Society of Automotive Engineers, Inc.
29 West 39th Street
New York City

AERONAUTICAL STANDARD AS 396

BANK AND PITCH INDICATOR (STABILIZED TYPE)
(Gyro Horizon, Attitude Gyro)

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Revised

1. PURPOSE: To specify minimum requirements for gyroscopically stabilized Bank and Pitch indicators for use in aircraft, the operation of which may subject the instrument to the environmental conditions specified in Section 3.4.

2. SCOPE: This specification covers two basic types as follows:

Type I - Having limited freedom of operation.

Type II - Having unlimited freedom of operation.

3. GENERAL REQUIREMENTS:

3.1 Material and Workmanship

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

3.1.2 Workmanship: Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2 Radio Interference: The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3 Identification: The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument
(b) S.A.E. Spec AS 396
(c) Rating (Electrical, Vacuum, etc.)
(d) Manufacturer's Part Number.
(e) Manufacturer's serial number or date of manufacture.
(f) Manufacturer's Name and/or Trade Mark.

3.4 Environmental Conditions: The following conditions have been established as design criteria only. Tests shall be conducted as specified in Sections 5, 6 and 7.

3.4.1 Temperature: When installed in accordance with the instrument manufacturer's instructions the unit shall function over the range of ambient temperatures shown in Column A below and shall not be adversely affected by exposure to the temperatures shown in Column B below:

Instrument Location	A	B
Heated Areas (Temperature Controlled)	-30 to 50C	-65 to 70C
Unheated Areas (Temperature Uncontrolled)	-55 to 70C	-65 to 70C

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3.4.2 Humidity: The instrument shall function and not be adversely affected when exposed to a relative humidity up to and including 90 percent at a temperature of approximately +32C.

3.4.3 Altitude: The instrument shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to -1000 to +40,0000 feet standard altitude, except as limited by application of Section 3.4.1.

3.4.4 Vibration: When installed in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subject to the following vibrations:

Type of Instrument Mounting	Cycles Per Minute*	Amplitude*	Maximum Acceleration
Shock Mounted Panel Instruments	500 - 3000	0.005 in.	0.8 g
Unshock Mounted Panel Instruments	500 - 3000	0.010 in.	1.3 g
Structure Mounted Instruments	500 - 3000	0.030 in.	3.8 g

*NOTE: It is understood that the unit shall withstand vibration at higher frequencies, but the acceleration values need not exceed those shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150 - 3000 cycles per minute.

4. DETAIL REQUIREMENTS:

4.1 Indicating Method: One of the following methods of indication shall be employed:

Method I - Horizontal bar which moves with respect to a fixed pitch reference marker. At the top of the dial, a pointer which moves angularly with respect to the bezel mask. Horizontal bar appears to move toward top of instrument face for dive and appears to rotate clockwise for left bank. Banking pointer appears to rotate clockwise for left bank.

Method II - Spherical dial which moves with respect to a fixed reference marker. The spherical dial appears to move down for dive and appears to rotate clockwise for left bank.

4.2 Operating Range:

Type I - The useful operating range and the indicating range of the instrument shall be at least plus or minus 60 degrees in pitch and at least plus or minus 90 degrees in roll.

Type II - The useful operating range of the instrument shall be through 360 degrees in pitch and 360 degrees in roll. The range of indication in pitch for Method I indication shall be at least plus or minus 25 degrees and for Method II it shall be 360 degrees.

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4.3 Dial Markings:

4.3.1 Increments:

Type I - Right and left bank graduations shall be provided at intervals not to exceed 30 degrees between 0 and 90 degrees.

Type II - Bank graduations shall be as specified for Type I above. In addition, the sphere shall be graduated at intervals not to exceed 30 degrees from 0 to 90 degrees above and below the horizontal centerline.

4.3.2 Visibility: Index and dial markings shall be visible from any point within the frustum of a cone the side of which makes an angle of 30 degrees with the perpendicular to the dial and small diameter of which is the aperature of the instrument case.

4.3.3 Finish: Unless otherwise specified, luminescent material (self-activating) shall be applied to major graduations and numerals.

4.4 Power Variation: All units shall properly function with ± 15% variation in D.C. voltage and/or 10% variation in A.C. voltage and frequency, provided the A.C. voltage and frequency vary in the same direction.

4.5 Turn Error: The pitch or bank indication error resulting from a coordinated turn of 180 degrees in 1 minute at a true airspeed of 180 MPM shall not exceed 5 degrees.

4.6 Gyro Caging Provisions: Unless the gyro assembly has unrestricted freedom of operation in the pitch and roll axes, means shall be provided for caging and/or releveling the gyro. Means shall be provided to indicate when the gyro is caged, except when it is not possible to leave the gyro in caged condition.

4.7 Power Indication: Means shall be provided to permit the operation of a device to indicate whether the instrument is receiving power.

5. TEST CONDITIONS:

5.1 Atmospheric Conditions: Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.

5.2 Vibration (to minimize friction): Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1500 to 2000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3 Power Conditions: Unless otherwise specified, all tests for performance shall be conducted at the power rating recommended by the manufacturer.

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5.4 Position: Unless otherwise specified, all tests shall be made with the instrument in normal level position.

5.5 Vibration Stand: For vibration tests a stand shall be used which will vibrate at any desired frequency between 500 and 3000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. INDIVIDUAL PERFORMANCE REQUIREMENTS: All instruments, or components of such, shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification, including the following requirements where applicable:

6.1 Starting: The gyro rotor shall start to rotate and continue to run on application of 50 percent of rated suction for air operated instruments and 80 percent of rated voltage for electrically operated instruments. Rated instrument performance speed shall be reached within 3 minutes after normal rated power is applied.

6.2 Roll, Pitch and Yaw: When the gyro has erected and attained equilibrium speed, and the instrument has been oscillated through an angle of ± 7½ degrees about each axis at a frequency of 5 to 7 cycles per minute for 10 minutes and then returned to level position, the alignment of the bank pointer (or vertical centerline of sphere) with their respective zero reference markers shall be within one degree.

6.3 Climbing and Diving: With the instrument level, the gyro running at equilibrium speed and the gyro offset to the 20 degree climb indication, the time required for the gyro to erect to the 10 degree climb indication shall not exceed 8 minutes.

The time required to erect from the 10 degree climb indication to the zero pitch indication shall not exceed 12 minutes.

6.4 Banking: With the instrument level, the gyro running at equilibrium speed and the gyro offset to the 20 degree right bank indication, the time required for the gyro to erect to the 10 degree right bank indication shall not exceed 8 minutes.

The time required to erect from the 10 degree right bank indication to the zero bank indication (within 1 degree) shall not exceed 12 minutes.

The same tolerances shall apply when the gyro is offset to the 20 degree left bank indication and allowed to erect to the zero bank indication.

6.5 Dielectric Test: The instrument shall be subject to a dielectric test with a R.M.S. voltage equivalent to five times operating voltage, but at a commercial frequency, applied between each ungrounded terminal and the instrument case for a period of 5 seconds. The breakdown resistance shall not be less than 20 megohms at that voltage (A.C. or D.C. as applicable).

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