Society of Automotive Engineers, Inc.
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AERONAUTICAL STANDARD AS 408

PRESSURE INSTRUMENTS - FUEL, OIL, AND HYDRAULIC

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Revised

1. PURPOSE: To specify minimum requirements for Pressure Instruments for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in Section 3.3.

2. SCOPE: This specification covers instruments intended for use in airplanes to indicate the fuel, oil or hydraulic pressures.

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 (Fuel, Oil or Hydraulic Pressure)
(b) SAE Specification, AS-408
(c) Range
(d) Rating (Nominal electric or vacuum etc.)
(e) Manufacturer's Part Number
(f) Manufacturer's Serial Number or date of manufacture.
(g) Manufacturer's name or trademark

3.3 Environmental Conditions: The following are established as design requirements only. All tests shall be run as per 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 indicated in Column A below, and shall not be adversely affected by exposure to the temperatures shown in Column B below.

Component Location	"A"	"B"
Power Plant Compartments	-30 to 100C	-65 to 100C
Other Areas	-30 to 70C	-65 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.

3.3.3 Altitude: The instrument shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to -1000 feet to 40,000 feet standard altitude except that the instrument temperature shall not be lower than -30C.

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3.3.4 Vibration: When mounted in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subjected to the following vibrations at a frequency of 500 to 3000 cycles per minute. When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150 to 3000 cycles per minute.

Type of Component Mounting	Amplitude	Max. Acceleration
Shock Mounted Panel Component	0.005 inch	0.8g
Unshock Mounted Panel Component	0.010 inch	1.3g
Structure Mounted Component	0.030 inch	3.8g
Power Plant Compartment Component	0.20 inch	25 g

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

3.3.5 Overpressure: Pressure instruments shall not be adversely affected when subjected to overpressure as specified in the following table:

Fuel Pressure - 50 percent greater than maximum indicating range.
Hydraulic Pressure - 30 percent greater than maximum indicating range.
Oil Pressure - 500 lbs. per square inch.

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

4. DETAIL REQUIREMENTS:

4.1 Indicating Method: The pressure instrument shall indicate by means of a pointer moving over a fixed dial.

4.2 Dial Markings:

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

4.2.2 Graduations: Minor graduations shall be used at intervals not to exceed 10% of full scale value.

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 Name: The word "Fuel Pressure", "Oil Pressure" and/or "Hydraulic Pressure" whichever is applicable may be the same finish as the numerals. The inscription "PSI" or equivalent shall appear on the dial.

4.3 Visibility: The pointer and all dial markings shall be visible from any point within the frustum of a cone whose side makes an angle of not less than 30 degrees with the perpendicular to the dial, and whose small diameter 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 0.25 of an inch.

4.4 Connection Markings: The back of the case, where applicable, adjacent to the connections shall be distinctly marked to identify the pressure and vent connection.

4.5 Power Variations: All units shall properly function with +10 or -20% variation in DC voltage and/or plus or minus 10% variation in AC voltage and frequency provided the AC voltage and frequency vary in the same direction.

5. TEST CONDITIONS:

5.1 Atmospheric Conditions: Unless otherwise specified all tests required by this specification shall be met 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 pressure or the temperature substantially different from these values allowances shall be made for the variations from the spedified conditions.

5.2 Vibration: (To minimize friction). Unless otherwise specified, all tests for performance may be made with the instrument subjected to a variation 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 Vibration Stand: A Vibration 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.

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

5.5 Test Position: Unless otherwise specified, the instrument shall be mounted and tested in its normal operating position.

5.6 Test Liquid: The liquid used for applying pressure during the tests shall be the liquid with which the instrument is intended to be used or its equivalent.

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 Scale Error: The instrument scale errors determined at each major graduation shall not exceed 5 percent of full scale value.

6.2 Dielectric: The insulation of the components shall withstand, without evidence of damage, an application of 500 volts at a commercial frequency for a minimum period of 5 seconds between any one of the connector pins and any metal part of the case. On grounded components this test shall be performed prior to grounding of any leads.

Field tests, when applicable, shall be conducted at a commercial frequency for a period of 5 seconds at a value of 375 volts (75% of manufacturing value).

6.3 Leak: There shall be no evidence of leakage after subjecting the instrument to a pressure of 80% of full scale value for a 15 minute period. The applied pressure shall be sealed off at a point within two inches of the instrument.

6.4 Position Error: The differences in instrument indication between tests in normal position and test in any other position shall not exceed 2-1/2% of full scale value.

7. QUALIFICATION TESTS: As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1 Low and High Temperature: The instrument shall be subjected to temperatures of Section 3.4 Column A for 3 hours, and while at this temperature the scale errors shall not exceed 10% of full scale value.

7.2 Extreme Temperature Exposure: The instrument shall after alternate exposures to ambient temperatures of -65C and 70C, for periods of 24 hours each, and a delay of 3 hours at room temperature following completion of the exposure, meet the requirement of Section 6.1. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.3 Magnetic Effect: (Applicable only to components mounted outside of power plant). The magnetic effect of the instrument shall be determined in terms of the deflection of a free magnet, approximately 1-1/2 inches long, in a magnetic field with a horizontal intensity of 0.18, plus or minus 0.01 gauss, when the instrument is held in various positions on an east-west line with its nearest part five inches from the center of the magnet. (An aircraft compass with the compensating magnets removed therefrom may be used as the free magnet for this test). The maximum deflection of the magnet shall not exceed one degree for any pointer deflection.

7.4 Humidity: The instrument shall be subjected to the conditions specified in paragraph 3.3.2 for a period of 10 hours, after which it shall meet the requirements of Section 6.

7.5 Vibration: The instrument shall be subjected, while in normal operation, to vibration of 0.010 inch at frequency from 500 to 3000 cycles per minute in order to determine whether the natural frequency of the instrument is in this range. While the instrument is being vibrated, the maximum range of the pointer oscillation shall not exceed 5 degrees. After 3 hours' exposure to vibration amplitude as specified in Section 3.3.4 and at the natural frequency, if between 500 and 3000 cycles per minute, otherwise at 2000 cycles per minute, no damage shall be evident and the instrument shall meet the requirements of Section 6.

7.6 Drift: The instrument shall be subjected to a pressure equivalent to half scale deflection for a period of one hour. At the end of that time the indicator reading shall not have changed by more than 1-1/2%.