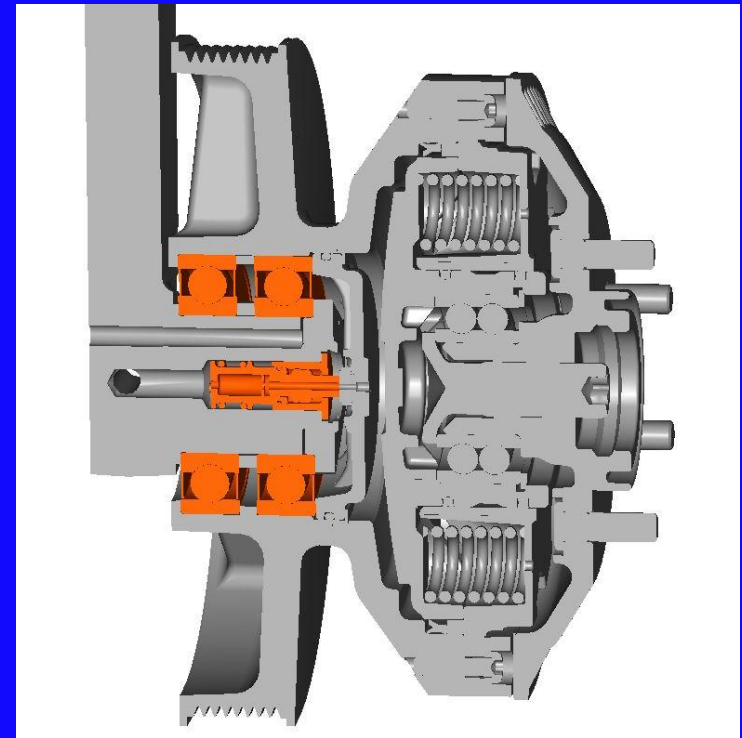
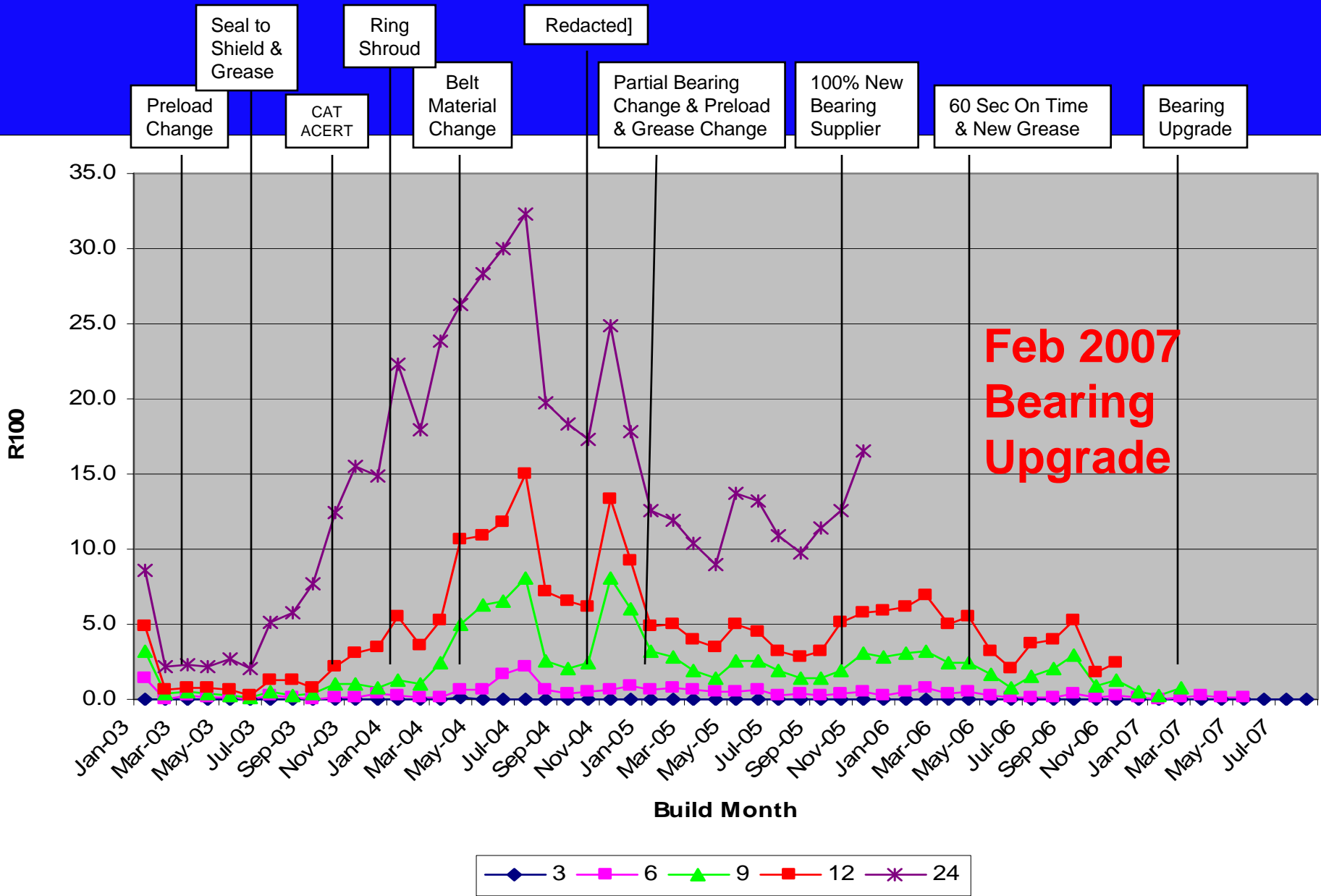


Horton Fan Hub



Horton Fan Clutch Failures



Horton Fan Hub Failure Modes

Hub failures have two similar causes

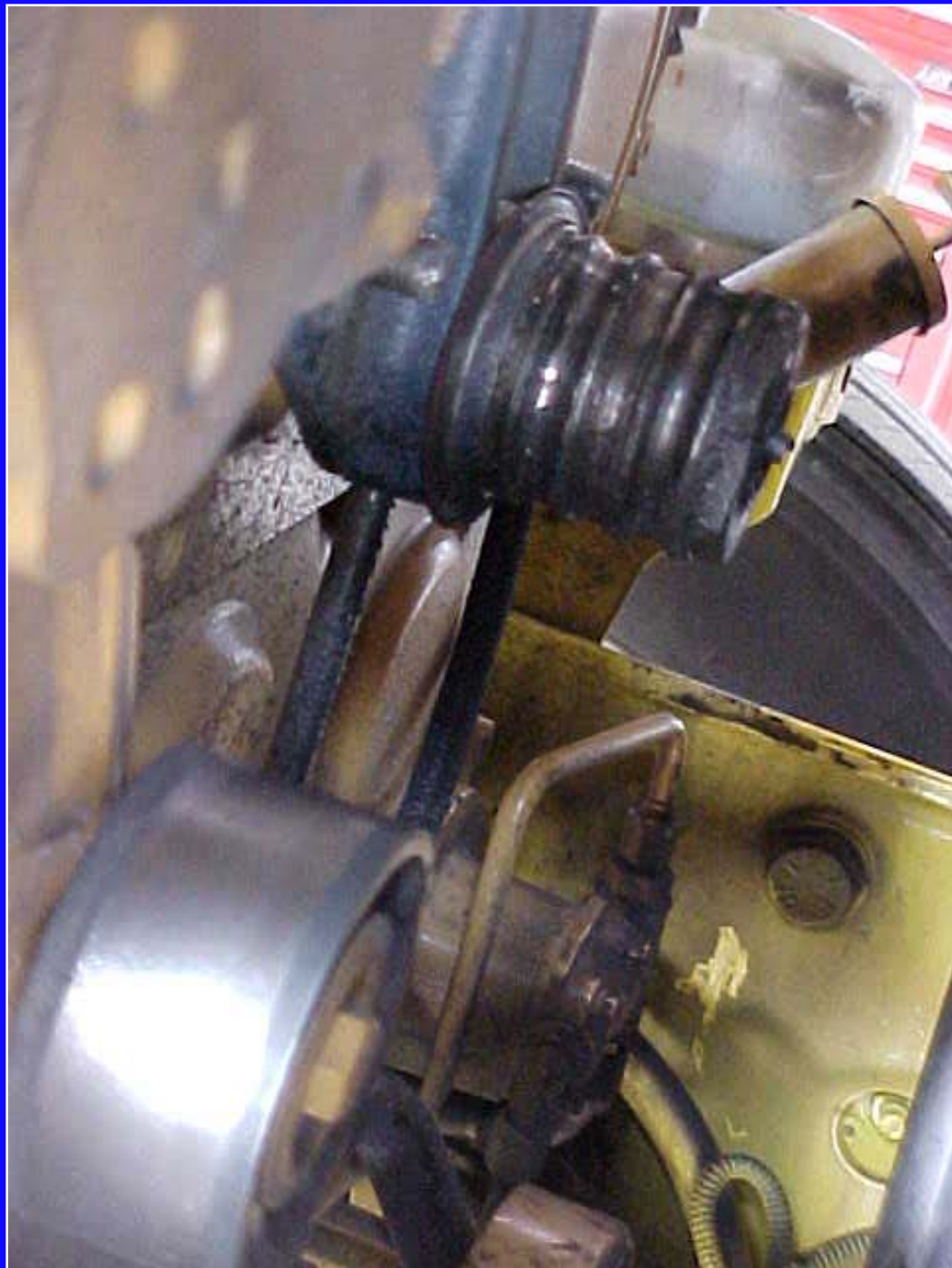
- Oil separation due to excessive heat
- Grease purge due to excessive heat

