



U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Standardized Procedures for
Performing Aircraft Magnetic
Compass Calibration

Date: 8/7/17

AC No: 43-215

Initiated by: AFS-300

Change:

- 1 PURPOSE OF THIS AC.** This advisory circular (AC) describes procedures for calibrating an aircraft magnetic compass to minimize the effect of aircraft-induced magnetic fields. These procedures are often referred to as “swinging the compass” or a “compass swing.” This AC is not mandatory and does not constitute a regulation. These means are not the only means to perform aircraft compass calibration. However, if you use one of the means described in this AC, you must follow it in all important respects. The content of this AC may be of interest to aircraft technicians performing compass swings or to users of aircraft compass systems.
 - 2 AUDIENCE.** This AC applies to repair stations and maintenance personnel performing aircraft magnetic compass swings.

Note: Air carriers and commercial operators operating under Title 14 of the Code of Federal Regulations (14 CFR) part [121](#), part [129](#), § [129.14](#), and part [135](#), § [135.411\(a\)\(2\)](#) may apply the special provisions of 14 CFR part [43](#), § [43.13\(c\)](#). Repair stations certificated under 14 CFR part [145](#) may perform work for the operators identified above, in accordance with part 145, § [145.205](#) and the special provisions of § 43.13(c). Refer to AC [120-77](#), Maintenance and Alteration Data.
 - 3 WHERE YOU CAN FIND THIS AC.** A list of all ACs can be found at http://www.faa.gov/regulations_policies/advisory_circulars. You can also obtain current CFRs at <http://www.ecfr.gov/>.
 - 4 ROLES AND RESPONSIBILITIES.** Compass calibration, adjustment of compass compensators, and/or preparation of an aircraft compass correction table are aircraft maintenance procedures, as defined in 14 CFR part [1](#), § [1.1](#). Certificated airframe mechanics and certificated repair stations (CRS) with the appropriate ratings are authorized to perform a compass swing, which includes adjustment of compass compensators. Repairs or alterations to a compass may only be made by a CRS holding an appropriate instrument or limited instrument rating.
 - 5 BACKGROUND.** Compass calibration typically involves two steps. First, compass compensators are adjusted to minimize the influence of aircraft-induced fields that generate errors; and second, a correction card is prepared to indicate remaining error. The pilot offsets the compass reading using these corrections to obtain accurate (calibrated) compass direction. Since aircraft fields may vary, dependent on different aircraft configurations or equipment operation, compass correction tables may be prepared for
-

different configurations. Owners/operators should swing an aircraft (1) at periodic intervals as recommended by the manufacturer, (2) after a major component change, (3) after major servicing, or (4) if it is relocated to a significantly different latitude. While compass compensation and correction card preparation is accomplished using a standard procedure, alternative standards may be employed to establish alignment of the compass with the Earth's magnetic field. This AC identifies five different, acceptable procedures that may be employed and provides generic procedures for compensation of a standby compass and the preparation of a correction card.

6 REGULATORY BASIS AND REFERENCE DOCUMENTS.

Table 1. Regulatory Basis

Installation Requirements	Placard Requirements
14 CFR § 23.1327	14 CFR § 23.1547
14 CFR § 25.1327	14 CFR § 25.1547
14 CFR § 27.1327	14 CFR § 27.1547
14 CFR § 29.1327	14 CFR § 29.1547

6.1 Reference Documents. The Federal Aviation Administration (FAA) referenced the following current ACs and industry documents in writing this AC:

- AC [43.13-1](#), Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair.
- AC [120-77](#), Maintenance and Alteration Data.
- AC [150/5300-13](#), Airport Design.
- Barfield SC 063 Sight Compass User Instruction Manual, Document Number [56-1-1-01200](#), Revision E, November 7, 2014.
- Capital Avionics Inc. CA-320 Digital Compass Operators Manual, Part Number [150-0102-07](#), Revision 7, November 2016.
- Firstmark Aerospace Standby Compass Calibrator Overview at <http://www.firstmarkaerospace.com/literature.asp>.

7 COMPASS SWING METHODS. This AC describes five acceptable procedures that may be used when compensating a standby compass or preparing a correction card: A surveyed site (often referred to as a compass rose), a master site compass, a simulated rotation system, a portable magnetic standard, or an air swing. Before beginning any method, refer to the manufacturer's documents for complete instructions. If the aircraft

has an electrical system, two complete compass checks should be performed, one with minimum electrical equipment operating and the other with all electrical accessories on (e.g., radios, navigation, radar, and lights). If the compass readings are not identical, the mechanic should make up two separate compass correction cards—one with all the equipment on and one with the equipment off.

