Rough Idle On MPFI Vehicles

If you encounter a rough idle complaint on any sequential injection MPFI vehicle, basic checks should be made to ensure that the correct injector wire connector is on the correct injector. Injector wiring will either be numbered or can be checked by comparing wire colors with the wiring diagrams. This may seem like an obvious check, but sometimes in your zeal to quickly diagnose a vehicle, the obvious can be overlooked. If two injector connectors have been inadvertently switched, the symptoms can be a slightly rough or irregular idle on a fully warmed up engine and a hesitation coming off the line.

Reading OBD Readiness Codes

Many states are now including an inspection of the OBD system as part of their emissions test procedure. This includes, but may not be limited to, inspection of the MIL or Check Engine Light for proper illumination, operation, and status of the Readiness Codes.

Readiness Codes can be checked with a generic scan tool and the New Select Monitor (NSM). Follow the tree below to access the Readiness Codes with the New Select Monitor:

- Each System Check
- EGI
- OBD System
- 12 Data Display

Any item that is a Readiness Code will have an indicator to the right that tells you whether it is Complete or Incomplete. Complete means that the system has been tested by the onboard diagnostic system. Incomplete means that the system has not been tested. In either case the results of the test are not indicated. No support indicates that this vehicle is not equipped with that system.

A vehicle must have all of the Readiness Codes reading Complete before it can be inspected for proper emissions.

Misfire, Fuel System and Component Monitoring are continuously checked and will change from Incomplete to Complete while the ignition is turned from off to on.

The Readiness Codes will all indicate incomplete after the memory of an ECM has been cleared.

Follow the steps below to activate the Readiness Codes to complete:

- **1996 models:** Connect the Test Mode (inspection mode connector) and drive on a flat road (highway) at approximately 50 to 55 mph for 20 to 30 minutes.
- **1997 and later:** Drive on flat road (highway) at approximately 50 to 55 mph for 30 minutes for warm-up. Then perform 10 minutes at steady speed (without any throttle angle change) at 50-60 mph.

Blue Versus Gray Connectors During Diagnosis

When performing electrical diagnostics involving the fuel injection ECM on 1995 through 1997 Legacy and Impreza vehicles, pay particular attention to the color of the connector that mates to the engine control module. Some will be gray and some will be blue. The connectors are not the same and the pin terminal locations that correspond to the related systems in the car are different.

An example of where this could cause confusion would be diagnosing a TCM Code 23 (engine speed signal) on a 1996 Legacy vehicle. Looking in the 1996 Supplement Manual, you'll find that there is no Troubleshooting Section 3-2. This means the transmission control system has not changed since 1995 and is, therefore, not included in the Supplement. Opening the 1995 service manual, you will see that in Troubleshooting Section 3-2, the circuit pertaining to Trouble Code 23 consists simply of one wire from the ECM to the TCM. However, since this is a 1995 Manual, the pin terminal connection for the ECM referred to in the diagnostic flow charts is B84, pin 33, which is correct for only the gray connector of a 1995 ECM, not the blue connector on the 1996 vehicle you are working on. Referring to the engine control module (ECM) I/O (input/output) chart (Sec. 2-7, page 68-70) in the 1996 Legacy service manual Supplement, we find that the correct pin location for the engine speed signal for a 1996 blue connector is B84, pin terminal 64.

Without taking the extra step of looking in the 1996 Manual, the wrong wire would be checked at the ECM and the wrong diagnostic conclusion would be reached. To minimize the possibility for error, always double check the connector colors before attempting to locate the pertinent pins.

Legacy (Non Turbo), SVX and Impreza ISC Valves

If you encounter a vehicle with a driveability complaint (stalling, idle surge or a whistle noise) and you have determined that it is caused by the ISC valve, this condition may be due to carbon buildup inside the valve. In these cases, use the ISC cleaning procedures found in the 1995 Legacy service manual, Book 1, Section 2-7. Use Subaru Top Engine Cleaner (SOA868V9160). Products such as Brake Clean do not effectively remove the deposits.

White exhaust smoke during ISC valve cleaning is normal. An odor also may linger for a few days.

These valves are pre-set. Never try to adjust them in an attempt to repair a vehicle. If you find yourself working on a driveability concern, and this valve shows signs of tampering, the valve must be replaced. There are no procedures to return them to the factory settings.