Both causes lead to Hub Bearing Failure



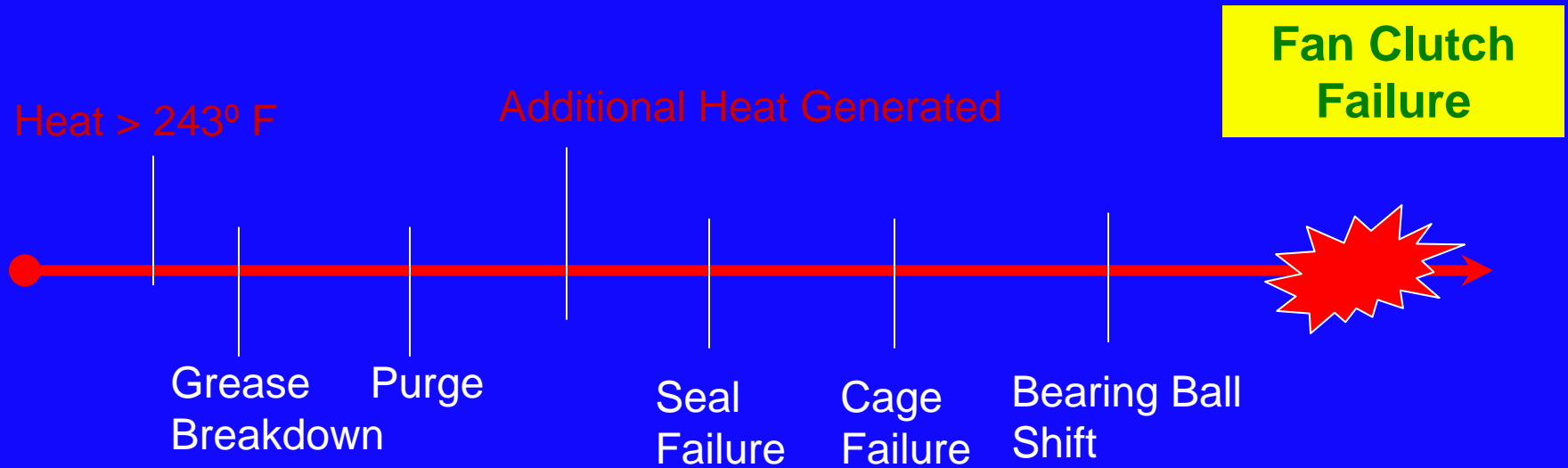
Old Installation





Horton Fan Hub Status Update

Fan Hub Failure Timeline



Horton Fan Hub Failure Modes

Failure Modes:

- Oil Separation - leading to grease breakdown
- Grease Purge



Horton Fan Hub – Corrective Action

Grease Purge:

- **Changed from GWP grease to GXK grease**
- **GWP grease failure rates were ~0.5%**
- **GXK grease failure rates are showing ~0.15%**



Before (GWP grease)



After (GXK grease)

Horton Fan Hub – '07 Design

Seal Improvements (grease purge): (February 07)

- **Change to Viton seal**
- **Higher temp rating, improved grease retention**



Before (NBR)



After (Viton)

Horton Fan Hub – '07 Design

Steel Bearing Cage (bearing life): (February 07)

- **Change to Steel bearing cage from Plastic**
- **Higher temp rating, improved bearing retention**



Before (plastic)



After (steel)

Horton Fan Hub – '07 Design

Hardened Race (bearing life): (February 07)

- **Change to Heat stabilized steel**
- **Consistent load at high temperature, improved bearing life**



Before (standard race)



After (heat stabilized)

Corrective Action Summary

Key Product Improvements for 2007 conditions:

- **GXK grease: (May 2006)**
 - **Reduced oil separation at high temperature**
 - **Capable of -40° F to 356° F**
- **Viton seal: (February 2007)**
 - **Reduced risk of seal degradation at high temperature, resulting in less grease purge**
 - **Capable of -40° F to 392° F**

Horton Fan Hub – Corrective Action

GXK Grease – (grease breakdown):

- **Change to GXK grease (June 2006)**
- **Hot Box testing confirms field test results**



Before (GWP grease)



After (GXK grease)

Upgraded Bearings

The new bearing is expected to positively affect the robustness of the DriveMaster related to heat induced failures in 2007 and beyond



Product Pictures

Model Year 2009



HORTON®

A Climate of
DURABILITY

Historical Perspective 2008

- *In anticipation of higher heat in 2010, Horton proactively developed a new sheave bearing package capable of handling extreme high heat applications.*
- *Due to the overwhelming benefits, this technology has been pulled forward for immediate implementation.*
- *Introducing...*

DM Advantage[™]

Spring-Engaged Fan Drive



A Climate of
DURABILITY



Engine **Cooling Solutions** Worldwide[™]

HORTON

DM Advantage™

Spring-Engaged Fan Drive

- **Improvements**

- High Durability Double Row Angular Contact (DRAC) bearing.
- 40% longer life on air cartridge
 - Redesigned with longer wear length
 - Decreased maintenance intervals
- Upgraded friction liners for high torque applications
 - Innovative dual-lipped backing plate stiffens assembly
 - Improved durability and lining protection helps prevent “chunking”
 - Backing plate doubles as a visual wear indicator
- Available in on/off, Remanufactured, and 2-speed

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DM Advantage™

Spring-Engaged Fan Drive

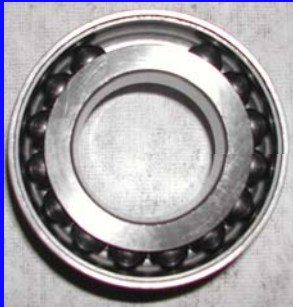
- Double-Row Angular Contact (DRAC) sheave bearing.
 - More than a three-fold improvement in predicted reliability over the successful 2007 design.
 - Field testing of DRAC brg over the past three years in over 340 trucks and 71 million miles.



