HEAD BOLTS VS STUDS: WHICH ARE BEST?

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WHAT FAILS AND WHY?

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FORD POWER STROKE 6.0L

Part 1: What Fails and Why

BY JOHN STEWART
PHOTOGRAPHY: JOHN STEWART AND COURTESY OF BANKS POWER

Normally, it's pretty difficult to kill a diesel engine. But there are folks who seem to get that job done via too much nitrous, copious amounts of fuel leading to nuclear EGT meltdown, or even a turbo failure that spits metal shards into the engine. As a general rule, diesels go down because of lubricant failure. Something gets into the oil, the oil breaks down, heat builds up, and mechanical failures soon follow.

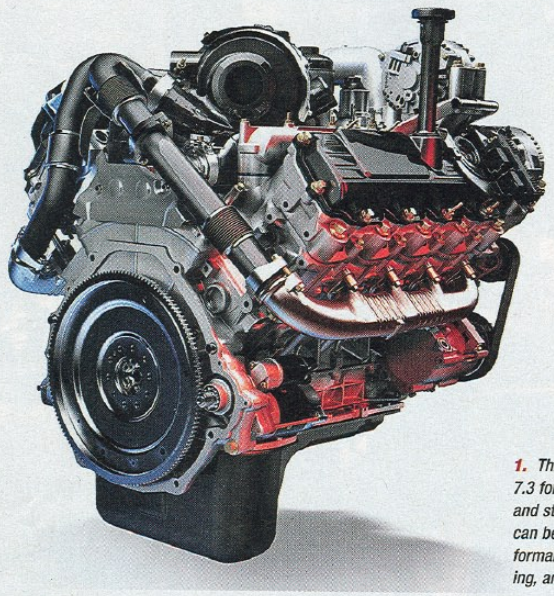
Speaking specifically of the Ford/Navistar 6.0L Power Stroke V-8, the usual blame falls on the head gasket, which leaks and allows coolant and oil to mix, thereby creating lubricant failure and the subsequent cascade of mechanical mayhem. But the gasket doesn't fail by itself. The bolts holding it down would have to fail first, and there would have to be a reason why. One reason for head bolts to blow would be water in the fuel, which creates steam that stretches the bolts.

Another way for a diesel to die quickly is contamination of the air supply with sand or dust, which would get into the cylinders, get past the rings and into the oil, and eventually, take out bearings and mating surfaces everywhere. A third cause—fuel dilution of the lubricant—is often due to failure of seals in the injectors. We mention this only to remind readers that filters—those simple devices responsible for keeping oil clean and water out of the fuel—are what keep an engine alive. When filters get plugged or allow contaminants to pass through, lubrication fails and the entire engine is at risk. Then again, it's always possible that the cause of failure is due to simple wear, abuse or design weakness.

It's no secret that 6.0L Ford/Navistar Power Stroke engines have been notable for warranty issues. These included EGR valve sticking due to carbon deposits, which can be remedied by installing a new-design stainless EGR cooler. There are not many mechanics who like to work on the 6.0, but we found one—Wayne Dugas of Dugas Engine Service in New Iberia, La., who does a fair amount of 6.0L rebuilds for local Ford dealerships. He told us the EGR cooler was a recurring issue. "The EGR cooler, a lot of times, leaks, puts water in the cylinders, creates a hydraulic effect, which blows the head gasket," Dugas noted.

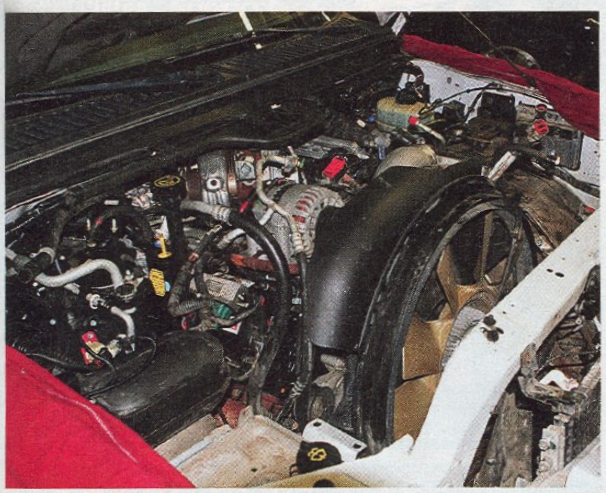
Head gasket failure became a common cause of repair. "Especially on the 6.0L, there was a design flaw—not enough head bolts. The head bolts pass through an aluminum carrier and cast-iron head, and you just don't get the clamping force," Dugas noted. This can be addressed by replacing the torque-to-limit head bolts with head studs that offer better clamping power.

