2012 - Mazda6 - Engine

DTC P2195:00, P2197:00 [MZI 3.7 V6]

DTC P2195:00 DTC P2197:00	P2195:00: A/F sensor (RH) signal stuck lean P2197:00: A/F sensor (LH) signal stuck lean
DETECTION CONDITION	• P2195:00 indicates that A/F sensor (RH) signal is stuck lean • P2197:00 indicates that A/F sensor (LH) signal is stuck lean • An A/F sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.
POSSIBLE CAUSE	**Electrical System:** • Open/short circuit in A/F sensor circuit • A/F sensor malfunction • HO2S malfunction • Short to power supply in wiring harness or A/F sensor • Water in wiring harness connector • Open A/F sensor pumping current circuit • Corrosion or incorrect harness connections • PCM malfunction **Fuel System:** • Insufficient fuel pressure • Ethanol content in fuel • Contaminated fuel injectors • Leaking fuel pressure regulator • Low fuel pressure or fuel nearly depleted • Vapor recovery system **Intake Air System:** • Vacuum leaks • PCV system malfunction

	• Air leaks after the MAF sensor • Incorrectly seated engine oil dipstick **Base Engine:** • Oil overfill • Camshaft timing • Cylinder compression • Exhaust leaks before or near the A/F sensor

Diagnostic procedure

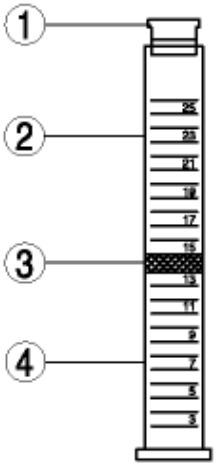
STEP	INSPECTION		ACTION
1	**VERIFY FREEZE FRAME DATA HAS BEEN RECORDED** • Has FREEZE FRAME DATA been recorded?	Yes	Go to the next step.
		No	Record FREEZE FRAME DATA on the repair order, then go to the next step.
2	**VERIFY RELATED REPAIR INFORMATION AVAILABILITY** • Is any related Service Bulletins available?	Yes	Perform repair or diagnosis according to the available Service Bulletins. • If the vehicle is not repaired, go to the next step.
		No	Perform the PCM reprogramming procedure. (See **PCM CONFIGURATION [MZI 3.7 V6]**) Then go to the next step.
3	**VERIFY RELATED PENDING CODE OR STORED DTCs** • Switch the ignition off then to the ON position (Engine off). • Verify the related PENDING CODE or stored DTCs using the M-MDS. • Are any DTCs present other than the following: ▪ P0171:00, P0174:00, P2195:00 or P2197:00?	Yes	Go to the appropriate DTC troubleshooting. (See **DTC TABLE [MZI 3.7 V6]**.)
		No	Go to the next step.
4	**PERFORM VISUAL INSPECTION ON INTAKE AIR SYSTEM AND ALL VACUUM HOSES** • Switch the ignition off. • Check the intake air system for leaks,	Yes	Repair if necessary. Then go to Step 7.
		No	Go to the next step.

	obstructions, and damage. • Inspect the entire length of all the vacuum hoses for: ▪ In correct connections ▪ Damage or cracks ▪ Damaged or cracked vacuum hose joint ▪ Improperly seated engine oil dipstick, tube or oil fill cap • Verify the integrity of the positive crankcase ventilation (PCV) system. • Verify that the PCV valve part number is correct. • Is a concern present?		
5	**INSPECT FOR PRESENCE OF VACUUM LEAK** **NOTE:** • Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle. • The BARO PID is not a commended PID to monitor when diagnosing a vacuum leak. BARO is calculated during high engine load, when the vacuum leak represents a small portion of the total air flow. • When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%. • If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82—101 °C {180—215 °F} and the intake air temperature at less than 46 °C {115 °F}. • Switch the ignition ON (Engine running). • Access the PCM and monitor the ECT, CHT and IAT PIDs. • Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs. • Allow the engine to stabilize at the temperature necessary to recreate the concern.	Yes	No vacuum leak is present. Go to Step 8.
		No	Go to the next step.

