VEHICLE FACTORS GROUP CHAIRMAN'S
FACTUAL REPORT

Vehicle Attachment 2 - 2005 Ford – Engine Visual Inspection Report from Navistar, Inc.

Oxnard, CA

HWY15MH006

(15 pages)

Visual Inspection

6.0L DIT ESN 6367159
Engine build date 8/12/04 @ Indianapolis

Summary: Ford F-450 (VIN 1FDXF46P55E[redacted], build date 8/18/04) was involved in a train crash in Oxnard, CA on 2/24/15. Vehicle was powered by a Navistar built 6.0L DIT V8 engine. Engine was disassembled and reviewed to assist the NTSB led investigation.

Conclusion: There was no conclusive evidence that the engine was running at the time of the initial impact. There were also no mechanical failures evident that would prevent the engine from running.

Location:	**3620 E Florence Ave, Huntington Park, CA 90255**
Date & time:	**Tuesday March 3rd. 9:30am – 3:30pm**
Participants:	**Patrick Nolan (Navistar), Kirk Fulk (Navistar), Steve Prouty (NTSB), Officer Brown (Oxnard Police Dept.), support by technicians from Fred Boerner Motors**

Control Modules

Injector drive module (IDM) was inspected and the connectors appeared to be intact. The module was not interrogated due to lack of connection equipment. The vehicle powertrain control module (PCM) was visually inspected. There was significant connector damage and the housing appeared to be punctured from the impact. The air bag control module was not part of the review.

Turbochargers

The turbo was not attached to the engine on arrival. Earlier pictures indicated it was still attached after the initial impact. Turbo p/n & s/n are shown in figure 1 in appendix – turbo serial number is the same as original build. Turbo was in good condition. Compressor and turbine wheels were still attached to the shaft and spun freely. Oil was present in the center housing oil cavity.

Oil Pan

The lower oil pan was separated from engine during the impact. It was severely damaged. There were no indications of any anomalies that would have been present prior to the impact. Only small fragments of the upper oil pan were available for the review.

Fuel filter

The fuel filter assembly was intact. The fuel filter lid was removed. Fuel filter appeared to be in good condition with no signs of debris or restriction. Normal fuel level was present in fuel filter bowl. A fuel sample was taken. An additional sample of fuel was taken from the injector fuel rail in the passenger side cylinder head. Presence of fuel in the rail indicates fuel was available to injectors at the time of impact.

Valve Cover

Passenger side valve cover was removed first. Picture of emissions label is in figure 2 in appendix. MY 2005 engine start of production was 6/30/2004.

High Pressure Oil System

Both high pressure oil rails were in good condition and filled with oil. An oil sample was taken from the passenger side rail. Case to head tubes and seals were removed and inspected – seals appeared normal and intact. Check valves were present and intact. ICP sensor (injection control pressure) was present and showed no signs of oil leaks.

High Pressure Pump & Branch Tube

A schematic of the high pressure oil system is included in figure 3 in the appendix. IPR (injection pressure regulator) valve was removed from pump. The end screen was intact and in good condition. O-rings were intact and in good condition – see figure 4. Snap to connect fitting at pump was connected and in good external condition. Fitting was disconnected and reviewed - sealing surfaces were in good condition. O-rings between snap to connect fitting and branch tube were intact and showed no evidence of leakage. High pressure oil pump was removed and inspected. Pump gear was undamaged and pump turned freely. Mating crank gear showed no evidence of damage and teeth were in good condition. Oil supply cavity to high pressure pump was unobstructed. Oil reservoir in front valley of engine was full and screen was intact.

Oil Filter Module

The oil filter cap & oil filter were not present at the time of inspection. They do not appear attached to the engine from crash scene photos either. The oil cooler was removed from the engine. Coolant and oil were present and a coolant sample was taken. There were no abnormalities noted.

Intake Manifold

Intake manifold assembly was removed from the engine. There were no obstructions noted.

EGR Cooler

EGR cooler was reviewed for evidence of coolant leaks – none were found. Inlet and outlet were dry with no signs of obstructions or failures. EGR cooler was an aftermarket unit.

EGR Valve

EGR valve was present and showed normal levels of soot buildup.

Injectors
Injectors were in good external condition with wires and connectors in good condition. Injector tips were intact and in normal condition.

