

ROYAL CANADIAN AIR FORCE



REPAIR & OVERHAUL  
INSTRUCTIONS

QUANTITY INDICATORS

(LIQUIDOMETER)

**"REVISION"**  
NOTICE

**LATEST REVISED PAGES  
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Insert revised pages into basic  
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# LIST OF RCAF REVISIONS

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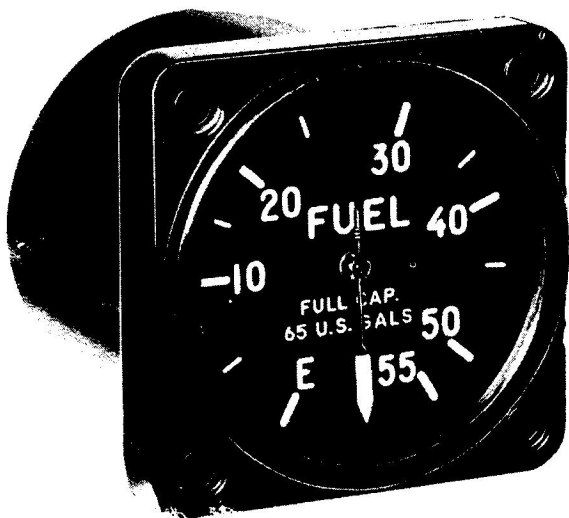


Figure 1-1. Typical EA-100AN Indicator

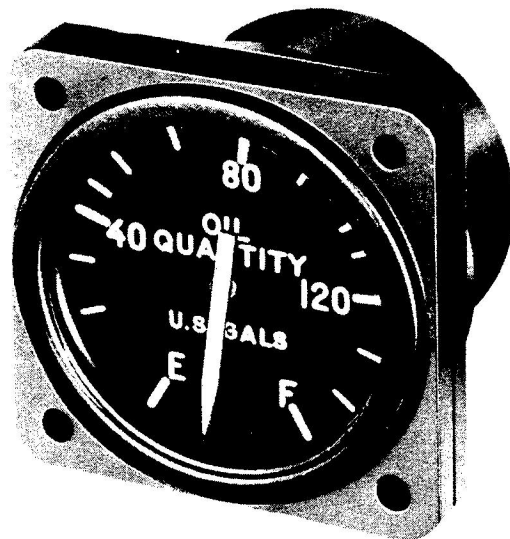


Figure 1-4. Typical EA-100ANH Indicator



Figure 1-2. Typical EA-102AN Indicator

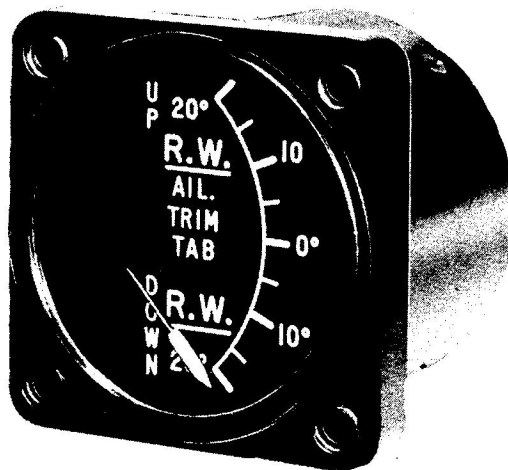


Figure 1-5. Typical EA-133AN Indicator

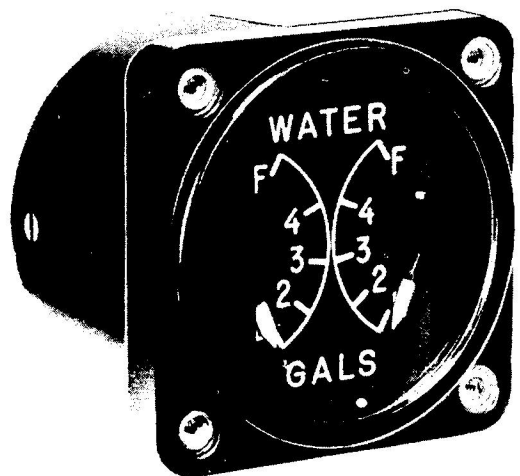


Figure 1-3. Typical EA-148AN Indicator

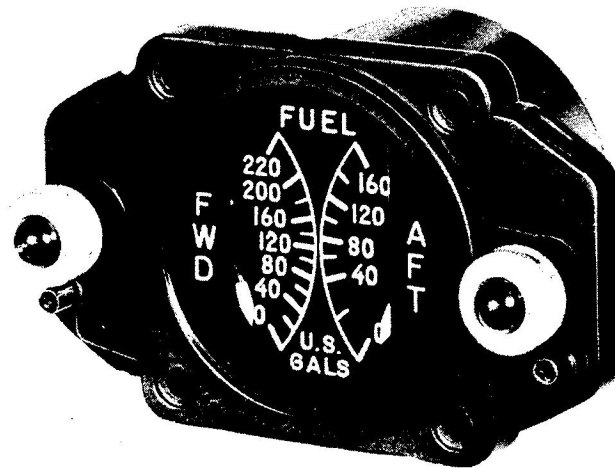


Figure 1-6. Typical EA-148ANW Indicator

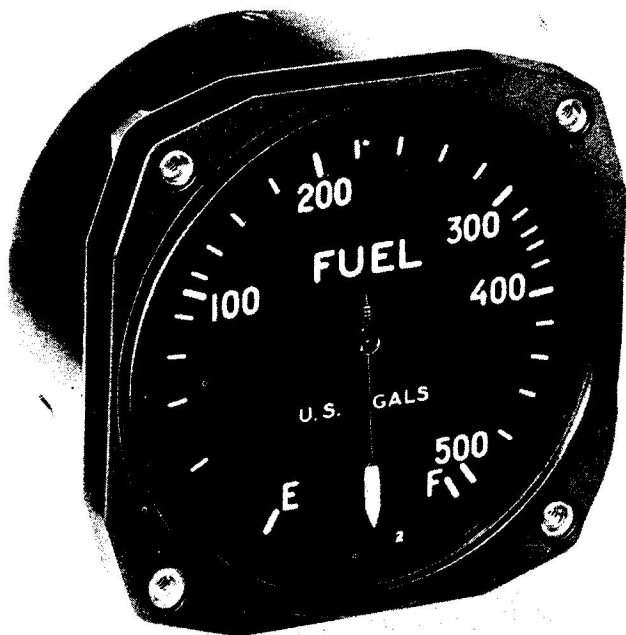


Figure 1-7. Typical EA-101AN Indicator

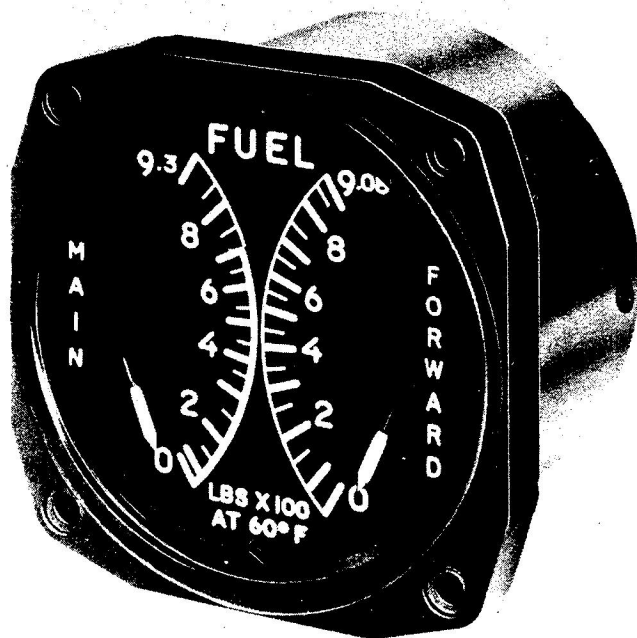


Figure 1-8. Typical EA-124AN Indicator

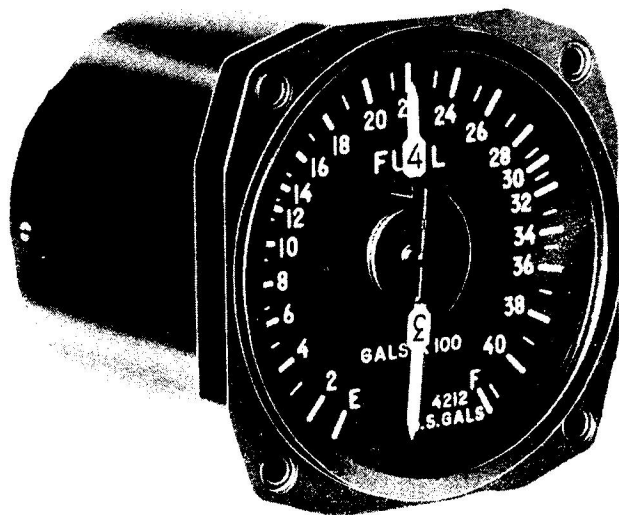


Figure 1-9. Typical EA-150AN Indicator

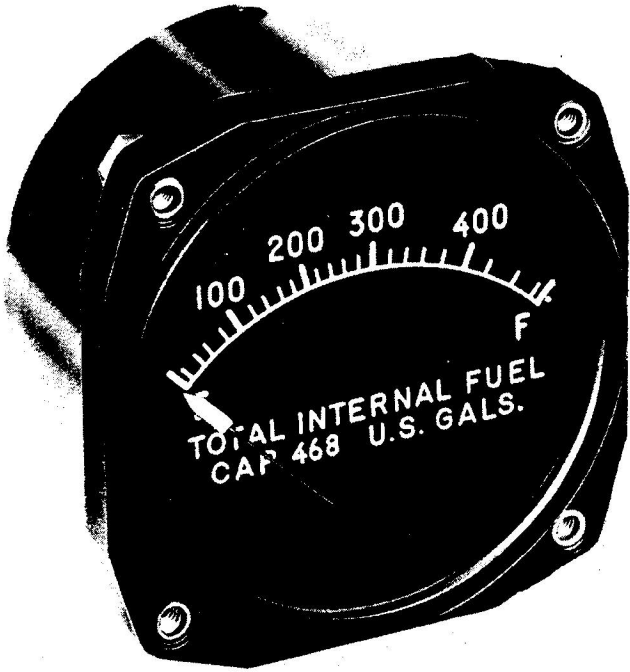


Figure 1-10. Typical EA-303AN Indicator

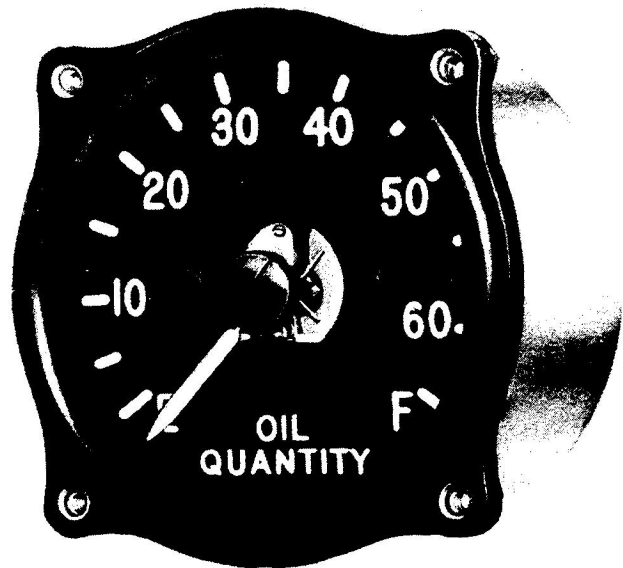


Figure 1-11. Typical EA-31 Indicator

## SECTION I INTRODUCTION

### 1-1. GENERAL.

1-2. This handbook contains the basic overhaul instructions for electrically operated indicators manufactured by the Liquidometer Corporation, Long Island City 1, N. Y.

1-3. The indicators covered herein are divided into families or groups covering various types including the hermetically sealed indicators. These indicators are used for gauging fuel quantity, oil quantity, anti-icing fluid quantity, hydraulic fluid, water, water injection, aileron trim tabs and oil cooler flaps.

### 1-4. LIQUIDOMETER INDICATORS.

1-5. The indicator and transmitter make a complete system for gauging the contents of fuel tanks, etc. The indicator is usually mounted on the instrument panel and connected electrically to the transmitter which is mounted on the tank to be gauged. The electrical mechanism of each indicator is independently shielded so that all the mechanisms (if there are one or more) within the close confines of the indicator case function independently without electrical interference between them.

#### Note

The hermetically sealed indicators function the same as the other indicators except for the

general disassembly as shown in Section II. These differences are specifically shown in the data sheets under Section IV.

1-6. The electrical arrangement of a single 90-degree type indicator is shown in Figure 1-12. The indicator consists of a magnetic rotor carrying a suitable pointer. The rotor is surrounded by three coils, the bottom one being known as a scale control coil. The connections shown are for 90-degree indicators resulting in a clockwise motion of the pointer. For 120-degree indicators the wiring is identical with the exception that the polarity of the scale control coil is reversed. A second magnet is provided to bring the pointer off the empty end of the scale when the current is off. A voltage limiting resistor protects the system from overload should the transmitter be accidentally short circuited. The indicator is connected to the transmitter by two wires in grounded system and by three wires in an ungrounded system.

1-7. The single 300-degree scale indicator shown in Figure 1-13, has a ratio type mechanism having a magnetic rotor moving in a field produced by stationary coils. The rotor carries the pointer. The variable resistance in the transmitter controls the current flowing through the stationary coils. These coils in turn produce a magnetic field which controls the rotor.

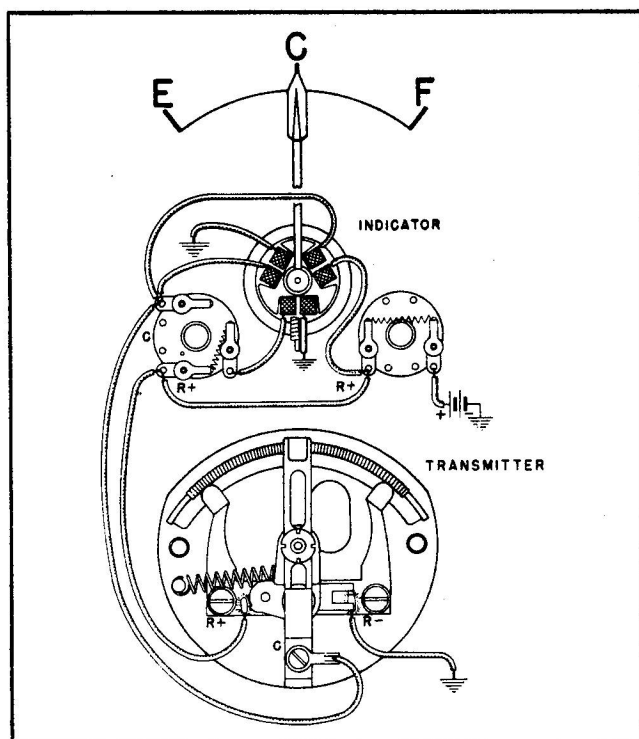


Figure 1-12. 90° Circuit

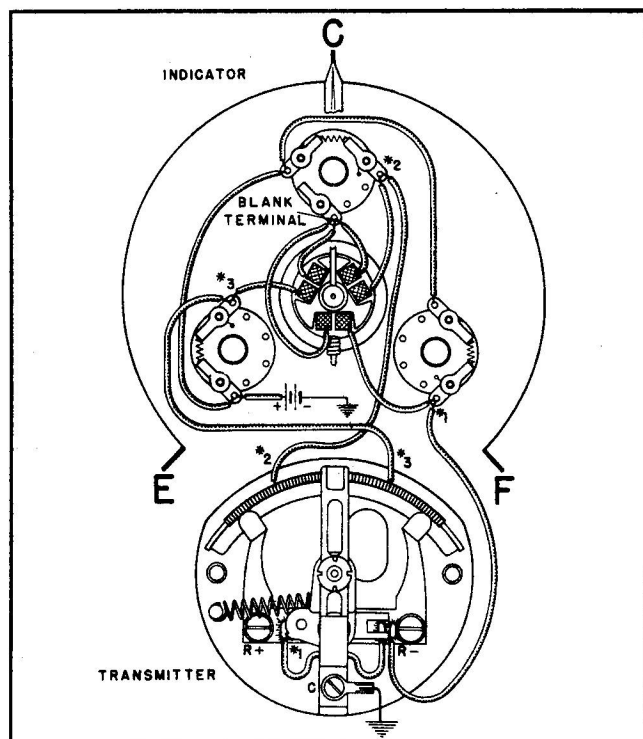
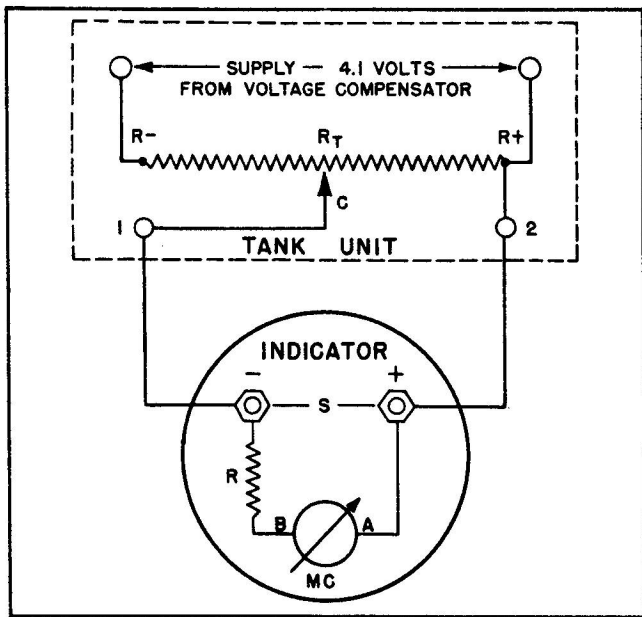


Figure 1-13. 300° Circuit



A—Top Bridge  
 B—Bottom Bridge  
 MC—Moving Coil  
 R—Resistance Spool  
 RT—Tank Unit Potentiometer  
 S—Connection Studs  
 C—Movable Arm

Figure 1-14. Schematic Wiring Diagram

1-8. In the transmitter, a contact shoe is caused to operate over a resistance strip through a suitable leverage by the movement of a float in the tank. A seal against vapors of fluid from the tank, entering into the unit is made by using a bellows seal assembly. As the contact shoe moves over the resistance strip the current distribution in the indicator coils is varied causing the rotor to follow. It will be noted that the leads R- and R+ contact resistance strip at each end through an adjustable shoe. This adjustment varies the effective resistance value of the strip and affords a convenient means for adjusting the pointer position at either end of the dial scale in conformity with the position of the float at the top and bottom of the tank.

**1-9. WESTON INDICATORS.**

1-10. This indicator is essentially a voltmeter type indicator responding to the output of a transmitter. The instrument, as supplied by Weston to Liquidometer Corp. has an uncalibrated black scale with only the bottom, center and top marks indicated in white. The Liquidometer Corp. places a dial calibrated in terms of fuel tank level over the Weston Scale and the indicator after adjustment by the Liquidometer Corp., reads fuel level directly. The indicator consists of a direct current instrument of the permanent magnet, moving coil type designed for 250-degree deflection. The indicator connected electrically to a transmitter with a float operated potentiometer transmits the fuel changes in the tank. A line voltage compensator connected into the system assures accuracy to the system by supplying constant voltage.

1-11. Voltage from the transmitter is applied to the indicator as shown in Figure 1-14. In the indicator the

d-c voltage is impressed through a series resistance spool on a moving coil free to rotate 270 mechanical degrees in the field of a permanent magnet. A pointer which is attached to the moving coil shaft moves over the dial indicating the fuel level. The moving coil is mounted in a magnetic circuit so that it is free to turn in the magnetic field produced by this circuit. This magnetic circuit is shown in Figure 1-15. Two magnets are charged so that their north poles are at the bottom and the south poles are at the top. The iron core is attached to the top of the magnet, therefore, the core becomes the south pole. The pole piece being a "U" shaped iron piece becomes a double north pole, since it is attached to the north pole of the magnet. Because of the physical relation between the core and pole pieces, a uniform flux is produced in the air gap between these parts. A moving coil mounted in this flux will rotate if a current is passed through the wires, since a wire carrying a current in a magnetic field will tend to move at right angles to the lines of flux. The direction of motion will depend upon the direction of the flux in the air gap and the direction of the current in the wires. When a current is passing through the wires on the top (side nearest front of instrument) of the moving coil, the coil will be forced to move in a clockwise direction. Since this same current also passes through the bottom wires of the coil, the direction being opposite to that of the top, the force on the bottom wires will also tend to move the coil in a clockwise direction. The rotation of the coil is opposed by two hair springs mounted on the staff. Therefore, the distance the pointer rotates will depend upon the force exerted on the moving coil wires. This force is proportional to the voltage output of the transmitter. The dial of the instrument can, therefore, be calibrated in terms of fuel tank level. The instrument has a full scale sensitivity of 5 milliamperes (d-c) and total resistance of 820 ohms. The copper moving coil has a resistance of approximately 60 ohms, the constantan series spool having the remaining 760 ohms. Since the copper coil is only a minor portion of the total resistance, no temperature compensation is necessary.

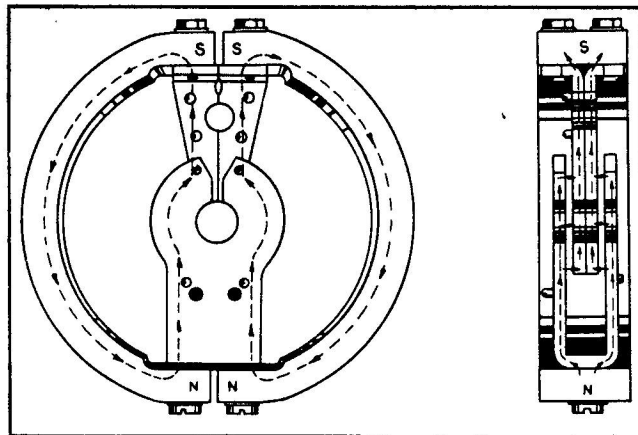


Figure 1-15. Magnetic Circuit

## SECTION II

### OVERHAUL INSTRUCTIONS

#### 2-1. LIQUIDOMETER INDICATORS.

#### 2-2. SPECIAL OVERHAUL TOOLS.

2-3. None required.

#### 2-4. DISASSEMBLY. (See Figure 2-1.)

2-5. CASE REMOVAL. Compress case (2) for easy removal of three case screws (1).

2-6. GLASS REMOVAL. After case has been removed disengage snap ring (3) from inside of case and remove glass (4) and scrape out old putty.

2-7. POINTER REMOVAL. This step is only necessary on some indicators where the dial must be removed prior to the removal of the resistors. Consult specific data sheet for indicator involved.

2-8. DIAL REMOVAL. See specific data sheet for indicator involved.

2-9. MECHANISM REMOVAL. After removal of case (2), pointer (5), dial (8) and subdial (10), inspect instrument noting position of mechanism in relation to the mounting plate (20). Note the terminal positions of all leads coming from mechanism (consult internal wiring diagram for checking) as these leads must be connected again in their original positions at reassembly.

2-10. Disconnect all leads coming from mechanism.

2-11. Loosen lock screw (22), to remove mechanism (26) from clamp (24).

2-12. RESISTOR REMOVAL. See specific data sheet for indicator involved.

2-13. REMOVAL OF RECEPTACLE. Take out four screws (31) and four lock washers (32). Pull receptacle away gently from backplate (28) and unsolder wire leads.

#### 2-14. CLEANING.

2-15. Use a clean, dry and low pressure supply of air to blow out any foreign matter in the instrument. Wipe dial and glass with lintless cloth.

#### 2-16. INSPECTION.

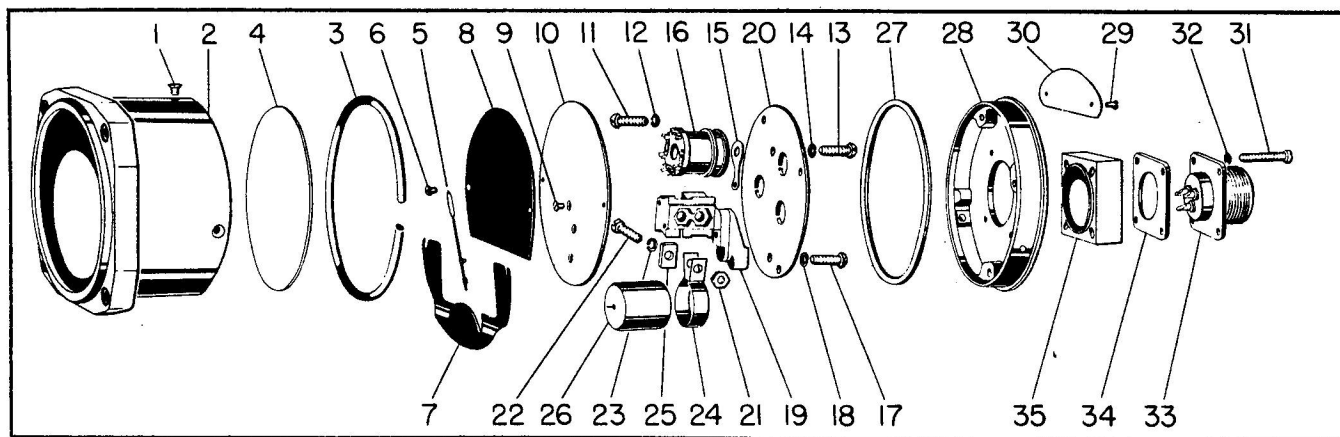
2-17. Make sure all connections are clean and tight. Examine all leads to make sure no wire is broken.

2-18. Check all parts, screws and washers for wear and stripped threads.

2-19. The mechanism and resistors can be inspected for physical defects but must be subject to electrical inspection and testing in the specific data sheet for the instrument concerned.

#### 2-20. TESTING.

2-21. The mechanisms and resistors are the only parts to be subjected to an electrical test and will be covered in the specific data sheet for the indicator involved. All other parts need only a physical check to see if they are in good condition.



1. Screw
2. Case
3. Snap-Ring
4. Glass
5. Pointer Assembly
6. Screw
7. Shield
8. Dial
9. Screw

10. Sub Dial
11. Screw
12. Lockwasher
13. Screw
14. Lockwasher
15. Solder Lug
16. Resistor Assembly
17. Screw
18. Lockwasher

19. Saddle
20. Mounting Plate
21. Nut
22. Screw
23. Lockwasher
24. Mechanism Clamp
25. Spacer
26. Mechanism Assembly
27. Case Gasket

28. Back Plate
29. Screw
30. Name Plate
31. Screw
32. Lockwasher
33. Receptacle
34. Spacer
35. Mounting Block

Figure 2-1. Disassembly of Typical Indicator

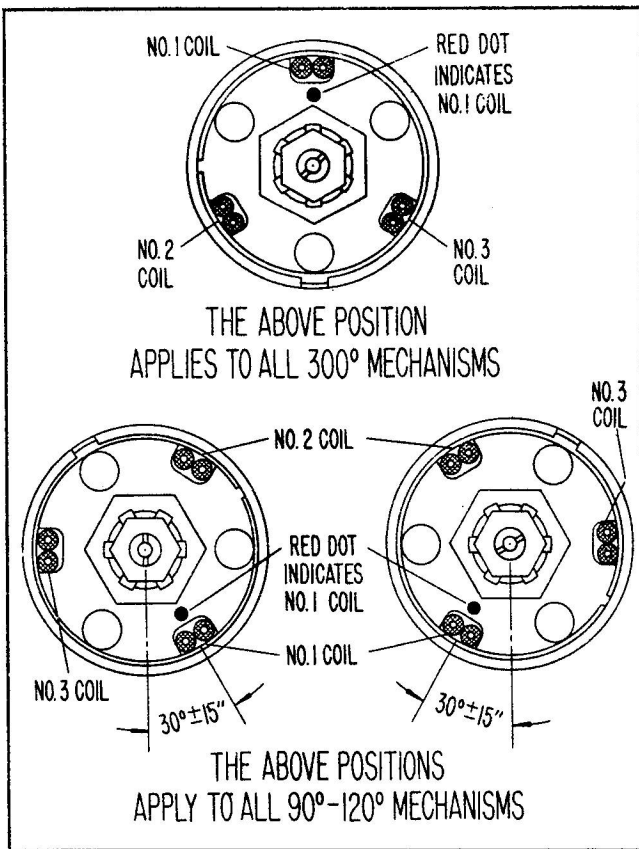


Figure 2-2. Methods of Mounting Mechanisms

**2-22. REPAIR AND REPLACEMENT.**

2-23. After carefully examining all parts for wear or breakage and screw holes for stripped threads replacements can be made of parts that show any of the above faults. Bent pointer and damaged pointer stops must be replaced. Cracked or broken glass must be replaced. Damaged dial should be replaced. Gaskets stretched out of shape must be replaced.

