AMMETER RELAYS
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-5342, KS-5348, KS-5561, KS-5662, KS-5787, KS-15570, KS-15573, KS-15796, KS-15802, and KS-15803 ammeter relays.

1.02 This section is reissued to revise the requirement and adjusting procedures covering contact cleaning.

1.03 Reference shall be made to Section 020-010-711, covering general requirements and definitions, for additional information necessary for the proper application of the requirements listed herein.

1.04 ***Asterisk (*):*** Requirements are marked with an asterisk when to check for them would necessitate the 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.

1.05 Covers are dust tight and moistureproof. They should be removed as infrequently as possible to prevent dust, lint, or other dirt from getting on working parts, particularly relay contacts.

1.06 ***Description***

(a) ***KS-5342*** ammeter relays are available with 250-millivolt shunts in steps from 25 to 1200 amperes. Scales are marked 0 to 100 and readings are in per cent of shunt ampere rating. The loop resistance of shunt leads must not exceed 0.3 ohm.

(b) ***KS-5348*** ammeter relays are available with 250-millivolt shunts in steps from 25 to 1500 amperes. Scales are read in amperes and shunt leads are furnished with each ammeter relay. With a suitable relay connected to terminal 2 as shown in Fig. 7, a part of the relay coil current flows in the ammeter relay coil after high contact is made. This causes the high contact to break at a lower load current than that at which it makes and tends to prevent chatter.

(c) ***KS-5561*** ammeter relays are available with 250-millivolt shunts for 30 or 40 amperes. Scales are read in amperes. The loop resistances of the shunt leads should be 0.028 ohm. For example, 7 feet 0 inch of No. 16 wire.

(d) ***KS-5662*** ammeter relays are available in 100- and 200-ampere ratings for use with 250-millivolt shunts. Scales are read in amperes and shunt leads are furnished with each ammeter relay. With a suitable relay connected to terminal 2 as shown in Fig. 9, a part of the relay coil current flows in the ammeter relay coil after high contact is made. This causes the high contact to break at a lower load current than that at which it makes and tends to prevent chatter.

(e) ***KS-5787*** ammeter relays are available in 250-ampere ratings for use with 312.5-millivolt shunts. Scales are read in amperes and shunt leads are furnished with each ammeter relay. With a suitable relay connected to terminal 2 as shown in Fig. 10, a part of the relay coil current flows in the ammeter relay coil after the high contact is made. This causes the high contact to break at a lower load current than that at which it makes and tends to prevent chatter.

(f) ***KS-15570 and KS-15573*** ammeter relays are available with 250-millivolt shunts in steps from 100 to 1500 amperes. Scales are read in amperes and shunt leads are furnished with each ammeter relay. With a suitable telephone-type relay connected to terminal 2 as shown in Fig. 11 or 12, a part of the telephone-type relay coil current flows in the ammeter relay coil after high contact is made. This current adds to that which normally flows in the ammeter relay coil and causes high-con-

tact lockup. That is, it causes the high contact to break at a lower load current than that at which it makes and tends to prevent chatter.

(1) ***KS-15570 Ammeter Relay:*** This circuit associated with the low stationary contact and moving pointer will not provide antichatter torque for the operating coil.

(2) ***KS-15573 Ammeter Relay:*** When the low contact is made, part of the telephone-type relay current flows through the ammeter relay coil in a direction which is opposite to normal. This causes low-contact lockup and prevents chattering.

(g) ***KS-15796*** ammeter relays are available for use with a 250-millivolt external shunt. Scales are marked 0 to 100 and readings are in per cent of 250-millivolt shunt drop. With a suitable telephone-type relay connected to terminal 2 as shown in Fig. 13 or 14, a part of the telephone-type relay coil current flows in the ammeter relay coil after high contact is made. This current adds to that which normally flows in the ammeter relay coil and causes high-contact lockup. That is, it causes the high contact to break at a lower load current than that at which it makes and tends to prevent chatter. When the low contact is made, part of the telephone-type relay current flows through the ammeter relay coil in a direction which is opposite to normal. This causes low-contact lockup and prevents chattering.

