AN UPDATE TO THE SAE S-12 COMMITTEE ON ACCEPTABLE MEANS OF COMPLIANCE FOR IBF POWER AVAILABLE AND DISTORTION

EASA 11TH ROTORCRAFT SYMPOSIUM

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SAE INTERNATIONAL®

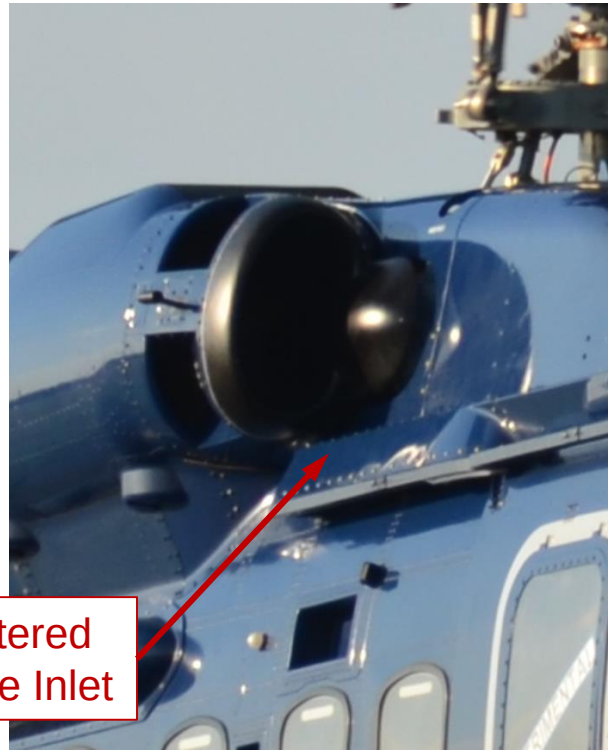
Agenda

Inlet Barrier Filters (IBF): Main Concepts

The SAE S-12 Committee

SAE ARP6912 Document

Inlet Barrier Filter - Overview



Inlet Barrier Filter - Overview

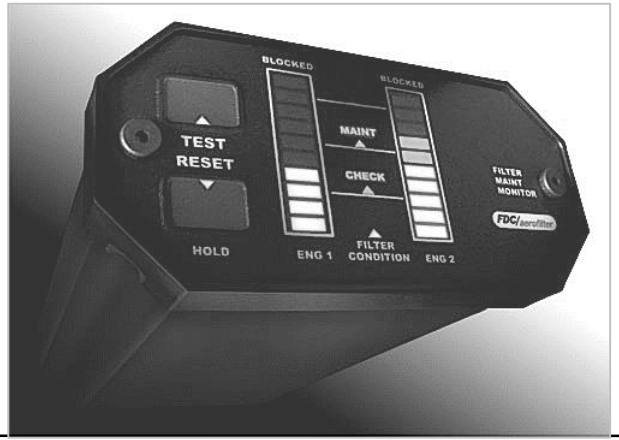
Description:

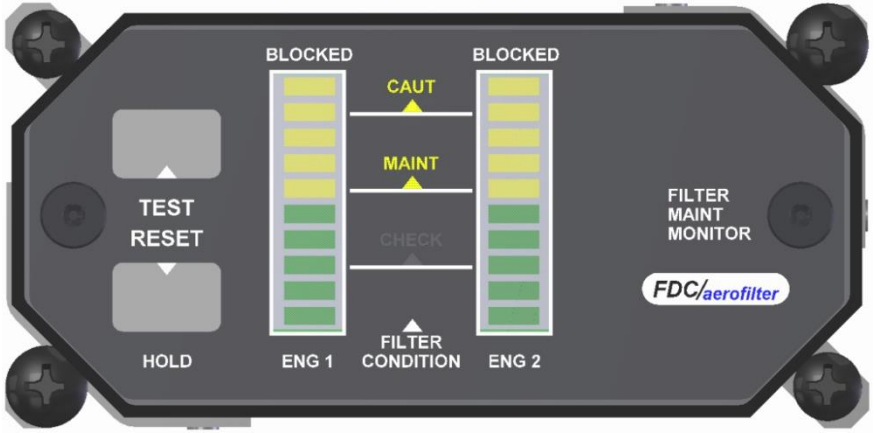
- Most common filters are pleated and oil impregnated design, resulting in filtration of 99% of the contaminants.
- Air into the engine is forced to go though the filter media.
- As the filter collects sand, dirt, and debris, it impedes the airflow, creating a pressure differential.

