1996 GEO TRACKER SERVICE MANUAL
BOOK 2 (PRELIMINARY)

FOREWORD

This publication contains preliminary service information on diagnosis, service procedures, adjustments and specifications for the 1996 Geo Tracker, prepared before all of the final production specifications were established. Complete service information will be contained in a final service manual to be released later in the model year. Upon receipt of this final manual, discard this preliminary publication.

An understanding of the material contained in this manual and in the appropriate Dealer Service Bulletins will help technicians to better service vehicle owners.

The 1996 Geo Tracker service manual information has been separated into two books:

BOOK 1
Contains all sections EXCEPT Driveability and Emissions (Sections 6E and 6E3), Automatic Transmission Diagnosis (7A-10A and 7A-11A), and Electrical Diagnosis (Section 8A).

BOOK 2
Contains Driveability and Emissions (Sections 6E and 6E3), Automatic Transmission Diagnosis (7A-10A and 7A-11A), and Electrical Diagnosis (Section 8A).

Information on unit repair (overhaul) can be found in the 1996 Transmission/Transaxle/Transfer Case Unit Repair Manual, GMPT/96-TURM (available separately). It contains information on automatic and manual transmissions and transaxles, and transfer cases for all GM passenger cars and light duty trucks, including the fluid flow and circuit description information.

When reference is made in these manuals to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations, and specifications contained in these manuals are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

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NORTH AMERICAN OPERATIONS
General Motors Corporation
WARREN, MICHIGAN 48090

1996 GEO TRACKER SERVICE MANUAL
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GENERAL MOTORS SERVICE MANUAL COMMENTS

If you find an error, omission, or have a suggestion on any General Motors Service Manual, we want to hear from you.

United States and Canada - (General Motors Dealer Employees Only)
1-800-828-6860
(Monday - Thursday 8:00 AM to 8:00 PM EST)
(Friday 8:00 AM to 6:00 PM EST)
Fax #: 810-265-9327

Canada French Speaking - (General Motors Dealer Employees Only)
1-800-503-3222
(Monday - Friday 8:00 AM to 6:00 PM EST)
Fax #: 810-265-9327

International English Speaking - (General Motors Dealer Employees Only)
810-265-0840
(Monday - Friday 8:00 AM to 6:00 PM EST)
Fax #: 810-265-9327

These phone numbers can be called Monday through Friday. Be prepared to give the following information:

- Your name
- Your dealership's name
- Your phone number
- Model year and vehicle line
- Publication part number (if present)
- Vehicle Identification Number of vehicle being worked on.
- Section and page number(s)
- Description of problem

This phone number cannot provide technical assistance. Contact your regular technical assistance source.

The personnel answering this phone number will provide the author of the information with your comments and will follow-up until an answer is given.

If you wish to send examples or marked-up pages, the person who takes your call will tell you how to do that.

United States and Canadian Vehicle Owner/Operator

If you are the owner or operator of the vehicle, please give your comments to the applicable Customer Assistance Center. The phone number and address are in your Owner's Manual.

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Engine Controls

General Information

Contents

General Description

The Engine Control Module (ECM) will be referred to as a control module. The control module constantly monitors information from various input sensors and controls the various component systems. The control module in OBD II equipped vehicles also performs diagnostic tests of emissions related systems to ensure that the systems operate correctly and have not degraded to a point where the vehicle emissions will exceed local emission standards.

Review the component sections and wiring diagrams to determine which systems are controlled by each specific control module. The control module monitors numerous engine and vehicle functions and controls the following operations:

- Fuel control
- Ignition Control (IC)
- Automatic Transaxle shift functions
- Cruise Control Enable
- Generator
- Evaporative Emission (EVAP) Purge
- Exhaust Gas Recirculation (EGR)
- A/C Clutch Control
- Cooling Fan Control

Control Module Function

The control module supplies a buffered voltage to various sensors and switches. This is accomplished through resistance in the control module which is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10 megohm input impedance digital voltmeter (J 39200) to assure accurate voltage readings.

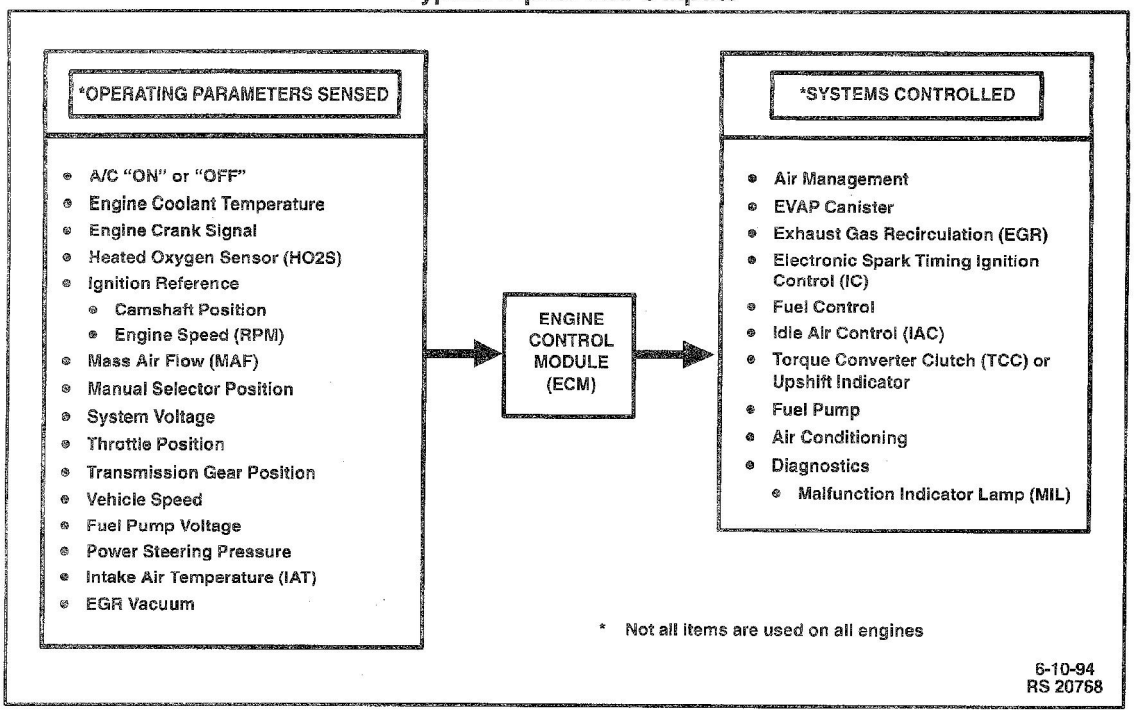
The input/output devices in the control module include analog to digital converters, signal buffers, counters, and special drivers. The Engine Control Module (ECM) controls most components with electronic switches which complete a ground circuit when turned "ON." These switches are arranged in groups of 4 and 7, called either a surface mounted Quad Driver Module (QDSM), which can independently control up to 4 outputs (ECM) terminals or Output Driver Modules (ODMs) which can independently control up to 7 outputs. Certain outputs may not be used depending on vehicle application.

