

The EndWrench™

A Publication for Professional Repair Technicians from Subaru N.E.W. Horizons Dealers

Subaru Electrical Systems

GENUINE SUBARU
O.E.PRO
REPLACEMENT PARTS

Information Inside

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Vehicle servicing performed by untrained persons could result in serious injury to those persons or others.

Information contained in this newsletter is intended for use by trained, professional auto repair technicians ONLY. This information is provided to inform these technicians of conditions which may occur in some vehicles or to provide information which could assist them in proper servicing of these vehicles.

Properly trained technicians have the equipment, tools, safety instructions, and know-how to perform repairs correctly and safely. If a condition is described, DO NOT assume that a topic covered in these pages automatically applies to your vehicle or that your vehicle has that condition.

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The End Wrench™

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The on-board computer is capable of monitoring all of the sensors and actuators to determine whether they are working as intended. It can detect a malfunction or deterioration of the various sensors and actuators, usually well before the driver becomes aware of the problem.



15 O.E. PRO is a commitment to provide you an expanded line of Subaru parts priced to allow you a fair profit. These Genuine Subaru parts meet rigorous OEM standards of performance, fit and reliability. And, they're all backed by the Genuine Subaru parts limited warranty, so you can install them with confidence.



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All automobiles (including Subaru vehicles) are filled with dozens of multi-terminal connectors. They can be the source of intermittent and/or hard to diagnose electrical problems.

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24 Subaru technical bulletins are a great source of service and repair information. This selection of TSBs covers a wide variety of Subaru diagnosis and repair issues.



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All late model Subaru four cylinder engines employ a "waste spark" ignition system. Testing methods for this type of coil are slightly different from what you might be accustomed to.

Subaru On-Board Diagnostic Systems



Early OBD (on-board diagnostic) systems, now referred to as OBD-I, could turn on a malfunction indicator light (MIL) and store hard fault codes when an emission-related system or component fault was detected. A hard fault is defined as a fault that is present while the vehicle computer is monitoring a particular circuit or device (meaning the fault is not intermittent). If the fault went away, the MIL was turned OFF by the computer.

Introduction

The Environmental Protection Agency (EPA) now has regulations in place that establish requirements for on-board diagnostic (OBD-II) systems on light-duty vehicles and light-duty trucks. The purpose of the OBD-II system is to ensure proper emission control system operation for the vehicle's lifetime by monitoring emission-related components and systems for deterioration and malfunction. There's a big difference between detecting only hard faults (OBD-I) and having the ability to actively monitor the system for proper operation, deterioration or a malfunction (OBD-II).

Engines in today's vehicles are largely electronically controlled. Sensors and actuators sense the operation of specific components (e.g., the oxygen sensor) and actuate others (e.g., the fuel injectors) to maintain optimal engine control. An on-board computer, known as the "powertrain control module," controls all of these systems.

With proper software, the on-board computer is capable of monitoring all of the sensors and actuators to determine whether they are working as intended. It can detect a malfunction or deterioration of the various sensors and actuators, usually well before the driver becomes aware of the problem through a loss in vehicle performance or driveability. The sensors and actuators, along with the diagnostic software in the on-board computer, make up what is called “the OBD-II system.”

The purpose of the OBD-II system is to assure proper emission control system operation for the vehicle’s lifetime by monitoring emission-related components and systems for deterioration and malfunction. There are circumstances under which the vehicle computer will detect a system problem before the driver notices a driveability problem. Furthermore, OBD-II can detect problems that may not be noticeable upon visual inspection because many component failures that have an effect on emissions can be electrical or even chemical in nature. By detecting these emission-related failures and alerting the driver to the need for potential repair, vehicles can be properly repaired before emissions become a problem.

When the OBD-II system determines that a problem exists, a corresponding Diagnostic Trouble Code (DTC) is stored in the computer’s memory. The computer also illuminates a dashboard CHECK ENGINE light. This light serves to inform the driver that a problem has been detected and vehicle service is needed. When the car is delivered to the repair shop, a service technician can quickly retrieve the stored diagnostic trouble codes from the computer memory of the vehicle using newly developed diagnostic tools. Since the diagnostic trouble codes will specifically identify the problem, the service technician can more quickly and accurately make the proper repair.

The following is a brief description of the Subaru OBD-II system:

- The Subaru on-board diagnostic (OBD-II) system has the ability to detect and indicate faults in various inputs and outputs of the vehicle’s electronic control systems. A CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter indicates the occurrence of a fault or trouble.
- A fail-safe function is provided to ensure minimal driveability in the event of a failure of a component or sensor that may disable the electronic control system.
- The OBD-II system incorporated in all Subaru vehicles since 1996 complies with Section 1968.1 of the California Code of Regulations (OBD-II regulation), and all applicable Federal Clean Air Act regulations. The OBD-II system monitors components and system malfunctions which may have an effect on emissions.
- When the system decides that a malfunction has occurred, the MIL illuminates. At the same time that the MIL illuminates or blinks, a diagnostic trouble code (DTC) and freeze frame data of engine conditions are stored in the on-board computer’s memory.
- When it detects a malfunction, the OBD-II system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into the on-board computer memory.
- If the OBD-II system detects various malfunctions, including a fuel trim fault or misfire, the OBD-II system first stores freeze frame engine conditions about the fuel trim or misfire.
- If the malfunction does not occur again for three “trips,” the MIL turns off, but the DTC remains in the on-board computer’s memory.
- The OBD-II system is capable of communication with a generic scan tool (OBD II generic scan tool), defined by ISO 9141 CARB specifications.
- The OBD-II diagnostic procedure is different from the usual diagnostic procedure. When troubleshooting Subaru OBD-II vehicles, it is necessary to connect a Subaru Select Monitor or New Select Monitor to the vehicle. If these tools are not available, a generic OBD-II scan tool may also be used.



Figure 1 Original Select Monitor

New Select Monitor

The Hitachi Auto Systems Company, Ltd. is the manufacturer of the Subaru New Select Monitor (NSM). While this tool was originally supplied to Subaru dealership technicians, Hitachi has announced that it also plans to offer it to the automotive aftermarket at some time in the future.

At present, information on specific Subaru models is provided on interchangeable data cartridges. One of the NSM's main capabilities is to function as an OBD-II diagnostic interface with Subaru vehicles. Since OBD-II standards and protocols are common to all OBD-II compliant vehicles, the NSM could also be used for OBD-II diagnosis on other vehicles. With the substitution of a "domestic" or "generic OBD-II" data cartridge, the NSM could have the capability to function with vehicles built by manufacturers other than Subaru.

The hand-held NSM display screen measures 95 mm by 71 mm and provides a backlit LCD screen with adjustable contrast. Twelve functions can be displayed on the screen at the same time and ON/OFF signals can be monitored by observing illuminated LEDs at the side of the LCD screen. This function is similar to the original Select Monitor diagnostic tools (**Figure 1**), which the NSM is designed to replace.

Four channels of graphical information can be displayed at the same, with the ability to adjust values per division and time base.

A memory feature is built in, powered by four AA batteries that maintain memory when the NSM is turned off. Memory capacity is 256K bytes. Information stored on the NSM can be outputted to a printer, using an infrared or conventional printer interface. Software to download stored NSM diagnostic information to a PC will also be offered by Hitachi.

The NSM has many features, several of which we will describe with the following text and photographs. We're concentrating primarily on OBD-II and engine management diagnosis in this issue of *The End Wrench*, so after the next three photos, we'll be connected to a 1997 Subaru Outback equipped with a 2.5 liter engine. The additional capabilities of the NSM for diagnosis of other Subaru vehicle systems, as well as its multimeter and scope capabilities, will be discussed in future issues of *The End Wrench*.



Figure 2 NSM Main Menu



Figure 3 OBD-I Diagnostic Connector

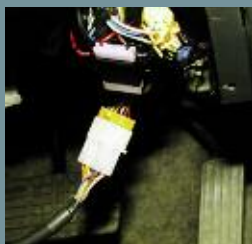


Figure 4 OBD-II Diagnostic Connector

NSM Main Menu

After inserting the proper data cartridge and turning on the NSM, the Main Menu comes into view (**Figure 2**). The NSM has the capability of monitoring and diagnosing several Subaru vehicle systems, using the OBD-II diagnostic connector (**Figure 3**). Earlier pre-OBD-II Subaru vehicles can also be accessed by the NSM, using the proper adapter cable and the vehicle's conventional underdash diagnostic connector (**Figure 4**).

The NSM can also serve as a digital multimeter, a two channel scope meter (actually a graphing multimeter), and it can save data to its internal memory.

