EO 20-25JA-2

ROYAL CANADIAN AIR FORCE

HANDBOOK WITH PART LIST COMPASS MAGNETIC STANDBY TYPE AE341-1A AND AE341-2A

(AVIATION ELECTRIC)

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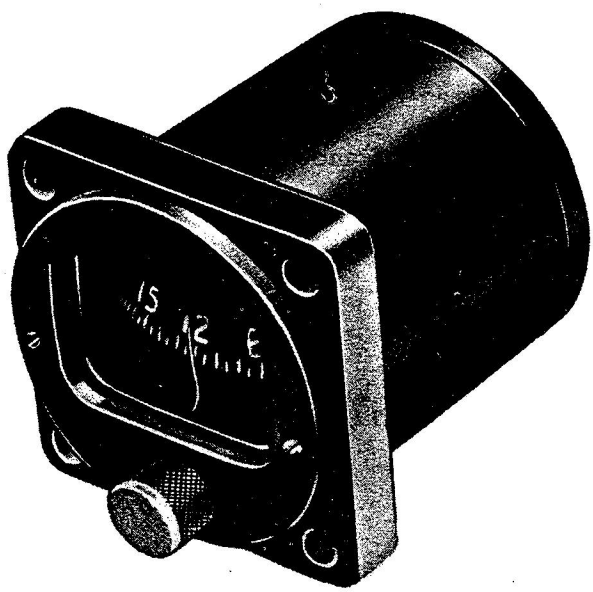

Three-Quarter View. Compass Magnetic, Standby AE 341-1-A and -2A.

INTRODUCTION

PURPOSE

1. This Engineering Order contains instructions for the Installation, Operation and Overhaul of the Standby Magnetic Compass, Types AE 341-1-A and AE 341-2-A manufactured by Aviation Electric, Montreal. Group Assembly and Numerical Part Lists are contained in Part 3 of this Handbook.

EXPLANATION OF MODEL NUMBERS

2. The significance of the two type number designations covered in this Handbook is as follows:

(a) The AE 341-1-A is equipped with a 3 volt lamp and suitable holder.

(b) The AE 341-2-A is identical except for the use of a 28 volt lamp with appropriate holder and contact assembly.

REFERENCED PUBLICATIONS

3. The following publications are referenced in the test:

(a) AN Aeronautical Specification No. MIL-C-7834.

(b) Applicable aircraft maintenance schedules (-7 series E.O's)

(c) Major inspection of magnetic compasses, EO 20-25-1.

PART 1

BASIC CONSTRUCTION DATA

DESCRIPTION (See Figure 1-1)

1. The standby compass consists of the following principal subassemblies and parts: housing assembly, compensator assembly, card assembly, jewel post and support assembly, lubber line, window, front plate, rear cover, filling hole cap, cover assembly, knob and contact assembly, and plug assembly.

2. Housing assembly - This assembly consists of a housing which is suitable for panel mounting and may be provided with stop nuts or tinnerman nuts. All types are provided with a "Caution" note regarding filling of the compass. The housing contains three compartments: air chamber, main compass card chamber, and compensator chamber. The air chamber is provided to allow for the expansion and contraction of the compass fluid due to temperature and altitude changes. It eliminates the use of a diaphragm or bellows chamber.

3. Compensator assembly. - The compensator is a removable unit which fits into the bottom compartment of the housing. It consists of two sets of permanent magnets arranged in two planes at right angles to each other. The positions of the magnets are changed by gears which are controlled by two screw-type compensator knobs marked "NS" and "EW". The compensator assembly is provided with two contacts which form a light socket in front and two contacts at the rear, interconnected by two wires, to complete the lighting circuit from the bulb to the plug assembly. A red filter is provided on the top surface of the compensator, over the bulb, to diffuse the light.

4. Card assembly. - This assembly is contained in the main compartment of the housing which is filled with compass fluid. It pivots on the jewel post and consists of a compass card to which two magnets have been attached in such a way that their axes are parallel to each other and to the north-south axis of the card. The card has graduations around its outer edge and has a pivot at its center. The cardinal headings of the card are designated by "N", "E", "S", and "W", and each 30-degree point is indicated by a number corresponding to the angle.

5. Jewel post and support assembly. - This assembly is secured with two screws to the inner side of the rear cover and consists of a support plate to which a jewel post is secured. This support plate also serves as a shock mount for the card. The card assembly pivots on the jewel post and is held in place by a spring-type card retainer which is part of the jewel post and support assembly.

6. Lubber line and window. - A lubber line is mounted in the housing behind the window. The line which provides a reference when reading the compass is close to the card to reduce parallax error. A plane passing through the line and the center of the jewel post pivot is parallel to the longitudinal axis of the airplane at installation. The window is mounted over a gasket in front of the housing and has another gasket in front.

7. Front plate, rear cover, and filling hole cap. - The front plate is secured to the front of the housing with six screws. The rear plate is secured over a gasket to the rear of the housing with seven screws. The filling hole cap is screwed over a gasket into a tapped hole in the rear cover.

8. Cover assembly. - This assembly consists of a cover and two screws with retainers. The assembly is secured to the front plate, acts as a lock for the compensator assembly, and improves the appearance of the compass.

9. Knob and contact assembly, bulb and plug assembly. - The knob and contact assembly screws onto a contact ring at the front of the compensator assembly and closes the circuit to the bulb. The plug assembly is secured to the rear cover and closes the circuit to the two contacts at the rear of the compensator assembly. (See Figure 1-2.)

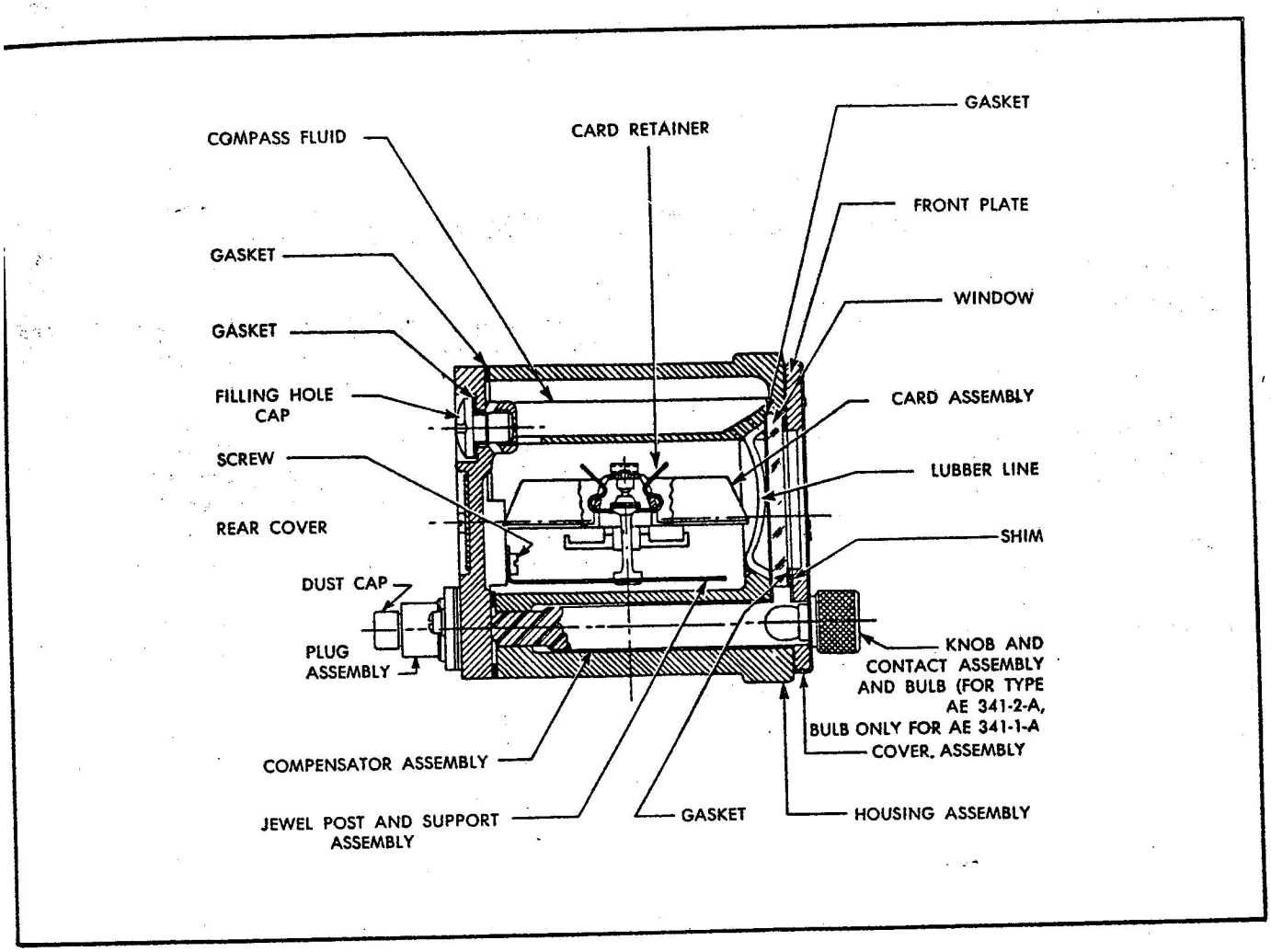

Figure 1-1. Sectional View-Standby Compass AE 341-1-A and -2-A.

