



## **Memorandum for Record**

**Fabian Salazar**  
**Air Safety Investigator**  
**National Transportation Safety Board**  
**Investigator in Charge**

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**NTSB Accident Number: WPR20LA189**  
**Aircraft Registration & Make/Model: SA-342J / N342J**  
**Accident Location: Minden, NV**  
**Accident Date: June 21, 2020**

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The following pages are documents provided by the engine manufacturer and address engine compressor cleaning, washing, and protection.

**T U R B O M E C A**  
**ASTAZOU XIV B TURBOSHAFT ENGINE**  
**MAINTENANCE MANUAL**

3. Check of the housing of the 1st stage axial wheel of the countercasing

If there are rubs: acceptable as it is if the axial wheel blades are compliant as per this chapter. Do a ground run check for 15 minutes with vibration check, measurement of the run-down time and inspection of the magnetic plugs.

If compliant, return to service with inspection of the magnetic plugs after the last flight of the day or every 5 hours for the next 25 hours.

If there are particles, remove the turboshaft engine.

4. Compressor cleaning, washing and protection (Figure 203)

A. General

Engine performance degradation generally results from the compressor fouling and/or corrosion. The operator may prevent this deterioration by applying the compressor field cleaning procedure.

The compressor cleaning must be carried-out often to be effective, because if applied too late, the coat of dirt is fixed and it becomes very difficult to clean it without dismantling the engine.

The frequencies defined hereafter are to be determined by the user according to the type of atmosphere and the conditions of use expected for the engine. Contact a TURBOMECA representative to specify the servicing schedule that is applicable to your environment.

The other reasons for engine performance degradation are:

- erosion of the air duct,
- ingestion of foreign objects,
- vibrations with rubs leading to an abnormal increase of functional clearances,
- unbalance caused by the accumulation of foreign objects.

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**B. Terminology**

- Rinsing: It involves a brief cleaning to partially remove corrosive or salty deposits which are in the air path after operation in a corrosive or salty atmosphere (this procedure applies to daily servicing).
- Cleaning: Operation intended to remove dirt, insects, oil, etc... (Refer to Chapter 72-00-11).
- Washing: Operation intended to remove corrosive and/or salt laden deposits from the air path after operation in corrosive or salt laden atmosphere. (Refer to Chapter 72-00-11).
- Protection: Operation intended to protect the air path with an inhibiting and damp-proof product. (Refer to Chapter 72-00-11).
- Drying: Operation intended to eliminate residual products.
- Contaminated atmosphere: Atmosphere which is permanently laden with contamination such as industrial or volcanic dust, sprayed fertilizers, chemical products or high pollen levels. Deposits systematically form in this atmosphere.
- Saline atmosphere: An engine is operated in a saline atmosphere if:
  - the airframe on which it is installed is on-board a ship,
  - it operates over the sea (or salt surface) at a height of less than 1,000 feet (305 meters),
  - it operates inland less than 5 km from the sea (or salt surface).
- Sandy atmosphere: An engine is operated in a sandy atmosphere:
  - during take-off, landing or hovering in ground effect over unprepared landing strips in sandy areas,
  - during operations over deserts or similar environments, at any height, with a significant concentration of sand or dust floating in the air (e.g. sandstorm).

**C. Definition**

Demineralized and drinking water used for the practices described hereafter must be in accordance with the definitions described in Chapter 72-00-10.

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**D. Periodicities**

**1) All atmospheres**

| <b>Frequency</b>                                                                                                        | <b>Rinsing</b> | <b>Washing</b> | <b>Cleaning</b> | <b>Internal protection</b> | <b>External protection</b> |
|-------------------------------------------------------------------------------------------------------------------------|----------------|----------------|-----------------|----------------------------|----------------------------|
| After an in-flight inspection showing unfavorable evolution of the turboshaft engine condition (refer to Flight Manual) |                |                | X               |                            |                            |
| After 50 operating hours                                                                                                |                |                | X               |                            | X                          |
| Before beginning scheduled inspections                                                                                  |                |                | X               |                            |                            |
| After ingestion of foreign bodies                                                                                       |                |                | X               |                            |                            |
| Before a downtime of more than 72 hours                                                                                 |                |                | X               | X                          | X                          |
| Before storage of the engine                                                                                            |                |                | X               | X                          | X                          |