The 1993 Legacy we initially connected the NSM to gave us the possibility of access to the following vehicle systems:

- EGI/EMPI (fuel system)
- AT/ECTV (automatic transmission or electronic continuously variable transmission)
- Air Conditioning System
- Cruise Control
- ABS/TCS
- 4WS
- Air Suspension System

The NSM lists all of the possibilities for a particular model year range, then attempts to communicate with all of the systems that are present on the subject vehicle. All of the systems listed here probably won't be present on a single vehicle (**Figure 5**).



Figure 5 System Selection Menu





Figure 6 EGI/EMPI Diagnosis Menu

EGI/EMPI Diagnosis

The EGI/EMPI Diagnosis menu allows the choices shown in **Figure 6**. The **Current Data Display & Store** option allows the user to monitor a wide range of engine management system inputs and outputs, using the vehicle's serial data interface and the OBD-II connector. A listing of the information available in this mode is shown on page 10.

A maximum of 12 different inputs can be displayed on the NSM screen at once (**12 Data Display**), so it will be necessary to scroll up or down through the data if you want to see everything that's being monitored by the NSM (**Figure 7**). Most diagnostics will not require you to see all of the data at once, so it's best to limit your choices to related information only. This speeds up the unit's refresh rate, cuts the clutter on the LCD and makes it easier for you to monitor data from particular inputs.

In addition to **12 Data Display**, there are several other ways to look at the data. **Six Data & LED Display** (**Figure 8**) allows you to choose up to six different data inputs, then display them in numerical form. The status of four ON/OFF inputs are also displayed along the right side of screen. Red LEDs turn ON or OFF to indicate the status of these inputs. This function is similar to the original Select Monitor.

If you're looking for an input that may be going out of range or want to track something over time, the **Four Data Display With Max & Min** may be selected (**Figure 9**). This feature may also be reduced to **One Data Display With Detail** (**Figure 10**).

Data may also be presented in a graphical format by switching over to the **Four Channel Graph** or **Two Channel Graph** screens. This converts the NSM into a graphing multimeter (**Figure 11**). The voltage scale of individual inputs can be adjusted in this mode. The graphing function can be especially useful if you're looking for a glitch in a signal. If the glitch should occur, the display can be held and the results saved to the NSM's memory.



Figure 7 12 Data Display



Figure 8 Six Data & LED Display



Figure 9 Four Data Display With Max & Min



Figure 10 One Data Display With Detail



Figure 11 Graphing Multimeter

OBD Menu

The NSM also offers full OBD-II diagnostic capabilities. A menu of the unit's OBD-II functions is shown in **Figure 12**. A complete list of the Current Data Display parameters that are monitored by the NSM for a 1998 Legacy in OBD-II mode can be found on page XX. This list is shown for illustrative purposes, as other Subaru vehicles may have more parameters, and some may have less. For a complete listing of the OBD-II parameters for the particular Subaru vehicle you are servicing, refer to the appropriate Subaru service manual.

The NSM allows you to look at up to 12 data parameters at once, the same as in the Normal mode (**Figure 13**). Because there will always be more than 12 data parameters, you'll need to scroll through the list if you want to see them all in this mode. If a particular parameter is not found on the vehicle being tested, the NSM will list "no support."

Freeze Frame Data Display

One of the most useful features of OBD-II for diagnostic purposes is Freeze Frame Data. If the vehicle's OBD-II system detects a fault that might cause increased vehicle emissions or might damage the catalytic converter, it stores freeze frame data at the moment the fault occurred. So instead of being left with just a Diagnostic Trouble Code (DTC) to work with, we also have freeze frame data to help us with our diagnosis.



Figure 12 OBD Menu

Diagnostic Trouble Codes (DTC) Display

OBD-II regulations require the use of standardized DTCs. There's no longer a need to learn the diagnostic language of individual vehicle manufacturers. Diagnostic Trouble Code (DTC) definitions and numbers were prescribed by the Society of Automotive Engineers (SAE) under J2012.

Powertrain DTCs beginning with the prefix "P0" have standardized meanings and may be used by all vehicle manufacturers. Powertrain DTCs beginning with the prefix "P1" are considered "manufacturer specific" and may be used to define systems or functions that are unique to a particular manufacturer or a vehicle from that manufacturer.

While this system of identification eliminates most of the confusion surrounding DTC definitions, it also multiplies the number of available DTCs for a particular vehicle by several fold. We checked the powertrain DTC list for a late model Subaru Legacy and found there were over 100 possibilities. There's no way you're going to be able to memorize all those DTCs, so reliable service information becomes even more important than it has been in the past.

We intentionally triggered several DTCs to produce the list of DTCs shown in **Figure 14**. DTCs can also be cleared using the NSM, but be advised that the freeze frame data that goes along with the DTCs will be erased at the same time.

Other OBD Mode Features

The NSM can also access the PCM to monitor O₂ sensor operation (**O₂ Sensor Monitor Test**). Information obtained during this test includes rich-to-lean and lean-to-rich threshold voltages and times, and low/high sensor voltages for switch time calculations (**Figure 15**). This data can be especially useful if a "lazy" or dying oxygen sensor is suspected. The numbers shown here don't lie.

Some DTCs are considered to be temporary, meaning they haven't yet met the criteria to trigger the Malfunction Indicator Light (MIL). Perhaps a fault was detected just once, then not repeated. While this may not be enough to trigger the MIL, it doesn't mean the PCM's OBD-II function looks the other way. Quite the contrary. The PCM will store this information under a temporary DTC. If the conditions that triggered the original temporary DTC are not repeated for a prescribed number of vehicle "trips," the PCM will eventually strike the temporary DTC from its memory.

Until the PCM's set of code removal requirements is met, any stored temporary DTC can be viewed under the **Temporary Codes Inspection** mode on the NSM. This mode can be very useful when diagnosing intermittent problems that refuse to reveal themselves during normal troubleshooting activities.

System Operation Check Mode

The last NSM function we're going to look at is the **System Operation Check Mode** (**Figure 16**). Connecting the two green underdash Check connectors (**Figure 17**) places the vehicle in "Check Mode." When the ignition is turned ON, the CHECK ENGINE light on the Combination Meter will begin flashing OFF and ON and several fuel system and emission components will begin cycling OFF and ON.

This mode can be useful for checking the operation of specific components. Using the NSM and the underdash Check connectors, it's possible to test one component at a time. We selected the A/C Compressor Relay (**Figure 18**), then took the NSM under the hood to listen for the compressor clutch to cycle OFF and ON (**Figure 19**).

Selecting one component at a time allows you to more closely. If the component cycles OFF and ON as it should, you can be certain that the wiring between the component and the PCM are okay. Running through each system operation check doesn't take long and eliminates a lot of guesswork. Don't forget to disconnect the Check connectors when you're done.



Figure 13 12 Data Parameter Display

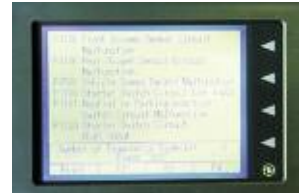


Figure 14 Stored DTC Display



Figure 15 Oxygen Sensor Monitor



Figure 16 System Operation Check Mode



Figure 17 Green Check Connectors



Figure 18 Actuator ON/OFF Menu



Figure 19 Monitoring A/C Relay Operation

New Select Monitor Current Engine Data Display (Normal Mode)