	NOTE: • If the engine speed cannot be increased to 3,500 rpm, increase the engine speed to maximum RPM without activating RPM limiting. • Add and record the LONGFT PID value to the SHRTFT PID value for each bank, correction at idle. • Increase the engine speed to 3,500 rpm for 10 s. Record the LONGFT1, SHRTFT1, LONGFT2, and system SHRTFT2 PID values. • Add and record the LONGFT PID value to the SHRTFT PID value for each bank, correction at 3,500 rpm. • Is the total fuel correction value difference between idle and 3,500 rpm less than 15%?		
6	**LOCATE VACUUM LEAK** **CAUTION:** • Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose. **NOTE:** • Restricting the EVAP vapor hose while the EVAP emission canister is purging may shift the SHRTFT. Perform a visual inspection if necessary. • When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%. • Locate the vacuum hose joint for the intake air and PCV systems. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Restrict the vacuum lines one at a time for 30 s. If a vacuum leak in the intake is present, the SHRTFT PID values decrease as the hose is restricted. • Is the decrease in the SHRTFT PIDs more than 15% when one of the vacuum hoses is restricted?	Yes	Repair if necessary. Then go to the next step.
		No	Inspect the intake air system for a vacuum leak in the intake manifold or intake gaskets. Repair if necessary. Then go to the next step.
7	**VACUUM LEAK REPAIR VERIFICATION** **NOTE:** • If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the	Yes	Reset the keep alive memory. Then go to Step 30.
		No	A vacuum leak is still present.

	freeze frame ECT PID is not available, maintain the engine coolant temperature between 82—101 °C {180—215 °F} and the intake air temperature less than 46 °C {115 °F}. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Allow the engine to stabilize at the temperature necessary to recreate the concern. • Record the SHRTFT1 and SHRTFT2 PID values. • Switch the ignition off. • Repair the vacuum leak. • Switch the ignition ON (Engine running). • Allow the engine to stabilize at the temperature necessary to recreate the concern. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Compare the recorded SHRTFT PID values, prior to the no -vacuum leak repair, to the current SHRTFT PID values. • Is the decrease in the SHRTFT PIDs more than 15%?		Return to Step 6.
8	**INSPECT A/ F SENSOR PUMPING CURRENT CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Only the suspect A/F sensor needs to be diagnosed. • Switch the ignition off. • Disconnect suspect A/F sensor connector and PCM connector. • Measure the resistance between suspect A/F sensor harness-side connector terminal G and following PCM harness-side connector terminal: ▪ For P2195:00: A/F sensor (RH) terminal G—PCM terminal 2AS ▪ For P2197:00: A/F sensor (LH) terminal G— PCM terminal 2AO • Are the resistances less than 5 ohms?	Yes	Go to the next step.
		No	Repair for an open circuit, then go to Step 30.
9	**INSPECT FUEL PRESSURE** **WARNING:** • Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death.	Yes	Go to Step 20.
		No	Go to the next step.

	Fuel can also irritate skin and eyes. To prevent this, always complete the "BEFORE REPAIR PROCEDURE". **NOTE:** • For vehicle specific fuel pressure ranges, refer to the "FUEL LINE PRESSURE INSPECTION". • Remove the jumper wire(s). • Connect the A/F sensor connector. • Relieve the fuel pressure. • Connect the mechanical fuel pressure gauge. • Pressurize the fuel system. • Switch the ignition ON (Engine running). • Allow the fuel pressure to stabilize. • Switch the ignition off. • Switch the ignition ON (Engine running). • Measure the fuel pressure. • Is the fuel pressure within the range for the vehicle being diagnosed?		
10	**INSPECT FUEL LINE PRESSURE** • Switch the ignition off. • Connect the mechanical fuel pressure gauge. (See **FUEL LINE PRESSURE INSPECTION [MZI 3.7 V6]**.) • Connect the FP connector. • Switch the ignition ON (Engine off). • Pressurize the fuel system. • Cycle the key several times to charge the fuel system. • Relieve the fuel pressure. • Is the fuel pressure within range?	Yes	Go to Step 13.
		No	Go to the next step.
11	**INSPECT FUEL PUMP GROUND CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Refer to the Wiring Diagrams Manual for schematic and connector information. • Switch the ignition off. • Disconnect the FP and fuel pump relay connectors.	Yes	Go to the next step.
		No	Repair for an open circuit, then go to Step 30.

	• Verify the continuity between FP (wiring harness-side connector) terminal D and ground. • Is there any continuity?		
12	**INSPECT FUEL PUMP POWER CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Refer to the Wiring Diagrams Manual for schematic and connector information. • Switch the ignition off. • Disconnect the FP and fuel pump relay connectors. • Verify the continuity between FP (harness-side connector) terminal B and fuel pump relay (harness-side connector) terminal C. • Is there any continuity?	Yes	Go to Step 15.
		No	Repair for an open circuit, then go to Step 30.
13	**CALCULATE PERCENTAGE OF ETHANOL IN FUEL** **NOTE:** • Use the illustration as an example for calculating the percentage of ethanol using the following steps. If the separation level is at 14 ml {14 cc, 0.85 in^3} the calculation is: 14 min 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.  	Item Number	Description
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1	Stopper
2	Gasoline
3	Separation Point at 14ml
4	Ethanol / Water Mixture | • Switch the ignition off. • Take the recorded separation level from the previous step and subtract the amount of water	Yes	Go to the next step.
		No	Go to Step 15.