Inlet Barrier Filter - Overview

- A differential pressure switch or transducer is used to monitor the pressure drop across the media.

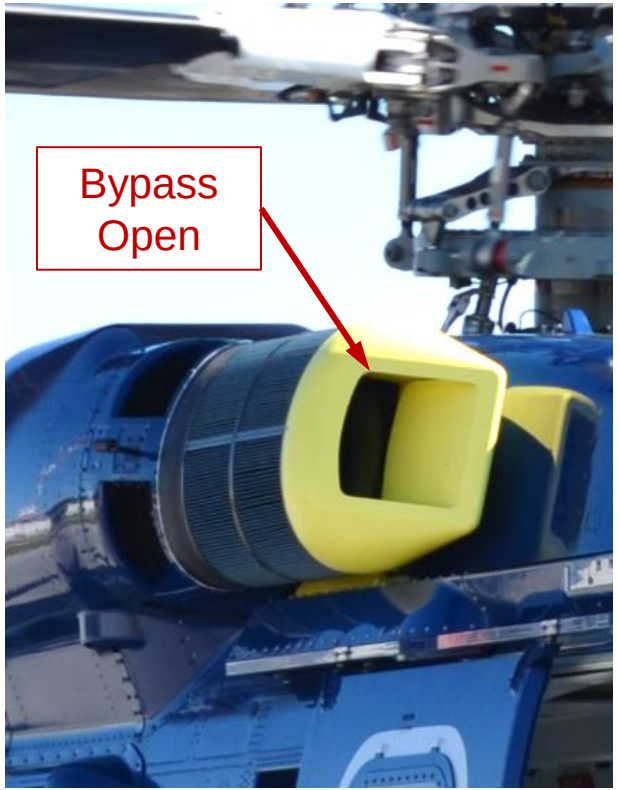
- Some designs provide real time filter blockage levels using a monitor, other designs provide indication once a threshold pressure differential value is obtained.



