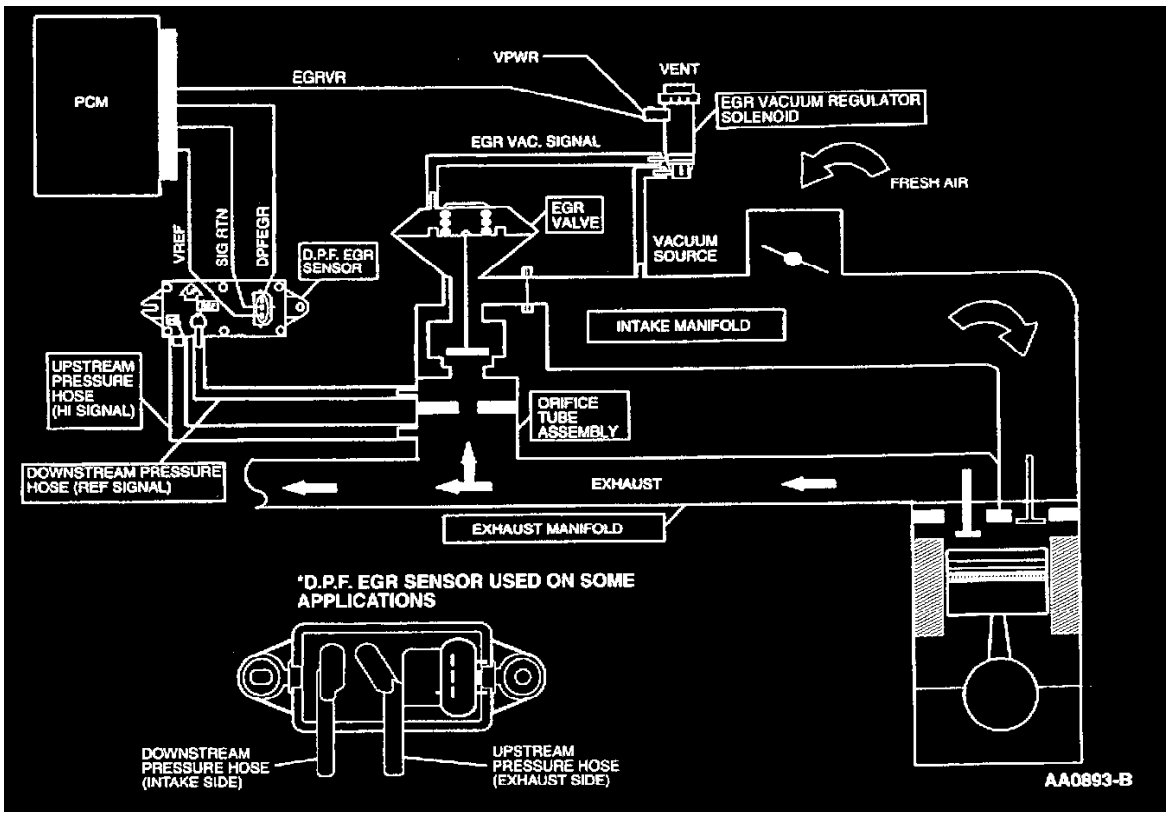
Computers and Control Systems: Pinpoint Tests
Test HE: Exhaust Gas Recirculation (EGR) Systems

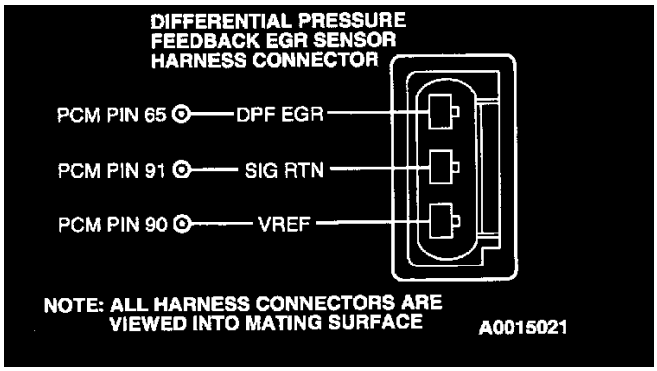


Exhaust Gas Recirculation (EGR) System

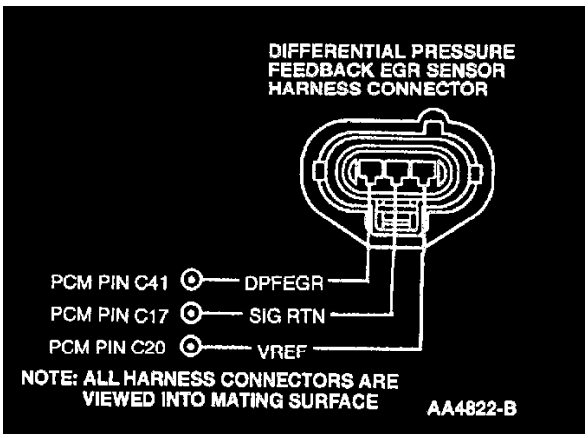
NOTE

This Pinpoint Test is intended to diagnose the following:
- Differential pressure feedback EGR sensor
- Exhaust Gas Recirculation **(EGR)** valve
- EGR vacuum regulator solenoid
- Orifice tube assembly
- Differential pressure feedback EGR sensor pressure hoses
- Vacuum lines
- Harness circuits: VREF, DPFE, SIG, SIG RTN, EVR, EVR PWR
- Powertrain Control Module **(PCM)**