Regardless of the cause, once a breakdown occurs, the choice is to rebuild or to replace. In the case of the '03 Ford F-



1. This is what the Ford/Navistar 6.0L V-8 looks like in pristine condition. The 6.0 replaced the 7.3 for the 2003 model year, was used in thousands of Super Duty Pickups from 2003 to 2007, and still appears in Ford Econoline vans today. There are many still in use. Properly built, the 6.0 can be a clean, strong-running diesel with good reliability characteristics. In our upcoming performance rebuild, we'll investigate the weak points, look for fixes, improve breathing and cooling, and install better parts where they are available.

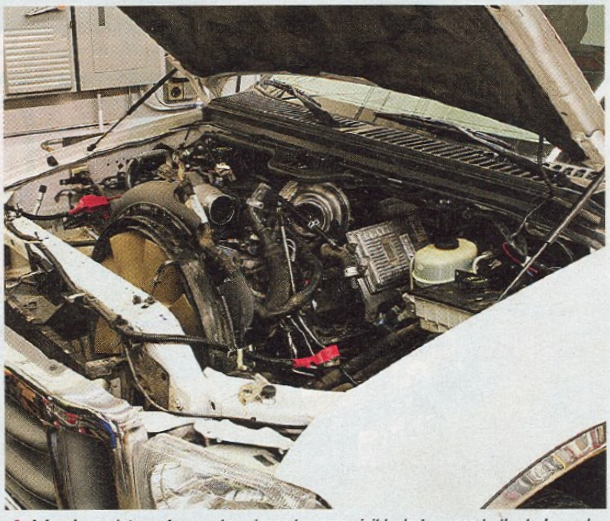
2. *This is our project truck, an '03 F-350 4x4 dually. The rig didn't have a whole lot of miles, but judging by the mud under the body, it had seen some hard use. Once in the Banks workshop, the first challenge was just to get at the engine.*



3. *It doesn't take long to realize the Ford engine compartment is remarkably crowded. Most of the engine is actually under the dash. Components are layered on top so thickly, it's practically impossible to get at the engine.*

350 you see here, the owner chose to rebuild and upgrade in the process. He brought the truck, which had obvious engine issues, to Banks Performance in Azusa, Calif., to assess and recondition.

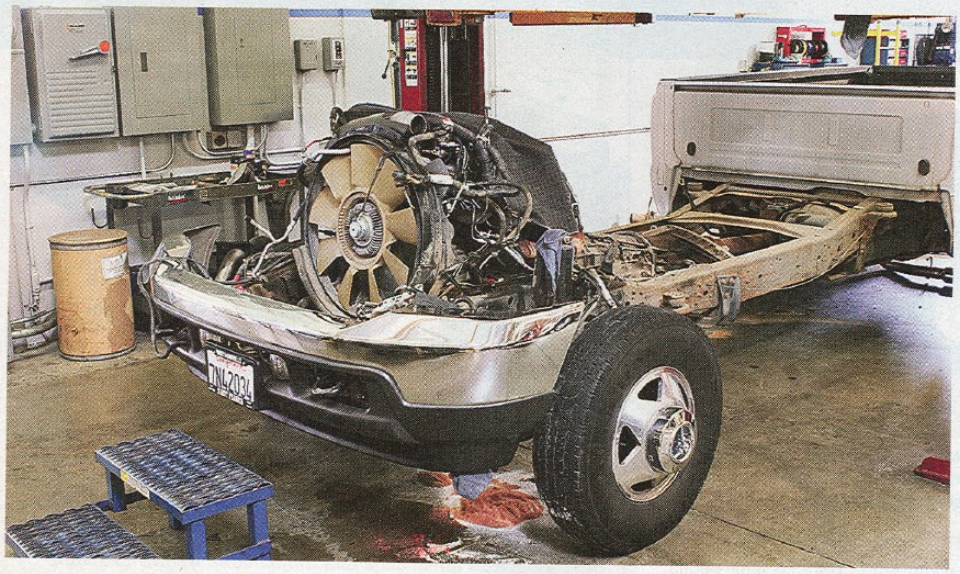
One area of the sprawling Banks Campus includes a shop and retail area, in which customers can bring their trucks for upgrades. The company calls it the Banks Powerhouse. It's a roomy facility in which vehicles of all kinds—diesel pickups, Jeeps, and other 4x4s—can receive professional consultation and installation. The crew at the Banks Powerhouse set up a repair and upgrade program intended to make the F-350 run stronger, cooler, faster and more reliably, without compromising existing emissions provisions.



