KS-14399 CONTACT-MAKING AMPERE-MINUTE METERS
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers KS-14399 contact-making ampere-minute meters manufactured by the Sangamo Electric Company.

1.02 This section is reissued to omit information with reference to the cleaning and replacement of armature pivots and bearings. Detailed reasons for reissue will be found at the end of the section. Since this reissue covers a general revision, the arrows used to indicate changes have been omitted.

1.03 The first use of this meter was in the traffic register circuit of the No. 4A toll switching system.

1.04 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.

*1.05 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.

1.06 No adjustment shall be made on these meters without authorization from the supervisor.

1.07 This meter has a full-load rating of 2.5 amperes, a disc constant of 10-ampere-seconds per disc revolution, a speed of 15 rpm at full load, and requires six revolutions of the meter element for each contact closure.

2. REQUIREMENTS

2.01 General Condition: The case shall be in good mechanical condition and securely fastened to the meter. The glass shall be undamaged and securely fastened. It shall be dust tight.

2.02 Mounting: The meter shall be securely mounted with its base in a vertical plane with the top edge of the base approximately level.

Use level.

*2.03 Direction of Rotation: The meter shall be so connected that the counterweight rotates in a counterclockwise direction as viewed from above, or from left to right as viewed from the front when current is flowing.

2.04 Accuracy: At 70F, the speed of the meter with current flowing through it shall be:

Per Cent of Rated Load	Number of Revolutions	Seconds Min	Seconds Max	Approximate Contact Closures
10 (0.25 Amps)	6	234.0	246.0	1.0
100 (2.50 Amps)	15	59.4	60.6	2.5
200 (5.00 Amps)	30	-	62.1	5.0

Note: The meter should be hot before making these accuracy measurements. That is, the thermocouple should be connected to 48 volts for at least 30 minutes and the meter element should carry one-half full-load current for at least 30 minutes prior to checking for accuracy.

2.05 Contacts shall be clean and smooth, and shall make reliable contact.

Gauge by eye and by the action of associated relays.

The contacts shall make one closure for every six revolutions of the meter disc. The contact pressure shall be

Min 1.25 grams
Max 1.75 grams

Use the No. 70F gauge.

