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

AERONAUTICAL STANDARD AS412

Issued 11-1-48
Revised

CARBON MONOXIDE DETECTORS, (SIGNAL ASSEMBLY)

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

2. SCOPE: This specification covers the basic type of instrument for detection of toxic concentrations of carbon monoxide whose operation is based on measurement of heat changes through catalytic oxidation.

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
(b) SAE Specification AS-412
(c) Rating (Electrical, Vacuum, etc.)
(d) Manufacturer's Part Number
(e) Manufacturer's Serial Number or Date of Mfgr.
(f) Manufacturer's Name and/or Trademark

3.3 Environmental Conditions: The following are established as design criteria 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.

Instrument Location	"A"	"B"
Heated Areas (Temp. controlled)	-30 to 50C	-65 to 70C
Unheated Areas (Temp. uncontrolled)	-55 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.

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 Instrument Mounting	Amplitude	Max. Acceleration*
Shock Mounted Panel Instruments	0.010 inch	1.3 g
Structurally Mounted Instruments	0.030 inch	3.8 g
Engine Compartment Mounted Instruments	0.20 inch	25 g

*Note: It is understood that the units shall withstand vibrations at higher frequencies, the acceleration values not to exceed those shown above.

3.4 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.

4. DETAIL REQUIREMENTS:

4.1 Design: The instrument shall consist of a means for testing air for contamination with carbon monoxide. It shall include an alarm circuit or control circuit which will indicate the presence of contamination when it reaches a concentration between .005 and.007 per cent of carbon monoxide by volume.

4.1.2 Sampling Method: A means shall be incorporated in the design to direct 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 (including failure) in the instrument shall not result from variations in flight attitude, from normal amounts of gasoline vapors and dust likely to accumulate in the instrument in normal flight operations, from accelerations encountered in flight or landing, or from variations in voltage, (+25% -100% of the rated).

4.4 Power Variations: All units shall properly function with +10% -20% variation in DC voltage and/or ±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 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 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 Air Sample: Unless otherwise specified, the air sample shall be air containing 0.0075% ±0.0005% of carbon monoxide by volume.

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 5.6 is introduced the alarm circuit or control circuit shall be energized within a maximum of 5 minutes.

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 Stability: The instrument shall be operated continuously for twenty-four hours at room temperature. At the end of the first and twenty-fourth hour of operation a sample of air, per Section 5.6, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit at the end of the twenty-fourth hour shall not exceed that observed at the end of the first hour of this run by more then 30 seconds and in no case shall it exceed the time specified in Section 6.1.

7.2 Suction Variation: The instrument shall be operated continuously by varying the suction from 25% below to 25% above the normal rated suction. At each of these values a sample of air, per Section 5.6, shall be introduced and the time required for operation of the alarm circuit or control circuit shall not differ from that observed under the normal response time test at normal rated suction, by more than plus or minus 30 seconds, and in no case shall it exceed the time specified in Section 6.1.