From: Eeley, Scott (A.)
Sent: Wednesday, December 02, 2009 12:59 PM
To: Espinoza, Bob (R.J.); Bergeron, Leon (F.L.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Smith, Ryan (R.E.); Hale, Curt (B.C.); Armesto, Carlos (.); Dumler, Jeff (J.D.); Rudd, David (D.); McAllister, Derek (D.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.)
Subject: RE: 6.4 Pump & Injectors

Attachments: Stackchart.ppt

Leon and Bob(s),

Youz guyz got way ahead of me… I have been keying as fast as I am able….. Please forgive my grammatical and spelling errors.

This is a two part response. The first part is short - much shorter - than the second part.

1. Regarding the engine bank at start of production. I don't see how this impacted warranty. Please see the attached

Stackchart.ppt

stack chart.

2. …………….

This is a sensitive topic with the engine folks - as you know. We don't want to take the FIE replacement warranty hit due to water in fuel. We know the systems guys don't want to take a hit on HFCM warranty. We know that we need to empathize with our customers. (Not apathy.)

A. We understand that some customers ignore the WIF light. > Hopefully changes to the P2269 FMEM and stored information available to technicians will reduce warranty costs.
B. We understand that some technicians minimize the importance of P2269 in diagnostics - "It is just a WIF code and not a REAL DTC. Tell me how to fix the P0087 and P2291." I have been told that the Hotline hears this statement from time to time.
C. We understand that all water separation mechanisms / systems have their limitations.

If the customer ignores the light, they should be held responsible (insurance claim). again> Hopefully changes to the P2269 FMEM and stored information available to technicians will reduce warranty costs.
If the customer inadvertently puts more than ~120 ml of water in the fuel tank, we should not be held responsible. (insurance claim - comprehensive coverage)

Arnie - Here are some thoughts / changes towards improving our "2269 AND RUST" situation. (P2269 with no water is a different deal.)

Could we amend PPT O to help? Something like this? (Or it could be placed in O3?)

O2 : CHECK FOR WATER OR CONTAMINANTS IN THE FUEL

NOTE: The fuel sample should fill the 0.95 L (1 quart) clear container half full. Flow out of the fuel drain should be a steady stream. Insufficient flow may indicate a fuel drain restriction or contaminants blocking the fuel drain. Repair as necessary.

NOTE: Inspect the fuel sample in the clear container. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container.

Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.** Open the fuel conditioning module drain valve and fill the clear container until it is half full. Close the drain valve. Inspect the fuel sample for water or contaminants. Is water or contaminants present in the fuel sample in the clear container?

PPT M - (P2291 and P0087 - low injection pressure DTC's) sends our tech to 10. Sufficient Clean Fuel Test in Diagnostic Subroutines.

We could change to look something like>>>>?

Recommended Procedure:

Open the drain valve integrated in the fuel conditioning module and drain fuel into a clear 1 liter container. Close the drain valve. The flow out of the drain valve should be steady and should produce at least 1 liter/1 quart of fuel within 2 minutes. If the volume of the fuel collected within 2 minutes is short of the required 1 liter/1 quart there may be insufficient amount of fuel in the tank and the fuel level may not be correctly indicated on the fuel level gauge. If a fuel level indication concern is suspected, refer to the Workshop Manual Section 413-01 to continue diagnosis.

Observe the WIF indicator. If the indicator is illuminated, the fuel may be contaminated with water.

Inspect the fuel sample in the clear container. Dyed red or blue fuel indicates off-highway fuel. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container. Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.**

The fuel sample should not indicate evidence of waxing or gelling. Waxing or gelling in some fuels in cold weather could clog fuel filters and the fuel pump and cause restrictions in the fuel or low fuel pressure.

~~Some sediment and water may be present in the fuel sample if the fuel filter has not been replaced for a prolonged period of time or if the sediment and water have not been drained recently. If that is the case, a second sample may be required to determine fuel quality.~~

We could change PPT M3 to look like >>>>>>?

M3 : CARRY OUT THE SUFFICIENT CLEAN FUEL TEST
Carry out the Sufficient Clean Fuel Test. Refer to Section 4, Hard Start/No Start Diagnostic Procedures
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain. Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide..
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.

Is a concern present?

Yes
REPAIR as necessary.
CLEAR the DTCs. REPEAT the self-test.

Yes No
Click for details. Go to M4.

In PPT ME14 - - The final PPT of the HP pump.

We could change PPT ME14 to look like >>>>>>?

ME14 : CARRY OUT THE FUEL SYSTEM DEBRIS CHECK
Carry out the Fuel System Debris Check. Refer to Section 4, Hard Start/No Start Diagnostic Procedures.
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain. Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: If the HP is replaced, remove the HP pump transfer pump (vane pump) cover and inspect mechanisms for rust. Rust indicates use of non-specified fuel.

Is a concern present?

I am done for now. Fire a way…. If there is not further discussion, Craig Davis - please issue a SPECS case.

Scott

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 11:28 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

ONE TEAM - ONE PLAN - ONE GOAL - **ONE FORD** www.thefordstory.com

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 11:21 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator / filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 10:48 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 10:07 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Tuesday, December 01, 2009 6:36 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone:[redacted] (cell) / Fax: (313)-390-4437

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---

From: Pekarscik, Brian (B.)
Sent: Tuesday, December 01, 2009 4:06 PM
To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications

- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,

Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254 Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but

poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

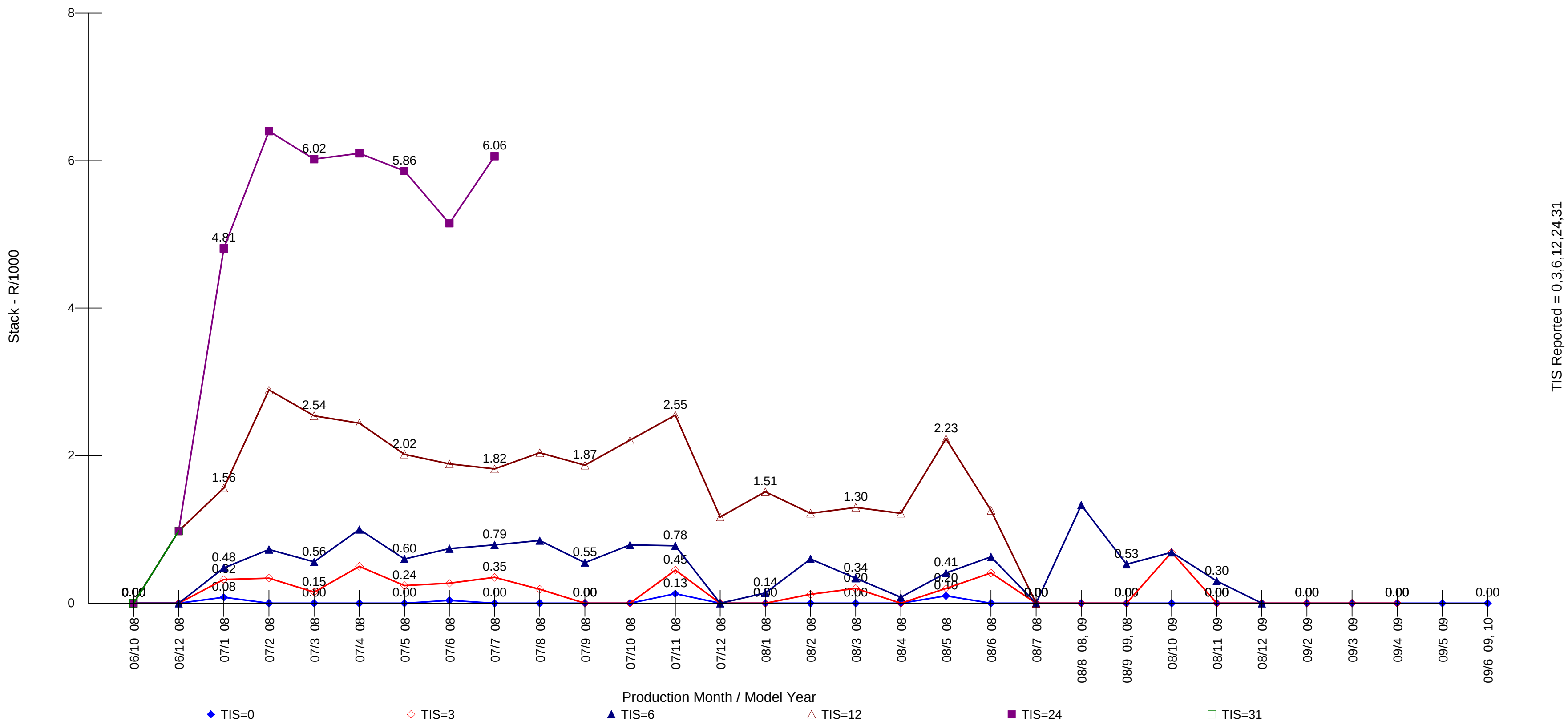
Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

All 6.4L diesel claims with "2269" in tech comments – TIS stack chart – Cut off Sept 17, 09



From: Simpson, Timothy (T.A.)
Sent: Monday, July 27, 2009 12:13 PM
To: Raney-Pablo, Beth (H.E.)
Cc: Eeley, Scott (A.)
Subject: 6.4L Diesel Fuel Analysis Question

Follow Up Flag: Follow up
Due By: Tuesday, July 28, 2009 12:13 PM
Flag Status: Flagged

Attachments: DSC00713.JPG

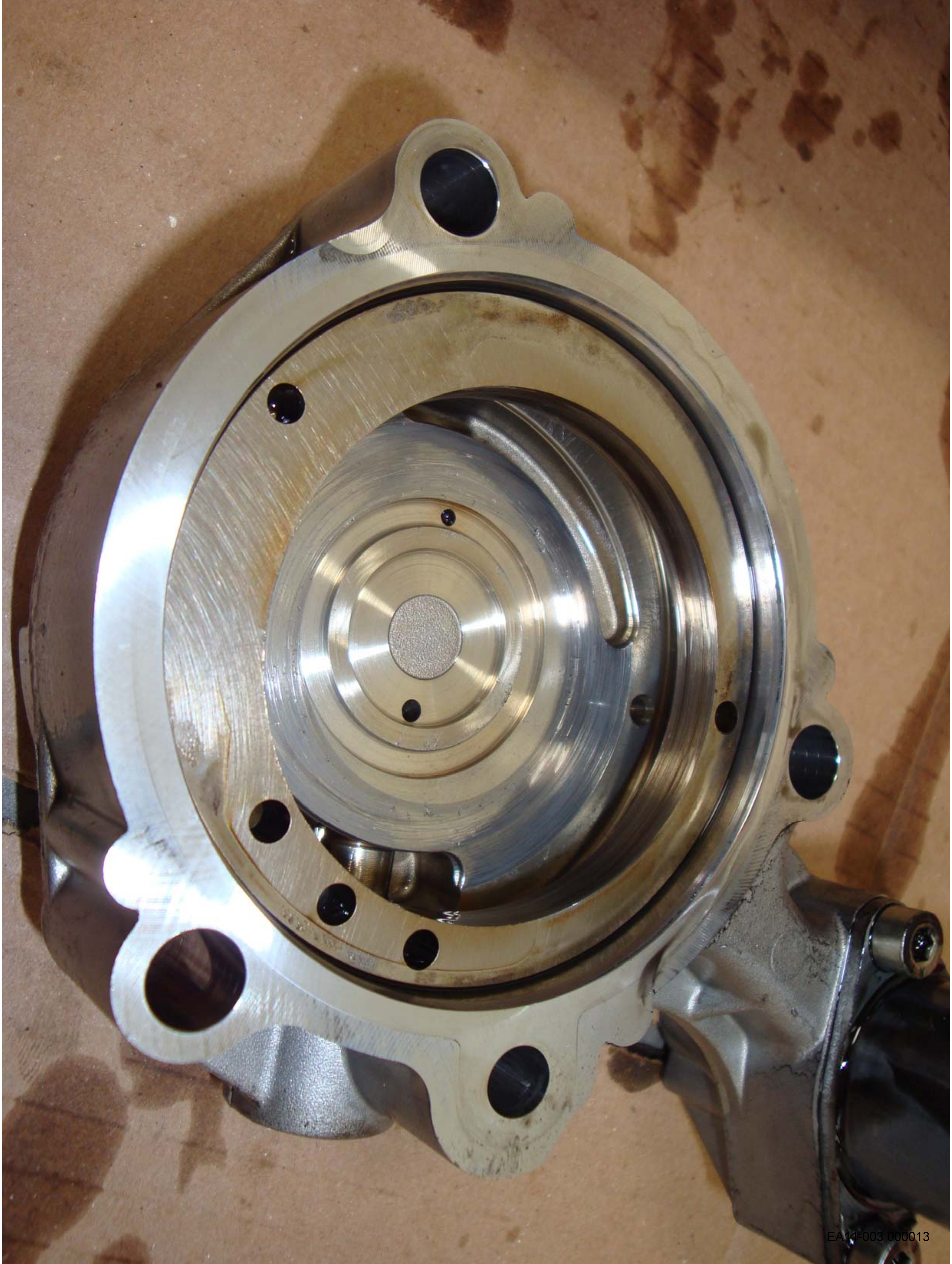
Beth,

A visual analysis of a picture of a failed 6.4L diesel High-Pressure Fuel Pumps from Mexico shows galling in the ITP housing. This suggest a lubrication issue. We've requested that fuel samples be taken from vehicles that exhibit this type of wear. Our counterpart in Mexico has agreed to take samples and have them analyzed. He needs to know what to look for. Can you help by sending us the diesel Fuel Test Standards and Fuel Requirements; e.g., viscosity and lubricity vs. temperature? The attached JPG is a picture of the galling.

Thanks!

DSC00713.JPG

Timothy A. Simpson
LGDEE OPD Systems Dept.-6.4L Diesel
2000 Rotunda Dr.
Dearborn, Mi 48124
Bldg #1, Cube 13H020, Mail Drop 1107
Email: TSimpso1@ford.com
Cell Phone #: 313-805-9880



From:	Heggie, Forest (F.)
Sent:	Thursday, March 03, 2011 12:12 PM
To:	Curtis, Andrew (A.); Eeley, Scott (A.); Dobbs, Dan (K.D.)
Cc:	Heggie, Forest (F.)
Subject:	6.4L wif One final suggestion

"Rust/corrosion within the ITP confirms that water/contaminated fuel caused fuel system damage".

This would make the acid additive/accelerant part be covered in my brain. Let me know

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From:	Stendardo, David (D.)
Sent:	Wednesday, March 23, 2011 2:13 PM
To:	Barragan, Genaro (G.); Bayne, Rick (R.); Beamer, Nathaniel (N.); Bishop, Chris (C.); Bobrowski, David (D.); Boyd, Evan (E.); Buenger, Nick (N.); Burkhart, Fred (F.); Burns, Gaven (G.); Christians, Hesston (H.); Curtis, Andrew (A.); Cutler, John (J.); Deweese, David (D.); Domaire, Daniel (D.); Dominato, Daniel (D.); Dowdy, Jonathon (J.); Dunn, Nathan (N.); Fitzpatrick, Aron (A.); Hamilton, Donald (D.); Herdzik, John (J.); Jimenez, Gonzalo (G.); Johnson, Seth (S.); Johnston, William (W.); Jones, Keith (K.); Kern, Donald (D.); Kiser, Travis (T.); Klein, Mark (M.A.); Kunze, Erik (E.); Lamonde, Sebastien (S.); Law, Karl (K.); Lewis, Kevin (K.); Luke, Dan (D.); McAllister, Derek (D.); McClelland, Mark (M.); Mentgen, Brian (B.); Miller, Michael (M.); Miya, Beth (B.); Olson, Eric (E.); Peters, Paul (P.); Petersen, Nancy (N.); Pienton, Simon (S.); Schmidt, Matthew (M.); Sova, Zak (Z.); Steinmetz, Joseph (J.); Stendardo, David (D.); West, Devin (D.); Yinger, Joel (.); Zieleniewski, Gordon (G.)
Cc:	Heggie, Forest (F.); Palczynski, Kimberly (K.A.)
Subject:	6.4L Fuel System: WIF Detection and P2269
Attachments:	6.4L: WIF detection operation and HP fuel system failure.

Team,
When addressing a drivability/fuel system concern with a P2269 present, be sure that we are addressing this fault first in our responses as well as providing an appropriate direction. Here is an example of some verbiage:

"With the mention of a P2269, please review and perform pin point test O as outlined in the online PC/ED. This will help in determining a cause for the DTC as well as provide insight into the cause for possible subsequent fuel system failures that may be present at this time."

This is just one example and we all know that there are multiple scenarios that involve WIF and fuel system concerns

6.4L: WIF detection operation ...

Regards,

David Stendardo
6.0L / 6.4L SME
Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From: Stendardo, David (D.)
Sent: Monday, December 06, 2010 2:44 PM
To: Baker, Zachary (Z.); Baumeister, Eric (E.); Bayne, Rick (R.); Beamer, Nathaniel (N.); Bishop, Chris (C.); Bobrowski, David (D.); Boyd, Evan (E.); Burkhart, Fred (F.); Burns, Gaven (G.); Christians, Hesston (H.); Curtis, Andrew (A.); Cutler, John (J.); Deweese, David (D.); Domaire, Daniel (D.); Dowdy, Jonathon (J.); Dunn, Nathan (N.); Fitzpatrick, Aron (A.); Hamilton, Donald (D.); Hazzard, Benjamin (B.); Herdzik, John (J.); Johnson, Seth (S.); Johnston, William (W.); Jones, Keith (K.); Kern, Donald (D.); Kiser, Travis (T.); Klein, Mark (M.A.); Kunze, Erik (E.); Lamonde, Sebastien (S.); Law, Karl (K.); Lewis, Kevin (K.); Luke, Dan (D.); McAllister, Derek (D.); Mentgen, Brian (B.); Miller, Michael (M.); Miya, Beth (B.); Olson, Eric (E.); Peters, Paul (P.); Petersen, Nancy (N.); Pienton, Simon (S.); Schmidt, Matthew (M.); Sova, Zak (Z.); Stendardo, David (D.); West, Devin (D.); Yinger, Joel (.); Zieleniewski, Gordon (G.)
Subject: 6.4L: WIF detection operation and HP fuel system failure.

Importance: High

Team,
When handling a HP fuel system failure concern with the suspicion or evidence that water is the cause of failure. Have the tech perform PPT O as outlined in the PC/ED to ensure that the WIF system is functioning properly. If there is a concern with the WIF system, it may not be setting a fault when it should be. This can lead to repeat failures due to the customer not being warned and will help with determining cause of failure.

David Stendardo
6.4L SME / Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From:	Bandoske, Pete (P.F.)
Sent:	Thursday, May 19, 2011 1:56 PM
To:	Eeley, Scott (A.); Heggie, Forest (F.)
Cc:	Johnson, Seth (S.); Dobbs, Dan (K.D.); Whitmyer, Al (A.W.); Palczynski, Kimberly (K.A.)
Subject:	6.4L WIF Service Engineer Approval Guidelines.xls
Attachments:	6.4L WIF Service Engineer Approval Guidelines.pdf

Scott and Forest, Attached for your information is the guidelines we will be using at the Hotline in support of the 6.4L WIF Job Aid. Thanks.

6.4L WIF Service Engineer Appr...

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs)	**Runs Rough/Lack Of Power**	1) Requesting less than 3 Injectors	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise dealer to re-run Debris Test to be certain no debris. The concern may not be warrantable based on findings and Job Aid. If there are no indications of contamination or maintenance concerns, approve.
			2) No debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
			5) Injector electrical codes present.	Do not ask for Debris test - Approve
		2) Requesting Greater Than 3 Injectors	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise dealer to re-run Debris Test to be certain no debris. The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support

NOTE: In addition to repair direction; also advise dealer to make certain any open FSA is completed before releasing vehicle back to customer.

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Runs Rough/Lack Of Power (Cont)**	2) Requesting Greater Than 3 Injectors (Cont)	2) No debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility. • If dealer does not want make decision, escalate to Tier II support.
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility. • If dealer does not want make decision, escalate to Tier II support.
		3) Requesting HPP	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
			2) No debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Runs Rough/Lack Of Power (Cont)**	3) Requesting HPP (Cont)	3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
			5) No Debris, P0088 only. Lack of Power Symptom only.	Approve per TSB 11-04-22
		4) Requesting complete system	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibilitybased on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
			2) No debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support

NOTE: In addition to repair direction; also advise dealer to make certain any open FSA is completed before releasing vehicle back to customer.

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Runs Rough/Lack Of Power (Cont)**	4) Requesting complete system (Cont)	4) Debris and one or more of the following: • DTCs P0087, P2269, P120F • Any Cyl. Contribution DTCs • Multiple cylinders with greater than 10% on STFT	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
	Cranks, No Start	1) Requesting less than 3 Injectors	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise dealer to re-run Debris Test to be certain no debris. The concern may not be warrantable based on findings and Job Aid. If there are no indications of contamination or maintenance concerns, approve.
			2) No debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise dealer to remove and flush rails into clean container due to 0 FRP (i.e. No flow) and look for debris. The concern may not be warrantable based on findings and Job Aid. If there are no indications of contamination or maintenance concerns, approve.
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Cranks, No Start (Cont)**	2) Requesting Greater Than 3 Injectors	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise dealer to re-run Debris Test to be certain no debris. The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			2) No debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise dealer to remove and flush rails into clean container due to 0 FRP (i.e. No flow) and look for debris. Findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility. • If dealer does not want make decision, escalate to Tier II support.
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise that findings suggest a concern that may not be warrantable. Get auth. to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility. • If dealer does not want make decision, escalate to Tier II support.

NOTE: In addition to repair direction; also advise dealer to make certain any open FSA is completed before releasing vehicle back to customer.

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Cranks, No Start (Cont)**	3) Requesting HPP	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
			2) No debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.
		4) Requesting complete system	1) No debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibilitybased on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.

6.4L WIF - Service Engineer Approval Guidelines

Support	Symptom	Request Scenario	Web Form Response	Direction
Tier I (Diesel SEs) (Cont)	**Cranks, No Start (Cont)**	4) Requesting complete system (Cont)	2) No debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise dealer to remove and flush rails into clean container due to 0 FRP (i.e. No flow) and look for debris. Findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility. • If dealer does not want make decision, escalate to Tier II support.
			3) Debris and one or more of the following: • Lack Of Fuel Filter Maintenance • Rust in secondary housing • Standing Water in Secondary Housing	The concern may not be warrantable based on findings and Job Aid. • If not enough evidence (service records OK/no FF) Approve • If evidence confirms LOM as cause, direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support
			4) Debris and one or more of the following: • FRP 0 psi • FRP very low <500psi • P0087/2291/2269/fuel system DTC's	Advise that findings suggest a concern that may not be warrantable. FoMoCo will authorize payment to remove the cab and inspect the ITP for corrosion per job aid. • If not enough evidence Approve. • If corroded, advise tech that water in fuel caused failure and direct dealer to make a decision on warranty eligibility based on Job Aid and complete Warranty Cancellation Request. • If dealer does not want make decision, escalate to Tier II support.

Support	Actions to Take
Tier II (Diesel SMEs) Paul Peters Aron Fitzpatrick	1) Review Results of Job Aid with technician/service management at Dealer to build dealer confidence. 2) Have dealer email images of ITP and SFH to detreina warranty eligibility. 3) Send Centro Inspector if necessary to collect evidence. 4) Dealer or SME to make warranty determination and document results in GCQIS. If dealer does not agree with results, escalate to Tier III.
Tier III (PA Manager) Pete Bandoske	1) Review Results of Job Aid, Images and Centro Inspection Results. 2) TAR GCQIS Report to have FSE perform an onsite inspection and warranty determination.

NOTE: In addition to repair direction; also advise dealer to make certain any open FSA is completed before releasing vehicle back to customer.

From:	Heggie, Forest (F.)
Sent:	Monday, May 09, 2011 2:59 PM
To:	Eeley, Scott (A.)
Subject:	FW: 6.4 Pump & Injectors
Attachments:	RE: 6.4 Pump & Injectors

Some of the original requests for help

From:	Davis, Craig (C.B.)
Sent:	Wednesday, November 11, 2009 11:34 AM
To:	McDonagh, Scot (S.M.)
Subject:	FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

Forest Heggie
LGDEE: OPD Diesel
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt

313-618-5054

From:	Eeley, Scott (A.)
Sent:	Friday, March 19, 2010 12:24 PM
To:	Heggie, Forest (F.)
Subject:	FW: 6.4 Pump & Injectors

From: Davis, Craig (C.B.)
Sent: Friday, December 11, 2009 7:56 AM
To: Eeley, Scott (A.)
Subject: RE: 6.4 Pump & Injectors

Scott, your recommendations on the attached PCED changes look great see attached email and they should be incorporated

RE: 6.4 Pump & Injectors

However this string appeared to going off on a different Tangent, and I wanted to get everyone back on track…keep in mind this string doesn't have your comments, and not knowing if anyone had sent rebuttals to your email.

We held a teleconference, Scot McDonagh has taken on a couple of tasks, and should be sending meeting minutes

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From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 7:08 AM
To: Davis, Craig (C.B.)
Subject: RE: 6.4 Pump & Injectors

What is wrong with my recommend PCED updates?

From: Davis, Craig (C.B.)
Sent: Monday, December 07, 2009 7:18 AM
To: Armesto, Carlos (.); Pekarscik, Brian (B.)
Cc: Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.); Neumann, Richard (R.E.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

All, STOP Hold everything. We need to get back on track. Products are developed and released, issues rise up, corrective actions are taken. As previously indicated whether it is the design engineer or product concern engineer "we have to have confidence in each other and represent our products accordingly."

The issues at hand are

- Fuel Systems failure due to fuel contamination (water/biodiesel %)

- WIF system…there may be other issues with the WIF, lets stick with the issues below

- Customer/operator/dealer technician education

Fuel Systems failure due to rust/corrosion
- my original note was on engine and fuel system failures that we (Ford of Canada) believe may be caused by fuel contamination
- need clear direction on what the dealer/technician needs to do to confirm if is this a warrantable failure or not. Give them the tools to do this. Parts are still mandatory return and claims are still subject to review and chargeback

Scenario (Coles note version)
Vehicle is towed into the dealer, stalled won't run. Dealer diagnosis the issue through normal channels (may even contact National Hotline for direction). Diagnosis leads to fuel system failure, metal filings in both primary and secondary filters in the fuel cooler, injectors dribble or leak down, no HPP pressure
Repairs required All fuel system component replacement (HPP, Fuel Cooler, both fuel filters assemblies, all 8 injectors all fuel lines fuel tank/lines flushed.
Total cost $15,000 average repair…….plus engine damage due to leaking fuel injectors Total cost $30,000 average repair cost
Who pays? Ford...the technician is not directed to open any components to assist in root cause failure analysis. Dealer claims as Ford warranty as they believe the HPP failed causing the failure
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely indicate major fuel system issues) as this is the fuel return portion

of the injector

WIF
Major engine and fuel system failures due to fuel contamination, we need direction for the dealer to be able to determine these faults are the result of
- ignoring the WIF light over saturation of the WIF allowing water to bypass…**maybe a derate is added to the system when the WIF is illuminated after X key cycles**
- fuels bypassing the WIF - alcohol based fuel additives
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely induicate major fuel system issues) as this is the fuel return portion of the injector

- Fuel contamination may be high water content, high levels of biodiesel
- Water in the fuel may be introcduced in many ways
  1. naturally occuring
  2. during fuel fill, enter through filler pipe (body build?) or high levels from the fuel source/station
  3. operator ignoring the WIF warning

Customer/operator/dealer technician education
- Why the need for a WIF system
- the importance of drainng the WIF
- through diagnosis by the technician

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From:	Armesto, Carlos (.)
Sent:	Friday, December 04, 2009 4:48 PM
To:	Pekarscik, Brian (B.)
Cc:	Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.)
Subject:	RE: 6.4 Pump & Injectors

Brian, last year's fuel market study does not indicate that water in fuel is a widespread issue (see slide 1) and we have seen an improvement with time (slide 2)
This study would indicate that a **large** amount water contamination is a special case not a normal occurrence. Some responsibility remains with the operator to assure the fuel is of reasonable quality (gas or diesel).

Here is some survey data from our Fuels Group (Beth Raney-Pablo):
- Total of 1740 samples tested
- Water content ranges from 18 - 554 mg/kg
- Average water content = 77 mg/kg
- 99.6% of the samples (1733) tested contain less than 200 mg/kg of water
- 0.3% (5 samples) contain between 200 - 400 mg/kg of water
- Only 0.1% (2 samples) contain more than 500 mg/kg of water: 502 and 554 mg/kg.

That being said, we understand that our HFCM (Horizontal Fuel Conditioning Module) is design limited due to its orientation which was driven by Super Duty specific issues. The horizontal orientation makes it more susceptible to slosh in the water reservoir (vehicle maneuvers) so we had to compensate with software strategy.
The water reservoir is also smaller than we would like (100ml) with indication at 80 ml - 200-250 ml is ideal. However, we have dual filtration system (our competitors single) and we have the best water separation performance. Even after the HFCM reservoir is overwhelmed, the secondary filter will separate the water and it will take some time before that water is passed through to the engine. So the customer should have some time to act. The large amounts of water in your example (even an eighth of that) would saturate all of our competitors systems. (1 gallon or even 1 liter capacity needed is unrealistic and water in prolonged storage can become acidic and attack materials).

The more likely cause of water contamination on the P356 may be the use of biodiesel (see US survey chart slide 1, 3 &6). Slide 3 shows States that currently promote or mandate biodiesel. Our HFCM is capable with 5% bio. However, our efficiency falls quickly as the biodiesel increases (approx 50% with B20). Many of our customers (specially fleets) have been using much higher biodiesel blends that we did not design for in the P356. The amount of biodiesel may also be higher than advertised as shown on the survey data (see slide 5). Again, it is the operators responsibility to assure proper quality and storage.

The 7.3L system was much worst for water separation since it had a dirty side pump (non-filtered) that emulsifies the water and a single filter on the pump outlet flow-however the Unit injection system (and specially the Caterpillar oil amplified injectors) was much more robust to water than the newer HPCR systems.

I think the WIF team understood the software idle lock implications but risk management dictated that we would be exposed to the rare case where the truck idles all day without moving (If the truck moves then the strategy will be active again) versus the alternative to exposing most people that may park on an incline for a short period of time with false positives.

The 6.7L system has a DFCM (vertical module) with 200 ml of water capacity. It has over a 95% efficiency with B20. It also has a lower current WIF sensor to improve corrosion issues seen in the past. Since it's vertical the water sits at the bottom of the bowl and indication is more robust. But it took a complete redesign to get there.

From my experience, there is usually a good reason we do what we do (at least at that time). Again we're not perfect and we'll keep improving & fixing problems together. But we have to have confidence in each other and represent our products accordingly.

Feel free to give me a call if you would like to discuss further.

Take care,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

<< File: Diesel Water Content.ppt >>

From: Pekarscik, Brian (B.)
Sent: Wednesday, December 02, 2009 1:01 PM
To: Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

With the fuel system in the 6.4 being so susceptible to water what is the reasoning behind the WIF light and code strategy?

When a 7.3L had water it turned the light on right away warning the customer. What was the capacity of the 7.3 and how much water did it hold before it started bypassing the water?

See below description of the light/code operation from the PCED:

NOTE: The PCM must detect water in fuel during engine idle at least 6 consecutive times to set DTC P2269 and to light the WIF indicator. The PCM monitors the WIF sensor for 30 seconds at idle. Each time the PCM checks for water in fuel it must detect a change in the vehicle speed before it will check for water in fuel again.

NOTE: In this step the vehicle needs to be driven enough so the PCM can detect a change to the vehicle speed.

Scenario as follows, customer fuels up because they are low on fuel, 5 gallons left, they fuel up with contaminated fuel that is 10% water and puts 10 gallons in the tank. Water gets in the HFCM and fills it with water to the point it is by passing because the customer is driving down the road not idleling or cycling the key. The light never comes on because there was only one key cycle but by now the truck stalls because the high pressure pump, injectors are wiped out.

Why is the capacity so small in the HFCM? The truck above has a gallon of water in it but it started bypassing with 3.2 oz with no light that leaves 125 more oz to go through the system with no light.

What about trucks that idle all day at a job site but never get driven or more? One could run water through the system and never set a light what is the logic behind that?

With such a low capacity by the time the light comes on and sets the code the fuel system is already compromised. I have over 1000 CQIS reports of p2269 which tells me there are a lot of fuel supply stations that have water in their fuel.

Is the 6.7 going be as susceptible to water as the 6.4?
Are there plans for a better WIF light strategy?
Is the FCM going to have more of a capacity for water/contamination?

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 11:28 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: (313)-805-7057 (cell) / Fax: (313)-390-4437

From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 11:21 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator/filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 10:48 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: (313)-805-7057 (cell) / Fax: (313)-390-4437

From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 10:07 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)

Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Tuesday, December 01, 2009 6:36 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: (313)-805-7057 (cell) / Fax: (313)-390-4437

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From: Pekarscik, Brian (B.)
Sent: Tuesday, December 01, 2009 4:06 PM
To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			

Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications
- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea.

If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,

Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254 Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, December 02, 2009 12:59 PM
To: Espinoza, Bob (R.J.); Bergeron, Leon (F.L.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Smith, Ryan (R.E.); Hale, Curt (B.C.); Armesto, Carlos (.); Dumler, Jeff (J.D.); Rudd, David (D.); McAllister, Derek (D.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.)
Subject: RE: 6.4 Pump & Injectors

Attachments: Stackchart.ppt

Leon and Bob(s),

Youz guyz got way ahead of me… I have been keying as fast as I am able….. Please forgive my grammatical and spelling errors.

This is a two part response. The first part is short - much shorter - than the second part.

1. Regarding the engine bank at start of production. I don't see how this impacted warranty. Please see the attached

Stackchart.ppt

stack chart.

2. …………….

This is a sensitive topic with the engine folks - as you know. We don't want to take the FIE replacement warranty hit due to water in fuel. We know the systems guys don't want to take a hit on HFCM warranty. We know that we need to empathize with our customers. (Not apathy.)

A. We understand that some customers ignore the WIF light. > Hopefully changes to the P2269 FMEM and stored information available to technicians will reduce warranty costs.
B. We understand that some technicians minimize the importance of P2269 in diagnostics - "It is just a WIF code and not a REAL DTC. Tell me how to fix the P0087 and P2291." I have been told that the Hotline hears this statement from time to time.
C. We understand that all water separation mechanisms / systems have their limitations.

If the customer ignores the light, they should be held responsible (insurance claim). again> Hopefully changes to the P2269 FMEM and stored information available to technicians will reduce warranty costs.
If the customer inadvertently puts more than ~120 ml of water in the fuel tank, we should not be held responsible. (insurance claim - comprehensive coverage)

Arnie - Here are some thoughts / changes towards improving our "2269 AND RUST" situation. (P2269 with no water is a different deal.)

Could we amend PPT O to help? Something like this? (Or it could be placed in O3?)

O2 : CHECK FOR WATER OR CONTAMINANTS IN THE FUEL

NOTE: The fuel sample should fill the 0.95 L (1 quart) clear container half full. Flow out of the fuel drain should be a steady stream. Insufficient flow may indicate a fuel drain restriction or contaminants blocking the fuel drain. Repair as necessary.

NOTE: Inspect the fuel sample in the clear container. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container.

Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.** Open the fuel conditioning module drain valve and fill the clear container until it is half full. Close the drain valve. Inspect the fuel sample for water or contaminants. Is water or contaminants present in the fuel sample in the clear container?

PPT M - (P2291 and P0087 - low injection pressure DTC's) sends our tech to 10. Sufficient Clean Fuel Test in Diagnostic Subroutines.

We could change to look something like>>>>?

Recommended Procedure:

Open the drain valve integrated in the fuel conditioning module and drain fuel into a clear 1 liter container. Close the drain valve. The flow out of the drain valve should be steady and should produce at least 1 liter/1 quart of fuel within 2 minutes. If the volume of the fuel collected within 2 minutes is short of the required 1 liter/1 quart there may be insufficient amount of fuel in the tank and the fuel level may not be correctly indicated on the fuel level gauge. If a fuel level indication concern is suspected, refer to the Workshop Manual Section 413-01 to continue diagnosis.

Observe the WIF indicator. If the indicator is illuminated, the fuel may be contaminated with water.

Inspect the fuel sample in the clear container. Dyed red or blue fuel indicates off-highway fuel. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container. Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.**

The fuel sample should not indicate evidence of waxing or gelling. Waxing or gelling in some fuels in cold weather could clog fuel filters and the fuel pump and cause restrictions in the fuel or low fuel pressure.

~~Some sediment and water may be present in the fuel sample if the fuel filter has not been replaced for a prolonged period of time or if the sediment and water have not been drained recently. If that is the case, a second sample may be required to determine fuel quality.~~

We could change PPT M3 to look like >>>>>>?

M3 : CARRY OUT THE SUFFICIENT CLEAN FUEL TEST
Carry out the Sufficient Clean Fuel Test. Refer to Section 4, Hard Start/No Start Diagnostic Procedures
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain.
Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide..
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.

Is a concern present?

Yes
REPAIR as necessary.
CLEAR the DTCs. REPEAT the self-test.

Yes No
Click for details. Go to M4.

In PPT ME14 - - The final PPT of the HP pump.

We could change PPT ME14 to look like >>>>>>?

ME14 : CARRY OUT THE FUEL SYSTEM DEBRIS CHECK
Carry out the Fuel System Debris Check. Refer to Section 4, Hard Start/No Start Diagnostic Procedures.
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain. Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: If the HP is replaced, remove the HP pump transfer pump (vane pump) cover and inspect mechanisms for rust. Rust indicates use of non-specified fuel.

Is a concern present?

I am done for now. Fire a way…. If there is not further discussion, Craig Davis - please issue a SPECS case.

Scott

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 11:28 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
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Email: respino1@ford.com / Phone: (313)-805-7057 (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 11:21 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator/filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From:	Espinoza, Bob (R.J.)
Sent:	Wednesday, December 02, 2009 10:48 AM
To:	McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc:	Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject:	RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

ONE TEAM - ONE PLAN - ONE GOAL - **ONE FORD** www.thefordstory.com

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 10:07 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From:	Espinoza, Bob (R.J.)
Sent:	Tuesday, December 01, 2009 6:36 PM
To:	Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc:	Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject:	RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: Pekarscik, Brian (B.)
Sent: Tuesday, December 01, 2009 4:06 PM
To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications

- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root
cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,
Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254 Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but

poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

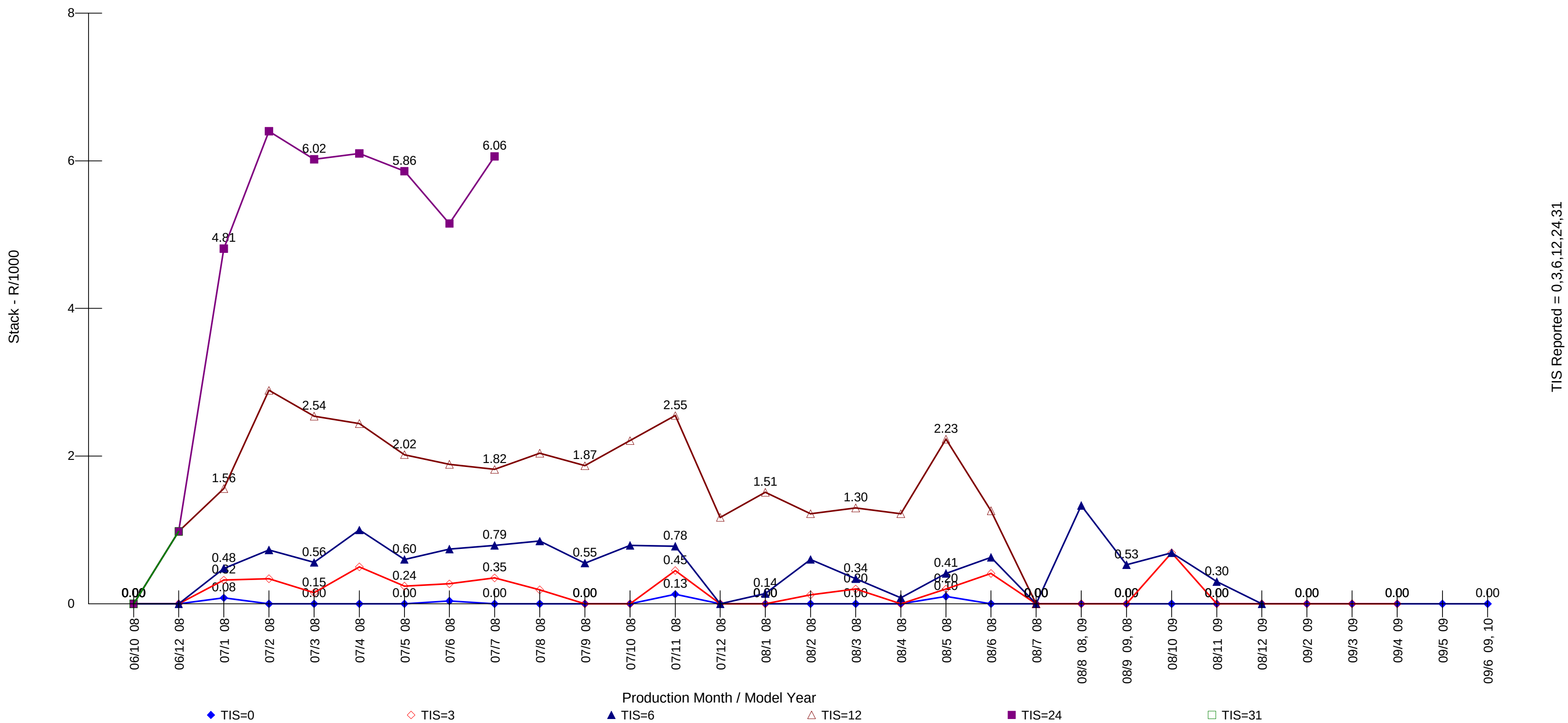
Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

All 6.4L diesel claims with "2269" in tech comments – TIS stack chart – Cut off Sept 17, 09



From: Willmann, Carsten Jens (C.J.)
Sent: Tuesday, February 15, 2011 9:51 AM
To: Thomas, David (D.B.); Fulton, Brien (B.L.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Armesto, Carlos (.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Subject: AW: US defect investigation on 2009-2010 diesel FIP

David, Brien,

NA has a system in place from Martin Rea, but I think it is only for petrol passenger cars. It is a separate development from the system used in Europe, but there is a lot of communication between the teams on that subject:
C520 NA and EU will get a global system from ITW starting the implementation of a common system.

If you are looking for more details on applications and plans please ask Paul Chretien (FNA capless) or Michael Wohlfahrter (FoE capless).

Regards,
Carsten

Quality and Warranty, 6σ BlackBelt
PTI Fuel Systems, FoE
Maildrop: D-ME-4/4084
Tel.: +49 221 90 33372 Ford Tel.: 8703 3372
Fax: +49 221 90 31809 Ford Fax: 8703 1809

Von: Thomas, David (D.B.)
Gesendet: Dienstag, 15. Februar 2011 15:44
An: Fulton, Brien (B.L.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Armesto, Carlos (.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Betreff: RE: US defect investigation on 2009-2010 diesel FIP

Brien I deal with campaigns , not money, for all the PT systems - I can't know that detail but know someone who may :

Carsten - can you help ?

From: Fulton, Brien (B.L.)
Sent: 15 February 2011 14:40
To: Thomas, David (D.B.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Armesto, Carlos (.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Based on Ken's note, even though we are isolated form mis-fueling warranty, it is a very expensive issue for the customer and if it happens most likely creates a lot of dis-satisfaction.
<< Message: RE: US defect investigation on 2009-2010 diesel FIP >>
About 3 years ago I knew that FoE was developing MFIs for applications, but I didn't know they were in production yet. Like I said in this note below, I was not involved in any discussions here in FNA about using MFIs, so there maybe some very valid reasons they were not used, but I hope that it is something that is being developed or seriously considered for diesel applications here.

David,
What is the approximate cost of the MFI used in the PDE capless system?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com [redacted] ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Thomas, David (D.B.)
Sent: Tuesday, February 15, 2011 4:03 AM
To: King, Lamar (L.L.); Fulton, Brien (B.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Thanks Brien,
We too have a larger diameter diesel nozzle for commercial vehicles for the same reasons but these are at separate filling bays which are diesel only

Some of our PDE cars have fuel coolers on the return line to tank to manage fuel temperature , so assume significant flow back to tank

In PDE , our Ford easyfuel capless system has an MFI (MisFuel Inhibitor) which appears to be fairly effective (providing the service stations put the correct diameter nozzles on the hoses .. There have been a couple that haven't) It mechanically senses the OD of the nozzle and either opens or doesn't . It is dependant on nozzle diameter - we had an issue in China where, despite a national standard, gasoline nozzles in Beijing were a different diameter to elsewhere in the country ……..

These have been in service since 2007 - Carsten is a good contact for information on this system . Also see *www.**ford**.co.uk/**Easy_Fuel*** Best ask JL why the US did not adopt this system for B299N & C346N

Look forward to seeing you wearing your 'king of the world' crown. Suggest your first proclamation could be to standardise gas and diesel prices worldwide

Regards David Thomas

From: King, Lamar (L.L.)
Sent: 14 February 2011 18:32
To: Thomas, David (D.B.); Fulton, Brien (B.L.)
Cc: King, Lamar (L.L.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Thank You Brien…

A PASSION FOR "CUSTOMER SATISFACTION" EVER VIGILANT...
Lamar L. King ll Supervisor- SDS Trustmark CECEP & Campaign Prevent Section V8 GAS ENGINE SYSTEMS and Quality, Large Gas and Diesel Engine Engrg. Phone (313) 24-88999 Fax (313) 390-6600 lking1@ford.com Text/Page (313) 795-5332

From: Fulton, Brien (B.L.)
Sent: Monday, February 14, 2011 1:21 PM
To: King, Lamar (L.L.); Billings, Thomas (T.P.)
Cc: Eeley, Scott (A.); Pumford, Ken (K.G.); Armesto, Carlos (.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Yes we see gasoline contaminated diesel fuel. Scott Eeley can give you an idea of how much.

We have the larger ***commercial*** diesel filler pipes, these are the very large ones so that our customers can use the commercial pumps available for Class 8's that really pump fuel out. These filler pipes are even bigger than the diesel pump nozzles that you see at corner gasoline stations. This increases the ability of our customer base to have access to more stations particularly on highways and freeways and pump fuel faster.

There are things that can be done to help make the pump more robust to gasoline, but unless you make it out of unobtainium, it will eventually fail. My guess is that VW probably made control system changes to help keep it running and not stall, possibly also re-circulating more fuel, cars have very little recirculation, much less than even what we have on P473. Based on how much we re-circulate on P473, I don't believe we stall right away and allow the customer to be able to control the vehicle to the side of the road, but it will run like crap when it starts to fail.

There are also filler neck designs to help prevent putting gasoline into a diesel vehicle by putting an inner filler neck in the tube that basically creates an interference to alert the customer to the condition and open a flap to the tank. I think these have been reviewed here, but I was not apart of any of those discussions so I don't know why we do not use that.

BMW offers it as standard on all diesels: http://green.autoblog.com/2009/01/31/new-bmw-diesels-feature-incorrect-fueling-protection-system/

Other products: http://www.powerfuluk.com/products/nissan-navara-navara-d40/mpd002d40-diesel-only---fuel-filler-neck-insert.html

If it were me and I was king of the world, I would look closely at the gasoline fill prevention systems, you can only make the high pressure pump so robust to that condition, but all will eventually fail.

With SCR systems we are also seeing DEF contamination in diesel fuel, this is another issue, but it is happening.

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** [redacted] [redacted] (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: King, Lamar (L.L.)
Sent: Monday, February 14, 2011 12:46 PM
To: Fulton, Brien (B.L.); Billings, Thomas (T.P.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Brien/Thomas,
Have we had any issues with gasoline contaminated Diesel Fuel failing HPFP on are Diesel Engines? See VW recall further below…

A PASSION FOR "CUSTOMER SATISFACTION" EVER VIGILANT...
Lamar L. King ll Supervisor- SDS Trustmark CECEP & Campaign Prevent Section V8 GAS ENGINE SYSTEMS and Quality, Large Gas and Diesel Engine Engrg. Phone (313) 24-88999 Fax (313) 390-6600 lking1@ford.com Text/Page (313) 795-5332

From: Thomas, David (D.B.)
Sent: Monday, February 14, 2011 9:59 AM
To: Bell, Paul (P.); Hillier, Ben (B.E.); Chen, Jun-Lon (J.L.); King, Lamar (L.L.)
Cc: Ginster, Michael (M.); Born, Caroline (C.)
Subject: US defect investigation on 2009-2010 diesel FIP

All FYI

Lamar : have we been having any similar issues on Ford diesels?

JL : does the US have the same convention as elsewhere , that diesel fillers are larger diameter than gasoline , so it would be easy to fill a diesel car with gasoline by mistake , or does the US design capless system (where fitted) for diesel not open for a gasoline nozzle like the PDE capless design ?

Paul, Ben , I Assume there are a limited number of manufacturers of HP diesel FIPs , so are we using same design/source as VW on Gemini engines ?

I note that despite the misfuelling data supplied VW stated they were improving pump robustness against poor quality fuel - Any idea what these changes were and whether they are on pumps specified for Gemini DV & DW engines ?

****
**

NHTSA Action Number : EA11003 NHTSA Recall Campaign Number : N/A
Vehicle Make / Model: Model Year(s):

AUDI / A3 2010

VOLKSWAGEN / GOLF 2010

VOLKSWAGEN / JETTA 2009-2010

VOLKSWAGEN / JETTA SPORTWAGEN 2009-2010

Manufacturer : VOLKSWAGEN OF AMERICA, INC
Component(s) :
FUEL SYSTEM, DIESEL

Date Investigation Opened : February 7, 2011
Date Investigation Closed : Open
Summary:
The Office of Defects Investigation (ODI) and Volkswagen (VW) have received a total of 160 complaints and field reports alleging incidents of engine stall and/or loss of power that appear to be related to high pressure fuel pump (HPFP) failures in certain model year (MY) 2009 through 2010 Volkswagen Jetta and MY 2010 Volkswagen Golf and Audi A3 vehicles equipped with TDI clean diesel engines. Approximately half of the reports indicate that the failure resulted in an engine stall incident, with many of these alleging stall incidents at highway speeds in traffic with no restart. There has been one minor crash alleged to have resulted from HPFP failure in the subject vehicles. In response to ODI's information request for PE10-034, VW indicated that it had "found no defect related to motor vehicle safety with relation to the TDI Clean Diesel fuel system at issue in this investigation" and attributed problems with HPFP failure to operation with gasoline contaminated diesel fuel. Volkswagen stated that "even a small amount of gasoline in the diesel fuel may disrupt the necessary lubrication required and may cause the HPFP to fail." In response to concerns that fuel contamination was the major cause of HPFP and related fuel system failures, VW issued a Technical Service Bulletin in May 2010 (VW TB V011011 2023624 and Audi TB A011008 2023360-1), with instructions to inspect the diesel fuel for vehicles requiring fuel system service that have symptoms associated with HPFP failure. The bulletin states that "fuel system damage incurred by use of fuel not complying to ASTM-D-975 Grade 2 S15 (B5 or less biodiesel content) standards will not be covered under warranty." Volkswagen also provided information about 121 mis-fueling incidents reportedly acknowledged by consumers or dealers and test results for about 50 diesel fuel samples taken from complaint vehicles in late-August through early-October 2010. The mis-fueling incidents include about 20 reports involving incorrect fueling by dealer sales or service personnel and generally report symptoms such as rough running, stalling and/or no start within a few miles of refueling the vehicle with gasoline. Volkswagen indicated that the testing of fuel samples from complaint vehicles found that nearly 90 percent contained high amounts of gasoline. Volkswagen implemented design changes for the HPFP in May 2008, September 2009 and November 2010 to improve the robustness of the pump when used with poor quality fuel. ODI analysis of HPFP failures identified from all sources shows failure rates of 0.53% for MY 2009 vehicles and 0.11% for MY 2010 vehicles. This investigation has been upgraded to an Engineering Analysis to continue to investigate the issues with mis-fueling and HPFP design identified during the Preliminary Evaluation.

Regards David Thomas

6.4L Diesel:
Compare IDS server upload to claims for **P2269**
Water in fuel

- One Warranty Solution – OWS DTC search for P2269: 14352 uploads
  - Sample 100 VIN's IDS Server Upload 04/19/2011-04/20/2011 with P2269
    - 90 of 100 VIN's have warranty history in AWS
    - Repair history 378-claims
    - 7 with Tech comments incl. P2269
      - 3-HFCM, 2-EGT sensor, 1-HP pump cover gskt, 1-short block
    - 8 with DTC field include P2269
      - 3-HFCM, 1-short block, 1-EGT sensor, 1-WIF sensor, 1-injector, 1-HP pump cover gskt

HP pump & injector as causal

- In history of 90 VIN's:
  - 7 causal 9E527 injectors
  - 6 causal 9A543 HP pumps

- P2269 is stored in PCM more often than addressed in warranty claims

6.4L Diesel:
Compare IDS server upload to claims for **P0088** Fuel Pressure High

- One Warranty Solution – OWS DTC search for P0088: 14211 uploads
  - Sample 100 VIN's IDS Server Upload 04/19/2011-04/20/2011 with P0088
    - 91 of 100 VIN's have warranty history in AWS
    - Repair history 410-claims
    - 37 with Tech comments include P0088
    - 33 with DTC field include P0088

	Counts	
Causal Part	Comments	DTC Field
HP pump	28	26
WIF sensor	2	1
Injector	1	1
RECAL	1	1
EGR valve	1	1
PCM	1	1
Wire harness	1	1
HP harness	1	0
Diag	1	1
	37	33

HP pump & injector as causal

- In history of 91 VIN's:
  - 10 causal 9E527 injectors
  - 41 causal 9A543 HP pumps
- P0088 is stored in PCM more often than addressed in warranty claims

Relationship of DTC found in claim to causal part

- P2269
  - 43-50% of the causal parts relate to the DTC.
- P0088
  - 76-78% of the causal parts relate to the DTC.

(The causal part could induce the DTC.)

6.4L Diesel:
Compare IDS server upload to claims for **P2291**
Fuel Pressure High

- One Warranty Solution – OWS DTC search for P0088: 39881 uploads
  - Sample 100 VIN's IDS Server Upload 04/19/2011-04/20/2011 with P2291
    - 87 of 100 VIN's have warranty history in AWS
    - Repair history 406-claims
    - 12 with Tech comments include P2291
    - 9 with DTC field include P2291
      - 7-HP pump, 2-WIF sensor

Causal Part	Quantity
HP pump	4
Injector	2
Shortblock	1
Cyl head	1
EGT sensor	1
HFCM	1
HP pump cover gskt	1
RECAL	1

HP pump & injector as causal

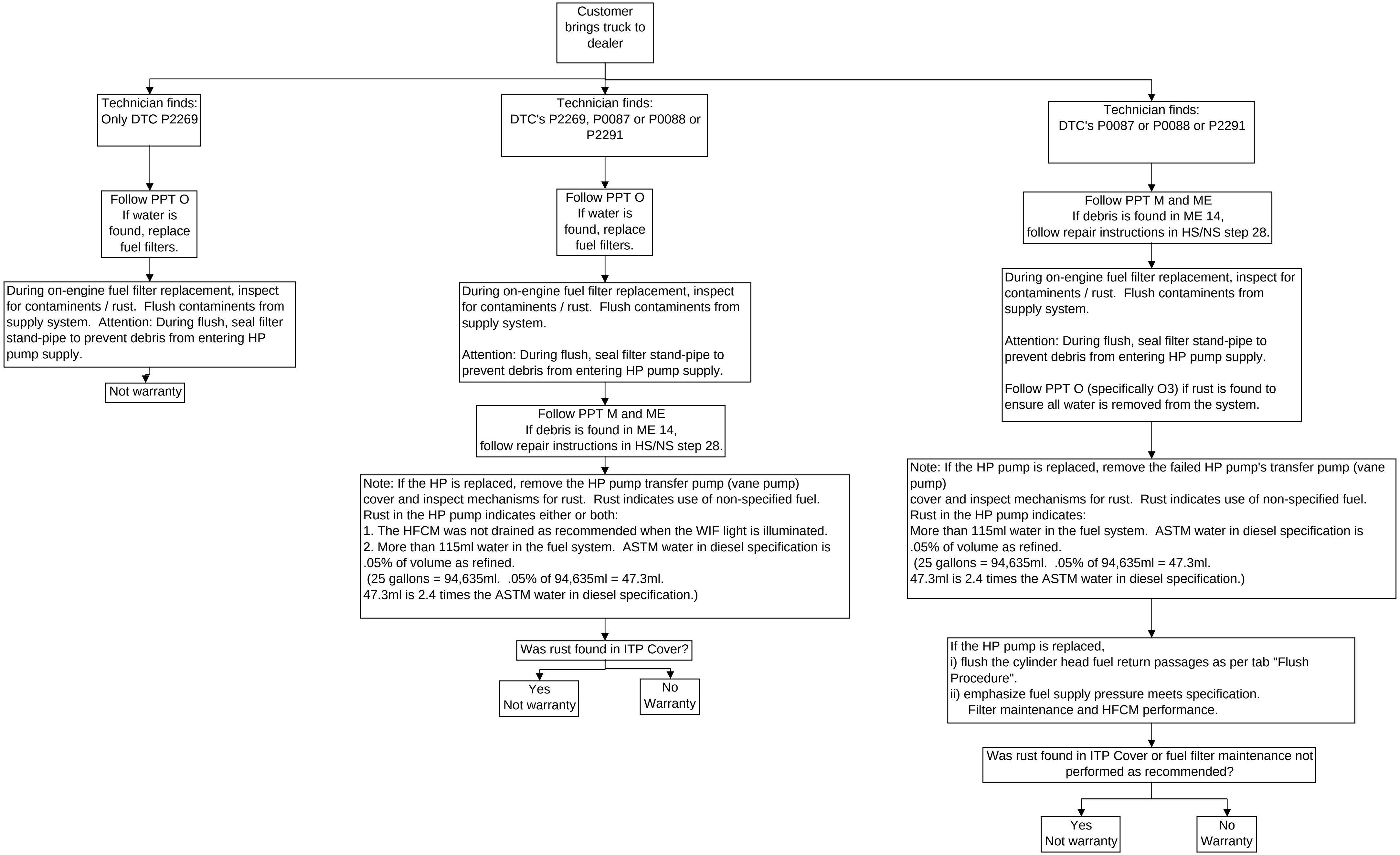
- In history of 91 VIN's:
  - 7 causal 9E527 injectors
  - 22 causal 9A543 HP pumps
  - (43 causal 8009 radiators)

- P2291 is stored in PCM more often than addressed in warranty claims

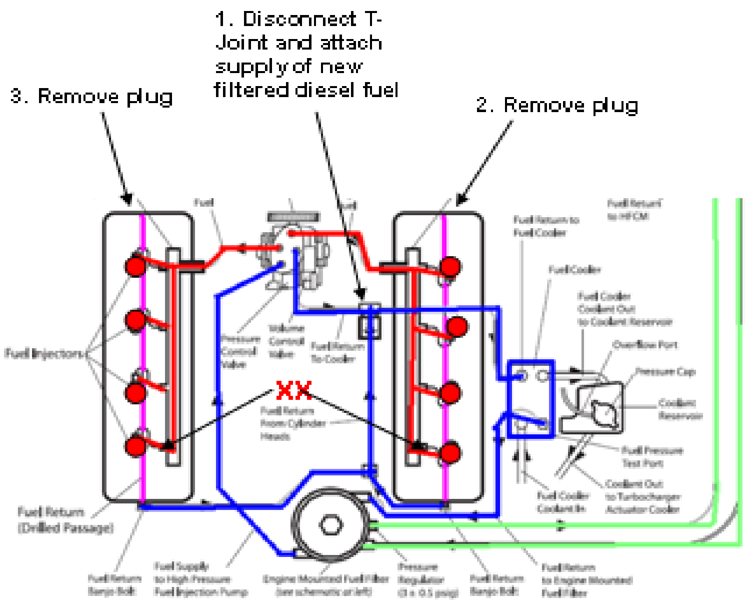
Relationship of DTC found in claim to causal part

- P2269
  - 43-50% of the causal parts relate to the DTC.
- P0088
  - 76-78% of the causal parts relate to the DTC.
- P2291
  - 58-78% of the causal parts relate to the DTC.

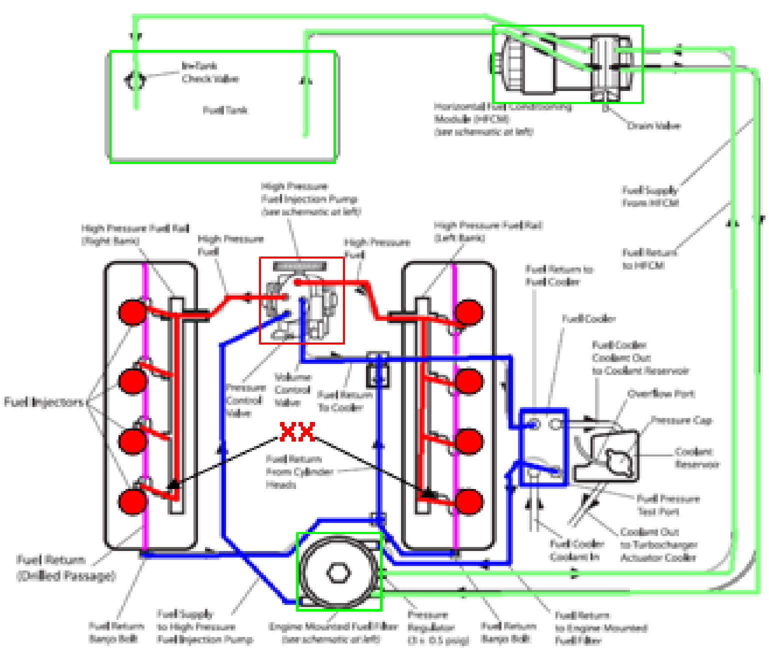
(The causal part could induce the DTC.)


Customer brings truck to dealer
Technician finds: Only DTC P2269
Follow PPT O If water is found, replace fuel filters.
During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system. Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.
Not warranty
Technician finds: DTC's P2269, P0087 or P0088 or P2291
Follow PPT O If water is found, replace fuel filters.
During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system.
Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.
Follow PPT M and ME If debris is found in ME 14, follow repair instructions in HS/NS step 28.
Note: If the HP is replaced, remove the HP pump transfer pump (vane pump) cover and inspect mechanisms for rust. Rust indicates use of non-specified fuel.
Rust in the HP pump indicates either or both:
1. The HFCM was not drained as recommended when the WIF light is illuminated.
2. More than 115ml water in the fuel system. ASTM water in diesel specification is .05% of volume as refined.
(25 gallons = 94,635ml. .05% of 94,635ml = 47.3ml.
47.3ml is 2.4 times the ASTM water in diesel specification.)
Was rust found in ITP Cover?
Yes Not warranty
No Warranty
Technician finds: DTC's P0087 or P0088 or P2291
Follow PPT M and ME If debris is found in ME 14, follow repair instructions in HS/NS step 28.
During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system.
Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.
Follow PPT O (specifically O3) if rust is found to ensure all water is removed from the system.
Note: If the HP pump is replaced, remove the failed HP pump's transfer pump (vane pump)
cover and inspect mechanisms for rust. Rust indicates use of non-specified fuel.
Rust in the HP pump indicates:
More than 115ml water in the fuel system. ASTM water in diesel specification is .05% of volume as refined.
(25 gallons = 94,635ml. .05% of 94,635ml = 47.3ml.
47.3ml is 2.4 times the ASTM water in diesel specification.)
If the HP pump is replaced,
i) flush the cylinder head fuel return passages as per tab "Flush Procedure".
ii) emphasize fuel supply pressure meets specification.
Filter maintenance and HFCM performance.
Was rust found in ITP Cover or fuel filter maintenance not performed as recommended?
Yes Not warranty
No Warranty

Flush Recommendation



- Flush cylinder heads individually by removing one plug at a time.
- Use only new clean filtered diesel fuel.
- Do not exceed 8 PSI during flush.
- Replace all components in BLUE after cylinder head flushing is complete. (Leave original injectors in cylinder head until flushing is complete.)
- Replace fuel filters after flushing is complete.



- **Regarding indication to replace HP fuel system for debris contamination**
- Replace if debris is found at XX – Injector Supply Tube
- Replace only if damaged. Flush with new clean diesel fuel. Pressure not to exceed 8 PSI
- See previous page page

Customer brings truck to dealer

Technician finds:
Only DTC P2269

Follow PPT O
If water is found, replace fuel filters.

During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system. Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.

Not warranty

Technician finds:
DTC's P2269, P0087 or P0088 or P2291

Follow PPT O
If water is found, replace fuel filters.

During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system.

Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.

Follow PPT M and ME
If debris is found in ME 14,
follow repair instructions in HS/NS step 28.

Parts to Inspect for Rust - on engine filter bowl, injector return ports

~~Note: If the HP is replaced, remove the HP pump transfer pump (vane pump) cover and inspect mechanisms for rust.~~

Rust indicates use of non-specified fuel.
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1. The HFCM was not drained as recommended when the WIF light is illuminated.
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47.3ml is 2.4 times the ASTM water in diesel specification.)

Was rust found in **XXXX** Cover?

Yes
Not warranty

No
Warranty

Technician finds:
DTC's P0087 or P0088 or P2291

Follow PPT M and ME
If debris is found in ME 14,
follow repair instructions in HS/NS step 28.

During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system.

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If the HP pump is replaced,
i) flush the cylinder head fuel return passages as per tab "Flush Procedure".
ii) emphasize fuel supply pressure meets specification.
Filter maintenance and HFCM performance.

Was rust found **XXXXX** or fuel filter maintenance not performed as recommended?

Yes
Not warranty

No
Warranty

Typical fill in gallons	25
ASTM WIF Spec / vol	0.0005
Gal to ml	94635
B4XB3	47.3175
HFCM ONLY capability	
On-engine filter addes	
~110ml capability	115
B6/B5	2.43039

Customer brings truck to dealer

Technician finds:
Only DTC P2269

These cases pump may be already damaged, no start,

Follow PPT O
O1: set the P2269 code idle then drive 8 times

updated sufficient clean fuel test

O2: check for water or contaminates in the fuel, fill 1/2 L or 1/2 quart from the fuel conditioning module drain valve

aerated

section 4 performance diag procedures caRRY OUT THE FUEL AERATION TEST

YES water/contaminants

O3: check 2 additional fuel samples for water in the fuel: 2 times from the HFCM
Is water present in the final fuel

Validated water in the fuel

YES

Flush and clean the fuel tank and fuel system

fuel sample from the tank

Where should engine rust check be

NO

Check WIF sensor

Check for short to ground

Check the WIF for contamination

NO water/contaminants

emulsified

replace the fuel filters

Rust at on engine filter bowl

do we want to add other components

During on-engine fuel filter replacement, inspect for contaminents / rust. Flush contaminents from supply system. Attention: During flush, seal filter stand-pipe to prevent debris from entering HP pump supply.

Not warranty

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Was rust found in **XXXX** Cover?

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Not warranty

No
Warranty

Technician finds:
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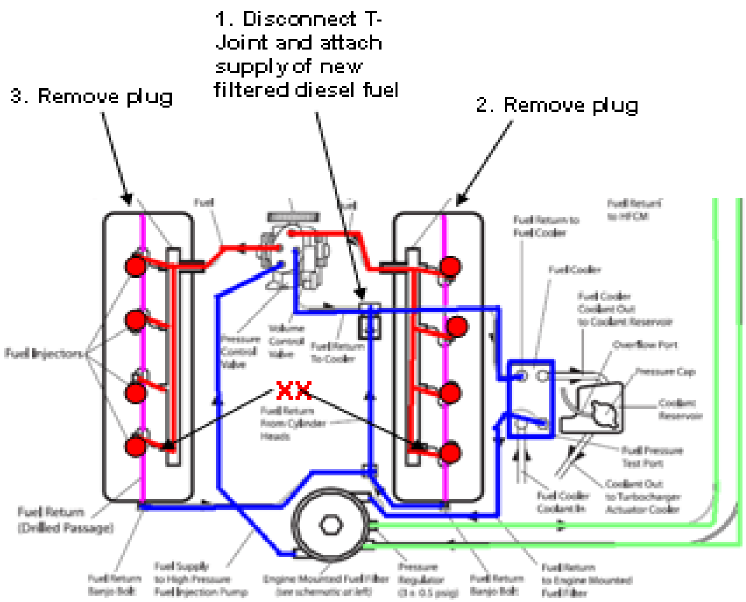
Filter maintenance and HFCM performance.

Was rust found **XXXXX** or fuel filter maintenance not performed as recommended?

Yes
Not warranty

No
Warranty

Flush Recommendation



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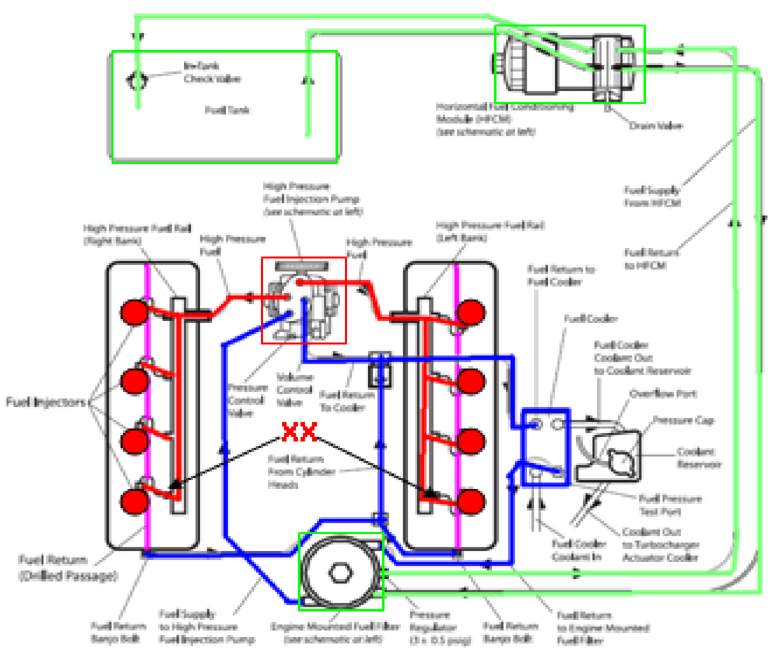


- **Regarding indication to replace HP fuel system for debris contamination**
- Replace if debris is found at XX – Injector Supply Tube
- Replace only if damaged. Flush with new clean diesel fuel. Pressure not to exceed 8 PSI
- See previous page page

From: Fulton, Brien (B.L.)
Sent: Monday, February 09, 2009 5:21 PM
To: Pumford, Ken (K.G.); Eeley, Scott (A.); Heggie, Forest (F.)
Cc: Haven, Keith (K.)
Subject: RE: Corrosion failure in P473 HP fuel pump

Yes,
We are storing number of lights and time on.

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Pumford, Ken (K.G.)
Sent: Monday, February 09, 2009 4:57 PM
To: Eeley, Scott (A.); Heggie, Forest (F.)
Cc: Fulton, Brien (B.L.); Haven, Keith (K.)
Subject: RE: Corrosion failure in P473 HP fuel pump

Scott,

I looked through the presentation and don't see WIF called out separately as a repair cause. Is there any data for pump failures due to fuel quality?

Brien,
Scott's note and the presentation raises a good point - the real warranty $$ from LP fuel system affecting the HP fuel system is due to low pressure. Now that the system has a low pressure switch, has there been any discussion around affecting vehicle driveability if customers ignore the low pressure message, similar to the discussions you had around the WIF light during the P356 program?

Regards,

Ken Pumford
Ford Super Duty Diesel
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Eeley, Scott (A.)
Sent: Monday, February 09, 2009 2:26 PM
To: Heggie, Forest (F.); Pumford, Ken (K.G.)
Cc: Fulton, Brien (B.L.); Haven, Keith (K.)
Subject: RE: Corrosion failure in P473 HP fuel pump

Ken,

This stuff was included in the presentation / discussion we had with Adam prior to Christmas. (Keith's presentation)
1. Need a WIF light
2. Need a low pressure fuel system sensor
3. Need a timer on the WIF light that the technician can 'see' - how long were they driving with water in the fuel
4. Need a timer on the low fuel pressure monitor - how long were they driving around with low fuel pressure

Keith's presentation has the 6.0 and 6.4 WIF / low fuel PSI $$$'s. (I think)

Scott

From: Heggie, Forest (F.)
Sent: Monday, February 09, 2009 1:46 PM
To: Pumford, Ken (K.G.); Eeley, Scott (A.)
Subject: RE: Corrosion failure in P473 HP fuel pump

One suggestion I have is to have the information available to the service technician for how long the WIF light has been on.

Forest Heggie
MASc, P. Eng
Fuel Systems Diesel OPD
Ford Motor Company
313-282-1627

From: Pumford, Ken (K.G.)
Sent: Monday, February 09, 2009 1:21 PM
To: Heggie, Forest (F.)
Subject: Corrosion failure in P473 HP fuel pump

Forest,

Attached is the presentation that contains the photos that I shared while at your office earlier today. This was something that we quickly put together for a discussion between Scorpion engine manager Adam Gryglak and chassis fuel system manager Shawn Lightener. In that meeting the decision was made to leave the hardware (engine and chassis fuel) as is, because it appears to be functioning correctly and is state of the art and best-in-class. The Vehicle Engineering team is prepared to concur, but requested a review of current 6.4L HP fuel pump warranty before making a final decision. They are looking for evidence either way to say whether water-in-fuel related issues are a significant source of 6.4L HPP warranty or not. Thanks.
<< File: P473 HP Pump Corrosion_M1 vehicle 517W790.ppt >>
Regards,

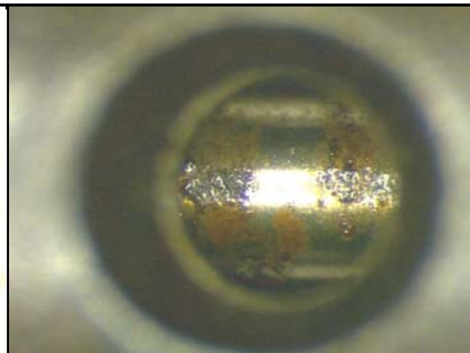
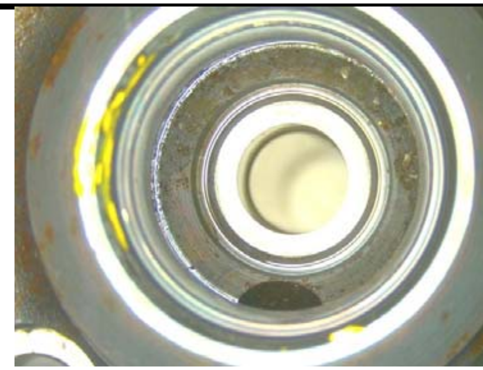
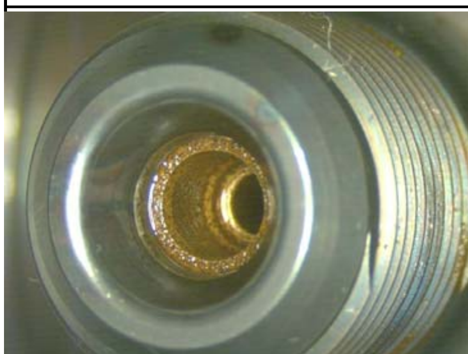
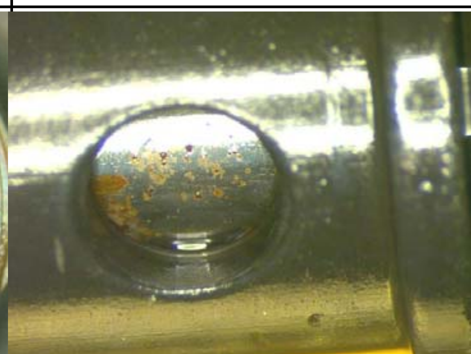
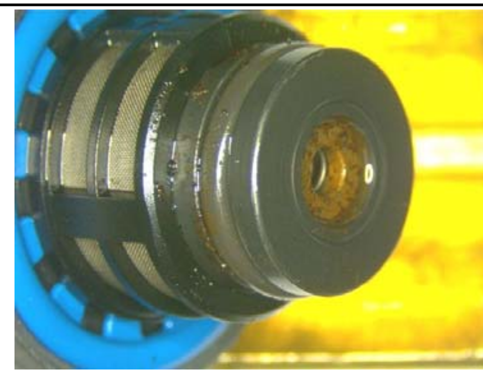
Ken Pumford
Ford Super Duty Diesel
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

P.S. - Best of luck with the arrival of #2

P473 HP Pump Corrosion / WIF

Brien Fulton
Ken Pumford
Carlos Armesto

Bosch Tear Down Analysis

			
SV cyl 1 top	SV cy1 valve stem	HP element 1	HP element cyl SV area
			
HP outlet cyl 1	KUEV Piston	MPROP	MPROP

P473 HP Pump Corrosion / WIF

Background

- Management Drive vehicle W790 had a high pressure fuel system failure 1/09.
  - Reported that the WIF light was illuminated on the vehicle
  - Other symptoms include DFCM noise due to high pressure – deadhead of the DFCM pump

Root Cause – Water Ingestion

- Excessive fuel pressure due to debris at the pressure regulator causing a pressure regulator failure
- High pressure pump showed corrosion on operating parts most likely due to water ingestion
- Other Root causes?

P473 HP Pump Corrosion / WIF

Current Scorpion Prevention and Detection

- Low Pressure Prevention
  - Low pressure fuel system DFCM has a water separator to remove water from the fuel and store that water in the reservoir
  - When water separator reservoir is full, the 2^{ndary} filter will also separate water from the fuel until it has reached a saturation point.
- Low Pressure Detection
  - Low pressure fuel system DFCM has a WIF sensor to detect when the water reservoir has reached a level it is required to be drained
  - The signal from the WIF sensor is processed by the ECU and a message is sent to the message center to tell the driver to drain the water separator
  - Fuel delivery pressure switch is present at the end of the engine low pressure fuel system to detect low pressure conditions – Water in filters can freeze causing low pressure
- High Pressure Fuel System Detection
  - PCV / VCV duty cycle detection – After PCV or VCV have reached their respective control limits, the operating strategy is toggled between both actuators and a difference in duty cycle is detected.
    - Current thresholds are pretty generous as type B errors are as bad as actual errors.

P473 HP Pump Corrosion / WIF

Other options

- Graduated response with WIF light on time – only possible in short time
  - Implement actions to further alert the customer to the water drain condition.
    - Rough operation / reduced power / vehicle shutdown is done to the customer
    - Options were available for P356, but were not used and team was very against this option
- High pressure detection in LP fuel system
  - High fuel pressure caused the pressure regulator to fail in the high pressure fuel system
    - High pressure caused by debris in the pressure regulator, failure already happened and high pressure detection would not prevent failure as debris already in the pump
- Modification of Low Pressure fuel system
  - Larger water separation volume – may not be effective as WIF light was already reported (significant cost / packaging / timing issues)
  - Second coalescer and WIF sensor in 2^{ndary} filter- again this may not be effective as WIF already reported (significant cost / packaging / timing issues)
  - Automatic water reservoir drain feature (significant cost / packaging / timing issues)
    - EPA issue of “where” to drain.
- Modification of High Pressure fuel system
  - Pump material change to be robust to water (significant cost / packaging / timing issues)

Question to Bosch

- One question the team had for Bosch was "how do we know that current permissible amount of water will not result in this type of corrosion"?

Bosch WIF testing

- Bosch tested 99% fuel 1% water (non-emulsified) per NACE TM0172 method
- Results are highly dependant on fuel mixture rest time in HP components
  - 6 hr run time, 0 hour rest – no issues
  - 12 hour, 18 hour – no issues
  - 18 hour, 36 hour – functionally OK, visual degradation on some units, failure on others
  - 24 hour, 54 hour – complete functional and mechanical failure

From: Heggie, Forest (F.)
Sent: Thursday, September 16, 2010 10:38 AM
To: Curtis, Andrew (A.)
Subject: Diag for rust in fuel system

Attachments: Diagnostic flow chart9-16.xls

Diagnostic flow chart9-16.xls

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

•PCED Step 28: Debris found in the Fuel System at the injectors Entry condition

Inspect the Secondary (On-Engine)Filter Housing for Rust
-Opportunity to tell the cutomser repair may be customer pay depending on findings

→ No Rust - Ford Pay -
: ~76% with no rust in housing will have rust in the HP Pump ITP

Inspect Fuel Filter inspection/maintenance

→ Filters not maintained properly
-Not HP Pump causal
customer pay

Perform Pin Point Test o

Fail → Issue found - Ford pay, not HP Pump Causal

Is there Rust in the Tank

YES → Acid in Fuel
– Not HP Pump causal
-TBD - ford policy ?

Inspect for Rust in the ITP/VCV
High Pressure Pump

YES → Water in Fuel
– Not HP Pump causal
- Customer Pay

No Rust in TANK/Housing/Pump
HP Pump Causal - Ford Pay
~82% of cases with rust in the housing will have rust in the ITP
~71% of the study also had bad fuel

B) PCED does not lead to step 28: Engine Runs no issues but observation of Rust in the Housing is made at the Dealer or By the Customer: this is an opportunity to warn customer about water in fuel, fuel filter maintenance, and draining hfcm properly
Senarios:
Customer comes in WIF on: No performance issues
During maintenance rust observed in housing: No performance issues

Inspect Fuel Filter inspection/maintenance

→ Filters not maintained properly
-Not HP Pump causal
customer pay

Pin Point Test o

Replace both filters
and education of properly draining WIF
education of proper fuels

From: James.Sobieski@vftis.spx.com
Sent: Tuesday, April 06, 2010 12:58 PM
To: Heggie, Forest (F.)
Subject: Diagnostic Draft Procedure
Attachments: DiagnosticTree.xls

Hi, Forest,

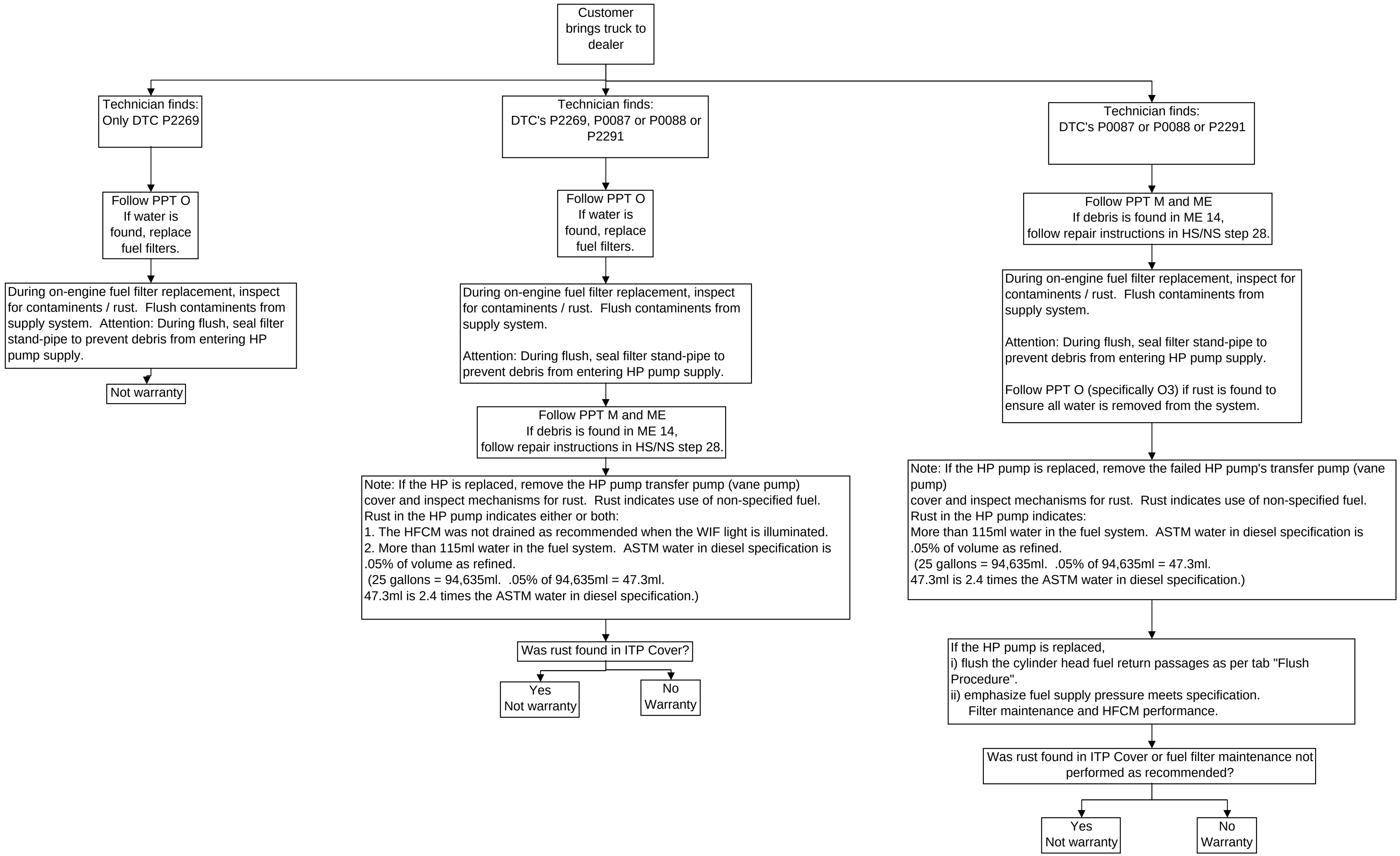
Per your request, here is the draft procedure by Scott Eeley.

Thanks,

James Sobieski
Technical Author

SPX Service Solutions
1555 Fairlane Circle | Allen Park, MI 48101 | USA
T: 313 317 1646

james.sobieski@spx.com
www.SPX.com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Not warranty
Technician finds: DTC's P2269, P0087 or P0088 or P2291
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47.3ml is 2.4 times the ASTM water in diesel specification.)
Was rust found in ITP Cover?
Yes Not warranty
No Warranty
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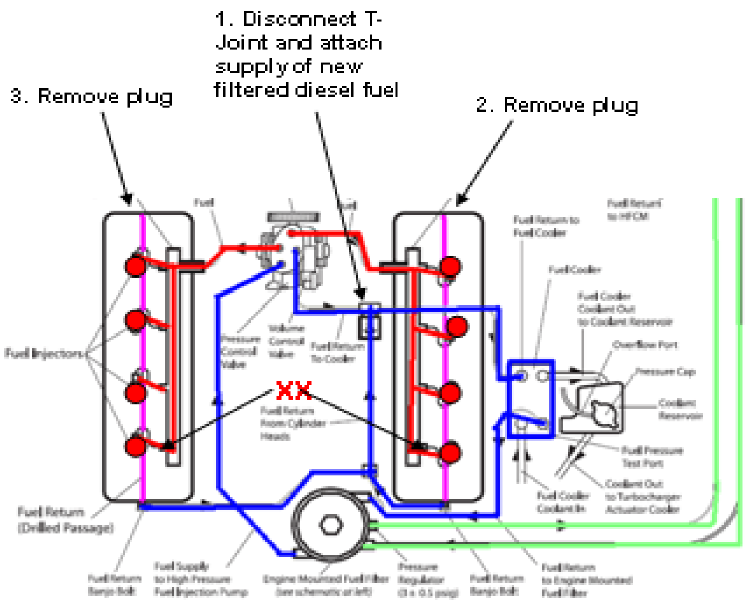
No Warranty

Flush Recommendation



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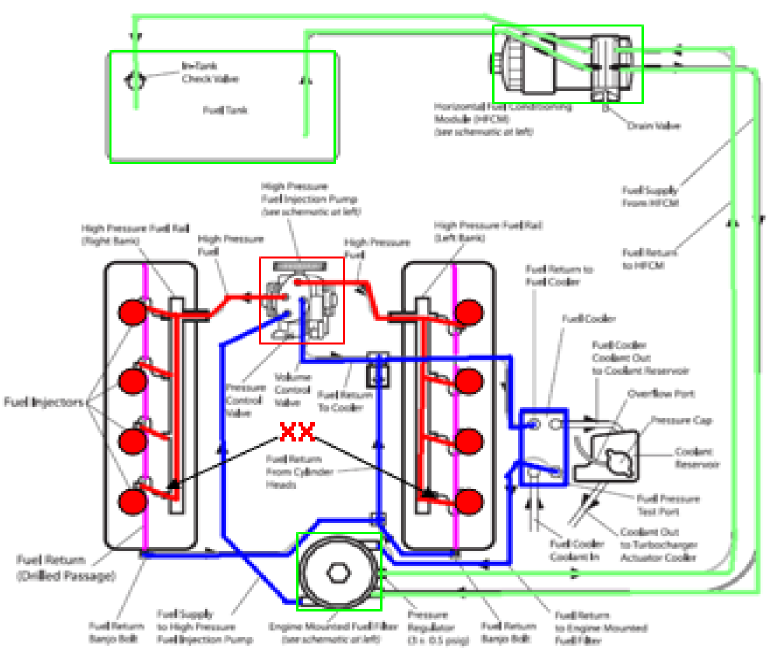

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- See previous page page

DRAFT FOR INPUT ONLY

•PCED Step 28: Debris found in the Fuel System at the injectors Entry condition

Perform Pin Point Test o should be perfomed before this entry condition if applicable

Inspect the Secondary (On-Engine)Filter Housing for Rust
-Opportunity to tell the cutomser repair may be customer pay depending on findings

No Rust - Ford Pay -
: ~76% with no rust in housing will have rust in the HP Pump ITP

Inspect Fuel Filter inspection/maintenance

Filters not maintained properly
-Not HP Pump causal
customer pay

Inspect for Rust in the ITP/VCV
High Pressure Pump

YES

Water in Fuel
– Not HP Pump causal
- Customer Pay

If it is a chasis cab steel tank: Is there Rust in the Tank
Drop the Fuel Tank

YES

Acid in Fuel
– Not HP Pump causal
-TBD - ford policy ?

No Rust in TANK/Housing/Pump
HP Pump Causal - Ford Pay
~82% of cases with rust in the housing will have rust in the ITP
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Senarios:
Customer comes in WIF on: No performance issues
During maintenance rust observed in housing: No performance issues

Inspect Fuel Filter inspection/maintenance

Filters not maintained properly
-Not HP Pump causal
customer pay

Pin Point Test o

Replace both filters
and education of properly draining WIF
education of proper fuels

F. Direction for Repair and Parts to be Replaced
Repeat Repair Rates and Non Value Repairs

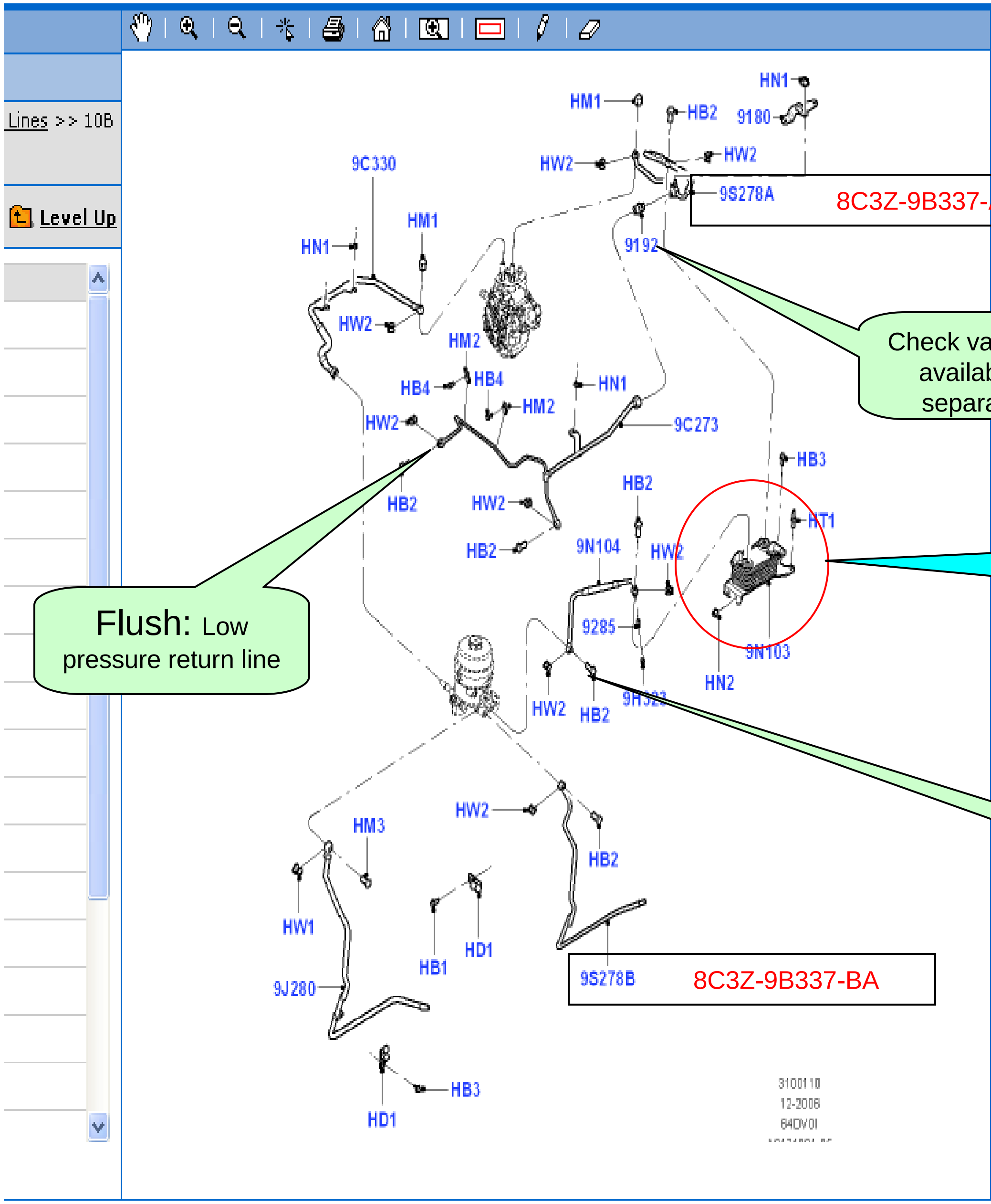
- 0.4% Return for a repair to the high pressure pump or injector after an initial visit where only the hp pump was replaced. (0.02% after a whole high pressure fuel system replacement)
- 14% return rate for an HFCM after high pressure system replaced
- 9C273. If this line does not need to be removed for the repair and can be flushed via the cyl head plugs it will eliminate the need for turbo hardware and eliminate the need for the 6007B52 labor op which pays 4.8 hours. The savings to ford would be in the area of $600-$800 per claim if removal of this line is not required. As of now we have been paying for these when claimed

Parts to be replaced- 6.4L when there is metal contamination per step 28.

- **<u>Replace</u>**
  - **Fuel Filter Housing:** if rusty or debris packed under standpipe on the supply to the high pressure pump
  - **HFCM:** replace, also replace when high mileage and FF filters (wet pump)/filter collapse
  - **Fuel Cooler:** replace

- **<u>Do NOT Replace Low pressure fuel lines</u>**
  - Puma does not clean the low pressure system after a pump failure, the lines from the high pressure sides are changed
  - 0.4% Return for a repair to the fuel high pressure pump or injector after an initial visit where only the hp pump was replaced.

Parts to be Replaced/Flushed- 6.4L when there is metal contamination per step 28.



Flush: Low pressure return line

Check valve is also available as a separate part

Flush: Low pressure return line

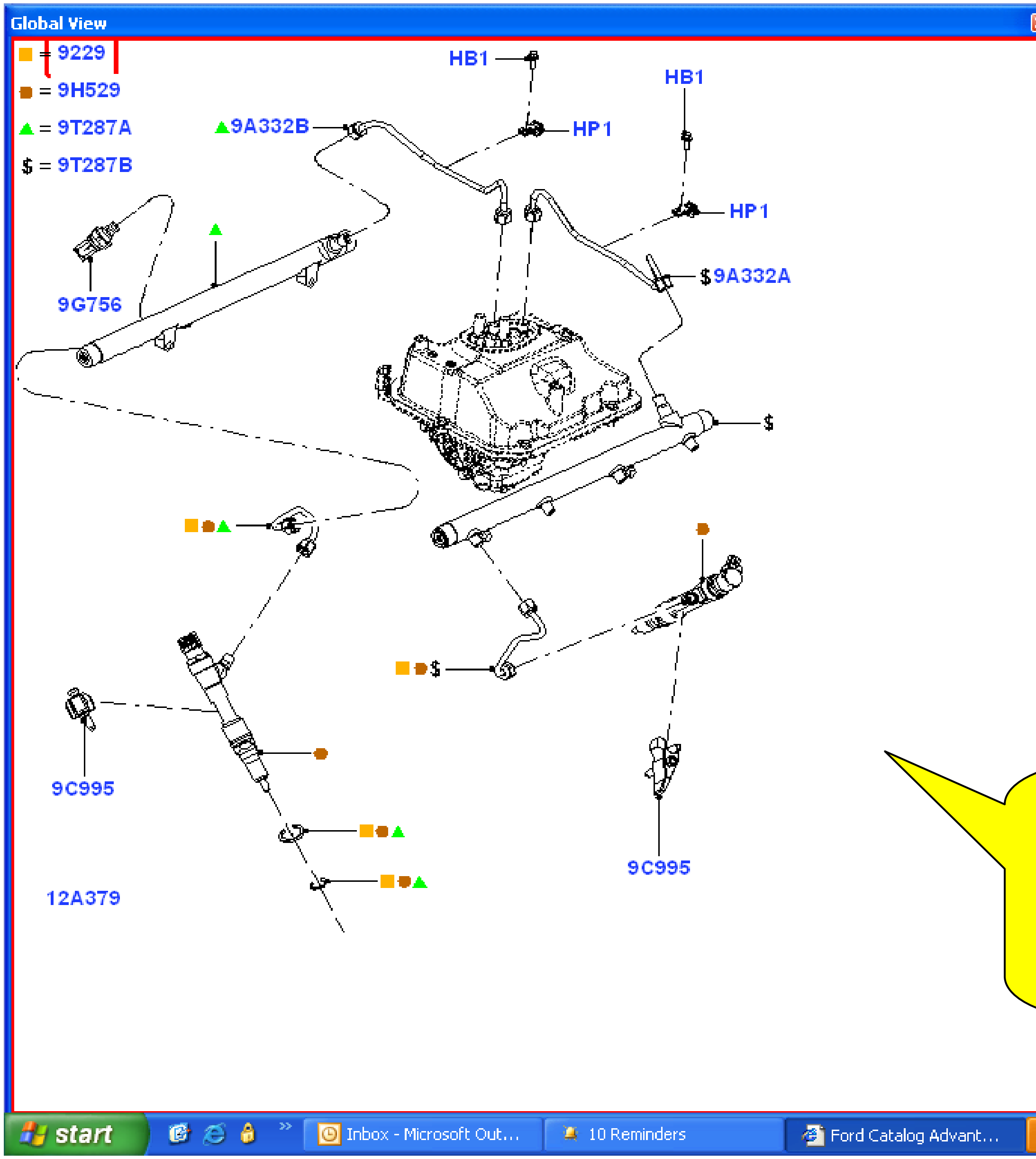
Flush: Low pressure return line

Current instruction – flush the low pressure fuel return lines until they are free of any contamination

Current Instruction: Replace Fuel Cooler is only exception to low pressure system. Continue to Replace

Addition to instruction current SSM ifor low pressure line, Do NOT reuse if : rust internally on the banjo fittings/flaking, Sealing surface – Is concave/deformed then do not reuse

Parts to be replaced- 6.4L when there is metal contamination per step 28.

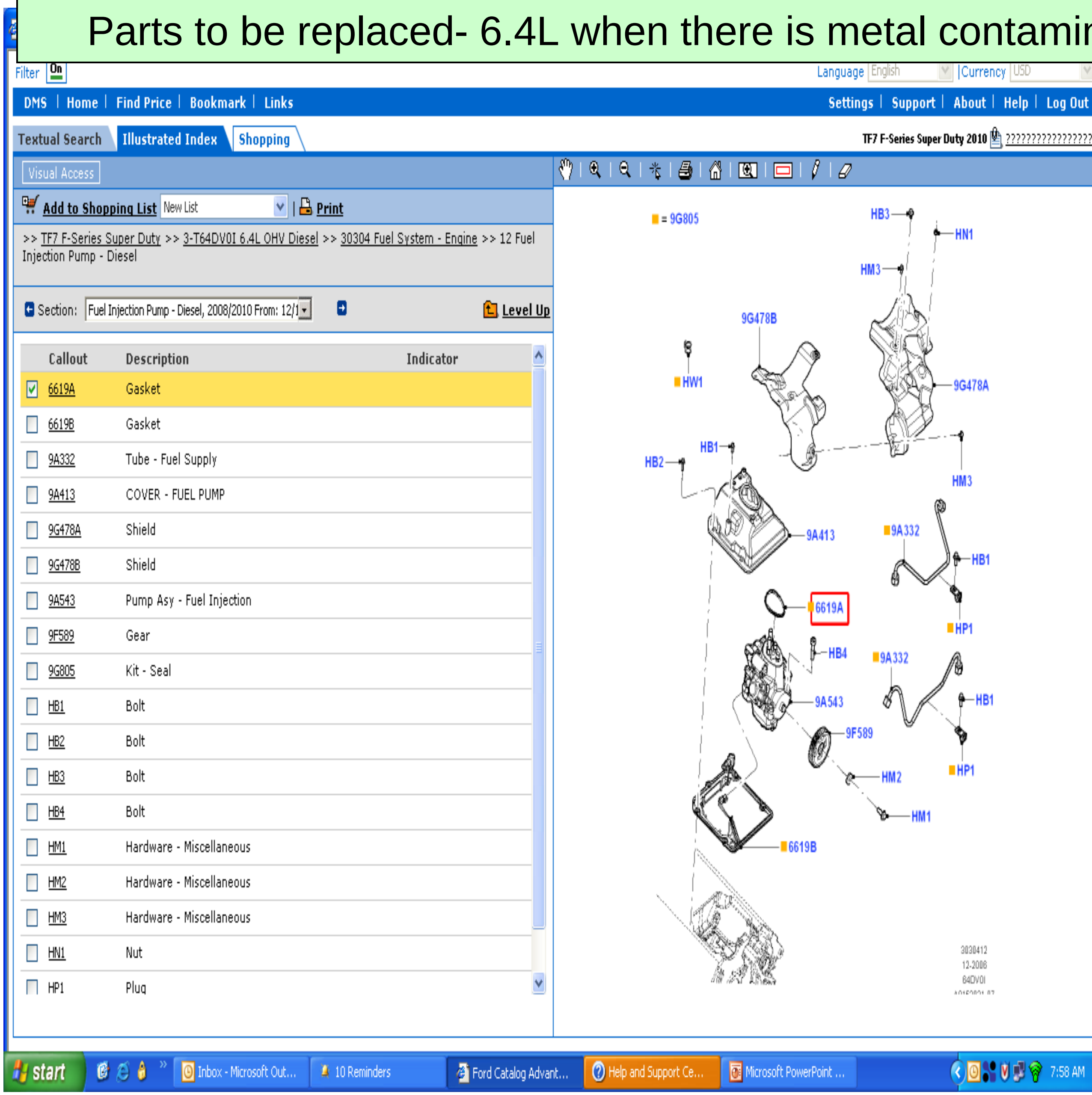


All Parts need to be replaced

-new high pressure fuel system rails, new fuel injectors, new high pressure lines and a new fuel cooler

Addition to instruction is replace the fuel supply line from housing to HP Pump when debris under secondary fuel filter housing to outlet/supply to pump port

Parts to be replaced- 6.4L when there is metal contamination per step 28.



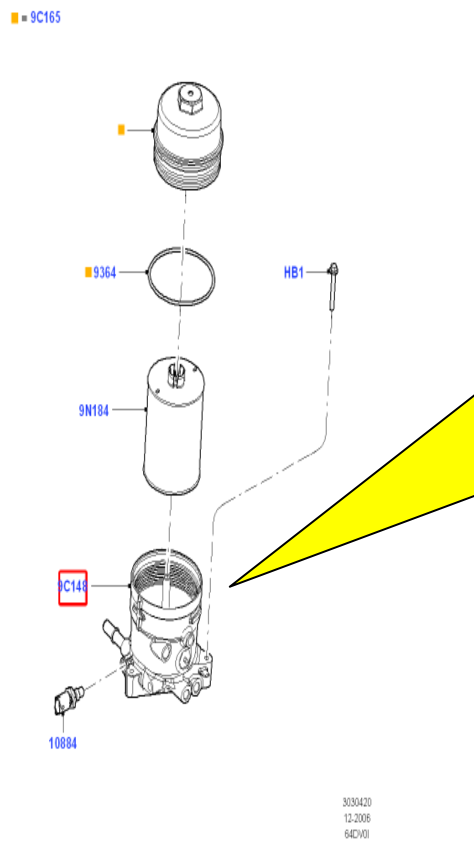
Parts to be replaced- 6.4L when there is metal contamination per step 28.

Add to Shopping List New List | Print

>> TF7 F-Series Super Duty >> 3-T64DV0I 6.4L OHV Diesel >> 30304 Fuel System - Engine >> 20 Fuel Filter

Section: Fuel Filter, 2008/2010 From: 12/18/2006 To: 02/12 Level Up

Callout	Description	Indicator
☑ 9C148	HOUSING - FUEL FILTER	
☐ 9C165	Kit - Seal	
☐ 9N184	Element	
☐ 9364	Seal	
☐ 10884	Sender Assy - Temperature	
☐ HB1	Bolt	



start Inbox - Microsoft Out... 10 Reminders Ford Catalog Advant... Help and Support Ce... Microsoft PowerPoint ... 7:59 AM

9C148:
Additional/new instruction:
Inspect housing if rust internally, or debris/material under stand pipe on supply side to high pressure pump housing
(includes fuel pressure regulator)

Additional $209.36 catalog price
Need to assess labour time

Parts to be replaced- 6.4L when there is metal contamination per step 28.

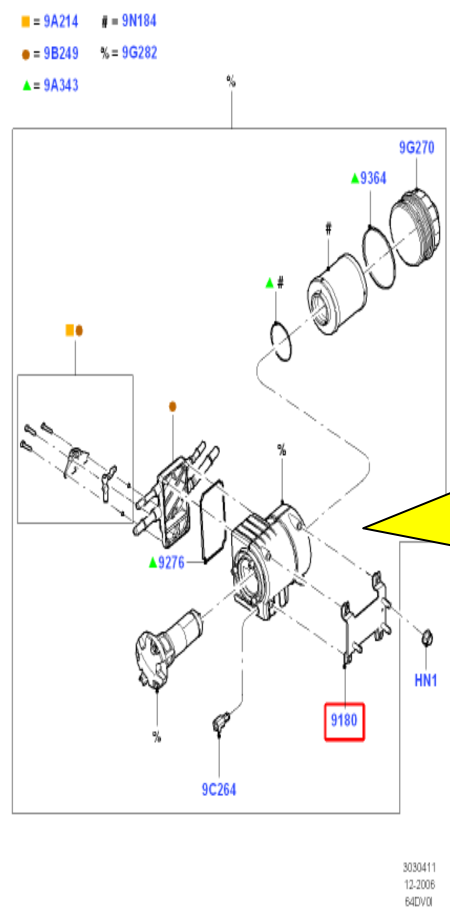
Visual Access

Add to Shopping List | New List | Print

>> TF7 F-Series Super Duty >> 3-T64DV0I 6.4L OHV Diesel >> 30304 Fuel System - Engine >> 11 FUEL PUMP - IN LINE

Section: FUEL PUMP - IN LINE, 2008/2010 From: 12/18/200 | Level Up

	Callout	Description	Indicator
☑	9180	Bracket - Fuel Filter	
☐	9N184	Element	
☐	9A214	Adaptor	
☐	9B249	Kit - Fuel Inlet/Outlet	
☐	9C264	Kit	
☐	9G270	Cap	
☐	9276	Gasket	
☐	9G282	Pump Asy - Fuel	
☐	9A343	Kit	
☐	9364	Seal	
☐	HN1	Nut	

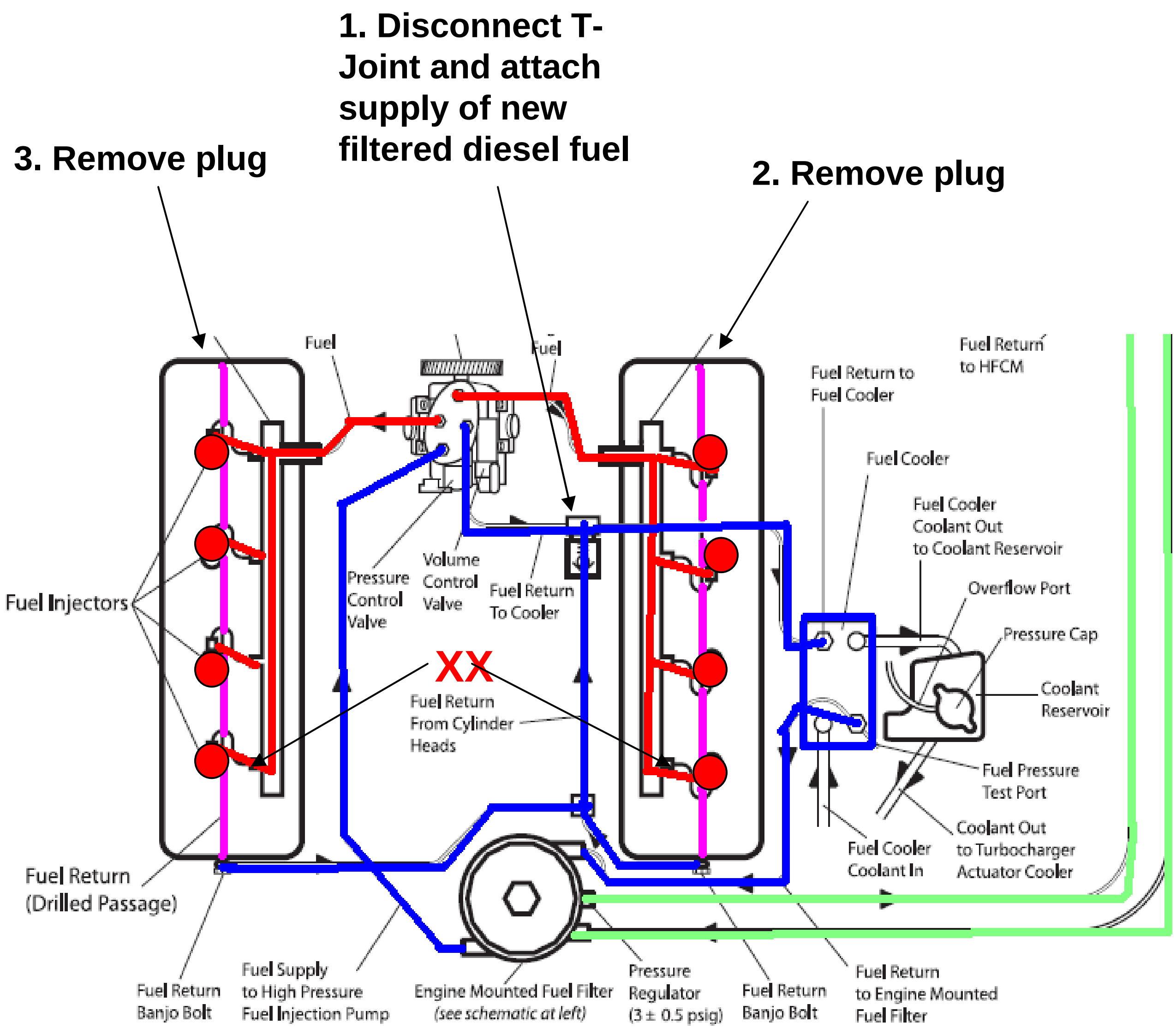


start | Inbox - Microsoft Out... | 10 Reminders | Ford Catalog Advant... | Help and Support Ce... | Microsoft PowerPoint ... | 7:56 AM

WIF damage replace the HFCM. Note: wet pump water, metallic debris will affect the pump/create leakage or degradation over time.

Need to confirm clear instructions for time vehicle needs to be off before water will drain.

Flush Recommendation



- Flush cylinder heads individually by removing one plug at a time.
- Use only new clean filtered diesel fuel.
- Do not exceed 8 PSI during flush.
- .Leave original injectors in cylinder head until flushing is complete.
- **Replace fuel filters after flushing is complete.**

From: Castleberry, Larry (L.)
Sent: Wednesday, February 04, 2009 11:54 AM
To: Pumford, Ken (K.G.); Fulton, Brien (B.L.); Haven, Keith (K.)
Subject: Emailing: P473 HP Pump Corrosion.ppt

Attachments: P473 HP Pump Corrosion.ppt

P473 HP Pump Corrosion.ppt

The message is ready to be sent with the following file or link attachments:

P473 HP Pump Corrosion.ppt

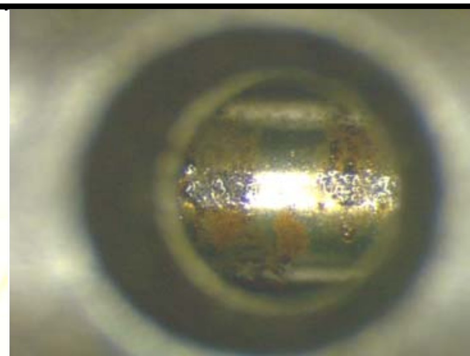
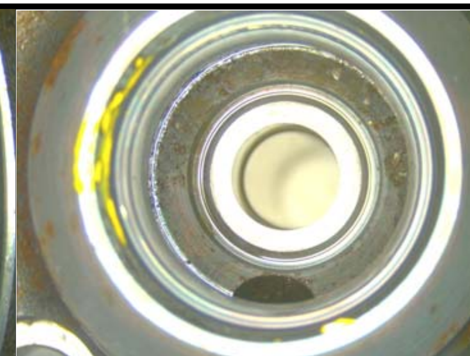
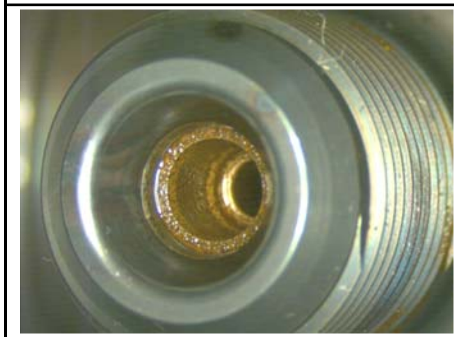
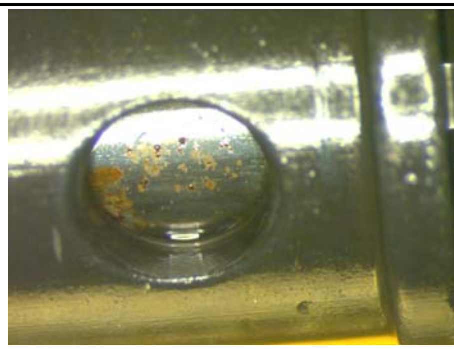
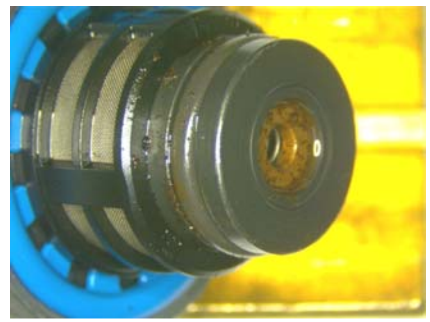
Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.

P473 HP Pump Corrosion / WIF

Brien Fulton

Ken Pumford
Carlos Armesto

Bosch Tear Down Analysis

			
SV cyl 1 top	SV cy1 valve stem	HP element 1	HP element cyl SV area
			
HP outlet cyl 1	KUEV Piston	MPROP	MPROP

P473 HP Pump Corrosion / WIF

Background

- Durability vehicle W790 had a high pressure fuel system failure 1/09.
  - Reported that the WIF light was illuminated on the vehicle
  - Other symptoms include DFCM noise due to high pressure – deadhead of the DFCM pump

Root Cause – Water Ingestion

- Excessive fuel pressure due to debris at the pressure regulator causing a pressure regulator failure
- High pressure pump showed corrosion on operating parts most likely due to water ingestion
- Other Root causes?

P473 HP Pump Corrosion / WIF

Current Scorpion Prevention and Detection

- Low Pressure Prevention
  - Low pressure fuel system DFCM has a water separator to remove water from the fuel and store that water in the reservoir
  - When water separator reservoir is full, the 2ndary filter will also separate water from the fuel until it has reached a saturation point.
- Low Pressure Detection
  - Low pressure fuel system DFCM has a WIF sensor to detect when the water reservoir has reached a level it is required to be drained
  - The signal from the WIF sensor is processed by the ECU and a message is sent to the message center to tell the driver to drain the water separator
  - Fuel delivery pressure switch is present at the end of the engine low pressure fuel system to detect low pressure conditions – Water in filters can freeze causing low pressure
- High Pressure Fuel System Detection
  - PCV / VCV duty cycle detection – After PCV or VCV have reached their respective control limits, the operating strategy is toggled between both actuators and a difference in duty cycle is detected.
    - Current thresholds are pretty generous as type B errors are as bad as actual errors.

P473 HP Pump Corrosion / WIF

Other options

- Graduated response with WIF light on time – only possible in short time
  - Implement actions to further alert the customer to the water drain condition.
    - Rough operation / reduced power / vehicle shutdown is done to the customer
    - Options were available for P356, but were not used and team was very against this option
- High pressure detection in LP fuel system
  - High fuel pressure caused the pressure regulator to fail in the high pressure fuel system
    - High pressure caused by debris in the pressure regulator, failure already happened and high pressure detection would not prevent failure as debris already in the pump
- Modification of Low Pressure fuel system
  - Larger water separation volume – may not be effective as WIF light was already reported (significant cost / packaging / timing issues)
  - Second coalescer and WIF sensor in 2ndary filter- again this may not be effective as WIF already reported (significant cost / packaging / timing issues)
  - Automatic water reservoir drain feature (significant cost / packaging / timing issues)
    - EPA issue of "where" to drain.
- Modification of High Pressure fuel system
  - Pump material change to be robust to water (significant cost / packaging / timing issues)

Question to Bosch

- One question the team had for Bosch was "how do we know that current permissible amount of water will not result in this type of corrosion"?
  - Bosch has agreed to conduct simulation test with 500ppm of water and allow the fuel/water mixture to "sit" in the pump.

From: Lusardi, Tony (T.K.)
Sent: Monday, January 31, 2011 10:47 AM
To: Malik, Wesley (W.K.); Pumford, Ken (K.G.); Rauch, Jim (J.R.); Heggie, Forest (F.); Dobbs, Dan (K.D.); Davis, Craig (C.B.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Ives, David (D.C.); Corlew, Randall (R.L.); McDonagh, Scot (S.M.); Fulton, Brien (B.L.); Burkeen, Doran (D.C.); Curtis, Andrew (A.); Hale, Curt (B.C.); Bandoske, Pete (P.F.); Armesto, Carlos (.); Jones, Keith (K.)
Subject: Fuel Contamination TSB draft photos and reference table 070-2010-1624

Attachments: 070 2010 1624 Contamination Photos.doc; Fuel Contamination Table.pdf

Attached are the proposed/draft reference table and photos to be included in the proposed fuel contamination TSB for 6.7L that you will be getting in an separate e-mail.