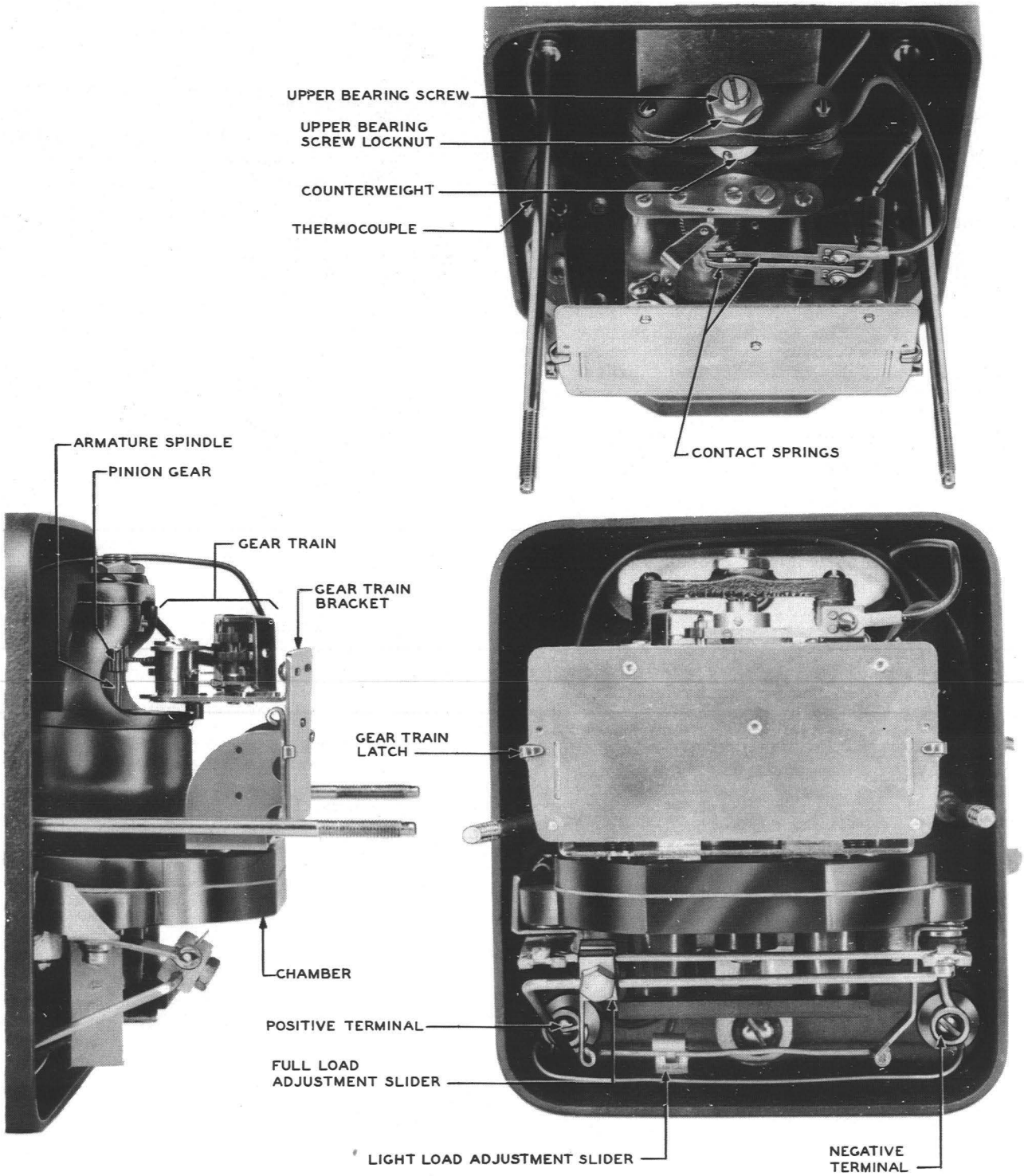

Fig. 1 - KS-14399 Ampere-Minute Meter

3. ADJUSTING PROCEDURES

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

Code or Spec No.	Description
Tools	
265C	Contact Burnisher
KS-14164	Brush
R-1542	Adjustable Wrench, 6 inches
R-6854	Screwdriver
-	P-Long-Nose Pliers 6-1/2 inches
Gauges	
70F	Gauge 10-0-10 Grams
KS-3008	Stop Watch
-	Metallic Level, 2-1/2 inches, L.S. Starret Co. No. 135
-	Volt-Ammeter D.C. Weston Model 281 Range Volts 60/30/3, Amperes 15/3/0.3
Materials (See Section 065-370-101)	
KS-14666	Cleaning Cloth
Test Apparatus	
18 Type	Resistors, as Required
-	Instrument Fuse, 6 Amp, 3AG
-	Storage Battery, One cell of Central Office Battery, or One Cell of an Automotive Battery, Obtained Locally
-	Battery Clips
-	Rheostat, Ohmite, Type 0528, 5 ohm, 150 watt
-	Rheostat, Ohmite, Type 0309, 1 ohm, 50 watt
-	Switch, Single Pole, Single Throw, 5-ampere Capacity Obtain Locally
-	Wire, as Required

3.002 Test Circuit: With the ampere-minute meter mounted and the red thermocouple lead connected to 48-volt central office battery, remove the associated No. 347 patching plug and insert a make-busy plug into the jack to maintain continuity of service. Connect in series, one cell of the central office battery or a storage battery, the No. 281 ammeter of appropriate range, a fuse, a switch, and a suitable rheostat (see 3.003) to the main terminals of the meter as shown in Fig. 2. Connect central office ground to the positive terminal of the ampere-minute meter. Use wire of a size adequate to carry the current. Battery clips may be used for connections.

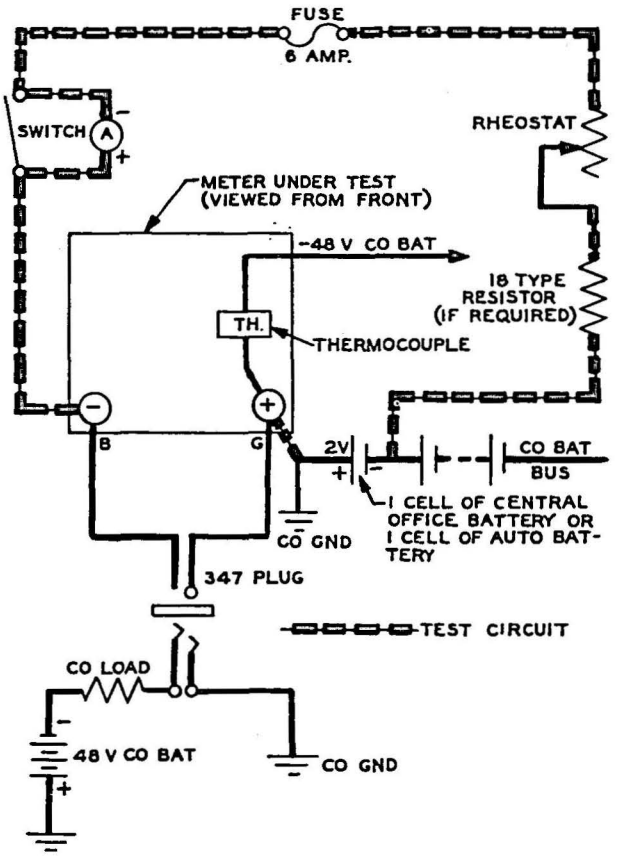

Fig. 2 - Test Circuit for KS-14399 Ampere-Minute Meter

Note: If this meter is tested prior to central office installation, the red thermocouple lead must be connected to the negative side of a 48-volt battery and the positive terminal of the meter under test connected to the positive side of the 48-volt battery. The storage battery, ammeter fuse, switch, and rheostat should be connected in the same way as for a permanently mounted meter. Make sure that the meter under test is mounted or held in an operating position; that is, the base is in a vertical plane with the top edge of the base approximately level. Use level.

