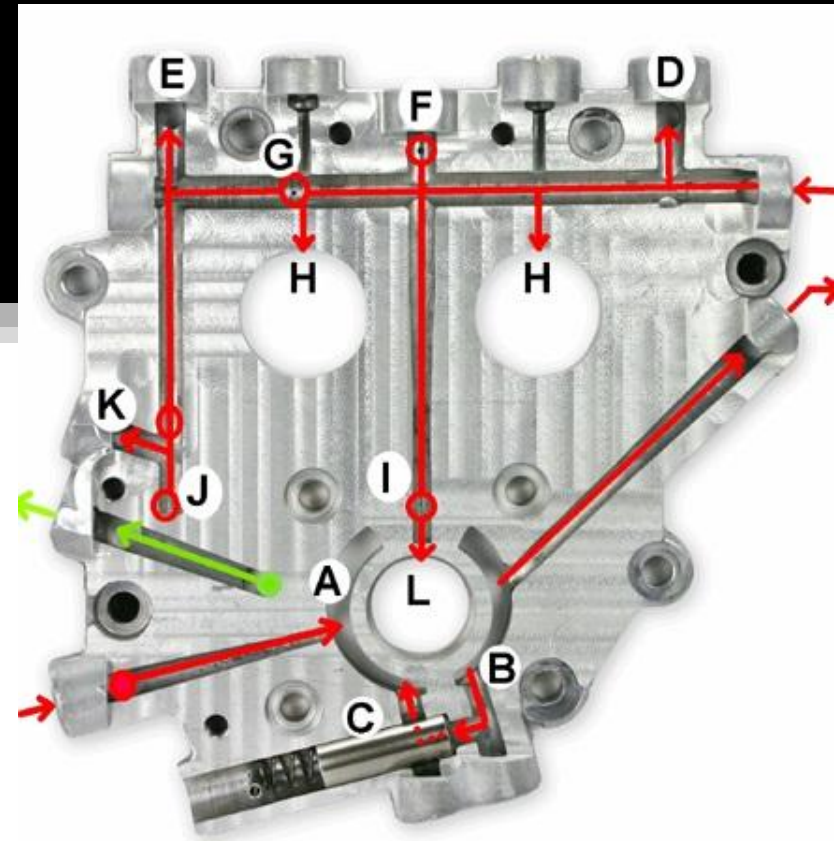




Oiling & Valve Train Issues & Solutions

Solutions Engineered for
Twin Cam™ Engines, Based on
Commonly Found Problems in the
Field



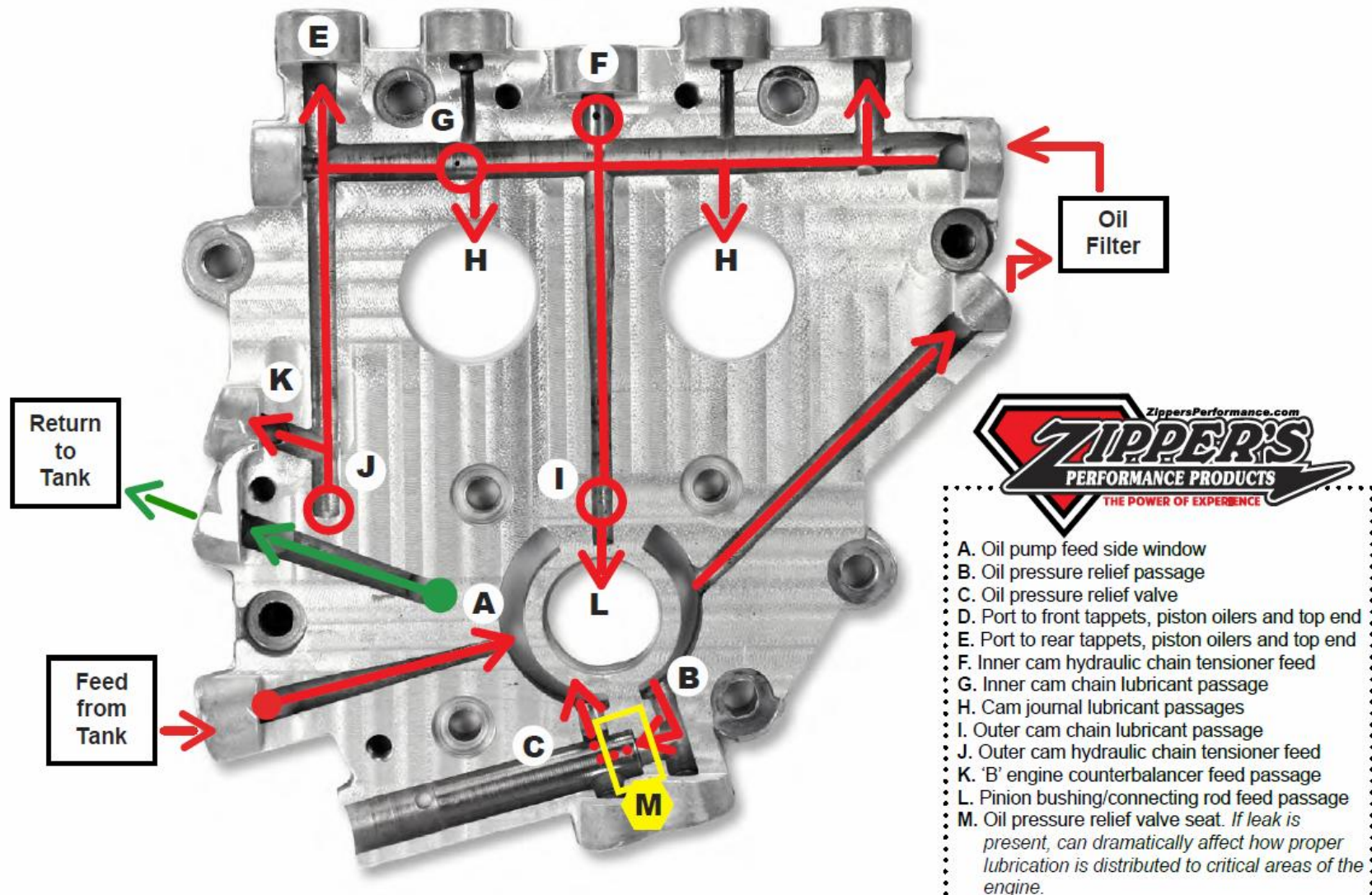


Common Issues

- **Low Oil Pressure**
 - Accelerated Internal Component Wear
 - Noise
 - Performance Loss
 - Heat Build-up at High Pressure Points in Engine
- **Causes – Internal Wear**
 - Leaking Oil Pressure Relief Valve
 - Casting Porosity
 - Cam Support Plate
 - Loose OEM Tolerances
 - Out of Spec Bushings
- **Affected Components:**
 - Cam Event Timing
 - Cam Chain Tensioners
 - Lifters
 - Rocker Arm Assemblies
 - Valve Tips, Valve Stems