(h) ***KS-15802*** ammeter relays are used to measure current values up to 156 milliamperes. The scale is graduated in milliamperes. The internal circuit arrangement of the relay is such that a permanent resistance is bridged across the input terminals (1 and 2). The operation of the contacts does not affect the operation of the relay.

(i) ***KS-15803*** ammeter relays are used to measure current values up to 125 milliamperes. The scale is graduated in milliamperes. The internal circuit arrangement of the relay is such that a resistance network is bridged across the input terminals (1 and 2) and the value of the resistance is varied dependent upon external circuit operation. The current through this network determines the movement of the pointer. The operation of the contacts affects the value of resistance in the network.

(j) ***Contacts*** are furnished as follows.

	ADJUSTABLE	ADJUSTABLE WITH COVER ON	APPROX FACTORY SETTING
KS-5342			
Low Contact	0 to 95%	Yes	—
High Contact	5 to 100%	Yes	—
Spread, High to Low	5% Min	No	10%
KS-5348			
Low Contact	−10 to 90%	†No	−5%
High Contact	0 to 100%	†Yes	100%
KS-5561, LO1			
Low Contact	0 to 5A	No	3A
High Contact	25 to 30A	No	30A
KS-5561, LO2			
High Contact	30 to 40A	No	35A
KS-5562, KS-5787, and KS-15796			
Low Contact	0 to 90%	No	10%
High Contact	10 to 100%	Yes	100%
KS-15570			
Low Contact	−10 to 90%	No	−5%
High Contact	0 to 100%	Yes	100%
KS-15573			
Low Contact	0 to 40%	No	10%
High Contact	60 to 100%	Yes	100%
KS-15802			
Low Contact	0 to 40%	No	4%
High Contact	60 to 100%	Yes	80%
KS-15803			
Low Contact	0 to 80%	No	25%
High Contact	20 to 100%	Yes	75%

†Prior to 1947, the low contact on the KS-5348 was adjustable and the high contact was not adjustable, with the cover on.

2. REQUIREMENTS

2.01 ***Tightness of Shunt and Shunt Leads:*** The connections on the shunt and shunt leads shall be tight.

> ***Caution: Shunts reach temperatures at which it is dangerous to touch them.***

Gauge by feel.

Check this requirement periodically.

2.02** ***Contact Cleaning: Contacts shall be cleaned as covered herein and in Section 069-306-801. ←

2.03** ***Freedom of Movement: When the current value is gradually changed, the pointer shall smoothly follow this change.

Gauge by eye.

2.04** ***Contact and Pointer Accuracy: The accuracy of the pointer reading at any convenient point between contact settings shall be ±3 per cent of the full-scale reading. The difference between pointer and stationary contact readings in per cent of full-scale reading, at the time when the contacts make, shall be within the following.

KS-5342 ± 3 per cent
KS-5348 ± 2 per cent
KS-5561 ± 2 per cent
KS-5662 ± 2 per cent
KS-5787 ± 2 per cent
KS-15570 ± 2 per cent
KS-15573 ± 2 per cent
KS-15796 ± 2 per cent
KS-15802 ± 2 per cent
KS-15803 ± 2 per cent

2.05 ***Temperature:*** The shunt temperature shall not exceed 120 C (248 F).

Use the R-1032 thermometer. ←

If conditions indicate that the temperature is excessive, that is, coloration or smoking, check as follows. Hold the thermometer bulb against the shunt and cover that part of the bulb not in contact with the shunt with a small felt pad. Where the shunt has two or more laminations, the bulb may be held between any two laminations and the felt pad omitted.

> ***Note:*** Where high temperatures cause the felt pad to smoke or char, asbestos on the face of the pad is suggested.