2-24. REPLACEMENT OF MECHANISM. Insert mechanism in adaptor, taking care that the coils are mounted as shown in figure 2-2.

2-25. Wire mechanism according to the internal wiring diagram for the particular indicator being repaired. Make sure all connections are clean and tight. Paint soldered joints with insulating varnish to prevent corrosion.

2-26. ASSEMBLY OF POINTER TO INDICATOR. Connect indicator according to circuit diagram applicable to the indicator (see specific data sheet).

2-27. With the transmitter at "EMPTY" set the pointer of the indicator to the approximate corresponding position on the dial. The pointer is to be set only once, and when assembled is not to be removed. Apply a small quantity of quick drying clear lacquer to the hole in the pointer hub to cement the hub and rotor shaft together.

**Note**

Care should be taken to see that the lacquer does not flow down between the jewel and the rotor shaft.

2-28. With the pointer indicating correctly over the first and last marks on the dial for the corresponding positions of the transmitter and the pointer clearance of the dial is between .030 and .045 of an inch, no further adjustments are required. The lock screw (22) should be tightened to hold the mechanism (26) firmly in place (see figure 2-1).

2-29. When the pointer indicates correctly, but the clearance over the dial is incorrect, loosen lock screw (22) and move mechanism (26) in or out as required to obtain proper spacing. The lock screw should then be tightened to hold mechanism firmly in place.

2-30. If the pointer indications are shifted to either one side or the other, loosen lock screw and turn mechanism about its axis until pointer indications correspond to the transmitter settings at "EMPTY" and "FULL". If a slight unbalance is noted it should be divided equally at both ends of the scale.

2-31. Check operation of magnetic return. When the power is off, the pointer should swing off scale from any position of the dial. If the magnetic return does not swing the pointer off scale, make sure that the pointer is free and the mechanism has been wired correctly. If the instrument still fails to operate, due to magnetic return, the mechanism should be replaced.

2-32. Check for free operation of the pointer over the whole scale by operating the pointer slowly back and forth a few times.

2-33. CHECK POINTER STOPS. Pointer stops should be set to allow pointer to travel a maximum of 3/32 of an inch beyond the first and last marks on the dial.

**2-34. POINTER BALANCE ADJUSTMENT.**

2-35. To adjust pointer balance, place the indicator in a horizontal position and adjust the transmitter so that the pointer of the indicator is over the first mark on the dial. Pick up the indicator so that the dial is in a vertical position and rotate the complete indicator until the pointer is horizontal. Note any change in indication. Rotate indicator 180 degrees (dial still vertical) and again note any change in indication. Balance pointer by moving weight on the tail of the pointer until balance in the three positions mentioned is within one degree. Balance at any other position should be within two degrees. It should be noticed at this time that the side of balance of the rotor has been taken in consideration during the charging of the rotor. Rotors are charged so that the heavy side of the rotor always lines up with the axis of the pointer. With a normal straight pointer no trouble should be encountered with side balance.



**2-36. LUBRICATION.**

2-37. None required due to no moving parts except shaft of mechanism which moves in dry jewel bearings.

**2-38. REASSEMBLY.**

2-39. The instrument can be reassembled in reverse order as shown by exploded view. (See figure 2-1).

**2-40. HERMETICALLY SEALED INDICATORS.****2-41. SPECIAL OVERHAUL TOOLS.**

2-42. None required.

**2-43. DISASSEMBLY.** (See figure 2-3).

2-44. CASE REMOVAL. The case has a sealing band (1) approximately  $\frac{3}{8}$ " wide at the back. A fine line is noticeable where the band ends. Pry this upwards and grip with a pair of pliers and tear off from around case. Bezel (2) can now be pulled away from the indicator.

2-45. BEZEL REMOVAL. Take out four screws (4) and slide bezel support (3) over bezel (2). Bezel (2) lifts off case (5).

2-46. GLASS REMOVAL. Is not recommended as the glass (6) has a metalized edge and together with an expansion ring (7) is soldered onto case.

2-47. POINTER REMOVAL. Lift off pointer (8) with pointer puller.

2-48. DIAL REMOVAL. Take out two screws (10) and lift off dial (9).

2-49. MOUNTING PLATE REMOVAL. Take out four screws (12) and gently pull away from mounting plate (11) to the length of wire leads. Unsolder leads from receptacle pins.

2-50. MECHANISM REMOVAL. Loosen screw (14) in mechanism strap (13) and slide out mechanism (16).

2-51. RESISTOR REMOVAL. Take out the screws (19) and lockwashers (20) holding resistors (17) and (18) to mounting plate (11).

2-52. RECEPTACLE REMOVAL. Receptacle is soldered to back plate (21) and removal is not recommended.

**2-53. CLEANING.**

2-54. Blow out foreign matter with clean, dry air. Wipe dial and glass with lintless cloth.

**2-55. INSPECTION.**

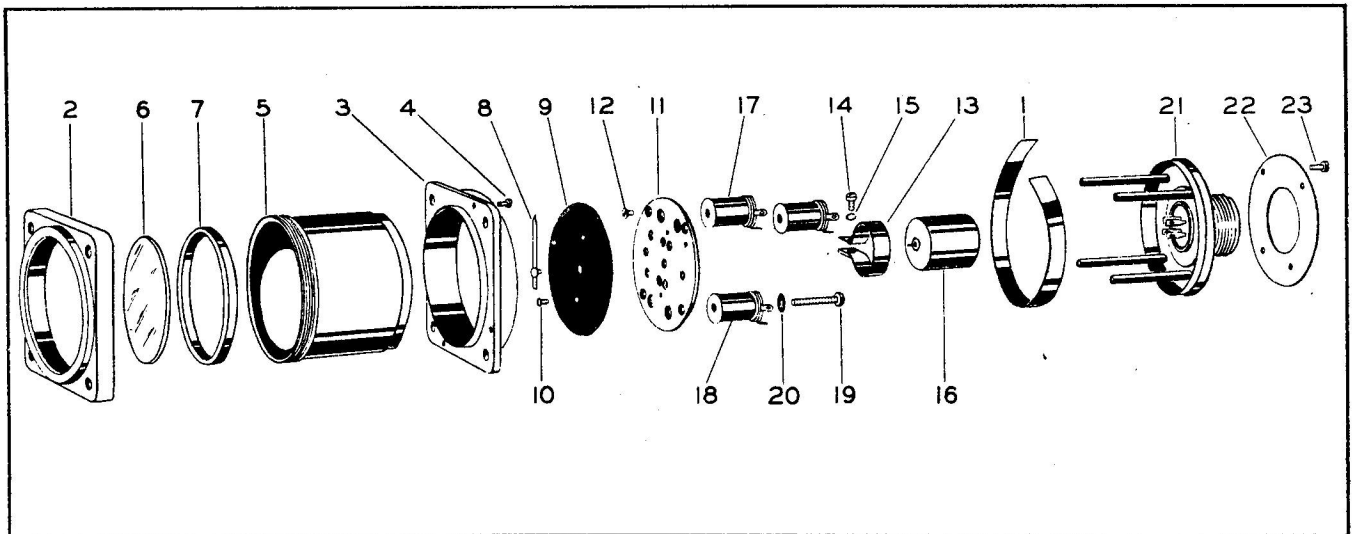
2-56. Make sure all connections are clean and tight. Examine all leads for broken wires.

2-57. Check all parts for wear and screws for stripped threads.

2-58. Inspect mechanism and resistors for physical defects only.

**2-59. TESTING.**

2-60. The mechanism and resistors are the only parts that need to be subjected to an electrical test and this procedure will be covered in the specific data sheet for the indicator involved.



1. Sealing Band  
2. Bezel  
3. Bezel Support  
4. Screw  
5. Case  
6. Glass

7. Expansion Ring  
8. Pointer  
9. Dial  
10. Screw  
11. Mounting Plate  
12. Screw

13. Mechanism Strap  
14. Screw  
15. Lockwasher  
16. Mechanism  
17. Resistor  
18. Resistor

19. Screw  
20. Lockwasher  
21. Back Plate  
22. Name Plate  
23. Screw

Figure 2-3. Disassembly of Typical Hermetically Sealed Indicator

**2-61. REPAIR AND REPLACEMENT.**

2-62. After carefully examining all parts for wear or breakage and stripped threads, replacement should be made of parts showing these faults. Bent pointer or damaged dial should be replaced.

**2-63. REPLACEMENT OF MECHANISM.**

2-64. Insert mechanism in adaptor and place in position as shown in figure 2-2. Wire mechanism according to the internal wiring diagram for the particular indicator being repaired. Make sure all connections are clean and tight. Paint soldered joints with insulating varnish to prevent corrosion.

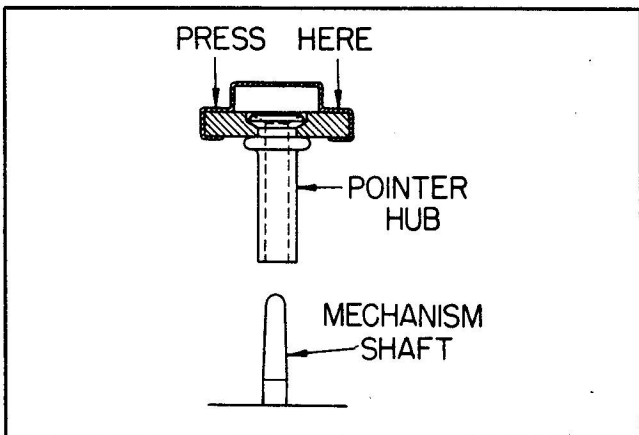


Figure 2-4. Attaching Pointer

**2-65. ASSEMBLY OF POINTER TO INDICATOR.** Fit pointer over shaft of mechanism and press down carefully on both sides of pointer blade. (See figure 2-4).

**CAUTION**

Do not press on center of blade.

2-66. See paragraphs 2-26 to 2-35 inclusive for further details of pointer adjustments.

**2-67. LUBRICATION.**

2-68. None required due to no moving parts except shaft of mechanism which rotates in dry jewel bearings.

**2-69. REASSEMBLY.**

2-70. Clean off all excess solder from case and back plate. Solder new tear band to back plate assembly.

2-71. Dry out inside of case and indicator assembly thoroughly before attaching together.

**Note**

Test filling tube to be sure it is clear before evacuating and filling.

2-72. Evacuate indicator of all air and fill with helium (two atmospheres). Test for leaks, if no leaks appear reduce pressure to one atmosphere of helium and seal off filling tube.

**2-73. INDICATOR TROUBLES AND REMEDIES.**

TROUBLE	PROBABLE CAUSE	REMEDY
FRICTION	Damaged jewels	Replace mechanism.
	Damaged pivots	Replace mechanism.
INDICATOR SCALE DOES NOT CORRESPOND TO EMPTY, CENTER AND FULL	Faulty Resistor	Test and replace resistor.
	Mechanism coil open or shorted	Test and replace mechanism.
	Rotor in mechanism is demagnetized	Replace mechanism.
	Wiring faulty	Check interconnecting wiring.
POINTER SLAMS RIGHT OR LEFT	Open coil in mechanism	Check and replace mechanism.
	Incorrect wiring	Check with wiring diagram.
	Leads shorted at receptacle pin	Resolder leads and clear short circuit.

**2-74. WESTON INDICATORS.**

**2-75. ADJUSTMENT STANDARD.**

2-76. The indicator is adjusted by using the circuit shown in figure 2-5. The indicator is connected in series with a standard millimeter and the combination is connected across a variable d-c voltage source. Coarse adjustment is obtained by varying  $R_1$  and fine adjustment by varying  $R_2$ .

**2-77. DISASSEMBLY.** (See figure 2-6).

2-78. **MAGNETIC SHIELD REMOVAL.** Remove the three screws (1), the three lock-washers (2) and lift off the magnetic shield (3).

2-79. **CASE REMOVAL.** Remove the four screws (4), four lock-washers (5) and lift off case (6).

2-80. **SCALE PLATE REMOVAL.** Remove the two scale plate screws (7), two lock-washers (8), dial (9) and scale plate (10).

2-81. Remove mechanism assembly from indicator base. (See figure 2-7).

2-82. Remove core and pole piece assembly from magnets by taking out four screws (1) and four lock-washers (2) at top and two screws (3) and two lock-washers (4) at bottom. Slip magnets (5) off the core and pole piece assembly.

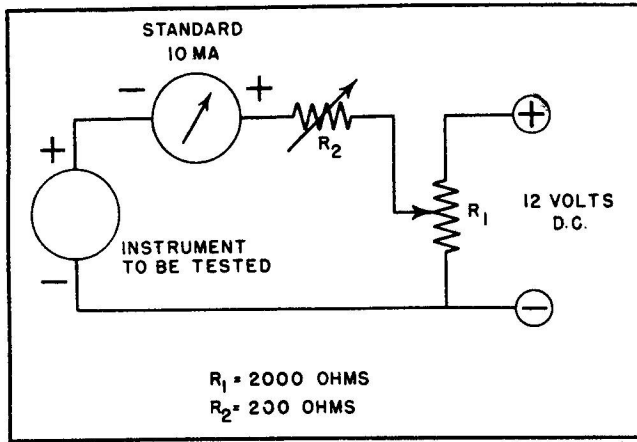


Figure 2-5. Calibration and Adjustment Standard

**2-83. REMOVAL OF MOVEMENT ASSEMBLY FROM POLE PIECE.** (See figure 2-8).

- 2-84. Unsolder top spring (1) at top bridge (2).  
 2-85. Unsolder bottom spring (3) at bottom bridge (4).  
 2-86. Rotate the top and bottom bridge abutments approximately 90 degrees so that movement will clear as it is lifted from the pole piece assembly.  
 2-87. Retract the jewel screw (5) until the movement falls free of the jewels.  
 2-88. Lift the movement out of the pole assembly.

**2-89. CLEANING.**

- 2-90. Clean the jewels by twirling the sharpened end of a piece of matchwood in the jewel cup.  
 2-91. Pivots stored in oil must first be cleaned by rub-

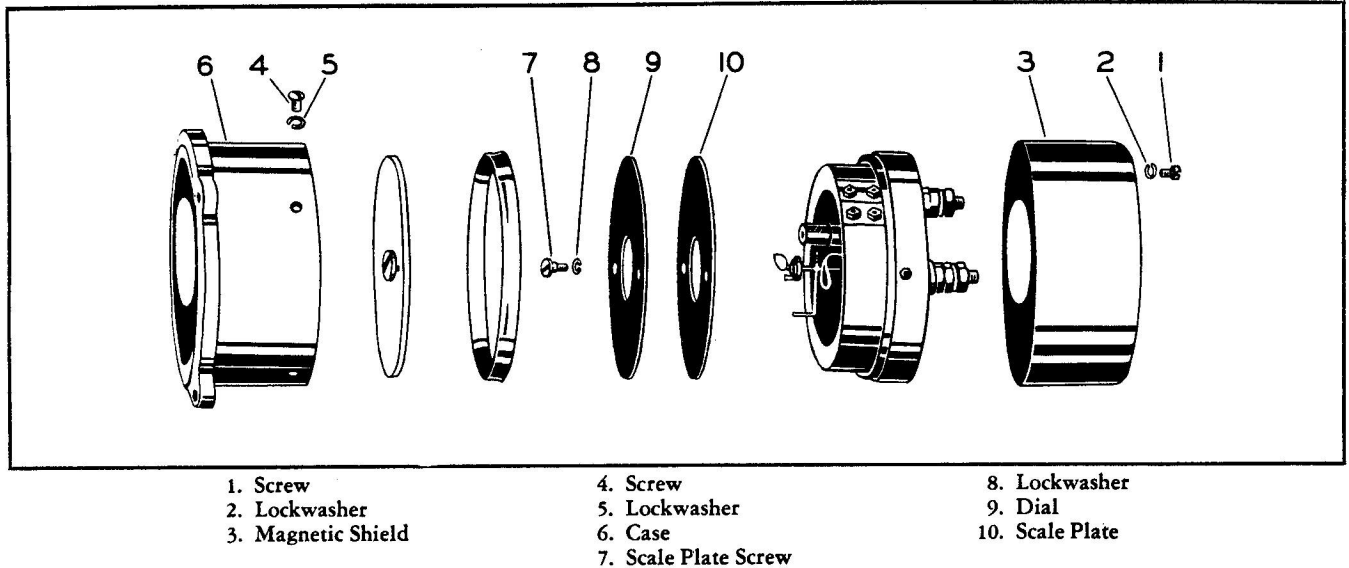


Figure 2-6. Exploded View of Indicator

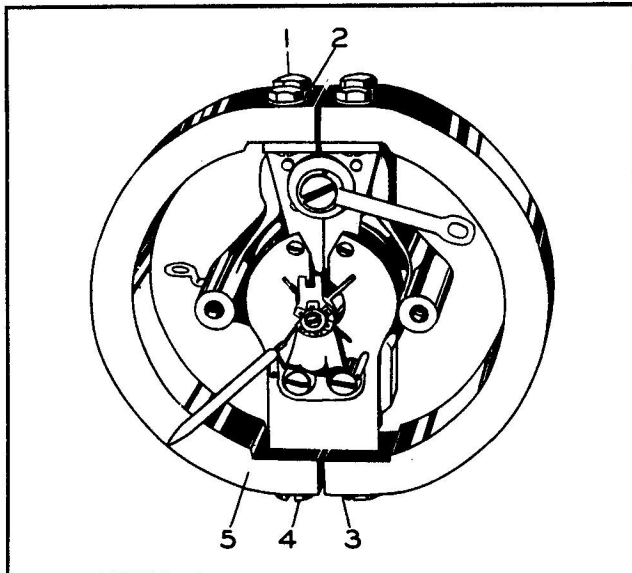


Figure 2-7. Magnet Removal

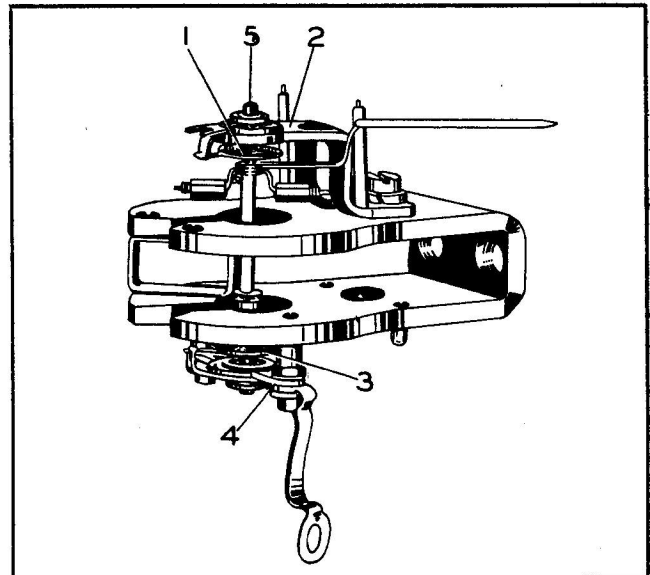


Figure 2-8. Movement Removal

bing them between two pieces of porous paper. After the pivots are inserted in the staff, they are cleaned by pushing the point into a piece of pithwood.

**CAUTION**

DO NOT HANDLE PIVOTS UNNECESSARILY AS PERSPIRATION WILL FOSTER THE FORMATION OF RUST IN THE ASSEMBLED INSTRUMENT.

**2-92. INSPECTION.**

2-93. Put the jewels under a microscope and inspect for cracks or a punctured surface. A sharp needle point moved around in the jewel cup will tend to catch on any punctured surface even though it may not be visible.

2-94. With the pivots under a microscope look for damaged tips. If the tip is flat or mushroomed and does not have definite radius, it should be discarded.

2-95. Check the moving coil for loose wires, lint and fuzz sticking to wire and frame, and for loose balance cross and pointer.

2-96. Make sure all connections to nuts and screws are tightened firmly against terminals and lock washers.

**2-97. TESTING.** (See figure 2-9).

2-98. MOVING ELEMENT. Measure the resistance of the moving element (moving coil plus springs). It should measure between 48 and 72 ohms at approximately 25 degrees C (77 degrees F). A resistance lower than 48 ohms indicates the presence of shorted turns or wrong moving coil. A resistance greater than 72 ohms indicates a high resistance break, a poorly soldered connection or the wrong moving coil. If the moving coil resistance is measured when the coil is mounted in

the mechanism, connection should be made between the right hand connection stud (front view, normal mounting position) and the lower terminal of the series resistance spool. If an open circuit is indicated, one or both springs are burned out or the moving coil is open circuited. To measure the resistance of the moving coil alone, the mechanism must be dismantled and connection made to the inner terminal of the top and bottom springs. The moving coil alone should measure between 45 and 69 ohms.

2-99. SPOOL. The resistance of the series spool should measure between 735 and 791 ohms. Measure between the top and bottom spool terminals. It is not necessary to disconnect the spool from the circuit.

2-100. INDICATOR RESISTANCE. The total resistance of the indicator (between connection studs) must measure 820 ohms plus minus 8.0 ohms.

**2-101. REPAIR.**

2-102. GENERAL. Do not disassemble the mechanism any further than necessary, since the removal of magnets, core and pole piece may necessitate recalibration because of the relatively large effect of small changes in pole piece and core positions upon scale distribution and sensitivity.

2-103. JEWELS. Replace cracked or punctured jewels.

2-104. PIVOTS. Replace damaged pivots only.

2-105. MOVING COIL. Cement any loose wires in place using bakelite cement. Remove all foreign particles from coil and staff. Tighten loose nuts.

2-106. SOLDERED CONNECTIONS. Resolder all poorly soldered connections.

2-107. CASE GLASS. The case glass, if cracked, may be forced out by placing the case, base end down in an arbor press and applying pressure to an iron disc placed over the glass. The disc should have a diameter slightly less than the case opening and a hole in the center to clear the zero corrector. A glass badly broken should be knocked out and the iron bezel distorted by gripping the rim with a pair of pliers and twisting the bezel out of place. Once distorted, the bezel may be easily pushed out. All old putty must be removed, new putty applied to the rim of the case front, a new glass inserted (this should be complete with zero corrector) and a new bezel where necessary, forced into place. When old bezels are replaced in the case, cement should be applied to the skirt of the bezel and the inside of the case to insure tightness.

**2-108. LUBRICATION.**

2-109. Because the only moving parts rotate in dry jewel bearings no lubrication is necessary.

**2-110. REASSEMBLY.**

2-111. This operation can be done by assembling parts in reverse order to which they were disassembled.

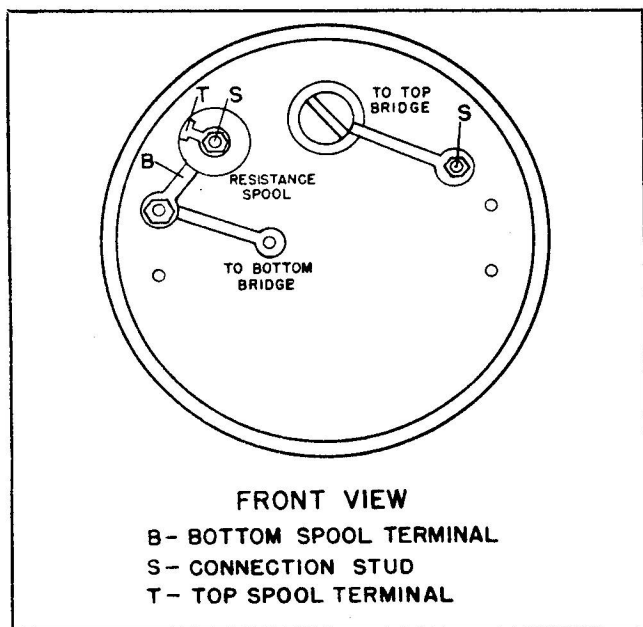


Figure 2-9. Pictorial Wiring Diagram

**2-112. INDICATOR TROUBLES AND REMEDIES.**

<i>TROUBLE</i>	<i>PROBABLE CAUSE</i>	<i>REMEDY</i>
FRICTION	Damaged pivots	Replace pivots.
	Damaged jewels	Replace jewels.
	Jewels too tight	Readjust to proper clearance.
	Fuzz on coil	Remove fuzz.
	Foreign particle in air gap	Remove particle.
	Moving coil frame touching core or pole piece	Readjust jewels for proper frame clearance.
	Distorted spring	Repair or replace moving element.
D-C SENSITIVITY TOO LOW (TOO MUCH CURRENT FOR FULL SCALE DEFLECTION)	Shorted turns on moving coil or wrong moving coil	Replace moving element if necessary.
	Spring torque too high	Replace moving element if necessary.
	Magnets not full charged	Recharge magnets.
D-C SENSITIVITY TOO HIGH (TOO LITTLE CURRENT FOR FULL SCALE DEFLECTION)	Incorrect moving coil	Replace moving element if necessary.
	Spring torque too low	Replace moving element if necessary.
NO READING	Series resistance spool open circuited	Replace defective spool.
	Moving coil open or short circuited	Replace moving element.
	Bottom bridge insulating washers or bushings broken or mounted incorrectly	Replace or rearrange washers or bushings.
	Bottom bridge connector to spool touching bracket	Bend connector down.
	Heavy friction or movement out of jewel	Repair.
	Magnet not charged	Charge magnet.
	Incorrect wiring	Rewire.
	Broken or loose connection	Repair.
EXCESSIVE CALIBRATION ERROR	Pole piece screws not properly adjusted	Readjust screws.
	Pointer not properly balanced	Rebalance pointer.

**SECTION III****TEST PROCEDURE****3-1. GENERAL.**

3-2. Unless otherwise specified, the instruments shall be tested in the normal operating position and shall be tapped lightly before taking a test reading. The instruments also shall be tested with an applied voltage of either 14 plus minus 0.25 volts or 28.5 plus minus one volt depending on the design operating voltage.

**3-3. TEST METHOD.****3-4. SCALE ERROR.**

3-5. Connect instrument to circuit as indicated on the electrical inspection diagram as shown on specific data sheet applicable to particular instruments involved.

3-6. Test scale at first, center and last marks.

**CAUTION**

The first and last calibration points on the finished dials are not in all cases symmetrical about the center line of the scale. However, when testing the indicator, the end points shall be checked in accordance with the 90-degree, 120-degree or 300-degree scale as shown in figure 3-1. If the first and last marks on the finished dial do not coincide with the points, the adjustments to these marks are to be made in the corresponding transmitter at the time of installation. For example, the last mark on a 120-degree dial may be 5-degrees short of the 120-degree mark. When testing the indicator with a standard transmitter, the pointer travel should be from 0 to 120-degrees. When the indicator is installed the transmitter is then to be adjusted so that the pointer travels from 0 to "F" or 5-degrees short of 120-degrees.

