

KS-5755, KS-15868, AND KS-15983, STARTERS REQUIREMENTS AND ADJUSTING PROCEDURES

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NOTICE

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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 paragraph 1.10. In some cases, it may be necessary to disconnect leads to maintain service.

1.09 When work is being done on a relay in an operating circuit, see that service is maintained. Typical starters are shown in Fig. 1 and 2.

Schematics for the starters are given in Fig. 3 through 7.

1.10 **Maintaining Service While Working on Relay:** To maintain service, proceed as follows:

- (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 paragraph 1.08), bridge the current-carrying contacts and insulate live parts as covered in (2) and (3), respectively.

Danger: Use care when working in close quarters with live circuits to avoid personal injury, equipment damage, and/or service interruption.

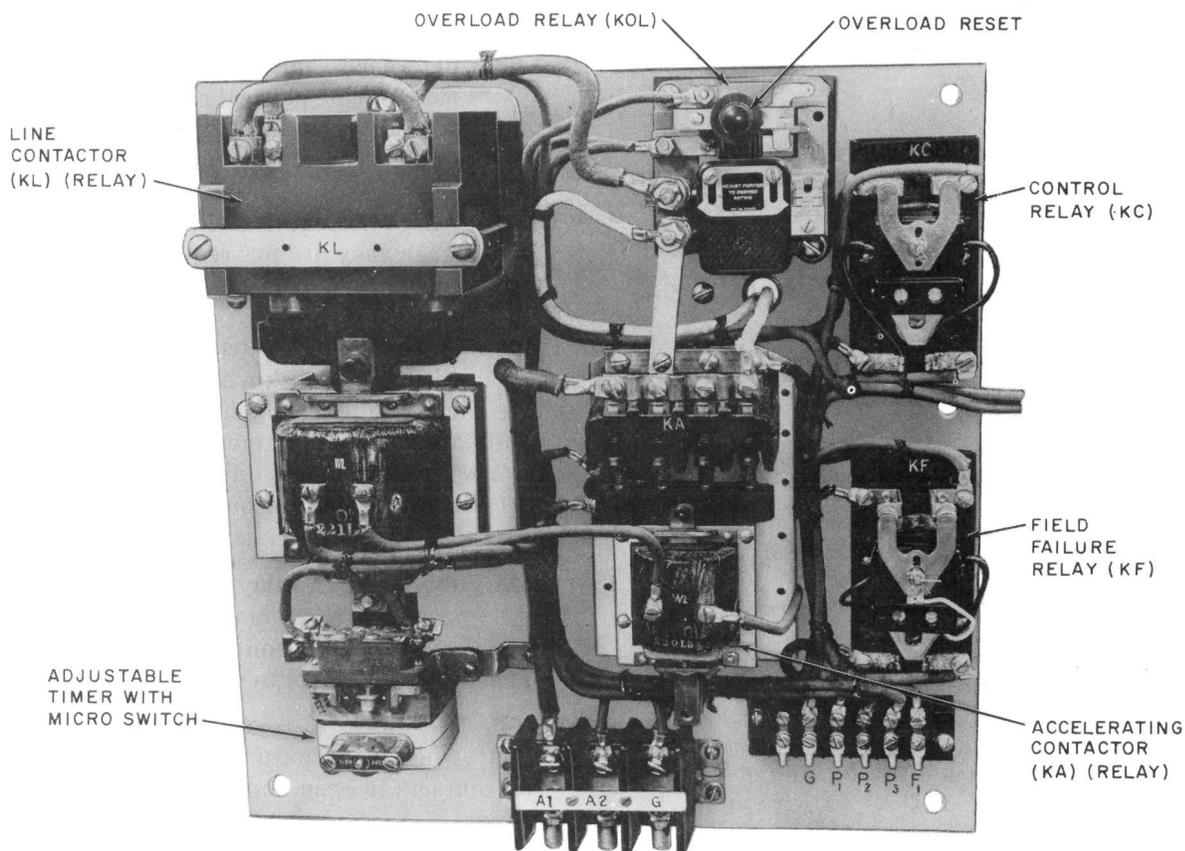


Fig. 1—General View of KS-15983, L1, Starter (Resistor Mounted on Rear of Plate—Cabinet Removed)

