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Availability: ISIS, Bus ISIS, FleetSIS

Major System: ENGINES

Current Language: English

Other Languages: NONE

Viewed: 31277

Document ID: IK1200991

Revision: 8

Created: 10/22/2013

Last Modified: 6/16/2015

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Coding Information

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Title: Diagnosing Hard Start / No Start, rough idle complaints or ICP pressure concerns with the CPA Tool

Applies To: EPA 2007, EPA 2010, HD OBD (2013) MaxxForce DT, 9 & 10, N9 & N10 engines

CHANGE LOG

- 2015/6/3- Added CPA Signal
- 2015/5/18 - Formatted Article
- 2015/4/29- Added links to SRT elemental steps
- 2014/12/16- Added hot test explanation
- 2014/11/01 - Revised formatting. Updated to CPA V5 with WAC for HPOP, ICP sensor, and 6 injectors (excessive oil leakage).

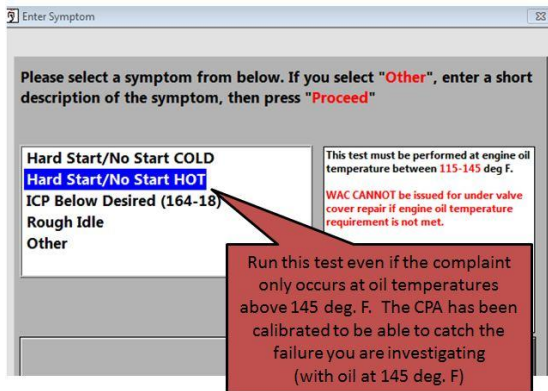
Note: 2007-2014 I-6 High Pressure Oil Pump(HPOP) is no longer an iApprove part. Use the diagnostics below to diagnose & repair as necessary. If HPOP replacement is needed during the warranty period it must be accompanied by a warranty authorization code issued by the CPA tool.

DESCRIPTION

This document describes the diagnostic process for the high pressure oil system utilizing the CPA tool. The CPA tool assists in diagnosing Hard Start / No Start / Rough idle and ICP pressure faults.

NOTE: The "Version 5" CPA software release coincides with an Essential Tool shipment 12-999-01-07 (November 2014). This CPA update allows the CPA HPOP test to monitor engine oil temperature (EOT) and the pressure at the outlet of the high pressure oil pump.

- Version 5 requires the use of engine oil temperature (EOT) breakout tee ZTSE4602 (be sure you have this tool)
- If the CPA tool detects a failed HPOP it will issue a WAC (warranty authorization code) for the HPOP (same as version 3 and 4)
- If the CPA tool detects a failed ICP sensor it will inform the technician (new)
- If the CPA confirms that the HPOP is ok but there is excessive oil leakage under the valve cover it will issue a WAC for the replacement of 6 injectors & 6 pucks (oil inlet adaptors) (new)
- CPA V5 asks the user to identify the engine symptom. Pay careful attention to the oil temperature requirements for the different tests.



- Do not upgrade your EZ-Techs to CPA software to V5 until you have the new Essential IPR block-off adaptor for CPA (kit [12-999-01-07](#)) available to you.
- Print the CPA HPOP V5 test set-up instructions (they are also displayed in the software) [here](#)

CPA HPOP Signals

CPA software analyzes 4 points in every test for each individual input signal

- Key OFF
- Key ON, Engine OFF
- Crank Engine

Stop Crank, Key ON

CPA HPOP software analyzes 4 signal inputs:
Engine Oil Temperature (EOT)
Camshaft Position (CMP)
Injection Control Pressure (ICP)
Engine Oil Pressure (EOP)



Use a DMM to measure the voltage signal from CPA HPOP cable, CPA Extension cable, and CPA Module

CAM Signal:

