

European Aviation Safety Agency

European Technical Standard Order (ETSO)

SUBJECT: CARBON MONOXIDE DETECTOR INSTRUMENTS

1 – Applicability

1.1. - General

This ETSO gives the requirements for new models of carbon monoxide detector instruments, which are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

1.2 - Specific

This ETSO refers to two basic types of detector instruments:

- TYPE A instruments are completely self-contained and carry their own power source and warning system.
- TYPE B instruments are powered by the aircraft power supplies including the alarm system.

2 - Procedures

2.1. - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None

3 - Technical Conditions

3.1 – Basic

3.1.1 - Minimum Performance Standard

See **Appendix 1**

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1 and **Appendix 2**

3.1.3 - Computer Software

See CS-ETSO Subpart A paragraph 2.2

3.1.4 – Electronic Hardware Qualification

See CS-ETSO Subpart A paragraph 2.3

3.2 - Specific

3.2.1 Failure Condition Classification

See CS-ETSO Subpart A paragraph 2.4

Failure of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition.

4. Marking

4.1 - General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2

4.2 – Specific

The component must be permanently and legibly marked with the equipment class as defined in paragraph 1.2 of this ETSO.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3

APPENDIX 1

Minimum Performance Standard

The following requirements apply to both TYPE A & B unless otherwise stated.

1 - Performance Standard

- a. The Instrument shall trigger visual and aural alarm when CO is detected.
- b. The concentration against time characteristic of the alarm activation shall meet the requirements of Table 1 below:
- c. The instrument may provide a readout of actual detected CO concentration level in parts per million (ppm) by volume.
- d. The probability of false alarms should be shown by the manufacturer to be sufficiently remote so as not to encourage the flight crew to distrust the instrument.
- e. The warm-up time of the instrument should not exceed 5 minutes.

CONCENTRATION (ppm by volume)	NO ALARM BEFORE (minutes)	ALARM BEFORE (minutes)
Less than or equal to 30	DO NOT ALARM	DO NOT ALARM
More than 30	120	180
More that 50	60	90
More than 100	10	40
More than 300	No delay	3

Table 1: Alarm Activation Concentration

2 - Alarm Operation

- a. There shall be a flashing AMBER indication, visible within the angle shown in Figure 1 below, whenever any of the criteria, described in Table 1, are met.

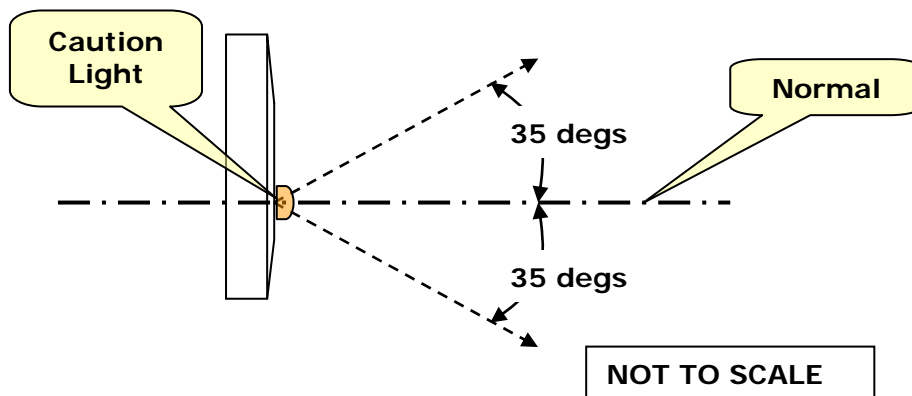


Figure 1 Plan View of Instrument showing Minimum Viewing Angle

- b. The flashing visual caution light shall be accompanied by an intermittent aural alarm of a distinctive characteristic that cannot be confused with other aural alarms or indications that are typically found in the aircraft.
- c. The aural alarm shall be of such a characteristic that the attenuation by an Automatic Noise Reduction Headset will be kept to a minimum.
- d. In order to mitigate any distraction at critical stages of the flight, the aural alarm should initially alarm at a low intensity. At each cycle of the alarm the intensity should be increased until it is at least 85dBA at a range of 3 metres.
- e. It shall be possible for the pilot to cancel the alarms. Once cancelled the instrument should re-set within 2 minutes. At this point, the instrument should continue to monitor the air and re-warn if the criteria of paragraph 1b are met.