3.003 Rheostats: The ohmite rheostats are adjustable over their entire range.

In testing the meter at light load, it may, in some instances, be necessary to insert additional resistance in the circuit to secure the small current desired. The 18-type resistors of 0.5- to 4.0-ohm rating are satisfactory. Some of the 18-type resistor codes are:

Code	Ohms
18AL	4.0
18GC	3.2
18AY	2.4
18BB	2.0
18CH	1.2

3.01 General Condition (Rq 2.01)

(1) Replace a damaged case or a broken glass. Retighten wing nuts or the nuts which hold the glass, as necessary, to exclude dust. Adjust or replace gaskets as necessary.

3.02 Mounting (Rq 2.02)

(1) If the top edge of the meter is not level, loosen the nuts on the mounting studs and correct. Tighten all nuts firmly after the adjustment has been made.

*3.03 Direction of Rotation (Rq 2.03)

(1) If the counterweight rotates in the wrong direction, reverse the connections at the main terminals after first checking the polarity or color code of all connecting wires as shown on the associated circuit drawing.

3.04 Accuracy (Rq 2.04)

(1) Before testing the meter, see that all internal connections, including those at the shunt, are tight. Set up the test circuit as shown in 3.002. Let the circuit warm up for at least 30 minutes as shown in the note of requirement 2.04. The temperature of the room should be as near 70F as possible. After warm-up, the meter should be gently shaken in a tilted position to permit the escape of any air bubbles that may be trapped in the mercury under the armature disc. This manipulation of the meter to remove any entrapped air is very important as the presence of air bubbles pressing against the meter disc can be the source of serious errors in meter registration. Test at 100 per cent, 200 per cent, and 10 per cent load in the order named.

*(2) Disconnect the 48-volt lead from the thermocouple circuit and test at light load. If the meter does not run slower than before, the thermocouple is defective and should be replaced. If no replacement of the thermocouple is indicated, replace the connection.

Meter Running Slow

*(3) Remove the leads from the contact springs and remove the gear train by releasing the gear train latches and lifting out the gear train bracket holding it to the meter. Hold the pinion gear on the armature spindle between the thumb and first finger and rotate the armature slowly. Friction will be apparent if the armature is rubbing against the top or bottom of the chamber. If it binds, loosen the upper bearing screw locknut and while rotating the armature slowly, turn the upper bearing screw until the armature bottoms lightly in the chamber. Then turn the screw back, one-half to three-quarters of a full turn and tighten the locknut. The armature should now turn freely and it should be possible to force it down about 1/64 inch (visual check) before it strikes the bottom of the chamber.

*(4) Test the meter with the gear train off. If it now registers within the requirement, or nearly so, the gear train is at fault. Inspect the gear train for dust and dirt and clean it with the brush. Examine the contacts as covered in 3.05. Remount the gear train on the meter and retest on light load. If the meter nearly meets the requirement, endeavor to correct by moving the light-load adjustment slide to increase the speed. If it is found impossible to bring up the speed sufficiently by this means, replace the gear train with a new one having the same ratio. After mounting a new gear train, adjust the light-load speed by means of the light-load adjustment.

*(5) If the meter runs too slowly when tested on light load with the gear train off, shake to remove air bubbles as described in 3.04(1). If the meter still runs slow after shaking, replace the meter.

*(6) Test the meter for 100 per cent load. If it is not within the limits, move the full-load adjustment slider of the meter as necessary. Then test with 200 per cent load. If it is not within limits, it will be necessary to readjust the full-load slider until both the 100 per cent and 200 per cent load requirements are met with the same setting of the slider. Then test the meter for the 10 per cent load requirement. The light-load adjustment slider may be moved to the right or left to bring the meter within the desired limits at light load. After making the light-load adjustment, check the 100 per cent and 200 per cent requirements to see that their limits are not exceeded as a result of the change in the light-load adjustment.

Meter Running Fast

*(7) If the meter runs too fast, correct by moving the full-load adjustment slider. If this fails, it will be necessary to replace the meter.

3.05 Contacts (Rq 2.05)

(1) As required, remove dirt from the contacts with the brush or a cleaning cloth and smooth them with the contact burnisher. If they do not make reliable contact, adjust as covered below.

(2) The contacts may be adjusted for reliable operation by shaping the contact springs. No other adjustments are feasible, and if difficulties arise, replace the entire gear train, including the contact mechanism.

(3) The closures of the contacts can be counted by observing the number of operations of the associated relay or counter.

REASONS FOR REISSUE

1. To revise Fig. 1.

2. To omit old Fig. 2.

3. To omit procedures covering the cleaning and replacement of armature, pivots, and bearings, and to revise the List of Tools and Materials (3.001) accordingly.