Note: The equipment listed after the methods below are just examples of equipment that use those methods.

- 7.1 Compass Rose Procedure.** A properly surveyed compass calibration pad, also called a compass rose, constructed to applicable FAA standards may be used to determine alignment of an aircraft compass with the Earth's magnetic field. Contact the airport authority to verify the compass rose is properly calibrated and certified for use.
- 7.1.1** Compass compensation and preparation of a compass card is performed by physically aligning the aircraft with the indices of the appropriate headings defined by the compass rose.
- 7.1.2** No test equipment setup or alignment is required when performing the compass rose procedure. See paragraphs [8](#), [9](#), and [10](#).
- 7.2 Master Site Compass Procedure.** A master site compass is a self-contained wet compass, which has been indexed to indicate 180 degrees from magnetic north. This allows the mechanic to stand facing the aircraft and align the calibrated reference compass with the aircraft to determine Magnetic Headings (MH). The master site compass must be properly calibrated and certified for use. One example of the equipment used in this method is the Barfield SC 063.
- 7.2.1** Compass compensation and preparation of a compass card is performed by physically aligning the aircraft at an approximate desired heading and then using the master site compass to determine the precise heading for calibration purposes.
- 7.2.2** No setup or alignment is required when performing the Master Site Compass Procedure. See paragraphs 8, 9, and 10.
- 7.3 Simulated Rotation Procedure.** The simulated rotation procedure makes use of a test apparatus that uses adjustable magnetic field strengths to neutralize the Earth's magnetic field at the test location and creates a simulated field for calibration purposes, allowing the aircraft to remain stationary. This apparatus is test equipment, which must be properly calibrated and certified for use at the calibration site. Site calibration is location-specific and can be used on any aircraft at that location without the need to recalibrate. One example of the equipment used in this method is the Firstmark Aerospace Standby Compass Calibrator.
- 7.3.1** Compass compensation and preparation of a compass card is performed by attaching the test apparatus to the standby compass after it has been referenced to magnetic north and adjusted to neutralize the Earth's existing magnetic field. A knob on the apparatus allows adjustment of the simulated heading field. While use of the simulated rotation system

does not require moving the aircraft, its initial alignment does require reference to magnetic north using a compass rose or master site compass.

Note: Preparation of the test apparatus is necessary to perform compass compensation and calibration card preparation.

7.3.1.1 A non-magnetic tripod and turntable are set up within approximately 10 feet of where the standby compass will be located when the aircraft is positioned along a referenced (surveyed) north line.

7.3.1.2 Normalize the Standby Compass Calibrator to the local magnetic field in accordance with the test equipment manufacturer's procedures.

7.3.1.3 Alignment and attachment of the Standby Compass Calibrator to the aircraft compass is accomplished by means of mounting screws.

7.4 Portable Magnetic Standard Procedure. A portable magnetic standard is a test apparatus that contains a highly accurate digital compass that employs magneto-resistive sensors to sense the Earth's magnetic field in three dimensions and a remote indication system that allows attaching the compass to the aircraft and reading aircraft headings at the standby compass position. An internal laser provides a means for accurate alignment of the digital compass sensor with the aircraft. This apparatus is test equipment which must be properly calibrated and certified for use. One example of the equipment used in this method is the Capital Avionics CA-320 Digital Compass Set.

7.4.1 Compass compensation and preparation of a compass card is performed by determining the actual MH of the aircraft using the laser sight, attaching the digital compass sensor to the aircraft, checking for magnetic disturbances that could distort accuracy, and use of the remote heading display to indicate aircraft heading accurately as the aircraft is rotated.

7.4.1.1 The reference digital compass sensor is placed in front of or behind the aircraft, and a magnetic disturbance test is performed in accordance with the manufacturer's procedures.

7.4.1.2 The sensor is aligned with the aircraft heading using its internal laser reference. This heading is set into the reference compass when mounted to the aircraft.

7.4.1.3 The sensor is attached to the aircraft using available brackets or mounts, and a second magnetic disturbance test is performed to ensure accurate operation.

7.4.2 The technician may now read accurate aircraft heading on the remotely located test set indicator. Compass compensation and calibration card preparation is accomplished by rotating the aircraft and referencing the test standard readings. See paragraphs [9](#) and [10](#).