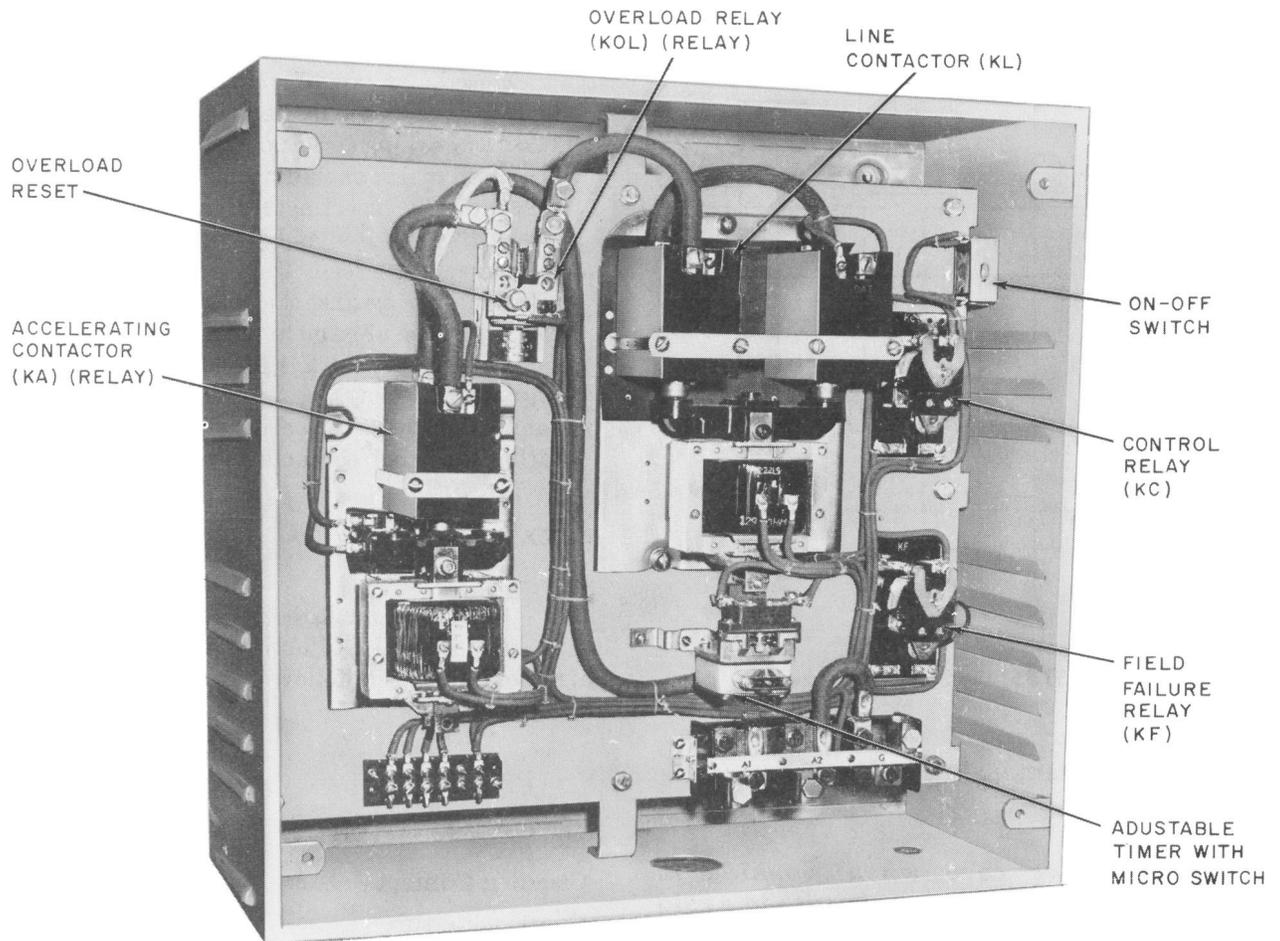


Fig. 2—General View of KS-15983, L2, Starter (Resistor Mounted on Rear of Plate)

(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. The 1W13A cords (3 feet long) or the 1W13B cords (6 feet long) with KS-6278 connecting clips (jaws insulated with 108 cord tips) are satisfactory for strapping purposes. Lengths of 14-gauge insulated wire or flexible cord such as is commonly used in lighting circuits, with KS-6780 connecting clips (jaws insulated with 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.

1.11 **Disconnect and Remove Relay:** To remove relay, proceed as follows:

(1) Where it is not practicable to disconnect the relay from the power supply, bridge around the contacts (see paragraph 1.10) or insulate between contacts with a strip of bond paper; disconnect leads, as necessary, in order to maintain circuit conditions unchanged. If it becomes necessary to remove the relay from its mounting in order to obtain access to the parts, proceed as follows. Patch through any working circuit and disconnect all power supply from the winding and contact circuits by opening switches, if provided, or by removing the fuse or fuses. Then disconnect