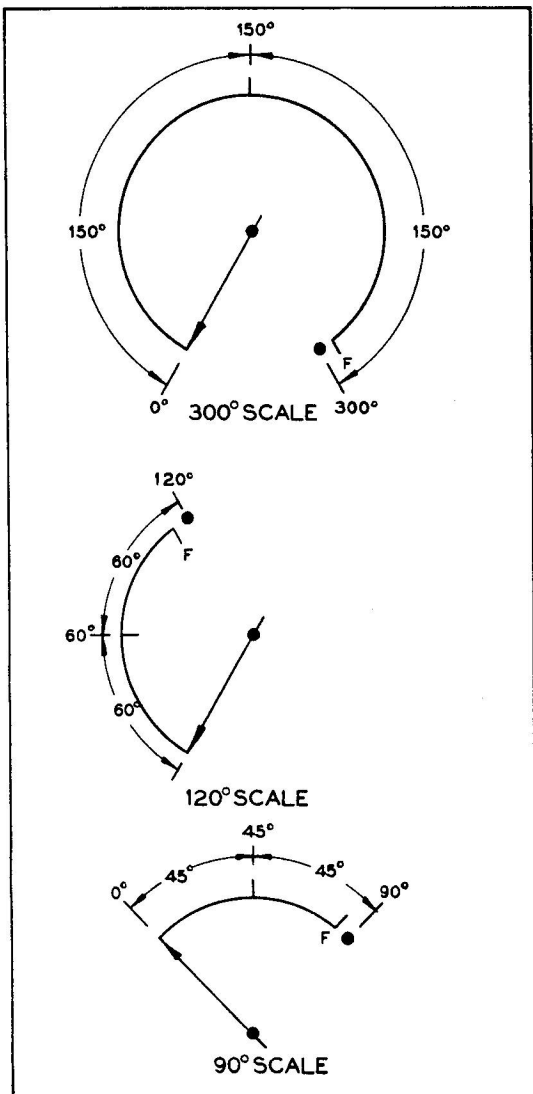


Figure 3-1. Calibration Scales

**3-7. FRICTION TEST.**

3-8. The friction of the indicator when measured at any point on the scale and after tapping should not exceed three degrees at zero, or four degrees at any other point on 90 and 120 degree scale indicators and three degrees at zero and five degrees at any other point on 300 degree scale indicators. The friction can be determined by bringing the pointer slowly to any indication on the scale and tapping the indicator lightly.

**3-9. POWER OFF RETURN.**

3-10. To test the effect of the zero return magnets set the transmitter for 90 and 120-degrees indicators at last mark and for 300-degree indicators approximately 10-degrees off the center position. With the pointer in this position, turn power off and note behavior of the pointer. The pointer must swing off scale and come to rest outside of the scale.

**3-11. PERFORMANCE.**

3-12. SCALE ERROR. The scale error at the first, center and last marks shall not exceed two percent of full scale or as follows:

- 90-degree indicators  $\pm 1.8$
- 120-degree indicators  $\pm 2.4$
- 300-degree indicators  $\pm 6.0$

3-13. FRICTION. The friction error shall not exceed the values given in Table 1.

**TABLE 1**  
 (Allowable Friction Error)

Indicator	Maximum Friction in Mechanical Degrees at Empty	Maximum Friction in Mechanical Degrees at Any Other Point on Scale
90°	3°	4°
120°	3°	4°
300°	3°	5°

**3-14. CHECKING INDICATORS WITH THE TYPE 0-1 FIELD TESTER.**

**3-15. GENERAL.** (See figure 3-2.)

3-16. The test unit provides for checking both the scale characteristics and the friction of indicators.

3-17. For checking the scale characteristics of an indicator, it is electrically connected to the test unit. With the appropriate transparent test dial, held in place over the indicator glass, the transmitter knob of the test unit is turned from position "E" through its intermediate positions to position "F", and the indicator pointer position noted to determine whether it falls within the corresponding scale position of the test dial.

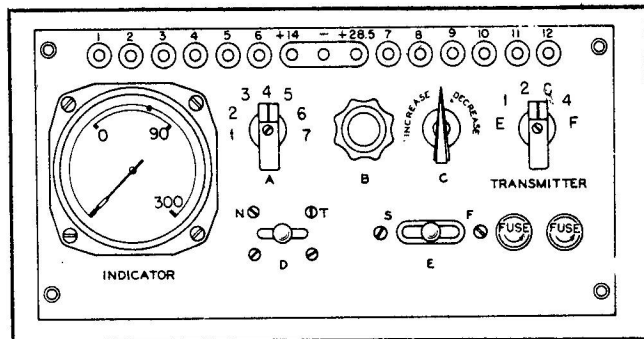


Figure 3-2. Designations of Panel Components

3-18. For checking the friction characteristics of an indicator, it is electrically connected to the test unit. The friction is determined by bringing the indicator pointer to any point, by slowly rotating the knob of the friction transmitter "B", and noting the difference in pointer position before and after tapping the indicator. (See Table 1 for allowable friction tolerances.)

3-19. Shop and field tests are performed in the same manner. In shop tests, the indicator should be checked in a vertical position, which corresponds with its normal operating position.

3-20. Before an indicator is checked, it must be electrically disconnected from its operating circuit.

3-21. Indicators of 65-, 90-, 120- and 250-degree pointer travel all operate, in use, from electrically equivalent tank units. Consequently they are all checked against the same transmitter circuit in the test box. For testing these indicators, switch "D" is put in position "N".

3-22. Indicators of 300-degree pointer travel all operate, in use, from electrically equivalent tank units. Consequently they are all checked against the same transmitter circuit in the test box. For testing these indicators, switch "D" is put in position "T".

3-23. Switch "E" is used for connecting the appropriate jacks of the test unit, either to the scale transmitter or to friction transmitter "B". For a scale characteristic check, switch "E" is put in position "S", while for a friction check, it is put in position "F".

3-24. In certain fuel gage installations, the ends of tank units are connected in parallel. This has the effect of modifying the electrical character of the tank unit slightly. By means of switch "A", equivalent tank units may be added in parallel with the test unit transmitter, to duplicate the actual operating conditions of the indicator being tested.

3-25. End adjustment potentiometer "C" is used to adjust the ends of the scale transmitter for checking 300-degree indicators, to the particular indicator being tested, so as to cause the length of the angular travel of the indicator pointer to be 300 degrees.

3-26. Before taking indicator readings in scale characteristic tests, the indicator is in all cases to be tapped lightly.

#### Note

Unless otherwise specified, test all indicators and tank units with an applied voltage of  $4.1 \pm .05$  volts dc,  $14.0 \pm 0.25$  volts dc or  $28.5 \pm 1.0$  volts dc, depending on the design operating voltage.





**SECTION IV  
SPECIFIC DATA SHEETS**

Overhaul and test procedures for the indicators included in this section are substantially the same as the procedures outlined in Sections II and III, except for the calibration and other minor details as noted in each specific data sheet. Page numbers for the specific data sheets are identified by the basic models in parenthesis and followed by a dash number, for example, the first page of a set of data sheets covering indicators in the EA100AN series is shown as (EA100AN)-1.

THE FOLLOWING SERIES OF INDICATORS ARE COVERED ON SPECIFIC DATA SHEETS.

EA100AN  
EA100ANH  
EA101AN  
EA102AN  
EA124AN  
EA133AN  
EA148AN  
EA148ANW  
EA150AN  
EA303AN  
EA31



## QUANTITY INDICATORS FOR EA100AN SERIES

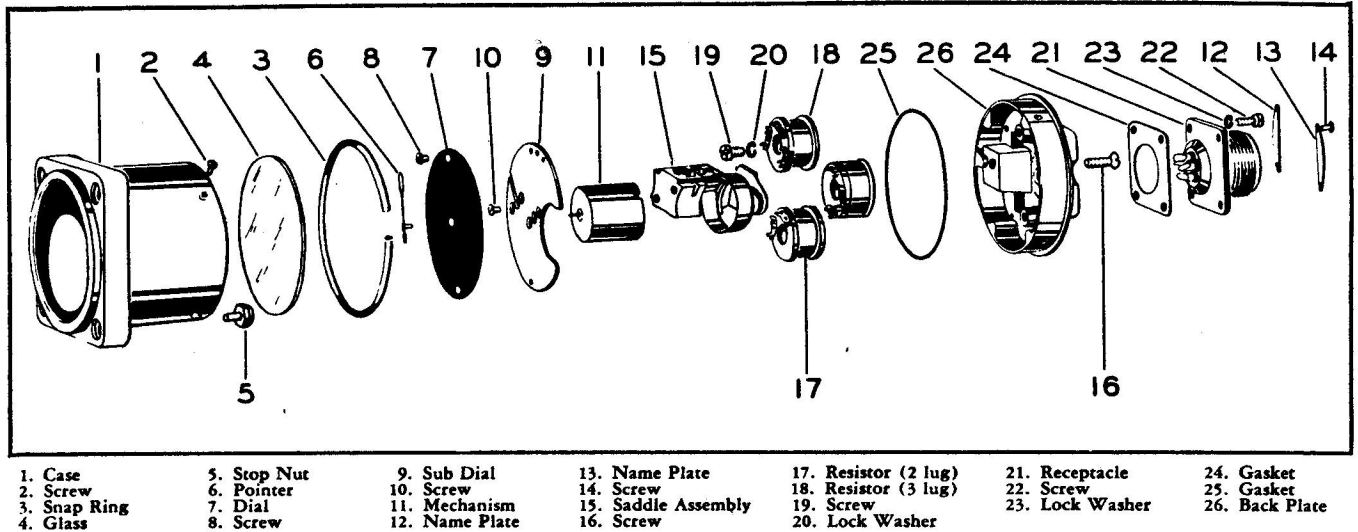


Figure (EA100AN)-1. Exploded View of EA100AN Indicator

**Note:** Item numbers mentioned in text correspond to those shown in figure (EA100AN)-1

**DISASSEMBLY.**

Item 6. Remove with a pointer puller.

Item 7. Take out two screws (8) and lift off from sub dial.

Items 17 & 18. Remove two screws (10) and sub dial (9). Take out screws (19) and washers (20) to remove resistors (17) and (18) from back plate (26).

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer (6) or damaged dial

(7); replace them.

Check mechanism (11) and resistors (17) (18) with an ohmmeter or bridge and replace them if resistance is not as follows:

Mechanism = 285-315 ohms

Resistors = two resistors with two soldering lugs =  
500 ohms  $\pm$  2%

one resistor with three soldering lugs =  
450 ohms  $\pm$  2%

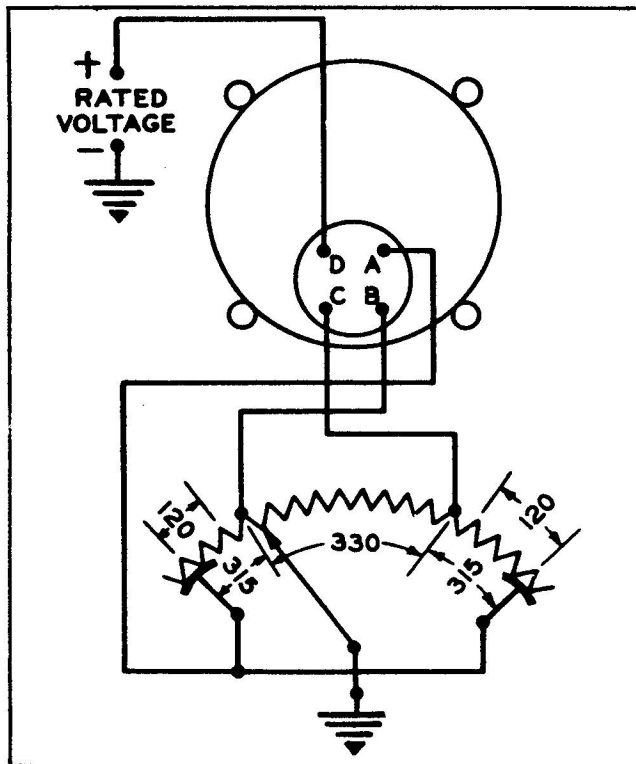


Figure (EA100AN)-2. Testing Diagram

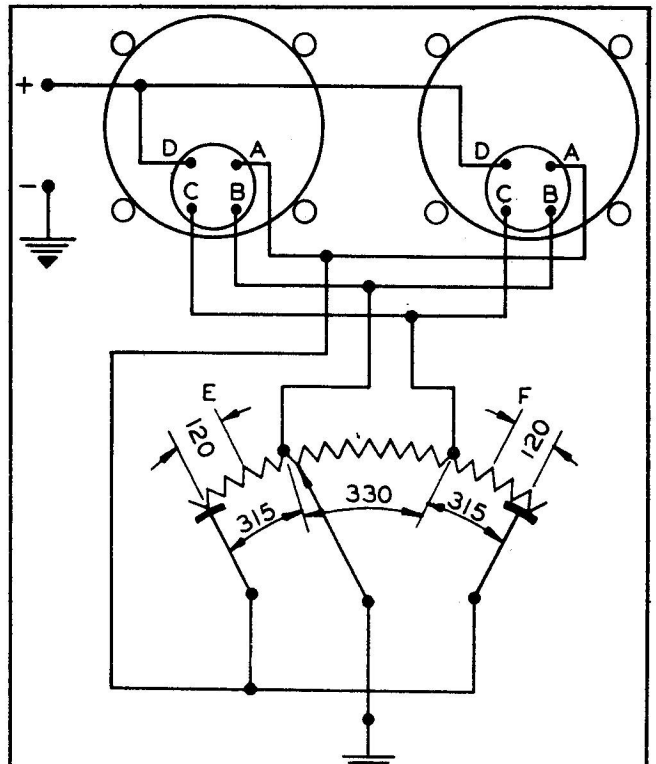


Figure (EA100AN)-3. Testing Diagram

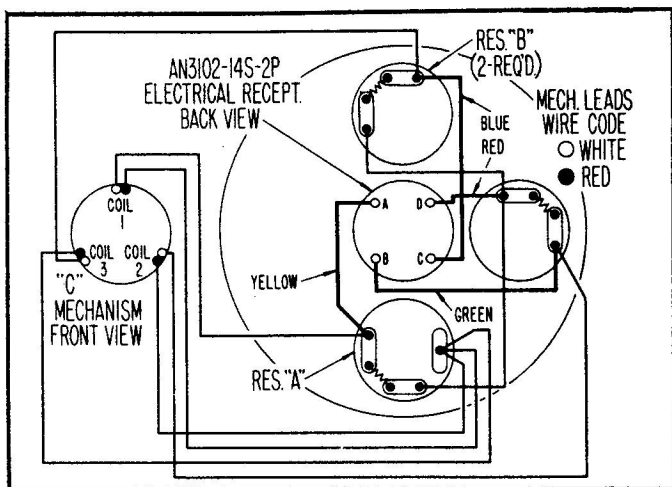


Figure (EA100AN)-4. Internal Wiring Diagram

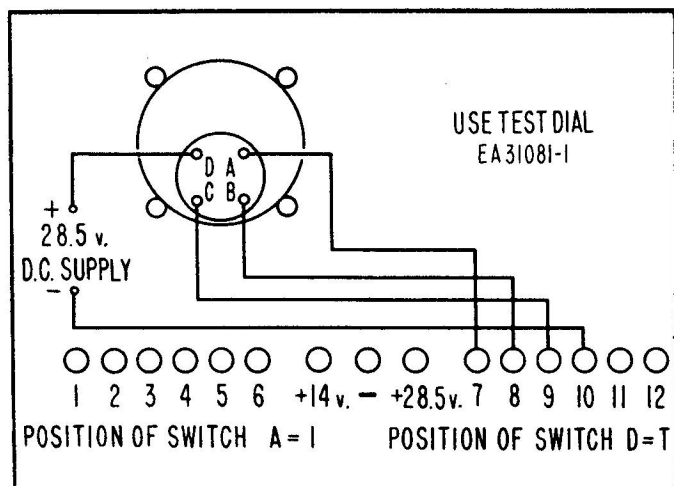


Figure (EA100AN)-5. Field Tester Connections

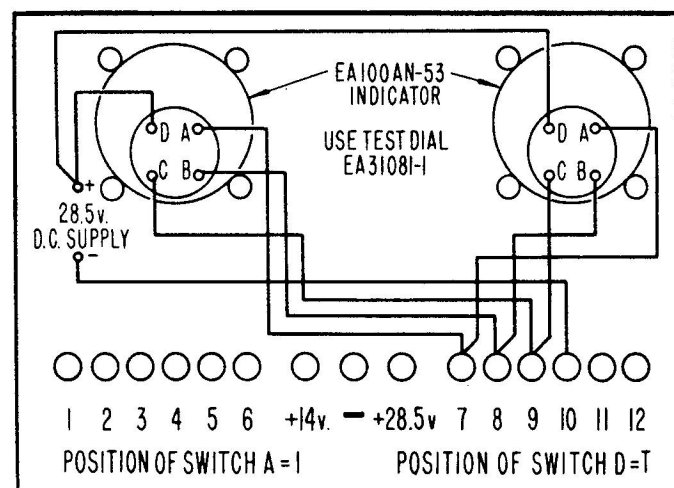


Figure (EA100AN)-6. Field Tester Connections

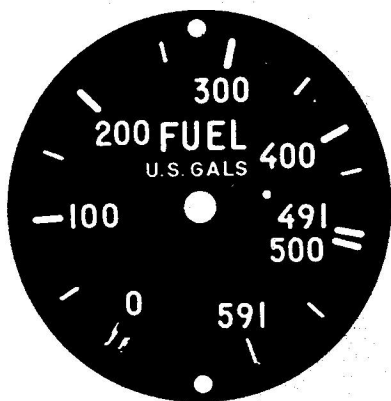
**FINAL TEST (See table).**

Test the indicator connected to transmitter as outlined in Section III using the applicable testing diagram as shown in table. When the Type 0-1 Field Tester is used follow instructions beginning with paragraph 3-14 and connect indicator to tester as per figure designated in table.

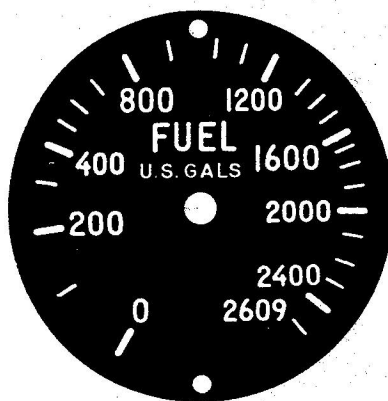
Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA100AN10	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN11	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN12	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN13	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN17	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN30	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN35	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN36	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN37	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN38	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN39	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN40	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN41	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN52	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN53	(EA100AN)-3	(EA100AN)-4	(EA100AN)-6
EA100AN56	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN57	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN62	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN63	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN66	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN68	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN70	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN74	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN75	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN76	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5
EA100AN93	(EA100AN)-2	(EA100AN)-4	(EA100AN)-5

**Note**

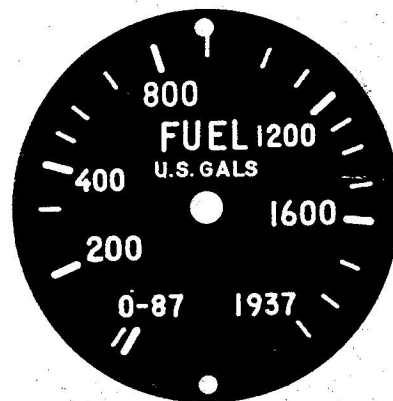
This family or series of EA100AN Indicators is similar to one another in most instances except for calibration. This difference is shown by the dials in figure (EA100AN)-7.



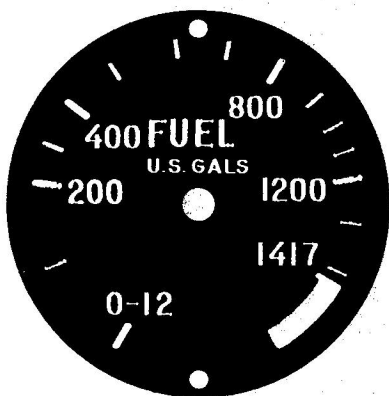
For EA100AN10 Indicator



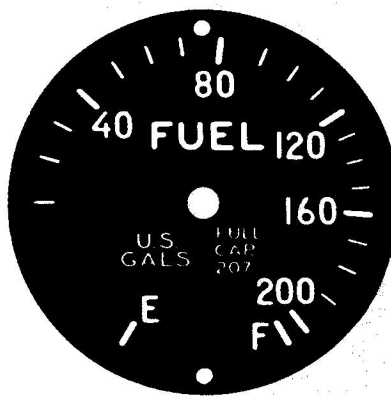
For EA100AN11 Indicator



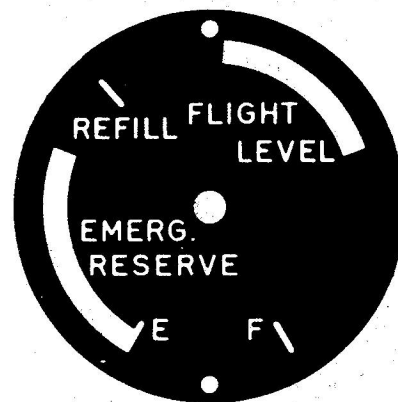
For EA100AN12 Indicator



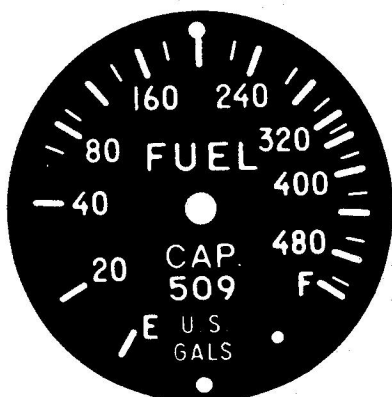
For EA100AN13 Indicator



For EA100AN17 Indicator



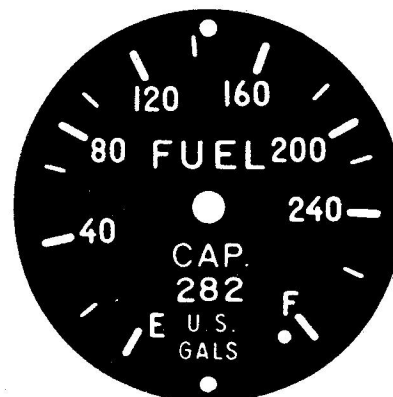
For EA100AN30 Indicator



For EA100AN35 Indicator

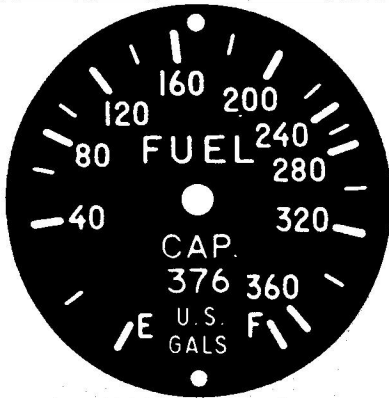


For EA100AN36 Indicator

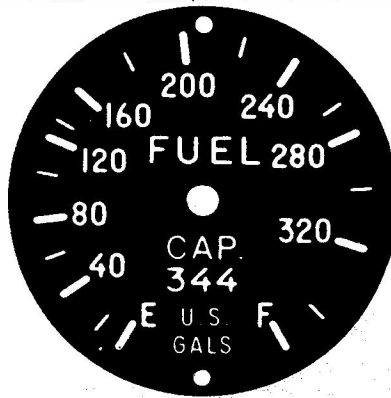


For EA100AN37 Indicator

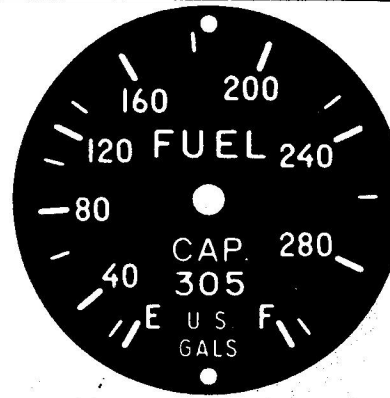
Figure (EA100AN)-7. (Sheet 1 of 3 Sheets) Calibrated Dials for EA100AN Indicators



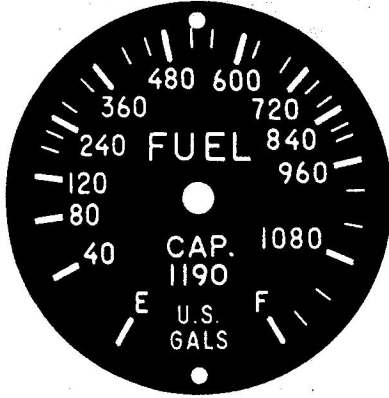
For EA100AN38 Indicator



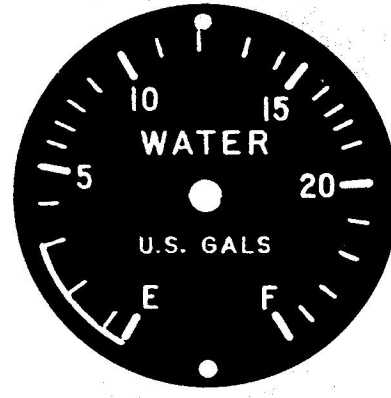
For EA100AN39 Indicator



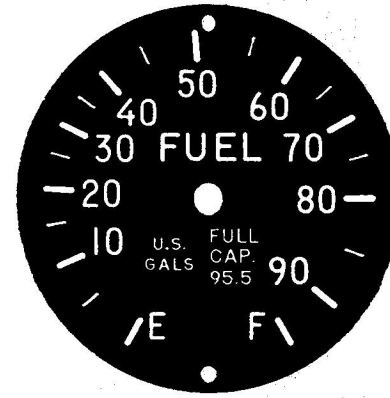
For EA100AN40 Indicator



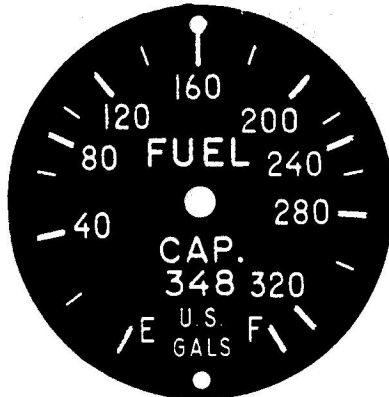
For EA100AN41 Indicator



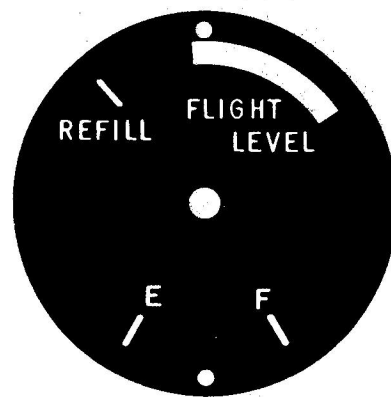
For EA100AN52 Indicator



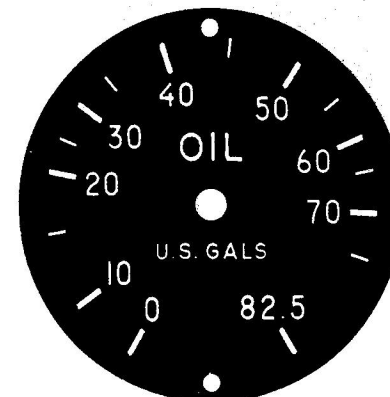
For EA100AN53 Indicator



For EA100AN56 Indicator



For EA100AN57 Indicator



For EA100AN62 Indicator



For EA100AN63 Indicator



For EA100AN66 Indicator



For EA100AN68 Indicator

Figure (EA100AN)-7. (Sheet 2 of 3 Sheets) Calibrated Dials for EA100AN Indicators

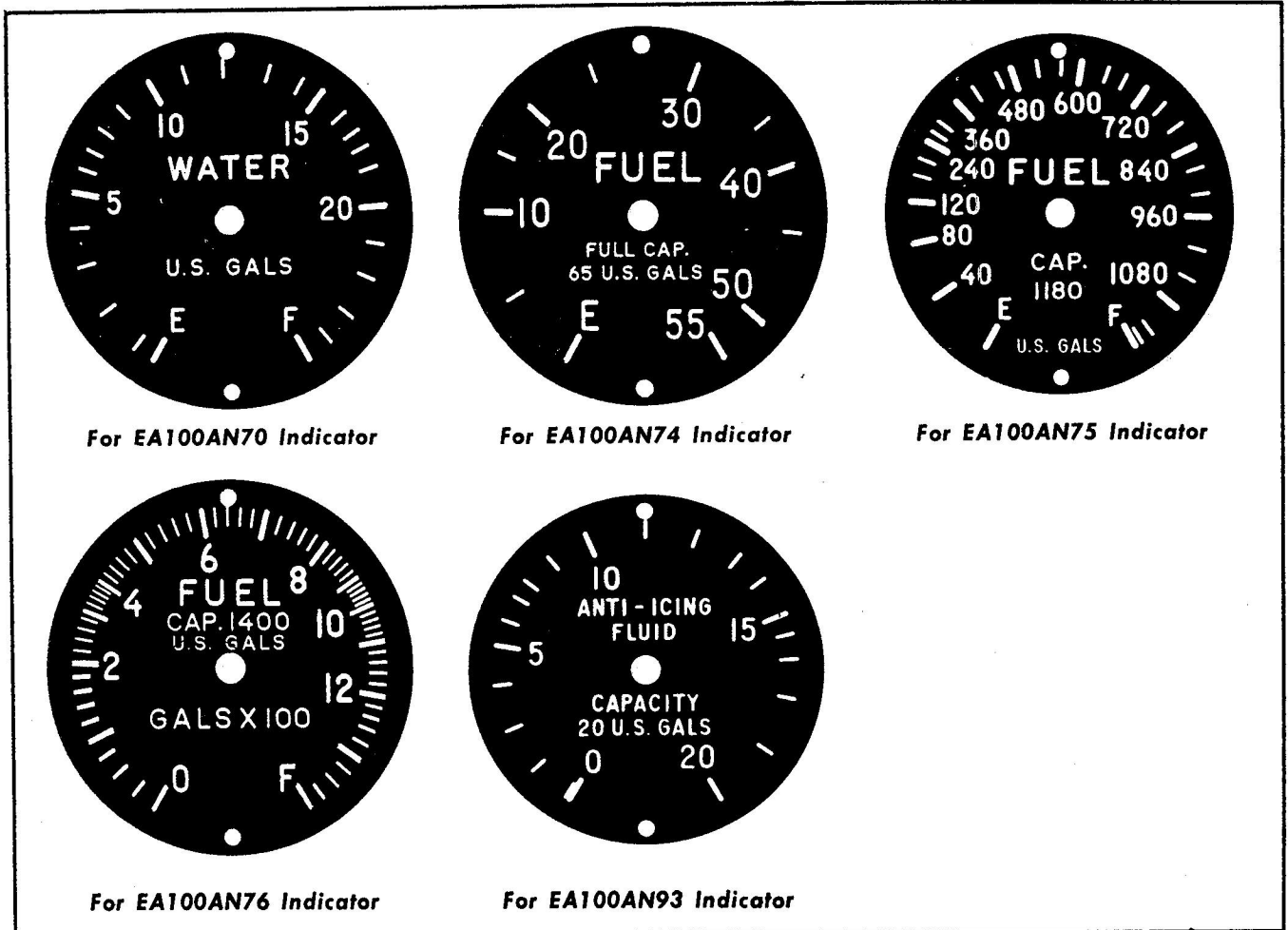


Figure (EA100AN)-7. (Sheet 3 of 3 Sheets) Calibrated Dials for EA100AN Indicators





**QUANTITY INDICATORS FOR EA100ANH SERIES****Note**

Overhaul of these indicators is covered in Section II. Testing of mechanisms, resistors and final test shown in this section only.

