, check for voltage across the terminals. If there is no voltage, check the circuit.

(2) If the armature does not move with voltage across the terminals and requirement 2.07 is met, replace the coil as covered in Section 040-641-801.

(3) If, when the operate current is applied to the coil, the armature moves part way to the core, it is an indication of excessive contact pressure, armature spring tension, or binding of the armature. Check requirements 2.06 and 2.07.

(4) If the relay fails to meet its nonoperate requirement, increase the armature air-gap by lowering the stationary NC contacts as outlined in 3.05 or increase the armature spring tension as covered in 3.06(4) and (5). See 3.006.

(5) If the relay does not meet its release requirement, check requirements 2.06 and 2.07. If sufficient armature spring tension cannot be obtained, replace the armature spring (tail spring or tension spring) as covered in Section 040-641-801. Check whether the stop pin of the armature provides a gap between the armature and pole face. If there is no gap, replace the armature as covered in Section 040-641-801.

(6) After readjusting any parts in connection with meeting the electrical requirements, check these parts for the applicable requirements.

3.09 *Temperature of Coils and Contacts* (Rq 2.09)

(1) If the temperature exceeds the specified limit, see that requirements 2.01, 2.03, and 2.06 are met. If these requirements are met and the temperature is still above the specified limit, with nameplate rated voltage not exceeded, refer the matter to the supervisor as the relay may have to be replaced.