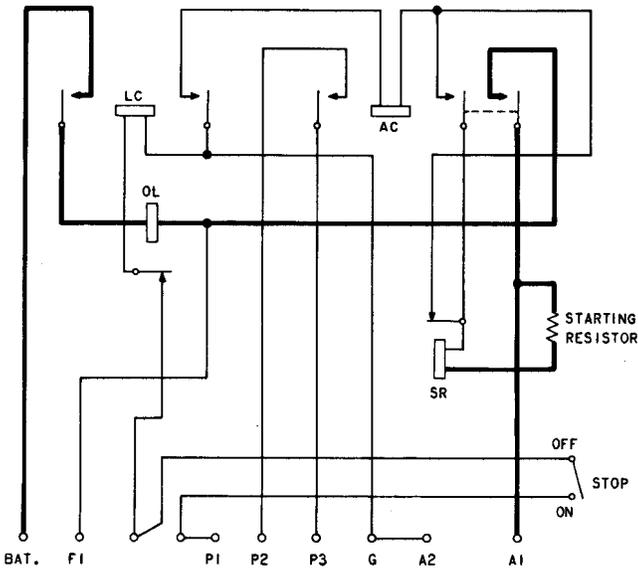


Fig. 3—KS-5755, L1, Starter Schematic

the leads from terminals. Remove the mounting screws.

Danger: Use care when working in close quarters with live circuits to avoid personal injury, equipment damage, and/or service interruption.

(2) In working circuits, contacts which are found closed and carrying current which should not be interrupted should be bridged. (See paragraph 1.10.) In working circuits, contacts which are found open and which should not be closed shall be kept separated by inserting a strip of bond paper between the movable and stationary contacts or by disconnecting a lead. To close a NO contact, hold the armature against the pole face, taking care not to disturb the alignment of the armature. NC contacts of a relay which is found operated in a working circuit may be closed by opening one connection to the coil after first bridging or insulating the other contacts as necessary.

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1.12 Information in both Part 2, Requirements, and Part 4, Adjusting Procedures, has been arranged under the following headings:

TITLE	REQUIREMENT PARAGRAPH NO.	PROCEDURE PARAGRAPH NO.
Mounting	2.01	4.01
Cleaning Contacts	2.02	4.02
Contact Pressure	2.03	4.03
Contact Follow	2.04	4.04
Contact Gap and Operated Magnetic Gap	2.05	4.05
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Temperature	2.07	4.07

