

T11/T12 Intake Valve

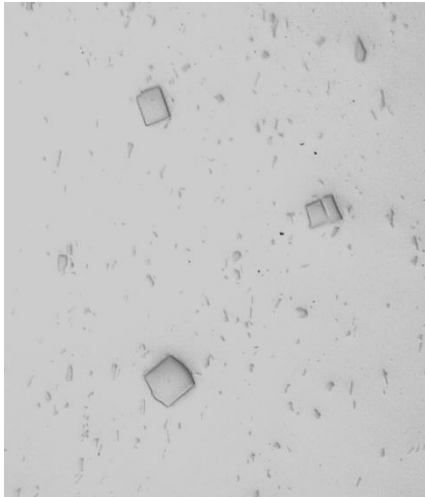
Comparison – July 2014

SwRI – Robert Warden

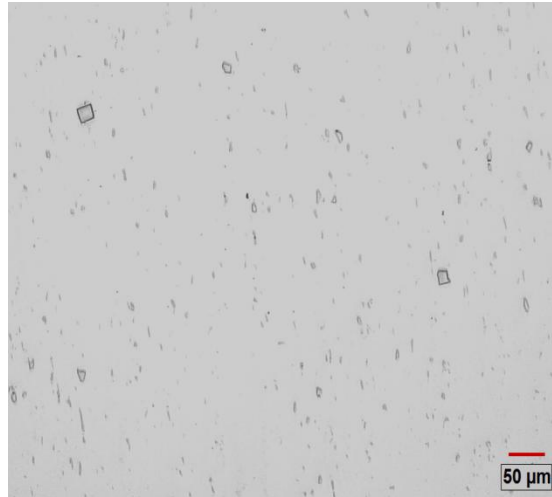
Overview

- New date code received from Grande Mack: 3-14 B
- Aftermarket valves located by TEI
- Destructive testing conducted to look at metallurgical structure near the area previous failures occurred

