

FORD POWERSTROKE DIAGNOSTICS 1994-2003

This guide is not a substitute for the proper diagnostic manuals and a scan tool. It is intended to be used with the proper tools to help diagnose and solve drivability issues.

PERFORMANCE BOXES

Performance boxes that tap into or connect into the vehicle wiring should be removed to make certain that they are not causing any of the following complaints. Also chips, including downloaded ones like Superchips, can cause false MAP readings on the scan tool. They will cause the actual EBP and MAP to go higher due to more fuel delivery

OIL LEVEL

Low or dirty oil can cause intermittent low power, miss, rough run, no start etc. Make sure the oil level is correct and the oil is in good condition (less than 3000 miles before trying to cure any other drivability or starting issues).

DIAGNOSTIC CODES

Most Powerstroke that we see, with starting or performance issues don't set codes, if you have DTC codes, proceed to the DTC code section first. If you don't have a scan tool, the diagnostics, other than visual examination or parts changing, is difficult at best.

NO START

1. DTC P0340 Bad CMP Sensor
2. Are you getting smoke while cranking (after about 10 seconds) if no smoke then no fuel is getting into the combustion chamber.
3. Low oil level
4. Fuel supply pressure low; Plugged fuel filter or no fuel in tank, minimum 20 PSI cranking, and 99-03 should be 50 PSI cranking
5. Refer to Hard Start or No Start Issues below

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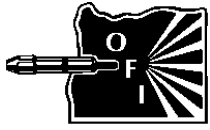


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NO START OR HARD START COLD

1. Check to make sure that 10.8 or more volts are going the glow plugs from the relay. The glow plugs don't cycle until EOT (engine oil temp.) is below specification, which varies by vehicle year. The engine should start without the glow plugs energized down to about 40 degrees. Look at the volt gauge in the dash, the glow plugs will cycle up to 120 seconds depending on EOT
2. Refer to No Start or Hard Start Issues below
3. Bad wire harness connections at the valve cover gaskets, internal or external connections. Examine the connections, do pin tension tests also smell for burnt wires.
4. Injectors bad; Injectors with high miles (200,000 miles or more) can fail to operate cold. If correct PW displays on cranking you can remove the valve cover and watch the oil spill discharge, every injector should discharge oil when pulsed by the IDM during cranking. If no pulse of oil then the injector isn't activating and putting fuel into the cylinders. Running several buzz tests cold will sometimes free up the injectors. This is a typical high miles problem particularly with inadequate oil change intervals.

NO START OR HARD START HOT

1. Refer to other hard start or no start issues below
2. IPR (Injection Pressure Regulator) bad, will cause low ICP
3. IPR o-rings bad, will cause low ICP
4. Injector o-rings bad, will cause low ICP. Should also show up as black fuel (from oil in fuel) in fuel filter canister.
5. High pressure oil pump bad, will show up as low ICP
6. Engine oil worn out or too thin
7. Cranking speed too slow, should be 180 rpm minimum when warm

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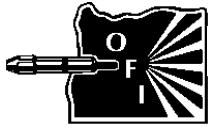


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OTHER NO START OR HARD START ISSUES

When trying to diagnose hard start or no start issues a scan tool is needed to check and monitor the ICP (Injection Control Pressure), RPM (From the CMP) Vehicle Voltage during cranking and PW (Pulse Width) signal.

1. RPM, minimum 100 rpm cranking speed (When warm it should be over 180 rpm)
2. ICP, minimum required for starting 500 PSI if no rpm signal, ICP won't go over 400 PSI
3. Voltage during cranking 7-10 volts minimum depending on year
4. Pulse Width; 0 ms means no sync, 1994-1997 .42 ms indicates that PCM and IDM are in sync (on 99-03 it should be .60 ms) and the PCM is waiting on the ICP to reach the minimum of 500 PSI. When min. ICP is reached PW should change to 1-6 ms
5. If any of the above doesn't meet the minimum specification, solve the problem as-per the appropriate Ford Diagnostic Manual.