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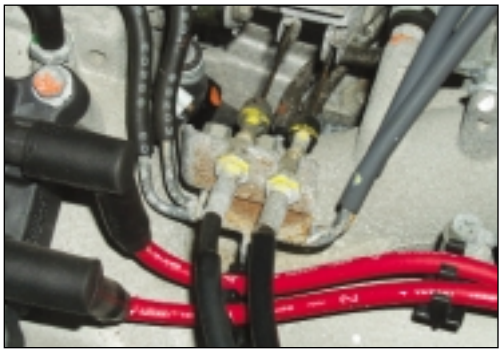
Impreza Throttle Position Switch Adjustment

When checking voltages for the Impreza throttle position switch, the engine must be at operating temperature and normal warm idle speed. If not, the readings you get will be incorrect and you may make an adjustment that is not necessary.

The throttle opener system which provides cold fast idle, mechanically opens the throttle valve and will cause your throttle position sensor readings to change. The Impreza service manual instructs you to be certain the engine is at normal operating temperature when making this adjustment. Changes when cold can affect driveability and vehicle emissions during cold engine operation.

DTC P0507 - Idle Control System RPM Higher Than Expected

If you find yourself diagnosing a DTC P0507 — Idle Control System RPM higher than expected — check to see if the accelerator or cruise control cables are adjusted properly.



DTC P0505

When following the diagnostic flow chart in the service manuals for DTC P0505, where the resistance of the idle air control valve has been measured to be 5 ohms or less, make the following revision to step #3 "Check Idle Air Control Solenoid Valve." After checking the resistance of the Idle Control Solenoid valve for "5 ohms or less," if the answer is "yes," the service manual tells you to "Replace idle air control solenoid valve and ECM." This conclusion is premature. Instead, you should replace the idle air control solenoid, clear the memory and test drive the vehicle. Confirm proper operation of the air control valve and see that no Check Engine Light occurs. If the Check Engine Light illuminates again with DTC P0505, perform all the other checks for the code as detailed in the service manuals. If the checks are good but the code still occurs, only then should the ECM be replaced.

Remember: This only pertains to situations where the resistance of the idle air control valve has been measured to be 5 ohms or less.

2.2 Liter Impreza Fuel Senders

2.2 liter AWD Impreza vehicles have a dual fuel sending unit configuration similar to the system that has been used on Legacy vehicles. There are main and sub-senders that operate the fuel gauge. The senders are wired in series, just like the Legacy.

The sub-sender is listed in the parts books but not shown in the illustrations.

Understanding P0440

In order to understand Code P0440, Evaporative Emissions Control System Malfunction (EVAP), we must first understand that it is a performance code rather than an electrical circuit code. What this means is that to produce this code, the computer is not looking for any improper resistances, electrical opens, shorts, or sensor out of range situations. Rather, it uses information from various sensors to draw conclusions about the proper or improper physical operation of the Evaporative Fuel Emission System. Any electrical failures have different failure codes associated with them.

The job of the Evaporative Fuel Emissions System is to prevent evaporating fuel vapors from entering the atmosphere and contributing to air pollution. In order to keep this from happening, the entire fuel system needs to be able to be sealed from any access to the outside air. Vapors in the system are trapped in a charcoal canister, and those vapors are later purged into the

intake manifold to be burned during the next driving cycle.

Only vehicles with the Enhanced Evaporative Emissions system can produce Code P0400. To identify which vehicles have the enhanced system and which do not, look for the location of the charcoal canister. If it is small and under the hood, the vehicle does not have the enhanced system. If the canister is not under the hood but is large and under the right rear of the vehicle, the vehicle has the enhanced system.

In the enhanced system, evaporative vapors leave the fuel tank and pass through lines to an electrically controlled pressure control valve and a mechanical rollover valve (both by the passenger's side front of the fuel tank) heading to the canister. The canister has an electrically controlled vent valve (next to the canister) and a line that goes to the front of the vehicle, where it is attached to the electrically controlled purge control valve (passenger's side of the engine compartment). Within the fuel tank, there are fuel level sensors (the same ones that are used for the dash gauge) and a fuel temperature sensor (attached to the passenger's side fuel sender). Tapped into the fuel filler neck air bypass pipe is a fuel tank pressure sensor (inside the trunk of a sedan or the luggage area of a wagon).