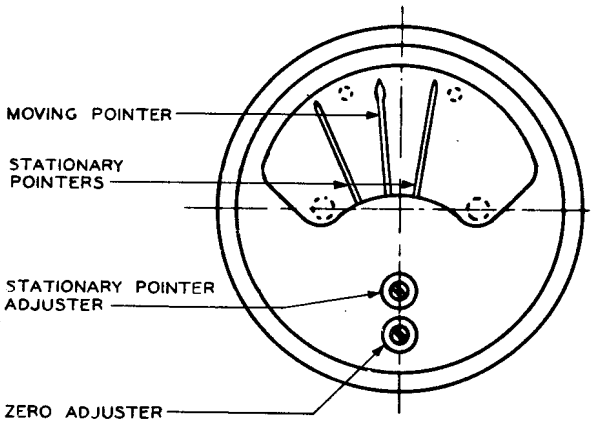

Fig. 1

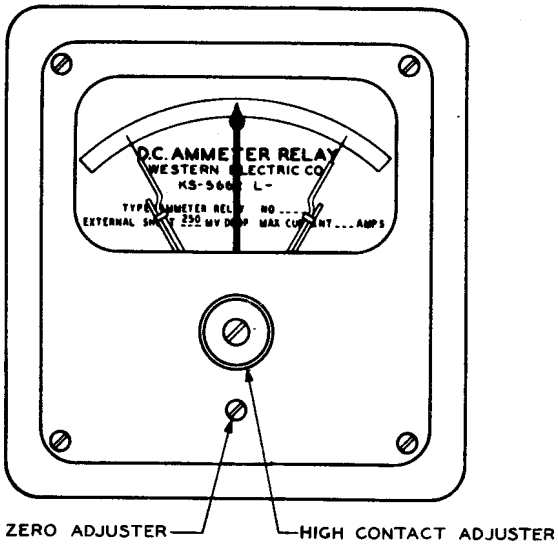

Fig. 2

Fig. 1 and 2 – Typical Ammeter Relays

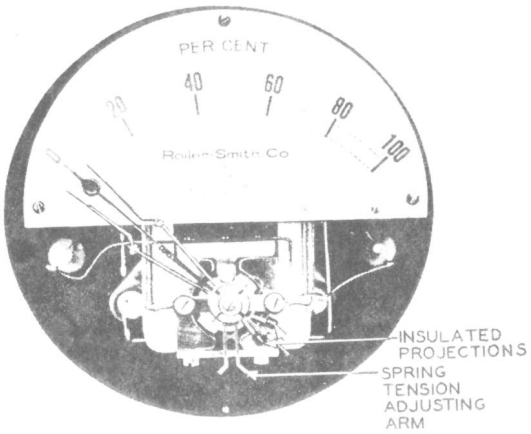

Fig. 3

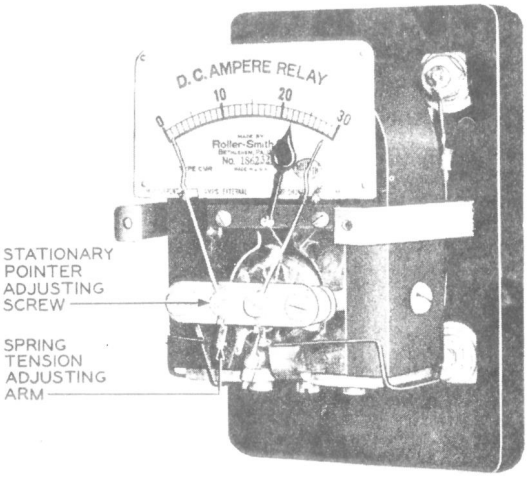

Fig. 4

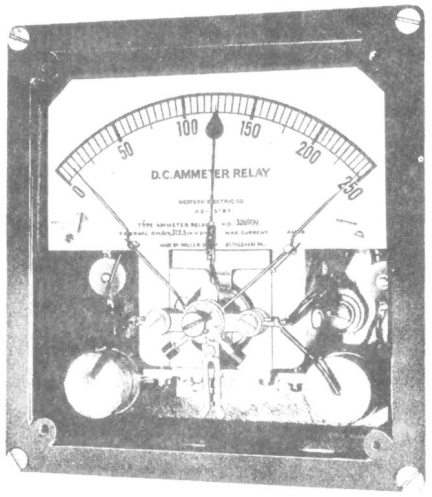

Fig. 5

Fig. 3, 4, and 5 – Typical Ammeter Relays — Covers Removed

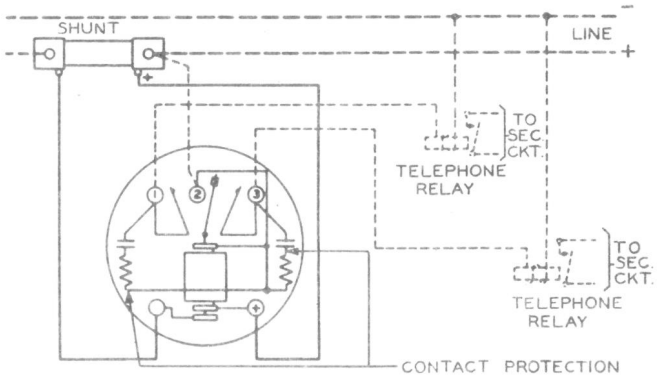

Fig. 6 – Schematic for KS-5342

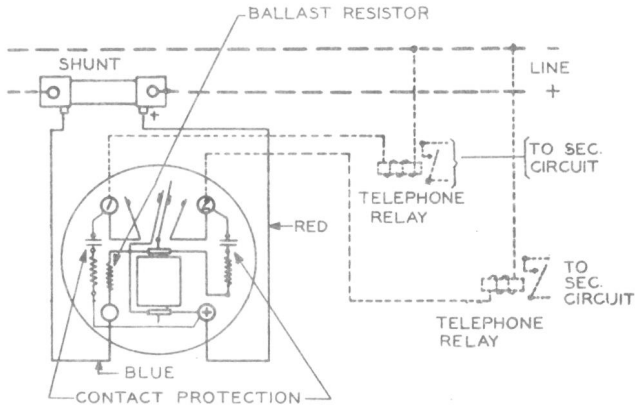

Fig. 7 – Schematic for KS-5348

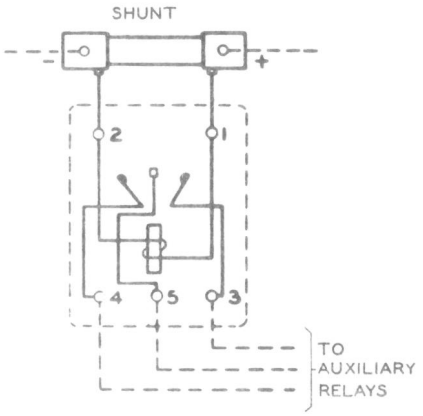

Fig. 8 – Schematic for KS-5561

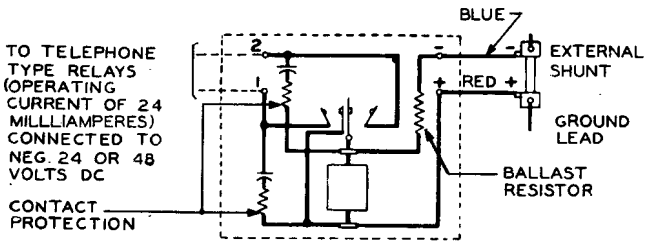

Fig. 9 – Schematic for KS-5662

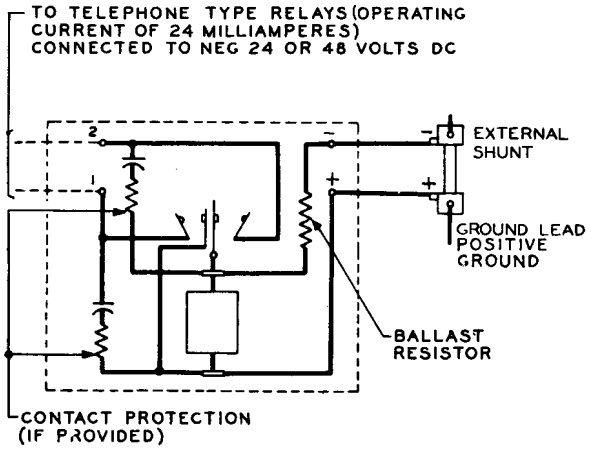

Fig. 10 – Schematic for KS-5787

