AIRWORTHINESS BULLETIN

Robinson R44 Engine Exhaust - Cabin Heater System Failures

AWB 78-001 **Issue** : 1
Date : 11 August 2011

1. Effectivity

All Robinson Helicopter Company (RHC) R44 - series helicopters.

2. Purpose

Alert operators and maintenance personnel to engine exhaust system failures in the region of the cabin heater shroud assembly and remind operators and maintainers of the RHC requirements regarding the installation of cabin carbon monoxide (CO) detectors.

3. Background

CASA has received a number of reports describing collapsed R44 engine exhaust mufflers inside the cabin heater shroud, and severely burnt cabin heating hoses. One danger posed by this mode of failure is that, should cabin heating be selected with a collapsed muffler inside the heater shroud, carbon monoxide can be introduced directly into the cabin and the pilot may become incapacitated.

Operators investigating muffler collapse incidents report finding the following associated problems which could be considered as contributing factors.

- Magneto timing outside limits.
- Mixture arm (at the fuel control unit) becoming stiff and binding and not achieving full travel, resulting in excessive lean mixture.
- Engine exhaust muffler cooling inlet rigging incorrect.

All engine exhaust systems will erode over time during normal operation. Engine exhaust system reliability depends on several factors, which include operating and maintaining the engine and the exhaust system in accordance with the manufacturer's data. The above key points will now be examined in some detail.

3.1 Magneto Timing

CASA has received reports from maintainers who were unable to achieve correct magneto timing on some R44 helicopters. The problem was traced to the installation of incorrect P/N magneto couplings. RHC advise that P/N 73000 coupling cannot be used on both magnetos in the IO-540-AE1A5 engine.

The IO-540-AE1A5 engine uses:
P/N 73000 coupling on the engine - left (retard) magneto and
P/N 73636 on the engine - right (tachometer) magneto.
Ignition timing is set for 20 degrees BTDC.

The O-540-F1B5 engine uses:
P/N 73013 coupling on the engine - left (retard) magneto and
P/N 73000 on the engine - right (tachometer) magneto.
Ignition timing is set to 25 degrees BTDC.

3.2 Fuel Mixture

Excessive exhaust gas temperatures (EGT) can reduce life of the exhaust system by increasing erosion rates. Inadvertent leaning, which can raise the EGT, may occur if the mixture lever at the fuel control unit is not firmly at the "full rich" position for flight. RHC further report that internal contamination of the fuel control unit can substantially increase the force required to enrichen the mixture.

It was found with the early version mixture control (identified by a full length flexible conduit) that even though the mixture knob may be pushed fully "home" (with spring back) in the cockpit, the mixture lever may not be against the stop at the fuel control unit due to contamination within the control unit. RHC have taken steps to minimise this factor. The R44 II airframe mixture control system was redesigned in July 2007 for greater authority via a rigid (but bendable upon installation) 18-inch metal tube between the mixture knob housing and flexible conduit, as shown in R44 IPC Figure 4-19F dated JUL 2008; (item 13). To retrofit the improved cable, order P/NA522-13 mixture control and two AN742-3 clamps (item 29).

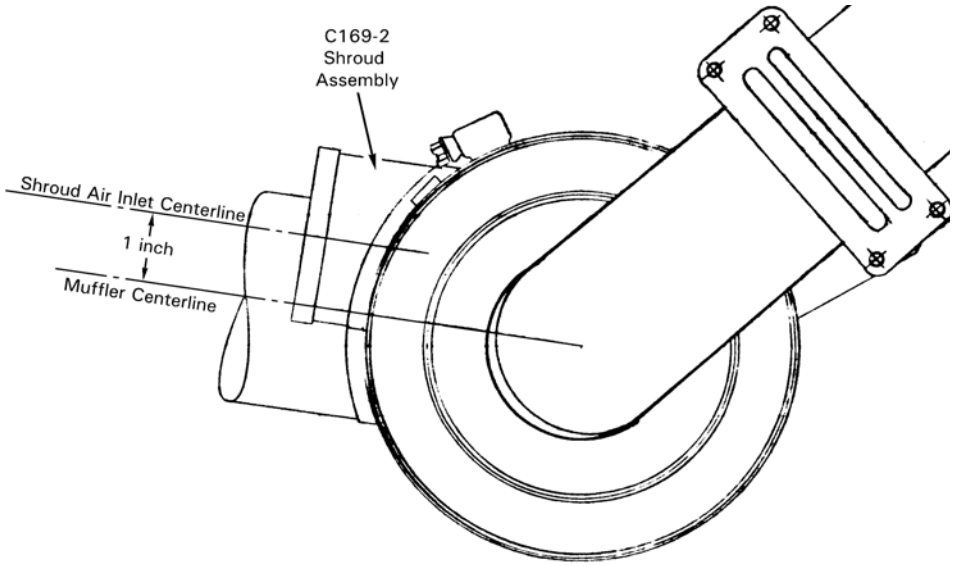
Also, a new stronger fuel injection servo lever safety spring has been introduced. To determine if the new version spring is installed, count the spring coils on the fuel injection servo mixture safety spring at the lever; if it has 3 coils of 0.040-inch diameter wire, then upgrading to the stronger, 2-coils of 0.047-inch diameter wire spring P/N D930-1 Rev B (or subsequent, item 7) may also be beneficial.