CONFIDENTIAL

Bearing Style Comparison

DM Advantage



- DRAC bearing
- 14 Rolling elements/row
- Rolling elements fill nearly the entire bearing diameter
- Highest load capacity
- High contact angle – able to withstand more thrust load
- Dual lip Viton seals
- Highest temp grease available
- Size:45x85x39mm

DriveMaster



- 6209 Deep Groove bearing 2 needed
- 10 Rolling elements/row
- Preloaded to increase stiffness
- Dual lip Viton seals
- Size:45x85x19mm

Other On/Off Mfg. (rear bearing)



- 6209 Deep Groove bearing
- 9 Rolling elements/row
- Low load capacity
- Not preloaded
- Size:45x85x19mm

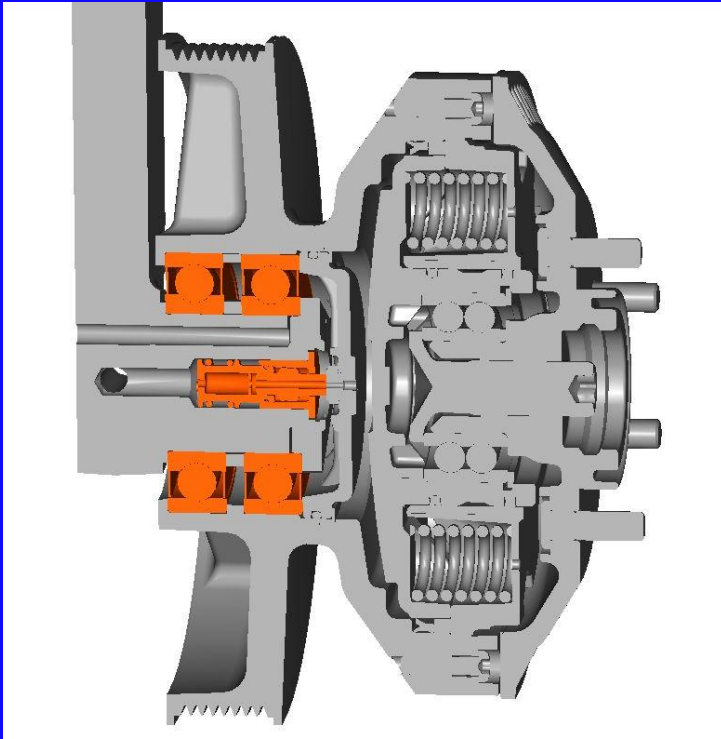
Other On/Off Mfg. (front bearing)



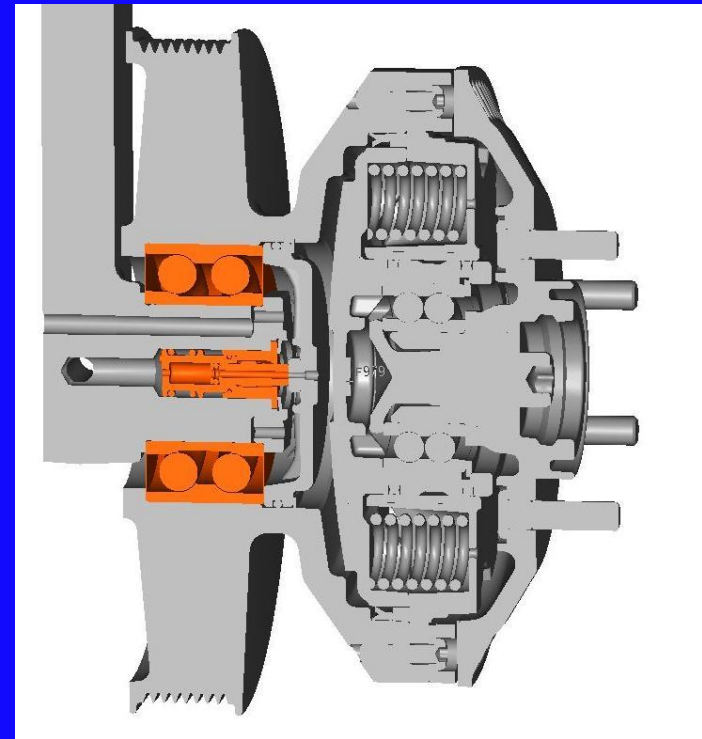
- 6207 Deep Groove bearing
- 9 Rolling elements/row
- Not preloaded
- Lowest load capacity
- Small size:35x72x17mm

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Cross-section Comparison



DriveMaster with (2x)
6209 bearings and spacer



DM Advantage with (1x)
DRAC bearing

- DriveMaster kits with bearings can NOT be used interchangeably with DM Advantage

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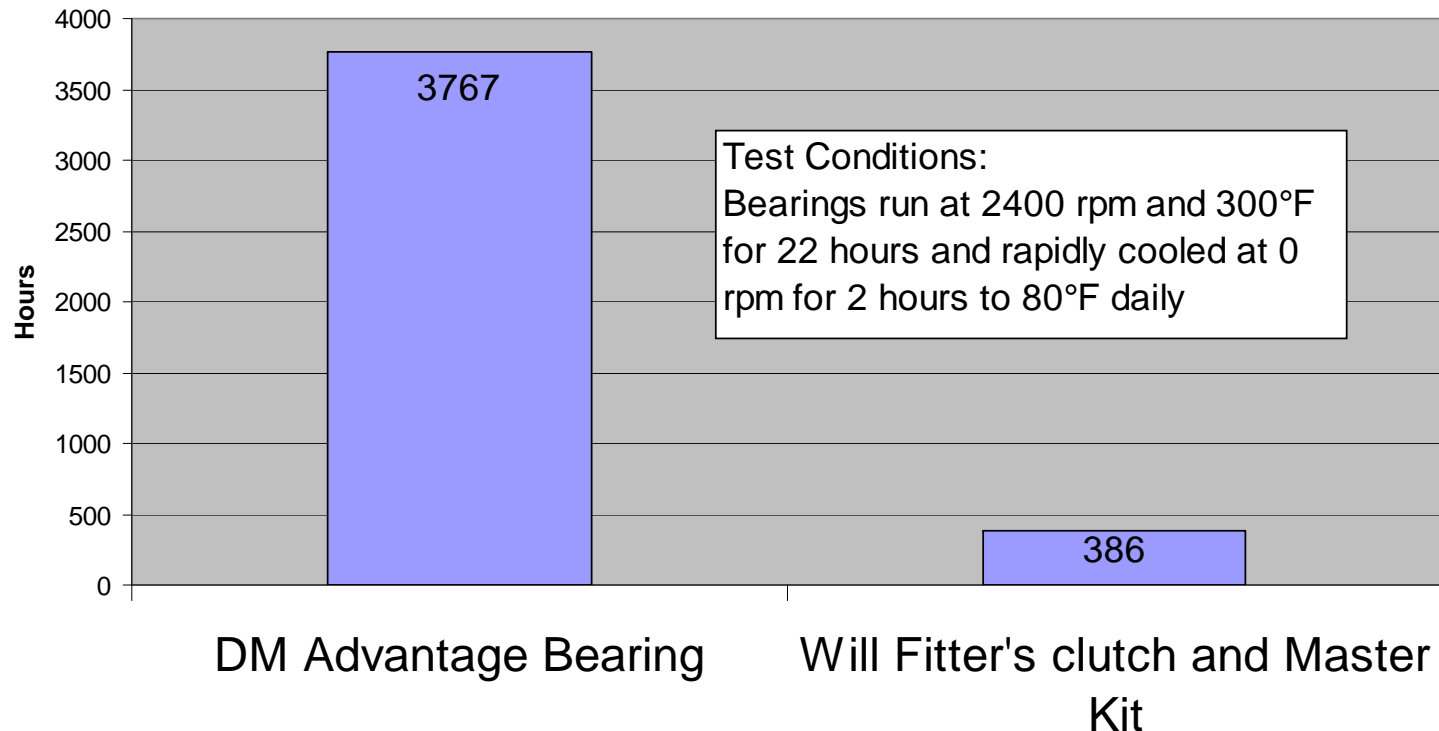
DM Advantage[™] *Spring-Engaged Fan Drive*