Bad Signal: Excessive noise/ interference



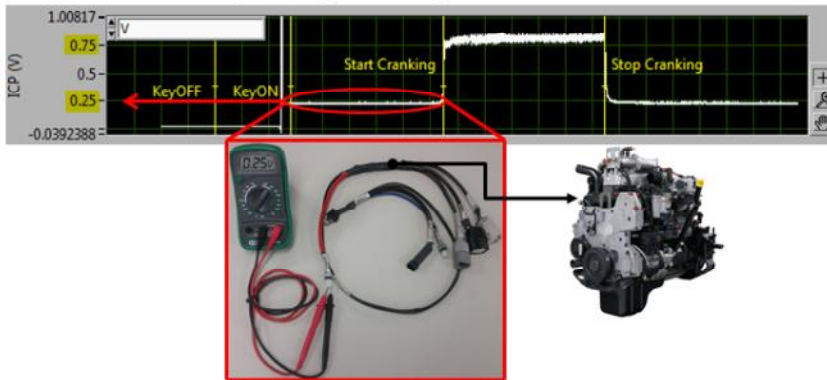
Note: At Key OFF there is a negative reading indicating connection error

Good Signal: No connection issues



ICP Signal:

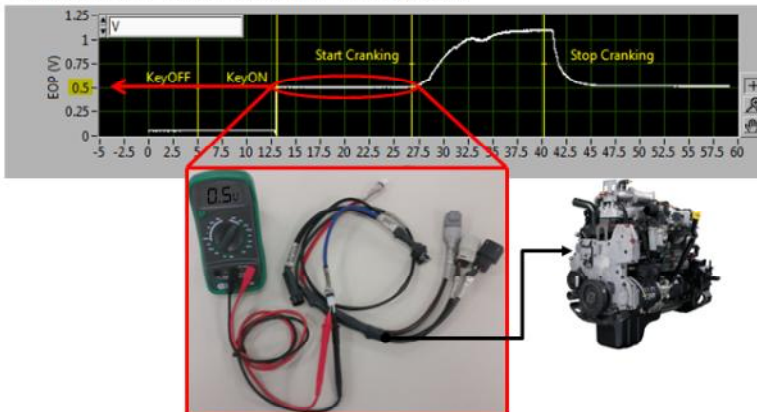
1. Key OFF: Voltage reading of 0.0v
 2. Key ON: Voltage reading of 0.25v
- Note: Residual pressure may be present for Test 3 & 4**
3. Start Cranking:
 - Test 1: Voltage reading of 0.75v or greater
 - Test 2 - 4: Voltage reading of 4.5v or greater



Diagnostics: With the key in the ON engine OFF position and the CPA HPOP cable connected to the engine use a DMM to measure voltage output

EOP Signal:

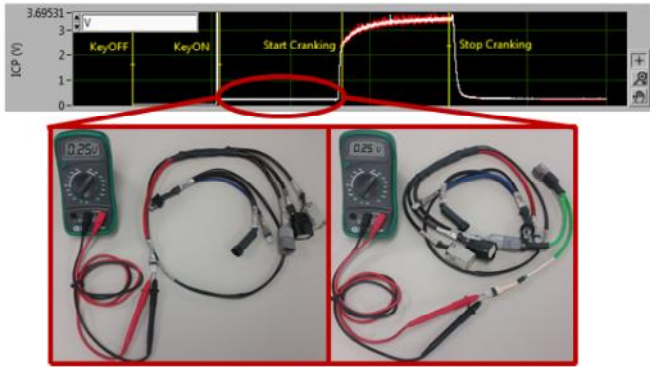
- Key OFF: Voltage reading of 0v
 Key ON: Voltage reading of 0.5v
 Start Cranking: Voltage reading of 0.7v or greater



Diagnostics: With the key in the ON engine OFF position and the CPA HPOP cable connected to the engine use a DMM to measure voltage output

ICP Signal at Test 3:

Test 3(IPR block off adaptor installed) is analyzing 2 ICP sensors simultaneously



Diagnostics: With the key in the ON engine OFF position and the CPA HPOP cable connected to the engine use a DMM to measure voltage output. Both ICP readings at key ON engine OFF position should be reading 0.25v

Note: Residual pressure may exist in the system. Both ICP sensors should be reading the same voltage value at KOEO

SYMPTOMS

Diagnostic Trouble Codes & Dashboard Indicator Lights:

DTC/Light	Description
SPN 164 FMI 1 (DTC 2335)	ICP Unable to Build During Engine Cranking
SPN 164 FMI 17 (DTC 3374)	ICP Unable to build during test
SPN 164 FMI 18	ICP below desired level
SPN 164 FMI 13	ICP adaptation in-range fault
SPN 8492 FMI 1 (DTC 3334)	ICP Below desired
SPN 1443 FMI 2 (DTC 2242)	ICP adaptation in-range fault