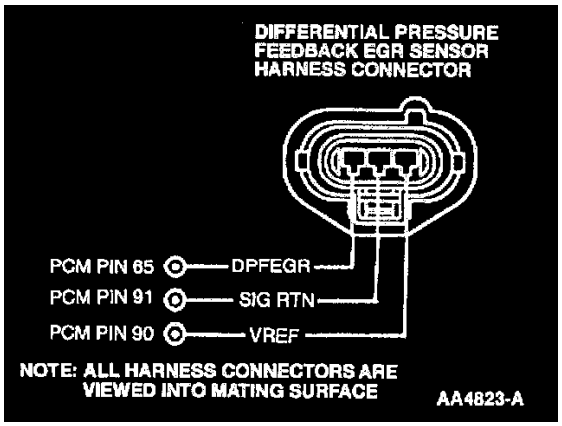
Pinpoint Test Schematics and Connectors



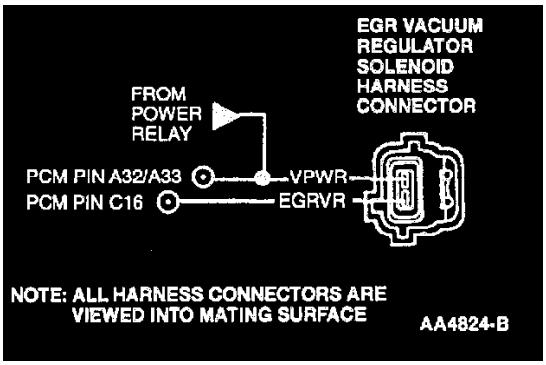
Taurus/Sable 3.0L 4V (Differential Pressure Feedback EGR Sensor)



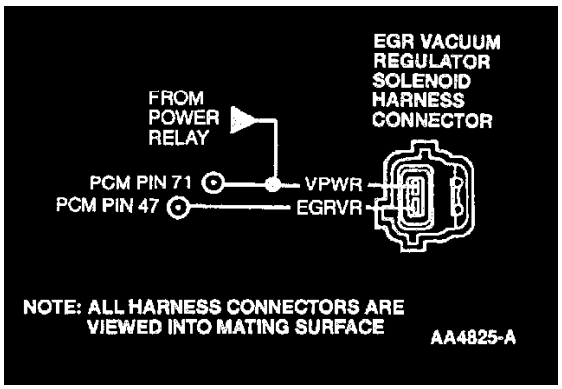
LS6/LS8 (Differential Pressure Feedback EGR Sensor)



All Others (Differential Pressure Feedback EGR Sensor)



LS6/LS8 (EGR Vacuum Regulator Solenoid)



All Others (EGR Vacuum Regulator Solenoid)

Pinpoint Tests

	Test Steps	Results →	Action to Take
HE1	DTC P1400: DETERMINE PRESENT DPFEGR PID VOLTAGE		
	• Key on, engine off. • Access DPFEGR PID. • **Is DPFEGR PID voltage less than 0.2 volt?**	Yes → No →	Fault is currently present. KEY OFF. GO to **HE2**. Fault is intermittent. GO to **HE5**.
HE2	ATTEMPT TO INDUCE OPPOSITE D.P.F. EGR SENSOR VOLTAGE		
	• Disconnect D.P.F. EGR sensor. • Key on, engine off. • **Is DPFEGR PID value between 4.0 and 6.0 volts?**	Yes → No →	REPLACE D.P.F. EGR sensor. GO to **HE3**.
HE3	CHECK VREF AND SIG RTN CIRCUITS FOR OPEN IN HARNESS TO D.P.F. EGR SENSOR		
	• Measure voltage between VREF and SIG RTN circuits at the D.P.F. EGR sensor harness connector. • **Is VREF voltage between 4.0 and 6.0 volts?**	Yes → No →	KEY OFF. GO to **HE4**. GO to **C1**.
HE4	CHECK DPFEGR CIRCUIT FOR SHORT TO GROUND AND SIG RTN IN HARNESS		
	Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. • Disconnect scan tool from DLC. • Disconnect PCM. • Measure resistance between DPFEGR and SIG. RTN circuits at the PCM harness connector. • Measure resistance between DPFEGR circuit at the PCM harness connector and battery negative post. • **Is each resistance greater than 10,000 ohms?**	Yes → No →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HE5	PERFORM WIGGLE TEST ON D.P.F. EGR SENSOR AND CIRCUIT WHILE MONITORING DPFEGR PID FOR A SUDDEN CHANGE		
	• While monitoring DPFEGR PID, tap on the D.P.F. EGR sensor and wiggle the wiring while looking for a sudden change in value as an indication of an intermittent. • **Is intermittent fault found?**	Yes → No →	REPAIR as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
HE10	DTC P1401: DETERMINE PRESENT DPFEGR PID VOLTAGE		
	• Key on, engine off. • Access DPFEGR PID with a scan tool. • **Is DPFEGR PID voltage greater than 4.0 volts?**	Yes → No →	Fault is currently present. KEY OFF. GO to **HE11**. Fault is intermittent. GO to **HE19**.
HE11	CHECK DPFEGR CIRCUIT FOR SHORT TO PWR		
	• Disconnect D.P.F. EGR sensor. • Key on, engine off. • Measure voltage between DPFEGR circuit at the D.P.F. EGR sensor harness connector and chassis ground. • **Is voltage greater than 10.5 volts?**	Yes → No →	KEY OFF. GO to **HE12**. GO to **HE13**.