HIGH PRESSURE OIL PUMP and IPR; checks for hard start, no start condition

1. To check for high pressure oil leaks block off one bank at a time with the proper tools and note IPR% for each bank. If the engine starts while one bank is blocked off, the other bank is where the high pressure leak is occurring. If the IPR is 2% higher on one bank then you have a high pressure leak on that bank.
2. If the engine still will not start, dead head the high pressure oil pump and note ICP, it should be over 2500 PSI during cranking. If not then the high pressure pump, IPR or IPR seals are causing the lack of high pressure oil.

LOW POWER POOR MILEAGE

1. Fuel filter dirty; recommend changing every 8-10,000 miles
2. Air Filter dirty; the filter minders don't always work, visually inspect the air filter for excessive contamination. CAUTION; When inspecting or changing the air filter on the 94-97 Powerstroke, make sure to clean out the air filter housing, because setting the

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filter back in on top of the bugs and dirt that dropped off will result in turbo or engine damage from unfiltered air.

3. Exhaust leak before the turbo at the turbo feed pipes or the donuts that seal them.
4. Fuel filter housing return screen, in the 1994-1997 the screen will become plugged not allowing aerated fuel to return to the tank.
5. Throttle voltage should be 3.85-3.95 volts at WOT; check floor mats or a bad throttle assembly
6. Fuel supply pressure below 50 PSI can cause a low power or hesitation problem.
7. Check at idle and at WOT a plugged fuel filter, bad fuel pressure regulator, bad supply pump or a restriction in the tank can cause low pressure.

LOW POWER POOR MILEAGE

To make further checks you need to monitor the following PIDs with a scan tool. Normal readings for EBP (exhaust back pressure) MAP (manifold air pressure, boost) and BARO (barometric pressure) Note; all readings are in absolute pressure, so you must subtract KOEO (key on, engine off) MAP readings from WOT (Wide open throttle) readings to get gauge pressure. The following readings are for about 500-1000 foot elevation, higher elevation will give lower base readings due to lower atmospheric pressure.

IE: At 5000 foot elevation BARO would be about 12.1 PSI

NOTE; at KOEO all three readings should be within .2/10ths, if not repair or replace the bad sensor before continuing. BARO won't change with the engine running

1994-1997.....KOEO..... IDLEWOT, HARD
ACCELERATION

EBP	14.2	14.3-14.4	28.0-32.5 PSI
MAP	14.2	14.0-14.1	27.5-30.0 PSI
BARO	14.2		

Boost pressure, net (gauge) is 13 PSI minimum

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1999-2003	KOEO	IDLE	WOT HARD
ACCELERATION			
EBP	14.2	14.5-14.8	38.0-43.0 PSI
MAP	14.2	14.0-14.1	30.0-32.0 PSI
BARO	14.2		

Boost pressure, net (gauge) is 16 PSI minimum

EBP; Will typically gain .2 PSI on 94-97 and .5 PSI on 99-03

Low readings at WOT mean that there isn't enough exhaust gas velocity to spin the turbo up to full boost

High readings at idle mean that the exhaust isn't flowing or the turbo isn't spinning, some sort of exhaust flow restriction. Early 99 may have 2 PSI more EBP due to the cat. Converter

MAP

Low readings with normal EBP usually mean a boost leak at the intercooler hoses or at the manifolds

Low readings with low EBP usually mean another cause, did you check the list above

Next check ICP (injection control pressure) and IPR (injection pressure regulator), because low oil pressure can cause low power. Pressures are approximate. If the IPR duty cycle % is high, but the ICP is low, it usually means some sort of high pressure oil leak. WOT in neutral readings are taken after 3 minutes of running at WOT no load (neutral)

1994-1997	IDLE	WOT in neutral	HARD ACCELERATION
ICP	575-600	1300-1400	2450-2700 PSI
IPR	11-14%	18-21%	35-40%