Valvetrain
All rocker arms were intact and appeared functional. Pivot balls, retainer clips and fulcrum plates were all intact and functional. All valve bridges were intact with typical levels of wear. Push rods were inspected for flatness and all were acceptable with minimal signs of wear. Roller follower support trays were removed with no signs of distress or roller misalignment. Roller followers were removed and showed no signs of roller bearing wear or loss of hydraulic adjustment capability.

Sensors
Cam shaft position sensor was removed and inspected. There were no signs of failure – connector and housing were intact. Trigger pin was present on camshaft and aligned with sensor. Crank position sensor was not present but the plastic housing for the sensor tip was present in the sensor bore and also the mounting tab for the sensor was present under the head of the mounting bolt. There was considerable crash damage in the area of the mounting location of the sensor. The crankshaft timing disk was rigidly attached to the crankshaft and had no evidence of teeth damage or warping.

Wiring Harness
The injector wiring harness was removed and inspected. All connectors appeared to be in good condition with no signs of damage. The engine sensor harness was also removed. Portions of the harness showed lacerations and damage consistent with the vehicle impact. Connections for most engine sensors were intact and functional with the exception being the crank position sensor which was missing.

Exhaust system
Passenger side exhaust manifold was cracked and showed signs of a large impact with broken bolts at cylinder 1 & 3 – see appendix figure 5 for cylinder naming convention. Driver side exhaust manifold was intact. Exhaust tubes were inspected and had no evidence of any obstruction prior to the impact damage. Up pipe assembly showed evidence of wire braiding failure over the bellows but no evidence of bellows cracking and no loss of function.

Vibration damper
Damper was intact and securely attached to the crankshaft. There was no evidence of rubber damage.

Oil Pump
Oil pump cover was removed. Engine had a service front crank seal installed. Oil pump was in good condition with no evidence of scoring or wear on side faces or mating surfaces and no evidence of debris or wear between the mating gerotor parts. Crankshaft drive surface was in good condition with a typical wear pattern and no evidence of binding.

Front Cover and Water pump

The fan hub, fan drive and pulley were not attached to the engine. The parts were inspected prior to engine disassembly. Fan hub turned freely. Fan drive and mounting bolts were separated with signs of impact. Water pump impellor was not present. Front cover assembly was removed and inspected. There were no signs of significant impellor rubbing or cavitation that would cause loss of water pump functionality. There were no signs of blocked coolant or oil passages in the front cover.

Rear Cover

The torque converter was still attached to the engine. It was bent relative to the crank axis and a mounting nut was embedded in the rear cover which had prevented the ability to manually crank the engine over. Torque converter was removed. Engine flexplate was bent similar to the converter axis. Flexplate mounting bolts were intact. Rear crank seal was intact with no evidence of oil leaks. Rear crank flange was removed. There was no evidence of crank gear tooth damage.

Cylinder Head Assemblies

Cylinder head, rocker carrier and exhaust manifolds were removed as an assembly. Cylinder head bolts were all tight and in good condition. Head gaskets were reviewed and showed no signs of combustion, oil or coolant leaks. All intake and exhaust valves were present and in good condition with minimal carbon buildup. Combustion surfaces appeared normal with minimal discoloration. Injector tips and glow plug tips were intact.

Connecting Rods

Connecting rod caps were removed and bearings inspected. Upper and lower rod bearings were in very good condition – there were no indications of excessive wear, no ‘copper’ was visible, minimal signs of debris scratches – see figure 7 for typical example. Rods all appeared straight with no signs of bending or twisting.

Piston Assemblies

All pistons were in good condition with minimal carbon build up. Piston p/ns were still visible on piston top surfaces. There was no evidence of bowl edge erosion or melting. All piston rings were free to turn and showed normal wear with no signs of scuffing. Piston pins were free floating. There were signs of oil coking on the underside of the piston.

Crankshaft

The bedplate was removed and the main bearings were inspected. All were in good condition with minimal signs of wear – no ‘copper’ was visible and minimal debris scratches. The thrust bearing was present. There were signs of scratching or wear on the crankshaft journals. The timing disk was securely attached to the crankshaft and showed no signs of tooth damage.

Camshaft

Cam shaft was removed from the block and reviewed. All lobes and journals appeared to be in good condition with typical wear patterns. By the time of the camshaft removal, there were impact marks on the cam gear. The cam gear had been used to turn the engine over and also used to support the engine during the teardown process. Gear damage was most likely caused during disassembly as there were no indications of damage to the mating gears, nor was any damage noted during a brief visual inspection of the gear teeth earlier in the teardown process.