HE1 - HE11

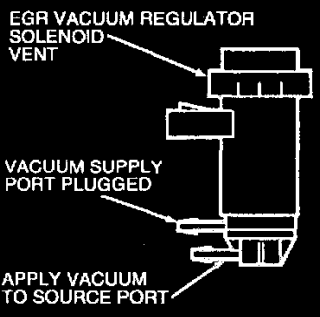
Test Steps		Results →	Action to Take
HE12	CHECK DPFEGR CIRCUIT FOR SHORT TO PWR IN HARNESS		
	Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. • Disconnect PCM. • Key on, engine off. • Measure voltage between DPFEGR circuit at the PCM harness connector and the battery negative post. • **Is voltage greater than 10.5 volts?**	Yes → No →	REPAIR short circuit. REPLACE damaged PCM.
HE13	INDUCE OPPOSITE D.P.F. EGR SENSOR VOLTAGE		
	• Connect a jumper wire between DPFEGR and SIG RTN circuits at the D.P.F. EGR sensor harness connector. Note: If a scan tool communication concern exists, key off, remove jumper immediately and GO to **HE18**. • Access DPFEGR PID. • **Is DPFEGR PID voltage less than 0.05 volt?**	Yes → No →	REMOVE jumper. GO to **HE14**. Unable to induce opposite signal. KEY OFF. GO to **HE16**.
HE14	CHECK VREF VOLTAGE TO D.P.F. EGR SENSOR		
	• Measure voltage between VREF and SIG RTN circuits at the D.P.F. EGR sensor harness connector. • **Is VREF voltage between 4.0 and 6.0 volts?**	Yes → No →	GO to **HE15**. GO to **C1**.
HE15	CHECK DPFEGR CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• Disconnect PCM. • Measure resistance between DPFEGR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.) • **Is resistance greater than 10 K ohms?**	Yes → No →	REPLACE D.P.F. EGR sensor. REPAIR short circuit.
HE16	CHECK DPFEGR CIRCUIT FOR OPEN IN HARNESS		
	• Disconnect PCM. • Measure resistance of DPFEGR circuit between PCM harness connector pin and D.P.F. EGR sensor harness connector. • **Is resistance less than 5.0 ohms?**	Yes → No →	GO to **HE17**. REPAIR open circuit.
HE17	CHECK SIG RTN CIRCUIT FOR OPEN IN HARNESS		
	• Measure resistance of SIG RTN circuit between PCM harness connector pin and D.P.F. EGR sensor harness connector. • **Is resistance less than 5.0 ohms?**	Yes → No →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.

HE12 - HE17

Test Steps		Results →	Action to Take
HE18	CHECK DPFEGR CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• Disconnect PCM. • Measure resistance between DPFEGR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.) • **Is resistance greater than 10,000 ohms?**	Yes → No →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HE19	COMPLETE A WIGGLE TEST ON D.P.F. EGR SENSOR AND CIRCUIT WHILE MONITORING DPFEGR PID FOR A SUDDEN CHANGE		
	• While monitoring DPFEGR PID, tap on the D.P.F. EGR sensor and wiggle the wiring while looking for a sudden change in value as an indication of an intermittent. • **Is intermittent fault found?**	Yes → No →	REPAIR as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
HE20	DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE DISCONNECTED		
	Note: If DTC P1405 is in continuous memory, diagnose that first starting with HE50. • Disconnect vacuum hose at EGR valve and plug hose. • Run Key On Engine Running (KOER) Self-Test. • **Is KOER DTC P0402 output or unable to run KOER Self-Test due to engine stall or no start?**	Yes → No →	KEY OFF. INSPECT pressure hoses first for pinching and icing. If OK, REMOVE and INSPECT the EGR valve and EGR tube for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary. RECONNECT vacuum hose to EGR valve. GO to **HE21**.
HE21	CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE CONNECTED		
	• EGR vacuum hose connected. • Run KOER Self-Test. • **Is KOER DTC P0402 output or unable to run KOER Self-Test due to engine stall or no start?**	Yes → No →	There is possible EGR flow at idle. GO to **HE22**. Fault is intermittent. INSPECT pressure hoses for pinching and icing. REPAIR as necessary. If OK, GO to **HE30**.