Please return any comments by COB 2/2/11, so TSB can be submitted for final approval.

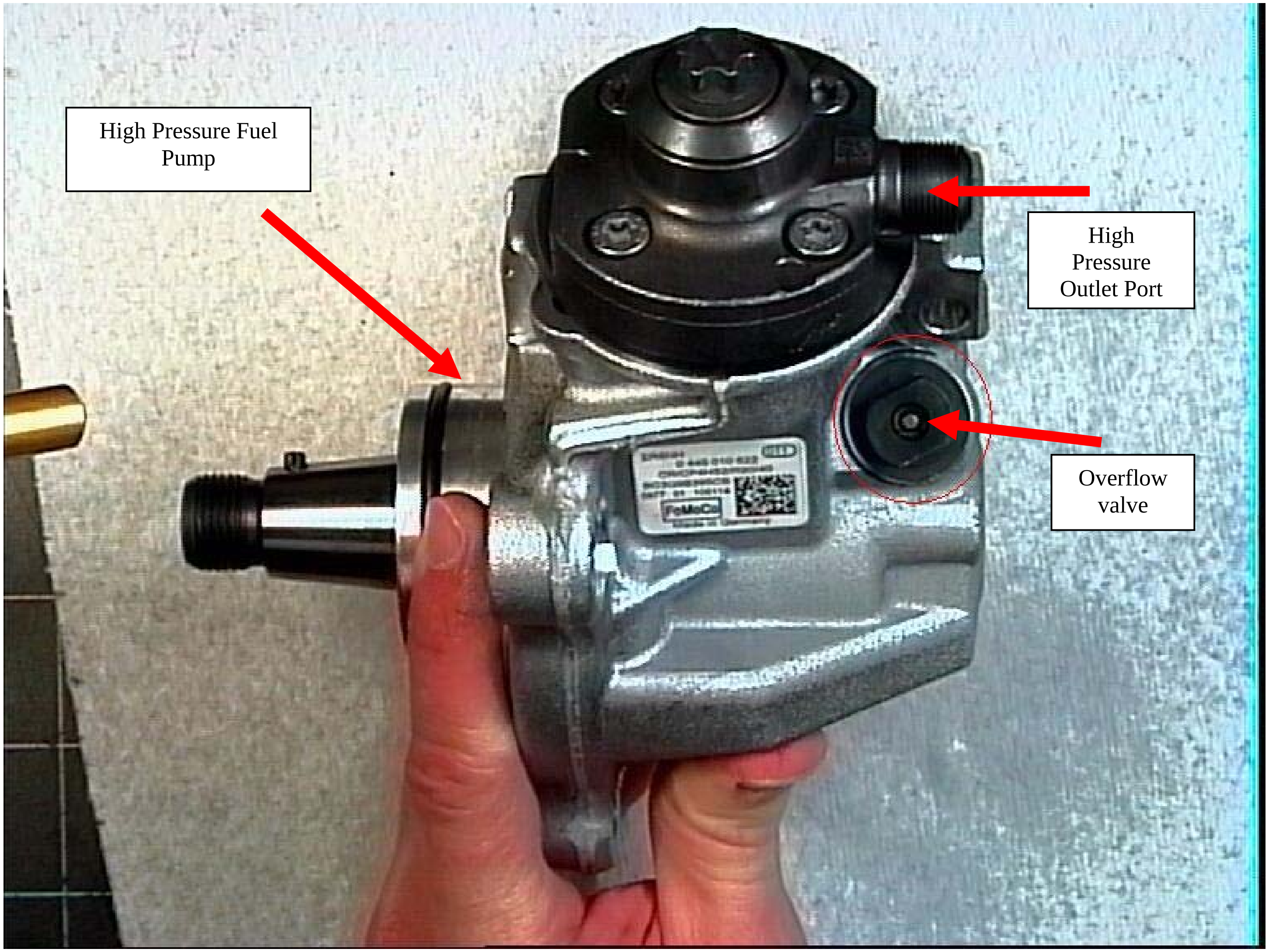
Thank you

070 2010 1624 Contamination Ph...   Fuel Contamination Table.pdf

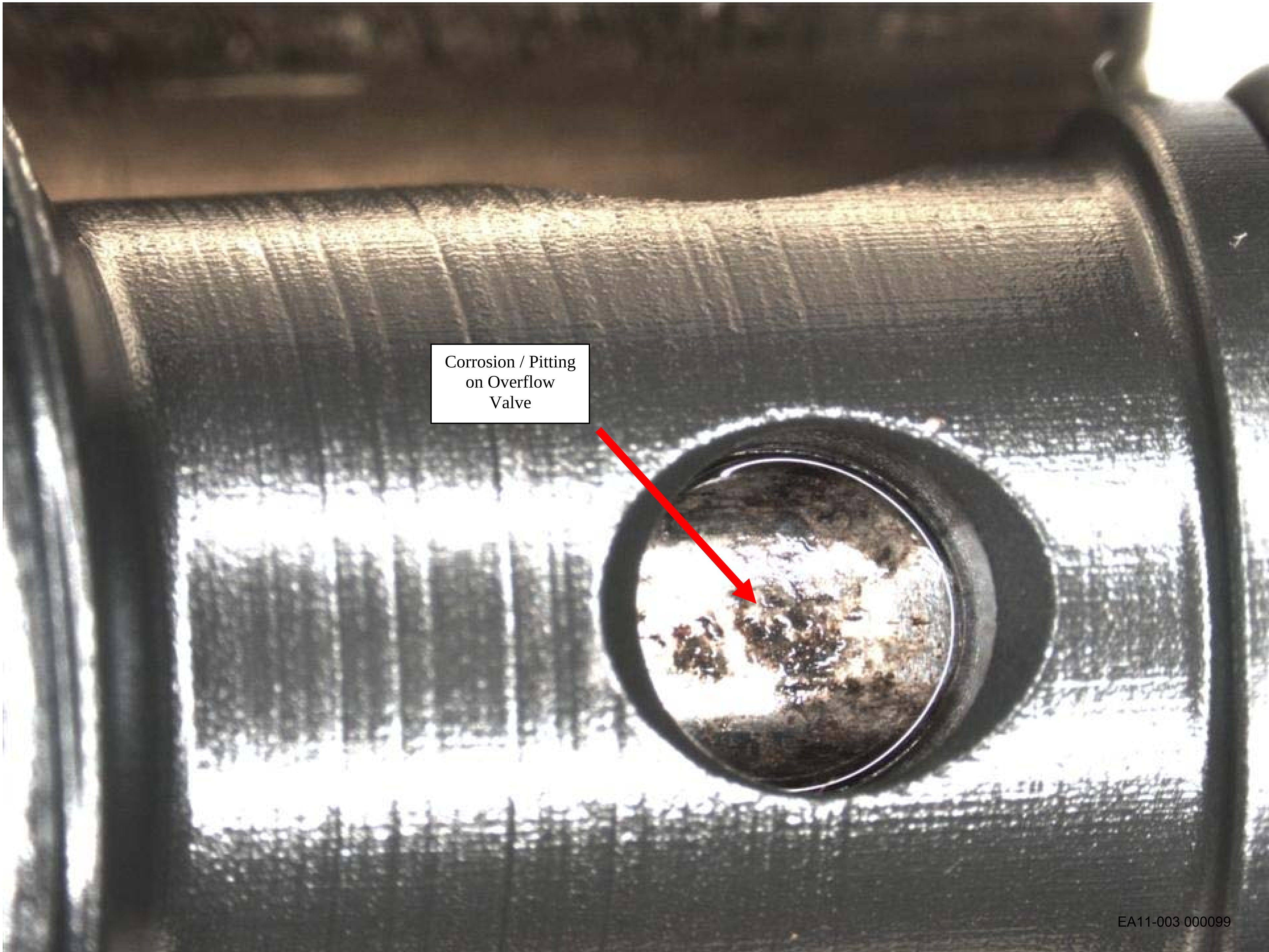
"Customer Service is an Attitude, Not a Department"

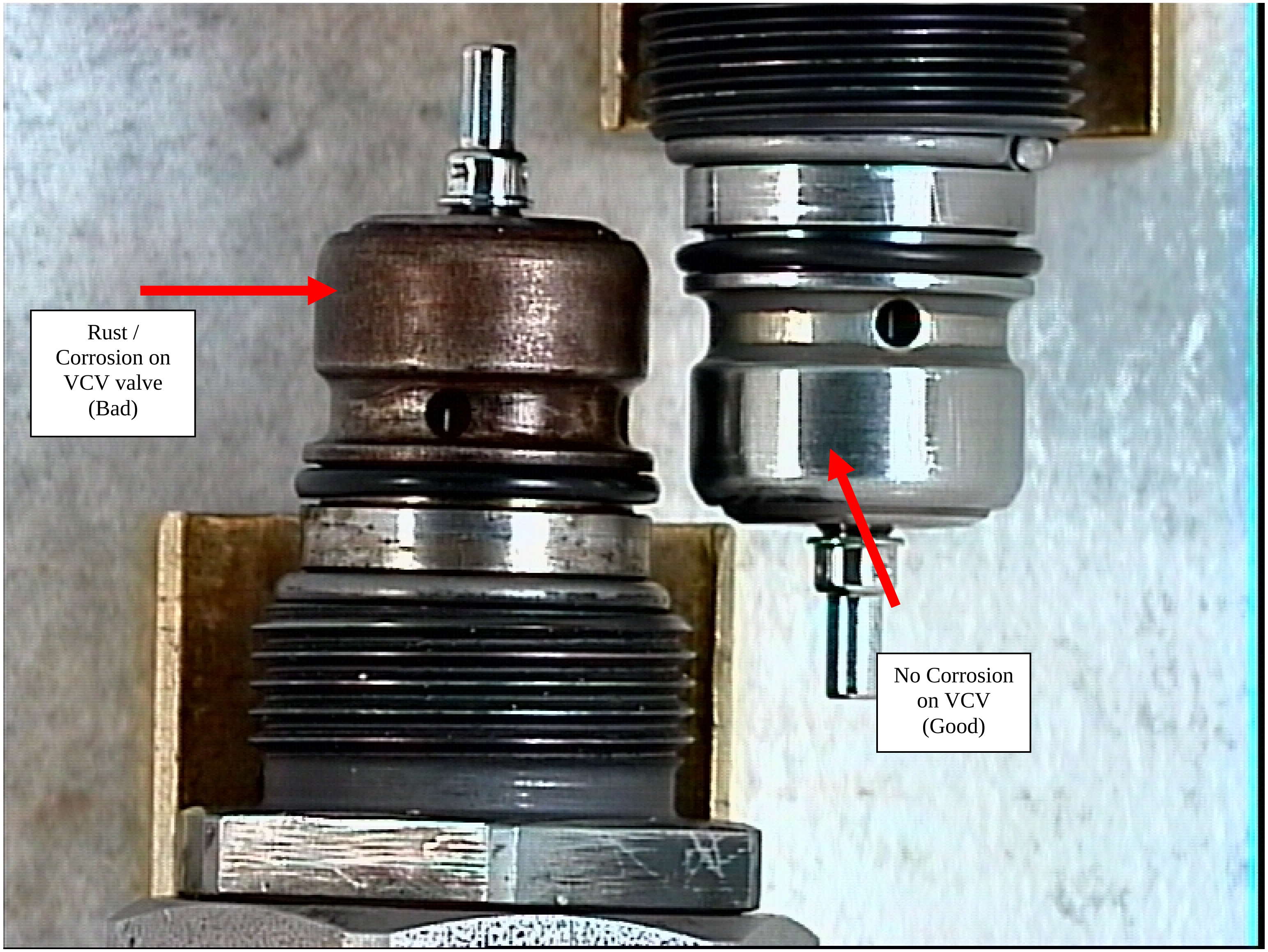
Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

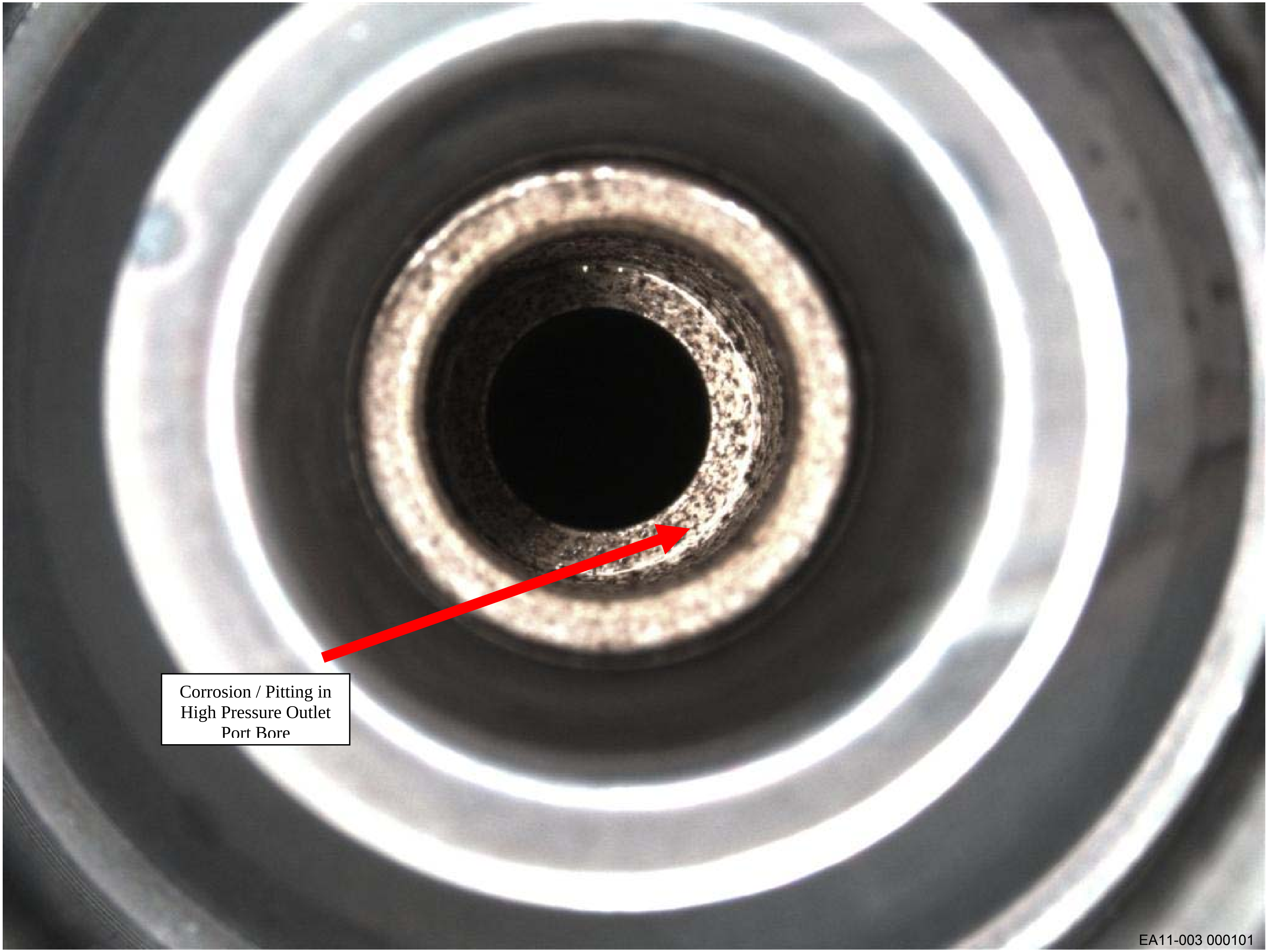
EA11-003 000096


High Pressure Fuel Pump
High Pressure Outlet Port
Overflow valve


Inspect Overflow
Valve Ports for
Signs of Corrosion


Corrosion / Pitting
on Overflow
Valve


Rust /
Corrosion on
VCV valve
(Bad)
No Corrosion
on VCV
(Good)


Corrosion / Pitting in
High Pressure Outlet
Port Bore

Contamination Reference Table

NOTE: Fuel contamination can be, but is not limited to dirt/debris, water, excessive % biodiesel, incorrect fuel additives, gasoline, kerosene, DEF etc.

Contaminant	**Issue**	**Factors**	**Indicator**
Gasoline/Ethanol/Kerosene/Alternative Fuels	Lubricity, cooling, aggressive chemical attack of materials in fuel system	Debris, NO rust/corrosion, distortion of materials	Smell, Styrofoam cup test, fuel sample: fuel aeration, Note: The return port check valve in the tank can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in the check valve falling off and increasing fuel aeration.
Water	Lubricity, cooling, corrosion/rust	Debris, rust/corrosion	-HP Pump Rust/corrosion, (can have water damage throughout system if large enough quantities ingested)
Excessive Biodiesel	Lubricity, cooling, bacterial/fungus growth/corrosion/rust	Debris, rust/corrosion, bacterial/ fungus growth	-Rust/corrosion HP Pump due to increased water content decrease water separation -Bacterial/fungus growth -aeration Note: The return port check valve in the tank can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in the check valve falling off and increasing fuel aeration.
Incorrect Fuel Additives	Lubricity, cooling, corrosion/rust depends on additive content (alcohol)	May have Rust/corrosion, or only debris	-Rust/Corrosion if water emulsifies/prevents water separation
Fuel Filters/maintenance	-decreased water separation-> lubricity/cooling corrosion/rust/particulate	Debris, may have rust/corrosion decreased efficiency water separation/plugged filters/ collapsed filters	-Rust/corrosion due to increased water content decrease water separation -FF filters - collapsed filters
DEF	Lubricity, cooling, aggressive chemical attack of materials in fuel system	Debris, pitting/corrosion, distortion of materials	Smell, white crystals on components when dried, fuel sample

From: Harrison, Mike (M.J.)

Sent: Wednesday, July 22, 2009 3:52 PM

To: Eeley, Scott (A.)

Subject: Furl pump ITP.

It's worn - very heavily, to an unacceptable level.

I would expect that the pump would have failed due to debris generated in the ITP.

Wear was probably due to lack of lubricity in the fuel (water in fuel, crappy bio-diesel), or fuel starvation (waxing, blocked filter etc).

Let me know if you need anything else.

As part of the DV we ran low lubricity fuel - and saw minor incidental tip wear.

Mike.

Mike Harrison

V8 Gasoline Engine Programs Manager

Ford Motor Company

mharris6@ford.com

Cell (313) 805 4744

From: Lusardi, Tony (T.K.)
Sent: Tuesday, February 01, 2011 10:59 AM
To: Pumford, Ken (K.G.); Heggie, Forest (F.); Rauch, Jim (J.R.)
Cc: Dobbs, Dan (K.D.); Hale, Curt (B.C.); Bandoske, Pete (P.F.)
Subject: FW: 2011 6.7L, 1FD8X3HT0BEA42667, GCQIS ALJCU004

Attachments: Picture 001.jpg; Picture 002.jpg; Picture 003.jpg; Picture 004.jpg; Picture 005.jpg; Picture 006.jpg; Picture 009.jpg; Picture 010.jpg

Ken, can you take a look at these photos and let me know your thoughts? I think this fits nicely into our pending TSB, but would like to get your thoughts/recommendations.

Vehicle built 5/19/2010.

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Lien, Rob (R.L.)
Sent: Tuesday, February 01, 2011 10:51 AM
To: Goebel, Ken (K.M.); Lusardi, Tony (T.K.)
Subject: 2011 6.7L, 1FD8X3HT0BEA42667, GCQIS ALJCU004

Hi Ken and Tony,

I inspected this vehicle onsite yesterday for a fuel system corrosion concern (rust observed on the inlet screen of the VCV valve). Initially, the dealership suspected that rust particles had entered the fuel system as the result of external contamination, however removal of the fuel tank indicated that corrosion build up on the under side of the fuel sender fitting and the upper rear corners of the fuel tank was the source of these particles. Based on my experience I have found that corrosion, which occurs as the result of excessive water in fuel levels, typically begins at the center weld seam on the fuel tank and emanates outward. However, on this tank the center seam and all other portions of the tank were free of corrosion with the exception of the rust which I referenced on the underside of the sender fitting and the upper rear corners. Specifically, in reference to the corrosion observed on the upper rear corners of the tank I suspect that at least some of this corrosion may have started before the interior lining was applied to the tank during the manufacturing process especially enlight of the limited time in service.

I realize that this vehicle is a chassis cab vehicle, however, based on my conversation with the dealership who delivered this vehicle and made arrangements to have the flat bed installed, it does not appear that this vehicle was left unattended for a significant amount of time.

The hotline report indicates that water in fuel was observed which is technically correct, however the only water which was recovered from the fuel system was approximately 3.5 ounces in the water separator (water in fuel light was not on and historical water in fuel codes were not stored in the PCM). Additionally, water was not observed in the fuel tank itself which I confirmed based on my inspection of fuel retained in clear jugs which the dealer used to capture the fuel removed from the tank.

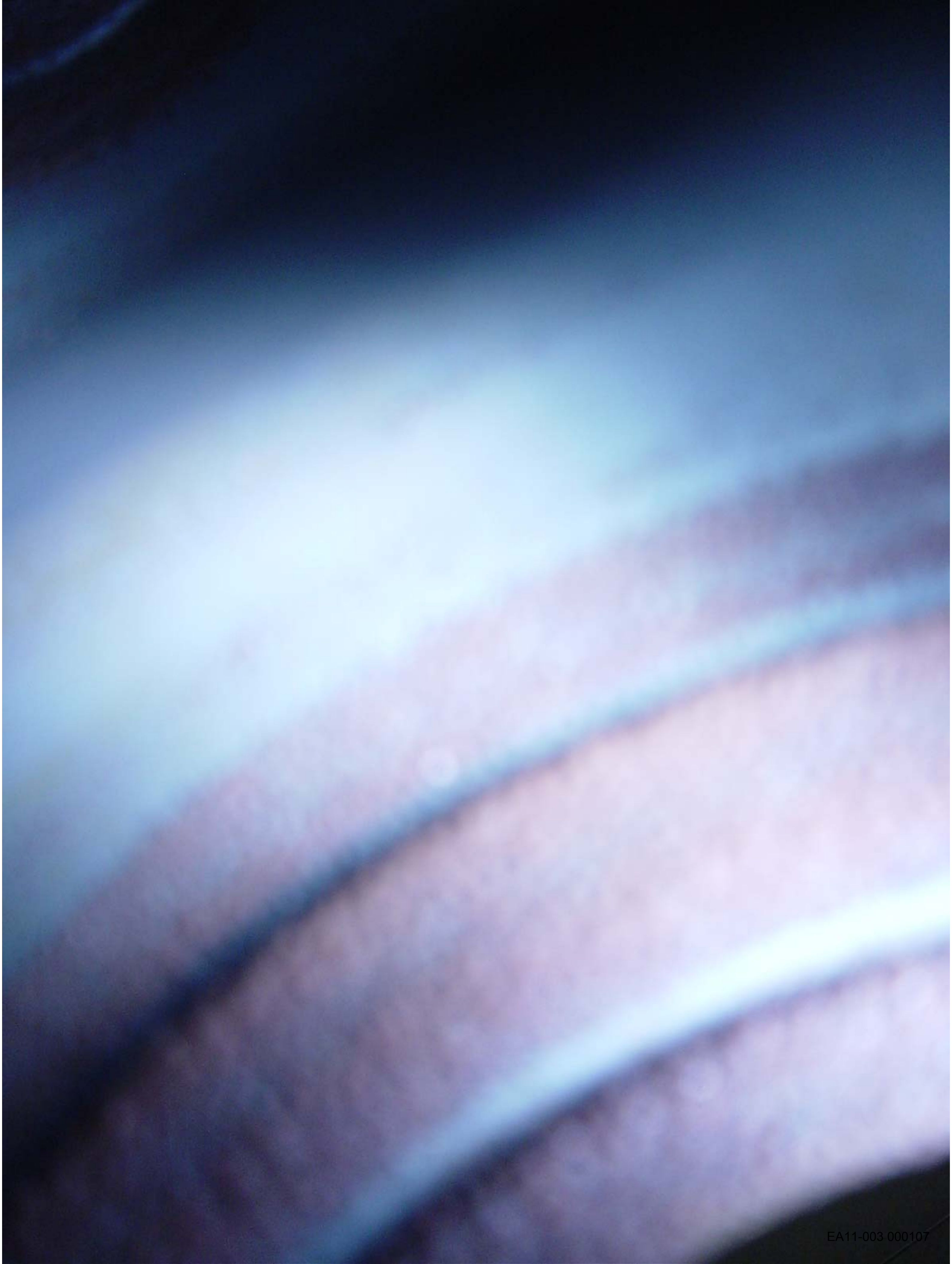
I attached several digital photos of corrosion observed in the fuel tank. The first images are of corrosion observed on the underside of the fuel sender fitting (obtained off of a pocket mirror) and photo 004 illustrates rust observed on the upper sides of the fuel tank in the right and left rear corners. The final photo illustrates rust captured on the inlet screen of the VCV valve which apparently starved the pump of fuel which is what I believe really damaged the high pressure pump versus the very limited water content observed. The following fault codes were retrieved from the PCM: P0087 - initial code when the vehicle was first delivered to the dealership, P0088 and P2291.

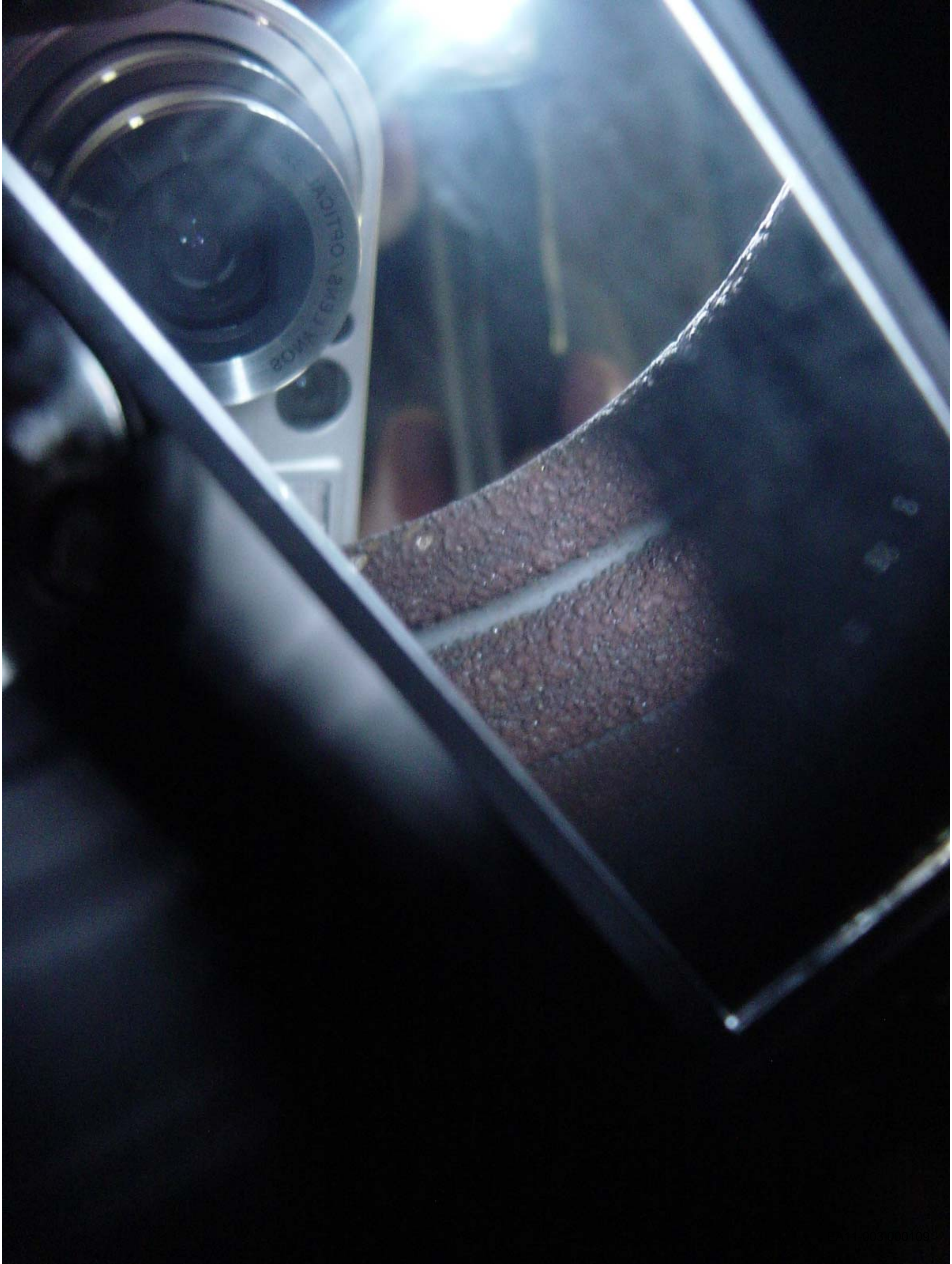
Please let me know what your thoughts are on this.

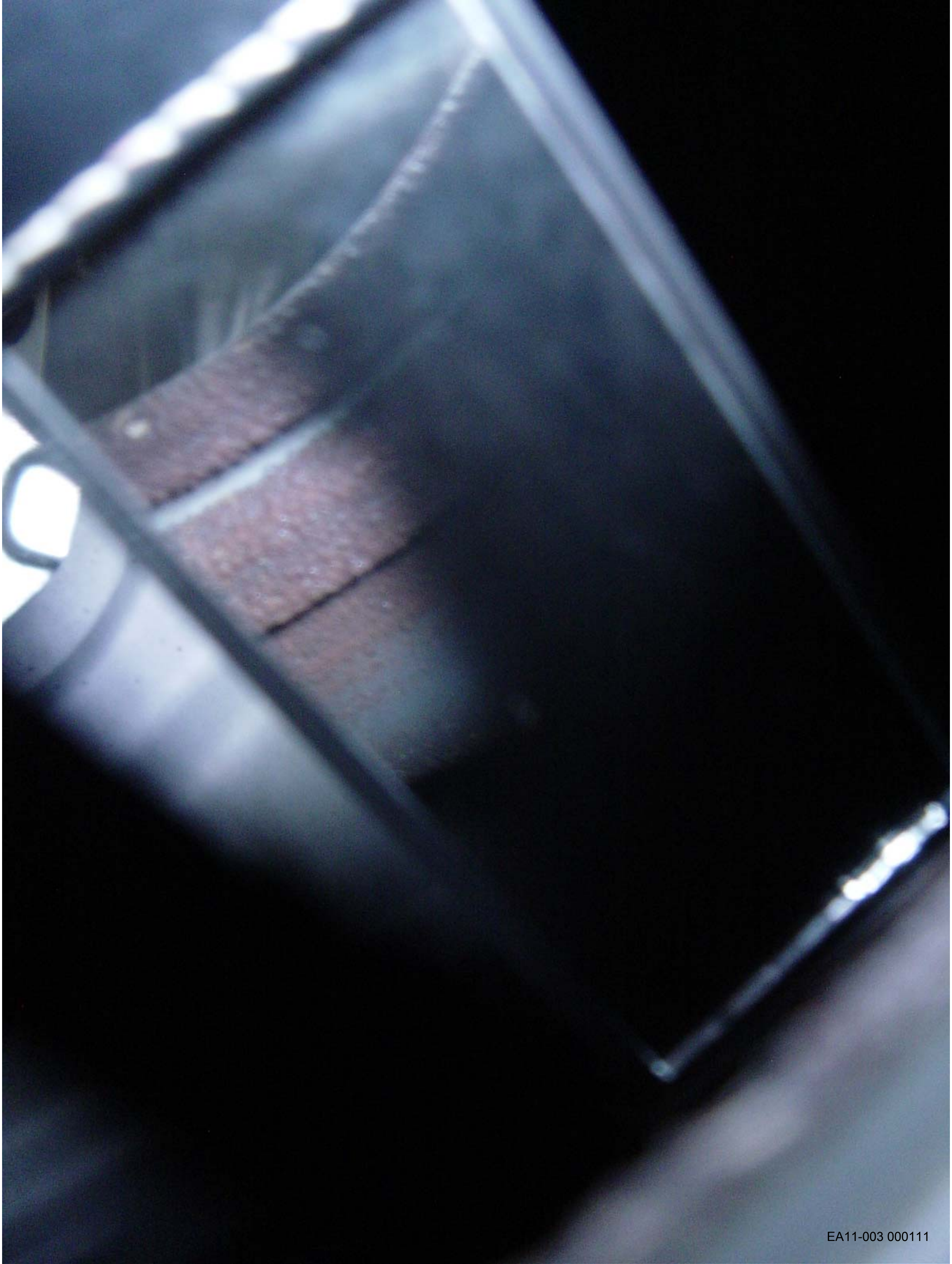
Robert Lien
Field Service Engineer
Kansas City Region
(913) 481-5489

Picture 001.jpg Picture 002.jpg Picture 003.jpg Picture 004.jpg Picture 005.jpg Picture 006.jpg Picture 009.jpg

Picture 010.jpg







From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

Attachments: Humber Motors B3807 006.jpg; Humber Motors B3807 004.jpg

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

EA11-003 000114

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications
- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root
cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)

Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,

Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254 Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

Humber Motors B3807 006.jpg

Humber Motors B3807 004.jpg

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

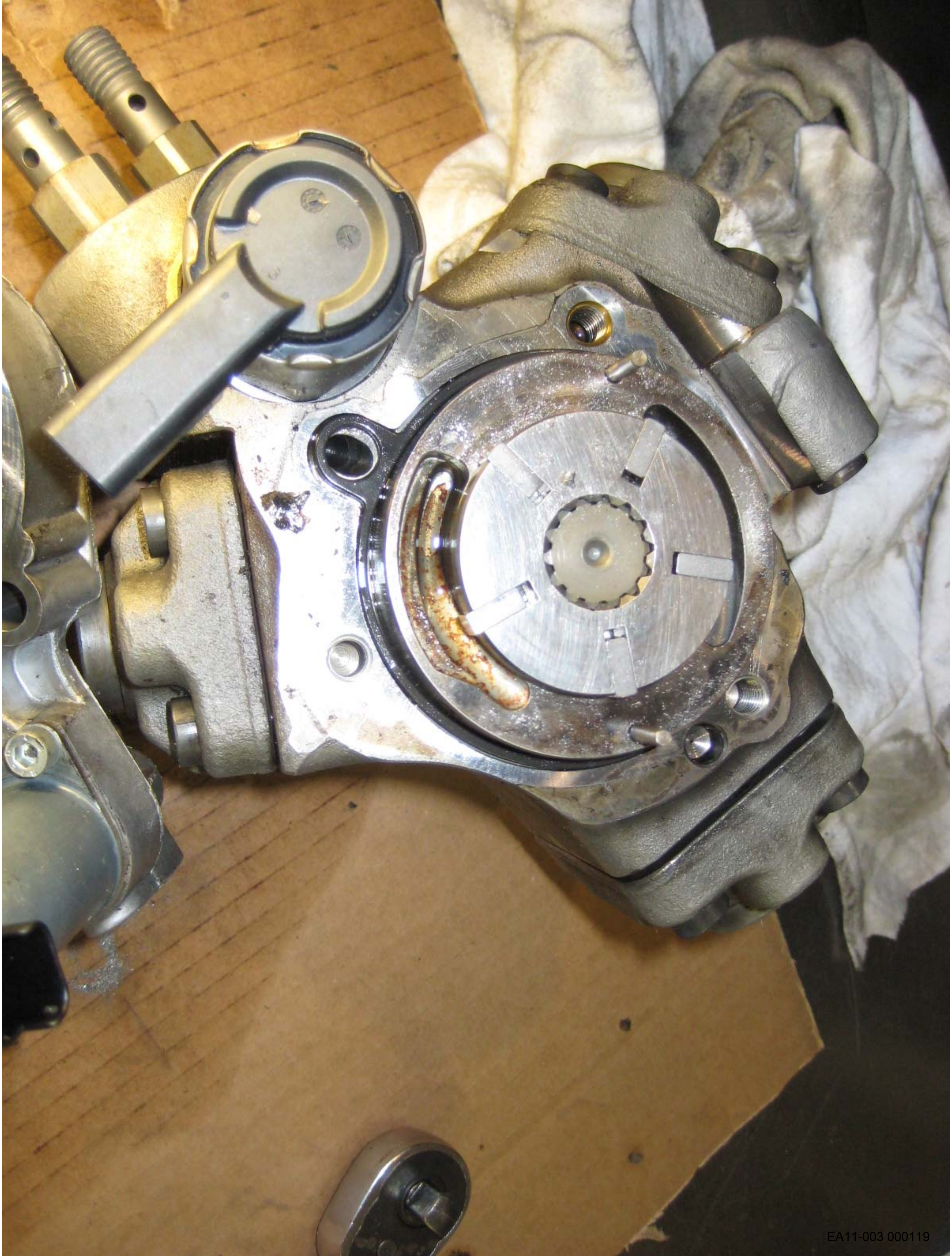
Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>




HUMBER
MOTORS
B3807
320134-01
10.14.09

From: Eeley, Scott (A.)
Sent: Wednesday, April 14, 2010 3:12 PM
To: Nolan, Patrick (Pat); 'Newman, Rob'; Ford, George J (Jeff)
Cc: Heggie, Forest (F.)
Subject: FW: 6.4L/6.0L Fuel additive assistance
Attachments: Document.pdf

Pat, Rob, and Jeff,

We are trying to get to the bottom as to why dealers are adding fuel lubricity additive to 6.0 and 6.4 diesels. We can not find any listing suggesting PM-15 for use in either the 6.0 or 6.4. All I have is this old scanned image - see attached. I am told that this document is or was sent with engine replacements. In the lower right corner - and no longer legible - it recommends PM-15 during engine replacement. I think this ONLY is / was important to 7.3 applications.

Will you please determine if this document is included with any service reman or new engine and let me know which engines? Please let me know if there is any other documentation that might call out PM-15.

Thanks.

Scott

From: Heggie, Forest (F.)
Sent: Wednesday, April 14, 2010 2:12 PM
To: Eeley, Scott (A.)
Subject: FW: 6.4L/6.0L Fuel additive assistance

Forest Heggie BaSc. MaSc. P.Eng
1-313-6185054
LGDEE Diesel OPD

From: Baumann, Robert E (Bob) [mailto:Bob.Baumann@Navistar.com]
Sent: Wednesday, April 14, 2010 12:56 PM
To: Heggie, Forest (F.)
Cc: Mezigian, Michael W
Subject: RE: 6.4L/6.0L Fuel additive assistance

Forest

I would see no reason to use a lubricity additive to the 6.4 engine and that lubricity additive was used back when injectors were replaced on the 7.3 but only for initial break in when new injectors were installed in an engine.

Not sure why warranty would be paying for fuel cetane improver as that should be a customer pay item. Now if it is customer pay we do see some poor quality fuel out there yet.

Bob Baumann
Manager, Vee Product Support
Navistar, Inc.

Melrose Park, IL
708-865-3495

From: Heggie, Forest (F.) [mailto:fheggie@ford.com]
Sent: Tuesday, April 13, 2010 8:09 AM
To: Baumann, Robert E (Bob)
Cc: Mezigian, Michael W
Subject: 6.4L/6.0L Fuel additive assistance

Hi Bob,

I was reviewing fuel additives and the cost, so I am looking for some help.

1. PM-15 is showing still being used

I keep finding PM-15 being used for 6.4L/6.0L and have found one sheet were there may be instructions to the technicians, I have a photocopy of a one page document that goes with a engine replacement/long block or short block and it referenced adding fuel lubricity additive to the tank, but my copy is not clear enough to see if they are told PM-15. Would you be able to give me a copy of this document.

2. Do we want fuel lubricity additive to be used when replacing an injector or high pressure pump.

<<fuel additives 4-13-10.ppt>>

Forest Heggie BaSc. MaSc. P.Eng
1-313-6185054
LGDEE Diesel OPD

DIESEL ENGINE CERTIFICATION

To perform the task of removing and installing a diesel engine, you should be A.S.E. certified in Automotive Engine Replacement or equivalent.

- ☐ Review all prior warranty history of the vehicle
- ☐ Review all Technical Service Bulletins and Special Service Messages pertaining to drivability and engine repair for the vehicle being serviced.
- ☐ Review engine removal and installation instructions in the appropriate Ford Workshop Manual. Determine the root cause of the engine failure.
- ☐ Remove failed engine
- ☐ Complete Step 1 of the Core Evaluation Form:
  1. *First, check for block damage. Notate on form.*
  2. *Drain oil and coolant from used engine core*

Inspect new engine for shipping damage, such as bent sheet metal, valve train damage, and debris of any kind.

IDENTIFICATION

Verify that you will be installing the correct engine.

- ☐ First, visually compare your failed engine to your new replacement engine. Assure that the major components below visually match between the two engines:
  - ☐ *Turbo Charger* ☐ *Oil Cooler*
  - ☐ *Fuel Filter System* ☐ *Exhaust Manifold*
  - ☐ *Water Pump* ☐ *Intake Manifold*
- ☐ Second, verify the existing part number with the part number you will be installing *(can be found in Remanufactured Diesel Engine Reference and Sales Manual).*

A couple minutes spent double-checking what engine you will be installing for your customer could save you many hours of wasted labor.

ASSEMBLY TIPS

- ☐ Seal threads on flywheel bolts with red tread sealant
- ☐ Use torque wrench on manifolds, oil cooler, water pump, and turbocharger, do not use power impact tools.

COOLING SYSTEM

- ☐ Radiator flushed/rodded or replaced.
- ☐ Replace coolant if contaminated, over recommended age, or weak in strength.
- ☐ Add FW-16 supplemental coolant additive to VC-4A, Ethylene Glycol (green color) engine coolant. Note: FW-16 is not used with Ford Premium Gold extended life coolant.
- ☐ Inspect the radiator pressure cap for wear and proper application
- ☐ Inspect coolant hoses and clamps; replace as necessary
- ☐ Install new or reman water pump (on base engines, 6009,6012, and 6006)

LUBRICATION SYSTEM

- ☐ Oil pan should be thoroughly cleaned and inspected for defects that would cause poor sealing. (on base engines, 6009 and 6012)
- ☐ Oil pickup tube screen cleaned or replaced
- ☐ Install a new or remanufactured oil pump on all short block engines (6009)
- ☐ Install a new oil cooler bundle on all short block engines (6009)
- ☐ Use Motorcraft Super Duty SAE 15W-40 engine oil or an equivalent oil meeting API service specifications CI-4/SL.

INTAKE AND EXHAUST SYSTEM

- ☐ Exhaust system checked for damage and restrictions

If transferring an old intake manifold from failed engine to your new Ford/Motorcraft engine you must thoroughly clean manifold of any debris that could cause a second engine failure (trapped in the intake).

FUEL SYSTEM

- ☐ Replace all fuel filters and add fuel lubricity additive to fuel tank *(Not applicable on 6007 base engines)*

START-UP

- ☐ Monitor oil pressure and water temperature
- ☐ Check for any leaks, correct before road test
- ☐ Drive 500-750 miles, then change oil and filter, recheck for leaks, [illegible] hoses and check belt adjustment

3

From:	Heggie, Forest (F.)
Sent:	Monday, January 03, 2011 10:40 AM
To:	Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc:	Eeley, Scott (A.)
Subject:	FW: 6.4L WIF Job Aid
Attachments:	Technical determination of water in fuel damage and repair process 1-3-11 .doc; water in fuel communciation draft 12-09 Short form.doc

6.4L Water in fuel meeting minutes and draft documents under review.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From:	Heggie, Forest (F.)
Sent:	Monday, January 03, 2011 10:37 AM
To:	Bandoske, Pete (P.F.); Eeley, Scott (A.); Johnson, Seth (S.); Dobbs, Dan (K.D.); Curtis, Andrew (A.); Lusardi, Tony (T.K.); Stendardo, David (D.)
Subject:	RE: 6.4L WIF Job Aid

Follow up from Dec 2010 WIF meeting

To develop the following documentation for WIF warranty determination:

1. Job Aid
2. Explanation of WIF strategy (information also part of the cal bundle update) to determine appropriate documentation

Roll out process

1. Once job aid completed conference call with FSE's to roll out process.
2. Job aid to be provided to FSE and technicians/Dealerships
3. EFC

4.. FSE to determine warrant ability

Open question:

Will we be providing the secondary fuel filter housing to be used as an indicator?

P. Bandoske and D. Dobbs to follow up on FCSD communication of decision.

This can not be used to determine damage to the fuel system caused by water in fuel.

DRAFT JOB AID

Attached is marked up documents from December meeting for review

Technical
etermination of wat.

Additional information suggested : Customer communication for care of 6.4L fuel system.

water in fuel
communciation dr...

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Bandoske, Pete (P.F.)
Sent: Friday, December 17, 2010 10:42 AM
Subject: 6.4L WIF Job Aid
When: Thursday, January 06, 2011 10:00 AM-11:00 AM (GMT-05:00) Eastern Time (US & Canada).
Where: DSC-1 Conf Room C (10)

DRAFT JOB AID

Issue:
When directed to perform a fuel system repair where corrosion exists on fuel facing surfaces: the fuel system replacement is not a Ford warrantable repair provided the water in fuel indicator system is operating properly

Ford Motor Company Warranty Policy - "What is not covered":
- Using contaminated or improper fuels/fluids. (Water in fuel.)
- Failures due to abuse, neglect, or improper maintenance, unapproved modification. (Fuel filters maintenance.)
- Using fuel types not covered under warranty. (Bio-diesel exceeding specified rating.)
- Using aftermarket products not cover by warranty. Using additives that do not meet or exceed Ford specifications. (Water in fuel dispersants such as alcohol based products.)

Action
For a F250-550 6.4L equipped Super duty when the PCED/hotline directs the technician to perform Step 28 in the PCED and as a result replace the whole high pressure fuel system. The high pressure fuel system components are required to be inspected for damage by water in fuel to determine warranty coverage.

Indicator for 6.4L
There is an opportunity before accessing the high pressure pump on the 6.4L to notify the customer the repair may not be covered by warranty by examining the secondary on engine fuel filter housing for corrosion.
- If there is corrosion in the secondary fuel filter housing there is a high probability of corrosion being present in the high pressure fuel pump.
- If there is no corrosion in the secondary housing it does not preclude corrosion being present in the high pressure pump.

Service Procedure for Determining if Water in Fuel caused Fuel System Damage

1) notify customer repair may not be covered by warranty

2) record PID INFORMATION

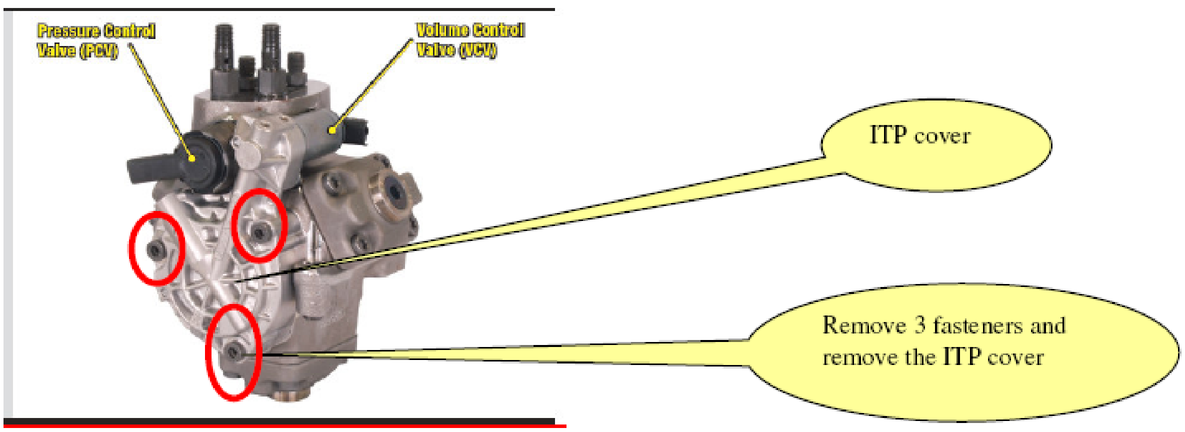
3) Validate the fuel filters have been changed per the operating conditions required maintenance schedule hours and mileage.
- Fuel filters separate the water.
- Incorrect maintenance will prevent water from separating

4) Validate the water in fuel indicator system is operating properly
- Perform PinPoint test O2: NEED TO VALIDATE WITH NEW DIAG
  - o Is the system operating properly?
  - o Is there sufficient clean fuel

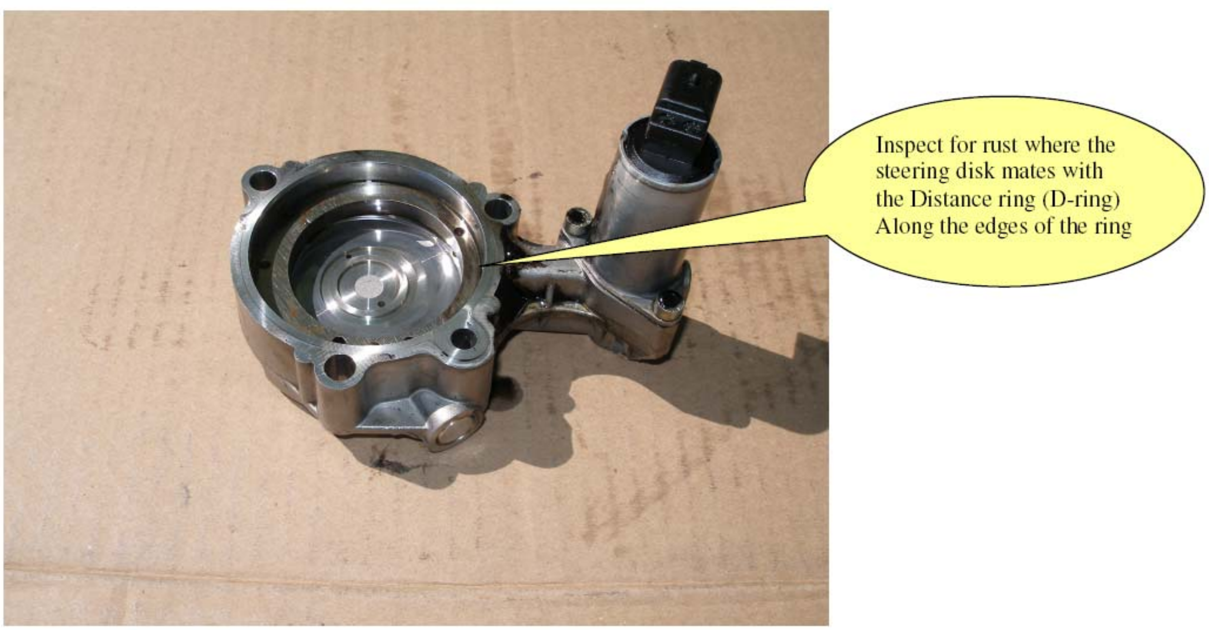
DRAFT JOB AID

5) Access the high pressure fuel system and remove the Internal transfer pump (ITP) cover from the high pressure fuel pump.

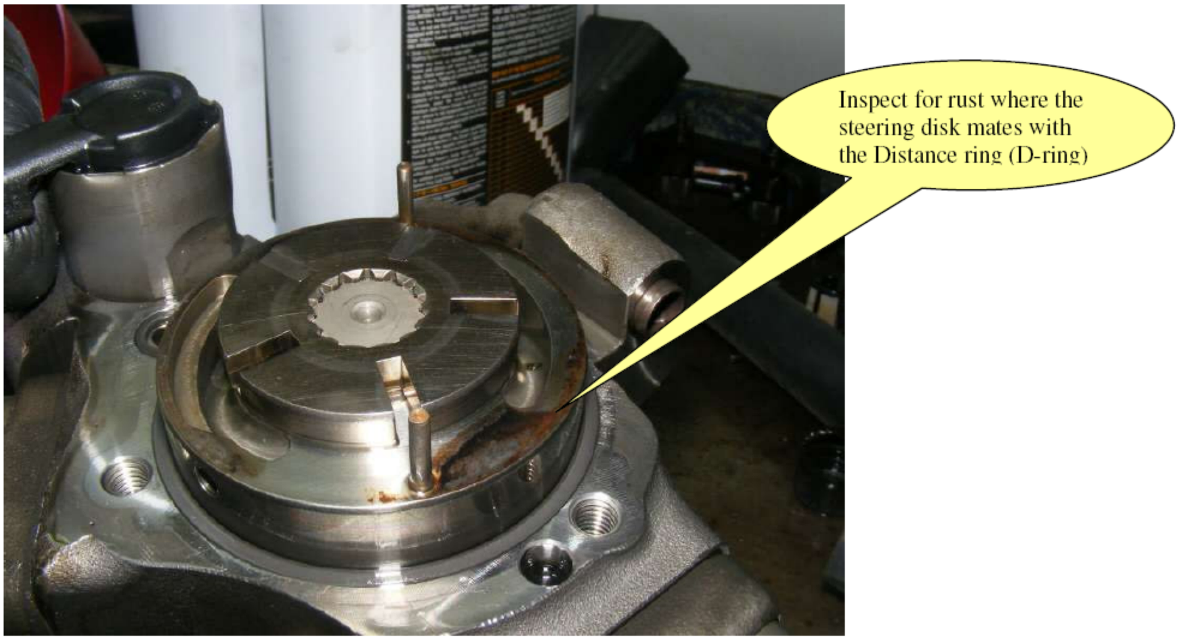
i) Remove the HPP following the workshop manual instructions
ii) Place the HPP flat ITP (internal transfer pump) cover facing up
iii) Remove the 3 fasteners with a 6mm Allen wrench and remove the ITP cover



iv) Inspect for rust where the steering disk mates with the distance ring on the ITP cover



v) Inspect for rust where the steering disk mates with the distance ring on the HPP side of the mating surface.



DRAFT JOB AID

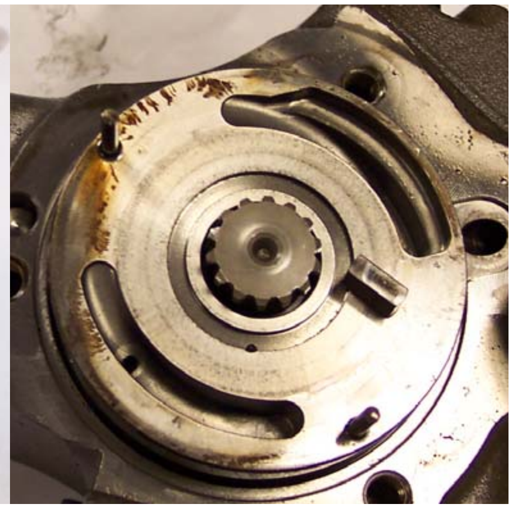
<u>Example of No corrosion on fuel facing surfaces: No water : 74,136 Miles</u>

Debris but no corrosion in the secondary fuel filter housing, debris in housing is not corroded.

DRAFT JOB AID

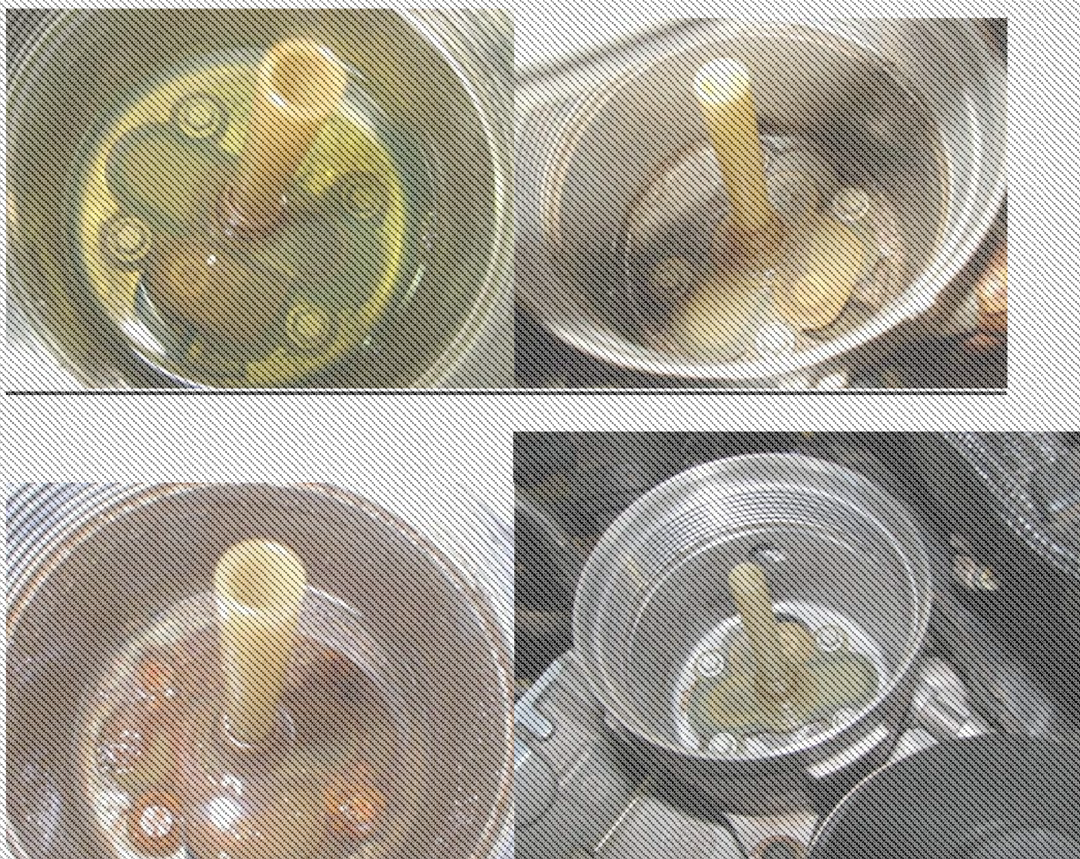
Examples of Corrosion on Fuel Facing Surfaces

Examples of Corrosion under the Internal Transfer Pump Cover


DRAFT JOB AID

Examples of Corrosion in Secondary Fuel filter housing



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Repair Instructions :
Replace the following components when metallic debris is found at the fuel injectors tubes when performing Step 28 Fuel System Debris Check in the PCED Hard Start No Start Diagnostics.

If there is shiny metallic material in the fuel at the fuel injector jumper tubes after performing Step 28 Fuel System Debris Check in the PCED Hard Start No Start Diagnostics,

The following components are to be Replaced:

Part Number	Part Common Name	*If Kit contains
9A543 (qt 1)	High Pressure Pump	
**9G805 (qt 1)	High Pressure Pump Gasket Kit	High pressure pump gaskets6619A and 6619B, high pressure pump to fuel rail manifold fuel lines 9A332A/B
9N103 (qt 1)	Fuel cooler	
**9H529 (qt 8)	Fuel injector kit	Fuel injector, jumper tubes, fuel injector gaskets
**8C3Z- 9T287-CA	LH and RH fuel rail manifold	*Left and right hand fuel rail manifold
9N184	Fuel filter	
9G756	Fuel Pressure sensor	
9C330	Fuel supply line	
9G282	HFCM	

The following components are to be Inspected/Flushed and Reused:

Part Number	Part Common Name	*If Kit contains
9B337 A/B	Low pressure return lines	
9N104	Low pressure return lines	
9C273	Low pressure return lines	
9N184	Fuel filter	
Fuel Tank	Inspect interior or tank	
Fuel pick up boot	Inspect non approved fuels can cause damage	

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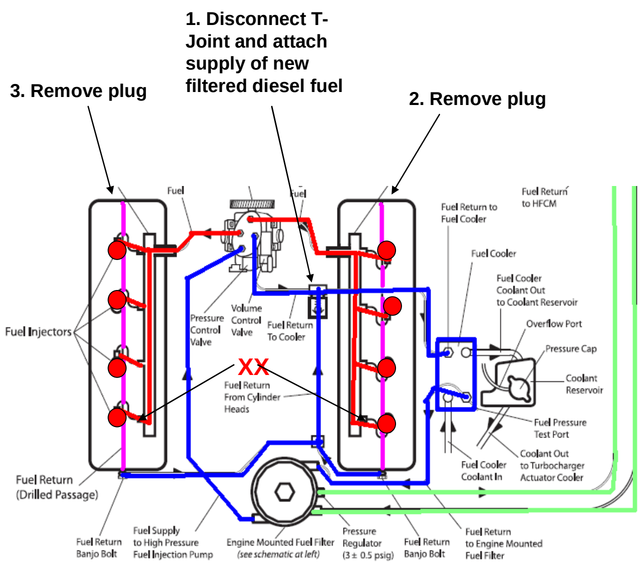
Flush Recommendation



- Flush **cylinder heads** individually by removing one plug at a time.
- Use only new clean filtered diesel fuel.
- Do not exceed 8 PSI during flush.
- .Leave original injectors in cylinder head until flushing is complete.
- **Replace fuel filters after flushing is complete.**

54

Request Type: Non-QSF

Would this make a good cost save business case? No

Activity Code: 070 F-Series >8500#

Vehicle Applications:

Vehicle Lines	Model Year Start	Model Year End	Assembly Plants	Body Styles	Engine	Trans Axles	Build From	Build To
F-250	2008	2010			6.4L TC DIESEL V8			
F-350	2008	2010			6.4L TC DIESEL V8			
F-450	2008	2010			6.4L TC DIESEL V8			
F-550	2008	2010			6.4L TC			

DRAFT JOB AID

					DIESEL V8			

How To Take Care of your 6.4L Fuel System so It takes care of you.

Your high pressure fuel system uses diesel fuel for lubricity and cooling and is designed to use only Ultra Low Sulfur Diesel fuel containing no more than 5% biodiesel. Other types of fuels and excessive water can cause the pump to fail due to lack of lubricity/cooling or aggressive chemical attack to fuel system materials.

Where does water come from and What does it do to the high pressure fuel system?

- Water and impurities can enter your tank with the fuel.
- Water does not burn, water carries oxygen and is Corrosive and it freezes.
- Water does not have the lubricant properties of diesel fuel and will corrode the high pressure fuel pump.
- Water also acts as a host to bacterial formation .

How can you prevent excessive amounts of water?

Your HFCM **fuel filter** removes water and impurities from the fuel before it enters the high pressure pump.

- The HFCM must be drained once a month and when the water in fuel light illuminates.
- Fuel filters must be changed by the recommended service interval. If your filters are not changed regularly it can:
  - decrease the water separation ability
  - cause the filters to become plugged or collapsed
  - allow water/impurities to the fuel system or starve fuel flow to the high pressure fuel system

  which can ultimately cause high pressure pump failure
- When draining the HFCM. If No fluid (fuel or water) drains from your HFCM take it to the dealer for inspection.

What about fuel additives?

Many aftermarket fuel additives are not acceptable for use in Power Stroke Diesel engines.

- Additives or alcohol/gasohol or other chemicals that cause water to disperse/emulsify or not be separated from the diesel fuel will damage your fuel system. Alcohol also decreases the lubricity of the fuel which can cause damage to the high pressure fuel pump. Do not use alcohol based additives to correct fuel gelling.
- The purpose of the filters is to be able to remove the water, but if chemicals are holding the water in the fuel it can not be separated.
- Dispersing/emulsifying the water carries the water through the fuel filters and water separators and right into your fuel system, exactly where you do not want it to be.

If you want to use fuel additives, only use Motorcraft additives as they are the only recommended additives and meet Ford specifications.

The customer warranty may be void from using additives that do not meet Ford specifications.

BIODIESEL

For any vehicle purchased before the 2011 model year, only a 5% biofuel concentration may be used. Vehicles in the 2011 model year and newer accept up to a 20% concentration. Higher than recommended concentrations can cause fuel filter restrictions that may result in a lack of power and or damage to components such as fuel tank, fuel lines, fuel pump, fuel sender and fuel injectors fuel pump and fuel injector failures.

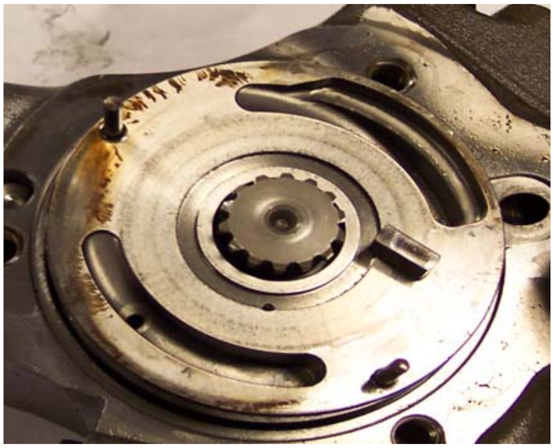
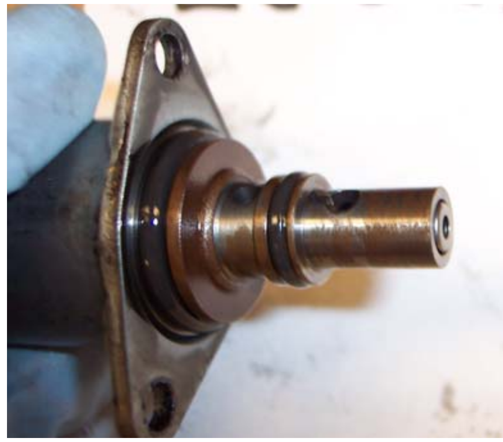
- Biodiesel should not be stored in the fuel tank for more than three months.
- Excessive Bio-diesel, poor bio-diesel fuel can cause bacterial/fungas growth, increased water content , aggressive chemical attack of fuel system material, premature fuel filter plugging and fuel starvation due to cold gelling.
-

Vehicle Parked for a long period of time / Fuel Storage

Biodiesel fuels degrade more easily than fuels not containing biodiesel and should not be stored in the fuel tank for more than 1 month & 6.7) 3 months (6.4)

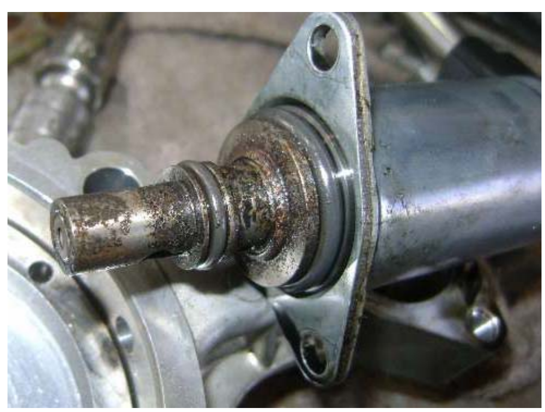
Diesel fuel must not be stored in a galvanized container.

What happens if water gets into the high pressure fuel system?
Should excessive water enter the fuel system, corrosion and damage are not far behind. In many case, the entire high pressure fuel system will have to be replaced.

Excessive water in the fuel led to this corrosion in the High Pressure Fuel Pump Internal Transfer Pump and on the Fuel Volume Control Valve


This corrosion in the High Pressure Fuel Pump internal transfer Pump and Secondary Fuel Filter Housing developed from excessive water in fuel

Corrosive fungus, algae and bacterial growth in secondary fuel filter housing and high pressure pump volume control valve.

From: Billings, Thomas (T.P.)
Sent: Monday, January 03, 2011 9:01 AM
To: Rauch, Jim (J.R.)
Cc: Pumford, Ken (K.G.); Heggie, Forest (F.)
Subject: FW: 6.7L Engine Warranty Claims for 12/21/2010

Jim,

Fyi -- Forest is going to be inviting us to a mtg so we can see how they've dealt with WIF in warranty on 6.4L…

Tom

From: Rauch, Jim (J.R.)
Sent: Monday, January 03, 2011 9:00 AM
To: Castleberry, Larry (L.); Pumford, Ken (K.G.)
Cc: Billings, Thomas (T.P.); Stroia, Kathy (K.); Hoang, Cuong (C.); Armesto, Carlos (.)
Subject: FW: 6.7L Engine Warranty Claims for 12/21/2010

Larry,
FYI - Water is getting into high pressure system and we are paying warranty due to no WIF light.

Have we ever done vehicle level testing do determine how much water our system can handle before it is passed to the HP pump? If not can you stop by our design review meeting tomorrow at 8:00 to discuss a potential test plan?

Ken,
Can we get a summary report from Bosch on all VCVs returned so we can understand total quantity that may have water damage?

From: Jones, Keith (K.)
Sent: Wednesday, December 22, 2010 10:32 AM
To: Billings, Thomas (T.P.); Pumford, Ken (K.G.)
Cc: Crudo, Frank (F.J.); Lusardi, Tony (T.K.); Rauch, Jim (J.R.); Dihle, Ken (K.M.); Johnson, Seth (S.); Bandoske, Pete (P.F.)
Subject: RE: 6.7L Engine Warranty Claims for 12/21/2010

Tom,

The Technical Hotline advised the dealer to check for contamination etc. The Field Service Engineer was at the dealer and reported "very little water; a couple of pockets that could be considered normal" and advised the dealer to perform the repair. Something that is concerning with this is there is no WIF code present. This is something we are currently fighting on the 6.4 as we speak. If there was water in the fuel, why was the customer not notified? Why is there no DTC present? As previously mentioned, this is something that is being fought at multiple different levels with multiple different approaches. If possible, please provide direction for future failures such as these and we will see what we can do.

Thanks,
Keith Jones
6.7 Engine SME
Diesel Drivability
Ford Technical Hotline
DSC1 Cube 308
313-248-7923
KJone286@ford.com

From: Billings, Thomas (T.P.)

Sent: Wednesday, December 22, 2010 9:11 AM
To: Pumford, Ken (K.G.)
Cc: Crudo, Frank (F.J.); Jones, Keith (K.); Lusardi, Tony (T.K.); Rauch, Jim (J.R.); Dihle, Ken (K.M.)
Subject: RE: 6.7L Engine Warranty Claims for 12/21/2010

Ken, we reviewed the claim yesterday and it references contaminated fuel.

Keith, Tony, how do we prevent these claims?

Tom

From: Pumford, Ken (K.G.)
Sent: Tuesday, December 21, 2010 1:10 PM
To: Dihle, Ken (K.M.); Billings, Thomas (T.P.); Crudo, Frank (F.J.); Lusardi, Tony (T.K.)
Cc: Rauch, Jim (J.R.)
Subject: RE: 6.7L Engine Warranty Claims for 12/21/2010

The attached photo shows rust on the end of the field-return VCV from this engine. Rust like this is due to excess water in the fuel, which is the customer's responsibility, not Ford's. FYI, a similarly rusted VCV was returned recently from BEA 85725, and that vehicle had been found to have 40% water in the fuel by dealership personnel.

<< File: BEA22430 - rusty VCV (Large).JPG >>
Regards,

Ken Pumford
Engine Design
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Pumford, Ken (K.G.)
Sent: Tuesday, December 21, 2010 8:51 AM
To: Dihle, Ken (K.M.); Billings, Thomas (T.P.); Crudo, Frank (F.J.); Lusardi, Tony (T.K.)
Cc: Rauch, Jim (J.R.)
Subject: RE: 6.7L Engine Warranty Claims for 12/21/2010

Why would Ford pay $7200 for the fuel system replacement on 1FT7W2BT4BEA22430 reported in today's list of AWS claims? Fuel system components don't rust unless they're exposed to water, whether it is in the tank when the customer comes into the dealership or not. Bosch will not warrant FIE parts that show obvious signs of corrosion, nor should we to the customer, for it exposes the Company to expenses over which we have no control.

Regards,

Ken Pumford
Engine Design
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Dihle, Ken (K.M.)
Sent: Tuesday, December 21, 2010 6:31 AM
To: Alark, Keli (K.); Armesto, Carlos (.); Armstrong, Brian (B.D.); Billings, Thomas (T.P.); Bird, Kevin (M.); Bolyard, Jay (John.); Bull, Tony (W.A.); Campbell, Henry (H.); Campbell, Julie (J.L.); Chisholm, Peter (P.M.); Collada, James (J.M.); Crudo, Frank (F.J.); Currie, David (J.); Desai, Narendra (S.); Ford, Roy (R.A.); Fsadni, Patrick (P.F.); Fulton, Brien (B.L.); Giordano, Sam (.); Hanspard, Taniya (.); Hernandez, Alejandro (A.); Hoang, Cuong (C.); Hudson, Anthony (A.W.); Ives, David (D.C.); Johnson, Ryan (L.); Jones, Keith (K.); Jungkunz, Rose (R.T.); Kosko, Jeff (J.R.); Krenz, Edwin (E.A.); Krolewski, David (D.R.); Kulkarni, Milind (M.B.); Lirette, David (D.F.); Lusardi, Tony (T.K.); Mathews, Shaji (S.); Melendez, Enrique (E.); Morelli, Anthony (A.J.); Murphy, Mark (M.T.); Naddaf, Fadi (F.M.); Opperman, Brad (B.); Padar, Frank (F.); Parkham, Jeffrey (J.W.); Provagna, John (J.D.); Pumford, Ken (K.G.); Rakotz, Ron (R.D.); Ramey, Blaine (B.D.); Rauch, Jim (J.R.); Roberts, James (J.B.); Schneidau, Dan (D.); Schreiber, Greg (C.); Self, Daryl (D.G.); Siddall, Stephen (S.); Smaldone, Ronald (R.P.); Solski, Michael (M.E.); Soto, Eduardo (E.); Sun, Bao (B.); Szynal, Kenneth (K.); Uranga, Isidro (J.); Volinski, Bridget (.); Wallin, Richard (R.J.); Waszczenko, Ed (E.W.); Wilker, Bob (R.J.); Young, Colin (C.J.)
Subject: FW: 6.7L Engine Warranty Claims for 12/21/2010

Team,

Here are the claims loaded yesterday. There are two engine exchange, both with low compression symptoms. Note also that there are two claims for 9E469 EGR inlet tubes built in August.

<< File: 6.7L Engine Claims for 12212010.xls >>

Ken Dihle
Product Development Engineer
Large Gas & Diesel Engine Engineering
Phone: 313-248-1101
Fax: 313-390-6600
Building 1 Cube 13G004

From: Dean, William (W.H.)
Sent: Monday, August 30, 2010 10:08 AM
To: Eeley, Scott (A.)
Cc: Balderas, Luis (L.G.); Clamont Bello, Octavio (O.)
Subject: FW: Diesel Engine Durability 5D

Attachments: Diesel Engine.ppt

Scott

Will you be presenting this in Mascarenas review Wednesday?

Is it fair to say that with 1.) the addition of the low pressure sensor, and 2.) the update to the corporate knowledge that the original complaint of pump failures has been addressed?

Octavio told me that you are looking at alternate pump from International- is that something that needs to be described in your 5D?

BILL DEAN
Senior Engineer
Core Vehicle Integration
(313) 805-3278
WDEAN@ford.com

From: Clamont Bello, Octavio (O.)
Sent: Monday, August 30, 2010 9:31 AM
To: Dean, William (W.H.)
Subject: FW: Diesel Engine Durability 5D

Diesel Engine.ppt

Issue Title:	**6.4L diesel HP pump & related FIE failures – Fuel Lubricity**	**Champion:**	Carlos Dounce / Colin Horbal
Source:	FoM Quality Office 9A543 – HP Pump	**Team:**	NA Diesel OPD, FoM PT Quality, FoM Technical Support
Issue Description:	*HP pump assembly / internal transfer pump wear on several surfaces and drive spline, debris throughout HP system forces replacement of sensitive fuel injection equipment.*		
Containment:	1. Improve service diagnostics and repair procedures. 2. Educate customers on the importance of maintenance.		
Potential Root Cause & Corrective Action :	1a. Misdiagnosis / over-repair. b. Repeat repair – improve ATT assistance & release instructional video. 2. Meetings with several top fleet customers to establish maintenance regiment.		
Next Steps or Prevent Action:	1. Replicate maintenance regiment with more customers. – Eduardo Santiago 2. Validate other service robustness options. - Eduardo Santiago SDS established / low pressure sensor on 2011 6.7L diesel. – Complete		

From: Fulton, Brien (B.L.)
Sent: Tuesday, September 28, 2010 1:32 PM
To: Heggie, Forest (F.)
Cc: Pumford, Ken (K.G.); Armesto, Carlos (.)
Subject: FW: fuel contamination quick guide
Attachments: TSB.doc

Here is a first cut on what you originally sent, don't be afraid to send to Ken or Carlos, they have a breadth of experience also.

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com **Cell:** [redacted] ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Heggie, Forest (F.)
Sent: Tuesday, September 28, 2010 10:44 AM
To: Fulton, Brien (B.L.)
Subject: fuel contamination quick guide

I am trying to put together a quick ref quide as an document ot use to develope a TSB ect and would really appreciate any input you have?

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Tuesday, September 28, 2010 9:13 AM
To: Armesto, Carlos (.)
Cc: Sowards, John (J.)
Subject: RE: Report Summary for the CQIS Report#AGGBA010

I am trying to put together a quck document to reference for a suggested TSB,

are there any other items you think should be added

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Armesto, Carlos (.)
Sent: Monday, September 27, 2010 10:57 PM
To: Heggie, Forest (F.)
Cc: Sowards, John (J.)
Subject: RE: Report Summary for the CQIS Report#AGGBA010

Yes, we have seen this before. The pick up boot in the tank can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in the boot falling off or the "ice valve" falling out. Both this will result in air ingestion at lower fuel levels since the fuel is not being picked up from the bottom of the tank any more.

Carlos

TSB: items to consider

Fuel contamination can be, but is not limited to dirt/debris, water, excessive % biodiesel, incorrect fuel additives, gasoline, kerosene etc.

Contamination	**Issue / Failure**	**Causal Factors**	**Indicator**
- Gasoline - Ethanol / Methanol - Kerosene - Un-approved fuel	- HP Pump failure - Injector failure - Fuel system leaks - Aggressive chemical attack of fuel system materials	- Debris w/wo rust / corrosion - Material distortion	- Fuel smell - Styrofoam cup test - Fuel sample - Fuel aeration, Note: The tank pick up boot can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in the boot falling off or the "ice valve" falling out causing aeration.
- Water	- HP Pump failure - Injector failure	- Debris - Rust / corrosion	- Fuel tank rust - HP Pump (inc. VCV valve) rust / corrosion - Injector rust / corrosion Note: components can have water damage without large quantities of water ingested
- Excessive Biodiesel Blends - Poor Biodiesel fuel	- HP Pump failure - Injector failure - Aggressive chemical attack of fuel system materials	- Debris - Rust / corrosion - Bacterial / fungus growth	- Rust/corrosion HP Pump due to increased water content decrease water separation - Bacterial / fungus growth - Fuel aeration (See note above)
- Incorrect Fuel Additives	- HP Pump failure - Injector failure - Aggressive chemical attack of fuel system materials	- Debris - Rust / corrosion - Material distortion	- HP Pump (inc. VCV valve) rust / corrosion - Injector rust / corrosion Note: components can have water damage if water emulsifies / disperses and prevents proper water separation
- Fuel filter maintenance	- HP Pump failure - Injector failure - Fuel system leaks	- Debris w/wo rust / corrosion - Decreased water separation ability - Plugged filters - Collapsed filters	- Rust/corrosion due to increased water content decrease water separation - FF filters - Collapsed filters - Low fuel pressure indication
- Acid	- HP Pump failure - Injector failure - Aggressive chemical attack of fuel system materials	- Debris - Rust / Corrosion	- Fuel sample - Fuel tank rust - HP Pump (inc. VCV valve) rust / corrosion - Injector rust / corrosion Note: components can have water damage without large quantities of water ingested
- Broken down diesel fuel - Bacteria		- Fuel bacteria / fungus growth - Corrosion	

Scenarios:

1. Customer does not want to pay after running on gas, water etc. requests flush of system and take chance for how long it takes for system damage
    a. put in warranty documentation no coverage until full system is replaced e x. case where gasoline had damage the sending unit valve and caused system aeration
    b. I believe that the engine warranty is already voided if run on gasoline

2. Possible causes of debris in high pressure fuel system failures
    a. Gasoline
    b. Water
    c. Acid
    d. Alcohol
    e. Ethanol / Methanol
    f. Contamination

3. Customer may end with tank of half water – may not get rust in the system (Did WIF minder come on?)
    a. This would be a fairly quick failure – lack of lubrication and cooling would be first failure mode
    b. Dealer would have first assessment
    c. May end up being ford pay, error to customers benefit

4. Customer had gasoline drains tank – debris in system
    a. Will not be able to differentiate unless present in a sample of fuel
    b. May have caused damage to low pressure system – resultant aeration
    c. Debris in system due to lack of lubrication / cooling

From:	Heggie, Forest (F.)
Sent:	Tuesday, February 08, 2011 3:28 PM
To:	Eeley, Scott (A.)
Subject:	FW: Fuel contamination table
Follow Up Flag:	Follow up
Due By:	Thursday, February 10, 2011 6:52 AM
Flag Status:	Flagged

Sent Andrew the original chart the 6.7 was based off of

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From:	Heggie, Forest (F.)
Sent:	Tuesday, February 08, 2011 3:24 PM
To:	Curtis, Andrew (A.)
Subject:	RE: Fuel contamination table

Here is an old copy of the original 6.4 eye chart put together

Fuel contamination can be, but is not limited to dirt/debris, water, excessive % biodiesel, incorrect fuel additives, gasoline, kerosene etc.

Contamination	**Issue / Failure**	**Causal Factors**	**Indicator**
• Gasoline • Ethanol / Methanol • Kerosene • Un-approved fuel • Broken down diesel fuel • Bacteria •	• HP Pump failure • Injector failure • Fuel system leaks • Aggressive chemical attack of fuel system materials	• Debris w/wo rust / corrosion • Material distortion • Fuel bacteria / fungus growth • Corrosion	• Fuel smell • Styrofoam cup test • Fuel sample • Fuel aeration, Note: The tank pick up boot can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in the boot falling off or the "ice valve" falling out causing engine malfunction caused by air ingestion
• Water	• HP Pump failure • Injector failure • Electric Fuel Pump failure • Filter Life • Promotes algae and bacterial growth • Promotes acid formation	• Debris • Rust / corrosion	• HP Pump (inc. VCV valve) rust / corrosion • Injector rust / corrosion Note: components can have water damage without large quantities of water ingested -fuel tank is Not rusted

• Excessive Biodiesel Blends • Poor Biodiesel fuel	• HP Pump failure • Injector failure • Aggressive chemical attack of fuel system materials • Premature filter plugging and fuel starvation due to cold gelling, diesel varnish dissolved by biodiesel or degraded fuel • Decreased water separation efficiency resulting in water breakthrough to the HP system	• Debris • Rust / corrosion • Bacterial / fungus growth	• Rust/corrosion HP Pump due to increased water content decrease water separation • Bacterial / fungus growth • Fuel aeration (See note above)
• Incorrect Fuel Additives	• HP Pump failure • Injector failure • Aggressive chemical attack of fuel system materials	• Debris • Rust / corrosion • Material distortion	• HP Pump (inc. VCV valve) rust / corrosion • Injector rust / corrosion Note: components can have water damage if water emulsifies / disperses and prevents proper water separation
• Prolonged Fuel filter maintenance	• Fuel Starvation and reduced fuel flow leading to HP Pump failure due to low lubrication and cooling • Injector failure • Fuel system leaks • Decreased water separation efficiency resulting in water breakthrough to the HP system • Seal deterioration causing air ingestion/leaks	• Debris w/wo rust / corrosion • Decreased water separation ability • Plugged filters • Collapsed filters	• Rust/corrosion due to increased water content decrease water separation • FF filters • Collapsed filters • Low fuel pressure indication
• Acidic/Aggressive Fuels	• HP Pump failure • Injector failure • Aggressive chemical attack of fuel system materials	• Prolonged biodiesel storage • Poor quality biodiesel or diesel fuels • Water in Fuel • Presence of catalysts (cooper alloys, Zinc etc..) • Debris • Rust / Corrosion	• Fuel sample • Fuel tank rust • HP Pump (inc. VCV valve) rust / corrosion • Injector rust / corrosion Note: components can have water damage without large quantities of water ingested
• Particulate (dirt/debris, sand, etc) contamination	- HP pump failure - secondary failure of injectors	• Debris	- collapsed primary fuel filter - visible contaminants in HP pump inlet port mesh filter - low fuel pressure indication - non-metallic debris on primary fuel filter

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Curtis, Andrew (A.)
Sent: Tuesday, February 08, 2011 3:03 PM
To: Eeley, Scott (A.); Heggie, Forest (F.)
Subject: RE: Fuel contamination table

Sorry, I forgot to send the table.

<< File: Fuel Contamination Table.pdf >>

Andrew Curtis
6.0L-6.4L CCE
Ford Technical Hotline - DSC 1
Cube # 257 Phone (313) 390-2132
ACURTI24@Ford.com

From: Curtis, Andrew (A.)
Sent: Tuesday, February 08, 2011 2:57 PM
To: Eeley, Scott (A.); Heggie, Forest (F.)
Subject: Fuel contamination table

Scott and Forest,
A fuel contamination table has been put together for the 6.7L. We are wondering if this would be a value add for the 6.0 and 6.4L. Is this table technically correct across the board for diesels? Obviously DEF is 6.7L specific.

Andrew Curtis
6.0L-6.4L CCE
Ford Technical Hotline - DSC 1
Cube # 257 Phone (313) 390-2132
ACURTI24@Ford.com

From: Eeley, Scott (A.)
Sent: Wednesday, December 16, 2009 4:17 PM
To: Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.); Misangyi, Pete (P.W.)
Cc: Mull, Ted (V.); Fulton, Brien (B.L.); Chyo, Timothy (T.); Horbal, Colin (C.P.); Mondragon, David (J.D.)
Subject: FW: Fuel System Limits

Attachments: FW: Lubricity Additives; FW: Fuel Analysis in Mexico

Beth, Chuck and Pete,

As you know, low lubricity PEMEX diesel fuel is affecting HP pump reliability in Mexico.

CBM Chemical is suggesting we recommend to our customers their "Diesel Performance" additive. CBM provided to us the attached email and we provided to CBM our system limit data on key factors (see below).

Do you have experience with CBM and do you have any recommendations or have information that would keep FoM from recommending their products for use in our 6.4 diesel product?

FW: Lubricity Additives

FW: Fuel Analysis in Mexico

Scott

From: Eeley, Scott (A.)
Sent: Wednesday, December 16, 2009 3:54 PM
To: Mull, Ted (V.); Santiago, Eduardo (S.); Fulton, Brien (B.L.); Chyo, Timothy (T.); Rudd, David (D.); Mondragon, David (J.D.); 'rmanilla@telcel.blackberry.net'; Simpson, Timothy (T.A.); Horbal, Colin (C.P.)
Subject: FW: Fuel System Limits

Ruben,

Please see the values provided by Tim. The smallest size for solid material is 4 microns.

Please let us know "Diesel Performance" stability and robustness to these environmental factors. Let me know if you have any questions.

Thanks.

Scott Eeley

From: Chyo, Timothy (T.)
Sent: Wednesday, December 16, 2009 12:24 PM
To: Eeley, Scott (A.)
Subject: Fuel System Limits

150C Maximum Fuel Temperature
170 Mpa Maximum Pressure

Timothy Chyo
Diesel P&E
313-805-5729

From: Santiago, Eduardo (S.)
Sent: Wednesday, December 16, 2009 12:09 PM
To: Eeley, Scott (A.); Mondragon, David (J.D.)
Subject: FW: Lubricity Additives

Attachments: bosch articulo 2008-01-0926.pdf

bosch articulo
2008-01-0926....

-----Original Message-----
From: Rubén Manilla [mailto:rmanilla@cbmmexico.com]
Sent: Miércoles, 16 de Diciembre de 2009 10:21 a.m.
To: Santiago, Eduardo (S.)
Subject: Lubricity Additives

Ing Eduardo

Este documento probablemente lo utilicemos para el conference, voy para alla

Saludos

Rubén Manilla
CBM Chemical
Ph. 555.378.5247 / 552.487.6767
Movil. 55 911.88.216
rmanilla@cbmmexico.com

SAE TECHNICAL PAPER SERIES

2008-01-0926

Investigation into the Formation and Prevention of Internal Diesel Injector Deposits

Jörg Ullmann, Marion Geduldig and Heinz Stutzenberger
Robert Bosch GmbH

Rinaldo Caprotti and Graham Balfour
Infineum

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Investigation into the Formation and Prevention of Internal Diesel Injector Deposits

Jörg Ullmann, Marion Geduldig and Heinz Stutzenberger
Robert Bosch GmbH

Rinaldo Caprotti and Graham Balfour
Infineum

1. ABSTRACT

High precision high pressure diesel common rail fuel injection systems play a key role in emission control, fuel consumption and driving performance.

Deposits have been observed on internal injector components, for example in the armature assembly, in the slots of the piston and on the nozzle needle. The brownish to colourless deposits can adversely impact driveability and result in non-compliance with the Euro 4 or Euro 5 emission limits.

The deposits have been extensively studied to understand their composition and their formation mechanism. Due to the location of these deposits, the influence of combustion gas can be completely ruled out. In fact, their formation can be explained by interactions of certain diesel fuel additives, including di- and mono-fatty acids. This paper describes the methodology used and the data generated that support the proposed mechanisms. Moreover, approaches to avoid such interactions are discussed.

2. INTRODUCTION

Current and future diesel powered vehicles are subject to increasingly stringent emissions regulations, whilst at the same time having to meet end user expectations of good driveability, i.e. power and torque, and excellent fuel economy.

Powertrain technologies have already undergone major technical advances in order to satisfy regulatory and end user requirements, and these will continue to be further developed. With respect to the fuel injection equipment (FIE), advances in common rail (CR) fuel injection technology have included increased injection pressure, multiple injection strategies, and high efficiency nozzles with smaller spray holes. These measures ensure the precise and repeatable metering of even the smallest quantities of fuel as well as providing the excellent fuel atomisation and spray characteristics necessary across all engine operating conditions to promote more complete combustion.

Fuel injection system technical advances often require components to be smaller and lighter, to ensure highly dynamic response. They need to be manufactured to very exacting tolerances and to operate within very small clearances. It is therefore essential that the FIE runs with fuel which is fit for purpose. Fuel detergent additives will increasingly be required as more stringent emissions legislation is enforced to ensure minimal build up of nozzle deposits which can adversely affect flow rates and spray patterns.

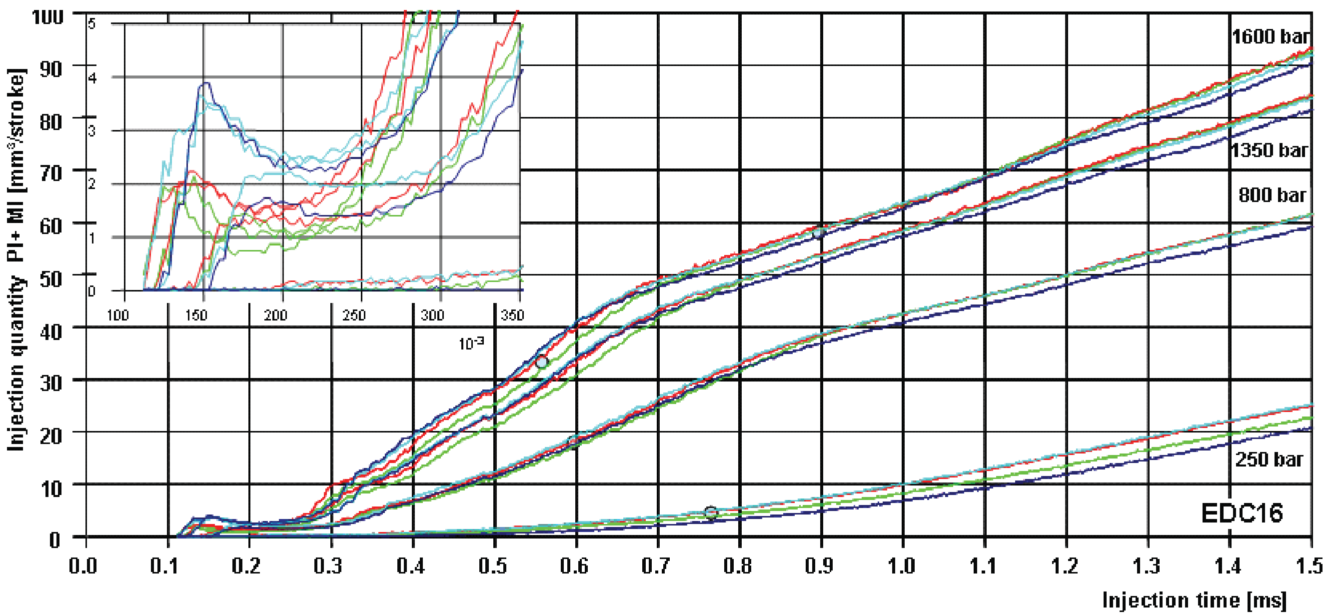
Fuel injector deposits are not new. The widespread use of indirect injection diesel engines in passenger cars during the 1980s highlighted the problems that excessive nozzle hole deposits could have on performance and emissions. This resulted in the development of injector coking test methods, which in turn could aid the development of diesel fuel detergents. More recently, advanced injection systems have also been found to be sensitive to nozzle hole and tip deposits, and a more relevant coking test is currently under development. This work has been well documented, refs. 1, 2 and 3. However, the formation of deposits in the spray holes and on the tip of the nozzle is not addressed in this paper.

The focus of the work presented here is on internal injector deposits that can occur in common rail fuel injection systems. Field and development test data have shown the adverse impacts that internal injector deposits can have on engine emissions and performance.

3. INTERNAL INJECTOR DEPOSITS

A new type of injector deposit has been observed with increased frequency during the last three years. These deposits have been observed on internal injector components and assemblies. Internal injector deposits can have a detrimental influence on injector dynamics, adversely affecting the complex injection profiles necessary to assure today's performance requirements of diesel engines. For example, pilot injection is widely used for combustion noise reduction and pilot injection quantity can be doubled by internal deposit formation, resulting in a rough running engine and non-compliance with the statutory engine emissions requirements, and specifically particulate emissions. High precision is essential for pilot injection, since the injection quantity is as small as 1 mm^3 and injection times are especially short, typically lasting only 100 microseconds. Small changes in the hydraulic performance can have a very substantial impact on the injection quantity. If the pilot injection amount exceeds certain levels, the maximum combustion pressure build up can be too high which can account for the engine damage that has been reported in extreme cases. At full load and high injection pressure internal injector deposits can reduce the injection amount resulting in power loss.

In fig. 1 the injection quantity map for a common rail injector is shown. Due to deposit formation inside the injector the pilot injection quantity is twice as much as expected (dark blue line). Change of the nozzle to a reference nozzle did not reduce the injection quantity, proving that the deposits are not located in the spray holes of the nozzle (light blue line). After additional cleaning of internal components from the solenoid assembly (red line) or of both the solenoid and valve assemblies (green line) the original injection behaviour is restored.



blue ➔ performance with deposits

light blue ➔ injector performance after replacement of the nozzle (reference nozzle)

red ➔ performance with reference nozzle and after cleaning of the solenoid assembly

green ➔ performance with reference nozzle and after cleaning of the solenoid and valve assemblies

Fig. 1: Influence of Deposits on CR Injector Performance

Disassembled injectors taken from engines in the field whose performance had attracted attention due to improper emission performance revealed significant deposits at the armature plate and guide, at the plunger guide and slots and at the nozzle needle. In fig. 2 injector components with typical deposit build-up are shown. It can be readily understood that such deposits, for example those at the bottom end of the nozzle needle where the clearance between the needle guide and the nozzle body is only 2 to 3 micrometer, can slow down the injector dynamics and delay the closing of the needle, with maximum effect at short injection times.


Nozzle needle


Bottom end of nozzle needle


Armature plate


Ball seat

Fig.2: Injector parts with typical deposit formation

Internal injector deposit formation has been observed in different types of injection systems, and within a given type of injection system, all generations are affected. With increasing injector performance requirements even small amounts of deposits can have significant effects. Additionally, decrease in fuel stability, possibly linked to desulphurisation, may increase the risk of deposits.

The higher risk of internal deposit formation can no longer be tolerated or neglected. Although small amounts of deposits are frequently observed which do not affect the injector functioning, fuel injection systems rely on a reasonable cleanliness to yield the designed performance level. Meanwhile, reported cases of severe deposit formation are now at a non-acceptable level.

Information gathered in the field, during in-house engine testing and from the analysis of internal injector deposits have proven very valuable in defining the areas of investigation which are necessary to gain understanding of the root causes for the formation of internal injector deposits.

3.1 TYPES OF INTERNAL INJECTOR DEPOSITS

The compositional data from the analysis of the internal injector deposits confirm the existence of two different types of deposit:

- Metal ion based, in particular sodium
- Organic polymeric based, identifiable by their specific infrared fingerprints.

3.2.1 Metal Ion Based Internal Injector Deposits

The analysis of this type of deposit clearly confirms the presence of sodium fatty acid soaps. Soap formation is not new. Previous publications have indicated that soaps can form deposits in the fuel injection system, refs. 4, 5, 6 and 7. Interestingly, the deposits in these older in-line type injection systems were generated by the presence of metal ions present in the crankcase lubricant in conjunction with dimer acids. FIE systems are now very different from those studied in those references, and the majority of systems today are lubricated by the diesel fuel itself, so the crankcase lubricant is no longer a source for metal ions. However, the fundamental process observed is the same - the formation of a metal based soap that in the right conditions can stick to surfaces.

The FIE systems typically being considered in this paper are of the common rail type, which rely on the diesel fuel to provide lubrication. Diesel fuel today contains a variety of acidic components. Fatty acids, with different degrees of un-saturation, are commonly used as lubricity additives in diesel fuel. Such acids have been shown to readily react with metal ion impurities in the fuel to form metal soaps, refs. 4 and 5.

Zinc based fatty acid soaps have been associated with the formation of nozzle tip/spray-hole deposits for a long time, and the mechanisms which describe the formation of metal salts in fuel are well understood, refs. 1, 2 & 3, but as far as the first type of internal injector deposits is concerned, the focus is on fatty acids and sodium.

Sodium salts, typically nitrite, are used as corrosion inhibitors additives in pipelines. One of the main ways of moving large quantities of diesel fuel is in pipelines. Therefore, there is the possibility that some of this metal is present in diesel fuel, albeit at very low levels far below 1 mg/kg. Furthermore, sodium salts like sodium chloride can be used as drying agents for standard diesel fuel, and sodium sulphate can be accidentally transferred into fuel during some refinery processes. Sodium contamination is also likely to rise with increasing use of fatty acid methyl esters (FAME), as this metal is a component of a typical catalyst used for the trans-esterification reaction. Furthermore, the increasing use of FAME could also further contribute to making this phenomenon more severe because acid impurities from FAME production or those formed by the auto-catalytic cleavage of the fatty esters by metal ions will further increase the presence of metal soaps. Finally, contamination by ballast water from sea transportation can not be ruled out either. Sodium fatty acid soaps are well known for their poor solubility in diesel fuel. Therefore, when the right conditions occur, these fatty acid salts can separate from the fuel and stick to injector component surfaces where diesel fuel is present. Although, sodium is the main metal present, other metals like calcium have also been identified.

3.2.2 Characterisation of the Metal ion Containing Internal Injector Deposits

Fig. 3 shows an infrared spectrum obtained by Fourier Transform Infra Red (FTIR) analysis of this type of internal injector deposit which has recently been found in injector complaints in both Southern Europe and North America. The FTIR spectrum closely correlates with that for sodium C18 fatty acid soap. Scanning electron microscopy and micro-analysis results are given in fig. 4 and show the presence of sodium.

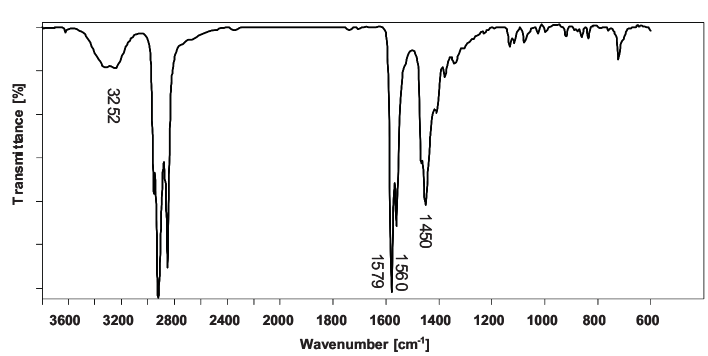


Fig. 3: Infrared spectrum of sodium fatty acid soap deposits as found on nozzle needles

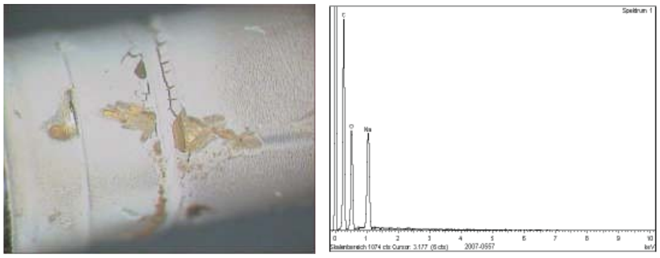


Fig. 4: Micro-analysis results of sodium fatty acid soap deposits as found on nozzle needles.

3.3.1 Organic Based Polymeric Internal Injector Deposits

In the last few years a chemically different type of internal injector deposit has been observed in the field, and the rate of incidence is increasing. As described previously for the fatty acid soaps, this second type of deposit is also found on the inner parts of the body of common rail injectors. Being completely free of metal ions, its composition essentially comprises polymeric fuel-borne material. In the most advanced common rail injection systems, operating conditions are typically 2000 bar and 120 °C in those regions where deposits have been observed, although this temperature can be much higher during hot soak. These conditions can promote chemical reactions. Many hundreds of incidents have been reported and these are not limited to one fuel system manufacturer, fuel system or fuel system generation.

3.3.2 Characterisation of the Organic Polymeric Internal Injector deposits

The deposits consist of a brownish, sticky material which is insoluble in all typical laboratory solvents or mixtures thereof, thereby making the characterisation significantly more difficult since most powerful spectroscopic methods require dissolved sample material. Moreover, the deposits consist of polymers with a broad distribution in molecular weight.

The FTIR of the deposits provides most useful information (fig. 5). Deposits of this type of material collected from different injectors always display the same FTIR fingerprint, allowing the conclusion that the material is homogeneous and not a varying mixture of different compounds dependant on various influences.

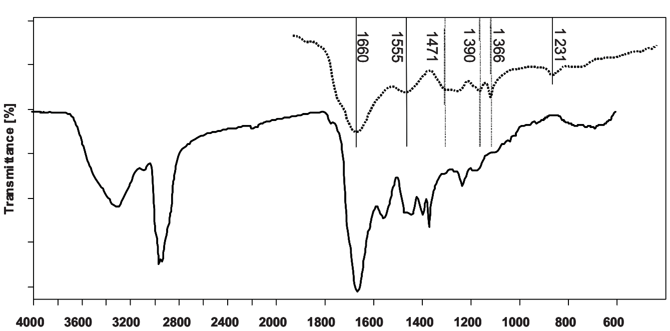


Fig. 5: Infrared spectrum of the organic polymeric internal injector deposits; Vibrations at 1471, 1390, 1366 and 1231 cm^{-1} are assigned to PIB and at 1660 and 1555 cm^{-1} to amide.

Interpreting this spectrum reveals

- Vibrations at 1471, 1390, 1366 and 1231 cm^{-1} clearly indicate the presence of an isobutylene group
- Absorptions at 1660 and 1555 cm^{-1} are indicative of the presence of amide bonds.
- An amino group (N-H) is evidenced by a band at 3305 cm^{-1}.

This information indicates that a detergent of the family poly isobutylene succinimide (PIBSI) may be involved, most likely by opening of the succinimide ring, because the typical succinimide vibration at 1705 cm^{-1} is reduced and replaced by the two peptide bands at 1660 and 1555 cm^{-1}. The nitrogen content is confirmed by scanning electron microscopy and micro-analysis results.

The PIBSI additive itself, although often present in fuels, does not appear in the FTIR spectra of the deposits. Films of PIBSI are very thin and far beyond the detection limit of the FTIR method, which is specifically designed for main component characterisation and less suited for trace analyses due to sensitivity limitations.

The insolubility of the deposits in any organic solvent makes it very difficult to fully clarify the chemical structure of this polymeric material. It was therefore decided to try to reproduce the deposit formation in laboratory tests by mixing PIBSI and other fuel additives.

4. LABORATORY TESTS TO REPRODUCE POLYMERIC DEPOSIT

The bulk of the work done in the laboratory used a variety of diesel fuel additives. The approach used was to blend the additives together and age the resulting mixtures at different temperatures.

4.1 DIESEL FUEL ADDITIVES TESTED

The analysis of the organic polymeric internal injector deposits have helped to focus the test work on the types of additives which are believed to be contributing to the formation of this type of deposits.

All the tests carried out in the laboratory used commercially available diesel fuel additives. The first type of additive used is a typical polyisobutylene succinimide (PIBSI). This diesel detergent, as usually described in patent literature, is typically obtained by reacting a poly-alkene backbone with a polar bridge. The polar bridge is usually maleic anhydride. The resulting product is then reacted with an industrial polyamine grade to obtain the final diesel detergent. These materials are usually very viscous. Therefore, the industrial grade detergents all have an amount of solvent in to ensure ease of handling. Some laboratory work was also done on the industrial polyamine that can be present in very low concentration in PIBSI.

Diesel detergents were then blended with a variety of other fuel additives, dimer acids and both acid and ester based lubricity additives.

Di-fatty acid is a product obtained from the dimerisation of mono fatty acids. It typically contains a level of di acid of approximately 80%, the rest being mostly poly-carboxylic acids (3 and 3+) with a minor amount of unreacted mono-acid.

The additive combinations which have been tested are summarised in table 1.

	Di-fatty acid	Fatty acid	Fatty acid ester
PIBSI 1	Y (*)	N	N
PIBSI 2	Y (*)	N	N
PIBSI 3	Y	Y	Y

Table 1: Additive combinations tested - (*) test also carried out with the addition of formic acid

4.2 TESTING OF ADDITIVES INDIVIDUALLY

Each additive was tested individually. Three different samples of the PIBSI family, PIBSI 1 to 3, were tested with di-fatty acid, fatty acid and fatty acid ester. All additives showed high thermal stability. None of the additives except the diesel detergents showed any real meaningful change when kept for 6 hours at 180 °C, and the FTIR and GPC (Gel Permeation Chromatography) traces confirm this. PIBSI showed some minor changes. PIBSI 3, for instance, showed some changes during the ageing period. In the FTIR in fig. 6 there is no indication of any decomposition of the detergent, but rather a degree of rearrangement from a di-amide to a succinimide (1700 cm^{-1}), which is likely to be due to the ratio of the components used when manufacturing this material. This chemical pathway is reversible. Thermo gravimetric analyses (TGA) of the PIBSI detergents were also carried out and the traces obtained confirm the exceptional thermal stability as they do not indicate any degradation. The traces, both in oxygen and nitrogen, show the same profile. There is a loss to 300 °C, in line with the amount of solvent present in this product.

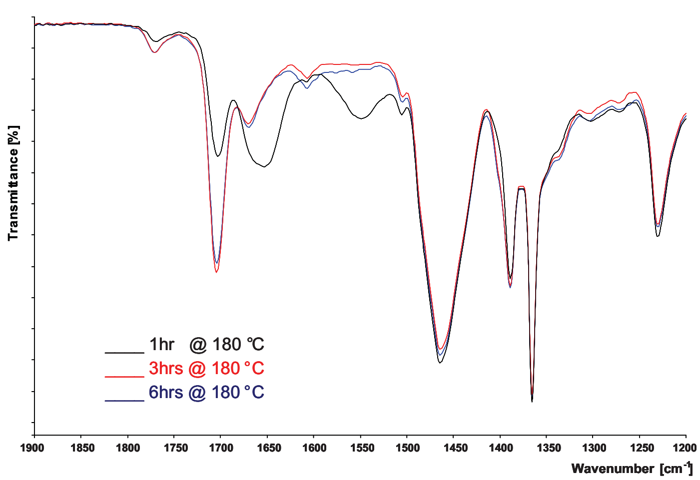


Fig. 6: Infrared spectrum (detail) of PIBSI 3 undergoing a rearrangement from the bis-amide to a succinimide

All the data developed confirm that it is very unlikely that any of these additives would generate deposits individually.

4.3 RESULTS FOR ADDITIVE COMBINATIONS

The PIBSI detergents were mixed with the other additives and then tested using the conditions described above. Additional tests were performed with polyamine.

4.3.1 Tests on Reactivity of PIBSI 1 and PIBSI 2 with other Additives

The test protocol used for this phase is as follows:

- The temperature was maintained at 180 °C
- The length of the experiment was 16 hours
- Ratios used
  PIBSI: 10 droplets, di-fatty acid: 0.2 g, formic acid: 2 ml
- Work-up of the reaction mixture using dichloromethane and heptane
- Identification by FTIR

Two different samples of diesel detergents, PIBSI 1 and PIBSI 2 were tested which had different PIBSA/ polyamine ratios. The mixtures with di-fatty-acids turned slightly brown during the ageing step and partial reaction was observed with either sample, as confirmed by the GPC. The majority of starting materials was re-isolated using standard laboratory techniques and did not display any significant changes in their FTIR spectra. No increased conversion was achieved for either PIBSI sample even when the ratios of the two additives in the mixtures were varied.

Interestingly, PIBSI reacted quantitatively if formic acid was also added. The sticky brownish reaction product did not display any succinimide vibration in the infrared spectrum anymore (figs.7 & 8); instead, a strong peptide bonding appeared at 1665 cm^{-1}, as found in the internal injector deposits (1660 cm^{-1}). The infrared fingerprint of this reaction product did not fully resemble that of the internal deposits in every detail, but it confirmed that the succinimide ring was cleaved and PIBSI was converted to sticky deposit-like material.

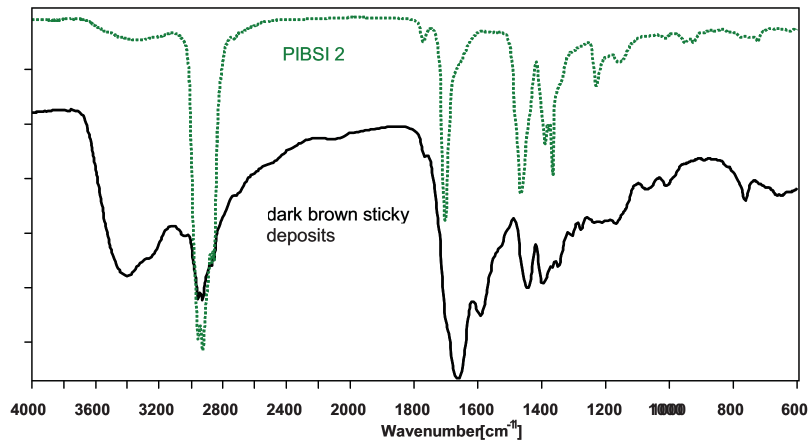


Fig. 7: Infrared spectrum of the organic polymeric material obtained as dark brown sticky deposits from reaction of PIBSI 2 and di-fatty acid in the presence of formic acid after 6 hours at 180 °C.

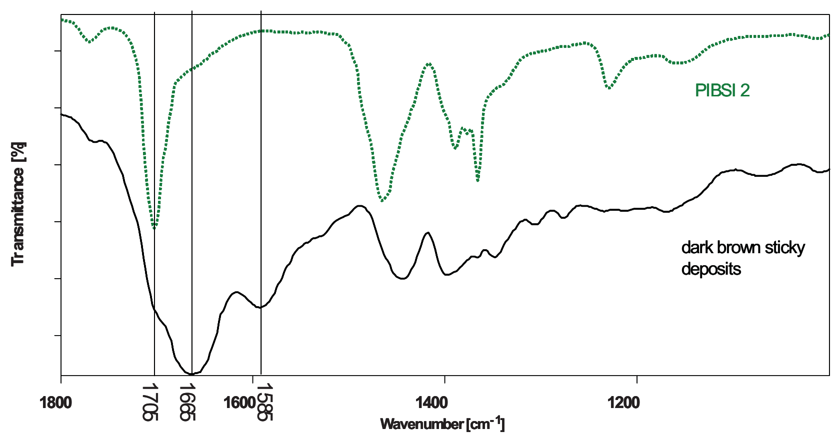


Fig. 8: Infrared spectrum (detail) of the organic polymeric material obtained as dark brown sticky deposits from reaction of PIBSI 2 and di-fatty acid in the presence of formic acid after 6 hours at 180 °C.

4.3.2 Tests on reactivity of PIBSI 2 and PIBSI 3 with other additives

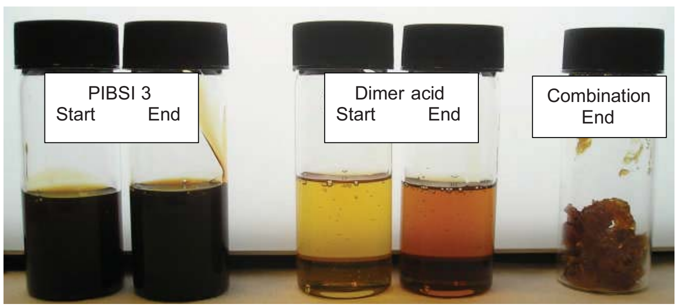
For this approach, the testing conditions were changed slightly. A mixer was additionally used to ensure that the resulting combinations were as homogeneous as possible. This approach was selected because the fuel additives under investigation are designed to be effective on metallic surfaces, since their role is either to prevent wear occurring or prevent the deposition of carbonaceous deposits. When combinations of such additives are present, it is very likely that they will interact with metallic surfaces to a certain degree. In the area where internal injector deposits are formed the additives tested are likely to be present at very high concentration. The approach adopted here therefore attempts to simulate the environment where internal injector deposits occur.

The other testing conditions are similar to those used in the previous section:

- The temperature was maintained at 180 °C
- The length of the experiment was 6 hours
- Samples were taken at regular intervals for analysis
- The main analytical techniques used were: FTIR and GPC. FTIR was used to monitor changes, but no isolation or purification of the reaction products was carried out. The GPC method is described in Appendix 1

The ratio of PIBSI used in combination with the di-fatty acid was based on a TBN to TAN ratio of 1.2 to 1. The same approach has been used with the two lubricity additives. Specifically for the ester based lubricity additive, TAN was substituted by the saponification value. This limits the impact of any solvent present in the components and, as it maintains the same mass ratio for all other combinations, enables an easier interpretation and comparison of the data across experiments.

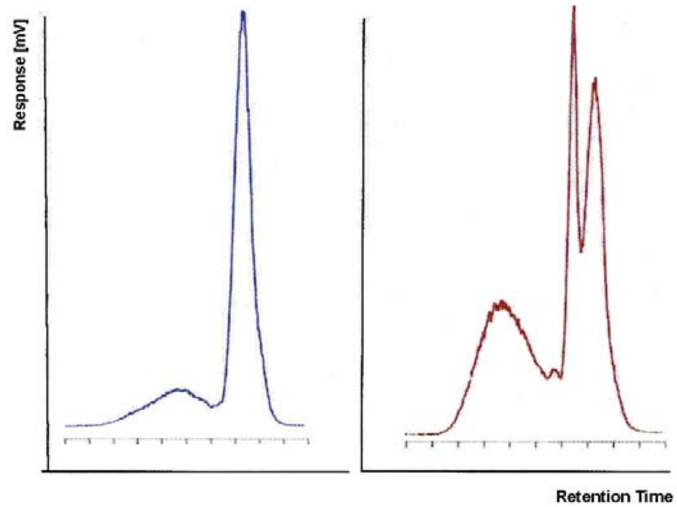
The testing of this additive combination provided a wealth of interesting information and further insight into the mechanism of deposit formation. There was a clear visual indication that a condensation/polymerisation reaction had occurred, see fig. 9. During the experiment, the mixture became very viscous within 3 hours, and by the end of the experiment the material has essentially formed an elastomer. The photos show the results when ageing the detergent and dimer acid individually. The photo on the far right shows the combination at the end of the ageing process.



left: PIBSI 3
middle: Di-fatty acid
right: Condensation/polymerisation of PIBSI 3 and Di-fatty acid

Fig. 9: Treatment at 180 °C for 6 hours

The GPC and FTIR data clearly confirm what was seen visually. Diesel detergents typically have a higher molecular weight compared with fatty acid or ester based additives. Therefore, the analysis focussed on the GPC trace of the detergent, being the material with the peaks at the lowest retention time. The two GPC traces have the same retention time range. The molecular weight of the detergent when in combination with the dimer acid showed a substantial increase, see fig.10. This is a further confirmation that a condensation reaction has occurred. The FTIR data provide a further insight into the mechanism, fig.11. The differences seen from start to end indicate that there is the formation of further amide structures that are the result of the reaction between the diesel detergent and the dimer acid. The dimer acid, due to its bi-functionality, allows bridging between different detergent molecules generating high molecular weight material. This sticky elastomeric material has poor solubility and therefore, if formed in the body of the injector, for example during engine stops when the engine is very hot, could generate internal injector deposits. In fig. 11, the FTIRs carried out at various stages of the reaction clearly show the formation of the peptide bond.



blue PIBSI 3
red PIBSI 3 + Di-fatty acid 6 hrs @ 180 °C

Fig. 10: GPC: Changing of molecular weight when PIBSI 3 was reacted with di-fatty acids

4.3.3 PIBSI 2 and dimer fatty acids

In order to confirm the above result, the testing in combination with dimer acid was repeated with PIBSI 2, which had been used in the set of experiments reported in section 4.3.1. The testing conditions used for this test were the same to those used for the tests reported in section 4.3.2. However, it must be stressed that the data reported here for PIBSI 2 is obtained with quite different conditions in terms of ratio and mixing to those reported in section 4.3.1. In this case, the GPC confirms that there is a large increase in molecular weight indicated by the shift of the main detergent peaks. The viscosity of the additive mixture increased continuously during the experiment and, by the end of the ageing step the viscosity of the mixture had risen dramatically. This is a further confirmation that condensation products occur when these two types of additives are aged at high temperature. However, in this second run, this detergent, although also based on PIBSI, did not form a solid elastomeric type material. It is highly likely that, given time, this additive combination would eventually generate solid deposits as was found in the first experiment.

4.3.4 PIBSI 3 and fatty acid based lubricity additive

This combination showed some increase in viscosity during the ageing period. The FTIR of the combination product shows that from start to end there has been amide formation to some extent which accounts for the increase in viscosity. This follows the same chemical pathway as the dimer fatty acid. Therefore, one would expect a resulting increase in molecular weight, and the GPC traces confirm this. There is an increase in the molecular weight of the detergent during the ageing period which indicates that 2 to 3 molecules of fatty acid have reacted with each diesel detergent molecule present.

4.3.5 PIBSI 3 and ester based lubricity additive

This combination, tested for six hours, did not show any significant changes.

The GPC trace, again focussing on the detergent main peak, does not show any change in profile and intensity. This is supported also by the absence of any significant changes in the FTIR trace. Actually, the FTIR traces from start to six hours show a minor degree of variation. However, these changes are much smaller than those observed when testing the detergent alone, see section 4.2 above.

These data confirm that this type of additive chemistry is neutral and cannot further react with the diesel detergent. Therefore, ester based lubricity additives cannot generate any additional potential harm when used in combination with diesel detergents.

4.3.6 Testing of dimer fatty acid with polyamines

Diesel detergents are typically manufactured using industrial grade polyamines. The typical manufacturing conditions generally yield a product that has some free/unreacted polyamine. Although the amount is minimal, it is also true that the amount of the internal injector deposit is extremely small. Therefore, there is value in assessing this possible deposit formation route.