7.5 Air Swing Procedure. Air swings may be accomplished on the aircraft magnetic compass by comparing readings against those obtained from an electrically calibrated and compensated system or against readings obtained from an inertial navigation system

(INS), Attitude and Heading Reference System (AHRS), or a Global Positioning System (GPS) as long as the variation of the system being used as a reference is known within 0.2 degrees. Ensure the heading being used as the reference is being displayed as, or is converted to, MH.

- 7.5.1** An air swing involves flying the aircraft (in smooth air) on eight headings: north, northeast, east, southeast, south, southwest, west, and northwest as established from the INS and checking the aircraft compass heading against these headings.
- 7.5.2** The compass calibration procedures and correction card completion would then be completed as shown in paragraphs 9 and [10](#). Airborne calibration of aircraft compasses should be conducted in accordance with the aircraft manufacturer's approved procedures or other procedures acceptable to the FAA.

Note 1: Air swings should only be conducted in day/visual flight rules (VFR) conditions.

Note 2: As stated in paragraph [11.1](#), a compass calibration is a maintenance action and requires an entry in the maintenance records for the aircraft. An air swing should only be accomplished on aircraft where a certificated airframe mechanic can be taken on the flight to perform the calibration/adjustments.

Note 3: The magnetic direction indicator (compass) is a required instrument under 14 CFR part [91](#) for VFR/instrument flight rules (IFR) operations; therefore, the operator is not allowed to take off with that instrument in an inoperable condition.

- 8 SITE PREPARATION.** Unless otherwise directed by the manufacturer, before calibrating an aircraft compass, evaluate the calibration site and immediate area. The site should be as far as possible from any magnetic disturbance. In the absence of manufacturer recommendations, it is acceptable to use a compass calibration pad as described in Appendix 6 of AC 150/5300-13.

9 COMPASS COMPENSATION.

- 9.1 Adjustment of Compensators.** Below is a brief description of the basic procedure to align the aircraft with cardinal compass headings and the compass adjustments at those headings:

1. Align the aircraft so it is pointing toward magnetic north.
2. Adjust the compass N-S compensating magnet so that the compass reads north.
3. Turn the aircraft so it is pointing toward magnetic east or 090 degrees.
4. Adjust the compass E-W compensating magnet so that the compass reads east.
5. Turn the aircraft so it is pointing toward magnetic south or 180 degrees.

6. Adjust the compass N-S compensating magnet to remove one half of the south error.
7. Turn the aircraft so it is pointing toward magnetic west or 270 degrees.
8. Adjust the compass compensating E-W magnet to remove one half of the west error.

Note: Make corrections using a non-magnetic screwdriver. Lightly tap the compass after each adjustment, and allow time to settle before taking the readings.

10 CORRECTION CARD PREPARATION.

10.1 Preparing the Correction Card. After completing compensating magnet adjustment on the four cardinal headings, test personnel fill out a compass correction card to compensate for any remaining compass error. Typically, a compass swing is performed with aircraft engine(s) running, radios on, and the aircraft at normal flying attitude (tail wheel aircraft may need to have their tail elevated). An additional swing with radios off may be performed and an alternate correction card prepared for that configuration.

10.2 Preparing a Worksheet (Optional). First, make a copy of the blank worksheet similar to the one shown in Table 2, Compass Correction Worksheet (Optional). Populate the table with the data recorded and calculated by accomplishing the steps that follow:

1. Starting on any convenient 30-degree heading, align the aircraft so that the reference compass system reads within 5 degrees of the desired heading.

Note: The 30-degree increments may be determined by aligning an aircraft gyro with north, as indicated by the compensated standby compass, and then using the gyro to indicate the increments.

2. Record the aircraft compass reading in column 2 and the reference compass system reading in column 3 adjacent to the appropriate heading in column 1.
3. Repeat steps 1 and 2 for each subsequent 30-degree heading. These directions are 270, 300, 330, 000, 030, 060, 090, 120, 150, 180, 210, and 240 degrees.
4. Record the difference between the readings of the aircraft and reference compass system readings in column 4.

Note: If the aircraft compass reads higher than the sight compass, the error is positive (+). If the aircraft compass is less than the reference compass system, the error is negative (-).

5. Add or subtract the compass errors in column 4 to or from the desired headings in column 1. Enter the results in column 5. See Table 3, Example of a Completed Compass Correction Worksheet (Optional), as a guide while making these calculations.