HE18 - HE21

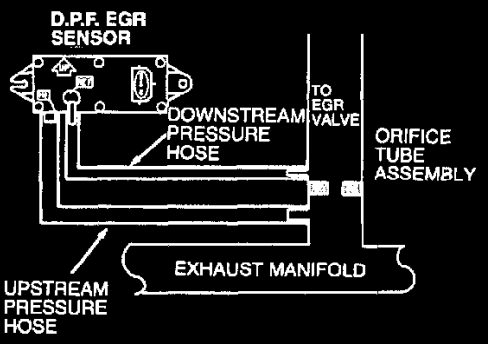
Test Steps		Results →	Action to Take
HE22	CHECK EGR SYSTEM VACUUM HOSES FOR INTEGRITY AND CONNECTION		
	Note: A pinched or plugged EGR vacuum hose can trap vacuum between the EGR vacuum regulator solenoid and EGR valve not allowing the EGR valve to close. • Trace each vacuum hose from EGR vacuum regulator solenoid and verify that each hose is connected correctly. (Refer to vehicle vacuum diagram label.) • Verify that the EGR valve vacuum hose is not pinched or plugged and routed properly. • **Are vacuum hoses OK?**	Yes → No →	RECONNECT vacuum hoses. GO to **HE23**. REPAIR vacuum hoses as necessary.
HE23	CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes → No →	REPLACE D.P.F. EGR sensor. RECONNECT D.P.F. EGR sensor. GO to **HE24**.
HE24	CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM REGULATOR SOLENOID CONNECTOR OFF		
	• Disconnect vacuum hose at EGR valve and connect hose to vacuum gauge. • Start engine and bring to an idle. • While monitoring vacuum gauge, disconnect the EGR vacuum regulator solenoid harness connector. — The EGR valve requires vacuum greater than 5.4 kPa (1.6 in-Hg) to begin to open. If the vacuum reading remains greater than 5.4 kPa (1.6 in-Hg) after the EGR vacuum regulator solenoid is electrically disconnected, this would indicate a mechanical fault in the EGR vacuum regulator solenoid. • **Does the EGR vacuum remain greater than 5.4 kPa (1.6 in-Hg) at idle even after EGR vacuum regulator solenoid is electrically disconnected?**	Yes → No →	This indicates a fault in the EGR vacuum regulator solenoid. KEY OFF. GO to **HE25**. KEY OFF. GO to **HE26**.

Test Steps	Results →	Action to Take
HE25 INSPECT EGR VACUUM REGULATOR SOLENOID VENT FOR PLUGGING		
Note: A plugged EGR vacuum regulator solenoid vent will not allow EGR vacuum to vent to atmosphere. • Disconnect EGR vacuum regulator solenoid vacuum hoses. • Remove EGR vacuum regulator solenoid vent cap (if removable). • Remove filter and inspect for blockage or icing in some cases. • With the EGR vacuum supply port plugged, apply 34 to 51 kPa (10 to 15 in-Hg) of vacuum directly to EGR vacuum regulator solenoid vacuum source port with a hand vacuum pump. If the vacuum holds or is slow to release to atmosphere, the EGR vacuum regulator solenoid vent could be plugged or restricted.  • **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**	Yes → No →	REPAIR EGR vacuum regulator solenoid as necessary. If unable to repair, REPLACE EGR vacuum regulator solenoid. REPLACE EGR vacuum regulator solenoid.
HE26 MEASURE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE		
• Measure resistance across EGR vacuum regulator solenoid. • **Is resistance between 26 and 40 ohms?**	Yes → No →	GO to **HE27**. REPLACE EGR vacuum regulator solenoid.
HE27 CHECK EGRVR CIRCUIT FOR SHORT TO GROUND IN HARNESS		
Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. • Disconnect scan tool from DLC. • Disconnect PCM. • Measure resistance between EGRVR circuit at the PCM harness connector and battery negative post. • **Is resistance greater than 10,000 ohms?**	Yes → No →	GO to **HE28**. REPAIR short circuit.

Test Steps		Results →	Action to Take
HE28	CHECK EGRVR CIRCUIT FOR SHORT TO VREF		
	• Measure resistance between EGRVR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.) • **Is resistance greater than 10,000 ohms?**	Yes →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.
HE30	CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes →	REPLACE D.P.F. EGR sensor.
		No →	RECONNECT D.P.F. EGR sensor. GO to **HE31**.