Two different experiments were carried out. A typical polyamine was mixed with dimer fatty acid at a ratio of 1 to 1 and heated to 180 °C for 3 hours. The conversion product consists of brownish, high molecular weight CO-NH structured deposits which form rapidly and quantitatively. The characteristic FTIR vibrations at 1650 and 1555 cm^{-1} are assigned to the new peptide bondings (figs. 12 & 13).

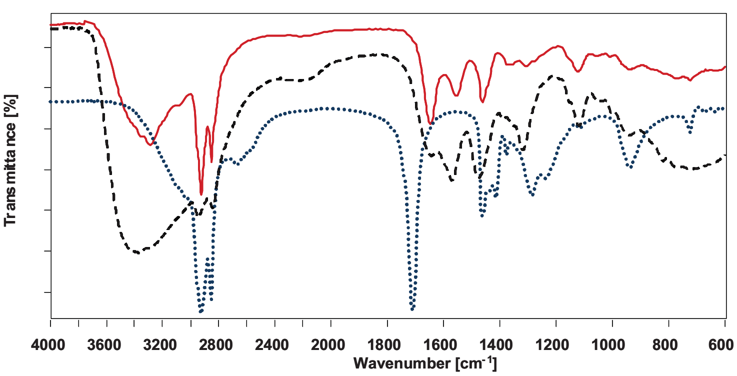


Fig. 12: Infrared spectrum of the organic polymeric material obtained as sticky material (red line) from reaction of a polyamine (black) and di-fatty acids (blue).

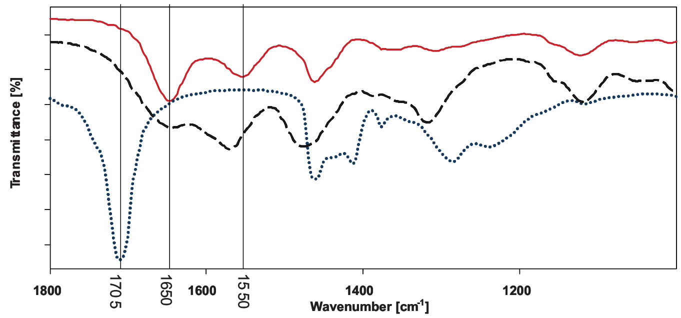


Fig. 13: Infrared spectrum (detail) of the organic polymeric material obtained as sticky material (red) from reaction of polyamine (black) and di-fatty acids (blue).

A second set of tests were carried out on a different commercial polyamine stream. The conditions selected are again as described in section 4.3 above. The ratio polyamine to dimer fatty acid was 1 to 1. Then, the blend was diluted in solvent at an active ingredient level of 20%. Therefore, each component in the blend was at 10% mass. This helped to obtain a more homogeneous mixture. The combination was heated to 150 °C and stored for 7 days without any mixing. There was rapid formation of insoluble sticky material. The photos of the mixture and of the sticky deposit are shown in fig. 14. The reaction product/sticky material was analysed using FTIR. Fig. 15 shows again that the deposit forms the peptide bonding at 1645 cm^{-1}. As could have been expected, dimer fatty acids do not only react with PIBSI, but also with any other reactive amino group that can be present in fuel.

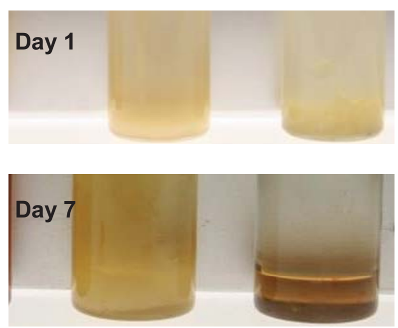


Fig. 14: Formation of polymeric deposit with commercial polyamine and di-fatty acid

This further demonstrates that some additives with amino groups may generate internal injector deposits when reacting with acidic components. Indeed, failure analyses of high pressure fuel injectors sometimes display similarly structured polymeric internal deposits displaying peptide bondings in the FTIR spectra, without showing the typical polyisobutylene pattern with vibrations at 1471, 1390, 1366 and 1231 cm^{-1}.

4.4 DIMERISATION OF MONOFATTY ACIDS

The dimer acids used in the experiments above have been derived from mono fatty acids. Typical industrial conditions used to manufacture them are temperature ranging from 150 to 200 °C, pressure up to 10 bars and use of a catalyst. The resulting dimer acid is typically a mixture of several isomers.

These reaction conditions are not dissimilar to those which could exist inside the injector, particularly when a vehicle is stopped after a severe driving pattern. Hot soak can increase the fuel temperature to a level similar to that used to manufacture dimer acids. The FIE system pressure is far in excess of that required and diesel fuel can contain a variety of contaminants that could catalyse this reaction. Therefore, there is the possibility that the presence of mono fatty acids could further exacerbate the level of polymeric deposits. Already the experiment on the combination of fatty acid and diesel detergent has shown an increase in molecular weight and viscosity. Should any dimerisation occur, then it is likely that this would lead to further molecular weight increase and result in an extensive deposit formation similar to that experienced with dimer acids.

4.5 SUMMARY ON THE FORMATION OF POLYMERIC DEPOSITS

The test work out carried in laboratory conditions has successfully reproduced deposits which have a similar FTIR fingerprint to those seen inside the body of injectors. The data suggest that when additives are present alone, they do not seem to be able to generate any degradation product and hence no internal injector deposits.

The scenario can change substantially when combinations of additives are present. Specifically, combinations of typical diesel detergents like PIBSI and di-fatty acids seem to be the most critical and can form gum-like polymeric deposits. This is exacerbated when formic acid is present. Mono-fatty acids have also been shown to follow a similar chemical pathway and the possibility that they could dimerise locally, in the injector body, make them also a potentially active player in the formation of injector deposits.

The role of formic acid in the formation of internal deposits, especially in respect to the opening of the succinimide ring of PIBSI needs further study, and it is intended that this will be reported in a future paper. This topic is gaining more and more importance since desulphurised fuels with biogenic content can significantly suffer from stability loss due to both desulphurisation and biofuel blending. The risk of ageing acids such as aggressive formic acid being generated is continuously increasing.

The use of ester based lubricity additives has been shown to be neutral when in combination with detergents. This can easily be explained when considering their main chemical functionality, the ester, which can not further react with the diesel detergent in the conditions typically encountered in the body of the injector.

5. STRATEGIES TO AVOID INTERNAL INJECTOR DEPOSITS

The test work has confirmed that the internal injector deposits which can give rise to a variety of problems such as poor driveability, rough noisy running or emissions non-compliance can be reproduced under laboratory conditions.

The indications are that the source of such deposits can be traced back to the use of a variety of additive chemistries in the field. However, the test work reported here has clearly identified that such deposits can only form when specific pairs of additives are present. These pairs can react to form salts or high molecular weight compounds which are insoluble in fuel, as summarised in table 2 below. It is possible to devise a strategy which allows the necessary market protection provided by the identified additives to be maintained whilst at the same time avoiding any internal injector deposits.

The two types of deposits are described as metal soaps and metal-free polymeric material. In table 2 the interrelationships of several additives with respect to deposit formation is summarised. When in bold uppercase, this indicates that the deposits formed in the laboratory tests show a strong correlation with the specific pair of fuel additives. When not in bold uppercase, the indications from the work carried out are that there is only the possibility for the materials indicated to interact and then form internal injector deposits.

	Metal based Corrosion Inhibitor	PIBSI-based Detergent	Polyamine
Fatty acid	**SOAPS**	polymeric	polymeric *
Dimer acid	**SOAPS**	**POLYMERIC**	**POLYMERIC**
Fatty acid Ester lubricity additive	none	none	none *

* Test not carried out, but these outcomes would be strongly expected based on the experimental work carried out

Table 2: Potential for forming internal deposits by additive combinations

As mentioned earlier in the paper, fuel additives are necessary to enhance the quality of diesel fuel and ensure it is fit-for-purpose, for example lubricity additives, and also to minimise any degradation that could lead to poor engine performance, for example detergents.

From inspection of table 2 it would seem that all the benefits provided by additives can be maintained if the correct combinations are used in the market.

This is not a new state of affairs. Fuel additives have previously been associated with field issues and the additive industry spends a lot of time and effort ensuring that any application of such compounds is harm free in the field, ref 4. However, new physical environments are continually being created as new or improved engine components are used to meet ever more stringent emissions regulations and other customer requirements. Therefore, practices that have been acceptable in the past might need to be updated to ensure safe field operations. It is clearly indicated that the use of lubricity additive chemistries that do not have the ability to further react with other compounds present in the fuel represents the best way to avoid the new type of injector deposits described in this paper.

6. CONCLUSIONS

Two new types of deposits have been observed on internal injector components. These new deposits can adversely impact driveability and result in non-compliance with the Euro4 or Euro5 emission limits. The number of incidents in the field is increasing.

These deposits have been extensively studied to understand their composition and their formation mechanism.

Analysis of the deposits and laboratory investigation has identified:

- Metal based deposits, particularly those containing sodium. Sodium ions in the fuel react with fatty acids to form a soap.

- Ashless polymeric deposits derived from the reaction of typical PIBSI detergents and acidic fatty acid based materials in the market today. The resulting polymer is characterised by the presence of a strong peptide bond due to the reaction of the detergent with acidic materials, particularly di-fatty acids.

Where possible, if acidic based additives are replaced by neutral chemistries, this would help to avoid these types of deposits whilst maintaining the protection provided by diesel detergents.

7. ACKNOWLEDGMENTS

We appreciate the contributions for this project from Nadia Bhatti and the participation of Angela Breakspear and Alan Clarke in the review and critique of the experimental results and conclusions.

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(2) Detergency requirements of future diesel injection systems, R. Caprotti, A.Breakspear, O. Graupner, T. Klaua, SAE 2005-01-3901

(3) Injector Deposit Test For Modern Diesel Engines, O. Graupner, T. Klaua – Siemens VDO Automotive AG, R. Caprotti, A. Breakspear - Infineum UK, A. Schik, C. Rouff - APL Automobil Prueftechnik Landau GmbH. - TAE Symposium, 2005.

(4) Harm free use of diesel additives. R. Caprotti, SAE 982569

(5) Deposits in diesel-injection pumps caused by the incompatibility of fuel and oil additives. S. Mikkonen et al. SAE 872119

(6) Interaction between Fuel Additive and Oil Contaminant: (I) Field Experiences D. Wooten, D.M. Stehouwer, H. L. Fang, H. Martin, SAE 2003-01-3139

(7) Interaction between Fuel Additive and Oil Contaminant: (II) Its Impact on Fuel Stability and Filter Plugging Mechanism. H. L. Fang, D. M. Stehouwer, J.C. Wang, SAE 2003-01-3140

APPENDIX 1

The determination of the composition of the materials was done by Gel Permeation Chromatography (GPC), also known as Size Exclusion Chromatography (SEC).

This technique allows the separation of molecules by size and was therefore useful in our programme to understand any molecular weight increase due to reaction - polymerisation.

The apparatus used is a high performance liquid chromatography system characterised by having a vacuum degassing unit, an automatic injection unit, a refractive index detector, a digital integrator and an oven to control the temperature of the column and the detector (set at 35 °C).

The GPC columns used to test the products shown in fig 10 were: two PLgel 5μm, of mixed -D pore size and with dimensions of 300x7.5 mm.

The Main instrument conditions were:

Mobile phase	THF at 1 ml/min
Injection	Typically 50 µl of 70 mg/ml

The columns were calibrated using appropriate polystyrene calibration standards (EasiCal PS-2):

From: Santiago, Eduardo (S.)
Sent: Tuesday, December 15, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: FW: Fuel Analysis in Mexico
Signed By: There are problems with the signature. Click the signature button for details.

Scott, confirmed the phone conference for tomorro around 11:00 AM Mexico time (12:PM ET)

From: Mondragon, David (J.D.)
Sent: Martes, 15 de Diciembre de 2009 03:51 p.m.
To: Santiago, Eduardo (S.)
Subject: RE: Fuel Analysis in Mexico

Para mi esta bien.

Wishing you a HAPPY day!
Jose David Mondragon Avelar
Powertrain & Chassis PD Quality Supervisor
Product Development Mexico
Phone at Sta. Fe (011-5255) 1103 – 3246
Ford net 943 - 3246
e mail: jmondrag@ford.com

From: Santiago, Eduardo (S.)
Sent: Tuesday, December 15, 2009 3:22 PM
To: 'Rubén Manilla'; Mondragon, David (J.D.)
Cc: Eeley, Scott (A.)
Subject: FW: Fuel Analysis in Mexico

Rubén, Dave:
Podemos agendar una teleconferencia mañana alrededor de las 11:00 AM? favor de confirmar

---

From: Eeley, Scott (A.)
Sent: Martes, 15 de Diciembre de 2009 03:16 p.m.
To: Santiago, Eduardo (S.)
Cc: Mondragon, David (J.D.); Fulton, Brien (B.L.); Chyo, Timothy (T.); Mull, Ted (V.); Horbal, Colin (C.P.); Rudd, David (D.); Simpson, Timothy (T.A.)
Subject: RE: Fuel Analysis in Mexico

Fantastic.

Could you set up a technical review between Ruben, some US PD folks and David Mondragon?

From: Santiago, Eduardo (S.)
Sent: Tuesday, December 15, 2009 4:11 PM
To: Eeley, Scott (A.)
Subject: FW: Fuel Analysis in Mexico

Here you are....

From: rmanilla@telcel.blackberry.net [mailto:rmanilla@telcel.blackberry.net]
Sent: Martes, 15 de Diciembre de 2009 03:05 p.m.
To: Santiago, Eduardo (S.)
Subject: Re: Fuel Analysis in Mexico

Ing Eduardo

There are 2 types of lubricity additives one is based on acid compounds and esther based additives

We do have both technologies depending application we can supply both

Diesel Performance for Ford application has esther based additive for lubricity

As soon as I return to my office I will send more details

Regards
Ruben

Enviado desde mi oficina móvil BlackBerry® de Telcel

From: "Santiago, Eduardo (S.)" <esantiag@ford.com>
Date: Tue, 15 Dec 2009 15:30:14 -0500
To: RubÃ©n Manilla<rmanilla@cbmmexico.com>
Subject: FW: Fuel Analysis in Mexico

next question....

From: Eeley, Scott (A.)
Sent: Martes, 15 de Diciembre de 2009 02:18 p.m.
To: Santiago, Eduardo (S.)
Subject: RE: Fuel Analysis in Mexico

What is the lubricity component?

From: Santiago, Eduardo (S.)
Sent: Tuesday, December 15, 2009 3:16 PM
To: Eeley, Scott (A.)
Subject: FW: Fuel Analysis in Mexico

Is it enough?

From: Rubén Manilla [mailto:rmanilla@cbmmexico.com]
Sent: Martes, 15 de Diciembre de 2009 01:58 p.m.
To: Santiago, Eduardo (S.)
Subject: Re: Fuel Analysis in Mexico

Ing. Eduardo,

Diesel Performance has no salts or acid components, some of the most important ingredients are:

Inhodor Kerosine (Ultra Low Sulfur)
Ethylexhyl Nitrate (Cetane Improver)
Butyl Oxytol

Lubricity Additive, complaint with ULSD (ultra low sulfur diesel)

PH of Diesel Performance is 6.5 to 7.2 (most neutral)

If you have further questions, please let me know

Regards

Rubén Manilla
CBM Chemical
Ph. 555.378.5247 / 552.487.6767
Movil. 55 911.88.216
rmanilla@cbmmexico.com

El 15/12/2009, a las 01:47 p.m., Santiago, Eduardo (S.) escribió:

Hola Scott:
Let me ask to the supplier, the TSB is almost to be released, do you wnt it "hold" until know if the additive contains some salts?

Ruben: woald you please tell us if the "Diesel Performace" additive contains some salts?

From: Eeley, Scott (A.)
Sent: Martes, 15 de Diciembre de 2009 01:44 p.m.
To: Santiago, Eduardo (S.)
Cc: Mull, Ted (V.); Chyo, Timothy (T.); Simpson, Timothy (T.A.); Horbal, Colin (C.P.)
Subject: RE: Fuel Analysis in Mexico

We need to find out if "Diesel Performance" contains acid salts.

Do you have the ingredients?

From: Johnson, Seth (S.)
Sent: Wednesday, January 19, 2011 10:57 AM
To: Heggie, Forest (F.)
Subject: FW: High pressure fuel pump

Attachments: 1769021_110118_113218_054.jpg; 1769021_110118_112949_040.jpg

Forest,

Here is one where it is assumed the parts stuck together due to corrosion.

1769021_110118_113218_054.jpg 1769021_110118_112949_040.jpg

From: Stendardo, David (D.)
Sent: Wednesday, January 19, 2011 10:10 AM
To: Jones, Keith (K.); Peters, Paul (P.)
Subject: RE: High pressure fuel pump

It is to my understanding that the "steering disc" as engineering calls it, should remain on the pump when the cover is removed. I was also told that there is a tool to remove this disc and that is not in the field. If this is how it came apart, you would be correct to assume corrosion or significant damage for these parts to be bound together. I agree with Keith about denying.

Regards,

David Stendardo
6.0L / 6.4L SME
Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From: Jones, Keith (K.)
Sent: Tuesday, January 18, 2011 5:50 PM
To: Peters, Paul (P.)
Cc: Stendardo, David (D.)
Subject: RE: High pressure fuel pump

This is not normal. That inner portion is pressed in according to previous info we have. From looking at the rust, I hope you denied it!
Keith Jones
6.7 Engine SME
Diesel Drivability
Ford Technical Hotline
DSC1 Cube 308
313-248-7923
KJone286@ford.com


POWDER FREE

From: Heggie, Forest (F.)
Sent: Tuesday, November 09, 2010 3:18 PM
To: Eeley, Scott (A.)
Subject: FW: HP fuel system failure and when the HFCM should be replaced.

Attachments: Microsoft Office Excel Chart; Picture (Metafile); Microsoft Office Excel Chart; Microsoft Office Excel Chart

I need to dig into this a bit more but here is what I am seeing right now

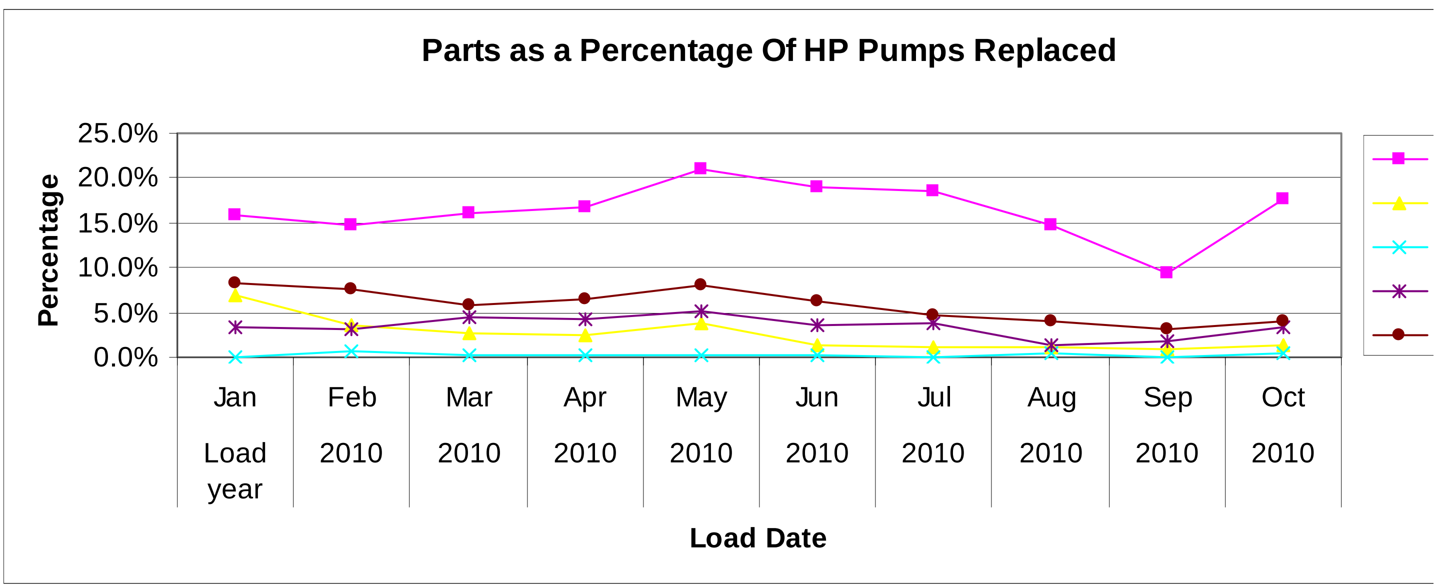
9B337 has increased in Oct,

It decreased in Sept when the instructions went out now it has jumped up almost to the peak annual level

9C166 - can not find this base number ??? It is low but what is it?

9C273 - dropped aug and sept - now starting to increase again

9G805 is running around 88% replaced with HP Pumps



	Load Mont	claims with 9A543	9A543 reported with claim	9B337	9C166	9C264	9C273	9
Load year	Jan	419	329	66	29	0	14	
2010	Feb	447	367	66	16	3	14	
2010	Mar	519	403	83	14	1	23	
2010	Apr	702	546	118	18	2	29	
2010	May	787	606	166	29	2	40	
2010	Jun	967	774	183	13	2	35	
2010	Jul	914	711	169	11	1	35	
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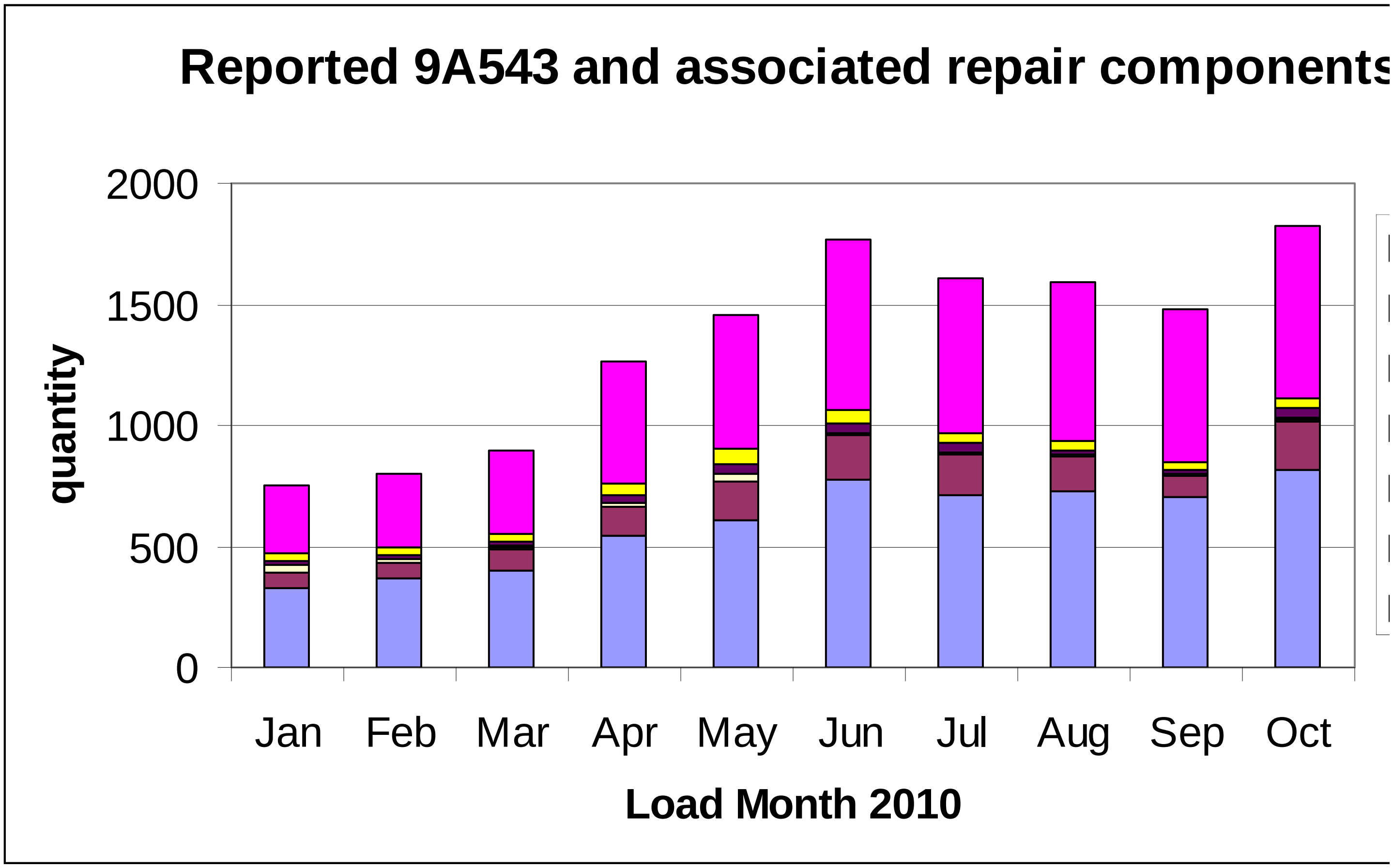
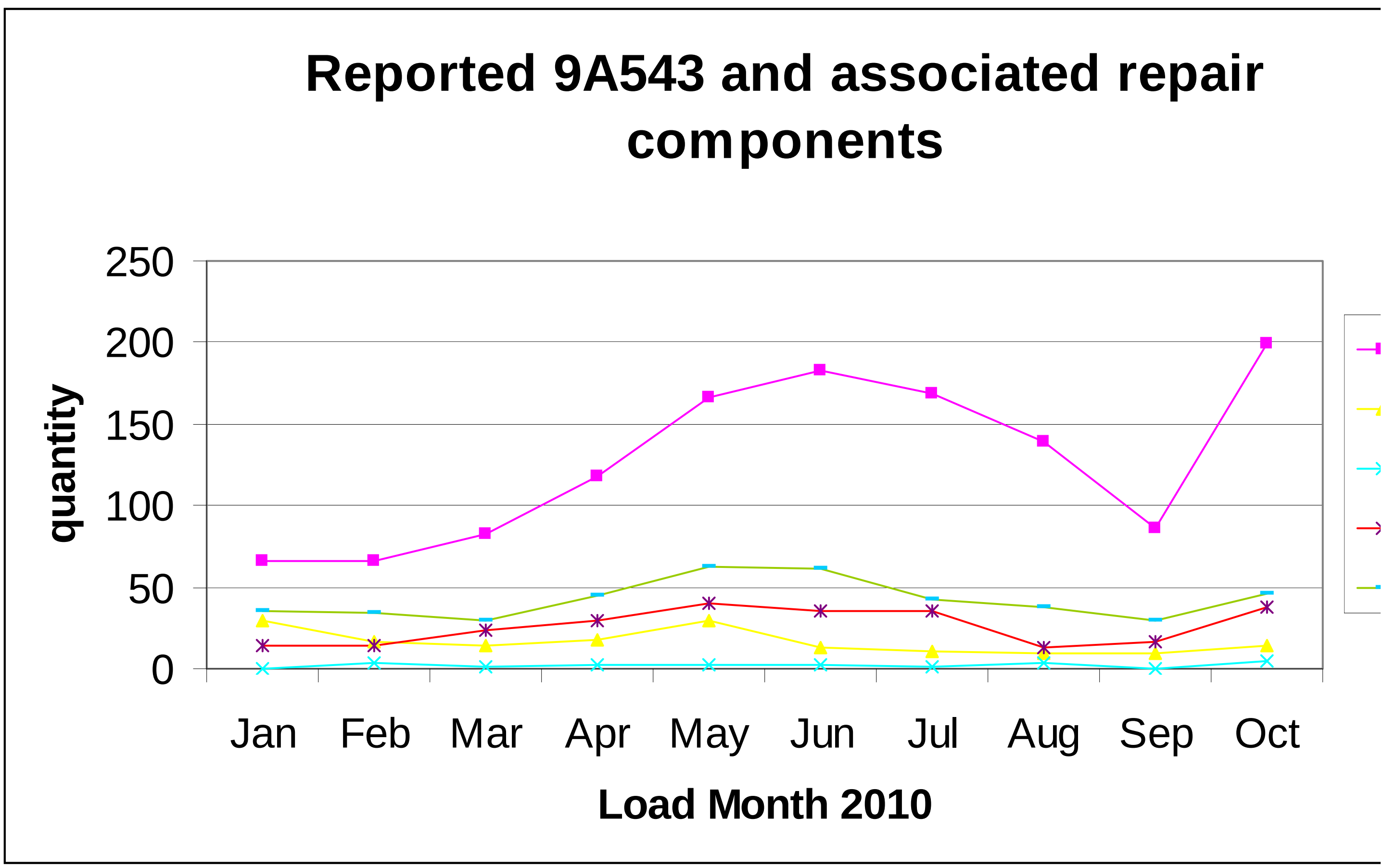


Reported 9A543 and associated repair components
2000
1500
1000
500
0
quantity
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Load Month 2010



Reported 9A543 and associated repair components
250
200
150
100
50
0
quantity
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Load Month 2010

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: McDonnell, William (W.J.)
Sent: Tuesday, November 09, 2010 10:24 AM
To: Heggie, Forest (F.); Eeley, Scott (A.)
Subject: RE: HP fuel system failure and when the HFCM should be replaced.

Good for me, thank you.

Keep Your Mind Always Open.

William （Bill） McDonnell
Supervisor, Warranty Claims Assessing
Regent Court Building, 4S-146（wmcdonne@ford.com）
313-845-3550

From: Heggie, Forest (F.)
Sent: Tuesday, November 09, 2010 9:55 AM
To: Eeley, Scott (A.); Heggie, Forest (F.)
Cc: McDonnell, William (W.J.)
Subject: RE: HP fuel system failure and when the HFCM should be replaced.

No problem I can do this,

If it is acceptable give me a day or two and I can send you the report,

Then I will also follow up 1st of December and then we can look again in Jan

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Eeley, Scott (A.)
Sent: Monday, November 08, 2010 12:38 PM
To: Heggie, Forest (F.)
Cc: McDonnell, William (W.J.)
Subject: RE: HP fuel system failure and when the HFCM should be replaced.

Forest…

From: McDonnell, William (W.J.)
Sent: Friday, November 05, 2010 8:27 AM
To: Eeley, Scott (A.)
Subject: FW: HP fuel system failure and when the HFCM should be replaced.

Scott,

Good morning. Was wondering if this was your group, if so what do you think of what Scott is saying?

Keep Your Mind Always Open.

William (Bill) McDonnell
Supervisor, Warranty Claims Assessing
Regent Court Building, 4S-146 (wmcdonne@ford.com)
313-845-3550

From: Keary, Scott (L.)
Sent: Wednesday, November 03, 2010 5:03 PM
To: McDonnell, William (W.J.)
Subject: RE: HP fuel system failure and when the HFCM should be replaced.

Bill,

This may be out of our "scope" but I was thinking about this ……Until now we have not allowed the dealers to replace the hfcm/low pressure pump 9G282 for these HP fuel system repairs unless the pressure was below spec. I am already seeing techs documenting there was "visible metal" in the hfcm and also seeing techs state they could not clean the hfcm. These are tech comments that I don't recall seeing very often (rarely) until recently.

I'm curious if anyone would or could monitor the increase in hfcm replacement. For instance, can a report can be generated saying how many of this part (9G282) was replaced under warranty in the past 3 or 6 months and then compare that number to the same report 3 or 6 months from now? Or a report where the HPP and HFCM are both replaced on the same repair in the last 3 or 6 months and then again in another 3 or 6 months.

I'm very curious to know what the increase would be. Would that number double?, triple?

If the number does in fact increase dramatically, what would that mean? Would there be anything we or anyone else can use or learn from?

Personally, I predict there will be a substantial increase in 3 months an even greater increase after 6 months and 1 year from now every fuel system repair claim will have a HFCM on it.

Please let me know what you think. I will be glad to explain further or answer any questions on this…. Thanks for listening!

Scott Keary

Diesel Warranty Claims Assessing
FCSD Dearborn, Michigan
313-594-9755 skeary2@ford.com

From:	McDonnell, William (W.J.)
Sent:	Tuesday, November 02, 2010 12:03 PM
To:	Aulgur, Steven (SDA.); McDonnell, William (W.J.); Boarts, Jonathan (Jb.); Boone, Andrew (A.); Edick, John (J.); Ernst, John (J.); Fox, David (M.); Keary, Scott (L.); King, Anthony (A.); Lambert, Shane (S.); Harvey, Lewis (LAH.); Castleberry, Robert (R.); Root, Thomas (T.); Johnston, Steven (S.J.)
Subject:	FW: HP fuel system failure and when the HFCM should be replaced.
Importance:	High

FYI team.

Keep Your Mind Always Open.

William （Bill） McDonnell
Supervisor, Warranty Claims Assessing
Regent Court Building, 4S-146（wmcdonne@ford.com）
313-845-3550

From: Stendardo, David (D.)
Sent: Tuesday, November 02, 2010 10:08 AM
To: Baker, Zachary (Z.); Baumeister, Eric (E.); Bayne, Rick (R.); Beamer, Nathaniel (N.); Bell, Ralph (R.); Bishop, Chris (C.); Bobrowski, David (D.); Boyd, Evan (E.); Burkhart, Fred (F.); Burns, Gaven (G.); Curtis, Andrew (A.); Cutler, John (J.); Deweese, David (D.); Dowdy, Jonathon (J.); Dunn, Nathan (N.); Fitzpatrick, Aron (A.); Hamilton, Donald (D.); Hazzard, Benjamin (B.); Herdzik, John (J.); Johnson, Seth (S.); Johnston, William (W.); Jones, Keith (K.); Kern, Donald (D.); Kiser, Travis (T.); Klein, Mark (M.A.); Kunze, Erik (E.); Lamonde, Sebastien (S.); Lewis, Kevin (K.); Luke, Dan (D.); McAllister, Derek (D.); Mentgen, Brian (B.); Miller, Michael (M.); Miya, Beth (B.); Olson, Eric (E.); Peters, Paul (P.); Petersen, Nancy (N.); Pienton, Simon (S.); Schmidt, Matthew (M.); Sova, Zak (Z.); Stendardo, David (D.); West, Devin (D.); Yinger, Joel (.); Zieleniewski, Gordon (G.)
Cc: Eeley, Scott (A.); Heggie, Forest (F.); McDonnell, William (W.J.); Johnston, Steven (S.J.); Armesto, Carlos (.)
Subject: HP fuel system failure and when the HFCM should be replaced.
Importance: High

Team,

When handling a contact in regards to HP fuel system failure, the HFCM is **not** automatically replaced as part of the repair procedure.

The HFCM should only be replaced due to the following:

- If the failure is due to water or other non approved aggressive fuels, if the fuel filters have not been replaced for an extremely long time "way past maintenance" because it is a wet pump. (non approved fuels/bad fuel/maintenance issue).
- If there was visible metal debris in the HFCM during filter replacement. (must be documented).

Otherwise, the HFCM is to be flushed as part of the low pressure system and a new filter installed prior to repair completion and system bleeding.

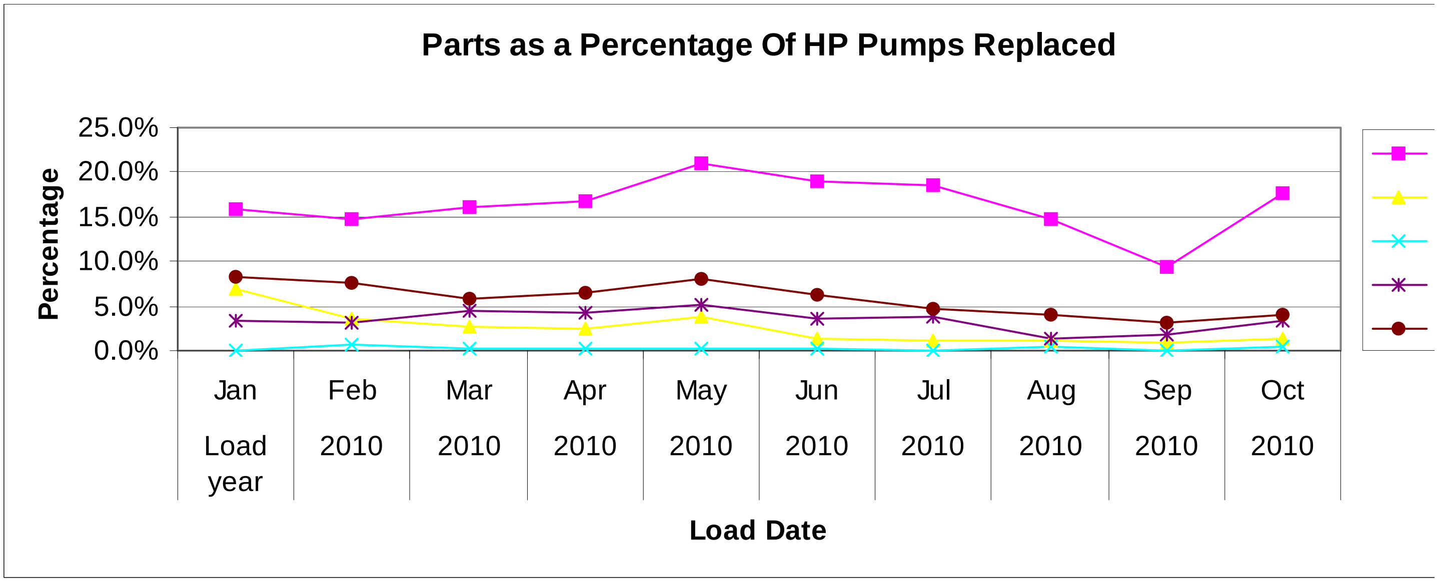
David Stendardo
6.4L SME / Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From: Heggie, Forest (F.)
Sent: Wednesday, November 10, 2010 12:03 PM
To: McDonnell, William (W.J.)
Cc: Eeley, Scott (A.); Heggie, Forest (F.)
Subject: FW: HP fuel system failure and when the HFCM should be replaced.

Attachments: Microsoft Office Excel Chart; Picture (Metafile); Picture (Metafile); Microsoft Office Excel Chart; Picture (Metafile); Microsoft Office Excel Chart

Here is the first look: please do not hesitate to call me to review any of this information or ask further questions.

I have tried to make it as confusing as possible.



9G282- hfcm - quantity is less than May -&June , it lowed to half the previous amount in spet then is starting to increase again, so it does correlate to seeing an increase trend for the last two months, but is less than May and June of this year. This part is worth keeping a close eye on. A good percentage is probably due to water in fuel or bad fuel. Once we have the policy enforcement sorted out we can address 9C166, but we need to keep a close watch on it either way, due to the differences in warranty coverage between the high pressure pump and the hfcm (9G282) and wif sensor (9C264) . If the whole HFCM is replaced because of wif sensor malfunction then we need to discuss how to handle it.

Load Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
9G282	35	34	30	45	63	61	42	38	29	46

9C264 - wif sensor - this is interesting - if the wif sensor is malfunctioning then it should be the base causal part to a high pressure fuel system failure.
but there is differences in warranty coverage between the high pressure pump and the hfcm (9G282) and wif sensor (9C264) so this one I would like to have further discussion on.

Load Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
9C264	0	3	1	2	2	2	1	4	0	5

These two parts 9B337 and 9C273 do not need to be replaced when replacing the whole high pressure fuel system unless there is rust in them (bad fuel) or the sealing surfaces are damaged.

9B337 has increased in Oct,

It decreased in Sept when the instructions went out now it has jumped up almost to the peak annual level

At first look this appears too high and opposite to instructions are you seeing the same?

9C273 - dropped aug and sept - now starting to increase again

At first look this appears too high and opposite to instructions are you seeing the same?

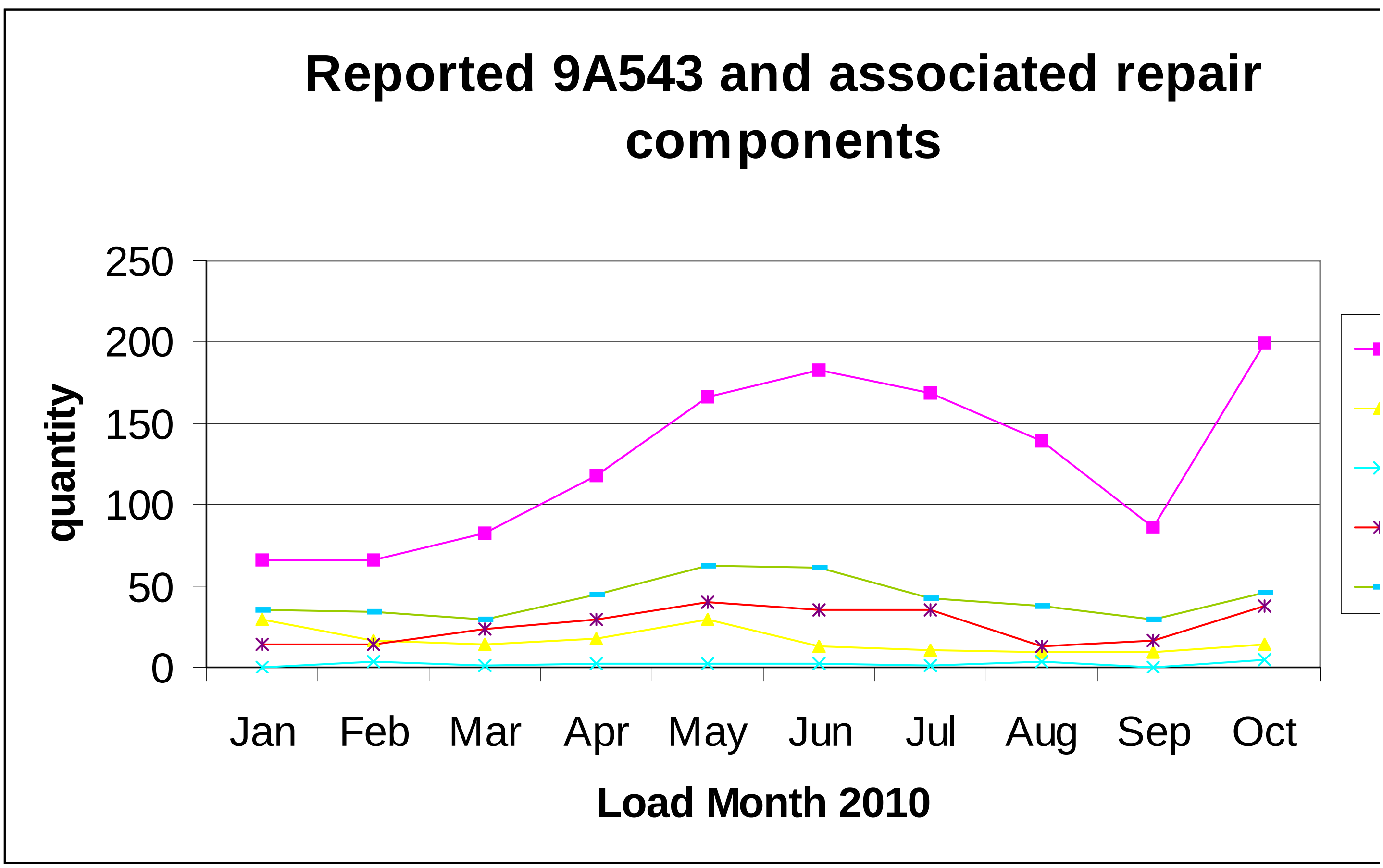
Some other interesting items

9C166 - secondary fuel filter housing - this typically is replaced when rusty - water in fuel indicator or bad fuel
Once we have the policy enforcement sorted out we can address 9C166

9G805 is running around 88% replaced with HP Pumps - this should be 100% every pump replaced should get a gasket kit.

Can we do an edit around this if a HP Pump (9A543) returns for a leak and did not get a gasket in the original repair?

First Graph
These parts as a percentage of High Pressure Fuel Pumps replaced



EA11-003 000176

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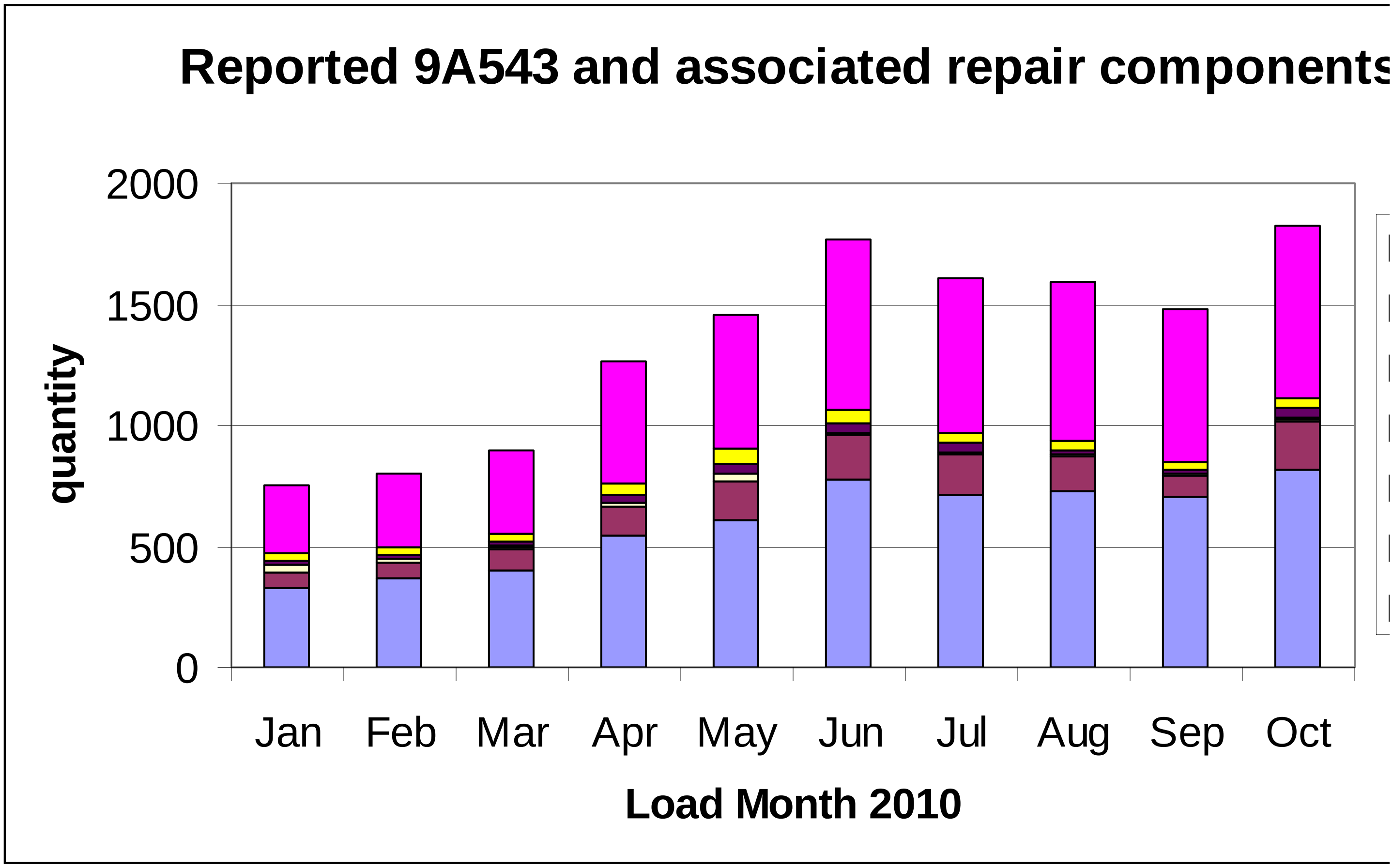

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BaSc. MaSc. P.Eng
OPD Diesel
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FYI team.

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David Stendardo
6.4L SME / Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From: McDonagh, Scot (S.M.)
Sent: Thursday, June 17, 2010 7:15 AM
To: Pumford, Ken (K.G.); Fulton, Brien (B.L.); Ives, David (D.C.); Billings, Thomas (T.P.); Hudson, Tony (A.W.); Dixon, Mark (M.R.); Lyon, Peter (P.M.)
Subject: FW: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

FYI

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Zuniga, Adelita (A.)
Sent: Wednesday, June 16, 2010 2:31 PM
To: McDonagh, Scot (S.M.); Pickens, Mitch (M.K.)
Cc: Wallin, Richard (R.J.); Jones, Keith (K.)
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Dealer has been contacted again yesterday, and he has all parts together. They will be sent via HOT REQUEST on their own individual requests. I advise to tracking when he sends.

Kind Regards,

Adelita Zúñiga
Ford Motor Company
Warranty Parts Analysis Center
WPAC Warranty Parts Expeditor
(313) 337-6999/Fax 313-322-3282
azuniga7@ford.com

From: McDonagh, Scot (S.M.)
Sent: Wednesday, June 16, 2010 2:27 PM
To: Zuniga, Adelita (A.); Pickens, Mitch (M.K.)
Cc: Wallin, Richard (R.J.); Jones, Keith (K.)
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

I have not received any component returns for this request. Please advise. Thanks

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From:	Zuniga, Adelita (A.)
Sent:	Thursday, June 03, 2010 12:49 PM
To:	Pickens, Mitch (M.K.); McDonagh, Scot (S.M.); Jones, Keith (K.)
Cc:	Wallin, Richard (R.J.)
Subject:	RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Can you please send me the CQIS report of this vehicle. I was unable to get into the SharePoint AWS and CQIS direct link below.

Thanks,

Adelita Zúñiga
Ford Motor Company
Warranty Parts Analysis Center
WPAC Warranty Parts Expeditor
(313) 337-6999/Fax 313-322-3282
azuniga7@ford.com

From:	Pickens, Mitch (M.K.)
Sent:	Thursday, June 03, 2010 12:44 PM
To:	McDonagh, Scot (S.M.); Jones, Keith (K.)
Cc:	Zuniga, Adelita (A.); Wallin, Richard (R.J.)
Subject:	RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Here is the parts list for the 6.7L

BC3Z-9N103-A COOLER ASY
BC3Z-9G282-A FUEL PUMP ASY
BC3Z-9A543-A PUMP
BC3Z-9H529-A FUEL INJECTOR KIT - QTY 4
BC3Z-9H529-B FUEL INJECTOR KIT - QTY 4
BC3Z-9D280-A MANIFOLD
BC3Z-9D280-B MANIFOLD
BC3Z-9A564-A TUBE
BC3Z-6K089-B INSULATOR
BC3Z-9E964-A PIPE
BC3Z-6K089-A INSULATOR

Please let me know if there is anything else that you need for the hot parts return process paperwork.

MITCH PICKENS
FORD CUSTOMER SERVICE DIVISION
FSE PHOENIX REGION
MOBILE PHONE: 602-574-1743
eFAX: 866-552-6963
MPICKEN2@FORD.COM

From:	McDonagh, Scot (S.M.)
Sent:	Thursday, May 27, 2010 8:38 AM
To:	Jones, Keith (K.); Pickens, Mitch (M.K.)
Cc:	Zuniga, Adelita (A.); Wallin, Richard (R.J.)
Subject:	RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Keith / Mitch- When available please provide a list of all parts replaced to resolve vehicle concern

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Wallin, Richard (R.J.)
Sent: Thursday, May 27, 2010 11:29 AM
To: McDonagh, Scot (S.M.); Zuniga, Adelita (A.)
Cc: Ives, David (D.C.); 'Graham Terrence (DS/ENC-NA)'; Hudson, Tony (A.W.); Pumford, Ken (K.G.); Fulton, Brien (B.L.); Dihle, Ken (K.M.)
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Need all parts that are to be swapped out,

R. J. Wallin
Senior Engineer Diesel Programs
Building #1
Cube 11C133
rwallin@ford.com
313-323-0415
cell 248-372-1074

From: McDonagh, Scot (S.M.)
Sent: Thursday, May 27, 2010 11:03 AM
To: Zuniga, Adelita (A.)
Cc: Ives, David (D.C.); 'Graham Terrence (DS/ENC-NA)'; Hudson, Tony (A.W.); Pumford, Ken (K.G.); Fulton, Brien (B.L.); Dihle, Ken (K.M.); Wallin, Richard (R.J.)
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Please hot process the enclosed BC3Z-9A543-A High Pressure Pump return to me at Bldg 2. Thanks

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Hudson, Tony (A.W.)
Sent: Thursday, May 27, 2010 10:40 AM
To: Pumford, Ken (K.G.); Fulton, Brien (B.L.); Dihle, Ken (K.M.); McDonagh, Scot (S.M.); Wallin, Richard (R.J.)
Cc: Ives, David (D.C.); 'Graham Terrence (DS/ENC-NA)'
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

I think Ken is on the right track……I'd be surprised if Bosch doesn't have a database of petrol damage already.

Tony Hudson
Supervisor | CBB | ***SCORPION*** Engine Design/Eng'g
FORD MOTOR COMPANY | LGDEE | Bldg1 | 11D141
Ph (313) 32-20730 | Cell (313) 805 0379 | email: thudson7@ford.com

From: Pumford, Ken (K.G.)
Sent: Thursday, May 27, 2010 10:36 AM
To: Fulton, Brien (B.L.); Dihle, Ken (K.M.); McDonagh, Scot (S.M.); Wallin, Richard (R.J.)
Cc: Ives, David (D.C.); 'Graham Terrence (DS/ENC-NA)'; Hudson, Tony (A.W.)
Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

Scot, Rich, please see that the pump comes back to my desk, then I'll get it to Bosch. Like the case we had with urea in the fuel during development, we should document this low-hour gasoline damage case.

Terry, this fueling error can't be all that rare. Does Bosch have a library of gasoline/petrol damage evidence that clearly points to this error state having occurred, or is it difficult to distinguish from general fuel quality / lubricity issues?

Regards,

Ken Pumford
Ford Super Duty Diesel
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Fulton, Brien (B.L.)
Sent: Thursday, May 27, 2010 9:31 AM
To: Pumford, Ken (K.G.); Dihle, Ken (K.M.); McDonagh, Scot (S.M.)
Cc: Ives, David (D.C.); 'Graham Terrence (DS/ENC-NA)'
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We need to make sure we get the pump back from this vehicle to Bosch, it would be a good sample for evidence for future claims. I am assuming that we are not going to get the tic for warranty as the dealer filled the tank with Petrol?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com *Cell:* (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Dihle, Ken (K.M.)
Sent: Thursday, May 27, 2010 9:03 AM
To: Aho, David (D.S.); Ali-Zaher, Houda (H.); Araiza, Enrique (E.A.); Bailey, Owen (O.R.); Baker, Zachary (Z.); Bansek, Catherine (C.K.); Bates, Erin (M.E.); Beattie, Mike (M.A.); Billings, Thomas (T.P.); Bird, Kevin (M.); Bliss, Brandon (B.); Bloom, David (D.A.); Boerger, Jim (J.G.); Bogema, John (P.); Boone, William (W.P.); Bruckner, Paul (P.R.); Buenger, Nick (N.); Bull, Tony (W.A.); Canjar, Joe (J.); Cervenan, Neil (N.J.); Chen, Kevin (S.); Condron, Brian (B.G.); Cooper, Scott (S.D.); Cowher, Terry (T.); Crudo, Frank (F.J.); Currie, David (J.); Czapski, Mark (M.G.); Davis, Craig (C.B.); Desai, Narendra (S.); Dihle, Ken (K.M.); Dixon, Mark (M.R.); Dobson, Kevin (K.E.); Douglas, Jason (J.); Erickson, Tom (T.C.); Ferdubinski, Ron (R.D.); Fields, Michael (M.); Flavell, Pete (P.D.); Fricke, Jon (J.R.); Fulton, Brien (B.L.); Garlick, Todd (T.M.); Garnica, Jose (J.L.); Gawronski, Robert (R.J.); Gedert, Anne (A.C.); Ghoddousi, Shahram (S.); Giunta, Michael (M.J.); Goebel, Ken (K.M.); Greca, Marc (M.A.); Gregoricka, David (D.J.); Gryglak, Adam (A.J.); Hale, Curt (B.C.); Hallgren, Brian (B.E.); Hansen, Randy (R.F.); Harrison, James (J.P.); Harrison, Mike (M.J.); Hill, Teresa (T.L.); Holmes, Douglas (D.A.); Horbal, Colin (C.P.); Hudson, Tony (A.W.); Isaacson, James (J.W.); Ives, David (D.C.); Janovich, Richard (R.); 'Jeff.Coyle@VFTIS.spx.com'; Jenkins, Tim (T.L.); Johnson, Risa (R.A.); Jones, Keith (K.); Jump, David (D.P.); Jungkunz, Rose (R.T.); Kacewicz, John (J.); Kay, Jeffrey (A.); Klas, Jeffrey (J.J.); Kloss, Phil (P.J.); Korpics, Frank (F.M.); Kramer, James (J.A.); Krolewski, David (D.R.); Kromberg, Arnold (A.W.); Kue, Ace (A.); Kulmaczewski, David (D.M.); Langley, Scott (C.S.); Lienau, Deborah (D.S.); Luke, Darrin (D.B.); Lusardi, Tony (T.K.); Lyon, Peter (P.M.); Uranga Lerma, Jesus Isidro (J.); Mahoney, Mark (M.M.); Mailloux, Richard (R.); Mazur, Jason (J.K.); McAllister, Derek (D.); McCoy, Jim (D.); McDonagh, Scot (S.M.); Melendez, Enrique (E.); Merrell, Robert (R.J.); Mohan, Robert (R.); Montgomery, Kerry (K.P.); Moreau, Jerimy (J.C.); Morelli, Anthony (A.J.); Moylan, James (J.J.); Mros, Nolan (N.E.); Myers, Dan (D.P.); Neasz, Ken (K.); Neder, Abraham (A.N.); Neff, Julie (J.M.); Nichols, Gary (G.S.); Nunez, Kyle (K.J.); Oberski, Christopher (C.); O'Connor, Tammy (T.A.); Opolsky, Norman (N.H.); Oyafuso, Kevin (K.G.); Pandolfi, Pete (P.G.); Parkham, Jeffrey (J.W.); Parra, Luis (L.A.); Pollitt, Dwayne (D.); Pumford, Ken (K.G.); Quandt, Ralph (R.B.); Rakotz, Ron (R.D.); Rauch, Jim (J.R.); Renteria, Mario (M.); Renwick, Rick (R.J.); Roberts, James (J.B.); Ruppert, Dave (D.R.); Saad, Thomas (T.J.); Schang, Amy (A.J.); Schneidau, Dan (D.); Siddall, Stephen (S.); Skoures, Evangelos (E.P.); Smaldone, Ronald (R.P.); Soto, Eduardo (E.); Sowards, John (J.); Sparks, Douglas (D.S.); Stanley, Daniel (D.J.); Stevens, Jim (T.); Stranges, Antonio (A.); Sulkowski, Rick (R.); Szymusiak, Scott (S.J.); Tait, Terry (T.N.); Tarquinto, Jody (JAT.); Taylor, James (J.D.); Tobiczyk, Michael (M.J.); Tucker, Christopher (C.H.); Turner, Tom (T.E.); Tyahla, Mark (M.A.); Varela, Gerardo (G.A.); Volinski, Bridget (.); Vroman, Dennis (D.A.);

Vykydal, Marianne (M.L.); Wallin, Richard (R.J.); Waszczenko, Ed (E.W.); Webb, Timothy (T.J.); Webb, Tony (.); Williams, Brent (B.A.); Williams, Brian (B.E.); Wong, Benny (.); Young, Colin (C.J.); Ziemba, Gregory (G.); Zilinskas, Steve (S.E.); Zimmerman, Bret (B.A.)

Subject: RE: P473 EWRT - CQIS/AWS Daily Summary - 6.7L Diesel Engine - 5/27/2010

2011 MY 6.7L Diesel EWRT

***Reminder**: Coordinate with the P473 EWRT and FCSD Hotline before contacting dealership personnel regarding any AWS or CQIS claim.*

The new GCQIS Reports are as follows:

*(repeat closed issues shown in **GRAY**)*

(1) 35 miles, 03/12/10 VPD – Potential Oil leak from front cover T joint
(2) 95 miles, 03/5/10 VPD – CEL, P249C(description NA), potential Nox sensor
(3) 75 miles, 03/9/10 VPD – Contaminated exhaust fluid, P207F code.
(4) 1766 miles, 04/19/10 VPD – CEL, Code P2138(TPS switch D/E correlation), inspect for wire chafe
(5) 227 miles, 04/8/10 VPD – Gas in fuel from dealership.
(6) 174 miles, 2/25/2010 VPD - P02EC after P0299(Diesel Intake Air Flow Control System - High Airflow Detected), recommend smoke test for intake
(7) 139 miles, 3/4/2010 VPD - CEL P20BD Reductant line transport damage
(8) 3079 miles, 3/29/2010 VPD - DEF distance to empty incorrect

<< Message: Report Summary for the CQIS Report#AEZCK003 >> << Message: Report Summary for the CQIS Report#AEZBC011 >> << Message: Report Summary for the CQIS Report#AEZA7008 >> << Message: Report Summary for the CQIS Report#AEZBP003 >> << Message: Report Summary for the CQIS Report#AEZAO001 >> << Message: Report Summary for the CQIS Report#AEZB9018 >> << Message: Report Summary for the CQIS Report#AEZCD012 >> << Message: Report Summary for the CQIS Report#AEZDD007 >>

These reports are highlighted in yellow in the GCQIS Reports tab in the summary file linked below.

The New AWS claims are as follows:

(1) P473 6.7L - 309 miles, 2/22/2010 VPD - CEL DEF message

(2) P473 6.7L - 519 miles, 3/26/2010 VPD - Oil separator damaged at KTP, previous CQIS

(3) P473 6.7L - 9 miles, 3/24/2010 VPD - coolant leak w/p to degas

(4) P473 6.7L - 44 miles, 3/5/2010 VPD - CEL, open circuit at G400

(5) P473 6.7L - 2245 miles, 4/27/2010 VPD - Oil leak at oil fill tube oring

<< File: 6.7L Powertrain claims 5272010.xls >>

Summary files:

SharePoint AWS and CQIS direct link: https://team.sp.ford.com/sites/ptquality/15%20-%20P473%20EWRT/default.aspx?RootFolder=%2fsites%2fptquality%2f15%20%2d%20P473%20EWRT%2fShared%20Documents%2fAWS%20and%20CQIS%20Claims&FolderCTID=&View=%7b3B9E7937%2d8241%2d4356%2dB4E6%2d6A57B8624CCB%7d

CQIS and AWS File Name: 2011 MY 6 7L Diesel CQIS-AWS Tracking

Ken Dihle
Product Development Engineer
Large Gas & Diesel Engine Engineering
Phone: 313-248-1101
Fax: 313-390-6600
Building 1 Cube 13G004

From:	Fox, Bill (W.D.)
Sent:	Thursday, March 31, 2011 12:19 PM
To:	Firoozgan, Hossein (H.); Fulton, Brien (B.L.); Nowak, Mark (M.E.); Waszczenko, Ed (E.W.); Tallio, Kevin (K.V.); Eeley, Scott (A.); Heggie, Forest (F.)
Cc:	Jiang, Siyuan (S.)
Subject:	FW: Prevent Recurrence CFE Review 03-28-2011 - Outcomes

These are the assignments from the CFE Review on Monday, 03-28-2011:

1. Cam Hot Ticking – 2011 5.0L Cam Hold Down – H. Firoozgan
   - Closed – Nano process becomes Bill of Process and Migration Plan completed. Hossien to get ME management approval.
2. Broken exhaust spring during FIE testing 2011 5.0L – M. Nowak
   - Mark to write a Design Rule or Consideration with respect to inclusion spec. No need to return to CFE Review.
3. Valve Tip Pitting 2011 5.0L – M. Nowak
   - Working with INA on polish rocker arm
   - Investigate additional countermeasures: Oil Type, Coating and additional oil passage to valve tip. Return to CFE review in eight weeks.
4. 11B23 PAC paper status – S. Eeley, F. Heggie, (B. Fulton)
   Get ready for April 14 Closure review.
   - Ensure 6.7L is covered with the actions. Work with Robin Lawther for FoE application coverage
   - Ensure Gas is covered for potential failure modes: Fuel leak in crankcase, Tstat failure, Cylinder Head to Block Seal, Cooler erosion and HP fuel pump damage due to lack of lubricity
   - SDS FY0029 may need to be elevated to Trustmark. C. Woodring , Chassis Fuel owns the SDS
   - Need service fix with Software upgrade for WIF warning.

Siyuan Jiang, Ph.D.
Supervisor, P/T Engineering, LGDEE - Forward Model Quality
Email: sjiang@ford.com
Phone: 313-805-7448

William D. Fox
FMQE - Powertrain Quality Office
ASQ Certified Quality Engineer, Ford 6σ Black Belt
Bldg.: #1, Cube 12G062
e-mail: bfox2@ford.com
phone: 313-805-3590

From:	Heggie, Forest (F.)
Sent:	Monday, December 06, 2010 8:24 AM
To:	Simpson, Timothy (T.A.); Eeley, Scott (A.); Heggie, Forest (F.)
Subject:	FW: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip
Follow Up Flag:	Follow up
Due By:	Tuesday, December 07, 2010 8:23 AM
Flag Status:	Flagged
Attachments:	fluish recommendations.ppt

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, December 06, 2010 8:06 AM
To: Lusardi, Tony (T.K.); Davis, Craig (C.B.); Jones, Keith (K.); Curtis, Andrew (A.); Hale, Curt (B.C.); Burkeen, Doran (D.C.); Ives, David (D.C.); Dobbs, Dan (K.D.); Pumford, Ken (K.G.); McDonagh, Scot (S.M.); Baker, Zachary (Z.); Stendardo, David (D.)
Cc: Eeley, Scott (A.)
Subject: RE: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip

1. I agree we need the added statement for water

2. Repair Procedures 6.4L

Procedure A.

- Recommend flush low pressure fuel lines between pump to cooler, cooler to secondary filter on 6.4L, flush cylinder head fuel return lines, all other fuel return lines, fuel cooler is the only component required to be replaced after the injectors.
- If water or other non lubricating fuels ingested into the fuel system, the HFCM should be inspected, pinpoint test O and check for debris if issue found then replace, otherwise flush the low pressure pump.

Procedure B. suggest add an inspection for HFCM to validate no low pressure system damage - validate not started, if damage present then addition inspection required.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Lusardi, Tony (T.K.)
Sent: Friday, December 03, 2010 2:54 PM
To: Davis, Craig (C.B.); Jones, Keith (K.); Curtis, Andrew (A.); Hale, Curt (B.C.); Burkeen, Doran (D.C.); Ives, David (D.C.); Heggie, Forest (F.); Dobbs, Dan (K.D.); Pumford, Ken (K.G.); McDonagh, Scot (S.M.); Baker, Zachary (Z.); Stendardo, David (D.)
Subject: RE: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip

2008 - 2011 Super Duty, equipped with the diesel engine that have been filled with gasoline, incorrect diesel fuel, other non-diesel fuels **or water that enters into the fuel system either through improper or incomplete service/maintenance or during re-fueling can damage the fuel system components**, including the High Pressure Injection Pump and fuel injectors. Non-recommended fuels and additives do not meet the lubricating, cooling and anti-corrosion properties that is required of the fuel system components. This may cause symptoms, but not limited to the following: Crank/No Start, Long Crank/Hard Start, Rough Run, Low Power, Engine Knocking, Exhaust Smoke and/or Fuel Rail Pressure (FRP) slow to build.

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Davis, Craig (C.B.)
Sent: Friday, December 03, 2010 1:42 PM
To: Jones, Keith (K.); Lusardi, Tony (T.K.); Curtis, Andrew (A.); Hale, Curt (B.C.); Burkeen, Doran (D.C.); Ives, David (D.C.); Heggie, Forest (F.); Dobbs, Dan (K.D.); Pumford, Ken (K.G.); McDonagh, Scot (S.M.); Baker, Zachary (Z.); Stendardo, David (D.)
Subject: RE: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip

I agree, we need to advise that water in the fuel system either through improper or incomplete service/maintenance or during re-fueling will also contribute to this.

From: Jones, Keith (K.)
Sent: Friday, December 03, 2010 1:32 PM
To: Lusardi, Tony (T.K.); Curtis, Andrew (A.); Hale, Curt (B.C.); Burkeen, Doran (D.C.); Davis, Craig (C.B.); Ives, David (D.C.); Heggie, Forest (F.); Dobbs, Dan (K.D.); Pumford, Ken (K.G.); McDonagh, Scot (S.M.); Baker, Zachary (Z.); Stendardo, David (D.)
Subject: RE: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip

Can we add the word water?

Keith Jones
6.7 Engine SME
Diesel Drivability
Ford Technical Hotline
DSCI Cube 308
313-248-7923

KJone286@ford.com

From: Lusardi, Tony (T.K.)
Sent: Friday, December 03, 2010 1:29 PM
To: Curtis, Andrew (A.); Hale, Curt (B.C.); Burkeen, Doran (D.C.); Davis, Craig (C.B.); Ives, David (D.C.); Heggie, Forest (F.); Dobbs, Dan (K.D.); Jones, Keith (K.); Pumford, Ken (K.G.); McDonagh, Scot (S.M.); Baker, Zachary (Z.)
Subject: TSB Request for Input: 070-2010-1624: 6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip

TSB Request for Input

***** NOTE: The system generated the email. *****

This message is being sent on behalf of TLUSARDI.
Please provide review and feedback for the article below. The person requesting this feedback may have provided further direction in the comment section below. Forward/Send any comments via email to the person who sent this email.

General Information

Last action taken (as of 12/3/2010 6:29:11 PM GMT):	Send for engineering input
Comment:	
Author:	TLUSARDI
Tracking Number:	070-2010-1624
Author Tracking Number:	103-2010-0041
Title:	6.4L & 6.7L Diesel Engine - Gasoline Or Other Non-Diesel Fuels Added To The Fuel Tank - Service Tip
Article Type:	TSB

TSB Issue:
This informational TSB provides the recommended repair directions when vehicle operators inadvertently add gasoline, other fluids or non-diesel fuel to the fuel tank.

2008 - 2011 Super Duty, equipped with the diesel engine that have been filled with gasoline, incorrect diesel fuel or other non-diesel fuels can damage the fuel system components, including the High Pressure Injection Pump and fuel injectors. Non-recommended fuels and additives do not meet the lubricating, cooling and anti-corrosion properties that is required of the fuel system components. This may cause symptoms, but not limited to the following: Crank/No Start, Long Crank/Hard Start, Rough Run, Low Power, Engine Knocking, Exhaust Smoke and/or Fuel Rail Pressure (FRP) slow to build.

TSB Action:
Follow the appropriate service procedure depending on if the engine has been started with the contaminated fuel system or not.

NOTE: Failure to follow these procedures may result in fuel system and or engine damage and may require vehicle warranty cancellation submission. Repairs required due to use of improper fluids and fuel, are not covered by the New Vehicle Limited Warranty. See Warranty and Policy Manual and Customer Information Guide for details.
TSB Service Procedure:
1. If the vehicle has been filled with gasoline or other than the correct diesel fuel, and the engine has been started, it is recommended to proceed to procedure 'A'. If the fuel tank was filled with gasoline or other non-diesel fuels and the truck has NOT been run, proceed to procedure 'B'.

Procedure A

1. Drain the fuel tank completely by removing the tank and cleaning to prevent the possibility of reintroducing contamination. (Dispose of the contaminated diesel fuel in an appropriate manner in conjunction with local laws and regulations)

2. Fill with fresh clean good quality diesel fuel.

3. Use the Low Pressure Fuel Pump to flush fresh clean diesel into the fuel system. (Refer to procedure 'C' as necessary)

4. Replace the fuel filters (primary and secondary filters).

5. Replace ALL High Pressure fuel system components; High Pressure Fuel Pump, fuel lines (from fuel cooler to pump and also from fuel rails to injectors), fuel rails and ALL 8 injectors.

6. Bleed the fuel system as per WSM section 312-00 procedures in order to get the vehicle started.

7. Change Oil and Filter and perform the High Pressure Fuel System test to verify for leaks, repair as necessary.

Procedure B

1. Drain the fuel tank completely by removing the tank and cleaning to prevent the possibility of reintroducing contamination. (Dispose of the contaminated diesel fuel in an appropriate manner in conjunction with local laws and regulations)

2. Fill with fresh clean good quality diesel fuel.

3. Replace the fuel filters (primary and secondary filters).

4. Use the Low Pressure Fuel Pump to flush fresh clean diesel into the fuel system. (Refer to procedure 'C' as necessary)

Procedure C - Fuel system flush:

1) Remove the rear Fuel Cooler Line that comes from the High Pressure Pump at the Fuel Cooler.

2) Cut a 1/2" length of 3/8" rubber hose to seal the banjo bolt when re-installing into the Fuel Cooler without the fuel line attached.

3) Place a larger hose over the return fuel line in order to direct the fuel into a suitable container.

4) Use Active Commands or Cycle the key to allow the fuel pump to flush the lines.

5) Plugging the Fuel Cooler during this process will prevent air from being introduced into the High Pressure Fuel System causing a no start.

Category: Service Tip - Long Term (10 years)
Request Type: Non-QSF
Would this make a good cost save business case? No
Activity Code: 070 F-Series >8500#
Vehicle Applications:

Vehicle Lines	Model Year Start	Model Year End	Assembly Plants	Body Styles	Engine	Trans Axles	Build From	Build To
F-250	2008	2010			6.4L TC DIESEL V8			
F-250	2011	2011			6.7L 4V V8 TC DIESEL			
F-350	2008	2010			6.4L TC DIESEL V8			
F-350	2011	2011			6.7L 4V V8 TC DIESEL			
F-450	2008	2010			6.4L TC DIESEL V8			
F-450	2011	2011			6.7L 4V V8 TC DIESEL			
F-550	2008	2010			6.4L TC DIESEL V8			
F-550	2011	2011			6.7L 4V V8 TC DIESEL			

If SPECS Case, Select all Other Affected Publications:
Changes Needed in Other Pubs:
TSBs to Supersede:
SSMs to Supersede: 21410
ISMs to Supersede:
Other application Articles:

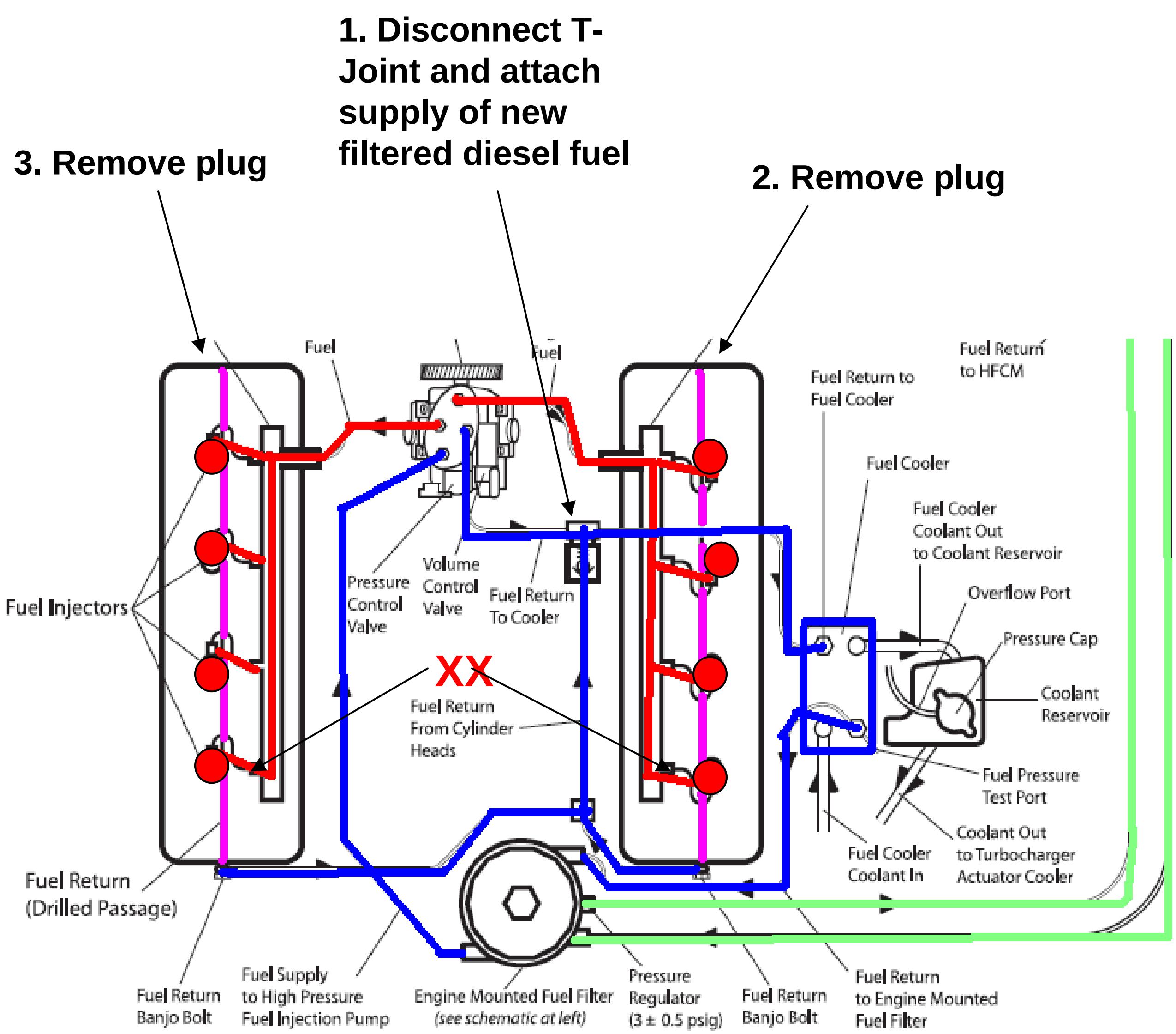
Select the reason for republication:	Replace Awareness/Interim Message
Procedure verified by CDSID:	cdavis6
Describe How The Procedure Was Verified:	field reports
Do you have access to a vehicle for time study?	N/A
If Yes, contact for vehicle CDSID:	
Labor Operations:	
Are Illustrations Required?	No
If Yes, Contact information for illustrations:	
CDSID(Ford only):	
Full Name:	
Phone:	
Illustration Notes:	
Trustmarks affected:	Ford
Additional Trustmarks To Notify:	
Article Distribution:	WDMO, Canada, Mexico, United States
DTC Codes and OASIS Service Codes:	, 400000, 403000, 404000, 497000, 600000, 601000, 602300, 603300, 606000, 606000, 607000, 608000, 609000, 610000, 611000, 612000, 613000, 614000, 615000, 623000, 698298
Causal Basic Part # or Finis Code:	
Calibrations List:	
White Paper Numbers:	

Parts Request Information

Are Parts Required?	No
Article Number:	
BCM Number:	

(End automated email)

Flush Recommendation



- Flush **cylinder heads** individually by removing one plug at a time.
- Use only new clean filtered diesel fuel.
- Do not exceed 8 PSI during flush.
- .Leave original injectors in cylinder head until flushing is complete.
- **Replace fuel filters after flushing is complete.**

From: Fulton, Brien (B.L.)
Sent: Monday, April 12, 2010 12:58 PM
To: Eeley, Scott (A.)
Cc: Heggie, Forest (F.); Kromberg, Arnold (A.W.); McAllister, Derek (D.); Armesto, Carlos (.); Bird, Kevin (M.)
Subject: FW: VCV Photo

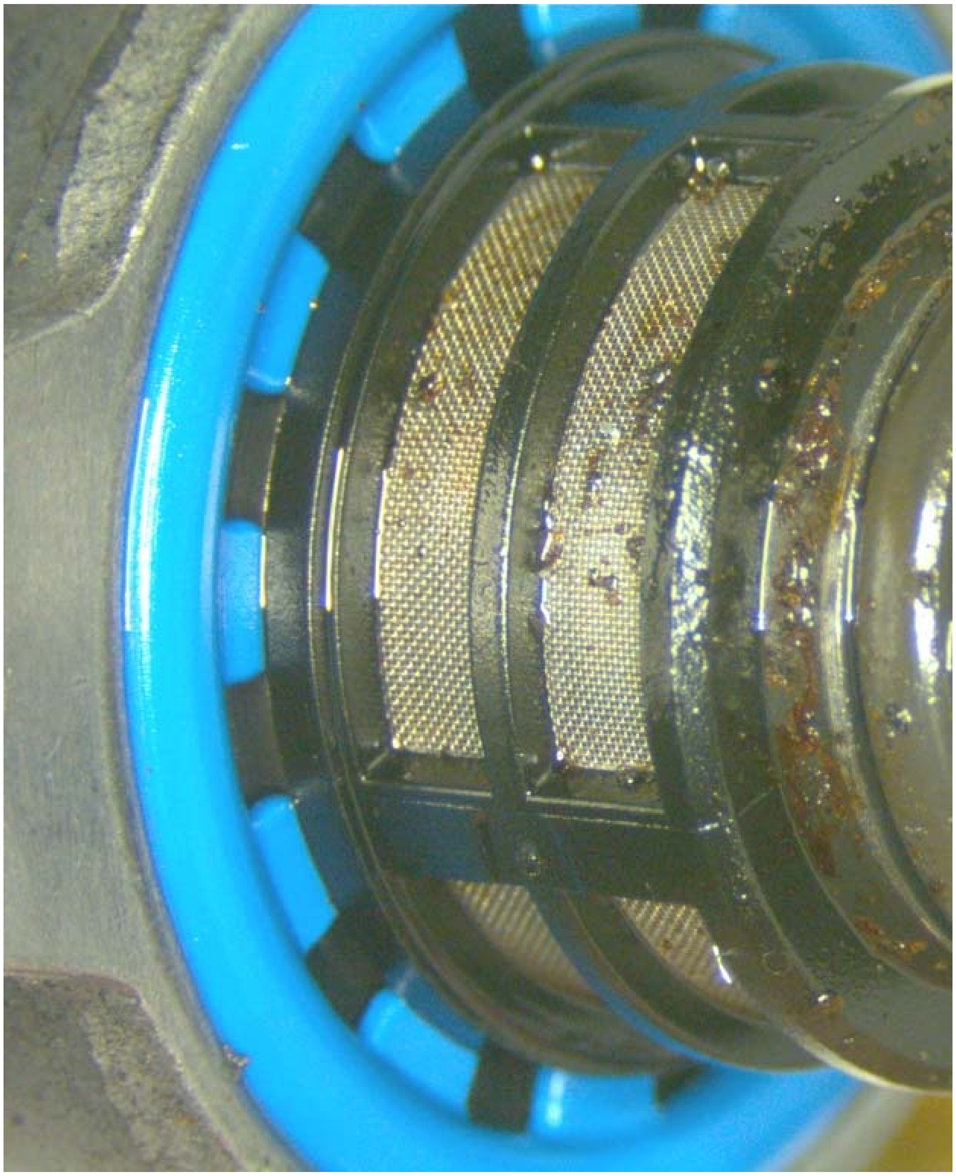
Here is a picture of a VCV that failed on one of the 6.7L development engines due to water. The rust is very evident on the VCV valve and if this shows up you are most certain that the pump failed due to water ingestion or oxidized fuel. Check with Conti on their VCV to see if there is similar corrosion rates with pump internals and you may have a quick and dirty test for corrosion.

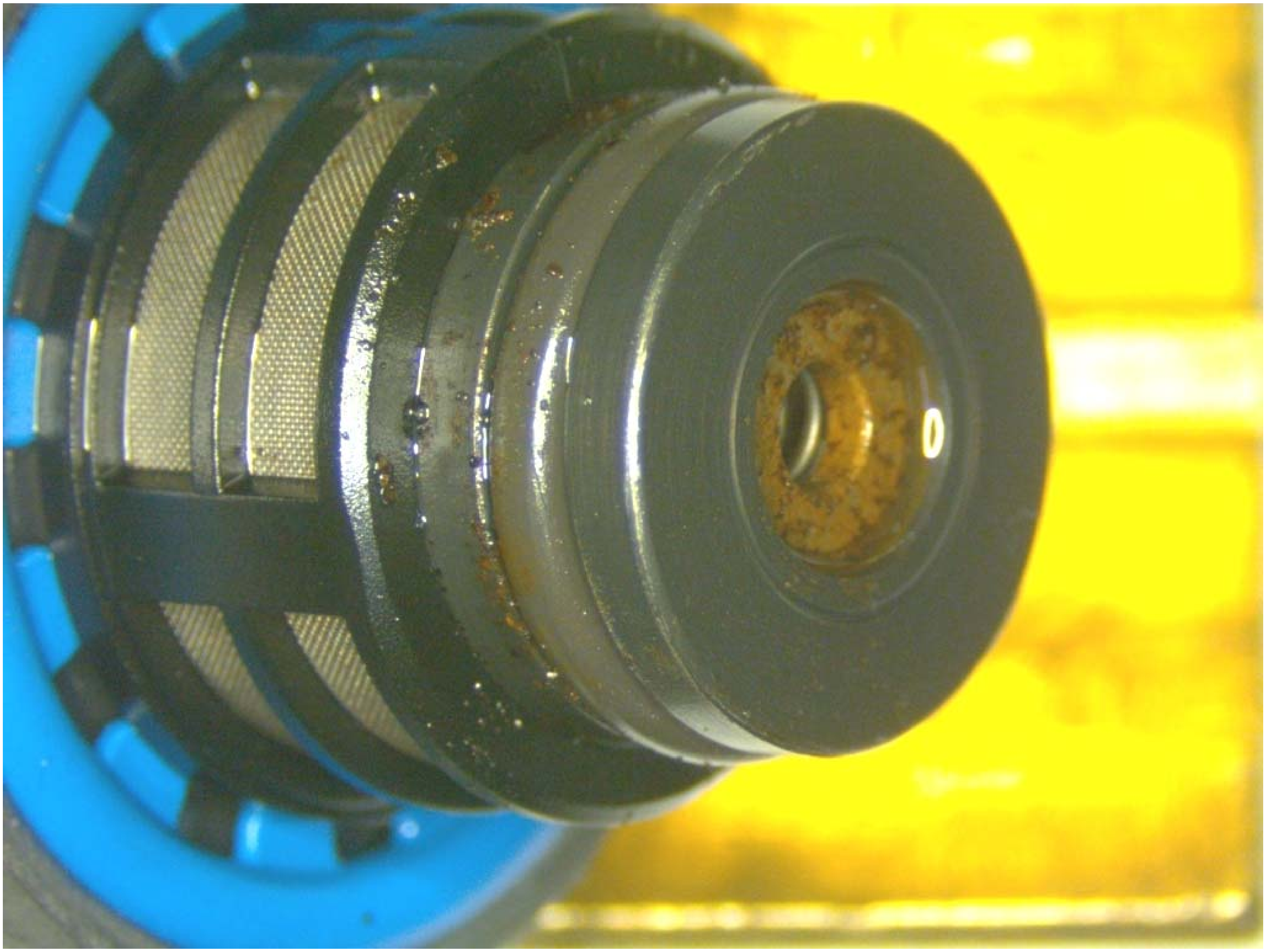
Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com *Cell:* (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Graham Terrence (DS/SFO2-NA) [mailto:Terrence.Graham@us.bosch.com]
Sent: Saturday, April 10, 2010 9:16 AM
To: Fulton, Brien (B.L.)
Subject:

Hi Brien,
Here is a picture of a rusted VCV plate.





Terrence D. Graham

Robert Bosch LLC, Diesel Systems
Senior Engineer
Component Engineering (DS/ENC-NA)
Cube 113A-2-005 Column 113A-2-L38
38000 Hills Tech Drive, Farmington Hills, MI 48331 USA
Phone: (248)876-2901 Cell: (248)514-5647 Fax: (248)876-2576
terrence.graham@us.bosch.com
www.boschusa.com

From: Heggie, Forest (F.)
Sent: Friday, December 10, 2010 11:13 AM
To: Heggie, Forest (F.)
Subject: FW: Water in diesel fuel P2269

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Kromberg, Arnold (A.W.)
Sent: Monday, March 22, 2010 1:54 PM
To: Heggie, Forest (F.)
Subject: RE: Water in diesel fuel P2269

This is likely the most complex WIF detection in the industry. Seems like the intended function is keeping he customer indication off. See comments in red. Hope it helps but may confuse you more…..

Regards,

Arnold Kromberg
6.0L/6.4L Diesel Calibration Supervisor
Phone: 313-805-0156
Fax:313-248-1494
e-mail: akromber@ford.com

From: Heggie, Forest (F.)
Sent: Monday, March 22, 2010 12:51 PM
To: Kromberg, Arnold (A.W.)
Subject: FW: Water in diesel fuel P2269

Well I am not sure who else to ask,

And your voicemail is full so I would appreciate being edumacated in some WIF light information.
I've been directed to not answer the phone for 6.4L. So I let my voice mail fill as well so then I don't have to return calls about it either…..

I just had this email from Jannette Nunn ect forward to me and would like to make sure I understand and ask a few other questions

My main question is is the initial idle check enough to set the WIF light? Or is further rpm changes/driving needed? For example

If a vehicle is used as a PTO only idling
- would it still set a WIF light?

The "stationary" (idle) detection requires many key cycles to enable any sort of detection. It takes something like six consecutive idle conditions (with water to enable the stationary detection.

IF the vehicle WIF light is on, the customer shuts off the vehicle does not drain and restarts
-will the WIF light set after just the idle check?

-or would it still need to be driven to set (how long could this take assuming there are 100mL in the HFCM)

When the key is cycled, the detection has to be set again in the next key cycle. This is true for the vehicle moving detection as well. The driving time varies depending on the speed, starts/stops, etc. Typically anywhere from 10-20 minutes of moving operation.

From reading this information:

There is at least one check of water at idle then other checks while driving? How many measurements of water greater than 60-70mL are needed to set the WIF light? How quickly can enough measurements to set the light occur?
I've seen detection at less than 60ml. For idle see above. For driving it's about 10-20 minutes to get the indicator.

I really appreciate your assistance and hopefully these questions make sense when written out,

Forest Heggie

From: Nunn, Janette (J.M.)
Sent: Monday, May 19, 2008 9:30 AM
To: Eeley, Scott (A.); Stuber, Suzanne (S.)
Cc: Hale, Curt (B.C.); Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Subject: RE: Water in diesel fuel P2269

- What it takes to set a P2269
  - How much water in the Horizontal Fuel Conditioning Module(HFCM)? - 90-100ml, but the light will trigger at about 60-70ml
  - What does the ECM have to see from the water in fuel light (WIF) sensor on the HFCM? light will trigger at about 60-70ml - There are two tests that the ECM looks at, vehicle idling and vehicle running (>18mph). During each condition, there ECM is collecting data. Once enough data is collected in either scenario the ECM calculates a ratio of water / no water. Once this ratio reaches certain thresholds the WIF light is turned on.
- What it takes to turn on the WIF light? light will trigger at about 60-70ml - There are two tests that the ECM looks at, vehicle idling and vehicle running (>18mph). During each condition, there ECM is collecting data. Once enough data is collected in either scenario the ECM calculates a ratio of water / no water. Once this ratio reaches certain thresholds the WIF light is turned on.
  - ECM calibration, can the code be set but no signal to the cluster? - Not that I am aware of. They should also get a message in the message center in addition to the light
  - Signal to the cluster from the ECM?
    - Pin#, voltages? - Fuel is typically around 4.6-4.7 Volts and Water is below 3.5V, but again remember that it is the ratio of water to no water is what the ECM is looking at and comparing the ratio to the threshold in order to turn the light on.
- Does the WIF light prove out on key up? - You must allow enough time for the idle tests to run.
- By the time the WIF light comes on from straight water in the fuel, not coolant, is it too late for the High Pressure Pump (HPP) and injectors? - It should not be b/c there is a secondary filter on the engine which also has the ability to prevent water from passing forward.

Suzie - Please comment and clarify.

Regards,
Janette Nunn
Ford Motor Company
PTE-Truck Fuel Systems
Phone: (313) 805 5815

From: Eeley, Scott (A.)
Sent: Wednesday, May 14, 2008 4:27 PM

To: Nunn, Janette (J.M.); Stuber, Suzanne (S.)
Cc: Hale, Curt (B.C.); Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Subject: RE: Water in diesel fuel P2269

Just because I saw you driving around in a Super Duty and water was always in close proximity… I thought you might know a little about this subject…?

From: Pekarscik, Brian (B.)
Sent: Wednesday, May 14, 2008 4:13 PM
To: Eeley, Scott (A.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Cc: Hale, Curt (B.C.)
Subject: Water in diesel fuel P2269

All, I am looking for some feedback on some issues listed below on water in diesel fuel:

- What it takes to set a P2269
  - How much water in the Horizontal Fuel Conditioning Module(HFCM)?
  - What does the ECM have to see from the water in fuel light (WIF) sensor on the HFCM?
- What it takes to turn on the WIF light?
  - ECM calibration, can the code be set but no signal to the cluster?
  - Signal to the cluster from the ECM?
    - Pin#, voltages?
- Does the WIF light prove out on key up?
- By the time the WIF light comes on from straight water in the fuel, not coolant, is it too late for the High Pressure Pump (HPP) and injectors?

I ask the questions above due to the fact that one of our FSEs has a unit that has a wiped out fuel system causing a no start and we are seeing more and more water in fuel related concerns. On the vehicle in question the dealer has a mason jar with about a 1/2 inch of water in the bottom and fuel on top but before the dealer drained the HFCM there was no WIF light just a no start and the code. Although there is a code 2269 the customer swears there was no WIF light.

We seem to be seeing more p2269 codes as represented in the monthly chart below.

Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08
					1	1	1			3	3	6	5	16	18	15	12	11

Brian "PK" Pekarscik
Super Duty Powertrain PCE
FoMoCo
PH# 313 317 9334

One Ford, one customer, and each customer is important.

The Bitterness of poor quality remains long after the sweetness of low price!

From: Heggie, Forest (F.)
Sent: Monday, May 10, 2010 1:53 PM
To: Bandoske, Pete (P.F.); McAllister, Derek (D.); Curtis, Andrew (A.)
Cc: Armesto, Carlos (.); Eeley, Scott (A.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.); Heggie, Forest (F.)
Subject: FW: WIF Special Study - photo revision and request of criteria

Attachments: Study Rust Inspection 5-10-2010 REVISION B.pdf

Per discussions this morning the following our proposed for the WIF special study

We capture 30 more samples (in addition to the ones we have) the first 20 calls with rust in the filter housing and 10 calls to original criteria

Total 30 more samples

1) 20 with rust in the filter housing (sample number ending on a full day of claims)

2) 10 original hotline criteria debris in the fuel system at the injector, more than 1 injector and hp pump required (sampling ending on a full day of claims)

We need to be able to normalize the data by days the study was run for each criteria , start the collection at the start of a new day, and end the sample collection at the end of a full day .

So If we run this for 3 days and on day 3 we have 19 samples collected with rust in the filter housing we either end on day 3. Or if we go into a 4th day we need to capture all the samples that are called in on day4.

Updated photsheet for inspectors: Added inspection of the FRP sensor

Study Rust
nspection 5-10-201.

Forest Heggie BaSc. MaSc. P.Eng

1-313-6185054

LGDEE Diesel OPD

Rust Inspection for Special Study REVISION B 5/10/201

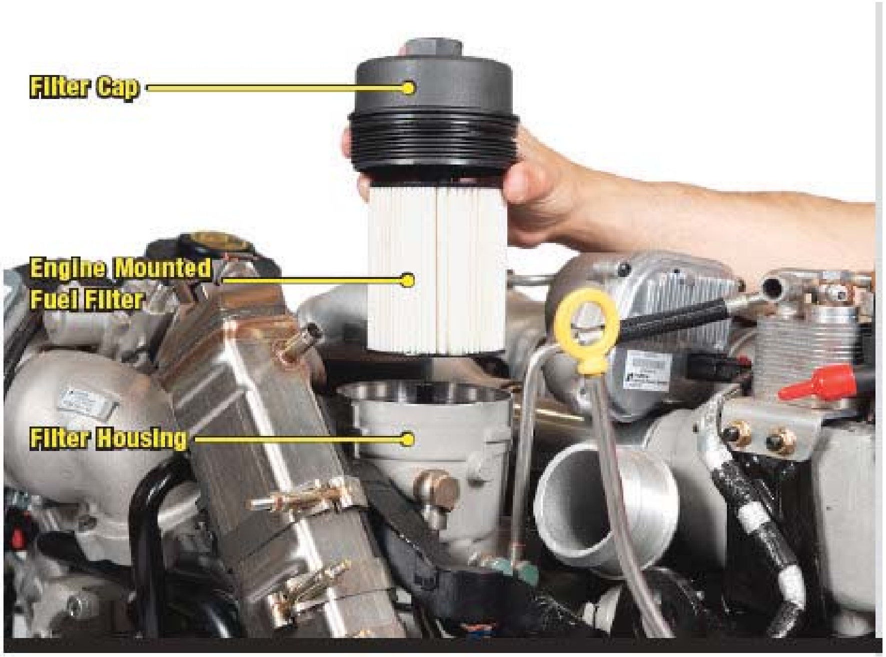
The following set of instructions is for a Special Study: Beginning 4/15/2010 and Ending 5/20/2010
Criteria Technician with the Hotline has determined a HP Pump is required to resolve a customer concern via the prior approval process and has been designated by the hotline as meeting either

a) Rust in the on Engine filter
b) Debris in the fuel system at the injectors

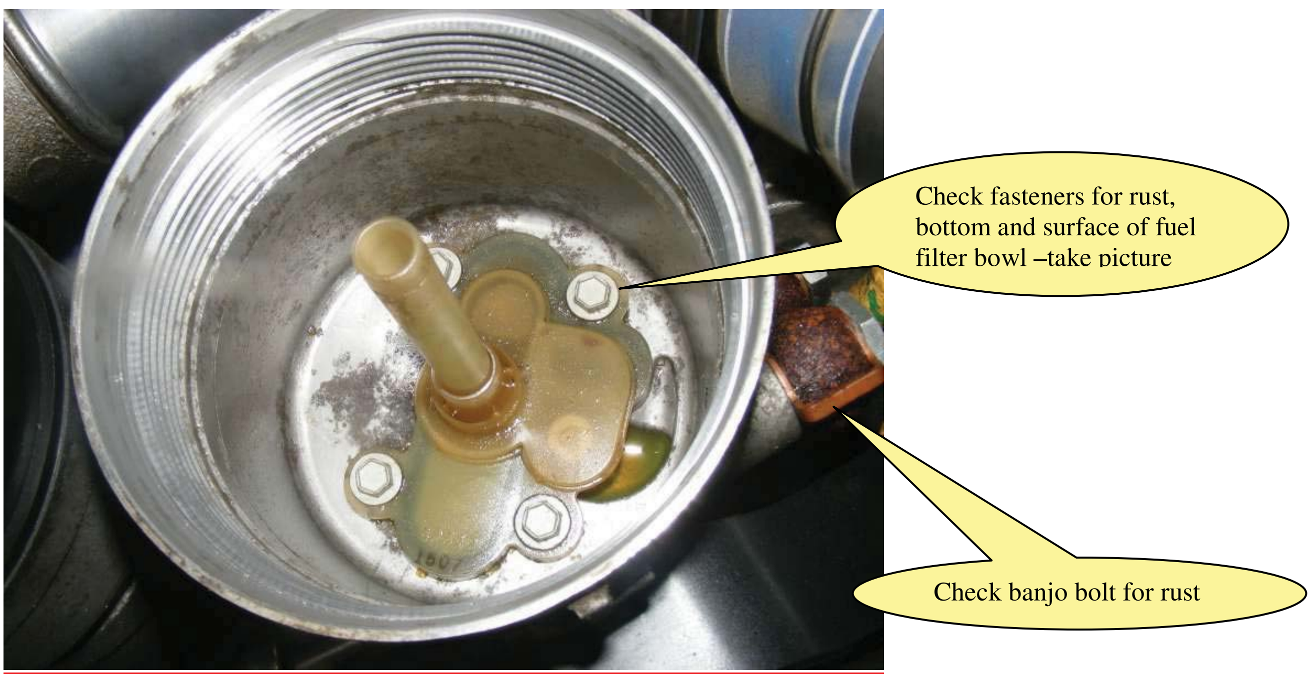
The following illustrates outline rust inspection for

1) **On Engine fuel filter bowl & filter inspection**
2) **Fuel Rail Pressure Sensor**
3) **HPP ITP inspection**
4) **HPP VCV valve inspection**

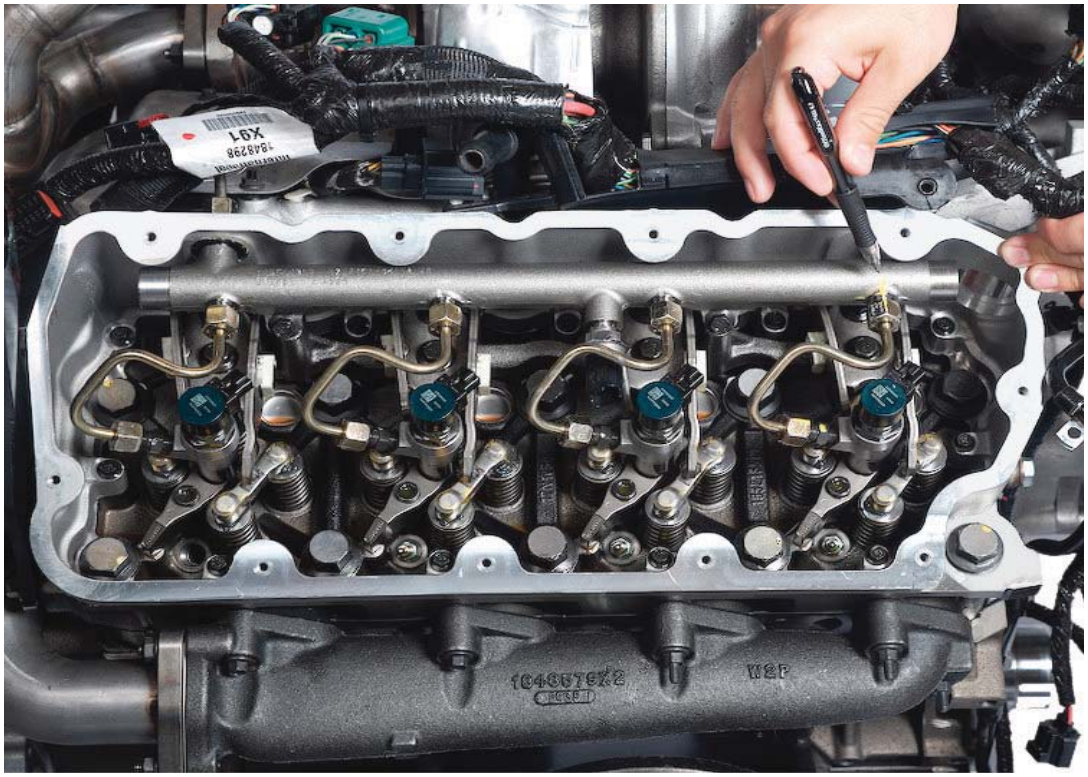
1) **On Engine Fuel filter bowl & filter**
   a. Do not wipe filter before inspecting – is there rust on the filter?
      i. take picture



   b. Is there rust inside the fuel filter bowl or on the fasteners inside the filter bowl?
      i. take picture



5) **Fuel Pressure Sensor – the FRP is located on the engines right side high pressure fuel rail under the cover. Remove the cover and FRP following the workshop manual procedure.**

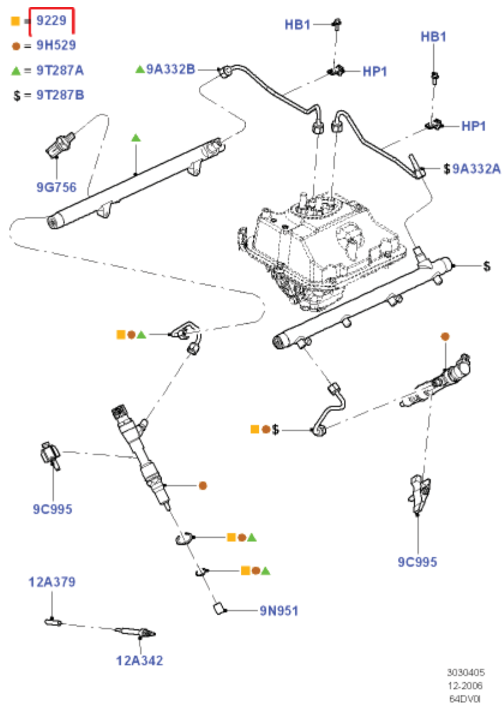


Inspect the FRP sensor for rust

i) is there any rust present

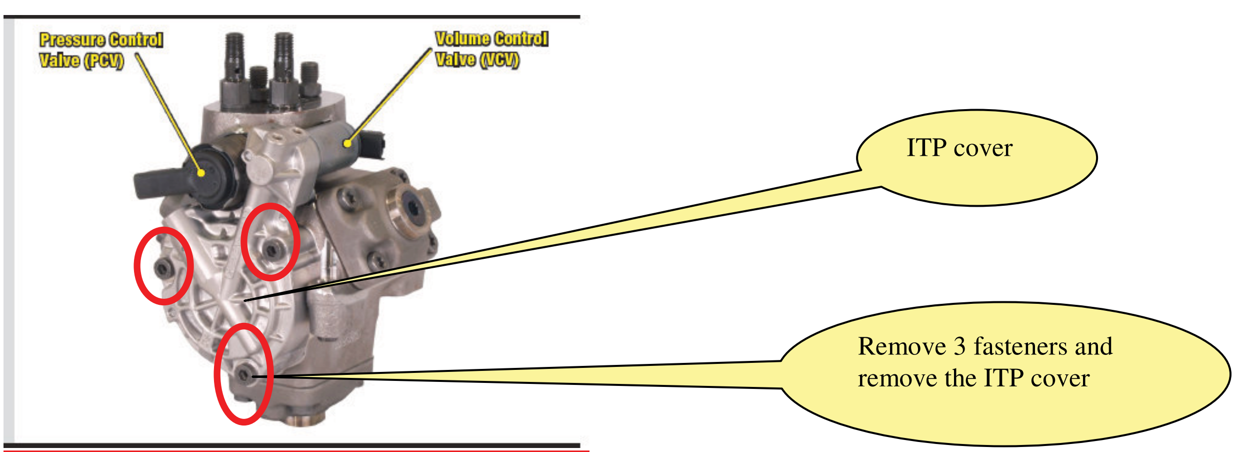
ii) take picture

6) HPP ITP – a) remove the HPP following the workshop manual instructions



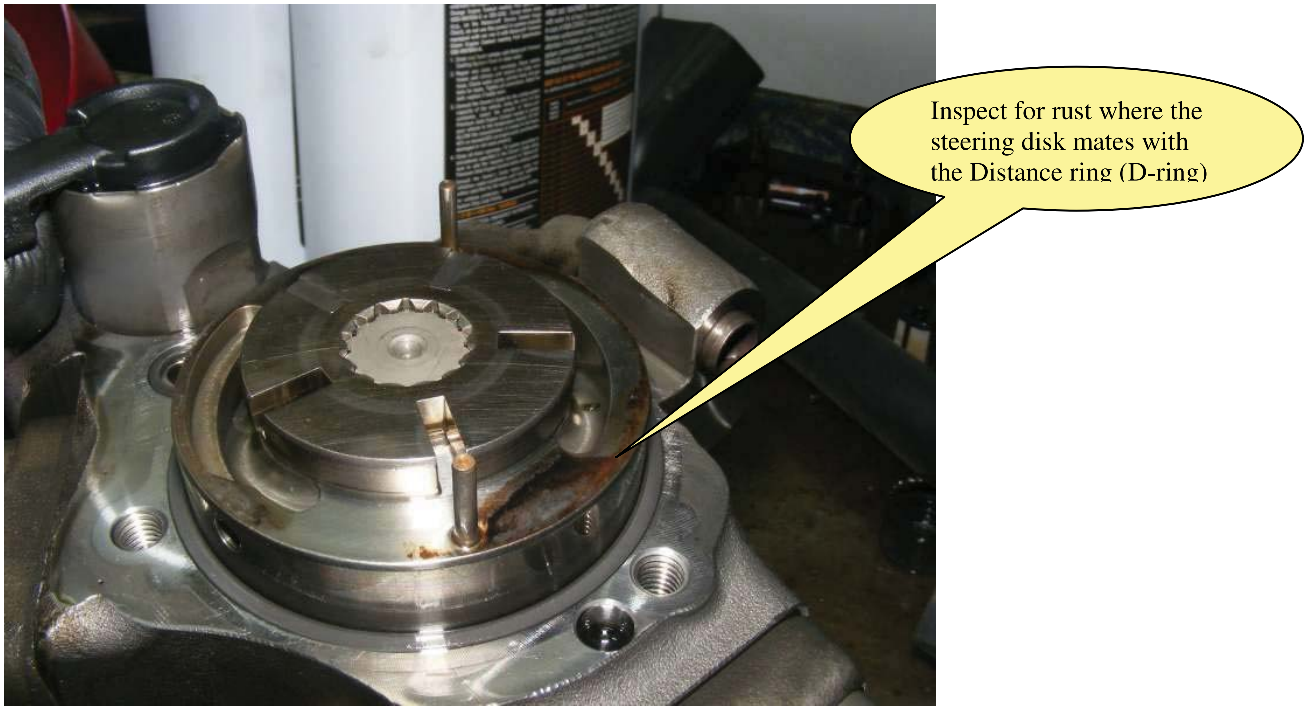
b) Place the HPP flat ITP cover facing up

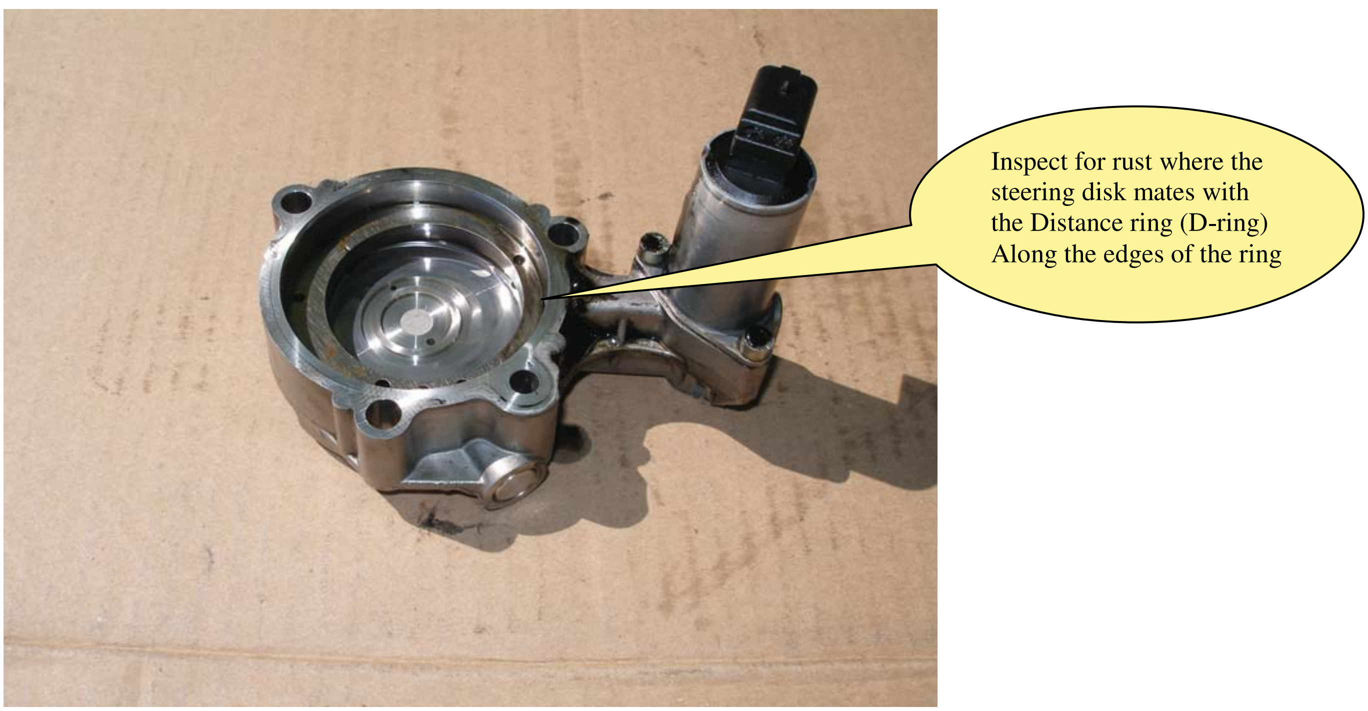
i) Remove the 3 fasteners with a 6mm Allen wrench and remove the ITP cover



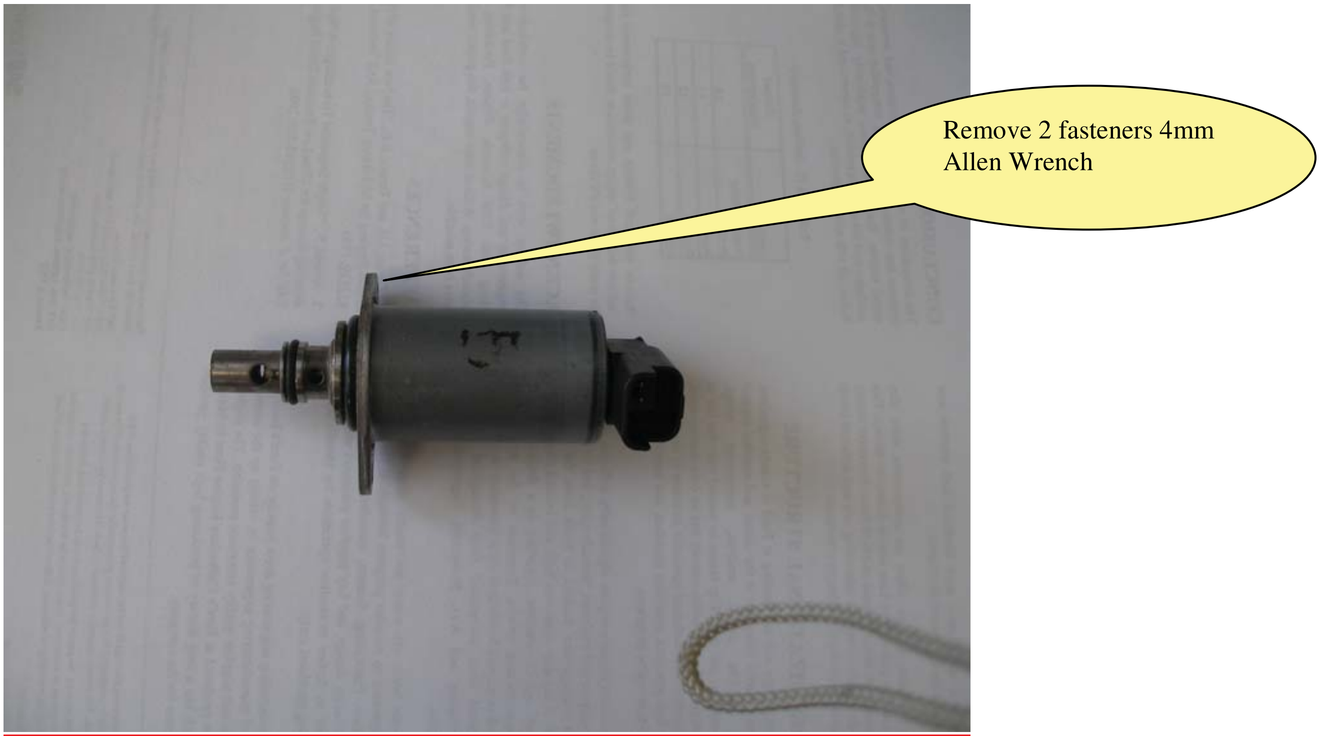
c) Inspect for rust – Is there any rust present?

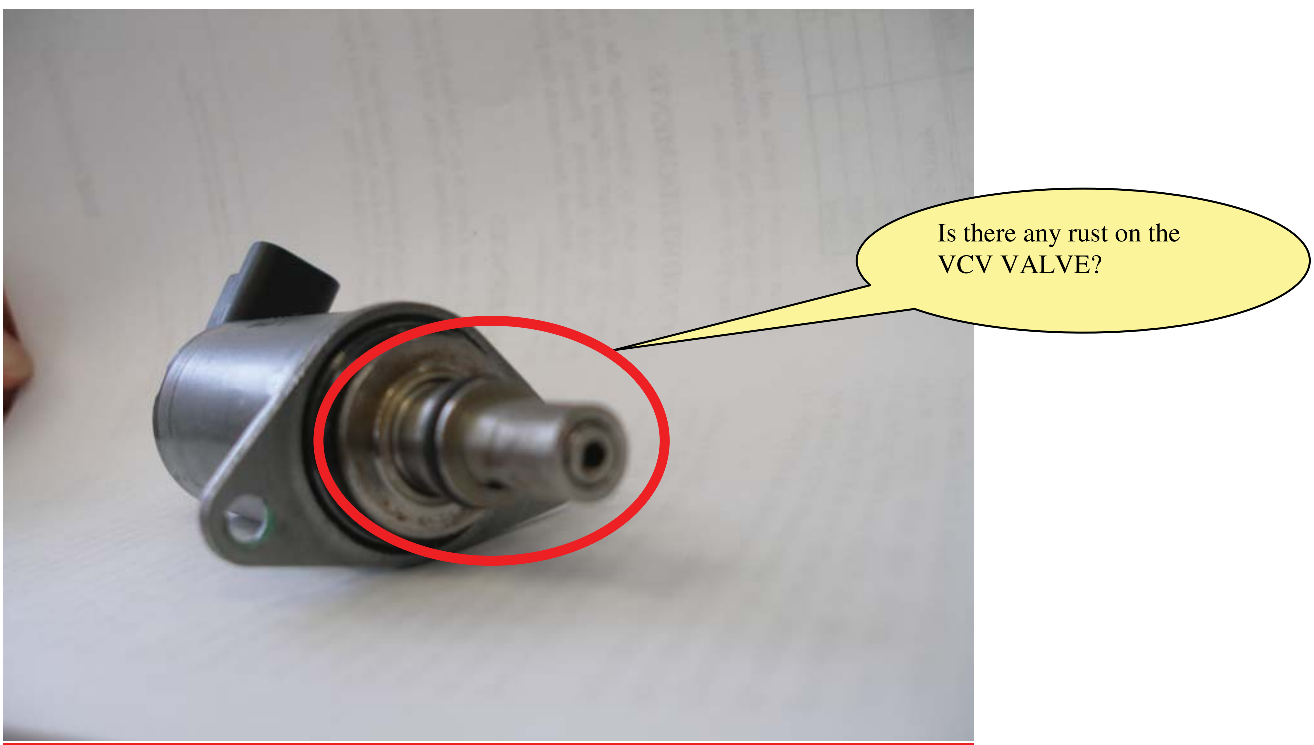
i. Take picture





7) Remove the - HPP VCV valve- 2 fasteners 4mm Allen Wrench
   i. Is there any rust on the VCV valve? – take picture





After inspecting reassemble the VCV and ITP snuggly but do not torque down tightly.

From: Heggie, Forest (F.)
Sent: Monday, October 25, 2010 9:42 AM
To: 'Krock, Matthew R (Matt)'
Subject: If you are interested in some editing

Attachments: water in fuel communciation draft 10-12.doc

Any input you would be willing to provide I would more than appreciate.

water in fuel
communciation dr...

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

How To take care of your Fuel system so It takes care of you.

Your high pressure fuel system uses diesel fuel for lubricity and cooling and is designed to use only Ultra Low Sulfur Diesel fuel containing no more than 5% biodiesel, other fuels and water can cause the pump to fail due to lack of lubricity/cooling aggressive chemical attack of fuel system materials.

Where does water come from and What does it do to the high pressure fuel system?

Water and impurities can enter your tank with the fuel. Water does not burn, water carries oxygen is Corrosive and it freezes. It robs the engine of B.T.U.'s, and can create deposit which are extremely harmful to the engine. Water also acts as a host to bacterial formation at the site where the water molecule interfaces with a fuel molecule.