Cam Support Plate

Oil Distribution - Twin Cam Engine



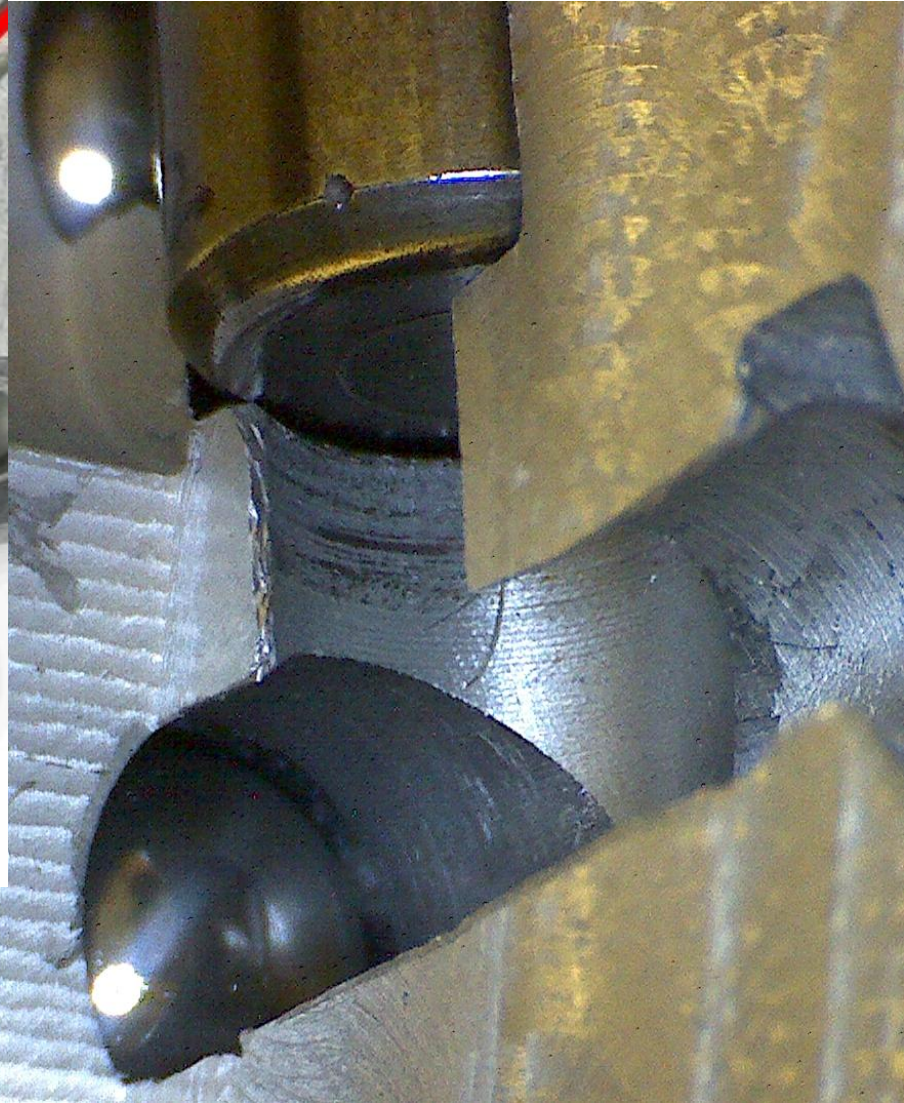
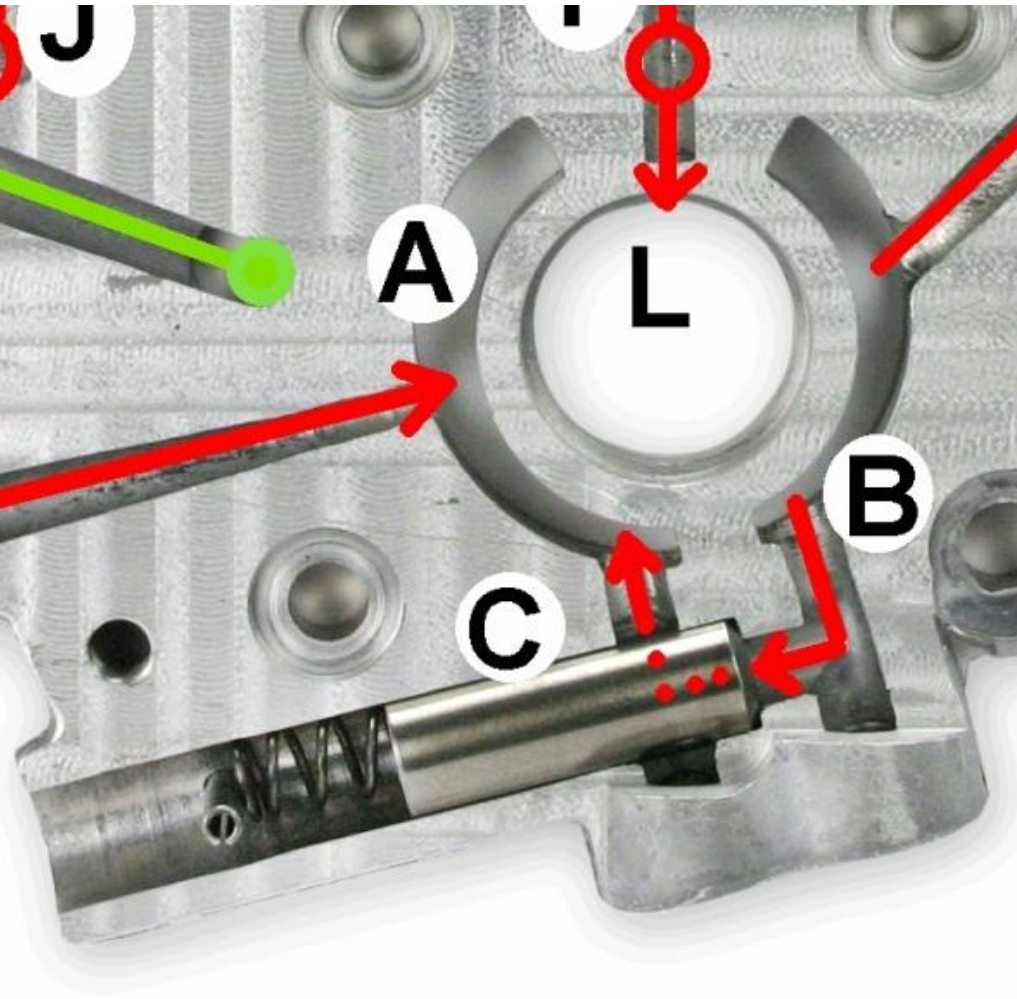


Oil Pressure Relief Valve

How it Works

- **Simple Valve Sealing on Seat**
 - Spring sets Open / Close Pressures
- **Blow-Off Pressure**
 - Limits the Maximum Oil Pressure the Engine Sees
 - Non-Adjustable from Factory
 - OEM = 40-42 psi, Zipper's recommends 50-60 psi
- **Reseat Pressure**
 - Pressure where the Valve Closes, After being Opened
 - You want the Valve to Release Excess Pressure, but Close once it's No Longer Excessive (RPM Based)
 - Heavily Leaking Valves will not Audibly Reseat when Checked
- **% Sealing at Idle RPM**
 - Many plates have between 50-100% leak
 - If the Pump is Producing 10 psi, 5-10 psi will be Lost

Oil Pressure Relief Valve





Oil Pressure Relief Valve

Why Does the Oil Pressure Relief Valve Leak?