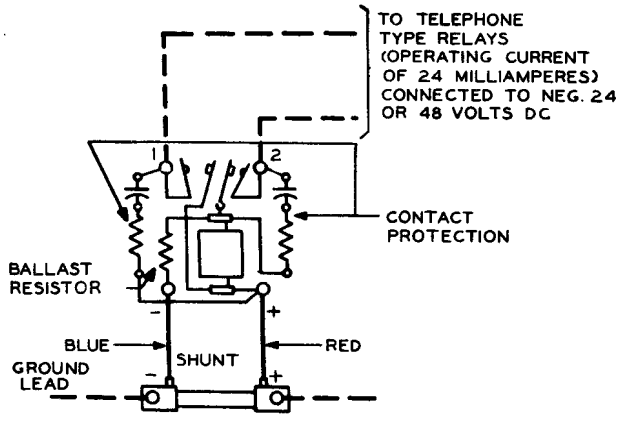

Fig. 11 – Schematic for KS-15570

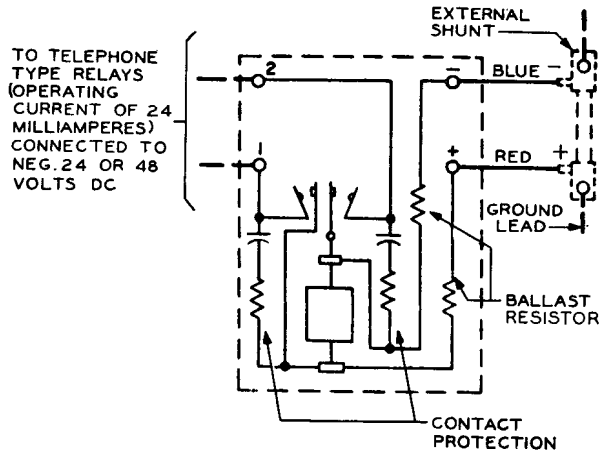

Fig. 12 – Schematic for KS-15573

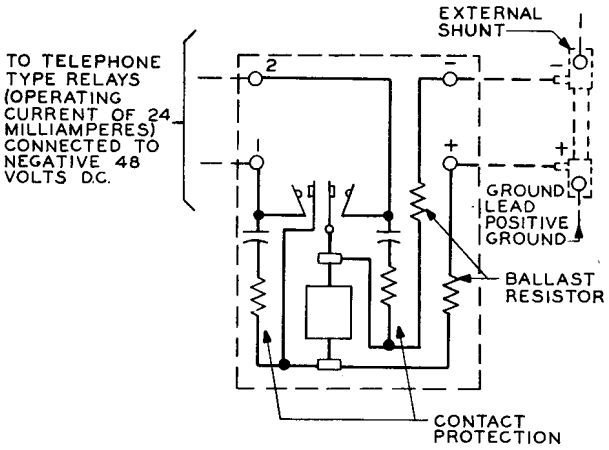

Fig. 13 – Schematic for KS-15796, List 1

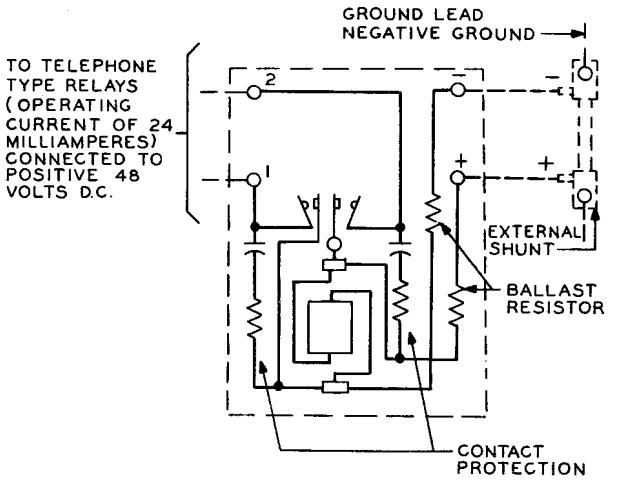

Fig. 14 – Schematic for KS-15796, List 2

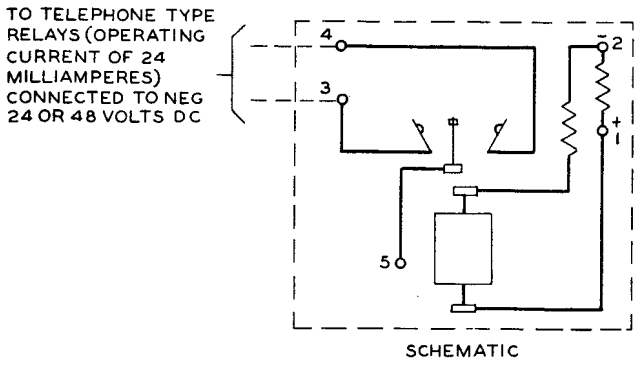

Fig. 15 – Schematic for KS-15802

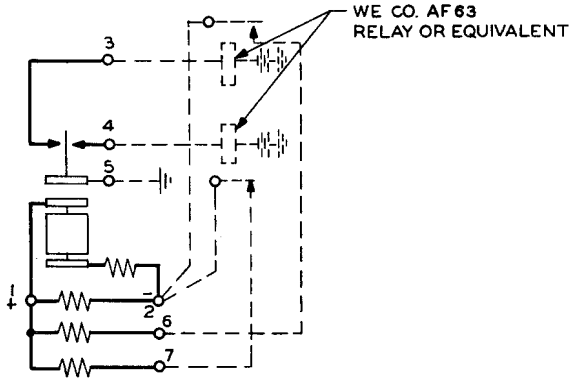

Fig. 16 – Schematic for KS-15803

3. ADJUSTING PROCEDURES

3.001 *List of Tools, Gauges, and Materials*

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-2512	Adjustable wrench, single end 8 inches or open end as required (to tighten current connection on shunts). Shunts require wrenches with openings as follows. 