MOONEY AIRCRAFT, INC.
LOUIS SCHREINER FIELD · KERRVILLE, TEXAS

Service Instruction

NUMBER: M20-27

DATE: 6-6-66

(FAA D.O. AUTHORIZATION SW-1 APPROVED)

TO: Distributors, Dealers, and Service Centers

FROM: Customer Service

SUBJECT: Trouble Shooting and Adjustment Procedures for Brittain Autopilot – Group I and Group III.

MODEL AND SERIAL NUMBERS AFFECTED:

All M20C and E model aircraft with Brittain Group I or III installed as optional equipment.

INTRODUCTION: A careful study and use of these procedures will aid in maintaining and adjusting those installed autopilots to provide maximum utilization. These procedures are to be used to supplement the Mooney Service and Maintenance Manual and Brittain Operation and Service Instructions 11968-1.

1. General Procedures and Adjustments:

   A. Ground Check

      1. Slide controller out of panel approximately 2/3 full out and connect voltmeter to color coded terminals on the right side of unit. Set hemisphere switch to the test (T) position. Set heading selector to 0 degrees and mode selector to "HDG".

      2. Turn aircraft to a northerly heading that gives a zero reading on the voltmeter and set brake to hold this position.

      3. Rotate heading selector to 30 degrees and adjust HDG pot on top left of circuit board until the appropriate zone voltage is attained. (Ref. Par. 5, Heading Gain Adjustment Mooney Nav-Coupler/Heading Lock Operation & Service Instructions 11968-1).

      4. Tune in an available omni source (simulator if no VOR can be received on the ground) and zero the OBS on a "TO" bearing and then turn OBS to five degrees from the zero bearing. Reset heading selector to the zero voltage position and then switch mode selector to "CAP". Turn the heading selector to 25 degrees or 335 degrees, whichever moves the voltmeter toward zero. Adjust "NAV" pot on circuit board to a zero voltage reading.

      5. Rezero both OBS and heading selector and set mode switch to "HDG". Rotate heading selector to both sides of zero and observe voltmeter and control wheel movement. Both should move in the direction the heading selector is turned, I.E., a 90 degree heading should cause meter and control wheels to deflect to the right and 270 degrees should cause them to deflect to the left.

      6. Return heading selector to zero voltage and turn mode selector to "CAP". Turn OBS to deflect needle to both sides of zero and again observe control wheels and voltmeter Again, they both should deflect in the direction of the omni needle. A reversal of this indicates a transposition of wires to omni coupler.

7. Return the mode selector to "HDG" and move aircraft to compass rose. Align aircraft on magnetic north and turn on all radio equipment and rotating beacon, if installed. Set DG and, with heading selector set on zero, rotate aircraft until voltmeter zeros and note deviation on DG. Set heading selector to 180 degrees and turn aircraft until voltmeter zeros and note deviation. Compute the total deviation and move aircraft to this heading. (If north has −5 deviation and south has +8 deviation, the total would be +3 degrees). Zero the voltmeter by turning the N-S pot on top right of circuit board near corner of transformer cut out. Turn this pot in small amounts and wait several seconds for voltage change as there is considerable delay in this circuit. Return to zero degree heading and repeat this procedure several times until an equal deviation is procured on both 0 and 180 degree headings. When this is accomplished return to magnetic north heading and zero voltmeter with heading selector. Loosen Allen type setscrew in heading selector knob and set indicator to 0 heading. Tighten setscrew.

8. Set heading selector to 90 degrees and turn aircraft to this heading on DG. Set voltmeter to zero with E-W pot on top right side of circuit board, forward on N-S pot. There is no delay in this circuit but there will be considerable voltage fluctuation due to aircraft movement. Set heading selector to 270 degrees and turn aircraft until voltmeter zeros. Note deviation and turn aircraft to one half of this and rezero voltmeter with E-W pot. Return to 90 degrees and repeat procedure until equal deviation exists on both headings. These should not exceed approximately 2 degrees and will normally be less.

9. Return to magnetic north and set the heading selector to 30 degrees. Note voltage and turn hemisphere switch to N and observe voltage. It should show a decrease. If voltage increases, this indicates wiring error in control head or heading selector dial installed 180 degrees off.

NOTE: A noticeable difference in voltage from 30 degrees either side of zero is an indication of a faulty magnetic sensor. Inability to compensate magnetic headings may be caused by faulty controller or magnetic sensor.

10. Remove voltmeter and reinstall controller in panel.

B. Flight Check

1. Climb to an altitude where a good omni signal can be received and the air is not turbulent. With the autopilot off, trim the aircraft to normal cruise configuration and adjust "PC" trim for wings level attitude.

2. Select one of the cardinal compass headings on the heading selector and switch autopilot to the "HDG" position. The aircraft should establish a one to one and one-half needle width turn. Roll out should begin not sooner than ten degrees or later than five degrees prior to the selected heading. Overshoot should not be greater than five degrees and the airplane should be locked on heading after no more than one oscillation.

3. Repeat this procedure on each of the other three cardinal headings in a manner that will allow a check of the turn rate and roll out from both the clockwise and counterclockwise directions. It will be noted that roll out will be much more accurate on the east and west headings and slightly less on south. It is normal for the aircraft to roll out too soon on the north heading and gradually work over to the heading. A continual overshoot with roll out not begun until after the selected heading has been passed is an indication of improper dip compensation, probably caused by a faulty magnetic sensor or by a sticking shunt valve. Usually a faulty controller will be detected during the preliminary ground adjustment.

4. Dial a heading on the heading selector that is approximately fifteen degrees off of the "TO" radial of the nearest omni station. When aircraft has established this heading, set omni bearing selector to the same heading and turn mode switch to "CAP". The aircraft should turn toward the omni needle and establish a new course between thirty and forty degrees from the selected course. If the intercept angle does not fall in this range, it is an indication of improper adjustment of "Nav Sense" and/or "HDG Sense".

5. When the aircraft is within five degrees of the selected omni radial, turn the mode switch to "TRK". The aircraft should then complete the intercept of the omni radial and keep the omni needle centered to the station. While flying the "TRK" mode, it should be noted that the heading being flown may not necessarily be that on the heading selector as the autopilot will compensate up to thirty degrees for wind drift in order to track the desired omni radial.

6. If the installation requires, the "LOC" mode should be checked by making a simulated ILS approach to an ILS runway to verify accuracy and stability of the flight path to the ILS runway. The "LOC" mode is to be used only with radio installations that do not interrupt the "LOC" signal when the transmitter is keyed. These include dual radio installations when transmitting on the radio not coupled to the autopilot or with radios such as the King KX-160 or Narco Mark 12A.

7. Altitude hold shall be checked by pulling on the "Pitch" valve and trimming the aircraft for level flight as shown by the "Pitch Trim" indicator. Pull on the "Altitude Hold" valve. An abrupt change in pitch up or down indicates a stoppage of one of the tubes associated with the altitude hold chamber or the altitude-pitch sensor.

8. Manually override the attitude hold to loose approximately one hundred feet of altitude. Release controls. Aircraft should climb back to original altitude, plus or minus not more than twenty feet. Manually climb one hundred feet above original altitude and release controls. Again the aircraft should return to the original altitude without building up excessive airspeed. With the heading selector, make some turns of at least ninety degrees in either direction and observe the altimeter during the turn. The aircraft should deviate not more than fifty feet from the original altitude at any time during the turn and should return to the original altitude upon completion of the turn. Failure to return to or hold an altitude indicates a leak in the altitude hold system or a faulty altitude-pitch sensor.