Check mechanism and resistors with ohmmeter or bridge and replace them if resistance is not as follows:  
Mechanism = 285-315 ohms.

Resistors =

Two solder lug type = 500 ohms  $\pm$  2%

Three solder lug type = 450 ohms  $\pm$  2%

**FINAL TEST.**

Connect indicator to transmitter as shown in figure (EA100ANH)-1 and perform tests as outlined in Section III.

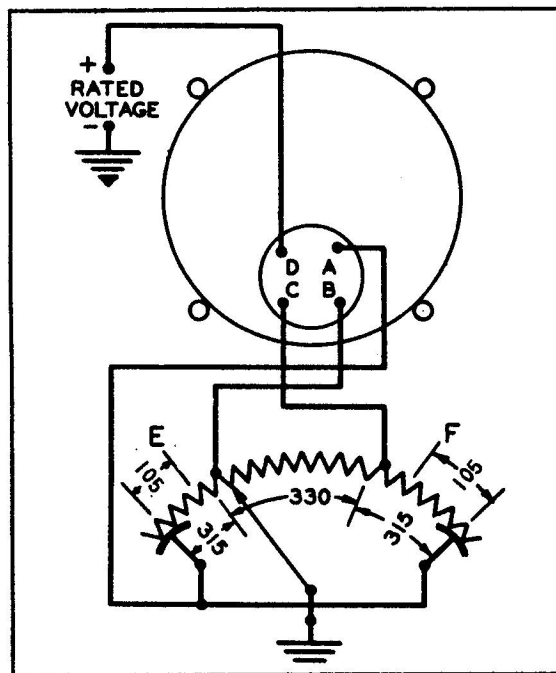


Figure (EA100ANH)-1 (Issue 1)  
Testing Diagram

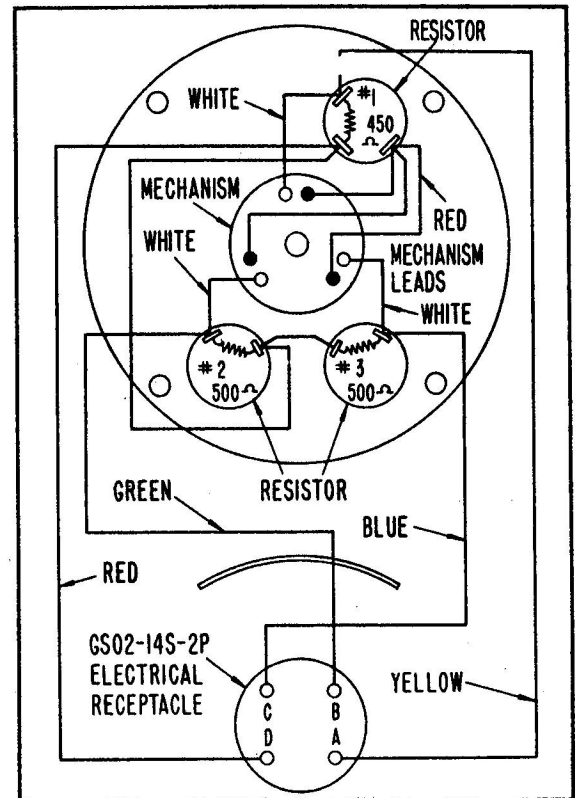


Figure (EA100ANH)-2. Internal Wiring Diagram

**Note**

If Type 0-1 Field Tester is used make connections as shown in figure (EA100ANH)-3 and follow instructions as outlined in paragraph 3-14.

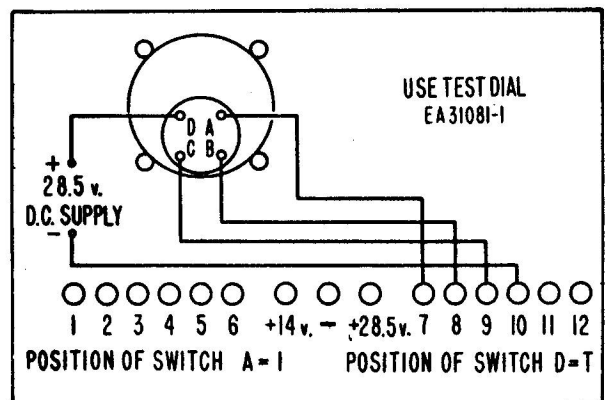
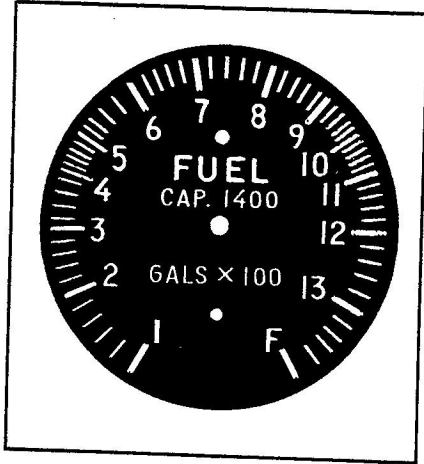


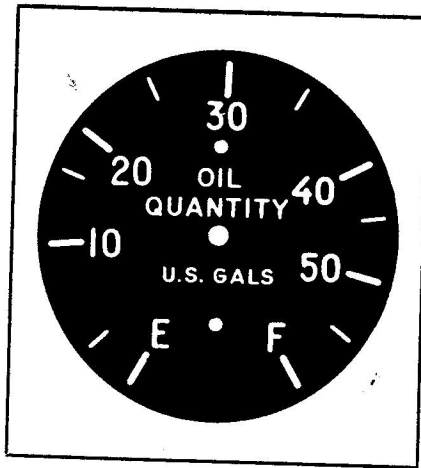
Figure (EA100ANH)-3. Field Tester Connections

Revised 18 Apr 56

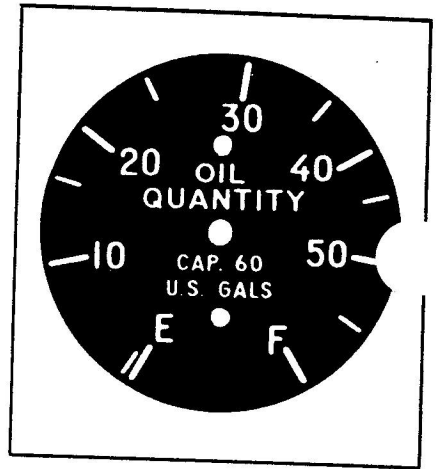
(EA100ANH)-1



For EA100ANH-92 Indicator



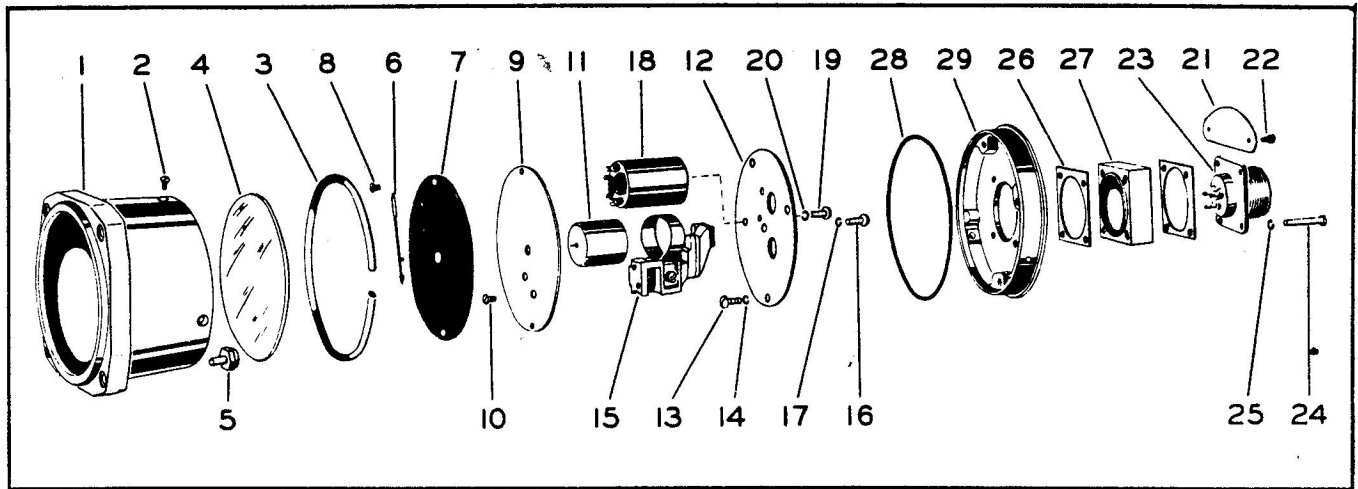
For EA100ANH-94 Indicator



For EA100ANH-97 Indicator

Figure (EA100ANH)-4 (Sheet 2 of 2). Calibrated Dials for EA100ANH Indicators

## QUANTITY INDICATORS FOR EA101AN SERIES



- |              |             |                     |                 |                 |                |
|--------------|-------------|---------------------|-----------------|-----------------|----------------|
| 1. Case      | 6. Pointer  | 11. Mechanism       | 16. Screw       | 21. Name Plate  | 26. Gasket     |
| 2. Screw     | 7. Dial     | 12. Mounting Plate  | 17. Lock Washer | 22. Screw       | 27. Adaptor    |
| 3. Snap Ring | 8. Screw    | 13. Screw           | 18. Resistor    | 23. Receptacle  | 28. Gasket     |
| 4. Glass     | 9. Sub Dial | 14. Lock Washer     | 19. Screw       | 24. Screw       | 29. Back Plate |
| 5. Stop Nut  | 10. Screw   | 15. Saddle Assembly | 20. Lock Washer | 25. Lock Washer |                |

Figure (EA101AN)-1. Exploded View of EA101AN Indicator

**Note**

Item numbers mentioned in text correspond to those shown in figure (EA101AN)-1.

**DISASSEMBLY.**

Item 6. Remove with a pointer puller.

Item 7. Take out two screws (8) and lift off from sub dial (9).

Item 18. Remove sub dial (9) by taking out two screws (10). Remove mounting plate (29) from back plate (29) by taking out three screws (13) and lock washers (14). Remove screw (19) and lock washer (20) holding resistor (18) from back of mounting plate (12).

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer or damaged dial; replace them.

Check mechanism (11) and resistor with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanism = 285-315 ohms

Resistors: Lugs #1 & #4 = 450 ohms  $\pm 2\%$

Lugs #2 & #4 = 500 ohms  $\pm 2\%$

Lugs #3 & #4 = 500 ohms  $\pm 2\%$

**FINAL TEST.** (See table.)

Test indicator connected to transmitter as outlined in Section III using applicable testing diagram as shown in table.

When using the Type 0-1 Field Tester follow instructions beginning with paragraph 3-14 and connect indicator to tester as per figure designated in table.

Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA101AN107	(EA101AN)-3	(EA101AN)-5	(EA101AN)-7
EA101AN89	(EA101AN)-2	(EA101AN)-4	(EA101AN)-6

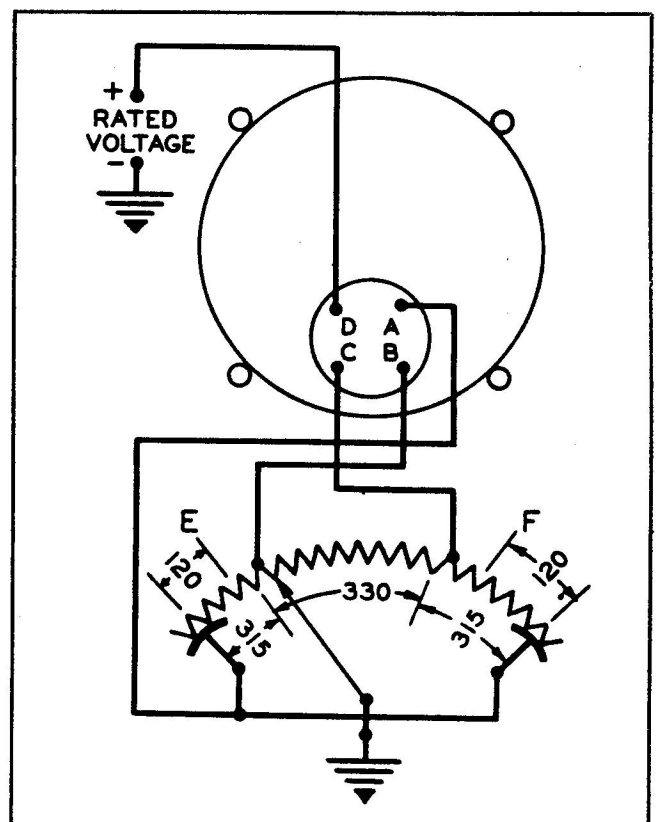


Figure (EA101AN)-2. Testing Diagram

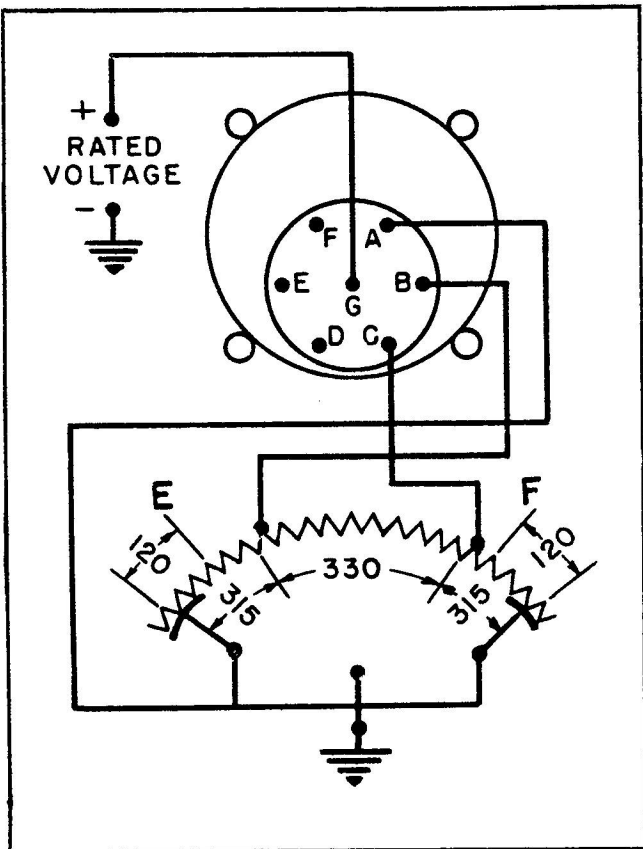


Figure (EA101AN)-3. Testing Diagram

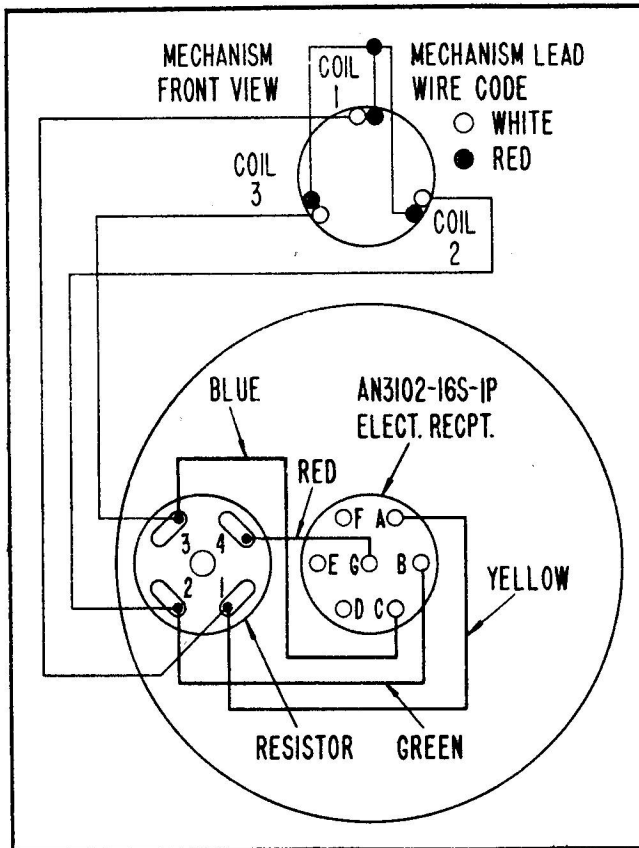


Figure (EA101AN)-5. Internal Wiring Diagram

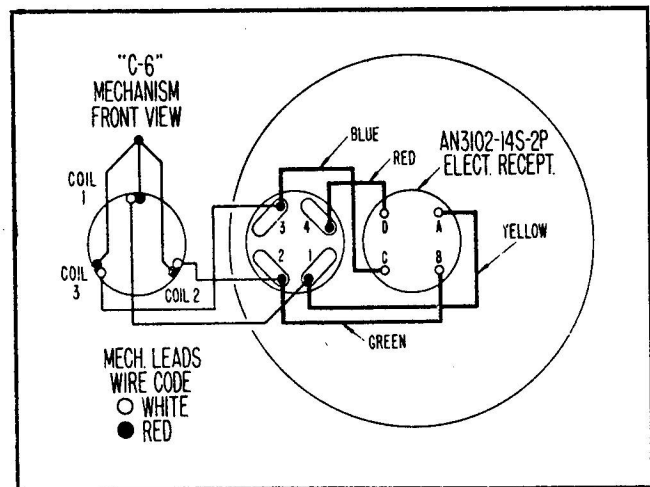


Figure (EA101AN)-4. Internal Wiring Diagram

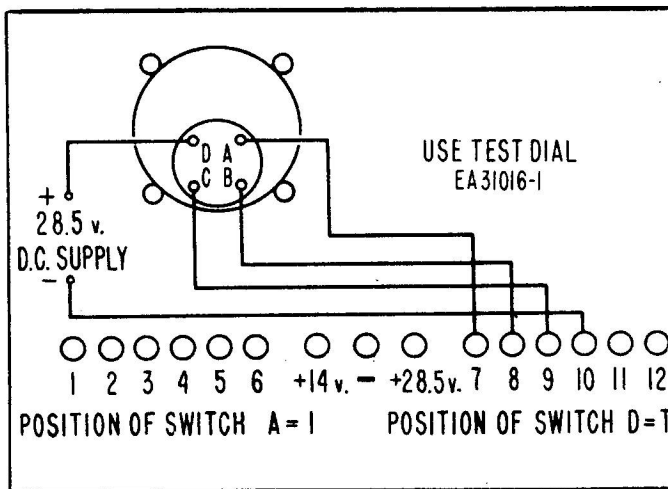


Figure (EA101AN)-6. Field Tester Connections

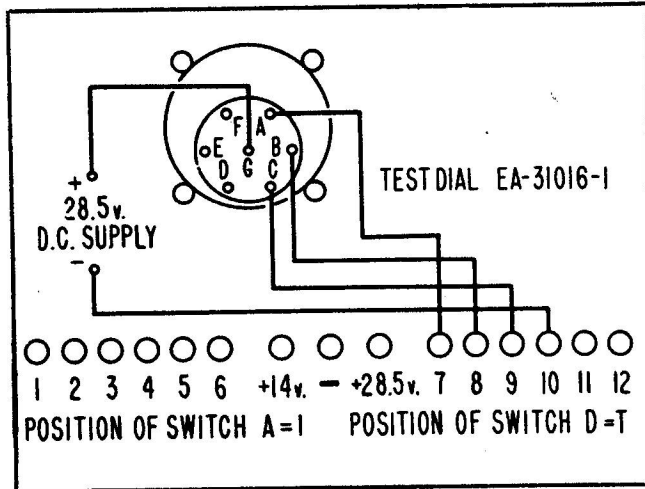
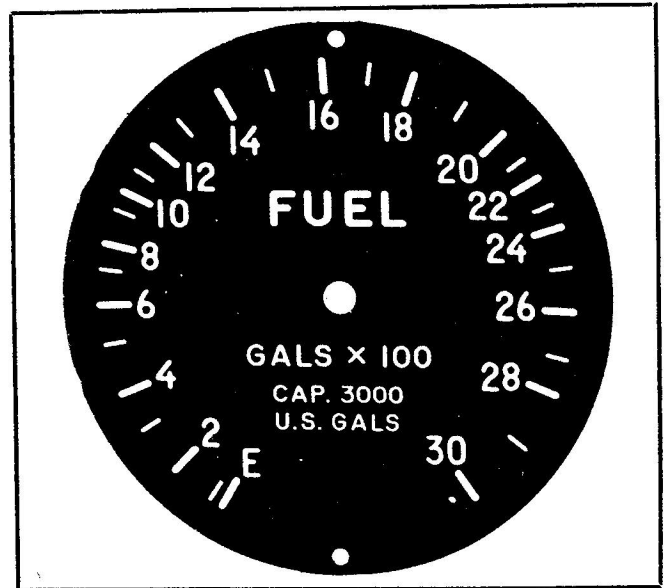


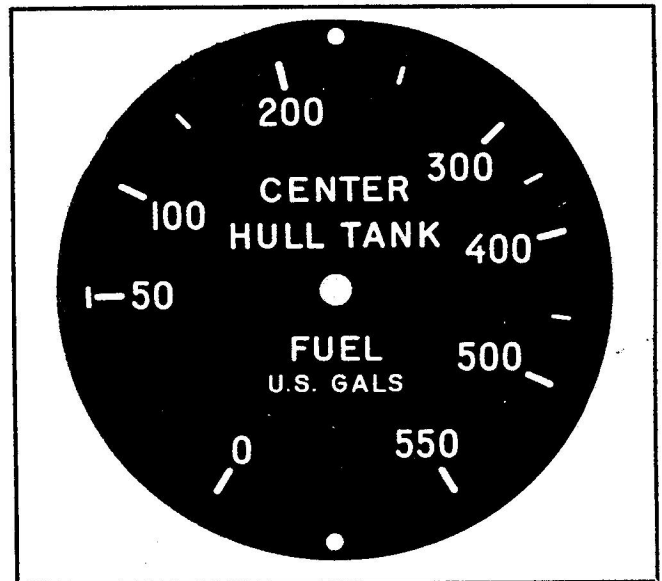
Figure (EA101AN)-7. Field Tester Connections

**Note**

This family or series of EA101AN indicators is similar to one another in most instances except for calibration. This difference is shown by the dials in figure (EA101AN)-8.



For EA101AN107 Indicator

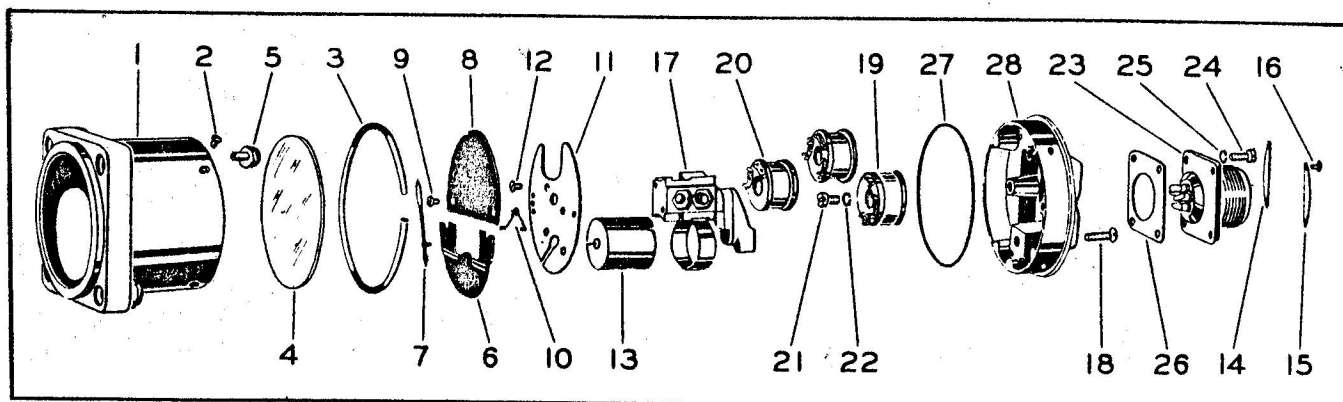


For EA101AN89 Indicator

Figure (EA101AN)-8. Calibrated Dials for EA101AN Indicators



## QUANTITY INDICATORS FOR EA102AN SERIES



1. Case  
2. Screw  
3. Snap Ring  
4. Glass  
5. Stop Nut  
6. Shield  
7. Pointer

8. Dial  
9. Screw  
10. Pointer Stop  
11. Sub Dial  
12. Mechanism  
13. Mechanism

15. Name Plate  
16. Screw  
17. Saddle Assembly  
18. Screw  
19. Resistor  
20. Resistor  
21. Screw

22. Lock Washer  
23. Receptacle  
24. Screw  
25. Lock Washer  
26. Gasket  
27. Gasket  
28. Back Plate

Figure (EA102AN)-1. Exploded View of EA102AN Indicator

**Note**

Item numbers mentioned in text correspond to those shown in figure (EA102AN)-1.

**DISASSEMBLY.**

Item 7. Remove with a pointer puller.

Item 8. Take out two screws (9) and lift off from sub dial (11).

Items 19 and 20. Remove two screws (12), lift off sub dial (11) and take out screws (21) and lock washers (22) which hold resistors (19) and (20) to back plate (28).

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer or damaged dial; replace them.

Check mechanism (13) and resistors (19) and (20) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanism = 285-315 ohms

Resistors: Two solder lug type = 225 ohms  $\pm$  2%

Three solder lug type = 2000 ohms  $\pm$  2%

Spool type = 2000 ohms  $\pm$  2%

Fixed type = 40 ohms  $\pm$  5%

**FINAL TEST.** (See table.)

Test indicator connected to transmitter as outlined in Section III using the applicable testing diagram as shown in table.