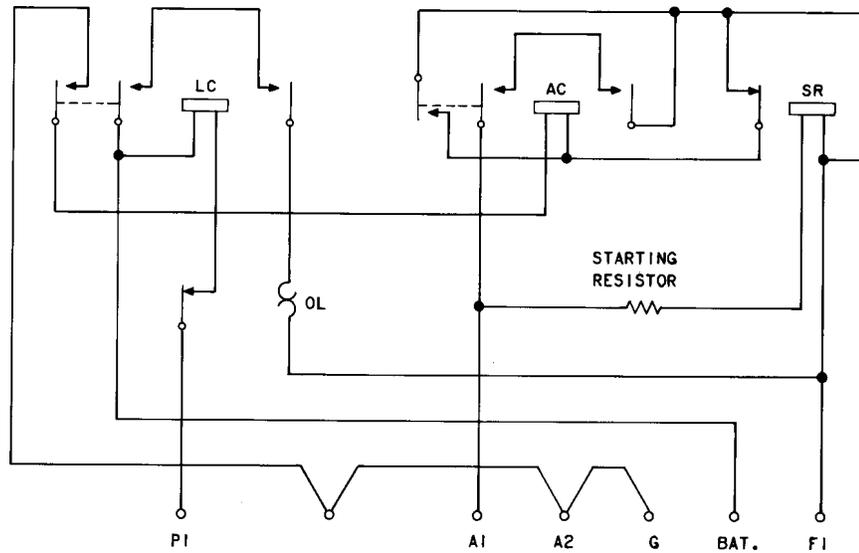
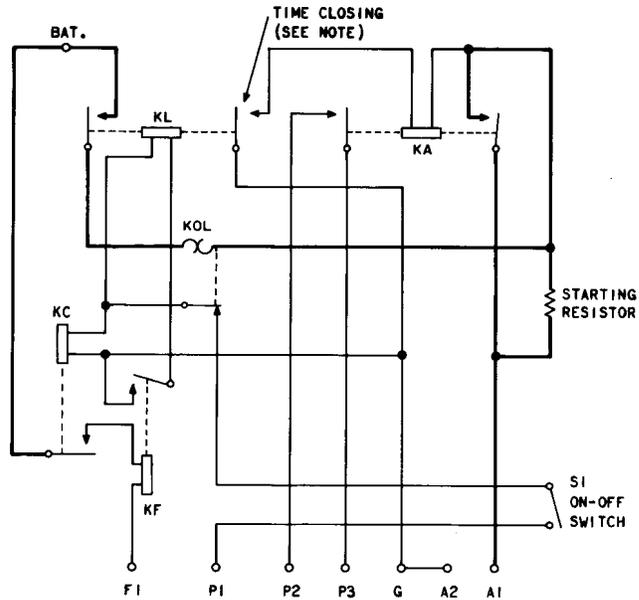
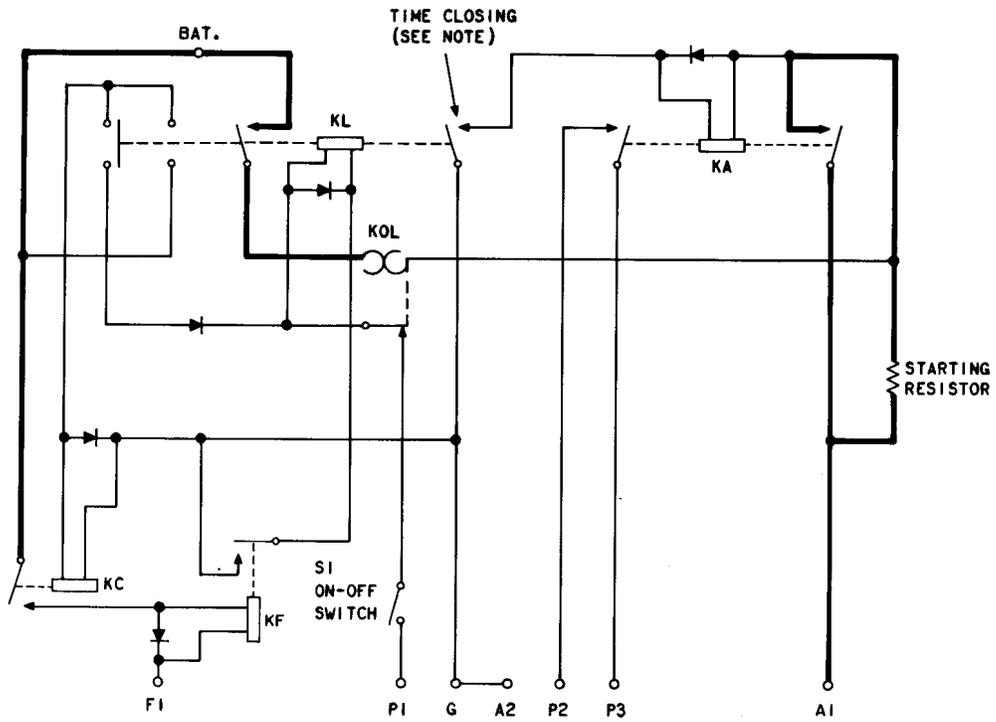


Fig. 4—KS-15868, L1, Starter Schematic



NOTE:
THIS IS A MICRO SWITCH CONTROLLED
BY A TIMER WHICH IS OPERATED
BY THE KL CONTACTOR.

Fig. 5—KS-15983, L1, L2, and L3, Starter Schematic



NOTE:
 THIS IS A MICRO SWITCH CONTROLLED
 BY A TIMER WHICH IS OPERATED
 BY THE KL CONTACTOR.