- Confidence in product
 - Backed with a 2 year / 200,000 mile nationwide warranty on OEM installations
 - 100,000 miles over base vehicle coverage
 - 1 year / 100,000 mile warranty support on over the counter sales

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Component Comparison

Hours to Failure in Hot Box Test

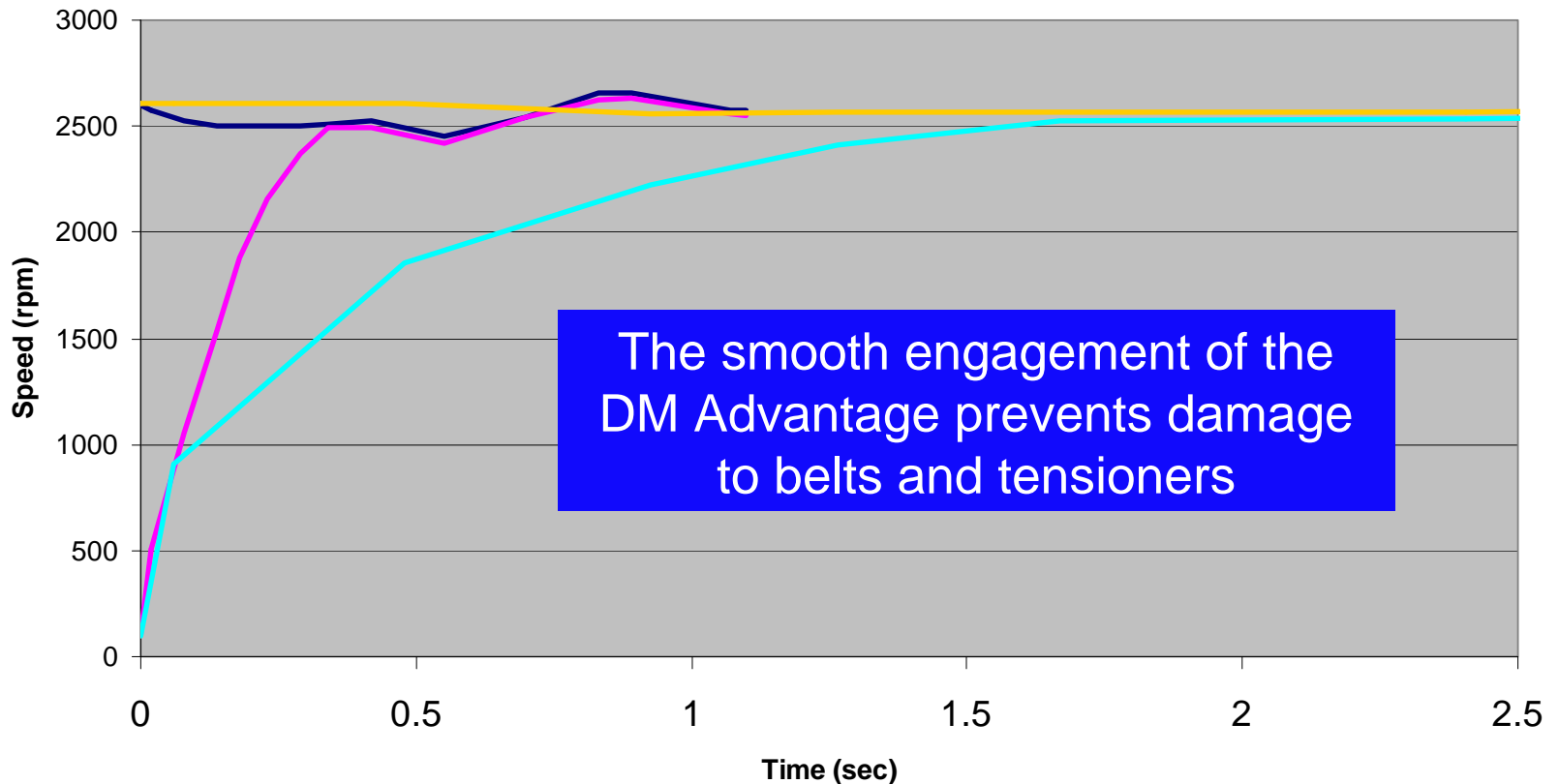


- *Testing in hot box to confirm seal and grease life*
- *DM advantage bearing ran 10 times longer than the bearing used in the will fitters clutch and master kit.*

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Component Comparison

Engagement Time at 2600 rpm Input speed



The smooth engagement of the DM Advantage prevents damage to belts and tensioners

— Will Fitter input — Will Fitter fan — DM Advantage input — DM Advantage fan

Summary

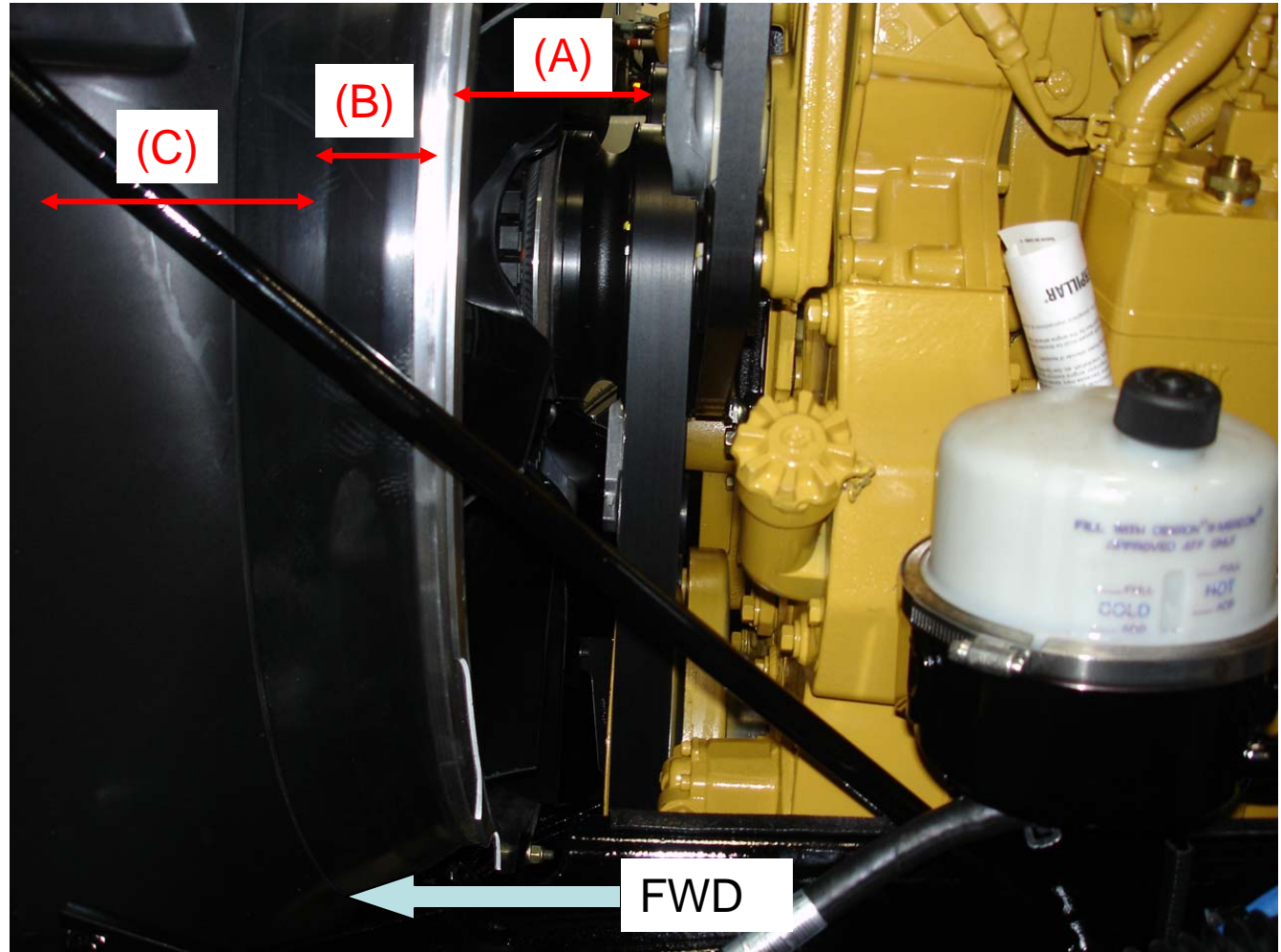
- Horton is again setting the benchmark for fan clutch durability
 - The DM Advantage has proven to have a superior sheave bearing design when compared to all other clutches and repair kits.
 - The DM Advantage is available NOW at all truck OEMs
 - A full line of DM Advantage Reman fan drives are available for upgrade and retrofits at no additional charge or core penalty