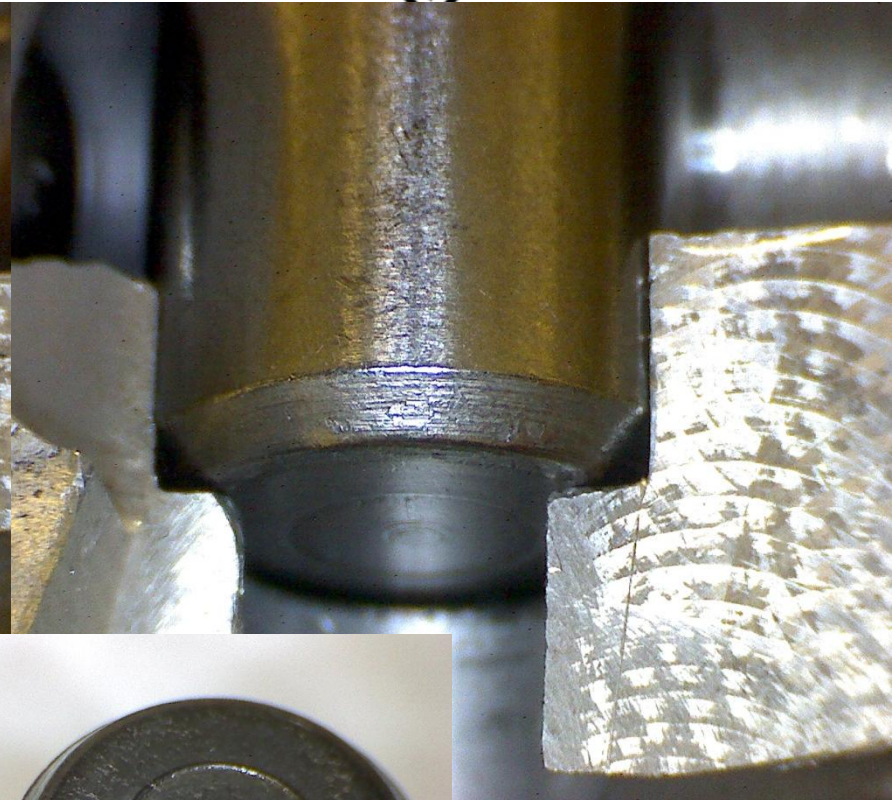
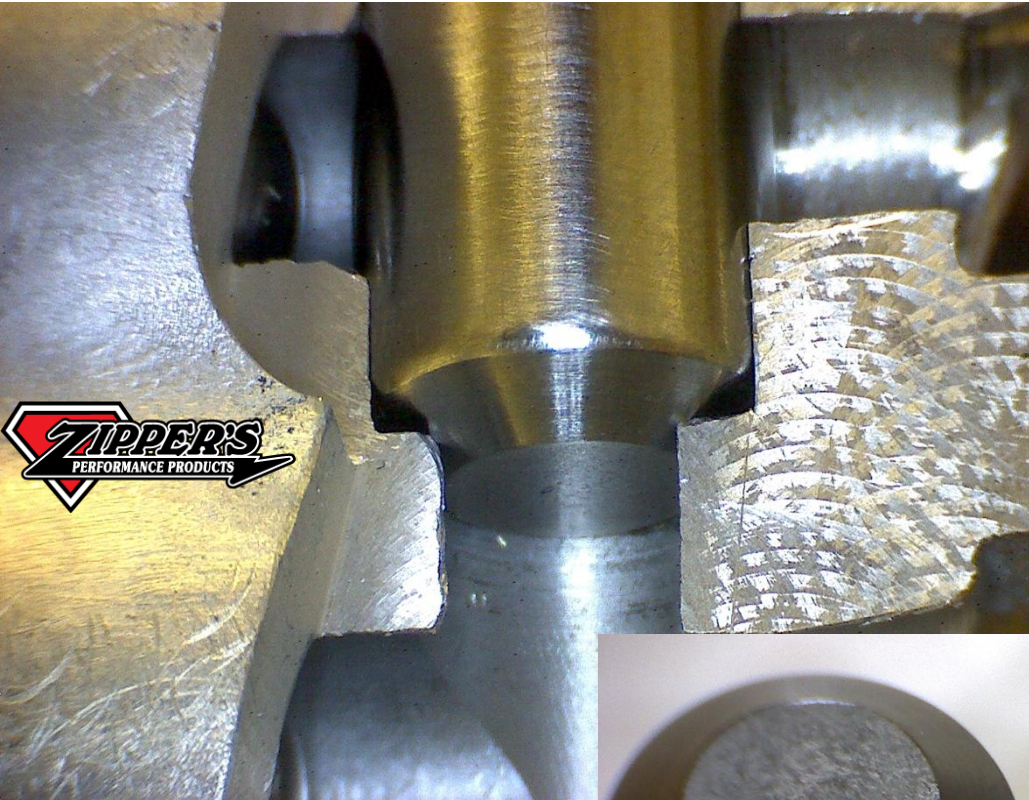
- **General Design**

- Non-Machined Seat in the Cam Support Plate
- Non-Concentric Chamfer on Sealing Plunger
 - OD Precision Ground
 - Seat Angle not Ground or Matched to Cam Support Plate

- **Manufacturing Issues**

- Porosity in the Cam Support Plate at the Seat
 - Investment Castings are known for Porosity Issues
- Non-Repairable in most cases
 - A proper Seat Angle cannot be added
 - Material Crumbles away after use
 - Material Missing on the Seat Surface

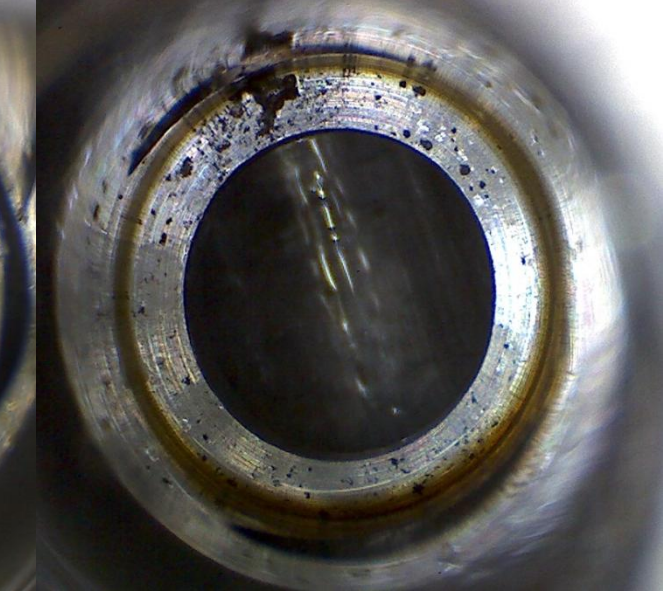
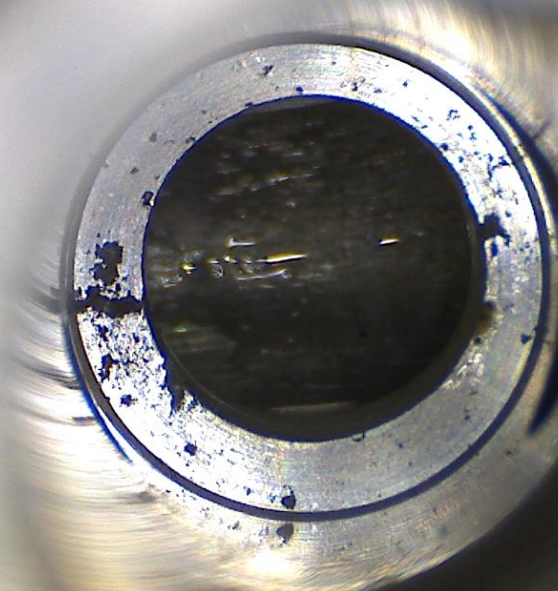
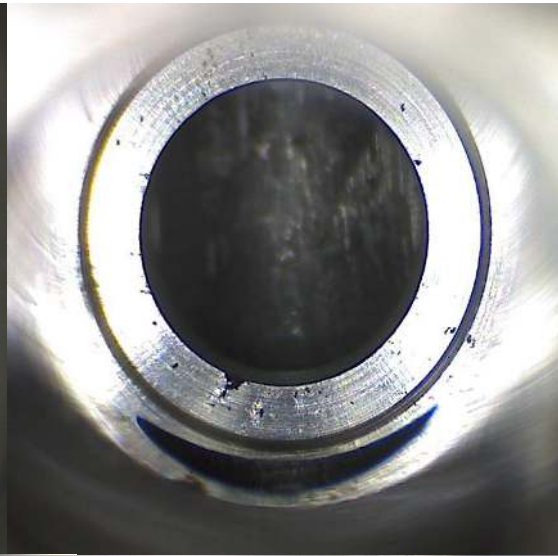
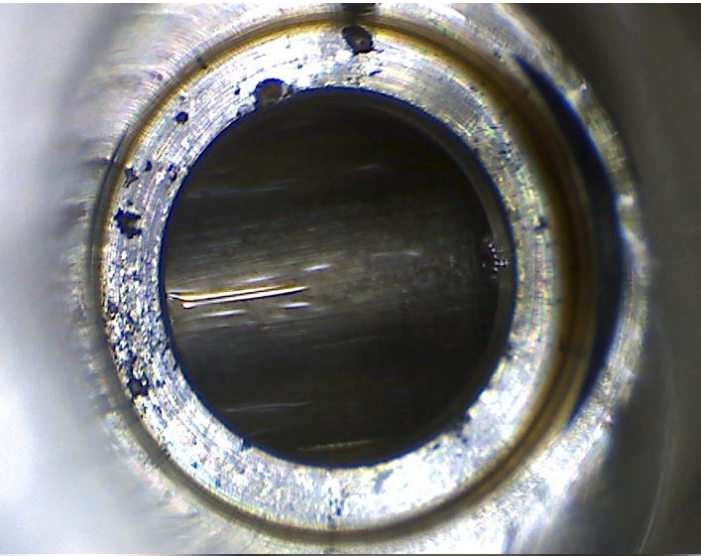
Oil Pressure Relief Valve