How do we get rid of water?

Your horizontal fuel condition module (HFCM) is there to remove water and impurities from the fuel before it goes to the high pressure pump. For your HFCM to remove the water from the fuel your filters need to be changed by the recommended service interval. If your filters are not changed it will decrease the water separation ability and or it can cause the filters to become plugged or collapsed and allow water/impurities to the fuel system or starve fuel flow to the high pressure fuel system causing high pressure pump falure due to low lubrication. Your vehicle is equipped with two fuel filters; one is mounted on top of the engine the other is inside the HFCM. Separate the water from the fuel. It's easier and much cheaper to replace the filters than replace the high pressure fuel system.

The HFCM needs to be drained once a month or when the water in fuel light illuminates. If the water is not drained when the HFCM container is filled it has no where else to go but to the high pressure pump. Water does not have the lubricant properties of diesel fuel and will corrode the pump. When draining your water separator do not have the engine running and wait at least 10 minutes after shutting off the vehicle for the pressure to equalize in order for the water to drain.

What happens if water gets into the high pressure fuel system?

If the water is not drained or if the filters are not changed or if fuel additives with water dispersants or emulsifier are used your fuel system will eventually look like this. And the whole high pressure fuel system will have to be replaced.

What about fuel additives?

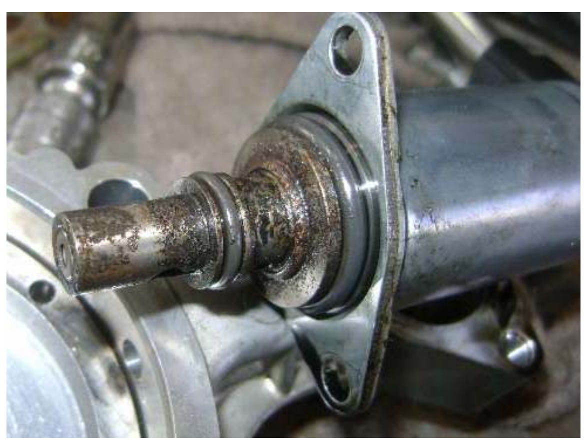
Additives or alcohol/gasohol that causes water to disperse/emulsify or not be separated from the diesel fuel will damage your fuel system. The purpose of the filters is to be able to remove the water if chemicals are holding the water in the fuel it can not be separated. Dispersing/emuslfying the water sends it to your fuel system, exactly where you do not want it to be, it tries to carry the water through the filters and water separators. Do not use alcohol based additives to correct fuel gelling.

It should not be necessary to add any aftermarket additives to your fuel tank if you use diesel fuel that meets the ASTM D 975 industry specification. If you want to use a fuel additive use only recommended fuel additives meeting ford specifications, Motorcraft parts are designed to meet Ford specifications. Alcohol and other fuel do not provide enough lubricant for the high pressure fuel pump and water will cause rust and corrosion to form in your high pressure fuel system this will cause the high pressure fuel system to fail and ultimately the whole system will need to be replace.

Additives that will improve fuel cetane numbers may be used to verify/enhance fuel quality. Use Motorcraft Cetane Booster & Performance Improver, PM-22-A (U.S.) / PM-22-B (Canada) or
equivalent. The customer warranty may be void from using additives that do not meet or exceed Ford specifications.

BIODIESEL

Concentrations greater than 5% can also cause fuel filter restrictions that may result in a lack of power and or damage to components such as fuel tank, fuel lines, fuel pump, fuel sender and fuel injectors fuel pump and fuel injector failures. Biodiesel should not be stored in the fuel tank for more than three months. Excessive Bio-diesel, poor bio-diesel fuel can cause bacterial/fungas growth, increased water content , aggressive chemical attack of fuel system material, premature fuel filter plugging and fuel starvation due to cold gelling.



What about other fuels besides Diesel or biodiesl 5%?

The high pressure fuel system uses diesel fuel for lubricity and cooling, other fuels can cause the pump to fail due to lack of lubricity/cooling aggressive chemical attack of fuel system materials. The tank pick up boot can distort with aggressive fuels, and cause air ingestion.

Do not use Raw or refined vegetable oil, animal fat, cooking oil or recycled greases should

Do not use home heating oil, agricultural fuel or any diesel fuel not intended for highway use. Damage to the fuel injection system, engine and exhaust catalyst can occur if an improper fuel is used. Do not add gasoline, gasohol or alcohol to diesel fuel. This practice creates a serious fire hazard and engine performance problems. Do not blend used engine oil with diesel fuel under any circumstances. Blending used oil with the fuel will significantly increase your vehicle's exhaust emissions and reduce engine life due to increased internal wear. The customer warranty may be void from using fuels that do not meet or exceed Ford specifications.

Running out of Fuel

Do not run your diesel vehicle out of fuel as this will allow air to enter the fuel system which will make restarting difficult. The engine is designed to run roughly as the fuel tank nears Empty. This is a warning to the driver to add fuel as soon as possible. Longer engine cranking time may be required once air is in the fuel system. If air enters the fuel system (either through running the fuel tank(s) empty or during a fuel filter change), the engine will self-purge the trapped air once it starts running.

Description	Benefits	Risks	Risk Management	Actions / Investigations Required	Assignments: Department	Person	Activity	Results
Electric pump	Eliminates ITP components - wear items	Long-term injector performance		Dyno test				
	Eliminates ITP as opportunity for debris in HP fuel system	Long-term electric pump performance		Calibration required for P0087 / P0088 monitor	FoM Calibration	Enrique Remes		
	Lower cost repeat repair	Fuel leaks		MAP / Compare ITP to electric pumpm - investigate P0087 / P0088 events	FoM Technical Support	Eduardo Santiago	Record DTC setting with INCA or ADR or MCS1 - See Enrique Remes or John Frase for parameters to be recorded	
		Introduction of debris		Design review				
		Cost						
		Pump control calibration						
		Packaging and service						
		Replication of ITP flow map						
Rebalance recirculation flow	Lower fuel temperature / retain fuel lubricity	Reduction in water separation capability		Fuel coolant pump calibration	FoM Calibration	Enrique Remes		
	Low cost	Increase flow through primary engine filter - accelerate loading		Screening DOE	Diesel OPD	Ted Mull	Screen DOE on truck Run dry test Check valve 1/16 inch hole Trailer tow	
	Precision not required	Filter deformation caused by increased localized heat - need shield - cost	Ted - Investigage with Alan Reaume	Noise factor DOE / Dyno needed	Diesel OPD	Ted Mull	Define wind tunnel test - with Chyo Schedule wind tunnel for factors limits and noise factor assesments	
	Cleanliness less critical	Insufficient fuel supply pressure to HP pump	Ted - Wind tunnel	Design review	Diesel OPD	Ted Mull / Tim Chyo		
	Improve WIF separation	Reverse flow in HP pump return loop under normal conditions or loaded filters	Ted - Investigate check valve, etc.					
	Decrease rate of cooling loop filter loading / split with external element							
2 HFCM / fuel return flow full recirculation	Eliminates ITP components - wear items	Introduction of debris		Need revised concept schematics	LGDEE PD	Tim Chyo	Provide concept schematics and BOM	
	Eliminates ITP as opportunity for debris in HP fuel system	Cost		Proof of concept	Diesel OPD	Tim Simpson	Install concept on vehicle	
	Lower fuel temperature / retain fuel lubricity	Packaging and service		Noise factor DOE / Dyno needed				
	Similar to benchmark	Replication of ITP flow map		Design review				
		Crash worthy						
		Pump control calibration						
P0087 / P0088	Prevent ITP from wear	Customer feedback		Calibration / software required	APTE or FoM Calibration	Arnold Kromberg or Enrique Remes	Provide FMEM strategy concepts	
	Protects HP fuel system from wear debris				Electronic Applications	Tom Erickson	Strategy proposal and quotation	
	Predicts supply system issues: - plugged filters - HFCM failure - gelling			Design review				
Lubricity Doser	Improve fuel lubricity factor / reduce risk of ITP wear	Accelerated filter loading		Determine suppliers	Diesel OPD	Scott Eeley		
	Reduce risk of ITP debris in fuel system	Cost		Review options	Diesel OPD	Scott Eeley		
		Long lead to market		Design review	Diesel OPD	Scott Eeley		
		Deposit formation in HP pump or injectors						
		Customer acceptance - maintenance						
Lubricity Additive	Improve fuel lubricity factor / reduce risk of ITP wear	Accelerated filter loading		Determine suppliers	Diesel OPD	Scott Eeley	Contact Ron Romano - FCSD Lubes and Chuck Richardson - PD Lubes	
	Reduce risk of ITP debris in fuel system	Cost		Review available Motorcraft products	Diesel OPD	Scott Eeley	Arrange product reviews of PM-15 and PM-22/23	
		Deposit formation in HP pump or injectors		Issue SSM	Diesel OPD	Scott Eeley		
		Customer acceptance - maintenance		Design review				

Actions / Investigations Required	Assignments			
	Department	Person	Activity	Results
Low lubricity DOE runs	FoM Quality	David Mondragon	Run all low lubricity DOE interactions Run end point first in order **Do not begin DOE till fuel lubricity is determined**	
High lubricity DOE runs	Diesel OPD	Tim Simpson	Run all high lubricity DOE interactions	
Aquire and set-up test pumps	Diesel OPD	Tim Simpson	EMDO - pre-test measurements	
			Pump wear-in	
			Send 4 pumps to FoM	
Replicate pump failure to be used with improvement concepts	FoM Quality	David Mondragon	Run DOE end point first	
Improvement concepts - Demonstrate betterment	FoM Quality	David Mondragon	**Pending DOE and proof of concepts**	
			Electric pump	
			Rebalance recirculation flow	
			2 HFCM / fuel return flow full recirculation	
			Lubricity Additive	
			Lubricity Doser	
Test fuel	FoM Quality	David Mondragon	Obtain and store 200 gallons test fuel - low lubricity Alternative - obtain fuel for each test run and send samples of fuel for each test run	
			Send sample of test fuel to Ted Mull	
Test fuel	Diesel OPD	Ted Mull	Obtain and store 200 gallons test fuel - high lubricity Alternative - obtain fuel for each test run and test lubricity	
			Test fuel lubricity	

Executive Summary Water in Fuel Special Study

Based on the results of the water in fuel study requested by the Technical Hotline, the recommendation is 6.4L high pressure fuel pumps that have internal corrosion/rust under the ITP are not warrantable.

When a vehicle is diagnosed at the dealer with debris in the fuel system (after performing step 28 from the PCED) the fuel system has been damaged requiring full fuel system replacement. At this time the secondary on engine fuel filter housing can be inspected for corrosion/rust, if corrosion/rust is present in the on engine fuel filter housing there is a 77%* opportunity the high pressure pump will have rust or corrosion. When corrosion/rust in the housing is found this is an opportune time to involve the customer in the process and raise the item that the repair may not be covered by warranty. If the secondary on engine fuel filter housing does not have corrosion/rust there is still a 71% *opportunity the high pressure pump has internal corrosion/rust. From the water in fuel study 75%* of all samples had corrosion/rust in the high pressure pump and are not recommended to be covered by warranty. Corrosion in the pump proves water damage the high pressure fuel pump. Once corrosion begins to occur particulates are generated leading to full fuel system contamination and damage. (*number decreased to project for opportunity for error in the assessment at the dealer).

The 6.4L fuel system has ample system in place to identify and prevent water from reaching the high pressure fuel system, when it is operated and maintained per the owner's manual. The customer must use fuel meeting ASTM standard for Diesel fuel, must not use alchohol/gasoline non approved fuels or non-approved additives. The HFCM has more than adequate volume to contain fuel that meets ASTM standard. If the fuel is at the industry average 0.0058% by volume for water in fuel the light will turn on between 78 tanks and 164 tanks, and need to be drained between 120 and 252 tanks of fuel (71.9L tank and 151L tank respectfully). If the fuel is at the maximum ASTM 0.05% water by volume standard for water in fuel the HFCM will need to be drained every 3-1.3 tanks of fuel (71.9L and 151L tank respectfully). The customer must maintain the fuel filter in the hfcm by the operating conditions in the owners manual. The customer must drain the HFCM monthly and when WIF light illuminate per the owners manual. The Cal bundle 2 will provide additional inducements to drain the HFCM and information available to the technician. The customer must also maintain the secondary on engine fuel filter.

In reference to Diesel High Pressure Design, the high pressure fuel pump is lubricated and cooled by the diesel fuel. Good lubricant qualities, the absence of free water, low dirt content are characteristics particularly important for the service life and consistent function of fuel injection systems (pg 34). "Free water, .. which cannot be dissolved in the fuel, can cause damage to fuel-lubricated injection pumps within a very short space of time and even when it present only in very small quantities." "Diesel and water emulsions are not suitable for modern fuel injection systems. For that reason they can not be sold on the open market. In many such systems, the fuel temperature can exceed 100 C, meaning that the water would vaporize and subsequently condense as free water within the fuel system." (pg39). Bosch Diesel-Engine Management 3rd Edition

The principles of corrosion were reviewed: Corrosion is the attack of a metal due to an electrochemical reaction (generally oxidation) with its environment. “Rust” is the corrosive attack of ferrous alloys. Being an electrochemical process, corrosion requires the presence of an electrolyte, water and oxygen. All three of these must be continue to be supplied or corrosion will not proceed to any significant extent.
The important non-ferrous alloys, aluminum and magnesium, form a **passive film** on exposure to water, **protecting the metals** from further corrosive attack. Impurities in aluminum and magnesium alloys (including the alloying elements themselves) **decrease** the corrosion resistance of the pure metals by allowing the formation of galvanic cells that accelerate the corrosion rate. Unlike ferrous alloys, the presence of dissolved oxygen does not effect the passivation or corrosion rate of non-ferrous alloys. Extremes in pH, both low and high, result in **increased** non-ferrous corrosion due to attack of the passive film which, like ferrous alloys, exposes fresh metal to the corrosive environment.The presence of dissolved salts in the electrolyte results in localized **pitting** corrosion, rather than increasing the uniform corrosion rate as in ferrous alloys.(courtesy G. Weber)

A fuel sample is not required to fail ASTM standards to prove water in fuel caused the damage based on the principles of corrosion.
1) A tank of fuel can not meet the ASTM standard but that does not prove it cause fuel system damage. An operator with proper fuel filter maintenance and draining the HFCM can prevent water from reaching the high pressure fuel system and system damage will not occur.
2) The current tank of fuel may not be the causal fuel. Tank may have been drained or previous tank of fuel may have caused the fuel system damage.

Executive Summary Water in Fuel Special Study

3)The fuel may meet ASTM standard but the customer does not drain the HFCM when indicated eventually filling HFCM capacity which will result in remaining water in the fuel having no where else to go but the fuel system.
4) Corrosion in the pump proves water entered and damage the high pressure fuel pump. Once corrosion begins to occur particulates are generated leading to full fuel system contamination and damage.

The remaining questions is there any other conditions which can create cause corrosion/rust in the high pressure fuel system, the only other causal is acid. The delineator is acid will rust the fuel tank, but water will not. Both conditions are caused by unacceptable fuel to the high pressure fuel system.

From: Heggie, Forest (F.)
Sent: Tuesday, October 12, 2010 3:03 PM
To: Eeley, Scott (A.)
Subject: One Page Executive Review WIF 10-12-10.doc

Attachments: One Page Executive Review WIF 10-12-10.doc

One Page
ecutive Review WIF

Executive Summary Water in Fuel Special Study

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In reference to Diesel High Pressure Design, the high pressure fuel pump is lubricated and cooled by the diesel fuel. Good lubricant qualities, the absence of free water, low dirt content are characteristics particularly important for the service life and consistent function of fuel injection systems (pg 34). "Free water, .. which cannot be dissolved in the fuel, can cause damage to fuel-lubricated injection pumps within a very short space of time and even when it present only in very small quantities." "Diesel and water emulsions are not suitable for modern fuel injection systems. For that reason they can not be sold on the open market. In many such systems, the fuel temperature can exceed 100 C, meaning that the water would vaporize and subsequently condense as free water within the fuel system." (pg39). Bosch Diesel-Engine Management 3rd Edition

The principles of corrosion were reviewed: Corrosion is the attack of a metal due to an electrochemical reaction (generally oxidation) with its environment. “Rust” is the corrosive attack of ferrous alloys. Being an electrochemical process, corrosion requires the presence of an electrolyte, water and oxygen. All three of these must be continue to be supplied or corrosion will not proceed to any significant extent.
The important non-ferrous alloys, aluminum and magnesium, form a **passive film** on exposure to water, **protecting the metals** from further corrosive attack. Impurities in aluminum and magnesium alloys (including the alloying elements themselves) **decrease** the corrosion resistance of the pure metals by allowing the formation of galvanic cells that accelerate the corrosion rate. Unlike ferrous alloys, the presence of dissolved oxygen does not effect the passivation or corrosion rate of non-ferrous alloys. Extremes in pH, both low and high, result in **increased** non-ferrous corrosion due to attack of the passive film which, like ferrous alloys, exposes fresh metal to the corrosive environment.The presence of dissolved salts in the electrolyte results in localized **pitting** corrosion, rather than increasing the uniform corrosion rate as in ferrous alloys.(courtesy G. Weber)

A fuel sample is not required to fail ASTM standards to prove water in fuel caused the damage based on the principles of corrosion.
1) A tank of fuel can not meet the ASTM standard but that does not prove it cause fuel system damage. An operator with proper fuel filter maintenance and draining the HFCM can prevent water from reaching the high pressure fuel system and system damage will not occur.
2) The current tank of fuel may not be the causal fuel. Tank may have been drained or previous tank of fuel may have caused the fuel system damage.

3)The fuel may meet ASTM standard but the customer does not drain the HFCM when indicated eventually filling HFCM capacity which will result in remaining water in the fuel having no where else to go but the fuel system.
4) Corrosion in the pump proves water entered and damage the high pressure fuel pump. Once corrosion begins to occur particulates are generated leading to full fuel system contamination and damage.

The remaining questions is there any other conditions which can create cause corrosion/rust in the high pressure fuel system, the only other causal is acid. The delineator is acid will rust the fuel tank, but water will not. Both conditions are caused by unacceptable fuel to the high pressure fuel system.

From: McDonagh, Scot (S.M.)
Sent: Friday, December 11, 2009 9:44 AM
To: Pekarscik, Brian (B.); Davis, Craig (C.B.); Armesto, Carlos (.); Espinoza, Bob (R.J.); Kromberg, Arnold (A.W.); Eeley, Scott (A.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Raney-Pablo, Beth (H.E.); McAllister, Derek (D.); Fulton, Brien (B.L.); Simpson, Timothy (T.A.)
Cc: Ricks, Kevin (K.J.); Polasek, John (J.A.); Neumann, Richard (R.E.); Dixon, Mark (M.R.); Lyon, Peter (P.M.); Horbal, Colin (C.P.)
Subject: P356 6.4L Diesel Pump & Injectors

Importance: High

Attachments: PCED_UPDATES.doc

<u>12/10/09 Meeting Minutes</u>

1) Rust in HP fuel system:
A) Update diagnostics for Water in Fuel concerns that lead to HPP & Injector replacements- Eeley/Simpson/Kromberg/Smith
B) Enclosed Word file contains proposed PCED diagnostic revisions

PCED_UPDATES.doc

2) WIF system failure to indicate:
A) FCSD, NAD and PT Fuel engineering requesting WIF content(eliminate key cycle resets/P-code latch/WIF Derate) currently planned for R57 Phase II be pulled ahead into R57 Phase I releases- 4/16/10 Kromberg/Fulton/Lyon

3) WIF Light with no water present:
A) FCSD Emerging Concern- CQIS report count at (40) with QSF threshold of (75) reports
B) P356 PCE and Diesel Hotline SME agreed to provide CQIS reports to PT Engineering- Pekarscik/McAllister
C) PT Fuel Engineering would prefer local vehicle for dealer visit
D) (1) WIF sensor received to date was determined to be TNI/NPF

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

EA11-003 000217

Amend PPT O or Add to O3 ?

O2 : CHECK FOR WATER OR CONTAMINANTS IN THE FUEL

NOTE: The fuel sample should fill the 0.95 L (1 quart) clear container half full. Flow out of the fuel drain should be a steady stream. Insufficient flow may indicate a fuel drain restriction or contaminants blocking the fuel drain. Repair as necessary.

NOTE: Inspect the fuel sample in the clear container. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container. Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.** Open the fuel conditioning module drain valve and fill the clear container until it is half full. Close the drain valve. Inspect the fuel sample for water or contaminants. Is water or contaminants present in the fuel sample in the clear container?

PPT M - (P2291 and P0087 - low injection pressure DTC's) sends our tech to 10. Sufficient Clean Fuel Test in Diagnostic Subroutines.

Recommended Procedure:

Open the drain valve integrated in the fuel conditioning module and drain fuel into a clear 1 liter container. Close the drain valve. The flow out of the drain valve should be steady and should produce at least 1 liter/1 quart of fuel within 2 minutes. If the volume of the fuel collected within 2 minutes is short of the required 1 liter/1 quart there may be insufficient amount of fuel in the tank and the fuel level may not be correctly indicated on the fuel level gauge. If a fuel level indication concern is suspected, refer to the Workshop Manual Section 413-01 to continue diagnosis.

Observe the WIF indicator. If the indicator is illuminated, the fuel may be contaminated with water.

Inspect the fuel sample in the clear container. Dyed red or blue fuel indicates off-highway fuel. The fuel sample should be clear, not cloudy. Some water and contaminants may be present in the fuel sample if the fuel filter has not been replaced recently. If water in the fuel is present, the water will separate from the fuel and condense in the bottom of the clear container. Contaminants may appear in the form of sludge, dirt or metallic corrosion particles in the fuel sample. If the fuel sample is cloudy, the fuel is aerated or emulsified with water. ~~If the fuel sample is aerated, refer to Section 4, Performance Diagnostic Procedures and carry out the Fuel Aeration Test.~~ If the fuel sample is emulsified, replace the fuel filters **and inspect the on-engine filter housing for rust and contaminants; flush the fuel supply system and tank of all water and contaminants. Rust in the on-engine housing indicates the presence of emulsified water in fuel or more than 115 ml of water had been in the fuel system.**

The fuel sample should not indicate evidence of waxing or gelling. Waxing or gelling in some fuels in cold weather could clog fuel filters and the fuel pump and cause restrictions in the fuel or low fuel pressure.

~~Some sediment and water may be present in the fuel sample if the fuel filter has not been replaced for a prolonged period of time or if the sediment and water have not been drained recently. If that is the case, a second sample may be required to determine fuel quality.~~

M3 : CARRY OUT THE SUFFICIENT CLEAN FUEL TEST
Carry out the Sufficient Clean Fuel Test. Refer to Section 4, Hard Start/No Start Diagnostic Procedures
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain. Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide..
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.

Is a concern present?
Yes
REPAIR as necessary.
CLEAR the DTCs. REPEAT the self-test.

Yes No
Click for details. Go to M4.

In PPT ME14 - - The final PPT of the HP pump

ME14 : CARRY OUT THE FUEL SYSTEM DEBRIS CHECK
Carry out the Fuel System Debris Check. Refer to Section 4, Hard Start/No Start Diagnostic Procedures.
Note: More than 115 ml water in the fuel system is abnormal and indicates excess water in the fuel supply chain. Failures caused by non-specified fuel are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: Failures caused by neglecting to drain the fuel conditioner when water in fuel light has been illuminated are not covered by Ford Motor Company Warranty - refer to Owners Guide.
Note: If the HP is replaced, remove the HP pump transfer pump (vane pump) cover and inspect mechanisms for rust. Rust indicates use of non-specified fuel.

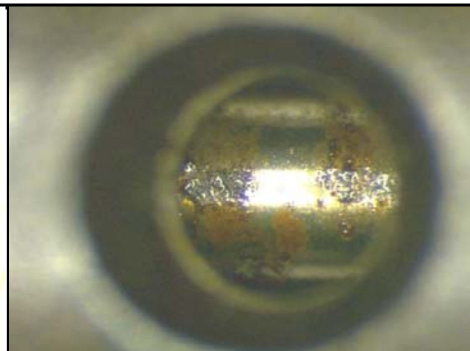
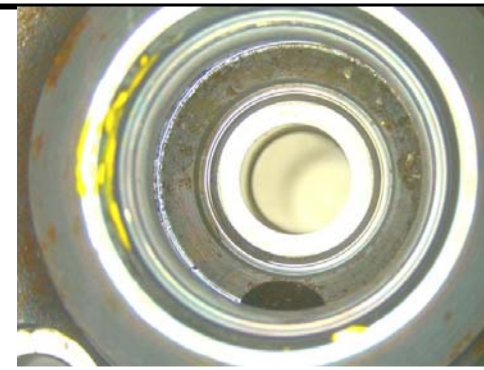
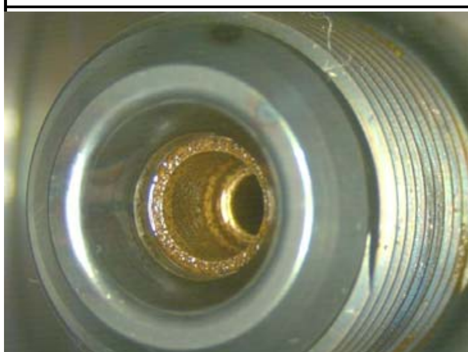
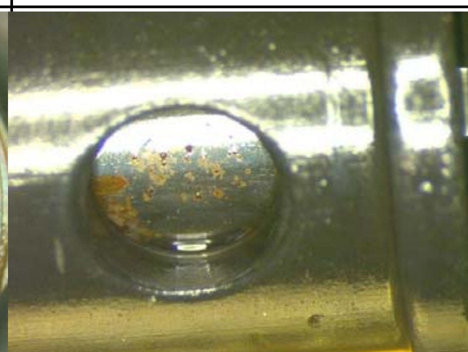
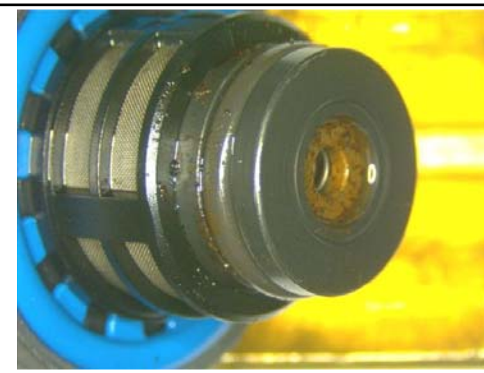
Is a concern present?

P473 HP Pump Corrosion / WIF

Brien Fulton

Ken Pumford
Carlos Armesto

Bosch Tear Down Analysis

			
SV cyl 1 top	SV cy1 valve stem	HP element 1	HP element cyl SV area
			
HP outlet cyl 1	KUEV Piston	MPROP	MPROP

P473 HP Pump Corrosion / WIF

Background

- Management Drive vehicle W790 had a high pressure fuel system failure 1/09.
  - Reported that the WIF light was illuminated on the vehicle
  - Other symptoms include DFCM noise due to high pressure – deadhead of the DFCM pump

Root Cause – Water Ingestion

- Excessive fuel pressure due to debris at the pressure regulator causing a pressure regulator failure
- High pressure pump showed corrosion on operating parts most likely due to water ingestion
- Other Root causes?

P473 HP Pump Corrosion / WIF

Current Scorpion Prevention and Detection

- Low Pressure Prevention
  - Low pressure fuel system DFCM has a water separator to remove water from the fuel and store that water in the reservoir
  - When water separator reservoir is full, the 2ndary filter will also separate water from the fuel until it has reached a saturation point.
- Low Pressure Detection
  - Low pressure fuel system DFCM has a WIF sensor to detect when the water reservoir has reached a level it is required to be drained
  - The signal from the WIF sensor is processed by the ECU and a message is sent to the message center to tell the driver to drain the water separator
  - Fuel delivery pressure switch is present at the end of the engine low pressure fuel system to detect low pressure conditions – Water in filters can freeze causing low pressure
- High Pressure Fuel System Detection
  - PCV / VCV duty cycle detection – After PCV or VCV have reached their respective control limits, the operating strategy is toggled between both actuators and a difference in duty cycle is detected.
    - Current thresholds are pretty generous as type B errors are as bad as actual errors.

P473 HP Pump Corrosion / WIF

Other options

- Graduated response with WIF light on time – only possible in short time
  - Implement actions to further alert the customer to the water drain condition.
    - Rough operation / reduced power / vehicle shutdown is done to the customer
    - Options were available for P356, but were not used and team was very against this option
- High pressure detection in LP fuel system
  - High fuel pressure caused the pressure regulator to fail in the high pressure fuel system
    - High pressure caused by debris in the pressure regulator, failure already happened and high pressure detection would not prevent failure as debris already in the pump
- Modification of Low Pressure fuel system
  - Larger water separation volume – may not be effective as WIF light was already reported (significant cost / packaging / timing issues)
  - Second coalescer and WIF sensor in 2ndary filter- again this may not be effective as WIF already reported (significant cost / packaging / timing issues)
  - Automatic water reservoir drain feature (significant cost / packaging / timing issues)
    - EPA issue of "where" to drain.
- Modification of High Pressure fuel system
  - Pump material change to be robust to water (significant cost / packaging / timing issues)

Question to Bosch

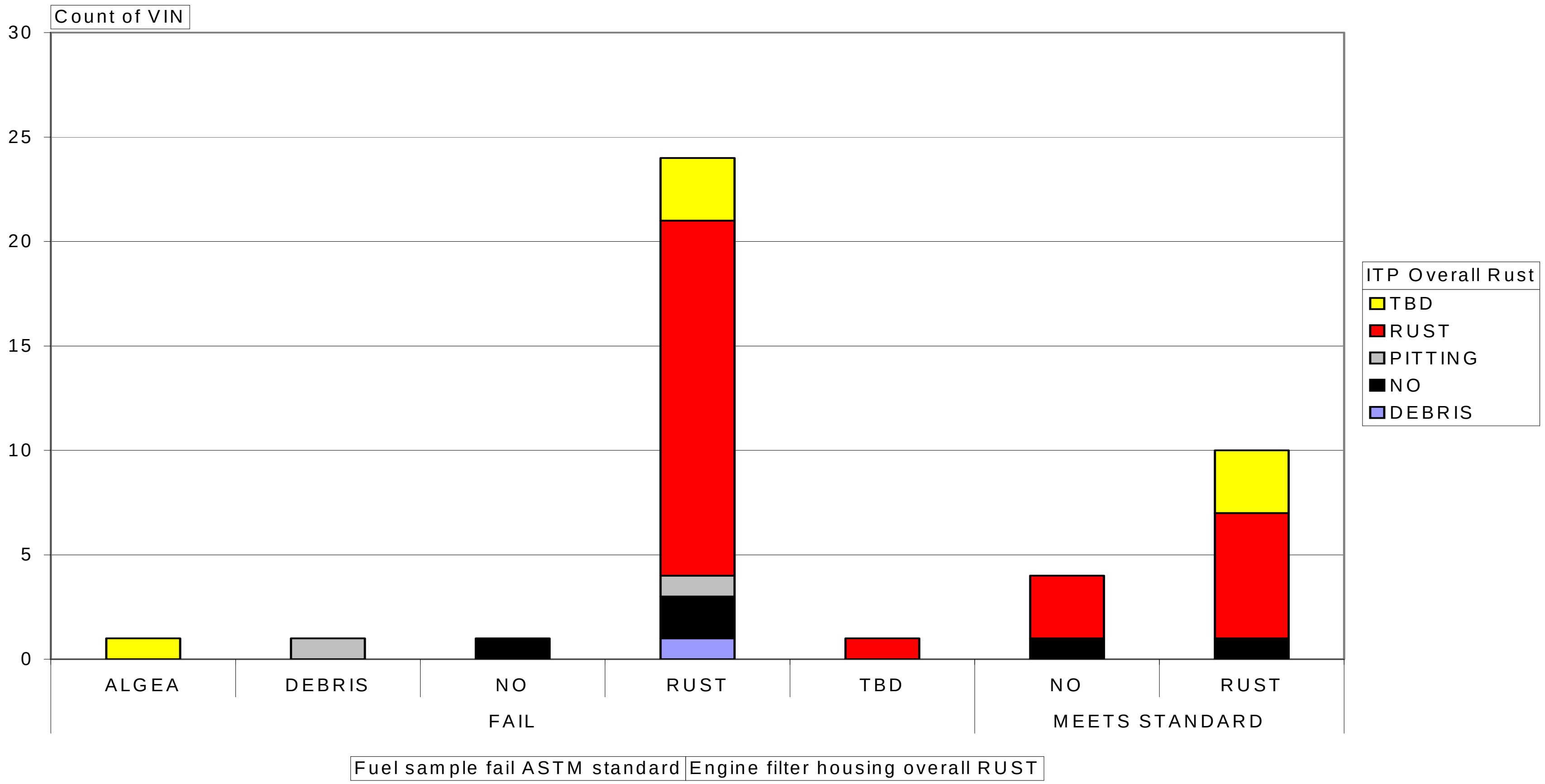
- One question the team had for Bosch was “how do we know that current permissible amount of water will not result in this type of corrosion”?

Bosch WIF testing

- Bosch tested 99% fuel 1% water (non-emulsified) per NACE TM0172 method
- Results are highly dependant on fuel mixture rest time in HP components
  - 6 hr run time, 0 hour rest – no issues
  - 12 hour, 18 hour – no issues
  - 18 hour, 36 hour – functionally OK, visual degradation on some units, failure on others
  - 24 hour, 54 hour – complete functional and mechanical failure

PHOTO REVIEW

Fuel Analysis – Housing – ITP

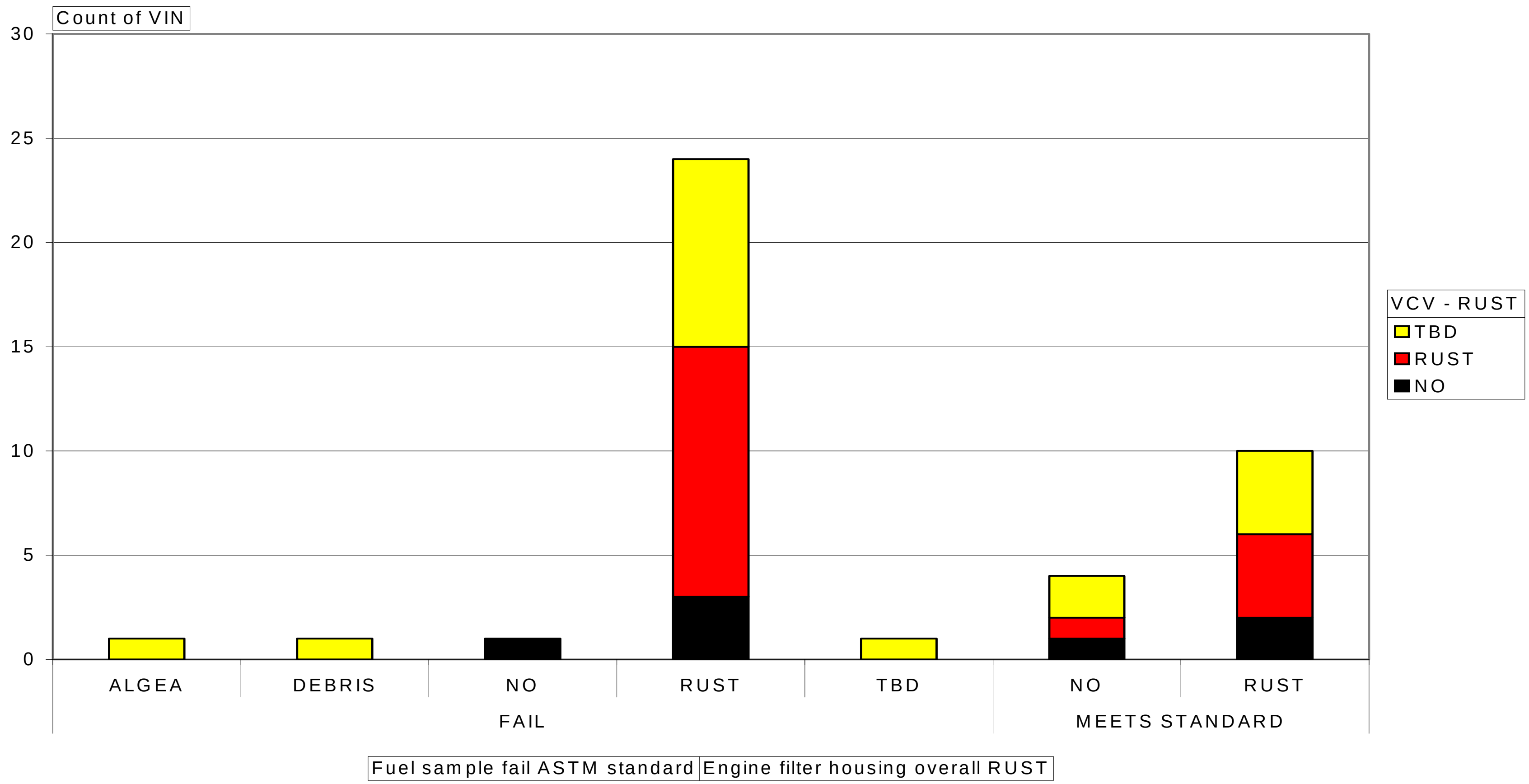


60 % (17/28) Fuel sample Fails ASTM standard, there is rust in the housing and rust in the ITP

64% (9/14) fuel sample Meets ASTM standard, there is rust in the housing and rust in the ITP

TBD included in the divisor therefore % may increase after part received and reviewed

Fuel Analysis – Housing – VCV

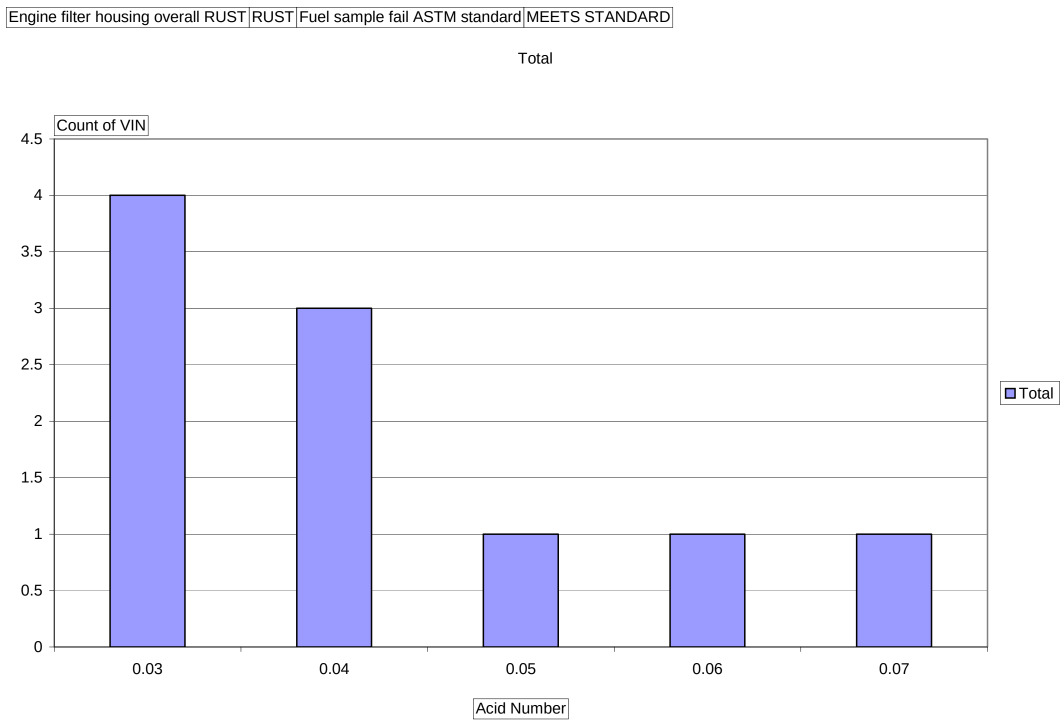


42 % (12/28) Fuel sample Fails ASTM standard, there is rust in the housing and rust in the VCV

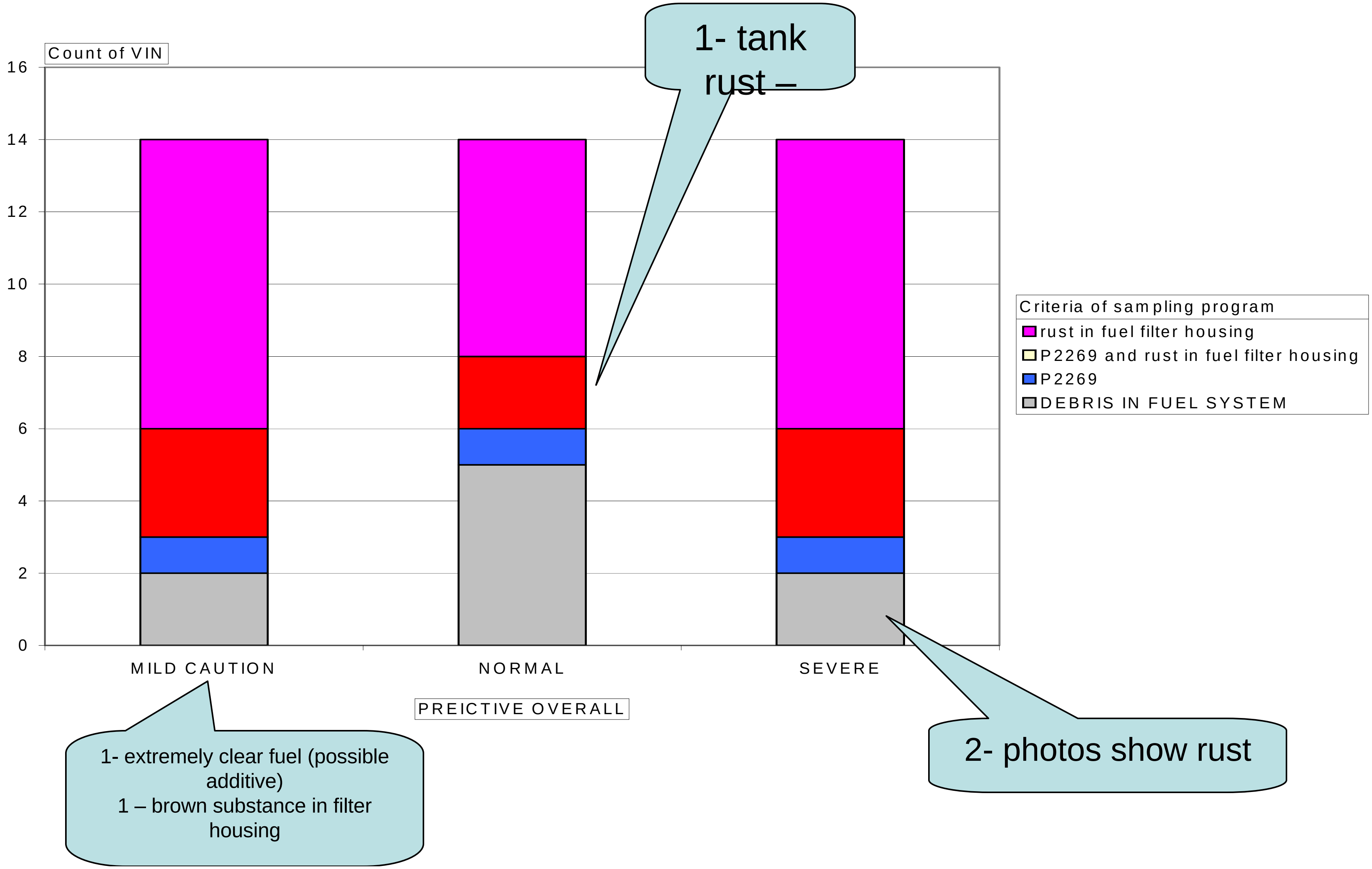
35% (5/14) fuel sample Meets ASTM standard, there is rust in the housing and rust in the VCV

TBD included in the divisor therefore % may increase after part received and reviewed

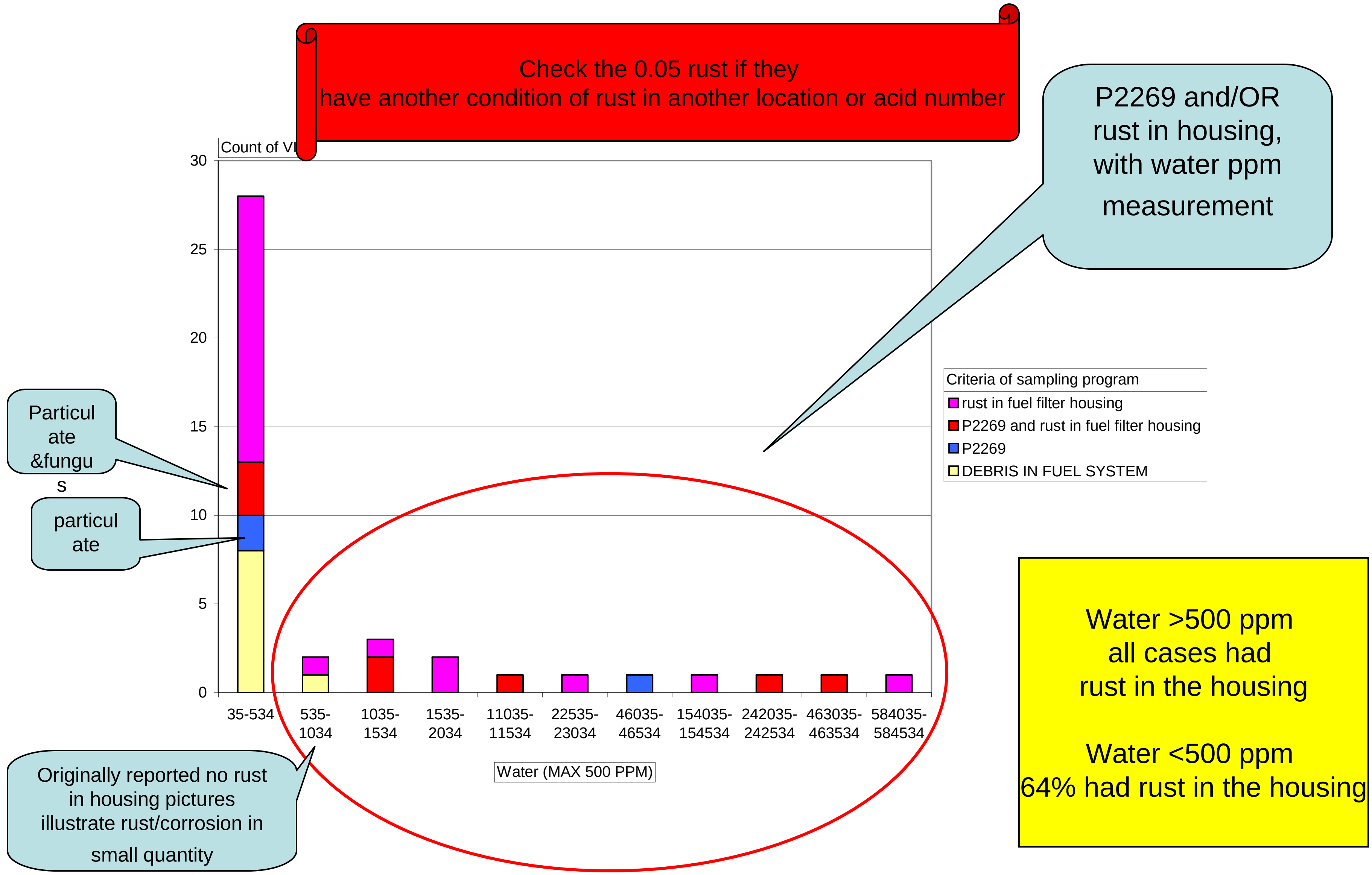
- Insert analysis of rust housing by tan and other criteria and oddity with respect to fuel samples meet criteria and rust in housing
- 1 – fuel tank and sender had rust (possible acid)
- 3 - P2269
- 7 – p0088
- 3- p2291



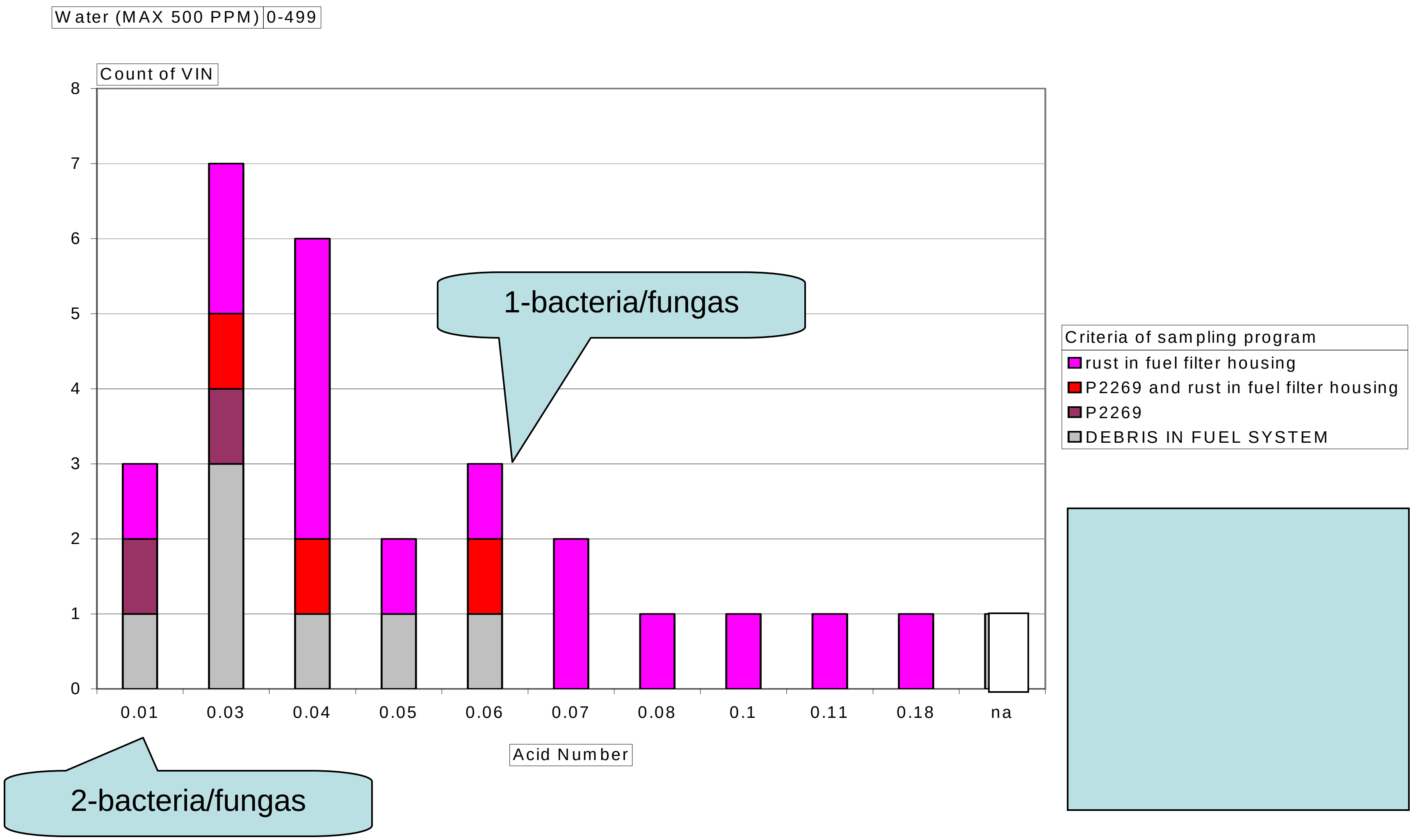
Selection Criteria with Respect to Fuel Sample Results



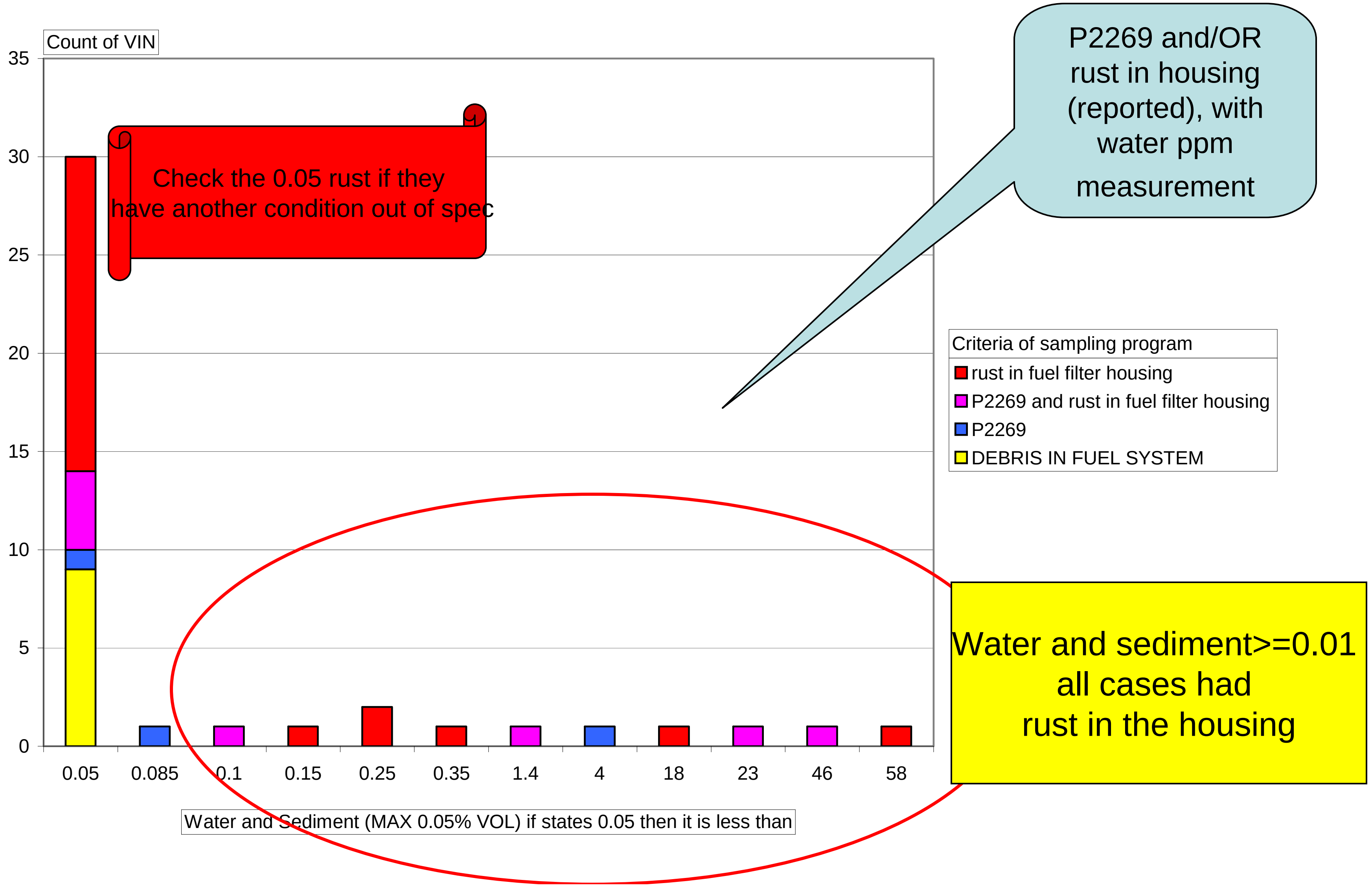
Selection Criteria vs Water in Fuel



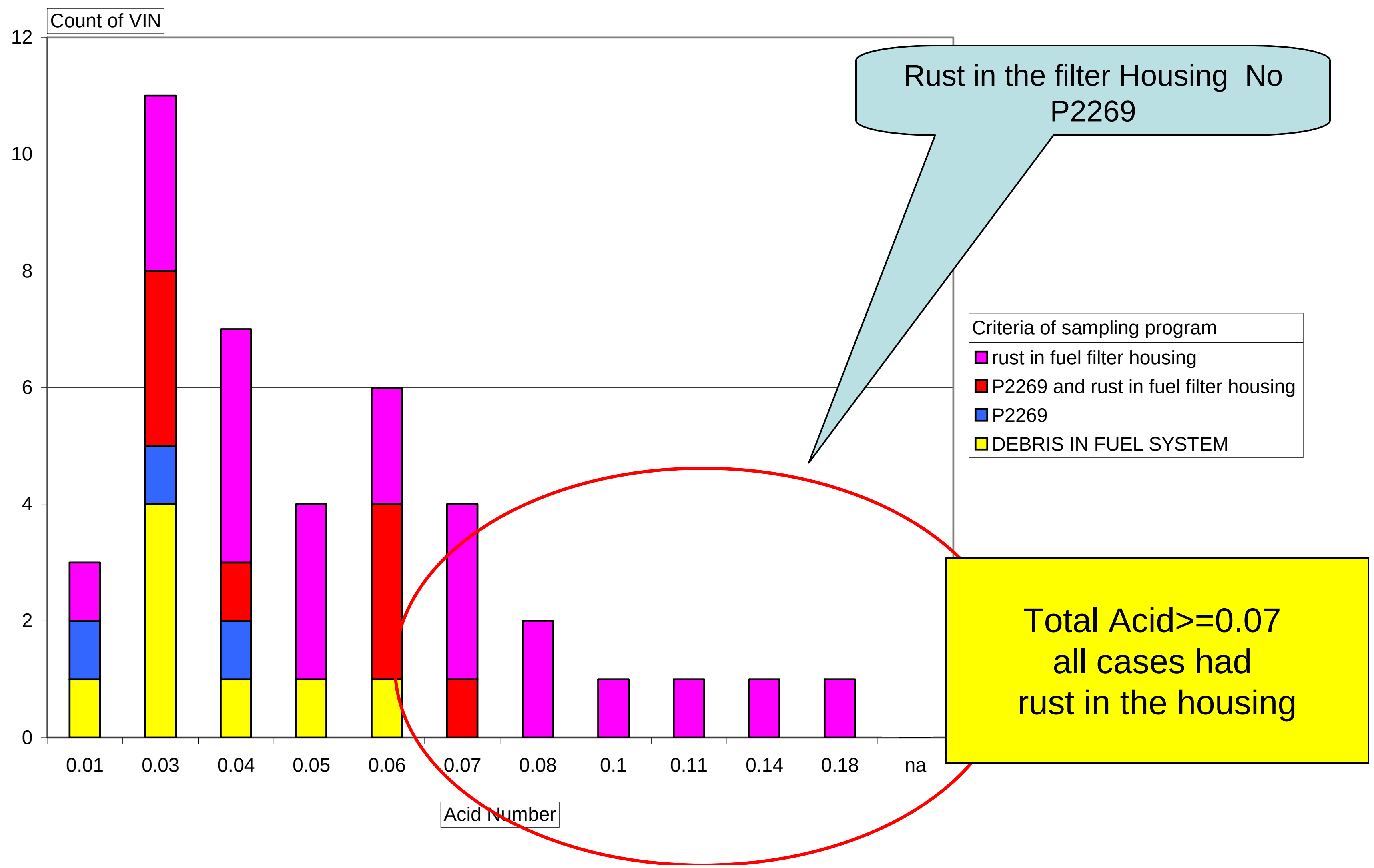
Sampling Critera <500 ppm Water wrt Acid Number



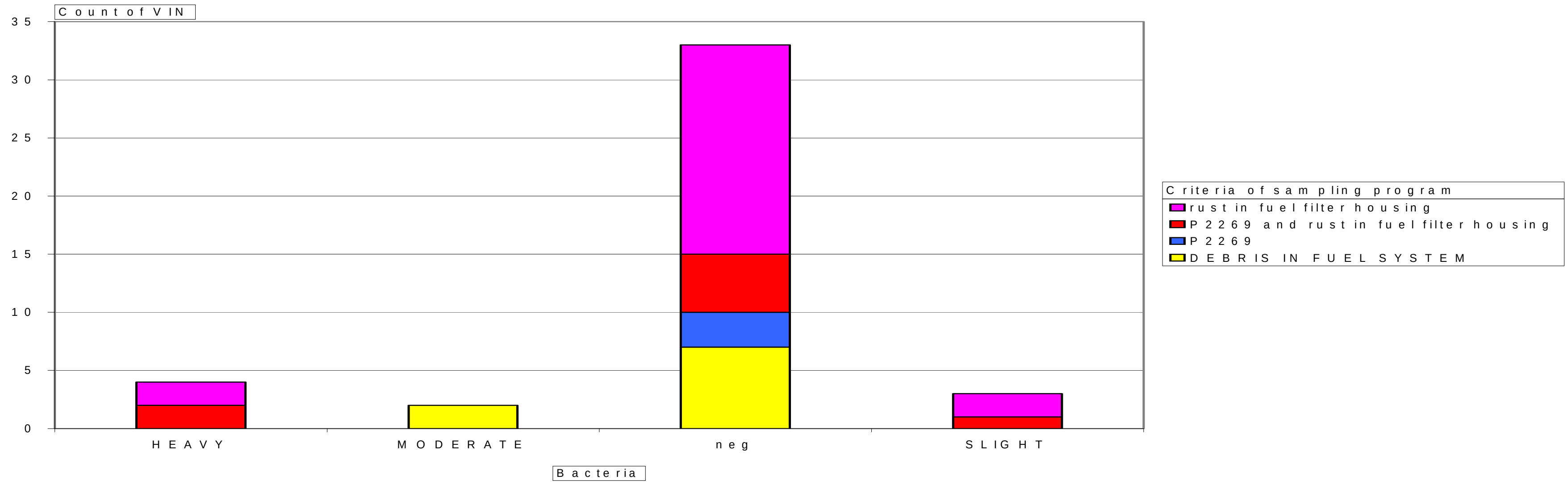
Selection Criteria vs Water and Sediment in fuel

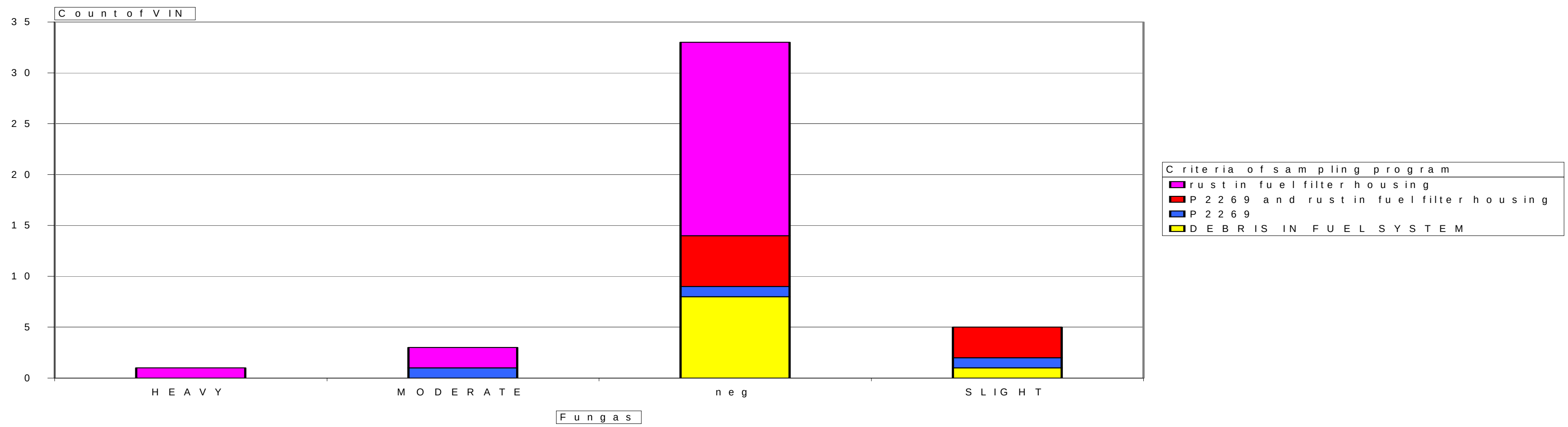


Selection Criteria vs Total Acid Number

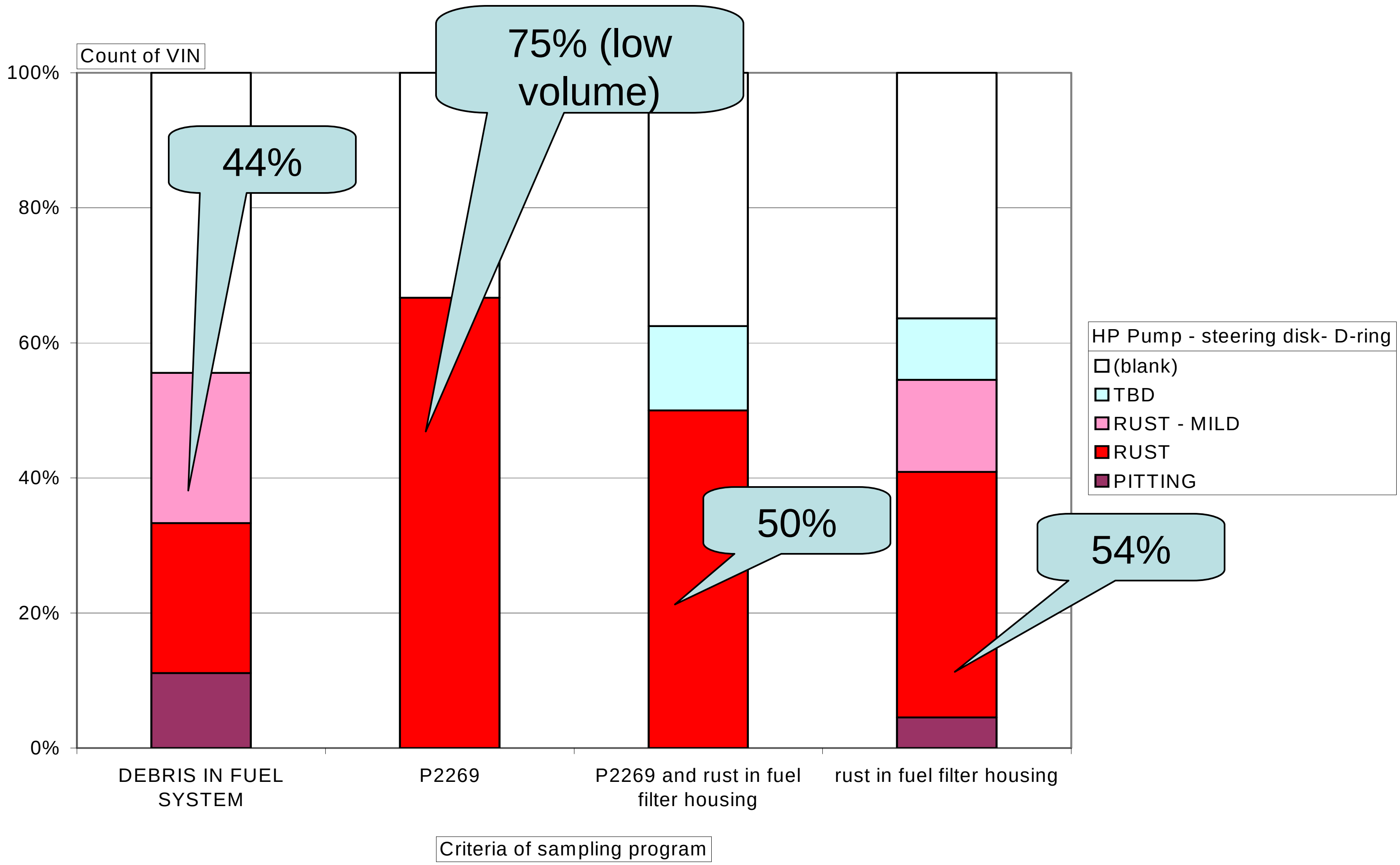


Selection Criteria vs Bacteria/Fungas



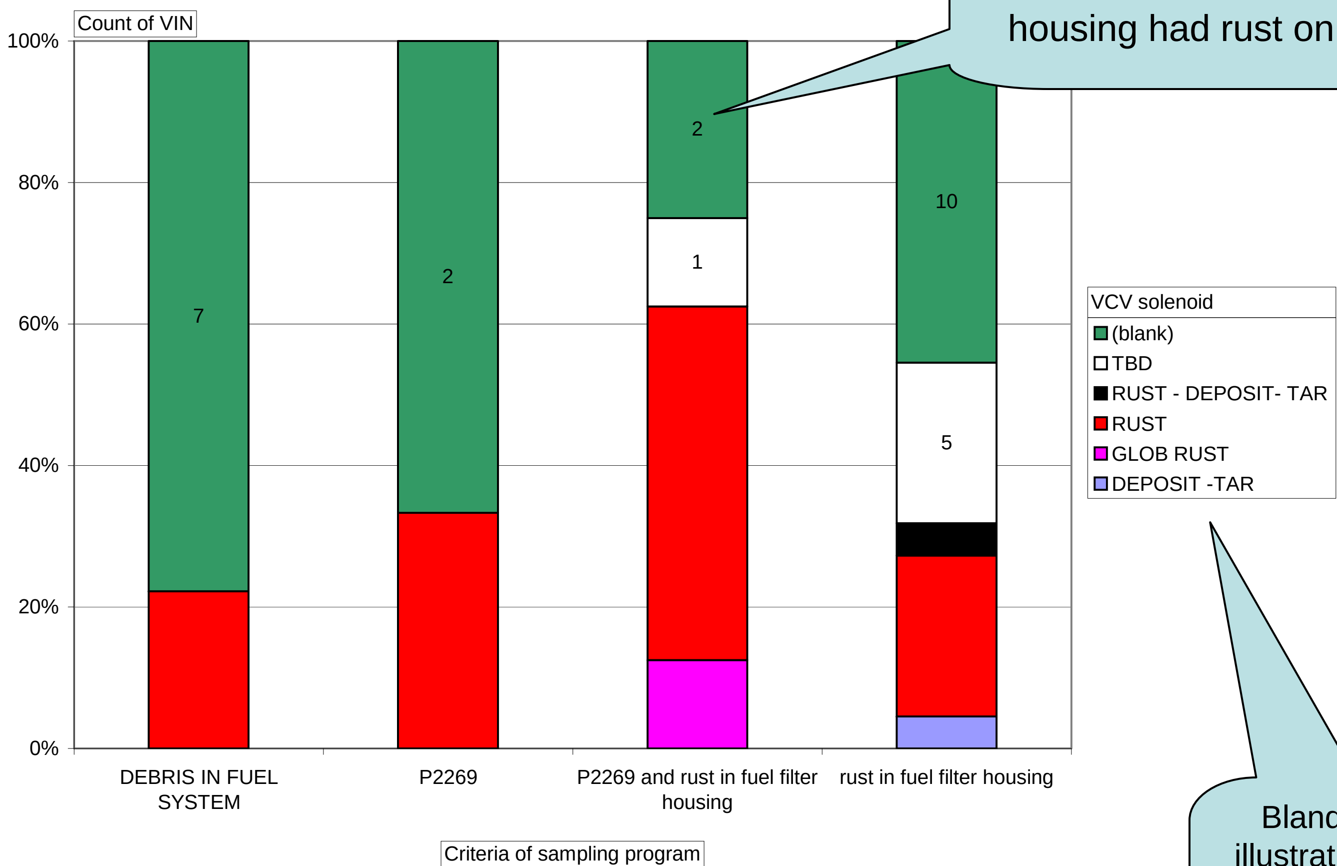


Selection Criteria vs % with Rust on ITP



Selection Criteria vs % with Rust on VCV

62% P2269 and rust in the housing had rust on the VCV



Bland no verbiage illustrating rust picture not clearly showing rust. Part needs to be reviewed upon receipt at WPAC

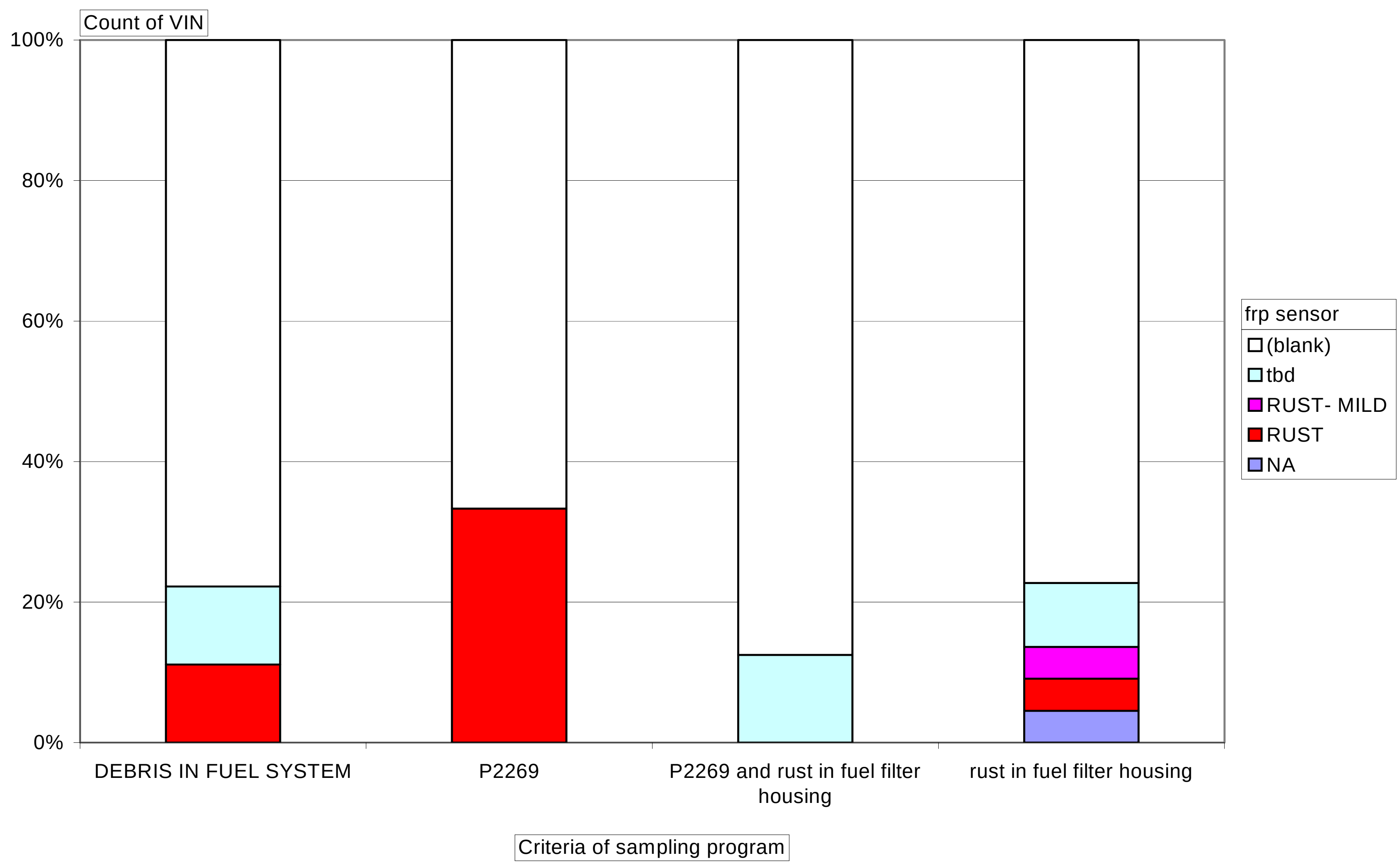
Mini study: housing and VCV submerged in standing water :

5 days –slight rust on housing fasteners and slight rust on VCV,

15 days slight rust on housing fasteners , VCV completely covered in rust

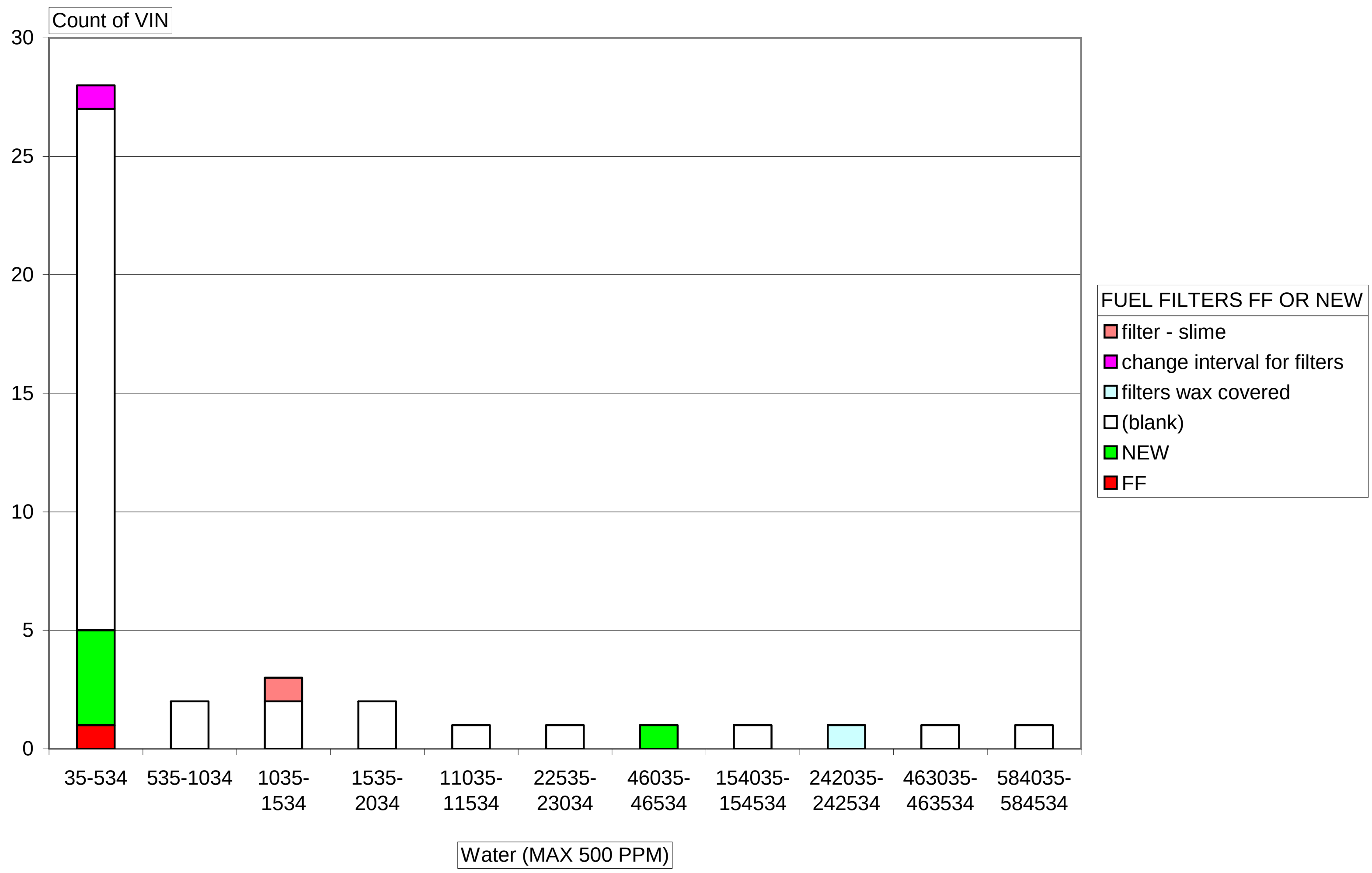
Expectation would be to always have rust on VCV if housing has rust :

Selection Criteria vs % with Rust on FRP

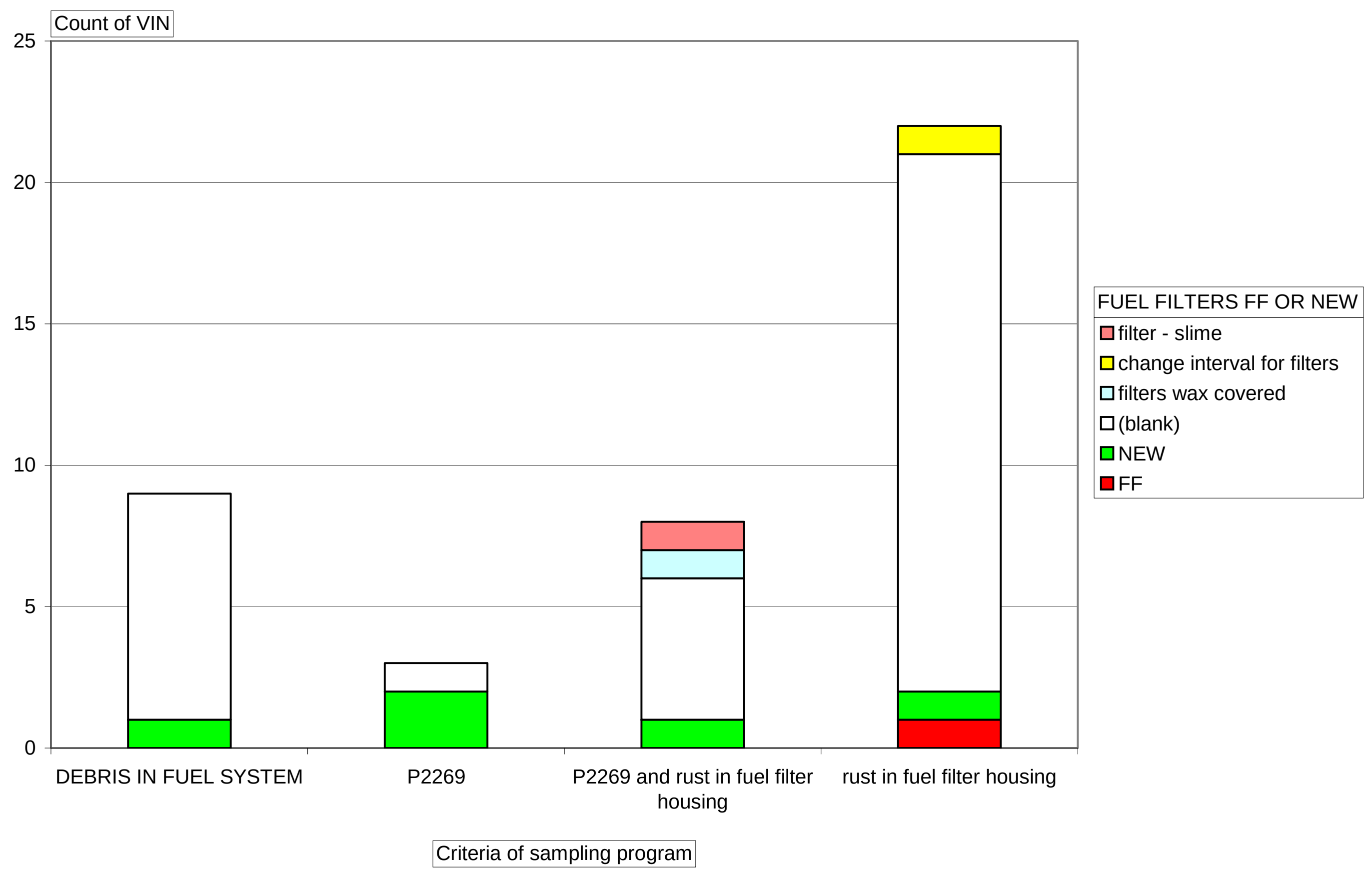


Analysis with respect to Reported Fuel Filter Status

FF status vs Water in fuel measurement

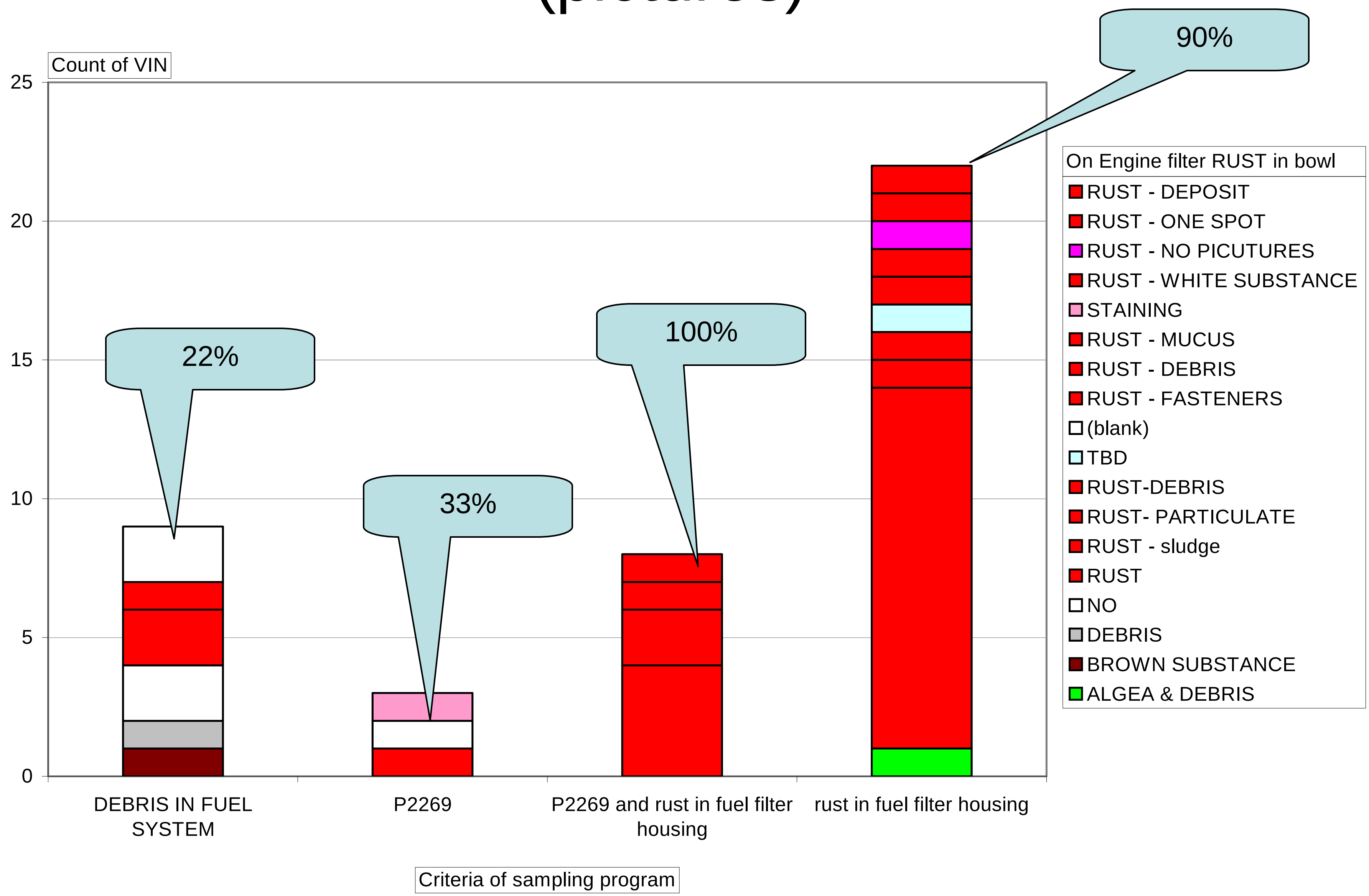


Fuel Filter reported condition vs Sampling criteria

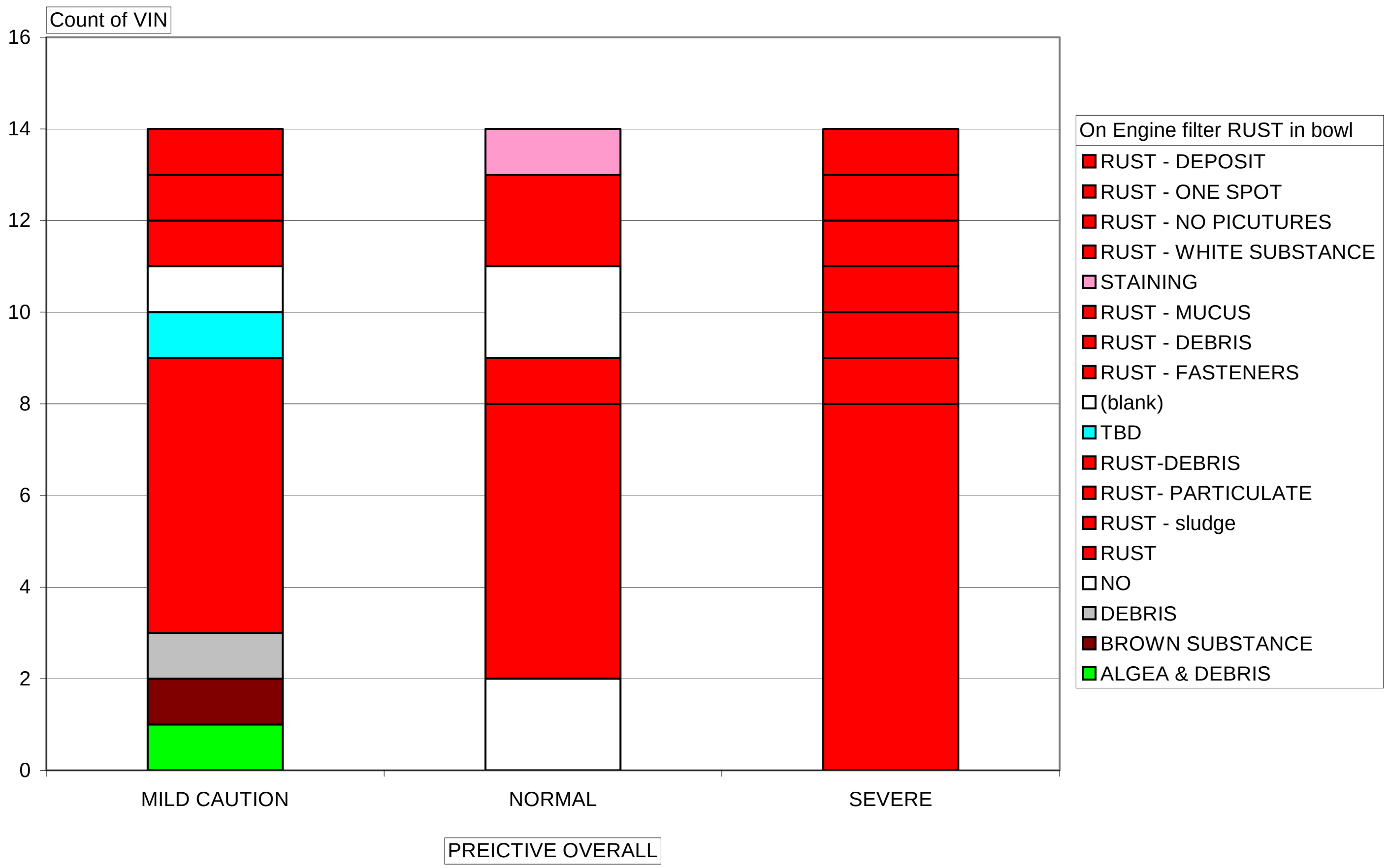


Analysis with respect to Photos of Rust in Locations

Selection Criteria vs Rust in Housing Filter (pictures)



Rust in Housing vs Fuel Sample Overall Criteria

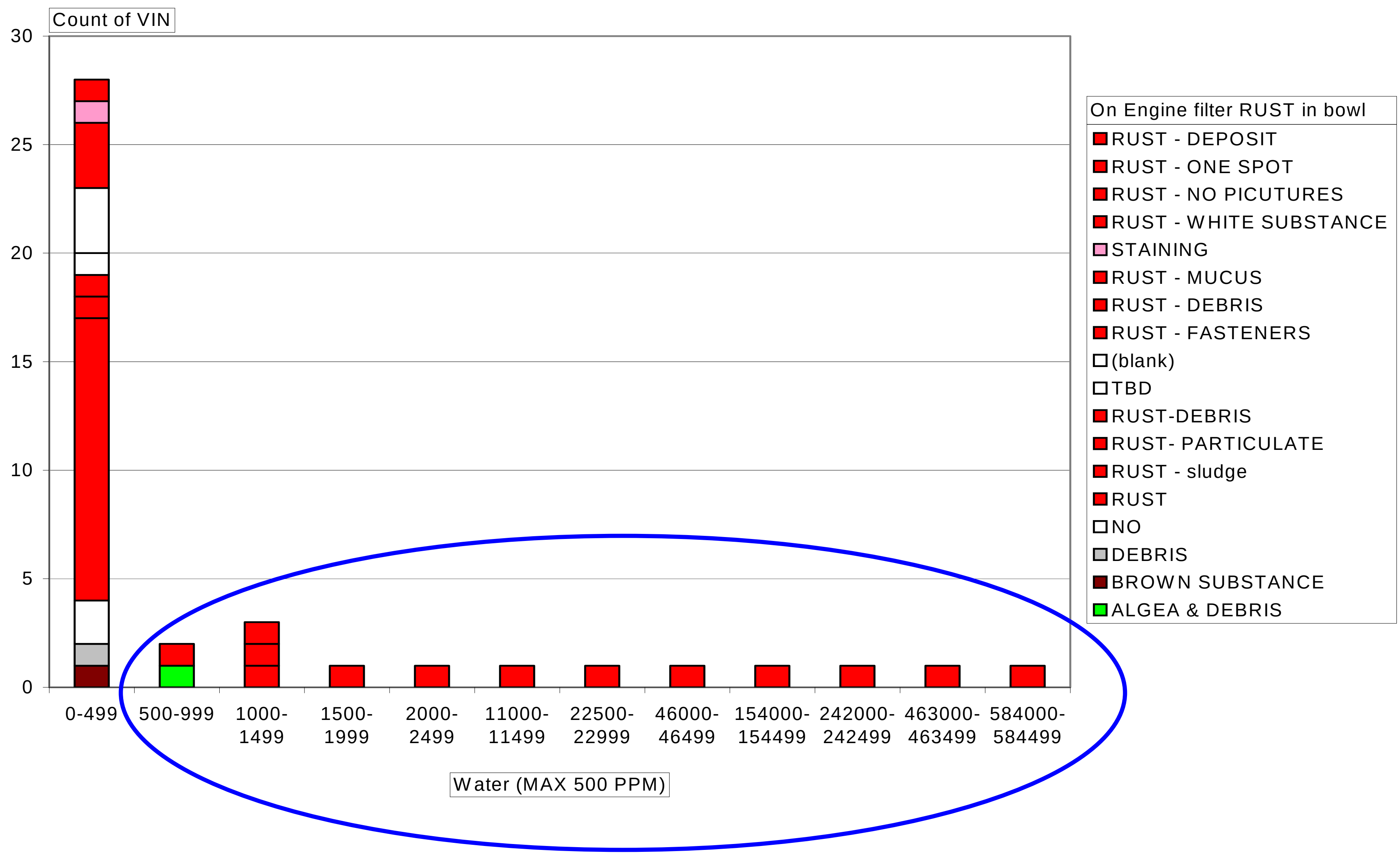


Rust in Housing and Mild or Severe Caution = 60% of all samples would be rejected

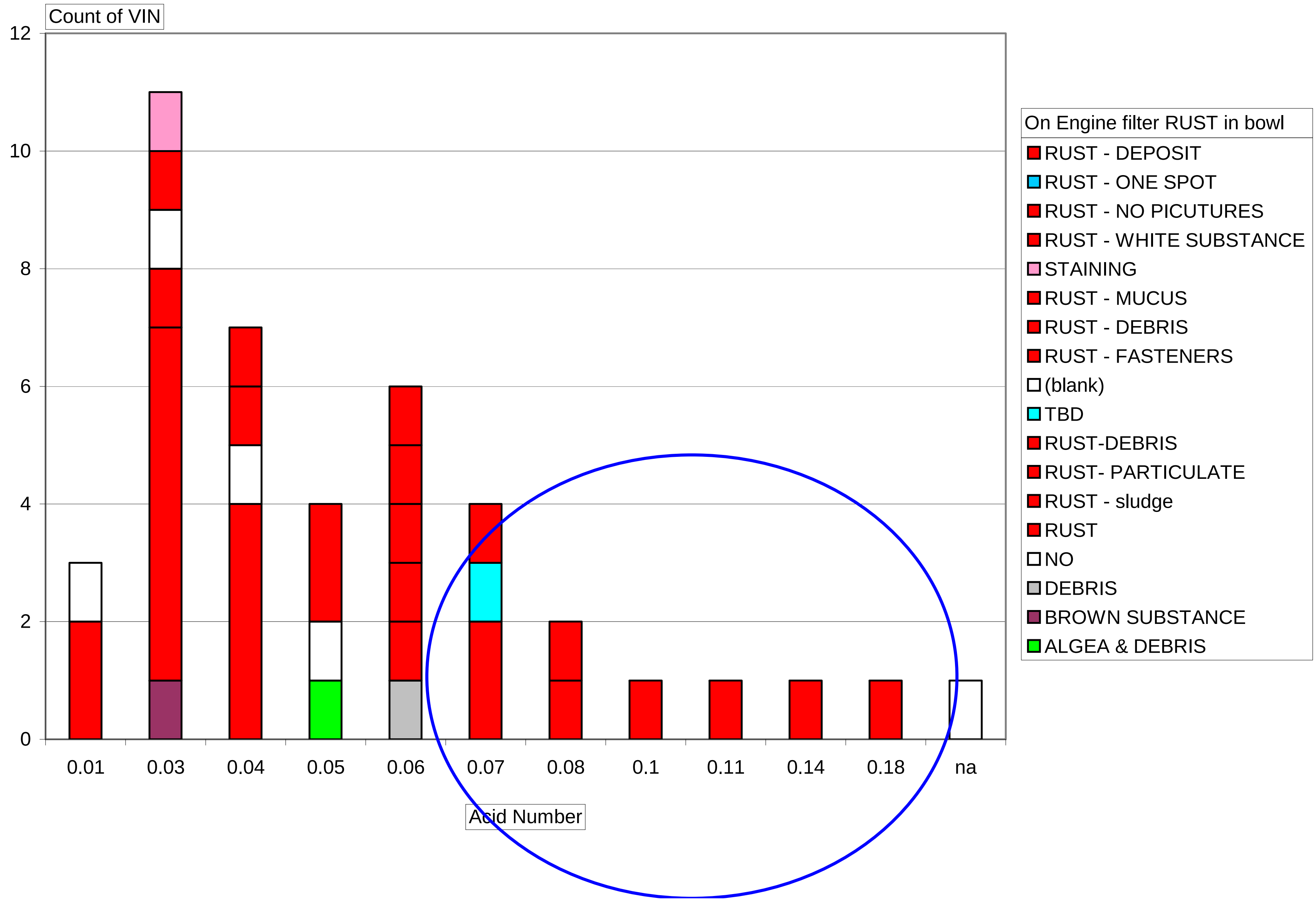
Mild or Sever Caution and NO rust in housing = 7% (difference)

Normal fuel = 33%, Rust in Housing and Normal fuel = 24%

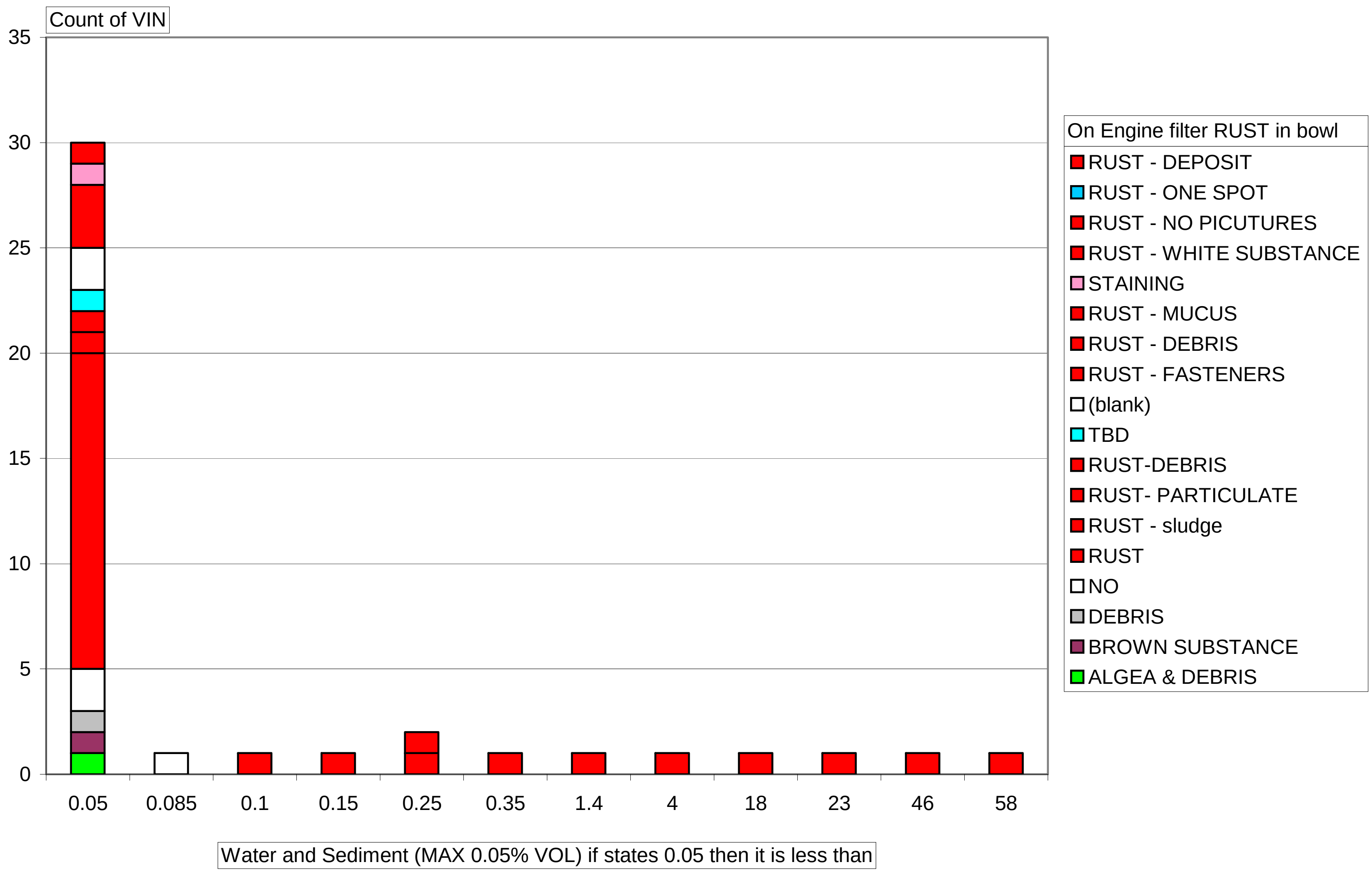
Rust in Housing vs Water in Fuel

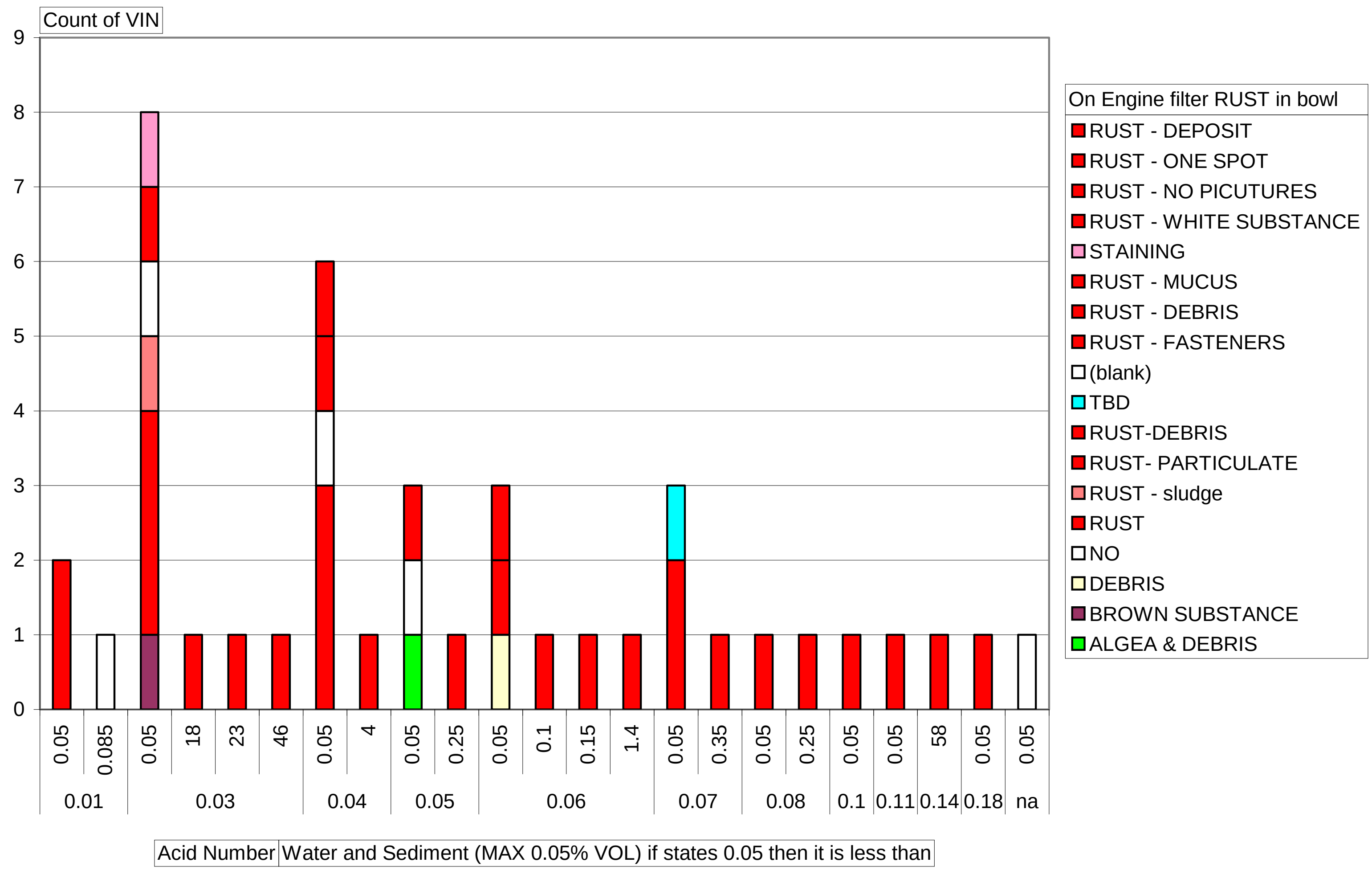


Rust Fuel Filter Housing vs Acid Number



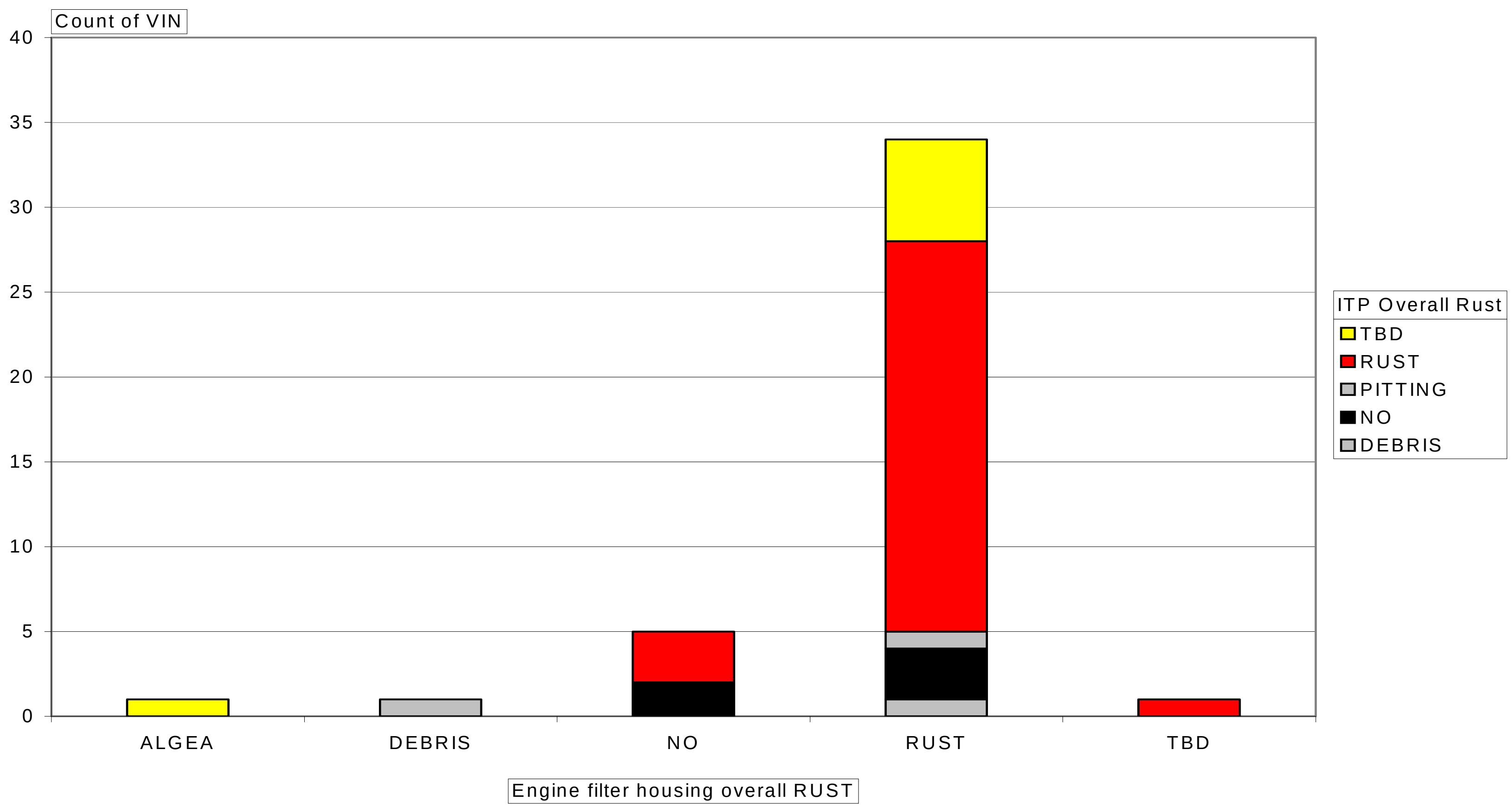
Rust in Housing vs Water and Sediment





Count of VIN
9
8
7
6
5
4
3
2
1
0
0.05
0.085
0.05
18
23
46
0.05
4
0.05
0.25
0.05
0.1
0.15
1.4
0.05
0.35
0.05
0.25
0.05
0.05
58
0.05
0.05
0.01
0.03
0.04
0.05
0.06
0.07
0.08
0.1
0.11
0.14
0.18
na
Acid Number
Water and Sediment (MAX 0.05% VOL) if states 0.05 then it is less than
On Engine filter RUST in bowl
RUST - DEPOSIT
RUST - ONE SPOT
RUST - NO PICUTURES
RUST - WHITE SUBSTANCE
STAINING
RUST - MUCUS
RUST - DEBRIS
RUST - FASTENERS
(blank)
TBD
RUST-DEBRIS
RUST- PARTICULATE
RUST - sludge
RUST
NO
DEBRIS
BROWN SUBSTANCE
ALGEA & DEBRIS

Rust on Housing vs Rust on ITP



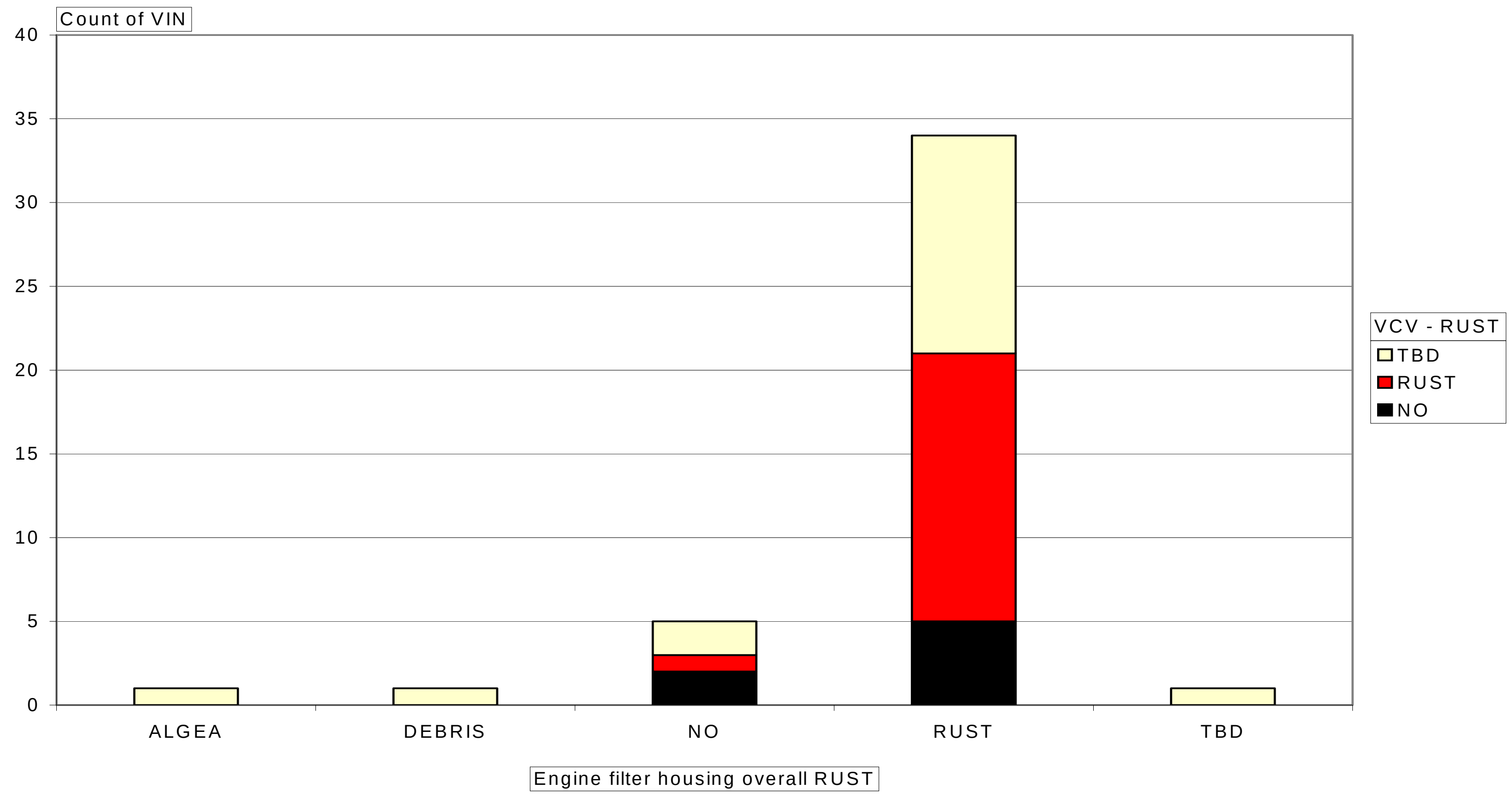
(3/5) 60% there is NO rust on filter housing but there is rust in the ITP (1:P2269 mild caution, 1:P0088 pass)

(23/34) 67% when there is rust on the housing there IS Rust on the ITP

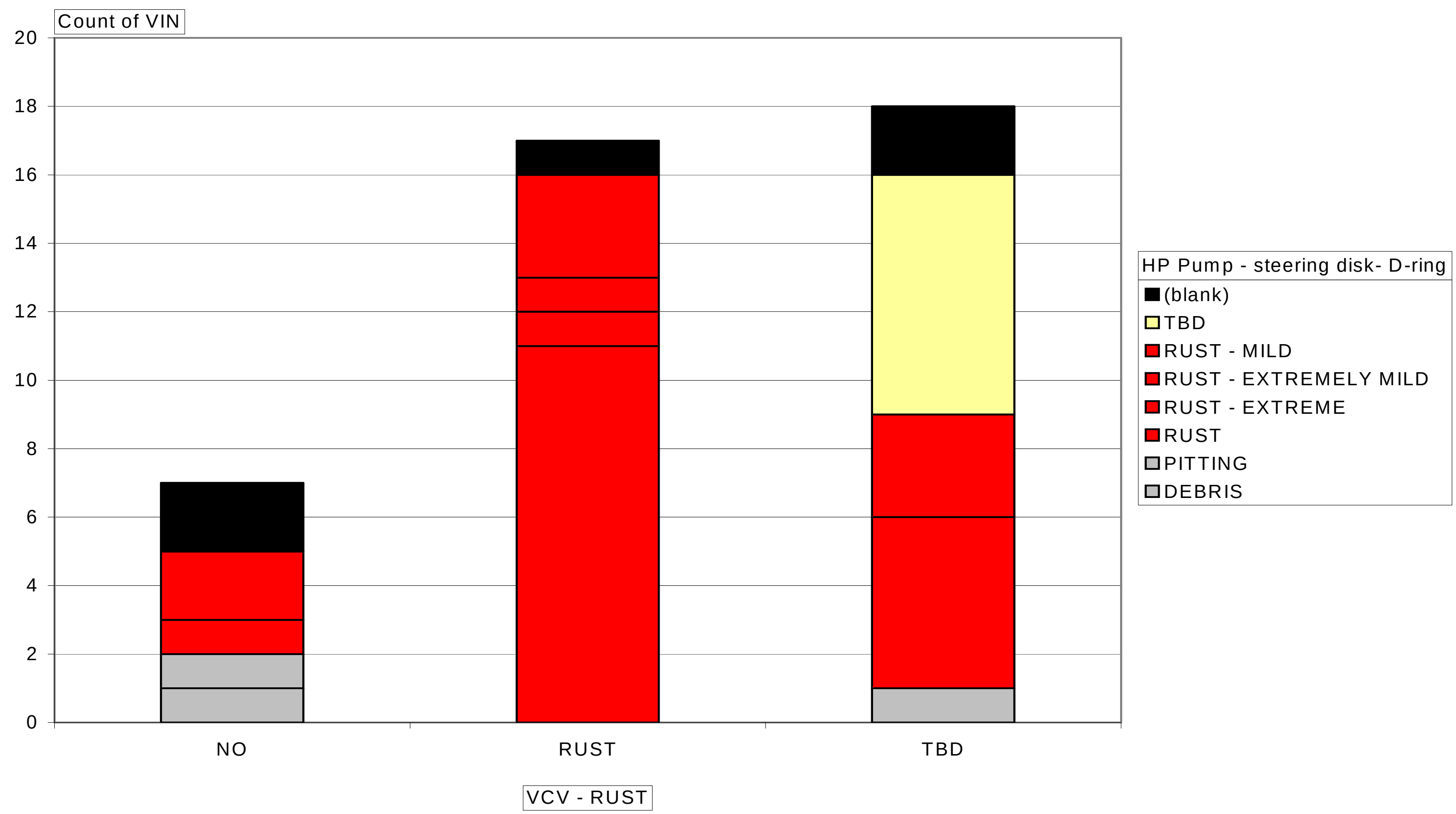
20% to be determined

(3/34) 11% rust in housing and no rust in ITP (1:P2269 tbd rust, 1:P0088 rust tank &VCV rust, 1:P0088

Rust in Housing vs Rust on VCV



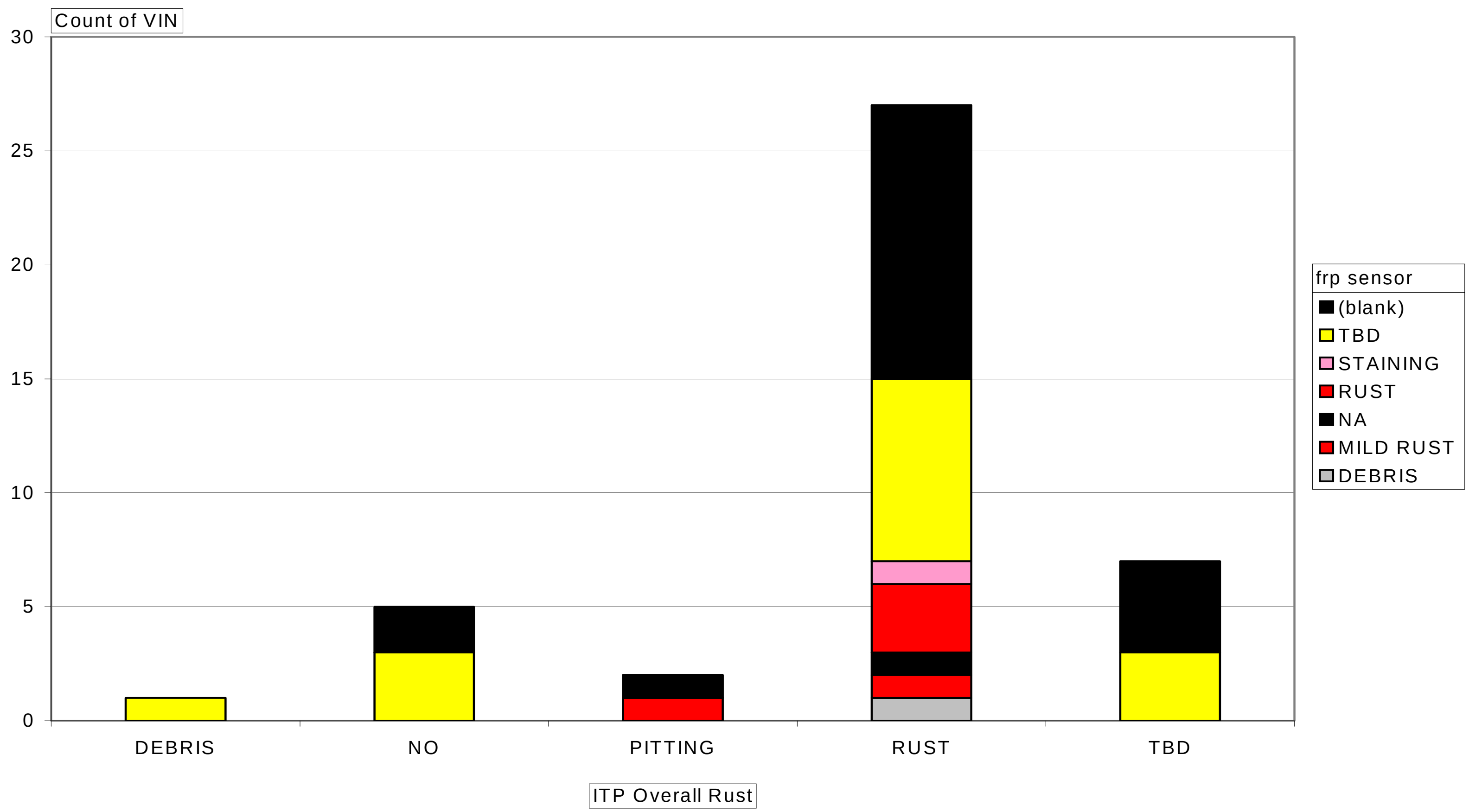
Rust on VCV vs Rust on ITP



If the VCV Has Rust then 88% of the time the ITP has rust
If the VCV does not have rust then 57% ITP has rust

TBD – large volume that needs to be reviewed to finalize numbers

Rust on ITP vs Rust on FRP



When the HPP ITP has rust - 48% FRP does not have rust
29% to be determined

PROBLEM SOLVING WORKSHEET
Root Cause Theories

A. On-engine filter internal-filter media (maintenance).
1. Filter media overloading causing a rupture allowing dirty return fuel from fuel-cooler to flow into the ITP.
2. Filter media not adhered to plastic ends allowing dirty return fuel from fuel-cooler to flow into the ITP.