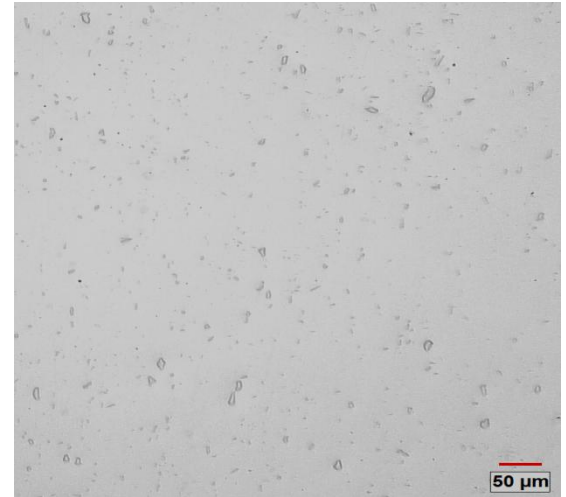
Surface



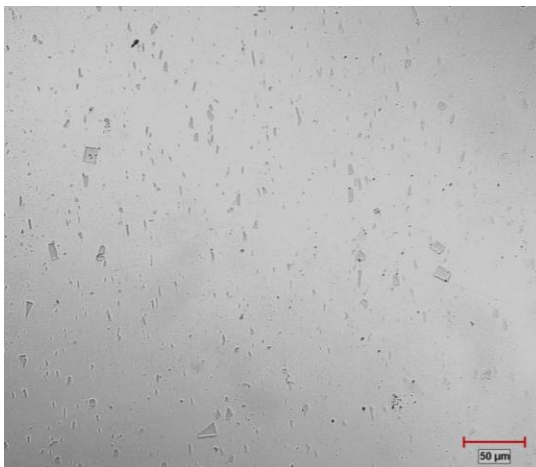
Fractured Valve



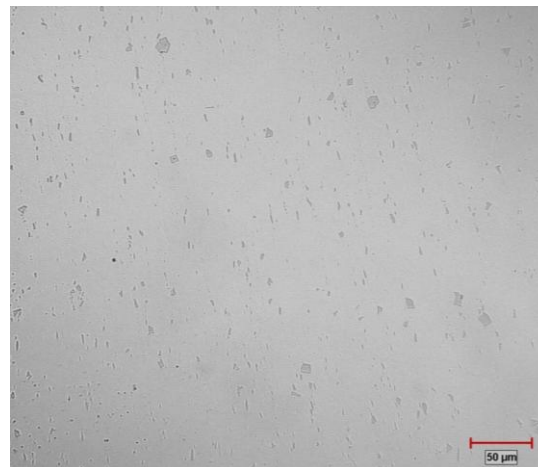
Fractured Batch



Good Batch

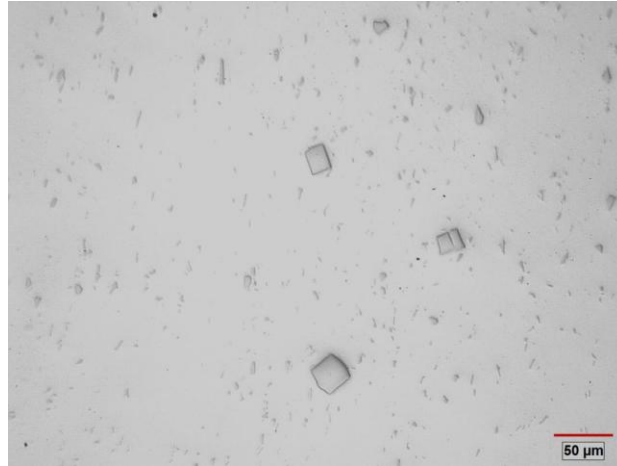


Mack 03-14 B

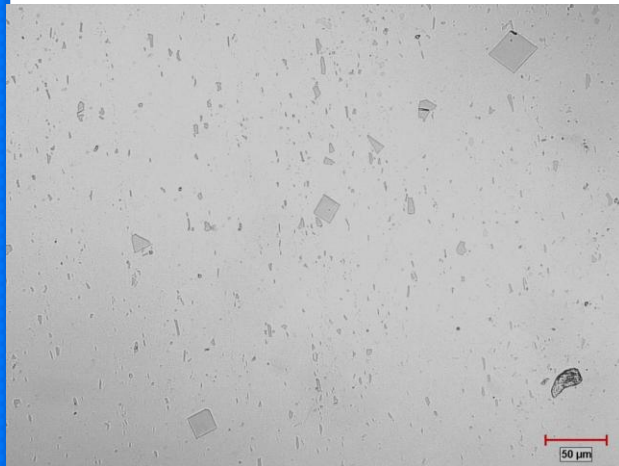


Aftermarket

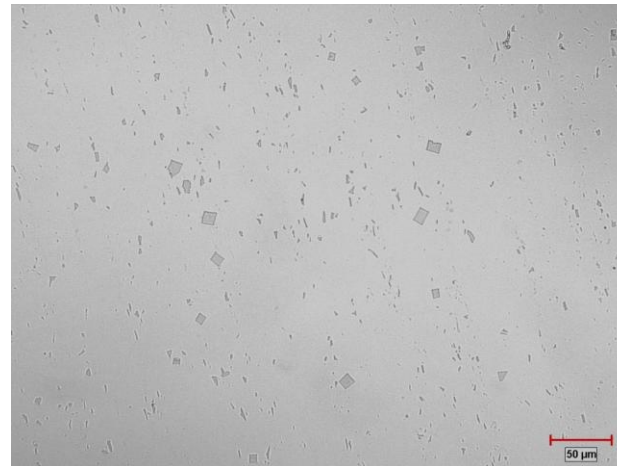