	added. • Multiply the new value by 5. This new value is the percentage of ethanol in the fuel. • Record the calculated percentage of ethanol in the fuel. • Is any ethanol present in the fuel?		
14	**DETERMINE IF PERCENTAGE OF ETHANOL IN FUEL IS LESS THAN 10%** • Verify the recorded (calculated) percentage of ethanol in the fuel. • Is the calculated percentage of ethanol in the fuel less than 10%?	Yes	Go to the next step.
		No	Replace the fuel. Advice the customer of the correct fuel type required for this vehicle. Refer to the Owner's Manual Literature for additional information. Go to Step 30.
15	**INSPECT FUEL PRESSURE LEAKDOWN** • Connect the mechanical fuel pressure gauge. • Switch the ignition to ON (Engine running). • Allow the fuel pressure to stabilize. • Record the stabilized reading. • Switch the ignition to off. • Monitor the fuel pressure for 1 min. • Does the fuel pressure remain within 34 kPa {255 mmHg, 10.0 inHg} of the recorded reading after 1 min?	Yes	Go to Step 17.
		No	Go to the next step.
16	**INSPECT FUEL INJECTOR FLOW AND LEAKAGE** **NOTE:** • Observe the Warnings, Cautions, and Notes. • Inspect the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel. • Are the test results satisfactory?	Yes	Go to the next step.
		No	Replace the suspect fuel injector, then go to Step 30.
17	**MONITOR FUEL PRESSURE WHILE ROAD TESTING VEHICLE** **WARNING:** • Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.	Yes	Unable to duplicate or identify the concern at this time. Go to Step 30.
		No	Go to the next step.

	NOTE: • Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer. • Switch the ignition off. • Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle. • Start the engine and run it at idle. • Warm up the engine to normal operating temperature. • Monitor the mechanical gauge. • From a stop, accelerate to 89 km/h (55 mph) at full throttle. • Repeat 3 times. • Is the fuel pressure always greater than 240 kPa {2.45 kgf/cm^2, 34.8 psi}?		
18	**INSPECT FUEL SUPPLY LINE FOR RESTRICTION** **NOTE:** • Observe the Warnings, Cautions, and Notes. • Switch the ignition off. • Disconnect the fuel supply line at the fuel rail. • Disconnect the fuel supply line at the fuel pump. • Verify the fuel supply line for restriction. • Apply 21—34 kPa {0.22—0.34 kgf/cm^2, 3.1—4.9 psi} air pressure to the fuel supply line. • Does air flow freely through the line?	Yes	Replace the fuel filter (low-pressure side). Go to the next step.
		No	Repair the cause of the restriction, then go to Step 30.
19	**VERIFY FUEL SYSTEM REPAIRED** **WARNING:** • Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury. • Start the engine and run it at idle. • Warm up the engine to normal operating temperature. • Monitor the mechanical gauge.	Yes	The test is complete and no concerns are present. Go to Step 30.
		No	Replace the fuel pump unit, then go to Step 30.

	• From a stop, accelerate to 89 km/h (55 mph) at full throttle. • Repeat 3 times. • Is the fuel pressure always greater than 240 kPa {2.45 kgf/cm^2, 34.8 psi}?		
20	**VERIFY FUEL SYSTEM FOR PRESSURE STABILITY- FAST DECREASE** **NOTE:** • When the fuel pump is commanded off, the fuel pressure may substantially decrease stabilize. • During output state control, the fuel pump stays commanded on for only about 5 s. • Switch the ignition off. • Switch the ignition ON (Engine off). • Access the PCM and control the FP PID. • Run the fuel pump to obtain maximum fuel pressure. • Command the fuel pump off. • Allow the fuel pressure to stabilize. • Record the stabilized reading. • Monitor the fuel pressure for 10 s. • Does the fuel pressure remain within 34 kPa {0.35 kgf/cm^2, 4.9 psi} of the recorded reading after 10 s?	Yes	Go to Step 22.
		No	Go to the next step.
21	**INSPECT FOR EXTERNAL FUEL LEAK** • Inspect the fuel tank, lines, and filler pipe for a fuel leak. • Is a concern present?	Yes	Repair for fuel leakage, then go to Step 30.
		No	Go to Step 24.
22	**VERIFY FUEL SYSTEM FOR PRESSURE STABILITY-SLOW DECREASE** • Continue to monitor the fuel pressure for 1 min. • Does the fuel pressure remain within 34 kPa {0.35 kgf/cm^2, 4.9 psi} of the recorded reading after 1 min?	Yes	Go to the next step.
		No	Go to Step 16.
23	**DETERMINE IF THE PERCENTAGE OF ETHANOL IN FUEL IS LESS THAN 10%** • Check the recorded (calculated) percentage of ethanol in the fuel referring to Step 13 and 14.	Yes	Go to the next step.
		No	Replace the fuel. Advice the customer of the correct fuel