B. On-engine filter stand-pipe gasket (design/manufacturing).
1. Embedded microscopic shiny (metallic?) debris particle causing a leak path for dirty fuel to flow into ITP.
2. Filter media ruptures causing high pressure failure of the stand-pipe gasket allowing dirty return fuel from fuel-cooler to flow into fuel bowl supplying fuel to the ITP.
3. Low sealing pressure against housing causing a gasket failure allowing dirty fuel into fuel bowl supplying fuel to the ITP.

C. Fuel quality.
1. Engine heat soaks causing very high fuel temperatures thereby reducing the scuff-load and wear-resistance of the fuel.
2. Lubricity enhancers, rust inhibitors, anti-wear agents, and biodiesel fuel additives degrading performance of the HFCM and on-engine fuel-water separators allowing water to pass to the ITP

D. ITP fuel starvation (maintenance).
1. Clogged HFCM and/or on-engine secondary filter causing insufficient lubrication to ITP.
2. Clogged HFCM and/or on-engine secondary filter causing high energy pressure pulsations of ITP rotor causing gear wear

E. Calibration.

From: McDonagh, Scot (S.M.)
Sent: Friday, December 11, 2009 9:56 AM
To: Eeley, Scott (A.); Ricks, Kevin (K.J.)
Cc: Horbal, Colin (C.P.)
Subject: RE: 6.4 Pump & Injectors

Follow Up Flag: Follow up
Due By: Monday, December 14, 2009 11:11 AM
Flag Status: Flagged

Done

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 8:16 AM
To: Ricks, Kevin (K.J.); McDonagh, Scot (S.M.)
Cc: Horbal, Colin (C.P.)
Subject: FW: 6.4 Pump & Injectors

FYI

Scot - please send to me the minutes.

I think we should move on the PCED changes.

From: Davis, Craig (C.B.)
Sent: Friday, December 11, 2009 7:56 AM
To: Eeley, Scott (A.)
Subject: RE: 6.4 Pump & Injectors

Scott, your recommendations on the attached PCED changes look great see attached email and they should be incorporated
 << Message: RE: 6.4 Pump & Injectors >>
However this string appeared to going off on a different Tangent, and I wanted to get everyone back on track…keep in mind this string doesn't have your comments, and not knowing if anyone had sent rebuttals to your email.

We held a teleconference, Scot McDonagh has taken on a couple of tasks, and should be sending meeting minutes

---

From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 7:08 AM
To: Davis, Craig (C.B.)
Subject: RE: 6.4 Pump & Injectors

What is wrong with my recommend PCED updates?

From: Davis, Craig (C.B.)
Sent: Monday, December 07, 2009 7:18 AM
To: Armesto, Carlos (.); Pekarscik, Brian (B.)
Cc: Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.); Neumann, Richard (R.E.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

All, STOP Hold everything. We need to get back on track. Products are developed and released, issues rise up, corrective actions are taken. As previously indicated whether it is the design engineer or product concern engineer "we have to have confidence in each other and represent our products accordingly."

The issues at hand are

- Fuel Systems failure due to fuel contamination (water/biodiesel %)

- WIF system…there may be other issues with the WIF, lets stick with the issues below

- Customer/operator/dealer technician education

Fuel Systems failure due to rust/corrosion
- my original note was on engine and fuel system failures that we (Ford of Canada) believe may be caused by fuel contamination
- need clear direction on what the dealer/technician needs to do to confirm if is this a warrantable failure or not. Give them the tools to do this. Parts are still mandatory return and claims are still subject to review and chargeback

Scenario (Coles note version)
Vehicle is towed into the dealer, stalled won't run. Dealer diagnosis the issue through normal channels (may even contact National Hotline for direction). Diagnosis leads to fuel system failure, metal filings in both primary and secondary filters in the fuel cooler, injectors dribble or leak down, no HPP pressure
Repairs required All fuel system component replacement (HPP, Fuel Cooler, both fuel filters assemblies, all 8 injectors all fuel lines fuel tank/lines flushed.
Total cost $15,000 average repair…….plus engine damage due to leaking fuel injectors Total cost $30,000 average repair cost
Who pays? Ford...the technician is not directed to open any components to assist in root cause failure analysis. Dealer claims as Ford warranty as they believe the HPP failed causing the failure
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely indicate major fuel system issues) as this is the fuel return portion of the injector

WIF
Major engine and fuel system failures due to fuel contamination, we need direction for the dealer to be able to determine these faults are the result of
- ignoring the WIF light over saturation of the WIF allowing water to bypass…**maybe a derate is added to the system when the WIF is illuminated after X key cycles**
- fuels bypassing the WIF - alcohol based fuel additives
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely induicate major fuel system issues) as this is the fuel return portion of the injector

- Fuel contamination may be high water content, high levels of biodiesel
- Water in the fuel may be introcduced in many ways
  1. naturally occuring
  2. during fuel fill, enter through filler pipe (body build?) or high levels from the fuel source/station
  3. operator ignoring the WIF warning

Customer/operator/dealer technician education
- Why the need for a WIF system
- the importance of drainng the WIF
- through diagnosis by the technician

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Armesto, Carlos (.)
Sent: Friday, December 04, 2009 4:48 PM
To: Pekarscik, Brian (B.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.)
Subject: RE: 6.4 Pump & Injectors

Brian, last year's fuel market study does not indicate that water in fuel is a widespread issue (see slide 1) and we have seen an improvement with time (slide 2)
This study would indicate that a **large** amount water contamination is a special case not a normal occurrence. Some responsibility remains with the operator to assure the fuel is of reasonable quality (gas or diesel).

Here is some survey data from our Fuels Group (Beth Raney-Pablo):

- Total of 1740 samples tested
- Water content ranges from 18 - 554 mg/kg
- Average water content = 77 mg/kg
- 99.6% of the samples (1733) tested contain less than 200 mg/kg of water
- 0.3% (5 samples) contain between 200 - 400 mg/kg of water
- Only 0.1% (2 samples) contain more than 500 mg/kg of water: 502 and 554 mg/kg.

That being said, we understand that our HFCM (Horizontal Fuel Conditioning Module) is design limited due to its orientation which was driven by Super Duty specific issues. The horizontal orientation makes it more susceptible to slosh in the water reservoir (vehicle maneuvers) so we had to compensate with software strategy.
The water reservoir is also smaller than we would like (100ml) with indication at 80 ml - 200-250 ml is ideal. However, we have dual filtration system (our competitors single) and we have the best water separation performance. Even after the HFCM reservoir is overwhelmed, the secondary filter will separate the water and it will take some time before that water is passed through to the engine. So the customer should have some time to act. The large amounts of water in your example (even an eighth of that) would saturate all of our competitors systems. (1 gallon or even 1 liter capacity needed is unrealistic and water in prolonged storage can become acidic and attack materials).

The more likely cause of water contamination on the P356 may be the use of biodiesel (see US survey chart slide 1, 3 &6). Slide 3 shows States that currently promote or mandate biodiesel. Our HFCM is capable with 5% bio. However, our efficiency falls quickly as the biodiesel increases (approx 50% with B20). Many of our customers (specially fleets) have been using much higher biodiesel blends that we did not design for in the P356. The amount of biodiesel may also be higher than advertised as shown on the survey data (see slide 5). Again, it is the operators responsibility to assure proper quality and storage.

The 7.3L system was much worst for water separation since it had a dirty side pump (non-filtered) that emulsifies the water and a single filter on the pump outlet flow-however the Unit injection system (and specially the Caterpillar oil amplified injectors) was much more robust to water than the newer HPCR systems.

I think the WIF team understood the software idle lock implications but risk management dictated that we would be exposed to the rare case where the truck idles all day without moving (If the truck moves then the strategy will be active again) versus the alternative to exposing most people that may park on an incline for a short period of time with false positives.

The 6.7L system has a DFCM (vertical module) with 200 ml of water capacity. It has over a 95% efficiency with B20. It also has a lower current WIF sensor to improve corrosion issues seen in the past. Since it's vertical the water sits at the bottom of the bowl and indication is more robust. But it took a complete redesign to get there.

From my experience, there is usually a good reason we do what we do (at least at that time). Again we're not perfect and we'll keep improving & fixing problems together. But we have to have confidence in each other and represent our products accordingly.

Feel free to give me a call if you would like to discuss further.

Take care,

Carlos Armesto

Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

<< File: Diesel Water Content.ppt >>

From: Pekarscik, Brian (B.)
Sent: Wednesday, December 02, 2009 1:01 PM
To: Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

With the fuel system in the 6.4 being so susceptible to water what is the reasoning behind the WIF light and code strategy?

When a 7.3L had water it turned the light on right away warning the customer. What was the capacity of the 7.3 and how much water did it hold before it started bypassing the water?

See below description of the light/code operation from the PCED:

NOTE: The PCM must detect water in fuel during engine idle at least 6 consecutive times to set DTC P2269 and to light the WIF indicator. The PCM monitors the WIF sensor for 30 seconds at idle. Each time the PCM checks for water in fuel it must detect a change in the vehicle speed before it will check for water in fuel again.

NOTE: In this step the vehicle needs to be driven enough so the PCM can detect a change to the vehicle speed.

Scenario as follows, customer fuels up because they are low on fuel, 5 gallons left, they fuel up with contaminated fuel that is 10% water and puts 10 gallons in the tank. Water gets in the HFCM and fills it with water to the point it is by passing because the customer is driving down the road not idleling or cycling the key. The light never comes on because there was only one key cycle but by now the truck stalls because the high pressure pump, injectors are wiped out.

Why is the capacity so small in the HFCM? The truck above has a gallon of water in it but it started bypassing with 3.2 oz with no light that leaves 125 more oz to go through the system with no light.

What about trucks that idle all day at a job site but never get driven or more? One could run water through the system and never set a light what is the logic behind that?

With such a low capacity by the time the light comes on and sets the code the fuel system is already compromised. I have over 1000 CQIS reports of p2269 which tells me there are a lot of fuel supply stations that have water in their fuel.

Is the 6.7 going be as susceptible to water as the 6.4?
Are there plans for a better WIF light strategy?
Is the FCM going to have more of a capacity for water/contamination?

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 11:28 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: (313)-805-7057 (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 11:21 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator/filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 10:48 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 10:07 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Tuesday, December 01, 2009 6:36 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: Pekarscik, Brian (B.)
Sent: Tuesday, December 01, 2009 4:06 PM
To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications
- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root
cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,
Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254   Phone (313) 31-74489

DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Armesto, Carlos (.)
Sent: Monday, December 07, 2009 8:44 AM
To: Davis, Craig (C.B.); Pekarscik, Brian (B.)
Cc: Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.); Neumann, Richard (R.E.); McAllister, Derek (D.); Fulton, Brien (B.L.)
Subject: RE: 6.4 Pump & Injectors

Craig, I agree.

Here are my comments on the issues:
1) Rust in HP system: When possible we should try to determine how water was introduced that is: is it a local above ground tank, environment, biodiesel etc..
There is also the possibility some rust may have occurred when many engines (10K?) were warehoused before 08 J1. We should try to cross-reference warranty to these engine S/Ns. At least the ones stored the longest. We will lose a customer if we deny a legitimate claim.

2) WIF system failure to indicate: Recommend software changes similar to P473: eliminate key cycle resets, include P-code latch and derate when WIF on for a period of time.(I think Brien Fulton already started this process)

3) WIF Light on with no water (Possible QSF) need parts ASAP. At first I would like some complete DFCMs. If the claim is local, I would like to visit the dealer if possible.
Possible WIF sensor contamination with fuel additives. (We saw this in June 06 during the change to ULSD with carboxylic acid- an additive added at the distributor to improve lubricity)

Let me know if you can help. Thanks,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

From: Davis, Craig (C.B.)
Sent: Monday, December 07, 2009 7:18 AM
To: Armesto, Carlos (.); Pekarscik, Brian (B.)
Cc: Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.); Neumann, Richard (R.E.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

All, STOP Hold everything. We need to get back on track. Products are developed and released, issues rise up, corrective actions are taken. As previously indicated whether it is the design engineer or product concern engineer "we have to have confidence in each other and represent our products accordingly."

The issues at hand are

- Fuel Systems failure due to fuel contamination (water/biodiesel %)

- WIF system…there may be other issues with the WIF, lets stick with the issues below

- Customer/operator/dealer technician education

Fuel Systems failure due to rust/corrosion

- my original note was on engine and fuel system failures that we (Ford of Canada) believe may be caused by fuel contamination
- need clear direction on what the dealer/technician needs to do to confirm if is this a warrantable failure or not. Give them the tools to do this. Parts are still mandatory return and claims are still subject to review and chargeback

Scenario (Coles note version)
Vehicle is towed into the dealer, stalled won't run. Dealer diagnosis the issue through normal channels (may even contact National Hotline for direction). Diagnosis leads to fuel system failure, metal filings in both primary and secondary filters in the fuel cooler, injectors dribble or leak down, no HPP pressure
Repairs required All fuel system component replacement (HPP, Fuel Cooler, both fuel filters assemblies, all 8 injectors all fuel lines fuel tank/lines flushed.
Total cost $15,000 average repair…….plus engine damage due to leaking fuel injectors Total cost $30,000 average repair cost
Who pays? Ford...the technician is not directed to open any components to assist in root cause failure analysis. Dealer claims as Ford warranty as they believe the HPP failed causing the failure
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely indicate major fuel system issues) as this is the fuel return portion of the injector

WIF
Major engine and fuel system failures due to fuel contamination, we need direction for the dealer to be able to determine these faults are the result of
- ignoring the WIF light over saturation of the WIF allowing water to bypass…**maybe a derate is added to the system when the WIF is illuminated after X key cycles**
- fuels bypassing the WIF - alcohol based fuel additives
If direction was given to open the HPP covers and no rust is found, the HPP failed due to a warrantable issue, if rust is present (see photo 004.jpg) the failure is the result of fuel contamination and the operator is advised this repair is not warrantable due to fuel contamination. The same for fuel injectors if rust is found as shown in the attached photo (006.jpg), cause is fuel contamination (this would surely induicate major fuel system issues) as this is the fuel return portion of the injector

- Fuel contamination may be high water content, high levels of biodiesel
- Water in the fuel may be introcduced in many ways
  1. naturally occuring
  2. during fuel fill, enter through filler pipe (body build?) or high levels from the fuel source/station
  3. operator ignoring the WIF warning

Customer/operator/dealer technician education
- Why the need for a WIF system
- the importance of drainng the WIF
- through diagnosis by the technician

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Armesto, Carlos (.)
Sent: Friday, December 04, 2009 4:48 PM
To: Pekarscik, Brian (B.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.); Raney-Pablo, Beth (H.E.)
Subject: RE: 6.4 Pump & Injectors

Brian, last year's fuel market study does not indicate that water in fuel is a widespread issue (see slide 1) and we have seen an improvement with time (slide 2)
This study would indicate that a **large** amount water contamination is a special case not a normal occurrence. Some responsibility remains with the operator to assure the fuel is of reasonable quality (gas or diesel).

Here is some survey data from our Fuels Group (Beth Raney-Pablo):

- Total of 1740 samples tested
- Water content ranges from 18 - 554 mg/kg
- Average water content = 77 mg/kg
- 99.6% of the samples (1733) tested contain less than 200 mg/kg of water
- 0.3% (5 samples) contain between 200 - 400 mg/kg of water
- Only 0.1% (2 samples) contain more than 500 mg/kg of water: 502 and 554 mg/kg.

That being said, we understand that our HFCM (Horizontal Fuel Conditioning Module) is design limited due to its orientation which was driven by Super Duty specific issues. The horizontal orientation makes it more susceptible to slosh in the water reservoir (vehicle maneuvers) so we had to compensate with software strategy.
The water reservoir is also smaller than we would like (100ml) with indication at 80 ml - 200-250 ml is ideal. However, we have dual filtration system (our competitors single) and we have the best water separation performance. Even after the HFCM reservoir is overwhelmed, the secondary filter will separate the water and it will take some time before that water is passed through to the engine. So the customer should have some time to act. The large amounts of water in your example (even an eighth of that) would saturate all of our competitors systems. (1 gallon or even 1 liter capacity needed is unrealistic and water in prolonged storage can become acidic and attack materials).

The more likely cause of water contamination on the P356 may be the use of biodiesel (see US survey chart slide 1, 3 &6). Slide 3 shows States that currently promote or mandate biodiesel. Our HFCM is capable with 5% bio. However, our efficiency falls quickly as the biodiesel increases (approx 50% with B20). Many of our customers (specially fleets) have been using much higher biodiesel blends that we did not design for in the P356. The amount of biodiesel may also be higher than advertised as shown on the survey data (see slide 5). Again, it is the operators responsibility to assure proper quality and storage.

The 7.3L system was much worst for water separation since it had a dirty side pump (non-filtered) that emulsifies the water and a single filter on the pump outlet flow-however the Unit injection system (and specially the Caterpillar oil amplified injectors) was much more robust to water than the newer HPCR systems.

I think the WIF team understood the software idle lock implications but risk management dictated that we would be exposed to the rare case where the truck idles all day without moving (If the truck moves then the strategy will be active again) versus the alternative to exposing most people that may park on an incline for a short period of time with false positives.

The 6.7L system has a DFCM (vertical module) with 200 ml of water capacity. It has over a 95% efficiency with B20. It also has a lower current WIF sensor to improve corrosion issues seen in the past. Since it's vertical the water sits at the bottom of the bowl and indication is more robust. But it took a complete redesign to get there.

From my experience, there is usually a good reason we do what we do (at least at that time). Again we're not perfect and we'll keep improving & fixing problems together. But we have to have confidence in each other and represent our products accordingly.

Feel free to give me a call if you would like to discuss further.

Take care,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

<< File: Diesel Water Content.ppt >>

From: Pekarscik, Brian (B.)
Sent: Wednesday, December 02, 2009 1:01 PM
To: Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

With the fuel system in the 6.4 being so susceptible to water what is the reasoning behind the WIF light and code strategy?

When a 7.3L had water it turned the light on right away warning the customer. What was the capacity of the 7.3 and how much water did it hold before it started bypassing the water?

See below description of the light/code operation from the PCED:

NOTE: The PCM must detect water in fuel during engine idle at least 6 consecutive times to set DTC P2269 and to light the WIF indicator. The PCM monitors the WIF sensor for 30 seconds at idle. Each time the PCM checks for water in fuel it must detect a change in the vehicle speed before it will check for water in fuel again.

NOTE: In this step the vehicle needs to be driven enough so the PCM can detect a change to the vehicle speed.

Scenario as follows, customer fuels up because they are low on fuel, 5 gallons left, they fuel up with contaminated fuel that is 10% water and puts 10 gallons in the tank. Water gets in the HFCM and fills it with water to the point it is by passing because the customer is driving down the road not idleling or cycling the key. The light never comes on because there was only one key cycle but by now the truck stalls because the high pressure pump, injectors are wiped out.

Why is the capacity so small in the HFCM? The truck above has a gallon of water in it but it started bypassing with 3.2 oz with no light that leaves 125 more oz to go through the system with no light.

What about trucks that idle all day at a job site but never get driven or more? One could run water through the system and never set a light what is the logic behind that?

With such a low capacity by the time the light comes on and sets the code the fuel system is already compromised. I have over 1000 CQIS reports of p2269 which tells me there are a lot of fuel supply stations that have water in their fuel.

Is the 6.7 going be as susceptible to water as the 6.4?
Are there plans for a better WIF light strategy?
Is the FCM going to have more of a capacity for water/contamination?

From: Espinoza, Bob (R.J.)
Sent: Wednesday, December 02, 2009 11:28 AM
To: McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 11:21 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator/filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From:	Espinoza, Bob (R.J.)
Sent:	Wednesday, December 02, 2009 10:48 AM
To:	McDonagh, Scot (S.M.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc:	Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject:	RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
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Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: McDonagh, Scot (S.M.)
Sent: Wednesday, December 02, 2009 10:07 AM
To: Espinoza, Bob (R.J.); Pekarscik, Brian (B.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Espinoza, Bob (R.J.)
Sent: Tuesday, December 01, 2009 6:36 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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From: Pekarscik, Brian (B.)
Sent: Tuesday, December 01, 2009 4:06 PM
To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications
- Collision related damage
- Abuse

- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root
cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,
Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254   Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, December 02, 2009 4:45 PM
To: Davis, Craig (C.B.)
Cc: Fulton, Brien (B.L.); Kromberg, Arnold (A.W.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.); Pekarscik, Brian (B.)
Subject: RE: 6.4 Pump & Injectors

Craig,

You are eluding to a third topic - notification. Notification is not the same as capability to remove water from diesel. The system is capable of removing 2x more water in fuel than water allowed in ULSD.

The ASTM ULSD water in fuel spec is .05% per volume = .05% of 25 gallons diesel is .0125 gallons or 47.3ml - over 2 times greater 115 ml.

We are discussing the '6 key cycles' with the calibration team - Notification. To get more than 115 ml in one fill up and less than 6 key cycles - twice the ASTM specification - is possible but I offer not as common as drivers ignoring the WIF light.

I recommend updating PCED to help with a majority of what is warranty and what is not warranty.

If we don't get bunches of emails in response to my earlier email, please issue a SPECS case.

Scott

From: Davis, Craig (C.B.)
Sent: Wednesday, December 02, 2009 1:18 PM
To: Eeley, Scott
Cc: Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Scott, yes however first topic drives the second topic.

Can I introduce water contamination that damages the fuel system and not turn the light on because it has not seen the 6 key cycles?

From: Eeley, Scott (A.)
Sent: Wednesday, December 02, 2009 1:11 PM
To: Pekarscik, Brian (B.); Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Can we divide and conquer?

One topic = capability / capacity

Second topic = "What is a tech to do? - Who pays?" How can we help a dealer determine CP v. warranty? See my other / lengthy note.

Craig - I think your initial concern was mainly related to the second topic?

From: Pekarscik, Brian (B.)
Sent: Wednesday, December 02, 2009 1:01 PM
To: Espinoza, Bob (R.J.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

With the fuel system in the 6.4 being so susceptible to water what is the reasoning behind the WIF light and code strategy?

When a 7.3L had water it turned the light on right away warning the customer. What was the capacity of the 7.3 and how much water did it hold before it started bypassing the water?

See below description of the light/code operation from the PCED:

NOTE: The PCM must detect water in fuel during engine idle at least 6 consecutive times to set DTC P2269 and to light the WIF indicator. The PCM monitors the WIF sensor for 30 seconds at idle. Each time the PCM checks for water in fuel it must detect a change in the vehicle speed before it will check for water in fuel again.

NOTE: In this step the vehicle needs to be driven enough so the PCM can detect a change to the vehicle speed.

Scenario as follows, customer fuels up because they are low on fuel, 5 gallons left, they fuel up with contaminated fuel that is 10% water and puts 10 gallons in the tank. Water gets in the HFCM and fills it with water to the point it is by passing because the customer is driving down the road not idleling or cycling the key. The light never comes on because there was only one key cycle but by now the truck stalls because the high pressure pump, injectors are wiped out.

Why is the capacity so small in the HFCM? The truck above has a gallon of water in it but it started bypassing with 3.2 oz with no light that leaves 125 more oz to go through the system with no light.

What about trucks that idle all day at a job site but never get driven or more? One could run water through the system and never set a light what is the logic behind that?

With such a low capacity by the time the light comes on and sets the code the fuel system is already compromised. I have over 1000 CQIS reports of p2269 which tells me there are a lot of fuel supply stations that have water in their fuel.

Is the 6.7 going be as susceptible to water as the 6.4?
Are there plans for a better WIF light strategy?
Is the FCM going to have more of a capacity for water/contamination?

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Scot,

There is no plan for an improved HFCM water separator/filter. We are looking at deleting the steel clip on the primary filter and replacing it with an ultrasonic weld, but this is only to prevent this clip from rusting and passing rust on further through the system. Water separation capability will remain the same.

Status of the ultrasonic weld project is that I have a quote and am waiting on the results of functional and material compatibility testing from Racor. I was supposed to have this week but as of this morning the new timing is Monday afternoon.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Mr. Eeley will have to advise on vehicle histories and ITEC engine banking processes. I thought we were investigating cost & timing for an improved HFCM water separator/filter ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

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Subject: RE: 6.4 Pump & Injectors

Ok thanks – here's a question:

Do we know for certain that the rust being found in these engines is due to water passed through the filters? Is there any other possible scenario that would cause rust?

For example:

- Is there any history on these vehicles that they had been stored for long periods without proper pre-storage preparation?
- Any history of flood damage (hurricane vehicles, etc…)?
- I have heard stories regarding thousands of engines that were built and stored for months while Ford and Navistar worked out commercial issues. Is there any tracking of banked engines to which vehicles they may have been installed in? How was this bank handled?

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Subject: RE: 6.4 Pump & Injectors

(2) separate concerns. FCSD emerging concern is WIF light with no water present in the HFCM. Enclosed concern from FoC is for water in HFCM bypassing the water separator causing concerns with Injectors and HP Pumps.

<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

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Sent: Tuesday, December 01, 2009 6:36 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

My understanding is that the WIF concern is on the deck due to indication with no water present. This would not cause the issues discussed below. Is there another WIF issue that I am unaware of?

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Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			
Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications

- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,
Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254 Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but

poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Espinoza, Bob (R.J.)
Sent: Thursday, December 03, 2009 5:27 PM
To: Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: RE: 6.4 Pump & Injectors

Following up – 10% water is unrealistic and would clearly be outside of what any system could be designed to handle.

US diesel fuel maximum spec is 0.05% water by weight.

The current HFCM separator is sufficient to hold this percentage of water from an entire 40 gallon tank of diesel fuel.

Bob Espinoza, P.E.
Supervisor - Fuel Systems Development Engineering and Truck Fuel Applications (P150/UP251/P356)
Powertrain Installations
Ford Motor Company

Email: respino1@ford.com / Phone: [redacted] (cell) / Fax: (313)-390-4437

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<< Message: P2269 - HFCM filter internal corrosion - 'clean side' >>

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To: McDonagh, Scot (S.M.); Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)

Subject: RE: 6.4 Pump & Injectors

Agreed, we need something better for diagnostics than what we have that's also why WIF is on the emerging concern deck. The system and strategy seem to needs some help detecting and holding water/contamination.

From: McDonagh, Scot (S.M.)
Sent: Tuesday, December 01, 2009 2:55 PM
To: Espinoza, Bob (R.J.); Mohan, Robert (R.); Dumler, Jeff (J.D.); Bergeron, Leon (F.L.); Armesto, Carlos (.); Pekarscik, Brian (B.); Hale, Curt (B.C.); Smith, Ryan (R.E.)
Cc: Davis, Craig (C.B.); Dixon, Mark (M.R.); Ricks, Kevin (K.J.); Horbal, Colin (C.P.); Polasek, John (J.A.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts on the enclosed Ford of Canada request ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Tuesday, December 01, 2009 11:21 AM
To: Rudd, David (D.); Mull, Ted (V.); Simpson, Tim (T.S.)
Cc: McAllister, Derek (D.); Baker, Zachary (Z.); McDonagh, Scot (S.M.); Eeley, Scott (A.); Pearson, Gavin (G.J.)
Subject: FW: 6.4 Pump & Injectors

All, following Zach's comments, looking to get a comphrensive TSB and an update to the WSM and PCED, advising the tech to inspect the secondary fuel housing for signs of corrosion and to remove the HPP covers to inspect for signs of corrosion, a result of fuel contamination. Not all technicians will contact the Hotline for directions

Currently technicians are not directed to inspect for corrosion/rust in these areas or to dismantle the HPP for inspection to determine root cause

Fuel sample is taken at time of the repair by the dealer, the fuel contamination may have been from a previous fuel fill or the WIF has recently been drained, or aftermarket fuel additives (alcohol based) have or are being used

PPT ME14, if all other test are ok, replace the HPP, with no direction to open up for inspection

Also as an example DTC P2269,

P2269 - Water in Fuel Condition

Description:	The water in fuel (WIF) sensor is monitored by the powertrain control module (PCM). If the PCM detects water in the fuel, the DTC is set and the WIF indicator lamp is turned on.			
Possible Causes:	• Water in fuel condition • WIF circuit short to ground in the harness • WIF sensor			

Diagnostic Aids:	Drain a fuel sample from the fuel conditioning module and inspect it for water or contaminants. If no water or contaminants are in the container, check for a circuit concern.			
Application		Key On Engine Off	Key On Engine Running	Continuous Memory
All		GO to Pinpoint Test O.		

Let me know your thoughts

From: Baker, Zachary (Z.)
Sent: Monday, November 23, 2009 4:21 PM
To: Davis, Craig (C.B.)
Cc: McAllister, Derek (D.)
Subject: FW: 6.4 Pump & Injectors

Craig,

I have come across several similar concerns recently. In many cases, the description of the concern is stalling while driving, white smoke from the exhaust, knocking, etc. Each of these concerns indicates probable faults in the HP fuel system, and in each case, one of the first things that I will have a technician do is check fuel quality in the HFCM as well as in the secondary filter housing. In addition to fuel quality, I will request that the technician inspect for corrosion in the secondary housing or other indications that water, biodiesel, or gasoline has been present in the fuel system. If fuel contamination is suspected to be the cause of the concern, I will then advise the technician obtain customer authorization to continue diagnostics using the Hard Start/No Start diagnostics in the online PC/ED to determine the damage to the HP fuel system.

In the event that fuel contamination is evident (contaminated fuel, corrosion in the secondary filter housing, rusted injector barrels, etc.), and there is a catastrophic fuel system failure with debris in the fuel system, I will advise the dealer that the repair will likely not be covered under warranty due to fuel contamination. In either a Hotline Assistance Request or Prior Approval request, I will supply the following response:

The vehicle may not be warrantable if the damage that has occurred is a direct result of any of the following:

- Lack of Maintenance
- Performance Modifications
- Collision related damage
- Abuse
- Water Ingestion
- Unauthorized Repairs
- Fuel contamination

Please refer to page 3-139 and 3-140 of the 2009 Warranty and Policy Manual for more details. If the stated non-warrantable root cause (as defined in the list above) is directly attributable to the failure, please complete the Warranty Cancellation request form on FMCDealer by following these steps:

- Select Parts and Service tab
- Select Warranty Administration & Warranty Parts Return
- Select Warranty Cancellation/Reinstatement Request Form
- Complete the form including photo uploads and details about failure and reason for warranty denial request.

This can be a difficult determination to make. It is recommended to obtain customer authorization for diagnosis and complete basic diagnostic steps to determine root cause. If you would like to discuss this in more detail please contact the Hotline by phone.

I realize that there are variances between the Warranty and Policy Manuals from the US to Canada, but you get the idea. If the fuel is currently contaminated, or if we heavily suspect fuel contamination, we can even go as far as sending an inspector to have a fuel sample analyzed by a lab.

Hope this helps. If there is anything else I can do to clarify our process, please let me know.

Zachary Baker
Diesel Drivability Service Engineer
SME for 6.7L Engine and Diesel Component Prior Approval
Diagnostic Service Center 1
1700 Fairlane Drive
Allen Park, MI 48101
313-317-7070

From: McAllister, Derek (D.)
Sent: Monday, November 23, 2009 3:18 PM
To: Baker, Zachary (Z.)
Subject: FW: 6.4 Pump & Injectors

Zach,

Please discuss how a case similar to this would be handled in the US with Craig Davis. Phone or email. . .your call.

Thanks,
Derek McAllister
Diesel Engine Team Leader
Ford Technical Hotline - DSC 1
Cube # 254   Phone (313) 31-74489
DMCALLI5@Ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 18, 2009 1:02 PM
To: Eeley, Scott (A.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Scott, thanks

The Prior Approval for 6.4L HPP and injectors not applicable in Canada at this time

Derek if you have not seen the photos. I see benefit in having a conference call on this.

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Eeley, Scott (A.)
Sent: Wednesday, November 18, 2009 11:01 AM
To: Davis, Craig (C.B.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Pearson, Gavin (G.J.); McDonagh, Scot (S.M.); McAllister, Derek (D.)
Subject: RE: 6.4 Pump & Injectors

Craig,

Please confer with Derek regarding their handling of fuel quality issues. Injectors and pumps are on the Prior Approval

Program. Fuel quality should be a primary question on Prior Approval.

Scott

From: Pearson, Gavin (G.J.)
Sent: Wednesday, November 18, 2009 8:59 AM
To: McDonagh, Scot (S.M.); Eeley, Scott (A.)
Cc: Davis, Craig (C.B.); Simpson, Timothy (T.A.); Mull, Ted (V.)
Subject: RE: 6.4 Pump & Injectors

Tim Simpson & Ted Mull are working on this sort of issue so I will leave them to comment.

Regards,
Gavin J. R. Pearson MSc BEng (Hons) ACGI
(313) 805-6498

From: McDonagh, Scot (S.M.)
Sent: Wednesday, November 18, 2009 7:54 AM
To: Eeley, Scott (A.); Pearson, Gavin (G.J.)
Cc: Davis, Craig (C.B.)
Subject: FW: 6.4 Pump & Injectors

Your thoughts ?

Scot G. McDonagh
PT Quality Engineering
Phone: (313)337-8091
smcdonag@ford.com

From: Davis, Craig (C.B.)
Sent: Wednesday, November 11, 2009 11:34 AM
To: McDonagh, Scot (S.M.)
Subject: FW: 6.4 Pump & Injectors

I was over to the Canadian Warranty Parts Evaluation Centre and one of the inspectors showed me the injector and HPP photos. I am looking for direction on the best way to handle these types of failures.

As we are aware there are many piston melted, metal filings through out the fuel system major engine/fuel repairs. We had a program on the fuel injectors yet we still see failures due to over fueling (may be the result of normal driving but poor maintenance causing over full crankcase and CAC

On the injectors, what is the cause of rust below the O rings? This section of the injector sits in the injector cup. Is this the result of poor fuel quality or loose injector or??

On the HPP, Navistar has advised to confirm for poor fuel quality to remove the secondary fuel filter and check the housing for signs of corrosion and then on the HPP remove the three end caps and check to see if rusty, or to remove the bottom cover of the pump, again if rust is found (as seen in the photos) fuel quality is the root cause. The 5 rotor blades and springs in the pump seize (due to rust) not allowing the blades to retract causing contact to the hub and putting metal filings through out.

These repairs become very costly, and if in fact are due to fuel quality should not be covered under warranty.

Is it possible to get a compressive TSB or repair procedure developed and released to aid in diagnosis. That a thorough fuel system inspection, checking Fuel Filter housing, the HPP for signs of rust and corrosion to confirm for fuel issues? (the current fuel sample out of the truck may be clean) As well as a section on injector failures as to what is is not warrantable? Also (if rust/corrosion is or is not found) what the repair should include. And also how to Customer Information sheet on proper fuel usage, WIF and fuel filter maintenance.

Both these issues can result in major engine and fuel system damage that should not be warrantable

Let me know your thoughts

From: Mccarney, John (J.)
Sent: Friday, November 06, 2009 1:37 PM
To: Davis, Craig (C.B.)
Subject: 6.4 Pump & Injectors

Humber Motors

<< File: Humber Motors B3807 006.jpg >> << File: Humber Motors B3807 004.jpg >>

From: Hawk, Steve (S.D.)
Sent: Thursday, April 15, 2010 10:10 AM
To: Heggie, Forest (F.)
Subject: RE: 6.4L/6.0L Fuel additive assistance

No not really. The process to remove sulfur from diesel fuel also removes the lubricity properties from the fuel. The oil companies add the lubricants back in at the end. Some customers feel that LSD doesn't have the same lubricity as the old fuel and use an additive. There's no data that shows that LSD is any different.

Steve Hawk
313-805-6946
NAD Garage

From: Heggie, Forest (F.)
Sent: Thursday, April 15, 2010 9:40 AM
To: Hawk, Steve (S.D.)
Subject: FW: 6.4L/6.0L Fuel additive assistance

Do you know of any reason we would need to add a fuel lubricant to 6.0L or 6.4L ?

Forest Heggie BaSc. MaSc. P.Eng
1-313-6185054
LGDEE Diesel OPD

From: Eeley, Scott (A.)
Sent: Wednesday, April 14, 2010 3:12 PM
To: Nolan, Patrick (Pat); 'Newman, Rob'; Ford, George J (Jeff)
Cc: Heggie, Forest (F.)
Subject: FW: 6.4L/6.0L Fuel additive assistance

Pat, Rob, and Jeff,

We are trying to get to the bottom as to why dealers are adding fuel lubricity additive to 6.0 and 6.4 diesels. We can not find any listing suggesting PM-15 for use in either the 6.0 or 6.4. All I have is this old scanned image - see attached. I am told that this document is or was sent with engine replacements. In the lower right corner - and no longer legible - it recommends PM-15 during engine replacement. I think this ONLY is / was important to 7.3 applications.

Will you please determine if this document is included with any service reman or new engine and let me know which engines? Please let me know if there is any other documentation that might call out PM-15.

Thanks.

Scott

From: Heggie, Forest (F.)
Sent: Wednesday, April 14, 2010 2:12 PM
To: Eeley, Scott (A.)

EA11-003 000296

Subject: FW: 6.4L/6.0L Fuel additive assistance

Forest Heggie BaSc. MaSc. P.Eng
1-313-6185054
LGDEE Diesel OPD

From: Baumann, Robert E (Bob) [mailto:Bob.Baumann@Navistar.com]
Sent: Wednesday, April 14, 2010 12:56 PM
To: Heggie, Forest (F.)
Cc: Mezigian, Michael W
Subject: RE: 6.4L/6.0L Fuel additive assistance

Forest

I would see no reason to use a lubricity additive to the 6.4 engine and that lubricity additive was used back when injectors were replaced on the 7.3 but only for initial break in when new injectors were installed in an engine.

Not sure why warranty would be paying for fuel cetane improver as that should be a customer pay item. Now if it is customer pay we do see some poor quality fuel out there yet.

Bob Baumann
Manager, Vee Product Support
Navistar, Inc.
Melrose Park, IL
708-865-3495

From: Heggie, Forest (F.) [mailto:fheggie@ford.com]
Sent: Tuesday, April 13, 2010 8:09 AM
To: Baumann, Robert E (Bob)
Cc: Mezigian, Michael W
Subject: 6.4L/6.0L Fuel additive assistance

Hi Bob,

I was reviewing fuel additives and the cost, so I am looking for some help.

1. PM-15 is showing still being used

I keep finding PM-15 being used for 6.4L/6.0L and have found one sheet were there may be instructions to the technicians, I have a photocopy of a one page document that goes with a engine replacement/long block or short block and it referenced adding fuel lubricity additive to the tank, but my copy is not clear enough to see if they are told PM-15. Would you be able to give me a copy of this document.

2. Do we want fuel lubricity additive to be used when replacing an injector or high pressure pump.

<<fuel additives 4-13-10.ppt>>

Forest Heggie BaSc. MaSc. P.Eng
1-313-6185054
LGDEE Diesel OPD

From: Asaf Arviv [A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Tuesday, April 21, 2009 5:41 AM
To: Eeley, Scott (A.); Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN; Edens, Brandon (B.); Bilicki, John (J.R.); Simpson, Timothy (T.A.)
Subject: RE: 6.4L Diesel issues
Attachments: P3200475.JPG

Scotte,

Sorry it took us so long to response. We just preformed the test on an engine after repair (the one that had the bleeding issue).
We install the injectors as requested with the tip oriented downward but it is impossible to position it at the same original installed angel (see attached positioning photo):
No spray from injector body has observed
After 15 seconds we observed that a drop built up at the bottom of the injector (at the tip)
We looked at the return ports (these that can be observed but they look dry)
We touch with fingers on the non visible return ports and they were wet

The conclusion is that some fuel is still flow from the return port although we have not visually seen where it comes from. We will prepare a special mirror tool to look at the injector body on the next test we will perform.

Thanks for your comprehensive assistance!

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, March 27, 2009 2:51 PM
To: Asaf Arviv; Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN; Edens, Brandon (B.); Bilicki, John (J.R.); Simpson, Timothy (T.A.)
Subject: RE: 6.4L Diesel issues
Importance: High

Asaf,

We applied the 'inverse' leak test to our test engine. We found: 1. The engine runs fine with no DTC's or oil growth. 2. When the injectors are installed with the tip pointed 'up' fuel will leak from the return ports. 3. When the injector is oriented with the tip 'down' - approximating installed angle yet removed from the head bore - no fuel will leak from the return ports on our 'good' injectors.

I suggest you run the test with the injectors pointed 'down'. Let me know your test results.

Thanks!

Scott Eeley

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Wednesday, March 25, 2009 6:47 AM
To: Eeley, Scott (A.); Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN; Edens, Brandon (B.); Bilicki, John (J.R.)

Subject: RE: 6.4L Diesel issues

Hi Scott,

We preformed the same test (Injector inverse leak test) on additional engine but this time straight after a repair of short block and HP pump replacement. The fuel system was inspected first for contaminations and it found all clear. Inverse leak test shows the same flow from the return ports on all injectors as it was on the previous vehicle which reported below. Theoretically this should not occur, as much as we understand, the passages to the return ports should be closed as the electrical connectors are disconnected. Could you review and see if technicians worldwide see the same fuel flow?

Additionally, following our conference meeting we performed oil capacity tests on the 6.4L engine and the results are given on the attached two photos.
We closed the draining plug, install new filter and start filling oil with constant portions of 1\2 liter starting from 12 liters.
Each time we add 1\2 liter, we waited 10 minutes and we record the dipstick reading.
This information might be useful for you as well.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Coate, Richard (R.M.) [mailto:rcoate@ford.com]
Sent: Tuesday, March 17, 2009 5:06 PM
To: Asaf Arviv
Cc: Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

FYI, you can communicate directly with one another, I just want to be kept informed. Thanks.

Asaf, for your information and action. Thanks.

Rick Coate

Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Eeley, Scott (A.)
Sent: Tuesday, March 17, 2009 10:57 AM
To: Coate, Richard (R.M.)
Subject: RE: 6.4L Diesel issues

It is disappointing to read that the replacement #3 injector was leaking. This does not make sense to me.

I think that we should now check for debris in the HP Fuel System. There is likely a cause for fuel to be leaking past the actuator valve - debris?

The debris check is in the PCED. I copied and pasted the debris check:

28. Fuel System Debris Check
Purpose:

This test determines if there is debris in the high pressure fuel system requiring the replacement of the entire high pressure fuel system (fuel rails/fuel lines/fuel injectors) when a new high pressure fuel injection pump is installed. To be carried out if the high pressure fuel injection pump did not have a solenoid concern, no electrical concerns and no leaks found.

Fuel System Debris Check

Carry out the Fuel System Debris Check.

Fuel System Debris	YES/NO

Recommended Procedure:

> Do not cut the secondary fuel filter open to determine if there is debris in the fuel system. The purpose of the fuel filter is to collect debris and may be indicating that it is correctly functioning.

Raise the rear tires of the vehicle 6 to 8 inches.
Disconnect the cylinder number 1 fuel injector from the jumper tube, connect a rubber hose, crank engine over and drain the fuel through a coffee filter or paint strainer.
Disconnect the cylinder number 2 fuel injector from the jumper tube, connect a rubber hose, crank engine over and drain the fuel through a coffee filter or paint strainer.
If there is shiny metallic material in the fuel, install new high pressure fuel system rails, new fuel injectors, a new high pressure fuel injection pump, new high pressure lines and a new fuel cooler. Flush the low pressure fuel return lines until they are free of any contamination.
Possible Causes:

Water in fuel
Gasoline
Tools Required:

Coffee filter or paint strainer

From: Coate, Richard (R.M.)
Sent: Tuesday, March 17, 2009 10:42 AM
To: Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

For your reply Thanks

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M *GO BLUE*

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Tuesday, March 17, 2009 8:48 AM
To: Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: RE: 6.4L Diesel issues

Rick,

Please refer to the information provided on early mails below (I marked it in yellow), we were guided to install the injectors as the tips facing upwards:

Quote:

"2. After you have bleed both banks then all injectors should be attached and nozzle facing upward (inverse or upside down fuel injector)

then crank the engine again this time look for leaks from the nozzle or return port in the injector (side of the injector)"

We are not sure why the suggestions are now different. Regarding the second comment: we crank the engine; obviously it will not run as the injectors removed and the connector (15 pins, disconnected). By the way, if the engine does not start, every starter attempt will continue for 10 seconds independently.

Please advise us if the return flow is normal or a concern.
Thank you

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Coate, Richard (R.M.) [mailto:rcoate@ford.com]
Sent: Monday, March 16, 2009 5:03 PM
To: Asaf Arviv
Subject: FW: 6.4L Diesel issues

Asaf,

For your review. Please reply to the questions below.

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Eeley, Scott (A.)
Sent: Monday, March 16, 2009 11:01 AM
To: Coate, Richard (R.M.); Kromberg, Arnold (A.W.)

Subject: RE: 6.4L Diesel issues

1. We don't perform this test with the injector nozzle tipped up. We usually pull the injector from the hole, attach it to the tube so that the orientation is somewhat maintained - nozzle down.
2. Were they running the engine or just cranking over on the starter? (Hopefully not running....) The 15 way connector at the front of each head should be disconnected.

From: Coate, Richard (R.M.)
Sent: Monday, March 16, 2009 10:28 AM
To: Kromberg, Arnold (A.W.); Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

Scott, Arnold

For your review

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Monday, March 16, 2009 8:32 AM
To: Coate, Richard (R.M.); Bilicki, John (J.R.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: FW: 6.4L Diesel issues

Rick,

Attached please find the Inverse injector test Video.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Thursday, March 12, 2009 11:22 AM
To: Coate, Richard (R.M.)
Cc: Bilicki, John (J.R.); Edens, Brandon (B.); SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: RE: 6.4L Diesel issues

Hi Rick,

We perform the fuel injectors inverse test leak on F550 vehicle that engineering pointed as a suspected vehicle for oil-overfill due to leakage (see attached note from Art).
Pump leak test found no fault.

Fuel leak into oil tests with valve covers off- found no fault
Inverse fuel injector test- preformed today. No leakage found from the nozzle, but we saw that all injectors exhibited fuel flow from the return ports. Below please find the instruction of this test, it is mentioned that if fuel leak from the return port is evident than the injector should be replaced. In this vehicle engineering ask us to replace injector No 3 as a recall action. We perform the Inverse test again with new injector No 3 and the fuel flow exist as well.

Attached is a video that shows the fuel flow from the return port during engine cranking. Could you please confirm with engineering if this flow is a normal operation or a concern? By any case, we assume that a flow from the return port can not contribute to oil overfill.

Thanking you in advance.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Bardell, Art (.) [mailto:abardell@ford.com]
Sent: Thursday, February 12, 2009 5:41 PM
To: Asaf Arviv
Cc: Bilicki, John (J.R.); SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: FW: 6.4L Diesel issues

Asaf,

Forest has provided some deeper explanation below, as well as the document containing these tests. Please let me know if this helps, or if I can help to better interpret the instructions for you.

Regards,

Art Bardell
Field Service Campaigns | Product Concerns
Customer Service Office
Export Operations & Global Growth Initiatives
Ford Motor Company
☎ 313-845-1748

Inverse fuel injector test - tube
1. the first step is to flip the fuel injectors -remove the injectors and turn them upside down - nozzle into the air and reattach to the fuel tube to the injector

when you do this you can introduce air into the fuel rail and when you run the test a leaking injector may not leak therefore you need to bleed the fuel rail ,

attach a clear hose to cylinder no 1 fuel injector jumper tube into a container (this is so you don't add more fuel to the oil) and crank the engine for 15 s- this is to get the air out of the rail and catch fuel in container - should be a couple oz of fuel

attache injector 1 to the jumper tube with nozzle faceing up

Then repeat for opposite bank.

2. After you have bleed both banks then all injectors should be attached and nozzle facing upward (inverse or upside down fuel injector)

then crank the engine again this time look for leaks from the nozzle or return port in the injector (side of the injector)

This paragraph they put in 3 different tests and a lot of parts of information my comments in red

Asaf, with the injectors removed & then reinstalled with the injector tips pointed up secure all the injectors back to the fuel rail. No plastic tube should be needed (this is a new part of the tests I will follow up with hot line to make sure they understand why this is done) .

Explain, the high pressure fuel system is high pressure but very low volume. Any leak will cause very low fuel pressure. Another way to check for a leaking injector is to remove all glow plugs (injectors installed correctly in the engine), 15-way connector disconnected. Crank engine over while watching the glow plug holes. (if your vehicle will not start, then you can do this test first to check for a leaking nozzle, if you do not see mist out of the glow plug hole, then the next step is to perform a return port leak test to check for leaks on the injector fuel return port. OR the inverse injector test. Until the all the new diagnostics are published the easiest way is just to do the inverse injector test)

Looking for a fuel mist coming from a glow plug hole. Replace that injector(s).

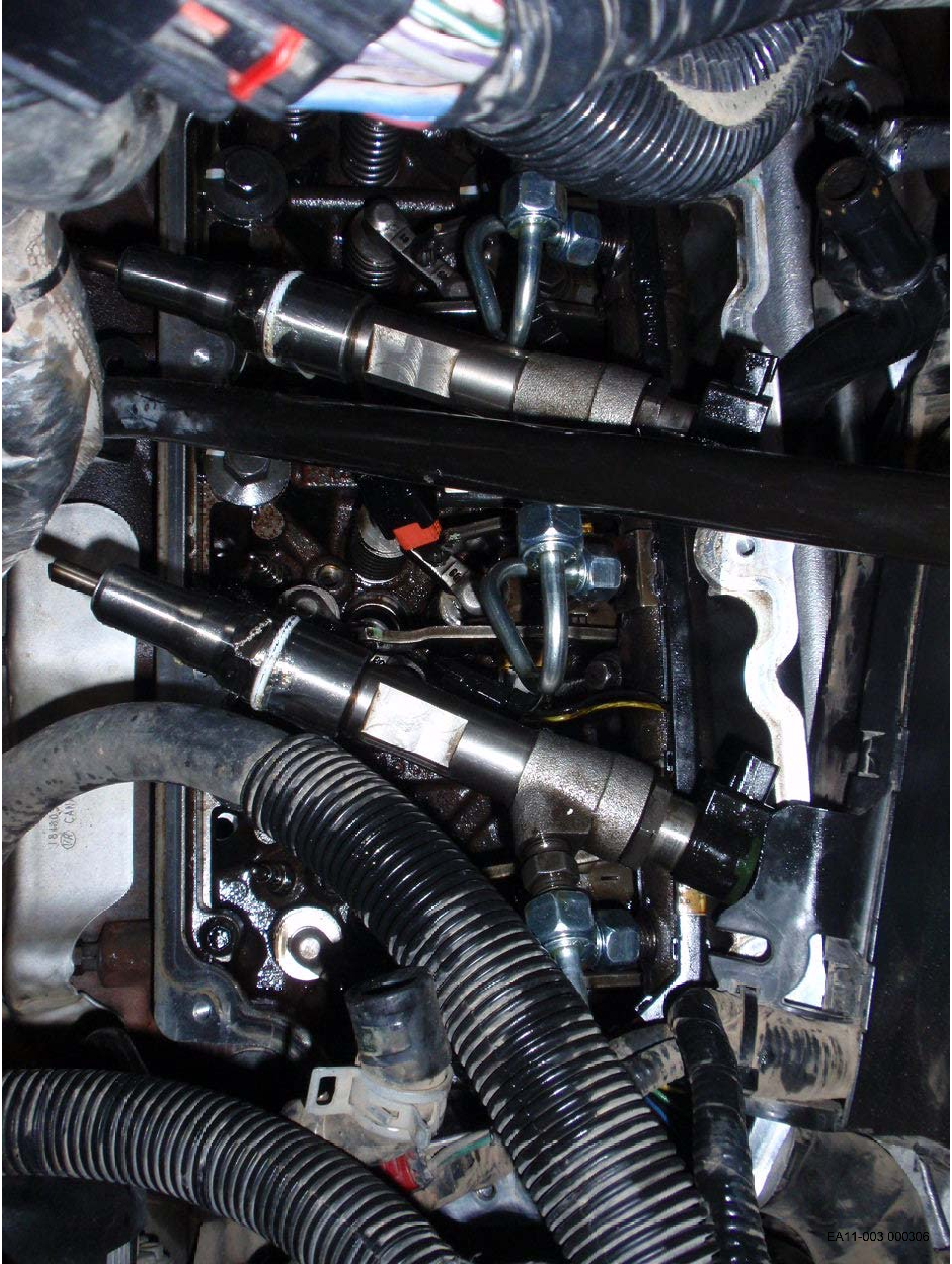
IF fuel was in the oil another test, if the injector tests prove inconclusive, is to test the high pressure fuel pump (low pressure side). Drain the oil from the oil pan, leave the plug out. Command the HFCM (low pressure fuel pump)on & leave on for 20-30 minutes. Watch for fuel/oil mix to run out the oil pan drain. If yes the shaft seal on the high pressure pump is leaking & the high pressure pump will need to be replaced.(this test should be done first if there is fuel in the oil)

Attached is a copy of the hard start no start sheet with all of these tests in it. There are a few typos as this is not final and I only have it in english. But mabye reading all the tests separately may help.

I don't have any pictures available but I will put it on the list for a video to be made.

<<PCED_enUSA_2009_64LDIESEL_00_040.pdf>>

Forest Heggie
MASc, P. Eng
Fuel Systems Diesel OPD
Ford Motor Company
313-282-1627



From: Asaf Arviv [A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Wednesday, March 25, 2009 6:47 AM
To: Eeley, Scott (A.); Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN; Edens, Brandon (B.); Bilicki, John (J.R.)
Subject: RE: 6.4L Diesel issues
Attachments: 6.4 Engine Dipstick Overfill Check.JPG; 6.4 Engine Dipstick Check.JPG

Hi Scott,

We preformed the same test (Injector inverse leak test) on additional engine but this time straight after a repair of short block and HP pump replacement. The fuel system was inspected first for contaminations and it found all clear. Inverse leak test shows the same flow from the return ports on all injectors as it was on the previous vehicle which reported below. Theoretically this should not occur, as much as we understand, the passages to the return ports should be closed as the electrical connectors are disconnected. Could you review and see if technicians worldwide see the same fuel flow?

Additionally, following our conference meeting we performed oil capacity tests on the 6.4L engine and the results are given on the attached two photos.
We closed the draining plug, install new filter and start filling oil with constant portions of 1\2 liter starting from 12 liters.
Each time we add 1\2 liter, we waited 10 minutes and we record the dipstick reading.
This information might be useful for you as well.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Coate, Richard (R.M.) [mailto:rcoate@ford.com]
Sent: Tuesday, March 17, 2009 5:06 PM
To: Asaf Arviv
Cc: Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

FYI, you can communicate directly with one another, I just want to be kept informed. Thanks.

Asaf, for your information and action. Thanks.

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Eeley, Scott (A.)
Sent: Tuesday, March 17, 2009 10:57 AM
To: Coate, Richard (R.M.)
Subject: RE: 6.4L Diesel issues

It is disappointing to read that the replacement #3 injector was leaking. This does not make sense to me.

I think that we should now check for debris in the HP Fuel System. There is likely a cause for fuel to be leaking past the actuator valve - debris?

The debris check is in the PCED. I copied and pasted the debris check:

28. Fuel System Debris Check
Purpose:

This test determines if there is debris in the high pressure fuel system requiring the replacement of the entire high pressure fuel system (fuel rails/fuel lines/fuel injectors) when a new high pressure fuel injection pump is installed. To be carried out if the high pressure fuel injection pump did not have a solenoid concern, no electrical concerns and no leaks found.

Fuel System Debris Check

Carry out the Fuel System Debris Check.

Fuel System Debris	YES/NO

Recommended Procedure:

> Do not cut the secondary fuel filter open to determine if there is debris in the fuel system. The purpose of the fuel filter is to collect debris and may be indicating that it is correctly functioning.

Raise the rear tires of the vehicle 6 to 8 inches.
Disconnect the cylinder number 1 fuel injector from the jumper tube, connect a rubber hose, crank engine over and drain the fuel through a coffee filter or paint strainer.
Disconnect the cylinder number 2 fuel injector from the jumper tube, connect a rubber hose, crank engine over and drain the fuel through a coffee filter or paint strainer.
If there is shiny metallic material in the fuel, install new high pressure fuel system rails, new fuel injectors, a new high pressure fuel injection pump, new high pressure lines and a new fuel cooler. Flush the low pressure fuel return lines until they are free of any contamination.
Possible Causes:

Water in fuel
Gasoline
Tools Required:

Coffee filter or paint strainer

From: Coate, Richard (R.M.)
Sent: Tuesday, March 17, 2009 10:42 AM
To: Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

For your reply Thanks

Rick Coate

Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Tuesday, March 17, 2009 8:48 AM
To: Coate, Richard (R.M.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: RE: 6.4L Diesel issues

Rick,

Please refer to the information provided on early mails below (I marked it in yellow), we were guided to install the injectors as the tips facing upwards:

Quote:

"2. After you have bleed both banks then all injectors should be attached and nozzle facing upward (inverse or upside down fuel injector)

then crank the engine again this time look for leaks from the nozzle or return port in the injector (side of the injector)"

We are not sure why the suggestions are now different. Regarding the second comment: we crank the engine; obviously it will not run as the injectors removed and the connector (15 pins, disconnected). By the way, if the engine does not start, every starter attempt will continue for 10 seconds independently.

Please advise us if the return flow is normal or a concern.
Thank you

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Coate, Richard (R.M.) [mailto:rcoate@ford.com]
Sent: Monday, March 16, 2009 5:03 PM
To: Asaf Arviv
Subject: FW: 6.4L Diesel issues

Asaf,

For your review. Please reply to the questions below.

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations

Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Eeley, Scott (A.)
Sent: Monday, March 16, 2009 11:01 AM
To: Coate, Richard (R.M.); Kromberg, Arnold (A.W.)
Subject: RE: 6.4L Diesel issues

1. We don't perform this test with the injector nozzle tipped up. We usually pull the injector from the hole, attach it to the tube so that the orientation is somewhat maintained - nozzle down.
2. Were they running the engine or just cranking over on the starter? (Hopefully not running....) The 15 way connector at the front of each head should be disconnected.

From: Coate, Richard (R.M.)
Sent: Monday, March 16, 2009 10:28 AM
To: Kromberg, Arnold (A.W.); Eeley, Scott (A.)
Subject: FW: 6.4L Diesel issues

Scott, Arnold

For your review

Rick Coate
Product Concern Engineer
Certified Six Sigma Blackbelt
Ford Motor Company - Customer Service Operations
Export Operations and Global Growth Initiatives
Phone: 313-594-1475 Fax: 313-845-3817
Email: rcoate@ford.com
M GO BLUE

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Monday, March 16, 2009 8:32 AM
To: Coate, Richard (R.M.); Bilicki, John (J.R.)
Cc: SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: FW: 6.4L Diesel issues

Rick,

Attached please find the Inverse injector test Video.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995

E-mail: a.arviv@delekmotors.co.il

From: Asaf Arviv [mailto:A.ARVIV@DELEKMOTORS.CO.IL]
Sent: Thursday, March 12, 2009 11:22 AM
To: Coate, Richard (R.M.)
Cc: Bilicki, John (J.R.); Edens, Brandon (B.); SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: RE: 6.4L Diesel issues

Hi Rick,

We perform the fuel injectors inverse test leak on F550 vehicle that engineering pointed as a suspected vehicle for oil-overfill due to leakage (see attached note from Art).
Pump leak test found no fault.
Fuel leak into oil tests with valve covers off- found no fault
Inverse fuel injector test- preformed today. No leakage found from the nozzle, but we saw that all injectors exhibited fuel flow from the return ports. Below please find the instruction of this test, it is mentioned that if fuel leak from the return port is evident than the injector should be replaced. In this vehicle engineering ask us to replace injector No 3 as a recall action. We perform the Inverse test again with new injector No 3 and the fuel flow exist as well.

Attached is a video that shows the fuel flow from the return port during engine cranking. Could you please confirm with engineering if this flow is a normal operation or a concern? By any case, we assume that a flow from the return port can not contribute to oil overfill.

Thanking you in advance.

Regards,

Asaf Arviv
Product Concern
Service & parts department
Delek Motors LTD
TEL: 972-8-9139995
E-mail: a.arviv@delekmotors.co.il

From: Bardell, Art (.) [mailto:abardell@ford.com]
Sent: Thursday, February 12, 2009 5:41 PM
To: Asaf Arviv
Cc: Bilicki, John (J.R.); SHMULIK DALLAL; SHAI SCHWARTZMAN
Subject: FW: 6.4L Diesel issues

Asaf,

Forest has provided some deeper explanation below, as well as the document containing these tests. Please let me know if this helps, or if I can help to better interpret the instructions for you.

Regards,

Art Bardell
Field Service Campaigns | Product Concerns
Customer Service Office
Export Operations & Global Growth Initiatives
Ford Motor Company
☎ 313-845-1748

Inverse fuel injector test - tube

1. the first step is to flip the fuel injectors -remove the injectors and turn them upside down - nozzle into the air and reattach to the fuel tube to the injector

when you do this you can introduce air into the fuel rail and when you run the test a leaking injector may not leak therefore you need to bleed the fuel rail ,

attach a clear hose to cylinder no 1 fuel injector jumper tube into a container (this is so you don't add more fuel to the oil) and crank the engine for 15 s- this is to get the air out of the rail and catch fuel in container - should be a couple oz of fuel

attache injector 1 to the jumper tube with nozzle faceing up

Then repeat for opposite bank.

2. After you have bleed both banks then all injectors should be attached and nozzle facing upward (inverse or upside down fuel injector)

then crank the engine again this time look for leaks from the nozzle or return port in the injector (side of the injector)

This paragraph they put in 3 different tests and a lot of parts of information my comments in red

Asaf, with the injectors removed & then reinstalled with the injector tips pointed up secure all the injectors back to the fuel rail. No plastic tube should be needed (this is a new part of the tests I will follow up with hot line to make sure they understand why this is done) .

Explain, the high pressure fuel system is high pressure but very low volume. Any leak will cause very low fuel pressure. Another way to check for a leaking injector is to remove all glow plugs (injectors installed correctly in the engine), 15-way connector disconnected. Crank engine over while watching the glow plug holes. (if your vehicle will not start, then you can do this test first to check for a leaking nozzle, if you do not see mist out of the glow plug hole, then the next step is to perform a return port leak test to check for leaks on the injector fuel return port. OR the inverse injector test. Until the all the new diagnostics are published the easiest way is just to do the inverse injector test)

Looking for a fuel mist coming from a glow plug hole. Replace that injector(s).

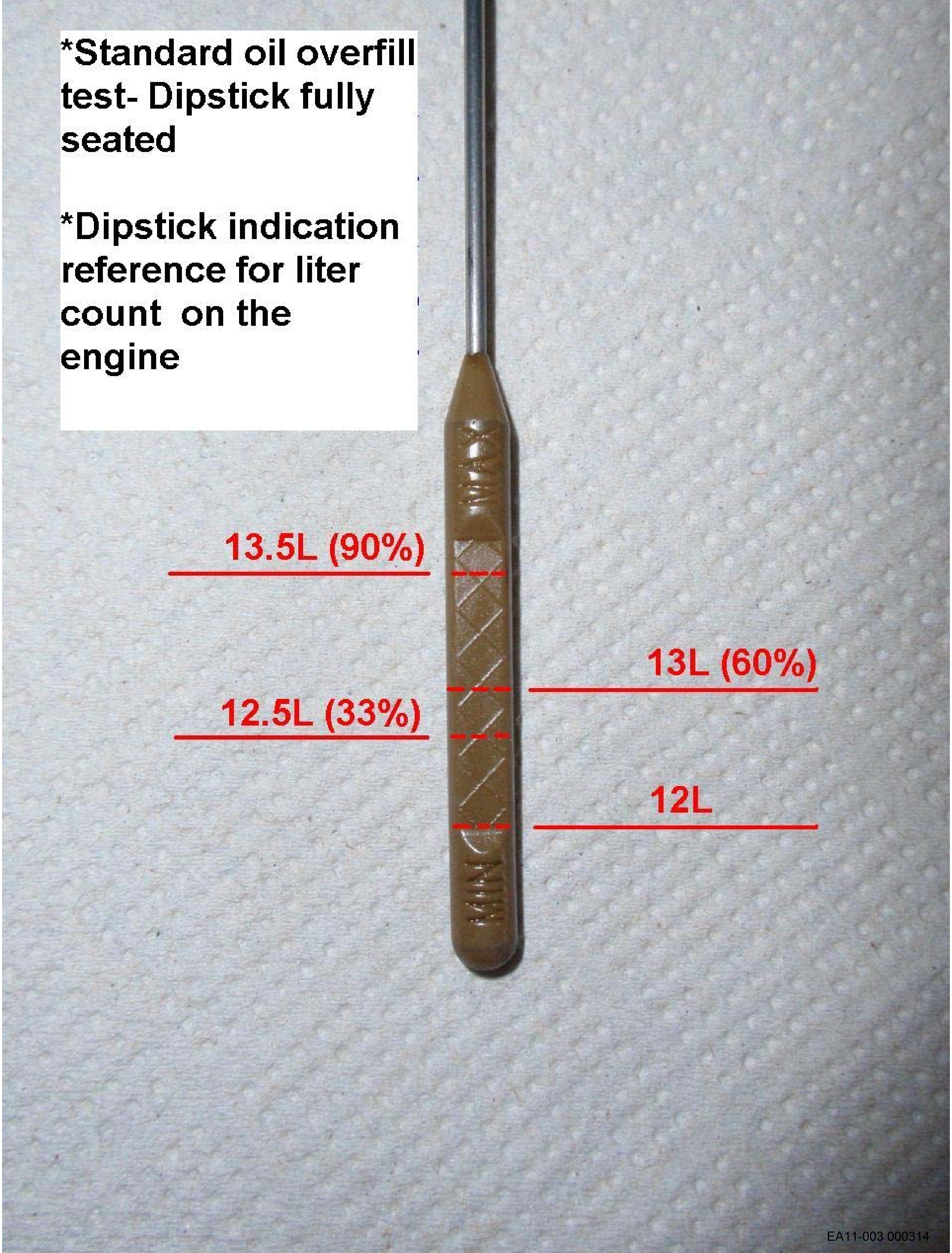
IF fuel was in the oil another test, if the injector tests prove inconclusive, is to test the high pressure fuel pump (low pressure side). Drain the oil from the oil pan, leave the plug out. Command the HFCM (low pressure fuel pump)on & leave on for 20-30 minutes. Watch for fuel/oil mix to run out the oil pan drain. If yes the shaft seal on the high pressure pump is leaking & the high pressure pump will need to be replaced.(this test should be done first if there is fuel in the oil)

Attached is a copy of the hard start no start sheet with all of these tests in it. There are a few typos as this is not final and I only have it in english. But mabye reading all the tests separately may help.

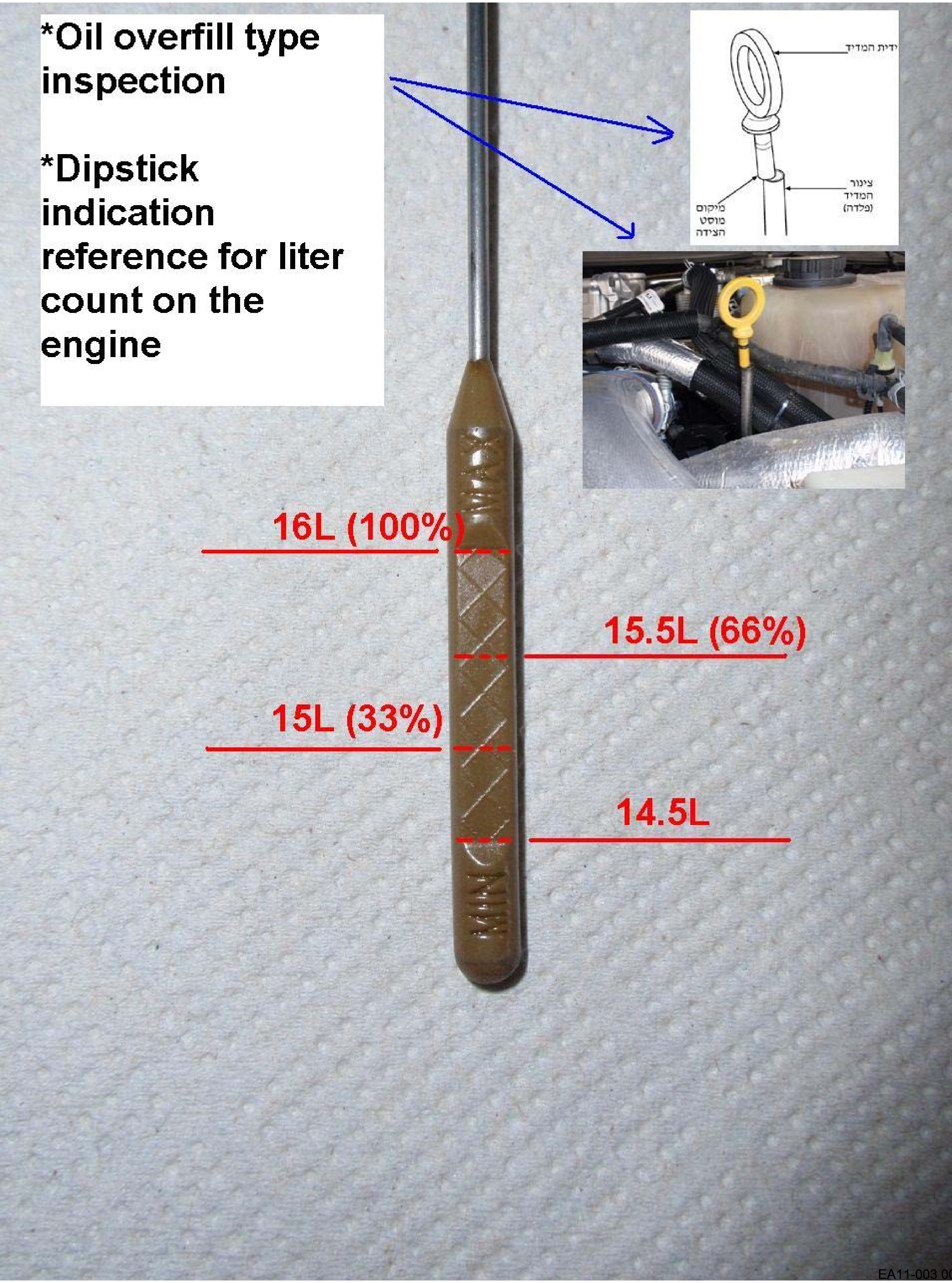
I don't have any pictures available but I will put it on the list for a video to be made.

<<PCED_enUSA_2009_64LDIESEL_00_040.pdf>>

Forest Heggie
MASc, P. Eng
Fuel Systems Diesel OPD
Ford Motor Company
313-282-1627


*Standard oil overfill test- Dipstick fully seated

*Dipstick indication reference for liter count on the engine
MAX
13.5L (90%)
13L (60%)
12.5L (33%)
12L
MIN


*Oil overfill type inspection
*Dipstick indication reference for liter count on the engine
ידית המדיד
צינור המדיד (פלדה)
מיקום מוסט הצידה
16L (100%)
15.5L (66%)
15L (33%)
14.5L

From: Heggie, Forest (F.)
Sent: Monday, December 13, 2010 2:44 PM
To: Stendardo, David (D.)
Subject: RE: 6.4l Fuel system: Clean sufficient fuel test. Please read!!!!!!

Thank You,

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Stendardo, David (D.)
Sent: Monday, December 13, 2010 2:38 PM
To: Heggie, Forest (F.)
Subject: FW: 6.4l Fuel system: Clean sufficient fuel test. Please read!!!!!!
Importance: High

From: Stendardo, David (D.)
Sent: Monday, December 13, 2010 2:37 PM
To: Baker, Zachary (Z.); Baumeister, Eric (E.); Bayne, Rick (R.); Beamer, Nathaniel (N.); Bishop, Chris (C.); Bobrowski, David (D.); Boyd, Evan (E.); Burkhart, Fred (F.); Burns, Gaven (G.); Christians, Hesston (H.); Curtis, Andrew (A.); Cutler, John (J.); Deweese, David (D.); Domaire, Daniel (D.); Dowdy, Jonathon (J.); Dunn, Nathan (N.); Fitzpatrick, Aron (A.); Hamilton, Donald (D.); Hazzard, Benjamin (B.); Herdzik, John (J.); Johnson, Seth (S.); Johnston, William (W.); Jones, Keith (K.); Kern, Donald (D.); Kiser, Travis (T.); Klein, Mark (M.A.); Kunze, Erik (E.); Lamonde, Sebastien (S.); Law, Karl (K.); Lewis, Kevin (K.); Luke, Dan (D.); McAllister, Derek (D.); Mentgen, Brian (B.); Miller, Michael (M.); Miya, Beth (B.); Olson, Eric (E.); Peters, Paul (P.); Petersen, Nancy (N.); Pienton, Simon (S.); Schmidt, Matthew (M.); Sova, Zak (Z.); Standardo, David (D.); West, Devin (D.); Yinger, Joel (.); Zieleniewski, Gordon (G.); McClelland, Mark (M.)
Subject: 6.4l Fuel system: Clean sufficient fuel test. Please read!!!!!!
Importance: High

Team,

When addressing a 6.4L with a fuel system related concern, please be sure to have the tech perform the clean sufficient fuel test as outlined in the PC/ED and stress it's importance. This step will help determine if there an adequate supply to support proper operation. There have been multiple concerns regarding sending unit and fuel pickup tube concerns that could have been isolated have this step been performed properly. If the tech is performing this test, please document the details of his results before moving onto the next recommendation.

The Clean Sufficient Fuel Test is in the following areas of the PC/ED:

Hard/No Start section: Step 10
Performance section: Step 3
Pinpoint test M: Step M3

Below is the test verbatim as per the PC/ED. Please read and become very familiar with it.

3. Sufficient Clean Fuel Test

Purpose:

The purpose of this test is to verify the fuel quality.

Sufficient Clean Fuel Test

• Check for illumination of the water in fuel (WIF) indicator.

• Drain a fuel sample from the fuel conditioning module.

Recommended Procedure:
Open the drain valve integrated in the fuel conditioning module and drain fuel into a clear 1 liter container. Close the drain valve. The flow out of the drain valve should be steady and should produce at least 1 liter/1 quart of fuel within 2 minutes. If the volume of the fuel collected within 2 minutes is short of the required 1 liter/1 quart there may be insufficient amount of fuel in the tank and the fuel level may not be correctly indicated on the fuel level gauge. If a fuel level indication concern is suspected, refer to the Workshop Manual Section 413-01 to continue diagnosis.
Observe the WIF indicator. If the indicator is illuminated, the fuel may be contaminated with water.
Inspect the fuel in the container. It should be clear, not cloudy. It also should be free of water and contaminants. Dyed red or blue fuel indicates off-highway fuel.
The fuel sample should not indicate evidence of waxing or gelling. Waxing or gelling in some fuels in cold weather could clog fuel filters and the fuel pump and cause restrictions in the fuel or low fuel pressure.
Some sediment and water may be present in the fuel sample if the fuel filter has not been replaced for a prolonged period of time and/or if the sediment and water have not been drained recently. If that is the case, a second sample may be required to determine fuel quality.

Possible Causes:
• Biodiesel-water separation, seal degradation, corrosion
• Corrosion to fuel system components
• No fuel in the tank
• Fuel supply line broken or crimped
• Fuel jelled
• Fuel quality
• Pickup tube screen in tank restricted
• Restricted fuel filters
Cloudy fuel indicates that the fuel may not be a suitable grade for cold temperatures.
Excessive water or contaminants may indicate that the tank and fuel system may need to be flushed and cleaned.

Tools Required:
Clear container — approximately 0.95 L (1 quart)

Any questions, please don't hesitate to ask.

Regards,

David Stendardo
6.0L/6.4L SME
Service Engineer/Diesel Drivability
Ford Technical Hotline
DSC1 #314
313-317-9287
dstendar@ford.com

From: Armesto, Carlos (.)
Sent: Wednesday, March 02, 2011 3:39 PM
To: Heggie, Forest (F.)
Subject: RE: 6.7L Fuel Contamination Communication

Forest, I talked to Tony on the phone.
My suggestions were more procedural - I wanted "mandate" procedure "C" (dump return flow at the cooler during system flush) for A and B. I seemed optional to me when I read it.

Thanks

Carlos

From: Heggie, Forest (F.)
Sent: Wednesday, March 02, 2011 3:33 PM
To: Armesto, Carlos (.)
Subject: FW: 6.7L Fuel Contamination Communication

Carlos please put your opinion in for any additions,

This was based off 6.4L so we need to make sure if is correct transfer to 6.7.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rauch, Jim (J.R.)
Sent: Wednesday, March 02, 2011 3:24 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: RE: 6.7L Fuel Contamination Communication

Tony,
I concur with Keith and Brien's comments. If you do not want to add photos at this point as Brien suggests I would recommend changes in red below. I do have the parts available to take the good part photos if we want to go that route. Lastly with this approach to the documents I think we can make the contaminant reference table more useful and specific to 6.7L. I will send a proposal for the table in a separate e-mail.

Refer to Figures 1 and 2 for key component locations
• 1-Pressure Control Valve (PCV)
• 2-Volume Control Valve (VCV)
• 3-High Pressure Pump Outlet Ports
• 4-High Pressure Pump Overflow Valve

b. Figure 3 PCV
• A - PCV valve non-warrantable corrosion example
• B - normal appearance of PCV condition with no corrosion

c. Figure 4 VCV
• A - VCV with rust particle contamination

• B – Corrosion and rust on VCV outlet ring - non-warrantable corrosion example

d. Figure 5 High Pressure Pump Outlet Ports
• Corrosion on high pressure pump outlet port bore - non-warrantable corrosion example
e. Figures 6 & 7 High Pressure Pump Overflow Valve
• Corrosion on high pressure pump overflow valve ports - non-warrantable corrosion example

6. Replace ALL High Pressure fuel system components; High Pressure Fuel Pump, all engine mounted high pressure fuel lines, both high high pressure fuel rails, ALL 8 injectors, the low pressure injector return hose assembly, and the low pressure fuel delivery pressure switch located near the secondary fuel filter.

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 2:02 PM
To: Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: 6.7L Fuel Contamination Communication
Importance: High

We are changing direction from a previously proposed TSB to now issuing a SSM and a Job Aid.

Please review the proposed SSM for 6.7L Fuel Contamination and the attached Job Aid that will be posted to the PTS website under service tips and respond with any comments by COB Friday 3/4.

Proposed SSM text:

2011 Super Duty vehicles equipped with the 6.7L diesel engine that have experienced fuel system contamination can damage the fuel system components, including the High Pressure (HP) Pump and fuel injectors. Operation on fuels and additives that do not meet the lubrication, cooling and anti-corrosion properties required by the high pressure fuel system components, may cause symptoms including, but not limited to the following: Crank/No Start, Long Crank/Hard Start, Rough Run, Low Power, Engine Knocking, Exhaust Smoke and/or Fuel Rail Pressure (FRP) slow to build. A Job Aid has been developed and is now available under the Service Tips tab, located on the PTS website, to help aid in diagnosis and repair direction.

<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

Thank you for your input

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Mahoney, Mark (M.M.)
Sent: Wednesday, March 02, 2011 3:37 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: RE: 6.7L Fuel Contamination Communication

Agree with Brien and Jim. I would have Al Isner take the photos so the lighting/exposure is optimized to make the damage crystal clear.

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 2:02 PM
To: Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: 6.7L Fuel Contamination Communication
Importance: High

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Proposed SSM text:

2011 Super Duty vehicles equipped with the 6.7L diesel engine that have experienced fuel system contamination can damage the fuel system components, including the High Pressure (HP) Pump and fuel injectors. Operation on fuels and additives that do not meet the lubrication, cooling and anti-corrosion properties required by the high pressure fuel system components, may cause symptoms including, but not limited to the following: Crank/No Start, Long Crank/Hard Start, Rough Run, Low Power, Engine Knocking, Exhaust Smoke and/or Fuel Rail Pressure (FRP) slow to build. A Job Aid has been developed and is now available under the Service Tips tab, located on the PTS website, to help aid in diagnosis and repair direction.

<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

Thank you for your input

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 2:53 PM
To: Heggie, Forest (F.); Rauch, Jim (J.R.); Dobbs, Dan (K.D.); Curtis, Andrew (A.); Rauch, Jim (J.R.)
Subject: RE: 6.7L Fuel Contamination Communication

No. 6.4L is more directly focused on WIF, while 6.7L is going across all sources of contamination. WIF is a very small subset of what we have seen on 6.7L at this time.

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Heggie, Forest (F.)
Sent: Wednesday, March 02, 2011 2:52 PM
To: Lusardi, Tony (T.K.); Rauch, Jim (J.R.); Dobbs, Dan (K.D.); Curtis, Andrew (A.); Rauch, Jim (J.R.)
Subject: RE: 6.7L Fuel Contamination Communication

Are we going to take the same approach for 6.4 and 6.7 and specify to validate the wif indicator system is operating properly .

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

From: Fulton, Brien (B.L.)
Sent: Wednesday, March 02, 2011 2:32 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.); Bird, Kevin (M.); Currie, David (J.)
Subject: RE: 6.7L Fuel Contamination Communication

It looks pretty good,

My only suggestions would be:

Consider including comparable pictures of non-corroded versions of the following components like you did with the PCV in figure 3:

- VCV (figure 4)

- Pump outlet (figure 5)
- Overflow valve (figure 7)

Also, to move the part inside the fuel quality verification / indicators between steps 4 and 5 to a location closer to the pictures, you are referencing it from Step 4, I found that I was flipping back and forth just confirming the names and text:

<< OLE Object: Picture (Metafile) >>

Brien Fulton

Diesel Powertrain Systems Technical Specialist

bfulton1@ford.com *Cell:* [redacted] ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 2:02 PM
To: Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: 6.7L Fuel Contamination Communication
Importance: High

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Please review the proposed SSM for 6.7L Fuel Contamination and the attached Job Aid that will be posted to the PTS website under service tips and respond with any comments by COB Friday 3/4.

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<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

Thank you for your input

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Jones, Keith (K.)
Sent: Wednesday, March 02, 2011 2:11 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Johnson, Seth (S.)
Subject: RE: 6.7L Fuel Contamination Communication

I like it. It is very detailed and has good photos. The only concern I found was the portion referecing the dealer to the bleed procedure is in WSM section 310-00, not 312-00.

Keith Jones
6.7 Engine SME
Diesel Drivability
Ford Technical Hotline
DSC1 Cube 308
313-248-7923
KJone286@ford.com

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 2:02 PM
To: Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: 6.7L Fuel Contamination Communication
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<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

Thank you for your input

"Customer Service is an Attitude, Not a Department"

Tony Lusardi

Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Bird, Kevin (M.)
Sent: Friday, March 04, 2011 3:15 PM
To: Lusardi, Tony (T.K.); Fulton, Brien (B.L.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Subject: RE: 6.7L Fuel Contamination Communication

Yep.
The suggestion comes from calls about rust on components and the water light not being on. In the document we provide information on possible sources. Thought we might also point out the service intervals of draining the DFCM.

From: Lusardi, Tony (T.K.)
Sent: Friday, March 04, 2011 2:26 PM
To: Bird, Kevin (M.); Fulton, Brien (B.L.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Subject: RE: 6.7L Fuel Contamination Communication

We had to remove all words from call outs on the pictures due to translation issues.

The WIF will get drained when they change the filters, so we did not see a need to call it out as another step.

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Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Bird, Kevin (M.)
Sent: Friday, March 04, 2011 2:14 PM
To: Fulton, Brien (B.L.); Lusardi, Tony (T.K.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Subject: RE: 6.7L Fuel Contamination Communication

Great document!
On page 1, step #5. Are we concerned if the customer just key's on and runs the fuel pump vs. "run". I know it's picking, but I have heard various tech talking about this.
Can we add the component names with the pictures instead of figure number, etc.
Another hot topic - Is there consideration to mention that just because the water light isn't "on" doesn't mean you shouldn't drain it. I say this because we tell the customer when to change the oil and check the coolant additive.

Kevin

From: Fulton, Brien (B.L.)
Sent: Wednesday, March 02, 2011 2:32 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.); Bird, Kevin (M.); Currie, David (J.)
Subject: RE: 6.7L Fuel Contamination Communication

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My only suggestions would be:

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- VCV (figure 4)
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- Overflow valve (figure 7)

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Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** [redacted] ☎ (313)-59-43365

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From:	Lusardi, Tony (T.K.)
Sent:	Wednesday, March 02, 2011 2:02 PM
To:	Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc:	Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject:	6.7L Fuel Contamination Communication
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<< File: 6.7L Fuel System Contamination Diagnosis & Service Procedure Job Aid.pdf >>

Thank you for your input

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Rauch, Jim (J.R.)
Sent: Thursday, March 03, 2011 12:20 PM
To: Heggie, Forest (F.); Lusardi, Tony (T.K.)
Subject: RE: 6.7L Fuel Contamination Communication

6.7L has the fuel pressure switch so you should get a P008A with blocked filters.

From: Heggie, Forest (F.)
Sent: Thursday, March 03, 2011 12:15 PM
To: Rauch, Jim (J.R.); Lusardi, Tony (T.K.)
Subject: RE: 6.7L Fuel Contamination Communication

In regards to the P codes: if you do not maintain your filters, or all you have in your tank is majority water or degraded fuel/biodiesel creating acid in the tank you may not get a Pcode but will still damage the system. So there are obsolute "contaminated fuel" causing fuel system damage that do not always have Pcode.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rauch, Jim (J.R.)
Sent: Thursday, March 03, 2011 10:40 AM
To: Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.)
Subject: RE: 6.7L Fuel Contamination Communication

Tony,
I understand on the PCED issue. Enclosed are two versions. One is just correcting a few items specific to 6.7L, the other, which I prefer, has the added symptom column. I really think the issues and factors columns in the current version are redundant. The added symptom column would be even better with P codes added or reference to pin point test M but I left those out for now. I will call you to discuss.

<< File: Fuel Contamination Table JR.doc >> << File: Fuel Contamination Table JR2.doc >>

From: Lusardi, Tony (T.K.)
Sent: Thursday, March 03, 2011 8:32 AM
To: Rauch, Jim (J.R.)
Subject: RE: 6.7L Fuel Contamination Communication

Jim, here is the table. Go ahead and mark it up and lets see what you are thinking. If it will have value add, I am for it. I do have some reservation that it might cross into the world of PCED diagnostics though?

<< File: Fuel Contamination Table.doc >>

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101

tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Rauch, Jim (J.R.)
Sent: Wednesday, March 02, 2011 4:21 PM
To: Lusardi, Tony (T.K.)
Subject: RE: 6.7L Fuel Contamination Communication

I want to make a proposal for change. I think the issue and factors column are saying the same thing and that we could combine them and add a symptom column to help the techs (i.e. a P008A code with a damaged fuel system could indicate lack of filter maintenance). There are also some 6.4L items still referenced. If you think this is too much tear-up call me tomorrow and we can discuss.

From: Lusardi, Tony (T.K.)
Sent: Wednesday, March 02, 2011 3:49 PM
To: Rauch, Jim (J.R.)
Subject: RE: 6.7L Fuel Contamination Communication

Are there some changes you would like to make or do you want to copy it for some other application?

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Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Rauch, Jim (J.R.)
Sent: Wednesday, March 02, 2011 3:43 PM
To: Lusardi, Tony (T.K.)
Subject: RE: 6.7L Fuel Contamination Communication

Tony,
Can you send me the table in its native format?

From: Rauch, Jim (J.R.)
Sent: Wednesday, March 02, 2011 3:24 PM
To: Lusardi, Tony (T.K.); Heggie, Forest (F.); Billings, Thomas (T.P.)
Cc: Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject: RE: 6.7L Fuel Contamination Communication

Tony,
I concur with Keith and Brien's comments. If you do not want to add photos at this point as Brien suggests I would recommend changes in red below. I do have the parts available to take the good part photos if we want to go that route. Lastly with this approach to the documents I think we can make the contaminant reference table more useful and specific to 6.7L. I will send a proposal for the table in a separate e-mail.

Refer to Figures 1 and 2 for key component locations
• 1-Pressure Control Valve (PCV)
• 2-Volume Control Valve (VCV)
• 3-High Pressure Pump Outlet Ports
• 4-High Pressure Pump Overflow Valve

b. Figure 3 PCV
• A - PCV valve non-warrantable corrosion example
• B - normal appearance of PCV condition with no corrosion

c. Figure 4 VCV
• A - VCV with rust particle contamination
• B – Corrosion and rust on VCV outlet ring - non-warrantable corrosion example

d. Figure 5 High Pressure Pump Outlet Ports
• Corrosion on high pressure pump outlet port bore - non-warrantable corrosion example
e. Figures 6 & 7 High Pressure Pump Overflow Valve
• Corrosion on high pressure pump overflow valve ports - non-warrantable corrosion example

6. Replace ALL High Pressure fuel system components; High Pressure Fuel Pump, all engine mounted high pressure fuel lines, both high high pressure fuel rails, ALL 8 injectors, the low pressure injector return hose assembly, and the low pressure fuel delivery pressure switch located near the secondary fuel filter.

From:	Lusardi, Tony (T.K.)
Sent:	Wednesday, March 02, 2011 2:02 PM
To:	Heggie, Forest (F.); Rauch, Jim (J.R.); Billings, Thomas (T.P.)
Cc:	Curtis, Andrew (A.); Mahoney, Mark (M.M.); Rivera, Santos (S.); Montgomery, Kerry (K.P.); Klump, Robert (R.F.); Dobbs, Dan (K.D.); Armesto, Carlos (.); Fulton, Brien (B.L.); Davis, Craig (C.B.); Hale, Curt (B.C.); Corlew, Randall (R.L.); Hazel, Jeff (J.D.); Myers, Dan (D.P.); Malik, Wesley (W.K.); Doss, Jacob (J.E.); Trifilio, Mike (M.J.); Pumford, Ken (K.G.); Dixon, Mark (M.R.); Bandoske, Pete (P.F.); Jones, Keith (K.); Johnson, Seth (S.)
Subject:	6.7L Fuel Contamination Communication
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Thank you for your input

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Tony Lusardi
Product Concern Engineer - 6.7L Diesel
1700 Fairlane Drive
Allen Park, MI 48101
tlusardi@ford.com
313-248-9543 office
313-337-5696 fax

From: Jones, Keith (K.)
Sent: Thursday, September 09, 2010 10:27 AM
To: Pumford, Ken (K.G.)
Cc: Hudson, Tony (A.W.); Lusardi, Tony (T.K.)
Subject: RE: BEA09321 - Gasoline Contamination System Report

Ken,

There is nothing the customer signs. In cases such as this, if the customer declines repairs, the entire engine warranty would be canceled. The dealer will complete a warranty cancellation form through FMC dealer. The form is then reviewed by the Technical Hotline and if determined, the warranty would be canceled. We can not cancel only the fuel system. We can only cancel the engine warranty, powertrain warranty or complete vehicle warranty. Currently there is an SSM for this concern on the 6.4. The SSM is 21410.

OASIS MESSAGE :
SOME F250-F550 6.4L EQUIPPED VEHICLES MAY EXHIBIT A RUNS ROUGH, WHITE SMOKE, NO START CONCERN. THIS CONCERN MAY BE CAUSED BY THE FUEL BEING CONTAMINATED WITH

GASOLINE OR ALCOHOL. GASOLINE/ALCOHOL LACK THE LUBRICITY OF DIESEL FUEL AND WILL CAUSE FUEL SYSTEM FAILURE. IF GASOLINE OR ALCOHOL IS FOUND IN THE FUEL, THE COMPLETE HIGH PRESSURE FUEL SYSTEM WILL NEED TO BE REPLACED PER THE PCED, SECTION 4 (HARD START/NO START DIAGNOSTICS PROCEDURES), STEP 28. GASOLINE OR ALCOHOL CONTAMINATION IS NOT A WARRANTABLE REPAIR. IF THE OWNER OF THE VEHICLE DENIES THE REPAIR, AN INFORMATION-ONLY CUDL SHOULD BE OPENED AND A WARRANTY CANCELLATION REQUEST FORM SHOULD BE SUBMITTED. THE REMAINDER OF THE FACTORY WARRANTY WILL BE REINSTATED ONCE THE REPAIR IS COMPLETED AND THE WARRANTY REINSTATEMENT FORMS ARE SUBMITTED.

Keith Jones
6.7 Engine SME
Diesel Drivability
Ford Technical Hotline
DSC1 Cube 308
313-248-7923
KJone286@ford.com

From: Pumford, Ken (K.G.)
Sent: Thursday, September 09, 2010 10:11 AM
To: Jones, Keith (K.); Hudson, Tony (A.W.)
Subject: FW: BEA09321 - Gasoline Contamination System Report

Keith,

FYI. The fuel system in the subject vehicle survived its short encounter with gasoline, per the attached report from Bosch. In this case, where the dealership filled the truck with gas, it was certainly necessary to change the HP fuel system. But a regularly customer, if they notice their mistake soon enough, may get lucky and not have to put thousands of dollars into a system replacement. However, such a customer, who runs gasoline through their truck and doesn't elect to change their hardware, should sign a fuel system warranty voiding disclaimer so they can't come back to Ford with a warranty claim later on. There is such a procedure in place already, isn't there?

Regards,

Ken Pumford

Ford Super Duty Diesel
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Romak Ken (DS/QMM1.2-NA) [mailto:Ken.Romak@us.bosch.com]
Sent: Friday, September 03, 2010 12:32 PM
To: Pumford, Ken (K.G.); Cervenan, Neil (N.J.); Dixon, Mark (M.R.); McDonagh, Scot (S.M.)
Subject: BEA09321 - Gasoline Contamination System Report

Good afternoon,
Here is the analysis findings on the fuel system from BEA09321 which was reported by the customer to have been contaminated with gasoline.
Best regards,

BOSCH
Diesel Systems

Ken Romak
Diesel Products Quality

From: Fulton, Brien (B.L.)
Sent: Thursday, February 24, 2011 1:10 PM
To: Heggie, Forest (F.)
Subject: RE: BEA22322 - CP4 Pump (contaminated)

Don't forget the introduction of DEF into the fuel tank

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com *Cell:* (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Heggie, Forest (F.)
Sent: Thursday, February 24, 2011 1:05 PM
To: Fulton, Brien (B.L.)
Subject: FW: BEA22322 - CP4 Pump (contaminated)

fyi

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Pumford, Ken (K.G.)
Sent: Thursday, February 24, 2011 1:03 PM
To: Mahoney, Mark (M.M.); Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.); Rauch, Jim (J.R.)
Subject: RE: BEA22322 - CP4 Pump (contaminated)

I can't comment on the maintenance, not having access to any records, but will comment about regular WIF draining. We've seen over and over that some operators introduce so much water into the fuel tank that it is guaranteed to overwhelm the water seperator, regardless of how often it is drained. There have been some cases where the fuel has a huge percentage of water, over 25%, that will corrode the system in short order, as if the truck didn't even have a seperator. Once the calibration includes WIF light on time tracking and prevents WIF light resets, and pumps are also being more closely examined for rust at the dealerships which should lead to more thorough fuel sampling, we'll be able to get a better picture of whether most corrosion damage is caused by gross water contamination or by poor maintenance.

Regards,

Ken Pumford
Engine Design
Ford Motor Company

Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Mahoney, Mark (M.M.)
Sent: Thursday, February 24, 2011 10:44 AM
To: Pumford, Ken (K.G.); Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.); Rauch, Jim (J.R.)
Subject: RE: BEA22322 - CP4 Pump (contaminated)

Would this not have happened if the operator drained the water separator monthly and drained it if the WIF tripped?

Did this vehicle get filters at 22500?

From: Pumford, Ken (K.G.)
Sent: Thursday, February 24, 2011 9:44 AM
To: Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.); Rauch, Jim (J.R.); Mahoney, Mark (M.M.)
Subject: FW: BEA22322 - CP4 Pump (contaminated)

Tony, attached is a field return fuel pump teardown report from Bosch, received yesterday, that has some good photos on pages 3 & 4 of corrosion found on the VCV and overflow valve.

FYI, of the most recent 4 field return pumps I've forwarded to Bosch, 3 had signs of corrosion, and 1 had sand particles inside.

Regards,

Ken Pumford

Engine Design
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Romak Ken (DS/QMM1.2-NA) [mailto:Ken.Romak@us.bosch.com]
Sent: Wednesday, February 23, 2011 12:52 PM
To: Pumford, Ken (K.G.)
Cc: Graham Terrence (DS/ENC-NA); Heston Joseph (DS/ENC-NA)
Subject: BEA22322 - CP4 Pump (contaminated)

Good afternoon Ken,
The pump from VIN BE[redacted] shows evidence of corrosion on the VCV and the overflow valve.

Joe Heston currently has the 8 fuel injectors from this truck. Is there any special information you require from the injectors? Or can they be scrapped out?

Best regards,

Ken Romak

Robert Bosch LLC
Diesel Systems Quality, (DS/QMM1.2)

From: Mahoney, Mark (M.M.)
Sent: Thursday, February 24, 2011 10:44 AM
To: Pumford, Ken (K.G.); Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.); Rauch, Jim (J.R.)
Subject: RE: BEA22322 - CP4 Pump (contaminated)

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Did this vehicle get filters at 22500?

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Sent: Thursday, February 24, 2011 9:44 AM
To: Lusardi, Tony (T.K.)
Cc: Heggie, Forest (F.); Rauch, Jim (J.R.); Mahoney, Mark (M.M.)
Subject: FW: BEA22322 - CP4 Pump (contaminated)

Tony, attached is a field return fuel pump teardown report from Bosch, received yesterday, that has some good photos on pages 3 & 4 of corrosion found on the VCV and overflow valve.

FYI, of the most recent 4 field return pumps I've forwarded to Bosch, 3 had signs of corrosion, and 1 had sand particles inside.

Regards,

Ken Pumford
Engine Design
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Romak Ken (DS/QMM1.2-NA) [mailto:Ken.Romak@us.bosch.com]
Sent: Wednesday, February 23, 2011 12:52 PM
To: Pumford, Ken (K.G.)
Cc: Graham Terrence (DS/ENC-NA); Heston Joseph (DS/ENC-NA)
Subject: BEA22322 - CP4 Pump (contaminated)

Good afternoon Ken,
The pump from VIN B[redacted] shows evidence of corrosion on the VCV and the overflow valve.

Joe Heston currently has the 8 fuel injectors from this truck. Is there any special information you require from the injectors? Or can they be scrapped out?

Best regards,

Ken Romak

Robert Bosch LLC
Diesel Systems Quality, (DS/QMM1.2)
125 Bosch 1886–2011

From: Lusardi, Tony (T.K.)
Sent: Tuesday, September 20, 2011 12:10 PM
To: Pumford, Ken (K.G.); Heggie, Forest (F.)
Cc: Curtis, Andrew (A.)
Subject: RE: BEA41313 - CP4 Pump (DEF contamination)

Ken, the dealers do not have direct access to the GCQIS reports. They do have direct access to CUDL reports, but I doubt if you have access to create or add comments to those reports. If the dealer were to contact the hotline, then they could share the information with the dealer and would serve a purpose, but that is only if the contact the hotline.

"Customer Service is an Attitude, Not a Department"

Tony Lusardi
Warranty Team Leader
16800 Executive Plaza Drive
Dearborn, MI 48126-4207
tlusardi@ford.com
313-248-9543 office

From: Pumford, Ken (K.G.)
Sent: Tuesday, September 20, 2011 11:31 AM
To: Heggie, Forest (F.); Lusardi, Tony (T.K.)
Cc: Curtis, Andrew (A.)
Subject: FW: BEA41313 - CP4 Pump (DEF contamination)

FYI. When I receive reports like this I put comments into CQIS about the findings. Does that serve a purpose; i.e., will the dealership read through previous claims if/when the truck comes in for service in the future? There should be a method to flag vehicles in situations like this where only one part in the fuel system was changed, and that part shows signs of contamination, which means there is a high likelihood of future fuel system warranty claims on that vehicle.

Regards,

Ken Pumford
Engine Design
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Romak Ken (DS/QMM1.2-NA) [mailto:Ken.Romak@us.bosch.com]
Sent: Tuesday, September 20, 2011 10:26 AM
To: Pumford, Ken (K.G.)
Cc: Graham Terrence (DS/ENC-NA); Katzschner Kai (FeP/QMM32)
Subject: BEA41313 - CP4 Pump (DEF contamination)

Good morning Ken,

The pump from BEA41313 is confirmed to have been contaminated with DEF. If the entire high pressure fuel system (pump, rails, injectors) was not replaced together, there is likely to be repeat failures from this truck due to debris / corrosion in the system.

Best regards,

Ken Romak

Robert Bosch LLC
Diesel Systems Quality, (DS/QMM1.2)

125 Bosch 1886–2011

From: Fulton, Brien (B.L.)
Sent: Thursday, August 25, 2011 10:49 AM
To: Heggie, Forest (F.); Goering, Dan (D.L.); Simpson, Timothy (T.A.); Renaud, Chris (C.M.); Billings, Thomas (T.P.); Hansen, James (J.B.)
Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.); Misangyi, Pete (P.W.)
Subject: RE: Biofuels
Attachments: Ford Diesel Products and Biodiesel.ppt

I am assuming that since Joel is on the note we are talking about operation of 6.0L and 6.4L on biodiesel fuels.

The issues we run into with higher than recommended levels of biofuel operation, even with ***good quality biofuel***, is material compatibility, durability issues due to that material compatibility (any components that touch fuel / EGR / oil), fuel in oil dilution levels due to higher evap temps of the biofuel, DPF ash accumulation, injector fouling due to higher zinc levels, etc. I do not have any pictures for 6.0L and 6.4L for issues when running higher than recommended content biofuels, the only pictures I have are when engines are run on biofuels of poor quality, at recommended levels or not which is a whole other discussion.

A while back (2006), I got asked to make a presentation of what I would recommend for people who were operating fleets that were going to run on biofuel levels higher than recommended levels regardless of our warranty statements and position on biofuels, here is what I made. It has dated material in it and has not been updated in about 4 years. The theme is pretty clear.

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** (313)-805-9342 ☎ (313)-59-43365

From: Heggie, Forest (F.)
Sent: Thursday, August 25, 2011 9:36 AM
To: Goering, Dan (D.L.); Simpson, Timothy (T.A.); Renaud, Chris (C.M.); Billings, Thomas (T.P.); Hansen, James (J.B.)
Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.); Fulton, Brien (B.L.)
Subject: RE: Biofuels

I believe Brian would have the latest and greatest " Some fleets and governments are pushing use of high bio content and we are trying to persuade them not to. "

Forest Heggie
6.7L Diesel Engine Systems Engineer
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt

313-618-5054

From: Goering, Dan (D.L.)
Sent: Thursday, August 25, 2011 9:22 AM
To: Simpson, Timothy (T.A.); Renaud, Chris (C.M.); Billings, Thomas (T.P.); Hansen, James (J.B.); Heggie, Forest (F.)

Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.)
Subject: RE: Biofuels

Absent of any pictures, any reports or documentation would assist. Some fleets and governments are pushing use of high bio content and we are trying to persuade them not to.

From: Simpson, Timothy (T.A.)
Sent: Thursday, August 25, 2011 9:20 AM
To: Renaud, Chris (C.M.); Billings, Thomas (T.P.); Goering, Dan (D.L.); Hansen, James (J.B.); Heggie, Forest (F.)
Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.)
Subject: RE: Biofuels

Forrest do you have any pictures?

From: Renaud, Chris (C.M.)
Sent: Thursday, August 25, 2011 9:09 AM
To: Billings, Thomas (T.P.); Goering, Dan (D.L.); Simpson, Timothy (T.A.); Hansen, James (J.B.)
Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.)
Subject: RE: Biofuels

I do not.

Tim, Jim,
Any pics?

Chris Renaud
6.0L & 6.4L Diesel Engineering
Ford Motor Company
Cell: 313-805-6559

From: Billings, Thomas (T.P.)
Sent: Thursday, August 25, 2011 8:46 AM
To: Goering, Dan (D.L.); Renaud, Chris (C.M.)
Cc: 'Brick, Joel'; Castleberry, Larry (L.); Armesto, Carlos (.)
Subject: RE: Biofuels

Dan, I don't have any -- Chris might. I've cc'd Larry Castleberry and Carlos Armesto who might have something (Larry, Carlos, this is for the Navistar engines).

Tom

From: Goering, Dan (D.L.)
Sent: Wednesday, August 24, 2011 3:19 PM
To: Billings, Thomas (T.P.); Renaud, Chris (C.M.)
Cc: Brick, Joel
Subject: FW: Biofuels

Tom / Chris,
Any pictures available on evidence of using too high a mix of bio?

From: Brick, Joel [mailto:Joel.Brick@Navistar.com]
Sent: Wednesday, August 24, 2011 3:15 PM

To: Goering, Dan (D.L.)
Cc: Crowell, Dustin
Subject: Biofuels

Can you access any information from NA Diesel regarding use of biofuel? Dustin is looking for pictures and information on what happens if you use too rich of a mixture of biofuel, e.g., clogged filters, fuel lines, etc.

Joel Brick
Channel Marketing Manager
Blue Diamond Parts, LLC.
Phone: (630) 719-7332 Fax: (630) 719-7798

Ford Diesel Products and Biodiesel

6/21/2006

Ford Diesel Products and Biodiesel

What is Biodiesel?

Biodiesel fuel is a mixture of petroleum diesel fuel and fatty acid methyl esters (FAME) that were produced from a transesterification process of either vegetable oils and/or animal fats.

What are biodiesel fuel blends?

Biodiesel fuel is used in blends of 2% to as high as 100% biodiesel. These blends are signified by the what is commonly called the “B” factor, ex. B20 is fuel containing 20% biodiesel / 80% petroleum diesel and B100 is pure biodiesel. ***It is critical that this nomenclature does not get confused with the “E” system or E-diesel nomenclature and that E-diesel should be not used in any Ford diesel product.***

Current Status

Recently efforts by the Engine Manufacturers Association (EMA) and ASTM are underway to develop specifications for Biodiesel fuels and to gain acceptance for this fuel in the marketplace. These specifications are currently being written, but if the ASTM specification does not match manufacturers' requirements, then it is critical that customers or fleets considering use of B20 be certain their fuel supply does meet the requirements of their engine manufacturer. Compliance to an ASTM specification does not assure manufacturer warranty. ***This presentation is in no way an endorsement to run at higher than recommended levels of biofuels on any Ford diesel products.***

Ford Diesel Products and Biodiesel

Biodiesel Fuel Properties to be aware of:

- Biodiesel requires special care at low ambient temperatures due to the high viscosity and reduced cold ambient properties of the fuel
- Biodiesel tends to store more water than diesel fuel and water is not completely miscible in biodiesel
- Higher water content leads to increased corrosion of the internal components of the fuel system
- Higher water content can lead to microbial contamination and growth in the fuel resulting in increased filter clogging and fuel system damage
- Higher water content during cold operation leads to ice crystallization enabling fuel gelling causing filter plugging in cold temperatures
- Biodiesel has a higher cloud point than petroleum diesel and can have issues with operation in cold weather
- Biodiesel has solvent properties that can release deposits in diesel fuel systems that were previously run on mineral based diesel fuels
- Biodiesel operation increases the amount of engine deposits
- Oxidation stability of the fuel is far reduced from mineral diesel and the current 3 hour specification is considered deficient

Ford Diesel Products and Biodiesel

There have been many Biodiesel Initiatives and fleet tests that have resulted in the most recent was in Minnesota involving B2 (2% biodiesel) fuel

- LAWS OF MN 2002 - CHAPTER 244 [S.F.No. 1495] requiring that diesel fuel sold in Minnesota contain at least 2% by volume of biodiesel (B2)
- The Minnesota Law was suspended due to the number of vehicle/engine problems resulting from the use of biodiesel.
- 62 percent of the Minnesota Trucking Association's fleet managers who responded to a December survey reported clogged fuel filters, engines failing to start, power loss on hills and roadside breakdowns.
- Biodiesel fuels used in Minnesota contained out of spec. glycerin levels, this was cited as the main contributor for the 2005/2006 cold issues.

Ford Diesel Products and Biodiesel

Biodiesel production and quality is not well controlled, current specifications are deficient and almost completely un-enforceable.

- Various organizations including farm co-ops, local entrepreneurs and individual owners are starting production facilities all over the country, these facilities are currently unregulated
- Even if proper fuel specifications were in place they would be unenforceable due to the nature of the production infrastructure currently developing in the biodiesel industry
- Other than the State of Minnesota, government agencies have not shown any desire to try and regulate this emerging industry infrastructure
- Large oil companies exercise some level of control on their products to meet ASTM D975 diesel fuel properties, due to the nature of biodiesel production, this industry does not have even this level of control
- Further there is no requirement for the mineral diesel fuel that is being mixed with the biodiesel fuel

Ford Diesel Products and Biodiesel

If you choose to operate biodiesel fuels at your own discretion, taking these preventive steps can help avoid costly vehicle repairs and potential safety issues involving vehicle performance:

- Verify that fuel supply meets the latest fuel specifications (EN14214 and ASTM D6751)
- Recommendation that fuel supplies and storage tanks are continuously checked and maintained to verify the fuel meets the required fuel specifications listed above
- Installation of a low pressure fuel system pressure sensor in the fleet vehicles to warn the driver of fuel system pressure loss due to fouling/clogging of fuel system components especially filters
- Increased fuel filter change intervals in the vehicle
- Increased Water reservoir drain intervals paying particular attention to WIF light
- Special cold weather storage and vehicle operation to ensure that the biodiesel fuels do not gel in the vehicle fuel system
- Operation of mineral diesel fuel before long periods of vehicle storage can help avoid potential damage to engine components

Ford Diesel Products and Biodiesel

Summary

Ford Motor Company recognizes the potential benefits that may be associated with the expanded use of high quality biodiesel fuel blends, but before we move forward with increased biodiesel content of the diesel fuel supply, Ford and biodiesel producers must fully evaluate biodiesel fuels operated in our engines to verify that these fuel blends do not have a negative impact on performance, durability, or the ability to meet emissions limits set by the regulating government agencies U.S. EPA and CARB.

Biodiesel by itself cannot meet Tier II emissions requirements without the addition of exhaust after-treatment components (particulate filters and NOx catalysts) and biodiesel fuel is not a key requirement or enabler to meeting Tier II emissions standards.

Ford Diesel Products and Biodiesel

Summary cont.

- Ford supports use of up to B5 (5% Biodiesel) in US Ford diesel products produced before 2010MY
- Ford does not support operation of biodiesel content above B5 in US Ford diesel products produced before 2010MY.
- Biodiesel used in any Ford diesel products must comply with the most recent specifications available (EN14214 and ASTM 6751).
- Manufacturers including Ford are determining what fuel specifications are required for B20 operation.
- Ford is studying product revisions required to support the use of Biodiesel up to B20 in future diesel products.
- Operation of biodiesel fuels greater than B5 is solely at the risk and discretion of the customer
- Compliance of a Biodiesel fuel to an ASTM specification does not assure manufacturer warranty.

Ford Diesel Products and Biodiesel

US Ford Product Summary Benchmark

- 7.3L Summary (Capable to B5 levels of biodiesel)
  - LPFS pressure switch up to 2002 MY
  - HEUI HP fuel system more robust to low pressure conditions than G2
  - Old WIF strategy – low reliability / low robustness to slosh
  - No regeneration requirements – reduced fuel dilution in oil concerns
  - No material compatibility analysis or testing of the vehicle & engine systems
- 6.0L Summary (Capable to B5 levels of biodiesel)
  - G2 HP fuel system less robust to low pressure conditions than HUEI
  - No ability to currently alert customers to low pressure conditions in the LPFS
  - Old WIF strategy – low reliability / low robustness to slosh
  - No regeneration requirements – reduced fuel dilution in oil concerns
  - No material compatibility analysis or testing of the vehicle & engine systems
- 6.4L Summary (Capable to B5 levels of biodiesel)
  - Enhanced WIF strategy alert to the customer (message center / memory / FMEM)
  - No LPFS pressure switch (no alert for customer to low pressure condition)
    - P0087 / P2291 codes present: helps, but not completely robust
  - DPF Regeneration required – Increased fuel in oil dilution concerns / No oil minder strategy present on this application
  - DPF Ash Accumulation when operating biofuels was not done
  - No material compatibility analysis or testing of the vehicle & engine systems

From:	Eeley, Scott (A.)
Sent:	Tuesday, November 16, 2010 8:22 AM
To:	Raney-Pablo, Beth (H.E.)
Cc:	Chrysafi, Sofia (S.); Lawther, Robin (R.); Mull, Ted (V.)
Subject:	RE: Diesel Fuel Analysis
Attachments:	RE: Diesel Fuel Quality in Mexico

Beth,

The Mexican warranty investigation concluded that technician diagnostics was the significant contributor to cost and repairs.

In the US, Canada and Mexico we see Internal Transfer Pump wear. This wear is not unique to Mexico. (We have witnessed this wear in one of our department controlled test trucks.) We have been asking Navistar about this observed wear for a long while. Navistar has responded by asking Continental to investigate using DLC on key ITP components for our Service parts. (The 6.4 is out of production for Ford and the 6.7 does not use an ITP.)

Scott

RE: Diesel Fuel Quality in Mex...

From:	Mull, Ted (V.)
Sent:	Tuesday, November 16, 2010 8:05 AM
To:	Raney-Pablo, Beth (H.E.)
Cc:	Chrysafi, Sofia (S.); Eeley, Scott (A.)
Subject:	RE: Diesel Fuel Analysis

Early in our 6.4L FoM high pressure pump warranty investigation we had 1 sample of diesel fuel that indicated poor wear scar (Chevron analysis). That analysis was consistent with the type of pump wear we where seeing and why we went down the fuel lubricity path. We sampled a few additional points but those indicated wear scar was ok (Chuck's email / analysis). We also completed a matrix of testing that ran 100% kerosene anticipating the kerosene would represent worst case wear scar but that testing did not produce the pump wear we where seeing in the field. Ultimately, despite the early indicators other factors where determined to be the cause of the pump wear, not lubricity. We did document a number of lesson learned that could benefit future diesel applications; Scott Eeley and I reviewed those with Robin Lawther some months ago.

<< Message: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels >> << Message: Diesel Fuel Analysis >>

Ted V. Mull, Jr.
Engine Engineering
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From:	Raney-Pablo, Beth (H.E.)
Sent:	Friday, November 12, 2010 1:37 PM
To:	Mull, Ted (V.)
Cc:	Chrysafi, Sofia (S.)
Subject:	FW: Diesel Fuel Analysis

Ted, FoE is asking about Mexican diesel fuel quality, particularly around diesel lubricity. The product planners are considering marketing a Europe-based product into Mexico and are trying to project the potential risks due to poor lubricity fuel availability.

Chuck mentioned that you were involved with some field issues thought to be related to diesel lubricity. He also mentioned a test program that was planned. Do you have any reports or emails that could be helpful for the FoE team? Thanks!

Regards,

Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
1500 Enterprise Drive (APTL, Cube 1FL09) - NEW!!
Phone: (313) 805-6129
Fax: (313) 594-4249 - NEW!!
E-mail address: hraney@ford.com

From: Richardson, Charles (C.E.)
Sent: Thursday, November 11, 2010 4:58 PM
To: Raney-Pablo, Beth (H.E.)
Subject: FW: Diesel Fuel Analysis

<< File: 172993_Mexico diesel.pdf >>

Regards,

Chuck Richardson
Ford Motor Company
Fuels & Lubricants Engr
1500 Enterprise Drive
Allen Park, Michigan 48101- USA
Phone: (313) 805-0380
E-mail: cricha12@ford.com

From: Mull, Ted (V.)
Sent: Tuesday, March 02, 2010 9:12 AM
To: Richardson, Charles (C.E.)
Subject: RE: Diesel Fuel Analysis

Interesting stuff. Can't conclude the fuel, after being heated and compressed, is any different…..and the data speaks volumes to your previous comments regarding the repeatability of HFRR testing.

