

KS-15519-TYPE CONTROL RELAYS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-15519, List 1 and 2, close differential voltage-type control relays.

1.02 The KS-15519, List 1 control relay is used in J86621, J86622, and J86624 main control cabinets; the KS-15519, List 2 control relay is used in J86622 main control cabinets. The cabinets are associated with 900-type engine-driven alternator plants.

1.03 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.

1.04 For the purpose of this section, contacts are normally open (NO) or normally closed (NC) if the contacts are open or closed, respectively, with no operating current flowing through the coil. 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.

- (a) All normally open contacts close and all normally closed contacts open.
- (b) 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 The relay assembly consists of the relay, rheostat, capacitor, and reactor which are mounted on an insulated base. Taps from the reactor and leads from the relay coil terminate in a terminal block on the base. Leads from the relay contacts have individual terminals not associated with the terminal block. By selecting taps from the reactor and adjusting the rheostat, the relay can be set to operate and release at values within the voltage ranges given below.

LIST NO.	OPERATE	RELEASE
1	190-230	180-220
2	103-122	98-117

The relay assembly is arranged for mounting on a vertical metal panel and is equipped with a cover switch to short-circuit the capacitor when the cover is removed from the terminal block. Fig. 1 shows the arrangement of the parts of the relay on the base and Fig. 2 a schematic of the relay circuit.

1.08 **Precautions Against High Voltage:** If this type of 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 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.

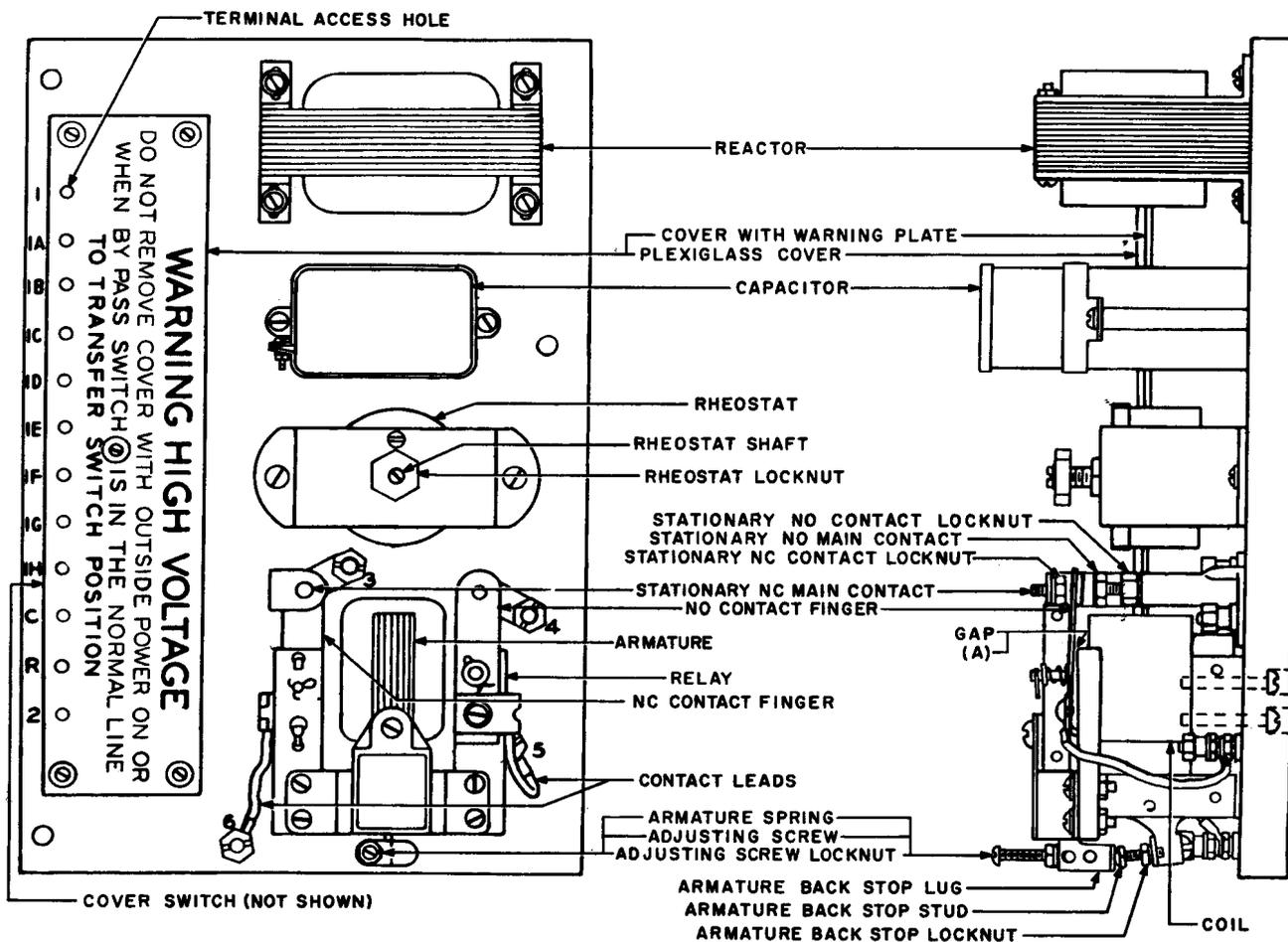


Fig. 1 - KS-15519 Relay (Armature Shown in Operated Position)