1996-1997 California emissions is like the 1999-2003 specification

1999-2003	IDLE	WOT in neutral	HARD ACCELERATION
ICP	475-490	1100-1200**	2450-2750 PSI
IPR	9-11%	18-21%	35-40%

** After engine s/n 896812 maximum no load after 3 minutes would be 1800 PSI

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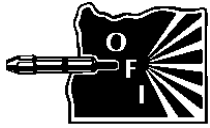


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The ICP will default to 725 PSI at idle if the PCM isn't getting the signal

ICP LOW; if the IPR duty cycle % is high, but the ICP is low, it usually means some sort of high pressure oil leak or bad IPR. This can also be caused by IPR o-rings, high pressure pump, or injector o-rings. Follow the Ford Service information to diagnose high pressure oil leaks or lack of pressure.

MISS OR ROUGH RUN

1. Check valve cover connectors for burnt or bad connections, perform a pin tension test.
2. Manual Transmissions; check for bad dual mass flywheel, this will cause false cylinder contribution codes if the flywheel is bouncing around.
3. Run a cylinder contribution test.
4. Check the turbo compressor wheel, if dusted or damaged from poor air inlet filtration, run a compression test before replacing any injectors. Low compression will cause a rough run.
5. Rough run and miss cold is either lack of heat (compression low or glow plugs) or injectors are badly worn (see hard start cold).

STALLING INTERMITTENT

1. DTC P0344 CMP sensor erratic
2. Loose IPR Solenoid or chaffed wires at solenoid
3. Low engine oil

KNOCK OR CACKLE

1. Low fuel supply pressure, Normal as follows;
1994-1997; 50 PSI at idle and 55 PSI at WOT
1999-2003; 50 PSI at idle and 45 PSI at WOT
2. Aeration in the oil

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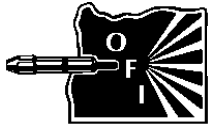


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CHIRP OR COMPRESSOR SURGE AT SHIFT POINTS

When a 99 ½ to 2003 has been “hopped up” it can cause the compressor wheel to chirp or surge at higher boost levels (25 PSI or so). You need to replace the compressor wheel with the same wheel used in the 1994-1997 turbos.

FUEL IN COOLANT

Normally a cracked injector sleeve will cause this because fuel pressure is higher than coolant pressure. If this occurs we recommend replacing all the Injector sleeves.

EXCESS ENGINE OIL CONSUMPTION

1. Bad injector o-rings, on the 94-97 oil from the leaking o-rings will return back to the fuel filter housing and the fuel will be black from oil.
2. Internal o-rings can cause excessive oil consumption and not show up as black fuel.
2. 99-03 engines don't have a fuel return off the heads, so in the unlikely event of injector o-ring failures, the fuel will not be black from oil.
3. Turbo; this is a closed crank vent system, which means it pulls crank vent fumes into the inlet of the turbo. You must compare the amount of oil at the compressor inlet with the amount of oil at the compressor outlet, before condemning a turbo. Excessive blow by will be pushed out the crank vent and pulled in by the turbocharger.

SURGE AT IDLE

1. ICP circuit problem, disconnect the ICP sensor, if the surge goes away then you possibly have a bad ICP sensor.
2. AA code injectors installed into a engine that require AB code injectors will cause a surge (California emissions in 96 and 97 require AB injectors)
3. 94-97; if you have any transmission range sensor codes repair these first. A bad transmission range sensor can back

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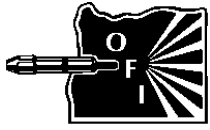


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feed to the IPR valve and cause a surge in park, but not in neutral.

DTC CODES

DTC P0301 – P0308 cylinder misfire detected (cylinder 1-8)

1. Injector weak, not contributing.
2. Cylinder weak

DTC P0340;

1. Usually a bad CMP (cam position sensor)

DTC P0344;

1. Usually a bad CMP
2. Can be caused by excessive cranking

DTC P0470

1. EBP Sensor malfunction

DTC P0476

1. Can set if the vehicle is equipped with an exhaust brake.
2. Check the EBP Reading KOEO, if not within .2 PSI vs. MAP and BARO, repair EBP tube or replace sensor.
3. Exhaust leaks at the turbo feed pipes will cause this code.