HE28 - HE30

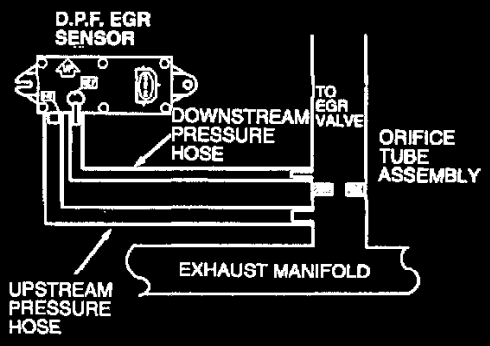
Test Steps		Results →	Action to Take
HE31	CHECK D.P.F. EGR SENSOR VOLTAGE WHILE EXERCISING EGR VALVE		
	• Key on, engine off. • View DPFEGR PID and make note of voltage. — Typical D.P.F. EGR sensor voltage with no EGR flow is between 0.2 and 1.3 volt. • Disconnect vacuum hose at EGR valve and plug hose. • Connect a hand vacuum pump to EGR valve. • Start engine and bring to idle. • Observe DPFEGR PID at idle and compare to the key on engine off voltage. (A higher voltage at idle could be due to a non-seating EGR valve.) • Apply just enough vacuum to EGR valve to open it 7-10 kPa (2-3 in-Hg) without stalling engine and release vacuum. Repeat several times while observing DPFEGR PID. (DPFEGR PID voltage must increase as valve begins to open and return to initial value as vacuum is released. A slow to return voltage could be an indication of a binding or a slow-closing EGR valve.) • **Does the DPFEGR PID voltage indicate an open, binding or slow-closing EGR valve?**	Yes → No →	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary. KEY OFF. GO to **HE32**.
HE32	MONITOR EGR VALVE VACUUM WHILE WIGGLING EGRVR CIRCUIT		
	Note: An intermittent short to GND in the EGRVR circuit will cause the vacuum applied to the EGR valve to be higher than normal while the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.0 in-Hg) and it takes about 5.4 kPa (1.6 in-Hg) for the valve to begin to open. • Remove hand vacuum pump. • Connect vacuum gauge to EGR valve vacuum hose. • Key on, engine running. • Observe vacuum gauge for an indication of a fault while performing the following: — Lightly tap on the EGR vacuum regulator solenoid; wiggle the EGR vacuum regulator solenoid connector and vehicle harness between solenoid and PCM. A fault is indicated by a sudden jump in vacuum reading. • **Is intermittent fault found?**	Yes → No →	ISOLATE fault and REPAIR as necessary. RECONNECT vacuum hose. KEY OFF. GO to **HE33**.

	Test Steps	Results →	Action to Take
HE33	INSPECT EGR VACUUM REGULATOR SOLENOID AND VACUUM HOSES FOR POTENTIAL PLUGGING		
	• Remove EGR vacuum regulator solenoid vent filter and inspect for contamination and excessive water absorption. (In cold climate, excessive water in filter could freeze and plug the EGR vacuum regulator solenoid vent.) • Inspect EGR vacuum hose for possible blockage or pinching. • **Is EGR vacuum regulator solenoid vent or filter contaminated or vacuum hose plugged?**	Yes → No →	REPAIR EGR vacuum regulator solenoid or EGR vacuum hose as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
HE50	DTC P1405: INSPECT UPSTREAM PRESSURE HOSE CONNECTIONS		
	• Inspect upstream hose at D.P.F. EGR sensor and orifice tube assembly for disconnect or poor connection. • **Is hose off or poorly connected?** 	Yes → No →	REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle. (REFER to Drive Cycles.) GO to **HE51**.
HE51	INSPECT UPSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that the D.P.F. EGR pressure hose used is the correct repair part and not a substitute. • Visually inspect upstream pressure hose routing. Hose must not be pinched or have dips in it where water could settle or freeze. • Remove upstream pressure hose and carefully inspect for plugging, water or leaks. • **Is there a fault detected in the hose?**	Yes → No →	REPAIR or REPLACE upstream pressure hose as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Drive Cycles). GO to **HE52**.

HE33 - HE51

Test Steps		Results →	Action to Take
HE52	CHECK ORIFICE TUBE ASSEMBLY AND D.P.F. EGR SENSOR		
	• Inspect the upstream connection on the D.P.F. EGR sensor for plugging or damage at the sensor. • Inspect the exhaust manifold side pressure pickup tube at the orifice tube assembly for plugging or damage. • **Is the D.P.F. EGR sensor or orifice tube assembly plugged or damaged?**	Yes →	REPAIR or REPLACE D.P.F. EGR sensor or orifice tube assembly as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle. (REFER to Drive Cycles.)
		No →	GO to **HE53**.
HE53	CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes →	REPLACE D.P.F. EGR sensor. COMPLETE an EGR Monitor Repair Verification Drive Cycle (REFER to Drive Cycles).
		No →	Unable to duplicate or identify fault at this time. GO to **Z1**.