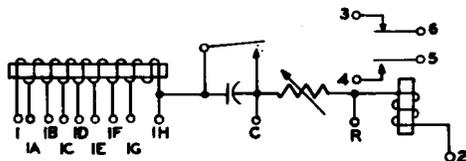


Fig. 2 - KS-15519 Relay - Schematic Showing Cover Switch Open (Cover in Place)

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

- (a) The relay shall be securely mounted.
- (b) 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.

To check cover switch contacts, remove the terminal block cover using the 4-inch regular screwdriver. If the requirement is met, remount the cover.

2.04 Contact Separation: The separation between mating contacts when open shall be

Main Contacts	Min 1/16 inch
Terminal Block Cover Switch Contacts	Min 1/8 inch

Use the R-8550 scale for main contacts.

Gauge by eye for cover switch contacts.

Before checking these requirements, disconnect the contacts from the power supply.

To check the requirements for NC main contacts, operate the armature with the KS-6320 orange stick. The cover switch contacts are in the terminal block at the inner end of position C. To check the requirement for these contacts, use the P-220366 dental mirror.

2.05 Contact Pressure

- (a) The pressure between closed main contacts shall be

Min 40 grams

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

- (b) The pressure between cover switch contacts shall be

Min 30 grams

Use the No. 79C gauge.

- (c) Before checking this requirement, disconnect the contacts from the power supply.

(d) To check the requirement for NO main contacts, operate the armature with the KS-6320 orange stick. For NC main contacts, check the requirement with the armature held in the unoperated position by the armature spring. Measure the contact pressure as covered in (f).

(e) To check the requirement for cover switch contacts, remove the terminal block cover using the 4-inch regular screwdriver. Measure the contact pressure as covered in (f) and remount the cover.

(f) Apply the finger of the gauge to the tip of the movable contact spring and exert pressure with the gauge away from the stationary contact. Read the gauge when the contacts just open.

2.06 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.

2.07 Electrical Requirements

- (a) The relay shall meet the electrical requirements specified in the circuit requirement table or other job information.

Use the Weston Model 528 voltmeter and provide a variable voltage supply as covered in 3.07.

(b) Electrical requirements may be checked at the temperature at which the relay is found, unless H (hot) or C (cold) is specified in the circuit requirement table.

(c) If 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.

(d) If 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.

3. ADJUSTING PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
365 (As reqd)	Connecting Clip
373D	Contact Burnisher Holder
374A	Burnisher Blade
417A (Two reqd)	1/4- and 3/8-inch Hex. Open Double-end Flat Wrench
418A	5/16- and 7/32-inch Hex. Open Double-end Flat Wrench
KS-2662	File
KS-6015	Duck-bill Pliers
KS-6278 (As reqd)	Connecting Clip (Jaws Insulated With No. 108 Cord Tips)
KS-6320	Orange Stick
KS-6780 (As reqd)	Connecting Clip
KS-14208 (Two reqd)	Brush
R-1542	6-inch Adjustable Wrench
R-3193	9/32- and 11/32-inch Open Double-end Flat Wrench
—	3-inch Cabinet Screwdriver
—	4-inch Regular Screwdriver
—	1-pound Ball Peen Hammer
—	5/32-inch Pin Punch (No. 565 L. S. Starrett Co or equivalent)
GAUGES	
79C	0-200 Gram Push-Pull Tension Gauge
R-8550	Steel Scale
—	Voltmeter, AC, Weston Model No. 528, Ranges 300-150

CODE OR SPEC NO.	DESCRIPTION
MATERIALS	
KS-2423	Cotton Twill Cloth
KS-7187	Bond Paper
KS-8372	Stabilized Trichloroethylene
—	Abrasive Cloth, 150 grade
—	Asbestos Pad
—	No. 14 Gauge Insulated Wire
—	1-ounce Bottle

TEST APPARATUS

35 Type	Test Set
1W13A (As reqd)	Cord (each end equipped with a No. 365 or KS-6278 connecting clip)
1W13B (As reqd)	Cord (each end equipped with a No. 365 or KS-6278 connecting clip)
—	Autotransformer, Continuous Tap (Variac, 2.5 amp, 230-volt input, type V-5HMT, General Radio Co, or equivalent)

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 No. 417A wrench. Remove the mounting screws with the screwdriver.