3 - Function/Power Indications

- a. Self test:

Both types of unit should have a function indicator which illuminates showing that a self test of the instrument has been successfully completed. The test should confirm as many of the functions as possible.

- b. Battery Power test. TYPE A only

The TYPE A unit shall provide the pilot with a steady visual indication that there is 5 hours or less of useful battery power remaining. If there is less than 2 hours left, the visual indication should be made to flash.

4 - Standard Performance Test

The following is a detailed test requirement to be carried out when specified. During all tests the detector should be mounted in its normal operating orientation.

- a. Test gases for Alarm Operation: the following concentrations should be used to check the alarm operation.

REF	CO TEST GAS (ppm by volume)	NO ALARM BEFORE (minutes)	ALARM BEFORE (minutes)
A	20-25	240	-
B	31-37	120	180
C	51-61	60	90
D	101-121	10	40
E	301-361	-	3
F	5000-5500	-	3

- b. The test conditions for the standard test are:
 - Temperature: 15 to 25°C
 - Humidity: Between 30% and 70% Relative humidity.
 - Pressure: 980 to 1050 hPa
- c. Standard Test procedure: the following is required:
 - Switch on instrument and allow to warm up for 5 minutes
 - Purge with clean air for 15 minutes

- Test Gas B and check alarm between 120 to 180 minutes
- Purge with clean air for 15 minutes
- Test Gas C and check alarm between 60 to 90 minutes
- Purge with clean air for 15 minutes
- Test Gas D and check alarm between 10 to 40 minutes
- Purge with clean air for 15 minutes
- Test Gas E and check alarm before 3 minutes

d. Digital Display

If a digital display is featured on the equipment then it should be checked that it reads in the band $\pm 10\%$ of the actual value for each of the conditions above.

5 - Low CO concentration test.

To ensure that nuisance warnings do not occur at low concentrations, carry out the following test exposing the instrument to the following gases:

- Clean air for 15 min
- Test gas A for 240 min or more
- Check that the alarm is not triggered
- Test gas B and ensure that alarm is triggered between 120 and 180 min

6 - High CO concentration test.

To ensure that the instrument is capable of reacting to extremely high concentrations, carry out the following test exposing the instrument to the following gases:

- Pass clean air for 15 min
- Pass test gas F.
- Check that the alarm is triggered within 3 min.
- Pass clean air for 10 min
- Pass test gas B.
- Check that the alarm triggers between 120 and 180 min.

7 – Documentation

The supplier shall provide written guidance in the following areas:

7.1 - Operation

General description including the principle of operation including;

- Details of and interpretation of warnings.
- Details of and interpretation of test indications.
- Limitations.
- Battery changing procedure if applicable.

Action in the event of receiving a warning

Suggest generic actions helping the installer defining appropriate AFM procedures.

7.2 - Installation

The installation instruction must make it clear which categories of aircraft the instrument is suitable for and any restrictions in its use must also be clearly stated.

A general description of

- the optimum position for the instrument in different aircraft types and
- the positions to be avoided to ensure reliable air sampling and to avoid compass interference.

7.3 – Continued Airworthiness

Cleaning and other instructions as required.

APPENDIX 2:

Additional Tests

The following additional tests are required.

a - Effect of Fuel contaminated air.

- i Air contaminated with 1,000 ppm by volume of 100LL fuel is to be passed through the instrument for 2 hours
- ii Verify that there are no false alarms during that period
- iii Pass test sample D through the instrument and ensure that the alarm is triggered between 10 and 40 minutes
- iv Repeat 2.2-a, 2.2-b and 2.2-c using JET A1 fuel.
- v Repeat 2.2-a, 2.2-b and 2.2-c using MOGAS Leaded fuel to BS:4040:1988.
- vi Repeat 2.2-a, 2.2-b and 2.2-c using MOGAS Unleaded fuel to BS:7070 or EN228:1995.
- vii Repeat 2.2-a, 2.2-b and 2.2-c using diesel fuel