



(This bulletin obsoletes Service Bulletins M20-8, M20-134, and M20-150.)

**SUBJECT:** MAGNETIC COMPASS INTERFERENCE

**MODELS**

**AFFECTED:** As noted below in Instructions I & II.

**TIME OF**

**COMPLIANCE:** MANDATORY compliance at next scheduled annual inspection or within next 100 hours, whichever comes first.

**OBJECTIVE:** The magnetic compass must always compensate within  $\pm 10^0$  at any heading.

The aircraft noted in Instruction I have wiring configurations that may magnetize the cabin tubular structures and must, therefore, be rewired. Instruction II discusses the wire replacement procedure necessary if demagnetizing the cabin is not effective for the aircraft listed under Instruction II. Instruction III refers to the compass swinging and cabin demagnetizing procedures.

**INTRODUCTION:**

A compass is essentially a magnetized pointer suspended so it will align with the magnetic medians of the earth. Aircraft compasses have compensating magnets that may be adjusted to offset local magnetic attraction. When an improperly reading compass cannot be compensated by adjusting its magnets, one or more of the following magnetic attractions may exist:

1. Cabin tubular structure has been magnetized as a result of certain wire routings.
2. Airframe has been used as a ground return path for electrical equipment such as navigation lights, a rotating beacon, and a heated pitot.
3. Aircraft has been exposed to an unwanted magnetic field (example: electric motors in a vacuum cleaner, electric buffer, etc.; transformers in a battery charger, magnafix machine, etc.).
4. Aircraft equipment has been removed, installed, or replaced, thereby disrupting previous compensation settings.

Any one or a combination of these magnetic attractions may disrupt accurate magnetic compass operation. To help prevent magnetic compass interference, perform Instruction I, II, and III.

**INSTRUCTION I:**

Refer to Figure 1 on page 8 and to magnetic attraction possibility number 1 in the Introduction.

Proceed with Instruction III if Service Bulletin M20-150 has been complied with.

Models Affected: M20B, S/N 1701 thru 1851, 1853 thru 1939  
M20C, S/N 1852, 1940 thru 3466, 670001 thru 670129  
M20D, S/N 101 thru 260  
M20E, S/N 101 thru 1308, 670001 thru 670062  
M20F, S/N 660002 thru 660004, 670001 thru 670362

- Step 1 Remove wires connecting "Aux Buss" circuit breaker and auxiliary buss bar. There are wire numbers: 800007-9 on M20B; 800007-169 on M20C, M20D, and M20E; and 800214-001 on M20F aircraft.
- Step 2 Select circuit breaker-to-buss bar wires having a 60-inch length of No. 6 MIL-W-5086, Type 2, wire with AMP 321298 terminals on each end. Mooney-manufactured wires conforming to these specifications carry wire number 800007-292 for M20B, M20C, M20D, and M20E; and 800214-147 for M20F aircraft (Refer to S.B. Kits Nos. M20-150A-1 & -2).
- Step 3 Route replacement wire forward from "Aux Buss" circuit breaker to firewall. Run wire across firewall with existing wire bundle and then straight aft to auxiliary buss bar.
- Step 4 Use cushioned clamps to attach wire to tubular structure, and string-tie wire to existing wire bundles across firewall.
- Step 5 Proceed with Step 1 of Instruction III.

**INSTRUCTION II:**

Refer to Figure 2 on page 8 and to magnetic attraction possibility number 2 listed in the Introduction.

Proceed with Step 4 of Instruction III if Service Bulletin M20-134 has been complied with.

Models Affected: M20B, S/N 1701 thru 1851, 1853 thru 1939  
M20C, S/N 1852, 1940 thru 3286  
M20D, S/N 101 thru 259  
M20E, S/N 101 thru 950

Twisting a ground wire together with each navigation light, or rotating beacon, and/or heated pitot circuit supply wire can reduce compass error induced by using the airframe as a ground return path for such equipment.

Step 1 For an aircraft listed above that is equipped with navigation lights, or a rotating beacon, and/or a heated pitot, remove upholstery panels, inspection plates, access panels, and fairings necessary to gain access to wiring.

Step 2 Navigation Light Wiring:

A) Remove wire leading from navigation light to navigation light switch.

B) Install S.B. Kit M20-150A-4.

NOTE: Be sure you do not displace wing rib and fuselage bulkhead grommets when "pulling" electrical wires.

C) Connect wires number 800007-60 & -64 to navigation light switch, and ground wires number 800007-268 & -270 to nearest instrument panel mounting bolt below navigation light switch.

D) Solder wires number 800007-90, -92, and -5 to center contacts of their respective navigation lights. Solder wires number 800007-262, -263, and -264 to outside light shells.

E) Check navigation light operation.

Step 3 Rotating Beacon Wiring (if applicable):

A) Remove wire leading from rotating beacon to beacon light switch, and disconnect beacon ground wire.

B) Install S.B. Kit M20-150A-5.

C) Connect wire number 800007-140 to beacon switch and beacon light positive terminal.