Fig. 6—KS-15983, L11, L21, and L31, Starter Schematic

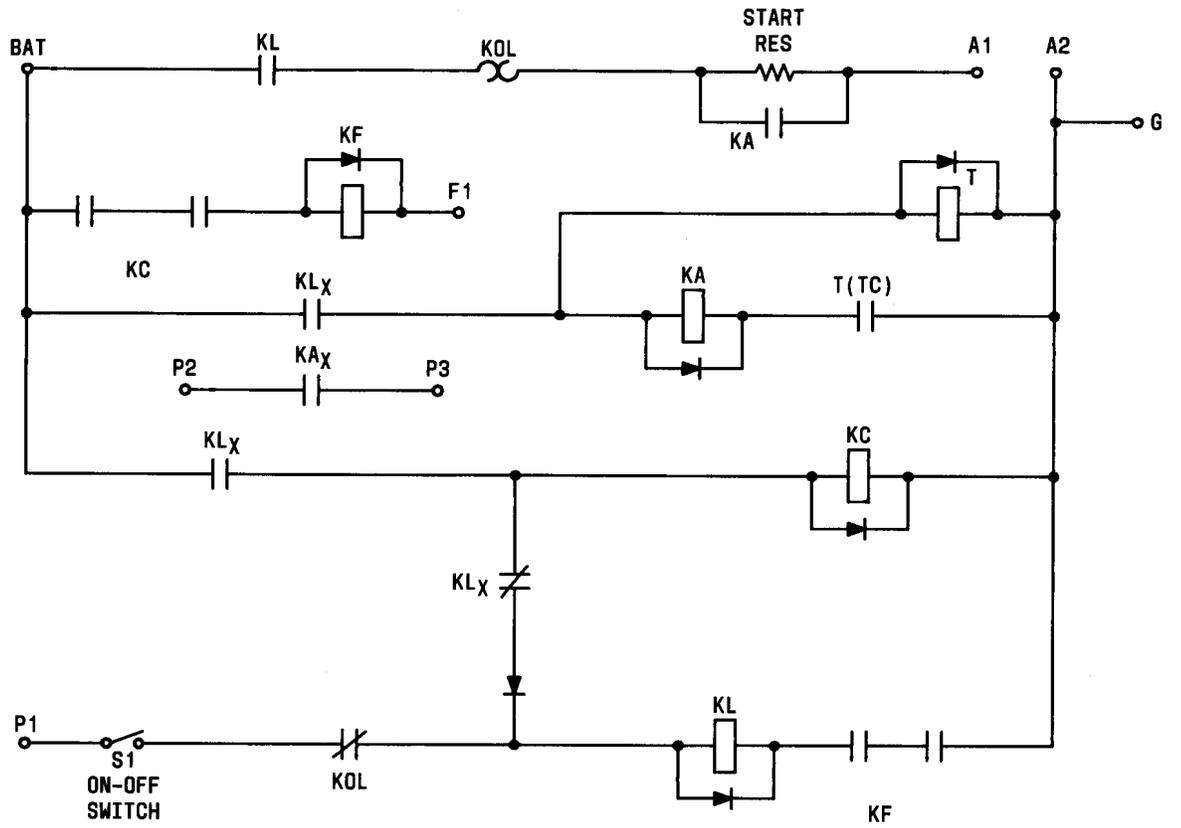


Fig. 7—KS-15983, L11A and L21A, Starter Schematic

2. REQUIREMENTS

Φ2.01 **Mounting:** Check mounting as follows:

- (a) The controller and starter shall be securely mounted.
- (b) All components shall be securely mounted to their respective supports. Screws or bolts used for holding components together shall be drawn up tightly. **Gauge by feel.**

Φ2.02 **Cleaning Contacts:** Check contacts as follows:

- (a) Contacts shall be clean and free from buildups which might interfere with reliable contact. **Gauge by sight.**
- (b) Contacts shall not be lubricated.

2.03 **Contact Pressure:** Using the R-2771 spring balance, check contact pressure as follows:

- (a) To check this requirement, pass a loop of cord around the head of the bolt which attaches the moving contacts to its support. Place the hook of the spring balance in this loop and, with the relay held operated manually, exert a pressure away from the stationary contact. Read the balance as the moving contact leaves the stationary contact. The pressure between main closed contacts shall be:

CODE	RELAY DESIGNATIONS	PRESSURE (POUNDS)
KS-5755, L1	AC, LC	Min 3-1/2
KS-5755, L2	AC, LC	Min 4-1/2
KS-15983, L1 L3, L11, L11A, and L31	KL	Nom 2
KS-15983, L1, L3, L11, L11A, and L31	KA	Nom 1/2
KS-15983, L2 L21, and L21A	KL, KA	Nom 4

- (b) To check this requirement, hold the armature firmly against the pole face, taking care not to press on any part of the contact finger or to force the armature out of alignment. Place the gauge against the contact finger as near the moving contact as possible and exert pressure with the gauge away from the stationary contact. Read the gauge as the moving contact leaves the stationary contact. Using the 68B gauge, the pressure between contacts of the KC and KF relays shall be:

CODE	PRESSURE
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	Nom 60 Grams

- (c) For relays not specified above, the contact pressure shall be such that contacts operate without excessive heating or roughening of their surfaces. **Gauge by sight.**

2.04 **Contact Follow:** Check relay contact follow (Fig. 8) as follows:

- (a) The contact follow of the NO auxiliary contacts of the relays shall be:

CODE	RELAY DESIGNATIONS	FOLLOW (INCH)
KS-5755, L1 and L2	LC, AC	Min 3/64
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	KA	Nom 1/4
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	KF, KC	Nom 1/32

(b) The contact follow of the main contacts of the relays shall be:

CODE	RELAY DESIGNATIONS	FOLLOW (INCH)
KS-15868, L1	LC, AC	Min 1/16
KS-15983, L1, L3, L11, L11A, and L31	KA	Nom 0.082, Min 1/16
KS-15983, L2, L21, and L21A	KA	Nom 1/8
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	KL	Nom 1/8

