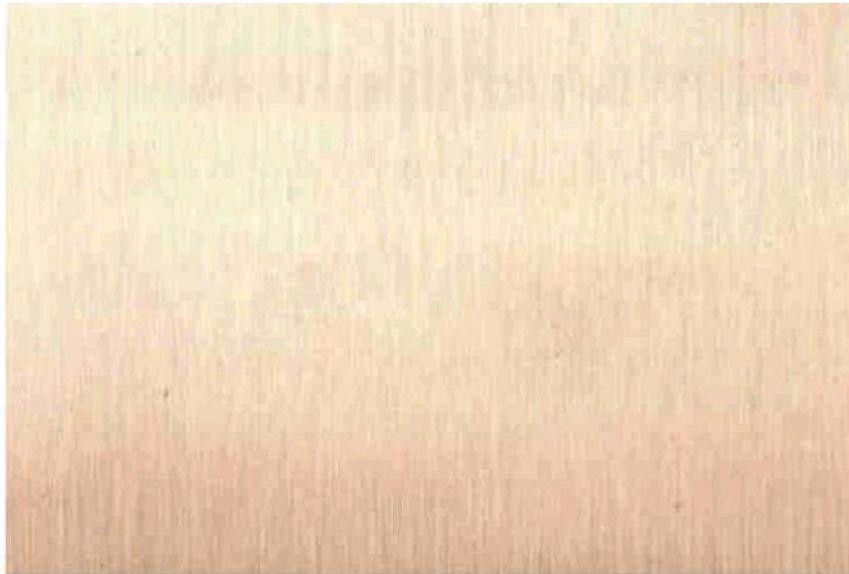




## Cummins Reuse Guidelines for Roller Camshafts and Followers/Tappets

The AERA Technical Committee offers the following information regarding camshaft and tappet reuse for Cummins diesel engines using roller components. The following information is suggested for consideration any time camshaft and tappet service is being evaluated.

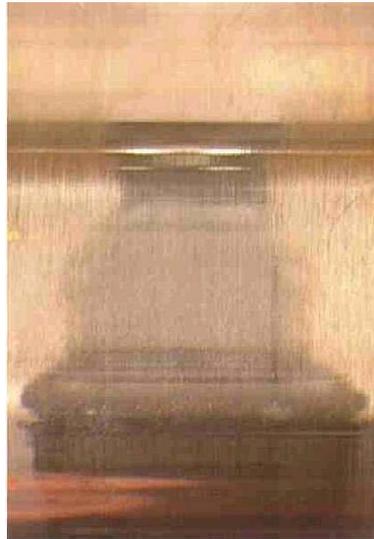
This bulletin applies specific visual inspection criteria for all Cummins® engines with roller followers or roller tappets in contact with the camshaft lobe surfaces. This bulletin addresses the instances in which surface deterioration is predominately the result of galling or spalling. Although this bulletin applies to all Cummins® engines with roller followers or roller tappets, it was revised to include knowledge gained from an injector camshaft engineering project completed on the Signature, ISX, QSX15 Heavy Duty engine. Based on the results of engineering analysis and endurance testing, the acceptable width for lobe galling damage on the injector camshaft was increased specifically for the Signature, ISX, QSX15, and ISX with CM870 control module engines. The updated lobe galling width limit applies for the surface damage indicated in Figures E and F.



**Figure A. New Lobe**

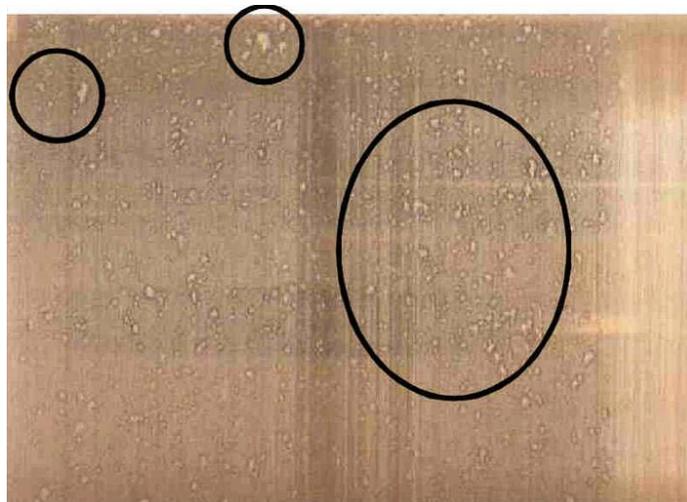
### Definitions:

**Polishing:** Normal surface condition where machining lines have been smoothed from contact between mating parts (see Figure B).



