

General Service Bulletin (GSB):	Engine Failure Analysis Tips
GSB Overview:	This bulletin supplements Workshop Manual information by providing images of engine failures and tips for preventing repeat occurrences.
NOTE: This information is not intended to replace or supersede any warranty, parts and service policy, Work Shop Manual (WSM) procedures or technical training or wiring diagram information.	

Engine Failure Analysis Tips

Guide to Preventing Repeat Engine Failures

Engine Failure Analysis Tips

**READ THIS TO HELP PREVENT
NON-WARRANTABLE REPAIRS**



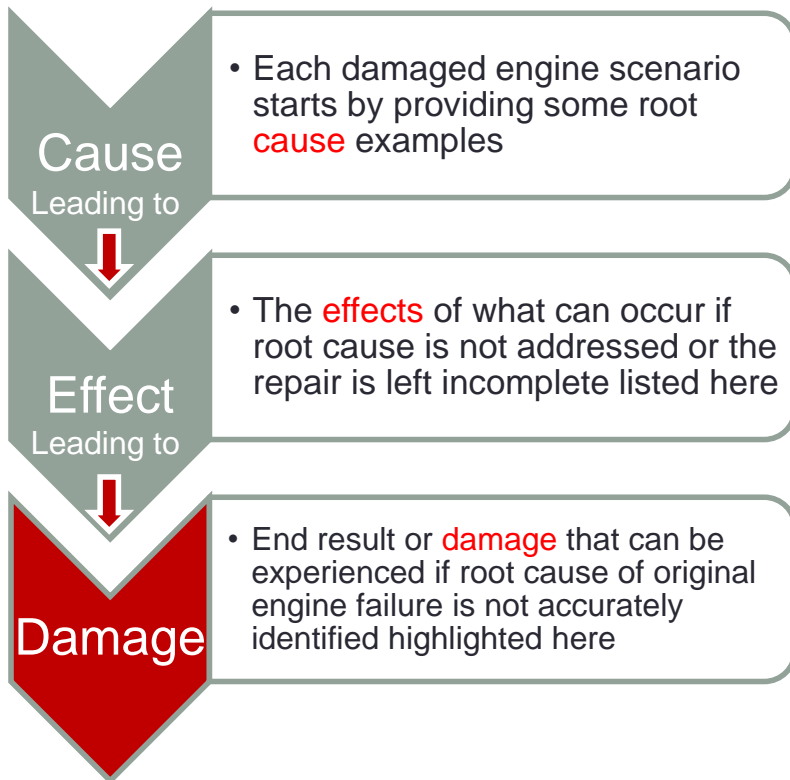
**BEFORE ENGINE IS REPLACED
AND VEHICLE STARTED**

Engine Failure Analysis Tips

Overview

Guide to preventing repeat engine failures

Progression List



In situations where partial diagnosis suggests engine replacement may be necessary, such as:

- Bearing damage
- Engine noise
- Cylinder misfire
- Loss of compression
- Metal contamination
- Undetermined oil consumption

If the true root cause is not identified (with visual confirmation to the extent of total damage), an over repair or an incomplete repair leading to repeat engine failure may result.

This bulletin targets specific gas engine failure modes and includes a progression list highlighting:

- Cause
- Effect
- Damage

The progression list assists in identifying certain common operational concerns, overlooked contamination scenarios, and incomplete repair possibilities. (see example on left)

Engine Failure Analysis Tips



Piston Damage

- Pre-ignition
- Excessive Levels of Detonation
- Engine Performance Modifications
- Aftermarket Fuel System Modifications

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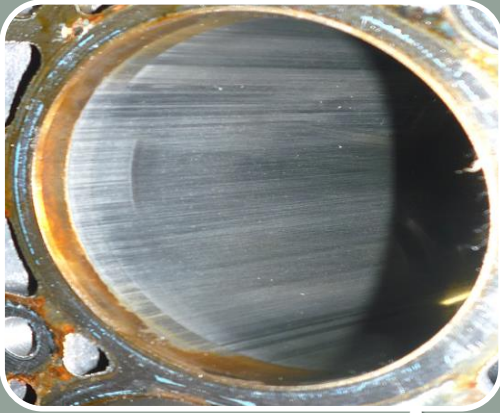
Misfire from Valve Leakage

- Excessively Lean Conditions
- Excessively High Cylinder Temperatures
- Aftermarket Induction Modifications

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Engine Failure Analysis Tips