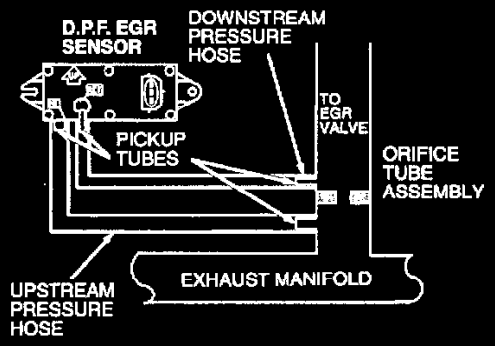
HE52 - HE53

Test Steps		Results →	Action to Take
HE60	DTC P1406: INSPECT DOWNSTREAM PRESSURE HOSE CONNECTIONS		
	Note: If the fault is currently present, DTC P1408 will be output in Key On Engine Running (KOER) Self-Test. • Inspect downstream hose at D.P.F. EGR sensor and orifice tube assembly for disconnect or poor connection. • **Is hose OFF or poorly connected?**  	Yes → No →	REPAIR as necessary. GO to **HE61**.
HE61	INSPECT DOWNSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that the D.P.F. EGR sensor pressure hose is the correct repair part and not a substitute. • Visually inspect downstream pressure hose routing. Hose must not be pinched or have dips in it where water can settle or freeze. • Remove downstream pressure hose and carefully inspect for plugging, water or leaks. • **Is there a fault detected in the hose?**	Yes → No →	REPAIR or REPLACE as necessary. GO to **HE62**.
HE62	CHECK ORIFICE TUBE ASSEMBLY AND D.P.F. EGR SENSOR		
	• Inspect the connections at the D.P.F. EGR sensor for plugging or damage. • Inspect the intake manifold side pressure pickup tube and orifice tube assembly for plugging, loose connection or damage. • **Is the D.P.F. EGR sensor or orifice tube assembly plugged, loose or damaged?**	Yes → No →	REPAIR or REPLACE D.P.F. EGR sensor or orifice tube assembly as necessary. GO to **HE63**.

HE60 - HE62

Test Steps		Results →	Action to Take
HE63	CHECK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes → No →	REPLACE D.P.F. EGR sensor. Unable to duplicate or identify fault at this time. GO to **Z1**.
HE70	DTC P0401: RUN KOER SELF-TEST		
	• Run KOER Self-Test. • **Is KOER DTC P1408 output?**	Yes → No →	Fault is currently present. GO to **HE71**. GO to **HE90**.
HE71	DTC P1408: RETRIEVE CONTINUOUS MEMORY DTCS		
	Note: If any DTC other than DTC P1406 is output, record DTC and refer to Diagnostic Trouble Code (DTC) Charts after completing this Pinpoint Test. • Retrieve all Continuous Memory DTCs. • **Is DTC P1406 output?**	Yes → No →	GO to **HE60**. GO to **HE72**.

HE63 - HE71

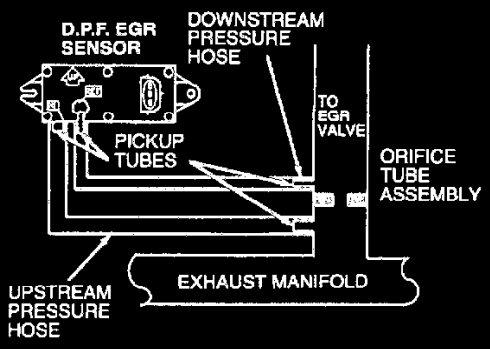
Test Steps		Results →	Action to Take
HE72	RUN KOER SELF-TEST WHILE MONITORING EGR VACUUM		
	• Disconnect vacuum hose at EGR valve and connect hose to a vacuum gauge. • Note: Since the EGR vacuum hose is disconnected, ignore DTCs during this KOER Self-Test. Run Key On Engine Running (KOER) Self-Test while monitoring gauge. Approximately 30 seconds into test, EGR flow will be requested for a few seconds. The vacuum at this time should increase above 5.4 kPa (1.6 in-Hg) to open the valve. • **Does the vacuum increase to 10 kPa (3.0 in-Hg) or greater at any time during KOER Self-Test?**	Yes → No →	The vacuum indicated is sufficient to open the EGR valve. Fault is unlikely to be in EGR vacuum control system. KEY OFF. GO to **HE73**. The vacuum indicated is insufficient to open the EGR valve. KEY OFF. GO to **HE80**.
HE73	INSPECT D.P.F. EGR SENSOR PRESSURE HOSES		
	• Visually inspect both pressure hoses for reversed connection at D.P.F. EGR sensor or at orifice tube assembly. • Inspect both hoses for improper routing. Hoses should not be pinched or have dips where water could settle or freeze. • Inspect both hoses for leaks and blockage. • Inspect D.P.F. EGR sensor and orifice tube assembly for blockage or damage at the pickup tubes. • **Is a fault detected?**  	Yes → No →	REPAIR pressure hoses as necessary. GO to **HE74**.

HE72 - HE73

Test Steps		Results →	Action to Take
HE74	CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube.) • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27-30 kPa (8-9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes → No →	REPLACE D.P.F. EGR sensor. RECONNECT pressure hoses. GO to **HE76**.
HE76	CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect vacuum hose at EGR valve and plug hose. • Connect a hand vacuum pump to EGR valve. • Start engine and bring to idle. • Access DPFEGR and rpm PIDs. • Slowly apply 27 to 34 kPa (8 to 10 in-Hg) of vacuum to the EGR valve and hold it for 10 seconds. If engine wants to stall, increase rpm with throttle to maintain a minimum of 1000 rpm. • Look for the following: — EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum indicated by increasing DPFEGR PID voltage. — DPFEGR PID voltage increasing until EGR valve is fully open. DPFEGR PID must read 2.5 volts minimum with full vacuum applied. — DPFEGR PID voltage steady when vacuum is held. If voltage drops within a few seconds, the EGR valve or vacuum source can be leaking. • **Does the DPFEGR PID voltage indicate that the EGR valve is operating as described in this test?**	Yes → No →	GO to **HE85**. REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding, leaking diaphragm and other damage. If EGR valve is OK, look for an obstructed EGR port in the intake manifold or plugged orifice tube assembly. REPAIR as necessary.

