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

AERONAUTICAL STANDARD AS 393

AIR SPEED TUBES
ELECTRICALLY HEATED

Issued 12-1-47
Revised

1. PURPOSE: To specify minimum requirements for Electrically Heated Air Speed Tubes for use on aircraft the operation of which may subject the instrument to environmental conditions specified in Section 3.4.

2. SCOPE: This specification covers the following basic types:

Type I - Pitot Pressure, Straight and L-shaped, 12 and 24 volt nominal, 2 wire circuit.

Type II - Pitot and Static Pressures, Straight and L-shaped 12 and 24 volt nominal, 2 wire circuit.

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 the purpose intended.

3.1.2 Workmanship: Workmanship shall be consistent with high grade 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 feedback, 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 units or attached thereto:

a. Name of instrument
b. S.A.E. Spec AS 393
c. Rating (Nominal Voltage)
d. Manufacturer's Part No.
e. Manufacturer's Serial No. 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, 7.

3.4.1 Temperature: When the instruments are mounted in accordance with manufacturer's instructions, they shall function over the range of ambient temperatures of -65C to +70C and shall not be adversely affected by exposure to temperatures of -65C to +70C.

3.4.2 Vibration: When the instruments are mounted in accordance with the manufacturer's instructions, they shall function and shall not be adversely affected when subjected to the following vibration:

Frequency:	500 - 3000 cycles per minute
Amplitude:	.250"
Maximum Acceleration	32.5 g

Note: It is understood that the unit shall withstand vibration at higher frequencies but the acceleration value need not exceed that 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 Drainage: The tube shall be designed to provide maximum drainage of water, resulting from rain or melting ice, consistent with maintaining the calibration specified in Sections 6.3, 6.4 and 6.5.

4.2 Marking: Pitot pressure and Static pressure lines shall be identified by the letters P and S, respectively, stamped, etched, engraved or otherwise permanently marked on the lines or fittings. The top of the tube shall be identified.

5. INDIVIDUAL PERFORMANCE TESTS: All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements, where applicable.

5.1 Leakage: With a pressure of 10 inches of mercury applied separately to the pitot pressure and/or the static pressure lines, there shall be no evidence of leakage when the corresponding pitot or static pressure openings and drain holes are sealed.

5.2 Dielectric: The insulation shall withstand without evidence of damage the application of a sinusoidal voltage at a commercial frequency between the terminals of the heater circuit and the shell (case) for a period of 5 seconds. The R.M.S. value of the sinusoidal voltage applied shall be 500 volts.

5.3 Heater Operation: When mounted in its normal position, the tube shall be tested for heater operation by applying the minimum rated voltage (12 or 24 volts) for a period of 2 minutes. The power consumption at that time shall be within ±30% of the power consumption at rated voltage.

6. 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, where applicable.

6.1 Vibration: The tubes shall be subjected to vibration for three hour periods in each of the three perpendicular reference planes such that a point on the tip of the tubes will oscillate 1/4 inch. The test shall be conducted such that each period of three hours shall consist of one hour at 1,000, 2,000 and 3,000 cycles per minute. Rated voltage shall be applied to the terminals continuously during this test. Ambient temperature shall be 20 to 30C. There shall be no failure of any kind.

6.2 Endurance: The tubes shall be made to operate continuously in still air at 15 or 30 volts (as applicable) for, at least, five hours. Ambient temperature shall be 70C. There shall be no damage of any kind except discoloration, which will not affect corrosion resistance.

6.3 Calibration at Zero Angle of Attack: The tube shall be mounted in a wind tunnel in line with the airflow and tested separately for pitot pressure and for static pressure at the values for air speeds specified in Table I. The test shall be made by comparison with the results obtained under similar conditions with a calibrated tube. The error of the tube expressed in terms of indicated air speed shall not exceed 1% of the indication or 1 MPH, whichever is greater, and the static pressure shall be within the tolerances specified in Table I.

TABLE I

Permissible Errors in Static Pressure

INDICATED AIR SPEED M.P.H.	TOLERANCE INCHES OF WATER
50	0.10
75	0.15
100	0.20
125	0.25
150	0.30
175	0.35
200	0.40
225	0.45
250	0.50

6.4 Calibration at Various Angles of Attack: The tube shall be tested as specified for "Error at Zero Angle of Attack" at approximately 125 MPH except that the angle of attack shall be varied by 2 degree intervals from +16 to -10 degrees inclusive. The indicated error expressed in terms of indicated air speed shall not differ from the indicated error at zero angle of attack by more than 3 miles per hour, and the error in static pressure shall not differ from the static pressure at zero angle of attack by more than 0.20 inch of water.