Contents	Display	Unit of Measure
Battery Voltage	Battery Voltage	V
Vehicle Speed Signal	Vehicle Speed	km/h or MPH
Engine Speed Signal	Engine Speed	RPM
Engine Coolant Temperature Sensor Signal	Coolant Temperature	°C or °F
Ignition Timing Signal	Ignition Timing	degrees
Mass Air Flow Signal	Mass Air Flow	g/s or lb/m
Mass Air Flow Signal	Air Flow Sensor Voltage	V
Throttle Position Signal	Throttle Opening Angle	%
Throttle Position Signal	Throttle Sensor Voltage	V
Injection Pulse Width	Fuel Injection #1 Pulse	ms
Idle Air Control Signal	ISC Valve Duty Ratio	%
Engine Load Data	Engine Load	%
Front Oxygen Sensor Output Signal	Front O ₂ Sensor	V
Rear Oxygen Sensor Output Signal	Rear O ₂ Sensor	V
Short Term Fuel Trim	A/F Correction #1	%
Knock Sensor Signal	Knocking Correction	degrees
Atmospheric Absolute Pressure Signal	Atmospheric Pressure	mmHg/kPa/InHg
Intake Manifold Absolute Pressure Signal	Manifold Relative Pressure	mmHg/kPa/InHg
A/F Correction (short term fuel trim) By Rear O ₂ Sensor	Rear O ₂ A/F Learning	%
Long Term Fuel Trim	Whole A/F Learning	%
Long Term Whole Fuel Trim	Front O ₂ A/F Learning	%
Front Oxygen Sensor Heater Current	Front O ₂ Heater	A
Rear Oxygen Sensor Heater Current	Rear O ₂ Heater	A
Canister Purge Control Solenoid Valve Duty Ratio	CPC Valve Duty Ratio	%
Fuel Tank Pressure Signal	Fuel Tank Pressure	mmHg/kPa/InHg
Fuel Temperature Signal	Fuel Temperature	°C or °F
Fuel Level Signal	Fuel Level	V
Ignition Switch Signal	Ignition Switch	ON or OFF
Automatic Transmission Vehicle Identification Signal	AT Vehicle ID Signal	ON or OFF
Test Mode Connector Signal	Test Mode Signal	ON or OFF
Neutral Position Switch Signal	Neutral Position Switch	ON or OFF
Air Conditioning Switch Signal	A/C Switch	ON or OFF
Air Conditioning Relay Signal	A/C Relay	ON or OFF
Radiator Main Fan Relay Signal	Radiator Fan Relay #1	ON or OFF
Fuel Pump Relay Signal	Fuel Pump Relay	ON or OFF
Knocking Signal	Knocking Signal	ON or OFF
Radiator Sub Fan Relay Signal	Radiator Fan Relay #2	ON or OFF
Engine Torque Control Signal	Torque Control Signal	ON or OFF
Pressure Sources Switching Solenoid Valve	Pressure Sources Change	ON or OFF
Front Oxygen Sensor Rich Signal	Front O ₂ Rich Signal	ON or OFF
Rear Oxygen Sensor Rich Signal	Rear O ₂ Rich Signal	ON or OFF
Federal Specification Vehicle Identification Signal	FED Spec. Vehicle Signal	ON or OFF
Exhaust Gas Recirculation System Diagnosis Signal	EGR System Diagnosis	ON or OFF
Catalyst Diagnosis Signal	Catalyst Diagnosis	ON or OFF
Pressure Control Solenoid Valve	PCV Solenoid Valve	ON or OFF
Exhaust Gas Recirculation Solenoid Valve	EGR Solenoid Valve	ON or OFF
Vent Control Solenoid Valve	Vent Solenoid Valve	ON or OFF



New Select Monitor Current Data (OBD Mode)

Contents	Display	Unit of Measure
Number Of Diagnostic Code	Number Of Diagnostic Code	—
Malfunction Indicator Lamp Status	MIL Status	ON or OFF
Monitoring Test Of Misfire	Misfire Monitoring	ON or OFF
Monitoring Test Of Fuel System	Fuel System Monitoring	ON or OFF
Monitoring Test Of Comprehensive Component	Component Monitoring	ON or OFF
Test Of Catalyst	Catalyst Diagnosis	ON or OFF
Test Of Heated Catalyst	Heated Catalyst	ON or OFF
Test Of Evaporative Emission Purge Control System	Evaporative Purge System	ON or OFF
Test Of Secondary Air System	Secondary Air System	ON or OFF
Test Of Air Conditioning System Refrigerant	A/C System Refrigerant	ON or OFF
Test Of Oxygen Sensor	Oxygen Sensor	ON or OFF
Test Of Oxygen Sensor Heater	Oxygen Sensor Heater	ON or OFF
Test Of Exhaust Gas Recirculation System	EGR System Diagnosis	ON or OFF
Air Fuel Ratio Control System For Bank 1	Fuel System For Bank 1	ON or OFF
Engine Load Data	Engine Load	%
Engine Coolant Temperature Signal	Coolant Temperature	°C or °F
Short Term Fuel Trim By Front Oxygen Sensor	Short Term Fuel Trim B1	%
Long Term Fuel Trim By Front Oxygen Sensor	Long Term Fuel Trim B1	%
Intake Manifold Absolute Pressure Signal	Manifold Absolute Pressure	mmHg/kPa/InHg
Engine Speed Signal	Engine Speed	RPM
Vehicle Speed Signal	Vehicle Speed	km/h or MPH
Ignition Timing Advance For #1 Cylinder	Ignition Timing Advance #1	°
Mass Air Flow Signal	Mass Air Flow	g/s or lb/m
Throttle Position Signal	Throttle Opening Angle	%
Front Oxygen Sensor Output Signal	Oxygen Sensor #11	V
Air Fuel Ratio Correction By Front Oxygen Sensor	Short Term Fuel Trim #11	%
Rear Oxygen Sensor Output Signal	Oxygen Sensor #12	V
Air Fuel Ratio Correction For Rear Oxygen Sensor	Short Term Fuel Trim #12	%
On-board Diagnostic System	OBD System	—

Freeze Frame Data (OBD Mode)

Diagnostic Trouble Code (DTC) For Freeze Frame Data	Freeze Frame Data	DTC
Air Fuel Ratio Control System For Bank 1	Fuel System For Bank 1	ON or OFF
Engine Load Data	Engine Load	%
Engine Coolant Temperature Signal	Coolant Temperature	°C or °F
Short Term Fuel Trim By Front Oxygen Sensor	Short Term Fuel Trim B1	%
Long Term Fuel Trim By Front Oxygen Sensor	Long Term Fuel Trim B1	%
Intake Manifold Absolute Pressure Signal	Manifold Absolute Pressure	mmHg/kPa/InHg
Engine Speed Signal	Engine Speed	RPM
Vehicle Speed Signal	Vehicle Speed	km/h or MPH

Oxygen Sensor Monitoring Test Results

Oxygen Sensor For Monitoring Test	<O ₂ Sensor Monitor (---)>	—
Rich To Lean Oxygen Sensor Threshold Voltage	Rich To Lean Sensor Volt	V
Lean To Rich Oxygen Sensor Threshold Voltage	Lean To Rich Sensor Volt	V
Low Oxygen Sensor Voltage For Switch Time Calculation	Low Sensor Voltage	V
High Oxygen Sensor Voltage For Switch Time Calculation	High Sensor Voltage	V
Rich To Lean Oxygen Sensor Switch Time	Rich To Lean Switch Time	sec
Lean To Rich Oxygen Sensor Switch Time	Lean To Rich Switch Time	sec
Maximum Oxygen Sensor Voltage For Test Cycle	Maximum Sensor Voltage	V
Minimum Oxygen Sensor Voltage For Test Cycle	Minimum Sensor Voltage	V



Figure 4

Figure 4

The Vetronix Mastertech offers a generic OBD-II cartridge. This means that it's unnecessary to answer any qualifying questions. Just plug the unit's diagnostic connector into the DLC and you're ready to go. After communicating with the vehicle's PCM, the Mastertech tells you what OBD-II options are available for the vehicle

Figure 5

The Mastertech's large LCD allows you to simultaneously view up to 12 different current data points. Scrolling up or down allows you to see all of the available data.



Figure 5



Figure 6

Figure 6

All generic scan tools must be able to display the results of the OBD-II Readiness Tests. All Readiness Tests for Continuous and Non-Continuous Monitors are displayed on the same screen. Our 1995 Legacy is not equipped with all of the possible OBD-II monitors, so the Mastertech showed "N/A" for these.

Figure 7

If the OBD-II system has stored a DTC, snapshot data will also be stored in the PCM memory. The Mastertech has its own snapshot capability, that is similar to the PCM's function. In Snapshot mode, the Mastertech can capture a sequence of data parameters that you define. Road testing the vehicle in this mode may allow you to capture an intermittent fault.



Figure 7



Figure 8

Figure 8

The Snap-on Scanner relies on a pair of data cartridges: a primary data cartridge and a Fast Track Troubleshooter cartridge that contains additional OBD-II diagnostic information. These cartridges will take you through 1997 model year import vehicles.

Figure 9

Because the Scanner handles OBD-I and OBD-II vehicles, a series of qualifying questions are required to let the Scanner know which vehicle it's hooked up to. The scanner relies on VIN information to zero in on the specific Subaru model. If you want to bypass this routine, it's possible to take the "OBD Generic" menu option.



Figure 9



Figure 10

Figure 10

The Snap-on Scanner requires the use of a "key" in its OBD-II diagnostic connector to fine-tune the Scanner to the vehicle that is being tested.