Observations or Concerns:

- Low / irregular ICP pressure
- Extended cranking / Hard Start
- Rough idle

SPECIAL TOOLS

Tool Description	Tool Number	Comments	Instructions
CPA Module (Tool)	OE-11178 or 12-999-01-01		4328032R4
EZ-Tech or laptop		Must have ServiceMaxx and "Engine Performance Analyzer" software version 5.0 or higher	IK2700062
Approved RP1210 communication device			
CPA CMP harness (yellow)	OE11178-2		
CPA HPOP harness	12-999-01-04		TL2900079
IPR Block-off kit for CPA	12-999-01-07	Shipped November 2014	includes new block-off tool, green CPA harness, and seal kit.
CPA extension harnesses	12-999-01-05	three are required	
CPA banana jack breakout	12-999-01-06	used to connect to ZTSE4602 (breakout tee)	
Engine oil temperature (EOT) breakout tee	ZTSE4602		

High Pressure Pump "dead head" plugs	12-999-01-07D (small) or 12-999-01-07C (large)	Part of kit 12-999-01-07	
IPR Block-off adaptor	12-999-01-07B	Part of kit 12-999-01-07	
1 1/4" angle wrench or crowsfoot	NA	Used to remove high pressure oil line in Test 4 on	
IPR valve socket	12-800-01		
IPR valve breakout tee	ZTSE4484 or 12-800-02	12-800-02 is for later style pigtail IPR valves	

[Tools Resource Center](#)

SERVICE PARTS INFORMATION

Kit Description	Part Number	Quantity Required	Notes
High pressure pump (EPA 2010)	5010755R92	1	CPA WAC or iApprove required
High pressure pump (EPA 2007)	1879747C2	1	CPA WAC or iApprove required
ICP sensor	1875784C93	1	CPA WAC required
6 oil inlet adaptors (pucks)	1841923C97	1	part of 6 injector WAC

Link to [Parts Catalog](#)

PROCEDURE OVERVIEW

For these tests the CPA Tool is connected to the:

- Engine oil pressure sensor (EOP)
- Engine oil temperature (EOT)- new requirement with Version 4
- Injection control pressure sensor (ICP)
- IPR block-off adaptor (new version with integrated pressure sensor is required with Version 5)
- Camshaft position sensor (CMP)

The CPA Tool connects to these circuits through special breakout cables designed for use with the CPA Tool. It is strongly recommended that the CPA application be launched from ServiceMaxx.

DIAGNOSTIC STEPS

Step	Action	Decision
1	DIAGNOSTIC: Per Health Report or PocketMaxx / ServiceMaxx are any of the codes below present? DTC 2335 or SPN 164 FMI 1 (ICP Unable to Build During Engine Cranking) DTC 3374 or SPN 164 FMI 17 (ICP Unable to build during test) SPN 164 FMI 18 (ICP below desired level) SPN 164 FMI 13 (ICP adaptation in-range fault) SPN 164 FMI 2 SPN 164 FMI 16 DTC 3334 or SPN 8492 FMI 1 (ICP below desired level) DTC 2242 or SPN 1443 FMI 2 (ICP adaptation in range fault)	Yes. Go to step 2
		No. Go to step 7