Control Module Learning Ability

The control module has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery cable is disconnected, the "learning" process resets. A change may be noted in the vehicles performance. To "teach" the vehicle, ensure that the engine is at operating temperature, then turn the ignition key "ON".

Another method to "teach" the vehicle to idle is to drive the vehicle at part throttle, with moderate acceleration. The vehicle may also be operated at idle conditions until normal performance returns.

Typical Inputs and Outputs



Use Of Circuit Testing Tools

Do not use a test light to diagnose the engine control electrical systems unless specifically instructed by diagnostic procedures. Use Connector Test Adapter Kit, J 35616 whenever diagnostic procedures call for probing any connectors.

ECM Service Precautions

The control module is designed to withstand normal current draws associated with vehicle operations. Avoid overloading any circuit. When testing for opens or shorts, do not ground or apply voltage to any of the control module circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200, while the control module connectors remain connected to the control module.

Aftermarket (Add-On) Electrical And Vacuum Equipment

Aftermarket (add-on) Electrical and Vacuum Equipment is defined as any equipment installed on a vehicle after leaving the factory that connects to the vehicle's electrical or vacuum systems. No allowances have been made in the vehicle design for this type of equipment.

Notice: No add-on vacuum equipment should be added to this vehicle.

Notice: Add-on electrical equipment must only be connected to the vehicles electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these strict guidelines, may still cause the engine control system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any engine control problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.

Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

Notice: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Section 6E3 Content

The driveability and emissions section describes the function and operation of the control module. Emphasis is placed on the diagnosis and repair of problems related to the system.

Section 6E3 is divided into three major sub-sections dealing with diagnosis and repair. They can be summarized as follows:

Section A: Engine Components/Wiring Diagrams/Diagnostic Charts

- Component Locations
- Wiring Diagrams.
- Control module Terminal End View and Terminal Definitions.
- On-Board Diagnostic (OBD) System Check.
- Diagnostic Trouble Code (DTC) charts with diagnostic support information pages containing circuit diagrams, circuit operation information, and helpful diagnostic information.

Section B: Symptoms

This sub-section assists in diagnosis of intermittent problems or problems which **do not** result in the storing of diagnostic trouble codes.

It is arranged by symptoms and lists possible causes of the problems.

Section C: Component System

- Component and circuit description.
- On-vehicle service for each sub-system.
- Functional checks and Diagnostic tables.

How To Use Electrical Systems Diagnostic Information

Strategy Based Diagnostics

The strategy based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The steps below are defined to instruct the technician how to proceed with a diagnosis.

1. Verify the Customer Concern
   To verify the customer concern, the technician should know the normal operation of the system.
2. Preliminary Checks
   Conduct a thorough visual and operational inspection, review the service history, detect unusual sounds or odors, and gather diagnostic trouble code information to achieve an effective repair.
3. Service Information (Manual) System Check(s)
   Section 6E3 contains "System Checks" where a system may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
4. Check Bulletins and Other Service Information
   This should include videos, newsletters, and Pulsat programs.
5. Service Diagnostics (Paper/Electronic)
   5.1. **DTC Stored** - Follow the designated DTC chart exactly to make an effective repair.
   5.2. **Symptom, No DTC** - Select the symptom from the symptom tables and follow the diagnostic paths or suggestions to complete the repair, or refer to the applicable component/system check in *Section 6E3-C.*
   5.3. **No Published Diagnostics** - Analyze the complaint and develop a plan for diagnostics. Utilize the wiring diagrams and theory of operation.
   Call technical assistance for similar cases where repair history may be available. Combine technician knowledge with efficient use of the available service information.
   5.4. **Intermittent** - Conditions that are not always present are intermittent. To resolve intermittents, perform the following steps:
   5.4.1 Observe history DTCs, DTC modes and freeze frame data.
   5.4.2 Evaluate the symptoms and conditions described by the customer.
   5.4.3 Use a check sheet or other method to identify the circuit or electrical system component.

5.4.4 Follow the suggestions for intermittent diagnosis found in the service documentation.

The Tech 1, Tech 2 and Fluke 87 have data capturing capabilities that can assist in detection of intermittents.

5.5. **Vehicle operates as designed/No trouble found**

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify against another vehicle that is operating normally. The condition may be intermittent. Contact Technical Assistance if the concern is common. Verify the complaint under the conditions described by the customer before releasing the vehicle.

6. Re-examine the Concern
When the complaint cannot be successfully found or isolated, a reevaluation is necessary. The complaint should be re-verified and could be intermittent or normal as per 5.3 or 5.5 above.
7. Repair and Verification Tests
After isolating the cause, the repairs should be made. Then validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify the complaint has been resolved under the following conditions:
   - Conditions noted by the customer.
   - If a DTC was diagnosed, verify a repair by duplicating conditions present when a DTC was set as noted in the Fail Records or Freeze Frame data.

Vehicle Emission Control Information Label

The underhood "Vehicle Emissions Control Information" label contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the year, the manufacturing division of the engine, the displacement of the engine in liters, the class of the vehicle, and type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every General Motors vehicle. If the label has been removed, it can be ordered from GM Service Parts Operations (GMSPO).

Maintenance Schedule

Refer to the *General Motors Maintenance Schedule* in *Section 0B* for the maintenance that should be performed to retain emission control performance.