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Richardson, Charles (C.E.)
Sent: Tuesday, March 02, 2010 8:45 AM

To: Mull, Ted (V.)
Subject: Diesel Fuel Analysis

Ted,
Analysis of diesel fuel samples from Mexico have been completed. HFRR lubricity results of samples from vehicle tank show that all fuels have HFRR lubricity below 400 micron wear scar diameter.

Sample	HFRR Lubricity	
	Tank	Return
VIN #M[redacted]	369 microns	392 microns
VIN #8M[redacted]	380 microns	281 microns
VIN #9M[redacted]	395 microns	306 microns
VIN #[redacted]	359 microns	354 microns

<< File: 172993_Mexico diesel.pdf >>

Regards,

Chuck Richardson
Ford Motor Company
Fuels & Lubricants Engr
2000 Enterprise Drive
Allen Park, Michigan 48101- USA
Phone: (313) 805-0380
E-mail: cricha12@ford.com

From: Eeley, Scott (A.)
Sent: Thursday, November 11, 2010 8:26 AM
To: Armesto, Carlos (.)
Cc: Chrysafi, Sofia (S.); Raney-Pablo, Beth (H.E.); Krenz, Edwin (E.A.); Horbal, Colin (C.P.)
Subject: RE: Diesel Fuel Quality in Mexico

Carlos,

The warranty spike in 6.4 FIE last year was caused by two things: 1. Techs were inspecting for debris at the fuel filter rather than at the HP fuel rails and replacing all HP FIE when debris was found at the filter. Directed the debris check to be performed at the HP fuel rail. 2. The recommended fuel filter maintenance was not being followed. We found trucks with as much as 2000 operating engine hours never having replaced the fuel filters. FoM FCSD Field service worked with the largest customer fleets and implemented maintenance programs.

We analyzed fuel from several trucks suffering FIE failure and found fuel lubricity (WSD) was within the range of U.S. samples known to Beth - at the high end of the U.S range… We ran vehicles at DTF on K-1 (WSD worse than Mexican fuel) and were not able to produce a failure.

We found 'metal soap' on a couple of the fuel filters (return loop). This could have been a byproduct of the failure. FoM PD visited with Pemex and alerted them of the acid salts - Pemex did not / would not follow up with testing and assured FoM that acid salts were not present in their fuel.

FoM released PM-22 fuel additive via Service Parts - January 2010. This is the same additive we sell in the U.S. FoM FCSD at the time felt the issue was related to fuel lubricity and wanted the additive. Are they applying this or any other additive to the Euro sourced vehicles? Are the additives compatible with the Euro FIE?

Let me know if you want us to look at some parts.

Good luck.

Scott

From: Armesto, Carlos (.)
Sent: Thursday, November 11, 2010 7:56 AM
To: Eeley, Scott (A.)
Cc: Chrysafi, Sofia (S.); Raney-Pablo, Beth (H.E.)
Subject: Diesel Fuel Quality in Mexico

Scott, Beth and Sofia (Fuels and Lubricants Group) are chasing down problems with European FIE in Mexico. The Fuel Lubricity seems to be one of their main concerns.

Could you share your experience/knowledge with the 6.4L FIE problems in Mexico?

Thanks,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

From: Chrysafi, Sofia (S.)
Sent: Thursday, November 11, 2010 9:59 AM
To: Eeley, Scott (A.); Horrocks, Roy Dr (R.W.); Kudar, Graham (G.)
Cc: Raney-Pablo, Beth (H.E.); Krenz, Edwin (E.A.); Horbal, Colin (C.P.); Armesto, Carlos (.)
Subject: RE: Diesel Fuel Quality in Mexico

Hi Scott,

Thank you very much for this information, very interesting.

I believe that the failure mode we 've seen on Puma Global when running a durability test on the dyno with our poor lubricity test fuels was similar in that the team found debris coming from the HP pump, which caused the injectors to stick open (Graham?).

With regards to the metallic soaps, that's worrying if we think they were a secondary failure mode caused by the metallic debris bonding with the organic material of the fuel..Did you manage to identify the type of metal? Was it Fe, Zn, or alkali/alkaline metals like Na, K, Ca, Mg?

We have seen this type of failure mode (clogged filters) in Europe when we run a B30 fuel trial, where the Calcium content of the B30 fuel was at the 0.2-0.6 ppm levels.

Releasing an aftermarket additive like a lubricity enhancer for this market is an idea and I believe we have done this before. Unfortunately it relies on the discretion of the customer to use it, but it's one way of mitigating the risk.

Roy and Graham- would it be useful to look at some parts as Scott is suggesting? I understand by talking to Carlos that it's a Siemens/Continental FIE system.

Kind regards,

Sofia Chrysafi
Fuels Quality/ Diesel Engines
Fuels and lubricants team
Ford Motor Company
Dunton Technical Centre
Laindon, Basildon,, Essex, SS15 6EE
GB-15/2A-M11-C
Tel: +44-126840-2719

From: Eeley, Scott (A.)
Sent: 11 November 2010 13:26
To: Armesto, Carlos (.)
Cc: Chrysafi, Sofia (S.); Raney-Pablo, Beth (H.E.); Krenz, Edwin (E.A.); Horbal, Colin (C.P.)
Subject: RE: Diesel Fuel Quality in Mexico

Carlos,

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We found 'metal soap' on a couple of the fuel filters (return loop). This could have been a byproduct of the failure. FoM PD visited with Pemex and alerted them of the acid salts - Pemex did not / would not follow up with testing and assured FoM that acid salts were not present in their fuel.

FoM released PM-22 fuel additive via Service Parts - January 2010. This is the same additive we sell in the U.S. FoM FCSD at the time felt the issue was related to fuel lubricity and wanted the additive. Are they applying this or any other additive to the Euro sourced vehicles? Are the additives compatible with the Euro FIE?

Let me know if you want us to look at some parts.

Good luck.

Scott

From: Armesto, Carlos (.)
Sent: Thursday, November 11, 2010 7:56 AM
To: Eeley, Scott (A.)
Cc: Chrysafi, Sofia (S.); Raney-Pablo, Beth (H.E.)
Subject: Diesel Fuel Quality in Mexico

Scott, Beth and Sofia (Fuels and Lubricants Group) are chasing down problems with European FIE in Mexico. The Fuel Lubricity seems to be one of their main concerns.

Could you share your experience/knowledge with the 6.4L FIE problems in Mexico?

Thanks,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

From: Morton, Richard (R.K.)
Sent: Friday, December 11, 2009 8:28 AM
To: Eeley, Scott (A.); 'Nolan, Patrick (Pat)'; 'Zydek, Larry B'
Cc: Horbal, Colin (C.P.); Rudd, David (D.); Mondragon, David (J.D.); Villareal, Carlos (CV.); Villalobos, Luisa (L.); Bastida, Graciela (G.); Flores, Elsa (E.); Santiago, Eduardo (S.); Del Barrio, Jose (J.L.); Mull, Ted (V.); Simpson, Timothy (T.A.); Chyo, Timothy (T.); Fulton, Brien (B.L.)
Subject: RE: Fuel Analysis in Mexico

Related to the first article, at the 2008 SAE conference, Bosch reported that certain pipeline additives were reacting with bio content, palimerizing in the injectors (needs heat and pressure). They reported that they have been seeing this cause of injector failures from all global markets to some degree. They were able to duplicate this in the lab in a beaker. You can search the SAE paper database for 2008 International conference.

Richard (Dick) Morton
Global and Export Supervisor
Large Diesel Engine Engineering,
Ford Motor Company
+1 (313) 390-7176
rmorton2@ford.com

From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 7:26 AM
To: Nolan, Patrick (Pat); 'Zydek, Larry B'; Morton, Richard (R.K.)
Cc: Horbal, Colin (C.P.); Rudd, David (D.); Mondragon, David (J.D.); Villareal, Carlos (CV.); Villalobos, Luisa (L.); Bastida, Graciela (G.); Flores, Elsa (E.); Santiago, Eduardo (S.); Del Barrio, Jose (J.L.); Mull, Ted (V.); Simpson, Timothy (T.A.); Chyo, Timothy (T.); Fulton, Brien (B.L.)
Subject: FW: Fuel Analysis in Mexico

Pat, Larry and Dick,

Please see the linked articles.

Larry - What compounds are used in the doser sent to us?

From: Mull, Ted (V.)
Sent: Thursday, December 10, 2009 2:26 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.)
Subject: RE: Fuel Analysis in Mexico

Just for Scott and a bit dated,
http://findarticles.com/p/articles/mi_m0CYH/is_21_7/ai_110573403/?tag=rel.res1

Another old article but a quick read,
http://findarticles.com/p/articles/mi_m0CYH/is_25_6/ai_96058335/

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Kowalski, George (G.S.)
Sent: Thursday, December 10, 2009 10:51 AM

To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

Ted,

After refining carboxylic acid salts are used for pipeline corrosion inhibitors. You are probably picking up the salts from the fuel distribution system.

George Kowalski

Engine Non-Metals Materials Engineering

Materials Engineering, Testing & Standards (MET&S)

(313) 805-4830 FAX (313) 31-74691

MD 1105, Bldg 1, Cube 12A035

From: Mull, Ted (V.)
Sent: Thursday, December 10, 2009 10:29 AM
To: Raney-Pablo, Beth (H.E.); 'Wang, Jerry C'; Trombat, Dana (D.C.); Bellile, David (D.E.); Misangyi, Pete (P.W.); Richardson, Charles (C.E.)
Cc: Kowalski, George (G.S.); Eeley, Scott (A.)
Subject: RE: Fuel Analysis in Mexico

Hello All, Regarding the high pressure pump failures on 6.4L diesel engines in Mexico: Our current thinking is the carboxylic acid salts (see Central Lab report) are part of the refining process, a catalyst, that has not been completely removed from the fuel before shipping to the fuel distribution network. Due to the unique engine cycling in Mexico (high key off + heat soak cycles => higher fuel system temperatures) the acid salts precipitate out of the fuel at a higher rate than other markets. These acid salts are caught in the vehicle filtration system and prematurely block the filters and are contributing to the high pressure pump failures. There are other contributors, like fuel lubricity, but the salts are also a factor.

My first question is, does this chain of events make since or are we missing something regarding the source and chemistry of the salts?

Second question, is there an ASTM or other standard test to check for and measure for the "salts" in a raw fuel sample?

Next question (for Jerry), are you aware of resources in Mexico that can provide fuel testing? Our current thinking is to request density, viscosity, HFRR scar, sulfur, and for "salts" to help manage the needed fuel sample size and test costs.

Thoughts and comments from all are appreciated, Thanks,

<< Message: FW: Completed Central Lab Report - 91859 >>

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Raney-Pablo, Beth (H.E.)
Sent: Wednesday, December 02, 2009 4:26 PM
To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

As discussed on the phone, here is a list of recommended analyses:

1. Density (ASTM D 4052)
2. Viscosity (ASTM D 445)

3. Lubricity, HFRR wear scar (ASTM D 6079)
4. Ash content (ASTM D482)
5. Particulate content (ASTM D 2276)
6. Sulfur content (optional, as Mexico sulfur content would be expected to vary up to 500 ppm, but I don't see higher values in the survey data)

Here are 2 possible contacts who may be able to recommend a test lab.

1. Graciela Bastida from the Ford Quality Office (gbastida).
2. ALVI Contact: Andrea Artusa; aartusa@alvi.com.mx, Phone : 55-50937023

Regards,

Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Mull, Ted (V.)
Sent: Wednesday, December 02, 2009 11:33 AM
To: Raney-Pablo, Beth (H.E.)
Subject: RE: Fuel Analysis in Mexico

That's ok, the holiday season is upon us. FoM would cover the cost. Fuel lubricity is a prime suspect along with high temperature due to their drive cycle (lots of restarts with heat soaks) and vehicle configuration (manual trans = high rpm). So density, viscosity, and HFRR seem to be a minimum but I wanted your input if say a distillation fraction would be valuable information to help understand why the high pressure pumps are failing.

Luisa (FoM) provided one contact and I wanted your input before calling them.

<< Message: Laboratory contact >>

Ted V. Mull, Jr.
Diesel Engine Systems
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Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Raney-Pablo, Beth (H.E.)
Sent: Wednesday, December 02, 2009 11:11 AM
To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

Sorry for the delayed response, I just returned to the office yesterday after being out was out of the office all last week, and am still wading through all of the emails.

The short answer is I am not aware of any fuel testing facilities in Mexico. My colleague Chuck Richardson has also been trying to get some fuel samples analyzed and may have found a possible lab through a contact in the Ford of Mexico Quality Office. He is getting the contact information so I can pass it on.

I have not had a chance to review your list below, but will do so. Knowing the analyses cost can add up quickly, who will be paying for this analysis?

From:	Mull, Ted (V.)
Sent:	Wednesday, December 02, 2009 11:02 AM
To:	Raney-Pablo, Beth (H.E.)
Subject:	RE: Fuel Analysis in Mexico

Beth, I never saw a response. Can you recommend a fuel testing facility in Mexico? What should we be requesting?

Ted V. Mull, Jr.
Diesel Engine Systems
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Phone: (313) 805-9310
<mailto:tmull@ford.com>

From:	Mull, Ted (V.)
Sent:	Monday, November 23, 2009 12:33 PM
To:	Raney-Pablo, Beth (H.E.)
Cc:	Villalobos, Luisa (L.); Bastida, Graciela (G.)
Subject:	Fuel Analysis in Mexico

Beth, to efficiently support fuel system concerns in the Mexico market, we'd like to identify suitable facilities who can analyze the fuel locally. Are you aware of facilities in Mexico that can perform fuel analyses and perhaps provide a contact? Also, what should we be asking for and what sample size of fuel should we be collecting? My short list:

Parameter	Test Method	Requirement
Cetane		
Density at 15 C, kg/m^3		
Viscosity cSt at 40 C	ASTM D 445, SOP CH017_02	1.3 - 4.1 cSt at 40C
Moisture Content, % wt	ASTM D 6304, SOP CH039_02	< 0.01
Sulfur Content, mg/kg	ASTM D 5185, SOP CH034_01	500 for Mexico?
HRFF Wear Scare, microns	ASTM D 6079	
Distillation Fraction		

Any information you can provide will be helpful, thanks,

Ted V. Mull, Jr.
Diesel Engine Systems
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Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Heggie, Forest (F.)
Sent: Tuesday, September 28, 2010 5:59 PM
To: Armesto, Carlos (.)
Cc: Fulton, Brien (B.L.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

I was thinking as long as you could reach the drain without crawling on the ground in any way shape or form, but remote sounds even better

---

From: Armesto, Carlos (.)
Sent: Tue 28/09/2010 5:45 PM
To: Heggie, Forest (F.)
Cc: Fulton, Brien (B.L.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

So you are talking about a remote actuated drain. We have discussed this internally (specially when U222 was going to have a diesel). I'm not aware of any but doesn't seem technically difficult (other than where to dump the water). It will be expensive compared to today's system.

From: Heggie, Forest (F.)
Sent: Tuesday, September 28, 2010 10:37 PM
To: Armesto, Carlos (.)
Cc: Fulton, Brien (B.L.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Access to it, do you have to crawl under the vehicle or can you reach it without going under? That is the complaint raised from Canadian FCSD - thinking Alberta in the winter/slush nasty.

Just thinking if your wif comes on your on the highway - you pull off to the side of the road - traffic going by can we make it easier to reach, more likely to be drained.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Armesto, Carlos (.)
Sent: Monday, September 27, 2010 10:46 PM
To: Heggie, Forest (F.)
Cc: Fulton, Brien (B.L.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

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What kind of rules are you thinking about?

Thanks,

Carlos Armesto

Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

From: Heggie, Forest (F.)
Sent: Monday, September 27, 2010 1:22 PM
To: Fulton, Brien (B.L.); Armesto, Carlos (.)
Subject: FW: High pressure fuel systems vs water in diesel fuel

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BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Lawther, Robin (R.)
Sent: Tuesday, September 21, 2010 3:30 AM
To: Heggie, Forest (F.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Forest, I have misplaced your note with the attached file. Please could you resend me the file - thanks

Regards

Robin Lawther
Technical Specialist - Fuel Injection Equipment, Engine Engineering
Ford Motor Company Ltd
GB15/2B-A11-B
[Dunton -738-] +44 1268 40-1162

From: Burroughs, Karl (K.M.)
Sent: 20 September 2010 16:42
To: Heggie, Forest (F.); Fulton, Brien (B.L.); Lawther, Robin (R.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Gents,
Thanks for the presentation material, couple of good things in there for me. A few points of note also:

- We size our water traps for service intervals with some sort of algorithm (i.e. not every tankful having maximum allowable water). Saying that our consumption is much less, so we don't expect to see the quantity you would. Dealers are instructed to drain the water trap every service, and dependant on system replace fuel filter on mileage or 'minder' criteria.
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concentrate, thereby giving high water concentration fuel from time to time.

- For me the speed of the fuel through the media is critical, a large filter with a large media means slow fuel flow and better water/particle separation.
- Historically our FIE suppliers have always stated the ISO4020 water separation test for fuel filter approval. With this 'standard' we see cases where no water is trapped in the water trap, but we have significant internal corrosion in the FIE. This could be down to system design (as above fuel flow speed/filter sizing), or the water dispersant chemicals the fuel companies use. These create smaller molecules of water, making them harder to separate.
- On new programmes we are moving to a new 'standard', the ISO16332 water separation efficiency test. This is considered to be closer to real world conditions.

Best regards

Karl

From: Heggie, Forest (F.)
Sent: 17 September 2010 16:41
To: Fulton, Brien (B.L.); Lawther, Robin (R.); Burroughs, Karl (K.M.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Perfect, I just wanted to make sure I had not missed any data point, and did not like the data gap/gloss over of the effect on the high pressure fuel system when using the special diesel-water emulsion studies with unknown amounts of stabilizing or additives added or other conditions that are not applicable in the real world.

I have attached a copy of our study - essentially water caused rust, as a note this study was for the purpose of providing direction/indicators for establishing water caused fuel system damage. I pdf the file to make it a little better for emailing.

<< File: WIF – SPECIAL STUDY 9-15-10 .pdf >>

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Fulton, Brien (B.L.)
Sent: Friday, September 17, 2010 10:44 AM
To: Lawther, Robin (R.); Heggie, Forest (F.); Burroughs, Karl (K.M.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Looks like Robin came up with the same answer I did, maybe the suppliers have something. Diesel fuel systems and water don't mix, even on the microscopic level, Key to these papers are that these test engines/vehicles are run in a laboratory environment and they flush the fuel system when they are complete. Another note to keep in mind is that high levels of even micro emulsion significantly increase the HFRR wear scar.

Further note in the SAE paper under the fuel/water emulsion injection into the combustion chamber and I quote, "A minimum amount of the stabilizing agent has to be added to the fuel to avoid any unknown effects on the combustion. Additional stirring fans and circulating pipelines are installed at the fuel tank and just ahead of the injector, as water drops tend to combine and submerge in the inherently unstable emulsion fuel." Pretty much sums it up.

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- Protects the low pressure fuel pump from contaminates in the fuel system
- Protects the low pressure fuel pump from water
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Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com [redacted] ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Lawther, Robin (R.)
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Subject: RE: High pressure fuel systems vs water in diesel fuel

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The FIE manufacturers control the allowable amount of water to enter the HP pump by specifying the max allowable water content in fuel (from filling stations) and the water separator efficiency. Clearly it is difficult to control the water in the fuel as bought, but SGS data (available from Beth Raney-Pablo) shows measured data for water content from all countries.

Bio fuel is hydroscopic so attracts & absorbs water. As Biofuel is growing in popularity, we have seen issues with vehicle corroding, but generally when left standstill for several weeks.

To proceed your question, I suggest we review your study then set up discussions with the FIE supplier directly, and including the Ford fuel specialists (Beth and Sofia Chysafi) and FOE OPD -> Karl Burroughs.

Forest, please can you set this up.

Karl, can you add any further comments ?

Regards

Robin Lawther
Technical Specialist - Fuel Injection Equipment, Engine Engineering
Ford Motor Company Ltd
GB15/2B-A11-B
[Dunton -738-] +44 1268 40-1162

From: Heggie, Forest (F.)
Sent: 15 September 2010 17:53
To: Fulton, Brien (B.L.); Lawther, Robin (R.)
Subject: High pressure fuel systems vs water in diesel fuel

Hi Robin,

I would appreciate any help you could provide, I am looking for any studies/papers performed that contain the impact of water in diesel fuel emulsions on the high pressure fuel system. We have just completed a water in fuel study for the 6.4L high pressure fuel system but would like to make sure I have not missed any benchmarking or altenative research information that may be available.

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-water separate out when pressure is reduced and stay in the pump
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3. freestanding water- see it in the tank (two distinct fluids easily visible)- easily separated by water separator

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Fulton, Brien (B.L.)
Sent: Wednesday, September 29, 2010 9:05 AM
To: Armesto, Carlos (.); Heggie, Forest (F.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

I know, but does that stop customers from doing it now?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Armesto, Carlos (.)
Sent: Tuesday, September 28, 2010 5:48 PM
To: Fulton, Brien (B.L.); Heggie, Forest (F.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Yes-I agree but I don't think we will be able to dump it on the ground!

From: Fulton, Brien (B.L.)
Sent: Wednesday, September 29, 2010 12:56 AM
To: Heggie, Forest (F.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Automatic WIF drain during CCSD (computer controlled shutdown) with an automated valve on the reservoir?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:***[redacted] [redacted] (313)-59-43365

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From: Heggie, Forest (F.)
Sent: Tuesday, September 28, 2010 8:37 AM
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To: Armesto, Carlos (.); Fulton, Brien (B.L.); Heggie, Forest (F.); Lawther, Robin (R.); Kudar, Graham (G.)
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Hi Carlos,
We had an interesting presentation from an Italian Filter Manufacturer UFI a few months ago. Their technical director sits on the ISO board and had some influence on the test.
Graham, you were in discussion with him on water content, could you share your experience and where we are going for Global please.

Cheers

Karl

From: Armesto, Carlos (.)
Sent: 20 September 2010 17:32
To: Burroughs, Karl (K.M.); Fulton, Brien (B.L.); Heggie, Forest (F.); Lawther, Robin (R.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Thanks, Karl interesting report and I agree with your comments.

The 16332 is definitely a better test (more controlled and repeatable) and we started using it for the P473 here in NA. It is also included in our new Filter/DFCM 9G282 spec. One large variable present is the water concentration %. I have heard the it is easier to separate water at the 2% than at the lower 0.15% concentration (the 16332 leaves this open by giving you a choice)-The reason the 2% is easier (I was told) is that when more water is present the water tends to connect and form larger droplets (downstream of the orifice plate) which are easier to separate.

If you are aware of any studies regarding water concentration and 16332 performance it would be very helpful.

Thanks again,

Carlos Armesto
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To: Fulton, Brien (B.L.); Heggie, Forest (F.); Lawther, Robin (R.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Certainly Conti have taken the new procedure, I think there is some resistance within Bosch as they claim there are repeatability concerns. Delphi were still with the 4020, but we got them to do comparitive testing earlier in the year and I would hope they can see the difference in the two tests. Report enclosed for your perusal.

Karl
<< File: ctbl-cr-01829-B_Ford C1_water separation improvement.pdf >>

From: Fulton, Brien (B.L.)
Sent: 20 September 2010 16:44
To: Burroughs, Karl (K.M.); Heggie, Forest (F.); Lawther, Robin (R.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Are the suppliers also warming up to ISO 16332?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:***[redacted] [redacted] (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Burroughs, Karl (K.M.)
Sent: Monday, September 20, 2010 11:42 AM
To: Heggie, Forest (F.); Fulton, Brien (B.L.); Lawther, Robin (R.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Gents,
Thanks for the presentation material, couple of good things in there for me. A few points of note also:

- We size our water traps for service intervals with some sort of algorithm (i.e. not every tankful having maximum allowable water). Saying that our consumption is much less, so we don't expect to see the quantity you would. Dealers are instructed to drain the water trap every service, and dependant on system replace fuel filter on mileage or 'minder' criteria.
- Bosch recently stated in a meeting that they believed water could separate in the fuel tank and concentrate, thereby giving high water concentration fuel from time to time.
- For me the speed of the fuel through the media is critical, a large filter with a large media means slow fuel flow and better water/particle separation.
- Historically our FIE suppliers have always stated the ISO4020 water separation test for fuel filter approval. With this 'standard' we see cases where no water is trapped in the water trap, but we have significant internal corrosion in the FIE. This could be down to system design (as above fuel flow speed/filter sizing), or the water dispersant chemicals the fuel companies use. These create smaller molecules of water, making them harder to separate.
- On new programmes we are moving to a new 'standard', the ISO16332 water separation efficiency test. This is considered to be closer to real world conditions.

Best regards

Karl

From: Heggie, Forest (F.)
Sent: 17 September 2010 16:41
To: Fulton, Brien (B.L.); Lawther, Robin (R.); Burroughs, Karl (K.M.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Perfect, I just wanted to make sure I had not missed any data point, and did not like the data gap/gloss over of the effect on the high pressure fuel system when using the special diesel-water emulsion studies with unknown amounts of stabilizing or additives added or other conditions that are not applicable in the real world.

I have attached a copy of our study - essentially water caused rust, as a note this study was for the purpose of providing direction/indicators for establishing water caused fuel system damage. I pdf the file to make it a little better for emailing.

<< File: WIF – SPECIAL STUDY 9-15-10 .pdf >>

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Fulton, Brien (B.L.)
Sent: Friday, September 17, 2010 10:44 AM
To: Lawther, Robin (R.); Heggie, Forest (F.); Burroughs, Karl (K.M.); Armesto, Carlos (.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Looks like Robin came up with the same answer I did, maybe the suppliers have something. Diesel fuel systems and water don't mix, even on the microscopic level, Key to these papers are that these test engines/vehicles are run in a laboratory environment and they flush the fuel system when they are complete. Another note to keep in mind is that high levels of even micro emulsion significantly increase the HFRR wear scar.

Further note in the SAE paper under the fuel/water emulsion injection into the combustion chamber and I quote, "A minimum amount of the stabilizing agent has to be added to the fuel to avoid any unknown effects on the combustion. Additional stirring fans and circulating pipelines are installed at the fuel tank and just ahead of the injector, as water drops tend to combine and submerge in the inherently unstable emulsion fuel." Pretty much sums it up.

Critical to our low pressure fuel system design is the placement of the primary filter and water separator in front of the low pressure fuel pump. The placement of this system in this order does a number of things:

- Protects the low pressure fuel pump from contaminates in the fuel system
- Protects the low pressure fuel pump from water
- Allows water separation before it gets into the pump where it really emulsifies it in the diesel fuel

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** [redacted] ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Lawther, Robin (R.)
Sent: Friday, September 17, 2010 5:14 AM
To: Heggie, Forest (F.); Burroughs, Karl (K.M.)
Cc: Fulton, Brien (B.L.)
Subject: RE: High pressure fuel systems vs water in diesel fuel

Hi Forest, this is an interesting topic, but am not ware of many papers on this.

The FIE manufacturers control the allowable amount of water to enter the HP pump by specifying the max allowable water content in fuel (from filling stations) and the water separator efficiency. Clearly it is difficult to control the water in the fuel as bought, but SGS data (available from Beth Raney-Pablo) shows measured data for water content from all countries.

Bio fuel is hydroscopic so attracts & absorbs water. As Biofuel is growing in popularity, we have seen issues with vehicle corroding, but generally when left standstill for several weeks.

To proceed your question, I suggest we review your study then set up discussions with the FIE supplier directly, and including the Ford fuel specialists (Beth and Sofia Chysafi) and FOE OPD -> Karl Burroughs.
Forest, please can you set this up.

Karl, can you add any further comments ?

Regards

Robin Lawther
Technical Specialist - Fuel Injection Equipment, Engine Engineering
Ford Motor Company Ltd
GB15/2B-A11-B
[Dunton -738-] +44 1268 40-1162

From: Heggie, Forest (F.)
Sent: 15 September 2010 17:53
To: Fulton, Brien (B.L.); Lawther, Robin (R.)
Subject: High pressure fuel systems vs water in diesel fuel

Hi Robin,

I would appreciate any help you could provide, I am looking for any studies/papers performed that contain the impact of water in diesel fuel emulsions on the high pressure fuel system. We have just completed a water in fuel study for the 6.4L high pressure fuel system but would like to make sure I have not missed any benchmarking or altenative research information that may be available.

There are a lot of studies on water emulsion in diesel fuel and impact to emissions but I could only find one that slighly included impact the the high pressure fuel system. Otherwise they were all statements of the corrosive nature of water.

SAE 2001-01-3525 used a micro-emulsion of water in diesel and stated it had no problems with the high pressure fuel system
Other studies either stated they flushed the system with diesel fuel after use of the emulsion or did not comment at all.

<u>Where I finding a bit of confusion is in the terminology used so I have divided the definitions/description of water in fuel mixtures by three categories</u>

<u>1. micro emulsion - visually transparent and thermodynamically stable</u> - stored without observing changes for a long period of time, thermodynamically stable micro emulsion of water fuel can withstand the temperature and pressure increases with no water separation in the injection system.
there is one paper fairly old ASE Performance and Emissions using water in diesel fuel micro emulsions 2001-01-3525 that infers no problems with the high pressure fuel system when using diesel water emulsions

<u>2. macro emulsions</u> - distinctive colour because water is distributed in micron range , water tends to settle over time

-water separate out when pressure is reduced and stay in the pump
- if in localized area potentially get to 100C then vaporized in pump or inj

<u>3. freestanding water</u>- see it in the tank (two distinct fluids easily visible)- easily separated by water separator

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OPD Diesel
313-618-5054

From: Krock, Matthew R (Matt) [Matt.Krock@Navistar.com]
Sent: Thursday, October 28, 2010 5:29 PM
To: Heggie, Forest (F.)
Subject: RE: If you are interested in some editing
Attachments: water_in_fuel_communciation_draft_10-12.doc

Forest,

Thanks for letting me help with your informational piece. I made some notes on the side of the page in addition to tracking changes. I attempted to reword the information without losing the important message you are trying to convey. Please let me know if you have any questions about my changes or comments. If you don't like a comment or change, just delete it, they are just my thoughts.

If you'd like me to help with future revisions of this or any other paper, just let me know!

Matt

From: Heggie, Forest (F.) [mailto:fheggie@ford.com]
Sent: Monday, October 25, 2010 8:42 AM
To: Krock, Matthew R (Matt)
Subject: If you are interested in some editing

Any input you would be willing to provide I would more than appreciate.

<<water in fuel communication draft 10-12.doc>>

Forest Heggie
BaSc. MaSc. P.Eng
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How To take care of your Fuel system so It takes care of you.

Your high pressure fuel system uses diesel fuel for lubricity and cooling and is designed to use only Ultra Low Sulfur Diesel fuel containing no more than 5% biodiesel. Other types of fuels and high concentrations of water can cause the fuel pump to fail due to lack of lubricity/cooling or aggressive chemicals in the fuel attacking the fuel system materials.

Where does water come from and What does it do to the high pressure fuel system?

Water and impurities may be included in a low quality fuel. Water can be damaging to the engine as it does not burn, water carries oxygen is corrosive and it freezes. Water also robs the engine of B.T.U.'s, and can leave mineral deposits which are extremely harmful to the engine. Water also acts as a host to bacterial formation at the site where the water molecule interfaces with a fuel molecule.

How do we get rid of water?

Your horizontal fuel condition module (HFCM) is there to remove water and impurities from the fuel prior to the high pressure pump. For your HFCM to remove the water from the fuel, your filters should be changed according to the recommended service interval. If your filters are not changed regularly, it will decrease the filter's ability to separate water from the fuel. Extended maintenance intervals can also cause fuel filters to become restricted or collapsed which may allow water/impurities to the fuel system or even lead to high pressure pump failure due to low lubrication. Your vehicle is equipped with two fuel filters; one is mounted on top of the engine the other is inside the HFCM. With the issues poor maintenance can cause, it's important to remember to change fuel filters regularly. It may very well save larger repairs in the future.

The HFCM should be drained once a month or when the water in fuel light illuminates. Should this maintenance requirement go unheeded, any water in the system can flow directly into the high pressure fuel pump. Water does not have the lubricant properties of diesel fuel and will begin to corrode the pump. When draining your water separator do not have the engine running and wait at least 10 minutes after shutting off the vehicle for the pressure to equalize in order for the water to drain.

What happens if water gets into the high pressure fuel system?

The pictures below give specific examples of what happens to an engine's internal components when water enters the system. In extreme cases, the entire high pressure fuel system had to be replaced. Water may have entered the system in a multitude of ways:

- Water was not drained when required
- Extended maintenance intervals caused fuel filters to become overly restricted
- Use of an aftermarket fuel additive with water dispersants or emulsifiers allowed water to bypass the fuel filters


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Comment [MK1]: What is the significance of water carrying oxygen? Water is not corrosive itself, so do you mean to say that water can cause corrosion on the engine block?

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Deleted: starve fuel flow to the high pressure fuel system causing

Deleted: Separate the water from the fuel.

Deleted: it's easier and much cheaper to replace the filters than replace the high pressure fuel system.

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Deleted: If the water is not drained when the HFCM container is filled it has no where else to go but

Comment [MK2]: Explain what these pictures are showing. A reader may not be familiar with the internal components of the pump/engine. Under each picture, explain what the reader is looking at and how water caused this piece to fail.

Deleted: If the water is not drained or if the filters are not changed or if fuel additives with water dispersants or emulsifier are used your fuel system will eventually look like this. And the whole high pressure fuel system will have to be replaced

What about fuel additives?

Aftermarket additives or alcohol/gasohol that causes water to disperse/emulsify or not be separated from the diesel fuel will damage your fuel system. Fuel filters are designed to remove any water in diesel fuel. If aftermarket additives have chemicals that hold the water in the fuel, the water is carried through the filters and water seperators. Dispersing/emulsfying water sends it into your fuel system, exactly where it does the most damage. Do not use alcohol based additives to correct fuel gelling.

It should not be necessary to add any aftermarket additives to your fuel tank if you use diesel fuel that meets the ASTM D 975 industry specification. If you want to use a fuel additive, only Motorcraft diesel fuel additives are recommended.

Additives that will improve fuels' cetane ratings may be used to verify/enhance fuel quality. Use Motorcraft Cetane Booster & Performance Improver, PM-22-A (U.S.) / PM-22-B (Canada). The customer warranty may be void from using additives that do not meet Ford specifications.

BIODIESEL

Concentrations greater than 5% can cause fuel filter restrictions that may result in a lack of power and or damage to components such as fuel tank, fuel lines, fuel pump, fuel sender and fuel injectors. Biodiesel should not be stored in the fuel tank for more than three months. Excessive Bio-diesel or poor bio-diesel fuel can cause bacterial/fungas growth, increased water content, aggressive chemical attack of fuel system material, premature fuel filter restriction and fuel starvation due to cold gelling.

What about other fuels besides Diesel or biodiesl 5%?

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Comment [MK3]: This was already covered in detail and can be redundant.

Deleted: fuel additives meeting ford specifications, Motorcraft parts are designed to meet Ford specifications. Alcohol and other fuel do not provide enough lubricant for the high pressure fuel pump and water will cause rust and corrosion to form in your high pressure fuel system This will cause the high pressure fuel system to fail and ultimately the whole system will need to be replace.

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Comment [MK4]: Again, I think explaining the pictures will help readers understand what they are seeing.

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The high pressure fuel system uses diesel fuel for lubricity and cooling. Inadequate fuels can cause the fuel pump to fail due to lack of lubricity/cooling or contain aggressive chemicals that attack the fuel system materials. The fuel tank pick up boot can distort with aggressive fuels, and cause air ingestion.
Do not use Raw or refined vegetable oil, animal fat, cooking oil or recycled greases.
Do not use home heating oil, agricultural fuel or any diesel fuel not intended for highway use. Damage to the fuel injection system, engine and exhaust catalyst can occur if an improper fuel is used. Do not add gasoline, gasohol or alcohol to diesel fuel. This practice creates a serious fire hazard and engine performance problems. Do not blend used engine oil with diesel fuel under any circumstance. Blending used oil with the fuel will significantly increase your vehicle's exhaust emissions and reduce engine life due to increased internal wear. The customer warranty may be voided from using fuels that do not meet or exceed Ford specifications.

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Running out of Fuel

Do not run your diesel vehicle out of fuel as this will allow air to enter the fuel system which will make restarting difficult. The engine is designed to run roughly as the fuel tank nears Empty. This is a warning to the driver to add fuel as soon as possible. Longer engine cranking time may be required once air is in the fuel system. If air enters the fuel system (either through running the fuel tank(s) empty or during a fuel filter change), the engine will self-purge the trapped air once it starts running.

From: Rivard, Frank (F.L.)
Sent: Monday, December 06, 2010 10:56 AM
To: Heggie, Forest (F.)
Subject: RE: Information on 566W521

Sorry I missed you there. I had an appt this morning. I will get over there shortly to look at it.

From: Heggie, Forest (F.)
Sent: Monday, December 06, 2010 7:55 AM
To: Rivard, Frank (F.L.)
Subject: FW: Information on 566W521

The pump is apart in our building 3 garage I am going to go there around 9:00am today to look at it.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rivard, Frank (F.L.)
Sent: Friday, December 03, 2010 1:34 PM
To: Heggie, Forest (F.)
Subject: RE: Information on 566W521

I'd like to see it…give me a call when you have it apart.

From: Heggie, Forest (F.)
Sent: Friday, December 03, 2010 12:08 PM
To: Rivard, Frank (F.L.)
Subject: RE: Information on 566W521

Thank you very much ,

I am going to pull apart the pump Monday so if you are interested I will let you know the mechanical results when I have them

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rivard, Frank (F.L.)
Sent: Friday, December 03, 2010 12:03 PM
To: Heggie, Forest (F.)
Subject: RE: Information on 566W521

Hi Forest, about 7 weeks ago I added 60ml of water and drove that way for a week or so. Never really saw any indication of water in fuel. We then(7 Oct) put the vehicle into DTF and ran it nearly out of fuel and it then sucked in the water. It ran rough until we re-fueled it and then it was fine. We drained about 40ml out and continued to drive it on the road.

Fast forward to 11/09. After driving from Oct to 11/09 without adding any water just several tanks of fuel I added 100ml of water.

- Within one mile the water was in the separator and indicating WIF
- I then drove 60miles and shut down

- I restarted and began drving. At about 22 miles in it began to run rough and I had a lot of trouble getting it to restart. There were 3 shut downs and restarts that were worrysome! Then drove it another 25 miles and it seemed to clear up
- Overnight soak
- On cold start the drive was good for the first 30 miles then it began to run rough like the night before and then it quit and would not start again.
- Building 9 drained out 60ml of water replaced the filters and could not get it to run
- It then went to building 3 where they ended up replacing all 8 injectors
- I picked it up and when I drove away had a rough idle and MIL.
- Drove it back to the garage and they found metal shavings in the fuel filter and have replaced the pump as far as I know.

From: Heggie, Forest (F.)
Sent: Friday, December 03, 2010 10:39 AM
To: Rivard, Frank (F.L.)
Subject: Information on 566W521

Hi Frank

Could you please provide me the history on 566W521 up to it dying in your driveway for it to be towed into our garage for diag.

I need to understand what types of testing had been done, amounts of water added/drainged, dtc ect results,or observations to work up the history for the failure of the pump.

Thank You,

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rivard, Frank (F.L.)
Sent: Monday, December 06, 2010 10:52 AM
To: Heggie, Forest (F.); Eeley, Scott (A.)
Cc: Hawk, Steve (S.D.); Kromberg, Arnold (A.W.)
Subject: RE: Information on 566W521

We gave the filters that were removed from W521 to Arnie. Last I saw them they were outside of the door by his desk because they were leaking fuel through the bag they were in.

As to other work, there were thermostat swaps but nothing to the fuel system.

From: Heggie, Forest (F.)
Sent: Monday, December 06, 2010 10:09 AM
To: Rivard, Frank (F.L.); Eeley, Scott (A.)
Cc: Hawk, Steve (S.D.); Heggie, Forest (F.)
Subject: RE: Information on 566W521

Questions

1. do you still have the filters that were originally in the truck
2. was there any work done between Oct 7 to 11/09 on the vehicle or anything else done before the vehicle was received at building 3 garage

Review of HP Pump and injectors: 566W521

1. debris seen after fuel system debris check
2. removed ITP cover from HP Pump
   - corrosion on pump under itp cover
   - scoring on pump under d-ring
   - corrosion and scoring indicates pump ingested water , corrosion and debris formed from water and lack of lubrication

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Rivard, Frank (F.L.)
Sent: Friday, December 03, 2010 12:03 PM
To: Heggie, Forest (F.)
Subject: RE: Information on 566W521

Hi Forest, about 7 weeks ago I added 60ml of water and drove that way for a week or so. Never really saw any indication of water in fuel. We then(7 Oct) put the vehicle into DTF and ran it nearly out of fuel and it then sucked in the water. It ran rough until we re-fueled it and then it was fine. We drained about 40ml out and continued to drive it on the road.
Was there any wif indication or filter changes or anything else done at this time

Fast forward to 11/09. After driving from Oct to 11/09 without adding any water just several tanks of fuel I added 100ml of water.

- Within one mile the water was in the separator and indicating WIF
- I then drove 60miles and shut down
- I restarted and began drving. At about 22 miles in it began to run rough and I had a lot of trouble getting it to restart. There were 3 shut downs and restarts that were worrysome! Then drove it another 25 miles and it seemed to clear up

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From: Heggie, Forest (F.)
Sent: Friday, December 03, 2010 10:39 AM
To: Rivard, Frank (F.L.)
Subject: Information on 566W521

Hi Frank

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I need to understand what types of testing had been done, amounts of water added/drainged, dtc ect results,or observations to work up the history for the failure of the pump.

Thank You,

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, September 27, 2010 2:36 PM
To: Davis, Craig (C.B.)
Subject: RE: Nice likttle statement about water in fuel

I am working on getting the groups that be to put an official sanctioned document together in the same idea

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Davis, Craig (C.B.)
Sent: Monday, September 27, 2010 2:34 PM
To: Heggie, Forest (F.)
Subject: RE: Nice likttle statement about water in fuel

Thanks

Can we add this to the publications or words to this effect?

From: Heggie, Forest (F.)
Sent: Monday, September 27, 2010 1:53 PM
To: Davis, Craig (C.B.)
Subject: FW: Nice likttle statement about water in fuel

Fyi - I found this site entertaining

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Tuesday, September 14, 2010 5:12 PM
To: Eeley, Scott (A.)
Cc: Heggie, Forest (F.)
Subject: Nice likttle statement about water in fuel

I think we may have a growing issue out there for fuel additves

http://www.refinery-research.com/dieseltechnical.htm

<< OLE Object: Picture (Metafile) >>

<< OLE Object: Picture (Metafile) >> **ASTM D-1094 WATER TREATMENT TEST** **This may be the most critical test for fuel. It is because water is a factor in so many problems associated with diesel fuel. Contrary to popular belief, the water present in fuel due to condensation may be minimal. A small amount might, but the majority may be introduced when the fuel is put into the tank.** ***The water comes with the fuel.***

Water gets into fuel in numerous ways. It is present in the refining process. It may not be demulsified at the refinery. It is picked up in the pipelines; or "pig buffer zones" are not properly handled. It is introduced through poor handling in tank trucks, fuel storage tanks, or leaking underground tanks. In marine applications sea wash may be a cause. Tank "bottoms" are generally the major problem cause.

WATER - DOES NOT BURN, CANNOT BE MADE TO BURN, CANNOT BE ENCAPSULATED OR RENDERED HARMLESS, CANNOT BE VAPORIZED and MADE HARMLESS, IS CORROSIVE AND CARRIES OXYGEN, and it FREEZES easily. It changes the density of the mixture that is introduced into the engine for combustion, thereby altering ratios. It causes an uneven burning pattern in the cylinders (cellular cooling) by cooling some of the fuel below the ignition point. This unburned or partially burned fuel passes out the exhaust and is pollution. Unburned fuel robs the engine of B.T.U.'s, and the deposit formations are extremely harmful to the engine. Water also acts as a host to bacterial formation at the site where the water molecule interfaces with a fuel molecule.

DISPERSE IT ? DON'T ! Some people would have you think that this gets rid of water. From *what* and to *where?* Dispersing the water distributes it throughout the fuel and sends it to the very place you don't want it; the engine. It fights against the demulsifiers the refiners add to the fuel, nullifying them. It tries to carry the water through the filters and coalescers / water separators, thus defeating the very purpose they were designed for; it tries to disperse all matter in the fuel trying to carry this particulate through the filters; it works AGAINST filters that are trying to remove the foreign matter and it spreads the water around for some nice sites for the bacteria to attach to. Some are excellent film formers to *help* injector fouling. Water, when reacted with some forms of sulfur, forms H_2SO_4; Sulfuric Acid.

DO Separate the water from the fuel. It's easier and much cheaper to replace or drain filters than replace or overhaul engines and injectors.

From: Romano, Ron (R.)
Sent: Friday, January 08, 2010 5:32 PM
To: Eeley, Scott (A.)
Subject: RE: PM-15 and lubricity additives

Your math is correct but it's not 1339 ppm of additive because about 60-70% of this is carrier oil. Then this is cetane booster, perfomance improver (whatever that is) and lubricity additive. So if youre just looking at lubricity additive take 30% of 1339 then divide by 3, just assumed equal parts of each (put you in the ballpark), and your have 134ppm lubricity additive. Which sounds about right judging from the treat rate Lubrizol recommended for their additive.

Thanks

Ron Romano
Service Lubricants Technical Expert
FCSD, Service Product Development, SEO
Diagnostic Service Center II
Room 410
1800 Fairlane Drive, Allen Park, MI 48101
Phone:(313) 84-54068 Fax:(313)-32-38042

From: Eeley, Scott (A.)
Sent: Thursday, January 07, 2010 12:41 PM
To: Romano, Ron (R.)
Subject: RE: PM-15 and lubricity additives

Ron,

Please review my math…

PM-22 is recommended @ 6oz / 35 gal. =.046875gal / 35 gal X 1,000,000 = 1339 PPM = overdose????

Scott

From: Romano, Ron (R.)
Sent: Thursday, December 17, 2009 1:38 PM
To: Eeley, Scott (A.); Richardson, Charles (C.E.)
Cc: Santiago, Eduardo (S.); Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Pekarscik, Brian (B.); Rudd, David (D.); Chyo, Timothy (T.); McDonagh, Scot (S.M.); Espinoza, Bob (R.J.)
Subject: RE: PM-15 and lubricity additives

Scott, Chuck,

1. What is the lubricity improvement factor for PM-22 and PM-23? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-22 or PM-23?)
Gold Eagle says their refernence fuel is 520 and at the recommended does both these will reduce this down to 300-425.

2. What is the lubricity improvement factor for PM-15? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-15?)
Information I have from when we released this 1996 shows the following
ISOPAR M = 580, w/200 ppm PM-15=370
Fuel P=560, w/200 ppm PM-15=320
Our treat rate is 250ppm from what I could find.

3. Is PM-15 compatible with HP common rail systems with temps as high as 150 C? (Does PM-15 have acid salts?)
Probably not. Information I have shows the active additive is a fatty acid. An older MSDS I have shows alkenyl carboxylic acid. I'm verifying this with Lubrizol. But if acid based additives create acid salts that are causing the deposits then this probably wouldn't be considered compatible. I'm looking into discontinuing this.

4. I would like to update SSM 20662 or issue an additional SSM.
   a) If our current products provide a significant lubricity improvement factor, we need to emphasize this fact.
   PM-22 and PM-23 are amide additives not acid so if the wear numbers listed above are acceptable then we should be able to recommend these. I've talked to the supplier about not changing the additive type also.
   b) Educate our Dealers that our products are good for HP common rail systems. Emphasize that some aftermarket products are not good for HP common rail systems and can lead to premature filter plugging and / or FIE failure.

Thanks

Ron Romano
Service Lubricants Technical Expert
FCSD, Service Product Development, SEO
Diagnostic Service Center II
Room 410
1800 Fairlane Drive, Allen Park, MI 48101
Phone:(313) 84-54068 Fax:(313)-32-38042

From: Eeley, Scott (A.)
Sent: Thursday, December 17, 2009 10:58 AM
To: Romano, Ron (R.); Richardson, Charles (C.E.)
Cc: Santiago, Eduardo (S.); Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Pekarscik, Brian (B.); Rudd, David (D.); Chyo, Timothy (T.); McDonagh, Scot (S.M.); Espinoza, Bob (R.J.)
Subject: PM-15 and lubricity additives

Ron and Chuck,

As we discussed in separate phone calls;

Please help me with the following:

1. What is the lubricity improvement factor for PM-22 and PM-23? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-22 or PM-23?)
2. What is the lubricity improvement factor for PM-15? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-15?)
3. Is PM-15 compatible with HP common rail systems with temps as high as 150 C? (Does PM-15 have acid salts?)
4. I would like to update SSM 20662 or issue an additional SSM.
   a) If our current products provide a significant lubricity improvement factor, we need to emphasize this fact.
   b) Educate our Dealers that our products are good for HP common rail systems. Emphasize that some aftermarket products are not good for HP common rail systems and can lead to premature filter plugging and / or FIE failure.

20662 1999-2009 MULTIPLE VEHICLES - DIESEL ENGINE FUEL CONDITIONER
SOME 1999-2009 F-SUPER DUTY, E-SERIES, EXCURSION, F650/750, AND LCF VEHICLES EQUIPPED WITH A DIESEL ENGINE MAY EXHIBIT LOW POWER, POOR FUEL ECONOMY, FUEL GELLING IN COLD WEATHER (A HIGHER OCCURRENCE OF FUEL GELLING MAY OCCUR WITH THE USE OF BIO-DIESEL BLENDED FUELS), EXCESSIVE WHITE SMOKE ON COLD START, HARD START, OR COKING OF COMPONENTS EXPOSED TO EXHAUST. THESE CONDITIONS MAY BE DUE TO POOR FUEL QUALITY. IF NO ROOT CAUSE IS FOUND DURING NORMAL DIAGNOSTICS, ADVISE THE CUSTOMER TO USE A DIFFERENT BRAND OF FUEL. USE OF A NON ALCOHOL ADDITIVE CAN IMPROVE CETANE LEVELS, SUCH AS "DIESEL CETANE BOOST AND PERFORMANCE IMPROVER" MOTORCRAFT PM-22-A (PM-22-B CAN). COLD FLOW PERFORMANCE CAN BE IMPROVED WITH "DIESEL FUEL ANTI-GEL AND PERFORMANCE IMPROVER" MOTORCRAFT PM-23-A (PM-23-B CAN).
EFFECTIVE DATE: 02/12/2009

Scott Eeley

From: Richardson, Charles (C.E.)
Sent: Friday, December 18, 2009 10:15 AM
To: Eeley, Scott (A.); Santiago, Eduardo (S.)
Cc: Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Rudd, David (D.); Chyo, Timothy (T.); Romano, Ron (R.); Flores, Elsa (E.); Mondragon, David (J.D.); Bastida, Graciela (G.); Villalobos, Luisa (L.); Villareal, Carlos (CV.); Pekarscik, Brian (B.); Misangyi, Pete (P.W.)
Subject: RE: PM-15 and lubricity additives

It is not necessary to add Motorcraft PM-22 at KTP because initial fill diesel is formulated with a diesel fuel additive that improves lubricity, cetane and cold flow performance to meet our M4C130A spec. Therefore, it is recommended that PM-22 is added when vehicles are first filled at dealer.

Regards,

Chuck Richardson
Ford Motor Company
Fuels & Lubricants Engr
2000 Enterprise Drive
Allen Park, Michigan 48101- USA
Phone: (313) 805-0380
E-mail: cricha12@ford.com

From: Eeley, Scott (A.)
Sent: Friday, December 18, 2009 8:45 AM
To: Santiago, Eduardo (S.)
Cc: Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Rudd, David (D.); Chyo, Timothy (T.); Romano, Ron (R.); Richardson, Charles (C.E.); Flores, Elsa (E.); Mondragon, David (J.D.); Bastida, Graciela (G.); Villalobos, Luisa (L.); Villareal, Carlos (CV.); Pekarscik, Brian (B.)
Subject: RE: PM-15 and lubricity additives

Eduardo,

As we discussed on the phone, we recommend that the TSB list Motorcraft PM-22-A. As you mentioned, Ford has done a good job of promoting PM-22 as a cetane improver and PM-23 as a cetane improver and anti-gelling agent resulting in improved power, fuel economy and startability. The Motorcraft website does mention "Adds lubricity.." We need to emphasize 22 and / or 23 lubricating properties in the TSB.

You might consider adding some comments in the TSB regarding PM-22 / 23 use in HP common rail systems. Not all additives are compatible with HP common rail systems. (PM-15 is NOT compatible with HP common rail fuel systems.) Using incompatible additives could significantly accelerate fuel filter plugging and / or cause fuel system damage. (It is not the lubricant that causes the problem. High pressure and temperature in HP common rail systems allow certain lubricants and other chemicals to react and combine leading to deposits.) Lubricant in PM-22 / 23 are compatible with temperatures and pressures produced in HP common rail systems

Please send to me a final copy of the TSB. I will work with David Rudd to draft a similar TSB for the US and Canada.

In addition,

1. Please let me know how we could get PM-22 into all unsold vehicle's fuel tanks: on Dealers lots, in Ford inventory, leaving KTP, et al.
2. Colin and I will take these 'lessons learned' to the Scorpion team.

Thanks.

Scott

From: Romano, Ron (R.)
Sent: Thursday, December 17, 2009 1:38 PM
To: Eeley, Scott (A.); Richardson, Charles (C.E.)
Cc: Santiago, Eduardo (S.); Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Pekarscik, Brian (B.); Rudd, David (D.); Chyo, Timothy (T.); McDonagh, Scot (S.M.); Espinoza, Bob (R.J.)
Subject: RE: PM-15 and lubricity additives

Scott, Chuck,

1. What is the lubricity improvement factor for PM-22 and PM-23? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-22 or PM-23?)
Gold Eagle says their refernence fuel is 520 and at the recommended does both these will reduce this down to 300-425.

2. What is the lubricity improvement factor for PM-15? (If I have fuel with HFRR = 570 WSD, how much improvement should be expected with PM-15?)
Information I have from when we released this 1996 shows the following
ISOPAR M = 580, w/200 ppm PM-15=370
Fuel P=560, w/200 ppm PM-15=320
Our treat rate is 250ppm from what I could find.

3. Is PM-15 compatible with HP common rail systems with temps as high as 150 C? (Does PM-15 have acid salts?)
Probably not. Information I have shows the active additive is a fatty acid. An older MSDS I have shows alkenyl carboxylic acid. I'm verifying this with Lubrizol. But if acid based additives create acid salts that are causing the deposits then this probably wouldn't be considered compatible. I'm looking into discontinuing this.

4. I would like to update SSM 20662 or issue an additional SSM.
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Thanks

Ron Romano
Service Lubricants Technical Expert
FCSD, Service Product Development, SEO
Diagnostic Service Center II
Room 410
1800 Fairlane Drive, Allen Park, MI 48101
Phone:(313) 84-54068 Fax:(313)-32-38042

From: Eeley, Scott (A.)
Sent: Thursday, December 17, 2009 10:58 AM
To: Romano, Ron (R.); Richardson, Charles (C.E.)
Cc: Santiago, Eduardo (S.); Horbal, Colin (C.P.); Mull, Ted (V.); Simpson, Timothy (T.A.); Fulton, Brien (B.L.); Pekarscik, Brian (B.); Rudd, David (D.); Chyo, Timothy (T.); McDonagh, Scot (S.M.); Espinoza, Bob (R.J.)
Subject: PM-15 and lubricity additives

Ron and Chuck,

As we discussed in separate phone calls;

Please help me with the following:

1. What is the lubricity improvement factor for PM-22 and PM-23? (If I have fuel with HFRR = 570 WSD, how much

improvement should be expected with PM-22 or PM-23?)
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20662 1999-2009 MULTIPLE VEHICLES - DIESEL ENGINE FUEL CONDITIONER
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EFFECTIVE DATE: 02/12/2009

Scott Eeley

From: Eeley, Scott (A.)
Sent: Tuesday, April 13, 2010 9:02 AM
To: Heggie, Forest (F.); Armesto, Carlos (.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.); Curtis, Andrew (A.); McAllister, Derek (D.)
Cc: Bergeron, Leon (F.L.); Stroia, Kathy (K.); Simpson, Timothy (T.A.); Espinoza, Bob (R.J.); Mull, Ted (V.)
Subject: RE: Recommendation Fuel Sample location for water in fuel testing for 6.4L

I sent the following to my Manager:

This is my recollection of the meeting's main points.

- Sampling fuel from the tank had been discussed in an earlier management review.
- Sampling from the on-engine filter housing would not be ideal as water separation at this location is a secondary feature and water is sent to the HFCM in the regulated fuel return circuit.
- Water in the fuel tank does not directly equate to equipment failure. Diesel fuel analysis indicating specific values is an important factor (not the only factor) brought up during customer discussions.
- Water in the HFCM does not directly equate to equipment failure.
- DTC P2269 or not having DTC P2269 does not directly equate to equipment failure.
- The HFCM is robust at indicating water presence to the PCM and the PCM provides reasonable notification to the operator.
- Rust in the on-engine filter housing is an alarm that water has passed the HFCM and there is increased risk of HP fuel equipment damage.
- Rust on HP pump internal fuel immersed components indicates presence of something other than recommended liquids.
- At this time, not one single measurement or attribute (indicator) stands out as the key determining factor in determining warranty coverage.

Conclusion
Systemic diagnostics and accumulating key indicators is preferred when determining warranty coverage. Indicators such as:

DTC P2269 (IDS)
Free standing water in HFCM (inspection)
Free standing water in tank (inspection & sample)
Emulsified water in fuel (sample)
Rust in on-engine housing (inspection)
Rust internal to HP pump (inspection) (potential additional check point)

Action items and follow-up

- FCSD to discuss acceptance criteria WIF - PPM shift to 2000.
- Eeley: discuss with Navistar long-term implementation of ITP / VCV inspection when other conditions exists.
- Curtis: discuss with Pete Bansoske process to add short-term inspection process for rust in on-engine filter housing and rust in HP pump locations when Inspectors sent by Hotline - 14-day period. (contingent maintaining fuel sampling program)
- Heggie: send to Andrew Curtis suggested procedure to access and inspect VCV / ITP.

From: Heggie, Forest (F.)
Sent: Monday, April 12, 2010 12:09 PM
To: Heggie, Forest (F.); Armesto, Carlos (.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.); Eeley, Scott (A.); Curtis, Andrew (A.); McAllister, Derek (D.)
Cc: Bergeron, Leon (F.L.); Stroia, Kathy (K.); Simpson, Timothy (T.A.); Heggie, Forest (F.); Espinoza, Bob (R.J.); Mull, Ted (V.)
Subject: RE: Recommendation Fuel Sample location for water in fuel testing for 6.4L

Attendees:
S.Eeley,
C.Armesto
B. Fulton
A. Kromberg

D. McAllister
C. Andrew

Recommendation from meeting is to base decision on ppm measurement of fuel sample And the presence of rust.

Requested: for next 2 weeks hotline inspection to include - ITP cover from the pump removed(photo) , VCV valve inspect for rust

-on engine filter housing inspect for rust (do not wipe filter)

F. Heggie:to provide: pictures and instructions for rust inspection

Forest Heggie BaSc. MaSc. P.Eng

1-313-6185054

LGDEE Diesel OPD

From: Heggie, Forest (F.)
Sent: Thursday, April 08, 2010 1:29 PM
To: Heggie, Forest (F.); Armesto, Carlos (.); Fulton, Brien (B.L.); Kromberg, Arnold (A.W.); Bld-1 11F094 (10); Espinoza, Bob (R.J.); Eeley, Scott (A.)
Cc: McAllister, Derek (D.); Bergeron, Leon (F.L.); Stroia, Kathy (K.)
Subject: Recommendation Fuel Sample location for water in fuel testing for 6.4L
When: Monday, April 12, 2010 9:30 AM-10:30 AM (GMT-05:00) Eastern Time (US & Canada).
Where: bldg 1 - 11F094

Goal: receive a recommendation where/how to sample fuel to determine if water content in fuel damaged high pressure fuel system 6.4L.

Thank You for your time,

From: Bremerkamp, Alan [Alan.Bremerkamp@Navistar.com]
Sent: Friday, June 17, 2011 8:54 AM
To: Eeley, Scott (A.); Heggie, Forest (F.); Goering, Dan (D.L.)
Cc: Brick, Joel
Subject: RE: REVIEW REQUEST by 6/20

Thanks for the feedback. We will make the changes and keep moving forward.

Alan Bremerkamp | Marketing Communications Manager | Blue Diamond Parts, LLC
(p) (630) 719-7334 | (e) alan.bremerkamp@bluediamondparts.com

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From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, June 17, 2011 7:51 AM
To: Bremerkamp, Alan; Heggie, Forest (F.); Goering, Dan
Cc: Brick, Joel
Subject: RE: REVIEW REQUEST by 6/20

"AND" would be my only suggestion.

From: Bremerkamp, Alan [mailto:Alan.Bremerkamp@Navistar.com]
Sent: Thursday, June 16, 2011 3:15 PM
To: Heggie, Forest (F.); Goering, Dan (D.L.); Eeley, Scott (A.)
Cc: Brick, Joel
Subject: RE: REVIEW REQUEST by 6/20

Thanks for your input. We have reworked the copy to include draining the water separator monthly or whenever the Water in Fuel light illuminates.

We have made some updates to the copy based on your feedback below and would like your review to ensure what has been revised is acceptable. If not, we would appreciate your suggested wording.

1. REVISED to: **Secondary Fuel Filter Housing Damage:** An undrained water separator allows standing water to corrode the secondary fuel filter housing. **By draining the water separator monthly AND whenever the Water in Fuel light illuminates, you will protect your factory warranty and avoid expensive fuel system repairs.**

2. REVISED to: **Internal Transfer Pump Corrosion:** When the water separator reaches capacity, water flows into the fuel system causing components, such as the internal transfer pump (pictured), to rust. This condition isn't covered under warranty, but is simple to prevent with genuine Motorcraft fuel filter changes and water separator servicing, on time, every time.

Alan Bremerkamp | Marketing Communications Manager | Blue Diamond Parts, LLC
(p) (630) 719-7334 | (e) alan.bremerkamp@bluediamondparts.com

---

From: Heggie, Forest (F.) [mailto:fheggie@ford.com]
Sent: Thursday, June 16, 2011 7:18 AM
To: Goering, Dan; Eeley, Scott (A.)
Cc: Bremerkamp, Alan

Subject: RE: REVIEW REQUEST by 6/20

A) you may want to point out a key difference in the HFCM filter - the "water screen" on the exterior, I not know but doubt our competitor products all have this screen-competitive edge

B) I attached a draft short form educational document not sure if I sent this to you before but here is a little more info.

1) Not quite correct statement: this is the easiest access point to visually determine if you have had standing water/corrosion occurring in the high pressure fuel system, the VCV/Pump will be corroding along with the housing at the same time.

Secondary Fuel Filter Housing

Damage: An undrained water separator allows standing water from contaminated fuel to corrode the secondary fuel filter housing and pass damaging water and metal contaminants to the injector pump. Protect your factory warranty and avoid expensive fuel system repairs by draining the water separator at every oil change or at least once monthly.

2) Suggest rewording I am not sure about the word "susceptible" : ie when water is not drained and the fuel filters not maintained, the only place left for the water to go is the fuel system, where "water causes rust", water does not lubricate . High Pressure pump designed to be cooled and lubricated by diesel fuel, excessive water will rust components.

Internal Transfer Pump Corrosion:

Located inside the High Pressure Fuel Injection Pump, the Internal Transfer Pump is susceptible to rust or corrosion beneath its cover when the fuel system is neglected. This condition isn't covered under warranty, but is simple to prevent with genuine

Ford or Motorcraft fuel filter changes

and water separator servicing, on time,

every time.

Forest Heggie
LGDEE: OPD Diesel
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt

313-618-5054

From: Goering, Dan (D.L.)
Sent: Wednesday, June 15, 2011 3:34 PM
To: Eeley, Scott (A.); Heggie, Forest (F.)
Cc: Goering, Dan (D.L.); Bremerkamp, Alan
Subject: REVIEW REQUEST by 6/20
Importance: High

Scott / Forest,
Here is the advisor sheet to use with customers on the perils of not performing maintenance. We need your suggestions by Monday, 6/20.

From: Heggie, Forest (F.)
Sent: Tuesday, October 26, 2010 2:00 PM
To: Raney-Pablo, Beth (H.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

to follow up on the emaikl,

I read this as 68 mg of water in Kg of solution (diesel) was that incorrect

sorry for all the emails I am out of the office today

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Raney-Pablo, Beth (H.E.)
Sent: Monday, October 11, 2010 1:32 PM
To: Heggie, Forest (F.); Armesto, Carlos (.)
Cc: Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

I'm in. You didn't allow enough time for me to complete the necessary data analysis to be able to respond with the requested information.

Attached is a histogram analysis of the US water content based on recent survey data. This water is likely dissolved in the fuel, not free water. The mean value (50%-ile) for summer is 68 mg/kg, for winter is 48 mg/kg and the overall (summer and winter) is 58 mg/kg. The US market fuel specification allows up to 500 mg/kg water in the fuel, although most samples are well below that limit.

Carlos Armesto may be able to help you determine how long it would take for the HFCM to fill if the customer consistently filled on fuel containing the mean value of water.

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 12:12 PM
To: Heggie, Forest (F.); Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Charles, I am not sur eif Beth is in so I am also sending this email to you,

I am looking for the mean and median of the % by volume of water in diesel fuel for summer and winter that I can use for some calculations to understand on average how often a customer would have to drain their HFCM.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 9:05 AM
To: Raney-Pablo, Beth (H.E.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Beth I was reviewing this presentation and am looking for an average water content number I could use for the 6.4L HFCM capacity calculation to understand on average how often the HFCM would need to be drained by tanks of fuel. Could you please advise what would be the average water content for the US.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Eeley, Scott (A.)
Sent: Monday, October 11, 2010 8:56 AM
To: Heggie, Forest (F.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 1:23 PM
To: Eeley, Scott (A.)
Cc: Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

While not presented in the same way, the attached file contains information on diesel market fuel quality charts for Mexico and other North and South American countries. Lubricity is on slide 12. The overall lubricity in Mexico is higher than in the U.S.

The most up-to-date quality charts are available online through the Fuels and Lubes EDMS site. Here's a link to the main fuel quality folder: https://www.edms.ford.com/webtop/drl/objectId/0b00cad980407a29. From here, click on the folder containing the type of fuel you're interested in: diesel/biodiesel, gasoline, or FFV/E85.

Regards,
Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

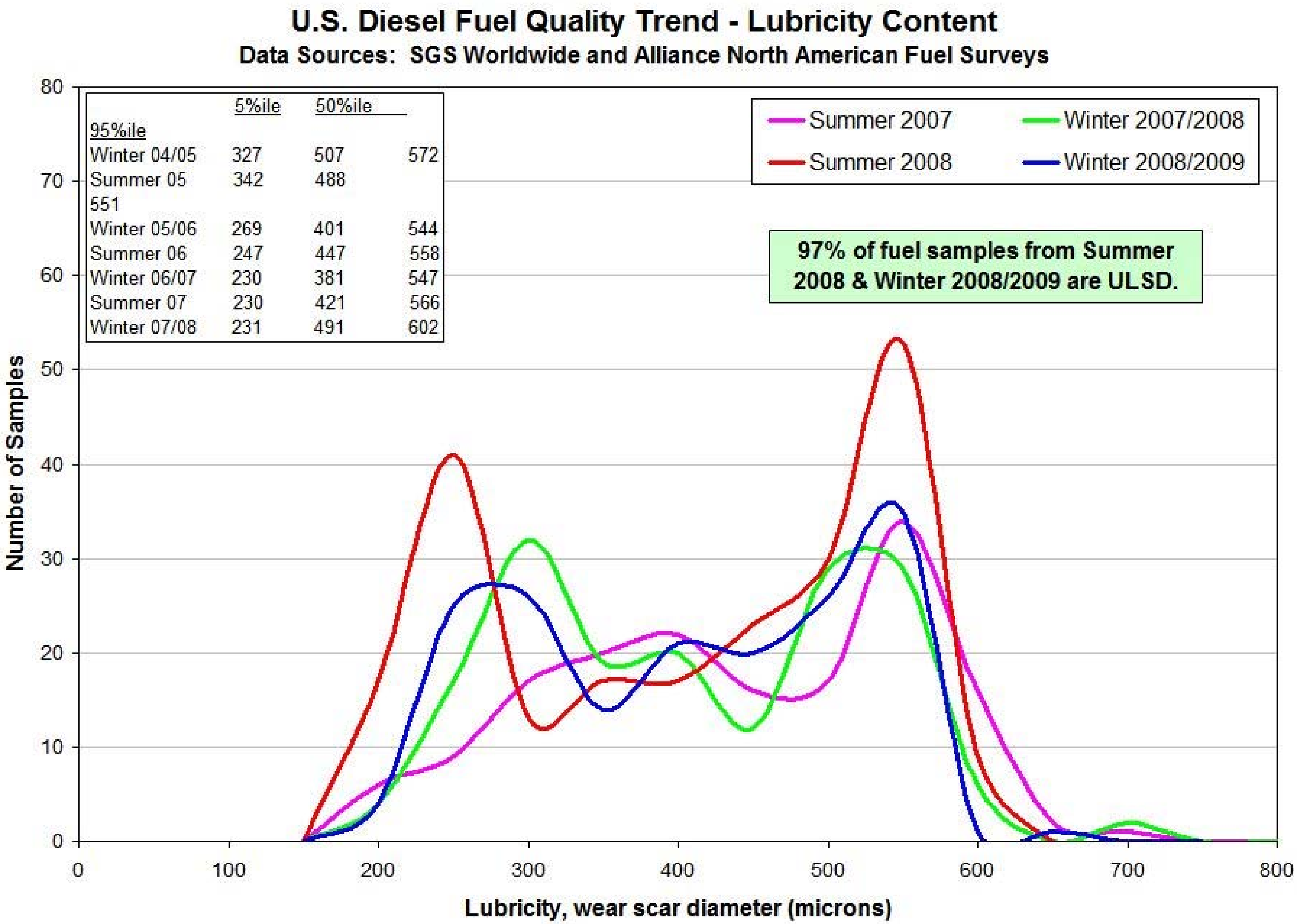
From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 12:54 PM
To: Raney-Pablo, Beth (H.E.); Fulton, Brien (B.L.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Thanks Beth.

Do you have anything like this for Mexico?

From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 11:01 AM
To: Fulton, Brien (B.L.); Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Here is an updated graph with the Summer 2008 and Winter 2008/2009 lubricity data. 97% of the fuel samples were ULSD.



Regards,
Beth Raney-Pablo
Ford Motor Company
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TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Fulton, Brien (B.L.)
Sent: Tuesday, November 17, 2009 9:57 AM
To: Eeley, Scott (A.)
Cc: Raney-Pablo, Beth (H.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

ULSD was just starting to roll out at that time and the data does contain some ULSD which due to the process to remove sulfur tends to reduce lubricity.

Beth,
Please send us the latest survey data you have for lubricity for ULSD.
thanks

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 8:09 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

???

From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Do you think this data was taken with ultra low sulfur fuel?

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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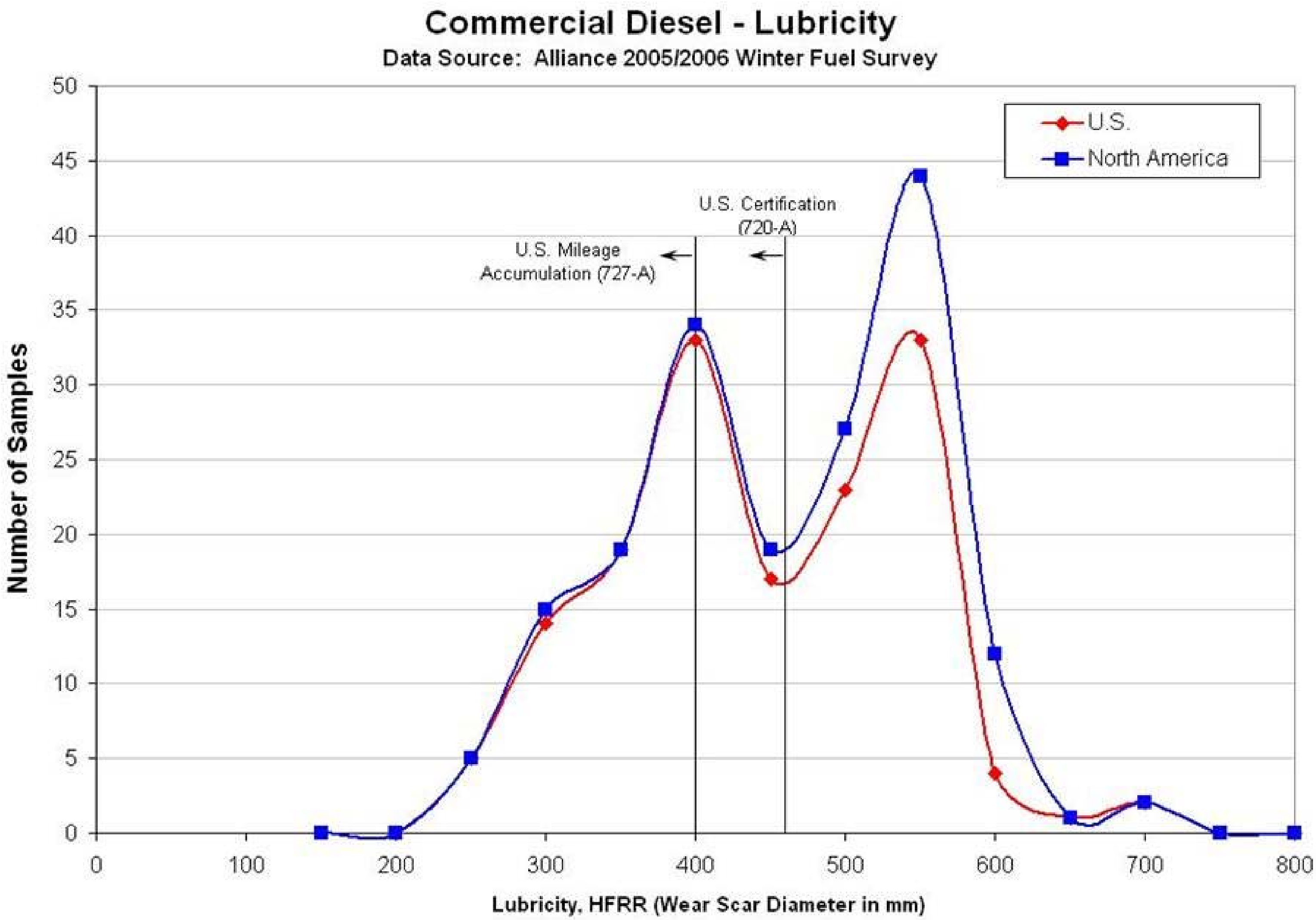
From: Fulton, Brien (B.L.)
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Ted, the limit in D975 for HFRR is 520. The baseline fuel is a good pass but the HFCM sample is a borderline fail so it supports the lubricity concern.

I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.™**

From: Li, Shenghua
Sent: Tuesday, November 10, 2009 8:38 AM
To: Wang, Jerry C
Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Jerry,

Please review the brief report on the HFRR testing of two of the three diesel samples from you. I will keep the HPP sample for your further instructions. Also let me know if you need the two tested samples to be returned to you or Gary.

Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

From:	Raney-Pablo, Beth (H.E.)
Sent:	Tuesday, November 17, 2009 1:23 PM
To:	Eeley, Scott (A.)
Cc:	Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject:	RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels
Attachments:	N and S AMERICA DIESEL Market Quality Charts.ppt

While not presented in the same way, the attached file contains information on diesel market fuel quality charts for
Mexico and other North and South American countries. Lubricity is on slide 12. The overall lubricity in Mexico is higher than in the U.S.

The most up-to-date quality charts are available online through the Fuels and Lubes EDMS site. Here's a link to the main fuel quality folder: https://www.edms.ford.com/webtop/drl/objectId/0b00cad980407a29. From here, click on the folder containing the type of fuel you're interested in: diesel/biodiesel, gasoline, or FFV/E85.

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

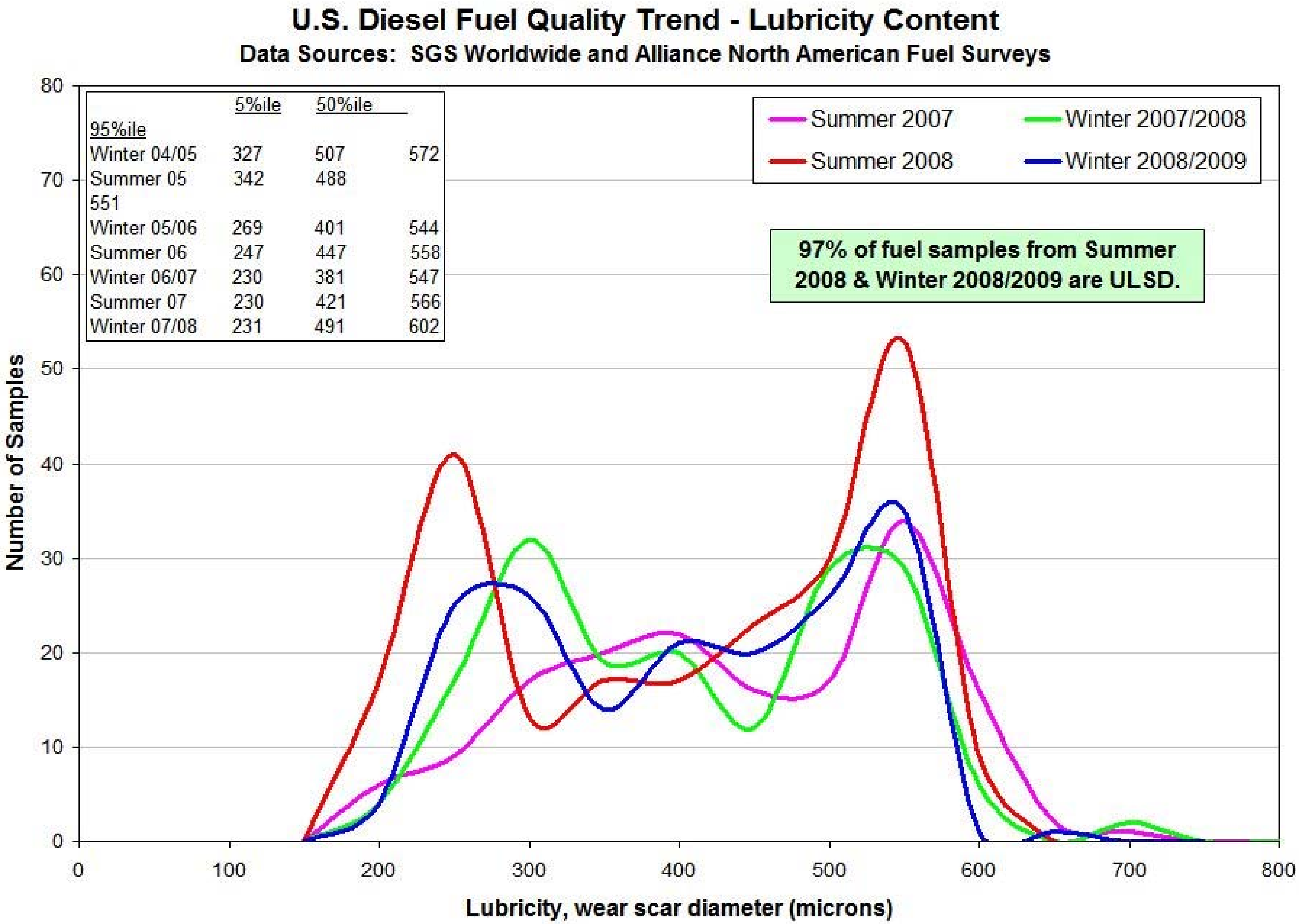
From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 12:54 PM
To: Raney-Pablo, Beth (H.E.); Fulton, Brien (B.L.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Thanks Beth.

Do you have anything like this for Mexico?

From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 11:01 AM
To: Fulton, Brien (B.L.); Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Here is an updated graph with the Summer 2008 and Winter 2008/2009 lubricity data. 97% of the fuel samples were ULSD.



Regards,
Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Fulton, Brien (B.L.)
Sent: Tuesday, November 17, 2009 9:57 AM
To: Eeley, Scott (A.)
Cc: Raney-Pablo, Beth (H.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

ULSD was just starting to roll out at that time and the data does contain some ULSD which due to the process to remove sulfur tends to reduce lubricity.

Beth,
Please send us the latest survey data you have for lubricity for ULSD.
thanks

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 8:09 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

???

From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

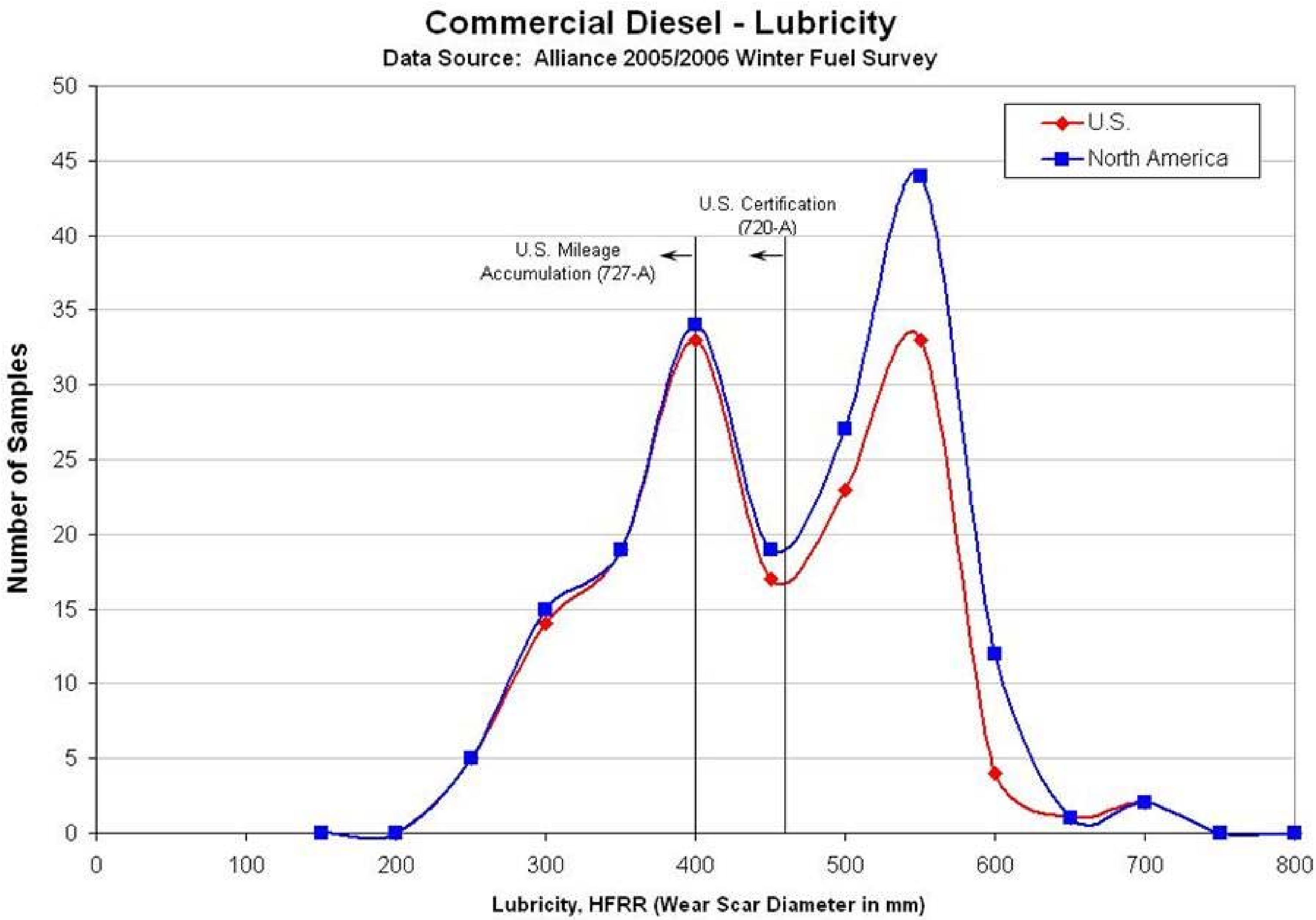
Do you think this data was taken with ultra low sulfur fuel?

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

---

From: Fulton, Brien (B.L.)
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

---

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

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Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.**™

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Sent: Tuesday, November 10, 2009 8:38 AM
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Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Jerry,

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Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

North and South America Market Diesel Quality

Countries Surveyed

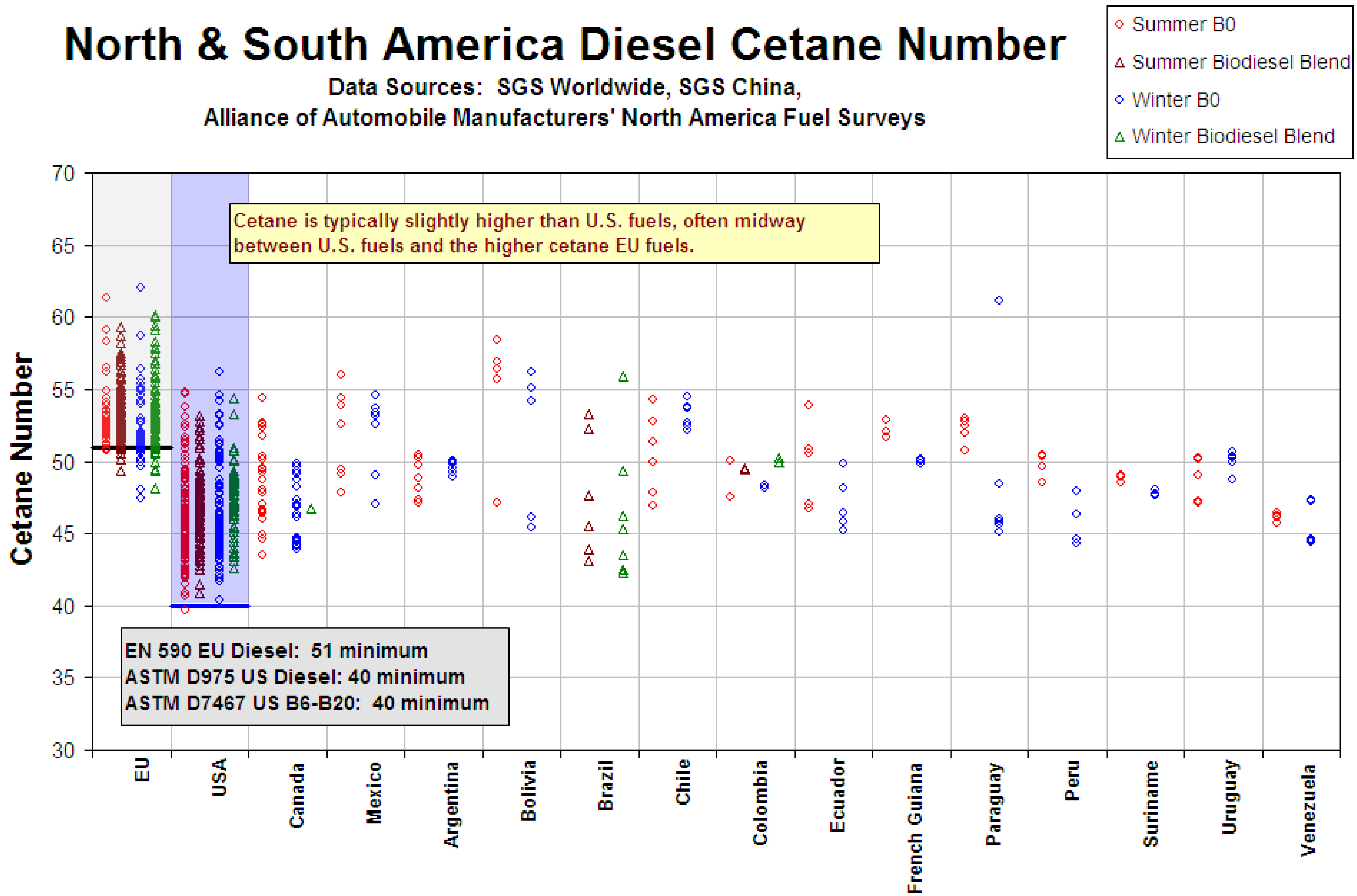
Country	Summer Season	Winter Season
USA	2008	2008-2009
Canada	2008	2008-2009
Mexico	2008	2008-2009
Argentina	2008-2009	2008
Bolivia	2007-2008	2008
Brazil	2008-2009	2008
Chile	2008-2009	2008
Colombia	2007-2008	2008
Ecuador	2007-2008	2008
French Guiana	2007-2008	2008
Paraguay	2007-2008	2008
Peru	2007-2008	2008
Suriname	2007-2008	2008
Uruguay	2007-2008	2008
Venezuela	2007-2008	2006

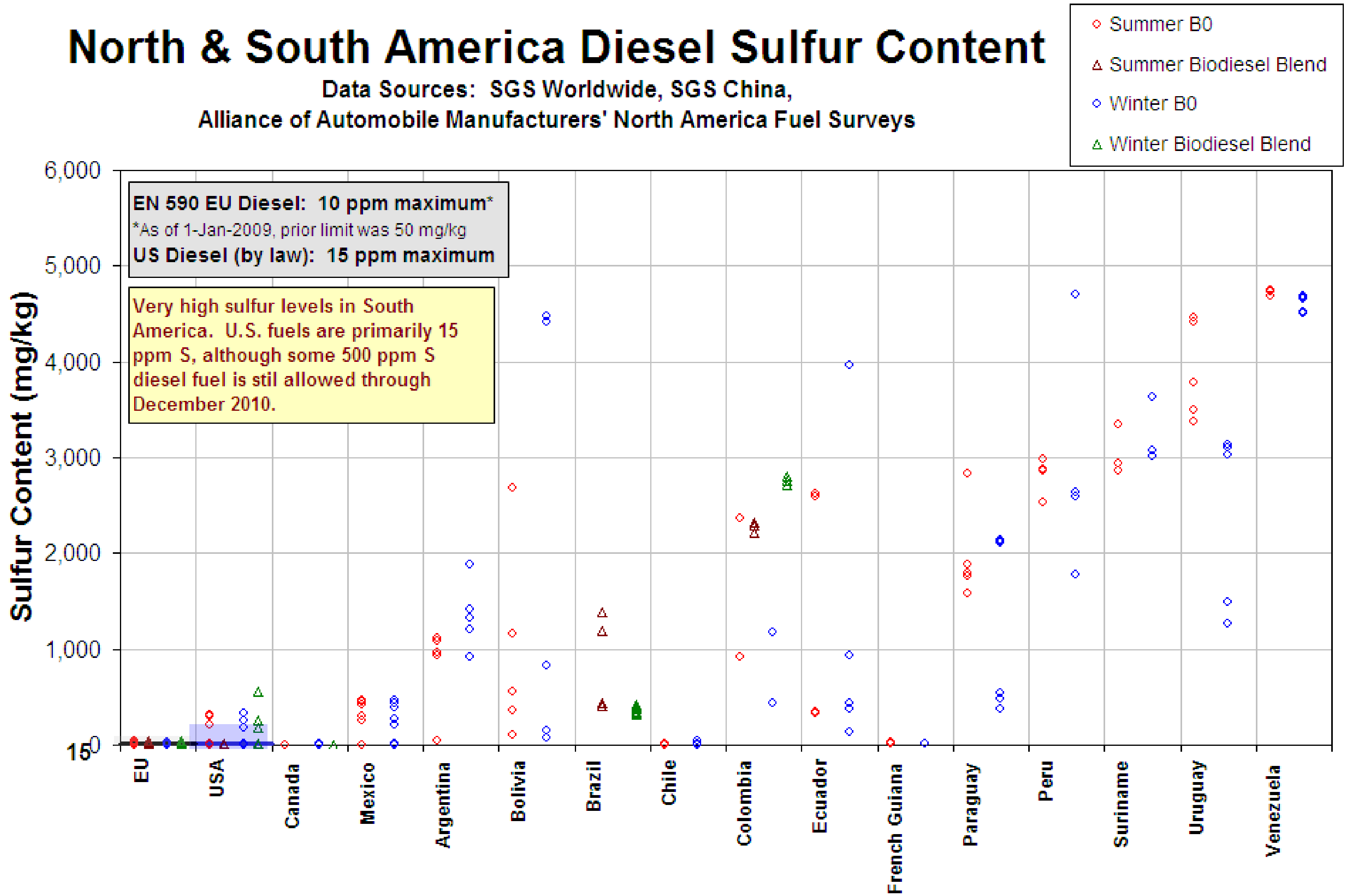
Overview: North & South America Diesel Quality

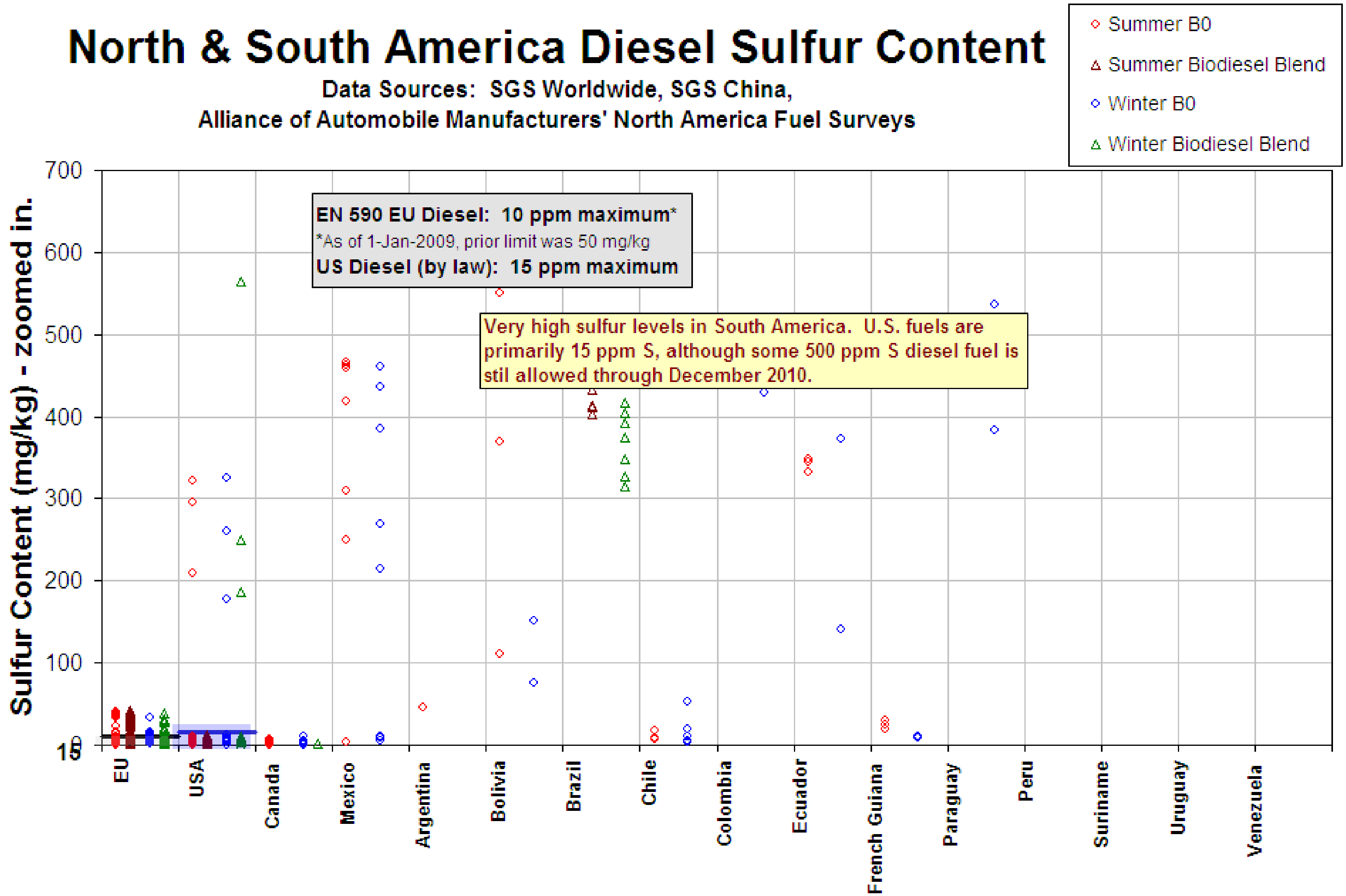
- Cetane levels are typically ~45-50, about midway between the low cetane U.S. fuels and the higher cetane of EU fuels.
- Very high sulfur fuels in South America.
- U.S. fuels are mostly 15 ppm S, although up to 500 ppm S diesel fuel can still be available through December 2010
- Density is comparable to the higher density of U.S. fuels
- North American fuels tend to have poorer lubricity and lower cetane
- South American fuels tend to have comparable lubricity to EU fuels
- Biodiesel is mandated in several areas and its use is expected to continue to expand in both North and South America
- Many U.S. fuels contain more biodiesel than labeled due to poor blending practices

Diesel Properties Reported

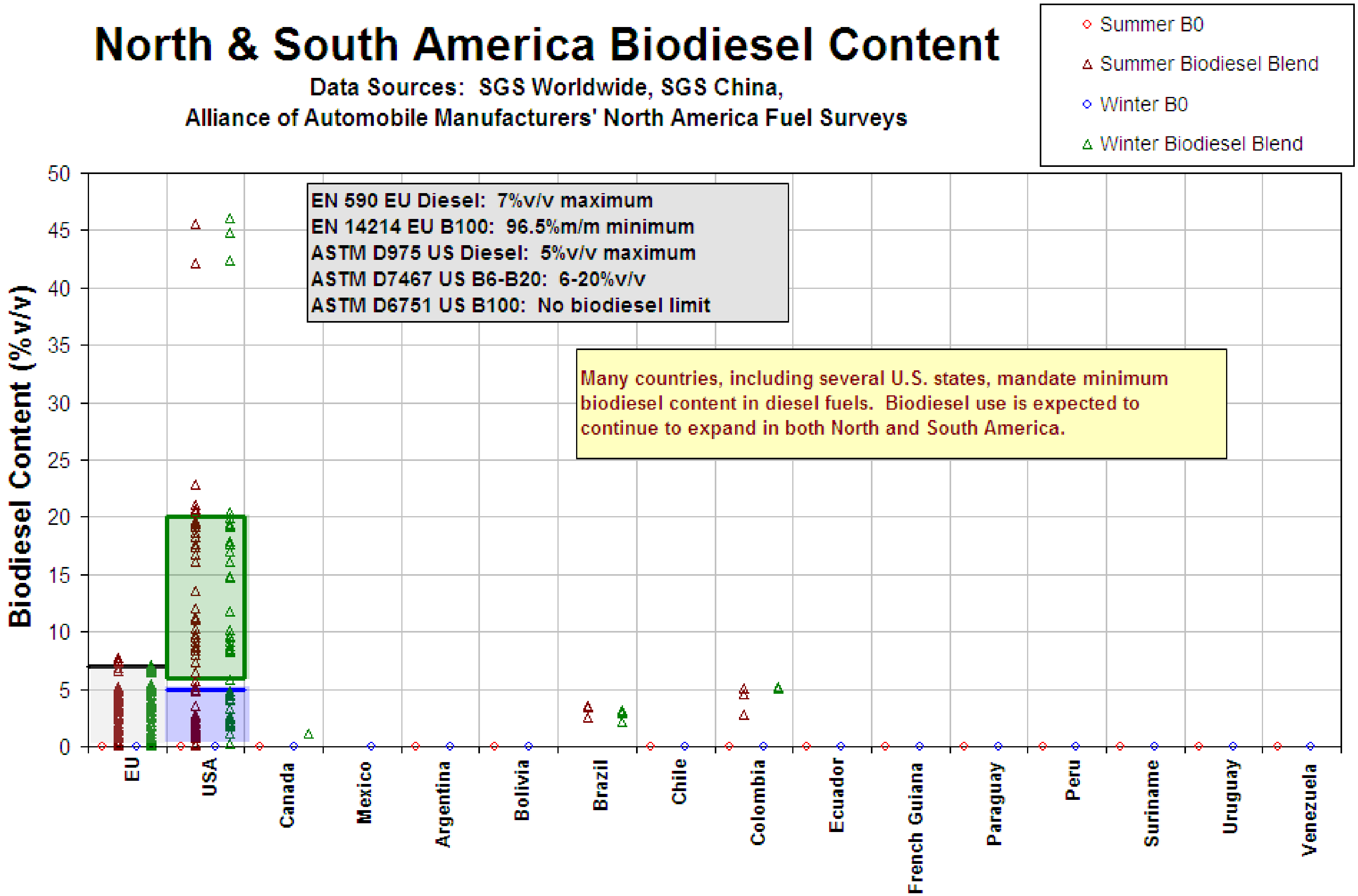
- Cetane Number
- Sulfur Content
- Biodiesel Content
- Density
- Viscosity
- Lubricity
- Aromatic/Polyaromatic Content
- Water Content
- Total Particulate Content
- Particle Size

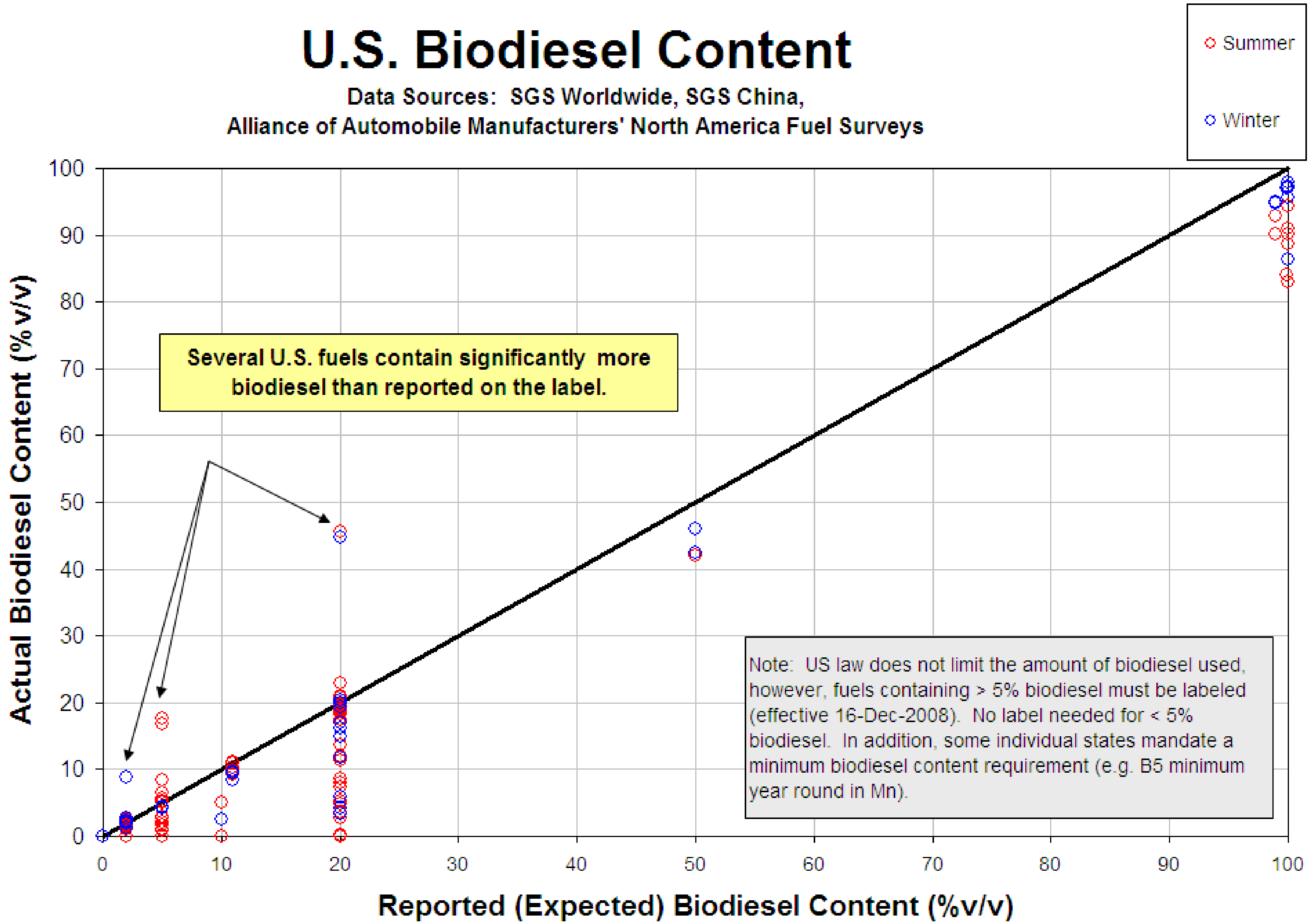

North & South America Diesel Cetane Number
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
Cetane Number
70
65
60
55
50
45
40
35
30
Cetane is typically slightly higher than U.S. fuels, often midway between U.S. fuels and the higher cetane EU fuels.
EN 590 EU Diesel: 51 minimum
ASTM D975 US Diesel: 40 minimum
ASTM D7467 US B6-B20: 40 minimum
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

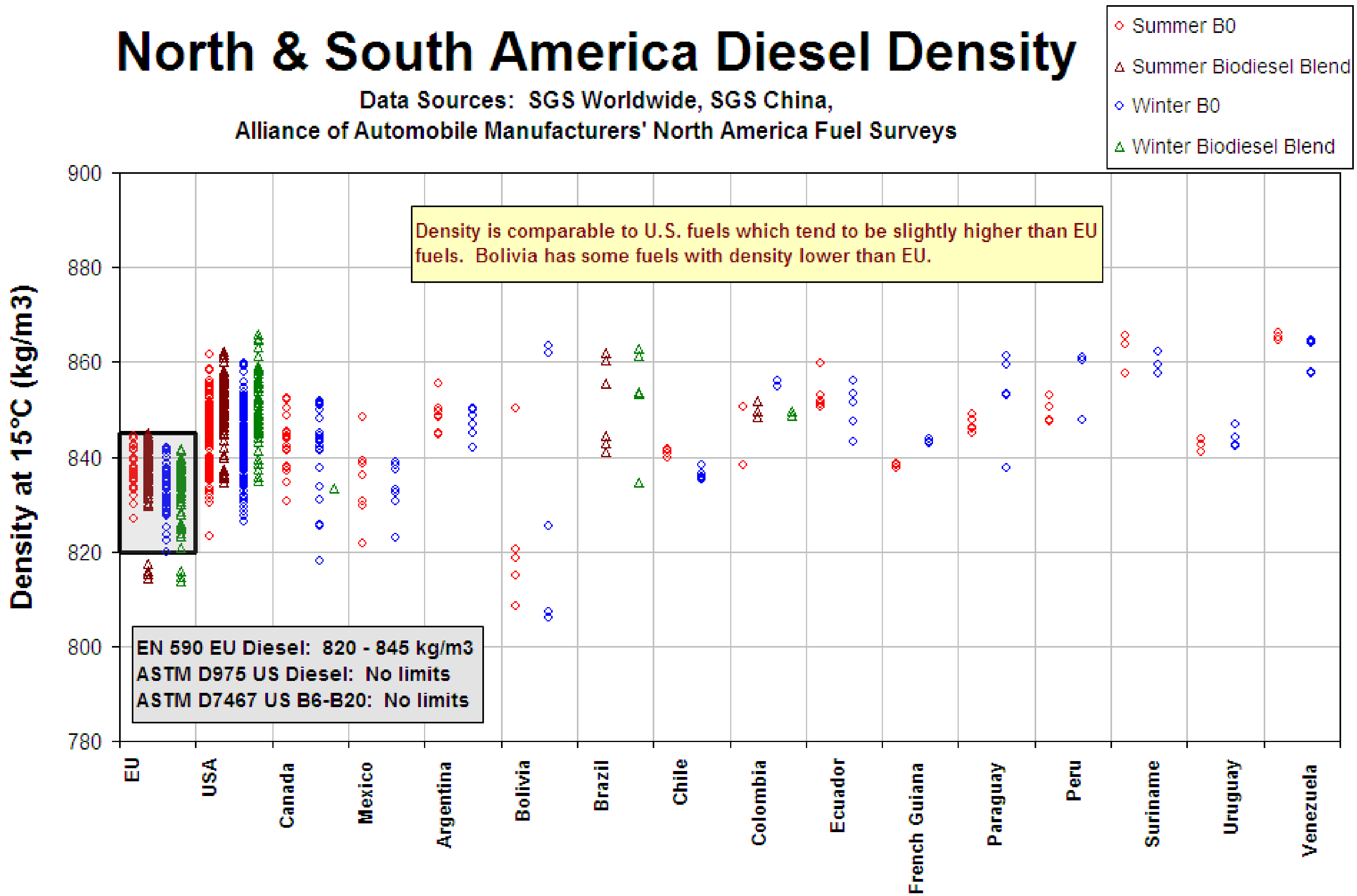

North & South America Diesel Sulfur Content
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
EN 590 EU Diesel: 10 ppm maximum*
*As of 1-Jan-2009, prior limit was 50 mg/kg
US Diesel (by law): 15 ppm maximum
Very high sulfur levels in South America. U.S. fuels are primarily 15 ppm S, although some 500 ppm S diesel fuel is stil allowed through December 2010.
Sulfur Content (mg/kg)
6,000
5,000
4,000
3,000
2,000
1,000
0
15
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

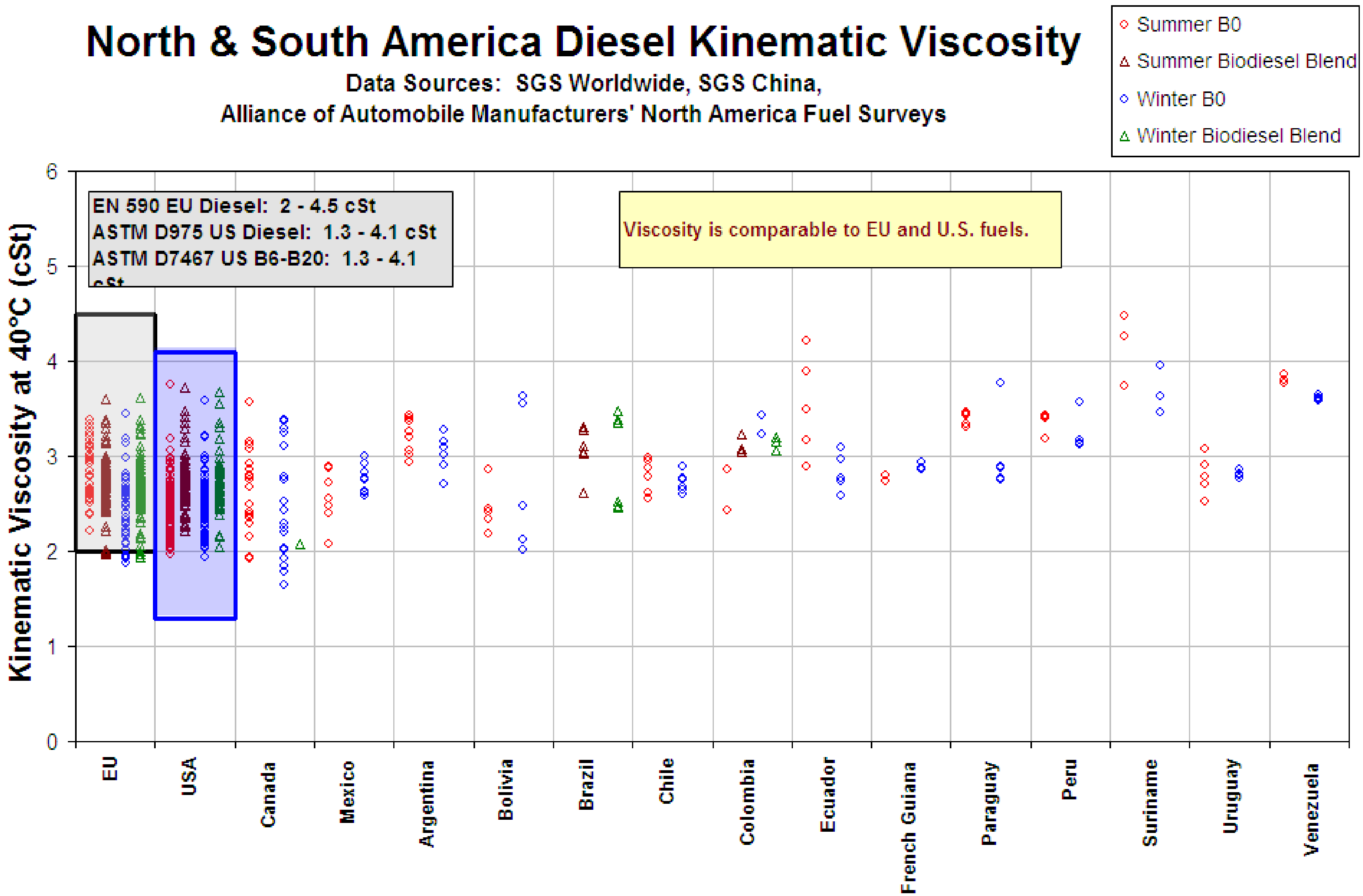


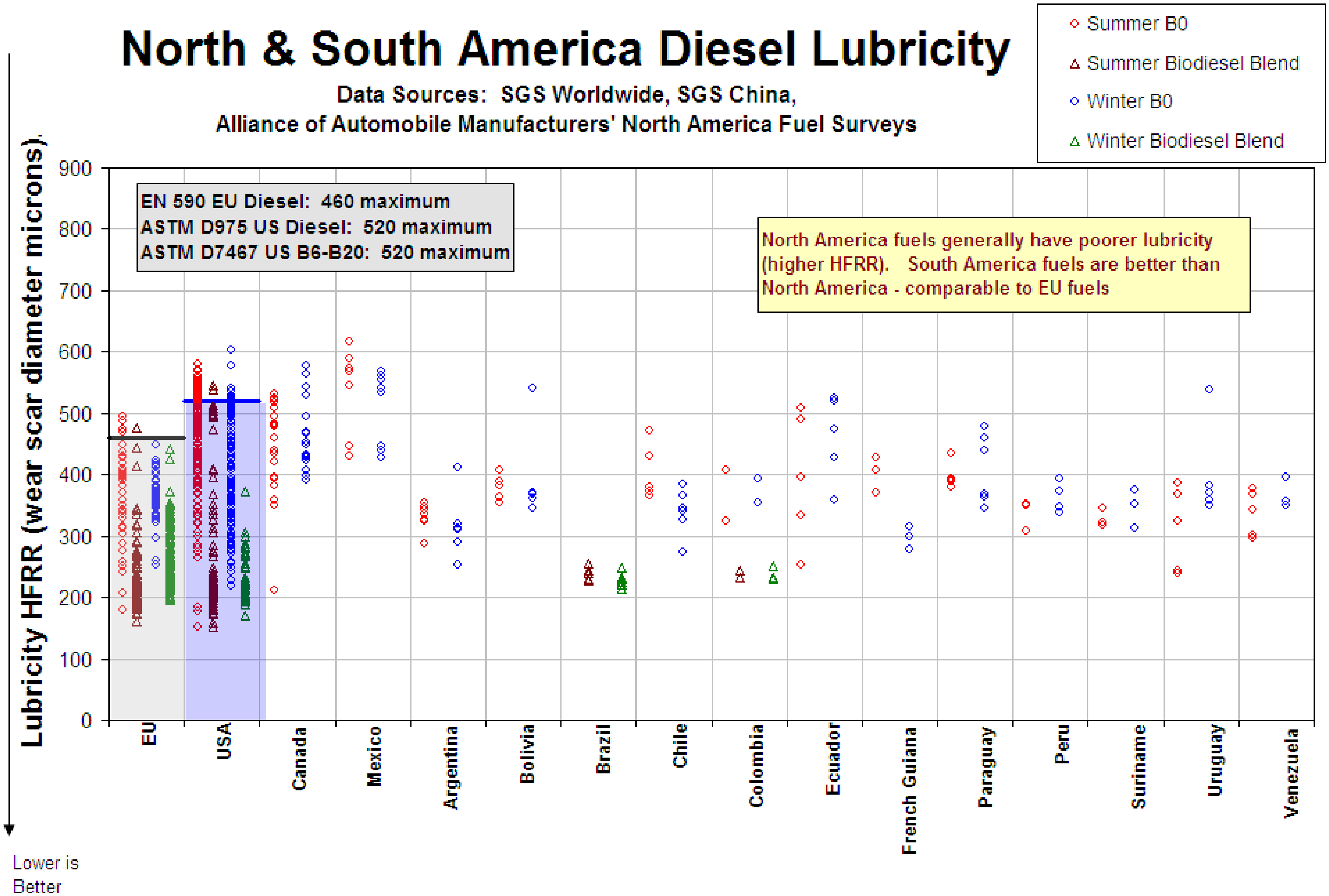
EA11-003 000415


North & South America Biodiesel Content
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
Biodiesel Content (%v/v)
50
45
40
35
30
25
20
15
10
5
0
EN 590 EU Diesel: 7%v/v maximum
EN 14214 EU B100: 96.5%m/m minimum
ASTM D975 US Diesel: 5%v/v maximum
ASTM D7467 US B6-B20: 6-20%v/v
ASTM D6751 US B100: No biodiesel limit
Many countries, including several U.S. states, mandate minimum biodiesel content in diesel fuels. Biodiesel use is expected to continue to expand in both North and South America.
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

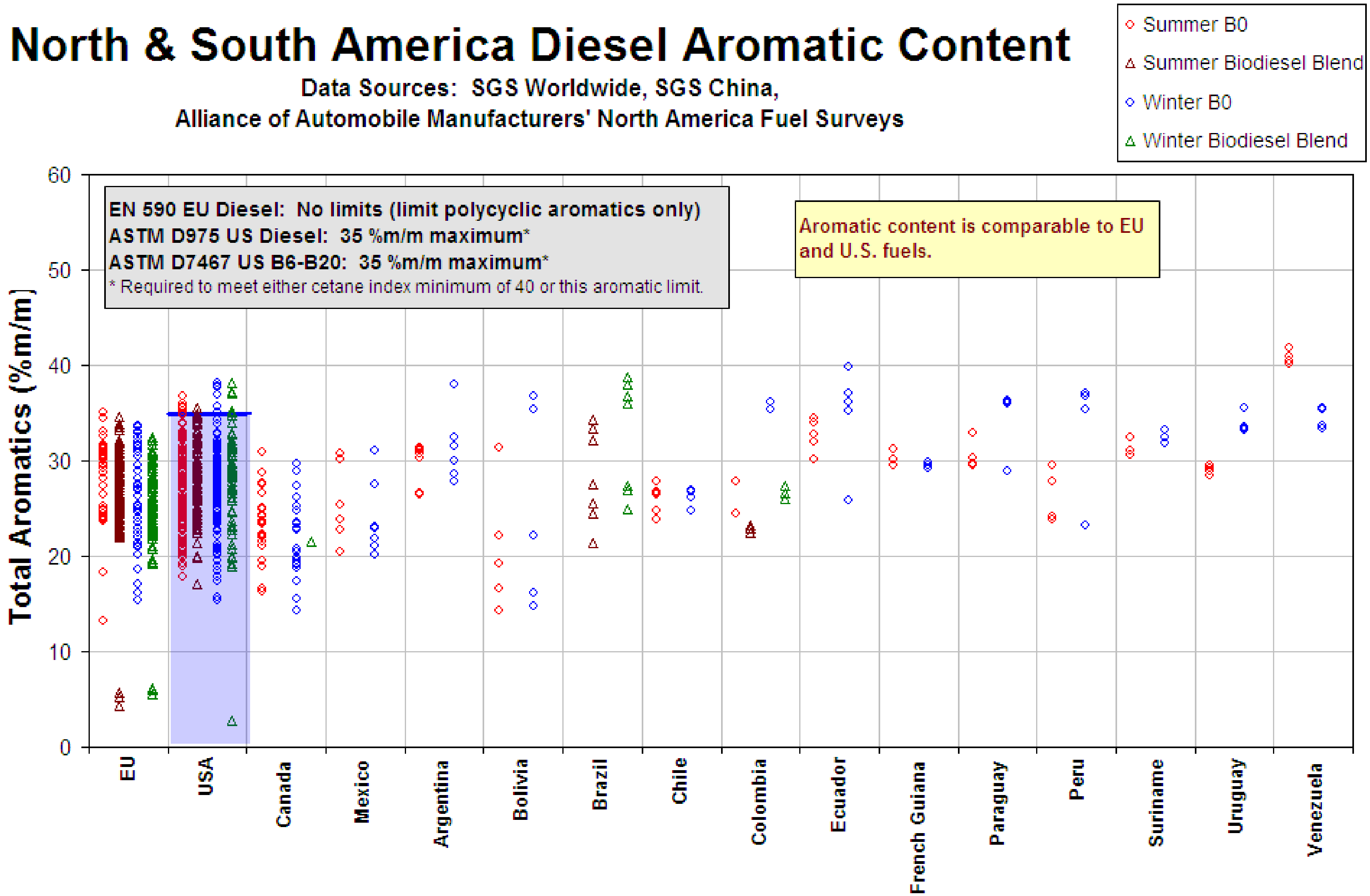

U.S. Biodiesel Content
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer
Winter
Several U.S. fuels contain significantly more biodiesel than reported on the label.
Note: US law does not limit the amount of biodiesel used, however, fuels containing > 5% biodiesel must be labeled (effective 16-Dec-2008). No label needed for < 5% biodiesel. In addition, some individual states mandate a minimum biodiesel content requirement (e.g. B5 minimum year round in Mn).
Actual Biodiesel Content (% v/v)
Reported (Expected) Biodiesel Content (%v/v)
0
10
20
30
40
50
60
70
80
90
100

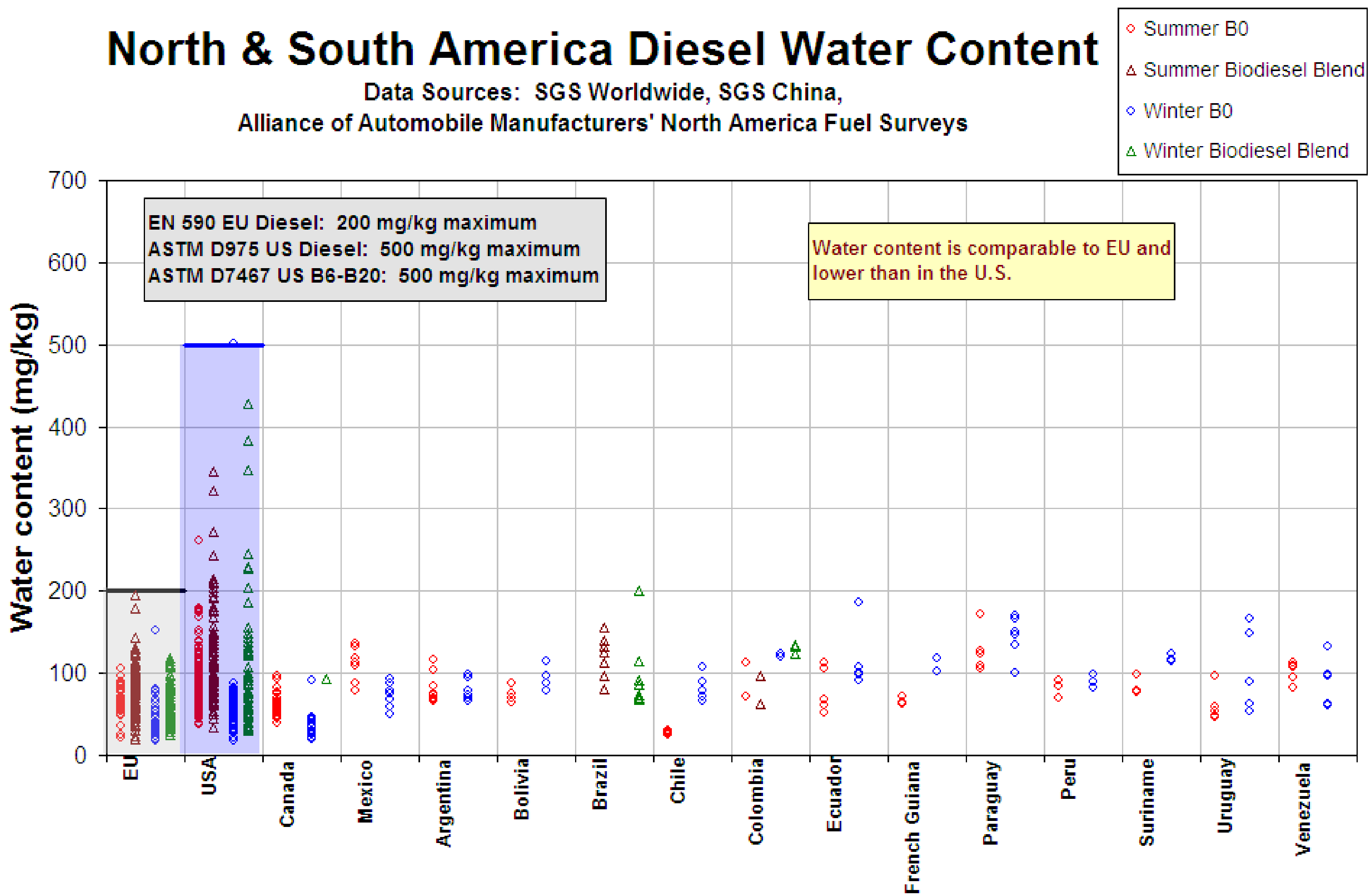

North & South America Diesel Density
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
Density is comparable to U.S. fuels which tend to be slightly higher than EU fuels. Bolivia has some fuels with density lower than EU.
EN 590 EU Diesel: 820 - 845 kg/m3
ASTM D975 US Diesel: No limits
ASTM D7467 US B6-B20: No limits
Density at 15°C (kg/m3)
900
880
860
840
820
800
780
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

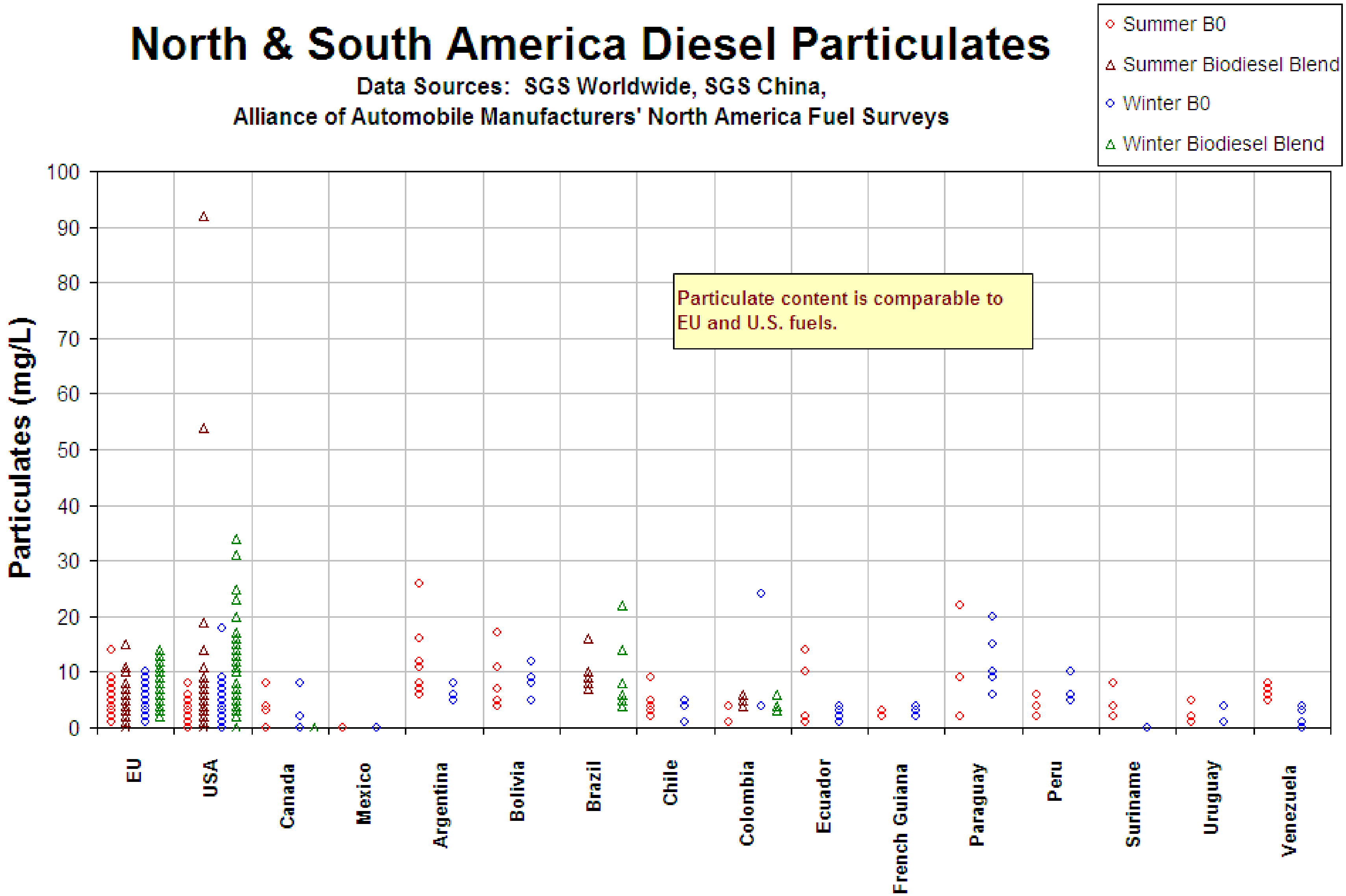

North & South America Diesel Kinematic Viscosity
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
EN 590 EU Diesel: 2 - 4.5 cSt
ASTM D975 US Diesel: 1.3 - 4.1 cSt
ASTM D7467 US B6-B20: 1.3 - 4.1 cSt
Viscosity is comparable to EU and U.S. fuels.
Kinematic Viscosity at 40°C (cSt)
0
1
2
3
4
5
6
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

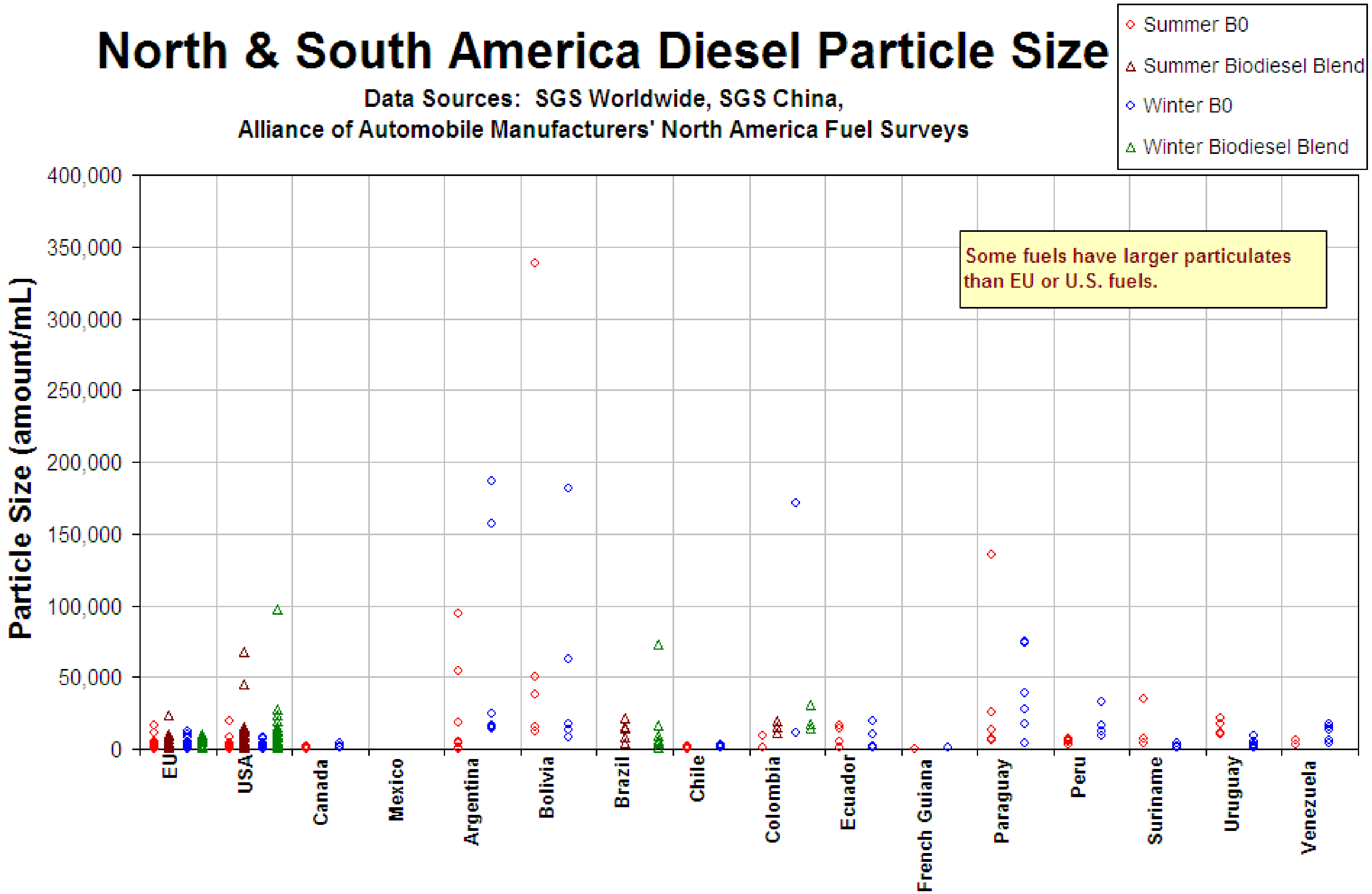


North & South America Diesel Lubricity
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
EN 590 EU Diesel: 460 maximum
ASTM D975 US Diesel: 520 maximum
ASTM D7467 US B6-B20: 520 maximum
North America fuels generally have poorer lubricity (higher HFRR). South America fuels are better than North America - comparable to EU fuels
Lubricity HFRR (wear scar diameter microns)
900
800
700
600
500
400
300
200
100
0
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela
Lower is Better


North & South America Diesel Aromatic Content
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
EN 590 EU Diesel: No limits (limit polycyclic aromatics only)
ASTM D975 US Diesel: 35 %m/m maximum*
ASTM D7467 US B6-B20: 35 %m/m maximum*
* Required to meet either cetane index minimum of 40 or this aromatic limit.
Aromatic content is comparable to EU and U.S. fuels.
Total Aromatics (%m/m)
0
10
20
30
40
50
60
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela


North & South America Diesel Water Content
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
EN 590 EU Diesel: 200 mg/kg maximum
ASTM D975 US Diesel: 500 mg/kg maximum
ASTM D7467 US B6-B20: 500 mg/kg maximum
Water content is comparable to EU and lower than in the U.S.
Water content (mg/kg)
700
600
500
400
300
200
100
0
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela


North & South America Diesel Particulates
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
Particulates (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Particulate content is comparable to EU and U.S. fuels.
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela


North & South America Diesel Particle Size
Data Sources: SGS Worldwide, SGS China,
Alliance of Automobile Manufacturers' North America Fuel Surveys
Summer B0
Summer Biodiesel Blend
Winter B0
Winter Biodiesel Blend
Some fuels have larger particulates than EU or U.S. fuels.
Particle Size (amount/mL)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
EU
USA
Canada
Mexico
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Paraguay
Peru
Suriname
Uruguay
Venezuela

More Fuel Questions?