(c) The contact follow (Fig. 8, location B) for the KC and KF relays shall be Nom 0.020 inch. **Gauge by sight.**

2.05 Contact Gap and Operated Magnetic Gap: Check gap as follows:

(a) Using R-8550 scale, the contact gaps for relays designated AC, LC, KL, and KA measured between contacting surfaces shall be:

CODE	MAIN CONTACTS (INCH)	NO AUXILIARY CONTACTS (INCH)
KS-5755, L1 and L2	Min 3/4	Min 1/2
KS-15868, L1	Nom 13/32	—
KS-15983, L1, L3, L11, L11A, and L31 (KL)	Nom 3/8	—
KS-15983, L2, L21, and L21A (KL)	Nom 1/2	—
KS-15983, L1, L3, L11, L11A, and L31 (KA)	Nom 13/32	Nom 1/16
KS-15983, L2, L21, and L21A, (KA)	Nom 1/2	Nom 1/16

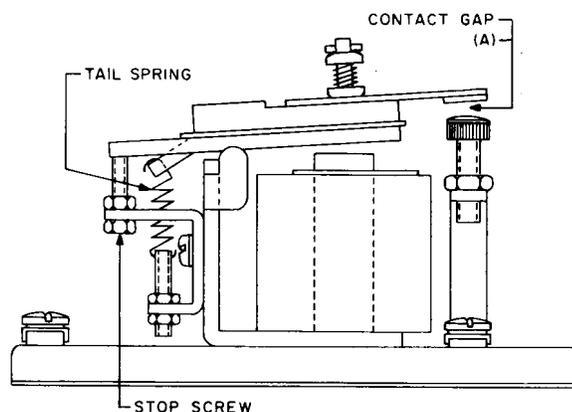
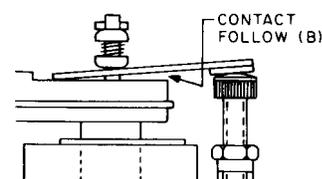
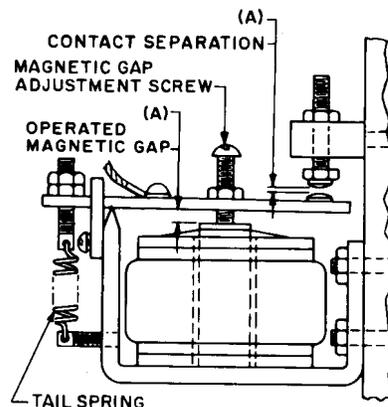


Fig. 8—Control Relays

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(b) For the SR, KF, or KC relays, the contact gaps and operated magnetic gaps (Fig. 8, location A) shall be:

CODE	CONTACT GAP (INCH)	OPERATED MAGNETIC GAP (INCH)
KS-5755, L1 & L2	Min 0.025	Max 0.180
KS-15868, L1	Min 0.025	Max 0.190
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	Nom 1/8	Max 0.003

2.06 Electrical Requirements: Check electrical requirements as follows:

(a) The relays 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, the following shall apply.

(1) Using the 35-type test set, verify that the relays operate on the following voltages:

CODE	RELAY DESIGNATIONS	VOLTS (MINIMUM)
KS-5755, L1 and L2	LC, AC	44
KS-15868, L1	LC, AC	125
KS-15983, L1, L2, L3, L11, L11A, L21, L21A, and L31	KL, KA	44

(2) SR relay shall operate on the motor starting inrush current, opening its normally closed (NC) contacts before its associated AC relay operates. Using an ammeter, verify the SR relay releases as the current decreases as follows:

CODE	MIN	AMPERES	MAX
KS-5755, L1	55		61
KS-5755, L2	135		145
KS-15868, L1	23		27

(3) Using an ammeter, verify that the OL relay releases on:

CODE	AMPERES
KS-5755, L1	71
KS-5755, L2	210

Φ(4) Using an ammeter, verify that the OL relay of the KS-15868, L1, starter releases the starter within 2 hours on a current of 27 amperes.

Φ(5) Using an ammeter, verify that the KOL relay of the KS-15983 starters releases the starter within 1 hour on currents of 75 amperes or 240 amperes, respectively.

Φ(6) Using an ammeter, verify that the KF relay of the KS-15983 starters operates on a current as follows:

CODE	AMPERES
KS-15983, L1, L11, and L11A	0.4
KS-15983, L2, L21, and L21A	0.65
KS-15983, L3, and L31	1.4

Φ(7) Using the KS-3008 stopwatch, verify that the time delay between the operation of the KL and KA contactors of the KS-15983 starter is 4.5 to 5.5 seconds.