When using the Type 0-1 Field Tester follow instructions beginning with paragraph 3-14 and connect indicator to tester as per figure designated in table.

Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA102AN10	(EA102AN)-2	(EA102AN)-5	(EA102AN)-8
EA102AN27	(EA102AN)-2	(EA102AN)-4	(EA102AN)-8
EA102AN29	(EA102AN)-2	(EA102AN)-4	(EA102AN)-8
EA102AN44	(EA102AN)-3	(EA102AN)-6	(EA102AN)-9
EA102AN54	(EA102AN)-2	(EA102AN)-4	(EA102AN)-8
EA102AN65	(EA102AN)-3	(EA102AN)-6	(EA102AN)-9
EA102AN82	(EA102AN)-3	(EA102AN)-6	(EA102AN)-9
EA102AN83	(EA102AN)-3	(EA102AN)-6	(EA102AN)-9

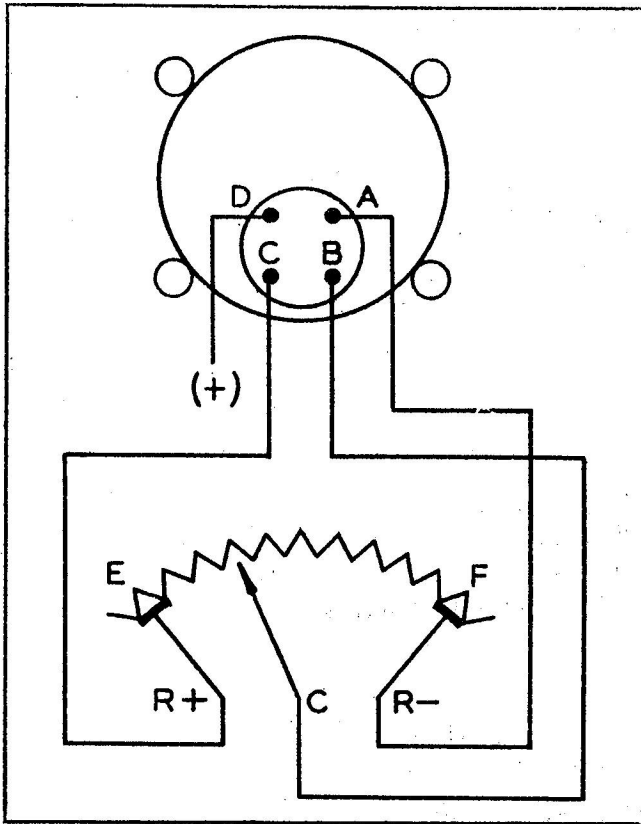


Figure (EA102AN)-2. Testing Diagram

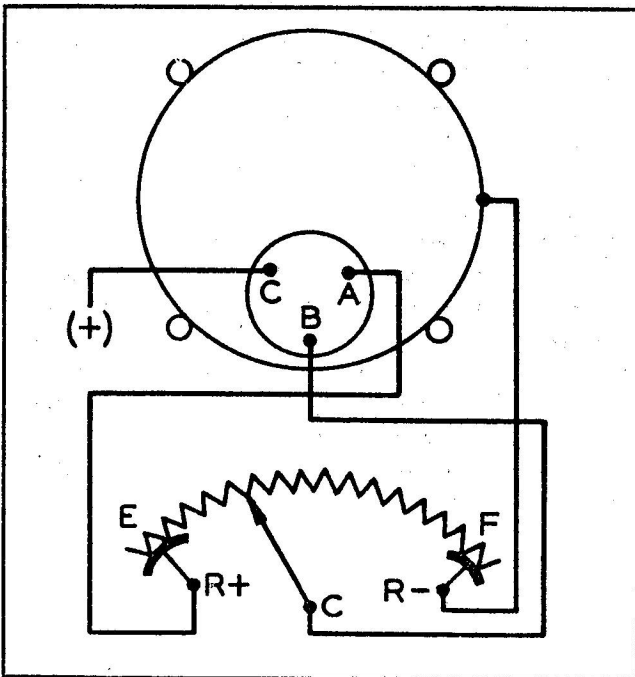


Figure (EA102AN)-3. Testing Diagram

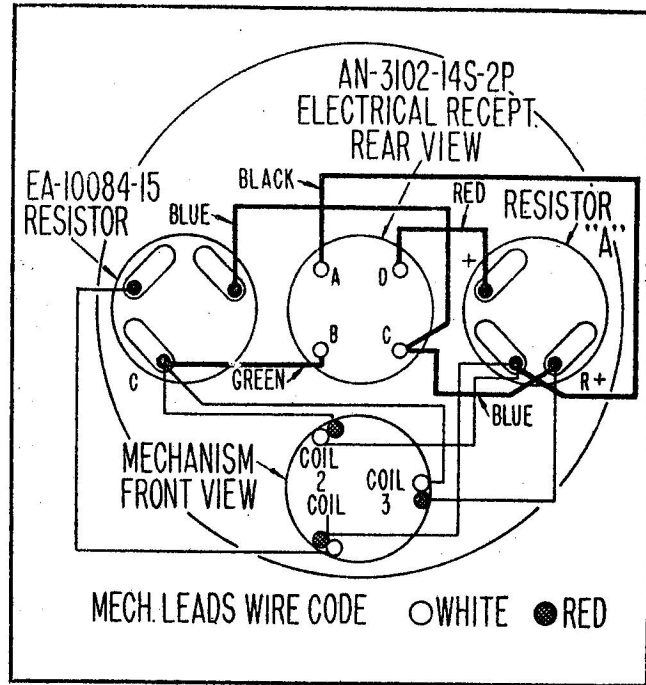


Figure (EA102AN)-4. Internal Wiring Diagram

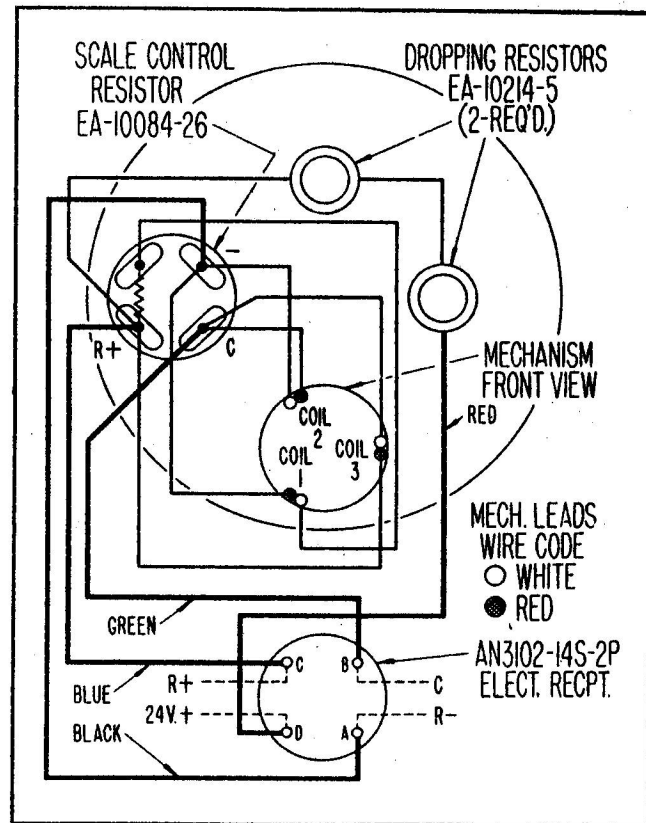


Figure (EA102AN)-5. Internal Wiring Diagram



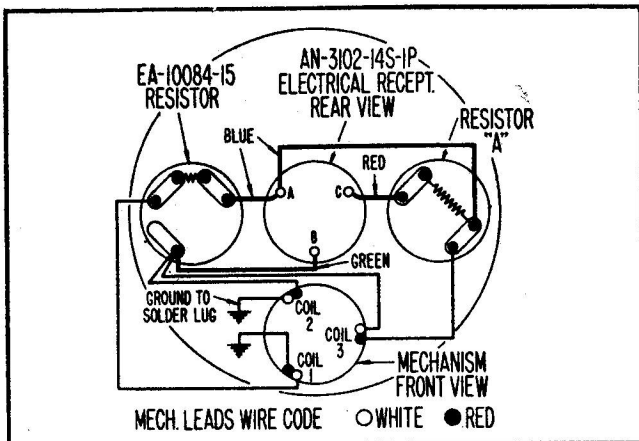


Figure (EA102AN)-6. Internal Wiring Diagram

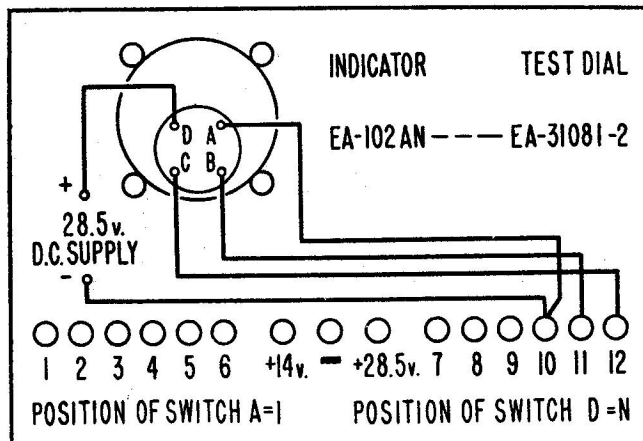


Figure (EA102AN)-8. Field Tester Connections

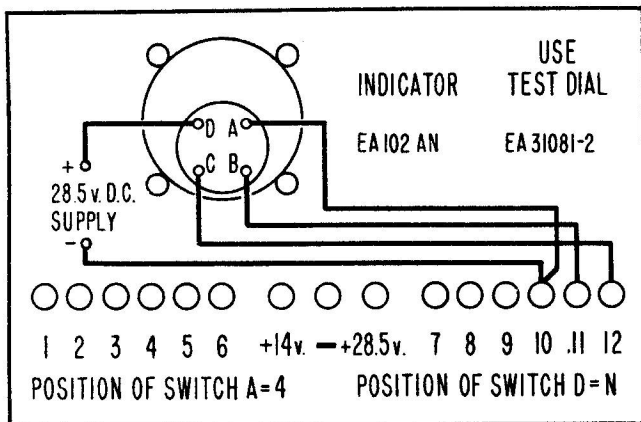


Figure (EA102AN)-7. Field Tester Connections

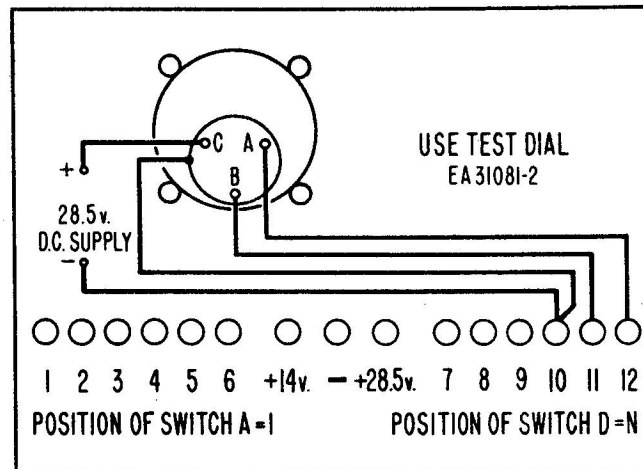
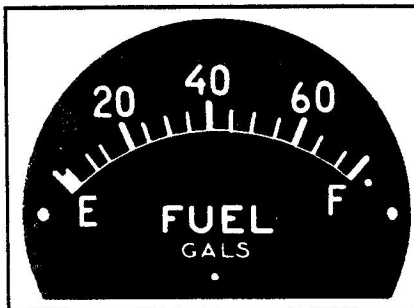


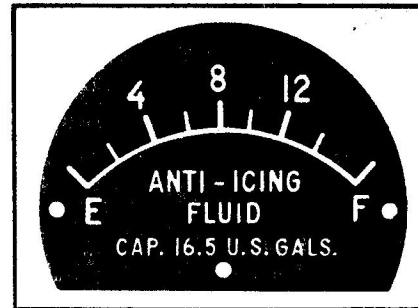
Figure (EA102AN)-9. Field Tester Connections

**Note**

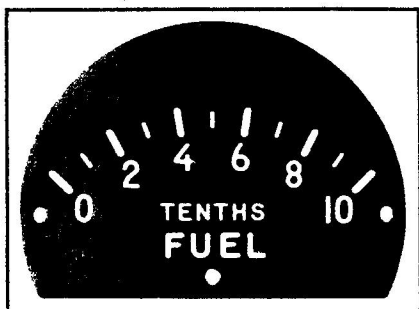
This family or series of EA102AN indicators is similar to one another in most instances except for calibration. This difference is shown by the dials in figure (EA102AN)-10.



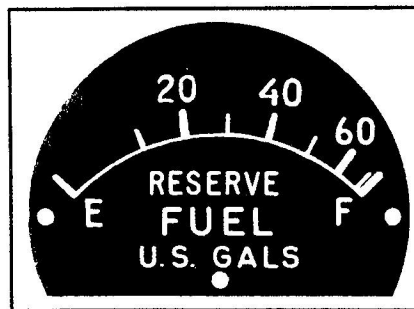
For EA102AN27 Indicator



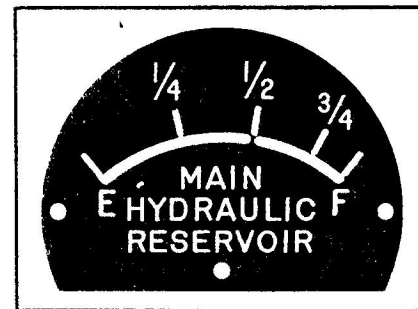
For EA102AN44 Indicator



For EA102AN10 Indicator

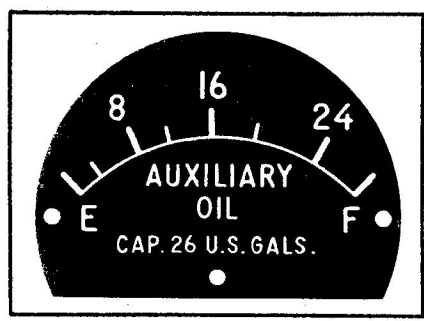


For EA102AN29 Indicator

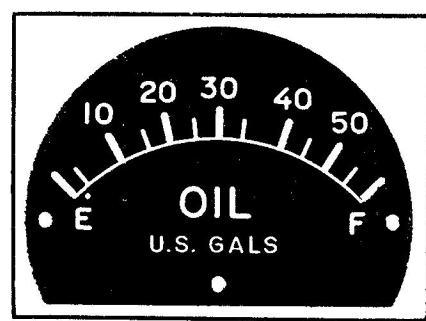


For EA102AN54 Indicator

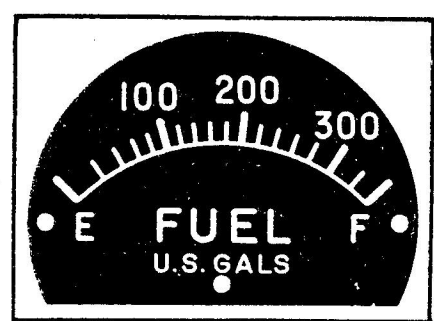
Figure (EA102AN)-10. (Sheet 1 of 2 Sheets) Calibrated Dials for EA102AN Indicators



For EA102AN65 Indicator



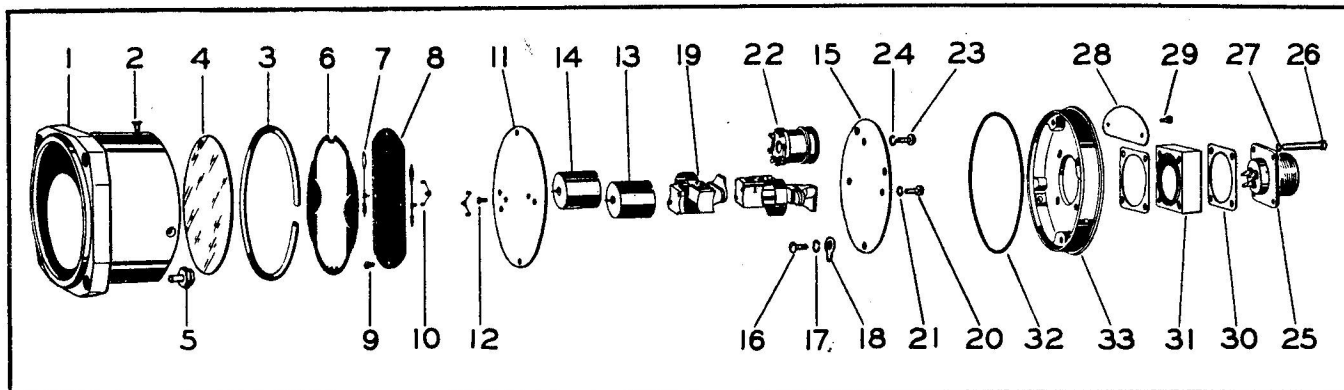
For EA102AN82 Indicator



For EA102AN83 Indicator

Figure (EA102AN)-10. (Sheet 2 of 2 Sheets) Calibrated Dials for EA102AN Indicators

## QUANTITY INDICATORS FOR EA124AN SERIES



1. Case  
2. Screw  
3. Snap ring  
4. Glass  
5. Stop nut  
6. Shield  
7. Pointer

8. Dial  
9. Screw  
10. Pointer stop  
11. Sub dial  
12. Screw  
13. Mechanism  
14. Mechanism

15. Mounting plate  
16. Screw  
17. Lock washer  
18. Solder lug  
19. Saddle assembly  
20. Screw  
21. Lock washer

22. Resistor  
23. Screw  
24. Lock washer  
25. Receptacle  
26. Screw  
27. Lock washer

28. Name plate  
29. Screw  
30. Gasket  
31. Adaptor  
32. Gasket  
33. Back plate

Figure (EA124AN)-1. Exploded View of EA124AN Indicator

**Note**

Item numbers mentioned in text correspond to those shown in figure (EA124AN)-1.

**DISASSEMBLY.**

Items 7 and 8. Take out two screws (9), lift off shield (6), remove pointers (7) with pointer puller and lift dial off sub dial (11). Remove pointer stops (10) from dial by bending prongs of rivets upwards on the back of dial and pushing rivets through dial.

Item 22. Remove sub dial (11) by taking out three screws (12). Take out three screws (16) and lockwashers (17) holding mounting plate (15) to back plate (33). Remove screws (23) and lockwashers (24) from back of mounting plate which holds resistors (22).

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer, damaged dial or pointer stops; replace them. Check mechanisms (13)

and (14) and resistors (22) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanism = 285-315 ohms

Resistors: See columns 2 and 3 in table for resistance tolerances.

**FINAL TEST.** (See table.)

Test indicator connected to transmitter as outlined in Section III using the applicable testing diagram as shown in table. When the Type 0-1 Field Tester is used follow instructions beginning with paragraph 3-14, and connect indicator to tester as per figure designated in table.

Indicator	Values of Resistance for Resistors		Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
	Lugs # 1 & # 4	Lugs # 2 & # 4			
EA124AN-P47	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-100	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-103	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-105	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-105A	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-108	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-110	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-111	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-112	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-3	(EA124AN)-5	(EA124AN)-7
EA124AN-115	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-29	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-40	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-74	1400 ohms $\pm$ 2%	200 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6
EA124AN-83	1400 ohms $\pm$ 2%	40 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-8
EA124AN-93	200 ohms $\pm$ 2%	1400 ohms $\pm$ 2%	(EA124AN)-2	(EA124AN)-4	(EA124AN)-6

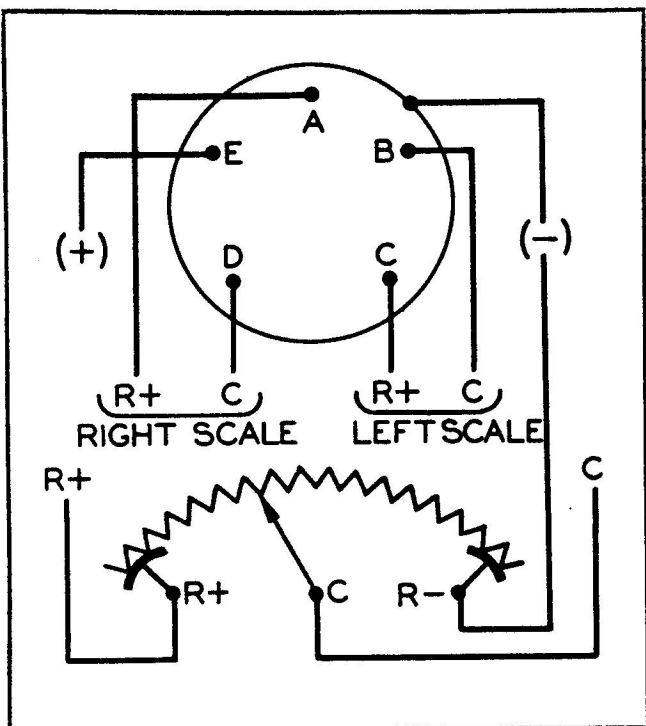


Figure (EA124AN)-2. Testing Diagram

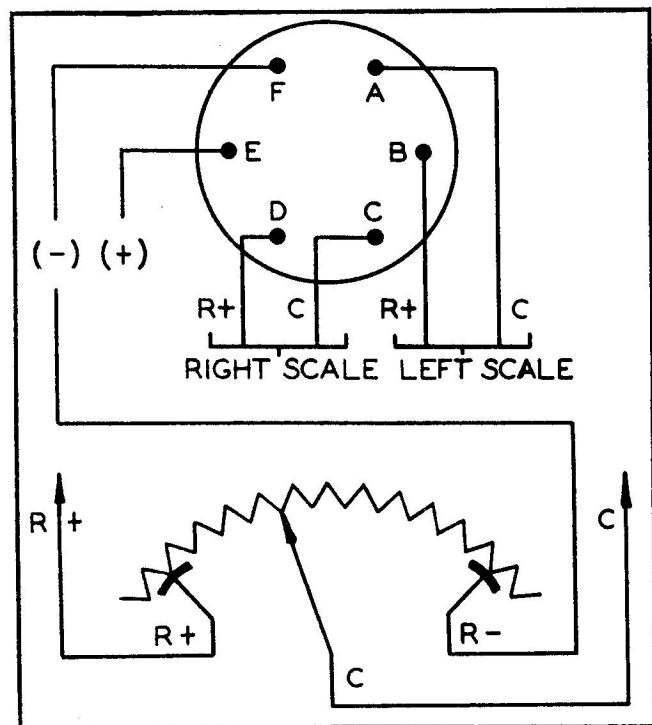


Figure (EA124AN)-3. Testing Diagram

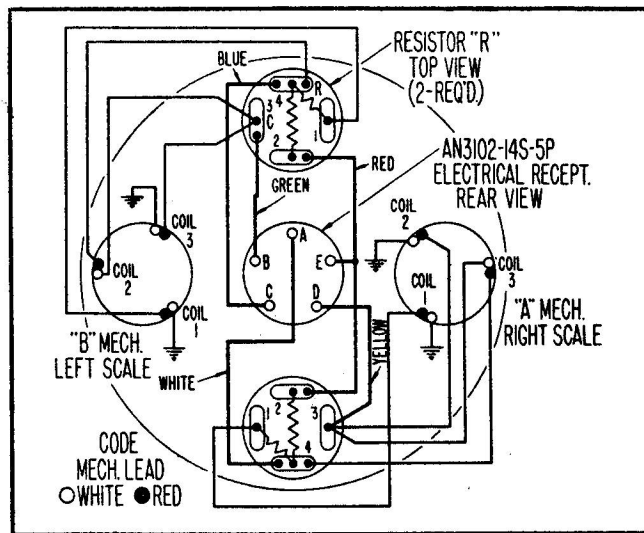


Figure (EA124AN)-4. Internal Wiring Diagram

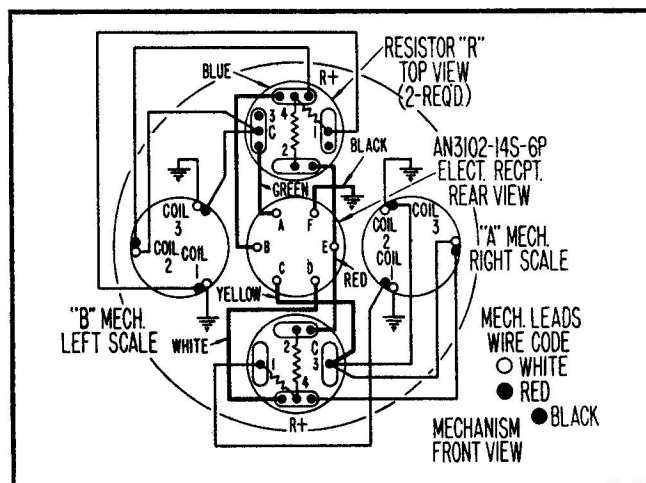


Figure (EA124AN)-5. Internal Wiring Diagram

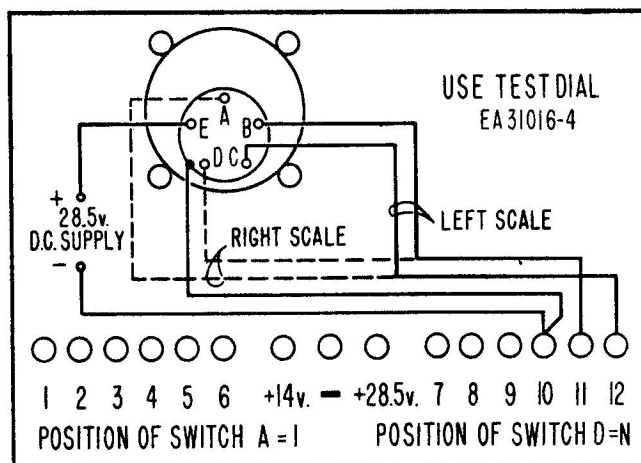


Figure (EA124AN)-6. Field Tester Connections

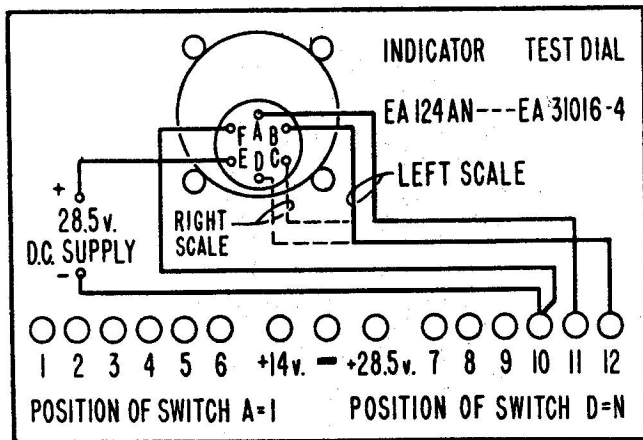


Figure (EA124AN)-7. Field Tester Connections

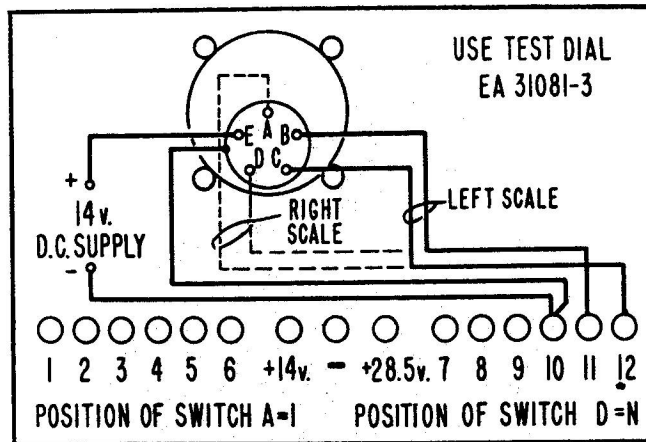


Figure (EA124AN)-8. Field Tester Connections

For EA124AN-P47 Indicator

**Note**

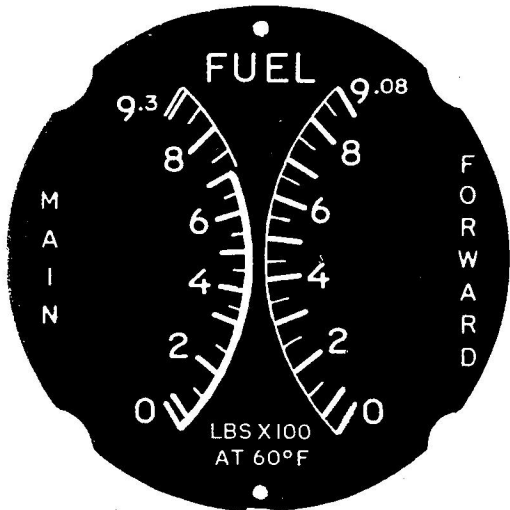
This family or series of EA124AN indicators is similar to one another in most instances except for calibration. This difference is shown by the dials in figure (EA-124AN)-9.