Visual/Physical Underhood Inspection

Perform a careful visual and physical underhood inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

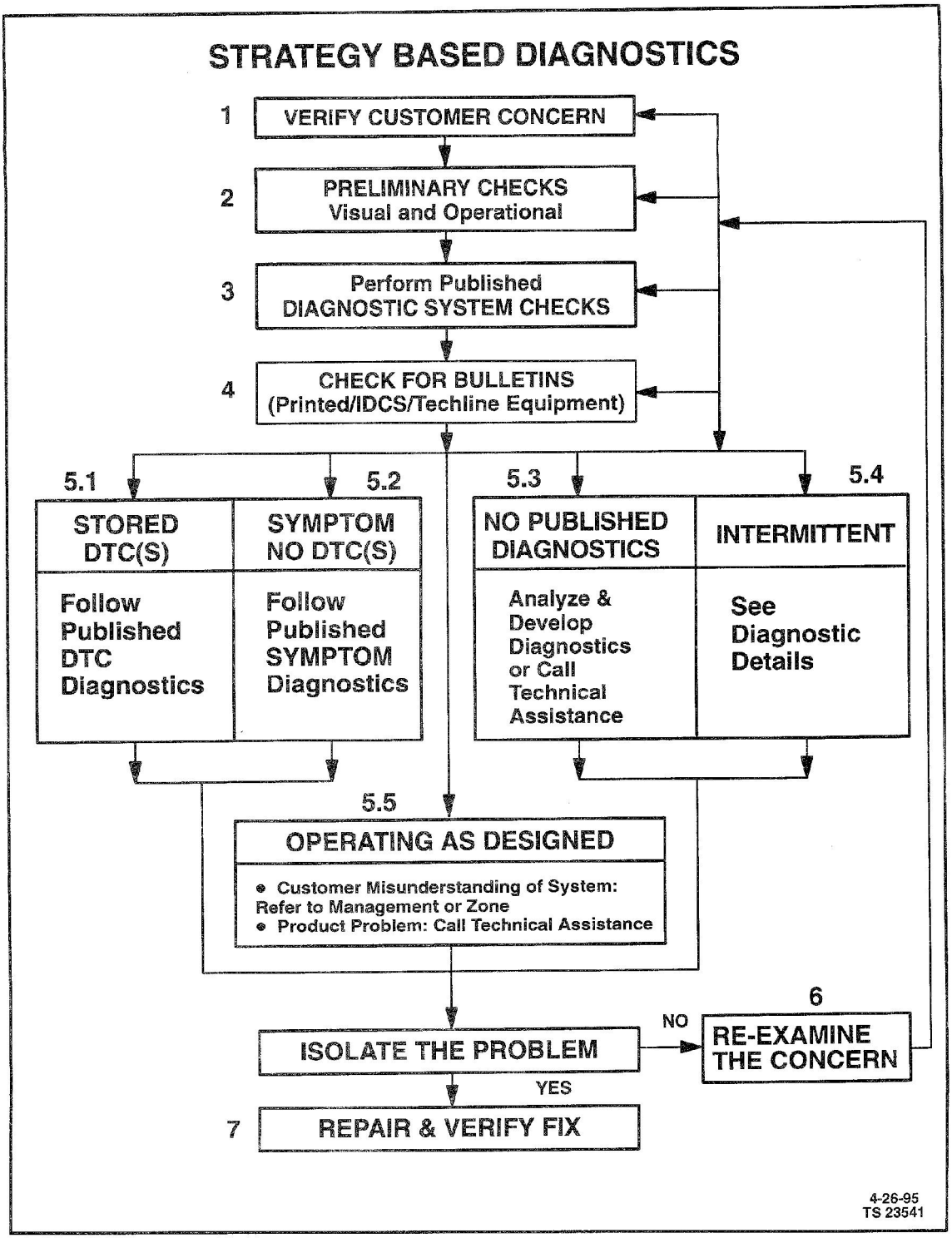
- Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects.
- Inspect hoses that are difficult to see beneath the air cleaner, A/C compressor, generator, etc.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds.

This visual/physical inspection is very important. It must be done carefully and thoroughly.

Basic Knowledge Of Tools Required

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Notice: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a engine control problem without this basic knowledge.


STRATEGY BASED DIAGNOSTICS
1
VERIFY CUSTOMER CONCERN
2
PRELIMINARY CHECKS
Visual and Operational
3
Perform Published
DIAGNOSTIC SYSTEM CHECKS
4
CHECK FOR BULLETINS
(Printed/IDCS/Techline Equipment)
5.1
STORED
DTC(S)
Follow
Published
DTC
Diagnostics
5.2
SYMPTOM
NO DTC(S)
Follow
Published
SYMPTOM
Diagnostics
5.3
NO PUBLISHED
DIAGNOSTICS
Analyze &
Develop
Diagnostics
or Call
Technical
Assistance
5.4
INTERMITTENT
See
Diagnostic
Details
5.5
OPERATING AS DESIGNED
• Customer Misunderstanding of System:
Refer to Management or Zone
• Product Problem: Call Technical Assistance
ISOLATE THE PROBLEM
NO
6
RE-EXAMINE
THE CONCERN
YES
7
REPAIR & VERIFY FIX
4-26-95
TS 23541

Serial Data Communications

UART Serial Data

Two methods of data transmission are used. One method involves a Universally Asynchronous Receiving/Transmitting (UART) protocol. UART is an interfacing device that allows the on board computer to send and receive serial data. "Serial data" refers to information which is transferred in a linear fashion - over a single line, one bit at a time. A "data bus" describes the electronic pathway through which serial data travels. The UART receives data in a serial format, converts the data to parallel format, and places them on the data bus (which is recognizable to the on board computer). The UART also accepts parallel data from the data bus, converts the data to serial format, and transmits them to the scan tool. This method has been the common strategy for establishing a communication link between the on board control module and the off board monitor/scanner since 1981.

ISO (9141-2) Serial Data

Regulations require that all automobile manufacturers establish a common communications system. The Tracker utilizes the International Organization for Standardization (ISO [9141-2]) communications system. It specifies the requirements for setting up the interchange of digital information between the on-board emission-related Engine Control Modules of road vehicles and the OBD II scan tool as specified in J1978. This communication is established to facilitate compliance with California Code of Regulation. The most significant result of this regulation is that it provides scan tool manufacturers with the capability of accessing data from any make or model vehicle.

Common OBD II Terms

Diagnostic

When used as a noun, the word *diagnostic* refers to any on-board test run by the vehicle's Engine Control Module. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. The following list defines the major vehicle on-board diagnostics. Depending on emission requirements in the area of vehicle sale, certain diagnostics listed below may not apply.

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required".

The enable criteria for each diagnostic is listed on the first page of the DTC description in *Section 6E3* under the heading "Conditions for Setting the DTC". Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- TCC enabled
- A/C on

Trip

Technically, a *trip* is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A *trip* is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of *trip* varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is at idle; some diagnostics function with the TCC disabled. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enable criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Warm-up Cycle

A warm-up cycle means that engine temperature must reach a minimum of 70°C (160°F) *and* rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Frame Data* for more detailed information.