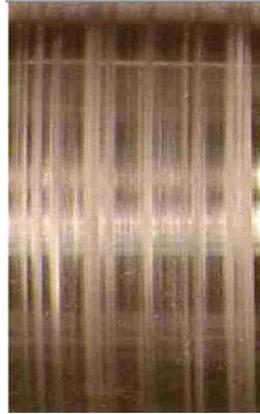
**Figure B. Polished**

**Denting:** A depression left in the surface by a piece of foreign material that is trapped between the lobe and roller. A dent has a relatively smooth, shiny bottom and does **not** have rough or sharp edges (see Figure C).



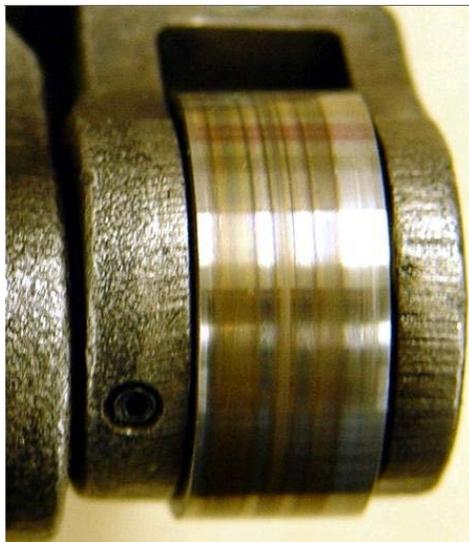
**Figure C. Dented**

**Frosted Bands:** A high-density micro-denting. Frosted (white) in appearance. Frosted bands are **not** detectable with a fingernail (see Figure D).



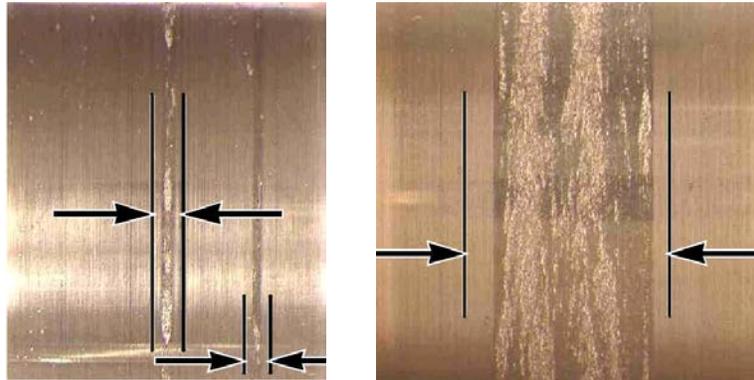
**Figure D. Frosted Bands**

**Varnished Bands:** Surface film of oxidized oil. Brown or blue color in appearance. Varnished bands are not detectable with a fingernail (see Figure E).



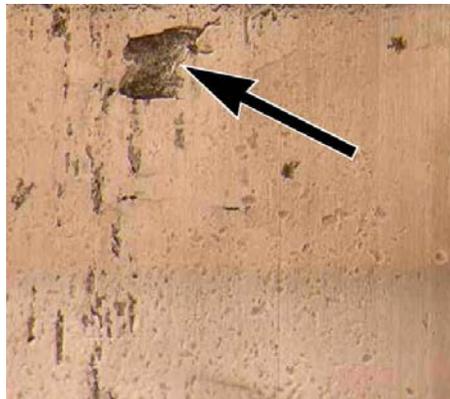
**Figure E. Varnished Bands**

**Galling:** Transfer of small pieces of material between the follower roller and the camshaft lobe surface by welding one surface to the other (see Figures F and G). Galling typically occurs when a follower roller skids on the camshaft lobe surface. This damage is detectable with a fingernail.