5 to 20A — 7/16 inch 25 to 50A — 9/16 inch 75 to 1000A — 3/4 inch 1200 to 1500A — 7/8 inch
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
GAUGES	
KS-8039	Volt-Milliammeter, dc (Model 622)
—	Ammeter, dc (Weston Model 1)
R-1032, Detail 1 or 2	Thermometer
MATERIALS	
—	Felt or Asbestos Pad

3.01 *Tightness of Shunt and Shunt Leads* (Reqt 2.01)

(1) When necessary, tighten connections to the shunt and shunt leads using the R-2512 wrench.

3.02 *Contact Cleaning* (Reqt 2.02)

(1) Clean the contacts as covered in Section 069-306-801. After doing this, check that reliable circuit operation is obtained. If it is still not satisfactory, repeat the cleaning operation until it is satisfactory, checking after each flushing operation.

3.03 *Freedom of Movement* (Reqt 2.03)

(1) Vary the current through the shunt. If the pointer does not follow this change smoothly, report it to the supervisor who may wish to return it for repairs.

3.04 *Contact and Pointer Accuracy* (Reqt 2.04)

(1) During calibration of the ammeter relay, the secondary standard used for determining actual current through the shunt may be either a Weston Model 1 dc ammeter with its shunt connected in series with the ammeter relay shunt or a KS-8039 volt-milliammeter. Use of a KS-8039 volt-milliammeter as the secondary standard millivoltmeter is covered in (2).