Diagnostic Information

The diagnostic tables and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The tables are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complimented by the diagnostic procedures contained in this service information. The language of communicating the source of the malfunction is a system of Diagnostic Trouble Codes (DTCs). When a malfunction is detected by the control module, a DTC is set and the Malfunction Indicator Lamp (MIL) ("Service Engine Soon" or "Check Engine") lamp is illuminated on some applications. Refer to *Section 6E3-A* for more information.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("Service Engine Soon" or "Check Engine") lamp. However, OBD II requires that it illuminate under a strict set of guidelines. Basically, the MIL is turned on when the ECM detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the ECM. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions-related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three-Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and then the MIL will stop flashing and remain on steady.

Extinguishing the MIL

When the MIL is on, the ECM will turn off the MIL after *three consecutive* trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned off, the DTC will remain in the ECM memory and Freeze Frame until *forty (40) warm-up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur within 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last test failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL (Service Engine Soon) is on the instrument panel and has the following functions:

- It informs the driver that a fault that affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come "ON" with the key "ON" and the engine not running. When the engine is started, the MIL will turn "OFF."

When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a *On-Board Diagnostic (OBD) System Check must be performed.* The procedures for these checks are given in *Section 6E3-A.* These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The ECM sets DTCs based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set.

The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL on the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
- Type B
  - Emissions related
  - "Armed" after one (1) trip with a fail
  - "Disarmed after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the *second consecutive trip* with a fail (the DTC will be armed after the first fail)
  - Stores a Freeze Frame on the *second consecutive trip* with a fail (if empty)

(Some special conditions apply to misfire and fuel trim DTCs).

- Type C (if the vehicle is so equipped)
  - Non- Emissions related
  - Requests illumination of the Service Lamp or the service message on the Driver Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - Updates the Fail Record each time the diagnostic test fails
- Type D (*Type D* non-emissions related are not utilized on certain vehicle applications).
  - Non- Emissions related
  - Does not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame

Special Cases Of Type B Diagnostic Tests

Unique to the misfire diagnostic, the ECM has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the ECM will command the MIL to "flash" at a rate of once per second during those the time that the catalyst damaging misfire condition is present.

Storing And Erasing Freeze Frame Data

Regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called *Freeze Frame* data. The freeze frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the freeze frame buffer.

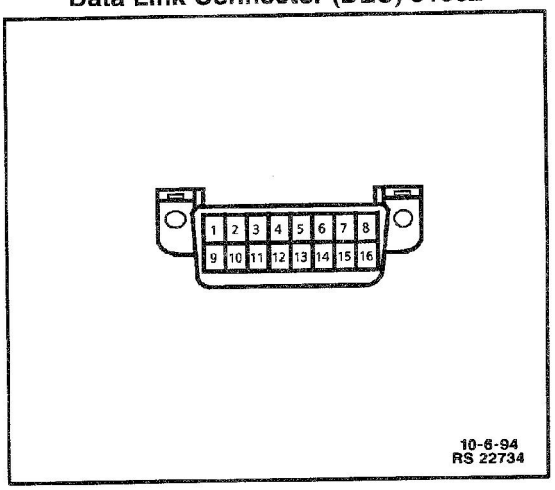
Freeze frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The freeze frame data will not be erased unless the associated DTC is cleared.

Intermittent Malfunction Indicator Lamp

In the case of an "intermittent" fault, the MIL (Service Engine Soon or Check Engine) may illuminate and then (after three trips) go "OFF". However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the "Diagnostic Aids" associated with the diagnostic trouble code. A physical inspection of the applicable sub-system most often will resolve the problem.

Data Link Connector (DLC) J1962

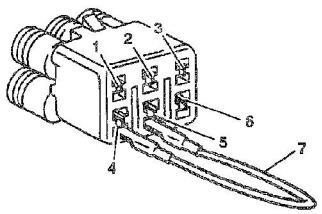


Data Link Connector (DLC) J1962

The provision for communicating with the control module is the Data Link Connector (DLC). It is usually located under the instrument panel. The DLC is used to connect to a scan tool. Some common uses of the scan tool are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs
- Performing output control tests.
- Reading serial data.

Duty Check Data Link Connector Pinout



1 NOT USED
2 DIAGNOSTIC REQUEST SIGNAL
3 MIL CONTROL/DIAGNOSTIC OUTPUT
4 GROUND
5 TEST SWITCH SIGNAL
6 DUTY CHECK OUTPUT
7 JUMPER WIRE

3-24-94
RS 21262

Duty Check Data Link Connector

When the Duty Check Data Link connector cavity "4" to cavity "5" are jumpered with the engine running, the ECM will set ignition timing to its initial (non-corrected) setting.

Decimal/Binary/Hexadecimal Conversions

Scan tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some scan tools will display encoded messages which will aid in determining the nature of the concern. This method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

The hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for scan tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

1. Review and record the freeze frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the freeze frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using a Tech 1, Tech 2 or Other Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic scan tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

Important: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the ECM will begin to count the "warm-up" cycles. When it has counted forty (40) consecutive "warm-up" cycles with no further faults detected, the DTC will automatically be cleared from the ECM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic scan tool "clear DTCs" or "clear information" function. When clearing DTCs follow instructions supplied by the tool manufacturer.

When a scan tool is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds:

Notice: To prevent system damage, the ignition key must be "OFF" when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery ECM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Primary System Based Diagnostics

There are primary system based diagnostics which evaluate system operation and their effect on vehicle emissions. The primary system based diagnostics are listed below with a brief functional description of the diagnostic.

Oxygen Sensor Diagnosis

The Fuel Control Heated Oxygen Sensor (HO2S 1) is diagnosed for the following conditions:

- Slow Response
- Inactive Signal (output steady at bias voltage - approx. 450mV)
- Signal Fixed High
- Signal Fixed Low

The Catalyst Monitor Heated Oxygen Sensor (HO2S 2) is diagnosed for the following functions:

- Heater Performance (time to activity on cold start)
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or decel fuel mode (deceleration when a lean mixture should be indicated).
- Inactive Sensor (output steady at approx. 438mV)

Fuel Control Heated Oxygen Sensor (HO2S 1)

The main function of the fuel control oxygen sensor is to provide the control module with exhaust stream information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control oxygen sensors in "closed loop to adjust fuel injector pulse width. While in closed loop, the ECM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability.

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degrade oxygen sensor performance. Refer to Section 8A-5, Heated Oxygen Sensor (HO2S) Repair.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required to begin closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensor HO2S to become active. The oxygen sensor heater is required by catalyst monitor sensor HO2S 2 to maintain a sufficiently high temperature. This allows accurate exhaust oxygen content readings further from the engine.