	• Is the calculated percentage of ethanol in the fuel less than 10%?		type required for this vehicle. Refer to the Owner's Manual Literature for additional information. Go to Step 30.
24	**INSPECT FUEL INJECTOR OPERATION** • Perform the "Fuel Injector Operation Inspection" for the right bank (with DTC P2195:00) or the left bank (with DTC P2197:00). (See **ENGINE CONTROL SYSTEM OPERATION INSPECTION [MZI 3.7 V6]**.) • Does the fuel injector operate normally?	Yes	Replace the suspected fuel injector, then go to Step 30. (See **FUEL INJECTOR REMOVAL/ INSTALLATION [MZI 3.7 V6]**.)
		No	Go to the next step.
25	**INSPECT HO2S OUTPUT VOLTAGE** • Switch the ignition off. • Disconnect suspect HO2S connector. • Visually inspect suspect HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. repair if necessary. • Measure the voltage between terminal B and terminal D on suspect HO2S component side connector. • Increase the engine speed to 2,000 rpm for 3 min. • Perform the KOER self-test. (See **KOEO/ KOER SELF TEST [MZI 3.7 V6]**.) • Monitor the signal voltage during the self-test. • Is the voltage greater than 0.5 V at any time during the self-test?	Yes	Go to the next step.
		No	Replace suspect HO2S, then go to Step 30.
26	**PERFORM THOROUGH WIGGLE TEST ON HO2S WIRING HARNESS** • Connect the HO2S connector. • Switch the ignition switch ON (Engine running). • Engine at normal operating temperature. • Access the PCM and monitor the suspect HO2S Signal PID. • Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM. • While monitoring the HO2S PID, does the HO2S stop switching?	Yes	Isolate the concern and repair if necessary. Then go to Step 30.
		No	Go to the next step.

27	**TEST DRIVE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING** • Access the PCM and monitor suspect HO2S signal PID. • Access the PCM and monitor the FUELSYS PID. • Start the engine and let idle until the vehicle goes into the closed loop fuel condition. • Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate original concern. • Does the HO2S PID switch?	Yes	Go to the next step.
		No	Replace the suspect HO2S, then go to Step 30.
28	**VERIFY FUNCTIONALITY OF MAF SENSOR** **NOTE:** • MAF PID value of less than 0.6 V may indicate an incorrectly installed air cleaner or a leak in the intake-air system. • Start the engine and run it at idle. • Allow the engine to stabilize at the correct operating temperature. • Access and monitor the MAF PID. • Inspect that the MAF PID at idle and P/N position is not greater than 30% of the normal MAF listed. Reference Values or not greater than 1.3 V. (See **PCM INSPECTION [MZI 3.7 V6]**.) • Is the PID value within the expected range?	Yes	Unable to duplicate or identify the concern at this time. Go to Step 30.
		No	Go to the next step.
29	**INSPECT TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURRENCE** **NOTE:** • Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable drivability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, replace the MAF sensor. • Switch the ignition off. • Disconnect the MAF/IAT sensor connector. • Start the engine and run it at idle. • Drive the vehicle on the road. • Does the lean drivability symptom (lack of power, spark knock/detonation, buck/jerk or	Yes	Replace the MAF/IAT sensor, then go to the next step. (See **MASS AIR FLOW (MAF)/ INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL/ INSTALLATION [MZI 3.7 V6]**.)
		No	Go to the next step. (The system is correctly at this time. The concern may have been caused by a loose or corroded connector.)

	hesitation/surge on acceleration) disappear?		
30	**VERIFY TROUBLESHOOTING OF DTC P2195:00, P2197:00 HAVE BEEN COMPLETED** • Verify that all disconnected connectors are reconnected. • Switch the ignition ON (Engine off). • Clear the DTC from the PCM memory using the M-MDS. • Perform no load racing at the engine speed of 2,500—3,500 rpm for 60s or more, then idle the engine for 60s or more. • Perform the KOER self-test. (See **KOEO/ KOER SELF TEST [MZI 3.7 V6]**.) • Is the PENDING CODE for this DTC present?	Yes	Repeat the inspection from Step 1. • If the malfunction recurs, replace the PCM. (See **PCM REMOVAL/ INSTALLATION [MZI 3.7 V6]**.) Go to the next step.
		No	Go to the next step.
31	**VERIFY AFTER REPAIR PROCEDURE** • Perform the "AFTER REPAIR PROCEDURE". (See **AFTER REPAIR PROCEDURE [MZI 3.7 V6]**.) • Are any DTCs present?	Yes	Go to the applicable DTC inspection. (See **DTC TABLE [MZI 3.7 V6]**.)
		No	Troubleshooting completed.