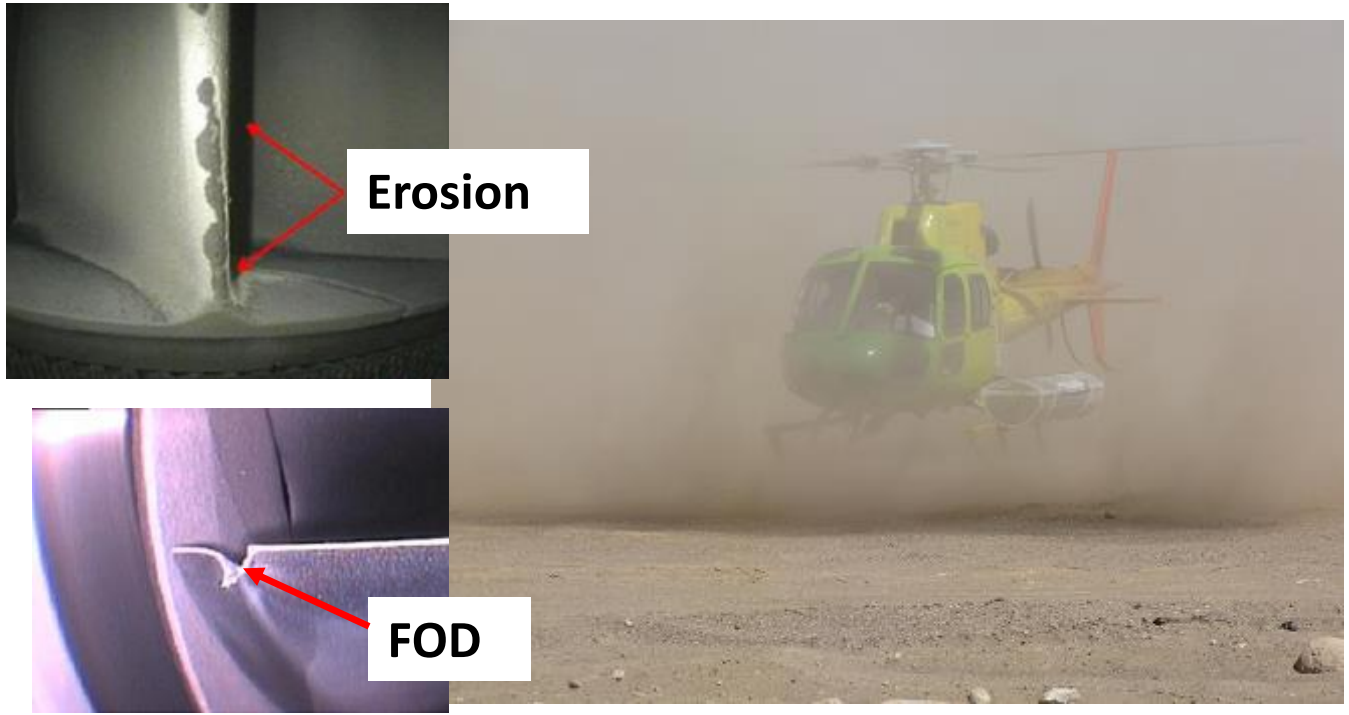


Inlet Barrier Filter - Overview

- If the filter system includes an integral bypass door, the door can be opened, providing power recovery to the engine.
- Dirty filters can be washed and re-oiled restoring most of the clean filter engine performance.
- Most operators keep a standby filter set oiled and ready to swap out to minimize aircraft down time.



Inlet Barrier Filter – In Operation



Inlet Barrier Filter – In Operation

Hollow Shaft
32g Dust Without Filter:

800 Hours

With Filter:

1500 Hours

Inlet Barrier Filter - Effect on Power

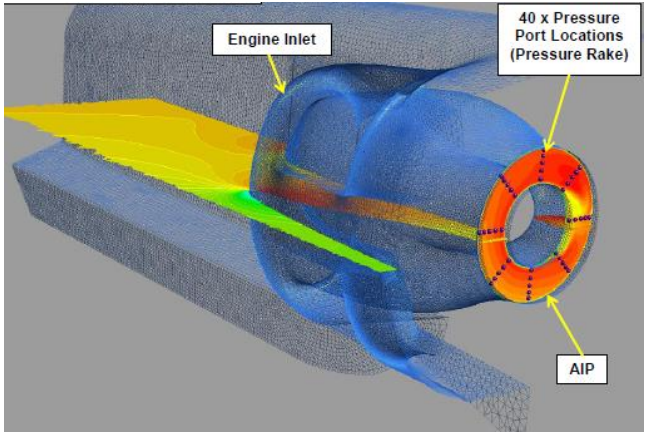
Effect on Power With a Filter Installed:

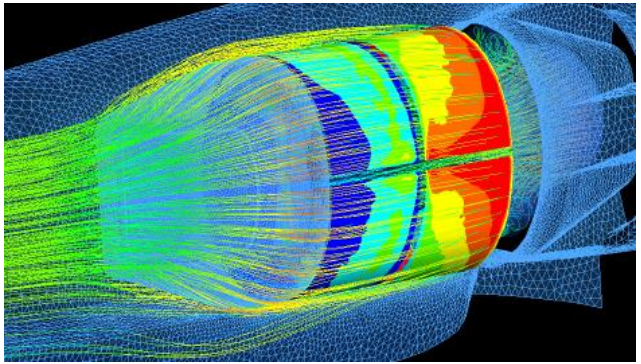
- With a filter is installed, there is less engine power available. Depending on aircraft inlet, engine, and filter design, this amount varies (1% to 15%).
- As the contaminants are collected, and pressure differential increases, resulting in an engine power available reduction.
- When the filter is cleaned, the engine power available is restored to clean filter levels.
- This cycle is repeated until TBO.