Catalyst Monitor Heated Oxygen Sensor (HO2S 2)

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gases, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The ECM has the ability to monitor this process using the HO2S 1 and the HO2S 2 heated oxygen sensors. The HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the HO2S 1 signal will be far more active than that produced by the HO2S 2 sensor.

In addition to catalyst monitoring, the HO2S 2 heated oxygen sensor has a limited role in controlling fuel delivery. If the HO2S 2 signal indicates a high or low oxygen content for an extended period of time while in closed loop, the ECM will adjust fuel delivery slightly to compensate.

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degrade oxygen sensor performance. Refer to Section 8A-5, Heated Oxygen Sensor (HO2S) Repair.

Catalyst Monitor Diagnostic Operation

The OBD II catalyst monitor diagnostic measures oxygen storage capacity. To do this, heated sensors are installed before and after the Three-Way Catalyst (TWC). Voltage variations between the sensors allow the control module to determine the catalyst emission performance. As a catalyst becomes less effective in promoting chemical reactions, its capacity to store and release oxygen generally degrades. The OBD II catalyst monitor diagnostic is based on an correlation between conversion efficiency and oxygen storage capacity. A good catalyst (e.g. 95% hydrocarbon conversion efficiency) will show a relatively flat output voltage on the post-catalyst Heated Oxygen Sensor (HO2S 2). A degraded catalyst (65% hydrocarbon conversion) will show greatly increased activity in output voltage from the post catalyst HO2S.

The post-catalyst HO2S is used to measure the oxygen storage/release capacity of the A high oxygen storage capacity indicates a good catalyst; low oxygen storage capacity indicates a failing catalyst. The TWC and HO2S 2 must be at operating temperature to achieve correct oxygen sensor voltages like those shown in the *Post-Catalyst HO2S Outputs graphic.*

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S Contamination
- Alternate fuels.

Exhaust system leaks may cause the following results

- Prevent a degraded catalyst from failing the diagnostic.
- Cause a false failure for a normally functioning catalyst.
- Prevent the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants at any HO2S will prevent the TWC diagnostic from functioning properly.

Three-Way Catalyst Oxygen Storage Capacity

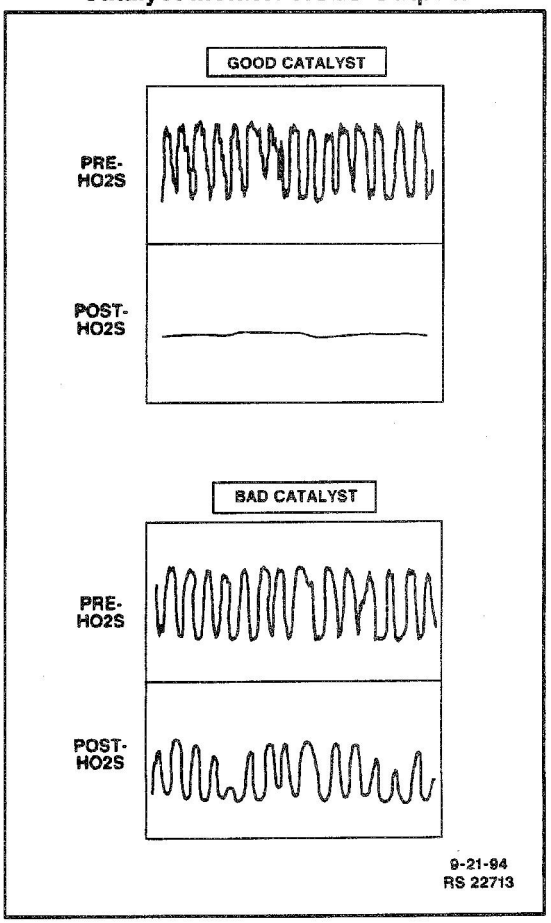
The Three-Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre-catalyst HO2S and post-catalyst HO2S oxygen sensors. When the TWC is operating properly, the post-catalyst oxygen sensor will have significantly less activity than the pre-catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post- catalyst oxygen sensor approaches that of the pre-catalyst oxygen sensor, the catalysts efficiency is degraded.

Stepped or staged testing levels allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on-board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The second stage then looks at the inputs from the pre and post catalyst O2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

Catalyst Monitor HO2S Outputs



Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The control module determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the control module can calculate when a misfire occurs.

For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions.

For catalyst damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be detected as a false misfire.

On automatic Transaxle equipped vehicles, the Torque Converter Clutch (TCC) will be disabled whenever a misfire is detected. Disabling the TCC isolates the engine from the rest of the drive line and minimizes the effect of drive wheel inputs on crankshaft rotation.

When the TCC has been disabled as a result of misfire detection, it will be re-enabled after approximately 3200 engine revolutions if no misfire is detected. The TCC will remain disabled whenever misfire is detected. This allows the misfire diagnostic to reevaluate the system.

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a concern under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Remember, use a scan tool to observe fuel trim while the problem is occurring.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To Illuminate The MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable (i.e. a Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage). Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Knock Sensor (KS)
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable.

Output components to be monitored include, but are not limited to the following circuits:

- Idle Air Control (IAC) Motor
- Control module controlled EVAP Canister Purge Valve
- Electronic Transaxle controls
- A/C relay
- Cooling fan relay
- VSS output
- MIL control
- Cruise control inhibit

Refer to *Section 6E3-C1* for more information on control module outputs.

CARB OBD II Comprehensive Component Monitoring List of Components* Intended to Illuminate MIL

Inputs	Outputs
Park Neutral Position switch	Transaxle Torque Converter Clutch (TCC) Control Solenoid
Transaxle Turbine Speed Sensor (HI/LO)	Transaxle TCC Enable Solenoid
Transaxle Vehicle Speed Sensor (HI/LO)	Transaxle Shift Solenoid A
Transaxle Vehicle Speed Sensor (HI/LO)	Transaxle Shift Solenoid B
Ignition Sensor (Cam Sync, Diag)	Transaxle 3/2 Shift Solenoid
Ignition Sensor Hi Res	Ignition Control (IC) System
Knock Sensor (KS)	Idle Air Control (IAC) Coil
Engine Coolant Temperature (ECT) Sensor	Evaporative Emission Purge Vacuum Switch
Intake Air Temperature (IAT) Sensor	Evaporative Emission Canister Purge (EVAP Canister Purge)
Throttle Position (TP) Sensor A, B	—
Manifold Absolute Pressure (MAP) Sensor	—
Mass Air Flow (MAF) Sensor	—
Automatic Transaxle Temperature Sensor	—

** Not all vehicles are equipped with these components.*

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure can not be determined. If no problem is found after performing diagnostics, then refer to the Default Matrix table for further diagnostic information.