Interior Stem Structure



Fractured Valve



Mack 03-14 B

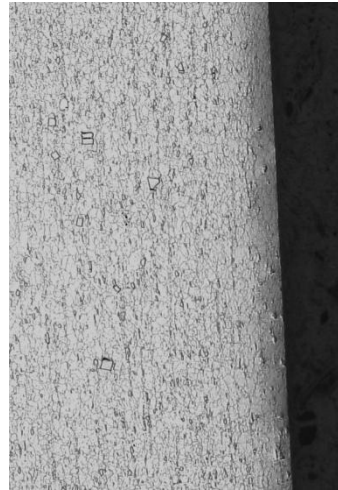


Aftermarket

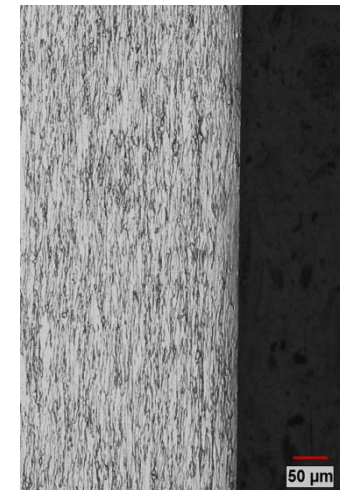
Grain Structure - Surface



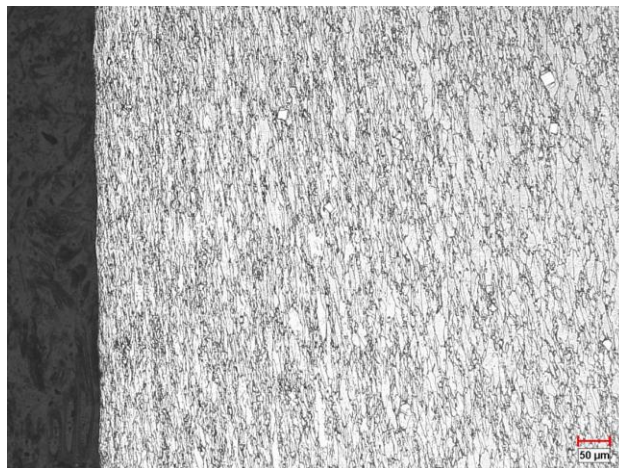
Fractured Valve



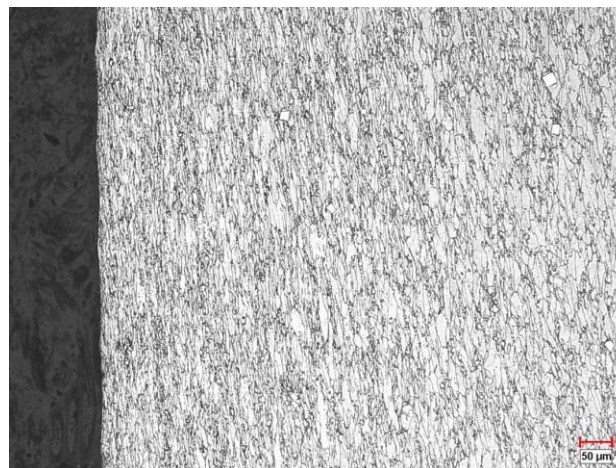
Fractured Batch



Good Batch