NOTE: *The Part Numbers provided in this AWB are provided as examples and while correct at the time of publication, they will not be*

revised. Always refer to the current revision of the applicable RHC Illustrated Parts Catalogue

3.3 Exhaust muffler cooling

Another factor to be considered in this installation is the exhaust muffler cooling within the heater shroud. When installing the P/N C169-3 muffler sub-assembly, examine the P/N C169-2 shroud assembly and ensure it has a 1-inch vertical offset between the heater shroud inlet and muffler centrelines as shown in Figure 1 below. This offset promotes air swirling around the exhaust muffler, and thus provides better cooling.



(VIEW FROM RIGHT SIDE LOOKING INBOARD)

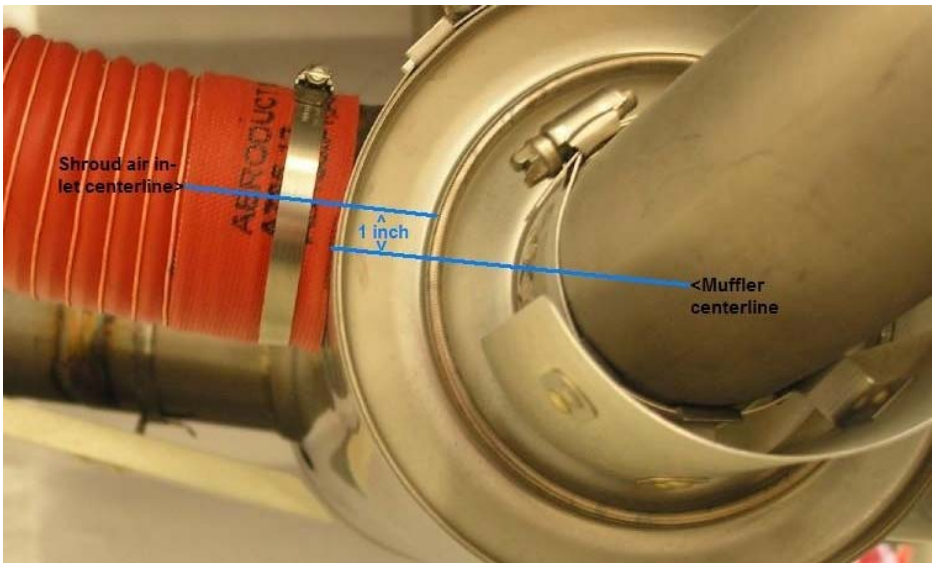


Figure 1. *Engineering sketch and photograph showing the 1-inch vertical off-set between the cooling air heater shroud inlet center line and the muffler centre line.*

3.4 Exhaust Gas Carbon Monoxide (CO) Detector

RHC consider the installation of a CO detector in the cabin to be mandatory because exhaust gasses can enter the cabin under certain operating conditions and cabin configuration - even though the engine exhaust system may be serviceable. RHC R44 SB-70 issued 25 March 2009, mandates retrofitting a CO detector to earlier R44's not previously equipped.

4. Recommendations

CASA makes the following recommendations:

1. Where difficulty is experienced in achieving correct magneto timing, ensure that the correct magneto coupling P/N is installed in the correct location on the engine. Check the latest revision of the Lycoming IPC for P/N and applicability.

2. During inspections verify that the mixture control arm on the fuel control unit has stop to stop travel. Consider fitting the optional improved design mixture control cable and fuel control unit safety spring.

3. Ensure the exhaust heater shroud assembly is at the latest configuration with a 1-inch offset between the inlet centre line and muffler centreline (P/N C169-2 Rev N or later).

4. With regard to CO detector installation, check the helicopter and review the requirements of RHC SB-70 for applicability.

5. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address:

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