Inlet Barrier Filter - Effect on Distortion

- Addition of a filter can improve or worsen Distortion depending on aircraft and filter design, and therefore will need to be verified.

- Generally, installation of a filter dampens pulsing distortion caused by rotor blades. In engines sensitive to this, installation of the filter has resulted in improvements to engine power and performance.





SAE S-12 Committee

- **SAE (Society of Automotive Engineers) was founded in 1905 by Andrew Riker and Henry Ford. Notables include Thomas Edison, Orville Wright…**
- **SAE International now has nearly 140 000 members.**
- **SAE S-12 (Rotorcraft Powerplant) is under the Aerospace Propulsion Systems Group.**
- **93 Members from Engine, Aircraft & Systems OEM, Government and Private aerospace industry members.**
- **S-12 maintains 32 documents (3 work in progress), some of them published as far as 1956.**

SAE S-12 Committee

- **5 December 2016, the FAA requested that SAE forms a committee to create an ARP to :**
  - **provide means to substantiate that the IBF does not exceed distortion limits [14 CFR 27.901(c)(1) and 29.901(b)(1)(i)]; and**
  - **define means to determine and verify power available as affected by the IBF [14 CFR 27/29.45(c) and (f), and 29.59(a)(4)].**

- **The draft ARP6912 is named:**

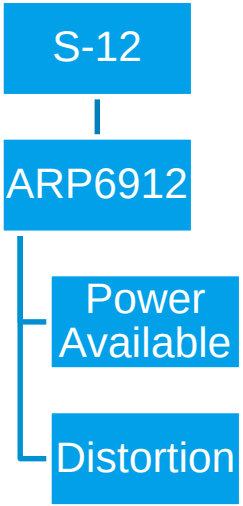
  Substantiation of Power Available and Inlet Distortion Compliance for Rotorcraft Inlet Barrier Filter Installations.

SAE S-12 Committee

- **20 March 2017, 20 members of the S-12 formed two sub-committees to start drafting the ARP6912.**

- **Each sub-committee includes specialists from these disciplines:**
  - Powerplant
  - Engine
  - Airframe
  - Flight Test

- **Icing is out-of-scope**



SAE ARP6912 - SUBSTANTIATION OF POWER AVAILABLE AND INLET DISTORTION COMPLIANCE FOR ROTORCRAFT INLET BARRIER FILTER INSTALLATIONS

SCOPE

This Aerospace Recommended Practice (ARP) identifies and defines methods of compliance to power available and inlet distortion requirements for rotorcraft with Inlet Barrier Filter (IBF) installations. The advisory material developed therein may be used as acceptable methods of compliance for determining power assurance, establishing power available, and for substantiating acceptable engine inlet distortion for IBF installations. It is agreed to treat dust, ice, salt water & snow as contaminants to IBF for the purpose of establishing power available and distortion.

RATIONALE

This SAE ARP is intended to safely improve the efficiency and expedite the certification process for the installation of inlet barrier filters on rotorcraft.

SAE ARP6912

- **Important Definitions:**
  - IBF as a system (filter, monitoring sub-systems)
  - Types of contaminants (including icing)
  - Types of blockage (clogged, blocked, contaminated)

- **Hot Topics:**
  - Involvement of engine manufacturers during design and testing (distortion)
  - Involvement of airframe manufacturers for STC (performance & distortion)
  - Acceptable performance penalty and PAC
  - Flight Test demonstration method
  - The use of bypass air as a mitigation

SAE ARP6912

- **Schedule:**
  - Estimate finalized draft by early next year
  - Submission to FAA by summer

THANK YOU