6. There should not be more than a plus or minus 10-degree difference between any of the aircraft compass readings and the sight compass readings. If the aircraft compass cannot be adjusted to meet the requirements, replace the compass and repeat compensation as in paragraph 9.
7. Enter the values from column 5 in the “STEER” portion of the aircraft compass correction card. There are many different types of correction cards in use. The correction card shown in Table 4, Sample Compass Correction Card, is just one example.

Table 2. Compass Correction Worksheet (Optional)

(Column 1) DESIRED HEADING	(Column 2) AIRCRAFT COMPASS READING	(Column 3) REFERENCE COMPASS SYSTEM	(Column 4) AIRCRAFT COMPASS ERROR	(Column 5) AIRCRAFT COMPASS CORRECTED
N				
030				
060				
E				
120				
150				
S				
210				
240				
W				
300				
330				

Table 3. Example of a Completed Compass Correction Worksheet (Optional)

(Column 1) DESIRED HEADING	(Column 2) AIRCRAFT COMPASS READING	(Column 3) REFERENCE COMPASS SYSTEM	(Column 4) AIRCRAFT COMPASS ERROR	(Column 5) AIRCRAFT COMPASS CORRECTED
N	356	359	-3	357
30	032	034	-2	028
60	062	063	-1	059
E	088	086	+2	092
120	125	121	+4	124
150	150	148	+2	152
S	177	175	+2	182
210	213	213	0	210
240	245	246	-1	239
W	268	270	-2	268
300	300	297	+3	303
330	333	335	-2	328

Table 4. Sample Compass Correction Card

FOR HEADING	000	030	060	090	120	150
STEER Radio On	357	028	059	092	124	152
Radio Off	357	028	059	092	124	152
FOR HEADING	180	210	240	270	300	330
STEER Radio On	182	210	239	268	303	328
Radio Off	182	210	239	268	303	328

Note: The figures used in the “STEER” sections were numbers taken from Table 3.

Table 5. Blank Compass Correction Card Example

FOR HEADING	000	030	060	090	120	150
STEER Radio On Radio Off						
FOR HEADING	180	210	240	270	300	330
STEER Radio On Radio Off						

Table 6. Placard Requirements

Each calibration reading must be in terms of magnetic headings in not more than 30° increments OR not more than 45° increments.	Must show the calibration of the instrument in level flight with the engines operating.	Must state whether the calibration was made with radio receivers on.	Must state whether the calibration was made with radio receivers off.	If a magnetic nonstabilized direction indicator can have a deviation of more than 10 degrees caused by the operation of electrical equipment.	Must State which electrical loads, or combination of loads, would cause a deviation of more than 10 degrees when turned on.
23.1547(d) - < 30° Increments	23.1547(b)	23.1547(c)	23.1547(c)	23.1547(e)	23.1547(e)
25.1547(d) – < 45° Increments	25.1547(b)	25.1547(c)	25.1547(c)	NA	NA
27.1547(d) – < 45° Increments	27.1547(b)	27.1547(c)	27.1547(c)	27.1547(e)	27.1547(e)
29.1547(d) – < 45° Increments	29.1547(b)	29.1547(c)	29.1547(c)	NA	NA

Note: A placard meeting the preceding requirements must be installed on or near the magnetic direction indicator.

11 DOCUMENTATION. A placard (correction card) must be installed on, or near, the magnetic direction indicator. There are several different versions of correction cards available. Table [5](#), Blank Compass Correction Card Example, contains a blank compass correction card that can be printed out, filled in, and sized to fit the card holder in the aircraft. See Table [6](#), Placard Requirements, to determine the specific placard requirements for your aircraft.

11.1 Logbook Entry. A compass calibration is a maintenance action and requires an entry in the maintenance records for the aircraft.

12 AC FEEDBACK FORM. For your convenience, the AC Feedback Form is the last page of this AC. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this AC on the Feedback Form.



John Barbagallo
Deputy Director, Flight Standards Service

Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Flight Standards Directives Management Officer at 9-AWA-AFS-140-Directives@faa.gov.

Subject: AC 43-215, Standardized Procedures for Performing Aircraft Magnetic Compass Calibration

Date: _____

Please check all appropriate line items:

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:

In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

Other comments:

I would like to discuss the above. Please contact me.

Submitted by: _____

Date: _____