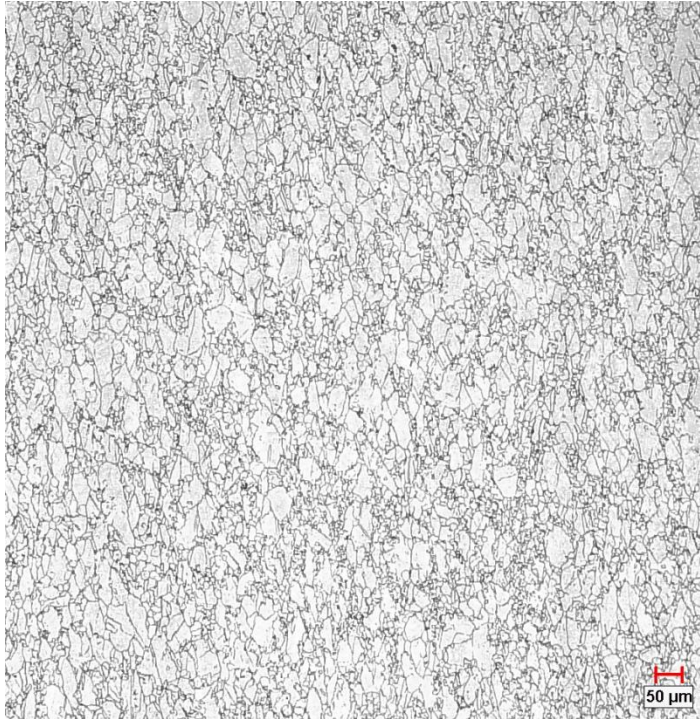


Mack 03-14 B

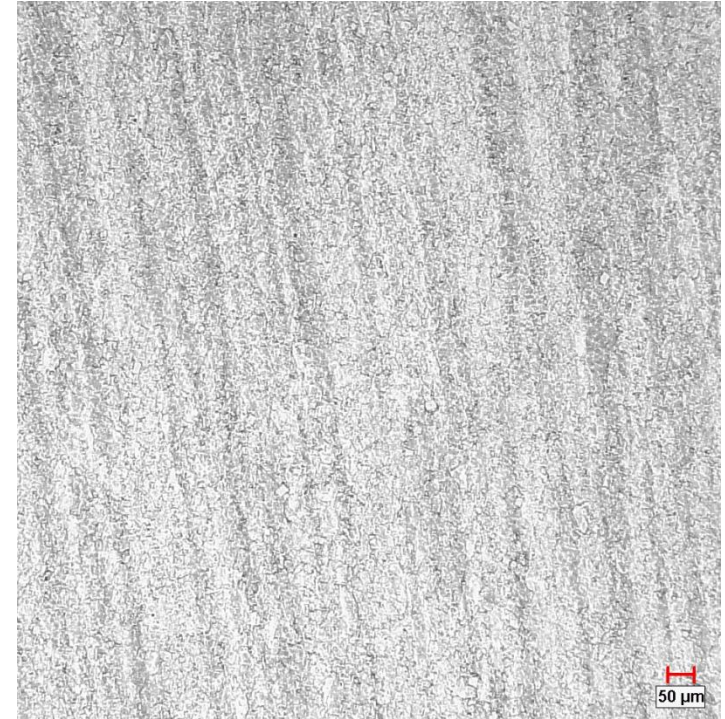


Aftermarket

Grain Structure - Interior



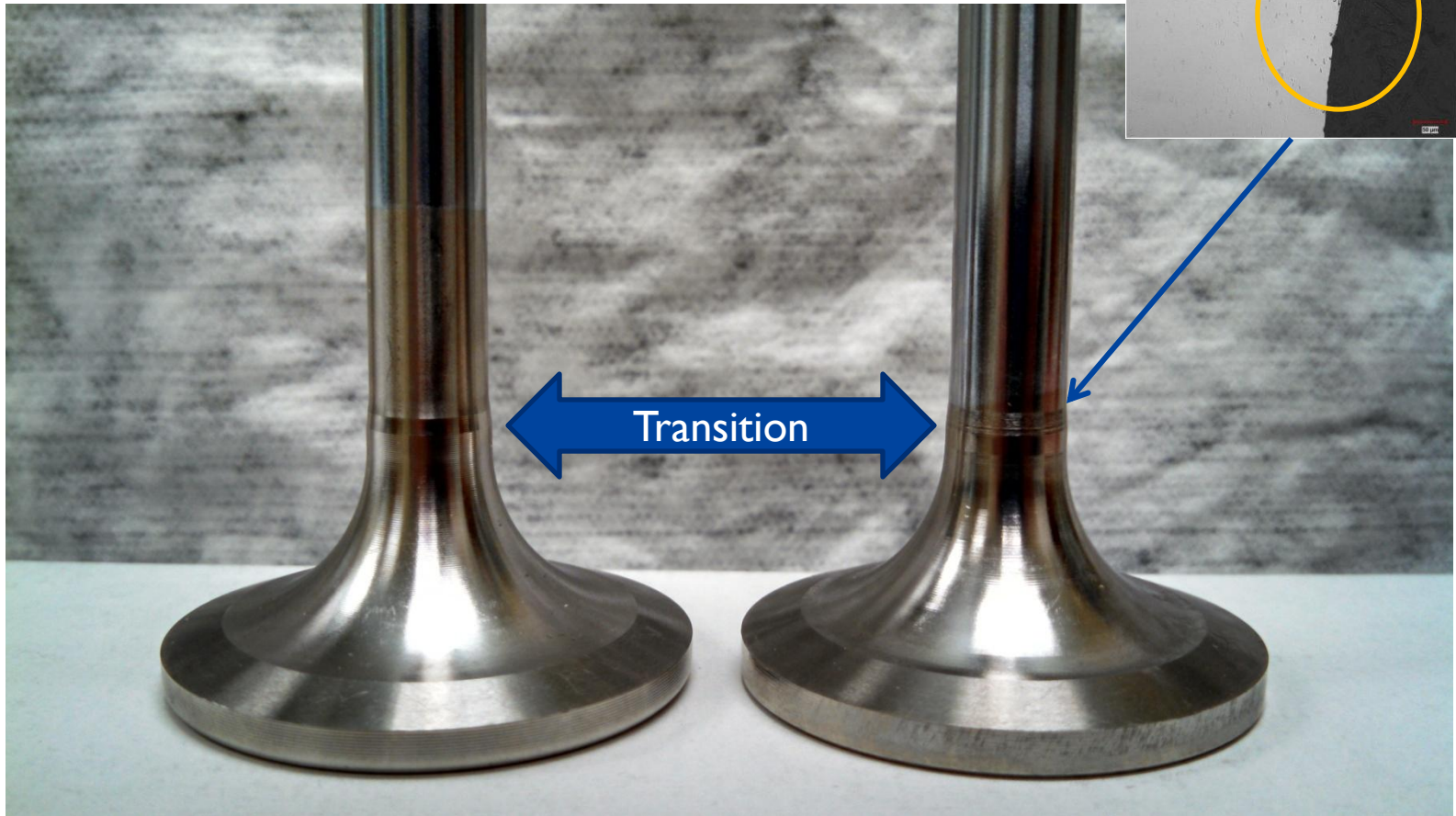
Mack 03-14 B



Aftermarket

May still have some heat-treating issue?
Unknown how this will impact durability

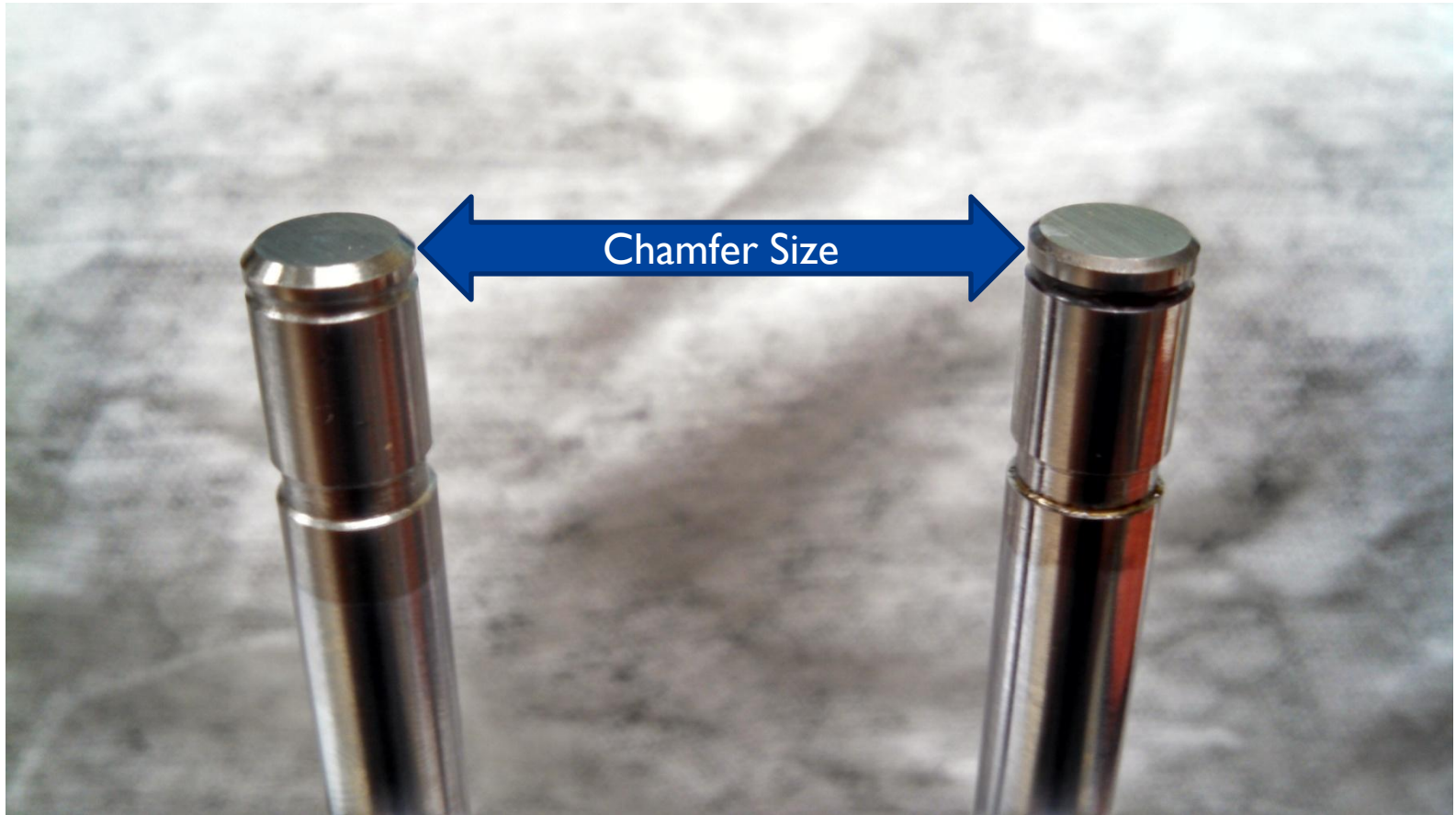
