European Union Aviation Safety Agency

Safety Information Bulletin

Airworthiness - Operations

SIB No.: 2020-01R1

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Subject: **Carbon Monoxide Risk in Small Aeroplanes and Helicopters**

Revision:
This SIB revises EASA SIB 2020-01 dated 27 January 2020.

Ref. Publications:
United Kingdom (UK) Air Accidents Investigation Branch (AAIB) Special Bulletin S2/2019 dated 14 August 2019.
UK Civil Aviation Authority (CAA) CAP 562 Civil Aircraft Airworthiness Information and Procedures, Leaflet B-190 "Carbon Monoxide Contamination", latest revision.
EASA Safety Information Bulletin (SIB) 2010-19 "Exhaust Mufflers Inspection for piston engine Helicopters and Aeroplanes" dated 02 June 2010.
EASA safety promotion leaflet Sunny Swift dated 14 March 2018 (available in all EU languages).
Commission Regulation (EU) No 1321/2014 and associated ED Decisions (EASA Easy Access Rules for Continuing Airworthiness).

Applicability:
Type Certificate and Supplemental Type Certificate holders, Maintenance Organisations, Continuing Airworthiness Management Organisations, personnel performing maintenance including pilot/owner maintenance, owners and operators of small aeroplanes (CS-LSA, CS-VLA and CS-23) and light helicopters (CS-27) with internal combustion engines or combustion heaters.

Description:
The dangers of carbon monoxide (CO) exposure have been highlighted by the UK AAIB following a fatal accident with a Piper PA-46 Malibu aeroplane. Toxicology tests of the blood of the passenger identified potentially fatal levels of carbon monoxide exposure. Prompted by these findings, the UK AAIB published Special Bulletin S2/2019 to raise awareness within the General Aviation community of the dangers of exposure to CO and the measures available to detect its presence in the cabin in order to mitigate this potentially fatal risk.

CO is a colourless, odourless gas produced from the incomplete combustion of carbon-containing materials. Piston-engine aircraft produce high concentrations of CO that are conveyed away from the aircraft through the exhaust system. Poor sealing of the cabin, or leaks into the heating or ventilation system from the exhaust, can provide pathways for CO to enter the cabin. Whilst piston engines produce the highest concentration of CO, exhausts from turbine engines also contain CO.

The risk of CO poisoning can increase in winter conditions as defective cabin heating systems, engine exhausts or combustion heaters can result in CO entering the cockpit/cabin. If the aircraft

occupants breathe in air that is contaminated with an excessive quantity of CO, it can cause incapacitation. The CO readily combines with haemoglobin (the oxygen-carrying protein molecule contained in red blood cells) in the blood, resulting in the production of carboxyhaemoglobin (COHb), which decreases the carriage of oxygen. Exposure to CO can lead to damage to the brain, heart and nervous system. The symptoms of CO poisoning worsen with an increasing percentage of COHb, as detailed in the table below:

COHb Level	Typical Symptoms
<10%	None
10-20%	Slight headache
20-30%	Headache, slight increase in respiration rate, dizziness, drowsiness
30-40%	Bad headache, impaired judgement, difficulty breathing, increasing drowsiness, blurring of vision, stomach pain
40-50%	Pounding headache, confusion, marked shortness of breath, marked drowsiness, increasing blurred vision
>50%	Unconsciousness, heart attack

This SIB is revised to add some recommendations on CO concentration checks to scheduled maintenance tasks, to add advice about “carry-on” detectors and to refer to a planned amendment to EASA CS-SC107a.

At this time, the safety concern described in this SIB is not considered to be an unsafe condition that would warrant either an Airworthiness Directive (AD) action under Regulation (EU) 748/2012, Part 21.A.3B, or a safety directive action under Commission Regulation (EU) 965/2012, Annex II, ARO.GEN.135(c).