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Typical Installations
of
Model Year 2007 & 2008
PACCAR Vehicles

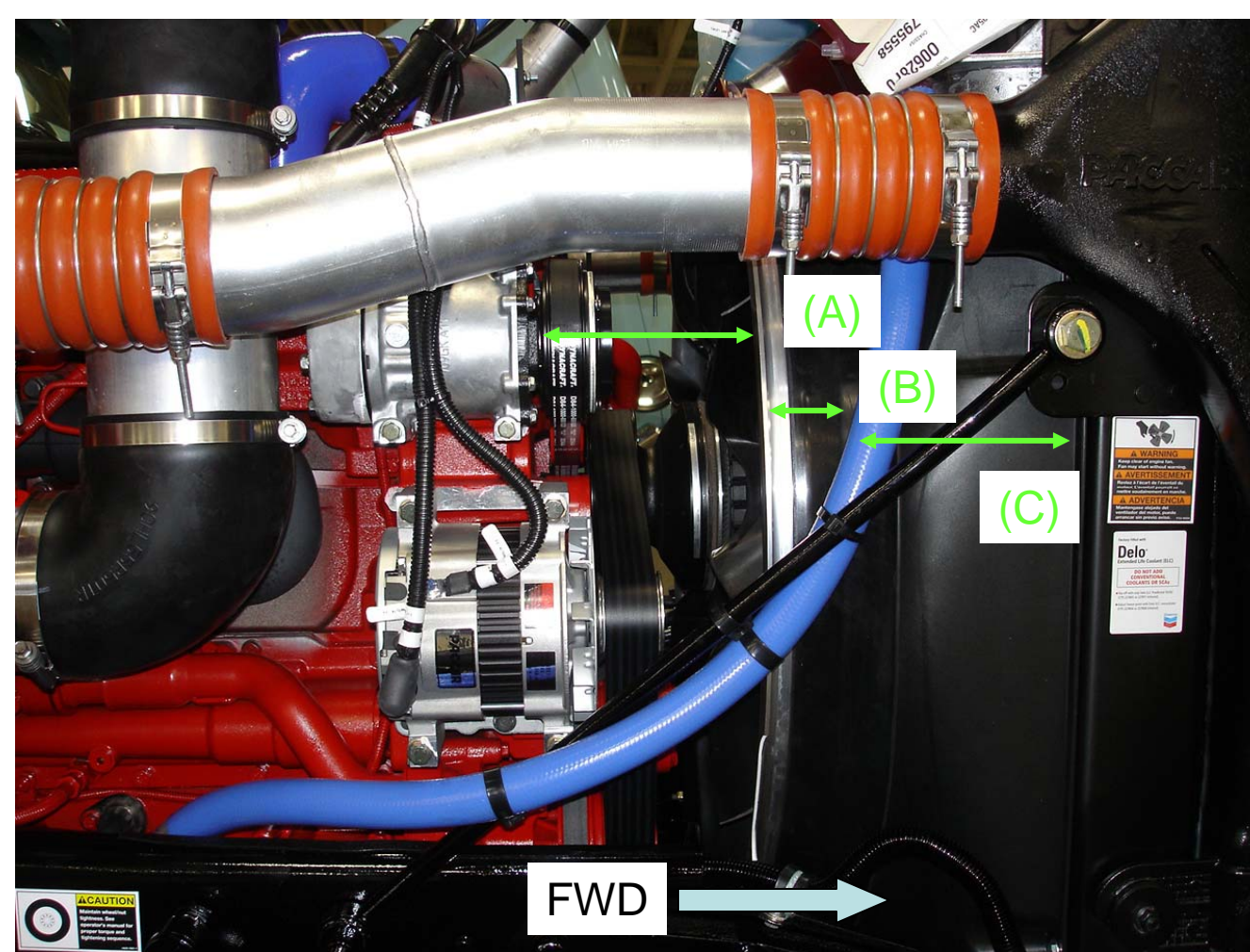
Caterpillar C15 Installation-Driver Side

- (A) = 6 inch space
- (B) = Metal Ring
- (C) = Molded Shroud



Cummins ISX Installation-Pass. Side

- (A) = 6 inch space
- (B) = Metal Ring
- (C) = Molded Shroud



Standard Warning Label

- Label affixed to both sides of cooling module all on PACCAR products



*Horton
DriveMaster status*



Horton understands the need to bring a
swift and effective solution to the current
situation



Failures Since January 2005

- Failures have two similar causes
 - Oil separation due to excessive heat
 - Grease purge due to excessive heat
- If the rough bearing is not identified in time the following may occur
 - More heat - loss of oil / grease - more heat, etc. until a seal failure and/or cage failure.
- If the cage fails, the bearing balls can lose their alignment, allowing the raceways to separate.



Result

- There have been incremental improvements with the bearing revisions for DriveMaster.
- Peterbilt warranty remained higher than other OEM's.
 - Extensive use of CAT C15 ACERT engine and
 - Under hood temperature?
 - Addition of ring shrouds?
 - Belt material and changes?
 - Different heat exchanger package?
- The change to the new grease is expected to significantly reduce the bearing failure rates for Horton products built since May, 2006.