Cylinder Wall Scuffing & Scoring

Catalyst Material Ingestion

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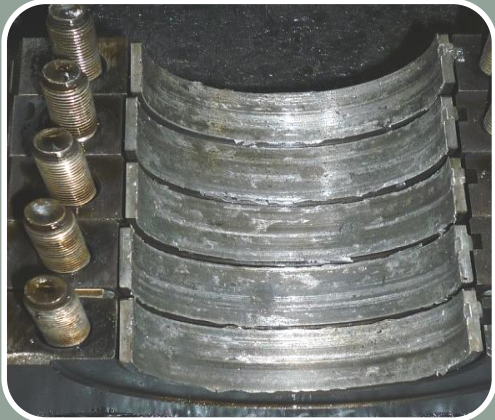


Piston and Valve Damage

Foreign Object Debris

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Engine Failure Analysis Tips



Severe Oil Consumption

Open Breather Tube Fitting in Place of PCV Valve on 2v Modular V8 & V10

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Bent Connecting Rod

Hydrolock
Injector Failure
External Water Ingestion

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Engine Failure Analysis Tips

Piston Damage

**Pre-ignition
Excessive Levels of Detonation
Aftermarket Modifications and Lean Conditions**

Engine Failure Analysis Tips

Pre-ignition, Detonation, and Lean Conditions

Lean or Modifications

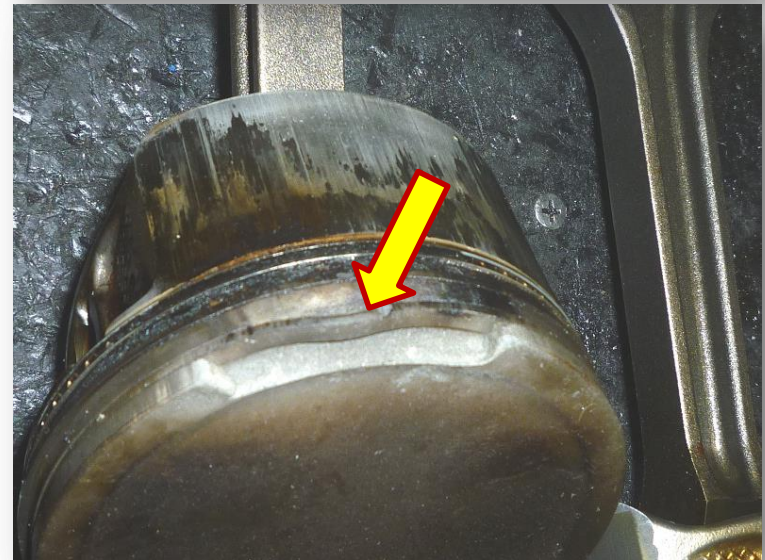
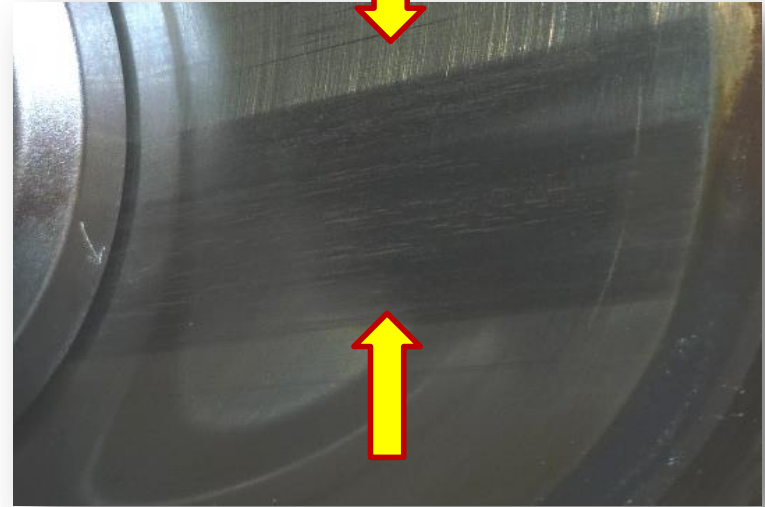
- Modifications (timing, CNG, incorrect spark plug)
- Overboost (Supercharger / Turbocharger)
- PCM Performance Chip / Programmer
- Lean conditions
- Mass Air Flow (MAF) sensor failure
- Damaged air inlet (MAF sensor turbulence)

High Cylinder Pressure or Spark Knock

- Excessively high combustion temperatures
- Excessive cylinder pressure
- Pre-ignition
- Excessive levels of detonation (fuel quality / low octane, etc.)

