

CFM56-7 main engine fuel pump shaft seal leakage



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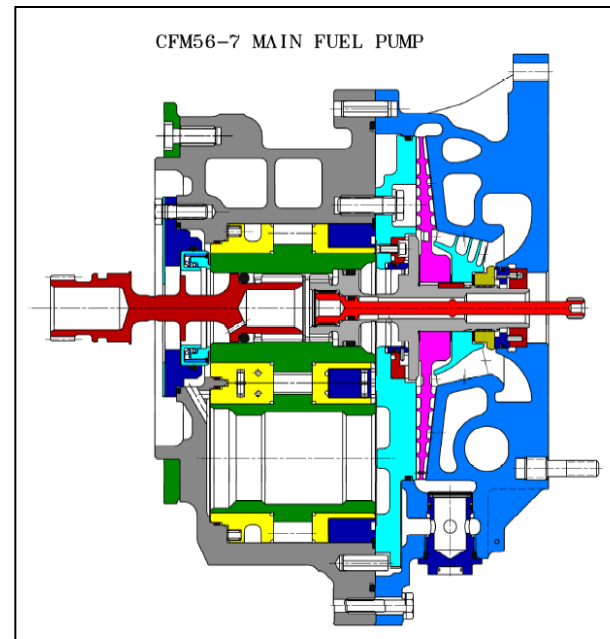
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Agenda

- Issue
- Configurations
- Root cause
- The solution
- Solving your leakage issue

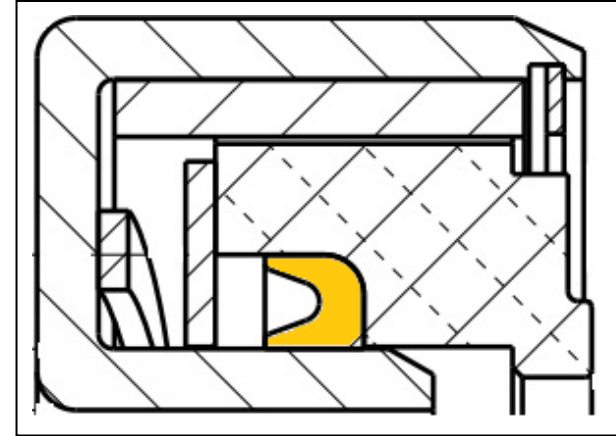
Issue/application

- Leakage from overboard drain mast
- CFM56-7 / 737 NG Main Engine Fuel Pump
 - Pump model 828300
- Lightly loaded seal provides long life
 - Early Tec-ring configured shaft seals in 828300-3/4/5 pumps prone to weeping
 - Later O-ring configured shaft seals in 828300-5/8 pumps exhibit occasional heavy leakage at engine start



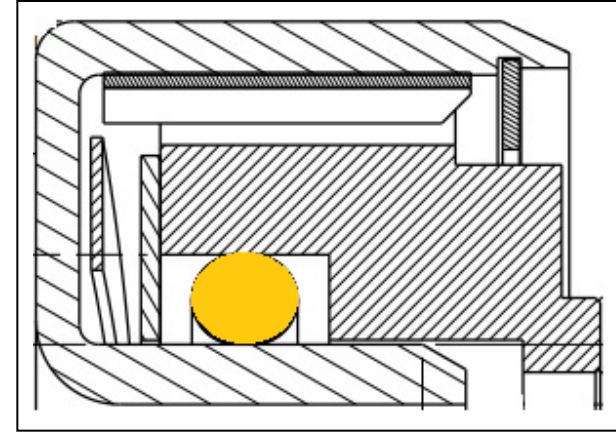
Tec-ring configured shaft seal

- OEM shaft seal 1994 through 2008
- Occasional leaks overnight or during inactive periods
- Typically low rate leakage – < 0.1 cc/min and often considerably less
- Leakage stops during 5-minute ground engine run (trouble-shooting per AMM)
- Leakage reoccurs frequently



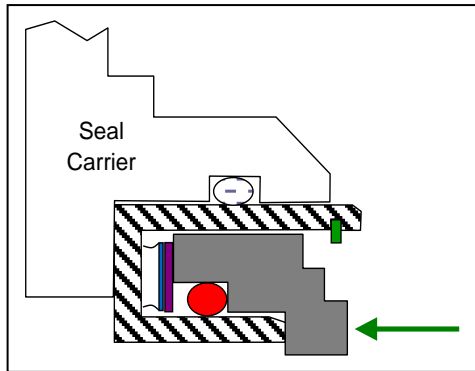
O-ring configured shaft seal

- Pump leaks at first start of the day
- Leakage is heavy stream
- Leakage stops during 5-minute ground engine run (trouble-shooting per AMM)
 - Zero leakage measured in 5 minutes
- Leakage events recur intermittently
 - 1 day to 4 months between leakage events
 - Pump removed when leakage exceeds AMM limit, pilot request or after repeated leaks