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle Does Not Enter Diagnostics	8A (Electrical Diagnosis)
On-Board Diagnostic (OBD) System Check	Vehicle Enters Diagnostics and Communicates with the scan tool. MIL is "ON" in Diagnostics. Engine Does Not Start and Run	6D4 (Ignition System Check)
On-Board Diagnostic (OBD) System Check	Engine Starts and Runs, no ECM Codes Set. Customer Complains of Vibration.	0
On-Board Diagnostic (OBD) System Check	Engine Starts and Runs, no ECM Codes Set. Customer Complains of Harsh or Soft Shift, Poor Performance, Delayed or No Engagement Into Drive or Reverse, Transaxle Fluid Leak, Transaxle noise or Vibration, or Improper TCC Operation.	Section 7, Section 4
ECM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Section 8A
ECM Power and Ground Check	On-Board Diagnostic (OBD) System Check. ECM Power and Ground Circuits OK. Data link Voltage Incorrect	Section 8A
On-Board Diagnostic (OBD) System Check	Engine Starts and Runs, no ECM Codes Set. Customer Complains of Harsh or Soft Shift, Poor Performance, Delayed or No Engagement Into Drive or Reverse, Transaxle Fluid Leak, Transaxle noise or Vibration, or Improper TCC Operation.	Section 7, Section 4
Intermittents	1. On-Board Diagnostic (OBD) System Check. 2. Careful visual/physical inspections.	Section 6E3-B, Section 8A
Hard Starts	1. On-Board Diagnostic (OBD) System Check. 2. Sensors (ECT, MAP, MAF, TP sensors), Section 6E3-C1. 3. Fuel system, Chart A-5, A-7, Fuel Injector Coil Test/Fuel Injector Balance Test Procedures. 4. Ignition system, 6E3-C4.	Section 6 (Engine Mechanical), 6D4 (Ignition System Check), 6F (Exhaust Diagnosis)

Default Matrix Table (continued)

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
Surges and/or Chuggles	1. On-Board Diagnostic (OBD) System Check. 2. Oxygen Sensors, 6E3-C1 3. Fuel system, Chart A-7 4. Ignition system, 6E3-C4.	Calibration ID/Service Bulletins, Section 6D (Ignition System check, Generator output) 6F (Exhaust Diagnosis), Section 7 (4T60-E Transaxle Functional Test)
Lack of Power, Sluggish or Spongy	1. On-Board Diagnostic (OBD) System Check. 2. Fuel system, Chart A-7 3. Ignition system, Section 6E3-C4 4. EGR operation, Section 6E3-C7.	Exhaust system (Chart B-1), TCC operation (Section 7), Calibration ID/Service bulletins, 6
Detonation/Spark Knock	1. On-Board Diagnostic (OBD) System Check. 2. EGR operation, Section 6E3-C7 3. TCC operation, Section 7 4. Cooling system, Chart 6E3-C12 5. Fuel system, Section 6E3-C2 6. Ignition system, Section 6E3-C4.	Transaxle Range switch (Section 7), TCC operation (Section 7), Cooling system (Chart C-12), 6A, 6D (Ignition System Check), Calibration ID/Service bulletins
Hesitation, Sag, Stumble	1. On-Board Diagnostic (OBD) System Check. 2. TP, MAP sensor, Section 6E3-C1 3. Fuel system, Chart A-7, 4. EVAP system, Section 6E3-C3 5. Ignition system, Section 6E3-C4.	EGR operation, Section 6E3-C7, Generator output voltage (Section 6D), Calibration ID/Service bulletins, Section 6D4 (Ignition System check), Section 6
Cuts Out, Misses	1. On-Board Diagnostic (OBD) System Check.	Section 6, 6D4 (Ignition System Check)
Rough, Unstable, or Incorrect Idle, Stalling	1. On-Board Diagnostic (OBD) System Check. 2. Fuel system, Fuel Injector Coil Test/Fuel Injector Balance Test Procedures. 3. Ignition system, 6E3-C4 4. IAC operation, Chart C-2C 5. EGR operation, Chart C-7.	MAP sensor (Section 6E3-C1), Throttle linkage, Transaxle Range Switch (Section 7), IAC operation (Section 6E3-C2), EGR operation (Section 6E3-C7), A/C system (Section 6E3-C10), Crankcase ventilation system (Section 6E3-C13), Calibration ID/Service bulletins, Generator output voltage (Section 6D), Section 6, 6F (Exhaust Diagnosis)

Default Matrix Table (continued)

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
Poor Fuel Economy	1. On-Board Diagnostic (OBD) System Check. 2. Careful visual/physical inspection, Section 6E3-B 3. Ignition system, Section 6E3-C4 4. Cooling system, Section 6B.	TCC operation (Section 7), Exhaust system (Section 6F), Section 6
Engine Cranks But Will Not Run	On-Board Diagnostic (OBD) System Check.	Electrical (8A), Fuel System (Chart A-5, A-7, Section 6E3-C2)
Excessive Exhaust Emissions or Odors	1. On-Board Diagnostic (OBD) System Check. 2. Emission Test 3. Cooling system, Section 6B, Chart C-12 4. Fuel system, Chart A-7, Fuel Injector Coil Test/Fuel Injector Balance Test Procedures. 5. Section 6E3-C3 6. Ignition system, Section 6D, 6E3-C4 7. Crankcase ventilation system, Section 6E3-C13 8. MAP, Section 6E3-C1.	EGR operation (Section 6E3-C7), Section 6F (Exhaust Diagnosis), Calibration ID/Service bulletins
Dieseling, Run-On	1. On-Board Diagnostic (OBD) System Check. 2. Careful visual/physical inspection, Section 6E3-B 3. Fuel system, Chart A-7.	—
Backfire	1. On-Board Diagnostic (OBD) System Check. 2. Ignition system, Section 6E3-C4 3. Fuel system, Chart A-7, Fuel Injector Coil Test/Fuel Injector Balance Test Procedures 4. EGR operation, 6E3-C7	6F (Exhaust Diagnosis) 6C (Intake casting flash), 6A, 6D (Ignition System Check)
Misfire	1. On-Board Diagnostic (OBD) Systems Check. 2. Ignition system, Section 6E3-C4 3. Fuel system, Chart A-7, Fuel Injector Coil Test/Fuel Injector Balance Test Procedures.	Vibrations (0A), Transaxle (Section 7) Driveshaft and Axle (Section 4)
Catalyst Monitor	1. On-Board Diagnostic (OBD) Systems Check. 2. Careful visual/physical inspection, Section 6E3-B 3. Oxygen sensors.	Exhaust system (6F)