D) Ground wire number 800007-261 to instrument panel mounting bolt nearest beacon switch, and connect other end to beacon light negative terminal.

E) Check rotating beacon operation.

Step 4 Heated Pitot Tube Wiring (if applicable):

A) Remove wire leading from pitot switch to pitot head.

B) Cut terminal from pitot ground wire, and install a knife disconnect on wire end.

C) Install S.B. Kit M20-150A-6.

D) Connect wire number 800007-141 to pitot tube switch, and ground wire number 800007-273 to nearest instrument panel mounting bolt.

NOTE: Polarity at pitot head is not critical.

E) Check heated pitot tube operation.

Step 5 Reinstall items removed in Step 1.

Step 6 Swing compass per Step 5 of Instruction III.

**INSTRUCTION III: Compass Swinging and Cabin Demagnetizing Procedures.**

Step 1 Check aircraft (with all radio and electric equipment off) for magnetized structure as follows:

- A) Center or remove compensating magnets from compass.
- B) Position aircraft on compass rose, run engine at 1500 to 2000 RPM, and check the four cardinal headings starting at north heading. If an error greater than  $\pm 30^\circ$  is found at any cardinal heading, proceed to demagnetize cockpit as outlined in Step 2. If error is less than  $\pm 30^\circ$  at any cardinal heading, proceed to swing the compass (Step 5).

Step 2 Demagnetize Cockpit:

**CAUTION:** Improper use of a growler can induce more magnetism in cabin structure, making extensive demagnetizing necessary.

Method I

- A) Remove compass from aircraft.
- B) Position aircraft at a heading of either  $90^\circ$  or  $270^\circ$ .
- C) Make sure growler is turned off. Place growler in cockpit, position seats aft, and support power cord so that it does not touch or pass within six inches of any structural member.
- D) Hold growler inside cockpit in a low position. Turn growler on and slowly move it close to landing gear handle, up toward and along windshield center post, and along overhead structure. Move growler down in a circular motion from behind shoulders to waist or midchest height before turning it off.
- E) Hold compass in place to see if headings now match aircraft heading. If too much heading error (more than  $\pm 15^\circ$ ) still exists, remove compass from aircraft.
- F) Turn on growler and move it along center side and overhead cross structure from one side of cockpit to the other.
- G) Again hold compass in place and compare headings. If heading error has not reduced sufficiently (to less than  $\pm 15^\circ$ ), then:
  - 1) Repeat steps D, E, F, and G.
  - 2) Proceed with cockpit demagnetizing, Method II.
  - 3) Proceed with Step 3.



- H) When heading error is reduced to less than  $\pm 15^\circ$ , install compass and proceed with steps 5 and 6 (Compass Swinging).

NOTE: Effective with M20C, M20E, and M20F, serial numbers 670001 and on, the windshield center post is fabricated of non-magnetic stainless steel. This post will require no demagnetizing, so demagnetizing efforts should concentrate on other airframe sections.

### Method II

This method consists of passing direct storage battery current through portions of the cabin structure. The compass need not be removed, for it serves as a convenient demagnetizing effectiveness indicator. Current is passed through each of three sections of the tubular structure until sufficiently low heading errors are obtained. These tubular structure sections are:

1. Left half of windshield bow from top center intersection of center windshield post to lower intersection of bow with instrument panel bottom support tube.
2. Right half of windshield bow.
3. Instrument panel bottom support tube.

The procedure for this demagnetizing method is as follows:

- A) Position aircraft at a heading of either  $90^\circ$  or  $270^\circ$ .
- B) Using thinner and/or steel wool, thoroughly remove protective finish from a small area of tubular structure at upper junction of windshield center post and windshield bow, and at both ends of instrument panel bottom support tube.
- C) Prepare two #6 AWG (or larger) wires by crimping AMP 321598 (or similar) terminals to both ends of both wires.
- D) Using a large (3- or 4-inch) C-clamp, firmly clamp one terminal of one prepared wire to exposed area of tube at one end of instrument panel bottom support tube. Terminal must be clamped tight enough so that it will not move when wire is wiggled vigorously.

CAUTION: An imperfect contact (dirty surfaces or loose clamp) between tubing and wire terminal will cause arcing and burning resulting in severe damage to aircraft structure.

- E) Fasten other end of wire to a terminal of a well-charged storage battery.
- F) Using a large C-clamp, firmly clamp one terminal of the other prepared wire to bared tube area at top center of windshield bow or at other end of instrument panel bottom

support tube. Terminal again must be clamped tight enough so that it will not move when wire is wiggled vigorously.

- G) Tap other end of second wire to other battery terminal; then observe compass reading. If error is aggravated, reverse battery polarity.
- H) If compass heading error is not reduced sufficiently (i.e. to less than  $\pm 15^{\circ}$ ) by passing current through this frame section, demagnetize other cabin sections or continue with remaining steps I & J.

**CAUTION:** Make certain that wire terminals are firmly clamped to tubular structure to prevent arcing.

- I) Refinish bared structure areas with zinc chromate primer.
- J) When heading error has been reduced to less than  $\pm 15^{\circ}$ , proceed with steps 5 and 6 (Swing compass), otherwise continue with the following step.