(8) When the coil of the KL contactor of the KS-15983 starter is de-energized, the pneumatic timing mechanism shall reset instantly. **Gauge by sight.**

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

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

(e) Where C is specified on the circuit requirement table without cooling instructions, the relay shall be de-energized for at least 2 hours prior to the test.

Φ*2.07 **Temperature:** If the temperature is thought to be excessive, check as follows. Hold the bulb of the thermometer against the hottest spot in question for at least 5 minutes, covering the part of the bulb not in contact with the apparatus by a piece of REFRA-SIL* insulating material. Using a thermometer, the measured temperature shall not exceed the ambient room temperature by more than the following:

COILS	MAX
Class A insulation	65°C (149°F)
Class B or H insulation	85°C (185°F)
Frames and other parts in contact with insulation	55°C (131°F)
Contacts	65°C (149°F)
Resistors	250°C (482°F)

* Registered trademark of Hitco Materials Division.

3. APPARATUS

3.01 List of Tools, Gauges, Materials, and Test Apparatus: The following tools, gauges, materials, and test apparatus are used in this section.

TOOLS	DESCRIPTION
265C	Contact Burnisher Holder
365	Connecting Clip (as required)
417A	1/4-, 3/8-Inch Hex. Open-End Wrench
418A	5/16-, 7/32-Inch Hex. Open-End Wrench
KS-6367	7/16-, 5/8-Inch Open-End Wrench
KS-6780	Connecting Clip (jaws insulated with 108 cord tip)
KS-6854	Screwdriver
KS-14208	Brush (2 required)
—	5-Inch E Screwdriver
GAUGES	
68B	Gauge
KS-3008	Stopwatch
KS-6909	Gauge
R-1032	Thermometer
R-2771	0- to 6-Pound Spring Balance
R-8550	6-inch Steel Scale
TP-91681	0.160- and 0.180-Inch Thickness Gauge
MATERIALS	
KS-7187	Bond Paper
KS-19578, L1	Trichloroethane

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TOOLS	DESCRIPTION
—	Abrasive Paper 150 Grade
—	REFRASIL Insulating Material
—	1-Ounce Bottle
TEST APPARATUS	
35 Type	Test Set
1W13A	Cord (each end equipped with a 365 connecting clip or KS-6278 connecting clip) (as required)
1W13B	Cord (each end equipped with a 365 connecting clip or KS-6278 connecting clip) (as required)
—	Voltmeter, DC, Weston Model 931, ranges 300/150/75/30 (or replaced 281) (if 35-type test set equipped to indicate voltage is not available)
—	Ammeter, DC, Weston Model 901, with 50-millivolt drop external shunt, KS-9442, L6, for 150 amperes or KS-9442, L14, for 1500 amperes (as required)
—	Wire, 14 gauge or Lamp Cord, 2 Conductors

(2) and then brush them with a dry, clean KS-14208 brush as covered in (3).

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

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

(3) Brush the contacts with a dry, clean KS-14208 brush. If necessary, burnish the contacts as covered in (b).

(b) There shall be as little smoothing of contacts as is consistent with satisfactory operation. Contacts should be smoothed while closed. To close NO contacts, hold the relay operated manually or electrically. In the case of contacts not connected to the power supply, insert a 265C burnishing tool or strip of abrasive paper (with contacts connected to the power supply, abrasive paper only) between the contacts to be cleaned, and draw it back and forth until the buildups are removed entirely or are reduced sufficiently to insure reliable contact. Then clean the contacts as outlined in (a).

(c) If the contacts become badly worn, replace the contacts where possible; if not, replace the relay in question.

4. ADJUSTING PROCEDURES

4.01 Mounting: Tighten all loose screws and nuts using a screwdriver or wrench as required.

4.02 Cleaning Contacts: Check contacts as follows:

(a) The purpose of cleaning contacts is to remove any gummy or dirty substance that would interfere with reliable contact. It is not necessary or desirable to keep contacts polished or shining. The contacts should be disconnected from the power supply during the cleaning operation. To remove dirt and gummy substance, clean the contacts with KS-19578, L1, trichloroethane as covered in (1) and

4.03 Contact Pressure: Check contact pressure as follows:

(a) Contact pressure for the main contacts of the LC, AC, KL, and KA relays is not adjustable and will fall below minimum values given for the KS-5755 and KS-15983 controllers only as a result of excessive wear or filing of the contacts or weakening of the pressure spring. If contact heating or excessive buildups develop, check the pressure and replace the contacts and the spring.

(b) The contact pressure of the SR relays is dependent upon the tension in the tail spring. If the pressure of the contact is thought to be insuffi-

cient, readjust the contact gap toward the minimum and increase the tension of the tail spring. See that requirements 2.05 and 2.06 are met. For adjustment of the KC and KF relays, follow the procedures given in Section 040-811-701.