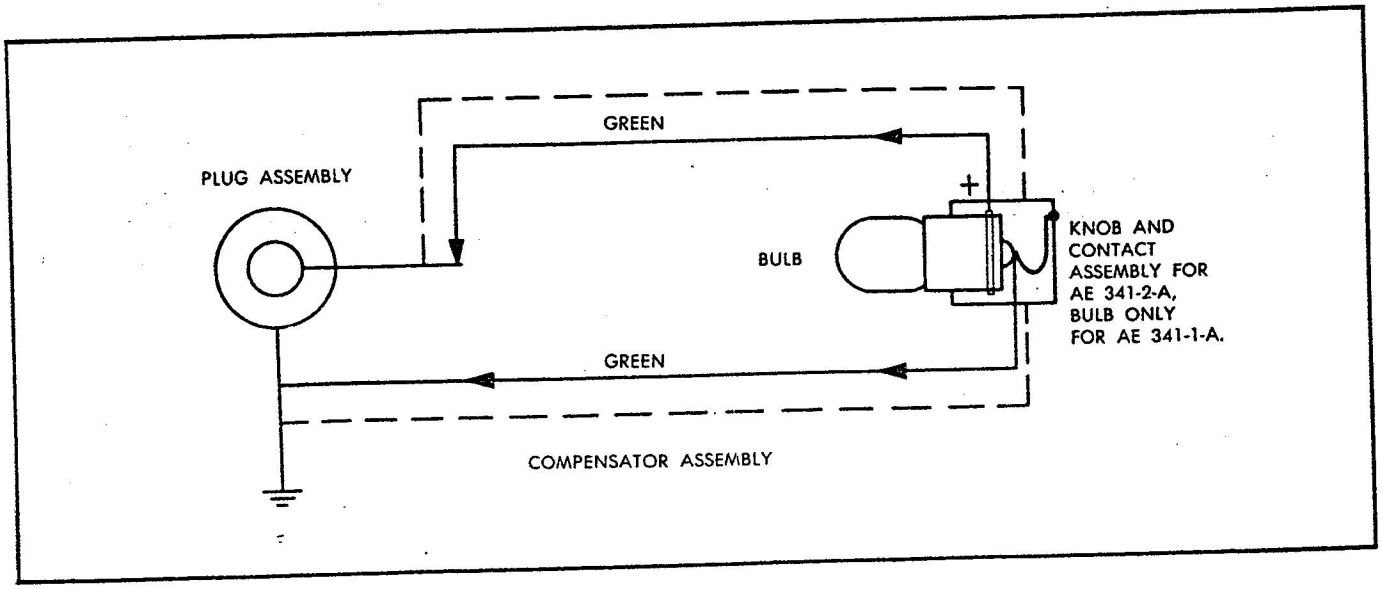

Figure 1-2 Wiring Diagram-Standby Compass AE 341-1-A and -2-A.

10. Compass Lighting - Provision has been made for reading the compass by using self-luminous fluorescent compound, Specification AN-L-1A, on major dial markings and lubber line and fluorescent compound. Specification C-28-96 on minor dial markings. The AE 341-1-A Compass employs a 3 volt light whilst the AE 341-2-A Compass employs a 28 volt light.

INSTALLATION

MOUNTING

11. Since the standby compass is a navigational instrument, locate it within the unobstructed view of the pilot. It is essential that the compass be mounted as far as possible from any magnetic disturbances. The compass must be installed so that a plane passing through the lubber line and the card pivot is parallel to the fore and aft axis of the aircraft. In addition, the mounting surface of the compass must be vertical when the aircraft is in its normal, level flight attitude. Metal used near the compass, or in connection with the mounting of the compass, should be non-magnetic type, such as brass or aluminum.

12. Make the panel cut-out and drill the necessary holes according to the dimension given in Figure 1-3. Secure the compass to the panel. The panel on which the compass is installed must not have a movement of vibration, from one extreme to the other, in excess of 0.010 inch over a range of frequencies of 500 to 3000 cycles per minute.

ELECTRICAL CONNECTION

13. To connect the light on type AE 341-1-A and -2-A use plug AN 3116-1.

NOTE

Before proceeding with compensation, mount a correction card holder in a convenient position near the compass and insert a correction card.

14. Check the compass on all magnetic headings to be sure that the original deviations do not exceed 24 degrees. In an ideal installation the necessary compensation would be zero. Therefore all the local (aircraft) disturbances should be reduced to a minimum before the fine adjustment is made with the compass compensator.

NOTE

Perform the compass compensation under closely simulated normal cruising conditions. Turn on the radio transmitter and receiver. See that the receiver head sets are in their normal flight positions. Turn on the navigation and panel lights. Be sure that the tail of the ship is raised so that the normal cruising angle of attack is simulated. The engines should be running at cruising speed while each heading is being determined, and may be idled back while the ship is being adjusted to each new heading. Determine the magnetic headings with a compass rose or pelorus.

15. Unscrew the cover assembly of the compas and remove it to a convenient place. This wil expose the "NS" and "EW" compensator adjustin screws.

16. Set the compensator to null effect by turnin both adjusting screws until the dots on the screw are matched with the dots on the compensato case.

17. Place the aircraft on a south magnetic heading by the most suitable method and note the compass reading. Determine and record the compass deviation on the south magnetic heading.

18. Place the aircraft on a west magnetic heading and note the compass reading. Determine and record the compass deviation on the west magnetic heading.

19. Place the aircraft on a north magnetic heading and note the compass reading. Determine and record the compass deviation on the north magnetic heading, and compute the coefficient "C" as follows:

$$C = \frac{\text{deviation on N - deviation on S}}{2}$$

With the aircraft still on the north heading, adjust the "NS" compensator screws so as to cause the compass reading to change by an amount equa in magnitude and algebraic sign to the coefficien "C".