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DTC P2195:00 DTC P2197:00	P2195:00: A/F sensor (RH) signal stuck lean P2197:00: A/F sensor (LH) signal stuck lean
DETECTION CONDITION	• P2195:00 indicates that A/F sensor (RH) signal is stuck lean • P2197:00 indicates that A/F sensor (LH) signal is stuck lean • An A/F sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.
POSSIBLE CAUSE	**Electrical System:** • Open/short circuit in A/F sensor circuit • A/F sensor malfunction • HO2S malfunction • Short to power supply in wiring harness or A/F sensor • Water in wiring harness connector • Open A/F sensor pumping current circuit • Corrosion or incorrect harness connections • PCM malfunction **Fuel System:** • Insufficient fuel pressure • Ethanol content in fuel • Contaminated fuel injectors • Leaking fuel pressure regulator • Low fuel pressure or fuel nearly depleted • Vapor recovery system **Intake Air System:** • Vacuum leaks • PCV system malfunction

	• Air leaks after the MAF sensor • Incorrectly seated engine oil dipstick **Base Engine:** • Oil overfill • Camshaft timing • Cylinder compression • Exhaust leaks before or near the A/F sensor

Diagnostic procedure

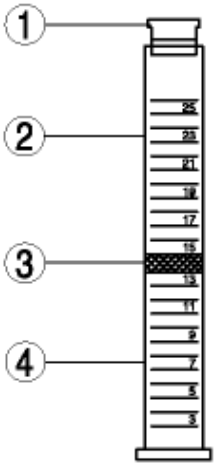
STEP	INSPECTION		ACTION
1	**VERIFY FREEZE FRAME DATA HAS BEEN RECORDED** • Has FREEZE FRAME DATA been recorded?	Yes	Go to the next step.
		No	Record FREEZE FRAME DATA on the repair order, then go to the next step.
2	**VERIFY RELATED REPAIR INFORMATION AVAILABILITY** • Is any related Service Bulletins available?	Yes	Perform repair or diagnosis according to the available Service Bulletins. • If the vehicle is not repaired, go to the next step.
		No	Perform the PCM reprogramming procedure. (See **PCM CONFIGURATION [MZI 3.7 V6]**) Then go to the next step.
3	**VERIFY RELATED PENDING CODE OR STORED DTCs** • Switch the ignition off then to the ON position (Engine off). • Verify the related PENDING CODE or stored DTCs using the M-MDS. • Are any DTCs present other than the following: ▪ P0171:00, P0174:00, P2195:00 or P2197:00?	Yes	Go to the appropriate DTC troubleshooting. (See **DTC TABLE [MZI 3.7 V6]**.)
		No	Go to the next step.
4	**PERFORM VISUAL INSPECTION ON INTAKE AIR SYSTEM AND ALL VACUUM HOSES** • Switch the ignition off. • Check the intake air system for leaks,	Yes	Repair if necessary. Then go to Step 7.
		No	Go to the next step.

	obstructions, and damage. • Inspect the entire length of all the vacuum hoses for: ▪ In correct connections ▪ Damage or cracks ▪ Damaged or cracked vacuum hose joint ▪ Improperly seated engine oil dipstick, tube or oil fill cap • Verify the integrity of the positive crankcase ventilation (PCV) system. • Verify that the PCV valve part number is correct. • Is a concern present?		
5	**INSPECT FOR PRESENCE OF VACUUM LEAK** **NOTE:** • Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle. • The BARO PID is not a commended PID to monitor when diagnosing a vacuum leak. BARO is calculated during high engine load, when the vacuum leak represents a small portion of the total air flow. • When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%. • If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82—101 °C {180—215 °F} and the intake air temperature at less than 46 °C {115 °F}. • Switch the ignition ON (Engine running). • Access the PCM and monitor the ECT, CHT and IAT PIDs. • Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs. • Allow the engine to stabilize at the temperature necessary to recreate the concern.	Yes	No vacuum leak is present. Go to Step 8.
		No	Go to the next step.

	NOTE: • If the engine speed cannot be increased to 3,500 rpm, increase the engine speed to maximum RPM without activating RPM limiting. • Add and record the LONGFT PID value to the SHRTFT PID value for each bank, correction at idle. • Increase the engine speed to 3,500 rpm for 10 s. Record the LONGFT1, SHRTFT1, LONGFT2, and system SHRTFT2 PID values. • Add and record the LONGFT PID value to the SHRTFT PID value for each bank, correction at 3,500 rpm. • Is the total fuel correction value difference between idle and 3,500 rpm less than 15%?		
6	**LOCATE VACUUM LEAK** **CAUTION:** • Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose. **NOTE:** • Restricting the EVAP vapor hose while the EVAP emission canister is purging may shift the SHRTFT. Perform a visual inspection if necessary. • When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%. • Locate the vacuum hose joint for the intake air and PCV systems. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Restrict the vacuum lines one at a time for 30 s. If a vacuum leak in the intake is present, the SHRTFT PID values decrease as the hose is restricted. • Is the decrease in the SHRTFT PIDs more than 15% when one of the vacuum hoses is restricted?	Yes	Repair if necessary. Then go to the next step.
		No	Inspect the intake air system for a vacuum leak in the intake manifold or intake gaskets. Repair if necessary. Then go to the next step.
7	**VACUUM LEAK REPAIR VERIFICATION** **NOTE:** • If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the	Yes	Reset the keep alive memory. Then go to Step 30.
		No	A vacuum leak is still present.