Damage

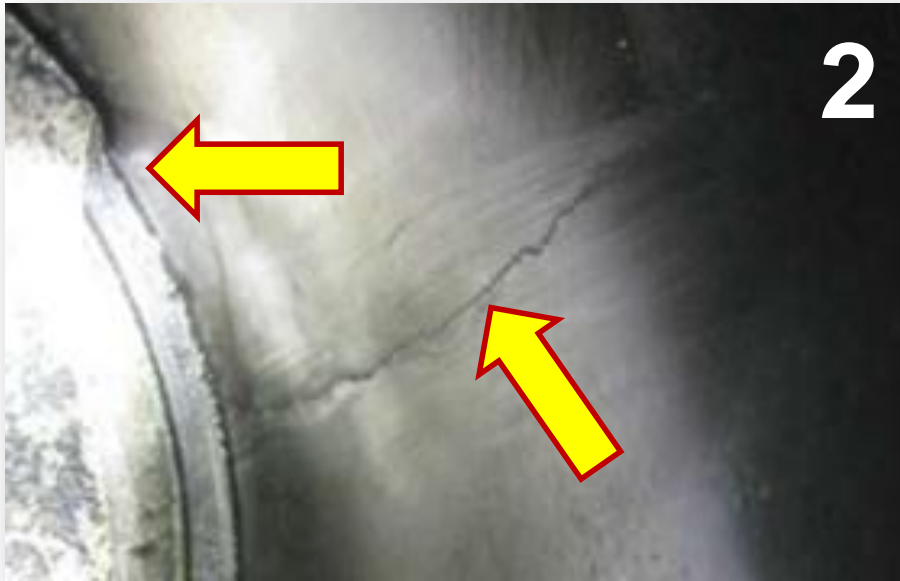
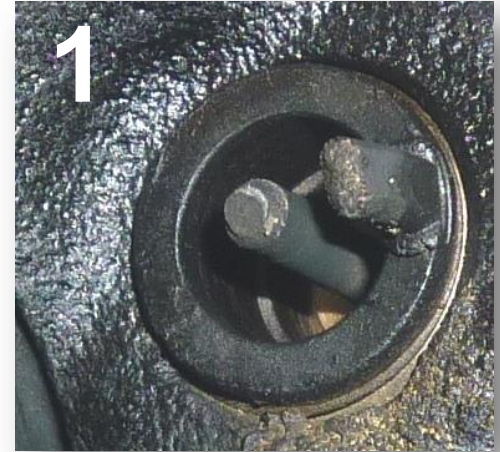
- Spark plug electrode damage
- Hole in center of piston (pre-ignition)
- Piston ring land damage (detonation)
- Pitted piston tops
- Cylinder wall scoring



Engine Failure Analysis Tips

Pre-ignition, Detonation, and Lean Conditions

1. Spark plug damage (porcelain fractured or electrode melted off) is an indication of excessive detonation.
2. Heat generated from friction caused cylinder wall to crack (note upper ring land damage).
3. Excessive levels of detonation cause excessive cylinder pressure spikes leading to piston ring land fractures. In this instance, the less obvious second ring land is damaged.



Engine Failure Analysis Tips

Misfire from Valve Leakage

Excessively Lean Conditions
Excessively High Cylinder Temperatures
Aftermarket Induction Modifications

Valve “Tuliping”

Engine Failure Analysis Tips

Valve Tuliping

Lean

- Induction modifications
- Mass Air Flow (MAF) sensor failure
- Damaged air inlet affecting MAF performance
- Incorrect air/fuel mixture

Lacks Power

- Excessively high combustion chamber temperatures
- Lean running engine = HOT

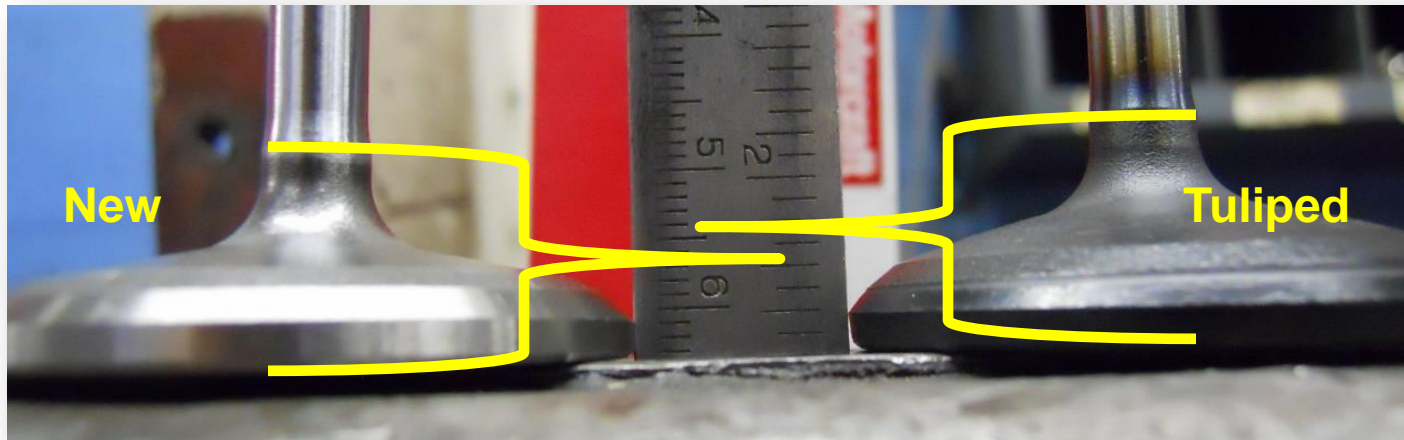
Damage

- Valve tuliping
- Valve seat recession



Engine Failure Analysis Tips

Valve Tuliping



If cylinder leakage is present past the valves:

- Check for valvetrain components out of position that could hold the valve open
- Check if the valve stem is sticking in the valve guide
- Inspect for possible debris preventing the valve from contacting the valve seat

Excessively lean conditions can cause valves to overheat. As an overheated, softened valve opens and closes on the valve seat, it will deform. The valve will no longer seal on the valve seat as it stretches or “tulips” causing leakage and a misfire.

Comparing total valve height of the suspect valve to a known good valve can help identify issues. A height difference in the suspect valve is an indication of valve tuliping.

Remember: Valve tuliping is the effect, not root cause of the concern.

Engine Failure Analysis Tips

Cylinder Wall Scuffing & Scoring

Catalyst Material Ingestion

Engine Failure Analysis Tips

Catalyst Material Ingestion

Mixture Issues

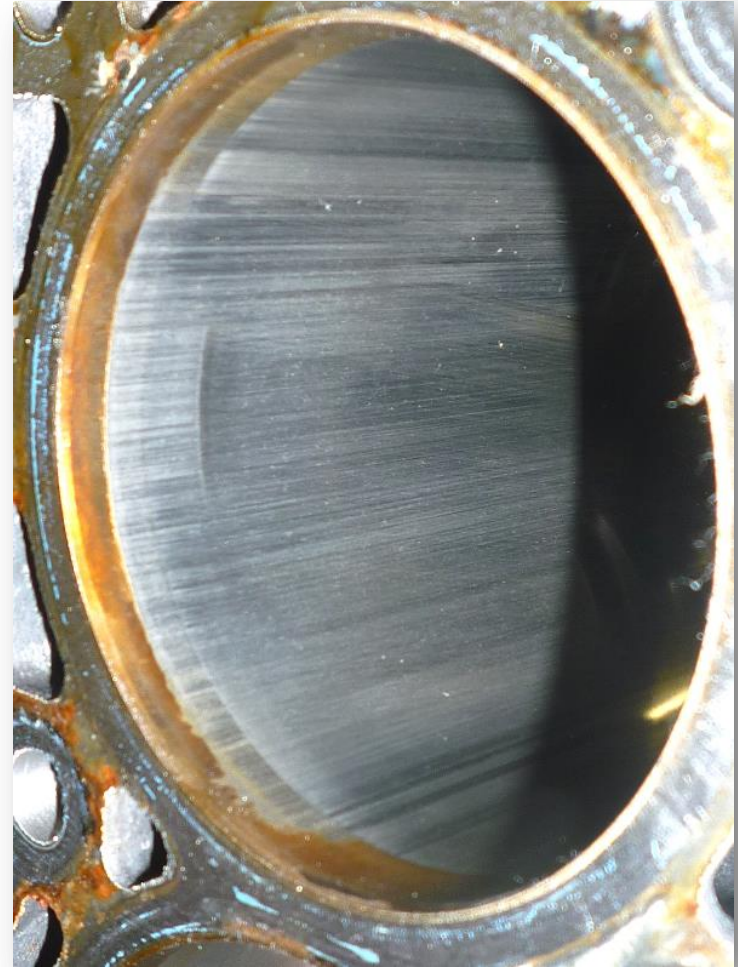
- Excessive Oil consumption
- Lean conditions
- Rich conditions
- Cylinder Misfire

Deterioration

- Catalyst material begins to dust or flake
- Catalyst dust or “sand” is pulled back into engine