20. Place the aircraft on an east magnetic heading and note the compass reading. Deter

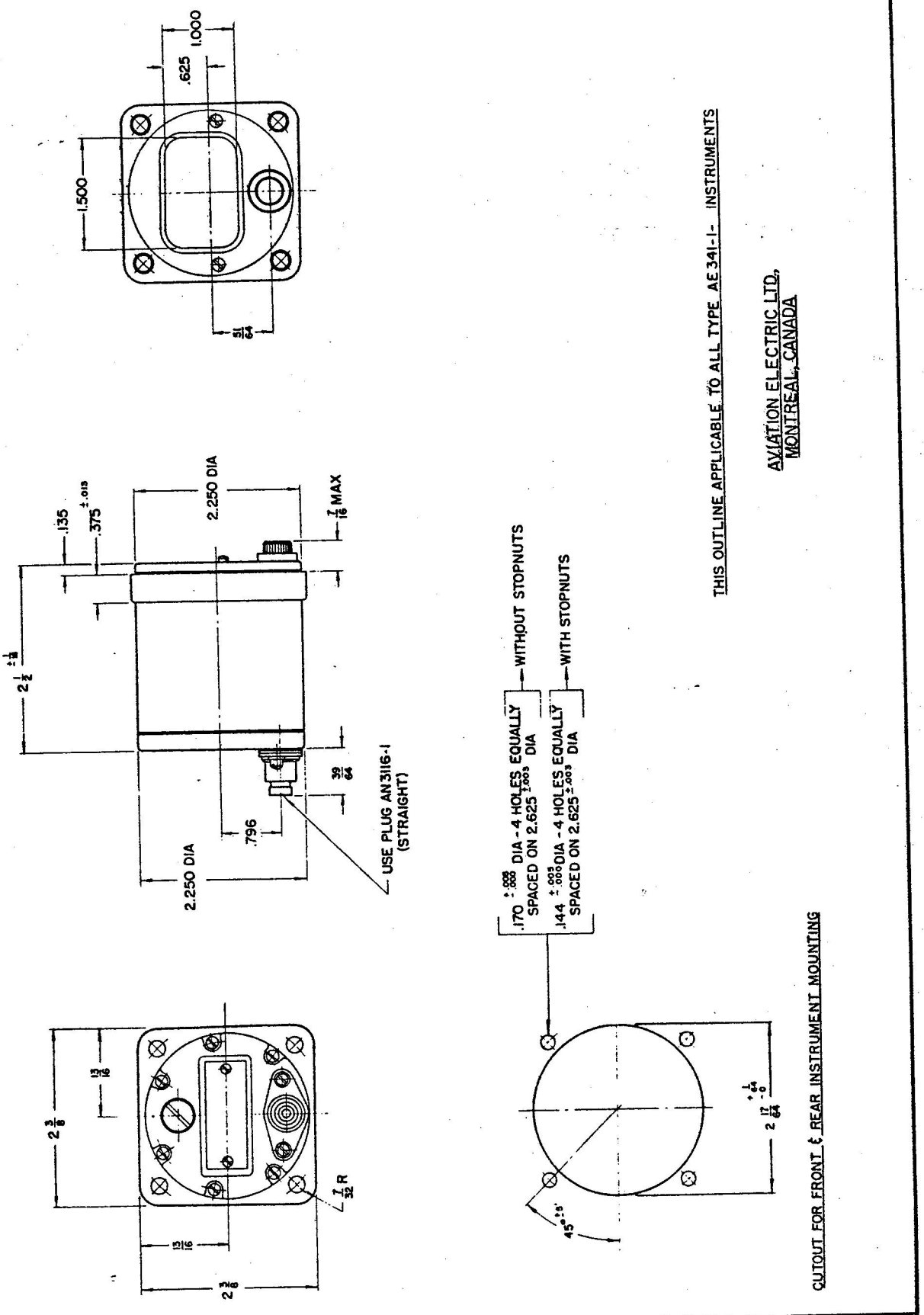

Figure 1-3 Installation Dimensions Diagram

mine the compass deviation on the east magnetic heading and compute the coefficient "B" as follows:

$$B = \frac{\text{deviation on E - deviation on W}}{2}$$

With the aircraft still on the east heading, adjust the "EW" compensator screw so as to cause the compass reading to change by an amount equal in magnitude and algebraic sign to the coefficient "B".

21. With the aircraft still on the east heading, compute the coefficient "A" as follows:

$$A = \frac{\text{deviation on N +deviation on E +deviation on S +deviation on W.}}{4}$$

22. Panel mounted compasses must be compensated for coefficient "A" if it exceeds two degrees. Make this compensation be realigning the instrument panel or by turning the face of the compass relative to the plane of the instrument panel by means of washers or spacers. The adjustment must change the compass reading by an amount equal in magnitude and algebraic sign to the coefficient "A".

23. After completing compensation, swing the aircraft on eight symmetrical headings. Record any remaining deviations on the compass correction card mounted near the compass.

24. For more detailed information, consult Army-Navy Aeronautical Specification No. MIL-C-7834.

NOTE

This compass is designed to incorporate an air chamber for liquid expansion. No air bubble should be visible when the compass is held at an angle of 18 degrees simulated dive position.

OPERATING INSTRUCTIONS

25. The AE 341-1-A or AE 341-2-A compass depends on the earth's magnetic field for its operation. A pair of magnets attached to the card assembly align with the earth's magnetic field.

26. The card and magnets are attached to a float assembly which, in turn, pivots on a hardened steel pivot supported by a spring-mounted jewel. The spring absorbs any external vibration.

27. The jewel-mounted card is contained in an air-tight case which is filled with damping liquid. An air bubble in the liquid allows expansion and contraction as the temperature changes. The case is filled with liquid through a filling hole.

28. The indications of the card are read against the lubber line which represents the longitudinal axis of the airplane when the compass has been properly installed. A projection of this line onto the compass card gives the magnetic heading of the aircraft.

29. A compensator is necessary to provide a means of compensating the compass for the effects of local magnetic interference in the aircraft, which causes errors in indication.

THEORETICAL OPERATION

30. The earth is surrounded by magnetic lines of force which have a general north-south direction. These lines, which are horizontal at or near the geographic equator, gradually incline downwards, as the distance from the equator increases, until they become vertical in the vicinity of Hudson Bay in the north, and South Victoria Land in the south. These two areas, wherein the earth's magnetic field is perpendicular to the earth's surface, are known respectively as the "North Magnetic Pole" and the "South Magnetic Pole." Any freely suspended magnet will align itself with the lines joining these two poles. It is the dependable directional uniformity of these lines that make them useful in obtaining horizontal direction. They are, however, subject to local distortion, which must be taken into account when flying cross-country.

31. Since compasses are designed to indicate in a horizontal plane, convenience requires that the earth's field of total strength be resolved into two components; a horizontal component and a vertical component. The horizontal component gives directive force to the compass magnet, while the vertical component causes the card to tilt or dip. The amount of dip varies over the earth's surface.

32. Since the magnetic and geographic poles do not coincide, there are two directions; the magnetic and geographic. The angle between the two meridians is known as "Variation." It is measured from the geographic meridian and is considered positive towards the east, negative towards the east, negative towards the west. The variation is different in different localities because of a variety of phenomena; and, consequently, it is always necessary to refer to a variation chart, when setting a compass course, in order to obtain the proper correction. Such charts are plotted from data obtained in extensive magnetic surveys.

FACTORS AFFECTING OPERATION

33. Characteristics of damping liquid. - The damping liquid prevents the card assembly from moving too freely. If there were none, the assembly would move continuously.

(a) The damping liquid must be one that is subject to minimum viscosity change with variations in temperature of from -65°C. (-85°F.) to +70°C. (158°F.). Only with such a liquid can room temperature operating characteristics be maintained within reasonable tolerances at all other temperatures.

(b) Other qualities of the damping liquid prevent discoloration and deterioration of the paint used in the compass.

34. Expansion of liquid. - Since compass liquid expands when heated and contracts when cooled, provision is made in the compass for this by an air bubble within the case.

35. Air in the compass. - The air bubble allows for liquid expansion, it should not normally be visible in level flight.

36. Swirl. - When an aircraft is turned, the motion of the compass bowl is imparted to the damping liquid, causing it to swirl. The outer layer of the liquid, which is in contact with the bowl, travels at nearly the same speed; while liquid in the center remains stationary. Since the magnetic element depends upon the damping liquid for stability, it must be affected by the liquid in motion. This is called "swirl effect."

37. Forces exerted on the card.

(a) The balance of the card assembly is controlled by two forces; the downward pull of its weight and the upward pull of the float. If properly related, these forces hold the assembly in a pendulous state so that it will quickly return to its normal horizontal position when free to do so after being deflected. If the assembly has too long a pendulum, acceleration forces will throw it off balance, resulting in oscillation. Too short a pendulum is affected to a greater degree by magnetic dip.

(b) Magnetic dip may be corrected by the addition of a small weight to balance the card.

NOTE

A compass balanced at any given latitude will start to dip toward the north as the north magnetic pole is approached, and towards the south as the south magnetic pole is approached.

38. The Float. - The function of the float is to relieve the pivot and jewel of the wear due to the weight of the card assembly, and to give it the proper degree of pendulousness. The float, being air filled, presents a greater surface to the liquid; and being at the center of the liquid, reduces the effect of swirl on the assembly.

39. The card. - The card, because it must accomodate the graduations, numerals, and cardinal letters, is large and therefore acts like a flywheel. This motion is overcome by the directive pull of the magnets and the retarding effect of the damping liquid.

40. Overswing. - Overswing is the amount the card will swing past the equilibrium position when it has been deflected artificially and released. The damping liquid serves to reduce the overswing.