Please contact Beth Raney-Pablo or one of the regional fuels experts from the Global Fuels Team to further discuss fuel quality or if you have more questions

- Further discussions about fuel quality
- Other fuel properties
- Other markets/countries
- Other market feedback
- Market fuel requirements (Note: Market fuel regulatory documents are available in GRID at https://www.grid.ford.com)

Ford of North America	Beth Raney-Pablo (HRANEY), Pete Misangyi (PMISANGY)
Ford of Europe	Sofia Chrysafi (SCHRYSAF), David Wheare (DWHEARE)
Ford of Australia	Graham Higgin (GHIGGIN)
Ford of Africa	Stuart Rayner (SRAYNER3)
Ford of South America	Leandro Benvenutti (LBENVENU)
Volvo	Lisa Jacobsson (LJACOBS6), Borje Grandin (BGRANDIN)
Jaguar/Land Rover	Adel Pishneshin (APISHNES)
Mazda	Shin Okamoto (SOKAMOTO), Sadato Kadoya (SKADOYA)

From: Raney-Pablo, Beth (H.E.)
Sent: Monday, October 11, 2010 1:32 PM
To: Heggie, Forest (F.); Armesto, Carlos (.)
Cc: Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels
Attachments: US diesel water.xls

I'm in. You didn't allow enough time for me to complete the necessary data analysis to be able to respond with the requested information.

Attached is a histogram analysis of the US water content based on recent survey data. This water is likely dissolved in the fuel, not free water. The mean value (50%-ile) for summer is 68 mg/kg, for winter is 48 mg/kg and the overall (summer and winter) is 58 mg/kg. The US market fuel specification allows up to 500 mg/kg water in the fuel, although most samples are well below that limit.

Carlos Armesto may be able to help you determine how long it would take for the HFCM to fill if the customer consistently filled on fuel containing the mean value of water.

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 12:12 PM
To: Heggie, Forest (F.); Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Charles, I am not sur eif Beth is in so I am also sending this email to you,

I am looking for the mean and median of the % by volume of water in diesel fuel for summer and winter that I can use for some calculations to understand on average how often a customer would have to drain their HFCM.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 9:05 AM
To: Raney-Pablo, Beth (H.E.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Beth I was reviewing this presentation and am looking for an average water content number I could use for the 6.4L HFCM capacity calculation to understand on average how often the HFCM would need to be drained by tanks of fuel. Could you please advise what would be the average water content for the US.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Eeley, Scott (A.)
Sent: Monday, October 11, 2010 8:56 AM
To: Heggie, Forest (F.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 1:23 PM
To: Eeley, Scott (A.)
Cc: Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

While not presented in the same way, the attached file contains information on diesel market fuel quality charts for Mexico and other North and South American countries. Lubricity is on slide 12. The overall lubricity in Mexico is higher than in the U.S.

The most up-to-date quality charts are available online through the Fuels and Lubes EDMS site. Here's a link to the main fuel quality folder: https://www.edms.ford.com/webtop/drl/objectId/0b00cad980407a29. From here, click on the folder containing the type of fuel you're interested in: diesel/biodiesel, gasoline, or FFV/E85.

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

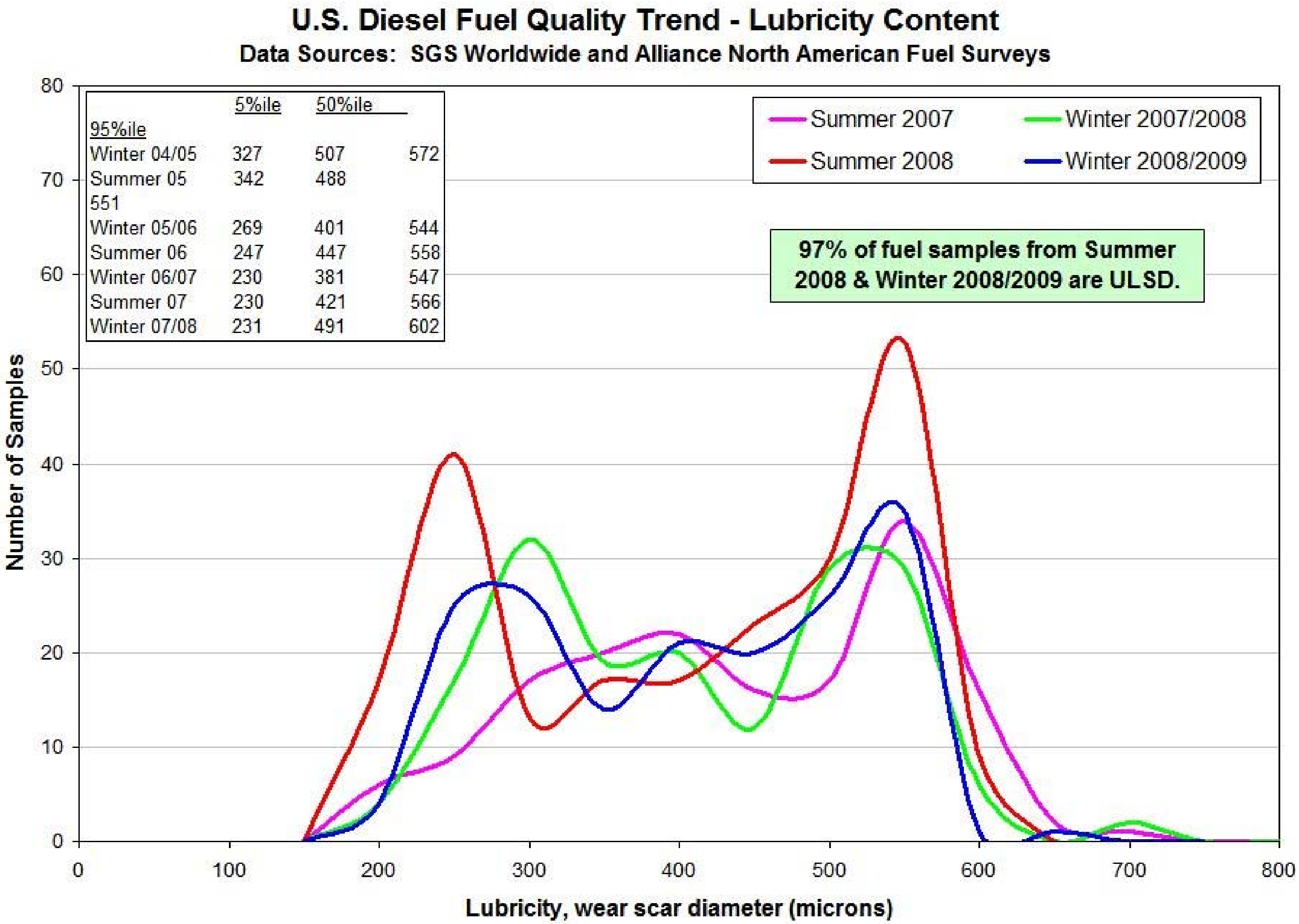
From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 12:54 PM
To: Raney-Pablo, Beth (H.E.); Fulton, Brien (B.L.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Thanks Beth.

Do you have anything like this for Mexico?

From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 11:01 AM
To: Fulton, Brien (B.L.); Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Here is an updated graph with the Summer 2008 and Winter 2008/2009 lubricity data. 97% of the fuel samples were ULSD.



Regards,

Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Fulton, Brien (B.L.)
Sent: Tuesday, November 17, 2009 9:57 AM
To: Eeley, Scott (A.)
Cc: Raney-Pablo, Beth (H.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

ULSD was just starting to roll out at that time and the data does contain some ULSD which due to the process to remove sulfur tends to reduce lubricity.

Beth,
Please send us the latest survey data you have for lubricity for ULSD.
thanks

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 8:09 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

???

From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

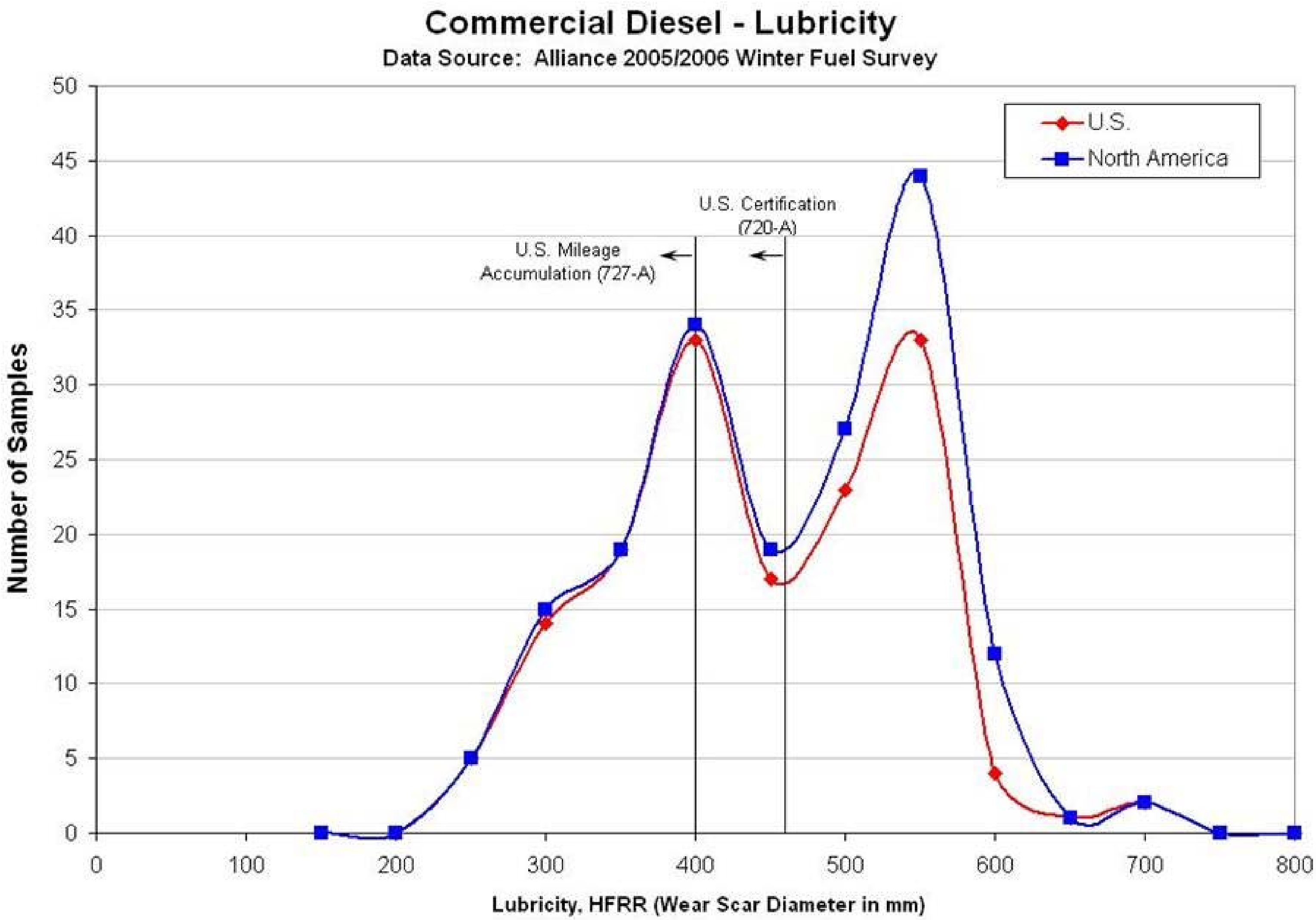
Do you think this data was taken with ultra low sulfur fuel?

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

---

From: Fulton, Brien (B.L.)
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Ted, the limit in D975 for HFRR is 520. The baseline fuel is a good pass but the HFCM sample is a borderline fail so it supports the lubricity concern.

I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.™**

From: Li, Shenghua
Sent: Tuesday, November 10, 2009 8:38 AM
To: Wang, Jerry C
Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

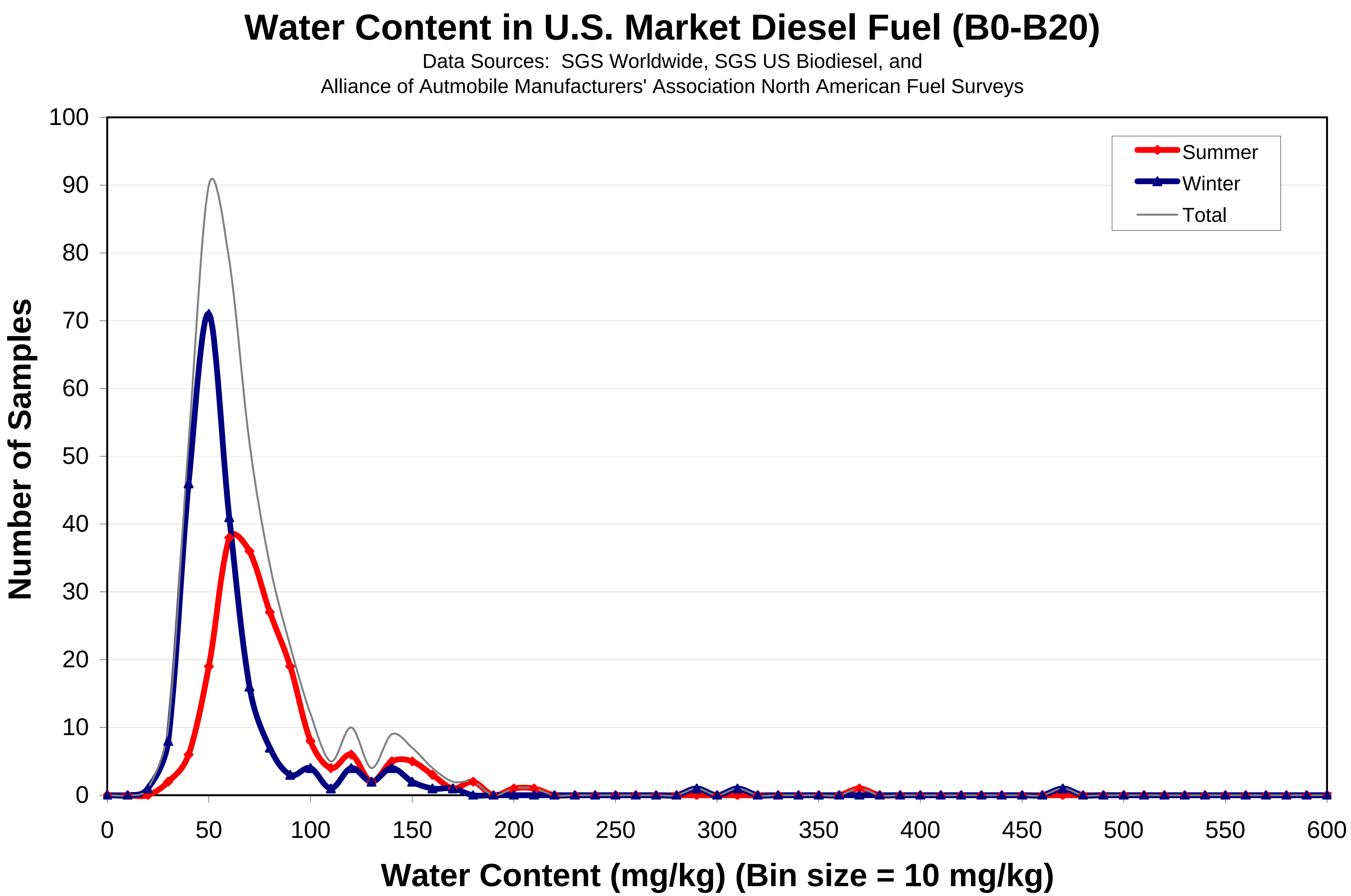
Hi Jerry,

Please review the brief report on the HFRR testing of two of the three diesel samples from you. I will keep the HPP sample for your further instructions. Also let me know if you need the two tested samples to be returned to you or Gary.

Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>



Water Content in U.S. Market Diesel Fuel (B0-B20)
Data Sources: SGS Worldwide, SGS US Biodiesel, and
Alliance of Autmobile Manufacturers' Association North American Fuel Surveys
Summer
Winter
Total
Number of Samples
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300
350
400
450
500
550
600
Water Content (mg/kg) (Bin size = 10 mg/kg)

From: Wang, Jerry C [JWDY@chevron.com]
Sent: Friday, November 13, 2009 10:07 AM
To: Eeley, Scott (A.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.); Parsons, Gary (GMPA); Parsinejad, Farzan
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels
Attachments: 952596.doc

The first step of failure analysis as we briefly discussed when we last meet was to check the fuel against the spec. This is usually not successful because the problem fuel is often burned and no longer available. Fortunately, the HFRR data show the fuel does not meet the lubricity requirement therefore serves as the smoking gun as Ted said. The next step is to decide what to do with this information. Typically there are three options:

1. this is an out of spec fuel issue so there is no need to change hardware and hope fuel quality will improve or just accept this as fact of life if the warranty is manageable
2. this is an out of spec fuel so Ford need to change hardware to be more robust instead of counting on the fuel suppliers to improve quality, or ask for tighter lubricity specification. (It is 460 HFRR in Europe).
3. this is an out of spec fuel so Ford needs to eliminate out of spec fuels by:
a. advocating this issue to the industry and asking for more inspection and quality control
b. advocating the benefit of aftermarket fuel additives
c. locate specific fuel suppliers that provide questionable fuels and demand quality there
d. all of the above or others

Oronite can certainly assist Ford with Option 3 should Ford decide to go that route.

Back to your question about what leads to low lubricity. The obvious reason is that this fuel probably contains no lubricity additive which will be hard to prove by just analysing the fuel. According to past studies, viscosity contributes to lubricity but the kind of wear you observed indicate metal contacts that required boundary lubriccation from the additives. Besides, it is rare to have a fuel not meeting a viscosity spec (which is very wide for diesel). The distillation curve correlates with viscosity so it is basically the same thing.

Attached is a paper of mine showing a "lubricity predictor" that demonstrates how di-aromatics (provides boundary lubrication as will be provided by lubricity additives) and viscosity complement each other to achieve the total lubricity. SLBOCLE correlates with HRFF and these two are usually used as alternative methods.

Thanks
Jerry C. Wang
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Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.™**

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 6:07 AM
To: Wang, Jerry C
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Jerry,

Please tell me why the lubricity is so low.

What is the distillation make up and viscosity?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

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Diesel Engine Systems
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Phone: (313) 805-9310
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From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
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Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

SAE 952596

Predicting Lubricity of Low Sulfur Diesel Fuel

Jerry C. Wang and Carmen M. Cusano
Cummins Engine Company

ABSTRACT

The lubricity of low sulfur diesel fuel was evaluated using a Scuffing BOCLE device. Physical and chemical properties of diesel fuels were then used to correlate with fuel lubricity. It is concluded that lubricity is primarily determined by viscosity and di-aromatic content. A lubricity predictor (Lp) using a linear combination of the two parameters is proposed to predict fuel lubricity. These two parameters are interchangeable within normal ranges of viscosity and di-aromatic content of No.1 and No.2 diesel fuels. Fuel lubricity has been interpreted to be the result of hydrodynamic lubrication, which is largely a function of viscosity, and boundary lubrication, which is contributed to by the di-aromatic content.

INTRODUCTION

THE LUBRICITY of low sulfur diesel fuel is a serious concern of manufacturers of all varieties of fuel injectors and fuel pumps used in heavy duty diesel engines. Recent investigations of unit injector and fuel pump failures have confirmed that the failures were the result of using low lubricity low sulfur fuels (1-7). While catastrophic failures have occurred in Western Canada and Sweden, the US has been spared from that kind of experience. Based on Cummins service records, sporadic failures have occurred as a result of using low lubricity fuels, usually winter blends.

Although speculation regarding the reduction of lubricity accompanied the introduction of low sulfur fuel in southern California in 1985 (8), these fuels were never a problem. The fact that many lubricity related failures are not catastrophic and the lack of an industry standard test has made the investigation of lubricity failures very difficult. Only recently have diesel injection equipment manufacturers been able to correlate their rig tests with simple bench tests (4,9).

During the past two years, mechanisms of fuel system wear have been studied. Several wear tests based on these mechanisms have been proposed to correlate with field performance of diesel fuels with different degrees of success. Among these tests, a scuffing Ball-on-Cylinder-Lubricity-Evaluator (S BOCLE) test is capable of correlating over 20 reference fuels. These reference fuels are from both US and European sources, and include performance issues of both unit injectors and rotary fuel pumps (4,9). Based on that correlation, the minimum load carrying capability of a fuel required to prevent scuffing wear for unit injectors is between 2500 to 3000 grams, and possibly higher for rotary pumps. With the help of this test, it has been further demonstrated through a fuel survey that fuel lubricity, as defined by S BOCLE, has indeed decreased after the introduction of low sulfur fuel. More significantly, the variation in lubricity of low sulfur fuel is much greater than high sulfur fuel (4). This indicates that the source of the problem could be related to the processing used to produce the low sulfur fuel.

In this study, the S BOCLE has been used to relate fuel lubricity with some physical and chemical properties of low sulfur fuel. The purpose is to develop a method to predict fuel lubricity without having to run the S BOCLE test. A discussion of the lubrication mechanism of diesel fuel is also given based on the results.

EXPERIMENTAL PROCEDURE

The BOCLE device is described in detail in ASTM D5001-90a. The modified procedure to perform a Scuffing BOCLE (S BOCLE) test was reported as Procedure D by Lacey (10). Basically, a stationary ANSI-52100 steel ball is brought into contact with a specially polished rotating ring made of SAE 8720 steel, and the friction of this wear process is measured. The ring is partially immersed in a reservoir of fuel and the fuel is brought to the wear contact by ring rotation. For each test, an initial load of 0.5 kg is applied for 30 seconds to provide a run-in wear scar. A higher load is then applied to the same wear contact for 1 minute to observe if scuffing has occurred. A new ball and a fresh track on the ring (if not available, a new ring) are used and the whole process is repeated at a second selected load. The selected load is lowered when scuffing occurs, and increased when there is no scuffing. This iterative process continues until the transition from no scuffing to scuffing is determined. The lowest load applied when the first scuffing occurs is called the scuffing load. Due to the limitation of incremental loading, the scuffing load is reported at a multiple of 100 grams. Many data points reported in this study are averages of multiple runs, and therefore may not be a number rounded to the nearest hundred.

Scuffing in this test is defined as a coefficient of friction (COF) higher than 0.175 occurring any time during the 1 minute period. The COF is calculated as follows:

$$COF = \frac{F}{2L} \qquad [1]$$

where F is the friction force measured by a strain gauge, and L is the applied load. All tests were performed by a single independent test lab so test repeatability is expected to be within $\pm$200 grams as reported by Lacey (10).

CORRELATION OF S BOCLE WITH FUEL PROPERTIES

Wei and Spikes attempted correlating lubricity with fuel properties(8). Since the test method did not correlate with fuel system failures, and the fuel was not representative of commercial fuel, the applicability of that study was indeterminate. Lacey and Westbrook (11) surveyed lubricity of fuels purchased by military installations using the S BOCLE. They concluded that lubricity of unadditized fuel was directionally correlated with di- and poly-aromatic content, and with viscosity to a lesser degree. The focus of this paper is to specifically examine commercial fuels with the S BOCLE to attempt the development of a method to predict fuel lubricity from fuel properties.

A total of 23 fuels comprising 14 No.2 diesel fuels, 5 No.1 diesel fuels, and 4 winter blends were collected in the fourth quarter of 1993, immediately after the nationwide introduction of low sulfur fuels in the on-highway market. These samples were collected from retail pumps and fleet storage tanks in 10 different states, including California. The basic properties required to distinguish No.1 and No.2 fuels based on ASTM D 975 guidelines are listed in Table 1, along with the S BOCLE data. Two non-additized calibration fluids (narrow cut fuels used for fuel system development) were also obtained to serve as additional reference points.

S BOCLE loads of No.2 diesel fuel range from 2300 grams to over 4000 grams. Although only 64% meet the 3100-gram requirement recommended by Engine Manufacturers Association (EMA, 12), 93% meet the minimum requirement of 2500 grams for unit injectors (4). The average of No.1 and winter blends is 2100 grams which is lower than the minimum requirement, and only 44% meet the minimum requirement for unit injectors.

Recent ISO (International Standardization Organization) round robin test showed that although fuel treated with normal doses of corrosion inhibitors improved S BOCLE only marginally, it still caused pump failures (9). Wang and Reynolds (4) also reported that the addition of corrosion inhibitors in a clay treated Jet A-1 fuel failed to improve the S BOCLE. It appears the S

BOCLE is a more severe test than normal BOCLE used for aviation fuel, and the correlation in this study is not likely to be affected by the presence of residual corrosion inhibitor additives.

Table 1 Basic properties of diesel fuels

Fuel Type	BOCLE Scuffing Load	Vis@ 40C	Total Aro-matic	Di-Aro-matic	90% Boiling Point
	grams	cSt	Vol. %	Vol. %	oC
DF2-1	2300	2.2	20.8	3.5	312
DF2-2	2800	3	29.2	3.5	326
DF2-3	4000	3.42	27.2	4.7	319
DF2-4	4200	2.38	27	4.5	287
DF2-5	3500	2.18	25.9	4.1	302
DF2-6	3600	2.71	32.4	5.8	309
DF2-7	2850	2.35	19.2	3.1	301
DF2-8	3100	2.79	27.1	6.3	318
DF2-9	3700	2.97	20.7	4.1	318
DF2-10	2700	2.43	32.4	6.5	306
DF2-11	4200	2.63	23.6	3.6	314
DF2-12	3950	2.8	25	6.4	306
DF2-13	2750	2.4	21.6	2.6	304
DF2-14	3300	2.57	21.1	5.1	309
DF1-1	2450	1.7	19.9	4	237
DF1-2	1700	1	18.8	0.9	-
DF1-3	1650	1.1	7.6	0.9	-
DF1-4	1200	1.1	18.6	0.8	239
DF1-5	1500	1.56	7.6	0.4	266
Winter Blend	1700	1.71	3.1	0.4	319
Winter Blend	2900	1.72	17.3	3.8	313
Winter Blend	2600	2.19	23.6	1.6	310
Winter Blend	2900	1.63	19.2	3.6	304
Calibra-tion Fluid	2000	3.1	1.5	1.5	243
Calibra-tion Fluid	1450	0.97	2.1	0.5	173

The following information was obtained for analysis: Viscosity (VIS) at 40°C (ASTM D445), boiling point distribution (initial, 50%, 90%, and final boiling point by GC, ASTM D86), specific gravity (modified ASTM D4052), percent sulfur (modified ASTM D5453), and the total aromatic (TA) content with a detailed breakdown into mono-aromatic (MA), di-aromatic (DA), and poly-aromatics (PA). The mono-aromatics were further separated into benzenes, naphbenzenes, and dinaphbenzenes. All aromatics were indicated as volume percent analyzed by Mass Spectroscopy (Amoco Robinson Method, 13).

A linear multiple regression was performed with all these parameters as independent variables and S BOCLE as the dependent variable. The statistics are listed in Table 2. The parameters with statistical significance from this simple treatment are the 50% boiling point, viscosity, sulfur content, and aromatic content. A detailed investigation of co-variance shows that the 50% boiling point is highly correlated with viscosity. Only viscosity is used as it bears more significance in lubrication. The sulfur content data is skewed by the extremely low sulfur content of the two calibration fluids (zero sulfur). Figure 1 shows that lubricity is not dependent on fuel sulfur. After eliminating the two calibration fluids from the group, the S BOCLE loads are independent of sulfur content which ranges from 0.02 to 0.05% (The specific sulfur analyzer was only accurate to show increments of 0.01%). It should be noted that the lubricity of some low sulfur fuel is as high as, or higher than, high sulfur fuels, and the lubricity is likely to be independent of sulfur levels even outside the low sulfur fuel limitations. PA was not detectable by the method in almost all of these low sulfur fuels and will not be further discussed.

The statistics also show that TA, MA, and DA are highly correlated. Since TA in low sulfur fuel is simply the combination of MA and DA (PA was zero), it is expected that a certain combination of MA and DA would probably be a better representation of TA. It is interesting to find that none of the subgroups in MA shows any direct significant correlation with S BOCLE. It is speculated that the correlation with TA is simply a correlation with DA. MA is related to DA probably due to the production process of low sulfur fuel. It is postulated that the hydrotreating process that had eliminated the sulfur also had eliminated PA and possibly DA resulting in proportionally more MA.

This hypothesis is tested by performing a series of S BOCLE tests with a clay treated Jet A-1 fuel blended with pure aromatic compounds. The S BOCLE load of the clay treated Jet A-1 is 1650 grams (5-test average). S BOCLE load is increased to 3000 grams by adding only 3% of di-methyl-naphthalene. In contrast, the addition of 12% of mono-aromatic (hexylbenzene) has no effect at all. The addition of either chemical has only a minor effect on viscosity. This simple matrix does not exclude the possibility that other MA or DA compounds might have behaved differently. It does support the further simplification of the correlation to include only viscosity and DA for the final iteration.

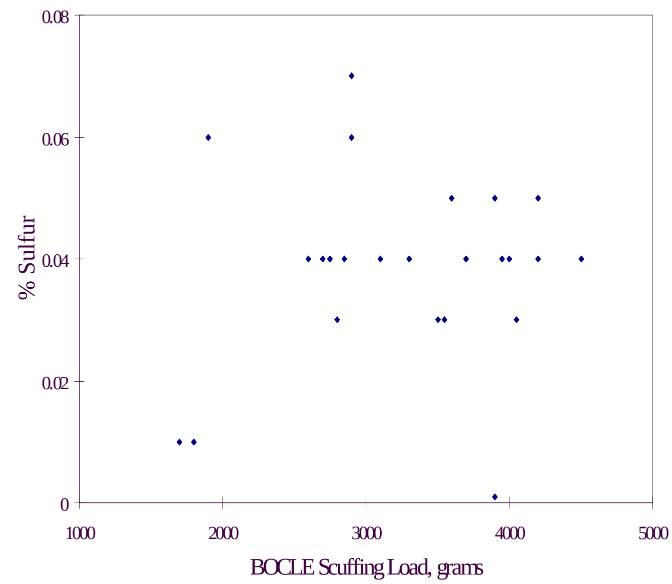

Figure 1 The lack of correlation of S BOCLE with fuel sulfur

Table 2 Correlation of BOCLE with fuel properties by performing a linear multiple regression and examine the t statistics of each parameter. Parameters with a P value much greater than 0.05 are rejected.

Parameters	*t Stat*	*P-value*	Status	Reason for rejection
IBP	-0.32795	0.746358	R	high P-value
50% BP	2.259158	0.035195	R	Correlate with viscosity
90% BP	-0.38773	0.702308	R	high P-value
FBP	0.327322	0.746825	R	high P-value
Vis@40	2.393776	0.026595	**A**	
sp.gr.	-0.19344	0.848562	R	high P-value
% S	2.033646	0.05547	R	Skewed by 2 extremely low sulfur fuels
Aromatics	-2.00586	0.058589	R	Highly dependent on aromatic sub-groups
Mono	2.0291	0.05597	**A**	
Di	2.05043	0.053659	**A**	
Benzene	0.151621	0.880933	R	high P-value
Naphbenzene	0.306594	0.762171	R	high P-value
Dinaphbenzene	1.79097	0.087725	R	high P-value

R: reject, A: accept

Pearson Correlation Table (bold numbers are significant at $p<0.05$ level)

	Vis@40	Total Aromatic	Mono-	Di	benzene	naphben	dinaphben	50%
Vis@40	1	**0.48489**	**0.41795**	**0.58227**	0.274139	0.370858	0.324423	**0.88743**
Total Aromatic		1	**0.98621**	**0.79475**	-0.37007	-0.33599	**-0.4219**	**0.73379**
Mono-			1	**0.68449**	-0.40381	-0.37198	**-0.4568**	**0.69195**
Di-				1	-0.14898	-0.12201	-0.19072	**0.69609**
Benzene					1	**0.98343**	**0.98518**	-0.00824
Naphbenzene						1	**0.9911**	0.085182
Di-Naphbenzene							1	0.011212

In order to test the validity of the hypothesis that viscosity and DA are the only two parameters needed for the prediction of lubricity, six additional special blends of unadditized diesel fuel were chosen with widely varying viscosity and di-aromatic content. The properties and the S BOCLE data of these special blends are shown in Table 3. One of them contained no detectable fuel sulfur (<10 ppm). In Figure 2, the viscosity of all fuels/fluids are plotted against the di-aromatic content. A viscosity range of 1-6 cSt and a DA of 0-7% were chosen because it was felt that these ranges would cover most low sulfur fuels in production. It shows that most commercial fuels fall within a certain band on this figure, yet the additional reference fuels fill in the upper left and lower right corners testing the hypothesis under various combinations of the two parameters. No special attempt was made to add data in the upper right corner in Figure 2 because it represents a combination of high viscosity and high di-aromatic content. An extensive survey of No.2 high and low sulfur fuel by Cusano et al (13) showed that the di-aromatic content of high sulfur fuels was 3.5% higher than low sulfur fuel on average while the viscosity was similar. High sulfur fuel that had no past lubricity problem would fall in the upper right quadrant. Of course, adding high sulfur fuel would no doubt improve the correlation to be proposed.

A lubricity predictor (Lp) is proposed as simply a linear combination of viscosity, in cSt at 40^{o}C, and DA, in volume percent:

$$Lp = DA + VIS \qquad [2]$$

By taking a natural log-log transformation of Lp and S BOCLE to eliminate possible non-linearity in the correlation, and performing a linear regression, an R-squared of 0.83 was obtained. The result is shown in Figure 3, and the equation is:

$$Ln\ (\ S\ BOCLE) = 6.91 + 0.617\ Ln\ (Lp) \qquad [3]$$

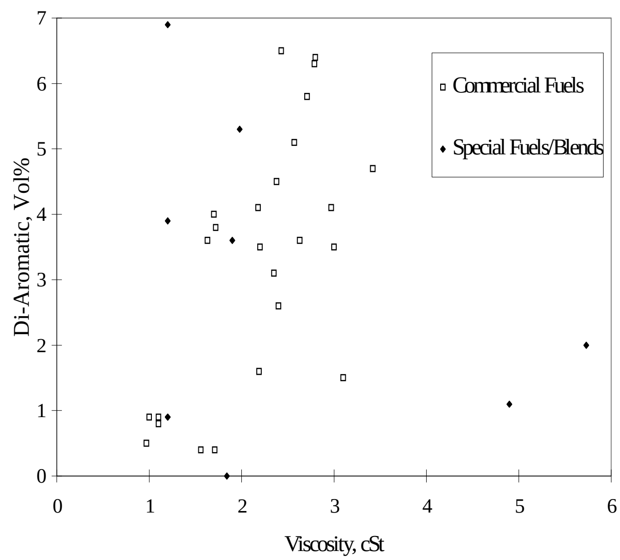

Figure 2 Ranges of viscosity and di-aromatic content of fuels studied.

Table 3 Properties of special unadditized fuels/fluids with selected viscosity and aromatic content

	BOCLE, grams	Vis@40 C cSt	Total Aromatic Volume %	Monoaromatic Volume %	Diaromatic Volume %
Jet A-1	1650	1.1	7.6	6.7	0.9
JetA-1+3% Di-aro	3000	1.2	10.6	6.7	3.9
JetA-1+6% Di-aro	3500	1.2	13.6	6.7	6.9
JetA-1+6% mono-aro	1200	1.3	13.6	12.7	0.9
JetA-1+12% mono-aro	1300	1.3	19.6	18.7	0.9
50:50 DF2-12+DF1-4	3700	1.9	21.8	18.2	3.6
No Sulfur Fuel	3900	2.7	23.9	15.7	8.2
R-225	1600	1.8	1.0	1.0	0.0
R-255	4200	5.7	16.0	14.0	2.0
R-230	3500	4.9	1.7	0.6	1.1
R-256	3500	2.0	65.2	59.3	5.9

The same treatment was applied to include MA but there was no advantage of adding another parameter. The tests using pure compounds and the result of the modeling indicate that viscosity and di-aromatic compounds largely determine lubricity. In Figure 3, the regression line fits commercial fuel (open symbols) and special reference fuel (closed symbols) equally well. This indicates that as long as Lp has a value over 5.9 (corresponding to 3000 grams in S BOCLE), the lubricity will be good regardless of the value of the individual VIS or DA.

DISCUSSION

In the literature, it has usually been suggested that the term "lubricity" referred to the boundary lubrication function of a fuel (6,8), and is a property independent of viscosity. The lubricity is then usually attributed to some trace amount of polar compounds existing in the fuel. On the other hand, recent ISO S BOCLE testing of reference fuel seems to indicate that S BOCLE correlates well with viscosity of non-additized fuel. This study concludes that viscosity is an essential part of lubricity but the chemical composition of the fuel is equally important. The role of trace polar materials is still not clear.

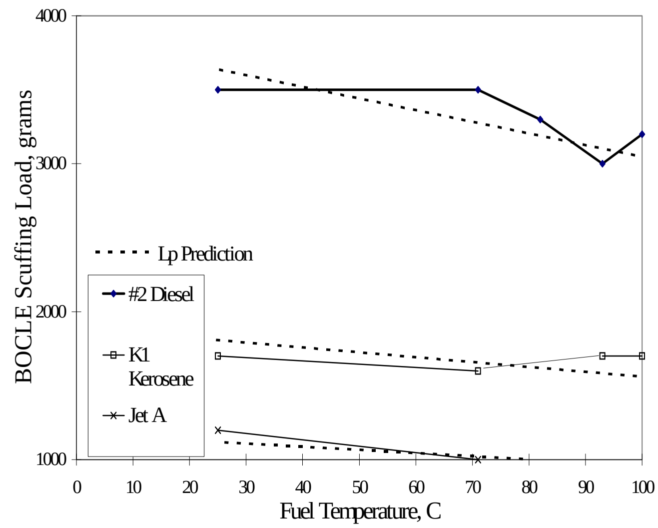

Figure 4 Temperature effect on S BOCLE

The contribution of viscosity to lubricity is further demonstrated by the temperature effect on lubricity. S BOCLE was performed on 3 non-additized reference fuels with the fuel temperature ranging between 25°C and 100°C. A difference of 75°C had a significant effect on viscosity as estimated by ASTM D 341. As a result, imposing

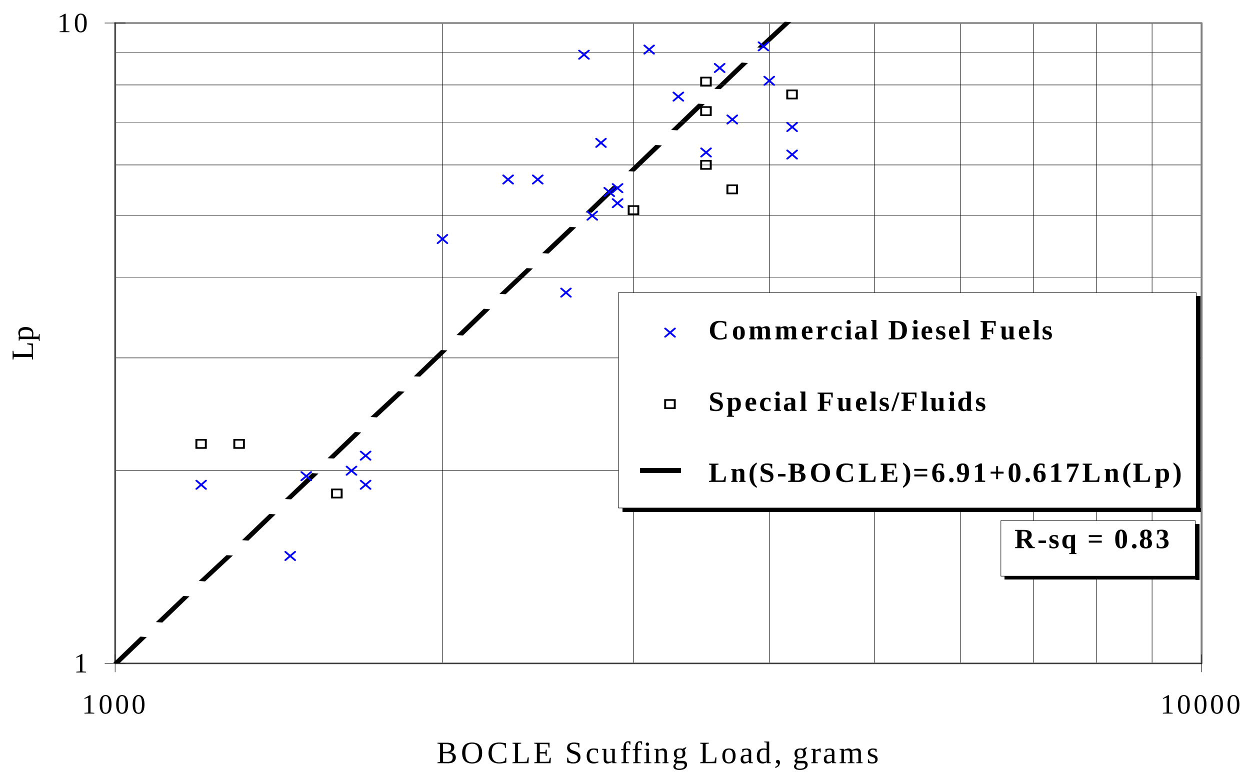

Figure 3 Predicted BOCLE scuffing load vs. actual test data

the temperature effect on viscosity in the Lp adequately predicted lubricity at higher temperatures (Figure 4).

Viscosity provides a hydrodynamic lubrication film. The role of DA is most likely providing boundary lubrication. The function of aromatics in forming friction polymers has been reported in the past (15, 16). A recent study showed that naphthalene and methyl-naphthalene indeed sustain higher seizure loads in a Falex V-Blocks apparatus than benzene and methyl benzene, respectively, through friction polymer formation (14). No apparent film was detected in the wear scar by Scanning Electron Microscopy (SEM) or AUGER Spectroscopy in this study, but it is possible that the film is very thin given the very light load applied. The light applied load may also explain why hydrodynamic lubrication is still involved.

This interchangeable nature of viscosity and DA in equation [2] implies the interchangeable nature of lubrication mechanisms, at least within the range of the parameters in this study. It is plausible that a fuel lubricity definition should include viscosity. A minimum requirement in either viscosity or DA may not be necessary to define a minimum lubricity

The interchangeability of lubrication mechanisms also allows the flexibility of formulating a good lubricity fuel by optimizing the Lp with available resources. The Lp presented in this study can possibly be further improved by fine-tuning the types of DA, or by adding a different weighing factor to VIS or DA. This correlation also offers a tool for optimizing fuel production quality control. While S BOCLE test is an effective way of evaluating fuel lubricity, the measurement of viscosity and DA through analysis like FTIR or mass spectroscopy is convenient and readily available.

CONCLUSIONS

A scuffing BOCLE test was used to evaluate lubricity of commercial and experimental low sulfur fuels. This test was selected based on its reported capability to correlate with field performance. This test was performed on over 30 reference fuels/fluids with known physical and chemical properties. By correlating S BOCLE with fuel properties, the following conclusions are derived:

1. Fuel lubricity as measured by S BOCLE can be correlated with the viscosity and the di-aromatic content of an unadditized fuel.
2. A lubricity predictor (Lp) has been developed based on the linear combination of viscosity and di-aromatic content.
3. The same Lp, and therefore lubricity, can be achieved by any combination of viscosity and di-aromatic content within their normal ranges.
4. The components of Lp imply that both hydrodynamic lubrication and boundary lubrication are important in preventing fuel system wear. The two lubrication mechanisms are both effective, and the predominance of one mechanism over another depends on the property of the fuel (or the combination in Lp).

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From: Heggie, Forest (F.)
Sent: Tuesday, October 12, 2010 9:10 AM
To: Raney-Pablo, Beth (H.E.); Armesto, Carlos (.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

The question we were asked was " how often would a customer have to drain their HFCM if they had the average water content in fuel.

Here is the calculation I performed using 95% efficiency of water separation per Carlos

Please let me know if there is any issue with this.

The average water content in fuel in the US is 0.0058% by volume from fuel survey (overall between summer and winter fuel)

Large tank (151L) wif light on ~78 tanks of fuel, then the HFCM capacity full of water after ~ 120 tanks of fuel

Small tank (71.9L) wif light on ~ 164 tanks of fuel, then the HFCM capacity full of water after 252 tanks of fuel

		Summer	Winter	Overall
mg/kg	500	68	48	58
	0.5	0.068	0.048	0.058
kg/kg	0.0005	0.000068	0.000048	0.000058
% by volume	0.05	0.0068	0.0048	0.0058

95% separated

Large Tank	151 L	0.97546	0.68856	0.83201
tanks until drain HFCM		102.5157	145.2306	120.1909
wif light on 65ml		66.63523	94.39991	78.12406
Small Tank	71.9L	0.464474	0.327864	0.396169
tanks until drain HFCM		215.2973	305.0045	252.4175
wif ligh on 65 ml		139.9432	198.2529	164.0714

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Raney-Pablo, Beth (H.E.)
Sent: Monday, October 11, 2010 1:32 PM
To: Heggie, Forest (F.); Armesto, Carlos (.)
Cc: Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Carlos Armesto may be able to help you determine how long it would take for the HFCM to fill if the customer consistently filled on fuel containing the mean value of water.

Regards,
Beth Raney-Pablo

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Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 12:12 PM
To: Heggie, Forest (F.); Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Hi Beth I was reviewing this presentation and am looking for an average water content number I could use for the 6.4L HFCM capacity calculation to understand on average how often the HFCM would need to be drained by tanks of fuel. Could you please advise what would be the average water content for the US.

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From: Eeley, Scott (A.)
Sent: Monday, October 11, 2010 8:56 AM
To: Heggie, Forest (F.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

---

From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 1:23 PM
To: Eeley, Scott (A.)
Cc: Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Thanks Beth.

Do you have anything like this for Mexico?

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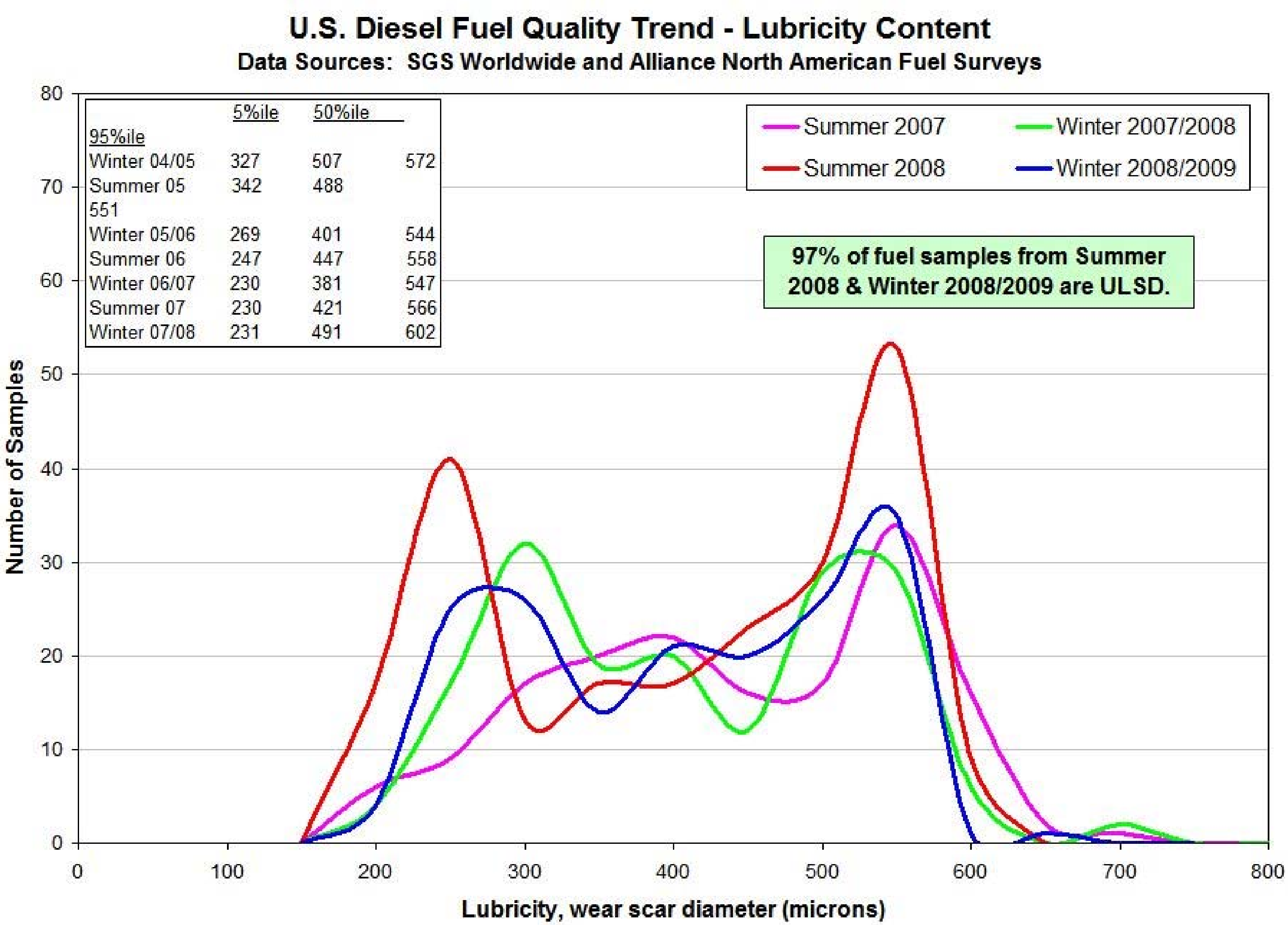

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Beth,
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thanks

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"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

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Sent: Tuesday, November 17, 2009 8:09 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

???

From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Do you think this data was taken with ultra low sulfur fuel?

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Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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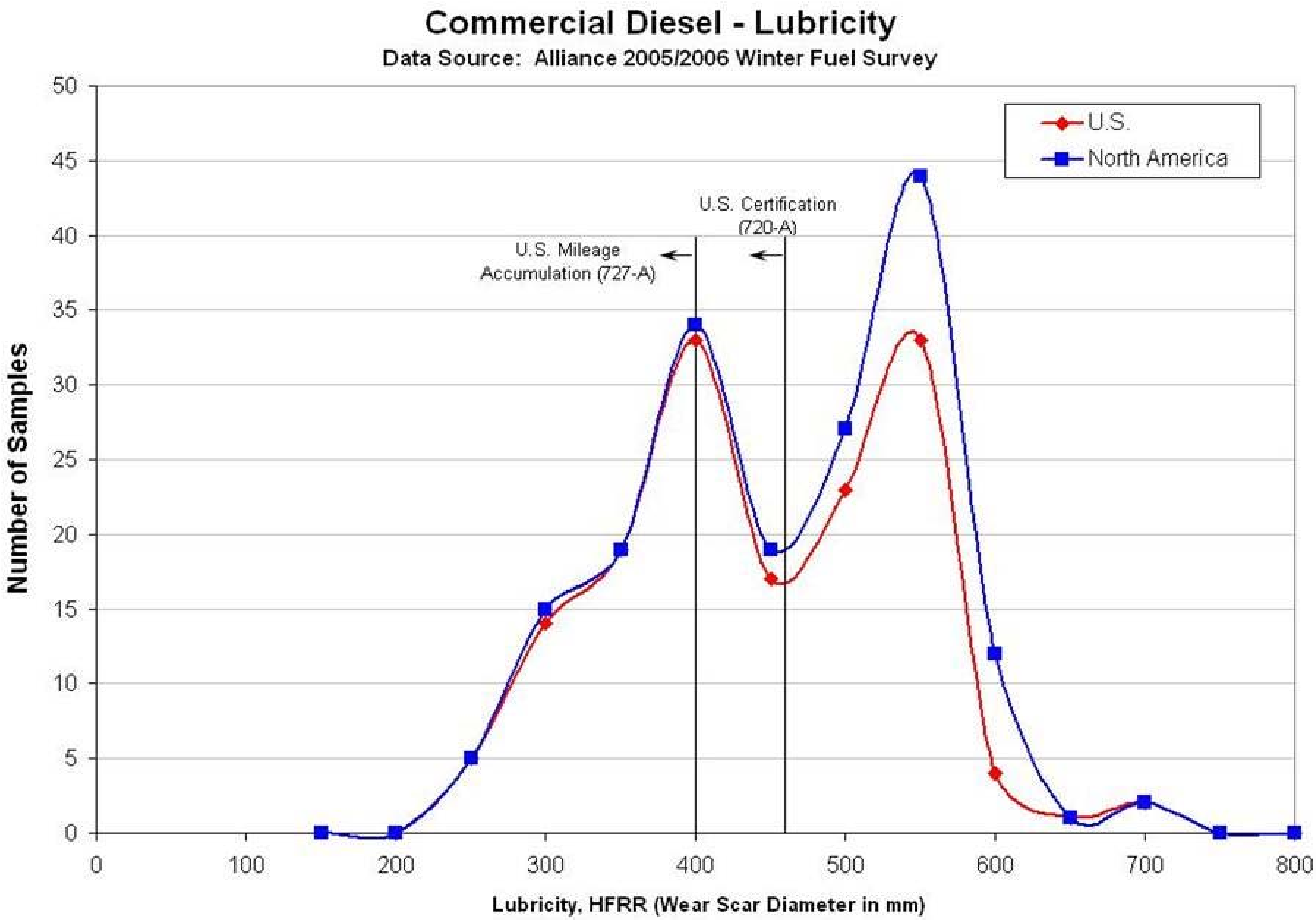
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



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Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Ted, the limit in D975 for HFRR is 520. The baseline fuel is a good pass but the HFCM sample is a borderline fail so it supports the lubricity concern.

I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.**™

From: Li, Shenghua
Sent: Tuesday, November 10, 2009 8:38 AM
To: Wang, Jerry C
Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Jerry,

Please review the brief report on the HFRR testing of two of the three diesel samples from you. I will keep the HPP sample for your further instructions. Also let me know if you need the two tested samples to be returned to you or Gary.

Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 1:34 PM
To: Raney-Pablo, Beth (H.E.); Armesto, Carlos (.)
Cc: Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Thank You very much

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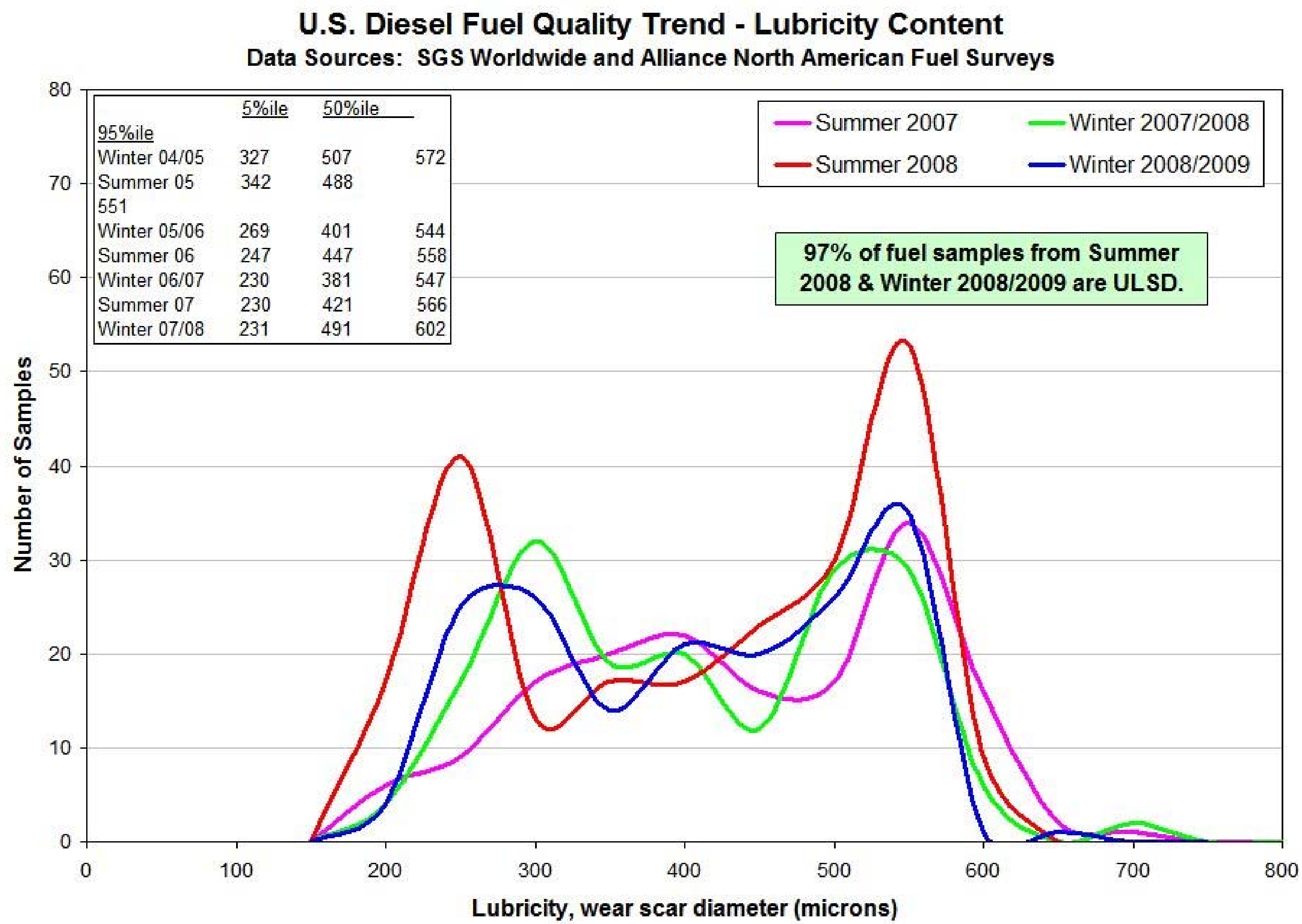

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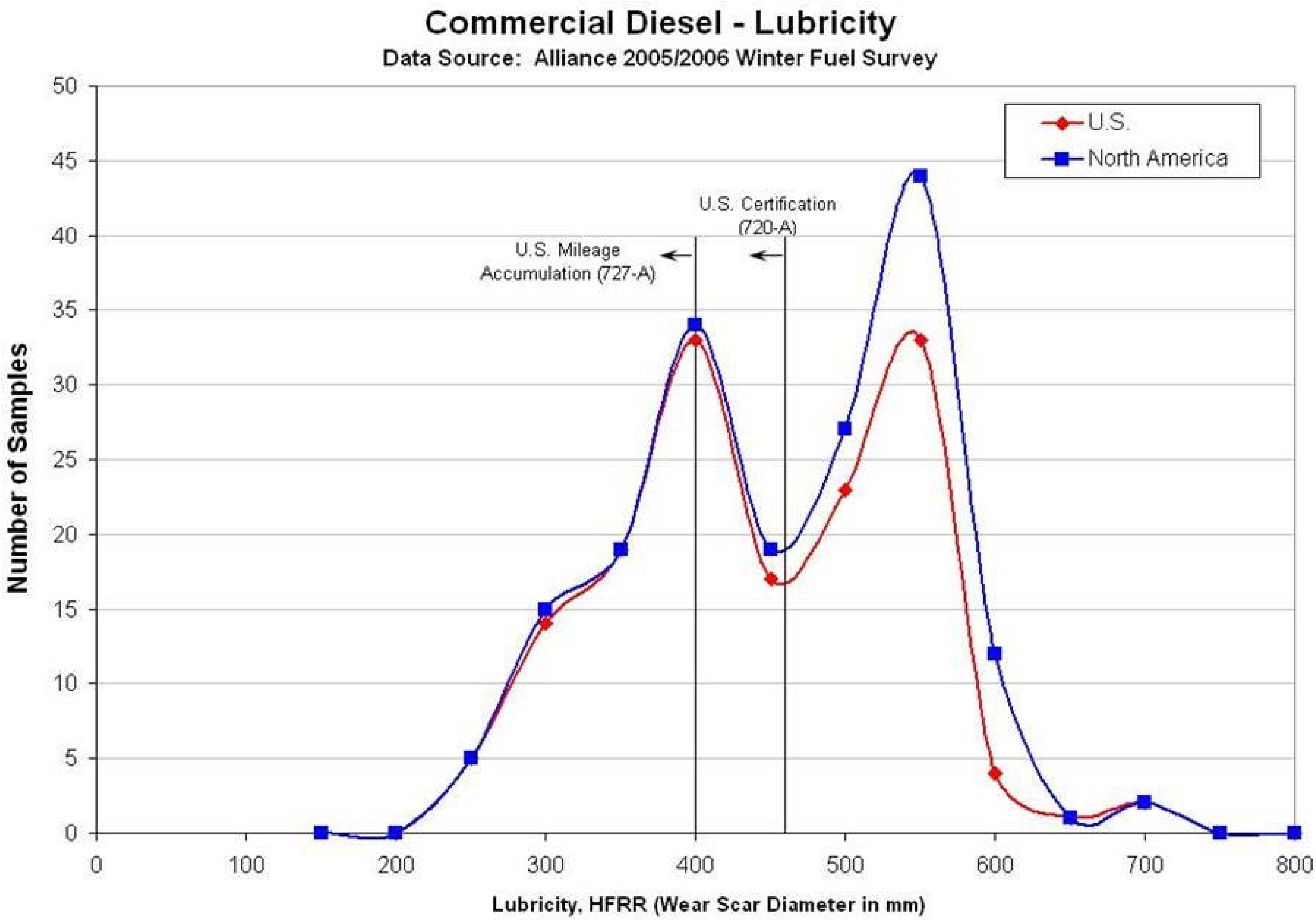

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
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Making the things that go, **go better.**™

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Cc: Palekar, Vivek (vmpa)
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Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 12:12 PM
To: Heggie, Forest (F.); Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Charles, I am not sur eif Beth is in so I am also sending this email to you,

I am looking for the mean and median of the % by volume of water in diesel fuel for summer and winter that I can use for some calculations to understand on average how often a customer would have to drain their HFCM.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 9:05 AM
To: Raney-Pablo, Beth (H.E.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Beth I was reviewing this presentation and am looking for an average water content number I could use for the 6.4L HFCM capacity calculation to understand on average how often the HFCM would need to be drained by tanks of fuel. Could you please advise what would be the average water content for the US.

Forest Heggie
BaSc. MaSc. P.Eng
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313-618-5054

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To: Heggie, Forest (F.)
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Sent: Tuesday, November 17, 2009 1:23 PM
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Cc: Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
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Mexico and other North and South American countries. Lubricity is on slide 12. The overall lubricity in Mexico is higher than in the U.S.

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Regards,

Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering

TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

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To: Raney-Pablo, Beth (H.E.); Fulton, Brien (B.L.)
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Do you have anything like this for Mexico?

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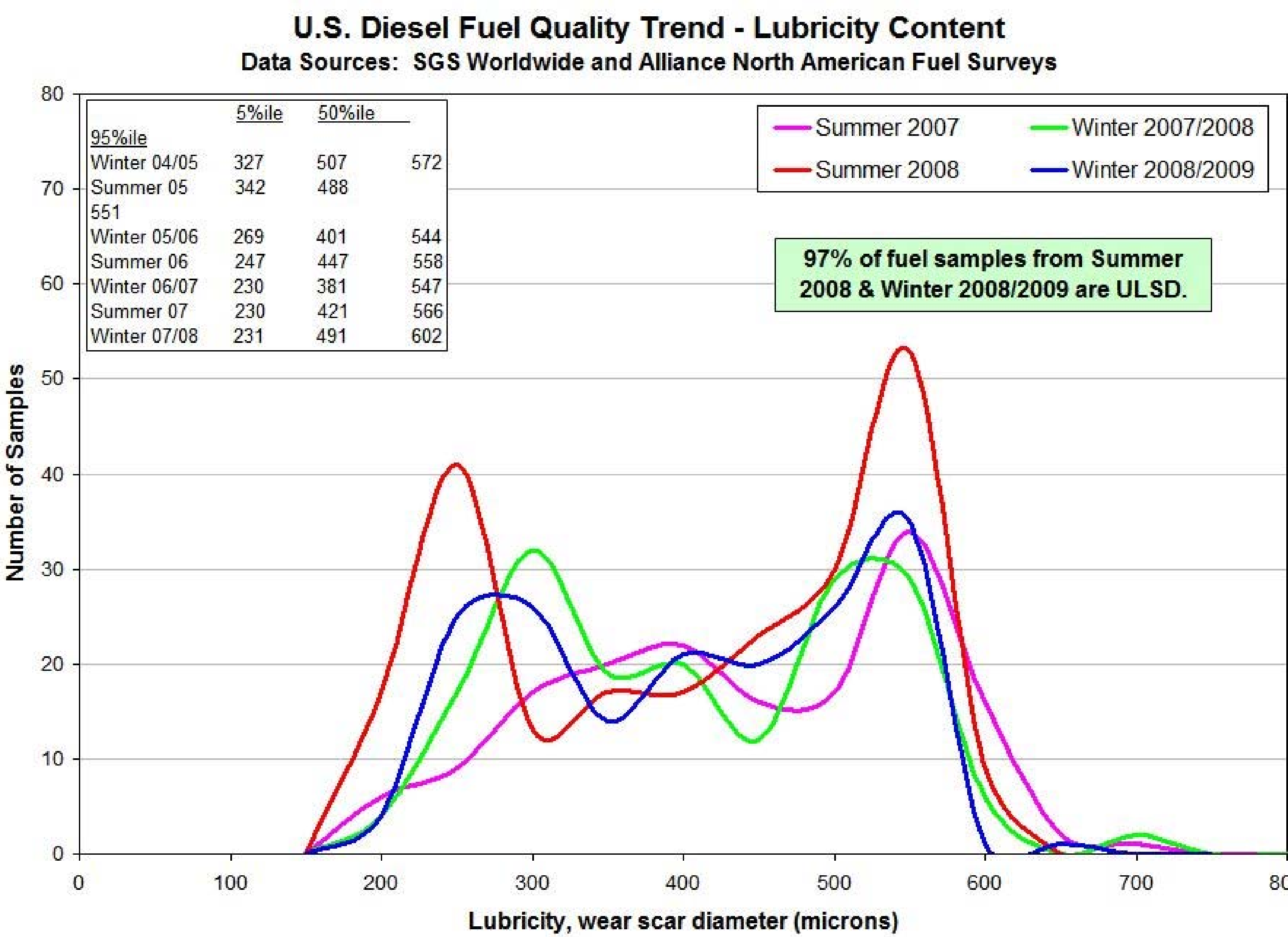

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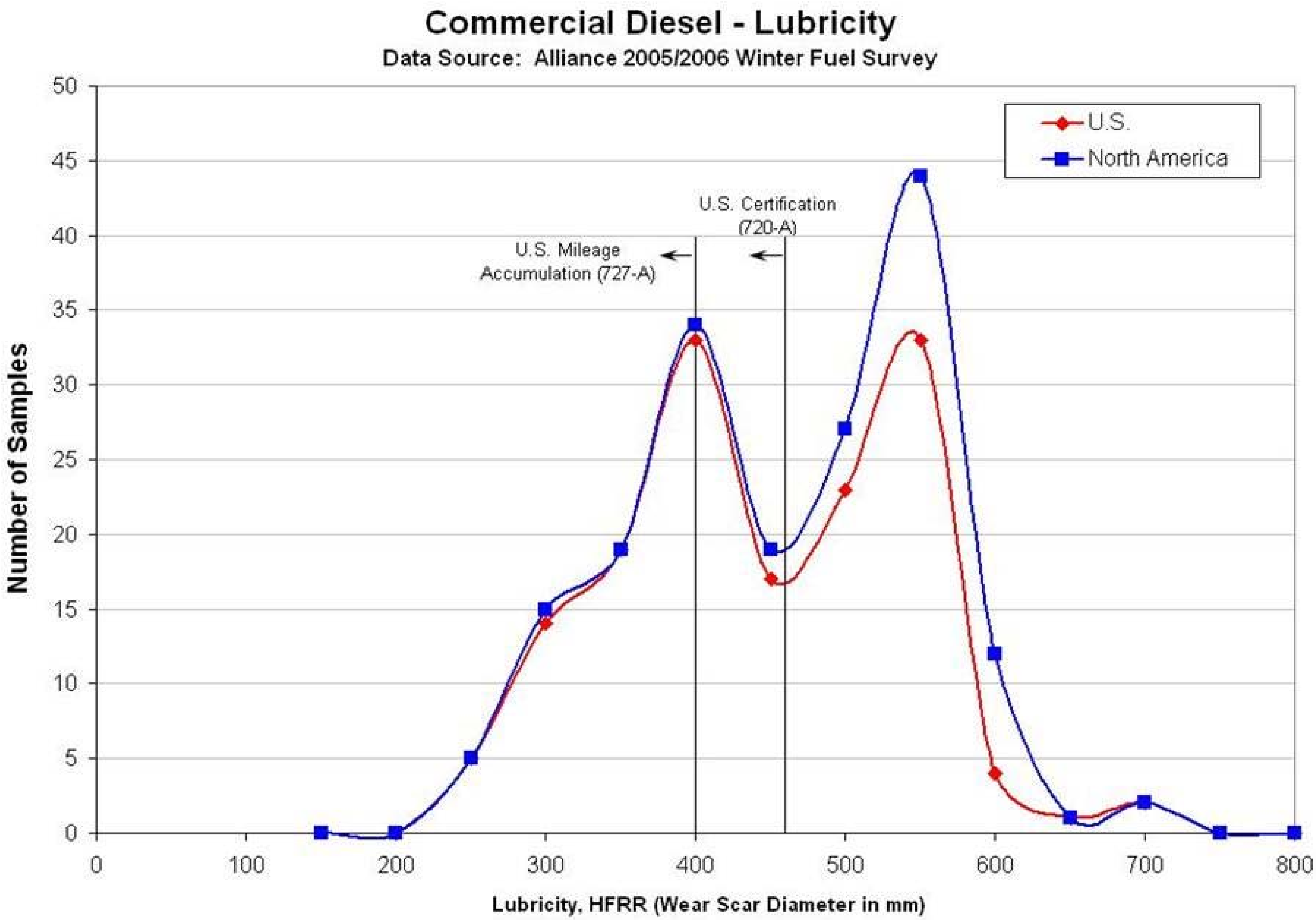

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Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

It looks like Mexico has fuel with a higher mean value for wear scar, but still within the wear scar range of the US fuels?

I suspected that it would be within the US fuel range, I believe that Mexico exports oil to us and we refine / export middle distillate to them, so that would support?

In the US we see fuels in the same range also, but we do not have the ambient temperatures that are present down there.

Brien Fulton
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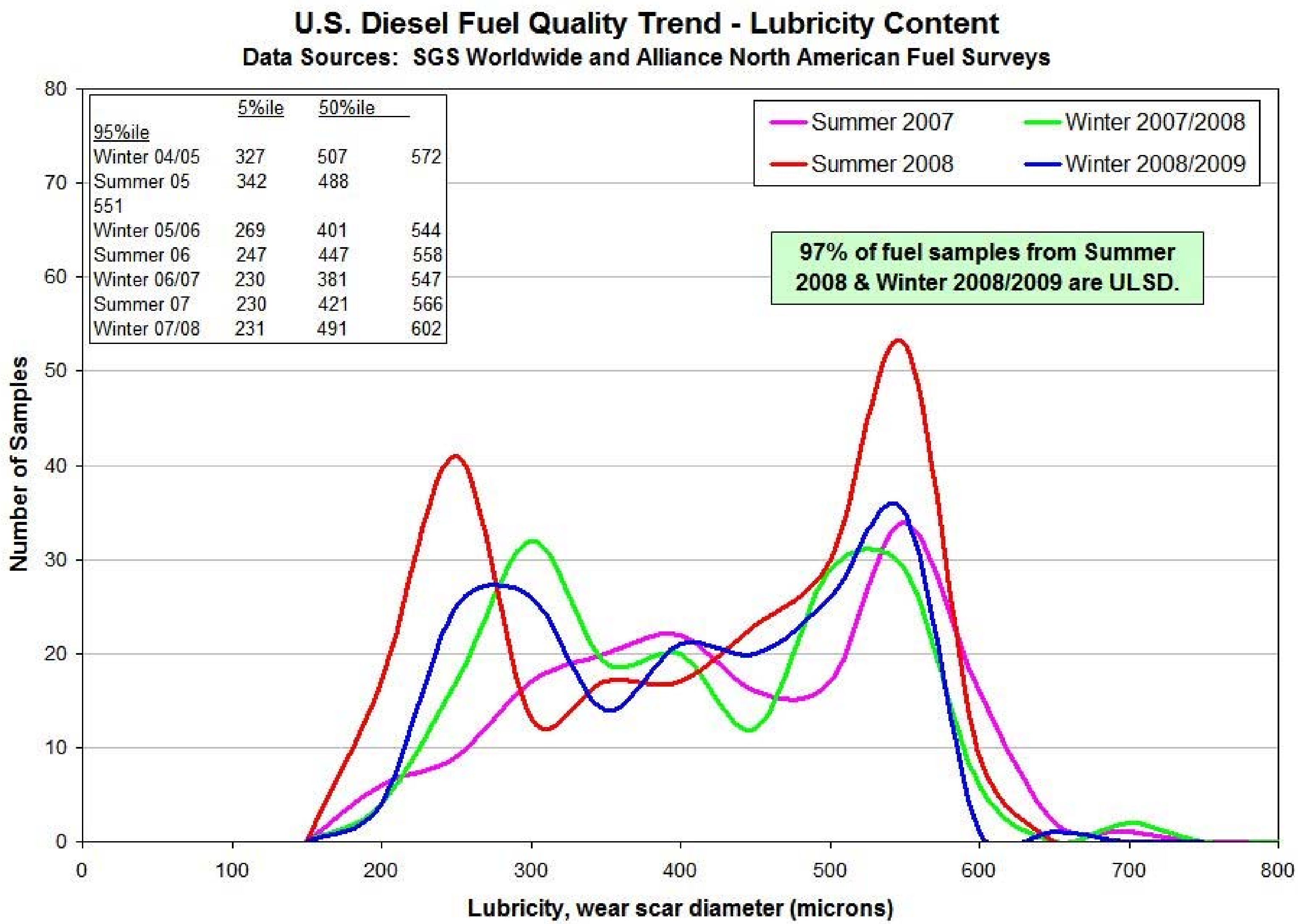

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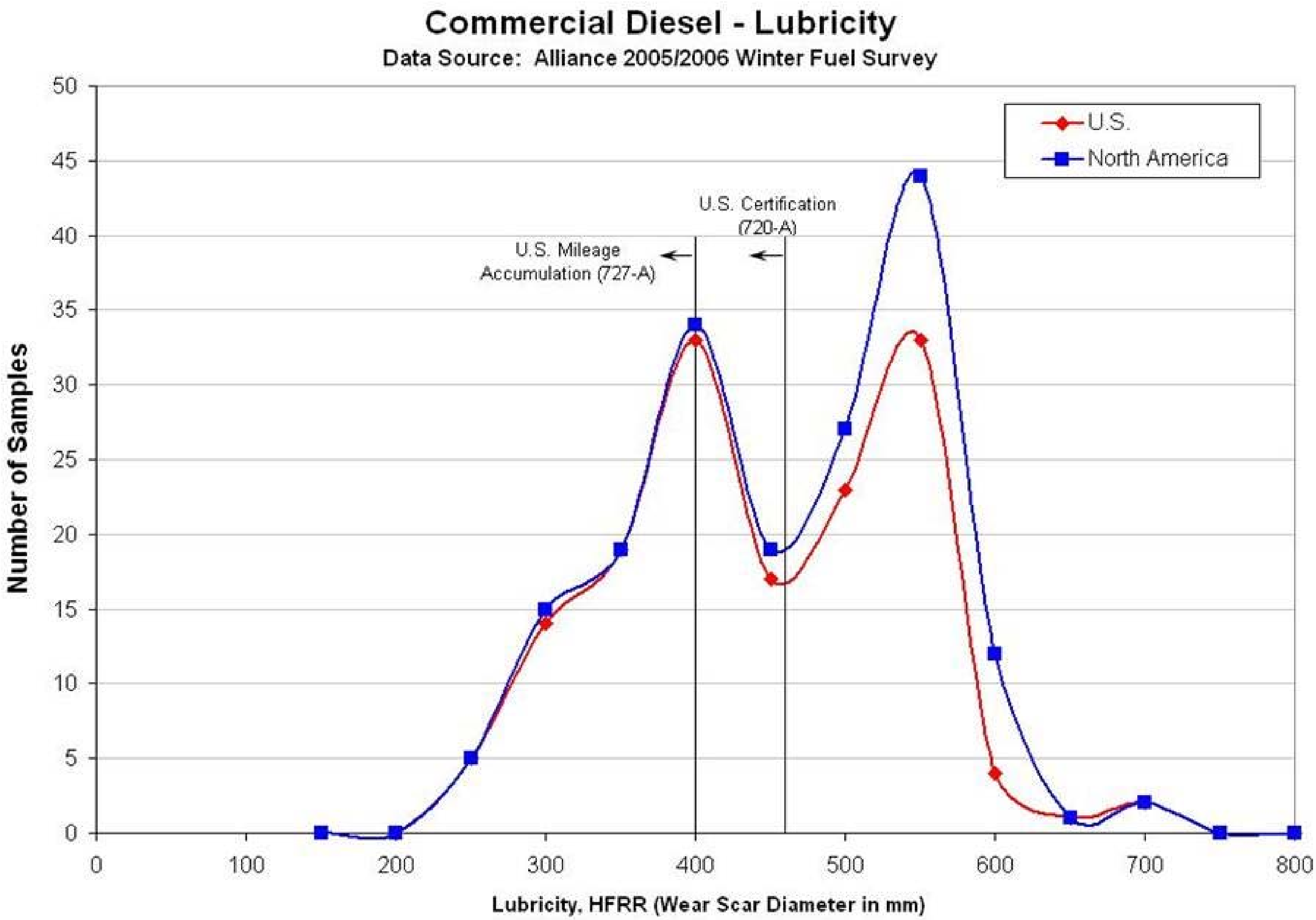

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From: Bastida, Graciela (G.)
Sent: Wednesday, November 18, 2009 6:20 PM
To: Fulton, Brien (B.L.); Lawther, Robin (R.); Eeley, Scott (A.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Sorry for my mistake, the engine we use in Transit is

Duratorq 2.2ltrs 4 cyl Diesel
110HP @3500RPM
Torque 210lb-ft @1750RPM

Tks

From: Fulton, Brien (B.L.)
Sent: Miércoles, 18 de Noviembre de 2009 01:31 p.m.
To: Lawther, Robin (R.); Eeley, Scott (A.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.); Bastida, Graciela (G.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Robin,
Do you have the specification for the Transit diesel engine fuel system, I believe it is either Denso or Conti?

Scott,
Make sure it is a 2.3L, that is the petrol displacement. Diesel Pumas are 2.0 / 2.2 / 2.4L with the 3.2L coming.

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Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Brien,

Will you please obtain the 2.3 diesel pump spec so we can compare to the Conti pump lubricity and temp specs?

Thanks.

Scott

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Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

I talked w/FoM PD guys yesterday about lubricity issue you discovered in the Oaxaca diesel sample analysis, and they have a valid point regarding Diesel fuel, we also have the Transit (2.3ltrs diesel engine) and no claims regarding lack of power/not start so i think maybe this Navistar engine is more sensitive to lubricy parameters maybe the experiment you want to conduct let us know a correlation...

From: Eeley, Scott (A.)
Sent: Miércoles, 18 de Noviembre de 2009 12:39 p.m.
To: Bastida, Graciela (G.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
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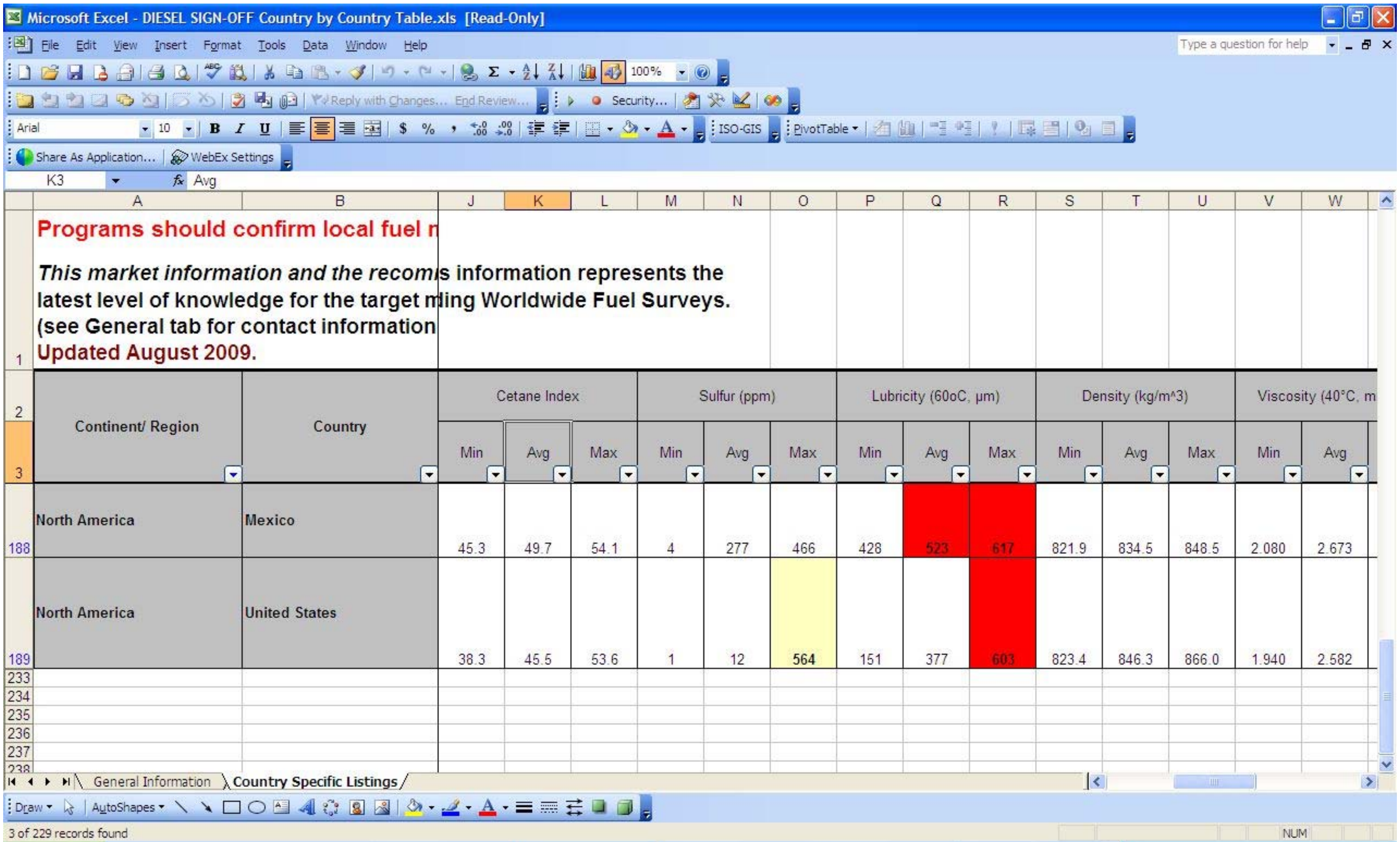
Curious?



Microsoft Excel - DIESEL SIGN-OFF Country by Country Table.xls [Read-Only]

Programs should confirm local fuel r

*This market information and the recom*s information represents the latest level of knowledge for the target m|ing Worldwide Fuel Surveys.
(see General tab for contact information
Updated August 2009.

Continent/ Region	Country	Cetane Index			Sulfur (ppm)			Lubricity (60oC, µm)			Density (kg/m^3)			Viscosity (40°C, m	
		Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
North America	Mexico	45.3	49.7	54.1	4	277	466	428	523	617	821.9	834.5	848.5	2.080	2.673
North America	United States	38.3	45.5	53.6	1	12	564	151	377	603	823.4	846.3	866.0	1.940	2.582

General Information | Country Specific Listings

3 of 229 records found

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Hi Scott,

This is the link for Mexico results, i think is the same that you have...

https://www.edms.ford.com/webtop/component/drl?objectId=0b00cad980407a29&Reload=1258497025862

Looking the data, in some areas Mexico has the same results as USA (even better in some ex water content), there is a comment regarding lubricity in US Diesel Quality also

I let you know about the local Lab studies

Tks in advance!

From: Eeley, Scott (A.)
Sent: Martes, 17 de Noviembre de 2009 01:29 p.m.
To: Villalobos, Luisa (L.); Bastida, Graciela (G.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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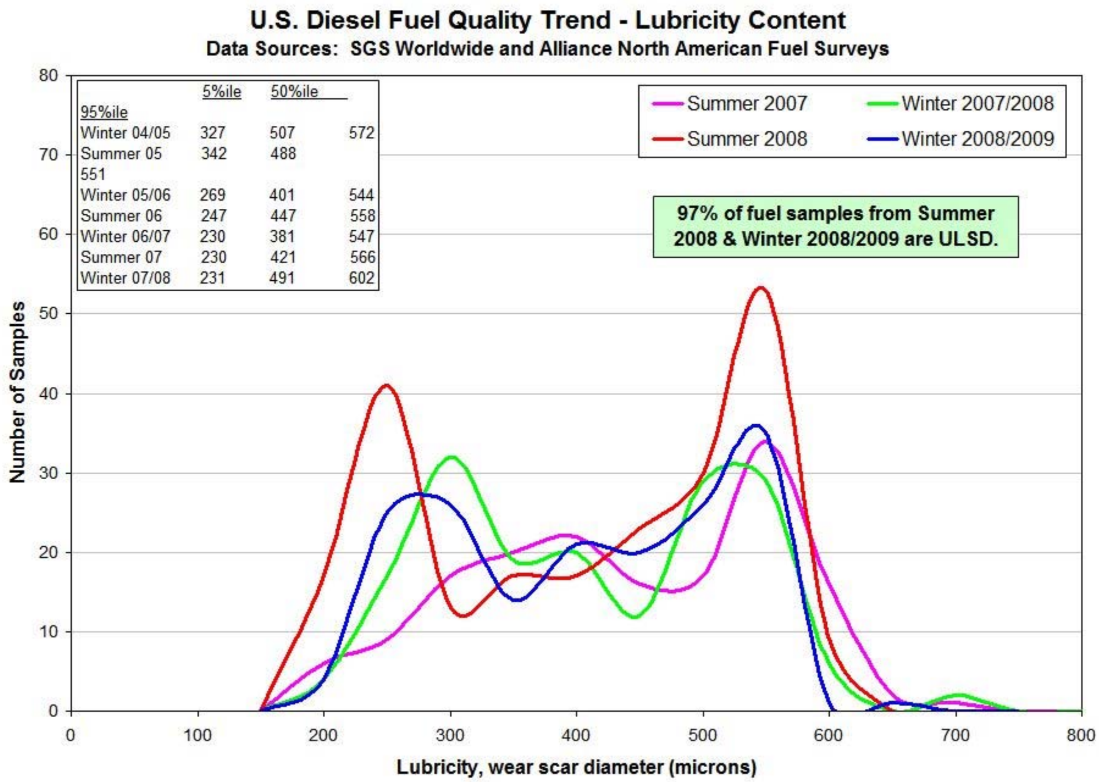

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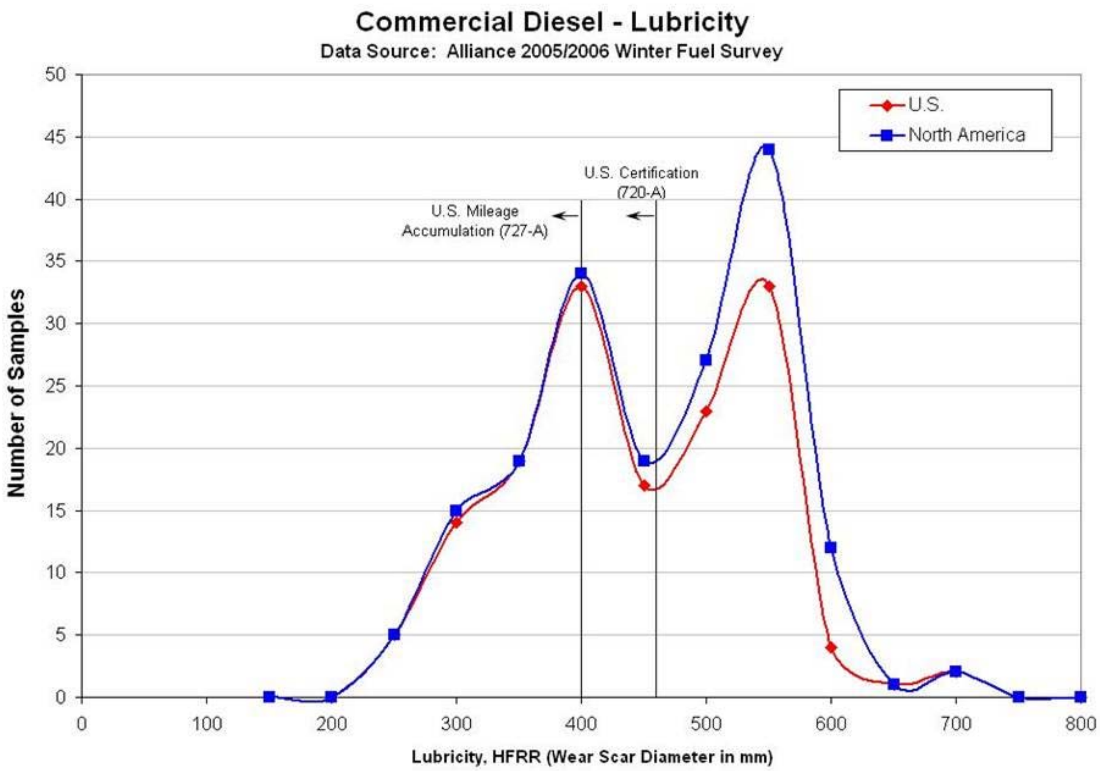
From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Do you think this data was taken with ultra low sulfur fuel?

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

From: Fulton, Brien (B.L.)
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]

Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Ted, the limit in D975 for HFRR is 520. The baseline fuel is a good pass but the HFCM sample is a borderline fail so it supports the lubricity concern.

I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.**™

From: Li, Shenghua
Sent: Tuesday, November 10, 2009 8:38 AM
To: Wang, Jerry C
Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Jerry,

Please review the brief report on the HFRR testing of two of the three diesel samples from you. I will keep the HPP sample for your further instructions. Also let me know if you need the two tested samples to be returned to you or Gary.

Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

From: Armesto, Carlos (.)
Sent: Monday, October 11, 2010 4:39 PM
To: Heggie, Forest (F.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Forest our separation efficiency is 95%. As you know there is a lot of variability that can affect this efficiency (temperature of the fuel, IFT (fuel's interfacial tension etc..)
You can use this number for an estimate.

Take care,

Carlos

From: Heggie, Forest (F.)
Sent: Tuesday, October 12, 2010 4:57 AM
To: Armesto, Carlos (.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Carlos is there a percentage of the water we separate out we could use as a guideline to understand how long it would take until the HFCM would need to be drained.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 1:56 PM
To: Eeley, Scott (A.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

I need to talk to carlose first but on average 58mg/kg of water --- if the hfcm separate out all of the water you would be looking at 155 tank of fuel until wif light and 239 tanks to fill HFCM at 71.9L (or 74 to light and 114 tanks fills for 151L tank) if the HFCM separated out all of the water.

I will see if Carlos has the percentage filtered.

		Summer	Winter	Overall
mg/kg	500	68	48	58
	0.5	0.068	0.048	0.058
kg/kg	0.0005	0.000068	0.000048	0.000058
% by volume	0.05	0.0068	0.0048	0.0058

If all is separated

Large Tank	151 L	1.0268	0.7248	0.8758
tanks until drain HFCM		97.38995	137.9691	114.1813
wif light on 65ml		63.30347	89.67991	74.21786
Small Tank	71.9L	0.48892	0.34512	0.41702
tanks until drain HFCM		204.5324	289.7543	239.7967
wif ligh on 65 ml		132.9461	188.3403	155.8678

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Raney-Pablo, Beth (H.E.)
Sent: Monday, October 11, 2010 1:32 PM
To: Heggie, Forest (F.); Armesto, Carlos (.)
Cc: Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

I'm in. You didn't allow enough time for me to complete the necessary data analysis to be able to respond with the requested information.

Attached is a histogram analysis of the US water content based on recent survey data. This water is likely dissolved in the fuel, not free water. The mean value (50%-ile) for summer is 68 mg/kg, for winter is 48 mg/kg and the overall (summer and winter) is 58 mg/kg. The US market fuel specification allows up to 500 mg/kg water in the fuel, although most samples are well below that limit.

Carlos Armesto may be able to help you determine how long it would take for the HFCM to fill if the customer consistently filled on fuel containing the mean value of water.

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 12:12 PM
To: Heggie, Forest (F.); Raney-Pablo, Beth (H.E.); Richardson, Charles (C.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Charles, I am not sur eif Beth is in so I am also sending this email to you,

I am looking for the mean and median of the % by volume of water in diesel fuel for summer and winter that I can use for some calculations to understand on average how often a customer would have to drain their HFCM.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Heggie, Forest (F.)
Sent: Monday, October 11, 2010 9:05 AM
To: Raney-Pablo, Beth (H.E.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Beth I was reviewing this presentation and am looking for an average water content number I could use for the 6.4L HFCM capacity calculation to understand on average how often the HFCM would need to be drained by tanks of fuel. Could you please advise what would be the average water content for the US.

Forest Heggie
BaSc. MaSc. P.Eng
OPD Diesel
313-618-5054

From: Eeley, Scott (A.)

Sent: Monday, October 11, 2010 8:56 AM
To: Heggie, Forest (F.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 1:23 PM
To: Eeley, Scott (A.)
Cc: Fulton, Brien (B.L.); Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

While not presented in the same way, the attached file contains information on diesel market fuel quality charts for Mexico and other North and South American countries. Lubricity is on slide 12. The overall lubricity in Mexico is higher than in the U.S.

The most up-to-date quality charts are available online through the Fuels and Lubes EDMS site. Here's a link to the main fuel quality folder: https://www.edms.ford.com/webtop/drl/objectId/0b00cad980407a29. From here, click on the folder containing the type of fuel you're interested in: diesel/biodiesel, gasoline, or FFV/E85.

Regards,
Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

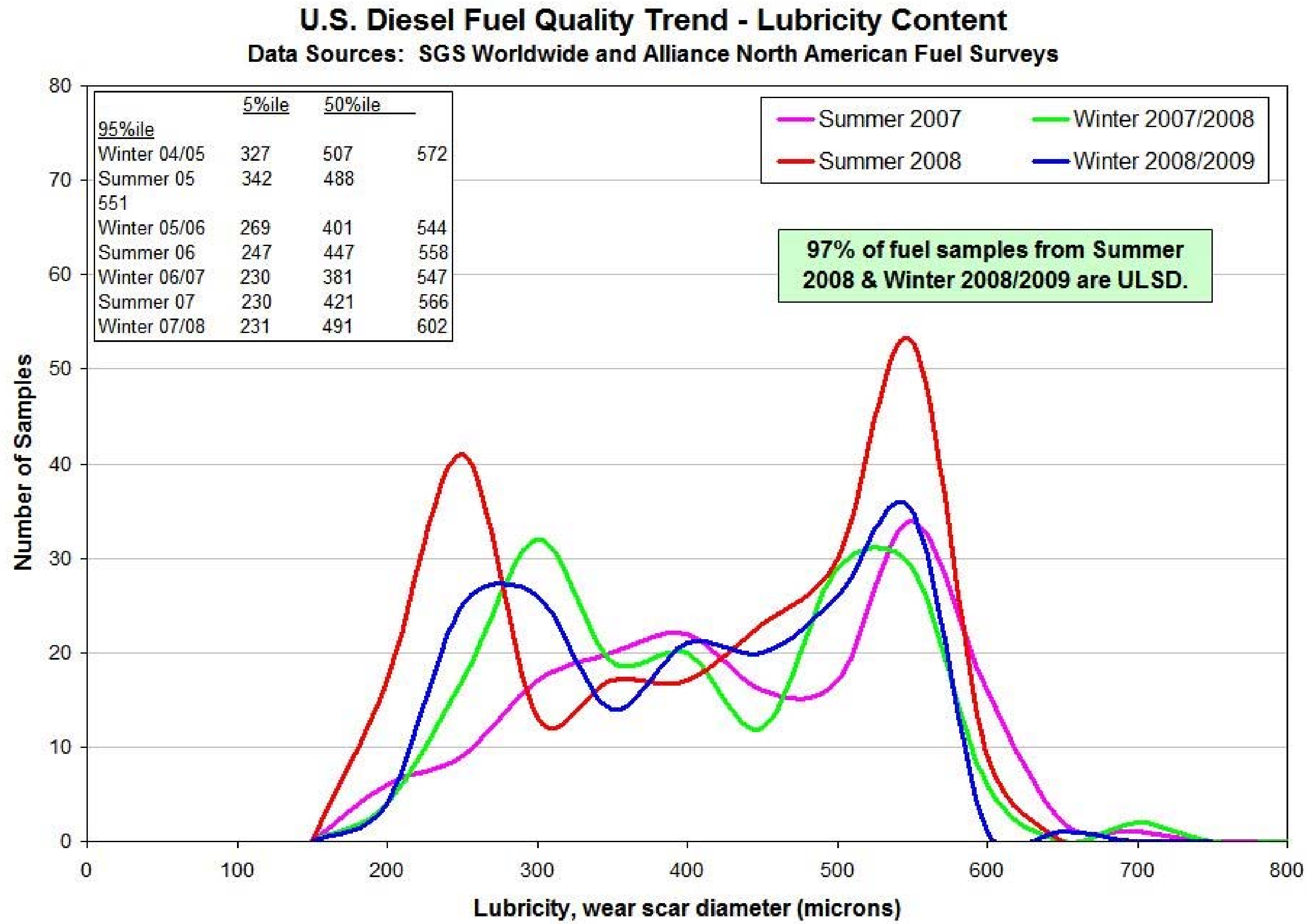
From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 12:54 PM
To: Raney-Pablo, Beth (H.E.); Fulton, Brien (B.L.)
Cc: Mull, Ted (V.); Simpson, Timothy (T.A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Thanks Beth.

Do you have anything like this for Mexico?

From: Raney-Pablo, Beth (H.E.)
Sent: Tuesday, November 17, 2009 11:01 AM
To: Fulton, Brien (B.L.); Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Here is an updated graph with the Summer 2008 and Winter 2008/2009 lubricity data. 97% of the fuel samples were ULSD.



Regards,

Beth Raney-Pablo
Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Fulton, Brien (B.L.)
Sent: Tuesday, November 17, 2009 9:57 AM
To: Eeley, Scott (A.)
Cc: Raney-Pablo, Beth (H.E.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

ULSD was just starting to roll out at that time and the data does contain some ULSD which due to the process to remove sulfur tends to reduce lubricity.

Beth,
Please send us the latest survey data you have for lubricity for ULSD.
thanks

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Tuesday, November 17, 2009 8:09 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

???

From: Nolan, Patrick (Pat) [mailto:Pat.Nolan@Navistar.com]
Sent: Friday, November 13, 2009 5:00 PM
To: Eeley, Scott (A.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

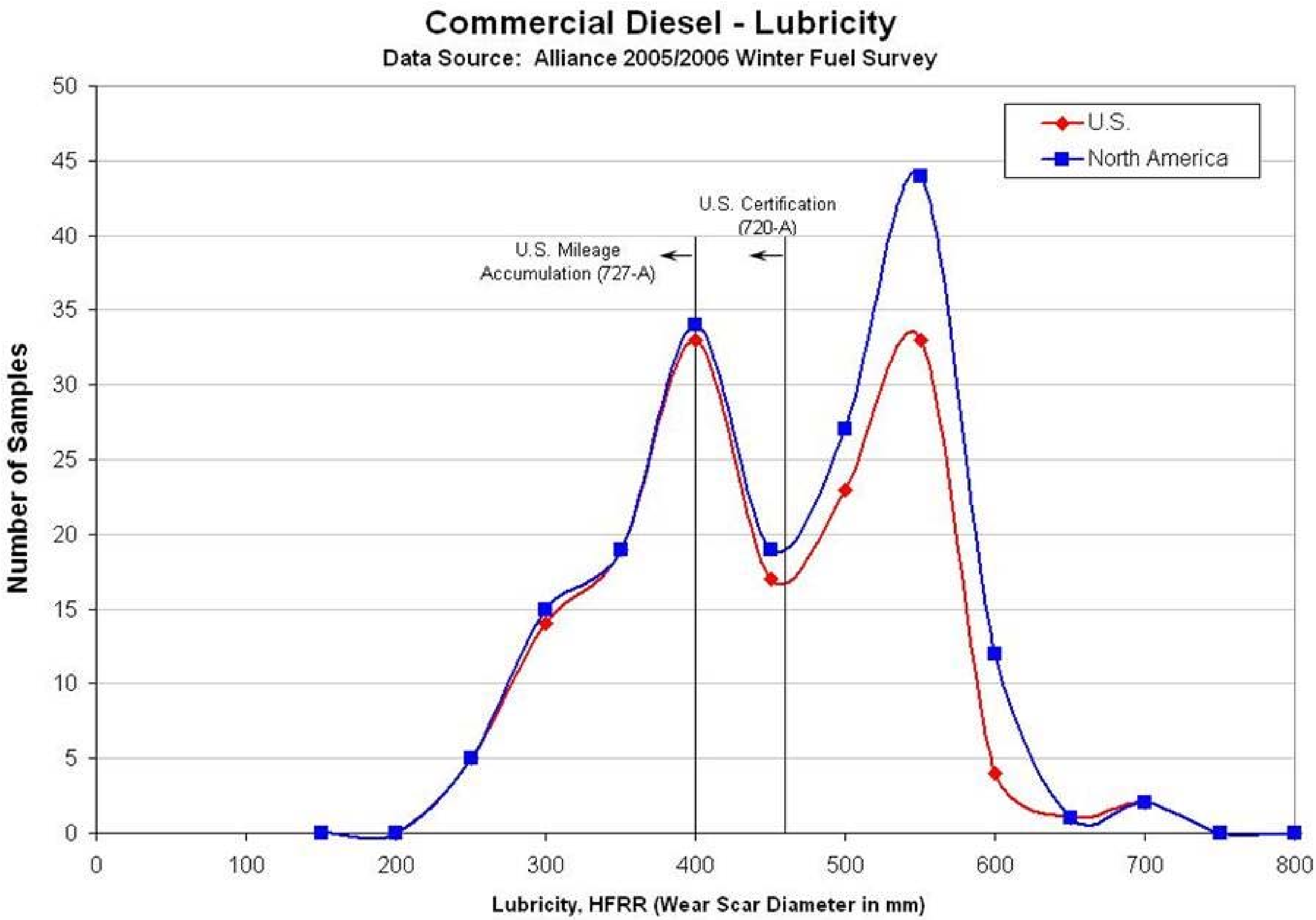
Do you think this data was taken with ultra low sulfur fuel?