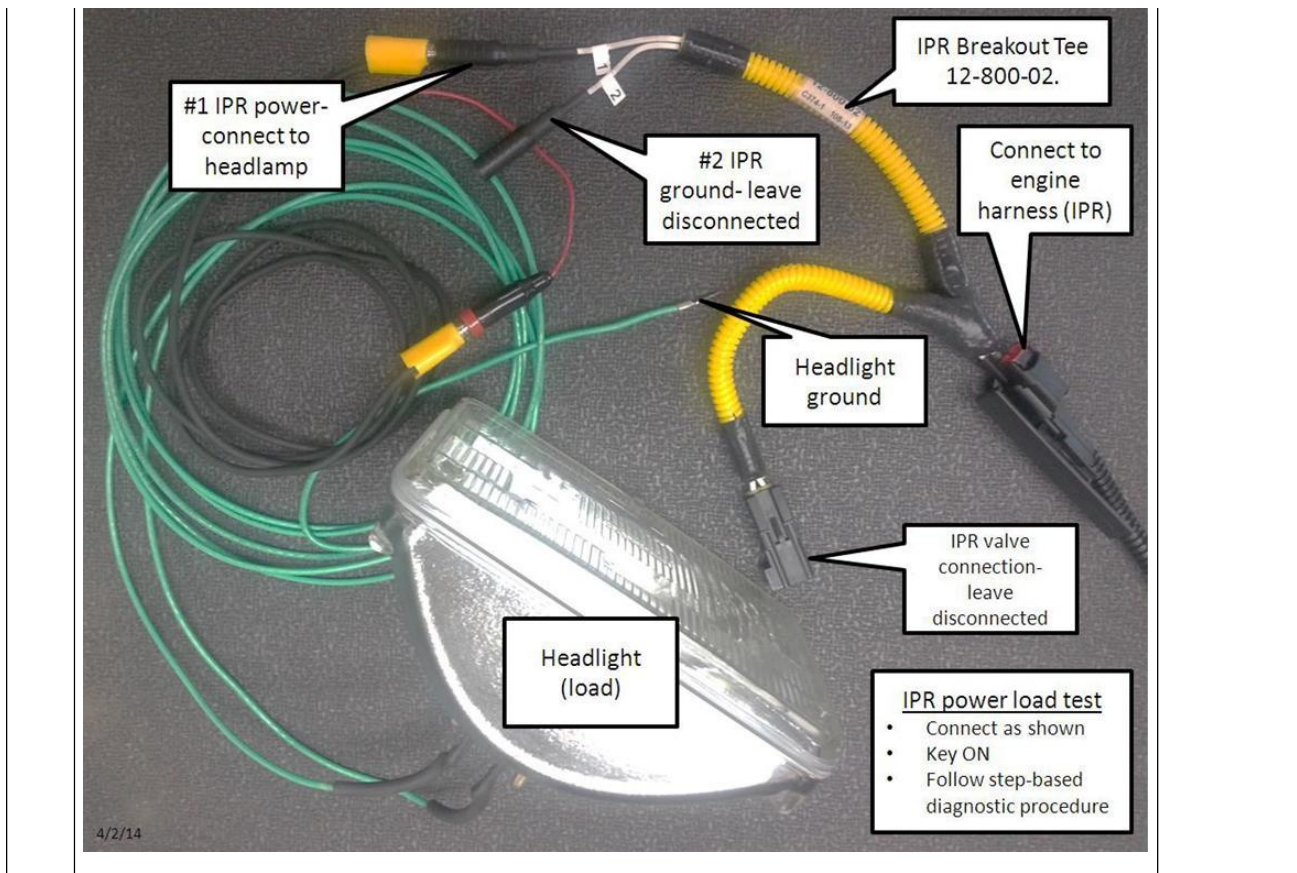
Step	Action	Decision
2	DIAGNOSTIC: Will engine start?	Yes. Go to step 3
		No. EPA 2007 and 2013 OBD- go to step 4 EPA 2010 go to step 5

Step	Action	Decision
3	<p>DIAGNOSTIC:</p> <p>With engine at low idle, wiggle harness connections on the ICP harness (leave valve cover in place), IPR harness, UVC connector (for ICP), 24 pin, 42 pin (IP), and 36 pin ECM connectors.</p> <p>Inspect IPR valve harness closely for repaired sections that could have high resistance.</p> <p>Does the engine stall or change sound as these connections & harnesses are wiggled? Was a DTC set?</p>	<p>Yes. Locate poor connection and repair. Confirm symptoms are resolved.</p>
		<p>No. Go to step 10</p>

Step	Action	Decision
4	<p>DIAGNOSTIC:</p> <p>Using ServiceMaxx or PocketMaxx run Continuous Monitor Test.</p> <p>Begin recording.</p> <p>Wiggle harness connections on the UVC (for ICP) connector, ICP harness (leave valve cover in place), 24 pin, 36 pin ECM, and 42 pin (IP) connectors.</p> <p>Playback recording and look for faults</p> <p>Was a DTC set?</p>	<p>Yes. Repair and confirm symptoms are resolved</p>
		<p>No. Go to step 6</p>