4. *A few hours later, a few engine pieces become visible, but access to the turbo and heads is still a long way off. Ultimately, it became obvious that the body would best be lifted from the chassis to get at the engine. While we're told that it is actually possible to do top-end work on the 6.0 with the body in place, it requires special tools and burns a lot of time.*

5. *To get the cab off the frame involved undoing six rusty body mount bolts, unplugging every connector in sight, and undoing the front brake lines, the throttle cable, ABS plugs, emergency brake cable; removing the exhaust system, oil/transmission cooler lines, fuel lines, steering shaft from the steering box…whew…. evacuating the R134 coolant from the A/C system and removing the lines, draining the cooling system and removing the radiator, intercooler and fan shroud…whew…then gingerly moving the body upward slightly to find out what was still attached. Which might include the antilock controller and any of half a dozen plugs that connect the cab to the engine or transmission. The process took an experienced mechanic, working in a highly organized professional environment with power tools and a lift, the better part of a full day.*

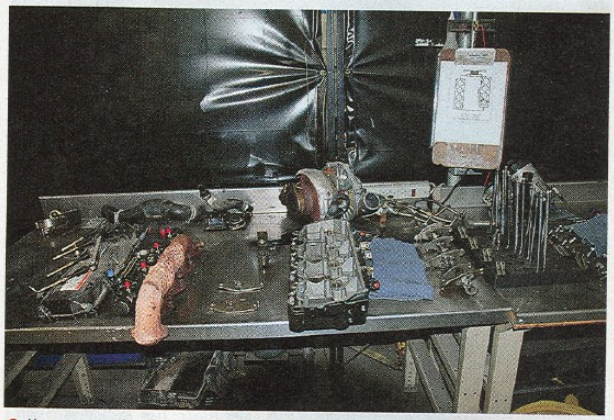
This month, we take a look at what was done to assess the engine at hand, part by part. We'll find out what failed and what didn't, and consider opportunities for upgrades. In subsequent installments, we'll show how those upgrades will be achieved, and finally, we will document the results.



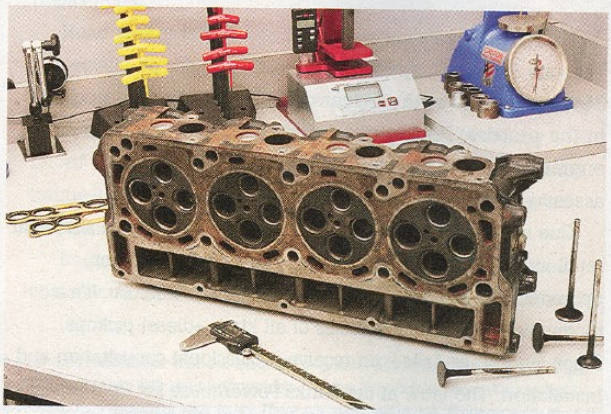
6. With the body separated from the frame, work could begin getting the huge engine fan and EGR pieces off the engine.

7. Not to put too fine a point on it, but engines these days have just slightly less wiring than the space shuttle. This is the kind of spaghetti you'll be dealing with when you finally get to the engine. Budget another eight hours to remate engine to cab once the rebuild is done.

8. However, now that everything is cleared away, engine disassembly can progress at a rapid pace.



9. Here we see the disassembled engine parts. The heads were taken to the clean room at Banks Performance for inspection. Injectors and turbo will be sent out for evaluation.