Geometric Differences



Mack 03-14 B

Aftermarket

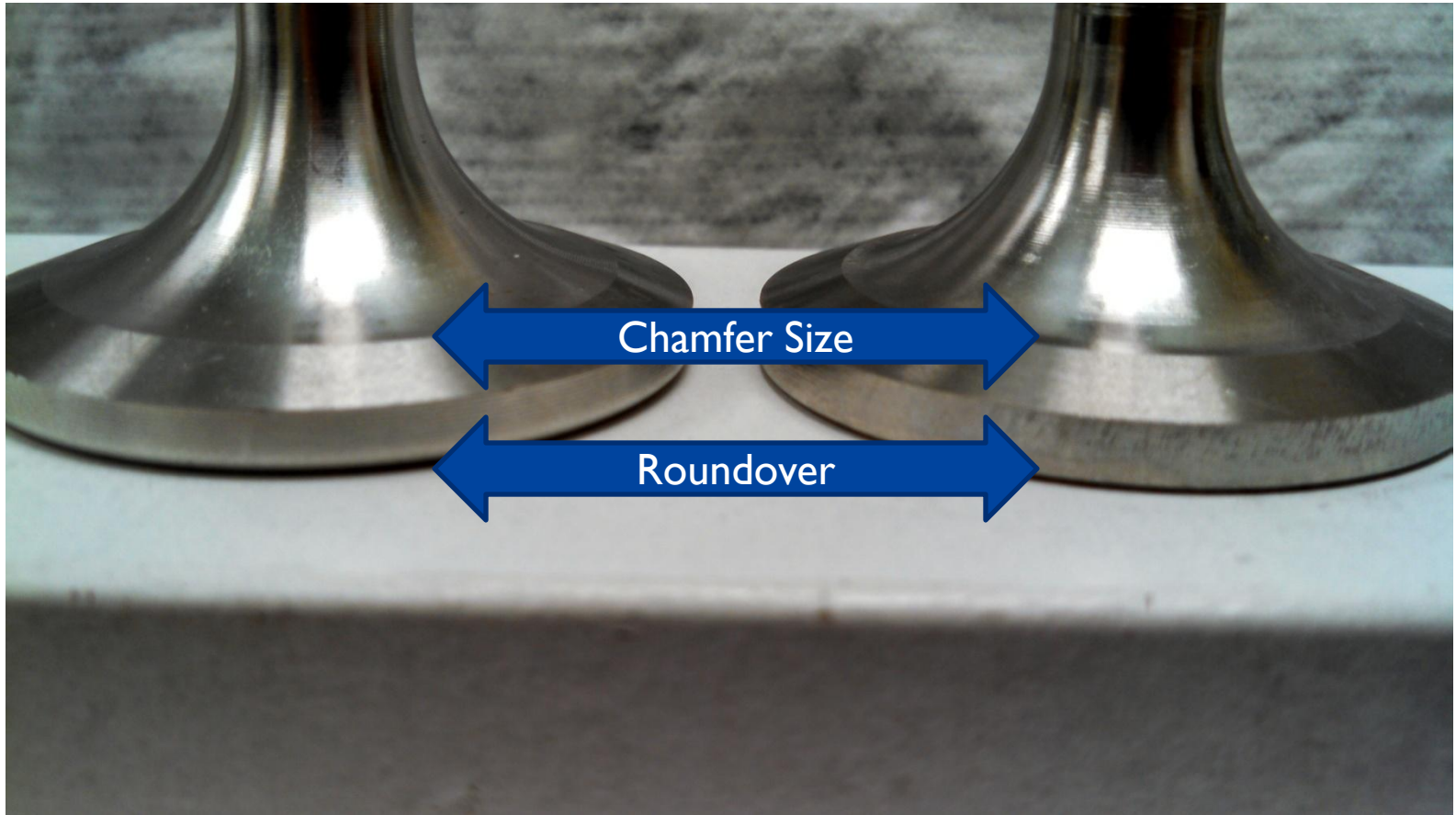
Geometric Differences



Mack 03-14 B

Aftermarket

Geometric Differences



Mack 03-14 B

Aftermarket

Geometric Differences



Mack 03-14 B

Aftermarket

Summary

- Lack of surface carbides on new Mack batch as well as Aftermarket valves
- Some signs of interior carbides and difference in grain structure for new Mack batch
 - Likely a heat treatment effect?
- Some noticeable geometric features on the Aftermarket valves at the transition from stem to tulip, potential for stress raiser
- Minor geometric differences between valves, but still allows head to be built to specs.