	freeze frame ECT PID is not available, maintain the engine coolant temperature between 82—101 °C {180—215 °F} and the intake air temperature less than 46 °C {115 °F}. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Allow the engine to stabilize at the temperature necessary to recreate the concern. • Record the SHRTFT1 and SHRTFT2 PID values. • Switch the ignition off. • Repair the vacuum leak. • Switch the ignition ON (Engine running). • Allow the engine to stabilize at the temperature necessary to recreate the concern. • Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs. • Compare the recorded SHRTFT PID values, prior to the no -vacuum leak repair, to the current SHRTFT PID values. • Is the decrease in the SHRTFT PIDs more than 15%?		Return to Step 6.
8	**INSPECT A/ F SENSOR PUMPING CURRENT CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Only the suspect A/F sensor needs to be diagnosed. • Switch the ignition off. • Disconnect suspect A/F sensor connector and PCM connector. • Measure the resistance between suspect A/F sensor harness-side connector terminal G and following PCM harness-side connector terminal: ▪ For P2195:00: A/F sensor (RH) terminal G—PCM terminal 2AS ▪ For P2197:00: A/F sensor (LH) terminal G— PCM terminal 2AO • Are the resistances less than 5 ohms?	Yes	Go to the next step.
		No	Repair for an open circuit, then go to Step 30.
9	**INSPECT FUEL PRESSURE** **WARNING:** • Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death.	Yes	Go to Step 20.
		No	Go to the next step.

	Fuel can also irritate skin and eyes. To prevent this, always complete the "BEFORE REPAIR PROCEDURE". **NOTE:** • For vehicle specific fuel pressure ranges, refer to the "FUEL LINE PRESSURE INSPECTION". • Remove the jumper wire(s). • Connect the A/F sensor connector. • Relieve the fuel pressure. • Connect the mechanical fuel pressure gauge. • Pressurize the fuel system. • Switch the ignition ON (Engine running). • Allow the fuel pressure to stabilize. • Switch the ignition off. • Switch the ignition ON (Engine running). • Measure the fuel pressure. • Is the fuel pressure within the range for the vehicle being diagnosed?		
10	**INSPECT FUEL LINE PRESSURE** • Switch the ignition off. • Connect the mechanical fuel pressure gauge. (See **FUEL LINE PRESSURE INSPECTION [MZI 3.7 V6]**.) • Connect the FP connector. • Switch the ignition ON (Engine off). • Pressurize the fuel system. • Cycle the key several times to charge the fuel system. • Relieve the fuel pressure. • Is the fuel pressure within range?	Yes	Go to Step 13.
		No	Go to the next step.
11	**INSPECT FUEL PUMP GROUND CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Refer to the Wiring Diagrams Manual for schematic and connector information. • Switch the ignition off. • Disconnect the FP and fuel pump relay connectors.	Yes	Go to the next step.
		No	Repair for an open circuit, then go to Step 30.

	• Verify the continuity between FP (wiring harness-side connector) terminal D and ground. • Is there any continuity?		
12	**INSPECT FUEL PUMP POWER CIRCUIT FOR OPEN CIRCUIT IN WIRING HARNESS** **NOTE:** • Refer to the Wiring Diagrams Manual for schematic and connector information. • Switch the ignition off. • Disconnect the FP and fuel pump relay connectors. • Verify the continuity between FP (harness-side connector) terminal B and fuel pump relay (harness-side connector) terminal C. • Is there any continuity?	Yes	Go to Step 15.
		No	Repair for an open circuit, then go to Step 30.
13	**CALCULATE PERCENTAGE OF ETHANOL IN FUEL** **NOTE:** • Use the illustration as an example for calculating the percentage of ethanol using the following steps. If the separation level is at 14 ml {14 cc, 0.85 in^3} the calculation is: 14 min 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.  	Item Number	Description
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1	Stopper
2	Gasoline
3	Separation Point at 14ml
4	Ethanol / Water Mixture | • Switch the ignition off. • Take the recorded separation level from the previous step and subtract the amount of water	Yes	Go to the next step.
		No	Go to Step 15.