ERRORS AFFECTING ACCURACY

41. The fact that the compass may be in error, due to installation and inherent characteristics, should be realized and these errors taken into account when extremely accurate use of the compass is required. These errors may be divided into three classifications as described below:

MECHANICAL

42. Mechanical errors are errors in the construction of the mechanism.

(a) Card error. - The card error is the difference between an indicated and a true reading. With a plane through the lubber line and the center of the jewel stud, parallel to the magnet, the compass should indicate north or south without any compensation being applied. Turning the compass about its vertical axis from the above described position, by reference to an accurate circular scale to each 30-degree headings, the headings, the error is overcome by accurately lettering the card and by aligning the directive magnets properly with the north and south indications.

(b) Friction error. - The friction error is caused by the condition of the pivot and jewel and is indicated by an irregular movement of the card. The use of a jewel and carefully formed pivot reduces friction to a minimum. The float reduces friction still further by relieving the downward pull of the card assembly.

(c) Balance. - The balance of the card is evidenced by its horizontal position. An unbalanced condition tends to increase the errors in compass indication. Correct balance is maintained by the addition of weight to the light side of the card assembly.

(d) Lubber-line positioning. - Error may be caused by the misalignment of the lubber line.

(e) Period. - The time of swing from equal angles either side of the equilibrium position should be the same for both directions. Improperly magnetized magnets or an unbalanced condition of the card may be the cause of unequal periods.

(f) Overswing. - The amount the card swings past the equilibrium position should not be too great. Too much overswing denotes weak directional magnets.

(g) Damping. - The maximum deflection of the card from its original equilibrium position, after completion of a 360-degree turn in one minute, should not be excessive. The proper selection of the damping liquid and the correct strength of the directive magnets determines this condition.

(h) Heeling. - When the compass is tilted to any position within 20 degrees from its normal upright position on any heading, the card should be perfectly free to revolve on the pivot. The card reading should remain the same, whether the compass is tilted or is in a normal upright position.

FUNCTIONAL

43. Functional errors are due to the action of the earth's magnetic field on the compass when the airplane is in flight.

(a) A compass card when installed in an airplane acts as a pendulum and, as such, is subject to the combined forces of gravity and acceleration. The effect of gravity is to keep the card in a horizontal plane; while the effect of acceleration is to tilt the card from its normal horizontal position. When the card is tilted, the vertical component of the earth's magnetic field exerts a directive force on the card, tending to deflect the north-south diameter of the card from the magnetic meridian and thereby introduce an error in the indications of the compass.

(b) Owing to its pendulous action during turns, the card assumes a position which is perpendicular to the resultant of the combined forces of gravity and acceleration. The direction of this resultant force is known as the "apparent vertical", and is the direction a plumb bob would assume if installed in an airplane. In correctly banked turns the apparent vertical is perpendicular to the floor. The amount that the apparent vertical differs from the true vertical depends upon the angle of the bank, which in turn depends on the speed of the airplane and the radius of the turn. The amount that the card is deflected from the meridian depends on the angle of bank, the duration of the turn, and the period of the card.

(c) As the airplane makes a complete turn, the vertical component tends to deflect the compass card from the magnetic meridian as follows: from north to east in the direction of the turn; from east to south, opposite to the direction of turn; from west to north, in the direction of the turn. A turn in the opposite direction has the same effect in each quadrant, as given above. The turning error is most pronounced when the airplane turns out of a northerly course. This gives rise to the term "Northerly Turning Error".

SERVICE INSTRUCTIONS

SERVICE TOOLS REQUIRED

44. No special tools are required to service the AE 341-1-A or -2-A magnetic compass.

SERVICE INSPECTION

45. The applicable aircraft maintenance schedules (-7 EO's) should be used as the basis for periodic compass inspection, however, the following instructions may be used as a guide in establishing schedules for aircraft inspection and maintenance.

DAILY INSPECTION

46. At each aircraft daily inspection.

(a) Check all compasses for broken or loose cover glasses or other visible defects.

(b) Clean the compass cover glasses with a clean cloth.

(c) Inspect compass visually for discoloration of liquid.

MINOR INSPECTION

47. At each aircraft minor inspection, the compass will be inspected for security of mounting, leakage of liquid, defective lighting system, broken glass, discoloration of liquid, unbalanced card, or any defect which impairs the visibility or might render the compass inoperative.

MAJOR INSPECTION

48. All compasses installed on aircraft will be compensated and the readings recorded at each major inspection period in accordance with the instructions contained in EO 20-25-1 and at such other periods as are specified therein.

49. When inspection indicates that any of the following conditions exist, the compass is to be removed from the aircraft and replaced with a serviceable instrument.

(a) Clouded or discolored liquid impairing visibility.

(b) Discoloration or fading of card markings to the extent that the markings are illegible.

(c) Loss of luminosity of the luminous paint to the extent that the markings are illegible with standard cockpit lighting.

(d) Card does not rotate freely and in a horizontal plane when the aircraft is in normal flying position. (Deflect the card by using a small permanent magnet).

(e) Leakage of liquid from the bowl which cannot be stopped by uniform tightening of the bezel screws.

(f) Cracked window glass.

(g) Bowl cracked or mounting frame or lugs broken.

(h) Compass not responsive or erratic in action after proper efforts to compensate.

(j) Lubber line loose or misaligned.

(k) Defective compensating system.

(m) Any major defects not enumerated above which might render the compass inoperative.

MAINTENANCE

50. Normally, the maintenance work to be accomplished by Units on compasses will consist of the tightening of screws to eliminate leakage of liquid, the compensation of compasses and the replacement of any defective compasses.

LUBRICATION

51. No lubrication of the compass is required.

STORAGE

52. Magnetic compasses, including magnets used in the compensation thereof, will not be stored in metal bins or metal cabinets and will be kept at least three feet from any electrical wires not enclosed in conduit. Compasses should not be placed near steam radiators or other sources of heat, as excessive heating will cause expansion of the liquid with resultant leakage.

PART 2

OVERHAUL INSTRUCTIONS

DISMANTLING DATA

1. (See Figure 2-1) Place the compass face down on a bench. With a screw driver, remove the filling hole cap (1) from the rear cover (19), together with the gasket (2). Drain out the compass fluid into a clean container. Then disassemble lighting assembly as follows:

(a) After removing filling hole cap (1) and gasket (2), remove knob and contact assembly (3) by unscrewing it from contact ring of compensator assembly (9). Remove bulb (7). On the AE 341-1-A, it is only necessary to unscrew the bulb.

(b) To disassemble knob and contact assembly (3), (AE 341-2-A only), remove rivet (5) and separate contact (4) from knob (6).

(c) After removing cover assembly (8) and compensator assembly (9), remove plug assembly (11), as follows: Remove dust cap cup (10), if present. Remove two screws (12), insulating tubing (13), and washers (14). Remove plug assembly (11), ground contact (15), and insulator (16).

(d) After removing the front plate (25), remove gasket (27), if it appears to be in poor condition.

CAUTION

Take extreme care not to damage the card assembly (21) after the liquid is drained off.

2. With a screw driver, take out the two screws holding the cover assembly (8) to the front plate (25), remove the entire cover assembly (8). Do not attempt to remove the screws and retainers from the cover assembly. If any part is damaged, replace the entire cover assembly. The retainers are used to avoid possibility of losing the screws.

3. Slide the compensator assembly (9) out from the housing (32).

NOTE

The compensator assembly (9) consists of a delicately adjusted series of gears and magnets. Do not attempt to disassemble it. If any part is damaged, replace the entire assembly.

4. If necessary, take out the two screws (18) and remove the name plate (17).

5. Keeping the compass face down, take out the six screws (20) and carefully remove the rear cover (19) from the housing (32).

CAUTION

The jewel post and support assembly (22) and the card assembly (21) will come off with the rear cover (19). Be extremely careful not to damage these parts.

6. Carefully remove the card assembly (21) from the jewel post and support assembly (22) by compressing the card retainer gently with the fingers to release the prongs of the retainer from the slots of the card.

NOTE

Do not attempt disassembly of the card assembly (21). If any part is damaged replace the entire assembly.

7. Take out the two screws (23) and remove the jewel post and support assembly (22) from the rear cover (19). Remove gasket (24).

NOTE

Do not attempt disassembly of the jewel post and support assembly (22). If any part is damaged, replace the entire assembly.