Damage

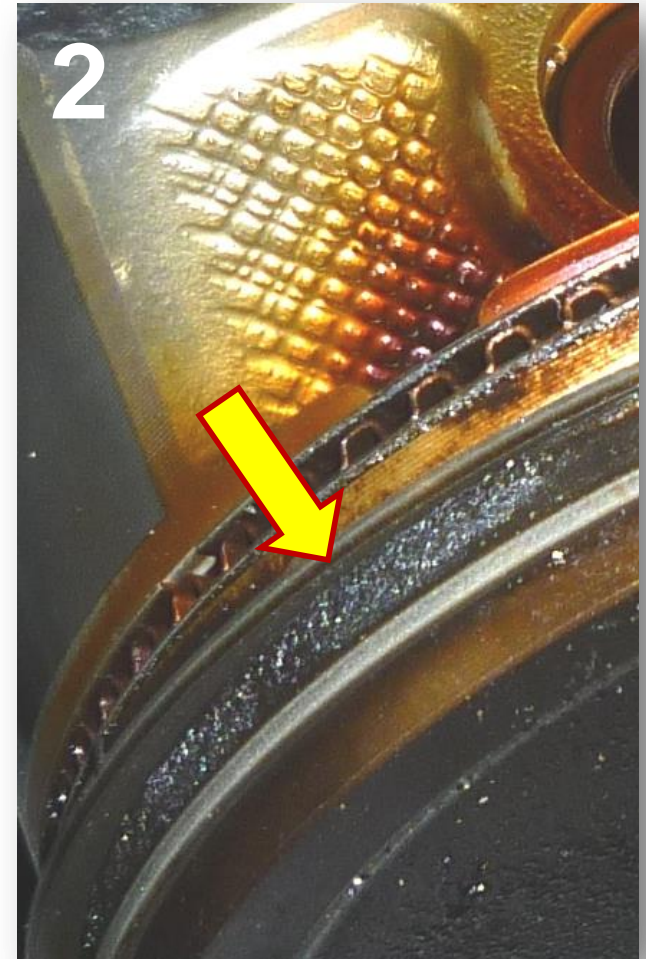
- Cross hatch is scraped/polished off cylinder walls. Bearing surfaces can be damaged if material is pushed past piston rings into the engine oil



Engine Failure Analysis Tips

Catalyst Material Ingestion

1. Inspection alone may not reveal deterioration. Tip the exhaust and check for debris falling out.
2. Catalyst material can collect on the sides of the piston damaging cylinder wall surfaces.



Engine Failure Analysis Tips

Foreign Object Debris

Piston and Valve Damage from Contamination Transfer

Foreign Object Debris

Contamination

Engine Failure

- Catastrophic combustion chamber damage
 - Broken pistons or rings
 - Broken valves
 - Dropped valve seats

Debris Transfer

- Original intake manifold transferred to the new engine
- **Warning:** Intake manifolds CANNOT be cleaned effectively in these instances!

Damage

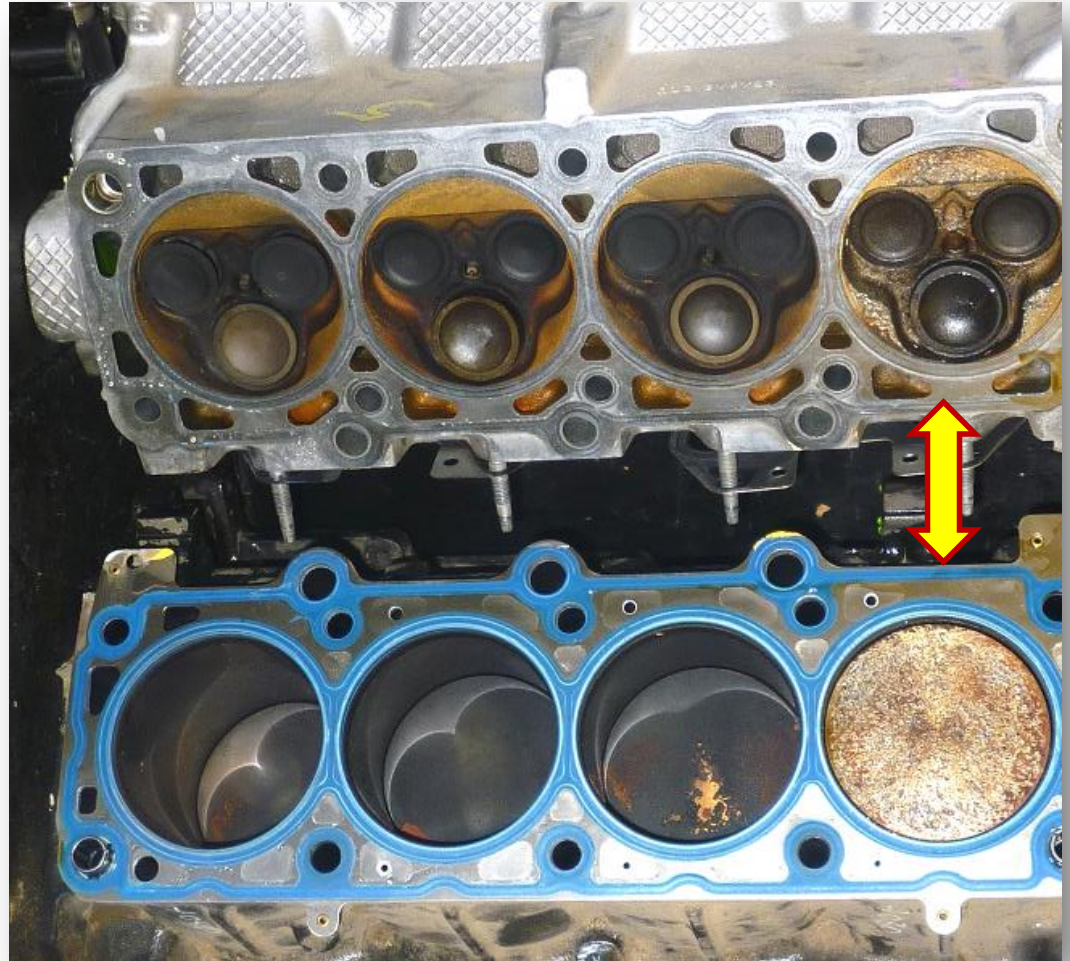
- Engine vacuum dislodges debris trapped in intake manifold. This can damage multiple engines if the intake manifold is not replaced.