Baisley
HI-PERFORMANCE

Oil Pressure Relief Valve

Typical Porosity Found in OE Cam Support Plates, Magnified Oil Pressure Relief Valve Seat

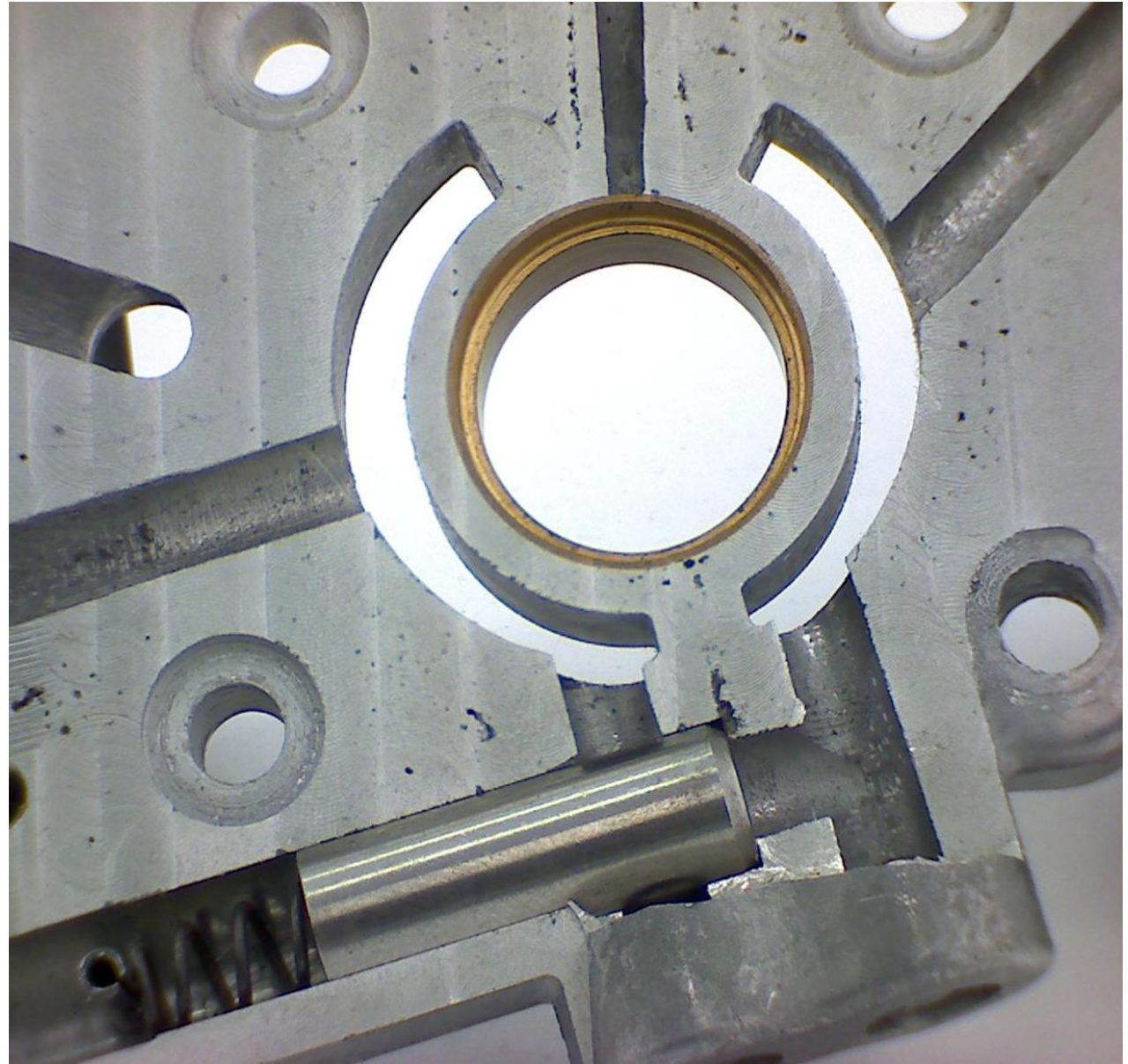


Oil Pressure Relief Valve

OE Cast Cam Support
Plate – Cutaway View

Note the Extent of
Porosity Through the
Entire Casting, and the
Significant Void at the
Oil Pressure Relief
Valve Seat

This is the Key
Component in Oil
Distribution in the Entire
Engine, and one of the
Largest Sources of
Internal Leaks.

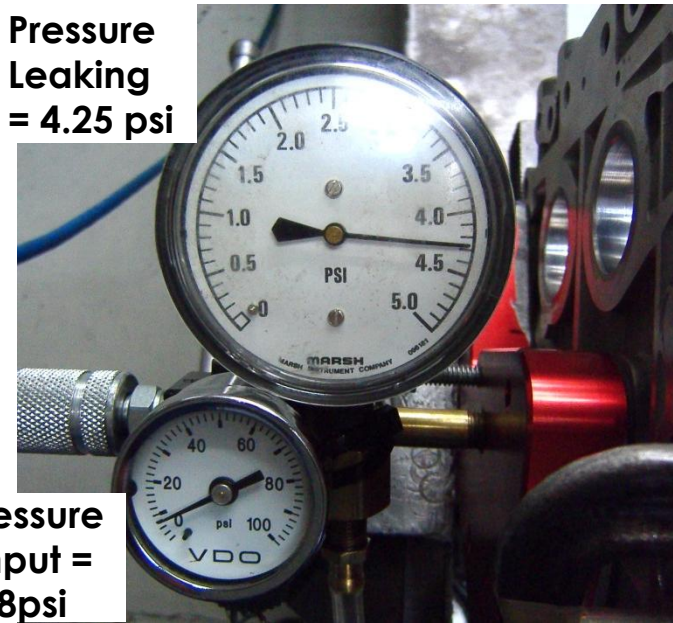


Oil Pressure Relief Valve

What Happens When it Leaks?

