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AERONAUTICAL RECOMMENDED PRACTICE

ARP 426

COMPASS SYSTEM INSTALLATIONS

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1. PURPOSE: This Aeronautical Recommended Practice is intended to outline the minimum requirements for Compass System installation design, performance and test recommendations for use as a guide by the aircraft industry.

2. SCOPE: These recommendations cover the mechanical and electrical installation and installation test procedures for Compass Systems of the type normally used in transport type aircraft. The recommendations in the ARP do not supersede any airworthiness requirements in Civil Air Regulations.

3. GENERAL REQUIREMENTS:

3.1 Equipment: The Compass Systems referred to herein should conform to Aeronautical Standard AS 398A: Direction Instrument, Magnetic, Non-Stabilized Type (Magnetic Compass) and AS 399A: Direction Instrument, Magnetic (Stabilized Type).

3.2 Materials: Materials should be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft.

3.3 Workmanship: Workmanship should be in accordance with high grade aircraft manufacturing practice.

3.4 Environmental Conditions: The design of the installation should be such that satisfactory performance may be obtained under all environmental conditions to which the aircraft may be subjected. Care should be taken that the unit is not placed in a location where it will be subjected to excessive collections of moisture or other foreign matter.

Care should be taken to avoid installing units in areas where the airframe's vibration characteristics would adversely affect the compass system unless, however, the units' mounting support is designed to dampen or isolate the affect so as to be acceptable in accordance with the equipment manufacturers' recommendations.

3.5 Installation Survey and Component Selection: The aircraft manufacturer should, to the best of his ability with respect to the aircraft design status relative to existing magnetic disturbances within the aircraft, select and combine the necessary components into a comprehensive system which can be expected to perform the desired necessary functions in accordance with AS 398A or AS 399A, as applicable. Final calibration should be checked and determined on the basis of flight tests of the initial installation.

4. DETAIL REQUIREMENTS:

4.1 Mechanical:

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4.1.1 Location and Mounting: Transmitter locations should be chosen to preclude, insofar as possible, all magnetic fields other than the earth's. A location should be chosen where the transmitter will be least affected by magnetic disturbances created in the aircraft itself. The purpose of making the compass system remote indicating is to permit the installation of the sensitive element in a position where, under all possible conditions of operation of the aircraft, the magnetic field will be as nearly as possible that of the undisturbed earth's magnetic field surrounding the craft.

In selecting a position for the transmitter, the vicinity of ferrous materials should be avoided. Locations near movable ferrous items, such as control rods, steel turnbuckles, landing gear, or other movable components should be avoided. Locations near baggage compartments, tool chests and storage space are undesirable, as are those near any structure that may change its magnetic characteristics with prolonged service. There should be no electrical wiring in the immediate vicinity of the transmitter, particularly conductors carrying direct current. If the aircraft uses a ground return system, the structure should be examined to make certain that no great amount of return current is carried in any structural section near the transmitter.

The various ferrous bodies in the aircraft should be distributed in a balanced formation with regard to the transmitter, insofar as practicable, particularly if it is not possible to isolate the unit from these bodies. If deviations cannot be eliminated by optimum transmitter location, they should be limited to 4° in any direction prior to compensation.

Direct reading and remote-indicating transmitters should be installed in their normal level position, ±1°, when the aircraft is in normal flight attitude. The fore and aft line of the sensing elements should coincide with longitudinal axis of the aircraft, ±1°. Use of shock mounts is highly undesirable and should be avoided whenever possible; however, shock mounts may be used if absolutely necessary, provided proper precaution is taken to avoid tilt in azimuth of the transmitter.
The use of compensators should be avoided if possible by the selected location of the transmitter. The indicators should be located on the instrument panels in such a manner that the index and dial markings are within 30° of the normal line of sight of the pilot, co-pilot or navigator, perpendicular to the instrument panel. The signal amplifier should be located in an aircraft equipment rack suitably shock mounted if required.

4.1.2 General:

4.1.2.1 Mounting Brackets: All mounting brackets should be designed to provide adequate strength, freedom from vibration and flexing that would interfere with the satisfactory operation of the Compass System under any flight conditions encountered in service. The material of the platform, support members, mounting screws, mounting locknuts, etc., shall be non-magnetic. ("Stainless steels" of a magnetic nature should be avoided in this installation.)

4.1.2.2 Ventilation: All components should be installed in accordance with the temperature requirements of the instrument. If it is impossible to locate the equipment in an aircraft location which has a temperature similar to that required, then provisions for direct conditioned air to this equipment must be made.

4.1.2.3 Safety: All attached fittings and fasteners such as bolts, nuts, clevis pins, etc., if not of the self locking type should be locked with safety wire or cotter pins.

4.1.2.4 Bonding: The chassis of mounting frames of all components should be electrically bonded to the aircraft structure. All mating surfaces which conduct a ground return should be clear of paint, anodized coating or other non-conducting materials.