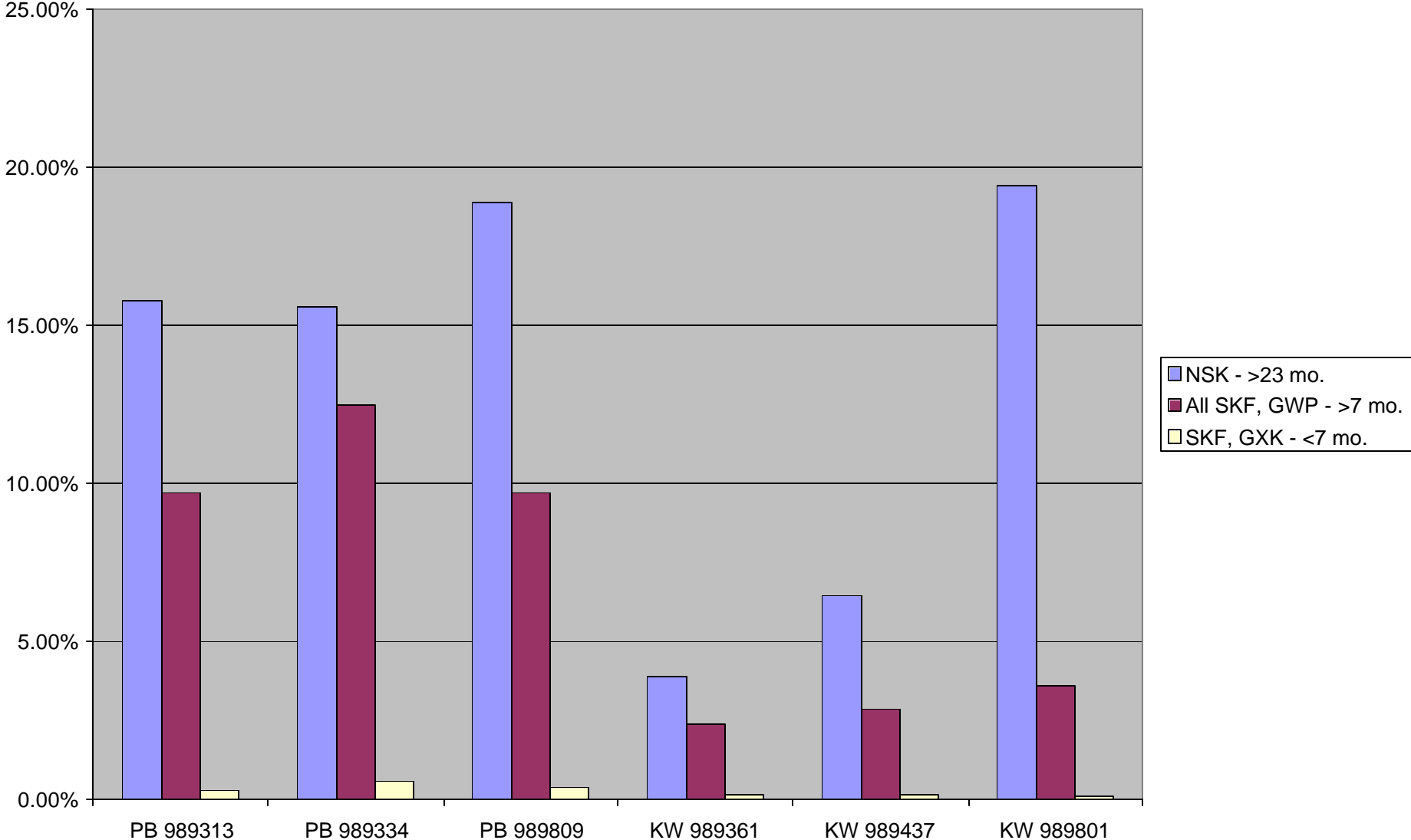
Improvement from GWP to GXK

- Although the Peterbilt warranty data for '06 build is somewhat immature, it does indicate a significant improvement.
 - GWP grease failure rates were ~0.5% at 6 months
 - GXK grease failure rates are showing ~0.15% at 6 months
- Breaking out the higher failure rates indicates 3 key Peterbilt Part Numbers to target.



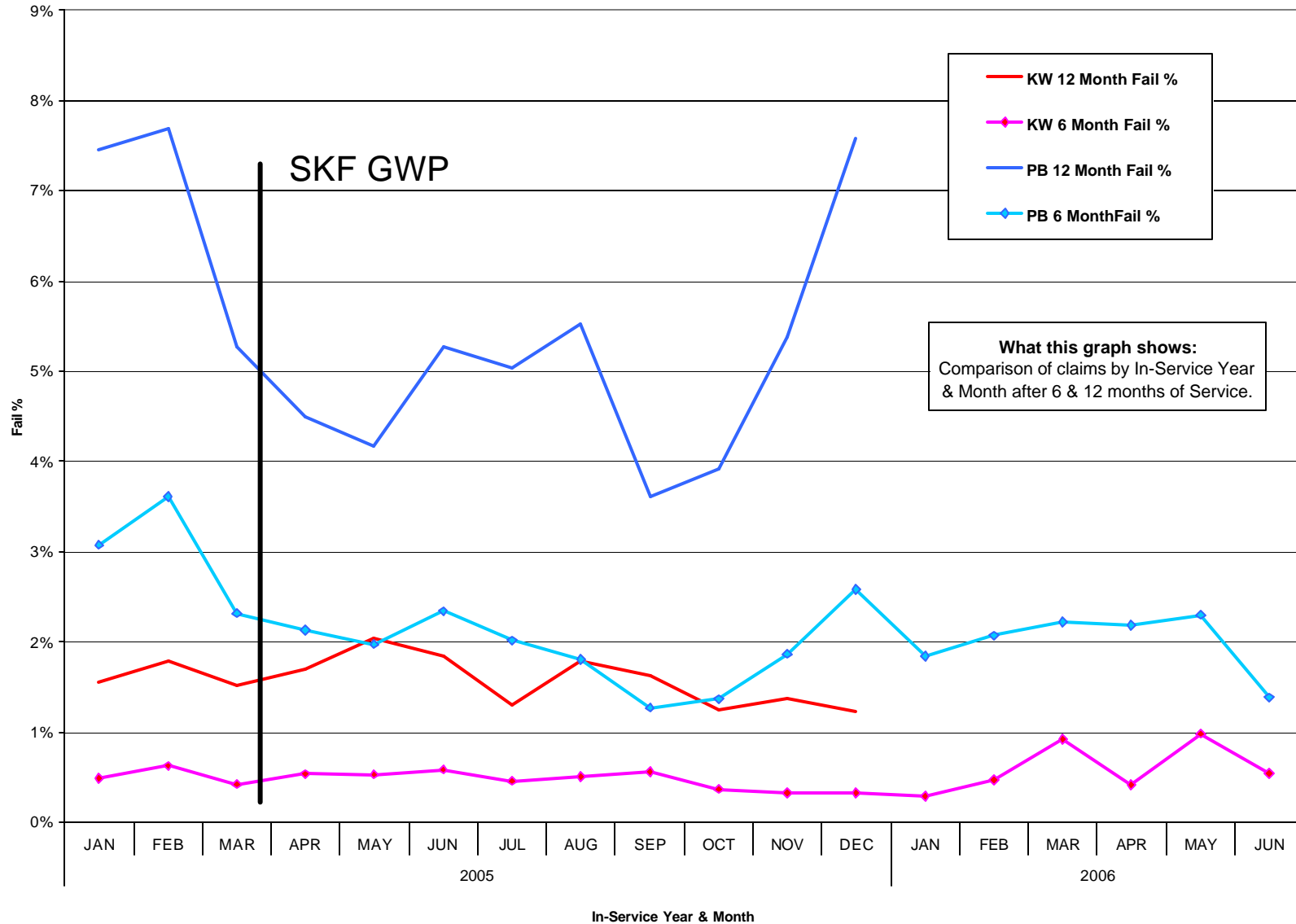
Key Part Numbers

Failure by Part for Different Bearings



PACCAR Bearing Failures

*Kenworth and Peterbilt Bearing Failure Percentages
6 and 12 Months of Service*



Proposed Upgrade Program

- Peterbilt trucks put into service in 2005 and 2006 with Horton part numbers 989313, 989334, or 989809 and pre-SKF GXK.
 - In service in 2005:
 - 995048 Kit at No Charge or
 - 995051 Special Super Kit at a 50% discount
 - In service date in 2006 and pre-SKF GXK:
 - 995048 Kit at No Charge or
 - 995051 Special Super Kit at a 50% discount
 - and
 - 2.5 hours of labor @ \$80/hr.
 - If customer selects Special Super Kit they will have warranty extended by 1 year 100K miles from repair date

Proposed Upgrade Program

- Exclude trucks that have received a repair since 7/1/06. They have received the SKF with GXK grease.
- Upgrades to be performed by September 1st 2007
- Horton will be able to support up to a total of 2000 Kits/Week
- Horton would like PACCAR's assistance in identifying the VINs of eligible trucks.
 - VIN range possible.
 - VIN of trucks that have been repaired since 7/1/06.