- **Lower Overall Oil Pressure**
 - Dangerously Low at Idle for Critical Top End Components
 - Valve Train sees Significantly Less Pressure than the Gauge
 - Gauge Pressure is Measured Pre-Oil Filter
 - Relief Valve Located Very Early in the System, Right after Pump
 - Numerous Leaks & Oiling Functions between Gauge and Rockerbox, Reducing the Top End Oil Pressure
- **Valve Train Noise**
 - Inadequate Lubrication
 - Compromised Hydraulics
 - Cam Chain Tensioners
 - Lifters
- **Premature Component Wear**
 - Every Internal Part that moves!
- **Increased Engine Temperatures**
- **Increased Overall Engine Noise**

Pressure
Leaking
= 4.25 psi

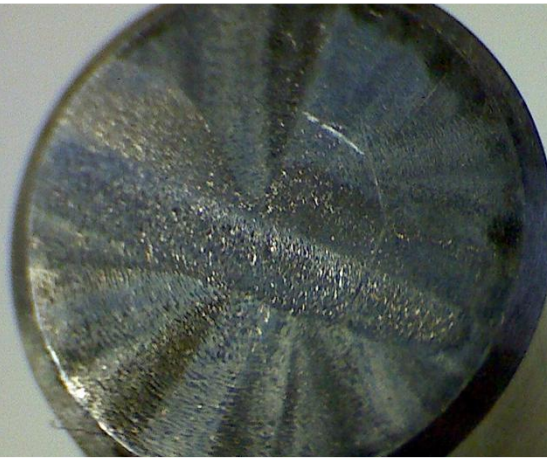


Pressure
Input =
8psi

Oil Pressure Relief Valve

What Happens When it Leaks?

Accelerated Internal Wear – Valve Stems & Tips, Rocker Arm Tips & Bushings, Lifters



Increased Heat & Stress on High Pressure Components (Noise)

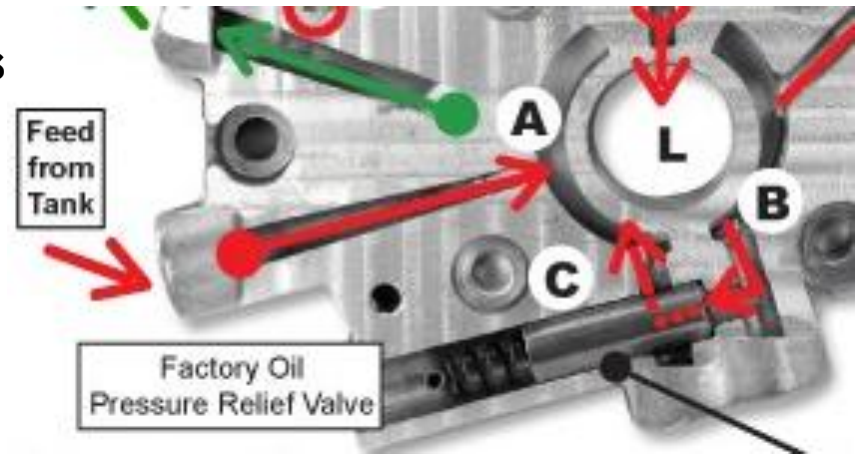




Oil Pressure Relief Valve

What Happens When it Leaks?

- **Feed Oil is Bypassed & Returned to Low Pressure Side of Gerotor**
 - **Short-Circuits the Oil System**
 - At the Lowest Point in the Engine
 - While Attempting to Pump Oil Uphill, Against Gravity
 - Decreases Oil Pressure to the Entire Engine
 - Especially the Top End, Valve Train & Other High Pressure Points
 - **Aerates the Oil**
 - Acts like a Blender Instead of a Pump
 - **Gerotor Shears the Polymer Chains**
 - Less Effective Oil
 - Lower Lubricity
 - Less Heat Transfer





Zipper's Solutions

Leaking Oil Pressure Relief Valve

- **Pre-Blueprinted Billet Cam Plate Systems**

- New Billet Cam Plate Upgrade Systems
- Blueprinted to Zipper's Enhanced Oiling System Specs
- Baisley's Concentrically Ground Plunger Valve
- Higher Blow-off Pressure
- Tested & Sealed Oil Pressure Relief Valve



- **Concentrically Ground Plunger Valve**

- Creates Proper Seal Inside Cam Support Plate
- Reduce and Eliminate Leaks at Low RPM



- **Increased Spring Pressure**

- Multiple Springs
 - Customize the Blow-Off Pressure
- OE, LMR2, LMR4, Fueling, Zipper's Shim



Zipper's Solutions

Leaking Oil Pressure Relief Valve

- **If you Must Retain the Cast OE Cam Support Plate**

- **Axtell Device for Porous Cast Plates**

- Cartridge Style Relief Valve
- Returns Oil to Cam Chest
 - Not Back into the Pump
- Reduced Oil Aeration
- Alternative to Full Cam Support Plate Replacement

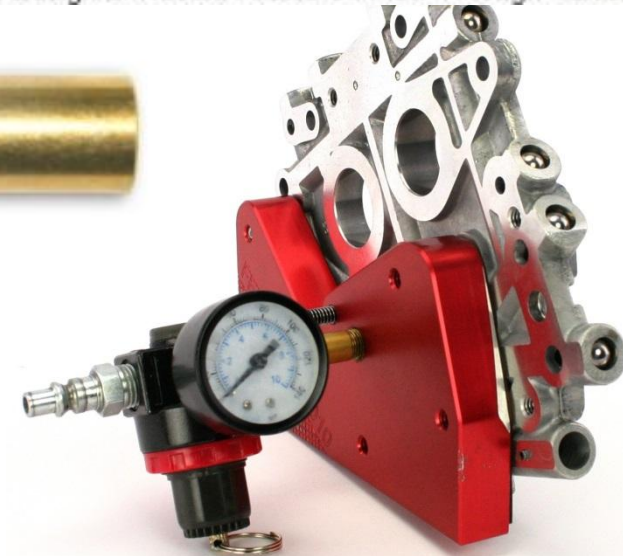
- Great for Plates with Minor Porosity



- **Tools for Checking & Setting Oil Pressure Relief Valve**



Cutaway Shows Oil Flow with #620-100 Bypass Valve
Fluted Design of Needle Allows Oil Flow Through Valve



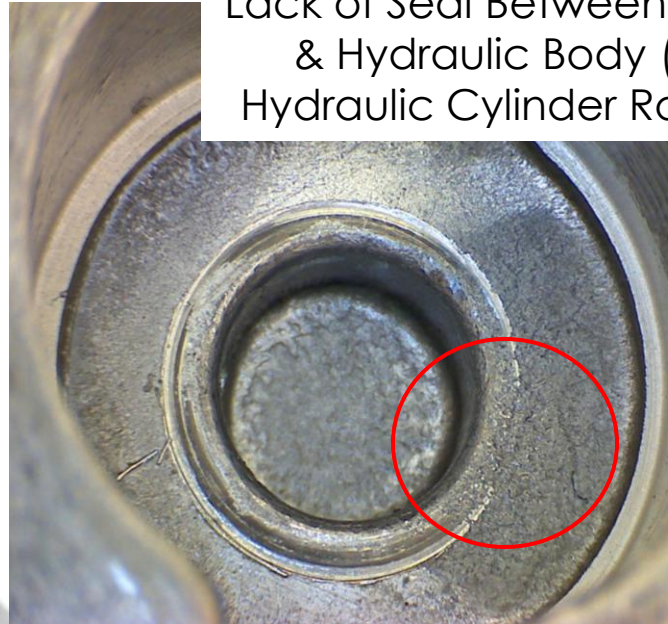


Cam Chain Tensioners

Primary Issues with OE Cam Chain Tensioners

- **Loss of Hydraulic Pressure**
 - Loose Manufacturing Allows Hydraulic Circuit to Leak
 - Rocking Motion of Shoe Breeches Hydraulic Rail Pressure
 - Once Airbound, Very Difficult to Regain Control
- **Sticking OEM Cam Chain Tensioner Shoes**
 - Noticeable Changes Made in Production
 - Coarser ID Finish in Factory Cast Body
 - Can Cause the Shoe to Stick in the Body
 - Complete Loss of Control of the Valvetrain
 - Excessive Noise & Component Damage
 - Unacceptable Valvetrain & Cam Chest Noise