8. Take out six screws (23) and remove the

front plate (25) from the housing (32). Remove gasket (28), window (29), and gasket (30).

9. Carefully pry the lubber line (31) loose with a screw driver and remove it.

10. If it is necessary to replace any of the four stop nuts in the housing (32), carefully punch out the damaged stop nut.

CLEANING DATA

11. Cleaning. After the compass has been disassembled, clean all the parts thoroughly by washing them in benzene, or an approved cleaning solution. After drying, a light blast of air may be used to blow loose dust off the parts. Particular attention must be paid to cleaning the air chamber and the main compartments in the housing. Exercise care to remove all traces of dust particles and metallic chips. After washing the window with soap and water, dry it with a soft cloth and avoid handling.

INSPECTION

12. Check all parts of the compass for dents, cracks, or other forms of damage. Check all threaded parts for stripped threads.

13. Jewel post and support assembly. Inspect the jewel in this assembly for any cracks or flaws in its smooth surface. Use the sharp point of a needle for this purpose, moving the needle point around in the cup jewel, or observe under a high powered microscope. See that the jewel post, the card retainer, and the support are not damaged in any way. The support must be perfectly flat and the jewel post must be perpendicular to the support. If damage is apparent in any part of the jewel post and support assembly, replace the entire assembly.

CARD ASSEMBLY.

14. Examine the pivot of this assembly for excessive wear or damage. Do not mistake a slight uniform roundness of the pivot for dullness. A very small radius at point of pivot is necessary to prevent excessive wear of both jewel and pivot.

15. Inspect the card very carefully to see that it is not warped or bent out of shape. Inspect graduations on card for chipped radium paint and general appearance.

16. Inspect the card magnets for proper position and tightness. Be sure that the axis of each is parallel to the other and also parallel to a line through the north-south points on the card within an accuracy of 1 degree.

17. If any part of the card assembly is damaged, replace the entire assembly.

18. Card Magnets. - Both age and vibration slightly decrease the magnetic strength of the card magnets. In such cases, replace the entire card assembly.

19. Balance. If the card assembly is out of balance, replace it with a new card assembly.

20. After card assembly has been checked, clean it thoroughly. Paint the magnets with dull black paint. The strength of the card magnets may be determined after magnetizing by measuring the time of the card swing from 30 degrees to 5 degrees.

NOTE

The time in seconds must be within the tolerance specified in Paragraph 52, Part 2.

GASKETS

21. Replace all gaskets to prevent leakage from the housing. The two cork gaskets must be thoroughly impregnated before assembly. This eliminates the natural porosity of the cork and makes the gaskets impervious to compass fluid. Perform the impregnation as follows:

(a) Place gaskets in a shallow dish and cover them with cellulose nitrate lacquer, Specification No. AN-L-29, diluted with approximately 25 percent cellulose nitrate thinner, Specification No. AN-TT-T-256.

(b) Agitate the mixture gently to eliminate bubbles, being careful not to injure the gaskets. Place a metal frame over gaskets to keep them from floating.

(c) Place the dish in a vacuum chamber. Evacuate the chamber to an absolute pressure of not more than 10 inches of mercury. If an altimeter is used as an absolute pressure gauge, it must indicate 30, 000 feet or more. Maintain the vacuum until bubbles no longer emerge from

the gaskets.

(d) Shut off the vacuum and vent the chamber to the atmosphere.

(e) Leave gaskets in the liquid at least 10 minutes longer.

(f) Remove the gaskets from the liquid, hang them separately on a rack, and allow them to dry at room temperature for at least 1 hour.

CAUTION

Gaskets must be used within 24 hours of impregnation. If they are not used within 24 hours, store them in a humidor containing a slight amount of Roxalyn Defensol Thinner No. 2950. Paint the cork gaskets all over with Black Airdry Lacquer. No. 7587, manufactured by L. J Kissling, New York City. Allow time for drying. Do not paint gaskets, unless they are to be used within 24 hours.

22 Compensator assembly. Inspect the compensator assembly for any damage. If damage is apparent, replace the entire assembly. Test the compensator assembly as described in paragraph 61, Part 2.

23 Knob and contact assembly. Clean the contact of the knob and contact assembly with No. 0000 polishing paper. If the contact is badly pitted, replace it with a new contact.

24 Bulb. Inspect and test the bulb. If it is in poor condition or does not light, replace it with a new bulb.

25 Plug assembly, insulation tubing, ground contact, and insulator. Examine these parts and replace, if damaged.

26 Compensator assembly. Clean the contacts of the compensator assembly with No. 0000 polishing paper. If the contacts are badly pitted, or if the wiring is damaged, replace the entire assembly.

RE-ASSEMBLY

27 See Figure 2-1. Mount the jewel post and support assembly (22) on the rear cover (19) with the two screws (23).

NOTE

The support must be flat and perpendicular to the mounting face on the rear cover, and the jewel post must be perpendicular to the support. Check the position of the support and jewel post in a sighting fixture.

28 Assemble the lubber line (31) in the slots of housing (32) so that the front edges of the lubber line are flush with the window gasket surface on the housing. If the lubber line is loose in the slot, cement in place with Roxalyn Cement No. 1510H and allow to dry. Place the housing in a fixture or jig to check the straightness of lubber line and bend the lubber line gently if necessary.

29 Coat one side of gasket (30) and also the well in the housing (32) with Roxalyn Cement No. 1510H. Allow to dry until tacky, then place gasket (30), cemented face down, in well of housing (32). Now coat other side of gasket (30) and the edge of window (29) with the same cement. Allow to dry until tacky, then place window (29), cemented face down, on gasket (30). Place gasket (28) and front plate (25) in position on window and assemble with six screws (26) being careful to pull front plate down evenly. When the six mounting screws have been pulled down tightly recheck straightness of lubber line (31) after the front plate (25) has been assembled.

29A The quantity of gaskets (28), (28A) is selected as required according to the thickness of the window (29). Window thickness varies from 0.135" to 0.115". Select a suitable combination of gaskets and window so that sufficient compression to present leakage is exerted on gasket (30) by cover (25) when screws (26) are tightened.

30 Assemble the card assembly (21) to the

jewel post and support assembly (22) so that the card assembly will be held on the jewel post by snapping the retainer spring in the slots of the card. There should be approximately 1/32-inch play between jewel post and card retainer spring.

NOTE

A fixture which would spread the prongs of the retainer spring while assembling the card to the jewel post would facilitate assembly and would avoid bending the retainer spring out of shape.

31. At this point flush out the main housing, with lubber line and front plate assembled, with compass liquid several times to clean thoroughly. Also flush with compass fluid the rear cover with card, jewel post, and support assembled, being careful not to injure the card.

NOTE

The filler plug (1) should be screwed in and out of the rear cover (19) during this operation to avoid possibility of metal chips later entering the main housing.

32. Coat one side of gasket (24) and rear of housing (32) with Roxalyn Cement No. 1510H. Allow to dry until tacky, then place gasket (24) cemented face down on rear of housing (32). Now coat other side of gasket (24) and boss side of rear cover (19) with the same cement. Allow to dry until tacky. Assemble rear cover (19), with the card assembly (31) and jewel post and support assembly (22) assembled to it, to the housing and stop nut assembly (32) with gasket (24) attached. Use the six screws (20), being careful to pull screws down evenly.

33. Fill the housing (32) with compass fluid, shake gently, and blow the fluid out through the filling hole with low pressure air. Repeat this operation four or five times until the fluid chamber is clean.

34 Fill compass assembly as follows:-

(a) Fill the compass with compass fluid at room temperature, approximately 25°C. (77°F). It will be necessary to tip the compass at a slight angle while filling.

(b) Place the compass on a stand set at an angle of 25 degrees, simulating a dive position, and allow the compass liquid to leak out until small bubbles just appear in the four holes in the housing as seen through the top of the window. Assemble filling plug (1) and gasket (2) to rear cover (19), closing up the compass.

NOTE

At room temperature, approximately 25°C. (77°F.), check the compass also at 18° dive position and make sure no bubble appears through the window.

(c) After the compass has been properly filled, place the compass face up in an oven at + 70° ± 2°C. (158° ± 3.6°F.) for two hours. At the end of the two hour hot test there should be a small air bubble, approximately 1/2 to 3/4 inch in diameter at the window of the compass. If there is no bubble in the compass, the unit has too much compass liquid. Remove the compass liquid and refill.