From: Eeley, Scott (A.) [mailto:seeley@ford.com]
Sent: Friday, November 13, 2009 1:09 PM
To: Simpson, Timothy (T.A.); Mull, Ted (V.); Nolan, Patrick (Pat); Zydek, Larry B
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

---

From: Fulton, Brien (B.L.)
Sent: Friday, November 13, 2009 10:35 AM
To: Eeley, Scott (A.)
Cc: Pearson, Gavin (G.J.)
Subject: RE: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

You need to be aware of the current fuel lubricity levels, this chart is old, but we have lots of fuel above 520 um



Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:56 AM
To: Fulton, Brien (B.L.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

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From: Eeley, Scott (A.)
Sent: Friday, November 13, 2009 8:55 AM
To: Raney-Pablo, Beth (H.E.); Misangyi, Pete (P.W.)
Cc: Simpson, Timothy (T.A.); Mull, Ted (V.); Chyo, Timothy (T.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Pete and Beth,

How to I go about purchasing fuel with an HFRR ~560?

Scott

From: Mull, Ted (V.)
Sent: Tuesday, November 10, 2009 3:33 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Smoking gun......

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Wang, Jerry C [mailto:JWDY@chevron.com]
Sent: Tuesday, November 10, 2009 12:41 PM
To: Mull, Ted (V.)
Cc: Li, Shenghua
Subject: FW: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Ted, the limit in D975 for HFRR is 520. The baseline fuel is a good pass but the HFCM sample is a borderline fail so it supports the lubricity concern.

I'll travelling and should be home later tonight. I'll try to talk to you tomorrow or Thursday.

Thanks
Jerry C. Wang
OEM & Industry Liaison, AMR
Chevron Oronite Company LLC
7080 Colchester Lane
Ypsilanti, MI 48197
Tel 734 485 3806
Cell 510 439 6838
JWDY@chevron.com
Making the things that go, **go better.**™

From: Li, Shenghua
Sent: Tuesday, November 10, 2009 8:38 AM
To: Wang, Jerry C
Cc: Palekar, Vivek (vmpa)
Subject: TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels

Hi Jerry,

Please review the brief report on the HFRR testing of two of the three diesel samples from you. I will keep the HPP sample for your further instructions. Also let me know if you need the two tested samples to be returned to you or Gary.

Best regards,

Shenghua

<<TLP09-117 Brief Report on HFRR Lubricity Evaluation of Diesel Fuels.pdf>>

From:	Eeley, Scott (A.)
Sent:	Tuesday, October 26, 2010 1:15 PM
To:	Curtis, Andrew (A.); Rivera, Santos (S.)
Cc:	Goebel, Ken (K.M.); Simpson, Timothy (T.A.)
Subject:	RE: TSB Request for Input: 070-2010-1935: 2008-2010 6.4L Diesel - Lacks Power - Diagostic Trouble Code (DTC) P0088
Importance:	High
Attachments:	labor time.xls

Andrew,

Please see the attached file. I would like Santos to review the TSB and the attachment then provide his recommendation as to whether or not we should have a TSB labor op and time. It seems to me that bunches of work should be avoided if the TSB is followed i.e. pulling the valve covers. Techs will avoid much diagnostic time and time getting access for diagnostics.

The attached file is 9A543 HP causal with material cost less than $3,500 - cull pump replacements only without injectors. The claims were from Mar 2007 to end of Aug 2010.

I suggest the following change to the 'Issue'.

Some F250-F550 Super-Duties equipped with a 6.4L Diesel engine may exhibit a lack of power concern with an intermittent DTC P0088. DTC P0088 is set when the Fuel Rail Pressure (FRP) is higher then desired. The purpose of this TSB is to duplicate the conditions required to set the P0088. If DTC's P0087, P2291 or P2269 are present, **or there is rust in the on-engine fuel filter housing,** do not continue with this TSB.

When Santos comes up with a proposed TSB labor time, we can compare to the current running average of ~14 hours / claim.

Scott

From: Curtis, Andrew (A.)
Sent: Monday, October 25, 2010 3:40 PM
To: Eeley, Scott (A.)
Subject: RE: TSB Request for Input: 070-2010-1935: 2008-2010 6.4L Diesel - Lacks Power - Diagostic Trouble Code (DTC) P0088

I wrote it as a service tip. We will need time to perform the test and then the replacement of the pump will be normal SLTS

Andrew Curtis
6.0L-6.4L CCE
Ford Technical Hotline - DSC 1
Cube # 257 Phone (313) 390-2132
ACURTI24@Ford.com

From: Eeley, Scott (A.)
Sent: Monday, October 25, 2010 3:38 PM
To: Curtis, Andrew (A.)
Subject: RE: TSB Request for Input: 070-2010-1935: 2008-2010 6.4L Diesel - Lacks Power - Diagostic Trouble Code (DTC) P0088

I gotta run some AWS data...

(Will this get a labor op and time? Would they get a TSB labor op for diag and then use SLTS to replace the pump?) I need the data first before I ask these questions.

From: Curtis, Andrew (A.)
Sent: Monday, October 25, 2010 2:32 PM
To: Curtis, Andrew (A.); Stendardo, David (D.); Goebel, Ken (K.M.); Eeley, Scott (A.); Simpson, Timothy (T.A.)
Subject: TSB Request for Input: 070-2010-1935: 2008-2010 6.4L Diesel - Lacks Power - Diagostic Trouble Code (DTC) P0088

TSB Request for Input

***** NOTE: The system generated the email. *****

This message is being sent on behalf of ACURTI24.
Please provide review and feedback for the article below. The person requesting this feedback may have provided further direction in the comment section below. Forward/Send any comments via email to the person who sent this email.

General Information

Last action taken (as of 10/25/2010 6:32:11 PM GMT):	Send for engineering input
Comment:	First shot at the P0088 TSB. Thoughts??
Author:	ACURTI24
Tracking Number:	070-2010-1935
Author Tracking Number:	--
Title:	2008-2010 6.4L Diesel - Lacks Power - Diagostic Trouble Code (DTC) P0088
Article Type:	TSB

TSB Issue:
Some F250-F550 Super-Duties equipped with a 6.4L Diesel engine may exhibit a lack of power concern with an intermittent DTC P0088. DTC P0088 is set when the Fuel Rail Pressure (FRP) is higher then desired. The purpose of this TSB is to duplicate the conditions required to set the P0088. If DTC's P0087, P2291 or P2269 are present do not continue with this TSB.
TSB Action:
Perform the following steps to diagnose this concern.
TSB Service Procedure:
1) Using the Integrated Diagnostic Software (IDS) select the following pids from data-logger:
A) RPM
B) FRPDES
C) FRP
D) FRT
E) ECT
2) Active command the RPM to 2700, monitor FRT and ECT.
3) Once FRT exceeds 131 degrees F (55 degrees C) and ECT exceeds 158 degrees F (70 degrees C) continue to step 4.
4) Release the RPM active command and sweep the RPM's using the accelerator pedal quickly, from idle to 2500, idle to 3000 and idle to Wide Open Throttle holding the at the top of the RPM band for 5 seconds each time.
Note: When the P0088 sets the RPM will be limited to 2400 and fluctuate.
5) If DTC P0088 sets during this test then there is an internal fault within the High Pressure Pump (HPP) and it will need to be replaced. Refer to the Work Shop Manual (WSM) for HPP replacement.

Category:	Service Fix (10 years - TSB Only)
Request Type:	Non-QSF
Would this make a good cost save business case?	No
Activity Code:	070 F-Series >8500#

Vehicle Applications:

Vehicle Lines	Model Year Start	Model Year End	Assembly Plants	Body Styles	Engine	Trans Axles	Build From	Build To
F-250	2008	2010			6.4L TC DIESEL V8			
F-350	2008	2010			6.4L TC DIESEL V8			
F-450	2008	2010			6.4L TC DIESEL V8			

F-550	2008	2010			6.4L TC DIESEL V8			

If SPECS Case, Select all Other Affected Publications:
Changes Needed in Other Pubs:
TSBs to Supersede:
SSMs to Supersede:
ISMs to Supersede:
Other application Articles:
Select the reason for republication:
Procedure verified by CDSID: seeley
Describe How The Procedure Was Verified:
Do you have access to a vehicle for time study? N/A
If Yes, contact for vehicle CDSID:
Labor Operations:

Are Illustrations Required? No
If Yes, Contact information for illustrations:
CDSID(Ford only):
Full Name:
Phone:
Illustration Notes:

Trustmarks affected: Ford
Additional Trustmarks To Notify:
Article Distribution: WDMO, Canada, Mexico, United States
DTC Codes and OASIS Service Codes: P0088, 600000, 606000, 611000, 611500, 614000, 614500, 614600, 698298

Causal Basic Part # or Finis Code:

Causal Part # or Finis Code	Warranty Condition Codes
9A543	Powertrain: 42

Calibrations List:

White Paper Numbers:

Parts Request Information

Are Parts Required? No

Article Number:
BCM Number:

(End automated email)

Labor Operation Code	Labor Op Code Desc	Count	AverageHour	CalcCost
6007B	(blank)	3233	5.9	$ 1,657,749.38
6007B47	(blank)	3234	2.5	$ 707,603.23
6584AT	GASKET - ROCKER ARM COVER REMOVE AND INSTALL OR REPLACE	729	3.4	$ 214,921.63
6005F	ENGINE PERFORMANCE DIAGNOSTICS - 7.3L DI TURBO EN DIAGNOSIS	2659	0.4	$ 91,375.96
MT9A543	(blank)	219	4.2	$ 79,844.18
6005F18	(blank)	1911	0.4	$ 66,051.93
6005F45	(blank)	1916	0.3	$ 49,821.52
MT071208	(blank)	252	2.1	$ 45,375.56
6005F41	(blank)	1716	0.3	$ 44,331.07
6005PA	(blank)	1523	0.3	$ 39,445.06
MT6007B	(blank)	90	4.9	$ 38,480.40
6.005E+14	(blank)	841	0.5	$ 36,015.28
MTACCESS	(blank)	119	3.4	$ 35,286.32
6584AR	GASKET - ROCKER ARM COVER REMOVE AND INSTALL OR REPLACE	230	1.7	$ 34,546.04
6005F13	(blank)	1906	0.2	$ 32,193.56
6.005E+22	(blank)	826	0.4	$ 28,326.10
6005F1	KEY ON ENGINE OFF - KOEO CHECK TEST	2537	0.1	$ 21,875.02
9527AT	NOZZLE AND HOLDER ASSY.-FUEL INJECTION REPLACE	59	4.3	$ 21,854.07
6005E	HARD START / NO START DIAGNOSTICS - 7.3L DI TURBO DIAGNOSIS	406	0.6	$ 20,399.50
6.005E+17	(blank)	186	1.2	$ 19,160.09
6005F12	BOOST PRESSURE TEST	580	0.3	$ 17,491.53
6005F6	KEY ON ENGINE RUNNING - KOER CHECK TEST	1995	0.1	$ 17,262.59
MT6007	(blank)	65	2.7	$ 15,304.85
072602A	(blank)	21	8.0	$ 14,570.31
6005F1X1	EXTRA TIME TO REPEAT FINAL QUICK TEST	1631	0.1	$ 14,184.71
60050000000	(blank)	393	0.4	$ 13,119.99
6005F2	KEY ON ENGINE OFF - KOEO INJECTOR ELECTRICAL SELF TEST	1539	0.1	$ 12,762.25
MTBOLT	(blank)	91	1.6	$ 12,711.59
6.005E+19	(blank)	168	0.9	$ 12,612.38
MTCAB	(blank)	37	3.8	$ 12,222.43
6005F19	(blank)	511	0.3	$ 12,132.45
MT9543	(blank)	27	4.8	$ 11,315.92
MTDIAG	(blank)	51	2.4	$ 10,808.74
MT6007B47	(blank)	34	3.3	$ 9,628.30
6.005E+47	(blank)	73	1.5	$ 9,245.17
MTAMBUL	(blank)	34	3.1	$ 9,209.30
MTBOLTS	(blank)	44	2.3	$ 8,736.96
MT6584AT	(blank)	30	3.3	$ 8,486.26
6.005E+20	(blank)	45	2.1	$ 8,335.25
6.005E+21	(blank)	162	0.6	$ 7,995.85
6005F47	(blank)	343	0.2	$ 7,386.04
8005A	RADIATOR ASSY. REMOVE AND INSTALL OR REPLACE	37	2.1	$ 6,794.64
9527AR	NOZZLE AND HOLDER ASSY.-FUEL INJECTION REPLACE	27	2.8	$ 6,493.62
MT9G756	(blank)	91	0.8	$ 6,491.00
MT9543A	(blank)	6	12.1	$ 6,325.48
6.005E+44	(blank)	253	0.3	$ 6,317.25
MT6584	(blank)	27	2.7	$ 6,270.46
MT6005	(blank)	28	2.6	$ 6,229.57
9527AL	NOZZLE AND HOLDER ASSY.-FUEL INJECTION REPLACE	24	2.9	$ 6,140.52
6005000000	(blank)	346	0.2	$ 5,707.55
6.005E+48	(blank)	227	0.3	$ 5,655.98
6005F14	(blank)	645	0.1	$ 5,079.31
MTPTO	(blank)	28	2.0	$ 4,918.14
9002A	FUEL TANK REMOVE AND INSTALL OR REPLACE	43	1.3	$ 4,689.30
9350E	FUEL PUMP - ELECTRIC (IN-TANK) REPLACE	65	0.8	$ 4,470.18
6.005E+46	(blank)	94	0.5	$ 4,238.50
MT9G805	(blank)	18	2.6	$ 4,127.51
12650D81	NGS RECORDER / MONITOR ROAD TEST DIAGNOSIS	106	0.4	$ 4,024.89
6854AT	(blank)	7	6.5	$ 3,963.36
MTAMBULANCE	(blank)	8	5.6	$ 3,917.06
MTRACK	(blank)	15	3.0	$ 3,897.65
6005F11	EXHAUST SYSTEM RESTRICTION TEST	498	0.1	$ 3,852.92
6007B45	(blank)	12	3.7	$ 3,814.55
6007B41T	(blank)	15	2.8	$ 3,614.93
MTCABON	(blank)	9	4.6	$ 3,590.96
6600A	OIL PUMP REMOVE AND INSTALL OR REPLACE	15	2.7	$ 3,571.16
6007B50	(blank)	27	1.4	$ 3,347.74
MT6005F45	(blank)	26	1.4	$ 3,239.79
600500	KEY ON ENGINE OFF - KOEO CHECK (6-7) TEST	383	0.1	$ 3,221.63
MT6007A	(blank)	2	17.8	$ 3,100.39
60050000	NGS TESTER - DATA LIST MONITORING (9) TEST	358	0.1	$ 2,987.24
6.005E+16	(blank)	51	0.6	$ 2,825.93
6584AL	GASKET - ROCKER ARM COVER REMOVE AND INSTALL OR REPLACE	17	1.9	$ 2,818.32
6.005E+15	(blank)	27	1.2	$ 2,794.40
13000BC	MAT OR FLOOR CARPETS ACCESS	17	1.9	$ 2,736.75
6005F10	CYLINDER CONTRIBUTION TEST	361	0.1	$ 2,696.98
MT9E527	(blank)	5	6.2	$ 2,685.55
MT9756A	(blank)	47	0.7	$ 2,671.31
6.005E+11	(blank)	115	0.3	$ 2,655.48
600500000	GLOW PLUG SYSTEM OPERATION (10) TEST	62	0.5	$ 2,634.51
MTWIRING	(blank)	19	1.6	$ 2,605.73
6007B41H	(blank)	10	2.9	$ 2,562.12
7000A	TRANSMISSION ASSEMBLY REMOVE AND INSTALL OR REPLACE	8	3.7	$ 2,555.21
6007B36T	(blank)	5	5.8	$ 2,526.18
MTACESORIES	(blank)	11	2.6	$ 2,472.05
MT6K682	(blank)	13	2.2	$ 2,444.62
6007B52	(blank)	5	5.5	$ 2,405.18
6007B38	(blank)	2	13.6	$ 2,359.28
MTNUTS	(blank)	20	1.4	$ 2,353.55
13000B	MAT OR FLOOR CARPETS ACCESS	13	2.1	$ 2,338.19
MTADDON	(blank)	7	3.8	$ 2,292.82
MTBUCKET	(blank)	6	4.3	$ 2,262.64
MT9453	(blank)	2	13.0	$ 2,259.77
12650D45	PIN POINT TEST DIAGNOSIS	101	0.3	$ 2,224.05
MT01B24	(blank)	11	2.2	$ 2,140.19
6005F26	(blank)	14	1.7	$ 2,111.41
MTBED	(blank)	2	11.4	$ 1,985.73
6005F39	(blank)	255	0.1	$ 1,962.69
6007B51	(blank)	26	0.8	$ 1,914.71
MT9756	(blank)	28	0.8	$ 1,897.49
MT6005F	(blank)	15	1.4	$ 1,874.33
MTBODY	(blank)	8	2.7	$ 1,860.80
6005F9	CRANKCASE PRESSURE TEST	244	0.1	$ 1,856.86
6007B44	(blank)	4	5.0	$ 1,751.90
MTCABBOLTS	(blank)	10	2.0	$ 1,750.08
6020A	GASKET OR CYLINDER FRONT COVER REPLACE	4	5.0	$ 1,749.55
MT9A332	(blank)	9	2.2	$ 1,706.13
14200A	WIRING ASSEMBLY REPAIR	51	0.4	$ 1,701.63

6007B40	(blank)	10	1.9 $	1,689.94
6005000	KEY ON ENGINE OFF - KOEO INJECTOR ELECTRICAL SELF TEST	214	0.1 $	1,685.23
9456AT	(blank)	4	4.8 $	1,667.02
8575B1A	(blank)	8	2.3 $	1,630.11
OSL	OUTSIDE LABOR	19	1.0 $	1,627.12
MT9A453	(blank)	4	4.6 $	1,617.45
MT9D930	(blank)	14	1.3 $	1,603.77
9155AT	(blank)	28	0.6 $	1,547.90
MT12B637	(blank)	4	4.2 $	1,470.63
MTBOOM	(blank)	4	4.2 $	1,469.59
MT99	(blank)	8	2.1 $	1,465.88
MT14401	(blank)	6	2.8 $	1,463.81
13000BA	MAT OR FLOOR CARPETS ACCESS	9	1.9 $	1,460.37
6007B57	(blank)	4	4.2 $	1,448.57
MT6584AR	(blank)	11	1.5 $	1,433.49
6.005E+50	(blank)	59	0.3 $	1,374.90
MT070809	(blank)	4	3.9 $	1,365.29
12650D	EEC - (QUICK TEST) DIAGNOSIS	93	0.2 $	1,362.87
MTAFTERMARK	(blank)	5	3.1 $	1,357.43
12650D30	EGR VALVE AND OR GASKET REPLACE	33	0.5 $	1,336.39
6.005E+29	(blank)	8	1.9 $	1,292.70
MT14200	(blank)	6	2.4 $	1,277.02
MTPUMP	(blank)	4	3.6 $	1,254.98
8575B1	THERMOSTAT TEST AND/OR REPLACE	6	2.4 $	1,246.80
6007B41L	(blank)	7	1.9 $	1,154.65
MTHPP	(blank)	1	12.8 $	1,114.26
MTUTILITY	(blank)	5	2.5 $	1,092.08
MTCABBOLT	(blank)	7	1.7 $	1,041.07
6731A	OIL FILTER ELEMENT REPLACE	45	0.3 $	1,025.94
MT19703	(blank)	2	5.7 $	995.61
9456AH	(blank)	2	5.7 $	986.85
9430AT	EXHAUST MANIFOLD AND/OR GASKET REPLACE	1	11.3 $	982.26
MT6005E17	(blank)	5	2.3 $	980.30
MTPPTME	(blank)	9	1.2 $	948.89
MT8005	(blank)	7	1.5 $	939.35
MT7Z369	(blank)	3	3.6 $	934.78
MT6005B	(blank)	3	3.6 $	928.05
MT9527	(blank)	5	2.1 $	909.19
MTTOWTRUCK	(blank)	2	5.0 $	876.25
12650D68F	(blank)	26	0.4 $	867.18
6007B14R	(blank)	1	10.0 $	866.69
MTAFTMKT	(blank)	6	1.7 $	863.25
12650D6	POWERTRAIN CONTROL MODULE (PCM) REPLACE	16	0.6 $	861.93
MTACESS	(blank)	2	4.8 $	836.17
16450AT	(blank)	19	0.5 $	834.54
12342D1T	GLOW PLUG REPLACE	7	1.3 $	818.14
MT70809	(blank)	1	9.3 $	811.30
MT072602A	(blank)	1	9.2 $	798.76
MT6K854	(blank)	5	1.8 $	793.91
MTAFTER	(blank)	4	2.3 $	788.15
MT8592	(blank)	3	3.0 $	788.02
MTACCESSORY	(blank)	3	3.0 $	781.53
MT78101C58	(blank)	6	1.5 $	778.36
9527A2T	(blank)	33	0.3 $	777.10
MT101C38	(blank)	3	2.9 $	766.80
MT6005E19	(blank)	14	0.6 $	760.87
9430AR	EXHAUST MANIFOLD AND/OR GASKET REPLACE	2	4.4 $	758.58
MTWRECKER	(blank)	2	4.4 $	758.07
MTPA543	(blank)	2	4.4 $	757.20
6007B36R	(blank)	4	2.1 $	738.03
MT9229	(blank)	3	2.8 $	732.99
MTHARNESS	(blank)	6	1.4 $	730.62
MTNUT	(blank)	9	0.9 $	730.04
12650D69N	(blank)	15	0.6 $	728.30
8005D	COOLING SYSTEM PRESSURE TEST DIAGNOSIS	19	0.4 $	714.23
5221A	(blank)	11	0.7 $	705.74
MT9332AT	(blank)	2	4.0 $	696.73
MTBUS	(blank)	1	8.0 $	696.66
MT16450	(blank)	6	1.3 $	692.31
MTFSE	(blank)	2	4.0 $	687.63
MT6007B41L	(blank)	2	3.9 $	682.62
MT5H267	(blank)	2	3.9 $	682.02
MT00154	(blank)	2	3.9 $	680.00
8616A	FAN DRIVE CLUTCH REPLACE	4	1.9 $	671.77
MT16450AT	(blank)	6	1.2 $	632.82
MTFRP	(blank)	2	3.6 $	627.02
MTW712878	(blank)	5	1.4 $	626.55
MT8005D	(blank)	1	7.1 $	618.22
MTIME	(blank)	3	2.4 $	616.86
MTBLEED	(blank)	5	1.4 $	612.91
MTADDTLDIAG	(blank)	1	7.0 $	608.58
13000AA	MAT OR FLOOR CARPETS REPLACE	3	2.3 $	599.04
MT12650	(blank)	2	3.4 $	590.00
080514A	(blank)	4	1.7 $	579.16
MT6005E14	(blank)	7	0.9 $	572.86
MT13000	(blank)	3	2.1 $	558.39
MT6L612	(blank)	3	2.1 $	549.37
MTAFTERMRKT	(blank)	2	3.1 $	547.94
MTAFTRMRKT	(blank)	1	6.2 $	542.74
MTTURBOBOLT	(blank)	3	2.1 $	542.43
MTCAGE	(blank)	6	1.0 $	539.56
12650D80	NGS DCL DISPLAY TEST	62	0.1 $	536.90
12650D68M	(blank)	16	0.4 $	529.92
MT14200A45	(blank)	2	3.0 $	528.10
MT6007F	(blank)	1	6.0 $	524.40
MT9438	(blank)	1	5.9 $	517.28
MT6854	(blank)	3	2.0 $	512.14
MT6007B40	(blank)	3	1.9 $	505.17
12650DX1	EXTRA TIME TO REPEAT FINAL QUICK TEST	68	0.1 $	505.02
MTADDONS	(blank)	2	2.9 $	502.58
MT9T514	(blank)	2	2.9 $	501.79
MT9A486	(blank)	2	2.9 $	500.61
MT6006	(blank)	2	2.9 $	499.44
MTLIGHTBAR	(blank)	1	5.7 $	496.40
6646AT	(blank)	3	1.9 $	490.06
MTLUMBRRACK	(blank)	1	5.6 $	488.50
MT9527AT	(blank)	1	5.6 $	487.60
MT6007B41H	(blank)	3	1.9 $	487.40
MTW302649	(blank)	3	1.9 $	486.88

MTABNORMAL	(blank)	3	1.8	$ 480.05
MTCAGENUTS	(blank)	3	1.8	$ 479.66
MT302649	(blank)	2	2.7	$ 468.86
6775A	COOLER ASSEMBLY (CHARGE AIR) REPLACE	10	0.5	$ 455.64
MT25001B24	(blank)	2	2.6	$ 448.20
MTPINPOINT	(blank)	5	1.0	$ 442.97
MT7000	(blank)	1	5.0	$ 436.42
MTACCESSORI	(blank)	2	2.4	$ 424.52
MT9424	(blank)	1	4.8	$ 420.66
MTTOW	(blank)	2	2.4	$ 413.66
MTCAGENUT	(blank)	3	1.6	$ 413.37
MT9430	(blank)	4	1.2	$ 410.57
9155AB	(blank)	10	0.5	$ 402.22
MT6005E11	(blank)	8	0.6	$ 395.93
MTBOX	(blank)	1	4.5	$ 389.17
MTRUNNING	(blank)	5	0.9	$ 381.35
9249A	HEADER - FUEL FILTER REPLACE	5	0.9	$ 377.37
MTLATTER	(blank)	1	4.3	$ 376.72
MT070802	(blank)	1	4.2	$ 367.67
MT9T287	(blank)	2	2.1	$ 367.38
6754A	TUBE ASSEMBLY - OIL LEVEL INDICATOR REPLACE	3	1.4	$ 366.55
6701A	SEAL - CRANKSHAFT REAR MAIN (FULL CIRCLE TYPE) REPLACE	1	4.2	$ 364.94
9155A	FILTER ASSEMBLY - FUEL REPLACE	9	0.5	$ 362.68
MT6007F45	(blank)	1	4.1	$ 359.32
MT1000155	(blank)	2	2.0	$ 355.92
MTAFTERMKT	(blank)	1	4.1	$ 354.60
6089A	(blank)	3	1.4	$ 352.89
6007D	ENGINE OIL LEAKS DIAGNOSIS	11	0.4	$ 352.36
MT6005E45	(blank)	10	0.4	$ 350.70
MTWIRE	(blank)	2	2.0	$ 349.43
9002A6	(blank)	17	0.2	$ 348.30
MT6007B50	(blank)	2	2.0	$ 346.46
MT17757	(blank)	4	1.0	$ 344.44
MTEMS	(blank)	2	2.0	$ 343.82
MT6005E16	(blank)	5	0.8	$ 341.40
100502C	(blank)	1	3.9	$ 338.28
MT6005F19	(blank)	2	1.9	$ 335.32
MT6007B44	(blank)	1	3.8	$ 332.97
8575B	THERMOSTAT - COOLING SYSTEM DIAGNOSIS	4	1.0	$ 332.75
6007B48T	(blank)	1	3.8	$ 331.83
MTBODYBOLT	(blank)	2	1.9	$ 331.51
MT6000	(blank)	1	3.8	$ 331.38
MT00155A	(blank)	1	3.8	$ 328.35
MTADDONEQUI	(blank)	1	3.7	$ 321.81
6730A	DRAIN PLUG AND/OR DRAIN PLUG GASKET/SEAL REPLACE	10	0.4	$ 320.08
MTFLIP	(blank)	1	3.7	$ 320.00
12650D9	EGR PRESSURE FEEDBACK - PFE / EXHAUST BACK PRESSU REPLACE	13	0.3	$ 316.44
MTLIGHTS	(blank)	3	1.2	$ 314.16
MT6584A	(blank)	1	3.6	$ 313.88
MTTORCH	(blank)	1	3.5	$ 302.96
MTTURBOBLTS	(blank)	1	3.5	$ 302.65
12650D68B	(blank)	12	0.3	$ 294.11
MT072602	(blank)	1	3.4	$ 292.80
MT101C58	(blank)	1	3.3	$ 290.13
12342D1R	GLOW PLUG REPLACE	4	0.8	$ 289.31
9275D	GAUGE ASSEMBLY - FUEL TANK UNIT TEST	5	0.7	$ 287.14
6007B36RT	(blank)	1	3.3	$ 285.39
16102AT	SHIELD-FRONT FENDER SPLASH REPLACE	4	0.8	$ 282.97
MT18124	(blank)	1	3.3	$ 282.75
MT072108	(blank)	1	3.2	$ 282.37
13007BT	BULB - HEADLAMP (SEALED BEAM) REPLACE	9	0.4	$ 280.37
6646AH	(blank)	1	3.2	$ 279.47
MT14001	(blank)	1	3.2	$ 279.36
MTBODYNUTS	(blank)	1	3.2	$ 278.56
6375A	FLYWHEEL AND RING GEAR ASSEMBLY - COVER OR SEPERA REPLACE	1	3.2	$ 277.12
MTUPPIPE	(blank)	1	3.2	$ 276.75
9456AV	(blank)	1	3.2	$ 274.24
MT9F759	(blank)	3	1.0	$ 270.22
9002A4	FUEL GAUGE TANK UNIT OR SEAL REMOVE AND INSTALL OR REPLACE	10	0.3	$ 268.65
MT14404	(blank)	1	3.1	$ 267.68
MTEXTRADGHO	(blank)	1	3.0	$ 264.60
MTWELDUTILI	(blank)	1	3.0	$ 264.45
MTSPUN	(blank)	3	1.0	$ 264.14
MT6K684	(blank)	1	3.0	$ 262.42
8080A	EXPANSION OR COOLANT RECOVERY TANK REPLACE	4	0.8	$ 261.91
MT16102	(blank)	1	3.0	$ 258.36
6209A	TENSIONER ASSEMBLY - DRIVE BELT REPLACE	3	1.0	$ 258.35
MTTOWPACKAG	(blank)	1	3.0	$ 257.34
MTAMB	(blank)	1	2.9	$ 256.62
MT9A542	(blank)	1	2.9	$ 255.39
MTRADIOEQUI	(blank)	1	2.9	$ 254.97
MTSNOWPLOW	(blank)	1	2.9	$ 254.97
MT712879	(blank)	1	2.9	$ 254.00
MT6619	(blank)	2	1.5	$ 253.83
	(blank)	1	2.9	$ 252.00
MT6A588	(blank)	1	2.9	$ 251.08
MTCRANEWIRE	(blank)	1	2.8	$ 247.75
13000A	MAT OR FLOOR CARPETS REPLACE	1	2.8	$ 241.00
MTBOARDS	(blank)	3	0.9	$ 240.02
MT6005PA	(blank)	9	0.3	$ 239.95
MT9527AR	(blank)	1	2.7	$ 237.31
MTCOMPUTER	(blank)	1	2.7	$ 236.90
MTSPOTLITE	(blank)	1	2.7	$ 236.90
MTYPIPE	(blank)	2	1.4	$ 236.90
MTGRILLGUAR	(blank)	1	2.7	$ 234.98
MTPRESPUMP	(blank)	1	2.7	$ 234.07
MTEQUIPADON	(blank)	1	2.7	$ 233.51
MT6854AL	(blank)	1	2.6	$ 228.81
8260AUP	HOSE - RADIATOR REPLACE	5	0.5	$ 227.57
MTSVCTRK	(blank)	1	2.6	$ 226.08
9350B	FUEL PUMP PRESSURE TEST ON VEHICLE DIAGNOSIS	10	0.3	$ 225.25
MTBUMPER	(blank)	2	1.3	$ 223.06
MT5230	(blank)	2	1.3	$ 223.02
MT12342D1T	(blank)	2	1.3	$ 222.79
MTASSCESSAY	(blank)	1	2.5	$ 221.22
3719AP	PRESSURE HOSE-POWER STEERING REPLACE	1	2.5	$ 218.75
MT9B337	(blank)	3	0.8	$ 218.45
MT6005B47	(blank)	1	2.5	$ 217.46
MTAMBEQUIP	(blank)	2	1.2	$ 217.10

MT071208B	(blank)	1	2.5	$	216.36
MTCABBOLTX4	(blank)	1	2.5	$	215.36
MTLADDER	(blank)	1	2.5	$	215.36
MTLADDERA	(blank)	1	2.5	$	215.36
	(blank)	8	0.3	$	214.19
MT6005E	(blank)	4	0.6	$	212.22
3674A	PUMP - POWER STEERING REMOVE AND INSTALL OR REPLACE	1	2.4	$	211.30
MTCABOLTS	(blank)	2	1.2	$	211.06
MT1B24	(blank)	1	2.4	$	211.05
MTHYDPUMP	(blank)	1	2.4	$	210.33
MT9F838	(blank)	2	1.2	$	209.06
MTAUXEQUIP	(blank)	2	1.2	$	208.73
MT71208	(blank)	1	2.4	$	207.84
MT9E756	(blank)	2	1.2	$	207.20
081302A	(blank)	5	0.5	$	205.72
MT9C166	(blank)	1	2.4	$	204.76
MTLIFTGATE	(blank)	1	2.3	$	203.76
	(blank)	1	2.3	$	201.50
MT302494	(blank)	1	2.3	$	200.15
MTAFTMRKT	(blank)	1	2.3	$	199.00
MT9E461	(blank)	2	1.1	$	196.69
MT081607	(blank)	1	2.2	$	194.20
MT9C968	(blank)	1	2.2	$	192.85
MT6005F44	(blank)	1	2.2	$	190.66
MTAUXWIRING	(blank)	2	1.1	$	189.55
MT12A581	(blank)	1	2.2	$	188.61
082501A	(blank)	3	0.7	$	187.25
MTAFTRMKT	(blank)	1	2.1	$	181.87
MT20471	(blank)	1	2.1	$	181.79
63100BB	(blank)	4	0.5	$	176.56
MTMAT	(blank)	1	2.0	$	175.76
MT5439	(blank)	1	2.0	$	175.08
MT6005E18	(blank)	3	0.7	$	171.25
MT0124	(blank)	1	2.0	$	170.65
MT6005E44	(blank)	1	2.0	$	170.45
MT9438A	(blank)	1	2.0	$	170.00
MTBOARD	(blank)	2	1.0	$	169.84
MTSTEP	(blank)	1	2.0	$	169.84
MTBEDRAILS	(blank)	1	1.9	$	165.50
MTME1	(blank)	1	1.9	$	165.34
MT9514	(blank)	1	1.9	$	164.60
MTBRUSH	(blank)	2	0.9	$	163.66
MTB6007B	(blank)	1	1.8	$	160.86
MTTURBO	(blank)	1	1.8	$	156.71
MT6K461	(blank)	1	1.8	$	156.52
MTMME	(blank)	1	1.8	$	156.52
MT9G438	(blank)	1	1.8	$	155.64
MT8005A	(blank)	1	1.8	$	155.63
12650D13	MANIFOLD ABSOLUTE PRESSURE SENSOR - MAP REPLACE	6	0.3	$	154.98
MT12A650	(blank)	3	0.6	$	153.29
MT12650D45	(blank)	3	0.6	$	152.63
14200A45	(blank)	6	0.3	$	150.52
MT17757A	(blank)	1	1.7	$	149.94
MT101658	(blank)	1	1.7	$	149.71
MT63100A	(blank)	1	1.7	$	149.20
12650D47	COMPRESSION PRESSURE TEST DIAGNOSIS	20	0.1	$	148.81
MT13008	(blank)	2	0.8	$	146.73
MTW302494	(blank)	1	1.7	$	146.52
MTWIRES	(blank)	2	0.8	$	144.75
	(blank)	1	1.7	$	143.70
MTFRNTCVR	(blank)	1	1.6	$	143.37
MTCONTROLS	(blank)	1	1.6	$	143.18
MTACCES	(blank)	1	1.6	$	141.83
MT6K6854	(blank)	1	1.6	$	141.62
MTSTATEQUIP	(blank)	1	1.6	$	141.60
MTPPTM	(blank)	2	0.8	$	139.98
MTUPFIT	(blank)	1	1.6	$	136.60
MT9438A2	(blank)	1	1.6	$	136.00
071703A	(blank)	3	0.5	$	135.89
MT071218	(blank)	1	1.6	$	135.24
8678A	IDLER PULLEY REPLACE	1	1.5	$	133.99
MTTRACE	(blank)	1	1.5	$	130.94
MTSPARETIRE	(blank)	1	1.5	$	130.85
MTEXHAUST	(blank)	1	1.5	$	130.26
MT12289	(blank)	1	1.5	$	129.69
6005F8	LOW IDLE STABILITY (ICP PRESSURE) TEST	3	0.5	$	129.41
MTACCCGNUT	(blank)	1	1.5	$	128.38
MT9J756	(blank)	1	1.5	$	126.90
MT70101C58	(blank)	2	0.7	$	126.29
MTBAR	(blank)	1	1.4	$	125.54
MT6005F8	(blank)	3	0.5	$	125.19
MT303659	(blank)	1	1.4	$	123.45
MTSTEAM	(blank)	4	0.3	$	121.60
9527A2TA	(blank)	7	0.2	$	120.51
MTAFTMKTAC	(blank)	1	1.4	$	120.45
MT3A674	(blank)	1	1.4	$	119.92
MT6005F25	(blank)	1	1.4	$	119.00
MTPPT	(blank)	1	1.4	$	118.61
MT14A411	(blank)	1	1.4	$	117.97
MTGRILL	(blank)	1	1.4	$	117.96
MTADDONES	(blank)	1	1.3	$	117.20
MT9461	(blank)	1	1.3	$	117.09
5212B	CATALYTIC CONVERTER REPLACE	2	0.7	$	116.22
MT9002	(blank)	2	0.7	$	116.08
MTHOTLINE	(blank)	1	1.3	$	115.18
12650D68T	(blank)	2	0.7	$	114.53
9926A	THROTTLE BODY - AIR INTAKE REPLACE	2	0.7	$	114.04
MT13007	(blank)	3	0.4	$	113.49
MTBOOMWIREI	(blank)	1	1.3	$	113.40
MTDEBRIS	(blank)	2	0.7	$	113.36
MTINJECTOR	(blank)	1	1.3	$	110.84
MTPPTAUE	(blank)	1	1.3	$	110.70
MTURBOBOLT	(blank)	1	1.3	$	110.70
13000AC	MAT OR FLOOR CARPETS REPLACE	1	1.3	$	109.47
MTWINCH	(blank)	1	1.2	$	107.68
MT8575	(blank)	1	1.2	$	106.76
13007CT	HEADLAMP ASSEMBLY REPLACE	4	0.3	$	105.92
MT7G756	(blank)	1	1.2	$	103.81
8146AUP	(blank)	1	1.2	$	103.71

17757A	BUMPER - FRONT REPLACE	1	1.2	$	102.22
19700A	PRESSURIZE, LEAK TEST, DISCHARGE, EVACUATE AND CH DIAGNOSIS	2	0.6	$	102.00
MT18472A	(blank)	1	1.2	$	102.00
MT6731	(blank)	1	1.2	$	101.25
MT9G282	(blank)	1	1.2	$	100.95
B	(blank)	1	1.2	$	100.19
MT7050202	(blank)	1	1.1	$	99.58
MT14200A	(blank)	2	0.6	$	99.14
MTFUELLINE	(blank)	1	1.1	$	97.54
MT7000F45	(blank)	1	1.1	$	96.91
MTYPIPEBOLT	(blank)	1	1.1	$	96.91
MT091815	(blank)	2	0.6	$	96.83
MT6007B51	(blank)	1	1.1	$	96.36
MTROAD	(blank)	1	1.1	$	96.25
MT9999	(blank)	1	1.1	$	95.26
MT091910A	(blank)	2	0.5	$	94.70
8010A	(blank)	2	0.5	$	94.18
63100B	(blank)	2	0.5	$	93.19
MT90543	(blank)	1	1.1	$	93.09
12342D2	RELAY - GLOW PLUG REPLACE	6	0.2	$	92.78
12650D69T	(blank)	3	0.4	$	91.37
MT6754	(blank)	2	0.5	$	91.09
14056D1	MONITOR ASSEMBLY-AIR BAG RESTRAINT REPLACE	1	1.0	$	90.46
MT6005E48	(blank)	1	1.0	$	89.91
MTMANUALCOM	(blank)	1	1.0	$	89.56
MT14405	(blank)	1	1.0	$	89.09
MT9E937	(blank)	1	1.0	$	88.33
MTCOMPRESS	(blank)	1	1.0	$	87.94
MTFUELSYS	(blank)	1	1.0	$	87.50
MTBOOT	(blank)	1	1.0	$	87.23
63100A	SEAT ASSEMBLY - FRONT ACCESS	1	1.0	$	87.03
63100BCT	(blank)	1	1.0	$	86.90
16038AT	MOULDING - FRONT FENDER WHEEL OPENING REPLACE	1	1.0	$	86.46
MTCOMPRESSO	(blank)	1	1.0	$	86.46
MT9155	(blank)	1	1.0	$	84.17
8287AT	HOSE CLAMP - RADIATOR REPLACE	1	1.0	$	83.52
4602AA	DRIVE SHAFT ASSEMBLY - REAR REMOVE AND INSTALL OR REPLACE	1	1.0	$	83.29
MTAFMKTWIRE	(blank)	1	1.0	$	82.85
MTAFTMKWIRE	(blank)	1	1.0	$	82.85
MTFLUSH	(blank)	1	1.0	$	82.70
MTEXHSTUD	(blank)	1	0.9	$	82.58
MT6005E12	(blank)	1	0.9	$	82.24
MTBRUSHGUAR	(blank)	1	0.9	$	82.24
MT091815A	(blank)	2	0.5	$	81.18
MT6005F18	(blank)	2	0.5	$	81.09
091815A	(blank)	2	0.5	$	81.05
MTHOSES	(blank)	1	0.9	$	81.00
MT001B24	(blank)	1	0.9	$	80.26
MT9155AT	(blank)	1	0.9	$	80.12
MTDIAGNOSE	(blank)	1	0.9	$	79.60
MT78101C38	(blank)	1	0.9	$	79.00
4602B	DRIVESHAFT ASSEMBLY - FRONT (4X4) REMOVE AND INSTALL OR REPLACE	3	0.3	$	78.84
MT6005F23	(blank)	2	0.4	$	78.01
MTLIGHT	(blank)	1	0.9	$	77.39
MT26001B24	(blank)	1	0.9	$	76.74
MTACESSORIE	(blank)	1	0.9	$	76.50
MTW708770	(blank)	1	0.9	$	75.50
63100ACT	(blank)	1	0.9	$	75.38
6646AC	(blank)	1	0.8	$	72.54
MT9N104	(blank)	1	0.8	$	72.54
12650D82	NGS SIGNAL SIMULATION TEST	4	0.2	$	72.40
MT6005F41	(blank)	3	0.3	$	72.04
8005A9	(blank)	1	0.8	$	70.89
MT600545	(blank)	2	0.4	$	70.03
MT13007CT	(blank)	1	0.8	$	69.87
MT5005	(blank)	1	0.8	$	69.39
MTMANCOMPRE	(blank)	1	0.8	$	67.66
3697A	RESERVOIR - POWER STEERING REPLACE	2	0.4	$	66.90
MT6005F38	(blank)	1	0.8	$	66.46
MTRADIATOR	(blank)	1	0.8	$	65.64
MT092403	(blank)	1	0.7	$	64.61
6005F33	(blank)	4	0.2	$	63.48
MT12342D1L	(blank)	1	0.7	$	62.88
MT81669	(blank)	1	0.7	$	62.69
	(blank)	2	0.4	$	62.59
10654CA	BATTERY TEST, CHARGE, AND RE-TEST	2	0.4	$	61.32
MT6756	(blank)	1	0.7	$	61.09
MTTHREAD	(blank)	1	0.7	$	60.53
MTACCC	(blank)	1	0.7	$	60.00
MT8080A	(blank)	1	0.7	$	59.50
082509A	(blank)	1	0.7	$	59.27
	(blank)	1	0.7	$	58.79
MT6005F47	(blank)	2	0.3	$	57.72
MTRUNBOARD	(blank)	2	0.3	$	57.72
9818A8	ACTUATOR SWITCH ASSEMBLY - SPEED CONTROL REPLACE	1	0.7	$	56.85
MT02461	(blank)	1	0.6	$	55.97
MT107323AR	(blank)	1	0.6	$	55.35
MT6007D	(blank)	1	0.6	$	55.35
MTCLEAN	(blank)	1	0.6	$	55.35
MT9488B	(blank)	1	0.6	$	55.23
MT9104	(blank)	1	0.6	$	55.16
6007ESP	(blank)	2	0.3	$	54.53
082507A	(blank)	1	0.6	$	54.34
MT9765A	(blank)	1	0.6	$	54.20
9488B	(blank)	1	0.6	$	54.03
9600A	AIR CLEANER ASSEMBLY REPLACE	5	0.1	$	52.16
MT19700	(blank)	1	0.6	$	52.07
MTMETESTS	(blank)	2	0.3	$	51.35
10838A	INSTRUMENT CLUSTER REMOVE AND INSTALL OR REPLACE	1	0.6	$	51.30
MT7395A	(blank)	1	0.6	$	51.00
16038A	MOULDING - FRONT FENDER WHEEL OPENING REPLACE	2	0.3	$	50.98
MT6N640	(blank)	1	0.6	$	50.74
11002A	STARTER MOTOR REMOVE AND INSTALL OR REPLACE	1	0.6	$	50.66
MTHEADLAMP	(blank)	1	0.6	$	50.22
MT9350B	(blank)	2	0.3	$	49.36
2853A	CABLE - PARKING BRAKE CONTROL TO EQUALIZER REPLACE	1	0.6	$	49.32
MT8260ALW	(blank)	1	0.6	$	47.97
16102A	SHIELD-FRONT FENDER SPLASH REPLACE	1	0.5	$	47.34
MT12650D69N	(blank)	1	0.5	$	47.34

MT9T516	(blank)	1	0.5	$	47.11
9456A1T	(blank)	1	0.5	$	46.94
MT9F543	(blank)	1	0.5	$	46.89
MT12A690	(blank)	1	0.5	$	46.18
MTRECAL	(blank)	1	0.5	$	45.80
MT6K382	(blank)	1	0.5	$	44.68
MT091609	(blank)	1	0.5	$	44.39
08B07B	(blank)	1	0.5	$	44.09
MT091609A	(blank)	1	0.5	$	43.85
14200A1	WIRING REPAIR - PIN POINT TEST TEST	2	0.3	$	43.50
MT6005F18A	(blank)	1	0.5	$	43.42
MT4602	(blank)	1	0.5	$	43.10
MT18472	(blank)	1	0.5	$	43.08
MTXTRACT	(blank)	1	0.5	$	43.08
MT6K775	(blank)	1	0.5	$	42.99
7564A	SLAVE CYLINDER - HYDRAULIC CLUTCH REPLACE	1	0.5	$	42.49
MT6775A	(blank)	1	0.5	$	41.82
MT15480	(blank)	1	0.5	$	41.13
MT9N103	(blank)	1	0.5	$	40.82
MTCAGEBLTS	(blank)	1	0.5	$	40.47
MTMTBOARDS	(blank)	1	0.5	$	40.27
MT8010A	(blank)	1	0.5	$	39.45
9002A8	(blank)	3	0.1	$	37.58
MTTEST	(blank)	1	0.4	$	36.63
6600B	OIL PRESSURE - ENGINE DIAGNOSIS	2	0.2	$	35.18
MT6005F12	(blank)	2	0.2	$	34.00
MT6005F13	(blank)	2	0.2	$	33.85
	(blank)	5	0.1	$	33.83
MT6005F21	(blank)	1	0.4	$	33.23
MT6005F1	(blank)	4	0.1	$	32.84
	(blank)	1	0.4	$	32.50
MTPPTK	(blank)	1	0.4	$	32.30
14526A	FUSE REPLACE	2	0.2	$	31.60
MT6005E47	(blank)	1	0.4	$	31.51
	(blank)	1	0.3	$	28.14
MT9759	(blank)	1	0.3	$	27.58
	(blank)	4	0.1	$	27.46
13021AT	BULB AND RETAINER ASSEMBLY REPLACE	1	0.3	$	27.37
19700A25C	(blank)	1	0.3	$	27.37
9735A	ACCELERATOR PEDAL OR PAD REPLACE	1	0.3	$	27.32
MT600541	(blank)	1	0.3	$	26.94
MTHEADLMPS	(blank)	1	0.3	$	26.26
12650D69U	(blank)	3	0.1	$	26.14
	(blank)	1	0.3	$	26.13
MT9002A4	(blank)	1	0.3	$	26.10
MT805	(blank)	1	0.3	$	26.09
12650D25	MASS AIRFLOW SENSOR ASSEMBLY REPLACE	3	0.1	$	26.07
11000A	STARTER CIRCUIT CHECK	1	0.3	$	25.98
3676ALW	(blank)	2	0.1	$	25.78
13007BR	(blank)	1	0.3	$	25.31
10654C1A	BATTERY REPLACE	1	0.3	$	23.93
MT9753	(blank)	1	0.3	$	22.30
MT6005E41	(blank)	1	0.3	$	22.23
2450F	(blank)	1	0.3	$	22.12
8200A	GRILLE ASSEMBLY - RADIATOR REPLACE	1	0.2	$	21.14
	(blank)	3	0.1	$	20.74
	(blank)	1	0.2	$	19.60
63100ARC	(blank)	1	0.2	$	19.17
10654C	BATTERY TEST, CHARGE, AND RE-TEST	1	0.2	$	17.50
MT6005F1X1	(blank)	2	0.1	$	16.93
MT6005F2	(blank)	2	0.1	$	16.93
080409A	(blank)	1	0.2	$	16.75
9456A1H	(blank)	1	0.2	$	16.55
6650AA	(blank)	1	0.2	$	16.41
MT9G376	(blank)	1	0.2	$	14.07
MTRECLAIM	(blank)	1	0.2	$	13.99
7000F11	PROCESSOR ASSY. - TRANSMISSION ELECTRONIC SHIFT REMOVE AND INSTALL OR REPLACE	1	0.2	$	13.98
MT9T517	(blank)	1	0.2	$	13.88
	(blank)	1	0.1	$	13.00
MT6005E3	(blank)	1	0.1	$	9.07
MT6005F39	(blank)	1	0.1	$	8.73
MT6005F11	(blank)	1	0.1	$	8.50
MT6005F14	(blank)	1	0.1	$	8.50
MT6005F6	(blank)	1	0.1	$	8.43
	(blank)	1	0.1	$	7.04
	(blank)	1	0.1	$	7.04
	(blank)	1	0.1	$	7.04
MT6005F10	(blank)	1	0.1	$	6.09
60070	(blank)	1	0.0	$	-
03100B	GLASS-WINDSHIELD RESEAL	1	0.0	$	-
10346AA	ALTERNATOR REMOVE AND INSTALL OR REPLACE	1	0.0	$	-
12650D57	SENSOR ASSEMBLY - CRANKSHAFT TIMING REPLACE	1	0.0	$	-
12650D60	CAMSHAFT POSITION / CYLINDER IDENTIFICATION (CID) REPLACE	1	0.0	$	-
2780A	PARKING BRAKE CONTROL REPLACE	1	0.0	$	-
5241A	GASKETS - EXHAUST SYSTEM REPLACE	1	0.0	$	-
6007B4	(blank)	2	0.0	$	-
6007E	(blank)	1	0.0	$	-
6007ESP1	(blank)	1	0.0	$	-
6700A	SEAL - CRANKSHAFT FRONT REPLACE	1	0.0	$	-
6854AR	(blank)	1	0.0	$	-
7395A	SHIFT CONTROL CABLE REPLACE	3	0.0	$	-
8260ALW	HOSE - RADIATOR REPLACE	2	0.0	$	-
ADD	(blank)	20	0.0	$	-
MT14S411	(blank)	1	0.0	$	-
MT6007B41T	(blank)	1	0.0	$	-
MT63100	(blank)	1	0.0	$	-
MT6584RR	(blank)	1	0.0	$	-
MT6700	(blank)	1	0.0	$	-
MT9350	(blank)	1	0.0	$	-
MT9456AT	(blank)	1	0.0	$	-
MT9F589	(blank)	1	0.0	$	-
MTBALLOON	(blank)	1	0.0	$	-
MTCOVER	(blank)	1	0.0	$	-
MTCUTOFFUTI	(blank)	1	0.0	$	-
MTELECCHECK	(blank)	1	0.0	$	-
MTINCAB	(blank)	1	0.0	$	-
MTRDTEST	(blank)	1	0.0	$	-
MTRUNNINGBO	(blank)	1	0.0	$	-
MTTESTS	(blank)	1	0.0	$	-

P5	CAB - COMPLETE (CAB)	1	0.0	$ -
(blank)	(blank)	1	0.0	$ -

From: Fulton, Brien (B.L.)
Sent: Tuesday, February 15, 2011 9:40 AM
To: Thomas, David (D.B.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Armesto, Carlos (.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Attachments: RE: US defect investigation on 2009-2010 diesel FIP

Based on Ken's note, even though we are isolated form mis-fueling warranty, it is a very expensive issue for the customer and if it happens most likely creates a lot of dis-satisfaction.

RE: US defect investigation on...

About 3 years ago I knew that FoE was developing MFIs for applications, but I didn't know they were in production yet. Like I said in this note below, I was not involved in any discussions here in FNA about using MFIs, so there maybe some very valid reasons they were not used, but I hope that it is something that is being developed or seriously considered for diesel applications here.

David,
What is the approximate cost of the MFI used in the PDE capless system?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: Thomas, David (D.B.)
Sent: Tuesday, February 15, 2011 4:03 AM
To: King, Lamar (L.L.); Fulton, Brien (B.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Thanks Brien,
We too have a larger diameter diesel nozzle for commercial vehicles for the same reasons but these are at separate filling bays which are diesel only

Some of our PDE cars have fuel coolers on the return line to tank to manage fuel temperature , so assume significant flow back to tank

In PDE , our Ford easyfuel capless system has an MFI (MisFuel Inhibitor) which appears to be fairly effective (providing the service stations put the correct diameter nozzles on the hoses .. There have been a couple that haven't) It mechanically senses the OD of the nozzle and either opens or doesn't . It is dependant on nozzle diameter - we had an issue in China where, despite a national standard, gasoline nozzles in Beijing were a different diameter to elsewhere in the country ……..

These have been in service since 2007 - Carsten is a good contact for information on this system . Also see *www.**ford**.co.uk/**Easy_Fuel*** Best ask JL why the US did not adopt this system for B299N & C346N

Look forward to seeing you wearing your 'king of the world' crown. Suggest your first proclamation could be to standardise gas and diesel prices worldwide

Regards David Thomas

From: King, Lamar (L.L.)
Sent: 14 February 2011 18:32
To: Thomas, David (D.B.); Fulton, Brien (B.L.)
Cc: King, Lamar (L.L.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Thank You Brien…

A PASSION FOR "CUSTOMER SATISFACTION" EVER VIGILANT...
Lamar L. King ll Supervisor- SDS Trustmark CECEP & Campaign Prevent Section V8 GAS ENGINE SYSTEMS and Quality, Large Gas and Diesel Engine Engrg. Phone (313) 24-88999 Fax (313) 390-6600 lking1@ford.com Text/Page (313) 795-5332

From: Fulton, Brien (B.L.)
Sent: Monday, February 14, 2011 1:21 PM
To: King, Lamar (L.L.); Billings, Thomas (T.P.)
Cc: Eeley, Scott (A.); Pumford, Ken (K.G.); Armesto, Carlos (.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Yes we see gasoline contaminated diesel fuel. Scott Eeley can give you an idea of how much.

We have the larger ***commercial*** diesel filler pipes, these are the very large ones so that our customers can use the commercial pumps available for Class 8's that really pump fuel out. These filler pipes are even bigger than the diesel pump nozzles that you see at corner gasoline stations. This increases the ability of our customer base to have access to more stations particularly on highways and freeways and pump fuel faster.

There are things that can be done to help make the pump more robust to gasoline, but unless you make it out of unobtainium, it will eventually fail. My guess is that VW probably made control system changes to help keep it running and not stall, possibly also re-circulating more fuel, cars have very little recirculation, much less than even what we have on P473. Based on how much we re-circulate on P473, I don't believe we stall right away and allow the customer to be able to control the vehicle to the side of the road, but it will run like crap when it starts to fail.

There are also filler neck designs to help prevent putting gasoline into a diesel vehicle by putting an inner filler neck in the tube that basically creates an interference to alert the customer to the condition and open a flap to the tank. I think these have been reviewed here, but I was not apart of any of those discussions so I don't know why we do not use that.

BMW offers it as standard on all diesels: http://green.autoblog.com/2009/01/31/new-bmw-diesels-feature-incorrect-fueling-protection-system/

Other products: http://www.powerfuluk.com/products/nissan-navara-navara-d40/mpd002d40-diesel-only---fuel-filler-neck-insert.html

If it were me and I was king of the world, I would look closely at the gasoline fill prevention systems, you can only make the high pressure pump so robust to that condition, but all will eventually fail.

With SCR systems we are also seeing DEF contamination in diesel fuel, this is another issue, but it is happening.

Brien Fulton
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"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

From: King, Lamar (L.L.)
Sent: Monday, February 14, 2011 12:46 PM
To: Fulton, Brien (B.L.); Billings, Thomas (T.P.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Brien/Thomas,
Have we had any issues with gasoline contaminated Diesel Fuel failing HPFP on are Diesel Engines? See VW recall further below…

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Lamar L. King ll Supervisor- SDS Trustmark CECEP & Campaign Prevent Section V8 GAS ENGINE SYSTEMS and Quality, Large Gas and Diesel Engine Engrg. Phone (313) 24-88999 Fax (313) 390-6600 lking1@ford.com Text/Page (313) 795-5332

From: Thomas, David (D.B.)
Sent: Monday, February 14, 2011 9:59 AM
To: Bell, Paul (P.); Hillier, Ben (B.E.); Chen, Jun-Lon (J.L.); King, Lamar (L.L.)
Cc: Ginster, Michael (M.); Born, Caroline (C.)
Subject: US defect investigation on 2009-2010 diesel FIP

All FYI

Lamar : have we been having any similar issues on Ford diesels?

JL : does the US have the same convention as elsewhere , that diesel fillers are larger diameter than gasoline , so it would be easy to fill a diesel car with gasoline by mistake , or does the US design capless system (where fitted) for diesel not open for a gasoline nozzle like the PDE capless design ?

Paul, Ben , I Assume there are a limited number of manufacturers of HP diesel FIPs , so are we using same design/source as VW on Gemini engines ?

I note that despite the misfuelling data supplied VW stated they were improving pump robustness against poor quality fuel - Any idea what these changes were and whether they are on pumps specified for Gemini DV & DW engines ?

****

NHTSA Action Number : EA11003 NHTSA Recall Campaign Number : N/A
Vehicle Make / Model: Model Year(s):
AUDI / A3 2010

VOLKSWAGEN / GOLF 2010

VOLKSWAGEN / JETTA 2009-2010

VOLKSWAGEN / JETTA SPORTWAGEN 2009-2010

Manufacturer : VOLKSWAGEN OF AMERICA, INC
Component(s) :
FUEL SYSTEM, DIESEL

Date Investigation Opened : February 7, 2011
Date Investigation Closed : Open
Summary:
The Office of Defects Investigation (ODI) and Volkswagen (VW) have received a total of 160 complaints and field reports alleging incidents of engine stall and/or loss of power that appear to be related to high pressure fuel pump (HPFP) failures in certain model year (MY) 2009 through 2010 Volkswagen Jetta and MY 2010 Volkswagen Golf and Audi A3 vehicles equipped with TDI clean diesel engines. Approximately half of the reports indicate that the failure resulted in an engine stall incident, with many of these alleging stall incidents at highway speeds in traffic with no restart. There has been one minor crash alleged to have resulted from HPFP failure in the subject vehicles. In response to ODI's information request for PE10-034, VW indicated that it had "found no defect related to motor vehicle safety with relation to the TDI Clean Diesel fuel system at issue in this investigation" and attributed problems with HPFP failure to operation with gasoline contaminated diesel fuel. Volkswagen stated that "even a small amount of gasoline in the diesel fuel may disrupt the necessary lubrication required and may cause the HPFP to fail." In response to concerns that fuel contamination was the major cause of HPFP and related fuel system failures, VW issued a Technical Service Bulletin in May 2010 (VW TB

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Regards David Thomas

From: Pumford, Ken (K.G.)
Sent: Monday, February 14, 2011 9:40 PM
To: Billings, Thomas (T.P.); King, Lamar (L.L.); Fulton, Brien (B.L.); Lusardi, Tony (T.K.); Jones, Keith (K.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

We saw a few gasoline and DEF contamination incidents in warranty in the beginning, but FCSD has been doing a good job of isolating us from cases of fuel contamination getting into the warranty system. From conversations with Tony Lusardi, FCSD working with the dealerships have denied many many more claims than the ones that show up in AWS. Tony can provide more information.

Regards,

Ken Pumford
Engine Design CAD Supervisor
Ford Motor Company
Dearborn, Michigan
Ph. +1.313.805.5741 mobile

From: Billings, Thomas (T.P.)
Sent: Monday, February 14, 2011 9:30 PM
To: King, Lamar (L.L.); Fulton, Brien (B.L.)
Cc: Pumford, Ken (K.G.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

I believe we've seen evidence of gasoline, water, and DEF put in the fuel tank. Ken has more details.

From: King, Lamar (L.L.)
Sent: Monday, February 14, 2011 12:46 PM
To: Fulton, Brien (B.L.); Billings, Thomas (T.P.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Brien/Thomas,
Have we had any issues with gasoline contaminated Diesel Fuel failing HPFP on are Diesel Engines? See VW recall further below…

A PASSION FOR "CUSTOMER SATISFACTION" EVER VIGILANT...
Lamar L. King ll Supervisor- SDS Trustmark CECEP & Campaign Prevent Section V8 GAS ENGINE SYSTEMS and Quality, Large Gas and Diesel Engine Engrg. Phone (313) 24-88999 Fax (313) 390-6600 lking1@ford.com Text/Page (313) 795-5332

From: Thomas, David (D.B.)
Sent: Monday, February 14, 2011 9:59 AM
To: Bell, Paul (P.); Hillier, Ben (B.E.); Chen, Jun-Lon (J.L.); King, Lamar (L.L.)
Cc: Ginster, Michael (M.); Born, Caroline (C.)
Subject: US defect investigation on 2009-2010 diesel FIP

All FYI

Lamar : have we been having any similar issues on Ford diesels?

JL : does the US have the same convention as elsewhere , that diesel fillers are larger diameter than gasoline , so it would be easy to fill a diesel car with gasoline by mistake , or does the US design capless system (where fitted) for diesel not open for a gasoline nozzle like the PDE capless design ?

Paul, Ben , I Assume there are a limited number of manufacturers of HP diesel FIPs , so are we using same design/source as VW on Gemini engines ?

I note that despite the misfuelling data supplied VW stated they were improving pump robustness against poor quality fuel - Any idea what these changes were and whether they are on pumps specified for Gemini DV & DW engines ?

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NHTSA Action Number : EA11003 NHTSA Recall Campaign Number : N/A
Vehicle Make / Model: Model Year(s):
AUDI / A3   2010

VOLKSWAGEN / GOLF   2010

VOLKSWAGEN / JETTA   2009-2010

VOLKSWAGEN / JETTA SPORTWAGEN   2009-2010

Manufacturer : VOLKSWAGEN OF AMERICA, INC
Component(s) :
FUEL SYSTEM, DIESEL

Date Investigation Opened : February 7, 2011
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Regards David Thomas

From: Eeley, Scott (A.)
Sent: Tuesday, February 15, 2011 11:08 AM
To: Fulton, Brien (B.L.); King, Lamar (L.L.); Billings, Thomas (T.P.)
Cc: Pumford, Ken (K.G.); Armesto, Carlos (.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

I do not have a number in my head regarding how frequent we see gasoline related diesel engine warranty claims.

I think that a number of years ago that the filler cap color was changed from black to green matching many pump handle coverings. I do not know if cap color is part of a design rule.

From: Fulton, Brien (B.L.)
Sent: Monday, February 14, 2011 1:21 PM
To: King, Lamar (L.L.); Billings, Thomas (T.P.)
Cc: Eeley, Scott (A.); Pumford, Ken (K.G.); Armesto, Carlos (.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Yes we see gasoline contaminated diesel fuel. Scott Eeley can give you an idea of how much.

We have the larger ***commercial*** diesel filler pipes, these are the very large ones so that our customers can use the commercial pumps available for Class 8's that really pump fuel out. These filler pipes are even bigger than the diesel pump nozzles that you see at corner gasoline stations. This increases the ability of our customer base to have access to more stations particularly on highways and freeways and pump fuel faster.

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There are also filler neck designs to help prevent putting gasoline into a diesel vehicle by putting an inner filler neck in the tube that basically creates an interference to alert the customer to the condition and open a flap to the tank. I think these have been reviewed here, but I was not apart of any of those discussions so I don't know why we do not use that.

BMW offers it as standard on all diesels: http://green.autoblog.com/2009/01/31/new-bmw-diesels-feature-incorrect-fueling-protection-system/

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If it were me and I was king of the world, I would look closely at the gasoline fill prevention systems, you can only make the high pressure pump so robust to that condition, but all will eventually fail.

With SCR systems we are also seeing DEF contamination in diesel fuel, this is another issue, but it is happening.

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com ***Cell:*** (313)-805-9342 ☎ (313)-59-43365

"Vehicle Programs are like a roll of toilet paper, the closer you get to the end the faster they go."

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Sent: Monday, February 14, 2011 12:46 PM
To: Fulton, Brien (B.L.); Billings, Thomas (T.P.)
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Sent: Monday, February 14, 2011 9:59 AM
To: Bell, Paul (P.); Hillier, Ben (B.E.); Chen, Jun-Lon (J.L.); King, Lamar (L.L.)
Cc: Ginster, Michael (M.); Born, Caroline (C.)
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Vehicle Make / Model: Model Year(s):
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VOLKSWAGEN / GOLF 2010

VOLKSWAGEN / JETTA 2009-2010

VOLKSWAGEN / JETTA SPORTWAGEN 2009-2010

Manufacturer : VOLKSWAGEN OF AMERICA, INC
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Regards David Thomas

From: Armesto, Carlos (.)
Sent: Tuesday, February 15, 2011 11:05 AM
To: Fulton, Brien (B.L.); Thomas, David (D.B.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Brien, we were developing the larger capless system for our P473 Diesel and actually built them at M1. The capless design has an inherent misfueling prevention (need to actuate rollers at a certain diameter). The larger capless was cancelled due to cost (variable and tooling). The European products have the smaller diesel capless in production.

Take care,

Carlos Armesto
Ford Motor Company
Core Diesel System Engineer
(313) 805-5789 BLD2 4N29
<<mailto:carmesto@ford.com>>

From: Fulton, Brien (B.L.)
Sent: Tuesday, February 15, 2011 9:40 AM
To: Thomas, David (D.B.); King, Lamar (L.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.); Pumford, Ken (K.G.); Armesto, Carlos (.); Renwick, Rick (R.J.); Krenz, Edwin (E.A.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Based on Ken's note, even though we are isolated form mis-fueling warranty, it is a very expensive issue for the customer and if it happens most likely creates a lot of dis-satisfaction.
<< Message: RE: US defect investigation on 2009-2010 diesel FIP >>
About 3 years ago I knew that FoE was developing MFIs for applications, but I didn't know they were in production yet. Like I said in this note below, I was not involved in any discussions here in FNA about using MFIs, so there maybe some very valid reasons they were not used, but I hope that it is something that is being developed or seriously considered for diesel applications here.

David,
What is the approximate cost of the MFI used in the PDE capless system?

Brien Fulton
Diesel Powertrain Systems Technical Specialist
bfulton1@ford.com *Cell:* (313)-805-9342 ☎ (313)-59-43365

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From: Thomas, David (D.B.)
Sent: Tuesday, February 15, 2011 4:03 AM
To: King, Lamar (L.L.); Fulton, Brien (B.L.)
Cc: Born, Caroline (C.); Willmann, Carsten Jens (C.J.); Chen, Jun-Lon (J.L.)
Subject: RE: US defect investigation on 2009-2010 diesel FIP

Thanks Brien,
We too have a larger diameter diesel nozzle for commercial vehicles for the same reasons but these are at separate filling bays which are diesel only

Some of our PDE cars have fuel coolers on the return line to tank to manage fuel temperature , so assume significant flow back to tank

In PDE , our Ford easyfuel capless system has an MFI (MisFuel Inhibitor) which appears to be fairly effective (providing the service stations put the correct diameter nozzles on the hoses .. There have been a couple that haven't) It mechanically senses the OD of the nozzle and either opens or doesn't . It is dependant on nozzle diameter - we had an issue in China where, despite a national standard, gasoline nozzles in Beijing were a different diameter to elsewhere in the country ……..

These have been in service since 2007 - Carsten is a good contact for information on this system . Also see *www.**ford**.co.uk/**Easy_Fuel*** Best ask JL why the US did not adopt this system for B299N & C346N

Look forward to seeing you wearing your 'king of the world' crown. Suggest your first proclamation could be to standardise gas and diesel prices worldwide

Regards David Thomas

From: King, Lamar (L.L.)
Sent: 14 February 2011 18:32
To: Thomas, David (D.B.); Fulton, Brien (B.L.)
Cc: King, Lamar (L.L.)
Subject: FW: US defect investigation on 2009-2010 diesel FIP

Thank You Brien…

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Regards David Thomas

From: Iskra Dave (DS-PC/SFO-NA) [Dave.Iskra@us.bosch.com]
Sent: Tuesday, April 12, 2011 5:15 PM
To: Fulton, Brien (B.L.)
Cc: Graham Terrence (DS/ENC-NA); Pumford, Ken (K.G.); DiCicco, Dominic (D.M.); Chakravarthy Ramesh (DS/ENC-NA)
Subject: RE: VW

Hi Brien,

I've been able to confirm that the issue is indeed gasoline mixed into the diesel fuel. Unfortunately we don't have further information on the subject since the issue is being handled directly by VW.

Cheers,
Dave

From: Fulton, Brien (B.L.) [mailto:bfulton1@ford.com]
Sent: Thursday, April 07, 2011 1:51 PM
To: Iskra Dave (DS-PC/SFO-NA)
Cc: Graham Terrence (DS/ENC-NA); Pumford, Ken (K.G.); DiCicco, Dominic (D.M.)
Subject: VW

Dave,
In the past month, I have been asked numerous times about a NHTSA investigation into VW Golf and Jetta vehicles. I learned today in a meeting with NHTSA that Bosch supplies the diesel fuel system to those VW vehicles. Is there any information that Bosch can supply us with regarding those investigations in relation to our fuel system on the 6.7L?

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Summary:
The Office of Defects Investigation (ODI) and Volkswagen (VW) have received a total of 160 complaints and field reports alleging incidents of engine stall and/or loss of power that appear to be related to high pressure fuel pump (HPFP) failures in certain model year (MY) 2009 through 2010 Volkswagen Jetta and MY 2010 Volkswagen Golf and Audi A3 vehicles equipped with TDI clean diesel engines. Approximately

half of the reports indicate that the failure resulted in an engine stall incident, with many of these alleging stall incidents at highway speeds in traffic with no restart. There has been one minor crash alleged to have resulted from HPFP failure in the subject vehicles. In response to ODI's information request for PE10-034, VW indicated that it had "found no defect related to motor vehicle safety with relation to the TDI Clean Diesel fuel system at issue in this investigation" and attributed problems with HPFP failure to operation with gasoline contaminated diesel fuel. Volkswagen stated that "even a small amount of gasoline in the diesel fuel may disrupt the necessary lubrication required and may cause the HPFP to fail." In response to concerns that fuel contamination was the major cause of HPFP and related fuel system failures, VW issued a Technical Service Bulletin in May 2010 (VW TB V011011 2023624 and Audi TB A011008 2023360-1), with instructions to inspect the diesel fuel for vehicles requiring fuel system service that have symptoms associated with HPFP failure. The bulletin states that "fuel system damage incurred by use of fuel not complying to ASTM-D-975 Grade 2 S15 (B5 or less biodiesel content) standards will not be covered under warranty." Volkswagen also provided information about 121 mis-fueling incidents reportedly acknowledged by consumers or dealers and test results for about 50 diesel fuel samples taken from complaint vehicles in late-August through early-October 2010. The mis-fueling incidents include about 20 reports involving incorrect fueling by dealer sales or service personnel and generally report symptoms such as rough running, stalling and/or no start within a few miles of refueling the vehicle with gasoline. Volkswagen indicated that the testing of fuel samples from complaint vehicles found that nearly 90 percent contained high amounts of gasoline. Volkswagen implemented design changes for the HPFP in May 2008, September 2009 and November 2010 to improve the robustness of the pump when used with poor quality fuel. ODI analysis of HPFP failures identified from all sources shows failure rates of 0.53% for MY 2009 vehicles and 0.11% for MY 2010 vehicles. This investigation has been upgraded to an Engineering Analysis to continue to investigate the issues with mis-fueling and HPFP design identified during the Preliminary Evaluation.

From: Kromberg, Arnold (A.W.)
Sent: Monday, March 22, 2010 2:51 PM
To: Heggie, Forest (F.)
Subject: RE: Water in diesel fuel P2269

We will know more about the new WIF function when the software implementation becomes available. I've been given no specific direction to avoid e-mail so that's good.

In your warranty investigations can you keep an eye out for water in fuel conditions and reference to engine miss conditions or cylinder balance DTC's P02xx codes?

Regards,

Arnold Kromberg
6.0L/6.4L Diesel Calibration Supervisor
Phone: 313-805-0156
Fax:313-248-1494
e-mail: akromber@ford.com

From: Heggie, Forest (F.)
Sent: Monday, March 22, 2010 2:29 PM
To: Kromberg, Arnold (A.W.)
Subject: RE: Water in diesel fuel P2269

Got it - if WIF light comes on check oil level

Who could I ask about the new calibration for WIF?

Do emails use up potential phone answers?

Thank You muchly

Forest

From: Kromberg, Arnold (A.W.)
Sent: Monday, March 22, 2010 1:54 PM
To: Heggie, Forest (F.)
Subject: RE: Water in diesel fuel P2269

This is likely the most complex WIF detection in the industry. Seems like the intended function is keeping he customer indication off. See comments in red. Hope it helps but may confuse you more…..

Regards,

Arnold Kromberg
6.0L/6.4L Diesel Calibration Supervisor
Phone: 313-805-0156
Fax:313-248-1494
e-mail: akromber@ford.com

From: Heggie, Forest (F.)
Sent: Monday, March 22, 2010 12:51 PM

To: Kromberg, Arnold (A.W.)
Subject: FW: Water in diesel fuel P2269

Well I am not sure who else to ask,

And your voicemail is full so I would appreciate being edumacated in some WIF light information.
I've been directed to not answer the phone for 6.4L. So I let my voice mail fill as well so then I don't have to return calls about it either…..

I just had this email from Jannette Nunn ect forward to me and would like to make sure I understand and ask a few other questions

My main question is is the initial idle check enough to set the WIF light? Or is further rpm changes/driving needed? For example

If a vehicle is used as a PTO only idling
- would it still set a WIF light?

The "stationary" (idle) detection requires many key cycles to enable any sort of detection. It takes something like six consecutive idle conditions (with water to enable the stationary detection.

IF the vehicle WIF light is on, the customer shuts off the vehicle does not drain and restarts
-will the WIF light set after just the idle check?
-or would it still need to be driven to set (how long could this take assuming there are 100mL in the HFCM)

When the key is cycled, the detection has to be set again in the next key cycle. This is true for the vehicle moving detection as well. The driving time varies depending on the speed, starts/stops, etc. Typically anywhere from 10-20 minutes of moving operation.

From reading this information:
There is at least one check of water at idle then other checks while driving? How many measurements of water greater than 60-70mL are needed to set the WIF light? How quickly can enough measurements to set the light occur?
I've seen detection at less than 60ml. For idle see above. For driving it's about 10-20 minutes to get the indicator.

I really appreciate your assistance and hopefully these questions make sense when written out,

Forest Heggie

From: Nunn, Janette (J.M.)
Sent: Monday, May 19, 2008 9:30 AM
To: Eeley, Scott (A.); Stuber, Suzanne (S.)
Cc: Hale, Curt (B.C.); Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Subject: RE: Water in diesel fuel P2269

- What it takes to set a P2269
  - How much water in the Horizontal Fuel Conditioning Module(HFCM)? - 90-100ml, but the light will trigger at about 60-70ml
  - What does the ECM have to see from the water in fuel light (WIF) sensor on the HFCM? light will trigger at about 60-70ml - There are two tests that the ECM looks at, vehicle idling and vehicle running (>18mph). During each condition, there ECM is collecting data. Once enough data is collected in either scenario the ECM calculates a ratio of water / no water. Once this ratio reaches certain thresholds the WIF light is turned on.
- What it takes to turn on the WIF light? light will trigger at about 60-70ml - There are two tests that the ECM looks at, vehicle idling and vehicle running (>18mph). During each condition, there ECM is collecting data. Once enough data is collected in either scenario the ECM calculates a ratio of water / no water. Once this ratio reaches certain thresholds the WIF light is turned on.
  - ECM calibration, can the code be set but no signal to the cluster? - Not that I am aware of. They should also get a message in the message center in addition to the light
  - Signal to the cluster from the ECM?

- Pin#, voltages? - Fuel is typically around 4.6-4.7 Volts and Water is below 3.5V, but again remember that it is the ratio of water to no water is what the ECM is looking at and comparing the ratio to the threshold in order to turn the light on.

- Does the WIF light prove out on key up? - You must allow enough time for the idle tests to run.
- By the time the WIF light comes on from straight water in the fuel, not coolant, is it too late for the High Pressure Pump (HPP) and injectors? - It should not be b/c there is a secondary filter on the engine which also has the ability to prevent water from passing forward.

Suzie - Please comment and clarify.

Regards,
Janette Nunn
Ford Motor Company
PTE-Truck Fuel Systems
Phone: (313) 805 5815

From: Eeley, Scott (A.)
Sent: Wednesday, May 14, 2008 4:27 PM
To: Nunn, Janette (J.M.); Stuber, Suzanne (S.)
Cc: Hale, Curt (B.C.); Pekarscik, Brian (B.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Subject: RE: Water in diesel fuel P2269

Just because I saw you driving around in a Super Duty and water was always in close proximity… I thought you might know a little about this subject…?

From: Pekarscik, Brian (B.)
Sent: Wednesday, May 14, 2008 4:13 PM
To: Eeley, Scott (A.); McDonagh, Scot (S.M.); Kromberg, Arnold (A.W.); Bettendorf, Sherri (S.A.); Chyo, Timothy (T.)
Cc: Hale, Curt (B.C.)
Subject: Water in diesel fuel P2269

All, I am looking for some feedback on some issues listed below on water in diesel fuel:

- What it takes to set a P2269
  - How much water in the Horizontal Fuel Conditioning Module(HFCM)?
  - What does the ECM have to see from the water in fuel light (WIF) sensor on the HFCM?
- What it takes to turn on the WIF light?
  - ECM calibration, can the code be set but no signal to the cluster?
  - Signal to the cluster from the ECM?
    - Pin#, voltages?
- Does the WIF light prove out on key up?
- By the time the WIF light comes on from straight water in the fuel, not coolant, is it too late for the High Pressure Pump (HPP) and injectors?

I ask the questions above due to the fact that one of our FSEs has a unit that has a wiped out fuel system causing a no start and we are seeing more and more water in fuel related concerns. On the vehicle in question the dealer has a mason jar with about a 1/2 inch of water in the bottom and fuel on top but before the dealer drained the HFCM there was no WIF light just a no start and the code. Although there is a code 2269 the customer swears there was no WIF light.

We seem to be seeing more p2269 codes as represented in the monthly chart below.

Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08

					1	1	1			3	3	6	5	16	18	15	12	11

Brian "PK" Pekarscik
Super Duty Powertrain PCE
FoMoCo
PH# 313 317 9334

One Ford, one customer, and each customer is important.

The Bitterness of poor quality remains long after the sweetness of low price!

From:	Eeley, Scott (A.)
Sent:	Friday, September 11, 2009 10:52 AM
To:	Wilson, Dennis (D.D.); Hansen, James (J.B.)
Cc:	Kromberg, Arnold (A.W.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.); Fulton, Brien (B.L.)
Subject:	RE: Water in Fuel concerns

We will make sure it is on the list.

From: Wilson, Dennis (D.D.)
Sent: Friday, September 11, 2009 10:51 AM
To: Eeley, Scott (A.); Hansen, James (J.B.)
Cc: Kromberg, Arnold (A.W.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.)
Subject: RE: Water in Fuel concerns

Scott, do those changes allow for setting the light without the idle requirement?

Regards,

Dennis Wilson
Field Service Engineer
dwilso20@Ford.com
Phone (317) 507-1273
E-FAX (866) 638-4301

From: Eeley, Scott (A.)
Sent: Friday, September 11, 2009 10:47 AM
To: Hansen, James (J.B.)
Cc: Kromberg, Arnold (A.W.); Simpson, Timothy (T.A.); Hawk, Steve (S.D.); Wilson, Dennis (D.D.)
Subject: RE: Water in Fuel concerns

We have drafted some changes to P2269. There are a few other factors… will not set at idle….. We would like a counter….

From: Hansen, James (J.B.)
Sent: Friday, September 11, 2009 10:27 AM
To: Eeley, Scott (A.)
Subject: FW: Water in Fuel concerns

Scott, can you help on this? Dennis Wilson is an FSE from PA. On today's 10:00 conf call, it's brought up again by Brian Beran in CA. thx

---

From: Hansen, James (J.B.)
Sent: Wednesday, September 02, 2009 3:35 PM
To: Kromberg, Arnold (A.W.)
Subject: FW: Water in Fuel concerns

Arnie, can you comment on this FSEs remarks below?

From: Wilson, Dennis (D.D.)
Sent: Wednesday, September 02, 2009 2:40 PM
To: Hansen, James (J.B.)
Cc: Eaton, Robert (F.)
Subject: Water in Fuel concerns

James, I had called into the daily Diesel Conference Call because of numerous concerns with the operation of the water in fuel light and setting of code p2269. As a result of the concerns I raised I was asked by the group to send you a summary of my concerns with the water in fuel light. Below are my comments and concerns.

I've had multiple (about 10) denials of warranty coverage due to water in the fuel (full separator) causing the failure of the high pressure pump. The concern that I have is that some of these customers claim that the WIF light had just come on or never came on when the damage occurred. I read the conditions required to turn on the WIF indicator and set the P2269 and understand how that can occur. If a customer gets a fresh load of fuel contaminated with water and sets out on a trip immediately, the WIF light will never set. We have many customers that are hauling loads long distances so this is more possible than you might expect. I've performed some basic calculations and determined that if a customer has a 40 gallon aft axle tank that has 600 PPM water content in the fuel, which is only 100 PPM over max ASTM spec, the water separator will fill all 100 cc's capacity after consumption of only one tank of fuel. The main problem I have with the requirements to set the light is that water in fuel has to be detected 6 **consecutive** times at **idle** for 30 **continuous** seconds. This is not real world operation of the vehicle. I think we should eliminate the idle requirement. I think I remember that we had false WIF indication on the 6.0 that led to these changes, but the changes are harming our 6.4 customers want and desire to prevent damage from water in fuel on the 6.4 which is far more sensitive to complete fuel system failure.

From the PCED: "The PCM must detect water in fuel during engine idle at least 6 consecutive time to set DTC P2269 and to light the WIF indicator. The PCM monitors the WIF sensor for 30 seconds at idle. Each time the PCM checks for water in fuel it must detect a change in the vehicle speed before it will check for water in fuel again."

Another suggestion is to have the cluster coax (via messages similar to DPF notifications) the customer to stop the vehicle immediately and drain the separator. This is detailed in the owner's manual, but most customers don't read it and generally continue on to their destination causing catastrophic damage to the fuel system. Thanks!

Regards,

Dennis Wilson
Field Service Engineer
dwilso20@Ford.com
Phone (317) 507-1273
E-FAX (866) 638-4301

From: Krock, Matthew R (Matt) [Matt.Krock@Navistar.com]
Sent: Wednesday, November 24, 2010 10:52 AM
To: Heggie, Forest (F.)
Subject: RE: WIF draft communication document
Attachments: water in fuel communciation draft 11-23 Point form format.doc

Forest,

I've made some changes to the document and added my notes on the side. Hopefully you're familiar with "tracking changes". I did it so you can see what I changed. In order to accept/reject a change, just right click it.

I'd be happy to give you another set of eyes on this whenever you make more changes.

Have a happy Thanksgiving!

Matt

From: Heggie, Forest (F.) [mailto:fheggie@ford.com]
Sent: Tuesday, November 23, 2010 8:51 AM
To: Krock, Matthew R (Matt)
Subject: WIF draft communication document

I would appreciate any more feedback you have, as i am having trouble with this document - it seems too wordy but I can not seem to cut much out

<<water in fuel communciation draft 11-23 Point form format.doc>>

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

How To Take Care of your 6.4L Fuel System so It takes care of you.

Your high pressure fuel system uses diesel fuel for lubricity and cooling and is designed to use only Ultra Low Sulfur Diesel fuel containing no more than 5% biodiesel. Other types of fuels and excessive water can cause the pump to fail due to lack of lubricity/cooling or aggressive chemical attack to fuel system materials.

Where does water come from and What does it do to the high pressure fuel system?

- Water and impurities can enter your tank with the fuel.
- Water does not burn, water carries oxygen and is Corrosive and it freezes.
- Water does not have the lubricant properties of diesel fuel and will corrode the high pressure fuel pump.
- Water also acts as a host to bacterial formation.

How can you prevent excessive amounts of water?

Your horizontal fuel condition module (HFCM) removes water and impurities from the fuel before it enters the high pressure pump.

- The HFCM must be drained once a month or when the water in fuel light illuminates.
- Fuel filters must be changed by the recommended service interval. If your filters are not changed regularly it can:
    - decrease the water separation ability
    - cause the filters to become plugged or collapsed
    - allow water/impurities to the fuel system or starve fuel flow to the high pressure fuel system which can ultimately cause high pressure pump failure.
- Your vehicle is equipped with two fuel filters; one is mounted on top of the engine while the other is inside the HFCM.
- When draining your water separator wait at least 10 minutes after shutting off the vehicle for the pressure to equalize in order for the water to drain.
-

It's easier and much cheaper to replace the filters than replace the high pressure fuel system. If the water is not drained and the HFCM container is filled it has no where else to go but to the high pressure pump.

What happens if water gets into the high pressure fuel system?

Should excessive water enter the fuel system, corrosion and damage are not far behind. In many case, the entire high pressure fuel system will have to be replaced.

Excessive water in the fuel led to this corrosion in the High Pressure Fuel Pump Internal Transfer Pump and on the Fuel Volume Control Valve.

Deleted: ,

Deleted: of

Deleted: at the site where the water molecule interfaces with a fuel molecule

Deleted: do we get rid of water?

Deleted: is there to remove

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Deleted: For your HFCM to remove the water from the fuel your

Deleted: need to

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Deleted: causing high pressure pump failure due to low lubrication.

Deleted: do not have the engine running and

Comment [MK1]: If you're looking to eliminate text, this is one that may not be necessary.

Deleted: <#> When draining the HFCM you should get approximately 750 ml of liquid (fuel and water) If No fluid (fuel or water) drain from your HFCM take it to the dealer for inspection.¶
Separate the water from the fuel.

Deleted: when

Comment [MK2]: Already covered this.

Deleted: <#>Water does not have the lubricant properties of diesel fuel and will corrode the pump.

Deleted: <#>¶

Deleted: If the water is not drained or if the filters are not changed or if fuel additives with water dispersants or emulsifier are used your fuel system will eventually look like this.

Deleted: And

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Deleted: from water in fuel.¶

 

This corrosion in the High Pressure Fuel Pump internal transfer Pump and Secondary Fuel Filter Housing developed from excessive water in fuel

What about fuel additives?

Many aftermarket fuel additives are not acceptable for use in Power Stroke Diesel engines.

- Additives or alcohol/gasohol or other chemicals that cause water to disperse/emulsify or not be separated from the diesel fuel will damage your fuel system. Alcohol also decreases the lubricity of the fuel which can cause damage to the high pressure fuel pump. Do not use alcohol based additives to correct fuel gelling.
- The purpose of the filters is to be able to remove the water, but if chemicals are holding the water in the fuel it can not be separated.
- Dispersing/emuslfying the water carries the water through the fuel filters and water seperators and right into your fuel system, exactly where you do not want it to be.

If you want to use fuel additives, only use Motorcraft additives as they are the only recommended additives and meet Ford specifications.

Ford approved additives that will improve fuel cetane numbers may be used to verify/enhance fuel quality. Use Motorcraft Cetane Booster & Performance Improver, PM-22-A (U.S.) / PM-22-B (Canada) or equivalent. The customer warranty may be void from using additives that do not meet Ford specifications.

BIODIESEL

For any vehicle purchased before the 2011 model year, only a 5% biofuel concentration may be used. Vehicles in the 2011 model year and newer accept up to a 20% concentration. Higher than recommended concentrations can cause fuel filter restrictions that may result in a lack of power and or damage to components such as fuel tank, fuel lines, fuel pump, fuel sender and fuel injectors fuel pump and fuel injector failures.

- Biodiesel should not be stored in the fuel tank for more than three months.
- Excessive Bio-diesel, poor bio-diesel fuel can cause bacterial/fungas growth, increased water content , aggressive chemical attack of fuel system material, premature fuel filter plugging and fuel starvation due to cold gelling.

Comment [MK3]: This may confuse people who are using Motorcraft Cetane/Anti gel.

Deleted: It should not be necessary to add any aftermarket additives to your fuel tank if you use diesel fuel that meets the ASTM D 975 industry specification.

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Deleted: it tries to carry the water through the filters and water separators.

Deleted: If you want to use a fuel additive use only recommended fuel additives meeting Ford specifications, Motorcraft parts are designed to meet Ford specifications.

Comment [MK4]: This has already been covered and is redundant.

Deleted: Alcohol and other fuels do not provide enough lubricant for the high pressure fuel pump and water will cause rust and corrosion to form in your high pressure fuel system this will cause the high pressure fuel system to fail and ultimately the whole system will need to be replace.

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 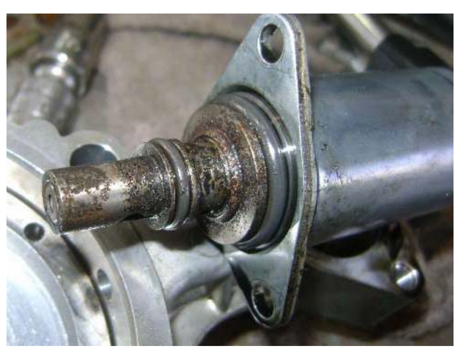

Corrosive fungus, algae and bacterial growth in secondary fuel filter housing and high pressure pump volume control valve.

What about other fuels besides Diesel or biodiesl 5%?

The high pressure fuel system uses diesel fuel for lubricity and cooling, poor quality biofuels can cause the pump to fail due to lack of lubricity/cooling aggressive chemical attack of fuel system materials.

- The tank pick up boot can distort from non approved fuel, and cause air ingestion.
- Do not use raw or refined vegetable oil, animal fat, cooking oil or recycled greases.
- Do not use home heating oil, agricultural fuel or any diesel fuel not intended for highway use.
- Damage to the fuel injection system, engine and exhaust catalyst can occur if an improper fuel is used.
- Do not add gasoline, gasohol or alcohol to diesel fuel. This practice creates a serious fire hazard and engine performance problems and lubricity for the high pressure fuel pump. Do not blend used engine oil with diesel fuel under any circumstances.
    - Blending used oil with the fuel will significantly increase your vehicle's exhaust emissions and reduce engine life due to increased internal wear. The customer warranty may be void from using fuels that do not meet or exceed Ford specifications.

Running out of Fuel

Do not run your diesel vehicle out of fuel as this will allow air to enter the fuel system which will make restarting difficult. The engine is designed to run roughly as the fuel tank nears Empty. This is a warning to the driver to add fuel as soon as possible. Longer engine cranking time may be required once air is in the fuel system. If air enters the fuel system (either through running the fuel tank(s) empty or during a fuel filter change), the engine will self-purge the trapped air once it starts running.

Deleted: Corrosion

Deleted: and

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From: Heggie, Forest (F.)
Sent: Thursday, March 03, 2011 7:49 AM
To: Curtis, Andrew (A.); Dobbs, Dan (K.D.)
Cc: Heggie, Forest (F.)
Subject: RE: WIF job aid revision 4

The one line is not quite correct:

Water in fuel may cause rust and corrosion to form within the fuel systems due to lack of lubrication and corrosion protection.

1. water causes rust/corrosion
2. water does not have the same lubrication quality as diesel
3. water does not have the same cooling effect as diesel

Fails' due to all of the above which one first is hard to tell but they are all part of the same failure chain.
it can fail due to lack of lubricity and then water sits and corrodes in pump
it can be a smaller amount of water corrosion forms and pump proceeds to jettison from corrosion and debris

- Corrosion does not form due to lack of lubrication
- Corrosion does not form due to lack of corrosion protection

Suggestion:

The high pressure pump is lubricated and cooled by fuel. Water in fuel can cause rust and corrosion to form within the fuel system causing the fuel system to fail. Water in fuel can cause the high pressure fuel system to fail due to lack of lubrication and/or cooling.

Forest Heggie
BaSc. MaSc. P.Eng
Certified Six Sigma Black Belt
OPD Diesel
313-618-5054

From: Curtis, Andrew (A.)
Sent: Wednesday, March 02, 2011 1:03 PM
To: Dobbs, Dan (K.D.); Heggie, Forest (F.); Eeley, Scott (A.)
Subject: WIF job aid revision 4

<< File: Water In Fuel4.doc >> Changes are in red

Andrew Curtis
6.0L-6.4L CCE
Ford Technical Hotline - DSC 1
Cube # 257 Phone (313) 390-2132
ACURTI24@Ford.com

From:	Eeley, Scott (A.)
To:	Mondragon, David (J.D.); Mull, Ted (V.)
Subject:	RE: Fuel Analysis in Mexico
Date:	Thursday, January 28, 2010 4:50:06 PM

David,

Dimer acid can be used in fuel additives as a lubricant. Dimer is one of ~4 additives used as a fuel lubricant.

It seems that the reactive additives are a concern only when they come in contact with noncompatible fluids - such as coolant or oil. Coolant and oil can have additives which might react with the fuel additives - accelerated by temperature we think.

Scott

From: Mondragon, David (J.D.)
Sent: Thursday, January 28, 2010 4:41 PM
To: Eeley, Scott (A.)
Subject: RE: Fuel Analysis in Mexico

Scott, question, in first article attached from Ted, is mentioned an dimer-acid fuel, so do you know what is it? and what dimer means?

Thanks for your help.

Wishing you a HAPPY day!
Jose David Mondragon Avelar
Powertrain & Chassis PD Quality Supervisor
Product Development Mexico
Phone at Sta. Fe (011-5255) 1103 – 3246
Ford net 943 - 3246
e mail: jmondrag@ford.com

From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 6:24 AM
To: Mondragon, David (J.D.); Villareal, Carlos (CV.)
Subject: FW: Fuel Analysis in Mexico

FYI

From: Eeley, Scott (A.)
Sent: Friday, December 11, 2009 7:22 AM
To: Mull, Ted (V.); Simpson, Timothy (T.A.); Villalobos, Luisa (L.); Chyo, Timothy (T.)
Cc: Bastida, Graciela (G.); Del Barrio, Jose (J.L.); Alvarez, Roberto (R.)
Subject: RE: Fuel Analysis in Mexico

THANKS!

Luisa and Tim C. - Please let me know how we might best approach PEMEX regarding the articles sent to us from Ted.

Scott

From: Mull, Ted (V.)
Sent: Thursday, December 10, 2009 2:26 PM
To: Eeley, Scott (A.); Simpson, Timothy (T.A.)
Subject: RE: Fuel Analysis in Mexico

Just for Scott and a bit dated,
http://findarticles.com/p/articles/mi_m0CYH/is_21_7/ai_110573403/?tag=rel.res1

Another old article but a quick read,
http://findarticles.com/p/articles/mi_m0CYH/is_25_6/ai_96058335/

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Kowalski, George (G.S.)
Sent: Thursday, December 10, 2009 10:51 AM
To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

Ted,

After refining carboxylic acid salts are used for pipeline corrosion inhibitors. You are probably picking up the salts from the fuel distribution system.

George Kowalski
Engine Non-Metals Materials Engineering
Materials Engineering, Testing & Standards (MET&S)
(313) 805-4830 FAX (313) 31-74691
MD 1105, Bldg 1, Cube 12A035

From: Mull, Ted (V.)

Sent: Thursday, December 10, 2009 10:29 AM
To: Raney-Pablo, Beth (H.E.); 'Wang, Jerry C'; Trombat, Dana (D.C.); Bellile, David (D.E.); Misangyi, Pete (P.W.); Richardson, Charles (C.E.)

Cc: Kowalski, George (G.S.); Eeley, Scott (A.)
Subject: RE: Fuel Analysis in Mexico

Hello All, Regarding the high pressure pump failures on 6.4L diesel engines in Mexico: Our current thinking is the carboxylic acid salts (see Central Lab report) are part of the refining process, a catalyst, that has not been completely removed from the fuel before shipping to the fuel distribution network. Due to the unique engine cycling in Mexico (high key off + heat soak cycles => higher fuel system temperatures) the acid salts precipitate out of the fuel at a higher rate than other markets. These acid salts are caught in the vehicle filtration system and prematurely block the filters and are contributing to the high pressure pump failures. There are other contributors, like fuel lubricity, but the salts are also a factor.

My first question is, does this chain of events make since or are we missing something regarding the source and chemistry of the salts?

Second question, is there an ASTM or other standard test to check for and measure for the "salts" in a raw fuel sample?

Next question (for Jerry), are you aware of resources in Mexico that can provide fuel testing? Our current thinking is to request density, viscosity, HFRR scar, sulfur, and for "salts" to help manage the needed fuel sample size and test costs.

Thoughts and comments from all are appreciated, Thanks,

<< Message: FW: Completed Central Lab Report - 91859 >>

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Raney-Pablo, Beth (H.E.)
Sent: Wednesday, December 02, 2009 4:26 PM
To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

As discussed on the phone, here is a list of recommended analyses:

1. Density (ASTM D 4052)
2. Viscosity (ASTM D 445)
3. Lubricity, HFRR wear scar (ASTM D 6079)
4. Ash content (ASTM D482)
5. Particulate content (ASTM D 2276)
6. Sulfur content (optional, as Mexico sulfur content would be expected to vary up to 500 ppm, but I don't see higher values in the survey data)

Here are 2 possible contacts who may be able to recommend a test lab.

1. Graciela Bastida from the Ford Quality Office (gbastida).
2. ALVI Contact: Andrea Artusa; aartusa@alvi.com.mx, Phone : 55-50937023

Regards,

Beth Raney-Pablo

Ford Motor Company
Fuels and Lubricants Engineering
TEE Bldg, 2000 Enterprise Drive (Cube 1AD53)
Phone: (313) 805-6129
Fax: (313) 323-8354
E-mail address: hraney@ford.com

From: Mull, Ted (V.)
Sent: Wednesday, December 02, 2009 11:33 AM
To: Raney-Pablo, Beth (H.E.)
Subject: RE: Fuel Analysis in Mexico

That's ok, the holiday season is upon us. FoM would cover the cost. Fuel lubricity is a prime suspect along with high temperature due to their drive cycle (lots of restarts with heat soaks) and vehicle configuration (manual trans = high rpm). So density, viscosity, and HFRR seem to be a minimum but I wanted your input if say a distillation fraction would be valuable information to help understand why the high pressure pumps are failing.

Luisa (FoM) provided one contact and I wanted your input before calling them.

<< Message: Laboratory contact >>

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Raney-Pablo, Beth (H.E.)
Sent: Wednesday, December 02, 2009 11:11 AM
To: Mull, Ted (V.)
Subject: RE: Fuel Analysis in Mexico

Sorry for the delayed response, I just returned to the office yesterday after being out was out of the office all last week, and am still wading through all of the emails.

The short answer is I am not aware of any fuel testing facilities in Mexico. My colleague Chuck Richardson has also been trying to get some fuel samples analyzed and may have found a possible lab through a contact in the Ford of Mexico Quality Office. He is getting the contact information so I can pass it on.

I have not had a chance to review your list below, but will do so. Knowing the analyses cost can add up quickly, who will be paying for this analysis?

From: Mull, Ted (V.)
Sent: Wednesday, December 02, 2009 11:02 AM
To: Raney-Pablo, Beth (H.E.)
Subject: RE: Fuel Analysis in Mexico

Beth, I never saw a response. Can you recommend a fuel testing facility in Mexico? What should we be requesting?

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

From: Mull, Ted (V.)
Sent: Monday, November 23, 2009 12:33 PM
To: Raney-Pablo, Beth (H.E.)
Cc: Villalobos, Luisa (L.); Bastida, Graciela (G.)
Subject: Fuel Analysis in Mexico

Beth, to efficiently support fuel system concerns in the Mexico market, we'd like to identify suitable facilities who can analyze the fuel locally. Are you aware of facilities in Mexico that can perform fuel analyses and perhaps provide a contact? Also, what should we be asking for and what sample size of fuel should we be collecting? My short list:

Parameter	Test Method	Requirement
Cetane		
Density at 15 C, kg/m^3		
Viscosity cSt at 40 C	ASTM D 445, SOP CH017_02	1.3 - 4.1 cSt at 40C
Moisture Content, % wt	ASTM D 6304, SOP CH039_02	< 0.01
Sulfur Content, mg/kg	ASTM D 5185, SOP CH034_01	500 for Mexico?
HRFF Wear Scare, microns	ASTM D 6079	
Distillation Fraction		

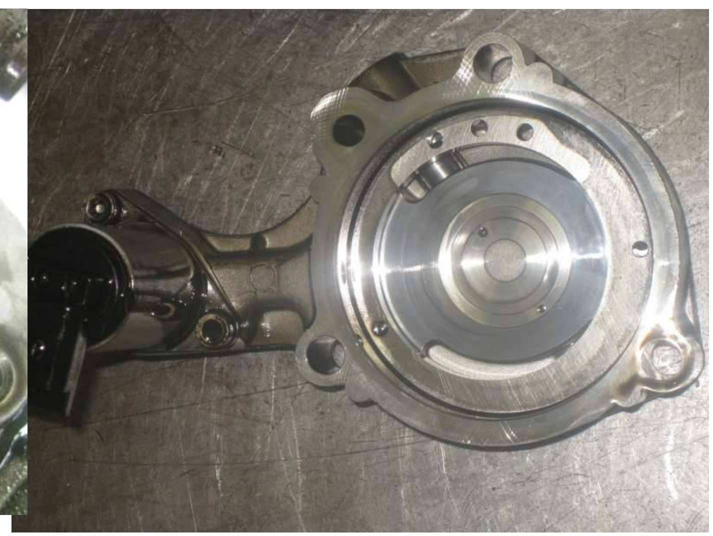
Any information you can provide will be helpful, thanks,

Ted V. Mull, Jr.
Diesel Engine Systems
Ford Motor Co.
Phone: (313) 805-9310
<mailto:tmull@ford.com>

No Rust in Housing No rust on pump or VCV – debris in system
(ED10289 : 74136 miles)

Cetane Index (MIN 40)	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 10000	>6UM LIMIT (5000	>14UM LIMIT(320	biodiesel	PREICTIVE OVERAL
48.55	81	39.6	neg	neg	na	6975	2480	315	1% OR LESS	NORMAL

WARRANTABLE

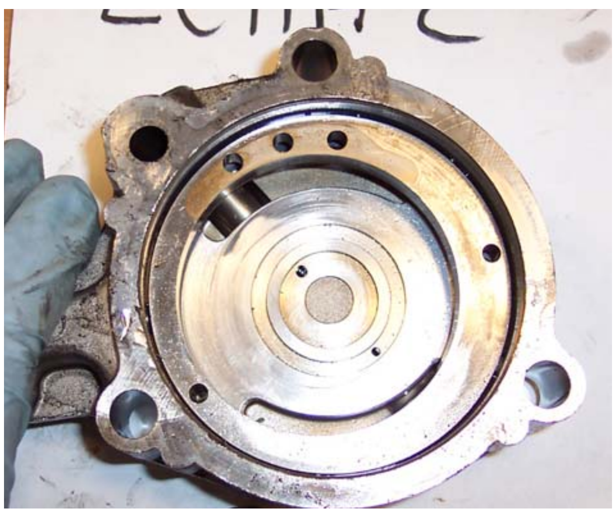


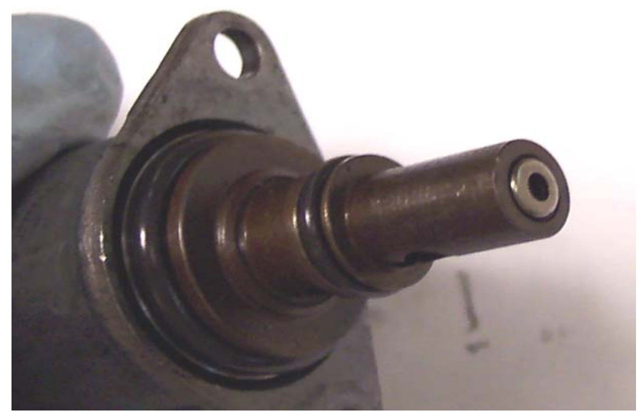
Rust on Housing, Inj, Pump, VCV

(EC11142 : 44773 miles)

Cetane Index (MIN 40	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 1000	>6UM LIMIT (5000	>14UM LIMIT(320	biodiesel	PREICTIVE OVERAL	COMMENTS
46.48	93	35.5	neg	neg	0.18	17430	6582	825	1% OR LESS	MILD CAUTION	ICLE COU NTS ARE

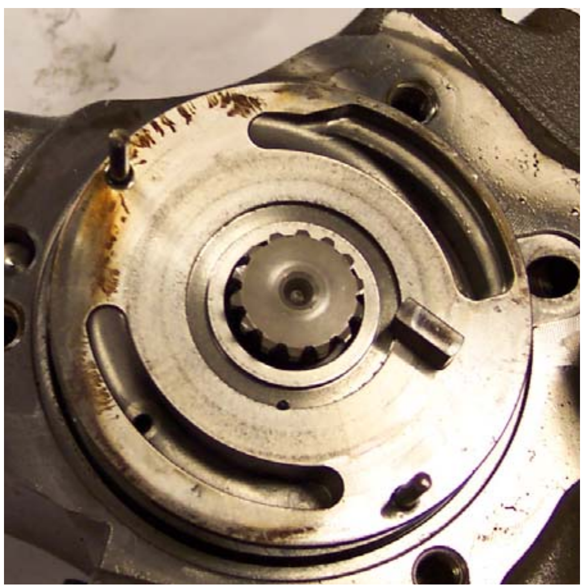
NOT WARRANTABLE

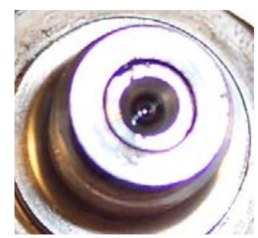




Rust on Housing: No Rust on Inj, Rust on HP and VCV (EC52768, 75095 miles)

Cetane Index (MIN 40)	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 1000(	>6UM LIMIT (5000	>14UM LIMIT (320	biodiesel	PREICTIVE OVERAL
51.53	70	39.5	HEA VY	neg	0.01	3862	1167	104	none	SEVERE

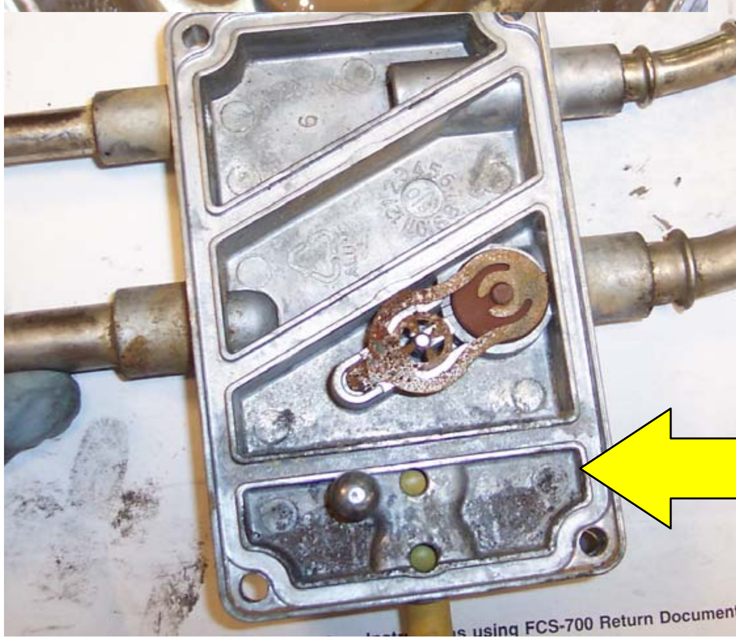




NOT WARRANTABLE

P2269 –rust inj and VCV 1066 ppm water, slight bacteria and fungus, acid number 0.06 (EB 40414: 69159)

Cetane Index (MIN 40	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 1000(	>6UM LIMIT (5000	>14UM LIMIT(320	biodiesel	PREICTIVE OVERAL
48	1066	36.6	SLIG HT	SLIG HT	0.06	2059	1121	191	1% OR LESS	MILD CAUTION



Water rust line in HFCM

NOT WARRANTABLE

Originally reported no rust in housing pictures illustrate rust/corrosion in small quantity

Rust in housing assessment at Dealer (EB16628:39191 miles)

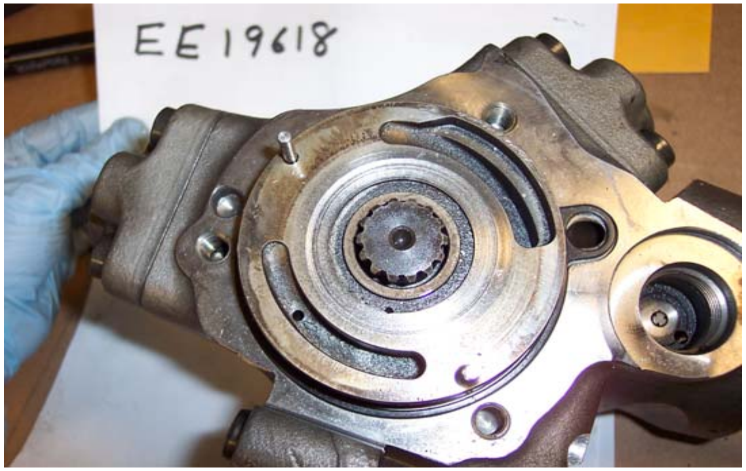
Cetane Index (MIN 40)	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 1000(	>6UM LIMIT (5000	>14UM LIMIT(320	biodiesel	PREICTIVE OVERAL
45.19	2013	34.8	HEAVY	MODERATE	0.06	8698	4736	806	1% OR LESS	SEVERE

NOT WARRANTABLE

Tank had rust

(4- had rust only 1 black inj) (EE19618 :12664 miles)

Cetane Index (MIN 40)	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 10000	>6UM LIMIT (5000)	>14UM LIMIT(320)	biodiesel	PREICTIVE OVERALL
45.86	126	36.57	neg	neg	0.1	28860	6708	733	1% OR LESS	MILD CAUTION



NOT PUMP CAUSAL

Blackend Inj (4 cases out of 42)

(EA60042 5919 miles) (ED44165 : 46676)
(EE 19618 : 12664 miles) (EB40414 : 69159 mileS)

Cetane Index (MIN 40	Water (MAX 500 PPM)	API Gravity	Bacteria	Fungas	Acid Number (TAN max in biodiesel =0.8)	>4 UM LIMIT - 10000	>6UM LIMIT (5000	>14UM LIMIT(320	biodiesel	PREICTIVE OVERAL
48.23	1074	36.5	neg	neg	0.07	158	86	15	1% OR LESS	MILD CAUTION

NOT WARRANTABLE

ON 09/24/2009 TRUCK CAME IN WITH WATER IN FUEL LIGHT ON HAD TO DRAIN AND CLEAN,TANK,LINES AND REPLACED FUEL FILTERS BECAUSE FUEL HAD WATER IN IT DUE TO BROKE FUEL FILLER CAP REPLACED TWO FUEL INJECTORS THEN BUT WHEN THE CAP GOT REPLACED THIS RESOLVED WATER INTRUSION CONCERN
DILUTED FUEL CLOUDY BUT NO WATER SEPERATION UPON REVIEWING THE SERVICE HISTORY OF THIS VEHICLE BE AWARE THE VEHICLE, **LESS THAN 500 MILES AGO, RECIEVED A COMPLETE HIGH PRESSURE** FUEL SYSTEM REPLACEMENT. THE FUEL LOOKED CLOUDY THEN. DURING THAT REPAIR, A SAMPLE WAS SENT OUT FOR TESTING AND CAME BACK NORMAL. **WHATEVER FUEL IS IN THIS TRUCK DOES NOT LOOK LIKE NORMAL DIESEL FUEL**. I WOULD LIKE TO SPEAK WITH SOMEONE ABOUT THIS TRUCK BEFORE A REPAIR IS

From: Bittner, Martin [martin.bittner@siemens.com]
Sent: Friday, April 20, 2007 8:00 AM
To: Lawther, Robin (R.)
Cc: Cluff, Jason; Klesse, Christoph; Aust, Martin; Barth, Reinhard
Subject: Use of F63 & F34 fuels with Siemens FIE
Attachments: Why_not_to_use_Jet_Fuels_in_CR-Systems.pdf

Hello Robin,

please find subsequently some information on this topic as well as a presentation which should help to understand the SV position.

F34 is a military classification (Nato-Code) for Jet Fuel. It is also called JP8. It is equivalent with the civil Jet A1 with additional additives. The most important parameters are listed in the ASTM standard D 1655.

Jet Fuels differ in al lot of properties from diesel fuel (see also attached slides).

The most challenging issue with Jet Fuels in our injection system is the lubricity in combination with the viscosity.
The viscosity is extremely low. This could lead to difficulties -especially in the pump - when high inlet temperatures are used.
The lubricity (HFRR-value) is not defined at all. Measurements show a HFRR value of about 700 µm (for comparison: diesel fuel in Europe is limited to max. 460 µm).
--> The result is increased wear and bad durability.

I hope this is helpful for you!
Regards
Martin

Best regards / Mit freundlichen Grüssen
Martin Bittner

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From: Lawther, Robin (R.) [mailto:rlawther@ford.com]
Sent: Friday, April 20, 2007 11:25 AM
To: Bittner, Martin

Subject: Use of F63 & F34 fuels with Siemens FIE

Hello Martin,
Please can we discuss this. I propose to audio in collegues from U.S. and would like to understand the implications to the FIE.

This will be programme intent, I want to understand the Siemens position first.

Thanks

Regards

Robin Lawther
System Engineer - Diesel Fuel Injection Equipment
Ford Motor Company Ltd
[Dunton -738-] +44 1268 40-1162

SIEMENS VDO

Why not to use Jet Fuels and Kerosene in Diesel Common Rail Systems

April 2007

SIEMENS VDO

Why not to use Jet Fuels and Kerosene in Diesel Common Rail Systems

Introduction

The components of Diesel Common Rail Systems are fuel lubricated. Extremely high fuel pressure and precise fuel injection quantity demand for a high quality diesel fuel.

Diesel fuels for the Siemens VDO PCR-System have to meet several requirements (e.g. lubricity, viscosity) to ensure the durability, the performance and to meet the emission targets.

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Why not to use Jet Fuels and Kerosene in Diesel Common Rail Systems

Comparison of Jet Fuel and Kerosene with diesel fuel

The following table shows the huge differences of Jet Fuels and Kerosene in comparison to diesel fuel.

Parameter	**Diesel Fuel acc. to D 975**	**Jet Fuel acc. to D 1655**	**Kerosene acc. to D 3699**	**Diesel Fuel acc. to EN 590**
Lubricity (HFRR)	Max. 520 µm	**Not defined** Measurements: 734 – 1000 µm	**Not defined**	**Max. 460 µm**
Viscosity @ 40°C	1,9 – 4,1 mm²/s	**Not defined @ 40°C** Measurement: 1,08 mm²/s	1,0 – 1,9 mm²/s	2,00 – 4,5 mm²/s
Density @ 15 °C	Not defined Measurements: 824 – 872 kg/m³	775 – 840 kg/m³	**Not defined**	**820 – 845 kg/m³**
Cetane Number	Min. 40	**Not defined** Measurements: 36 - 42	**Not defined**	**Min. 51**
Boiling Range	210 – 400 °C	150 – 300°C	150 – 300°C	220 – 390 °C
Sulfur content	Max. 15 ppm	3000 ppm	1-K: 400 ppm 2-K: 3000 ppm	Max. 50 ppm

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Why not to use Jet Fuels and Kerosene in Diesel Common Rail Systems

Effects of bad fuel parameters

- Lubrication properties are not defined in the standards. Nevertheless it is known that the lubrication of jet fuels is very bad.

⇨Increase in abrasion and breakdowns (typical values: HFRR > 700 µm)

- Lower viscosity creates a decrease of hydrodynamic lubrication of the injection components, which leads to increased wear and breakdowns.
- The Cetane number and the behavior at low temperatures influence each other. Low Cetane numbers lead to uncontrolled ignitions and therefore to very bad emission values and a bad characteristic of the engine at the usual calibration.
- Lower density of jet fuels creates lower calorific value. Lower calorific value results in a loss of efficiency of the engine.

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Why not to use Jet Fuels and Kerosene in Diesel Common Rail Systems

Summary

- Several important parameters are not defined in the standards of kerosene and jet fuels. Measurements show that these values are **not acceptable for modern DFIE**, especially for fuel lubricated components.
- "Lighter" fuels such as Kerosene and Jet A do not lubricate enough. Kerosene (K1) is made for space heaters and lamps. It is not taxed and it would be illegal to use in vehicles.
- The use of jet fuel or kerosene would reduce the durability of the PCR-System drastically (pump failures).
- Emission targets could not be reached if jet fuels or kerosene are used instead of diesel fuels.
- The use of kerosene and jet fuels would cause a loss of engine power.

⇨ NO RELEASE OF JET FUELS AND KEROSENE WITH USUAL COMPONENT DESIGN !!!

From: Eastman, David (D.L.)
Sent: Tuesday, October 19, 2004 4:19 PM
To: Fulton, Brien (B.L.)
Subject: Wif paper

Attachments: water in fuel.doc

Any comments on this before I send to Mike? Bosch has promised some pictures but don't know when I'll see them. Mike wanted this week so don't know if I can wait.

water in fuel.doc

Dave Eastman
Diesel Fuel Injection Systems
Rotunda Court 2, cube P49
deastman@ford.com
phone: 313 24-88870

WATER IN DIESEL FUEL – EFFECTS ON FUEL INJECTION EQUIPMENT

Effects of Water on FIE Components

- Corrosion on close tolerance steel injector and pump components, causing accelerated wear and potentially plugging of nozzle spray holes
- Water displaces surface fuel film used to lubricate sliding injector and pump components, causing accelerated wear
- In extreme cases water can collect in the nozzle sac and spray holes, cracking the nozzle tip if it freezes

Sources of Water in Diesel Fuel

- Water can be carried in a fuel supply either separated (fuel rises to the surface) or emulsified in the fuel (some natural content)
- Water is commonly condensed out on partially filled diesel tank inner surfaces during temperature changes, and the water settles to the bottom of the tank
- Diesel fuel has hygroscopic properties; that is, it can absorb water vapor directly from air

U.S. vs. European Diesel Fuel Handling

- U.S. diesel fuel standards (ASTM D975) allow up to 500-ppm water content in the fuel; European specifications (EN590) allow 200-ppm max.
- More variation in U.S. consumer fuel sources and fuel quality – high volume truck stops vs. low volume neighborhood gas stations equipped w/ diesel, use of off-road diesel fuel by some customers etc.