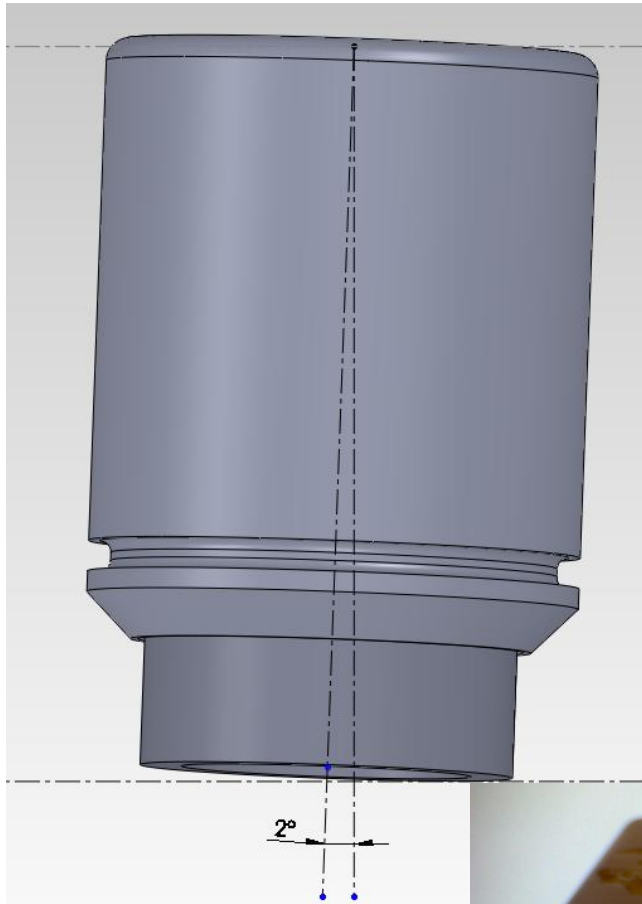
Cam Chain Tensioners



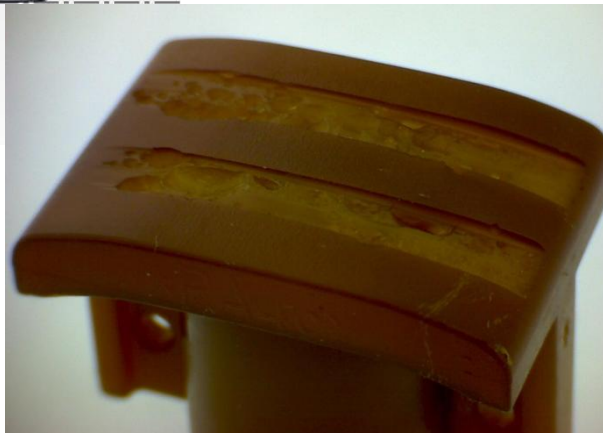
Lack of Seal Between the Oil Pressure Source & Hydraulic Body (Witness Marks Show Hydraulic Cylinder Rocking on Flat Surface)



Cam Chain Tensioners

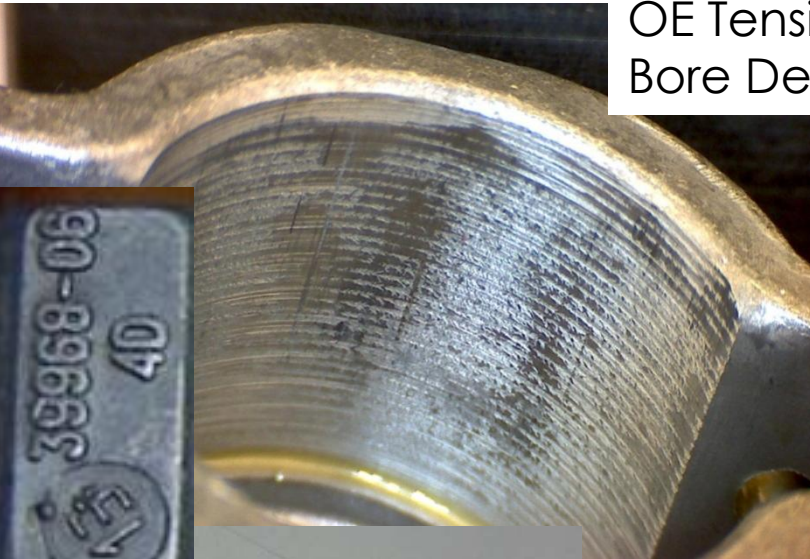


When Tipped 2° , the Oil Pressure Source is Compromised to the Hydraulic Body



Cam Chain Tensioners

OE Tensioner Manufacturing
Bore Degradation over Time



Very Coarse

"4D"
LATE TC PRODUCTION

"1A" & "1B"
EARLY TC PRODUCTION



Very Smooth

Sticking Late Model
"3A & 4D" OE Cam
Chain Tensioners





Cam Chain Tensioners

Primary Issues with OE Cam Chain Tensioners

- **Altered Cam Timing From Design**
 - Power Reduction
 - Throttle Response Degradation
 - Variance in Cranking Compression between Cylinders
 - Altered Cam Timing
 - General Performance & Ride Degradation
 - Accelerated Wear on Uncontrolled Valvetrain
- **Not Enough Pressure to Control Performance Valvetrains**
 - Larger Valves
 - Heavier Springs
 - Aggressive Cam Profiles
 - Higher Peak RPM



Zipper's Solutions

Cam Chain Tensioners

- **Patented Dual Piston Cam Chain Tensioners**

- Dual Piston Design Eliminates Chain Instability & Tensioner Shoe "Rocking"
 - Maintains Hydraulic Pressure in Lower Oil Pressure Scenarios
 - Dual Feed Provides a Larger Reservoir of Oil
- Accurate Cam Timing Events for Both Cylinders
- Tolerates Common Crankshaft Run-Out (Unlike Gear-Drive Cams)
- Improves Throttle Response, Acceleration and Across-The-Board Power
- Precision CNC Machined, Made From Superior Materials