Figure 11

OBD-II Current Data parameters are displayed six at a time across the Scanner's LCD. Scrolling with the unit's thumbwheel takes you through all parameters. All other generic OBD-II scanner functions are also supported by the Snap-on Scanner.



Figure 11

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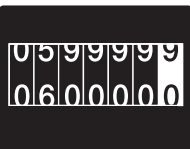
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Genuine Subaru Maintenance Parts

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performance:**

**Regular
maintenance
and Genuine
Subaru Parts.**



Renew Engine Performance...

with New Genuine Subaru Engine Components.

More Reliable than Rebuilds

Restoring an engine's performance with new Genuine Subaru Engine Components is a smart decision. Our new components are far more reliable—and precise—than rebuilt alternatives. Rebuilt engine components are based



on existing parts that have failed in service—for example, a rebuilt cylinder head from a core broker or junkyard. A component that has failed

once before may fail again—even after rebuilding—for similar reasons.

Rebuilding a component with non-Genuine Subaru parts allows suppliers to shortcut costs by using parts that not only don't meet stringent Subaru standards, but are also inferior in terms of fit and function. With Genuine Subaru Engine Components, you know you're getting the best—whether you're replacing a component or rebuilding an entire engine.

More Affordable than Alternatives

Restoring an engine by using new Genuine Subaru Engine Components may eliminate the expense of purchasing a completely new or rebuilt engine assembly—or even buying a new vehicle! Competitively priced with typical rebuilt parts, Genuine Subaru Engine Components also save time and money during installation compared to non-genuine parts that may require a force fit. And, most important in the long run, they provide the same precise quality and superb performance as those originally fitted to your customers' engines.

More Easily Available

Most new Genuine Subaru Engine Components are readily available from your Subaru dealer—generally more so than rebuilt engines, which may take weeks to order. Genuine Subaru Engine Components mean faster, more convenient turnaround time for your customers.

Why buy an entire engine, new or rebuilt, when all you need is a quality component?

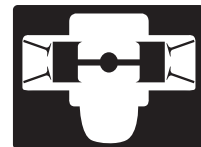
To restore your customers' engines to like-new performance and reliability, specify only the new Genuine Subaru Engine Components that you need.

Quality Tested

100 percent of completed head assemblies are leak-tested after assembly to insure proper seating and sealing of valves.

New Genuine Subaru Engine Components include:

- Complete Cylinder Head Assemblies
Subaru replacement cylinder head assemblies are all new, not rebuilt, ensuring the best performance and long life. Each assembly is complete, with all-new parts, including the cylinder head itself, valves, springs, seals and retainers. Plus, rebuilding costs are eliminated, since there are no parts or labor charges for servicing and/or rebuilding the old cylinder head(s).
- All-new replacement Short Blocks are manufactured to original equipment specifications, assuring not only precise, hassle-free installation, but predictable performance down the road.



**Genuine
Subaru Engine
Components.**

Speed your Subaru engine repair work with the full line of Genuine Subaru Engine Components including oil and water pumps, clutch disks, camshafts, gaskets, seals, belts and more.

GENUINE SUBARU
O.E. PRO
Maintaining Owner Satisfaction
at its Peak

**O.E. PRO
MEANS BUSINESS!**



All Genuine Subaru Remanufactured Parts...

Meet Strict Subaru of America Authorized Genuine Parts Specifications and Perform Like New

Since they are remanufactured by Subaru original suppliers, they incorporate the latest design enhancements, meet the latest, most stringent OEM specifications, and perform exactly like new Genuine Subaru parts.

Provide Exact Replacement and Perfect Fit

They're designed and engineered to be exact replacements for the original part that was installed on the car. All Subaru approved remanufacturing processes meet precise engineering standards.

Ensure Long Term Reliability

The highest level of quality control and meticulous attention to detail means you can count on long term, best possible performance.

Assure Uncompromised Safety

Because you don't just repair or replace items that are defective, worn out or broken, but instead, replace all critical components with new Genuine Subaru parts, your customers can depend on miles of trouble-free driving and unsurpassed safety.

Are backed by Genuine Subaru Parts Limited Warranty

Since they're as good as new, they're backed by the Genuine Subaru Parts Limited Warranty. Contact your dealer for complete details on all Genuine Subaru Remanufactured Parts Limited Warranties.

Are Fully Restored

Many components that some rebuilders consider satisfactory are automatically replaced with new components in our remanufactured parts. Remanufacturing of parts may cost a little more than rebuilding, but it's the only way to ensure the same quality, performance, and safety standards provided by an original part. And there are still substantial savings over new replacement parts.

Must Pass the Same Tests as New Parts

Unlike rebuilt parts—which are repaired just enough to pass the rebuilder's tests—our remanufactured parts must pass the same tests as a new part at each stage of reassembly. At the end of the line, every part must meet all of the quality control standards—the same tolerances and specifications—that the factory has established for new parts. Parts that don't pass all this precision testing never leave the factory.

And Cost Less Than New Parts.

Genuine Subaru Remanufactured Parts cost less only because they cost less to build. Instead of raw material, they start with a "core"—a used part that's been returned. Every core that's returned is checked by factory inspectors. If it's worn out, it's thrown out. Otherwise, it is disassembled, cleaned, machined, and refitted with new components.



**Genuine
Subaru
Remanufactured
Parts**

In short, Genuine Subaru Remanufactured Parts offer great value: the same quality and performance as a new unit, but at a reasonable price with substantial savings.



**Maintaining Owner Satisfaction
at its Peak**

Genuine Subaru Replacement Mufflers...

for Perfect Fit and Function.

Unlike typical generic mufflers, ONLY Genuine Subaru Replacement Muffler Assemblies offer these unique advantages...

Welded, One-Piece Assembly

A Genuine Subaru Replacement Muffler Assembly is a complete, all-welded, one-piece unit that ensures easy and precise installation and fit—the same exact fit as the assembly supplied on the vehicle as original equipment. A Genuine Subaru Replacement Muffler Assembly eliminates the need to deal with the all-too-common combination of leak-prone pipe adaptors; cumbersome, multiple clamps; and adaptable hangers that never fit quite right.

Fully Aluminized Steel Construction

A Genuine Subaru Replacement Muffler Assembly is a heavy-duty, integrated unit of thicker materials than typical aftermarket mufflers. Special corrosion-resistant aluminized steel construction allows for long life. Sound absorbing materials help subdue sound without hampering performance—unlike typical replacement mufflers with few baffles to suppress exhaust noise.

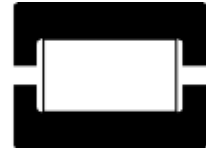
Specifically Designed for Your Customers' Cars

A Genuine Subaru Replacement Muffler Assembly is designed for each Subaru vehicle application—not “cross-fitted” to multiple makes and rigged with adaptors. All mounting parts precisely match the original Subaru assembly for easy, safe, no-rattle replacement.

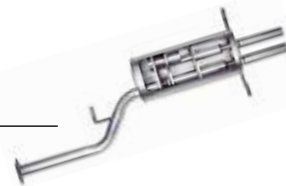
Backed by Warranty

A Genuine Subaru Replacement Muffler Assembly is backed by the Genuine Subaru Parts warranty that covers the entire, integrated unit—not just the muffler itself—including welded-on pipes, clamps, and hardware.

Typical warranties cover the muffler “box” only. When it rusts out and is replaced under warranty, you still pay for the related pipes, adapters, clamps and hangers used during replacement—unless you’ve chosen a Genuine Subaru Replacement Muffler Assembly, with no hidden costs. Contact your dealer for complete warranty details.



Genuine Subaru Replacement Mufflers



Wouldn't your customers prefer Genuine Subaru Replacement Mufflers? They're domestically-sourced and competitively priced with aftermarket mufflers.

APPLICATION GUIDE

Genuine Subaru Replacement Mufflers

Newly expanded line—covers 1980 through 1994

New Part Number	Previous Part Number	Application
SOA8375100	SOA5225119	82-87 BRAT 80-84 STATION WAGON & 4-DOOR SEDAN
SOA8375200	SOA5225119	81-89 HATCHBACK
SOA8375300	744304451	87-94 JUSTY
SOA8375600	44301GA211	85-93 LEONE/LOYALE SEDAN
	44301GA221	85-90 LEONE/LOYALE SEDAN-TURBO
SOA8375600	44301GA211	86-90 LEONE/LOYALE 3-DOOR
	44301GA221	86-90 LEONE/LOYALE 3-DOOR-TURBO
SOA8375700	44301GA231	85-94 LEONE/LOYALE WAGON
	44301GA241	85-90 LEONE/LOYALE WAGON-TURBO
SOA8375800	44304GA321	85-87 XT (THRU 12/86) INCL. TURBO
	44304GA341	87 XT TURBO (FROM 1/87)
	44304GA361	87-91 XT (FROM 1/87) 87-91 XT6
SOA8375500	44304AA080	90-94 LEGACY (2WD) WAGON
SOA8376000	44304AA110	90-94 LEGACY (2WD) SEDAN
SOA8375900	44304AA120	90-94 LEGACY (4WD) SEDAN
SOA8375400	44304AA130	90-94 LEGACY (4WD) WAGON

IMPORTANT NOTE: Federal and California law prohibits use of these parts in making repairs covered under emissions-related warranties extended on the vehicle at the time of its original purchase. No claims under those warranties will be honored unless OEM parts are used.