DTC P0603 KAM (keep alive memory)

1. If the batteries were previously disconnected, this code will set and be stored until cleared.
2. If the PCM was unplugged this may cause this code to set.

DTC P0605

1. If there is a chip plugged into the PCM that will cause this code.
2. Excessive cranking can cause this code.

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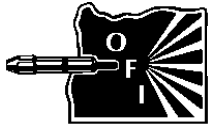


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DTC P1211 Indicates that the injection control pressure was above or below command desired during self test mode.

1. Check Oil level.
2. Possible bad IPR or IPR o-rings
3. Low fuel supply pressure will also cause this code, we have seen this several times.

DTC P1212 will set if 725 PSI ICP is not detected in 6-15 seconds of cranking.

1. Check oil level.
2. Possible bad IPR or IPR o-rings. 11/24/10

DTC P1261 to 1268 LOW side to battery +

1. Check valve cover wire harness connections first, including under the valve cover.

DTC P1271-1278 Low to high side open

1. Check wire harness connections and pin tension of valve cover connections

DTC P1280 ICP Circuit low, PCM will default to 725 PSI at idle

DTC P1298

1. If other codes are present repair those first.
2. IDM likely bad, replace

Miscellaneous Information

Oil Change Intervals; Oil changes done at 5000 miles when the vehicle is driven in the severe service category (3000 mile change interval) will result in premature failures of the turbo, IPR, High Pressure Oil Pump, and Injectors.

Diagnostic information available from the following:

1. www.Motorcraft.com on-line sign up by the day, month or year, follow the links to technical resources.

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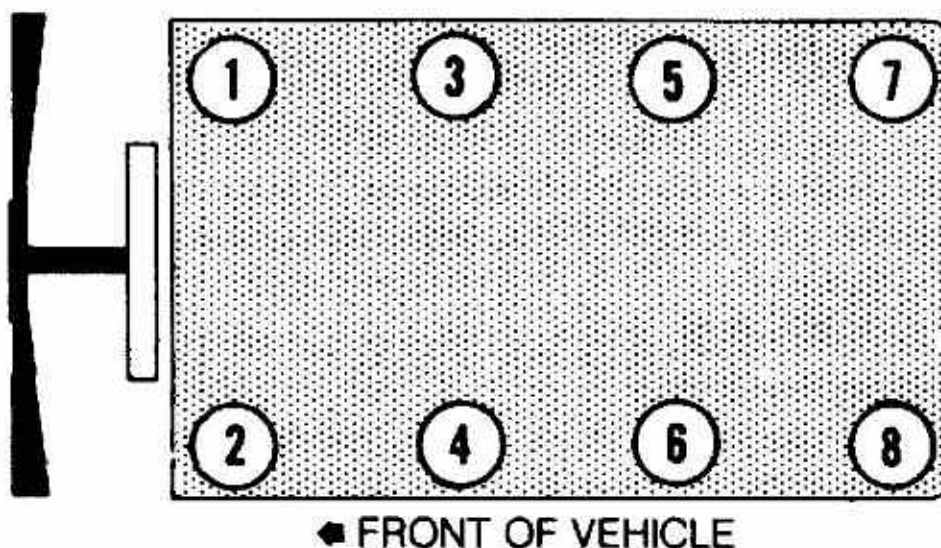
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2. www.helminc.com Service manuals and Powertrain and Emissions Control Diagnostic manuals.
3. www.Auto-Video.com 7.3L Diagnostics on DVD, you must have scan tool to make this DVD worthwhile.

Ford Diesel 7.3L IDI, 7.3L
& 6.0L Powerstroke

Firing Order 1-2-7-3-4-5-6-8



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