Intelligent Design Captures & Seals Hydraulic Cylinder





Hydraulic Lifters

Primary Issues with Hydraulic Lifters

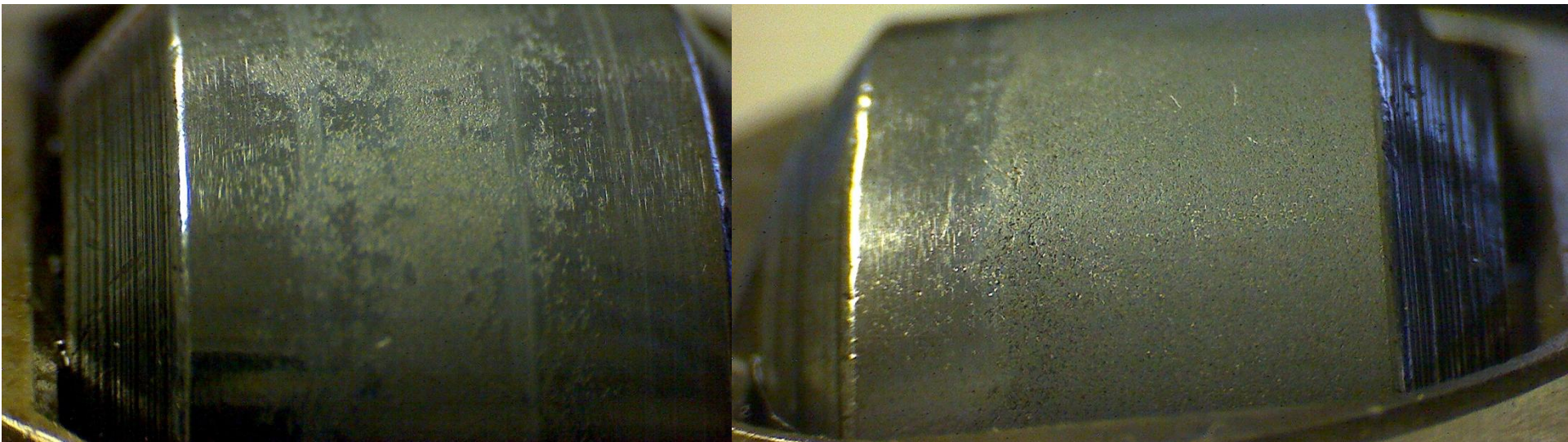
- **Most Issues with Hydraulic Lifters are Due to Low Oil Flow**
 - The Oiling System Failures are the Root of the Lifter Problems
 - New Lifters will also be Affected, if the Source is not Addressed
- **Quality Degradation Over the Life of the OE Twin Cam™ Engine**
 - Cheaper Sourced Imported OEM Lifters
 - Much Faster Roller Degradation & Failures
 - Roller Material Sheds onto Cam Lobe
 - Short Lifespan
- **Unacceptable Rotation of Lifter**
 - Loose Tolerancing Allows Lifter to Turn In Bore Under Operation
 - Loading / Unloading of the Valvetrain as the Lifter Changes Direction
 - Odd Wear Pattern on Cam lobe – Shows Unstable Roller Path

Hydraulic Lifters

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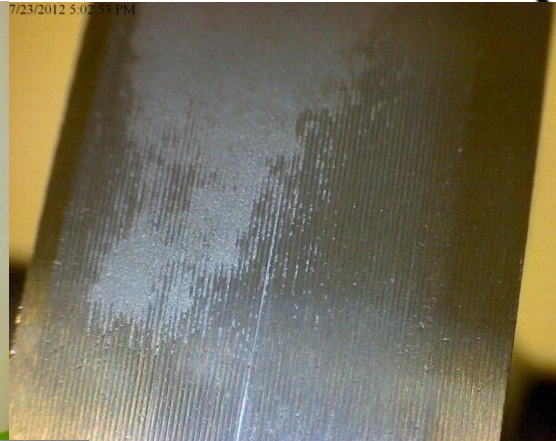


Material Transferring from the Roller onto the Camshaft, Rarely the Other Way Around



