

MALFUNCTION INDICATOR LAMP (MIL) ILLUMINATED—SYSTEM LEAN DIAGNOSTIC TROUBLE CODES (DTC'S)—SERVICE TIPS

TSB 04-17-4

FORD:

2000 Contour
2000-2002 Escort
2000-2003 Escort ZX2
2000-2004 Crown Victoria, Focus, Mustang,
Taurus
2002-2004 Thunderbird
2000-2003 Windstar
2000-2004 Econoline, Excursion, Expedition,
Explorer, F-Super Duty, Ranger
2001-2004 Escape
2004 Freestar
2000-2004 F-Series

LINCOLN:

2000-2002 Continental
2000-2004 LS, Town Car, Navigator
2002-2003 Blackwood
2003-2004 Aviator

MERCURY:

2000 Mystique
2000-2002 Cougar
2000-2004 Grand Marquis, Sable,
Mountaineer
2004 Monterey

ISSUE

This article is intended to aid in diagnosing DTC's P0171, P0174, P1130, P1131, P1150, P1151, P2195, or P2197 (system lean or lack of HEGO switches) when a vacuum leak is present. HEGO sensors, MAF sensors, and PCM replacements are not an effective repair when a vacuum leak is causing the above DTC's.

ACTION

Perform the following inspections/repairs when the above codes are found in memory. Procedure provides instructions on how to make comparisons of the total fuel corrections (using scan tool or equivalent) at idle and high RPM's to help determine if a vacuum leak is the root cause of the DTC's.

SERVICE PROCEDURE

NOTE

FREEZE FRAME AND ADAPTIVE FUEL VALUES (ASSOCIATED WITH "LONGFT" PID) WILL NOT BE AVAILABLE IF A KAM OR OBDII RESET WAS RECENTLY PERFORMED.

NOTE

FREEZE FRAME DATA WILL INDICATE THE ENGINE AND AMBIENT CONDITIONS WHEN THE DTC WAS SET. THESE ARE IMPORTANT BECAUSE THE VACUUM LEAKS MAY OCCUR ONLY WITHIN SPECIFIC TEMPERATURE RANGES AND MUST BE DUPLICATED TO DETECT THE LEAK.

NOTE

FUEL TRIMS AT IDLE ARE PARTICULARLY SENSITIVE TO VACUUM LEAKS SINCE THE UN-METERED AIR "LEAKAGE FLOW" IS A HIGHER PERCENTAGE OF TOTAL AIRFLOW AT IDLE THAN AT PART THROTTLE. THE BAROMETRIC PRESSURE (BP) PID IS NOT RECOMMENDED TO VIEW WHEN DIAGNOSING A VACUUM LEAK. BP IS AN INFERRED PID CALCULATED DURING HIGHER ENGINE LOADS.

1. Perform preliminary inspection, retrieve and record DTC's and Freeze Frame Data. DO NOT PERFORM KAM RESET OR OBDII RESET (CLEAR CODES) AT THIS TIME, ADAPTIVE FUEL TABLES MUST BE INTACT FOR THIS PROCEDURE.

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- a. If DTCs are continuous, or if other DTC's or drive symptoms are present other than at idle, diagnose and repair those codes/symptoms first.
- b. Perform visual inspection - look for disconnected/broken/cracked vacuum hoses especially near vacuum trees. Check PCV elbows for cracks or loose connection. Confirm vehicle has the correct PCV valve installed. If a suspect vacuum leak is found proceed to Step 4.

NOTE

EACH VEHICLE APPLICATION REQUIRES A PCV VALVE CALIBRATED FOR THAT VEHICLE. MOTORCRAFT PARTS ARE STRONGLY RECOMMENDED. ALSO, THERE WILL BE A NORMAL VARIATION IN FUEL TRIMS FROM VEHICLE TO VEHICLE.

2. Determine if vacuum leak is present.
 - a. Set up scan tool to monitor the following PIDS: ECT/CHT, LONGFT1, LONGFT2, SHRTFT1, SHRTFT2, IAT.
 - b. Start the engine and run at idle with all accessories off - gear lever in Neutral/Park.
 - c. Run engine until ECT/CHT matches the corresponding freeze frame data from Step 1. This will duplicate the customer's engine operating temperatures when the DTC was set in memory. Hood may remain open during this test to help reduce ECT/CHT/IAT temperatures. Keep IAT below 115° F (46° C).
 - d. Record LONGFT's and SHRTFT's.

NOTE

TO PREVENT HIGH ECT/CHT AND IAT TEMPERATURES IT MAY BE NECESSARY TO PERFORM THIS TEST WITH THE ENGINE RUNNING FOR SHORT INTERVALS, ESPECIALLY WHEN AMBIENT TEMPERATURE IS ABOVE 85° F (29°C). USE OF A GARAGE FAN WILL HELP TO KEEP ENGINE TEMPERATURES STABILIZED DURING TEST. IT MAY BE NECESSARY TO RUN THIS TEST AT SPECIFIC ECT/CHT/IAT TEMPERATURES, REVIEW FREEZE FRAME DATA. EXAMPLE: IF ECT WAS AT 160° F (71° C) THEN ENGINE MAY NEED A COLD START TO DUPLICATE THIS TEMPERATURE.