Step	Action	Decision
5	<p>DIAGNOSTIC:</p> <p>With KOEO wiggle harness connections on the IPR & ICP harness (leave valve cover in place), UVC (for ICP), 24 pin, 36 pin ECM, and 42 pin (IP) connectors.</p> <p>Check for faults / DTC's.</p> <p>Was an intermittent connection found (DTC set)?</p>	<p>Yes. Repair and confirm symptoms are resolved</p>
		<p>No. Go to step 6</p>

Step	Action	Decision
6	<p>DIAGNOSTIC:</p> <p>Load test IPR power circuit with IPR Breakout Tee tool 12- 800-02 (image below)</p> <ul style="list-style-type: none"> • Unplug IPR valve • Connect IPR breakout tee to engine harness • Connect terminal 1 to a headlamp bulb (+) and connect headlamp bulb (-) to chassis ground. <p>Do not connect to terminal 2 of the breakout Tee.</p> <ul style="list-style-type: none"> • Key ON • Wiggle IPR harnesses & connectors and look for headlamp to flicker. <p>Was an intermittent connection found?</p>	<p>Yes. Repair and confirm symptoms are resolved</p>
		<p>No. Reconnect IPR valve and go to step 10</p>



Step	Action	Decision
7	DIAGNOSTIC: Does the engine have a no start, hard start, or performance complaint or other DTC's?	1. Hard / No Start: Go to step 8
		2. Performance complaint: Go to step 9
		3. Other DTC: Diagnose DTC's using FAP or Diagnostic Manual. If diagnostic method leads to ICP pressure testing then go to Step 10

Step	Action	Decision
8	DIAGNOSTIC: Perform Hard Start / No Start diagnostics <ul style="list-style-type: none"> EPA 2007 MaxxFace DT, 9, 10 EGED375 EPA 2010 MaxxFace DT, 9, 10 0000001624 Note: If the diagnostic process above uncovers low ICP pressure then go to Step 10	Low or unstable ICP pressure: Go to Step 10
		Not ICP related- end

Step	Action	Decision
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9	DIAGNOSTIC: Perform Performance diagnostics <ul style="list-style-type: none"> • EPA 2007 MaxxForte DT, 9, 10 EGED380 • EPA 2010 MaxxForte DT, 9, 10 0000001624 	Low or unstable ICP pressure: Go to Step 10
	Note: If the diagnostic process above uncovers low or unstable ICP pressure then go to Step 10	Not ICP related- end

Step	Action	Decision
10	DIAGNOSTIC: Loosen EOT (engine oil temperature) sensor to the point where oil flows out. This confirms the HPOP reservoir contains oil. Was Oil Present?	1. Yes: go to step 11 2. No: See "Low Oil Pressure" in Symptom Diagnostics section of Engine Diagnostic Manual

Step	Action	Decision
11	DIAGNOSTIC: Connect CPA Tool to engine and to EZ-Tech. Follow CPA Tool instructions for performing CPA HPOP test CPA HPOP Test will test IPR control circuit, IPR valve, ICP sensor, High Pressure Oil Pump (HPOP) and excessive high pressure oil leaks	Note: Perform CPA HPOP test with the engine at the same temperature as the complaint or symptom is occurring

REPAIR STEPS

For all repair procedures and instructions, see the appropriate service manual.

WARRANTY INFORMATION

Claim Requirements/Approvals:

[WPL14-006x](#) - Warranty iApproval Requirements (HPOP test issues a WAC (warranty authorization code) for high pressure pump or 6 injectors and pucks, or ICP sensor) -**revised November 2014**

- A CPA HPOP WAC is required on warranty claims for high pressure oil pumps or 6 injectors or ICP sensor (or the iApprove process must be followed).

[WIL2800061](#) CPA WAC explanation (**revised November 2014**)

- The CPA HPOP WAC has 6 digits. The SRT's are synchronized to the WAC.
- The 5th digit is the type of WAC issued. A "2" means the proper SRT is Qualifier (H.P. Oil Pump Diag Steps 1-2). If "4", then the proper SRT is the Qualifier (H.P. Oil Pump Diag Steps 1-4).
- The 6th digit indicates the SYMPTOM that the technician selected when beginning the HPOP test
- The SRT for CPA HPOP test 1-4 is appropriate with the SRT for replacement of the ICP sensor and can also be applied when CPA issues a WAC for the replacement of 6 injectors.