Default Matrix Table (continued)

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
Fuel Trim	1. On-Board Diagnostic (OBD) Systems Check. 2. Careful visual/physical inspection, Section 6E3-B 3. Fuel system, Chart A-7, 6E3-C2 4. Oxygen sensors, MAF sensors.	Section 6, 6E3-B, Exhaust system (6F), Intake (6C)
Evaporative Emissions	1. On-Board Diagnostic (OBD) Systems Check. 2. Careful visual/physical inspection, Section 6E3-B 3. Fuel system, Chart A-7, 6E3-C2.	—
Secondary Air Injection System	1. On-Board Diagnostic (OBD) Systems Check. 2. Careful visual/physical inspection, Section 6E3-B.	—
Oxygen Sensors	1. On-Board Diagnostic (OBD) Systems Check. 2. Careful visual/physical inspection, Section 6E3-B.	Exhaust system (6F)

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.

Replace wire harnesses with the proper part number replacement.

Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.

The following wire harness repair information is intended as a general guideline only. Refer to Section 8A-5 for all wire harness repair procedures.

Connectors And Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use tachometer adapter J 35812, or equivalent, which provides a convenient connection to the tachometer lead. The connector test adapter kit J 35616, or equivalent, contains an assortment of flexible connectors used to probe terminals during diagnosis. Fuse remover and test tool BT-8616, or equivalent is used for removing a fuse and to adapt the fuse holder to a meter for diagnosis.

Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.

Be certain the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com Pack III terminals look similar, but are serviced differently.

ECM Connectors and Terminals

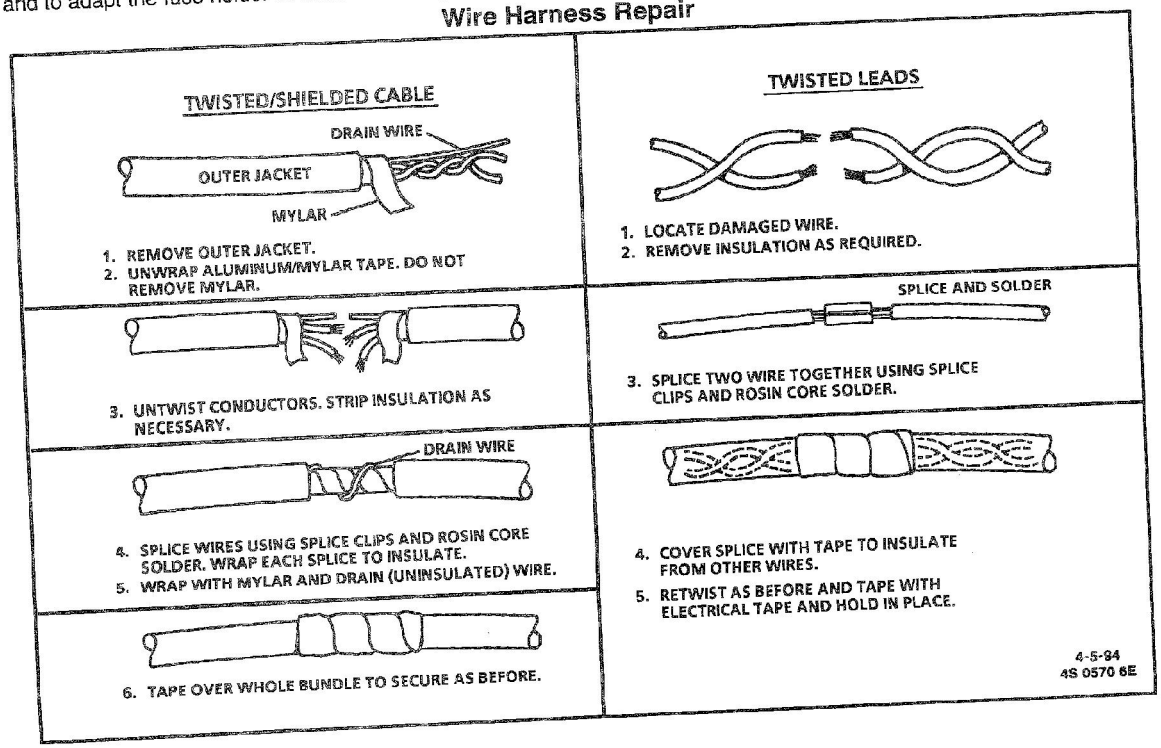
Remove or Disconnect

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

Install or Connect

1. Bend tab on connector to allow terminal to be pulled into position within the connector.
2. Pull carefully on wire to install the connector terminal retainer.

Wire Harness Repair



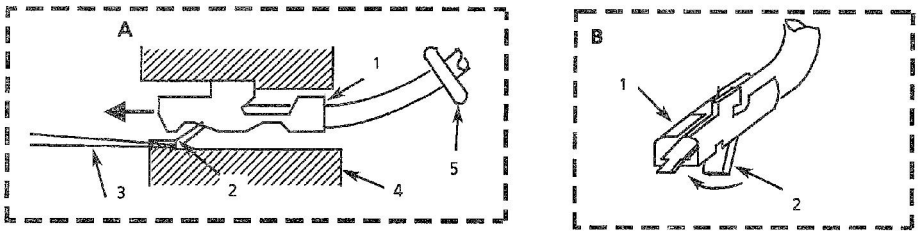
Metri-Pack

Some connectors use terminals called *Metri-Pack Series 150*. These may be used at the Engine Coolant Temperature (ECT) sensor.

Metri-Pack terminals are also referred to as "Pull-To-Seat" terminals, because to install a terminal on a wire, the wire must be inserted through the seal (5) and connector (4). The terminal is then crimped onto the wire. Then the terminal is pulled back into the connector to seat it in place. To remove a terminal, follow these steps:

- Slide the seal back on the wire.
- Insert tool (3) BT-8518, or J 35689, as shown in insert "A" and "B", to release the terminal locking tab (2).
- Push the wire and terminal out through the connector. If reusing the terminal, reshape the locking tang.

Metri-Pack Series 150 Terminal Removal



1. METRI-PACK SERIES 150 FEMALE TERMINAL
2. LOCKING TANG
3. TOOL J 35689 OR BT-8446
4. CONNECTOR BODY
5. SEAL

2-5-90
*7S 3213-6E

Weather-Pack

A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could form oxidation and deposits on the terminals. This protection is important, because of the low voltage and amperage found in the electronic systems.