(2) On ammeter relay shunts having 250-millivolt drop at rated full load, 40 per cent of full load would cause full-scale deflection on a KS-8039 volt-milliammeter if the shunt leads were connected to its 100-MILLIVOLT binding post. In a like manner, an ammeter relay shunt having 312.5-millivolt drop at full load, with 32 per cent of full load connected to the same binding post, would cause a 100-millivolt drop with a resulting full-scale deflection of

the KS-8039 volt-milliammeter. It is suggested, therefore, that when the KS-8039 volt-milliammeter is used, the 100-MILLIVOLT post be used for loads up to 35 per cent and 30 per cent of the ammeter relay full scale for 250- and 312.5-millivolt drops, respectively; and the 1.5-volt tap on the VOLTS switch be used for larger loads.

(3) Vary the load as required and check the accuracy of relay contact settings and pointer readings.

Example 1: With the 100-millivolt connection on the KS-8039 volt-milliammeter, 75 on the 0-300 scale would represent $\frac{75}{300} \times 100 = 25$ millivolts. This is $\frac{25}{250} = 10$ per cent of the 250-millivolt shunt rated drop and if a 1000-ampere scale on the ammeter relay is used, the correct reading is 100 amperes. Or $\frac{25}{312.5} = 8$ per cent of the 312.5-millivolt shunt rated drop and if a 250-ampere scale is used on the ammeter relay, the correct reading is 20 amperes.

Example 2: With the 1.5-volt connection on the KS-8039 volt-milliammeter, 20 on the 150 scale would represent $\frac{20}{150} \times 1500 = 200$ millivolts. This is $\frac{200}{250} = 80$ per cent of the 250-millivolt shunt rated drop and if an 800-ampere scale on the ammeter relay is used, the correct reading is 640 amperes. Or $\frac{200}{312.5} = 64$ per cent of the 312.5-millivolt shunt rated drop and if a 250-ampere scale on the ammeter relay is used, the correct reading is 160 amperes.

(4) If the relay does not meet the specified accuracy requirements, clean the contacts as covered in 3.02. If after cleaning, the relay still does not function satisfactorily, readjust as required.

(5) To adjust, proceed as follows.

(a) ***KS-5342 Pointer:*** Remove cover and move the spring tension adjusting arm with a small screwdriver or other pointed tool.

(b) ***KS-5342 Contacts:*** The stationary pointers may be adjusted by the stationary pointer adjuster on the front of the cover. However, if the spacing between the two stationary pointers is to be changed, remove the cover and manipulate the insulated projections on the lower part of the pointer arm. These contacts cannot be set closer together than 5 per cent.

(c) ***KS-5348, KS-5662, KS-5787, KS-15570, KS-15573, KS-15796, KS-15802, or KS-15803 Pointer:*** Adjust by the zero adjuster on the front of the cover.

(d) ***KS-5348, KS-5662, KS-5787, KS-15570, KS-15573, KS-15796, KS-15802, or KS-15803 Contacts:*** One stationary pointer may be adjusted by the stationary pointer adjuster on the front of the cover. To adjust the other stationary pointer, remove the cover and manipulate the insulated projection on the lower part of the pointer arm.

(e) ***KS-5561 Pointer:*** Remove the cover and move the spring tension adjusting arm with a small screwdriver or other pointed tool.

(f) ***KS-5561 Contacts:*** Remove the cover and change the setting of the stationary pointer adjusting screw. A pin has been provided to limit the adjustment because the moving pointer contact will not make contact with the stationary pointer contact outside of a given range.

(6) After adjustment, replace the cover and recheck. If there is an adjustment screw on the outside of the cover, it is suggested that it be covered with wax or a sticker to insure that the adjustment will not be tampered with.

3.05 ***Temperature*** (Reqt 2.05)

(1) If the temperature exceeds the specified limit, replace the shunt.