Warranty Claim Coding:

Group:	12000
Noun:	454 PUMP, OIL/FUEL (HI PSI INJECTION SYSTEM)

Group:	12000
Noun:	168 Sender, ICP/FRP

Group:	12000
Noun:	563 Injector Unit (Electrical)

Standard Repair Time(s):

12-Cylinder Performance Analyzer (CPA) Tool, Diagnosis

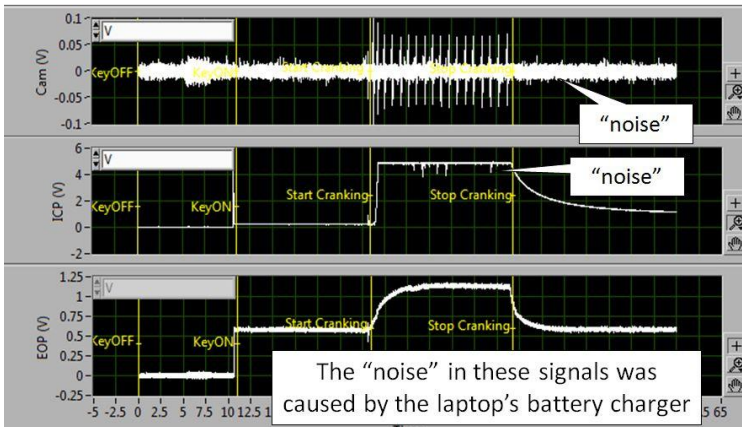
Step	Description	Chassis	Engine	SRT	Hours
1-2	IPR ECM powered and IPR full fielded test	All Models	MaxxForce DT/9/10 2010 Emissions	A12-2158T-21	.6
1-3	IPR block-off test	All Models	MaxxForce DT/9/10 2010 Emissions	A12-2158T-22	.9
1-4	HPOP Dead-head test	All Models	MaxxForce DT/9/10 2010 Emissions	A12-2158T-23	1.1

[SRT Manual](#)
[SRT's related to CPA high pressure pump diagnostics](#)

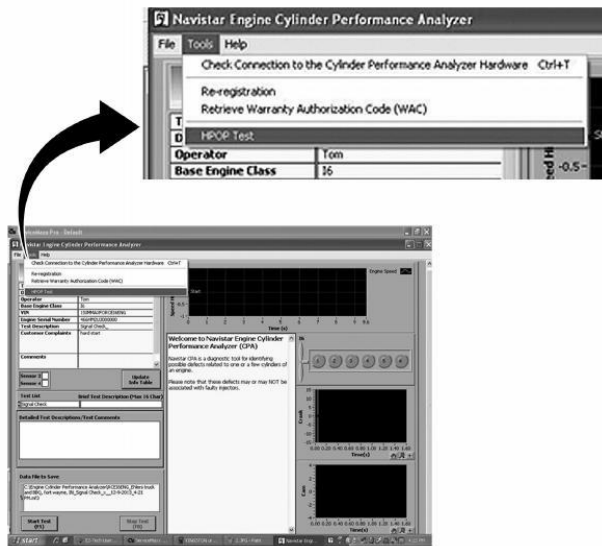
OTHER RESOURCES

CPA TIPS

- Perform CPA HPOP test with the engine at the same temperature as the complaint or symptom is occurring.
- If the CPA issues a "Engine oil pressure(EOP) too low during cranking" message **do not ignore this**. Broken piston cooling nozzles have been found after diagnosing this fault. **Do not** use a mechanical gauge as a substitute for the electronic tool.
- Attach battery charger to the vehicle before beginning CPA testing. Place charger as far away from CPA module as possible.
- If you replace a HPOP (which includes a new IPR valve) or if you replace just the IPR valve it is important to run the engine (preferably a road test) before repeating a CPA HPOP Test 1 or 2 as IPR valve break-in is important.
 - There is a pin and a seat inside the IPR valve. How they mate is critical to idle stability. These two parts have to "wear in" before the valve's performance is ideal. The break-in is usually complete anywhere between 15 minutes to 2 hours of mixed load engine operation. Also high pressure component replacements introduce air into the oil circuit. The air plays tricks on the ECM as it tries to control IPR pressure.
- If CPA issues a "residual pressure detected" message then you may have to wait for pressure to decay before retesting, de-power IPR valve momentarily (Test 2 only), loosen the high pressure hose to relieve pressure, or connect injectors and briefly crank engine to allow ICP pressure to decay.
- If using "No WAC" or repeating a single test multiple times and the CPA give you a conclusion or message that does not make sense remember that it may be assuming that the prior test number failed. **Example-** if you perform Test 3 in "No WAC" mode and it passes the test, the CPA message may state that you have an IPR valve problem. If this occurs its because the CPA assumes you are performing Test 3 because Test 2 (IPR full fielded) failed.
- Laptop power supply's, chargers, inverters, and battery chargers can cause interference with the CPA tool. See below:



- The name of this CPA Tool test is "CPA HPOP Test" (select from top left of CPA screen).



