

# Technician High Pressure Pump Guide for the 7.3 *Power Stroke* Engine

## HIGH PRESSURE PUMP



- PUMP LEAKS

- ICP SYSTEM DIAGNOSTICS

- REPAIR PARTS

- TOOLS

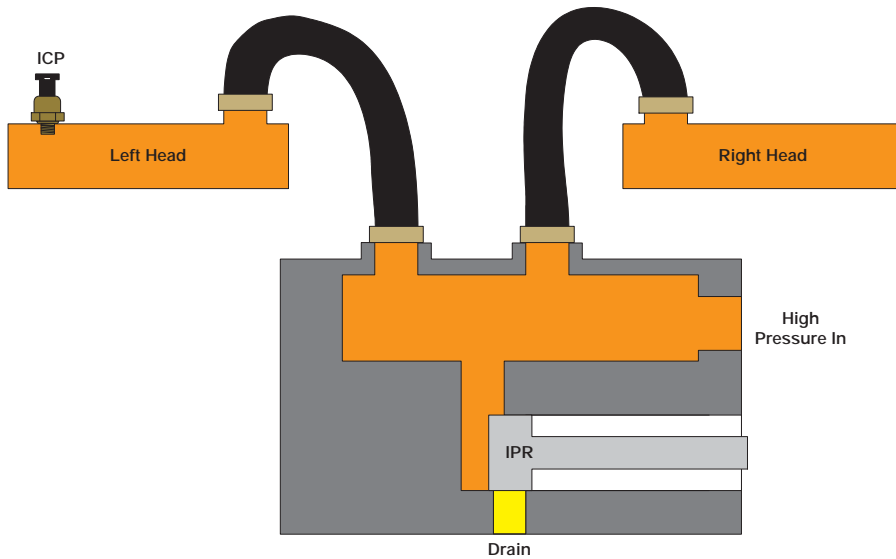
## TEST TOOLS AND ICP



## IPR







With max IPR% the ICP should be at its highest value.

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The PCM attempts to increase ICP by raising the IPR%.

KOEO	14%
Crank to Start	Less than 30% typically with no leaks and engine starts
Idle	8 - 16% @ operating temperature
Full Load	Less than 50% with no ICP system leaks
No Start (Max Command)	54% for 94 to 97 MY 65% for 98 MY or newer

**Note:** As a general rule 7.3 Power stroke engines require 500 psi ICP (1.0 volts ICPv) minimum to start.

## 1.) ICP SYSTEM DIAGNOSTICS

P1211 sets if ICP is 410 psi above or 280 psi below the desired pressure for 7.5 seconds.

P1212 sets if 725 psi of ICP is not detected in 6 to 15 seconds of cranking.

P1280 code is for ICP circuit low (often open circuits). Typical issues include, corrosion, spread pins, or improperly crimped terminals at the ICP sensor harness connector.

If a P1280 is set, the PCM will display a default value of 725psi at idle. To verify open circuit concern use ICPv.

**ICP KOEO signal voltage should be between .16 to .28 volts.**

## 2.) NO START DIAGNOSTICS

IPR% goes high with no or low ICP. - A leak exists in the ICP system - P1211 or 1212 may be present.



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Use test plugs tool # D94T 6600 A for 94 thru 98 MY

Use test plugs tool # 303-627 & 303 - 628 (Kit #T99T-1000-E) for 99 MY and newer with quick connect connections.

## CONDENSED FROM PC/ED

- Block off right bank (passenger side).
- Attempt to start
- Start indicates leak in right bank
- Reconnect hose to right bank
- Remove right side valve cover.
- Unplug injector connectors at both valve covers
- Crank the engine
- Observe spill spout of the injector and top of injector bore for oil leakage.  
(No oil should be coming from the spill spouts or around the injector)
- Replace injector if oil leaks from spill spout or o-rings if leak is from injector bore.

If no start - leak/loss may not be in right head, but ICP still low

- Block off left bank and move ICP into adapter
- Attempt to start
- Start indicates leak in left bank
- Reconnect hose to left bank and install ICP into left head
- Remove left side valve cover.
- Unplug injector connectors at both valve covers
- Crank the engine
- Observe spill spout of the injector and top of injector bore for oil leakage.  
(No oil should be coming from the spill spouts or around the injector)
- Replace injector if oil leaks from spill spout or o-rings if leak is from injector bore.

If no start / low ICP on both previous tests

- Block off both high pressure lines
- Crank engine
- If pressure is below 1000 psi remove IPR valve and inspect o-rings.
- If the IPR valve o-rings are damaged replace them with kit # F6TZ-9C977-AA and retest.
- If o-rings are ok, then replace the IPR valve and retest.