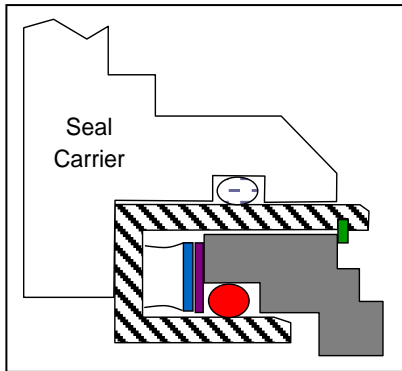


Root cause

- Leak caused by separation between carbon nose and seal runner (seal-liftoff) at engine start condition
 - Requires axial movement of seal during prior engine shutdown/cooldown



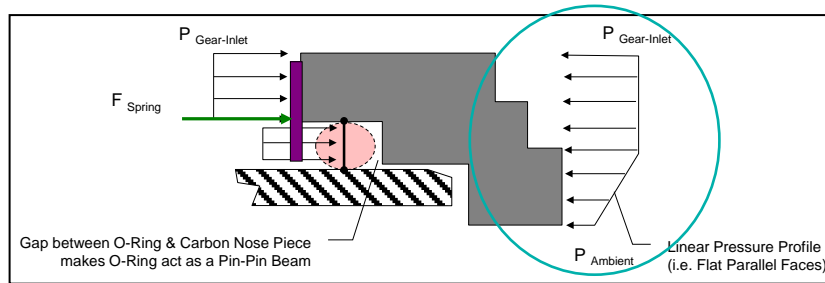
Seal compressed – O-ring slides on cup neck



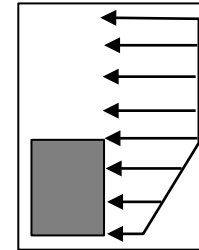
Seal extends – O-ring *rolls* away from carbon nose piece leaving gap between O-ring and carbon piece gland wall

Root cause

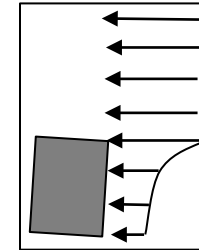
- Leak caused by separation between carbon nose and seal runner (seal-liftoff) at engine start condition
 - Requires atypical pressure distribution across carbon



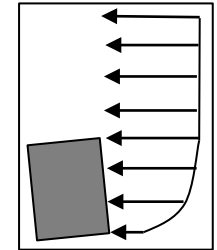
Seal compressed – O-ring slides on cup neck



Typical



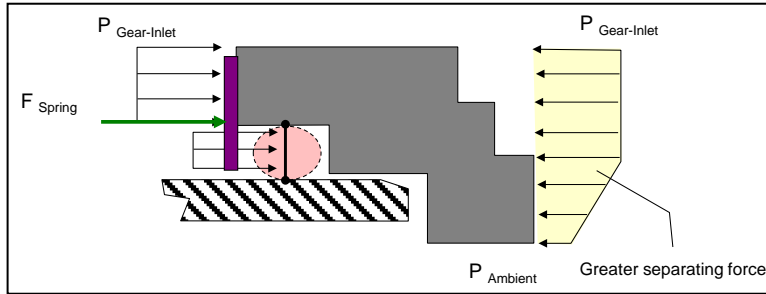
Atypical



Atypical

Root cause

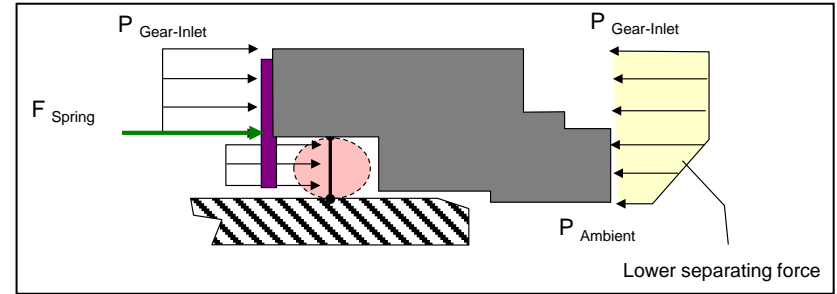
Lift-off likely due to low pressure balance ratio



Current design

Low pressure balance ration

- Higher separating force
- More susceptible to process variation
- Lower face pressure (less wear)

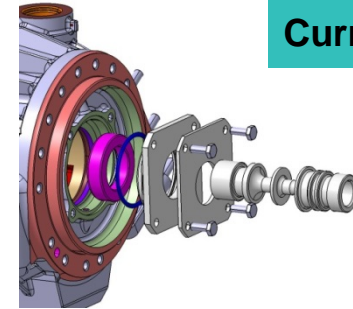


High pressure balance ration

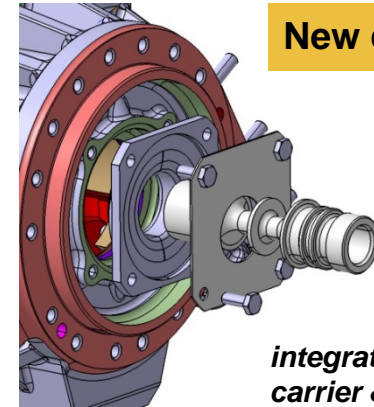
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- Less susceptible to process variation
- Greater face pressure (more wear)