- It is strongly recommended that the CPA application be launched from ServiceMaxx.
 - The CPA software records every completed HPOP test and automatically creates a .zip file that contains every test that was completed on a VIN (during that session). This zip file resides in a folder on the EZ-Tech titled "Engine Cylinder Performance Analyzer"
 -
- Beginning with Version 5 the CPA stores a screenshot (.jpg) of every WAC screen in the "Engine Cylinder Performance Analyzer" folder on the EZ-Tech

CPA Related Links:

- CPA HPOP test instructions ([here](#)) (Note: this PDF is also inside the CPA software under "Help" menu)
 - CPA software installation (upgrade) [IK2700062](#)
- Note:** CPA Tool software must be updated to version 5.0.0.1 or higher in order to perform HPOP test and be able to issue WAC's for HPOP, 6 injectors, or ICP sensor.
- CPA Update kit 12-999-01-E1 ([TL2900079](#))
 - IPR Block-off adaptor with integrated sensor kit [12-999-01-07](#) (**new tool shipped Essential in November 2014**)
 - CPA LMS Training Course. "Cylinder Performance Analyzer Tool Instruction Update"
 - Course Catalog > Service > Engine
 - [HPOP Oil Inlet Screen](#)
 -
 - If SPN 164 FMI 16 or FMI 15 set after a HPOP replacement, please refer to article [IK1201043](#) (ICP Adaptation)
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If you would like to order additional Tools, have questions, concerns, feedback, or need replacement parts, please contacts the Navistar Service [Tool Support Center](#) Phone: 1-800-365-0088 (Toll Free) or 630-985-4171 or submit a Service Tool IKNow Case

Staff ID	Client ID	Comments	Created Date
	DYYGLM2	You received the following feedback From: dyyglm2 - Gerry McClellan Email Address: warranty@noerrs.com Job Classification: AD006, Warranty Manager Dealer: NOERR'S INTERNATIONAL Feedback: Article needs formatted for printing	6/17/2015 6:30:54 AM
	DYYEXRY	You received the following feedback From: dyexry - Andy Roberson Email Address: aroberson@clt.com Job Classification: SE008, Service Technician Dealer: CUMBERLAND INTL TRUCKS Feedback: I am following this as part of FCAP for code 164-18. Step one, I have code 164-18, step two engine will start - yes, Step three Wiggle test. No change when harness is wigged, step ten Loosen EOT sensor and check for oil. This is where I run into a problem. The engine runs. Why would the diagnostics take me to something to check if the engine does not run. If the engine is running there has got to be oil at the resevoir. Why would the diagnostics not take me right to the CPA test after step three?	6/18/2015 7:35:51 AM
	DYYBAG3	You received the following feedback From: dyybag3 - Bill Grewell Email Address: bagrewell@yahoo.com Job Classification: SE003, Service Manager Dealer: REDDING FLT TRUCK SUP Feedback: toward the bottom of article under "other resources" item 4 regarding break in of ipr. We have been advised by Kevin at I 6 group that ipr break in requires 15 to 20 mi roadtest. We recently replaced a HPOP under warranty and I claimed the test drive "to break in ipr per tech support". That time was denied as not warranty. Per Neil at Warranty - if it were documented in a casefile, they would pay it. Now using cpa for wac code so no need for casefile. Is ipr break in warrantable or no? Thanks Bill	6/19/2015 12:30:52 PM
U01E402		You received the following feedback From: U01E402 - Ryan Hendrickson Email Address: Ryan.Hendrickson@navistar.com Feedback: Is there any way that we can explain how to review a test that was previously recorded so it can be reviewed before a bad file is sent in costing the customer down time?	6/25/2015 10:59:39 AM