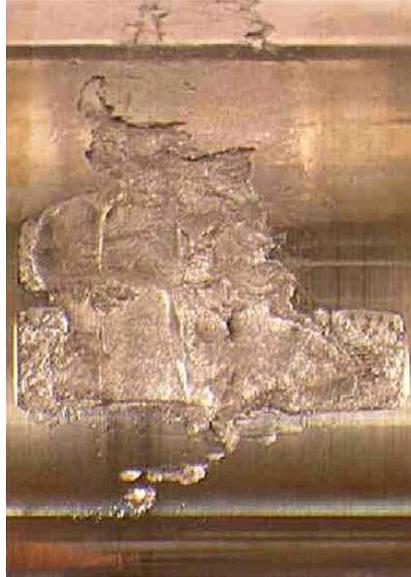
**Figure F & G. Galling**

**Pitting:** Loss of a piece of material from the lobe resulting in a hole that is visible to the naked eye. Pits typically have rough, dark bottoms and sharp edges, and usually occur in the heavily-loaded areas of the lobe (see Figure H).



**Figure H. Pitting**

**Macro-Spalling:** Loss of large pieces of material from the lobe surface (see Figure I). This amount of damage will affect the operation of the engine.



**Figure I. Macro-Spalling**

**Reuse Guidelines** - Analysis of lobe deterioration, as represented in the photographs in Figures A through I, can be made objective by following the reuse information presented in Table 1 below, Figures A through I. Inspect and replace as necessary all cam follower rollers and pins, or assemblies. Use the criteria from this bulletin for visual inspection of the rollers. Also reference the appropriate engine service manual for other, dimensional reuse guidelines.

**Lubricating Oil System Inspection:** In the event that macro-spalling is observed, inspect the lubricating oil filter for metallic debris. If metallic debris is found in the filter, inspect and replace as necessary the main and rod bearings, camshaft bushings, turbocharger, lubricating oil pump and pressure regulator and the lubricating oil cooler.



**Table 1: Unconditional Reuse Guidelines for Figures A, B, C, and D**

Figure	Condition of Lobe	Reuse	Engines Affected
A	New	Unconditional reuse	All
B	Polish, no damage	Unconditional reuse	All
C	Denting	Unconditional reuse	All
D	Frosted bands	Unconditional reuse	All
E	Varnished bands	Unconditional reuse	All
F	Galling <sup>1</sup> - Less than 1.5 mm [1/16 in] wide surface distress, no pits	Conditional reuse <sup>2</sup>	All - Except injector camshaft for ISX, Signature, QSX15 and ISX with CM870 Control Module
	Galling <sup>1</sup> - Less than 5 mm [3/16 in] wide surface distress, no pits	Conditional reuse <sup>3</sup>	ISX, Signature, QSX15 and ISX with CM870 Control Module - injector camshaft <b>only</b>
G	Galling <sup>1</sup> - More than 1.5 mm [1/16 in] wide surface distress, no pits	Replace	All - Except injector camshaft for ISX, Signature, QSX15 and ISX with CM870 Control Module
	Galling <sup>1</sup> - More than 5 mm [3/16 in] wide surface distress, no pits	Replace	ISX, Signature, QSX15 and ISX with CM870 Control Module - injector camshaft <b>only</b>
H	Pitting	Replace	All
I	Macro-spalling	Replace	All

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### Explanation of Notes:

1. If multiple gall streaks are present but **not** connected, apply the width criteria to each streak individually.
2. Do **not** reuse the camshaft if the engine is being overhauled or if the camshaft is out of the engine.
3. Do **not** reuse the camshaft if the engine is being overhauled.

It is important to note that the choice to reuse engine components during an engine build process should not automatically infer the life expectancy and durability of a new engine component.