**Step 3** Unless already accomplished, perform Instruction II for designated aircraft. If Instruction II does not apply to designated aircraft or if procedure has been accomplished, proceed with the following step.

**Step 4** If Instruction II is not applicable, or if procedure given in Instruction II does not correct the magnetic attraction problem, replace compass with an Airpath C-2350-L4-M23 compass (Refer to S.B. Kit M20-150A-3).

**Step 5** Swing compass:

- A) Run engine at 1500 to 2000 RPM. Turn on rotating beacon, and proceed to swing compass both with "Radio On" and "Radio Off" after reinstalling and centering compensator magnets (if removed).
- B) Position aircraft on compass rose, and adjust N-S compass compensating screw for a  $0^{\circ}$  indication at north heading. (Use non-ferrous tools.)
- C) Turn aircraft to east heading, and adjust compass E-W compensator screw for a  $90^{\circ}$  indication.
- D) With aircraft on south heading, adjust N-S compensator to reduce indicated error by 50 percent (example: If compass reads  $184^{\circ}$ , adjust compensators so it reads  $182^{\circ}$ ).
- E) With aircraft on west heading, adjust E-W compensator to reduce indicated error by 50 percent.
- F) Return aircraft to north heading, reset directional gyro and, using DG, check and record compass error at every  $30^{\circ}$  heading through  $360^{\circ}$ .

NOTE: Also check and record compass deviations for rotating beacon, navigation lights, and heated pitot (if applicable) in ON and OFF position for the following aircraft only: M20B, S/N 1701 thru 1851, 1853 thru 1939; M20C, S/N 1852, 1940 thru 3286; M20D, S/N 101 thru 259; and M20E, S/N 101 thru 950.

- G) Adjust compensator making sure compass reads within  $\pm 10^{\circ}$  at any heading, and proceed with Step 6. If compass does not read within  $\pm 10^{\circ}$  at any heading, proceed to de-magnetize cockpit as outlined in Step 2.
- Step 6 Fill out compass correction card(s) giving "Radio On" and "Radio Off" corrections at each  $30^{\circ}$  heading throughout  $360^{\circ}$ . Install card(s) on or in close proximity to compass in full view of pilot.
- Step 7 Fill out and mail attached Service Bulletin Compliance card. (Mandatory compliance is now accomplished.)

#### SERVICE BULLETIN KITS:

No. M20-150A-1 (M20B, M20C, M20D, M20E)--offered free of charge. See Step 2 of Instruction I.

800007-292 wire (1), AN526-832R8 screw (2), AN365-832 nut (2), AN960-8 washer (2), MS21919DG-4 clamp (2), MS21919DG-6 clamp (2), compass correction card (2), S.B. Compliance card (1).

No. M20-150A-2 (M20F)--offered free of charge. See Step 2 of Instruction I.

800214-147 wire (1), AN526-832R8 screw (2), AN365-832 nut (2), AN960-8 washer (2), MS21919DG-4 clamp (2), MS21919DG-6 clamp (2), compass correction card (2), S.B. Compliance card (1).

No. M20-150A-3 (all M20 series aircraft) See Step 4 of Instruction III.

Airpath Compass No. C-2350-L4-M23 (1), compass correction card (2), S.B. Compliance card (1).

No. M20-150A-4 (M20B, M20C, M20D, M20E) See Step 2 of Instruction II.

800007-5, -60, -61, -62, -64, -89, -90, -91, -92, -262, -263, -264, -265, -266, -267, -268, -269, and -270 wires (one each); compass correction card (2); S.B. Compliance card (1).

No. M20-150A-5 (M20B, M20C, M20D, M20E) See Step 3 of Instruction II.

800007-140 and -261 wires (one each), compass correction card (2), S.B. Compliance card (1).

No. M20-150A-6 (M20B, M20C, M20D, M20E) See Step 4 of Instruction II.

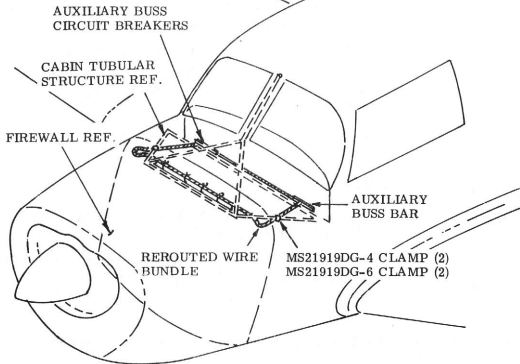
800007-93, -94, -141, -272, -273, and -274 wires (one each); compass correction card (2); S.B. Compliance card (1).

**COMPLIANCE  
NOTIFICATION:**

The above kits may be procured from your local Mooney Dealer or Distributor. Direct factory orders will not be accepted.

To fully comply with mandatory requirements, attached Service Bulletin Compliance card must be filled out and mailed to Mooney Aircraft, Inc., (Refer to Instruction III, Step 7).

**FIGURE 1**



**FIGURE 2**