Test Steps		Results →	Action to Take
HE80	CHECK VACUUM SOURCE AND VACUUM HOSES TO AND FROM EGR VACUUM REGULATOR SOLENOID		
	• Inspect vacuum lines between vacuum source and EGR vacuum regulator solenoid and between EGR vacuum regulator solenoid and EGR valve for leaks, kinks, disconnects, blockage, routing or any damage. • Disconnect vacuum hoses at EGR vacuum regulator solenoid. • Connect EGR vacuum regulator solenoid vacuum source hose to a vacuum gauge. • With engine warm and at idle, take vacuum gauge reading. • **Is the vacuum gauge reading a minimum of 51 kPa (15 in-Hg) at idle and vacuum lines OK?**	Yes → No →	KEY OFF. GO to **HE81**. ISOLATE fault and REPAIR as necessary.
HE81	CHECK VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID		
	• Disconnect EGR vacuum regulator solenoid. • Key on, engine off. • Measure VPWR circuit voltage at EGR vacuum regulator solenoid harness connector. • **Is EGR vacuum regulator solenoid VPWR voltage greater than 10.5 volts?**	Yes → No →	KEY OFF. GO to **HE82**. REPAIR open circuit.
HE82	CHECK EGR VACUUM REGULATOR SOLENOID RESISTANCE		
	• Measure EGR vacuum regulator solenoid resistance. • **Is solenoid resistance between 26 and 40 ohms?**	Yes → No →	GO to **HE83**. REPLACE EGR vacuum regulator solenoid.
HE83	CHECK EGRVR CIRCUIT FOR SHORT TO PWR IN HARNESS		
	Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. • Disconnect PCM. • Key on, engine off. • Measure voltage between EGRVR circuit at the PCM harness connector and battery negative post. • **Is voltage greater than 1.0 volt?**	Yes → No →	REPAIR short circuit. KEY OFF. GO to **HE84**.
HE84	CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS		
	• Measure resistance of EGRVR circuit between PCM harness connector pin and EGR vacuum regulator solenoid harness connector. • **Is resistance less than 5.0 ohms?**	Yes → No →	RECONNECT PCM and EGR vacuum regulator solenoid. GO to **HE85**. REPAIR open in EGRVR circuit.

HE80 - HE84

	Test Steps	Results →	Action to Take
HE85	CHECK EGR VACUUM REGULATOR SOLENOID VACUUM OUTPUT CAPABILITY BY GROUNDING EGRVR CIRCUIT		
	• Disconnect vacuum hose at the EGR valve and connect to a vacuum gauge. • Key on, engine running. • With engine at idle, jumper PCM EGRVR circuit to chassis ground. • **Is vacuum gauge reading 13.5 kPa (4.0 in-Hg) or greater?**	Yes → No →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPLACE EGR vacuum regulator solenoid.
HE90	INSPECT EGR SYSTEM FOR AN INTERMITTENT FAILURE		
	• Visually inspect the EGR system for signs of intermittent failure. • **Is a fault found?**	Yes → No →	REPAIR fault as necessary. GO to **HE91**.
HE91	INSPECT D.P.F. EGR SENSOR PRESSURE HOSES		
	• Visually inspect both pressure hoses for reversed connection at D.P.F. EGR sensor or at orifice tube assembly. • Inspect both hoses for improper routing. Hoses should not be pinched or have dips where water could settle or freeze. • Inspect both hoses for leaks and blockage. • Inspect D.P.F. EGR sensor and orifice tube assembly for blockage or damage at the pickup tubes. • **Is a fault detected?**  	Yes → No →	REPAIR pressure hoses as necessary. GO to **HE92**.

HE85 - HE91

Test Steps		Results →	Action to Take
HE92	CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at D.P.F. EGR sensor. • Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube.) • Key on, engine off. • Access DPFEGR PID and note PID value. • Apply 27-30 kPa (8-9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied. — The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?**	Yes →	REPLACE D.P.F. EGR sensor.
		No →	RECONNECT pressure hoses. GO to **HE93**.
HE93	CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect vacuum hose at EGR valve and plug hose. • Connect a hand vacuum pump to EGR valve. • Start engine and bring to idle. • Access DPFEGR and RPM PIDs. • Slowly apply 17 to 34 kPa (5 to 10 in-Hg) of vacuum to the EGR valve and hold it for 10 seconds. If engine wants to stall, increase rpm with throttle to maintain a minimum of 800 rpm. • Look for the following: — EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum indicated by increasing DPFEGR PID voltage. — DPFEGR PID voltage increasing until EGR valve is fully open. DPFEGR PID should read 2.5 volts minimum with full vacuum applied. — DPFEGR PID voltage steady when vacuum is held. If voltage drops within a few seconds, the EGR valve or vacuum source could be leaking. • **Does the DPFEGR PID voltage indicate that the EGR valve is operating as described in this test?**	Yes →	GO to **HE94**.
		No →	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding, leaking diaphragm and other damage. If EGR valve is OK, look for an obstructed EGR port in the intake manifold. REPAIR as necessary.