**Note: Do not replace the pump and IPR at the same time. If during any repair, the oil reservoir is allowed to drain it should be refilled before attempting to restart the vehicle.**

### 3.) ENGINE STARTS BUT HAS A P1211 CODE

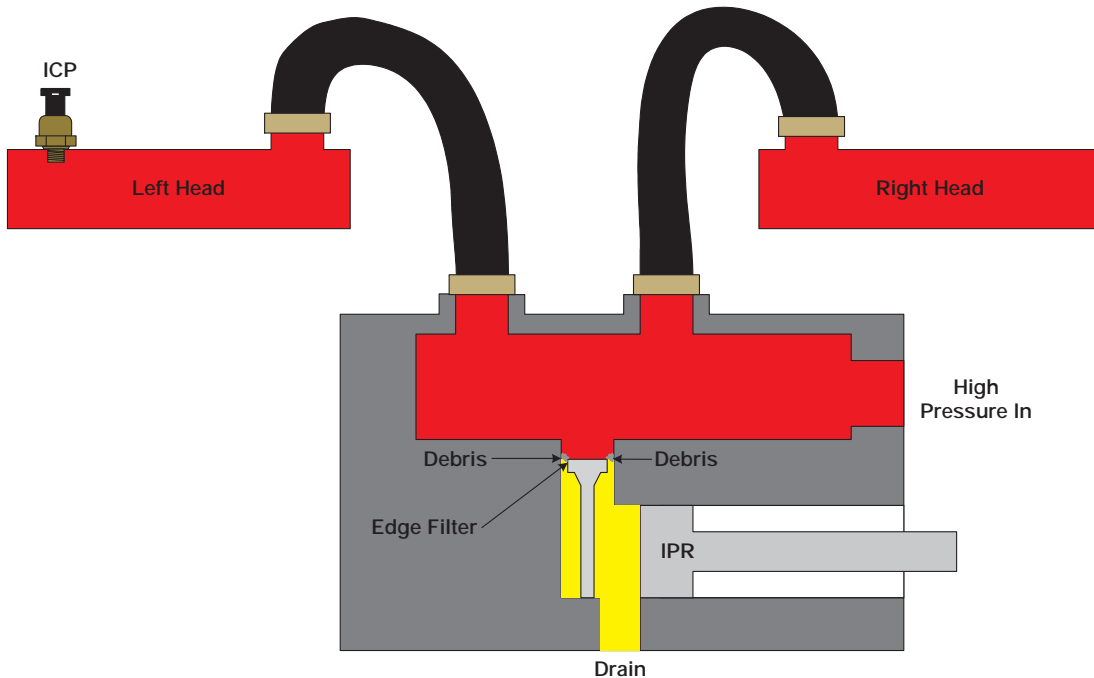
IPR% higher than expected (see chart on page #2). Stall shortly after cold start may also be a symptom. Prior to diagnosing a vehicle with a P1211, fuel pressure should be verified.

This indicates a smaller leak in the high pressure system. Using the same block off plugs described earlier to block off one bank and observing IPR% when engine is running on each bank at similar rpms. Higher IPR% on one bank compared to the other would indicate a leak on the higher IPR% bank. Example:

	LEFT BANK	RIGHT BANK
<b>COMMAND</b>	IPR% @ idle 16%	IPR% @ idle 26% (higher than other bank and out of spec)
<b>CONDITION</b>	Starts quickly	Long crank to start compared to left bank
<b>FINDING</b>	No leak	ICP system has leak on this bank

Repair as needed after locating leak as described in visual inspection in previous diagnostic routine.

## 4.) DIAGNOSING P1211 WITH IPR% LESS THAT 8 AT IDLE



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ICP more than 410 psi above command for at least 7.5 seconds can set a P1211 code. IPR with low duty cycle (less than 8% @ idle) and engine running, indicates a restriction in the drain circuit. This restriction is taking the place of the IPR valve, driving the IPR duty cycle lower, with higher than expected ICP. The excess restriction will be in the **reservoir, front cover, stuck IPR valve, or debris above the edge filter**. The drain path through the reservoir and front cover can be visually verified. Typically the pump or IPR must be replaced to repair this concern. Do not replace both components at the same time.



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This often occurs after the oil pan is resealed where excess sealant is forced through the lube system (short circuit check valve) and trapped at the edge filter of the high pressure pump.

In mid 1995 the edge filter moved out of the IPR, upstream into the pump.

## 5.) ABNORMAL LONG CRANK/STALL AFTER COLD START

A worn lube oil pump can negatively affect ICP system's performance in the following ways.