4.04 Contact Follow: Check contact follow as follows:

- (a) The NO auxiliary contacts of the LC and AC relays are adjusted for follow by loosening the mounting nuts which hold the stationary contact post in the panel and by moving the post as required. Tighten the nuts after the adjustment is completed.
- (b) If the contacts of the OL or KOL relay show overheating or roughening, the entire relay should be replaced.

4.05 Contact Gap and Operated Magnetic Gap: Check gap as follows:

- (a) If the contact gap of the LC and AC relays is less than the minimum, inspect the relay for obstructions which prevent it from releasing completely and remove them as required. The separation is not adjustable.
- (b) To adjust the NO auxiliary contacts of the KS-5755 controller, loosen the nuts which hold the stationary contact, make the required adjustment of their position along the stud, and retighten them.
- (c) To adjust the SR relay, operate it manually and set the operated magnetic gap at the maximum. This gap is determined by the length of the magnetic adjustment screw projecting through the armature and resting against the pole piece. To adjust, loosen the adjusting screw locknut and adjust the screw, as required. Tighten the locknut. After this gap has been set, hold the relay operated and adjust the contact gap to the minimum by means of the contact screw. Either the contact separation or the operated magnetic gap may require readjustment away from the extreme limits to meet requirement 2.06. The KC and KF relays are adjusted in a similar manner. See Section 040-811-701.

4.06 Electrical Requirements: Check electrical requirements as follows:

- (a) Where requirements are expressed in volts, a 35-type test set equipped to indicate volts should be used. If the available test set is not so equipped, it should be supplemented by a dc voltmeter. Where test set preparation has not been specified on the circuit requirement table, it is suggested that both of the relay coil terminals be disconnected and battery and ground be furnished through the test set with B/G/V or B/G preparation.
- (b) To check the SR series relay, connect the ammeter in series with the controller or starter, start the motor, and observe the current at the moment when the SR relay releases. In addition to the usual adjustment of tail spring tension, the operate value may be raised by increasing the contact gap and the release value lowered by decreasing the operated magnetic gap.
- (c) To check the OL relay, connect the ammeter in series with the coil of the relay, start the motor, and observe the current at the moment when the relay contacts operate.
- (d) To adjust the OL relay of the KS-5755 controller or KS-15983 starter, loosen the two screws on the front of the cover and move the cover up or down as required to bring the pointer opposite the required marking. The OL relay of the KS-15868 starter is not adjustable and if defective must be replaced as a unit.
- (e) To adjust the KOL relay of the KS-15983 starter, loosen the two screws on the front of the cover and move the cover up or down as required to bring the pointer opposite the required marking.
- (f) To check the KF field failure relay, connect the ammeter in series with coil of the relay, start the motor, and observe the current at the moment when the contacts operate.
- (g) To check the time delay interval between the activation of the KL and KA contactor relays perform the following:
 - (1) Remove the cover plate from the starter.

Note: Using the KS-3008 stopwatch, prepare to measure the time interval between the operation of the KL and KA relays.

(2) Momentarily operate the TEST key to the NO LOAD position and measure with the KS-3008 stopwatch the time delay interval between the operation of the KL and KA relays.

Requirement: The KA relay activates 4.5 to 5.5 seconds after the KL relay activates, the load transfers to the emergency supply, the AC FAIL lamp lights, and an audible alarm sounds.

(3) If the requirement in (2) is met, continue to (6). If the requirement is not met, continue to (4).

(4) Rotate knob with markings O A B C D E F on KL contactor slightly counterclockwise to decrease time interval and clockwise to increase time interval.

(5) Repeat Steps (2) through (4) until requirement in (2) is met.

(6) Operate the ALM CO key and continue to subparagraph 4.06(h).

Requirement: The AC FAIL lamp extinguishes, the audible alarm retires, and the FAIL G lamp lights.

(h) Allow the power plant to operate at full load for 15 minutes before continuing.

Note: Prepare to observe the resetting of the pneumatic timing relays as the plant transfers back to commercial ac power.

(1) Three-Phase Plants Only: Operate the TEST key to the NORMAL position.

Requirement: After about 4 minutes, the load transfers back to the commercial power service and the FAIL G lamp extinguishes.

(2) In the power plants equipped with the feature to allow manual transfer back to commercial ac power, operate the S1 switch to AC RESTORAL position about 4 minutes after the commercial ac power is restored.♦

4.07 Temperature: If the temperature exceeds the specified limit, check that requirements 2.02, 2.03, and 2.04 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 controller or starter may have to be replaced.