Electrical Connector Handling And Terminal Sliding Resistance Measurement

To facilitate the assembly process, all automobiles (including Subaru vehicles) are filled with dozens of multi-terminal connectors. Considering how many there are, these connectors are relatively trouble-free. However, they can be the source of intermittent and/or hard to diagnose electrical problems that can make you want to pull out your hair.

Here are a few of the problems that can befall a multi-terminal connector:

- The two connector halves may not be completely locked together. This may lead to an intermittent or open circuit between two or more of the terminals inside the connector.
- Individual terminals inside the connector may not be completely locked into place. A loose terminal may partially “back out” of the connector, also causing an intermittent or open circuit.
- The crimp that attaches a wire to an individual terminal may be damaged. Millions of these crimps are made by machines, and let’s face it, mistakes can happen. From outside the connector, the terminal may appear to be crimped to the wire, but a poor electrical connection can still result. The terminal may be crimped to the insulation, rather than the conductive wire within. This type of connection may appear normal, but will pass no current. Alternately, damaged wires may hang (literally) by a single strand of wire.
- Perhaps the most difficult connection to diagnose is the one that looks completely normal. Both halves of the multi-terminal connector may be firmly locked in place. All terminals may be firmly locked in place inside the connector halves. All of the terminal crimps inside the connectors may appear solid and electrically sound. But there still may be problems

inside the connector. These problems may be caused by a loose physical connection between the male and female terminals that are supposed to lock together tightly to pass the electrical current through the connector.

Disconnecting and Reconnecting Harness Connectors

- Always hold the connector itself. Don’t pull the harness.
- Insert a connector by pushing it all the way in. If the connector is equipped with a locking device, push it until a clicking sound is heard.
- To disconnect a locking connector, first release the lock, then pull the connector off. Unlock by pushing or pulling the locking tab.
- Generally, probes are inserted into connectors from the rear. Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.
- When removing the shock protector, take care not to deform it. This also applies to waterproof connectors, which cannot be tested from the wire side.
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, because the terminals may break off.)

Checking For Poor Contact On Plug-In Connectors

Most intermittent electrical problems are caused by poor contact of plug-in connectors. Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. To prevent the replacement of good component parts, sufficiently check the following points:



Figure 1

- Quite often a connector with a poor contact will work perfectly again after it has been separated and reconnected.
- Disconnect the two connector halves.
- Check the connector pins for signs of corrosion or foreign material.
- Check the connector for loose or damaged terminals, and make sure they are set correctly in the connector.

Note: When the harness is pulled lightly, the terminals should not come out.

- Insert the male pins of the connector into the female pins, then pull them out.

Note: If one of the pins pulls out easily, it is a likely source of a malfunction.

- Lightly shake the connector and the harness, while checking for sudden changes in voltage or resistance.

If the harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of the trouble.

The following photos explain the recommended procedure for checking the “sliding resistance” of terminal pairs inside a multi-terminal connector pair.

Figure 1

The best place to start a connector check is with a voltage drop test. Backprobe both sides of the connector with your DMM leads, then turn to the DC volt scale. Remember, current must be flowing through the circuit to perform a voltage drop test. The circuit must be on. No current flow, no voltage drop.

Figure 2

This connection appears to be okay, as it exhibits no measurable voltage drop with current flowing through the circuit. But a problem may still be hiding inside the connector.

Figure 3

Use the proper tools to remove both halves of the terminal pair from the connector bodies. Now plug the two terminals together. The male and female terminals should fit together tightly. The looseness or tightness of this connection is difficult or impossible to feel when you’re snapping together a connector pair that may contain a dozen or more terminals.

Figure 4

Did the connection feel tight? If not, you’ve got the perfect location for a voltage drop. Use the proper tools (a small needle-nose pliers in this case) to carefully bend the female terminal for a slightly tighter fit.

Figure 5

After bending the female terminal slightly, try plugging the terminal pair back together. This is the “sliding resistance test” we referred to earlier. The connection should be tight enough to ensure a resistance-free transmission of current through the connector. Don’t get carried away! We want to be sure the terminals mate together effortlessly when they are reinstalled in the connector body. If the opening in female terminal is completely closed up, the male terminal may bend out of the way rather than sliding into the female terminal. You won’t be able to see the damage unless you separate the connectors for an inspection.



Figure 2



Figure 3



Figure 4



Figure 5

Headlight Aiming



Figure 1 Aerodynamic Headlights

Subaru models equipped with aerodynamic headlights require no special fixtures for headlight alignment. Each headlight is equipped with a built-in headlight aiming mechanism. The following sequence demonstrates the correct technique for adjusting the headlights on a Subaru Legacy equipped with aerodynamic headlights.



Figure 2 Check Tire Pressure

- Turn off the headlight before adjusting headlight aiming (**Figure 1**). If the light is necessary to check aiming, do not turn on the headlights for more than two minutes.

- Inspect the area around the headlight for any damage. If the vehicle has been involved in an accident, it may not be possible to properly adjust the headlights until the damage has been professionally repaired.

- The vehicle must be parked on level ground and all four tires must be properly inflated (**Figure 2**).

- The vehicle's fuel tank must be completely filled.

- Bounce the vehicle several times to normalize the suspension.

- To simulate actual driving conditions, someone should be seated in the driver's seat (**Figure 3**).



Figure 3
Add Weight To Driver's Seat

- Locate the vertical aim adjusting screw (**Figure 4**). This adjustment must be made before the horizontal adjustment.

- Look at the beam angle gauge for vertical movement on top of the headlight assembly (**Figure 5**). The bubble on the gauge should not deviate from the center of the gauge. If adjustment is required, turn the vertical aim adjusting screw.

- Look at the beam angle gauge for horizontal movement (**Figure 6**). The center mark (red line on the inner scale) should not deviate from the black line on the outer case. If adjustment is required, turn the adjustment screw at the rear of the beam angle gauge.

- Recheck the vertical beam angle gauge. If the headlamp has moved and further adjustment is required, turn the vertical aim adjusting screw.

- Recheck the horizontal beam adjustment and adjust if necessary.



Figure 4 Vertical Aim Adjusting Screw



Figure 5 Vertical Movement Beam Angle Gauge



Figure 6 Horizontal Movement
Beam Angle Guide

insider info.

Use Of A/C Dyes In Subaru Air Conditioning Systems

The following recommendations have been issued by ZEXEL USA HVAC and Calsonic North America, Inc., the manufacturers of Subaru air conditioning systems, regarding the use of A/C dyes in Subaru A/C systems:

ZEXEL USA HVAC

- Non-ultraviolet (red dye) is strongly cautioned against. There are many contaminants in this type of dye that can cause premature compressor or other system component failure.
- Ultraviolet dye can be used as a last resort to attempt to find a repeat leak that can't be found using an adequate electronic leak detector. ZEXEL USA HVAC Technical Service Department utilizes a Yokogawa H10N and/or H10PM electronic leak detector for its field investigations. Zexel has found this detector to be very reliable and accurate, when properly maintained. This detector is also marketed by Kent-Moore Tool Company. In most instances, ZEXEL has not found it necessary to use any type of dye for leak detection. The most important part of leak detection is patience and properly maintaining your equipment.

Calsonic North America, Inc.

- Calsonic only recommends ultraviolet dye. Ultraviolet dye called "Brightness Solution" is an example of one product that is approved by Calsonic. Kent-Moore Tool Company sells the ultraviolet dye using their part number J-41447 for R-134a and J-39475 for R-12 systems. Also recommended are dye injector tools that do not require the use of refrigerant to introduce the dye into the A/C system. Use Kent-Moore A/C Tracer Dye Injector part numbers J-41459 for R-134a systems and J-41709 for R-12 systems.
- To find a leak with the dye injected into the A/C system, Calsonic recommends using the Universal 12 volt Leak Detection Lamp that can be ordered through Kent-Moore using part number J-42220.
- Calsonic recommends the use of a Yokogawa leak detector or the D-TEK leak detector which can be ordered from Kent-Moore Tool Company using part number J-41995.