Engine Failure Analysis Tips

Contamination

- Intake manifold must be replaced in these instances.
- Hot metal can adhere itself to the intake. Engine vacuum over time will dislodge debris damaging new engines.
- Understanding the extent of damage can help provide a complete estimate for the customer (i.e. engine + intake manifold).



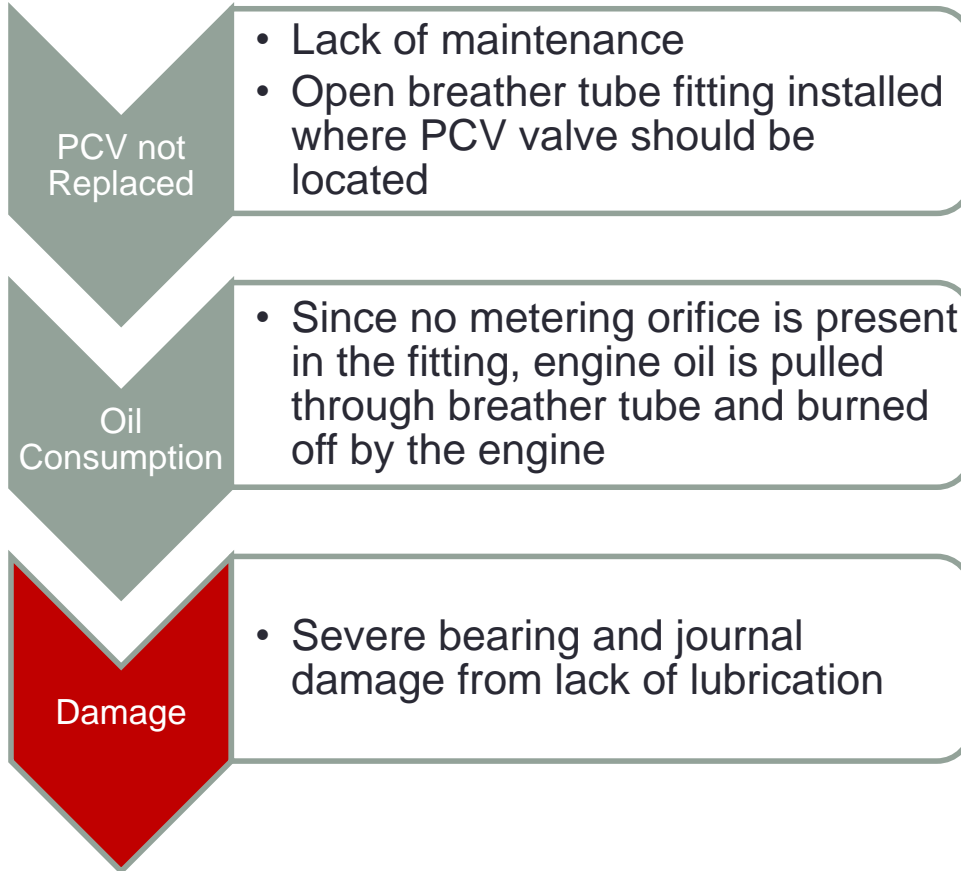
Engine Failure Analysis Tips

Severe Oil Consumption

Repeat Bearing Failure

Engine Failure Analysis Tips

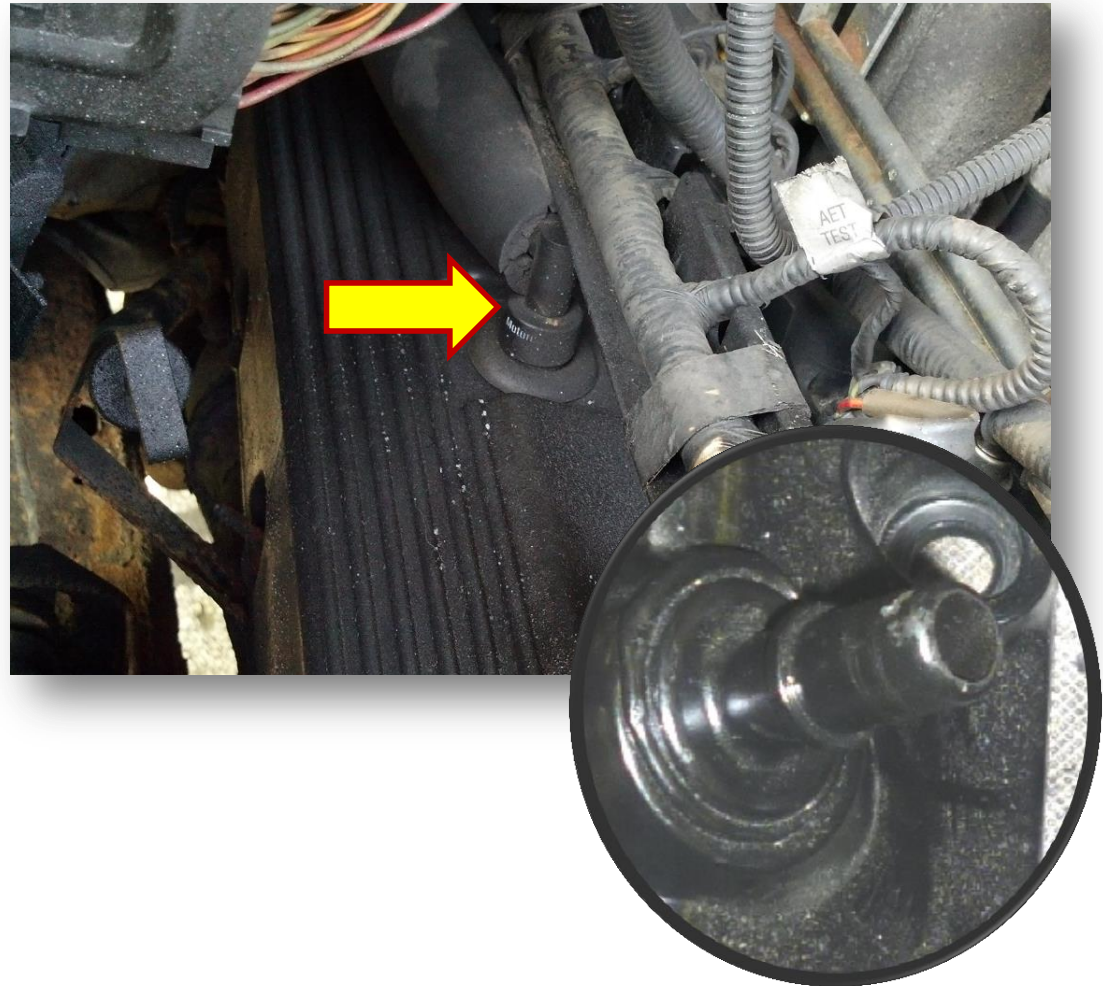
Repeat Bearing Failure



Engine Failure Analysis Tips

Open breather tube fitting in place of PCV valve

- **Notice:** On multiple/chain engine replacements, an open breather tube fitting (mistaken for a PCV valve) could be transferred from engine to engine causing bearing failure.
- Remanufactured Modular 2v V8 and V10 engines **NEVER** come with a PCV valve installed.
- If a PCV valve appears to be in place on a newly-installed Remanufactured 2v V8 or V10 engine, **REPLACE** it.



Engine Failure Analysis Tips

Bent Connecting Rod

Hydrolock

Engine Failure Analysis Tips

Hydrolock

Liquid
Ingested

- Stuck open or leaking fuel injector
- Water ingestion through air inlet
- Note: Air filter may appear water-damaged or warped