- e. Determine total fuel correction at idle for an in-line 4 cylinder engine or bank 1 of a V-engine by adding LONGFT1 to SHRTFT1. Determine total fuel correction for bank 2 of a V-engine, by adding LONGFT2 to SHRTFT2.

NOTE

MAKE SURE ONLY THE CORRECT BANKS AND TRIMS ARE ADDED TOGETHER (DO NOT ADD LONGFT1 TO LONGFT2 OR LONGFT1 TO SHRTFT2.)

- EXAMPLE 1: BANK1 LONG FUEL TRIM; LONGFT1 = +13% AND SHORT FUEL TRIM; SHRTFT1 = +23%. THE TOTAL CORRECTION ON BANK1 IS +36% (13%+23%=36%).
- EXAMPLE 2: BANK2 LONGFT2 = +24% AND BANK 2 SHRTFT2 = -3%. THIS TOTAL FUEL CORRECTION ON BANK 2 IS +21% (+24% -3%= +21%).

A TYPICAL VACUUM LEAK WHICH MAY SET A LEAN CODE DTC WILL HAVE TOTAL CORRECTION OF AROUND +20% OR GREATER AT OR NEAR IDLE (DEPENDS ON CALIBRATION)

- f. Depress and hold throttle pedal to maintain an engine RPM of 2500.
 - g. Observe PIDS with engine RPM at 2500. View and record LONGFT1, LONGFT2, SHRTFT1, SHRTFT2. Do not hold engine RPM's at 2500 for more than 20 seconds. Release pedal and repeat if more time is necessary to record PIDS.
 - h. Determine total fuel correction at 2500 RPM's by adding the LONGFT's to the associated SHRTFT's.
 - i. If the fuel correction decreases, more than 15%, (example: was +31% at idle on bank 1 but changed to +12% at 2500RPM on bank 1, a decrease of 19%) then a vacuum leak is most likely causing the lean diagnostic test codes. Proceed to Step 3.
 - j. If the total correction remains approximately the same then the lean condition is not caused by a vacuum leak. Refer to the PC/ED for further diagnostics.
3. Pinpointing vacuum leaks.
 - a. Monitor SHRTFT's with scan tool with engine running at idle.

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- b. Locate vacuum trees off air induction system and PCV system. Use hose clamp or pinch off pliers (avoid tools with sharp edges).

NOTE

USE CAUTION WHEN CLAMPING HOSES. A VACUUM CAP OR EQUIVALENT CAN ALSO BE USED TO BLOCK THE VACUUM SOURCE TO A SPECIFIC SYSTEM. DO NOT TRY TO PINCH OFF A HARD PLASTIC HOSE OR CONNECTION, TRY ISOLATING BY CAPPING. CLAMPING OF THE FUEL SYSTEM PURGE HOSE MAY SHIFT SHRTFT DURING PURGING MODES, USE VISUAL INSPECTION ON THIS HOSE IF RESULTS ARE NOT CONSISTENT.

- c. Observe short fuel trims when pinching specific vacuum lines. The SHRTFT values should decrease more than 15% towards the negative direction, if a vacuum leak was pinched off. (wait up to 20 seconds to observe if pinch has any effect on SHRTFT's).

NOTE

EXAMPLE: PINCH OFF THE BRAKE BOOSTER VACUUM HOSE (DO THIS ONLY IN PARK) AND OBSERVE SHRTFT'S. IF THE SHRTFT'S DECREASES, BY MORE THAN 15%, A VACUUM LEAK IS PRESENT. IF THE SHRTFT1 WAS AT +14% BEFORE PINCHING THEN SHIFTS TO -7% AFTER PINCHING, TOTAL SHIFT OF 21% TOWARDS NEGATIVE DIRECTION.

- d. If vacuum leak is located proceed to Step 4c.

NOTE

INTAKE GASKETS OR MANIFOLD LEAKS CANNOT BE DETECTED BY PINCHING OFF LINES. USE OTHER LEAK DETECTION METHODS, SUCH AS SMOKE TEST, SONIC TESTS, AND PROPANE.

- e. If no vacuum leaks are found, refer to the PC/ED for further diagnostics.
4. Verification of repair.
 - a. Prepare scan tool and vehicle to monitor short term fuel trims (SHRTFT's).
 - b. Get vehicle into stabilized idle condition, unless freeze frame indicates other temperatures.
 - c. Repair vacuum leak.
 - d. SHRTFTs should decrease by at least 15%. If they do not, return to Step 2.
 - e. Clear KAM and codes.

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New Vehicle Limited
Warranty Coverage And
Emissions Warranty
Coverage