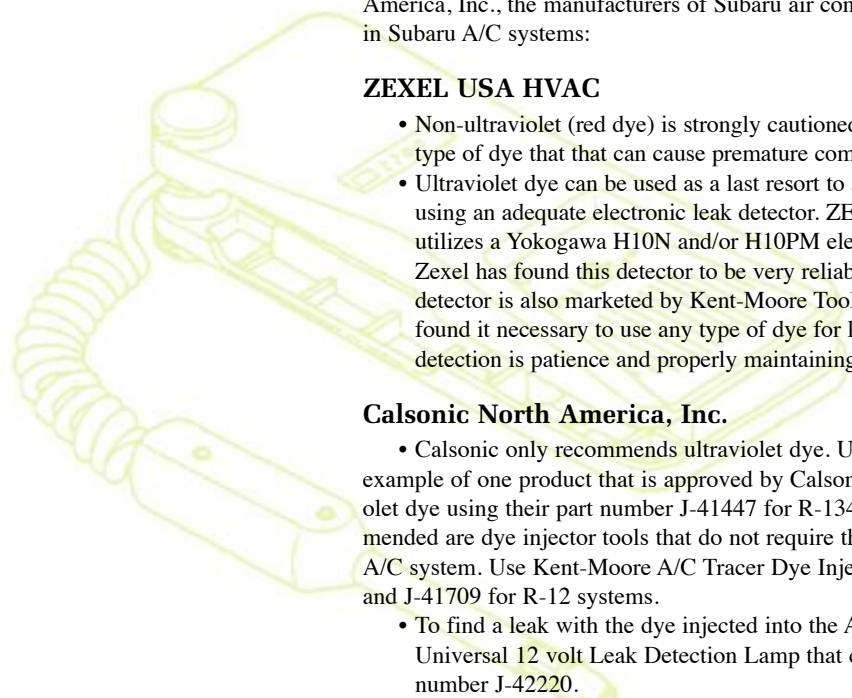
Replacement Wiper Blade Refills

This information pertains to wiper blade refills, Subaru P/N SOA473W319 and SOA473W321. If a customer complains of the wiper hitting the "A" pillar after installing these refills, check to make sure they are correctly installed. They are directional.

The refills have a metal "locking clip" on one end. When the refills are properly installed, the "locking clip" should be on the end of the wiper facing the passenger side of the vehicle. In other words, if the wipers were intentionally stopped in mid-cycle to ease refill installation, the "locking clip" should be at the end closest to the roof, not the hood.

Subaru Impreza Center Dash Vent Airflow

If you encounter a customer complaint of different air flow patterns from the driver's half/passenger's half of the center dash vent, be advised that this is a normal condition and no repairs should be attempted. Air flow will be greater from the passenger's half of the vent.



Improper Driver's Side Window Operation

Owners of late-model Subaru vehicles equipped with power windows may complain of improper driver's side window operation. The power window motor may continue to run after the window is all the way down, eventually causing the circuit breaker to trip. Another possible complaint is a power window switch that will not "pop" back after engaging the "auto down" function.

Both of these complaints may have some things in common:

- If the window switch will not operate properly in the "auto down" mode, determine whether it will function properly in the "manual down" mode.
- Check the operation of the power window switch with the ignition key ON, but the engine OFF. If the window switch now operates properly, you've found the problem.

Inspect the vehicle's charging system and check for erratic output voltages. If erratic output voltages are found, replace the alternator. The power window switch should now function normally.

Availability of Retrofit Air Bag "On-Off" Switches

Please be advised that Subaru has indicated that it will supply air bag "on-off" switches for the following dual air bag equipped vehicles. The exact time of availability is unknown at this time.

- 1995 and subsequent Legacy models
- 1994 and subsequent Impreza models
- 1998 and subsequent Forester models

Owners must obtain authorization from the National Highway Traffic Safety Administration (NHTSA) to be eligible for air bag "on-off" switch installation.

The NHTSA regulation allows dealers and independent repair shops to install such switches with a proper NHTSA authorization, however dealers and independent repair shops are not required by NHTSA to install the switches.

Watch for notification in a future issue of *The End Wrench* when Subaru air bag "on-off" switches become available.

Five Speed Manual Transmission Popping Out Of Gear

A customer complaint of a Subaru five speed manual transmission that pops out of first gear during deceleration may be caused by excessive radial clearance between the driven shaft and the 1st driven gear. Subaru Service Bulletin 03-46-90 addresses this complaint, but it should be used for basic information only, as the transmission internal parts have been changed since 1990. The part numbers listed in the bulletin are incorrect for later models.

The primary problem you will encounter if you were to use the part numbers mentioned in the Service Bulletin is that the key on the driven shaft that holds 5th gear is larger and will not fit into the keyway of the shaft mentioned in the Service Bulletin.

To cure the popping out of first gear, the radial clearance between the driven shaft and the 1st driven gear must be reduced. To accomplish this, it is necessary to select a driven shaft with a larger outside diameter and match it with a 1st driven gear with a smaller internal diameter.

An example can be seen using the 1997 Legacy Service Manual, Volume 6, Section 3-1, page 19 [W5B6]. Listed under item 6 is a chart showing The driven shaft part number and external diameter along with the 1st driven gear. You will have to refer to the appropriate parts manual for the 1st driven gear measurements, as they are not listed on this page.

Using this example, you could choose a driven shaft with P/N 32229AA140 (external measurement of 49.967-49.975 mm) and match it with a 1st driven gear with P/N 32231AA290 (internal measurement of 49.996-50.012 mm). This would result in the proper radial clearance (0.030-0.050 mm for AWD units).

Note: These part numbers are for use in a 2.5 liter MT.

Remember, this is an example. The actual parts you might need to correct the problem could be different than those mentioned here. Always refer to the appropriate parts manual for the correct parts listing and measurements.

What is a Subaru N.E.W. Horizons Dealer?

Subaru N.E.W. Horizons Dealers have been recognized for their outstanding performance in serving the wholesale market. N.E.W. Horizons dealers provide you with a direct wholesale parts hotline and also maintain a large inventory of competitively priced Genuine Subaru Parts, which means you can get most parts immediately. If not, the N.E.W. Horizons dealer's direct access to the Subaru Parts Distribution Network means it can get you almost any part you need quickly. If you have a question about a specific part or repair job, just ask. No one knows a Subaru, or the parts needed to repair them, like a Subaru N.E.W. Horizons Dealer.

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 Continental Motors
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 907 455-9816 907 456-6217

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Ramsey Subaru-Pontiac
800 669-6460 515 278-6400