What do the upgrades get you?

- GXK grease (no change from current production)
 - Reduced oil separation at high temperature over original.
- Viton seal
 - Reduced risk of seal degradation at high temperature which will result in less grease purge.
- Steel cage
 - Higher temperature rating able to withstand the higher operating temperatures expected in 2007 without degradation.
 - Failure is less likely to result in the separation of the bearing races.
- Heat stabilized steel races
 - Reduces deformation of the races at high temperatures resulting in more consistent preload throughout operation.
- In field and lab testing, the new bearing grease/package has greatly improved the reliability of the DriveMaster fan drive.



Bearing Upgrade Kit

- 995048 Contents:
 - All Seals and lubricant
 - Upgraded Bearings
 - Main Nut (for fresh lock patch)
 - Liner Screws (for fresh lock patch)
- Omissions that can be shipped as necessary:
 - Cage Nut (tool for disassembly)
 - Torx 55 Plus Bit (tool for disassembly)
 - Literature
 - teardown/rebuild instructions available on the website or via mail, fax and e-mail



Special Super Kit Upgrade

- 995051 Special Super Kit Contents:
 - New FMFD
 - New Liner
 - New Clutch Pack
 - All Seals and Lubricant
 - Upgraded Bearings
 - Main Nut (for fresh lock patch)
 - Liner Screws (for fresh lock patch)
- Omissions that can be shipped as necessary:
 - Cage Nut (tool for disassembly)
 - Torx 55 Plus Bit (tool for disassembly)
 - Literature
 - teardown/rebuild instructions available on the website or via mail, fax and e-mail

Upgrade Program Implementation

- Horton would prefer PACCAR assistance in distributing the parts and tracking the progress of the program.
 - Bearing kits will be shipped at N/C and thus no mark up \$'s
 - Special Super Kits will be shipped at 50% off of the regular price of Super Kits with upgraded bearings
 - No parts credit necessary on repairs
 - Could be sold at standard mark up, or special lower mark up to encourage higher take rate
 - Package price - parts and labor - on special super kit to make it a more attractive option, particularly for 2005 vehicles?



Appendix



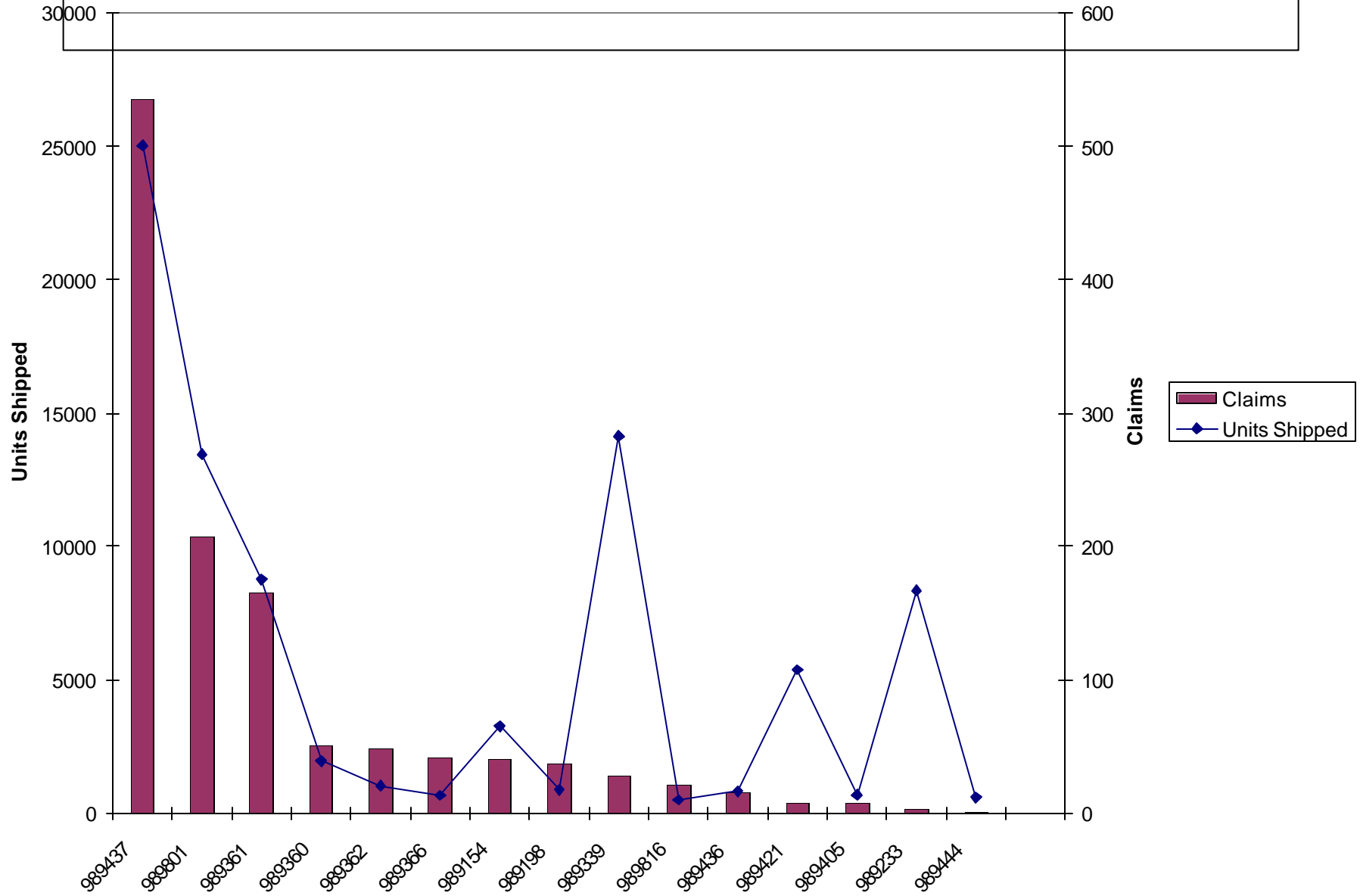
Key Applications

- 989313 – Peterbilt 387 with C15: 1.2:1 ratio
- 989334 – Peterbilt 379 with C15: 1.2:1 ratio
- 989809 – Peterbilt 379 with C15: 1.3:1 ratio

- 989361 – Kenworth W900L with C15: 1.25:1 ratio
- 989437 – Kenworth T600/800/C15: 1.25:1 ratio
- 989801 – Kenworth T2000 with ISX: 1.3:1 ratio