**(2) After running in corrosive or saline atmosphere**

| <b>Frequency</b>                       | <b>Rinsing</b> | <b>Washing</b> | <b>Cleaning</b> | <b>Internal protection</b> | <b>External protection</b> |
|----------------------------------------|----------------|----------------|-----------------|----------------------------|----------------------------|
| Daily after the last flight of the day | X              |                |                 |                            |                            |
| Weekly or 50 hours                     |                |                | X               |                            | X                          |

**(3) After running in contaminated atmosphere**

| <b>Frequency</b>                       | <b>Rinsing</b> | <b>Washing</b> | <b>Cleaning</b> | <b>Internal protection</b> | <b>External protection</b> |
|----------------------------------------|----------------|----------------|-----------------|----------------------------|----------------------------|
| Daily after the last flight of the day |                | X              |                 |                            |                            |
| Weekly or 50 hours                     |                |                | X               |                            | X                          |

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(4) After running in sandy atmosphere

| Frequency                              | Rinsing | Washing | Cleaning | Internal protection | External protection |
|----------------------------------------|---------|---------|----------|---------------------|---------------------|
| Daily after the last flight of the day | X (*)   |         |          |                     |                     |
| Weekly or 25 hours                     |         | X       |          |                     |                     |
| Monthly or 50 hours                    |         |         | X        |                     |                     |

(\*): If not fitted with a sand filter

E. Products approved by TURBOMECA

1) Recommended products

Refer to Chapter 72-00-10.

2) Other products authorized for use

Refer to Chapter 72-00-10.

F. Cleaning, washing, protection (Refer to Chapter 72-00-11).

#### D. Effects of engine cleaning on EPTC

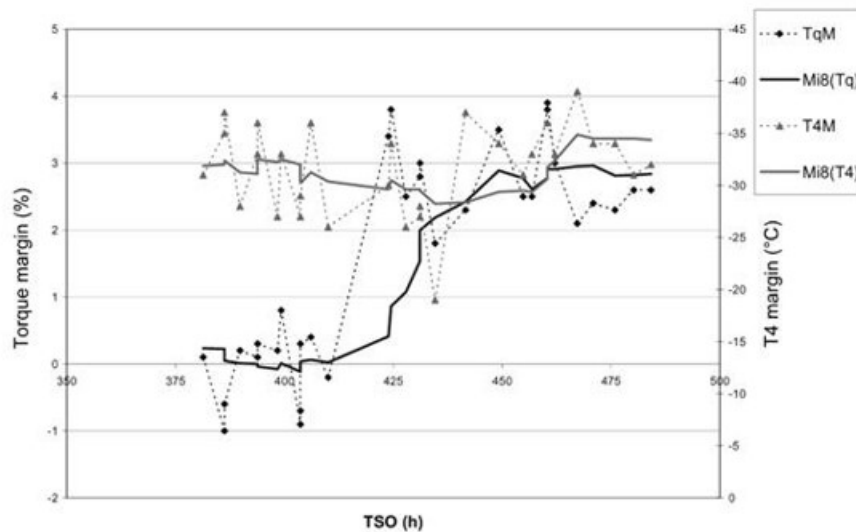
- (1) Cleaning following axial compressor and air path fouling

Refer to Figure 4

When operating in a dirty environment, the axial compressor and the air path tend to foul. This fouling causes a decrease of the compression ratio and the airflow resulting in a decrease of torque margin.

In order to solve this issue, operators have to perform a cleaning of the engine.

It is interesting to note that the engine recovered approximately 3% torque margin on this example. However, cleaning has to be carry out more frequently because fouling could lead to irreversible deterioration of the engine.



- (2) Cleaning following hot section parts corrosion and fouling

Refer to Figure 5

When engine operates in corrosive environment or a rinsing with non de-mineralized water is carried out, there is pollution of the hot section parts of the engine. This causes a decrease of the pressure in the combustion chamber and of the HP turbine performance. The result of this issue is an increase in the T45 measure and therefore a decrease of the T4 margin.

In order to solve this issue, users have to perform a cleaning of the engine and use de-mineralized water for rinsing.

It is interesting to note that the engine recovered about 15°C of T4 margin on this example. However, cleaning has to be carry out more frequently because fouling and corrosion could cause irreversible deterioration of the engine.

