

RATE OF CLIMB INDICATOR, PRESSURE ACTUATED (VERTICAL SPEED INDICATOR)

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1. **PURPOSE:** To specify minimum requirements for pressure, actuated Climb Indicators for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in paragraph 3.3.

2. **SCOPE:** This Aeronautical Standard covers four (4) basic types of direct indicating instruments as follows:

TYPE I - Range 0-2000 feet per minute climb and descent

TYPE II - Range 0-3000 feet per minute climb and descent

TYPE III - Range 0-4000 feet per minute climb and descent

TYPE IV - Range 0-6000 feet per minute climb and descent

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

- a. Name of instrument (Climb Indicator)
- b. Aeronautical Standard AS-394A
- c. Manufacturer's part number
- d. Manufacturer's serial number or date of manufacture
- e. Manufacturer's name and/or trademark
- f. Range

3.3 **Environmental Conditions:** The following conditions have been established as design requirements only. Tests shall be conducted as specified in Section 5, 6 and 7.

3.3.1 **Temperature:** When installed in accordance with instrument manufacturer's instructions, the instrument shall function over the range of ambient temperature of -30C and 50C and shall not be adversely affected by exposure to temperatures of -65C to 70C.

3.3.2 **Humidity:** The instrument shall function and shall not be adversely affected when exposed to any relative humidity in the range from 0 to 95% at a temperature of approximately 32C.

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- 3.3.3 **Vibration:** When installed in accordance with the instrument manufacturer's instructions, the instruments shall function and shall not be adversely affected when subjected to vibration of the following characteristics:

<u>Instrument Location in Airframe</u>	<u>Cycles Per Sec.</u>	<u>Max. Double Amplitude (In.)</u>	<u>Maximum Acceleration</u>
Instrument Panel or Vibration Isolated Mount	5-50	0.020	1.5g

- 3.3.4 **Altitude:** The instrument shall function and shall not be adversely affected when subjected to a pressure and temperature range equivalent to -1,000 to 40,000 feet standard altitude, per NACA Report Number 1235, except as limited by the application of paragraph 3.3.1. The instrument shall withstand an external case pressure of 50 inches Hg absolute when installed properly and vented to atmospheric pressure.

- 3.4 **Magnetic Effect:** The magnetic effect of the indicator shall not adversely affect the operation of other instruments installed in the same aircraft.

4. DETAIL REQUIREMENTS:

- 4.1 **Indicating Method:** Ascent shall be indicated by a clockwise rotation of the pointer from the zero at the 9 o'clock position. Descent shall be indicated by a counterclockwise rotation. Stops shall be incorporated to limit the pointer movement to not more than 178 degrees in each direction from zero.

4.2 Dial Markings:

- 4.2.1 **Finish:** Unless otherwise specified by the user, matte white material shall be applied to major graduations, numerals and pointers. Non-functional surfaces shall be a durable dull black.

- 4.2.2 **Graduations:** Markings may be provided as follows:

TYPES I AND II - Markings at 100 FPM intervals with major graduations at 500 FPM intervals.

TYPES III AND IV - Markings at 100 FPM intervals up to 2,000 FPM with major graduations at 500 FPM intervals.

- 4.2.3 **Numerals:** Sufficient numerals shall be marked to positively and quickly identify all graduations. Numerals shall distinctly indicate the graduations to which each applies.

- 4.2.4 **Instrument Names:** Instrument name or function it measures may be legibly indicated in the same finish as applied to the major graduations and numerals.



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- 4.2.5 Visibility: Pointer and dial markings shall be visible from any point within the frustum of a cone, the side of which makes an angle of not less than 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum and shall not exceed 0.250 of an inch.
- 4.3 Zero Setting System: If means for manually setting the pointer at zero is provided, it shall not be accessible in flight.
5. TEST CONDITIONS:
- 5.1 Atmospheric Conditions: Unless otherwise specified, all tests required by this Aeronautical Standard shall be conducted at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 25C. When tests are conducted with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified condition.
- 5.2 Vibration (to minimize friction): Unless otherwise specified, all tests for performance may be conducted with the instrument subjected to a vibration of 0.002 to 0.005 inch double amplitude at a frequency of 1500 to 2000 cycles per minute. The term double as used herein indicates the total displacement from positive maximum to negative maximum.
- 5.3 Vibration Equipment: Vibration equipment shall be used which will provide frequencies and amplitudes consistent with the requirements of paragraph 3.3.3 with the following characteristics.
- 5.3.1 Circular Motion Vibration: Vibration equipment shall be 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 double amplitude specified.
- 5.4 Position: Unless otherwise specified, all tests shall be made with the instrument mounted in its normal operating position.
6. INDIVIDUAL PERFORMANCE REQUIREMENTS: All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this aeronautical standard including the following requirements where applicable.
- 6.1 Zero Setting Range: The range of movement of the pointer by means of the zero adjustment shall not be less than 400 feet per minute for the "Up" and "Down" position.
- 6.2 Scale Error: When subjected to the rates of change of pressure indicated in Table I for the altitude intervals shown, the errors shall not exceed the tolerances specified.



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