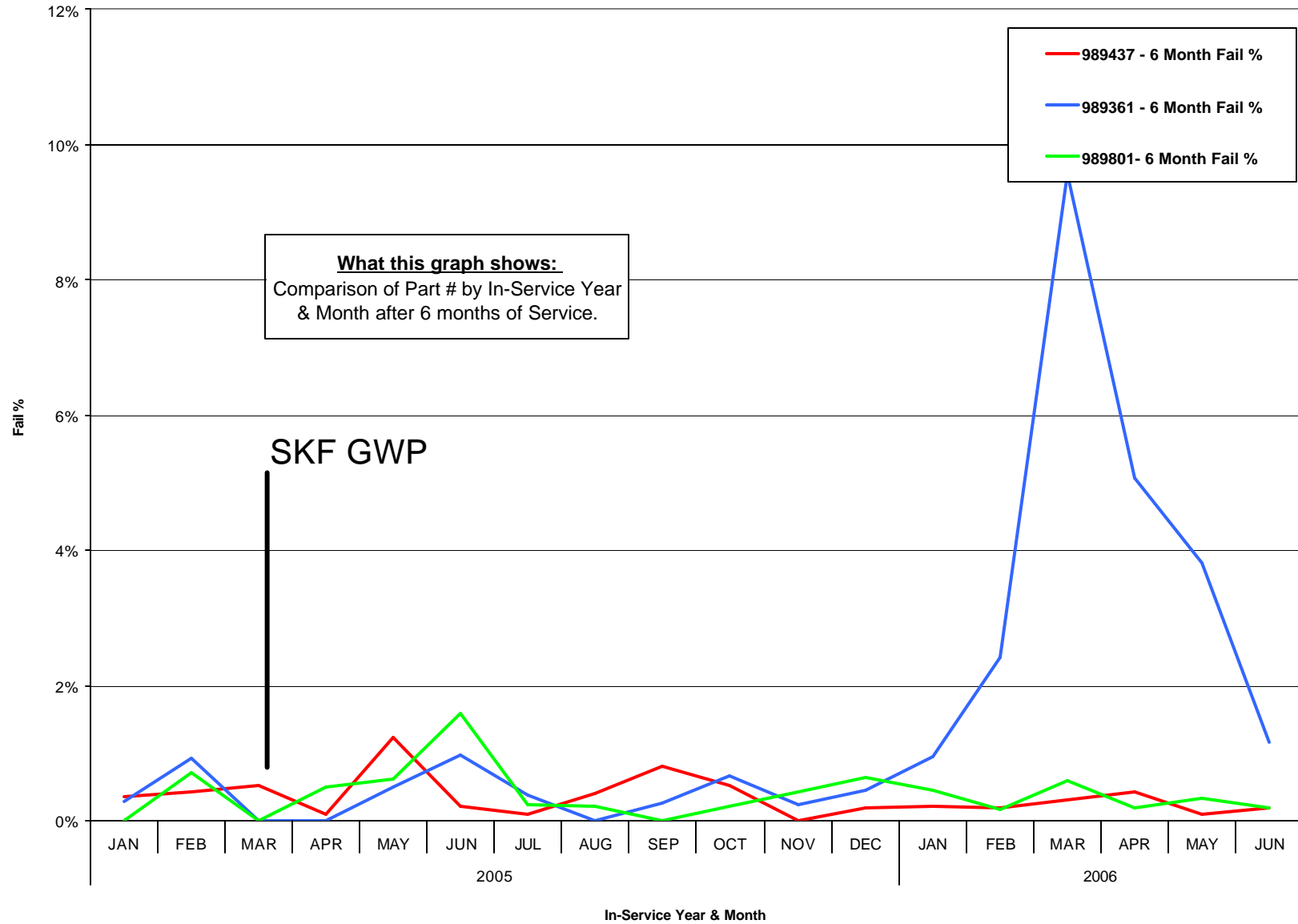


Kenworth Failures by Part Number



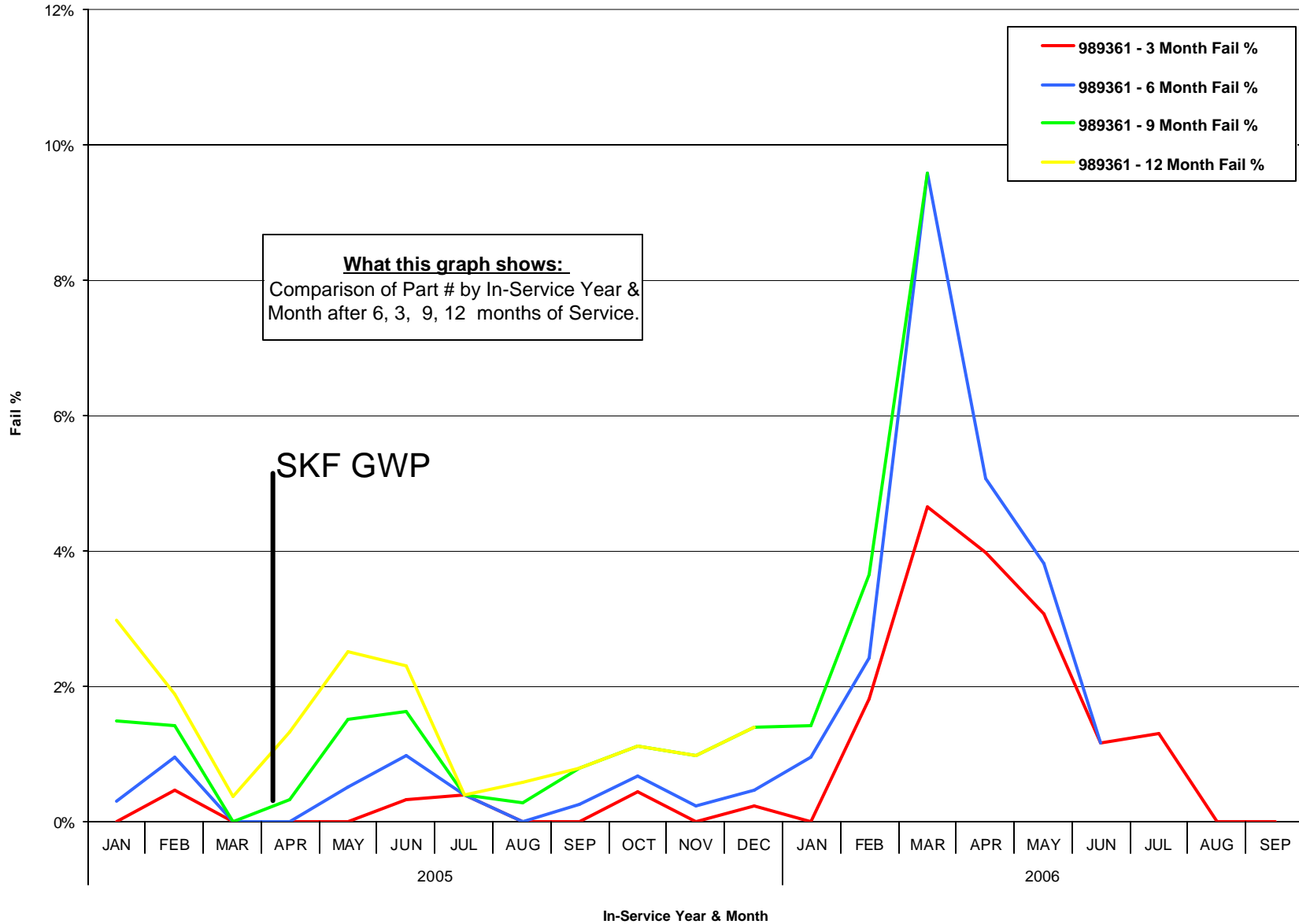
Kenworth Bearing Failures

Kenworth Part # 989347, 989361, 989801 Bearing Failure Percentages
6 Months of Service



Kenworth Bearing Failures

Kenworth Part # 989361 Bearing Failure Percentages
3, 6, 9, 12 Months of Service



Thank You

We value our partnership with PACCAR.

We continue to seek ways to improve our mutual customer's satisfaction.



2007-09-24 Fan Drive Improvements – Peterbilt

Submitted to the Office of Chief Counsel

With a Request for Confidential Treatment

2007_Airflow_TG841_Design Review

Submitted to the Office of Chief Counsel

With a Request for Confidential Treatment

DecisionAnalysis_2007_FanSystemSupplier

Submitted to the Office of Chief Counsel

With a Request for Confidential Treatment

DFMEA_2007_PCP840-841

Submitted to the Office of Chief Counsel
With a Request for Confidential Treatment

PACCAR Six Sigma_121207 rev 1

Submitted to the Office of Chief Counsel

With a Request for Confidential Treatment

Reliability Predict 2007 Initial

Submitted to the Office of Chief Counsel

With a Request for Confidential Treatment