3.005 Armature Hum and Chatter: Armature hum generally indicates the necessity of cleaning the armature and pole face. In such cases, clean the parts as covered in 3.06(1). Armature chatter may be due to excessive NO contact pressure or unsatisfactory seating of the armature on the pole face. Check requirement 2.05 covering contact pressure and readjust if necessary. To improve the seating of the armature on the pole face, draw a piece of 150 grade abrasive cloth across the armature and pole face with the armature held against the pole face with the KS-6320 orange stick.

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 (Reqt 2.01)

(1) **General:** Before cleaning contacts or removing build-ups, observe the precautions against high voltage covered in 1.08. In the case of cover switch contacts, disconnect the power supply from the relay. Remove the screws holding the terminal block cover using

the 4-inch regular screwdriver, and remove the cover. If contacts are badly worn, replace the contact finger, stationary contact, or cover switch contact spring as covered in Section 040-669-801.

(2) **Cleaning Contacts:** To clean the contacts, proceed as follows.

(a) Pour a small quantity of 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 as covered in (d) or (e). Do not burnish live contacts. After cleaning and burnishing as required, remount parts removed.

(d) To burnish the main contacts, insert between the contacts the No. 374A or 374B burnisher blade held in the No. 373D contact burnisher holder. If the contacts are normally open, press them together by holding the armature firmly against the pole face with the KS-6320 orange stick. Move the burnisher blade back and forth until the contacts are clean as determined by visual inspection. After burnishing, brush the contacts as covered in (c).

(e) To burnish the cover switch contacts, insert between the contacts the No. 374B burnisher blade held in the No. 373D contact burnisher holder. Move the burnisher blade back and forth until the contacts are clean as determined by visual inspection. Then, brush the contacts as covered in (c).

(3) **Removing Build-ups**

(a) To remove build-ups from main contacts in dead circuits, use a strip of 150 grade abrasive cloth, the KS-2662 file, or the No. 374A or 374B burnisher blade held in the No. 373D contact burnisher holder.

For main contacts in live circuits, use abrasive cloth only. For cover switch contacts, use abrasive cloth or the No. 374B burnisher blade held in the No. 373D contact burnisher holder.

(b) Insert the abrasive cloth, file, or burnisher blade between the contacts. If the main contacts are normally open, hold the armature firmly against the pole face with the KS-6320 orange stick. Move 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 removing the build-ups, brush the contacts with a dry KS-14208 brush.

3.02 Relay Mounting and Tightness of Component Parts (Reqt 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 (Reqt 2.03)

(1) If main contacts do not meet the requirement, shift the position of the contact finger as follows. Loosen the associated armature bar mounting screws, using the 4-inch regular screwdriver and the No. 418A wrench. Shift the bar as required to align the contacts and securely tighten the screws. If satisfactory contact alignment cannot be obtained, replace the relay.

(2) If the cover switch contacts do not meet the requirement, shift the fixed or movable contact springs, as required, to align the contacts. Use the 4-inch regular screwdriver to loosen the screw holding the fixed contact spring and the 3-inch cabinet screwdriver to loosen the movable contact spring screw. If the cover switch movable contact spring is distorted, reshape it with the KS-6015 pliers, if practicable, or otherwise replace the spring as covered in Section 040-669-801. After repositioning the springs, tighten the screws and remount the cover.

3.04 Contact Separation (Reqt 2.04)

(1) **Main Contacts:** To adjust the separation between main contacts, loosen the locknut of the stationary contact using two No. 417A

wrenches. Turn the stationary contact screw as required and tighten the locknut. While adjusting the separation between main NC contacts, block the armature operated by inserting the KS-6320 orange stick between the armature backstop stud and lug without forcing the armature stick.

(2) **Cover Switch Contacts:** Remove the cover from the terminal block using the 4-inch regular screwdriver. Bend the movable contact spring as required with the KS-6015 pliers. To check the contact separation with the cover removed, hold the cover across the terminal block and movable contact spring to open the contacts.

(3) After adjusting the contact springs, recheck the requirement and check requirements 2.03, 2.05, and 2.07. Remount parts removed.

3.05 Contact Pressure (Reqt 2.05)

(1) The contact pressure of main contacts is specified on a minimum basis and has a direct bearing on the electrical requirements. After changing contact pressure, check requirements 2.03, 2.04, and 2.07.

(2) To change the contact pressure of main contacts, adjust the height of the stationary contacts using two 417A wrenches.

(3) To change the contact pressure of the cover switch contacts, remove the cover using the 4-inch regular screwdriver. Bend the movable contact spring as required with the KS-6015 pliers. Remount the cover.