Hydrolock

- Liquid cannot be compressed

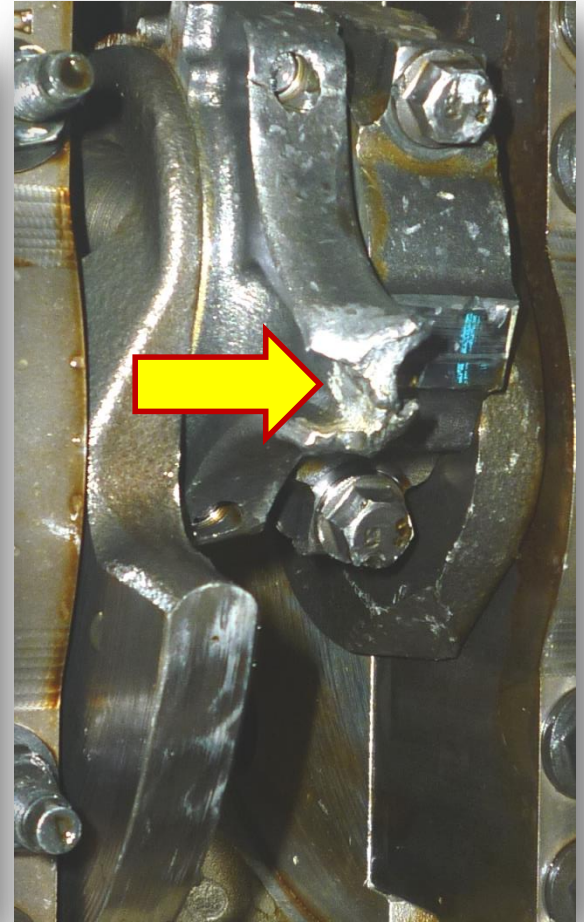
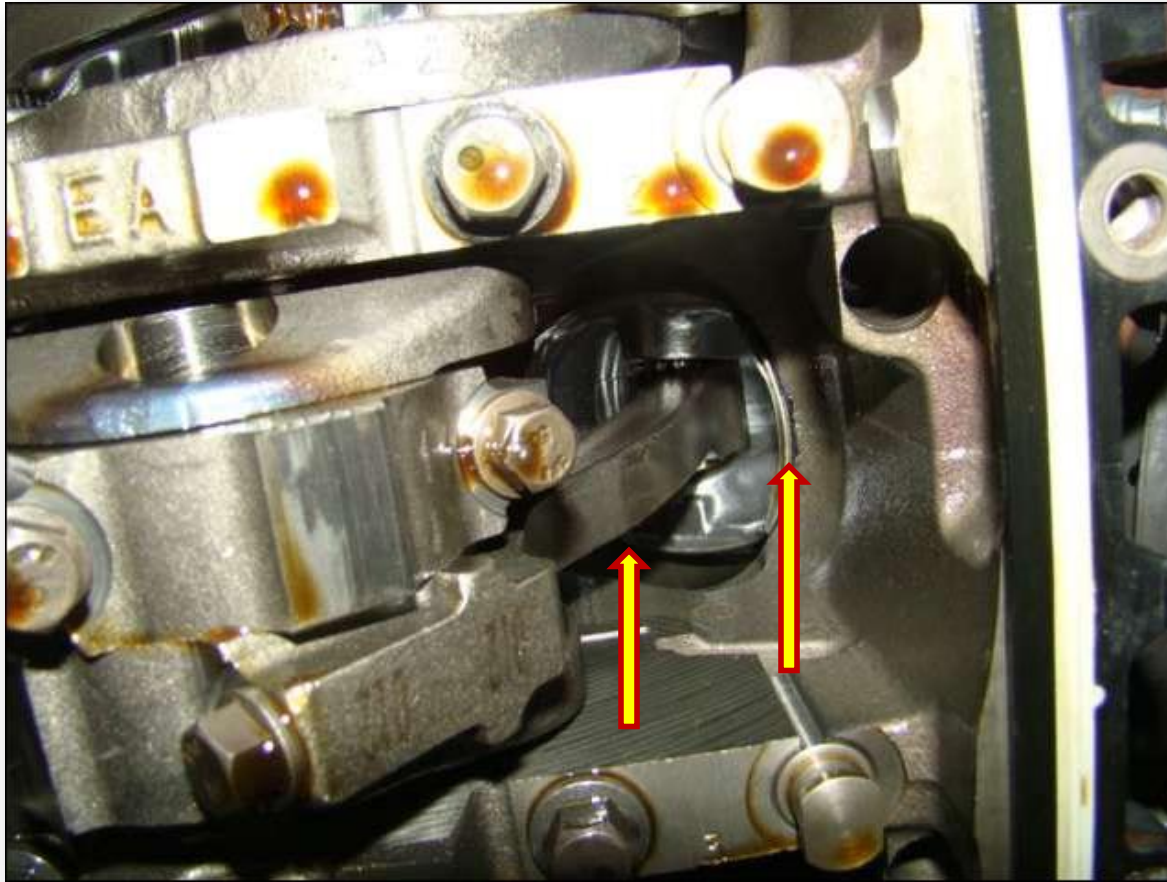
Damage

- Connecting rod bends or breaks



Engine Failure Analysis Tips

Hydrolock



Since fluids cannot be compressed, the connecting rod typically suffers from a hydrolock event.