Solution

- Shaft seal redesign agreed between Eaton and Snecma
 - Redesign eliminates the shaft seal lift-off by addressing 2 of the 3 contributing factors (Increased pressure balance and elimination of cup axial movement during transients)
 - Significantly reduces risk of “lift off” due to process variation
 - Anticipated availability is Q2 2017



Current config.



New config.

integrates current seal carrier & seal

Implementation

Eaton now shipping 828300-8 fuel pump

- Equipped with optimized 220063 shaft lapped to 1 HLB flatness
- Upgrade available via SB0212
- Design remains susceptible to lift-off due axial movement and uneven face wear

New shaft seal in development for release Q2 2017

Eaton will extend all SB0209 commercial terms to any 219982 or 220063 shaft seal

- Free of charge repair for pumps with less than 5 years or 3000 hours
- 50% parts credit allowance for pumps with less than 14,500 hours

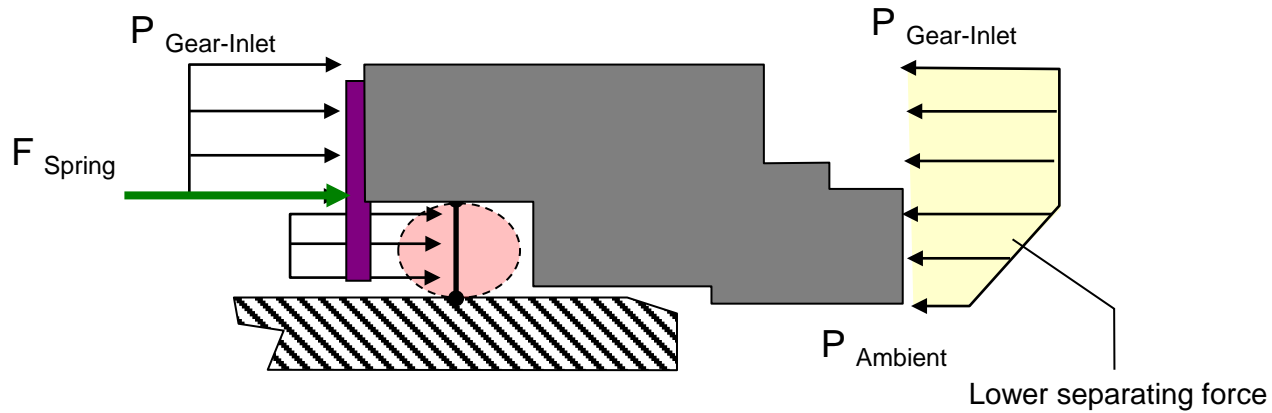


Questions/Comments



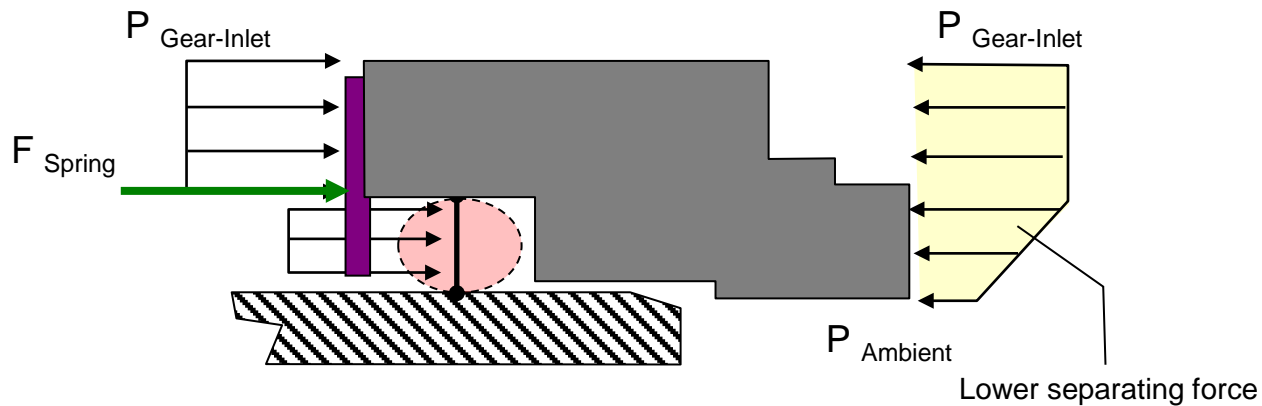
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