NOTE

When there is no air bubble at + 70°C. (158°F.) additional pressure is built up in the compass quite rapidly, resulting in possible leakage.

35. Assemble compensator assembly (9) into housing (32), and place front cover assembly (8) over bezel of housing (32) by tightening the two screws.

36. Assemble name plate (17) on rear plate (19) with two screws (18).

NOTE

Use Rogers Black Brushing Lacquer for touching up all surfaces in contact with compass liquid and Kissling Black Air-dry Lacquer No. 7587 for surfaces not in contact with compass liquid.

37. If gasket (27) has been removed, coat one side with Roxalin Cement No. 1510H. Allow to dry until tacky, then place gasket (27), cemented face down, around lower cutout of front plate (25).

38. After assembling rear cover (19) to the housing and data assembly (32), assemble plug

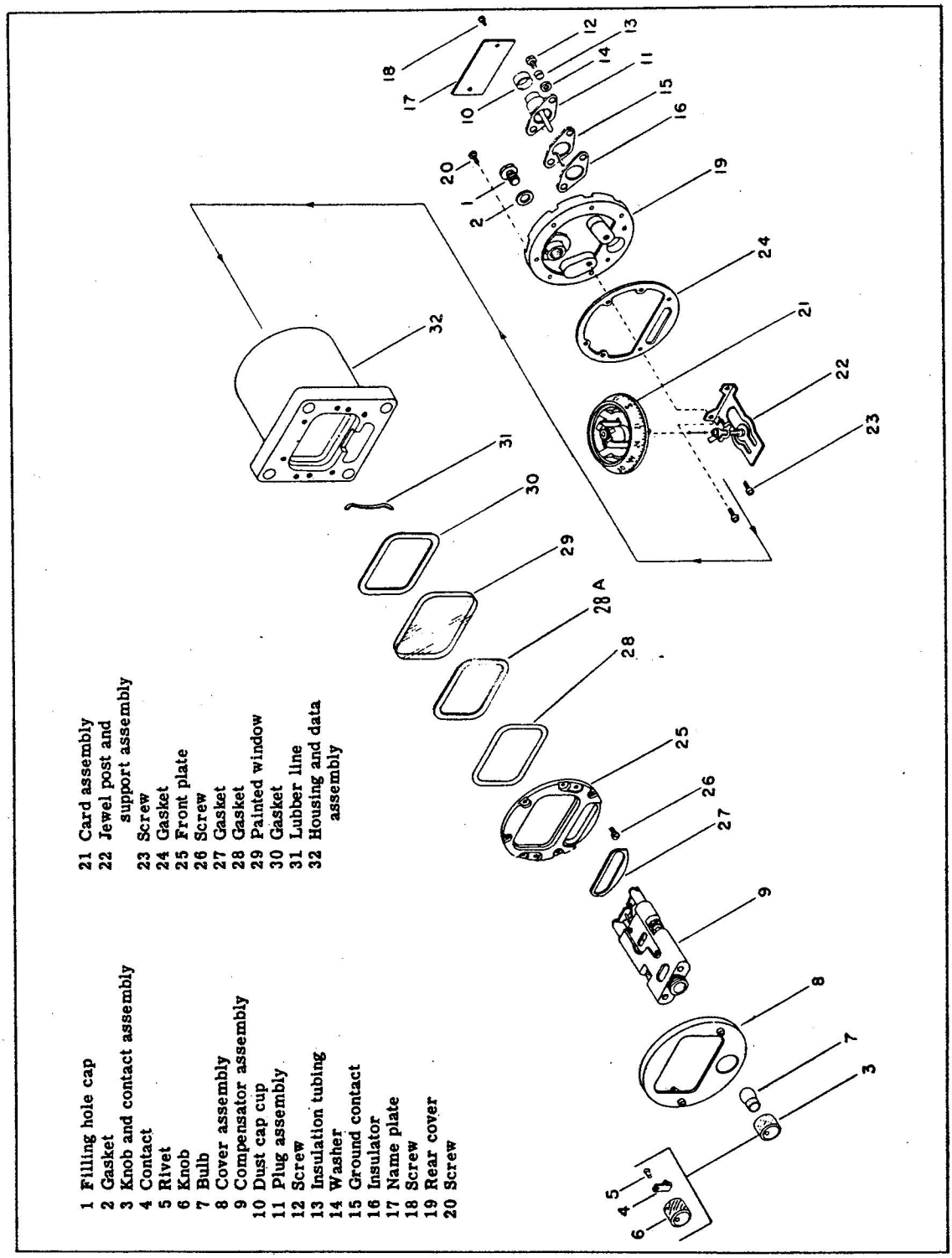

Figure 2-1 (Issue 1) Exploded View - Standby Compass - AE344-1-A and AE341-2-A

assembly (11) to rear cover (19) as follows: Position ground contact (15) and insulator (16) on rear of plug assembly (11) so that the insulator is between the rear cover (19) and plug assembly (11). Secure plug assembly (11) to rear cover (19) with two washers (14), insulation tubing (13), and screws (12). Assemble dust cap cup (10) on front end of plug assembly (11).

39. To assemble knob and contact assembly (3), place contact (4) into knob (6) and rivet together with rivet (5).

40. After assembling the compensator assembly (9) and front cover assembly (8) over bezel of housing (32), replace bulb (7) and screw knob and contact assembly (3) on to the contact ring of the compensator assembly (9).

TESTING

41. For special test equipment in connection with the work prescribed in this section, refer Table 2-2, and Figure 3-2.

CONDITIONS

42. Unless otherwise specified, all tests must be made at atmospheric pressure of approximately 29.92 inches of mercury and a temperature of approximately 25°C. (77°F.) and with the compass in a magnetic field having a horizontal component of approximately 0.18 gauss, and a vertical component of approximately 0.54 gauss. When tests are made with atmospheric pressure, temperature, or magnetic field substantially different from the above values, proper allowance for change in instrument reading must be made for the difference from the specified conditions.

NOTE

To create the proper magnetic field, use Helmholz coil, Eclipse-Pioneer type 13634-1-A, in conjunction with Compass adapter, Eclipse-Pioneer type QB 71327-1, and adapter plate, Eclipse-Pioneer type QB 71468-1.

Tool No.	Nomenclature	Application
QB 2663-1	Nonmagnetic Screw Driver	To adjust compensator
QB 71327-1	Compass Adapter	To support compass in helmholz coil (used with QB 71468-1)
QB 71468-1	Adapter Plate	To support compass in helmholz coil (used with QB 71327-1)
13634-1-A	Helmholz Coil	Calibration and Test

Figure 2-2 Overhaul Tools and Test Equipment.

43. Unless otherwise specified, the compass must be tested in normal operating position and must be lightly tapped before a test reading is taken.

CARD ERROR TEST

44. With the compensator removed from the compass, and with the plane through the lubber line and the center of the pivot post parallel to the magnetic meridian, mount the compass on compass adapter QB 71327-1 using adapter plate QB 71468-1. The standby compass must indicate north (0-degrees) and/or south (180-degrees) within 2 degrees. Turn the compass about its vertical axis from the above position, by reference to an accurate circular scale, to each 30-degree heading. The error at any point must not exceed 1 degree, after taking into consideration the alignment error.

45. If the tolerances specified above are exceeded, recheck the card assembly, and replace it, if found defective.

FRICTION ERROR TEST.

46. Deflect the compass card 5 degrees from its equilibrium position, release it, allow it to come to rest, and make a reading. Repeat the

test deflecting the card 5 degrees in the opposite direction. The card must return to within 1 degree of its original position, without vibration or tapping.

47. If the tolerance of 1 degree is exceeded, check the card pivot for concentricity and alignment. (Refer to paragraph 2-14). Check the card pivot and jewel for wear.

BALANCE TEST

48. Hold the compass in its normal operating position. The deviation of the plane of the card from the horizontal, as determined by any suitable method, must not exceed 1 degree.

49, If the tolerance of 1 degree is exceeded, replace the card assembly.

LEVELLING TEST

50. Hold the compass in its normal operating position. The deviation of the lubber line from the vertical as determined by any suitable method must not exceed 1 degree.