4.2 Electrical:

4.2.1 Power Supplies: The design of the electrical installation and the selection of the power supply components should conform to the best aeronautical practice. Intermittent loads, other than Compass System, should be carefully considered with regard to the compass system performance.

4.2.1.1 A.C. and D.C.: Voltages and frequencies supplied to the Compass System should be in accordance with its established design ratings.

4.2.2 Wiring: Connections should be made in accordance with the wiring diagrams supplied by the compass manufacturer. Power leads and circuit protective devices should be installed in accordance with standard practices or as specified by the compass manufacturer. Electrical cabling and wiring should be adequate to meet such requirements as maximum allowable voltage drop, lead resistance, and current as specified for the compass installation. References 1 and 2 may be used as a guide for aircraft wiring.

4.2.3 Shielding and Grounding: Strict conformance to the shielding specifications supplied by the compass manufacturer is recommended in all installations to eliminate any possibility of spurious signals. Where shielding is grounded at specified locations, the signal leads should be enclosed in sleeving to insulate the shielding from other circuits and ground contacts with the aircraft structure.

4.2.4 Switches, Signal Devices, and Interlocks: These items should be installed and electrically interconnected into the system, in accordance with the instructions of the compass manufacturer, to insure that adequate protection of the aircraft and the compass system is maintained.

4.2.5 Cockpit Control: The compass deslaving switch, if provided, should be located near the indicator.

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4.3 Maintenance:

4.3.1 Accessibility: Ready access should be provided for service points such as lubrication, adjustment, dehydrators, and other items requiring attention while the compass is installed in the airplane. Units requiring frequent replacement should be located to provide for ease of removal. The installation of such units behind stress panels and other units, which require prior removal for access, should be avoided wherever possible. Where units are located behind non stressed panels, the use of quick-fasteners is recommended for attaching the panel.

4.3.2 Clearances: Adequate clearance should be provided for:

(1) Installation of components in the aircraft, through openings and around other items.

(2) Normal movement of the unit during flexing of shock mounts.

(3) Installation and removal of electrical or mechanical connections.

(4) The use of tools required for removing and installing attachments.

(5) Removing the components completely from the aircraft, through openings and around other items.

4.3.3 Replaceability: Location of mounting nuts, bolt holes, and other such fasteners that are required should be governed by the tolerances of the matching unit being installed. The alteration of a component to match the aircraft fittings should be avoided in the interests of interchangeability. Where shims are required to align the unit they should be attached to and become a permanent part of the aircraft.

Use of the following devices is recommended wherever possible to facilitate replaceability.

(1) Vibration-proof nuts.

(2) Nut plate attached to mounting brackets.

(3) Mounting subplates equipped with quick-fasteners.

(4) Electrical disconnect plugs in lieu of terminal strips: however, disconnect plugs should be kept to a minimum for the low current carrying circuits of the compass system.

4.3.3.1 Hardware: The use of standard aircraft hardware is recommended wherever possible. All hardware used to install the transmitter must be non-magnetic.

4.3.4 Interchangeability: All components of a like type and function should be interchangeable with no further field modifications or internal adjustments at the time the unit is installed.

Where external adjustments are required to permit components to be used in different type aircraft or different portions of the system, it is recommended that instructions for making the adjustment be placed on the unit wherever possible. Where two units appear identical but produce different operating characteristics which, if misplaced, would tend to cause malfunctioning, means should be provided, such as dowel locating pins, or other such devices to physically prevent the components from being improperly installed. Where two or more components, having different functions but possessing identical connectors, are adjacent, means should be provided to physically prevent crossed connections. Each connector cable should be clamped close enough to the proper unit to prevent it from being cross connected to the wrong unit.

The use of placards, color coding, and other marking can be used but should not be relied upon for complete protection.

5. TESTS: The manufacturer's recommendations regarding any special test equipment required, and specific tests to be performed, should be utilized in conjunction with the following:

5.1 Mechanical Installation:

5.1.1 Mounting: All component mounting bases and brackets should be inspected for security of attachment to the basic structure and the components themselves for security of attachment to their respective mounting bases.

5.1.2 Electrical Installation:

5.1.2.1 Dielectric Test: As required to ascertain satisfactory system operation when dielectric failure is suspected.

5.1.2.2 Continuity: As required to ascertain satisfactory circuitry when discontinuity is suspected. (Note: To avoid electrical failures due to damaged connectors after continuity checks have been made use an ohmmeter with a receptacle pin or socket soldered on each prod.)

NOTE: Never use an ohmmeter to check the transmitter. DC voltage will magnetize and destroy the calibration.

5.1.2.3 Visual Inspection: All soldered connections, junctions and receptacles should be inspected for soundness or mechanical and electrical connections. Cables should be inspected for fraying, pinching, or damage to shielding or insulation.