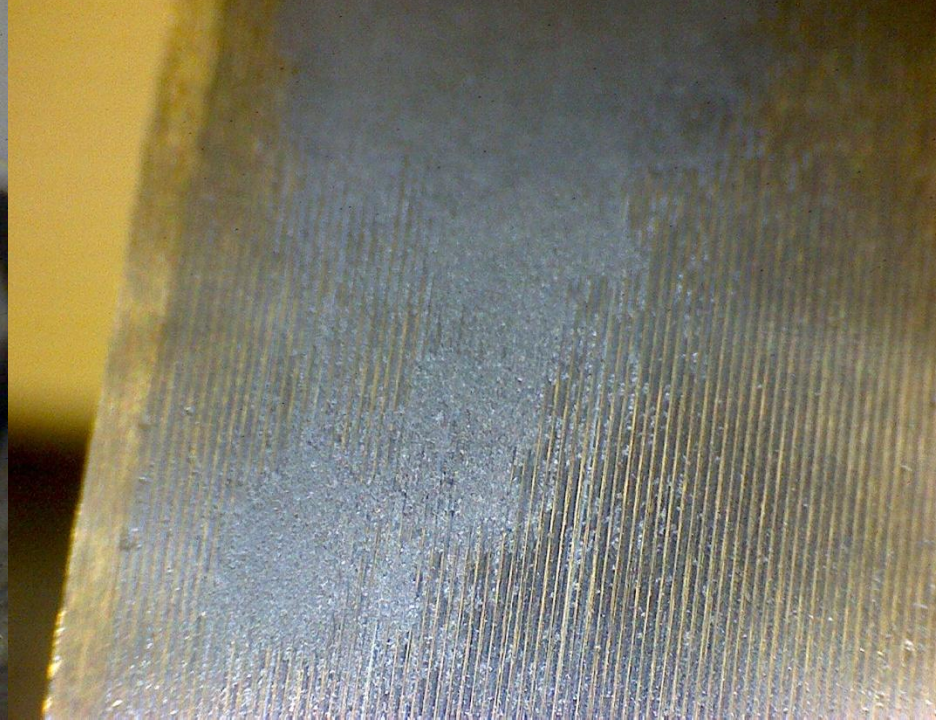
Hydraulic Lifters

**2012 OE
Lifters
1,400 Miles**

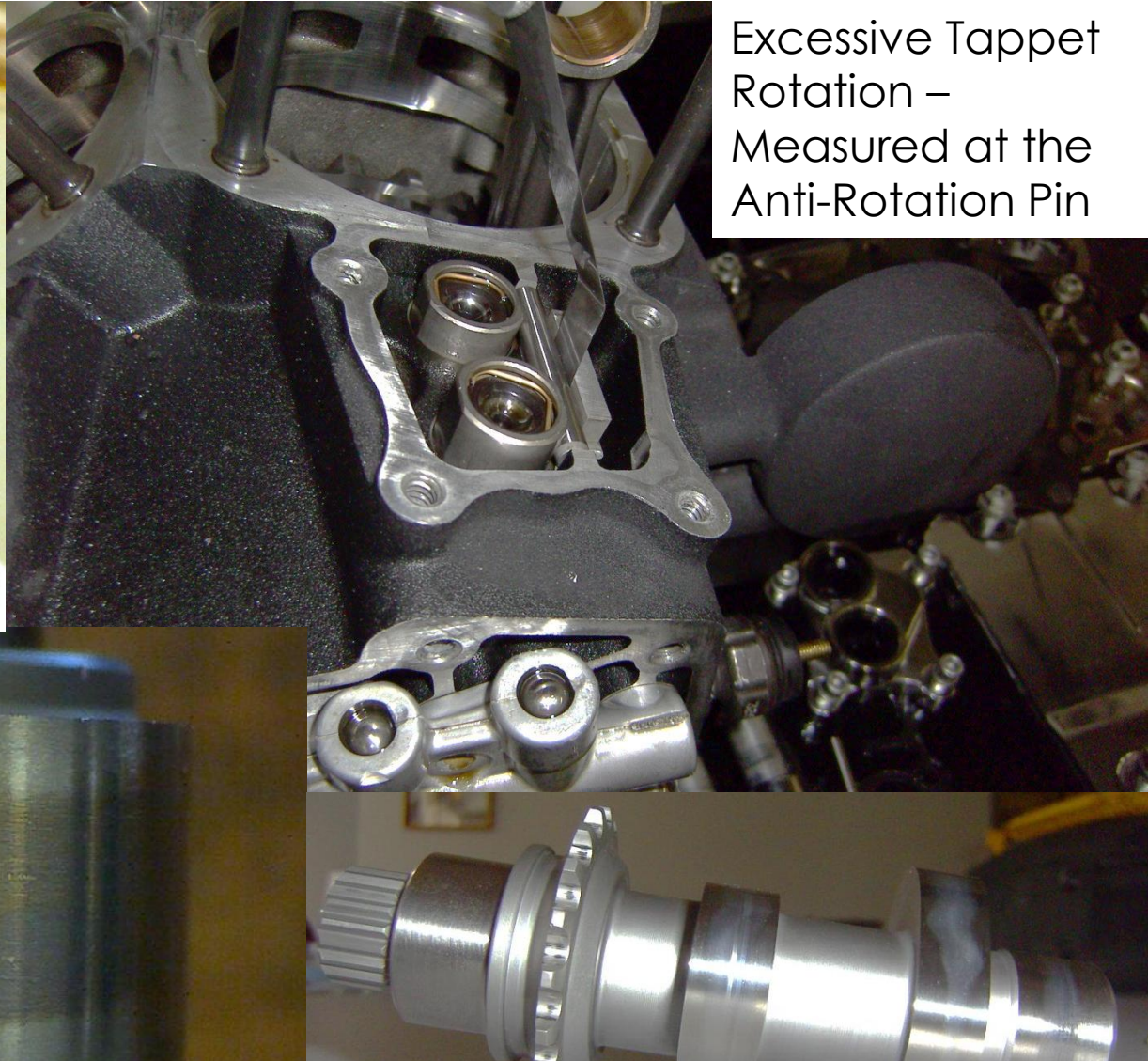
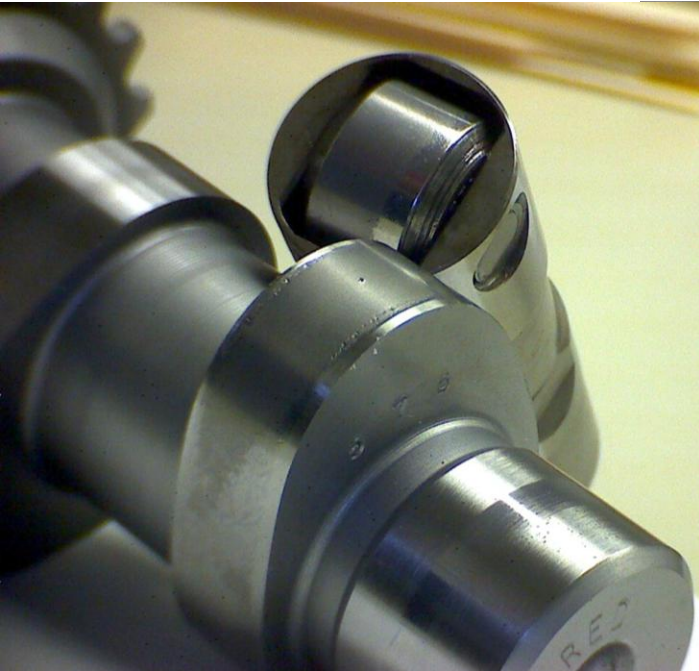


**2012 OE
Camshaft
1,400 Miles**

Material Transferring from the Roller onto the Camshaft



Hydraulic Lifters



Excessive Tappet Rotation –
Measured at the
Anti-Rotation Pin

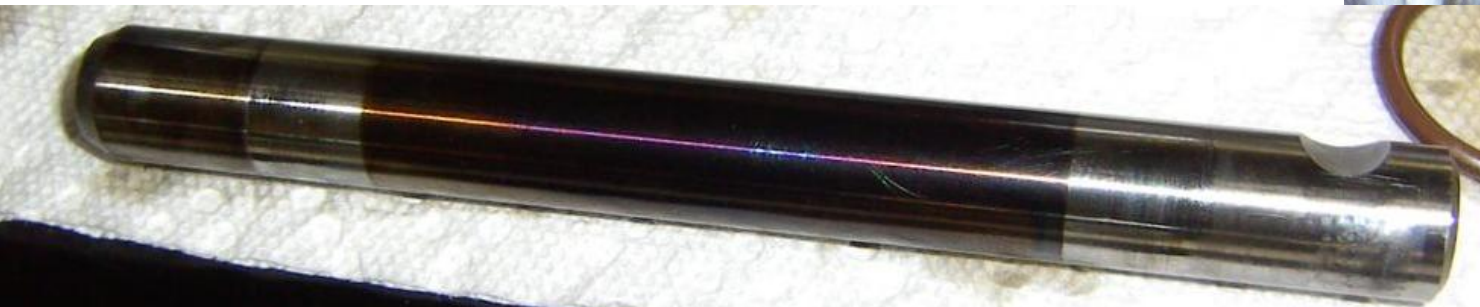
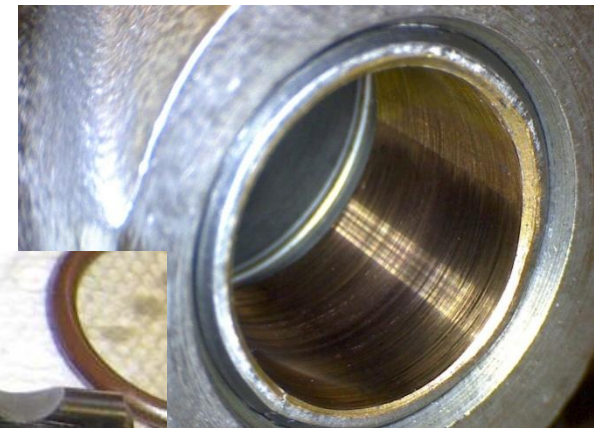


Excessive Tappet Rotation – Path of Roller Shown on Camshaft

Rocker Arm Systems

Primary Issues with Rocker Arms

- **Lack of Oil Pressure / Oil Volume**
 - Bushings are under High Pressure
 - Wear Out of Spec without Good Oil Pressure
 - General Noise and Clatter
- **Common to See Low Mileage Units Out of Spec**
 - Bushings can be Replaced & Resized
 - Sometimes Cheaper to Replace Entire Rocker Arm
 - OEM Replacements Very Affordable
- **Excessive Heat Transfer to Rocker Shaft**
 - Purple Shafts = Extremely Low Oil Pressure



Zipper's Solutions

Rocker Arms

- **Rocker Arm Shims**
- **Tools**
 - **Bushing Replacement**
 - **Bushing Re-sizing**
 - **Arm Grinding Fixture**
- **Replacement Rocker Arms**
 - **High Quality Roller Tip**
 - **OE Replacement**





Zipper's Solutions to Problems

- **Leaking Oil Pressure Relief Valve**
 - Blueprinted Billet Cam Plate Systems
 - Concentrically Ground Plunger Valve
 - Increased Spring Pressure (if Required)
 - Sealing Service / Tools for Testing for Leaks in Cam Plate
 - Axtell Device for Porous Cast Plates
- **Casting Porosity**
 - Increase Overall Oil Pressure
 - Reduce Other Leaks in System
- **Cam Chain Tensioners**
 - Dual Piston Cam Chain Tensioners
- **Lifters**
 - Higher Quality Lifter Replacements
 - Larger Anti-Rotation Pins to Reduce Allowable Lifter Spin
- **Rocker Arm Bushings**
 - Blueprinted Rocker Assemblies
 - Parts / Tools to Blueprint Yourself

**For Inquiries and
To Order Any of these
High Quality Components
and Services, Call Zipper's
410-579-2828**



6655-A Amberton Dr. Elkridge, MD 21075



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