	added. • Multiply the new value by 5. This new value is the percentage of ethanol in the fuel. • Record the calculated percentage of ethanol in the fuel. • Is any ethanol present in the fuel?		
14	**DETERMINE IF PERCENTAGE OF ETHANOL IN FUEL IS LESS THAN 10%** • Verify the recorded (calculated) percentage of ethanol in the fuel. • Is the calculated percentage of ethanol in the fuel less than 10%?	Yes	Go to the next step.
		No	Replace the fuel. Advice the customer of the correct fuel type required for this vehicle. Refer to the Owner's Manual Literature for additional information. Go to Step 30.
15	**INSPECT FUEL PRESSURE LEAKDOWN** • Connect the mechanical fuel pressure gauge. • Switch the ignition to ON (Engine running). • Allow the fuel pressure to stabilize. • Record the stabilized reading. • Switch the ignition to off. • Monitor the fuel pressure for 1 min. • Does the fuel pressure remain within 34 kPa {255 mmHg, 10.0 inHg} of the recorded reading after 1 min?	Yes	Go to Step 17.
		No	Go to the next step.
16	**INSPECT FUEL INJECTOR FLOW AND LEAKAGE** **NOTE:** • Observe the Warnings, Cautions, and Notes. • Inspect the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel. • Are the test results satisfactory?	Yes	Go to the next step.
		No	Replace the suspect fuel injector, then go to Step 30.
17	**MONITOR FUEL PRESSURE WHILE ROAD TESTING VEHICLE** **WARNING:** • Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.	Yes	Unable to duplicate or identify the concern at this time. Go to Step 30.
		No	Go to the next step.

	NOTE: • Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer. • Switch the ignition off. • Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle. • Start the engine and run it at idle. • Warm up the engine to normal operating temperature. • Monitor the mechanical gauge. • From a stop, accelerate to 89 km/h (55 mph) at full throttle. • Repeat 3 times. • Is the fuel pressure always greater than 240 kPa {2.45 kgf/cm^2, 34.8 psi}?		
18	**INSPECT FUEL SUPPLY LINE FOR RESTRICTION** **NOTE:** • Observe the Warnings, Cautions, and Notes. • Switch the ignition off. • Disconnect the fuel supply line at the fuel rail. • Disconnect the fuel supply line at the fuel pump. • Verify the fuel supply line for restriction. • Apply 21—34 kPa {0.22—0.34 kgf/cm^2, 3.1—4.9 psi} air pressure to the fuel supply line. • Does air flow freely through the line?	Yes	Replace the fuel filter (low-pressure side). Go to the next step.
		No	Repair the cause of the restriction, then go to Step 30.
19	**VERIFY FUEL SYSTEM REPAIRED** **WARNING:** • Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury. • Start the engine and run it at idle. • Warm up the engine to normal operating temperature. • Monitor the mechanical gauge.	Yes	The test is complete and no concerns are present. Go to Step 30.
		No	Replace the fuel pump unit, then go to Step 30.

	• From a stop, accelerate to 89 km/h (55 mph) at full throttle. • Repeat 3 times. • Is the fuel pressure always greater than 240 kPa {2.45 kgf/cm^2, 34.8 psi}?		
20	**VERIFY FUEL SYSTEM FOR PRESSURE STABILITY- FAST DECREASE** **NOTE:** • When the fuel pump is commanded off, the fuel pressure may substantially decrease stabilize. • During output state control, the fuel pump stays commanded on for only about 5 s. • Switch the ignition off. • Switch the ignition ON (Engine off). • Access the PCM and control the FP PID. • Run the fuel pump to obtain maximum fuel pressure. • Command the fuel pump off. • Allow the fuel pressure to stabilize. • Record the stabilized reading. • Monitor the fuel pressure for 10 s. • Does the fuel pressure remain within 34 kPa {0.35 kgf/cm^2, 4.9 psi} of the recorded reading after 10 s?	Yes	Go to Step 22.
		No	Go to the next step.
21	**INSPECT FOR EXTERNAL FUEL LEAK** • Inspect the fuel tank, lines, and filler pipe for a fuel leak. • Is a concern present?	Yes	Repair for fuel leakage, then go to Step 30.
		No	Go to Step 24.
22	**VERIFY FUEL SYSTEM FOR PRESSURE STABILITY-SLOW DECREASE** • Continue to monitor the fuel pressure for 1 min. • Does the fuel pressure remain within 34 kPa {0.35 kgf/cm^2, 4.9 psi} of the recorded reading after 1 min?	Yes	Go to the next step.
		No	Go to Step 16.
23	**DETERMINE IF THE PERCENTAGE OF ETHANOL IN FUEL IS LESS THAN 10%** • Check the recorded (calculated) percentage of ethanol in the fuel referring to Step 13 and 14.	Yes	Go to the next step.
		No	Replace the fuel. Advice the customer of the correct fuel

