



ATTACHMENT 4

MAINTENANCE AND POWERPLANT GROUP CHAIRMAN'S FACTUAL REPORT

ERA17MA316

**Turbomeca SL No. 1642/96/Arriel/25, 2nd issue, dated May 15, 1996, titled
ARRIEL 1 – ALL VARIANTS OIL COKING IN THE GAS GENERATOR REAR
BEARING HOUSING**

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Service Letter n° 1642/96/ARRIEL/25 (2nd issue)
This Service Letter supersedes the Service Letter
n° 1642/95/ARRIEL/25 dated 12th June 1995.

Subject : ARRIEL 1 - All variants
Oil coking in the gas generator rear bearing
housing

Bordès, 15th May 1996

Dear Sirs,

Cases of oil coking have been observed on the rear bearing housing walls in operation.

We will sum up the steps taken at short and middle term to improve the current situation.

Inside the gas generator rear bearing housing, coke can be found :

- either on the bearing lubricating jet
- or in the bearing oil scavenge orifice

It may result in the following :

- in the first case, a lack of lubrication of the bearing which can lead to deterioration and presence of particles in the oil system
- in the second case, inadequate oil scavenge, rear bearing housing blockage and oil flow into the exhaust gas duct which can cause smoke in the engine exhaust pipe.

A periodic flow check of the bearing permeability has been introduced (refer to the Maintenance Manual, chapter 5-10-2 and 72-40-10) which allows the presence of coke to be discovered so that maintenance can be taken to prevent the above events from occurring, particularly in flight. In addition to this permeability check, we recommend you install a post TU208 magnetic plug with warning on the rear bearing scavenge pipe. This will alert the operator to any initial deterioration that may be caused by insufficient lubrication. The intermittent illumination of the main oil pressure light and the oil pressure drop on the indicator inform the pilot that a problem is starting on the engine.

To solve the problem of carbon formation, different tests have been carried out on an engine equipped with measurement equipment.

We have noticed the following :

1. Operation influence :

- (a) Without Ng speed reduction stabilisation time before engine shutdown should be over 20 seconds. Above this value, an important temperature drop (20° C approx.) can only be obtained for a stabilisation time more than 5 minutes.

The Flight Manual recommends : stabilisation time above 30 seconds. This value can be adapted according to the missions of each operator.

- (b) Although it is possible to cool down the rear bearing temperature by 30° C by performing a ventilation after engine shutdown, **we do not recommend this procedure** because it can affect the mechanical resistance of the engine internal parts with thermal shocks.
- (c) The gas generator rotation speed is also an effective parameter, rear bearing temperature depends on the rating : the most unfavourable speed range is Ng around 80 %.
- The optimum stabilisation before shutdown is at a gas generator rotation speed between 50 % and 70 % which cools down the temperature by 40° C.**
- This result has been considered sufficient to be introduced in the Flight Manuals and engine Maintenance Manuals update.

Following this new procedure, Ng rotation speed below 70 % for a time above or equal to 30 seconds, should allow for a considerable reduction of the probability of encountering a coking problem.

2. Oil viscosity

Different recommended oil types have been also tested in the laboratory.

These tests showed that the behaviour of the 7.5 Cst oil is better than the 5 Cst oil when it is subjected to a temperature over 150° C :

- greater evaporation results in less deposit on the bearing walls

- a more fragile carbon deposit, less adhesive and more easily flushed to the oil filter.

The experience was gained in operation with TURMO engines. We are directing all our attention to the oil used in ARRIEL engines.

We remind you that we have recommended the use of 7.5 Cst oil to improve the lubricating conditions of the ARRIEL M05 reduction gear pinions.

The draining frequency is defined in our Maintenance Manuals and takes into account our experience of oil deterioration. Oil coloration is not a sufficient element to judge its behaviour in operation.

3. Technical improvement in progress

Simultaneously, a study has been initiated to reduce the consequence of oil coking, i.e. :

- relocation, inside of the rear bearing housing, of the bearing lubricating jet **in an area with reduced temperature**. This jet is used to determine the rear bearing cooling oil flow.
- This modification has now been validated. An evaluation program is in process on some modified engines to better estimate its efficiency in operation before releasing the modification for general use.

We want to reduce as much as possible the routine maintenance related to this problem.

We remain at your disposal for any information you may require.

Yours faithfully,

Customer Support Department
Technical Deputy Head of Department

J. MEIJET