To test the integrity of the system, the system shuts off all access of the tank to the outside atmosphere. When the engine is running, gasoline is being delivered to the injectors and the excess unused fuel is returned to the tank. Since the injector rails are hot due to their proximity to the engine, the fuel returning to the tank is warmer than the fuel in the tank. This returning warm fuel mixes with the tank fuel and gradually warms it up. As the fuel in the tank warms, its rate of evaporation increases. Because the tank and system are sealed, the pressure in the fuel tank increases.

The control unit looks for this pressure rise to determine if the system is sealed. If the desired pressure is achieved, the computer will continue on to the next part of the test. In this part, the control unit will close the canister vent valve, open the tank pressure control valve, and open the canister purge valve. This should draw a low pressure on the tank.

The computer monitors the fuel tank pressure sensor to determine whether the low pressure is achieved. If it is, it then proceeds to the next part of the test. In this

Continued on page 24.

part, it repeats the first part of the test to watch the pressure rise in the tank.

After the pressure rises, the control unit does some math comparing the initial high pressure and the difference between the low pressure and the final high pressure. If the values fall within a specified range, the test passes. If the values are outside the specified range, the test fails. After two consecutive failures, the Check Engine Light is illuminated.

The testing of this system is only conducted once per drive cycle and only under very specific conditions:

- The fuel tank must contain less than 9.6 gallons of fuel.
- The fuel temperature must be less than 113°F.
- Engine speed must be over 1500 RPM.
- Vehicle speed over 28 MPH.
- Throttle position must be mid-range.
- Intake manifold vacuum must be equivalent to cruising vacuum.
- 455 seconds must have elapsed since engine start.

The vast majority of P0400 codes occur due to gas caps that have been left loose or the gas cap retaining tether has become caught under the cap during tightening. With the cap loose, no pressure rises or falls in the tank, so the test fails. If a loose cap can be positively eliminated as the cause of the code, follow the diagnostics in the service manual. If the diagnostics don't lead to a definitive failure, there are a few other steps that can be taken.

The Select Monitor has a screen that displays fuel tank pressure. After starting the vehicle, you should see a gradual pressure rise in the tank due to the warming of the fuel. If you open the cap, the pressure should drop immediately.

If you don't see a pressure rise, there must be a vapor leak to the outside. Closely inspect all lines and hoses. Physically check the operation of the pressure control valve solenoid, the purge control valve solenoid and the canister vent valve. The service manual instructs you to listen to these valves to click, but that does not necessarily mean they are closing completely.

Disconnect the hoses from each valve, apply a hand vacuum pump to the valve and cycle the valve with the Select Monitor in the compulsory valve operation mode while confirming that the valve actually opens, fully closes and fully seals.

Note: The tank pressure control valve and the canister purge control valve should open when energized,. but the canister vent valve is a normally open valve so it should close when energized.

If the valves work properly, try pressurizing the fuel tank (engine off) and evaporative system with air to check for leaks. Do not exceed 3 psi when pressurizing the tank or major fuel tank damage can occur. You can pressurize the system through the fuel return line or with a modified gas cap with hose attached. Close or block off the canister vent solenoid to seal the system.

Another situation can exist if you do see a pressure rise on the Select Monitor while conducting the first part of the tests when running the engine. In this case, you may have a situation where the pressure won't go high enough (due to a very small leak or a poorly seating valve) or the pressure won't go low enough (due to insufficient purging vacuum). A vacuum of -1.338 kpa in the tank is required to satisfy the test. A functional valve test and a check of the supply of purging vacuum would be required.

Remember, because a precise set of parameters must be met before the test is conducted and two trips are required to turn on the Check Engine Light, a considerable number of days can pass after a gas cap is left loose before a Check Engine Light may come on. This may convince a customer that the light could not possibly be due to their leaving the cap loose. Nevertheless, it may well be, and most likely is, the cause.

Enhanced Evaporative Emissions Test

When the car is first started and you begin to drive, the Pressure Control Solenoid comes on a few seconds later. The computer is looking for some pres-

sure change in the fuel tank to indicate that the system has been sealed and can be purged.

If the computer sees a change in the pressure, after about 40 seconds the Pressure Control Solenoid will turn off, and the vehicle will have passed the first part of the test for the Enhanced Evaporative Emission System.

If the computer doesn't see any pressure change, the Pressure Control Solenoid will remain on for the remainder of the drive cycle.

