

TURN AND SLIP INDICATOR
(TURBINE POWERED, SUBSONIC, AIRCRAFT)

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Revised

1. PURPOSE: This Aerospace Standard establishes the essential minimum safe performance standards for turn and slip indicators primarily for use with turbine powered subsonic transport aircraft, the operation of which may subject the instruments to the environmental conditions specified in Section 3.3.
2. SCOPE: This Aerospace Standard covers three basic types of turn and slip indicators as follows:

Type I: Air Driven
Type II: D. C. Operated
Type III: A. C. Operated

3. GENERAL REQUIREMENTS:

3.1 Materials 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.
- (b) SAE AS 438
- (c) Manufacturer's part number.
- (d) Manufacturer's serial number or date of manufacture.
- (e) Manufacturer's name and/or trademark.
- (f) Range (if applicable).
- (g) Rating (electrical, vacuum, etc.)

3.2.1 Mounting Angle Restrictions: The body of the case shall be permanently and legibly marked in letters of a contrasting color approximately 1/4" high with the following information:

"FOR VERTICAL PANEL ONLY" or

"FOR (*) DEGREE INCLINED PANEL ONLY"

*Insert the nominal design value, i.e.,
20°, etc.

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- 3.2.2 Calibration Bank Angle: The body of the case shall be permanently and legibly marked in letters of a contrasting color approximately 1/4" high with the following information:

"CALIBRATED AT 20° BANK ANGLE"

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

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

<u>Instrument Location</u>	<u>A</u>	<u>B</u>
Pressurized areas	-30 to 50 C	-65 to 70 C

- 3.3.2 Altitude: When installed in accordance with the instrument manufacturer's instructions, the instruments shall function from sea level up to the altitudes and temperatures listed below: Altitude pressure values are per NACA Report 1235: The instrument shall not be adversely affected following exposure to extremes in ambient pressure of 50 and 3 inches of mercury absolute respectively.

<u>Instrument Location</u>	<u>Altitude</u>	<u>Temperature</u>
Pressurized Areas	15,000 ft.	50 C

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

<u>Instrument Location</u>	<u>Frequency Cycles Per Sec.</u>	<u>Max. Double Amplitude - Inches</u>	<u>Maximum Accel.</u>
Instrument Panel	5-30 30-1000	0.020	0.25 g

- 3.3.4 Humidity: The instrument shall function and shall not be adversely affected following exposure to any relative humidity in the range from 0 to 95% at a temperature of approximately 70 C.

- 3.4 Fire Hazard: The instrument shall be so designed to safeguard against hazards to the aircraft in the event of malfunction or failure, and the maximum operating temperature of surfaces of any instrument component contacted by combustible fuel or vapor shall not exceed 200 C due to self-heating.

- 3.5 Radio Interference: The instruments shall not be the source of objectional interference, under operating conditions at any frequencies used on aircraft, either by radiation or feedback, in electronic equipment installed in the same aircraft as the instrument.

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- 3.6 Magnetic Effect: The magnetic effect of the instruments shall not adversely affect the performance of other instruments installed in the same aircraft.

4. DETAIL REQUIREMENTS:

4.1 Display Markings:

- 4.1.1 Finish: Unless otherwise specified by the user, matte white material shall be applied to all graduations, numerals and indication means.

Non-functional surfaces and markings shall be durable dull black.

- 4.1.2 Indicating Means: Turns shall be indicated by means of a pointer, deflecting in direction of turn. Slips shall be indicated by means of a ball, free to move in a curved transparent tube.

- 4.1.3 Instrument Title: The words "Turn" and "Slip" may be indicated on the dial in the same finish as the graduations.

- 4.1.4 Visibility: The indicating means and all markings shall be visible from any point within the frustum of a cone the side of which makes an angle of at least 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.

- 4.2 Power Variation: The instrument shall properly function with plus or minus 15 percent variation in D.C. voltage and/or plus or minus 10 percent variation in A. C. voltage and plus or minus 5 percent variation in frequency, or pressure limits of plus or minus 30 percent of rated value.

- 4.3 Power Malfunction Indication: Means shall be incorporated in the instrument to indicate when adequate power (voltage and/or current) is not being made available to all phases required for the proper operation of the instrument. The indicating means shall indicate a failure or a malfunction in a positive manner. This requirement shall also apply to Type I instruments with respect to adequate pressure required for proper operation.

- 4.4 Hermetic Sealing: When hermetically sealed, the case shall be filled with an inert gas, free of dust particles, and sufficiently dry so that fogging of the indicator glass does not occur during the low temperature tests of this Aerospace Standard.

5. TEST CONDITIONS:

- 5.1 Atmospheric Conditions: Unless otherwise specified, all tests required by this Aerospace Standard shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 25C, and at a relative humidity of not greater than 85%. When tests are conducted with the atmospheric pressure or temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.