	• Is the calculated percentage of ethanol in the fuel less than 10%?		type required for this vehicle. Refer to the Owner's Manual Literature for additional information. Go to Step 30.
24	**INSPECT FUEL INJECTOR OPERATION** • Perform the "Fuel Injector Operation Inspection" for the right bank (with DTC P2195:00) or the left bank (with DTC P2197:00). (See **ENGINE CONTROL SYSTEM OPERATION INSPECTION [MZI 3.7 V6]**.) • Does the fuel injector operate normally?	Yes	Replace the suspected fuel injector, then go to Step 30. (See **FUEL INJECTOR REMOVAL/ INSTALLATION [MZI 3.7 V6]**.)
		No	Go to the next step.
25	**INSPECT HO2S OUTPUT VOLTAGE** • Switch the ignition off. • Disconnect suspect HO2S connector. • Visually inspect suspect HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. repair if necessary. • Measure the voltage between terminal B and terminal D on suspect HO2S component side connector. • Increase the engine speed to 2,000 rpm for 3 min. • Perform the KOER self-test. (See **KOEO/ KOER SELF TEST [MZI 3.7 V6]**.) • Monitor the signal voltage during the self-test. • Is the voltage greater than 0.5 V at any time during the self-test?	Yes	Go to the next step.
		No	Replace suspect HO2S, then go to Step 30.
26	**PERFORM THOROUGH WIGGLE TEST ON HO2S WIRING HARNESS** • Connect the HO2S connector. • Switch the ignition switch ON (Engine running). • Engine at normal operating temperature. • Access the PCM and monitor the suspect HO2S Signal PID. • Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM. • While monitoring the HO2S PID, does the HO2S stop switching?	Yes	Isolate the concern and repair if necessary. Then go to Step 30.
		No	Go to the next step.

27	**TEST DRIVE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING** • Access the PCM and monitor suspect HO2S signal PID. • Access the PCM and monitor the FUELSYS PID. • Start the engine and let idle until the vehicle goes into the closed loop fuel condition. • Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate original concern. • Does the HO2S PID switch?	Yes	Go to the next step.
		No	Replace the suspect HO2S, then go to Step 30.
28	**VERIFY FUNCTIONALITY OF MAF SENSOR** **NOTE:** • MAF PID value of less than 0.6 V may indicate an incorrectly installed air cleaner or a leak in the intake-air system. • Start the engine and run it at idle. • Allow the engine to stabilize at the correct operating temperature. • Access and monitor the MAF PID. • Inspect that the MAF PID at idle and P/N position is not greater than 30% of the normal MAF listed. Reference Values or not greater than 1.3 V. (See **PCM INSPECTION [MZI 3.7 V6]**.) • Is the PID value within the expected range?	Yes	Unable to duplicate or identify the concern at this time. Go to Step 30.
		No	Go to the next step.
29	**INSPECT TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURRENCE** **NOTE:** • Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable drivability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, replace the MAF sensor. • Switch the ignition off. • Disconnect the MAF/IAT sensor connector. • Start the engine and run it at idle. • Drive the vehicle on the road. • Does the lean drivability symptom (lack of power, spark knock/detonation, buck/jerk or	Yes	Replace the MAF/IAT sensor, then go to the next step. (See **MASS AIR FLOW (MAF)/ INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL/ INSTALLATION [MZI 3.7 V6]**.)
		No	Go to the next step. (The system is correctly at this time. The concern may have been caused by a loose or corroded connector.)

	hesitation/surge on acceleration) disappear?		
30	**VERIFY TROUBLESHOOTING OF DTC P2195:00, P2197:00 HAVE BEEN COMPLETED** • Verify that all disconnected connectors are reconnected. • Switch the ignition ON (Engine off). • Clear the DTC from the PCM memory using the M-MDS. • Perform no load racing at the engine speed of 2,500—3,500 rpm for 60s or more, then idle the engine for 60s or more. • Perform the KOER self-test. (See **KOEO/ KOER SELF TEST [MZI 3.7 V6]**.) • Is the PENDING CODE for this DTC present?	Yes	Repeat the inspection from Step 1. • If the malfunction recurs, replace the PCM. (See **PCM REMOVAL/ INSTALLATION [MZI 3.7 V6]**.) Go to the next step.
		No	Go to the next step.
31	**VERIFY AFTER REPAIR PROCEDURE** • Perform the "AFTER REPAIR PROCEDURE". (See **AFTER REPAIR PROCEDURE [MZI 3.7 V6]**.) • Are any DTCs present?	Yes	Go to the applicable DTC inspection. (See **DTC TABLE [MZI 3.7 V6]**.)
		No	Troubleshooting completed.

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