

**Fuel and Oil Quantity Instruments
(Turbine Powered Subsonic Aircraft)**

FOREWORD

This document has been declared "NONCURRENT". It is recommended, therefore, that this document not be specified for new designs. "NONCURRENT" refers to those documents which have previously been widely referenced and may continue to be required on some existing designs. "NONCURRENT" documents are available from SAE upon request.

1. PURPOSE:

This Aeronautical Standard establishes the essential minimum safe performance standards for Fuel and Oil Quantity Instruments primarily for use with turbine powered subsonic transport aircraft, the operation of which may subject the instrument to the environmental conditions specified in Section 3.3.

2. SCOPE:

This Aeronautical Standard covers the capacitance sensor type of instrument.

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.

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3.2 Identification:

The following information shall be legibly and permanently marked on each of the major components or attached thereto:

- a. Name of unit
- b. SAE AS 445
- c. Manufacturer's part number
- d. Manufacturer's serial number or date of manufacture
- e. Manufacturer's name and/or trademark
- f. Range
- g. Rating

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 instruments shall function over the range of ambient temperatures as listed in Column A below and shall not be adversely affected by exposure to the temperatures shown in Column B below.

<u>Instrument Location</u>	<u>A</u>	<u>B</u>
Power Plant Accessory Compartment	-30 to 150C	-65 to 150C
Pressurized Areas	-30 to 50C	-65 to 70C
Non-pressurized or External Areas	-55 to 70C	-65 to 70C

- 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.

<u>Instrument Location</u>	<u>Alt. ft.</u>	<u>Temp C</u>
Power Plant Accessory Compartment	50,000	80
Pressurized Areas	15,000	50
Non-pressurized or External Areas	50,000	20

The instrument shall not be adversely affected following exposure to extremes in ambient pressure of 50 and 3 inches Hg absolute respectively.

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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 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>
Nacelle, Nacelle Mounts, Wings, Empennage & Wheel Wells	5-1000	0.036	10g
Fuselage			
Forward of Spar Area	5-500	0.036	2g
Center of Spar Area	5-1000	0.036	4g
Aft of Spar Area	5-500	0.036	7g
	500-1000		5g
Vibration Isolated Rack & Instrument Panel	5-1000	0.030	1g

- 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 70C.

3.4 Fire and Explosive Hazard:

- 3.4.1 Explosive Atmosphere: All instruments located in the uninhabited areas of non-pressurized aircraft, or in the non-pressurized areas of pressurized aircraft shall not cause an explosion when operated in an explosive atmosphere.

- 3.4.2 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 sensor component contacted by combustible fuel or vapor shall not exceed 200C.

3.5 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 feedback in the electronic equipment installed in the same aircraft as the instrument.

3.6 Magnetic Effect:

The magnetic effect of the instrument shall not adversely affect the performance of other instruments installed in the same aircraft.

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3.7 Seal:

The tank connector head shall be an enclosed compartment designed to prevent fuel or oil leakage.

3.8 Automatic Fuel Compensation:

The basic instrument shall incorporate optimum compensation based on measurement of dielectric constant and/or density to correct for variations in fuel characteristics due to temperature and fuel grade variations and shall indicate mass of fuel.

3.9 Totalization:

The basic instrument shall provide an output signal for totalizing purposes. Incorporation of the added totalizing feature shall entail inclusion of a suitable electrical summing device and an indicating unit which shall be designed to indicate the total amount of fuel registered by the individual instruments.

4. DETAIL REQUIREMENTS:

4.1 Indicating Methods:

The instrument shall indicate by means of a pointer moving over a fixed dial and/or by means of a counter or by means of a moving tape.

4.2 Display Markings:

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

4.2.2 Graduations: The intervals employed shall be arranged to provide the maximum of readability consistent with the accuracy of the instrument.

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 Quantity" or "Oil Quantity", whichever is applicable, may be the same finish as the numerals. The inscription "lbs." or "gals." or equivalent, shall appear on the dial in lettering noticeably smaller than either numerals or title.

4.2.5 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.