Cylinder Block

Cylinder block was in good condition. Cylinder bore wear was typical for an aged engine – cross hatch hone pattern was visible in all bores except at the top ring turnaround area – which is typical. See figure 6 for a typical example. There was no evidence of any bore scratches or scuffing. All piston cooling tubes were intact and undamaged. Bedplate bolts were tight and intact.

Appendix

Figure 1 – turbo p/n and s/n

Figure 2 - valve cover and emission label

Figure 3 – High Pressure Oil Schematic

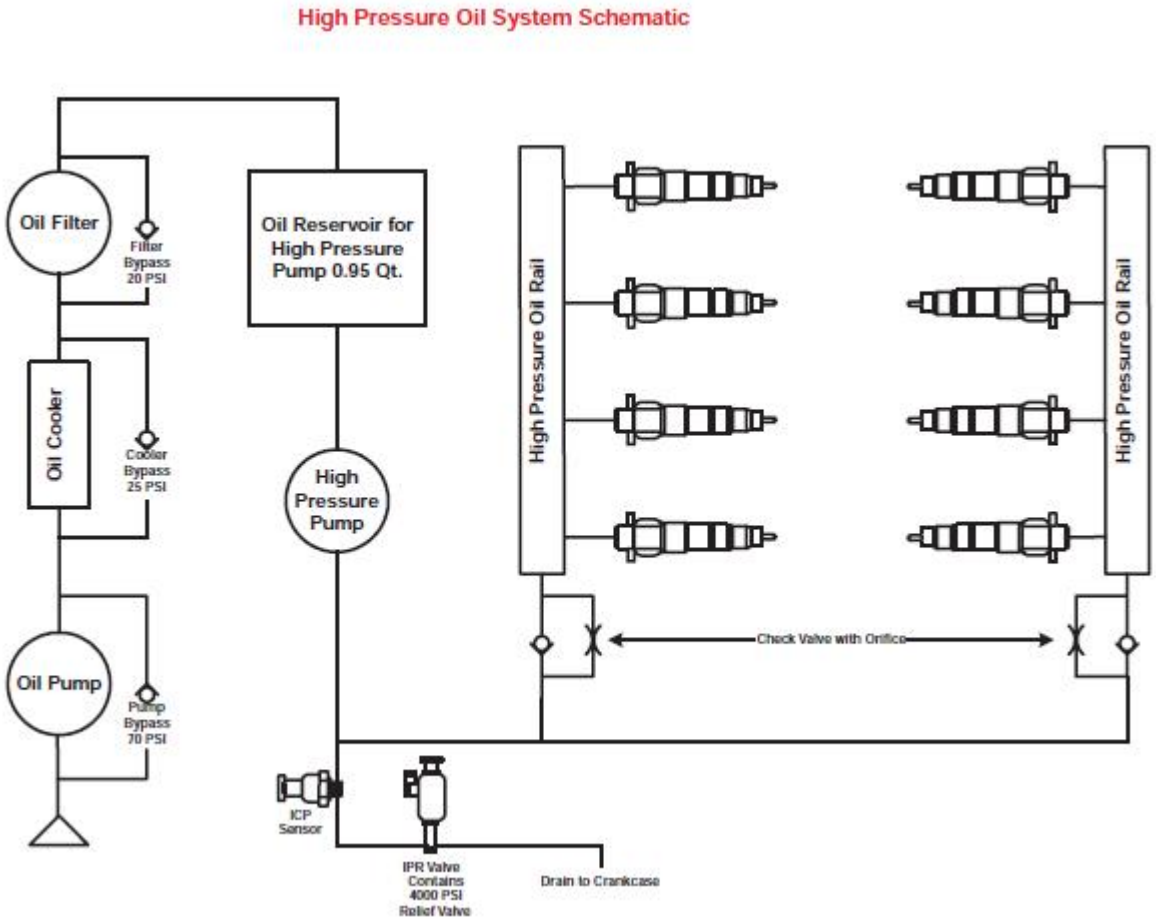

Figure 4 – IPR Valve

Figure 5 – Cylinder naming convention

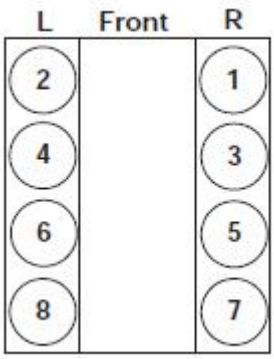

Figure 6 – Example of cylinder bore

Figure 7 – Typical rod bearing

Figure 8 – As received engine