3.06 Freedom of Operation of Armature (Reqt 2.06)

(1) Remove any foreign matter which may have lodged between the armature and pole face of the coil, using the KS-6320 orange 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, clean the pin as follows. Remove the screw securing the nameplate and bracket to the armature, using the 4-inch regular screwdriver. Suspend the bracket by the leads. Remove the armature pin by tapping it with the 5/32-inch drive pin punch and the hammer.

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 pin, using the drive punch and hammer. Center the pin with respect to the armature in order to insure clearance with the armature bracket. Remount the bracket and nameplate and securely tighten the screw. Check requirement 2.03.

(3) If the trouble cannot be corrected as covered above, replace the armature and frame assembly as covered in Section 040-669-801.

3.07 Electrical Requirements (Reqt 2.07)

(1) Disconnect the relay from the working circuit noting the terminal block positions to which the power supply leads are connected. Using a voltage supply equivalent to the working circuit power supply, provide means for varying the voltage over the required range as covered in (2) or (3).

(2) If the continuous tap autotransformer is available, connect the power supply to the input of the autotransformer protected by 3-ampere fuses. Connect the output of the autotransformer to the relay terminal block as covered in (4).

(3) If the autotransformer is not available and the relay is used in the J86621, J86622, or J86624 control cabinet of an engine-driven alternator, the alternator output may be used as a source of voltage. In this case, connect the alternator through 3-ampere fuses to the relay terminal block as covered in (4). Operate the alternator under manual control and adjust the alternator output voltage with the field rheostat.

(4) Using No. 1W13B cords, connect the output of the autotransformer or alternator to the same relay terminal block positions to which the power supply was connected in the working circuit. Connect the Weston Model 528 voltmeter across the output of the autotransformer or alternator.

(5) By varying the voltage from the autotransformer or alternator, determine the voltage at which the relay operates and releases.

(6) In general, the release value of the relay depends on the setting of the relay rheostat while the operate value depends on the reactor tap selected which is determined by the nominal service voltage with which the relay is used. A schematic of the relay circuit is shown in Fig. 1. The following Tables A and B show the terminal block positions (reactor taps) which may be used with various nominal voltages for the KS-15519, L1 and L2, control relays. One side of the power supply is connected to one of these positions and the other side to the coil winding, position 2 on the terminal block.

TABLE A — KS-15519, List 1, Control Relay

NOMINAL SERVICE VOLTAGE	TERMINAL BLOCK POSITIONS (REACTOR TAP)
240	1,1A,1B
230	1A,1B,1C
220	1C,1D,1E
208	1E,1F,1G

TABLE B — KS-15519, List 2, Control Relay

NOMINAL SERVICE VOLTAGE	TERMINAL BLOCK POSITIONS (REACTOR TAP)
130	1,1A
125	1A,1B,1C
120	1B,1C,1D
115	1C,1D,1E
110	1E,1F,1G

(7) If the relay does not meet the release requirement, adjust the relay rheostat as follows. Loosen the rheostat shaft locknut with the 6-inch adjustable wrench and turn the shaft fully counterclockwise with the 4-inch regular screwdriver. If the relay has released, operate it by increasing the applied voltage. Then, set the voltage to the nominal value specified in the release requirement. Turn the rheostat shaft clockwise until the relay releases. Securely tighten the shaft locknut and recheck the requirement.

(8) If the release requirement cannot be met by adjusting the rheostat as covered in (7), further adjustment may be obtained by changing the NO contact pressure as cov-

SECTION 040-669-701

ered in 3.05. Increasing or decreasing the contact pressure will cause the relay to release at higher or lower voltages, respectively. However, it is desirable to change these adjustments as little as practicable because of their effect on relay operate. If the relay fails to release, check whether the armature stop plates are worn or missing. If necessary, replace the armature and frame assembly as covered in Section 040-669-801.

(9) After adjusting the relay to meet the release requirement, check the operate requirement. If the relay fails to meet the operate requirement, shift the voltage lead connected to the reactor tap to another terminal block position in the group corresponding to the nominal voltage with which the relay is used as covered in (6). If the requirement cannot be met with the voltage lead connected to either of the remaining terminal block positions in the group, further adjustment may be obtained by changing the NC contact pressure as covered in 3.05.

(10) If the armature does not move when the operate voltage is applied across the coil and reactor and requirement 2.06 is met, the coil, rheostat, capacitor, or reactor may be defective. Check the circuit through these parts and make the necessary replacements as covered in Section 040-669-801.

(11) If, when the operate voltage is applied to the coil, the armature moves part way to the core, this is an indication of excessive contact pressure or binding of the armature. Check requirements 2.05 and 2.06.

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

(13) After the electrical requirements have been met, disconnect the test apparatus. Reconnect the relay in the working circuit, connecting the supply voltage leads to the terminal block positions with which the electrical requirements were met.