Recommendation(s):

1. PREVENT: Avoid CO exposure

The best protection against CO poisoning is to prevent exposure, as follows:

- Aircraft owners and operators should ensure that heating/ventilation systems and exhaust manifolds in the aircraft remain in good condition/working order, as specified by the manufacturer.
- All recommended maintenance tasks published in the applicable manuals or other publications (e.g. Service Letters) by the aircraft, engine or equipment manufacturer, should be included in the aircraft´s maintenance programme. All applicable instructions and procedures published by the aircraft, engine and equipment manufacturer should be followed. For aircraft no longer equipped with the original heating, ventilation or exhaust system the instructions and procedures published by the manufacturer of the replacement equipment should be followed.
- Where no such information is provided by the aircraft, engine or equipment manufacturer, scheduled maintenance tasks should be added to the aircraft’s maintenance programme,

covering the regular inspection and/or testing of all exhaust systems, including the manifolds, and cabin heating components, bulkheads and access panels in the fuselage, particularly those under the fuselage or with direct access to the cockpit/cabin, and the windows and windscreens.

- A specific CO concentration check for the exhaust heat exchanger should be included in the Minimum Inspection Programme (applicable since 24 March 2020; see AMC1 ML.A.302(d)). The UK CAA CAP 562 Civil Aircraft Airworthiness Information and Procedures Leaflet B-190 "CO contamination" provides generic expectations for maintenance-related measures to minimise the likelihood of contamination. It also addresses the means to conduct CO concentration checks. During ground tests, with the engine running and the heating equipment on, a CO detector (which does not necessarily need to be an active detector during ground trials) should be used to identify if there is any CO present in the cockpit/cabin. If the presence of CO is identified, additional maintenance checks and corrective actions should be carried out until no CO contamination in the cockpit/cabin is detected during further ground tests with the engine running and heating equipment on.
- Special attention should be paid to older and low utilisation aircraft, due to possible corrosion in the exhaust and heating systems. For aircraft with exceptionally high or low utilisation, some tasks should be performed more frequently than recommended by the manufacturer (i.e. flight hours/flight cycles-related tasks for low utilisation aircraft and calendar time-related tasks for high utilisation aircraft).

2. DETECT: Be actively warned if there is CO exposure

- EASA recommends that pilots and operators of aircraft with internal combustion engine or combustion heaters install in the aircraft, or equip the aircraft with, a CO detector, which must be maintained in accordance with the applicable equipment manufacturer's maintenance instructions.
- For "carry-on" detectors, pilots should ensure that the aural CO warning sound is audible even when wearing a noise-cancelling headset, but not so loud as to create a distraction in flight, or to be confused with other onboard warnings. Pilots should also ensure that the detector do not create a loose article hazard in the cockpit in flight. Active (by means of aural and/or visible warnings) CO detectors which are compliant with ETSO-2C48a standards are recommended.
- The following CS-STAN (Certification Specifications for Standard Changes) provisions aim to facilitate the installation and exchange of CO detectors without formal approval:
  - CS-SC107a Installation of carbon monoxide detectors;
  - CS-SC201b Exchange of powerplant instruments (which includes CO detectors).
- EASA intends to amend CS-SC107a to reflect the recommendation to use active CO detectors. It should be included within the publication of the next amendment to CS-STAN.

3. REACT: In case of CO exposure

Should occupants of an aircraft detect an unusual smell that could be from engine exhaust products, or should they experience any symptoms described in the table above, the possibility of exposure to CO should be considered, and the pilot should take the following actions as soon as practicable/safe to do so:

- Turn the cabin heating system off.
- Increase the rate of cabin fresh air ventilation to the maximum.

- Open windows if the flight profile and aircraft's operating manual permit such an action.
- If available (provided it does not represent a safety or fire hazard), consider using supplemental oxygen.
- Land as promptly as possible.
- Do not hesitate to let Air Traffic Control know of the concerns, and ask for vectors to the nearest safe landing opportunity.
- Once on the ground, seek medical attention.
- Before the next flight, make sure that the aircraft is inspected by a certified mechanic to investigate the possible cause of CO presence in the cockpit/cabin and to rectify any defects found.

Contact(s):

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