10. The heads on the 6.0 are cast iron; these were a little bit corroded, but they had not warped significantly or cracked.

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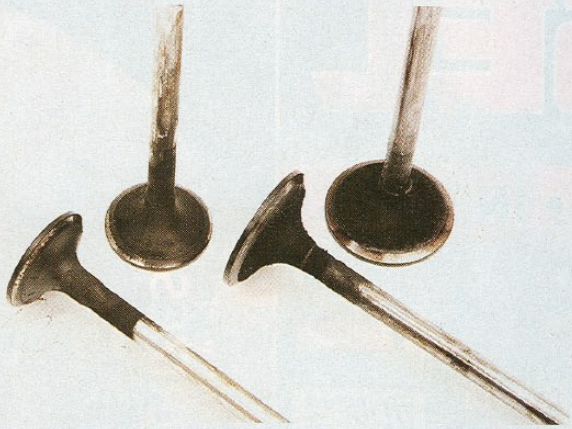
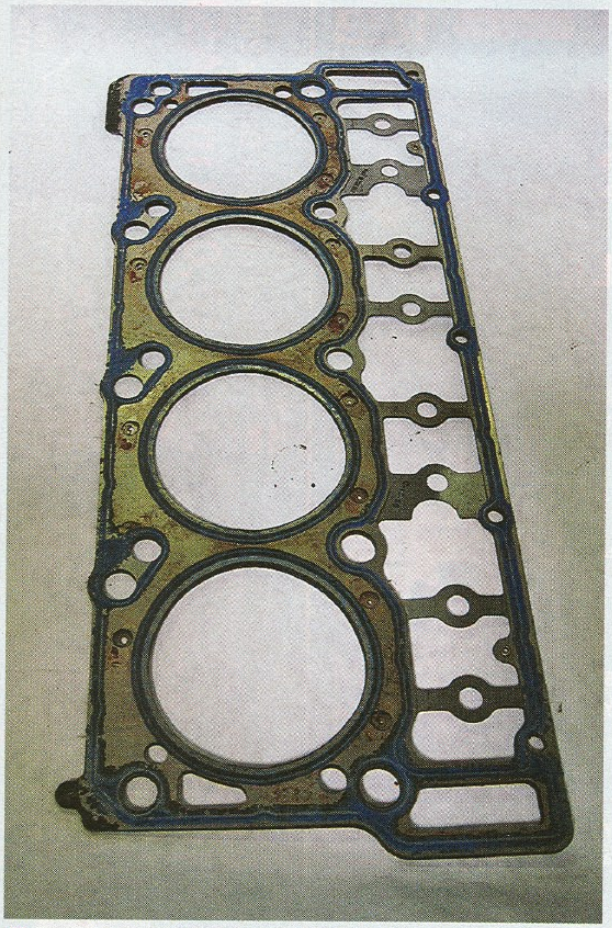


11. The valves had a fair amount of soot built up, but were in otherwise good condition.



12. The head gasket was actually in relatively good condition, and clearly not a factor in the engine's failure.

13. There was one portion of the head gasket that had begun to show progress toward leaking, but this gasket never actually gave way.

14. The EGR mechanism on early 6.0L engines was a source of a multitude of problems. A Ford service bulletin noted carbon deposits on the EGR valve could lead to turbo vane sticking, plug the MAP sensor hose, and even allow moisture to attack other problems. EGR cooler leaks were so common on early engines that a new EGR cooler was designed, and mechanics were advised to replace the old units with the newly designed part upon rebuild. One mechanic told us that the leaking EGR units caused more head gasket failures than the supposedly inadequate head bolts. In this case, the EGR tube was indeed sooty, but there was no evidence it had created any problems.