HE92 - HE93

	Test Steps	Results →	Action to Take
HE94	INSPECT EGR VACUUM SIGNAL SUPPLY FOR INTERMITTENT FAILURE		
	• Disconnect plugged hose at EGR valve and connect to a vacuum gauge. • Key on, engine running. • Connect a jumper wire between EGRVR circuit and ground to activate the solenoid to full on. At idle, the vacuum gauge should read above 13.5 kPa (4.0 in-Hg). • Observe vacuum gauge for an indication of a fault while performing the following: — Lightly tap on the EGR vacuum regulator solenoid and wiggle the EGR vacuum regulator solenoid connector, vacuum lines and vehicle harness between the solenoid and PCM. A fault is indicated by a sudden drop in vacuum reading. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. Unable to duplicate or identify fault at this time. (In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms up causing the intermittent DTC.) GO to **Z1**.
HE100	EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH EGR VACUUM HOSE DISCONNECTED AND PLUGGED		
	Note: Perform KOER Self-Test and repair any DTCs before proceeding with this test. The symptom charts have indicated possible EGR flow at idle with no EGR diagnostic trouble codes output. Possible causes: — EGR valve not fully seating. — EGR vacuum regulator solenoid vent restricted. — Damaged EGR vacuum regulator solenoid. • Disconnect vacuum hose at EGR valve and plug hose. • Key on, engine off. • Access DPFEGR PID and note voltage. • Start engine and bring to idle. • With engine at idle, look at the DPFEGR PID voltage and compare to the engine off reading. An increase in the voltage at idle indicates that the differential pressure feedback EGR sensor is sensing EGR flow. • **Is the DPFEGR PID voltage greater at idle by a minimum of 0.15 volt than with the engine off?**	Yes → No →	The DPFEGR PID voltage is indicating EGR flow at idle. Since the EGR vacuum hose is disconnected and plugged, the fault is most likely in the EGR valve. REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary. This indicates a fault in the EGR valve vacuum supply. INSPECT the EGR vacuum regulator solenoid vent and vent filter for restrictions. REPAIR as necessary. If OK, REPLACE EGR vacuum regulator solenoid.

HE94 - HE100

Test Steps		Results →	Action to Take
HE110	DTC P1409: CHECK EGR VACUUM REGULATOR SOLENOID RESISTANCE		
	• Disconnect EGR vacuum regulator solenoid. • Measure EGR vacuum regulator solenoid resistance. • **Is solenoid resistance between 26 and 40 ohms?**	Yes → No →	GO to **HE111**. REPLACE EGR vacuum regulator solenoid.
HE111	CHECK VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID		
	• Key on, engine off. • Measure VPWR circuit voltage at EGR vacuum regulator solenoid harness connector. • **Is voltage greater than 10.5 volts?**	Yes → No →	KEY OFF. GO to **HE112**. REPAIR open in VPWR circuit.
HE112	CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS		
	Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. • Disconnect PCM. • Measure resistance of EGRVR circuit between PCM Pin and EGR vacuum regulator solenoid harness connector. • **Is resistance less than 5.0 ohms?**	Yes → No →	GO to **HE113**. REPAIR open in EGRVR circuit.
HE113	CHECK EGRVR CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key on, engine off. • Measure voltage between EGRVR at the PCM harness connector and battery negative post. • **Is voltage less than 1.0 volt?**	Yes → No →	KEY OFF. GO to **HE114**. REPAIR short circuit.
HE114	CHECK EGRVR CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure resistance between EGRVR and PWR GND circuits at the PCM harness connector. • **Is each resistance greater than 10,000 ohms?**	Yes → No →	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HE120	CONTINUOUS MEMORY DTC P1409: WIGGLE EGR VACUUM REGULATOR SOLENOID WHILE MONITORING VPWR		
	Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. Note: If DTC P1409 was output in Key On Engine Off (KOEO) or Key On Engine Running (KOER) Self-Test, GO to **HE110** to diagnose present fault. • Disconnect PCM. • Key on. • Measure voltage between EGRVR and PWR GND circuits at the PCM harness connector. • Voltage must read greater than 10.5 volts. For an indication of a fault, look for this voltage to drop while performing the following: — Lightly tap on the EGR vacuum regulator solenoid. — Wiggle the EGR vacuum regulator solenoid connector. — Grasp the EGR vacuum regulator solenoid harness connector and wiggle wires between solenoid and PCM. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.