Kansas

Olathe
Jack Miller Subaru Olathe
913 780-1494 913 780-0400

Topeka
Figgs Imports, Inc.
800 757-7717 785 267-2390

Kentucky

Louisville
Neil Huffman Imports, Inc.
800 777-6509 502 448-6666

Louisville
Tri-City Subaru
800 626-2020 502 897-6541

Nicholasville
Oldham's Subaru
800 886-1777 606 885-3900

Louisiana

Baton Rouge
Perry's Auto World, Inc.
888 927-1900 504 927-1900

New Orleans
Performance Subaru
504 822-1231 504 822-2222

Maine

Auburn
Subaru Of Auburn
207 782-8810

Augusta
Charlie's Subaru
800 339-0986 207 622-7327

Bangor
Village Subaru
800 564-7900 207 942-7364

Ellsworth
Seacoast Subaru, Inc.
800 439-8989 207 667-4641

South Portland
Maine Mall Subaru
800 640-6685 207 774-1429

Woolwich
Bath Subaru
207 443-9781

Maryland

Annapolis
Annapolis Subaru-Volvo
800 765-9902 410 573-1300

Baltimore
Foreign Motors Subaru, Inc.
410 483-6434 410 488-5050

Baltimore
Russel Motor Cars, Inc.
800 638-8401 410 744-2300

Hagerstown
Sharrett, Inc.
301 739-9999 301 739-7700

Kensington
Fitzgerald Subaru
800 876-3748 301 881-4000

Owings Mills
Heritage Imports, Inc.
410 581-6696 410 363-8300

Pasadena
Wootton Motor Cars
800 420-0469 410 760-6300

Silver Spring
Tischer Autopark, Inc.
800 288-6984 301 890-3100

Massachusetts

Arlington
Cityside Subaru, Inc.
781 641-1900

Concord
Concord Subaru, Inc.
978 369-9600

Danvers
Ira Subaru, Inc.
800 774-8411 978 739-8200

Holyoke
C & C Subaru
413 536-5620

Hyannis
Beard Subaru
508 778-5066

Lunenburg
North End Auto Sales, Inc.
800 548-8887 978 582-4911

Natick
Natick Subaru, Inc.
888 456-2200 508 651-2000

Norwell
Norwell Subaru
781 681-3500

Norwood
Norwood Subaru, Inc.
800 541-6122 781 762-2400

Pittsfield
Pete's Chrysler-Plymouth-Subaru
800 651-7383 413 442-1584

Somerset
Metro Subaru
508 676-3071

Wakefield
Subaru Of Wakefield, Inc.
800 972-7877 781 246-3331

Webster
Tri-State Subaru
800 969-7822 508 943-7070

West Springfield
Bertera Subaru, Inc.
800 637-9661 413 734-4964

Wilmington
Car Mart Subaru
978 988-2300

Worcester
Patrick Motors, Inc.
800 344-7222 508 756-8364

Michigan

Ann Arbor
Ann Arbor Subaru
800 662-0073 734 662-3444

Bay City
Thelen Subaru
800 800-8910 517 684-2980

Commerce
Dwyer & Sons Imported Cars, Inc.
800 548-0993 248 624-0400

Ferndale
Hodges Imported Cars, Inc.
248 547-6167 248 547-8800

Kentwood
Go Subaru
800 678-1302 616 942-8040

Lansing
Williams Auto World
800 258-2853 517 484-1341

Traverse City
Cherry Capital Subaru
800 852-6475 616 947-9000

Troy
Fischer Automotive Group, Inc.
248 643-0735 248 643-7660

Minnesota

Bloomington
R. L. Imports, Inc.
800 451-5078 612 881-6200

Brooklyn Park
Brooklyn Park Automotive, Inc.
612 797-1699 612 424-4400

Minnnetonka
Morrie's Imports
800 332-4266 612 544-0376

Moorhead
Muscatell Subaru
218 287-1608 218 236-0191

Rochester
Clements Subaru
800 447-0882 507 289-0491

Vadnais Heights
Rudy Luther's White Bear Motors
800 852-3992 612 481-0230

Missouri

Ballwin
Dick Dean's Economy Cars, Inc.
314 227-6527 314 227-0100

North Kansas City
Jack Miller Oldsmobile-Subaru
816 472-4522 816 474-3100

St. Louis
Lou Fusz Motor Company, Inc.
800 341-5935 314 997-3400

Webster Groves
Webster Groves Subaru
800 966-5184 314 968-5167

Montana

Billings
Homestead Hyundai-Subaru
800 254-7240 406 652-1800

Bozeman
Dick Walter Subaru
800 735-2834 406 586-1771

Missoula
Four Seasons Motors
800 800-6565 406 728-2510

Nebraska

Omaha
Stan Olsen Pontiac-GMC-Subaru
402 393-1989 402 397-8300

Nevada

Reno
Reno Subaru Hyundai
800 495-6060 702 825-8474

New Hampshire

Belmont
Lakes Subaru Ltd.
603 528-3511

Claremont
Subaru Of Claremont
800 778-2278 603 542-9966

Concord
Ed Reilly Subaru, Inc.
603 225-0200

Conway
Profile Subaru, Inc.
800 638-8888 603 447-3845

Keene
Mountain View Subaru, Inc.
800 355-2434 603 355-5000

Manchester
Subaru of Manchester
603 668-2411

Milford
Subaru Of Milford, Inc.
800 242-2592 603 673-0510

Nashua
Granite State Subaru, Inc.
603 888-9999

North Hampton
AMD Subaru, Inc.
800 227-9303 603 964-9303

Plaistow
Commonwealth Subaru
800 328-1202 603 382-7101

Somersworth
Tri City Subaru, Inc.
800 821-0688 603 742-3647

Stratham
Exeter Subaru
800 540-1503 603 778-0300

New Jersey

Bloomfield
Lynnes Subaru, Inc.
800 782-7597 973 743-2111

Cherry Hill
Cherry Hill Subaru
609 661-8960 609 663-1500

Englewood
Town Motor Car Corporation
201 568-0990 201 568-5200

Flemington
Flemington Subaru, Inc.
908 782-6831 908 782-2025

Morristown
Heritage Subaru
800 541-1127 973 326-9131

Mount Holly
Miller Subaru
609 261-7844 609 267-4000

Oradell
Liberty Subaru
201 261-7495 201 261-0900

Sicklerville
Martin Subaru
800 288-8756 609 629-6833

New Mexico

Albuquerque
Lee Galles Oldsmobile-Subaru
505 884-9054 505 855-5800

Albuquerque
Rich Subaru
505 294-3438 505 294-1455

Santa Fe
Premier Subaru of Santa Fe
505 471 1411 505 471-7007

New York

Albany
Goldstein Motors, Inc.
800 955-1727 518 869-1250

Amherst
Northtown Hyundai-Subaru
716 835-4611 716 835-8500

Brewster
Smith Cairns Brewster
914 279-7427 914 278-8300

Glen Cove
North Coast Subaru Corp.
516 674-4447 516 676-3676

Huntington
Metric Auto Sales, Inc.
800 696-9980 516 499-6777

Jamaica
Lichtenberg Subaru
718 291-1145 718 291-0700

Jamestown
Ed Shults Subaru
800 752-7774 716 484-7151

Long Island City
Major Subaru, Inc.
718 837-1600 718 777-1800

Lynbrook
South Shore Subaru-Jeep-Eagle
516 887-5577 516 887-8600

Nanuet
Nanuet Subaru
800 762-6534 914 623-0810

Orchard Park
West-Herr Oldsmobile-Subaru
716 662-3570 716 662-3565

Pleasantville
Prestige Imports
914 769-1427 914 769-5100

Ravena
Marshalls Auto Exchange, Inc.
518 767-9701 518 756-6161

Rhinebeck
Ruge's Oldsmobile-Subaru
800 343-7843 914 876-7074

Rochester
Piehler Pontiac-Subaru
800 828-5201 716 458-4540

Rye
Rye Subaru
914 967-4830 914 967-6300

Sayville
Donaldsons, Inc.
516 567-8100 516 567-6400

Syracuse
Romano Subaru
315 475-3365 315 471-3665

Tarrytown
Rushneck Pontiac-Subaru
914 631-0670 914 631-0815

Utica
Don's Ford-Subaru
800 527-1027 315 797-1520

Victor
Van Bortel Motorcar, Inc.
800 724-8872 716 924-5230

Wantagh
Hassetf Lincoln-Mercury-Subaru
516 785-7200 516 785-7800

Wappingers Falls
Greer Subaru
914 297-8266 914 298-0700

Yonkers
Smith-Cairns Subaru Inc.
914 377-8116 914 377-8100

North Carolina

Asheville
Prestige Subaru
888 854-4293 828 298-9600

Boone
John Cook Subaru
800 844-2665 828 264-0675

Chapel Hill
Performance Subaru
800 476-3191 919 942-3191

Greensboro
Bob Dunn Subaru
800 489-7222 336 855-7222

Hendersonville
Hunter Subaru
800 968-8660 828 693-8661

Raleigh
Southern States Imports, Inc.
800 489-3684 919 828-0901

Winston Salem
Flow Motors, Inc.
800 467-5002 336 723-3524

Ohio

Cincinnati
Pontiac-Subaru Of Beechmont, Inc.
513 474-5720 513 474-4313

Columbus
Byers Imports
800 327-0360 614 864-5180

Columbus
Hatfield Subaru
800 852-1396 614 870-9559

Fairfield
Fairfield Buick-Subaru
888 402-8425 513 874-6980

Findlay
La Riche Subaru-Toyota, Inc.
800 545-6885 419 423-5656

Massillon
Waikem Motors, Inc.
800 225-0281 330 478-0281

North Olmstead
Ganley Westside Imports
800 433-2000 440 734-2000

Toledo
Yark Subaru
800 367-9275 419 841-7771

Warrensville Heights
Ellacott-Shaker Subaru
800 475-8555 216 475-3444

Wickliffe
Glavic Motors, Inc.