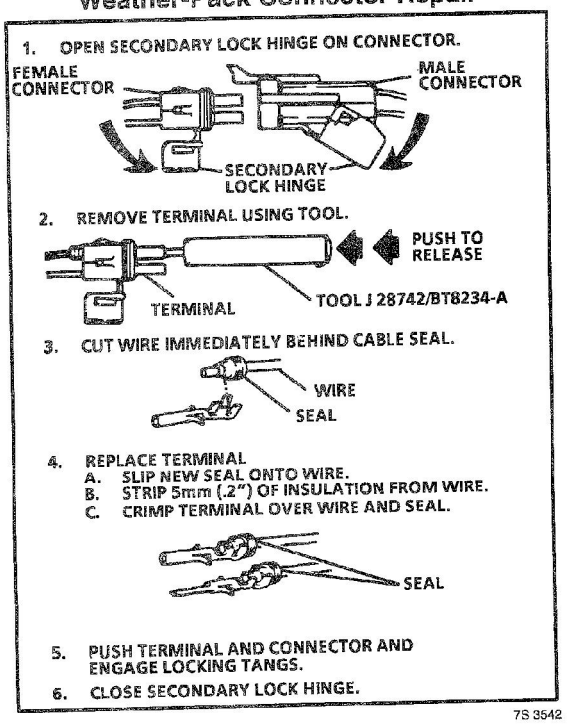
Refer to *Weather-Pack Connector Repair* illustration. Use tool J 28742-A, or BT-8234-A to remove the pin and sleeve terminals.

Do not use an ordinary pick or the terminal maybe bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after being improperly bent.

Make certain the connectors are properly seated and all of the sealing rings are in place when reconnecting leads. The hinge type flap provides a backup, or secondary locking feature for the connector. They are used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace Weather-Pack connections with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

Weather-Pack Connector Repair



7S 3542

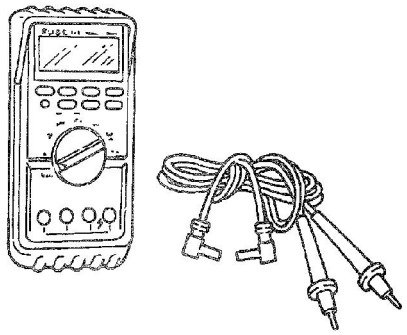
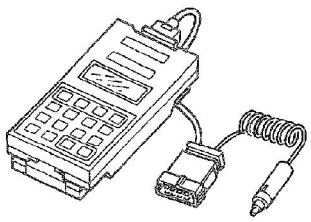
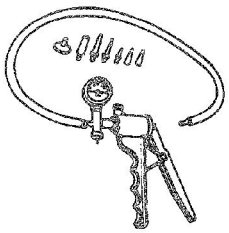
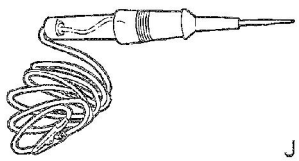
Com-Pack III

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or BT-8234-A. These will damage the terminals.

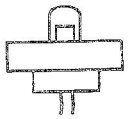
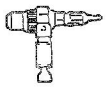
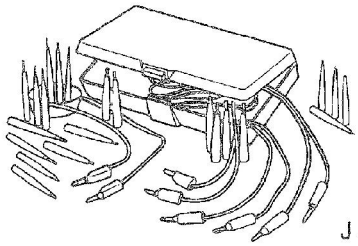
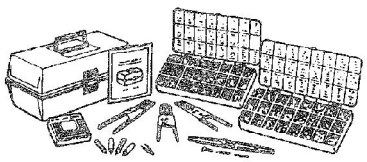
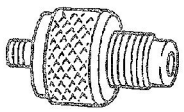
Tools Needed to Service the System

Refer to *Special Tools* at the end of this section for engine control tools for servicing the system.

Special Tools (1 of 3)

 J 39200	**DIGITAL MULTIMETER** **Voltmeter** - Voltage position measures magnitude of voltage when connected in parallel to an existing circuit. A digital voltmeter with a 10 megohm input impedance is used because this type of meter will not load down the circuit and result in faulty readings. Some circuits require accurate low voltage readings because they have a very high resistance. Refer to meter instructions for more information. **Ammeter** - When used as an ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for more information. • Selector must be set properly for both function and range. DC is used for most automotive measurements. **Ohmmeter** - Measures resistance of circuit directly in ohms. • Selector must be set to proper range. Refer to meter instructions for more information.
 TK00000	**TECH 1 DIAGNOSTIC COMPUTER** A hand-held scan tool used to analyze and diagnose fuel and emission system. Also can be used to analyze other systems.
 J 23738-A	**PLASTIC MITY-VAC® HAND VACUUM PUMP** Use the gage to monitor manifold engine vacuum and use the hand pump to check vacuum sensors, solenoids and valves.
 J 34142-B	**UNPOWERED TEST LIGHT** Used for checking wiring for complete circuit, short to ground or voltage.
	**TACHOMETER** Must have inductive trigger signal pickup. 5-11-94 RS 20720

Special Tools (2 of 3)

 J 34730-300	**INJECTOR TEST LIGHT** Used for checking the electrical circuit to a TBI fuel injector.
 J 26792	**H. E. I. SPARK TESTER** Used for checking the secondary ignition coil voltage.
 J 35616	**CONNECTOR TEST ADAPTER KIT** Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.
 J 38125-A	**TERMINAL REPAIR KIT** Used for making wiring harness repairs.
 J 34730-1	**FUEL PRESSURE GAGE** Used to check and monitor fuel pressure. Part of Diagnostic Kit/J 34730-B
 J 37746	**FUEL PRESSURE GAGE ADAPTER** Used to adapt J 34730-1 fuel pressure gage to Tracker TBI fuel system.

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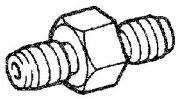
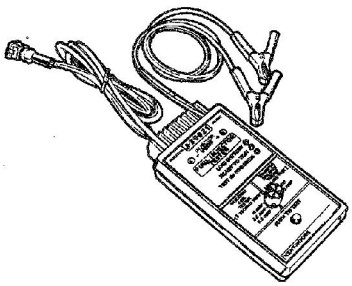
 J 41041	**FUEL PRESSURE GAGE ADAPTER** Used to adapt J 34730-1 fuel pressure gage to Tracker SFI fuel system.
 J 39021	**FUEL INJECTOR TESTER** Used to perform fuel injector coil load test and fuel injector balance test on Tracker SFI fuel system. 6-23-94 RS 20774