51. If the tolerance of 1 degree is exceeded, realign the lubber line by moving and straightening it.

TIME OF SWING TEST

52. With the compensator removed, deflect the card magnetically 30 degrees from its equilibrium position hold long enough for the liquid to come to rest, and release. Observe the time for the card to pass through 25 degrees toward its equilibrium position. Repeat the test with the card deflected 30 degrees to the other side of the equilibrium position. The average time of the two readings must not be less than 1.4 seconds or greater than 1.8 seconds. The position of the compass must not be changed during this test.

53. If the foregoing tolerances are exceeded, re-magnetize the card magnets.

DAMPING TEST

54. With the compensator removed, deflect the card magnetically 30 degrees from its equilibrium position, hold it at this position long enough for the liquid to come to rest, release, and note the overswing past the equilibrium position. Repeat the test with deflection of 30 degrees in the opposite direction. Do not change the position of the compass between deflections in opposite directions. The average of the two observations must not exceed 15 degrees.

NOTE

If desired, this test may be combined with the Time of Swing Test.

SWIRL TEST

55. With the compass in its normal upright position at any heading, and with the liquid at room temperature, turn the compass through 360 degrees in one minute of time. The maximum deflection of the card from its original heading must not exceed 2 degrees.

56. If the tolerance of 2 degrees is exceeded, replace the card assembly.

TILT ERROR TEST

57. Tilt the compass to any position within 18 degrees, from its normal upright position, and on any heading. The card must be perfectly free to revolve on its pivot when tilted. The card must also be visible from a point two feet in front of, and level with, the center of the compass when tilted 18° in any direction. During this test, either remove the compensator or adjust it to provide minimum compensation.

58. If the card heels or sticks, check the alignment of jewel post and play between card retainer spring and jewel post.

VIBRATION TEST

59. Mount the compass on a vibration stand with a line joining the center of the two lower mounting holes in a horizontal plane and with the plane of the mounting lug vertical and the heading observed. Subject the compass to vibration with an amplitude between 0.009 and 0.01 inch at frequencies varying from 500 to 3,000 cycles per minute. The differences between the card reading observed before vibration and during vibration must not exceed 3 degrees.

60. If the tolerance of 3 degrees is exceeded, check position of pivot in card, wear on pivot or jewel.

COMPENSATION TEST

61. Orient the compass first to indicate north (0 degrees) and then east (90-degrees). When the minimum increment of compensating mechanism is properly introduced for either heading (crosswise for north and for-and-aft for east), a deviation of not more than 2 degrees must result. Maximum compensation applied unnaturally (fore-and-aft for north and crosswise for east) on either heading must not affect the indication on the other heading by more than 2 degrees. With a vertical plane, through the lubber line and card pivot at right angles to the magnetic meridian and with the north-south compensating system set at zero, the east-west compensator shall be set successively to its maximum north and maximum south headings and the maximum card deviations noted. The maximum deviation produced by each compensating system must not be less than 30 degrees nor more than 40 degrees.

62. If the tolerances above are exceeded, replace the compensator assembly.

PART 3

PART LIST

INTRODUCTION

1. This part list contains a list of procurable and non-procurable parts for the Compass Magnetic Standby, Types AE 341-1-A and AE 341-2-A. This list is intended for use in all phases of supply and maintenance of the services for requisitioning, storing, issuing, for identifying new and reclaimed parts, and for illustrating assembly and disassembly sequences. The equipment is manufactured by Aviation Electric Ltd., Montreal.

HOW TO USE THE PART LIST

2. An explanation of the manufacturer's type numbering system outlined below, is given to facilitate reference to the instrument described.

AE	340	-1	-A
Company Identification	Type Number	Model Number	Style

3. Aviation Electric part numbers are the same as the drawing numbers for the parts.

4. When the part number is known, reference to the group assembly part list will provide the index and figure number. Reference to the exploded view drawing (Figure 2-1) will then provide the location and visual identification of the part.

5. When the part number is not known, the index number, obtained from the exploded view, will enable the part to be located readily in the group assembly part list where the corresponding part number, nomenclature and quantity are given.

6. The following coding is used in this part list:

Aviation Electric Type No.	Usage on Code
AE 340-1-A	A
AE 340-2-A	B

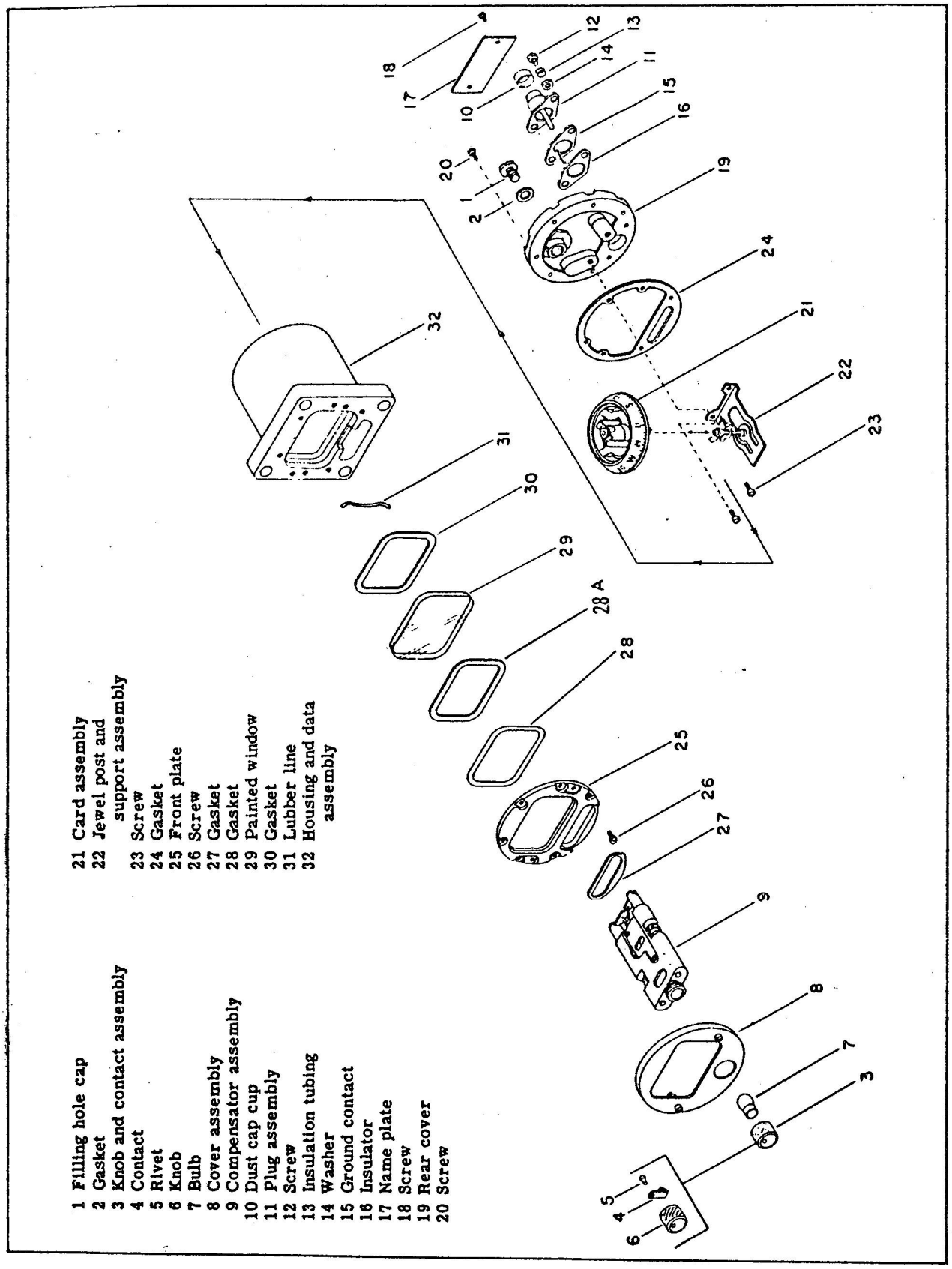

Figure 3-1 (Issue 1) Exploded View - Standby Compass - AE341-1-A and AE341-2-A

FIGURE and INDEX NUMBER	GROUP: Standby Compass MAJOR ASSEMBLY: Compass Assembly PART NUMBER	1 2 3 4 5 6 7 NOMENCLATURE	Units Per Ass'y	Usage on Code
3-1-	AE 341-501	Compass Assembly (See Figure 2-5)	1	A
	AE 341-502	Compass Assembly (See Figure 2-5)	1	B
-1	B709088-1	Filling Hole Cap	1	All
-2	B710054-1	Gasket	1	All
-3	B735604-1	Knob and Contact Assembly	1	B
-4	B735189-1	Contact	1	B
-5	FHR-0-201 1/28	Rivet - Flat Head (Steel)	1	B
-6	B735200-1	Knob	1	B
-7	AN3140-327	Bulb	1	B
	AN3136-323	Bulb	1	A
-8	AEA2076-501	Cover Assembly	1	A
	AEA2076-502	Cover Assembly	1	B
-9	AEA4015-501	Compensator Assembly	1	A
	AEA4015-502	Compensator Assembly	1	B
-10	AEP1558-4	Dust Cap Cup	1	All
-11	B737601-1	Plug Assembly	1	All
	ATTACHING PARTS			
-12	FIL-0-405-TE	Screw	2	All
-13	B735199-1	Insulation Tubing	2	All
-14	B768647-1	Washer	2	All
-15	B728204-1	Ground Contact	1	All
-16	B728203-1	Insulator	1	All
-17	AEP2021-1	Name plate	1	A
	AEP2021-2	Name plate	1	B