If the first part of the test passes, the computer will wait until you are driving in a cruising condition to perform the next three steps of the test. If the vehicle is cruising over 45 mph but under 80mph and has less than a half of a tank of fuel, the next part of the test will begin.

This second part of the test is the only time when you will ever see the Pressure Control Solenoid and the Vent Solenoid come on at the same time. When the Pressure Control Solenoid comes on, the computer is looking for a pressure change in the tank. If it sees one, part two of the test has passed.

The Vent Solenoid then comes on to shut off the vent to the outside air. Since the Canister Purge Valve is also open at this time, the entire evaporative system is drawn down to a low pressure: If the pressure in the tank can be lowered to below -1.338kpa, part three of the test has passed and the Vent Solenoid shuts off, opening the vent to the outside air.

The low pressure in the tank should begin to recover toward atmospheric pressure. If the pressure rise in the tank is sufficient to satisfy the fault code formula, part four of the test has passed, the Pressure Control Solenoid shuts off and the vehicle is judged to be okay.

More P0440 Information

With the introduction of the New Select Monitor (NSM), late model 1997 and newer vehicles with Enhanced Evaporative Systems can be diagnosed more easily for DTC P0440. The NSM can be set up to monitor the Pressure Control Solenoid with one LED and the Vent Solenoid with another LED while simultaneously reading the fuel tank pressure. With this setup, there is no necessity for the rapid button juggling that was necessary with the old Select Monitor to catch the changing pressures in the tank during the diagnostic phases of P0440. After the system does its tests, save the data. You can then graph the information on the screen.

LED 6 (on the old Select Monitor) corresponds to the Vent

Continued on page 30.

Continued from page 25.

Solenoid (on the new Select Monitor), and LED 8 (on the old Select Monitor) corresponds to the PCV (Pressure Control Valve) solenoid (on the new Select Monitor).

OBD II Cylinder Misfire Codes

If you encounter cylinder misfire codes on Subaru vehicles equipped with the OBD II system, check the past service history to see if the vehicle's fuel filter was recently changed.

There is a short period of time when the vehicle is first started, after the filter has been changed, when the cylinders may not get the fuel charge they should. This may translate into a slight cylinders misfire, which is enough to trigger a misfire DTC.

If the fuel filter was changed recently, clear the codes and test drive the vehicle. Chances are good that the codes will not return if the filter change was the cause of the problem.

Legacy and Impreza Engines with No Injection Pulse #1 Cylinder

Built into the fuel injection control unit is logic that will shut off the #1 injector if the computer believes that it can no longer control the Idle Air Control valve. Remember this while trying to diagnose a "hard" code for the Idle Air Control Valve or a dead miss in number one cylinder due to no injection at idle. A problem in the Idle Air Control valve circuit can be responsible. (Component testing shows that it is usually not the valve itself.)

Another unusual computer response is if the computer is deprived of its "back up power supply." If deprived of this power, some computers will generate a false code for the Idle Air Control valve and kill the injector for cylinder #1. The pin location of this power supply can be found in the Control Unit Module I/O Signal pages of the appropriate service manual.

1995 Subaru Legacy - DTC P0505 - Idle Control System Malfunction

If you encounter a 1995 Subaru Legacy with a DTC P0505 (Idle Control System Malfunction), check to see that the wire pins in connector B22 are securely fastened in the connector. If pin 13 (BY) has backed out of the connector, you will lose two grounds at the ECU.

Diagnostic Trouble Code P1507

If you are diagnosing a manual transmission-equipped vehicle with a DTC P1507 and can find nothing wrong after following the trouble tree in the appropriate service manual, inspect the Neutral Switch Circuit before replacing any parts. The Neutral Switch Circuit may cause this code to set. This could falsely indicate to the ECU that the transmission is in neutral when, in fact, it is actually in gear. This can cause the MIL to illuminate and set Code P1507.

Keep in mind that the problem can be intermittent and it may be necessary to pin test the connection and to shift into and out of neutral many times before the switch shows any problems.

1995 Subaru Legacy - DTC PO325 - Knock Sensor Circuit Malfunction

If you encounter a Check Engine Light with a DTC P0325 on a 1995 Subaru Legacy, check to see if the knock sensor mounting bolt has been torqued too tightly upon installation. Also check the threads of the sensor mounting bolt and the thread surfaces of the block to see that they are clean and not corroded. Any corrosion should be removed before installing the bolt.

The correct mounting bolt torque is 15-19 ft. lbs.

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