For EA124AN-100 Indicator

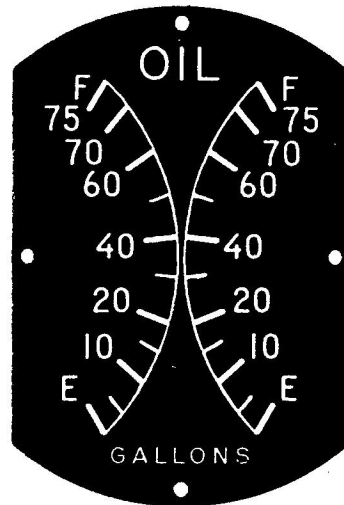
For EA124AN-103 Indicator

For EA124AN-105 Indicator

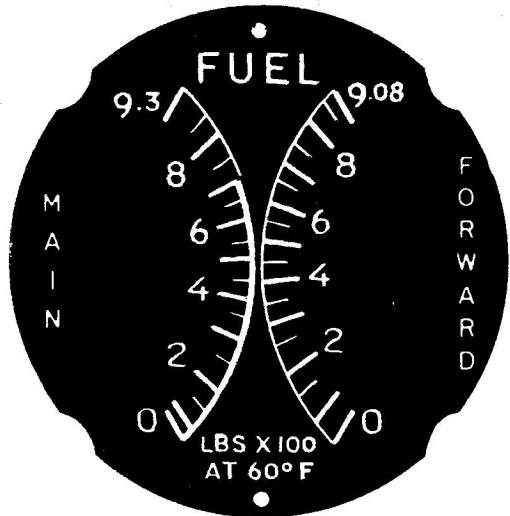
Figure (EA124AN)-9 (Sheet 1 of 3 Sheets). Calibrated Dials for EA124AN Indicators



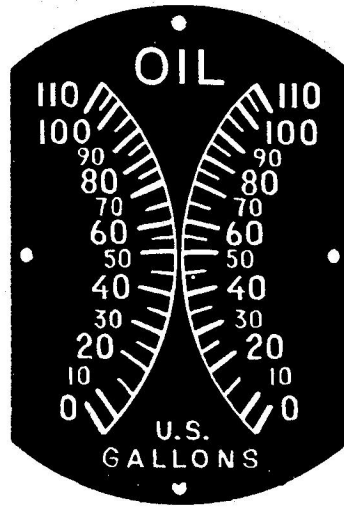
For EA124AN-105A Indicator



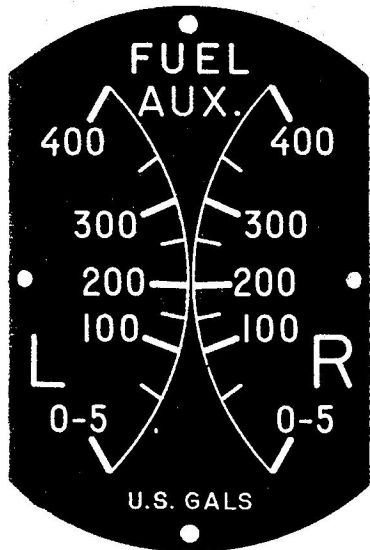
For EA124AN-108 Indicator



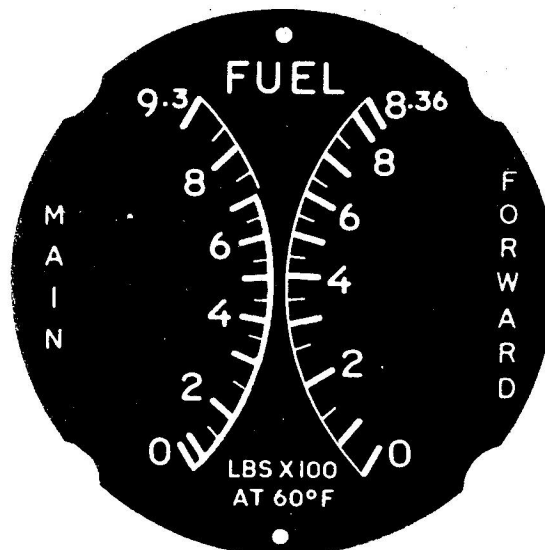
For EA124AN-110 Indicator



For EA124AN-111 Indicator

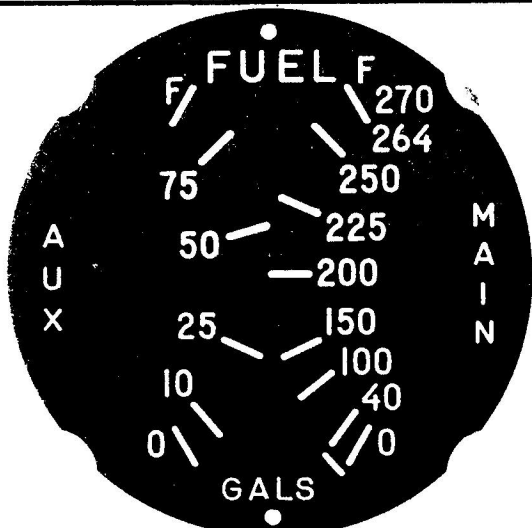


For EA124AN-112 Indicator

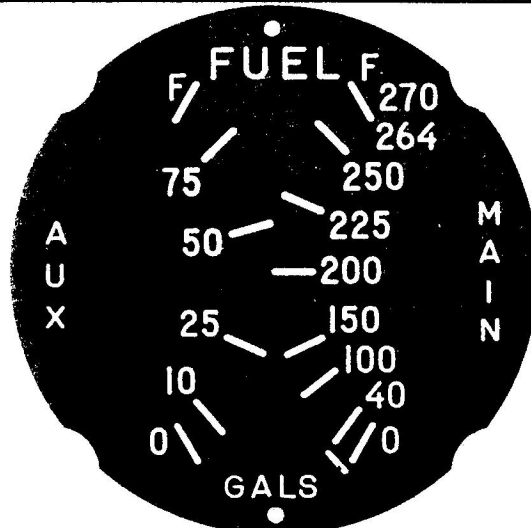


For EA124AN-115 Indicator

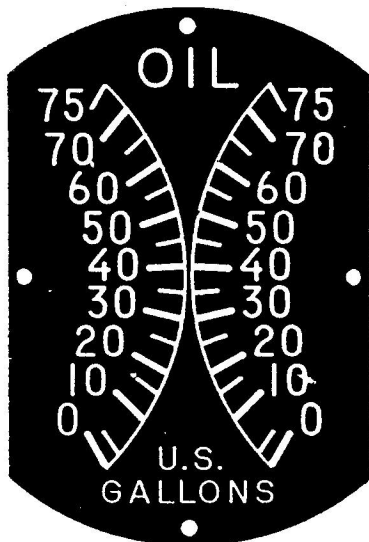
Figure (EA124AN)-9 (See 2 of 3 Sheets). Calibrated Dials for EA124AN Indicators



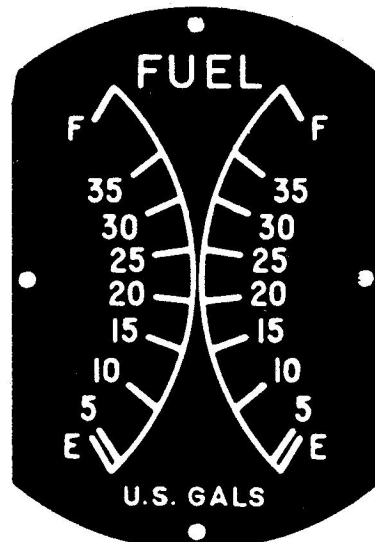
For EA124AN-29 Indicator



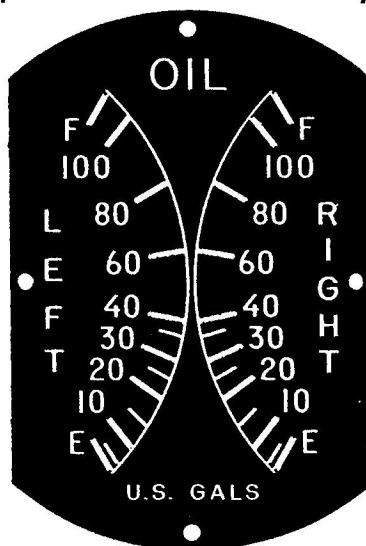
For EA124AN-40 Indicator



For EA124AN-74 Indicator



For EA124AN-83 Indicator



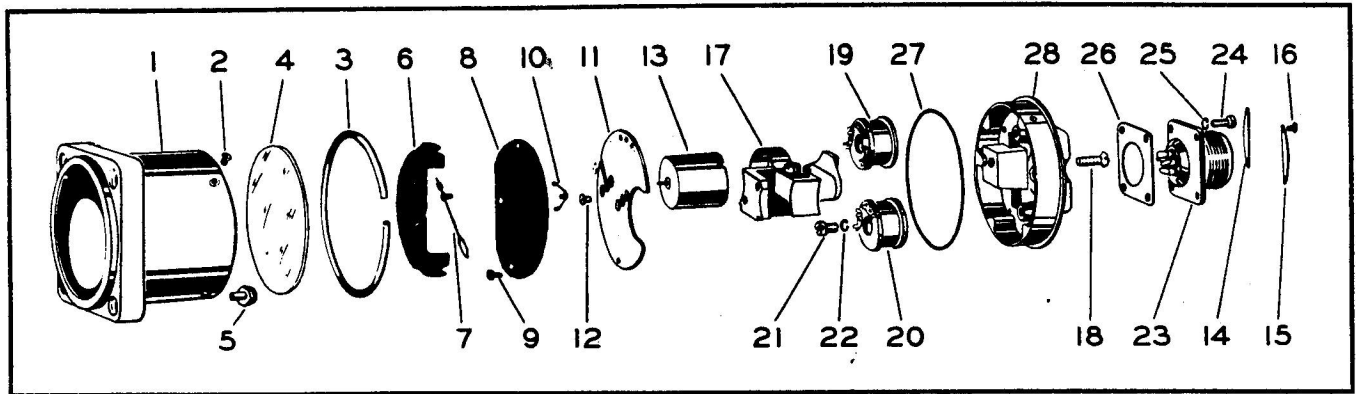
For EA124AN-93 Indicator

Figure (EA124AN)-9 (See 2 of 3 Sheets). Calibrated Dials for EA124AN Indicators





## QUANTITY INDICATORS FOR EA133AN SERIES



1. Case  
2. Screw  
3. Snap Ring  
4. Glass  
5. Stop Nut  
6. Shield  
7. Pointer

8. Dial  
9. Screw  
10. Pointer Stop  
11. Sub Dial  
12. Screw  
13. Mechanism  
14. Name Plate

15. Name Plate  
16. Screw  
17. Saddle Assembly  
18. Screw  
19. Resistor  
20. Resistor  
21. Screw

22. Lock Washer  
23. Receptacle  
24. Screw  
25. Lock Washer  
26. Gasket  
27. Gasket  
28. Back Plate

Figure (EA133AN)-1. Exploded View of EA133AN Indicator

### Note

Item numbers mentioned in text correspond to those shown in figure (EA133AN)-1.

### DISASSEMBLY.

Items 7 and 8. Take out two screws (9) and lift off shield (6). Remove pointer with pointer puller. Lift dial off sub dial (11). Remove pointer stops (10) from dial by bending prongs of rivets upwards on the back of dial and pushing rivets through dial.

Items 19 and 20. Remove sub dial (11) by taking out two screws (12). Take out screws (21) and lockwasher (22) which hold resistors (19) and (20) to back plate (28).

### REPAIR AND REPLACEMENT.

Do not repair broken pointer, pointer stops or damaged dial; replace them. Check mechanism (13) and resistors (19) and (20) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanism = 285-315 ohms

Resistors: Two lug type = 320 ohms  $\pm$  2%

Three lug type = 210 ohms  $\pm$  2%

**FINAL TEST.**

Connect indicator to transmitter as shown in figure (EA133AN)-2 and test as outlined in Section III.

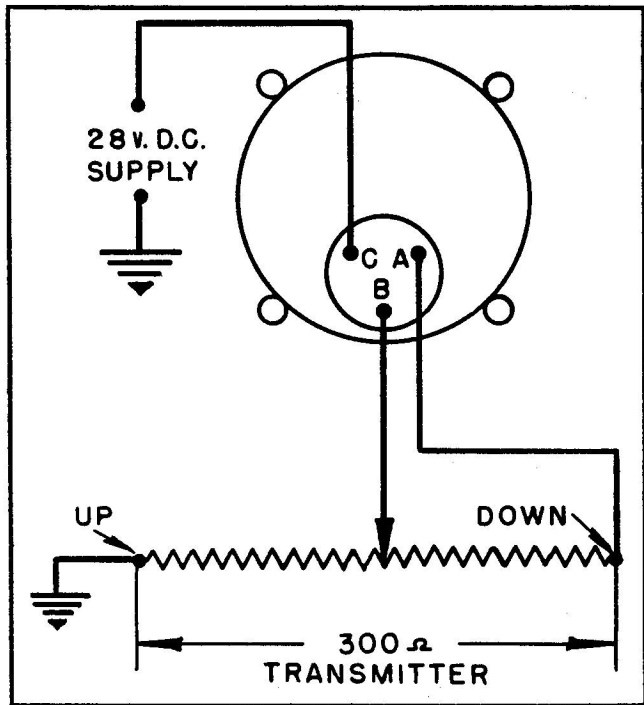


Figure (EA133AN)-2. Testing Diagram

**Note**

If Type 0-1 Field Tester is used connect as shown in figure (EA133AN)-4 and follow instructions beginning with paragraph 3-14.

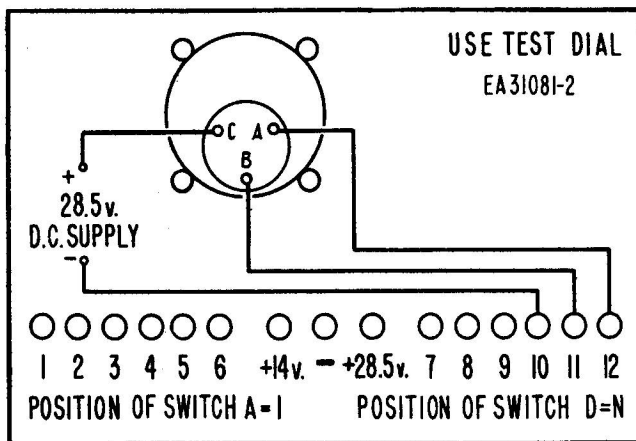


Figure (EA133AN)-4. Field Tester Connections

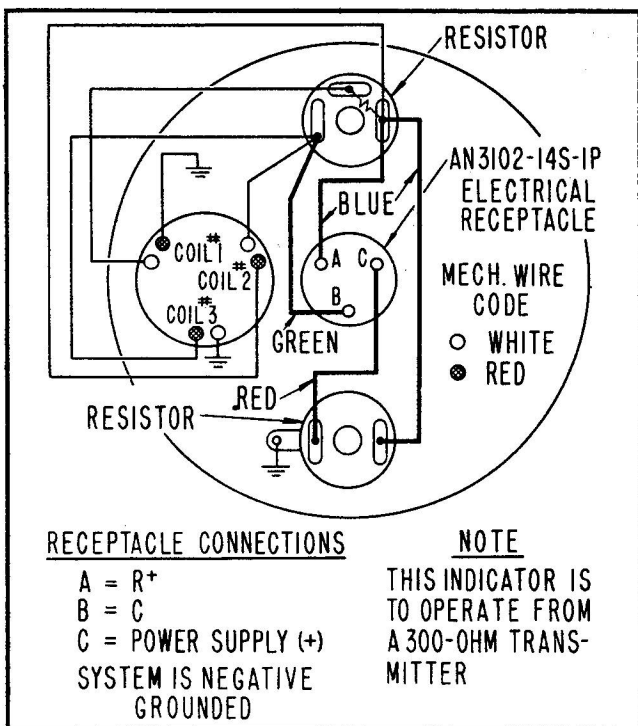
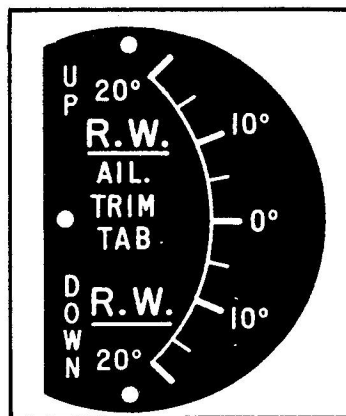


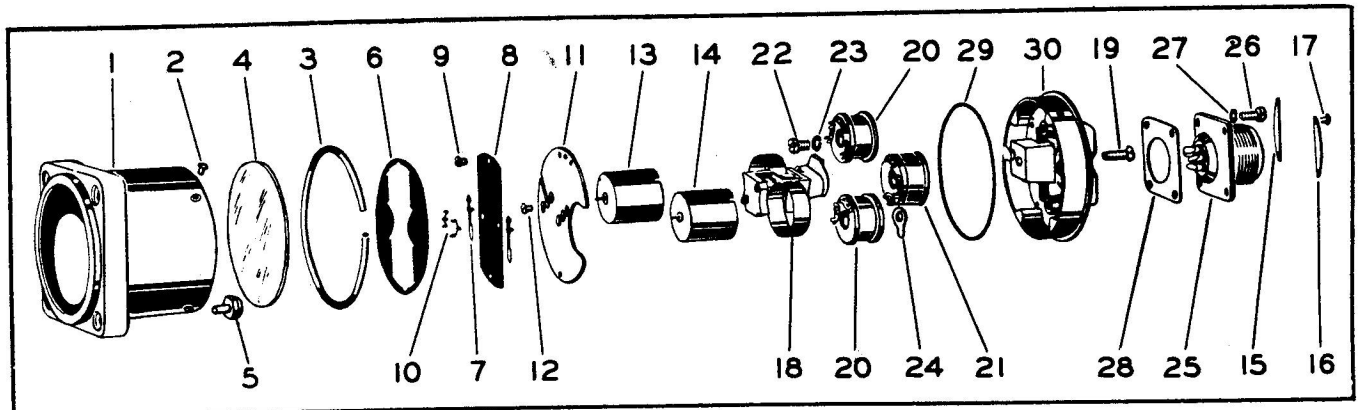
Figure (EA133AN)-3. Internal Wiring Diagram



For EA133AN-1. Indicator

Figure (EA133AN)-5. Calibrated Dial for EA133AN Indicators

## QUANTITY INDICATORS FOR EA148AN SERIES



1. Case  
2. Screw  
3. Snap Ring  
4. Glass  
5. Stop Nut  
6. Shield

7. Pointer  
8. Dial  
9. Screw  
10. Pointer Stop  
11. Sub Dial  
12. Screw

13. Mechanism  
14. Mechanism  
15. Name Plate  
16. Name Plate  
17. Screw  
18. Saddle Assembly

19. Screw  
20. Resistor  
21. Resistor  
22. Screw  
23. Lock Washer  
24. Solder Lug

25. Receptacle  
26. Screw  
27. Lock Washer  
28. Gasket  
29. Gasket  
30. Back Plate

Figure (EA148AN)-1. Exploded View of EA148AN Indicator

### Note

Item numbers mentioned in text correspond to those shown in figure (EA148AN)-1.

### DISASSEMBLY.

Items 7 and 8. Take out two screws (9), lift off shield (6) and remove pointers (7) with pointer puller and lift dial (8) off sub dial (11). Remove pointer stops (10) from dial by bending prongs of rivets upwards on the back of dial and push rivets through dial.

Items 20 and 21. Remove sub dial (11) by taking out two screws (12). Remove screws (22) and lockwashers (23) which hold resistors to back plate (30).

### REPAIR AND REPLACEMENT.

Do not repair broken pointer, pointer stops or damaged dial; replace them.

Check mechanisms (13) and (14) and resistors (20) and (21) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanisms = 285-315 ohms

Resistors = Stamped 1400 ohms should test  
1400 ohms  $\pm$  3%

Stamped 200 ohms should test  
200 ohms  $\pm$  2%

### FINAL TEST. (See table.)

Test indicator connected to transmitter as outlined in Section III using applicable testing diagram as shown in table. When the Type 0-1 Field Tester is used follow instructions beginning with paragraph 3-14, and connect indicator to tester as per figure designated in table.

Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA148AN11	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN12	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN13	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN16	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN36	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN40	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN42	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN43	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN46	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN47	(EA148AN)-2	(EA148AN)-4	(EA148AN)-6
EA148AN51	(EA148AN)-3	(EA148AN)-5	(EA148AN)-7

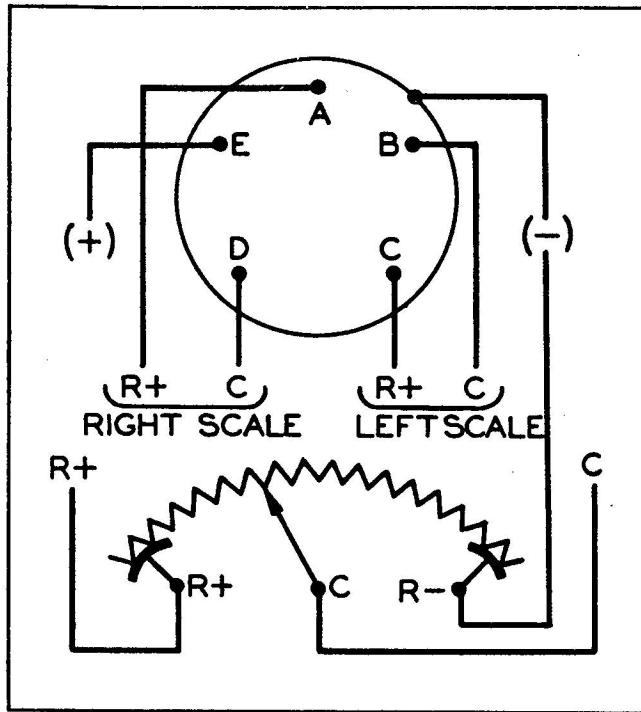


Figure (EA148AN)-2. Testing Diagram

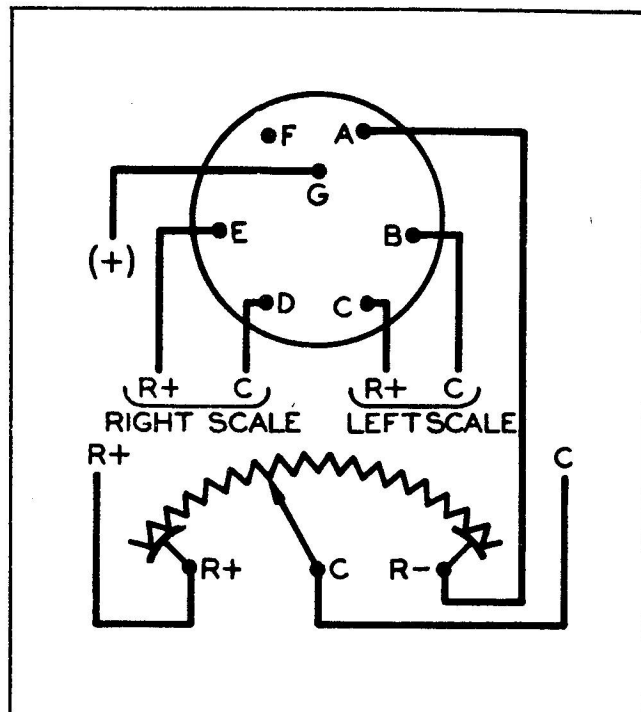


Figure (EA148AN)-3. Testing Diagram

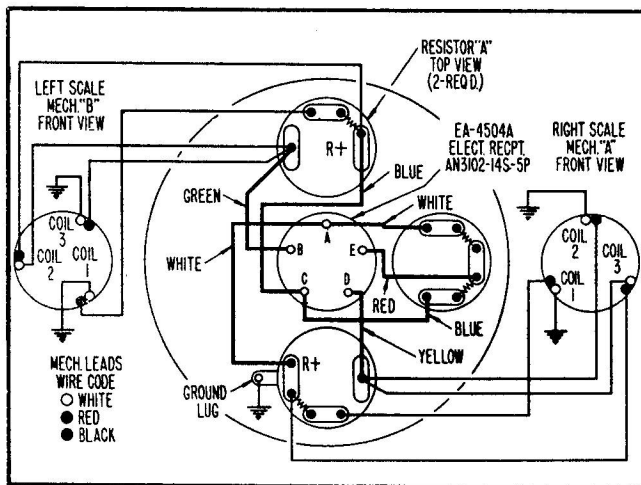


Figure (EA148AN)-4. Internal Wiring Diagram

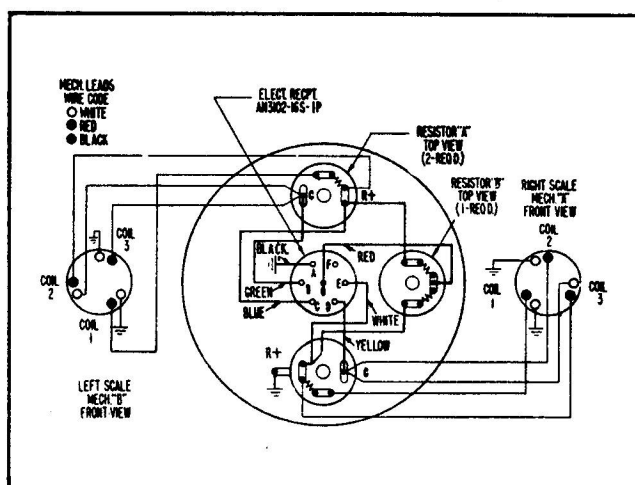


Figure (EA148AN)-5. Internal Wiring Diagram

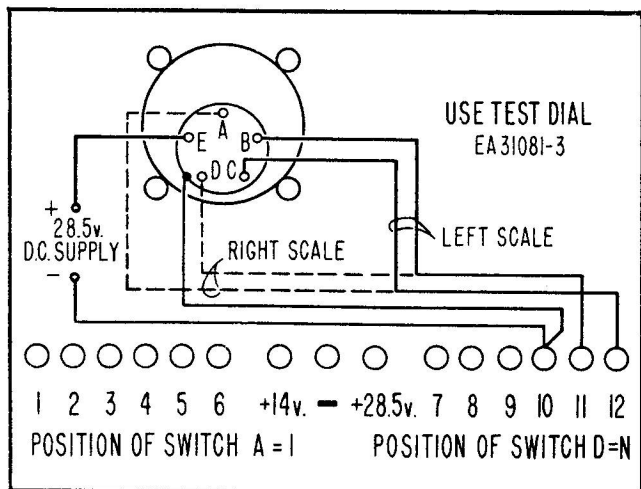


Figure (EA148AN)-6. Field Tester Connections

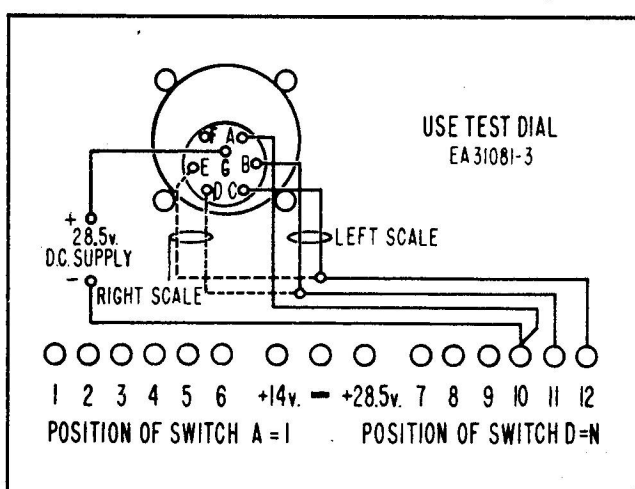
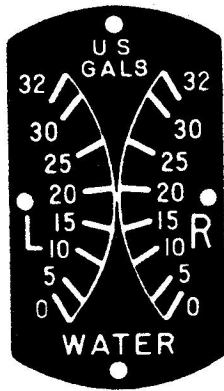


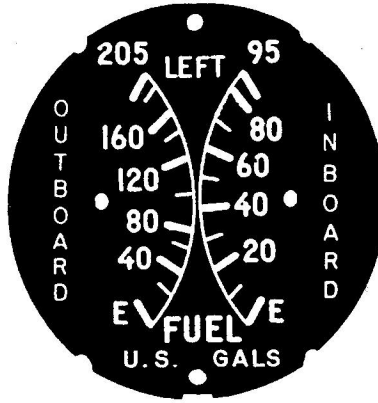
Figure (EA148AN)-7. Field Tester Connections

**Note**

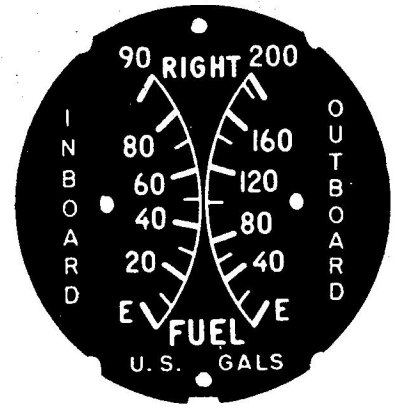
Indicators of the EA148AN series are similar except for dial calibrations, as shown in figure (EA148AN)-8.