FIGURE and INDEX NUMBER	GROUP Standby Compass MAJOR ASSEMBLY Compass Assembly PART NUMBER	1 2 3 4 5 6 7 NOMENCLATURE	Units Per Assy	Usage on Code
	ATTACHING PARTS			
3-1 -18	FFIL-0-202TE	Screw	2	All
-19	C727991-1	Rear Cover	1	All
	ATTACHING PARTS			
-20	FFIL-0-405TE	Screw	6	All
-21	AEA2025-501	Card Assembly	1	All
-22	B794863-1	Jewel Post and Support Assembly	1	All
	ATTACHING PARTS			
-23	AEM1513-1	Screw	2	All
-24	C727995-1	Gasket	1	All
-25	C727992-1	Front Plate	1	All
-26	FFIL-0-403T	Screw	6	All
-27	B727994-1	Gasket	1	All
-28	AEM1619-1	Gasket .021" to .041"	AR	All
-28A	AEM1619-2	Gasket .037" to .057"	AR	All
-29	B735194-1	Painted window	1	All
-30	B794865-1	Gasket	1	All
-31	AEP1088-1	Lubber Line	1	All
-32	E727990-1	Housing and data Assembly	1	All

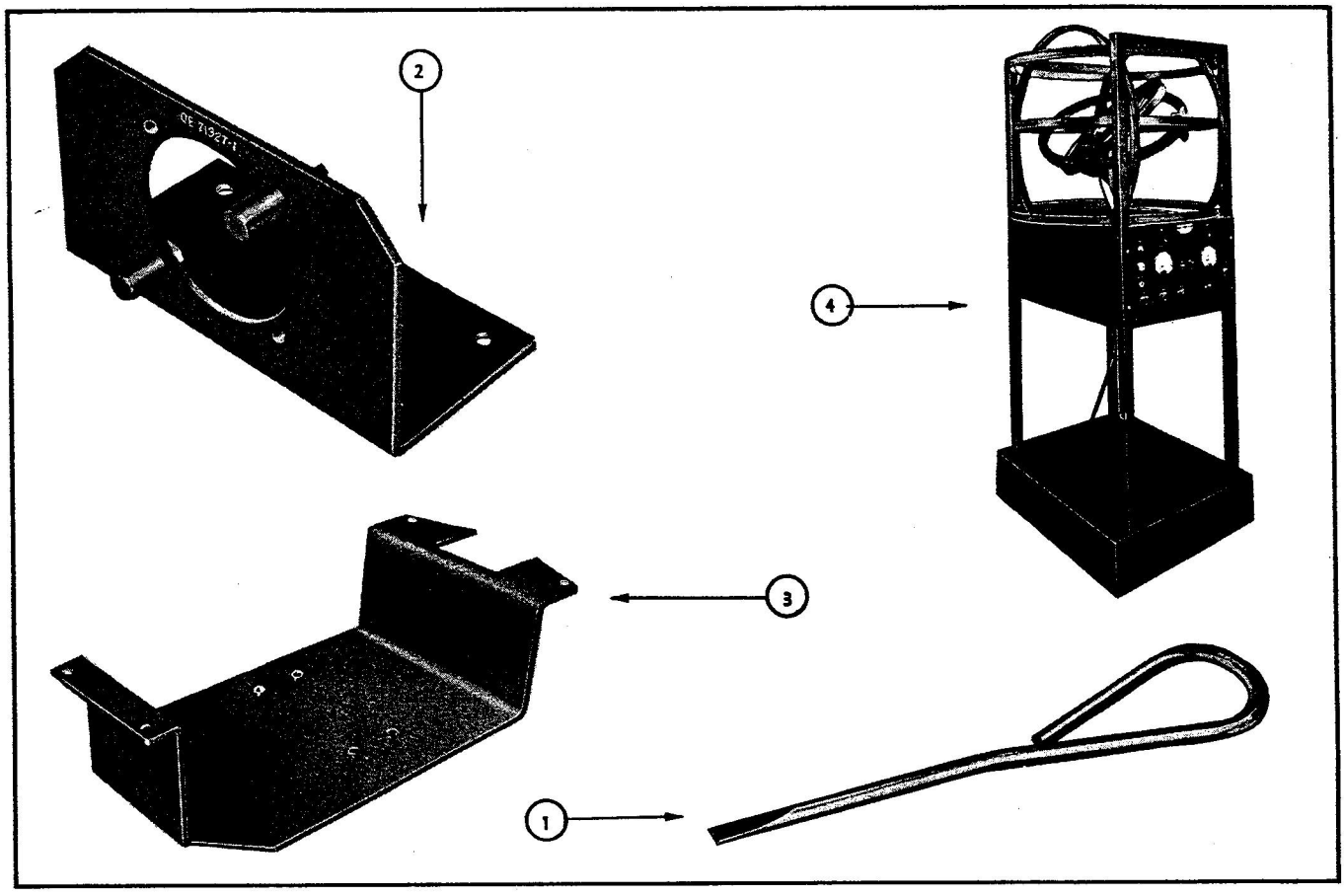

Figure 3-2 Special Tools

FIGURE and INDEX NUMBER	GROUP SPECIAL TOOLS MAJOR ASSEMBLY PART NUMBER	1 2 3 4 5 6 7 NOMENCLATURE	Units Per Ass'y	Usage on Code
3-2-				
-1	QB 2663-1	Non-Magnetic Screwdriver	1	All
-2	QB 71327-1	Compass Adapter	1	
-3	QB 71468-1	Adapter Plate	1	
-4	13634-1-A	Helmholtz Coil	1	

PART 4
NUMERICAL PART LIST

PART NUMBER	FIGURE AND INDEX NUMBER	TOTAL QUANTITY
AEA 2025-501	2-1-21	1
AEA 2076-501	2-1-8	1
AEA 2076-502	2-1-8	1
AEA 4015-501	2-1-9	1
AEA 4015-502	2-1-9	1
AEM 1513-1	2-1-23	2
AEM 1619-1	2-1-28	AR
AEM 1619-2	2-1-28A	AR
AEP 1088-1	2-1-31	1
AEP 1558-4	2-1-10	1
AEP 2021-1	2-1-17	1
AEP 2021-2	2-1-17	1
AN 3136-323	2-1-7	1
AN 3140-327	2-1-7	1
B 709088-1	2-1-1	1
B 710054-1	2-1-2	1
B 727994-1	2-1-27	1
B 728203-1	2-1-16	1
B 728204-1	2-1-15	1
B 735189-1	2-1-4	1
B 735194-1	2-1-29	1
B 735199-1	2-1-13	2
B 735200-1	2-1-6	1
B 735604-1	2-1-3	1
B 737601-1	2-1-11	1
B 768647-1	2-1-14	2
B 794863-1	2-1-22	1
B 794865-1	2-1-30	1
C 727991-1	2-1-19	1
C 727992-1	2-1-25	1
C 727995-1	2-1-24	1
E 727990-1	2-1-32	1
FFIL-0-202TE	2-1-18	2
FFIL-0-403T	2-1-26	6
FFIL-0-405TE	2-1-20	6
FHR-0-201-1/28	2-1-5	1
FIL-0-405TE	2-1-12	2