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

AERONAUTICAL STANDARD

AS 400

SMOKE DETECTORS

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Revised

1. PURPOSE: To specify minimum requirements for smoke detection instruments for use in aircraft, the operation of which may subject the instrument to environmental conditions specified in Section 3.4.

2. SCOPE: This specification covers two basic types as follows:

Type I	Carbon Monoxide
Type II	Photo-Electric Cell

3. GENERAL REQUIREMENTS:

3.1 Material and Workmanship:

3.1.1 Materials: Materials shall be of a quality which experience 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 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 feed-back, 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 instrument or attached thereto:

(a) Name of Instrument (Smoke Detector)
(b) SAE Spec. AS-400
(c) Rating (Electrical, Vacuum, etc.)
(d) Manufacturer's Part Number
(e) Manufacturer's Serial Number or Date of Manufacture
(f) Manufacturer's Name and/or Trademark

3.4 Environmental Conditions: The following conditions have been established as design criteria only. Test shall be conducted as specified in Sections 5, 6 and 7.

3.4.1 Temperature: When mounted in accordance with the instrument manufacturer's instructions, the instrument shall function over the range of ambient temperature of -55C to 60C and shall not be adversely affected by exposure to temperatures in the range -65C and to 70C.

3.4.2 Humidity: The instrument shall function and not be adversely affected when exposed to a relative humidity of up to and including 95% at a temperature of approximately 32C.

3.4.3 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.

3.4.4 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:

Type of Instrument Mounting	Cycles Per Minute*	Amplitude*	Max Acceleration
Shock Mounted Panel Instruments	500 - 3000	0.005 inch	0.8 g
Unshock Mounted Panel Instruments	500 - 3000	0.010 inch	1.3 g
Airframe Structure Mounted Instruments	500 - 3000	0.030 inch	3.8 g

*NOTE: It is understood that the unit shall withstand vibrations at higher frequencies, but the acceleration values need not exceed those 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 Design:

4.1.1 The instrument shall consist of a means for:

Type I - Testing air for contamination with gaseous products of combustion. It shall include an alarm circuit or control circuit which will indicate the presence of contamination when it reaches a concentration of not more than 0.010% of carbon monoxide by volume.

Type II - Testing air for contamination with smoke or gas of all colors or particle sizes. It shall include an alarm circuit or control circuit which will indicate the presence of contamination which reduces the light transmission to not less than 90% of that of clear air. Percentage of transmission is defined as the light falling on a photo-electric cell through a one foot distance as compared to the light transmitted in clear air.

4.1.2 A means shall be incorporated in the design to admit the air sample to the sensitive element of the instrument in a positive manner.

4.2 Indicating Method: The instrument shall be capable of actuating both visual and aural alarm indicators.

4.3 Reliability: False signals in the instrument shall not result from variations in voltage (+25% and -100% of the rated), flight attitude, accelerations encountered in flight or landing, and from normal amounts of dust thay may accumulate within the instrument under normal flight operation.

4.4 Integrity Test Provision: The instrument shall be provided with a means for being tested in flight. The test shall cause operation of the alarm circuit or control circuit by initiating the sequency of actions through a disturbance in the instrument.

4.5 Sampling Characteristics: When an instrument installation is designed to divert the air samples from more than one sampling station, it shall cycle at a rate not to exceed 30 seconds per sampling station, in which case, flow of air through all the sampling conduits shall be maintained continuously. In addition, when a smoke alarm is indicated, an alarm shall be actuated to indicate the location in which the smoke or gas is being generated and to continue to indicate the alarm until the condition is eliminated. It shall begin cycling in a normal manner within 30 seconds after releasing the alarm signal.

5. TEST CONDITIONS:

5.1 Atmospheric Conditions: Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of 220. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variations from the specified conditions.

5.2 Vibration (To minimize friction): Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of .002 to .005 inches 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 betwsen 500 and 3000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument 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 Test Position: Unless otherwise specified, the instrument shall be mounted and tested in its normal operation position.

5.5 Air Sample: Unless otherwise specified, air samples shall be as follows:

(1) Air containing 0.01% plus or minus .005% of carbon monoxide, or

(2) Air containing smoke or gas having a light transmission value of 85% to 92% of that of clear air.

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

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 Response Time: The instrument shall be tested, so that, when an air sample per Section 5.5 is introduced into the instrument under normal room temperature and atmospheric pressure conditions the alarm circuit or control circuit shall be energized within a maximum of 30 seconds.

6.2 Dielectric: The insulation shall be subjected to a dielectric test with an R.M.S. voltage at a commercial frequency applied for a period of 5 seconds equivalent to 5 times normal circuit operating voltage, except where circuits include components for which such a test would not be appropriate the test voltage shall be 1.25 times the normal circuit operating voltage. The insulation response shall not be less than 20 megohms at that voltage.

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. The tests of each instrument shall be conducted consecutively and after the tests have been initiated, no further adjustments of the instrument shall be permitted. For those instruments which employ a cycling device for testing a multiplicity of locations with one instrument, these tests shall be conducted on the basis of a single sample station. During these tests no false alarm shall result.

7.1 Stability: The instrument shall be operated continuously for 24 hours at room temperature. At the end of the first and twenty-fourth hour of operation a sample of air, per Section 5.5, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.

7.2 Suction Variation: The instrument shall be operated continuously by varying the suction from 25% below to 25% above the rated. At each of these values a sample of air, per Section 5.5, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.

7.3 Voltage Variation: The instrument shall be operated with the voltage varying from 110% to 85% of the rated. The instrument shall then be tested with an air sample, per Section 5.5, and the response time shall not exceed 30 seconds.

7.4 High Temperature: The instrument shall be exposed to a temperature at 70C for a period of six hours after which it shall be tested with air at 60C for a period of 30 minutes without giving a false alarm. The instrument shall then be tested with an air sample, per Section 5.5, and the response time shall not exceed 30 seconds.

7.5 Low Temperature: The instrument shall be exposed to a temperature of -65C for a period of 24 hours, after which it shall be raised to a temperature of -55C for a period of six hours. After operating for thirty minutes at a temperature -55C, without giving a false alarm, the response time to the air sample in Section 5.5 shall not exceed 30 seconds.

7.6 Humidity: The instrumsnt shall be subjected to an atmosphere 32C with a relative humidity of 95%, with the air sample being taken from the same atmosphers. After operating in this manner for five hours, an air sample per Section 5.5, shall be introduced into the instrumsnt and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.