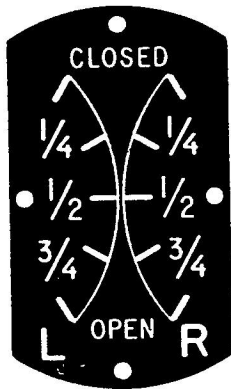
For EA148AN11 Indicator



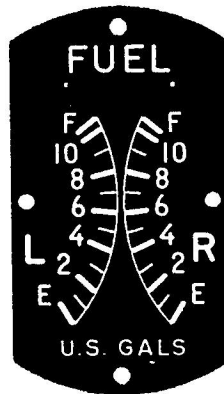
For EA148AN12 Indicator



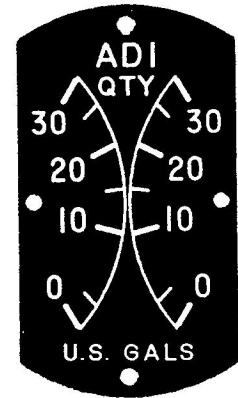
For EA148AN13 Indicator



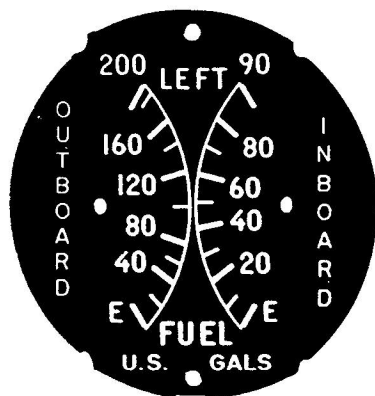
For EA148AN16 Indicator



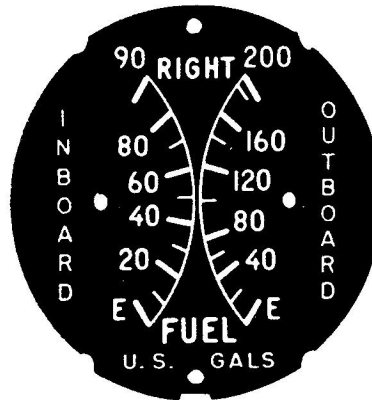
For EA148AN36 Indicator



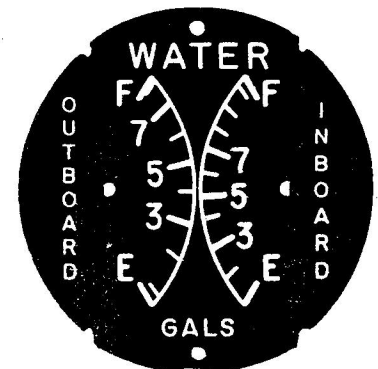
For EA148AN40 Indicator



For EA148AN42 Indicator

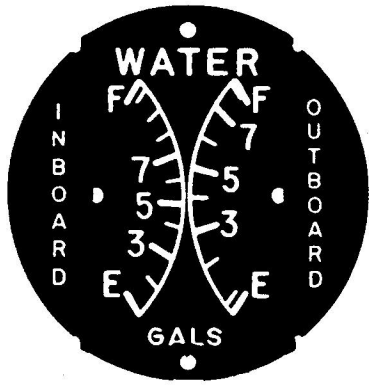


For EA148AN43 Indicator

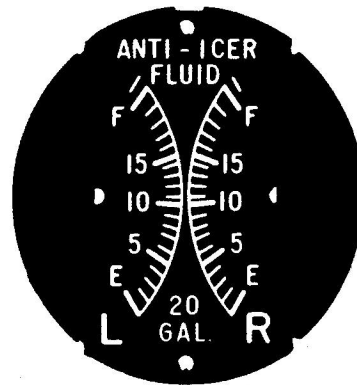


For EA148AN46 Indicator

Figure (EA148AN)-8 (Sheet 1 of 2 Sheet). Calibrated Dials for EA148AN Indicators



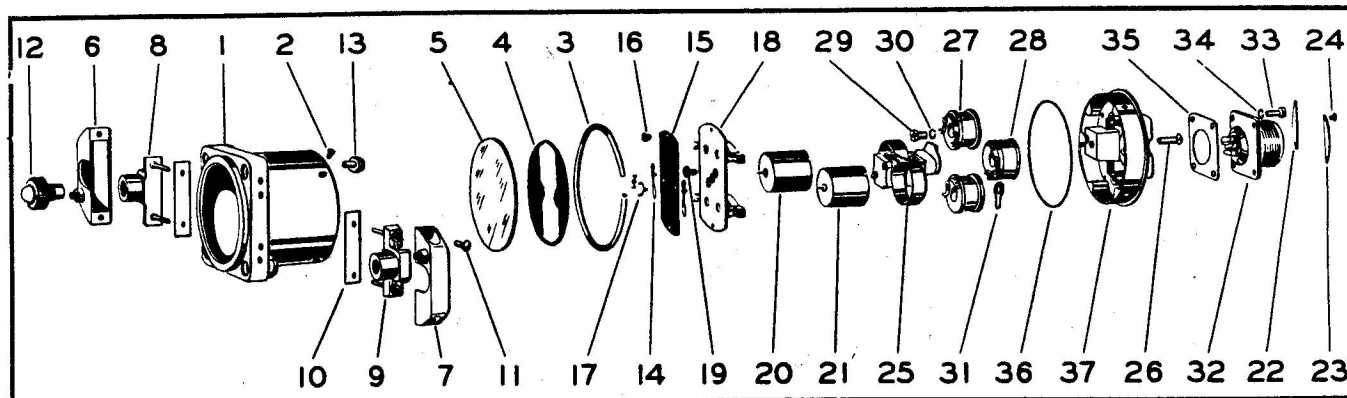
**For EA148AN47 Indicator**



**For EA148AN51 Indicator**

**Figure (EA148AN)-8 (Sheet 2 of 2 Sheets). Calibrated Dials for EA148AN Indicators**

## QUANTITY INDICATORS FOR EA148ANW SERIES



1. Case	9. Frame Assembly	17. Pointer Stop	24. Screw	31. Solder Lug
2. Screw	10. Insulator	18. Sub Dial	25. Saddle Assembly	32. Receptacle
3. Snap Ring	11. Screw	19. Screw	26. Screw	33. Screw
4. Shield	12. Lamp	20. Mechanism	27. Resistor	34. Lock Washer
5. Glass	13. Stop Nut	21. Mechanism	28. Resistor	35. Gasket
6. Housing Assembly	14. Pointer	22. Name Plate	29. Screw	36. Gasket
7. Housing Assembly	15. Dial	23. Name Plate	30. Washer	37. Back Plate
8. Frame Assembly	16. Screw			

Figure (EA148ANW)-1. Exploded View of EA148ANW Indicator

**Note**

Item numbers mentioned in text correspond to those shown in figure (EA148ANW)-1.

**DISASSEMBLY.**

Items 8 and 9. Take out two screws (11) and carefully pull assembly away from case (1).

Item 12. Unscrew from socket.

Items 14 and 15. Take out two screws (16), lift off shield (4) and remove pointers (14) with pointer puller. Lift dial (15) off sub dial (18). Remove pointer stops (17) from dial by bending prongs of rivets upwards on the back of dial and push rivets through dial.

Items 27 and 28. Remove sub dial (18) by taking out two screws (16). Remove screws (29) and lockwashers (30) which hold resistors to back plate (37).

**REPAIR AND REPLACEMENT.**

Do not repair broken pointers, pointer stops or damaged dial; replace them. Replace burned out lamps (12).

Check mechanisms (20) and (21) and resistors (27) and (28) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanisms = 285-315 ohms

Resistors = Three lug type = 200 ohms  $\pm$  2%

Four lug type = 1400 ohms  $\pm$  3%

**FINAL TEST.**

Connect indicator to transmitter as shown in figure (EA148ANW)-2 and test as outlined in Section III.

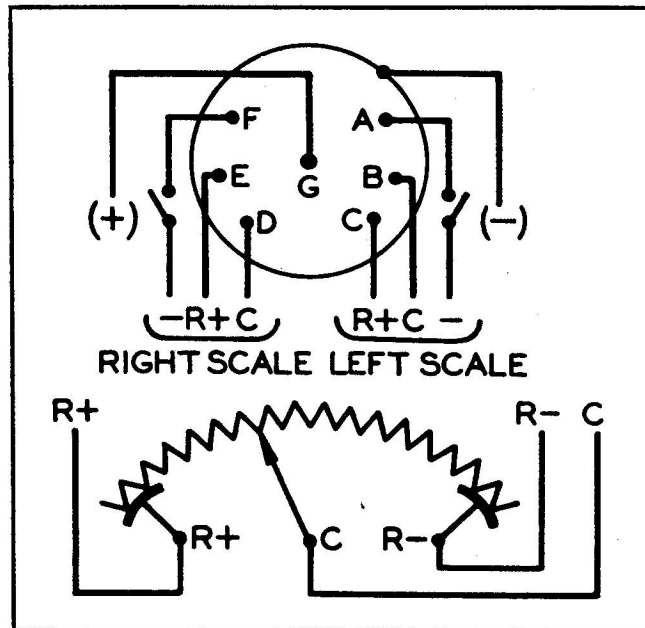


Figure (EA148ANW)-2. Testing Diagram

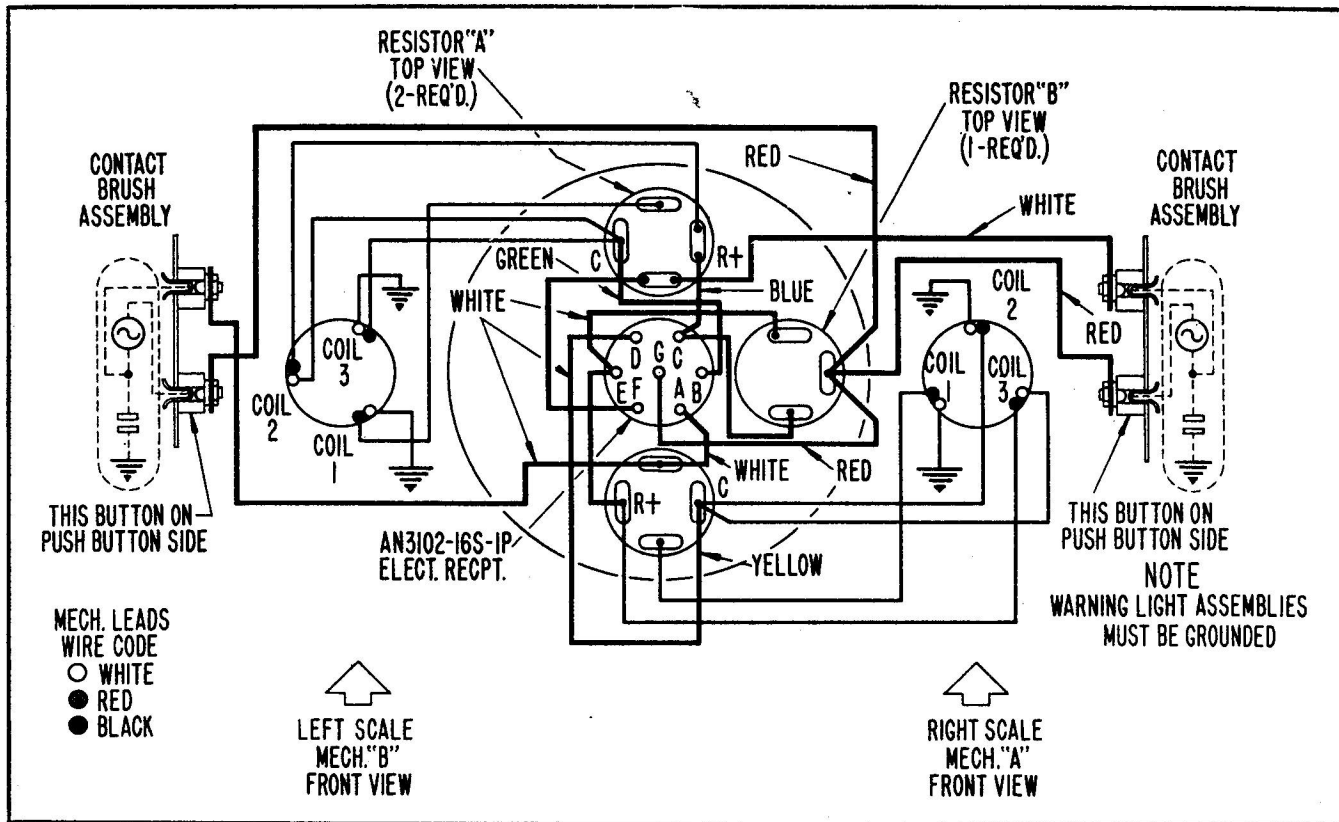


Figure (EA148ANW)-3. Internal Wiring Diagram

**Note**

If Type C-1 Field Tester is used connect as shown in figure (EA148ANW)-4 and follow instructions beginning with paragraph 3-14.

**Note**

This family or series of EA148ANW indicators is similar to one another in most instances except for calibration. This difference is shown by the dials in figure (EA148ANW)-5.

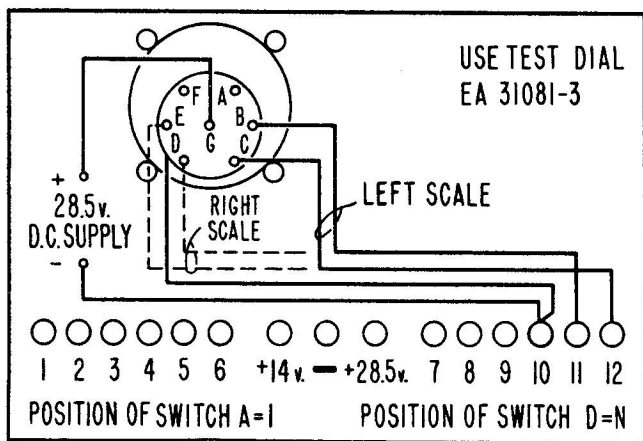
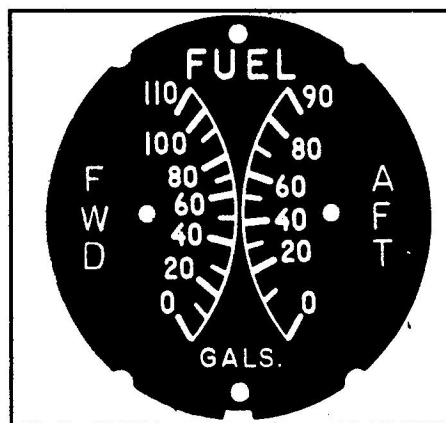


Figure (EA148ANW)-4. Field Tester Connections

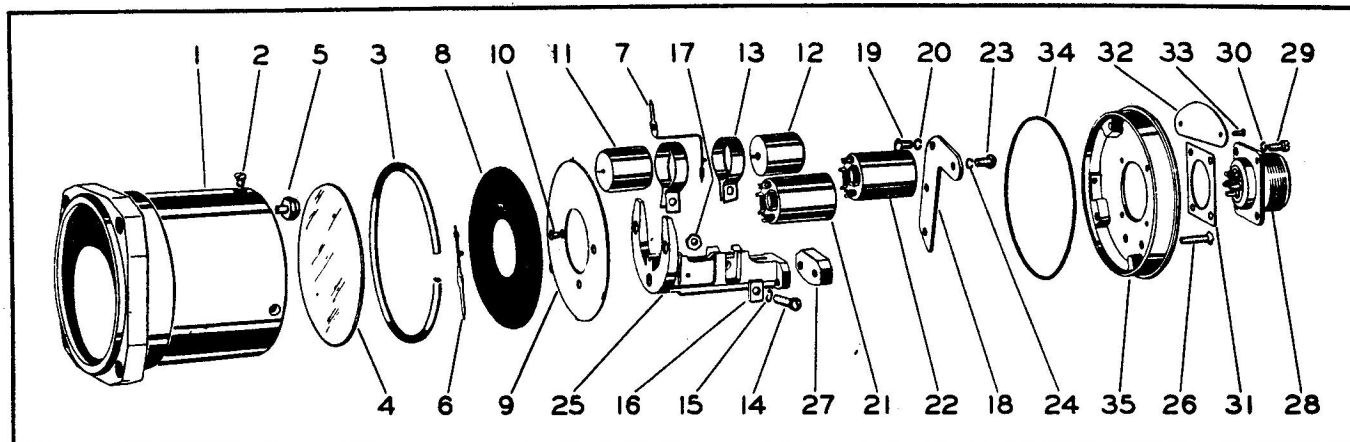


For EA148ANW45 Indicator

Figure (EA148ANW)-5. Calibrated Dials for EA148ANW Indicators



## QUANTITY INDICATORS FOR EA150AN SERIES



1. Case
2. Screw
3. Snap Ring
4. Glass
5. Stop Nut
6. Pointer
7. Pointer

8. Dial
9. Sub Dial
10. Screw
11. Mechanism
12. Mechanism
13. Spring Clamp
14. Screw

15. Lock Washer
16. Pressure Clamp
17. Nut
18. Resistor Plate
19. Screw
20. Lock Washer
21. Resistor

22. Resistor
23. Screw
24. Washer
25. Mechanism Bracket
26. Screw
27. Bracket Spacer
28. Receptacle

29. Screw
30. Washer
31. Gasket
32. Name Plate
33. Screw
34. Gasket
35. Back Plate

Figure (EA150AN)-1. Exploded View of EA150AN Indicator

**Note**

Item numbers mentioned in text correspond to those shown in figure (EA150AN)-1.

**DISASSEMBLY.**

Items 6 and 7. Remove top pointer (6) with pointer puller. Reach behind dial (8) and pry off second pointer very carefully from shaft of mechanism.

Item 8. Bend back prongs of sub dial (9) and lift off dial.

Items 21 and 22. Remove two screws (19) and lock-washers (20) holding resistor plate (18) to back plate (35). Remove two screws (23) and lockwashers (24) from back of resistor plate which hold resistors in place.

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer or damaged dial; replace them.

Check mechanisms (11) and (12) and resistors (21) and (22) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanisms = 285-315 ohms

**Note**

Resistors are stamped with their resistance values (See table).

Resistor	For Front Mechanism	For Rear Mechanism
Section 3, top lugs 3-4	500 ohms $\pm$ 2%	225 ohms $\pm$ 2%
Section 2, center lugs 2-4	500 ohms $\pm$ 2%	225 ohms $\pm$ 2%
Section 1, bottom lugs 1-4	450 ohms $\pm$ 2%	500 ohms $\pm$ 2%

**FINAL TEST.** (See table.)

Test the indicator connected to transmitter as outlined in Section III, using the applicable testing diagram as shown in table. When the Type 0-1 Field Tester is used follow instructions beginning with paragraph 3-14 and connect indicator to tester as per figure designated in table.

Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA150AN13	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN14	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN15	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN31	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN32	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN48	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN49	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN54	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN55	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN56	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN58	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4
EA150AN60	(EA150AN)-2	(EA150AN)-3	(EA150AN)-4

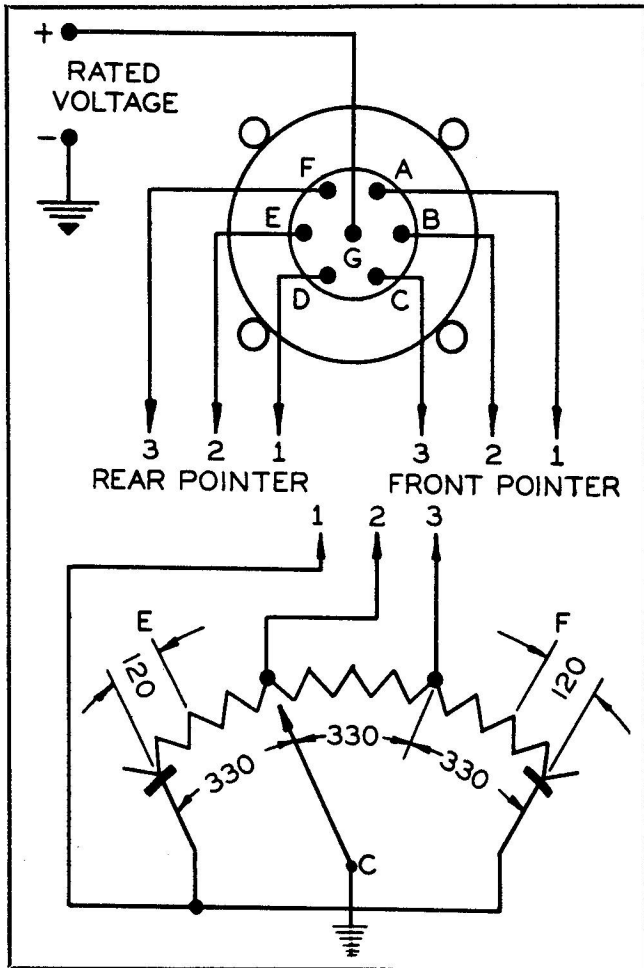


Figure (EA150AN)-2. Testing Diagram

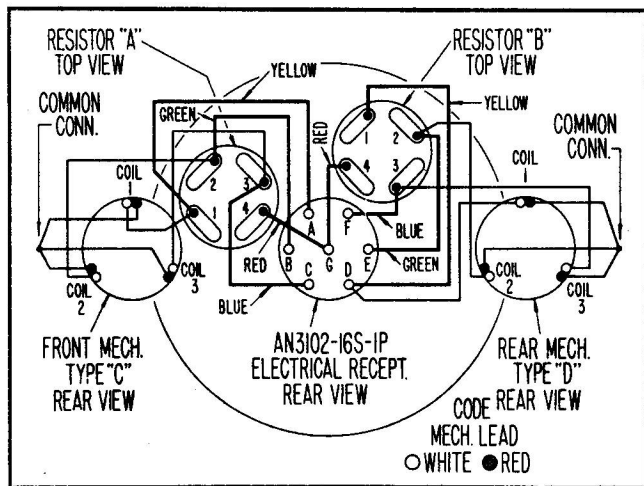


Figure (EA150AN)-3. Internal Wiring Diagram

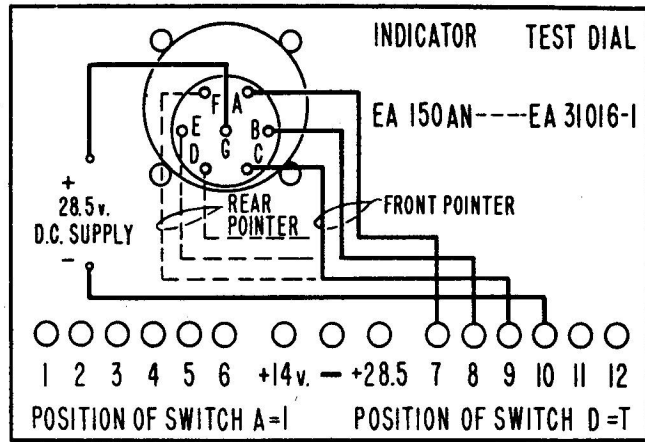
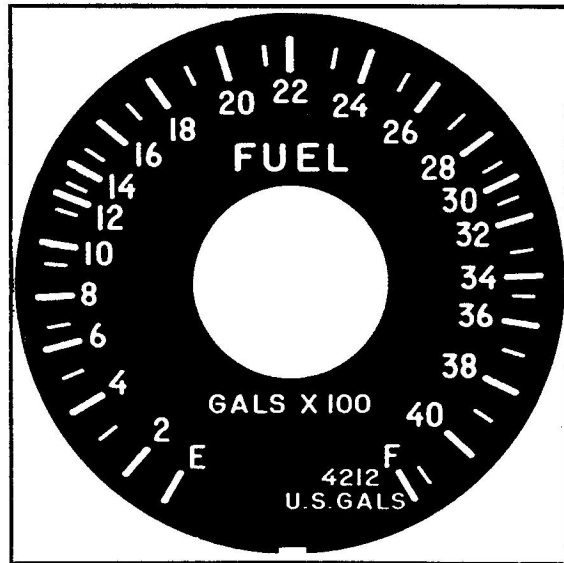


Figure (EA150AN)-4. Field Tester Connections

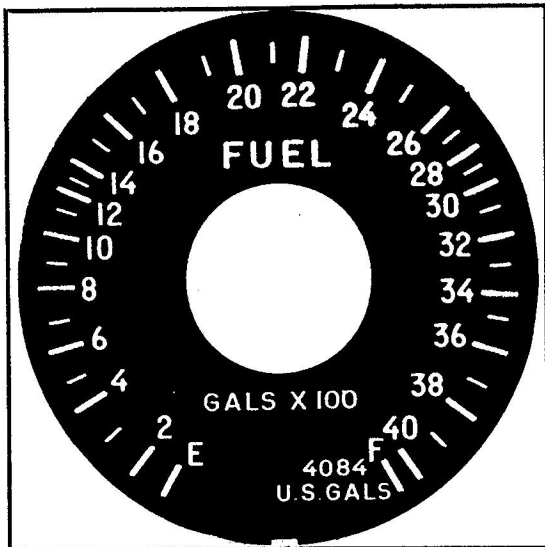
**Note**

This family or series of EA150AN indicators is similar to one another in most instances except for calibration. This difference is shown on the dials in figure (EA150AN)-5.