800 634-9770 440 585-1000

Oklahoma

Oklahoma City
Cable Motors, Inc.
800 522-6793 405 787-0433

Tulsa
Jim Norton Subaru-Isuzu
888 860-1868 918 582-2151

Oregon

Beaverton
Carr Chevrolet-Subaru
800 888-6793 503 644-2161

Eugene
Romania Subaru
800 231-2909 541 344-5566

Gresham
Gresham Subaru
800 669-1198 503 661-1200

Medford
Southern Oregon Subaru
800 866-9756 541 772-3377

Oregon City
Thomason Subaru
800 454-9465 503 656-0612

Portland
Wentworth Subaru
800 232-8097 503 232-2000

Salem
Capitol Subaru
800 888-1397 503 585-4141

Pennsylvania

Allentown
Becker Wagonmaster, Inc.
610 395-6530 610 395-3745

Bridgeport
Eger Subaru
610 277-6308 610 277-2050

Concordville
Concordville Motorcar, Inc.
800 220-3100 610 459-8900

Doylestown
Fred Beans Dodge-Subaru
800 227-6756 215 348-7500

East Petersburg
Lancaster County Motors, Inc.
800 215-5644 717 569-4514

Erie
New Motors, Incorporated
800 352-1052 814 868-4805

Feasterville
Colonial Subaru
800 345-8511 215 355-8800

Hanover
Lawrence Motors, Inc.
800 307-8348 717 637-6664

Harrisburg
Faulkner Subaru
800 522-2131 717 564-4545

Jenkintown
Glanzmann Subaru
800 440-0130 215 885-8282

Mechanicsburg
Cumberland Valley Motors
800 382-1436 717 697-9448

Moosic
Minooka Motor Sales, Inc.
800 982-4054 717 346-4641

Newtown Square
Rafferty Pontiac-GMC-Subaru
610 353-6906 610 353-6900

Philadelphia
Wilkie Subaru
800 962-4389 215 236-7500

Pittsburgh
Bianchi Subaru
724 244-4937 724 325-2888

Pittsburgh
Bill Gray Subaru
412 344-0181 412 344-0100

Pittsburgh
Bowler Subaru
800 231-4452 412 469-2100

Temple
Bob's Auto Sales
800 995-2627 610 929-4703

York
Apple Acura-Subaru
800 228-7299 717 854-1800

Rhode Island

North Kingstown
Pilgrim Motors, Inc.
800 243-8485 401 294-3395

North Smithfield
Anchor Subaru
401 769-1199

Warwick
Bald Hill Subaru
401 822-8110 401 822-8100

South Dakota

Rapid City
Courtesy Subaru
800 658-3054 605 342-7034

Sioux Falls
Terry Schulte Subaru
800 843-9976 605 336-1700

Tennessee

Dandridge
Quality Subaru
800 287-1281 423 397-9416

Knoxville
Harper Vehicles, Inc.
800 879-8733 423 691-5551

Memphis
Jim Keras Buick-Subaru
800 272-2012 901 373-2700

Nashville
Jim Reed Chevrolet-Subaru
800 522-2207 615 329-2929

Texas

Amarillo
Bradley Motors, Inc.
888 843-7539 806 359-2886

Austin
Austin Infiniti-Subaru
800 846-4403 512 454-9489

Dallas
Steakley Chevrolet-Subaru
800 442-6030 214 363-8341

El Paso
Mack Massey Subaru
888 763-8124 915 595-1777

Fort Worth
Garry McKinney Subaru
888 960-0888 817 560-7994

Houston
Gillman Subaru, Inc.
800 999-8309 713 776-6310

Irving
Westway Imports
800 338-3673 972 659-2204

San Antonio
Ancira Subaru
800 299-5286 210 681-2300

Tyler
Crown Motor Company
800 259-6769 903 581-7688

Utah

Midvale
Larry H. Miller Subaru
800 453-6456 801 565-4200

Salt Lake City
Mark Miller Subaru, Inc.
800 348-8207 801 268-3734

Salt Lake City
Nate Wade Subaru
800 221-4287 801 355-7571

Vermont

Bennington
Green Mountain Subaru, Inc.
802 442-4557

Burlington
Burlington Subaru, Inc.
800 394-7974 802 660-8099

Montpelier
Twin City Subaru, Inc.
802 223-5232

Norwich
The Car Store, Inc.
802 649-2727 802 649-1603

Rutland
Kinney Subaru
800 639-1951 802 775-6900

Virginia

Alexandria
Brown's Subaru Of Alexandria
800 864-7222 703 768-5800

Charlottesville
Brown's Charlottesville Subaru
800 635-3120 804 973-5317

Harrisonburg
Bob Wade Subaru
540 434-1892 540 434-3900

Midlothian
Pence Subaru
800 44PENCE 804 378-3000

Norfolk
Roughton Pontiac-Subaru
804 461-2967 757 461-1200

Roanoke
Team Motorsport, Inc.
800 277-8757 540 366-4830

Springfield
Subaru-VW Springfield, Inc.
703 451-2389 703 451-2380

Staunton
Staunton Nissan & Subaru, Inc.
800 296-3465 540 886-3465

Vienna
Stohman Subaru
800 697-4979 703 893-2990

Washington

Auburn
Auburn Subaru
800 827-2787 253 833-4940

Bellevue
Chaplin's Subaru
800 962-0822 425 641-2002

Bellingham
Dewey Griffin Subaru
800 846-1549 360 734-8700

Bremerton
Shoreline Subaru
800 458-5808 360 479-4320

Kirkland
Kirkland Subaru
800 860-7397 425 820-8993

Renton
Sound Subaru
800 261-7366 425 226-2775

Seattle
Carter Subaru
800 426-1332 206 542-1166

Spokane
Appleway Subaru
800 876-4439 509 924-6900

Spokane
Camp Subaru
800 776-9946 509 458-3288

Tacoma
Tacoma Subaru
888 473-6200 253 473-6200

West Virginia

Beckley
Eller Subaru, Inc.
304 255-1407 304 255-1406

Charleston
Jeff Morris Subaru, Inc.
888 926-9260 304 926-8000

Fairmont
Larry Myers Subaru
304 366-4476 304 366-3311

Morgantown
John Howard Motors
800 999-9194 304 296-3205

Wheeling
Wheeling Subaru
304 242-7447 304 242-7313

Wisconsin

Appleton
Gustman Motor Company, Inc.
800 283-6693 920 733-6693

Madison
Don Miller Pontiac-Subaru
800 362-3323 608 258-3500

Mequon
Sommer's Subaru
414 242-0129 414 242-0100

Schofield
Dave Kasten Motors, Inc.
715 359-2637 715 359-3638

Waukesha
Don Jacobs Subaru
800 334-3934 414 542-5711

Wyoming

Cheyenne
Dinneen Subaru
800 872-1408 307 778-2410



Ignition Coil Testing



Figure 1
Measuring
Secondary
Resistance
Between
Terminals
1 and 2



Figure 2
Measuring
Secondary
Resistance
Between
Terminals
3 and 4



Figure 3
Measuring
Primary
Resistance
Between
Terminals
1 and 2



Figure 4
Measuring
Primary
Resistance
Between
Terminals
2 and 3

All late model Subaru four cylinder engines employ a “waste spark” ignition system. Each time the ignition coil fires, it provides a spark to two cylinders at exactly the same time. Since only one of the two cylinders is on the compression stroke when the coil fires, the spark to the second cylinder (which is on the exhaust stroke) is “wasted.”

The ignition coil sits on top of the intake manifold and is divided into two halves. One half provides the spark to the number 1 and 2 cylinders, and the other half provides the spark to the number 3 and 4 cylinders. Instead of the familiar single secondary coil terminal, this coil has four secondary coil terminals.

Testing methods for this type of coil are slightly different from what you might be accustomed to as well. Using an accurate DMM, inspect the following items, and replace the ignition coil if it is found to be defective:

- Primary resistance
- Secondary resistance

Caution: *If the resistance is extremely low, this indicates the presence of a short circuit.*

Remove the secondary ignition wire as shown in **Figure 1**, set your DMM on the ohms scale, then insert the probes as shown. Secondary resistance between coil secondary terminal 1 and terminal 2 should be 21.0 K ohms ± 15 percent.

Move the DMM leads to coil secondary terminals 3 and 4. Resistance between these terminals should also be 21.0 K ohms ± 15 percent (**Figure 2**).

The next step is to measure the ignition coil primary resistance. Disconnect the ignition coil harness connector. The specified primary resistance between harness connector terminals 1 and 2 is 0.69 ohms ± 10 percent (**Figure 3**).

Move the DMM leads to terminals 2 and 3. Primary resistance between these terminals should also be 0.69 ohms ± 10 percent (**Figure 4**).

A resistance reading of the insulation between any primary terminal and the coil case should be 10M ohms or more. A lower resistance reading indicates that the coil primary windings are shorted to ground.