15. A close look at the rocker arms showed some corrosion and slight galling.

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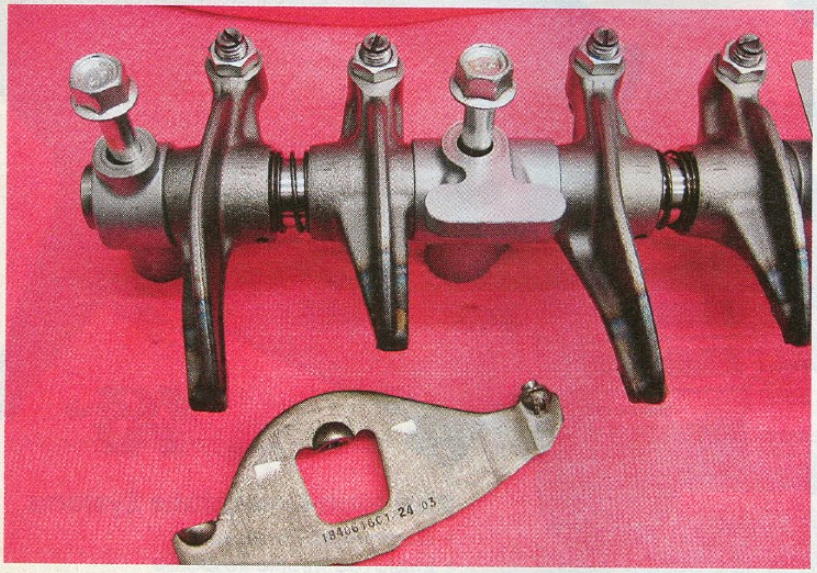
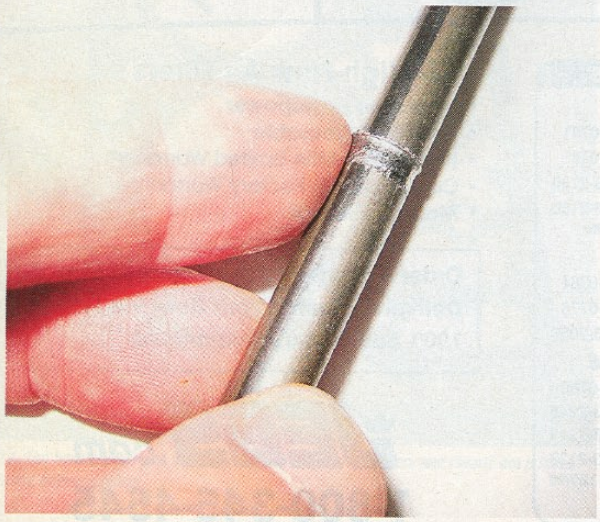
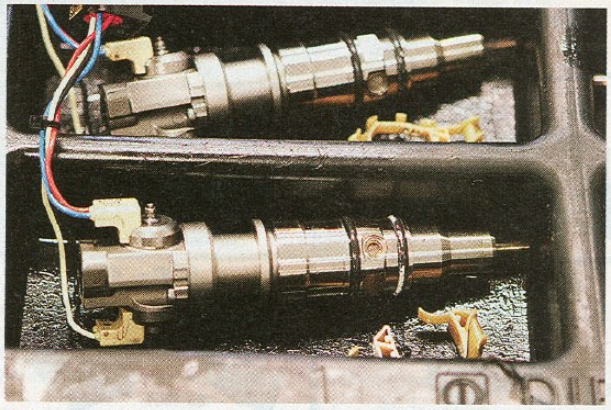


16. *From a design point of view, the Ford/Navistar 6.0 Rockers are not tremendously impressive pieces. Here one of the 6.0 rockers is compared to the rocker set from a Duramax, which have more material and a stronger design.*

17. *Sure enough, the culprit in this particular engine was a rocker that snapped in half. Upon rebuild, all will be replaced with new Ford parts, as no high-performance rockers are available yet for the 6.0.*



18. *The pushrods were all unbent and without undue wear, so they can be reused. The one exception was a rod that had a ring gouged around the circumference, possibly at the time the rocker arm failed. It will be replaced with a new pushrod.*



19. *Our injectors looked reasonably good, with no unusual patterns of soot or burning that might indicate blow-by from failed O-rings or seals. All eight were sent out to an injector specialist for testing. The turbocharger, likewise, appeared to be in good condition, but it was sent to a turbo specialist for examination and possible reconditioning. We'll have word on both components in our next installment, along with porting and rebuilding the heads.*

SOURCES:

GALE BANKS ENGINEERING
546 Duggan Ave.
Azusa, CA 91702
(800) 601-8072
www.bankspower.com

DUGAS ENGINE SERVICE
1748 Delasalle Dr.
New Iberia, LA 70560
(337) 365-1140