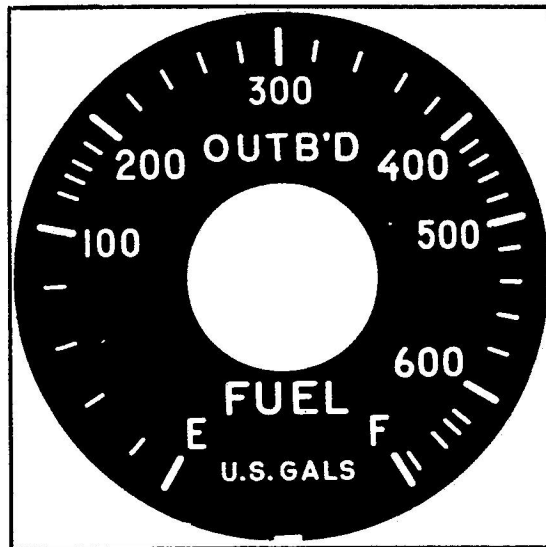


For EA150AN13 Indicator

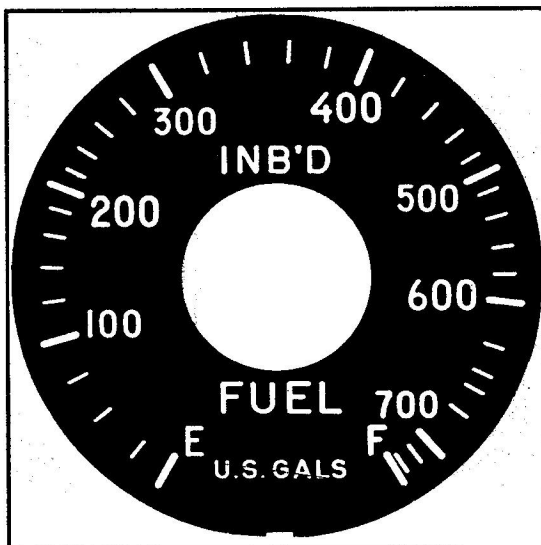
Figure (EA150AN)-5 (Sheet 1 of 3 Sheets). Calibrated Dials for EA150AN Indicators



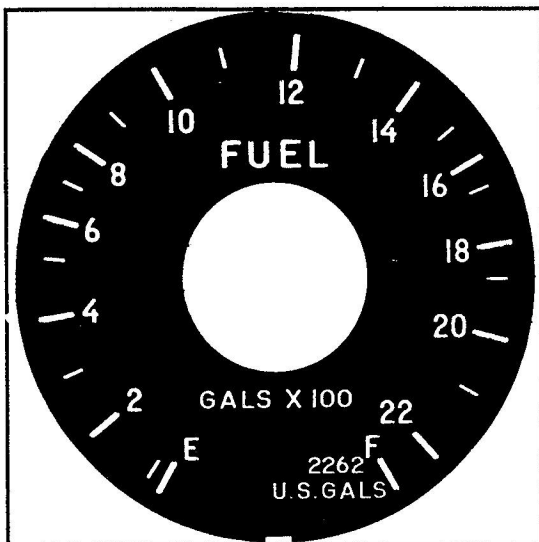
For EA150AN14 Indicator



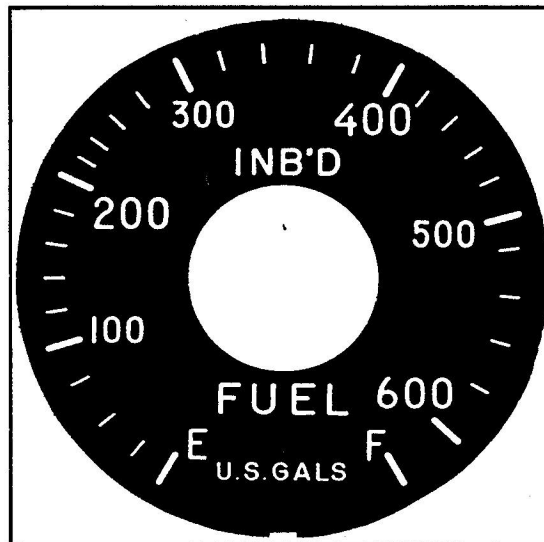
For EA150AN32 Indicator



For EA150AN31 Indicator

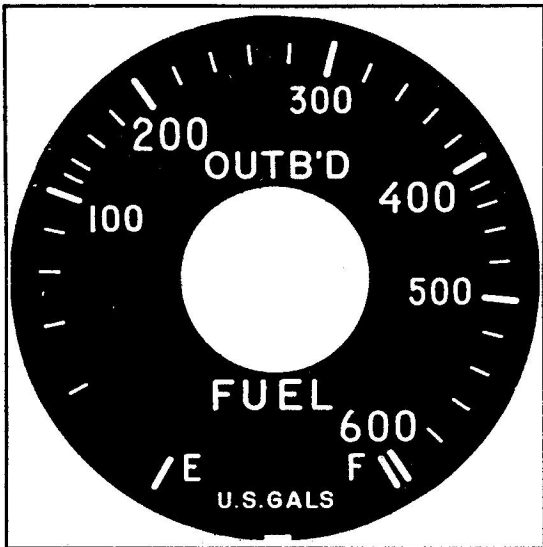


For EA150AN15 Indicator



For EA150AN48 Indicator

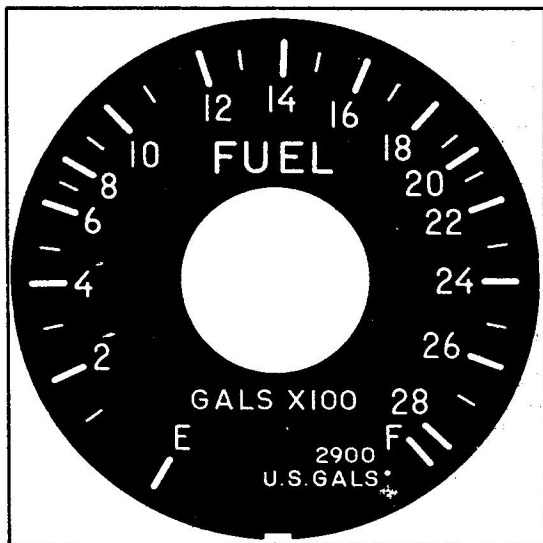
Figure (EA150AN)-5 (Sheet 2 of 3 Sheets). Calibrated Dials for EA150AN Indicators



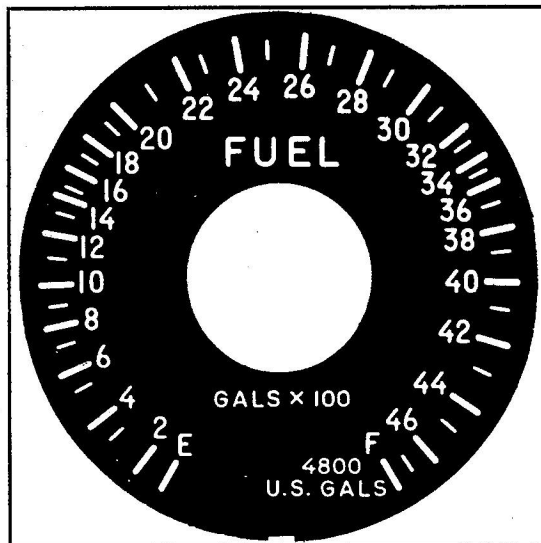
For EA150AN49 Indicator

Will be  
supplied  
at a  
later  
date

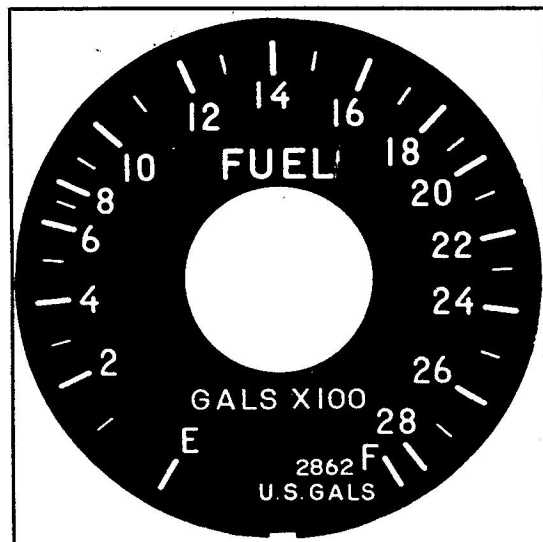
For EA150AN56 Indicator



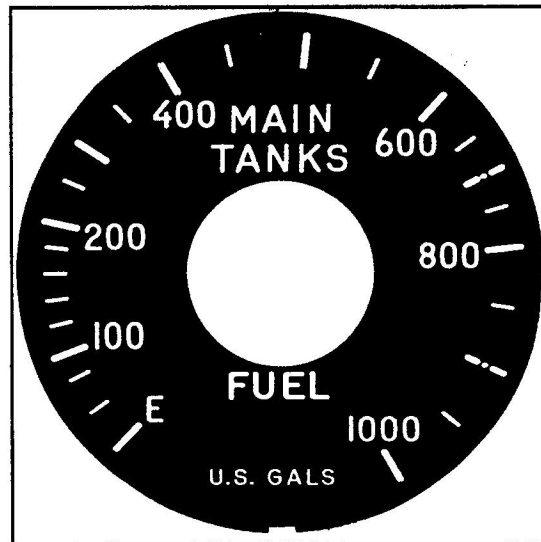
For EA150AN54 Indicator



For EA150AN58 Indicator



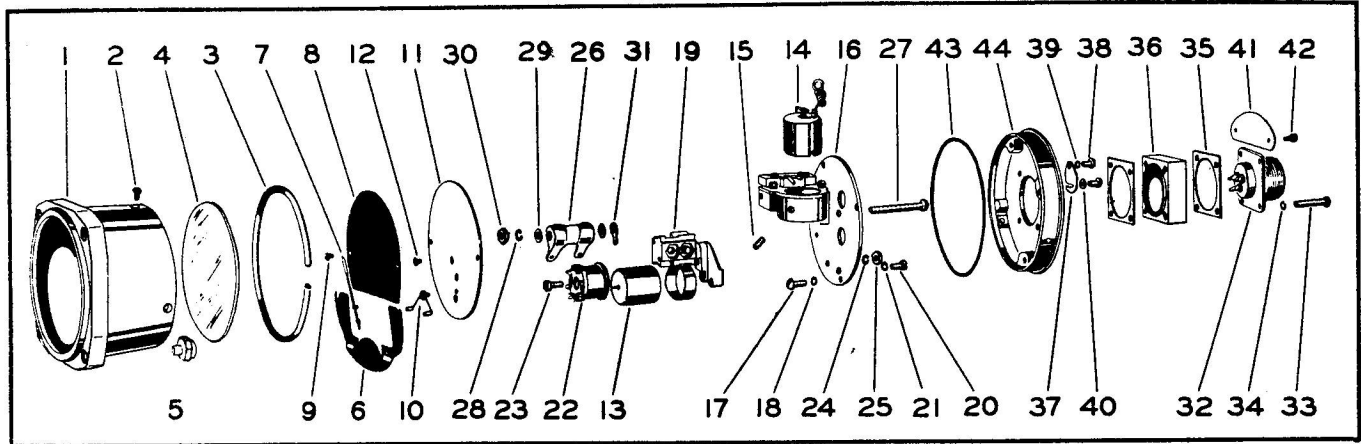
For EA150AN55 Indicator



For EA150AN60 Indicator

Figure (EA150AN)-5 (Sheet 3 of 3 Sheets). Calibrated Dials for EA150AN Indicators

## QUANTITY INDICATORS EA303AN SERIES



- |                  |                             |                  |                             |
|------------------|-----------------------------|------------------|-----------------------------|
| 1. Case          | 12. Screw                   | 23. Screw        | 34. Lockwasher              |
| 2. Screw         | 13. Mechanism               | 24. Lock Washer  | 35. Gasket                  |
| 3. Snap Ring     | 14. Mechanism               | 25. Nut          | 36. Adaptor                 |
| 4. Glass         | 15. Set Screw               | 26. Resistor     | 37. Switch Adjustment Cover |
| 5. Stop Nut      | 16. Mounting Plate Assembly | 27. Screw        | 38. Screw                   |
| 6. Shield        | 17. Screw                   | 28. Lock Washer  | 39. Lock Washer             |
| 7. Pointer       | 18. Lock Washer             | 29. Fiber Washer | 40. Washer                  |
| 8. Dial          | 19. Saddle Assembly         | 30. Nut          | 41. Name Plate              |
| 9. Screw         | 20. Screw                   | 31. Solder Lug   | 42. Screw                   |
| 10. Pointer Stop | 21. Lock Washer             | 32. Receptacle   | 43. Gasket                  |
| 11. Sub Dial     | 22. Resistor                | 33. Screw        | 44. Back Plate              |

Figure (EA303AN)-1. Exploded View of EA303AN Indicator

**Note**

Item numbers mentioned in test correspond to those shown in figure (EA303AN)-1.

**DISASSEMBLY.**

Item 7. Remove with a pointer puller.

Item 8. Take out two screws (9); this will release shield (6) from dial. Remove pointer stops (10) from dial by bending prongs of rivets upwards on the back of dial and pushing rivets through dial.

Item 11. Take out two screws (12).

Item 16. Remove three screws (17) and lockwashers (18).

Item 22. Take out screw (23).

Item 26. From back of mounting plate (16) remove screw (27).

Item 13. Remove nut and screw in saddle assembly (19) and slide out (13) from clamp.

Item 14. Loosen set screw (15) in bracket of mounting plate (16) and carefully slide mechanism (14) through bottom of bracket.

**REPAIR AND REPLACEMENT.**

Do not repair broken pointer, pointer stops or damaged dial; replace them.

Check mechanisms (13) and (14) and resistors (22) and (26) with ohmmeter or bridge and replace them if resistance is not as follows:

Mechanisms = 285-315 ohms

Resistors—Spool type = 2850 ohms  $\pm$  2%

Fixed type = 130 ohms  $\pm$  5%

**FINAL TEST.** (See table.)

Test the indicator connected to transmitter as outlined in Section III, using the applicable testing diagram as shown in table. When the Type 0-1 Field Tester is used follow instructions beginning with paragraph 3-14 and connect indicator to tester as per figure designated in table.

Indicator	Testing Diagram Figure No.	Internal Wiring Figure No.	Field Tester Connections Figure No.
EA303AN1	(EA303AN)-2	(EA303AN)-3	(EA303AN)-4
EA303AN3	(EA303AN)-2	(EA303AN)-3	(EA303AN)-4

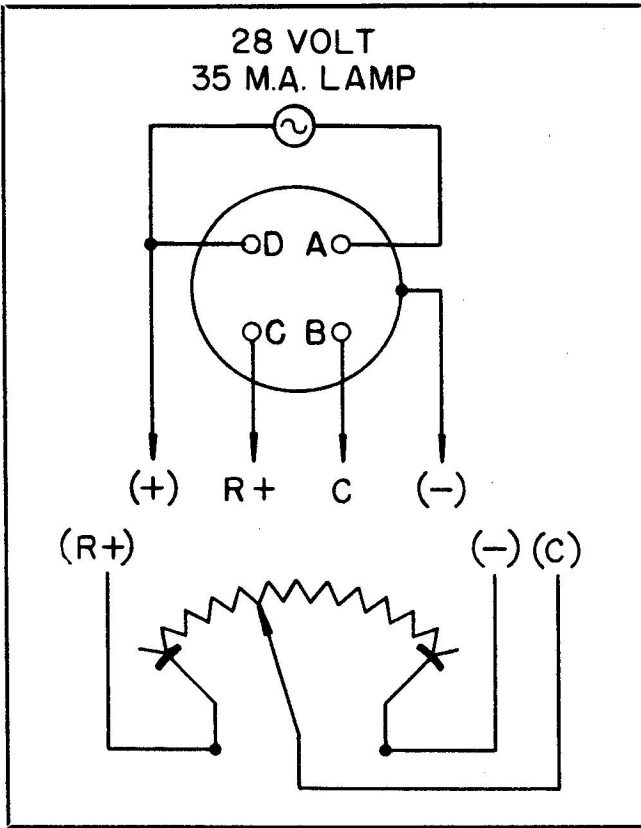


Figure (EA303AN)-2. Testing Diagram

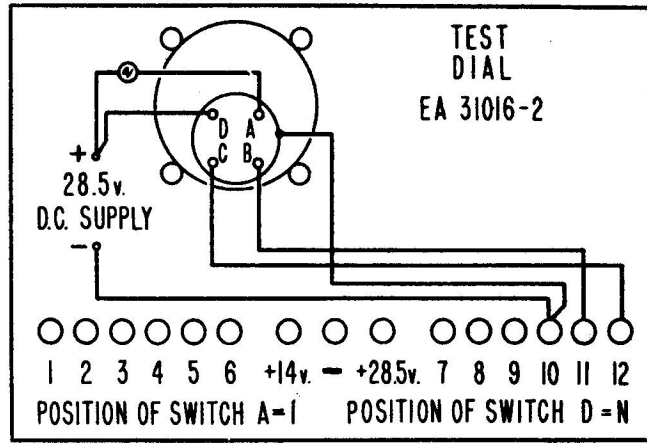
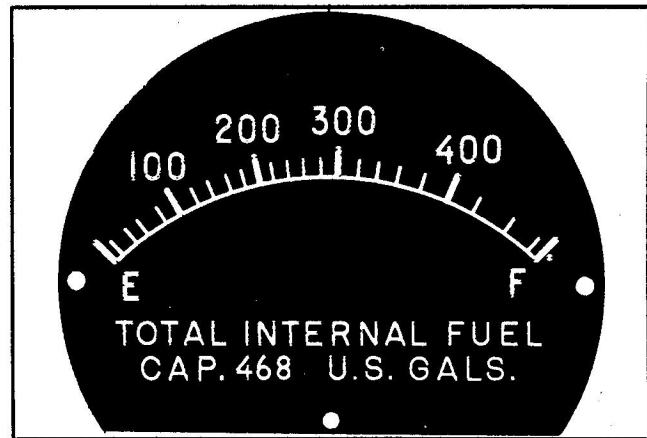


Figure (EA303AN)-4. Field Tester Connections



For EA303AN1 Indicator

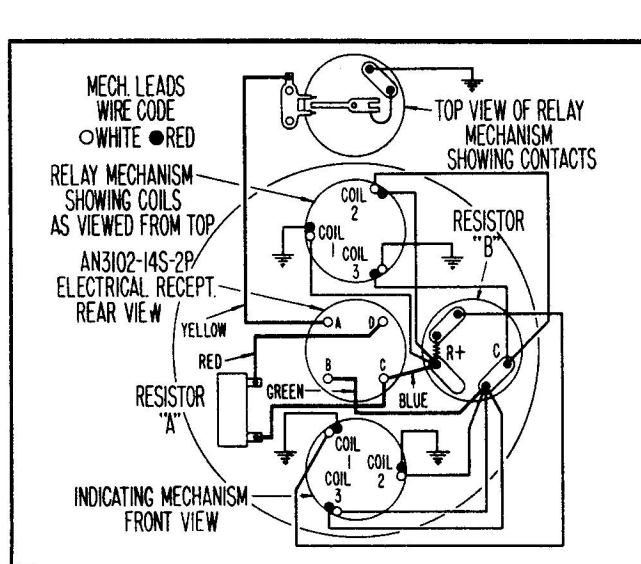
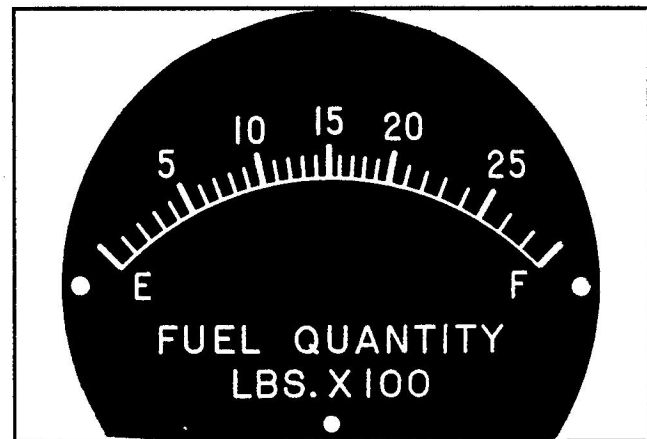


Figure (EA303AN)-3. Internal Wiring Diagram



For EA303AN3 Indicator

Figure (EA303AN)-5. Calibrated Dials for  
EA303AN Indicators

**QUANTITY INDICATORS EA31 SERIES**

**Note**

These EA31 indicators are covered for overhaul in Section II. Final test is performed in this section.

**FINAL TEST.**

Connect indicator to transmitter as shown in figure (EA31)-1 and perform tests as outlined in Section III.

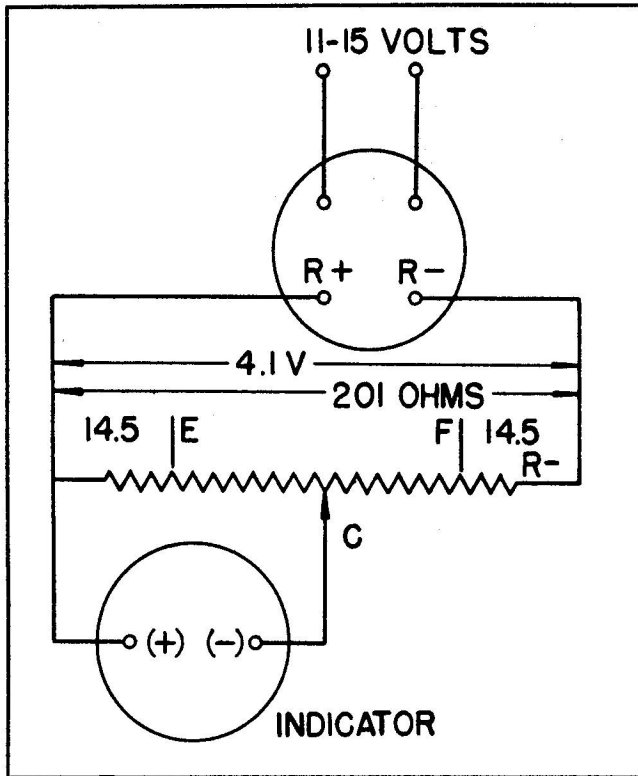


Figure (EA31)-1. Testing Diagram

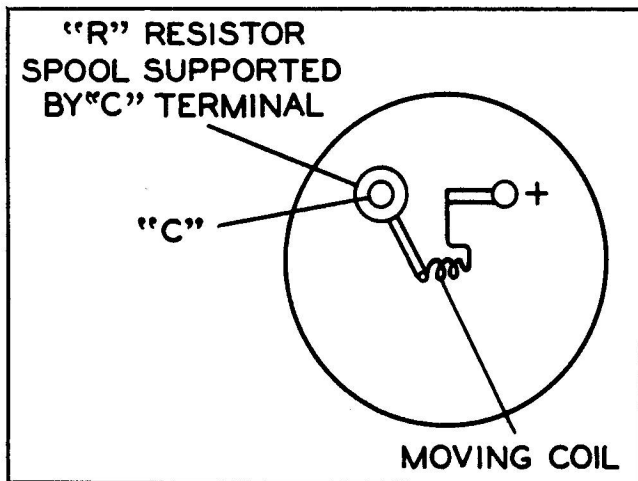


Figure (EA31)-2. Internal Wiring Diagram

**Note**

If Type 0-1 Field Tester is used make the connections as shown in figure (EA31)-3 and follow instructions as outlined in paragraph 3-14.

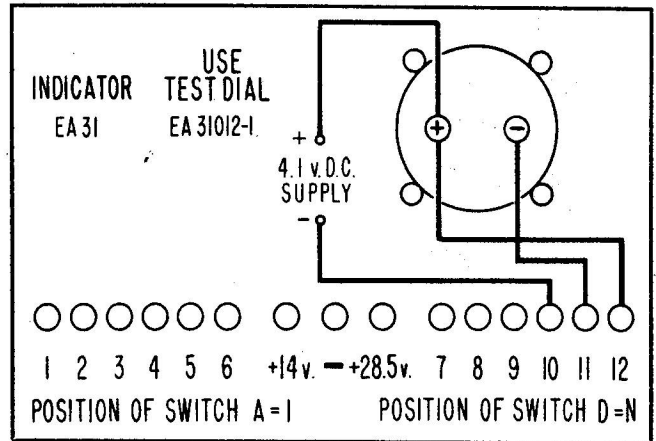
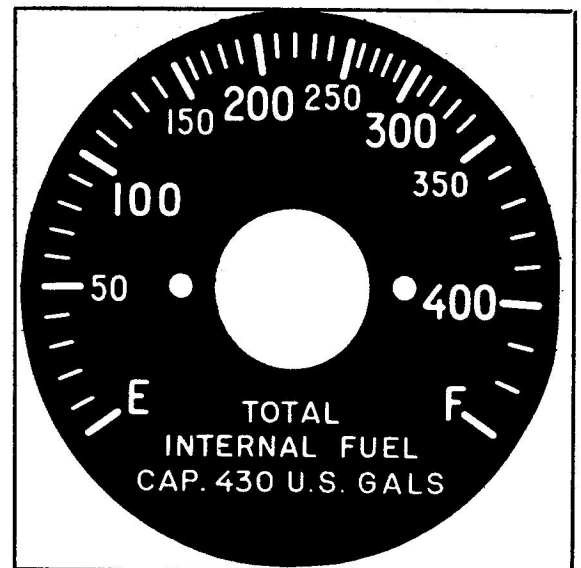


Figure (EA31)-3. Field Tester Connections

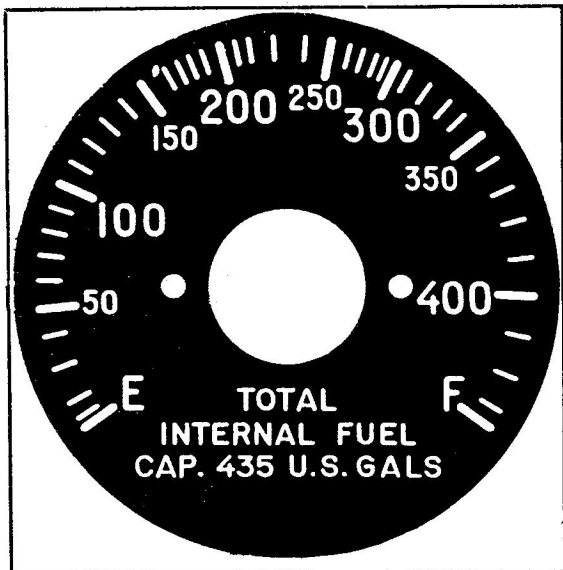
**Note**

This family or series of EA31 indicators is identical to one another except for calibration. This difference is shown by the dials in figure (EA31)-4.

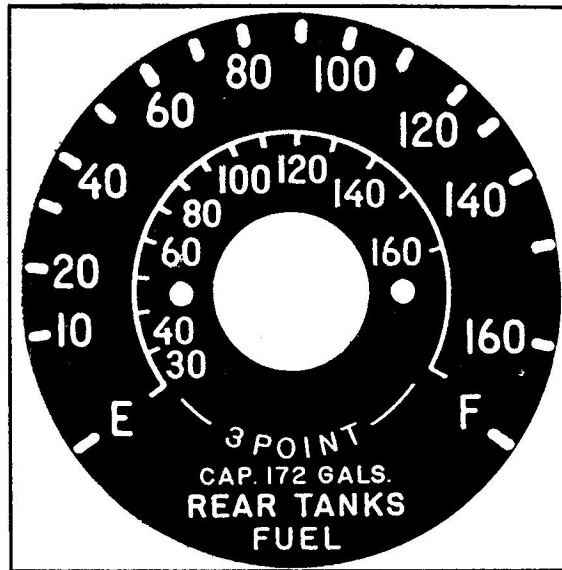


For EA31-1047 Indicator

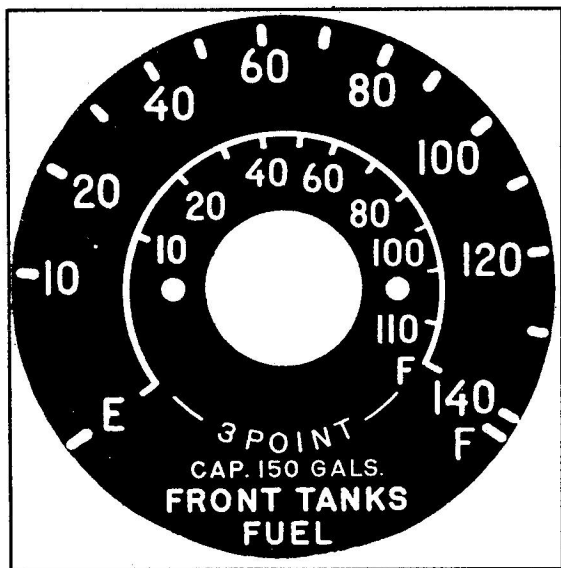
Figure (EA31)-4 (Sheet 1 of 2 Sheets). Calibrated Dial for EA31 Indicators



For EA31-150 Indicator



For EA31-337-IRF Indicator



For EA31-337-IFF Indicator

Figure (EA31)-4. (Sheet 2 of 2 Sheets). Calibrated Dials for EA31 Indicators