- Cold engine, abnormal long crank to start.
  - Cold engine, start then stall - then long crank to restart.
- } Oil pressure gauge on dash moves immediately prior to start.

These symptoms are often mis-diagnosed as high pressure oil (ICP) concerns. Both symptoms may be caused by wear in lube oil pump or thick oil (poor maintenance).

Pump wear causes a decrease in pump efficiency. Cold, thick oil becomes difficult to move.

Any lube oil system failure can negatively affect the performance of the ICP system.



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Wear



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.003" max  
Recession

Recession greater than .003" causes long crank to start and/or stall.

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To measure pump wear, place a straight edge across the pump housing and use a feeler gauge to measure clearance between the inner gear and the straight edge. A pump with excess gear recession will contribute to hard start issues.



Damper Recess

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Directional Markings



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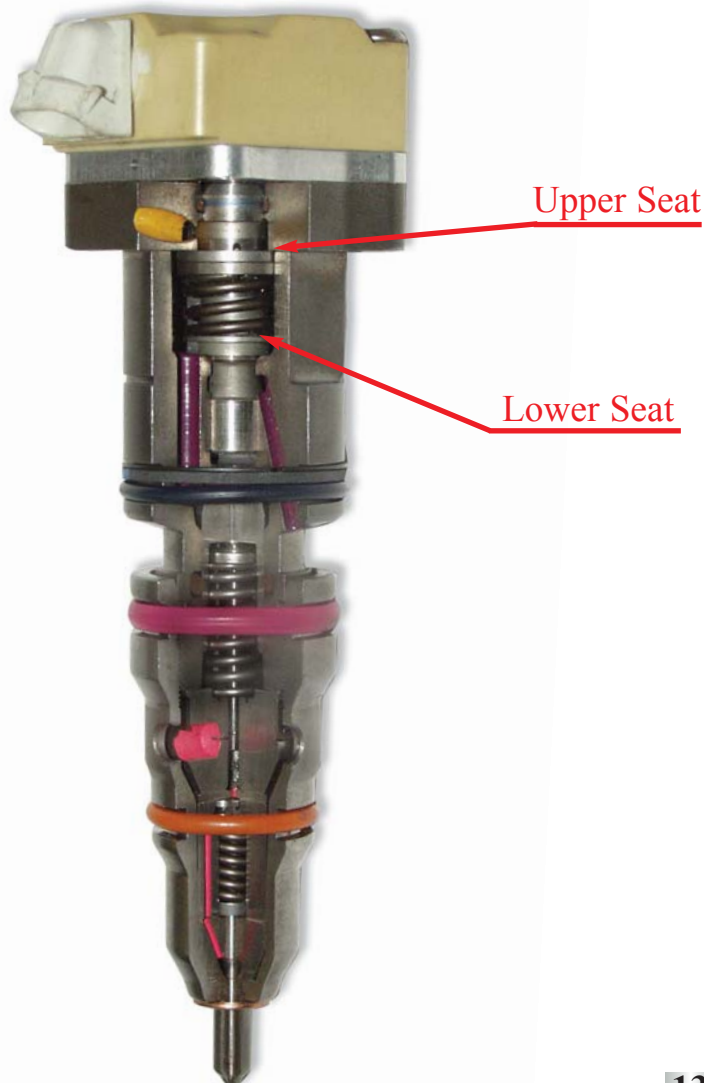
When replacing the pump, the directional markings ("OUT" or "Damper") must face the vibration damper. If installed correctly there is a recess that the vibration damper fits into on the inner gear. If installed incorrectly, the inner gear will cause major damage to the front cover.

## 6.) FOR HARD START LONG CRANK OR NO START WHERE THE INJECTORS WILL NOT BUZZ LOUDLY (HAS BACKGROUND BUZZ ONLY) WHEN COLD

Some engines have a no start/or long crank to start and the injector have a low background buzz, not a strong normal buzz. After performing the buzz test multiple times the injector may start to buzz and the engine may start and run fine the rest of the day until the next cold start. Typically, we find that this is a high mileage vehicle with poor maintenance as far as oil changes are concerned. What is occurring is that the poppet inside the injector is not able to move freely because of the thick old oil. If an oil change is performed after driving the vehicle and then driven again with new oil the next cold start the engine may improve.

**Note: This concern is related to poor maintenance and extended oil change intervals. If poor maintenance is the cause, then all 8 injectors will be affected. For additional information, refer to Section 3 of the Warranty & Policy Manual under "Damage Caused by Improper Maintenance."**

If this is not effective refer to PC/ED injector circuitry diagnostics.



The audible sound heard while performing an injector buzz test is the poppet stopping at the upper and lower seat during actuation.

