ASE 6 - Electrical Electronic Systems

Module 12
Strategy Based Diagnostics
Acknowledgements

General Motors, the IAGMASEP Association Board of Directors, and Raytheon Professional Services, GM’s training partner for GM’s Service Technical College wish to thank all of the people who contributed to the GM ASEP/BSEP curriculum development project 2002-3. This project would not have been possible without the tireless efforts of many people. We acknowledge:

- The IAGMASEP Association members for agreeing to tackle this large project to create the curriculum for the GM ASEP/BSEP schools.
- The IAGMASEP Curriculum team for leading the members to a single vision and implementation.
- Direct contributors within Raytheon Professional Services for their support of translating a good idea into reality. Specifically, we thank:
  - Chris Mason and Vince Williams, for their leadership, guidance, and support.
  - Media and Graphics department under Mary McClain and in particular, Cheryl Squicciarini, Diana Pajewski, Lesley McCowey, Jeremy Pawelek, & Nancy DeSantis.
  - For his help on the Electrical curriculum volume, Subject Matter Expert, Ken Beish, Jr., for his wealth of knowledge.

Finally, we wish to recognize the individual instructors and staffs of the GM ASEP/BSEP Colleges for their contribution for reformatting existing General Motors training material, adding critical technical content and the sharing of their expertise in the GM product. Separate committees worked on each of the eight curriculum areas. For the work on this volume, we thank the members of the Electrical committee:

- Jack Davis, Community College of Baltimore County - Catonsville
- Jim Halderman, Sinclair Community College
- Megan Kuehm, Community College of Allegheny County
- Frank Longbottom, Camden County College
- Jeff Rehkopf, Florida Community College at Jacksonville
- Randy Peters, Des Moines Area Community College
- David Rodriguez, College of Southern Idaho
- Ed Schauffler, Longview Community College
- Vince Williams, Raytheon
Introduction

This module will provide material and exercises that will allow the technician to successfully perform these tasks:

Objectives

NATEF Tasks:

Area VI. E.
1. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.

Area VI. F.
1. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.

Area VI. G.
1. Diagnose incorrect horn operation; perform necessary action.
2. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
3. Diagnose incorrect washer operation; perform necessary action.

Area VI. H.
1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.
2. Diagnose incorrect heated glass operation; determine necessary action.
3. Diagnose incorrect electric lock operation; determine necessary action.
4. Diagnose incorrect operation of cruise control systems; determine necessary action.

STC Tasks:
Identify steps to verify customer concern
Identify the steps to perform preliminary checks
Identify the steps to perform published diagnostic system checks
Identify the steps to check for bulletins
Identify the steps to perform service manual diagnostics
Identify the steps to re-examine a concern
Identify the steps to repair and verify the fix
Familiarize students with the process of Strategy Based Diagnostics

Diagnose faults in the following systems:
- Headlights
- Exterior Lights
- Horns
- Wiper/Washer
- Power Accessories
- Other systems as needed

Objectives of Strategy Based Diagnostics

Strategy Based Diagnostics was developed because of a recognized need for greater success by technicians in correctly diagnosing customers’ vehicles. Strategy Based Diagnostics (SBD) is based on the belief that the following statements are true:

- To be successful, you must have a process
- To improve your process, you must be able to visualize it
- To be successful, you must know what your resources are
- To be successful, you must be able to employ that strategy effectively

The objective of SBD is to provide technicians with a diagnostic process that works. An effective process will reduce unnecessary replacement of parts, lost time on unnecessary diagnostic procedures, and customer dissatisfaction from faulty or incomplete repairs.

To use SBD, you must first understand the strategy and know that it works. Second, you must know the strategy so well that you are able to visualize where you are in the SBD process while you are performing the diagnosis. Third, you must know what resources are available to complete each step of the process, and be competent at using them. Fourth, you need critical thinking skills. The last key to success is knowledge about the systems, equipment, and test procedures needed to perform accurate diagnoses.

The end result is that you can “visualize and discuss” the logical process followed during diagnosis and list the resources available. The key objective is to have the ability to break down the process of diagnosis and put that process into a mental picture. With this picture of the process, you can attach the appropriate actions and resources for successful diagnosis. This methodology will enable you to continually improve your process and use of resources.
STRATEGY BASED DIAGNOSTICS

1. VERIFY CUSTOMER CONCERN

2. PRELIMINARY CHECKS

3. DIAGNOSTIC SYSTEM CHECKS

4. CHECK FOR BULLETINS

5.1 STORED DTC(S)

5.2 SYMPTOM

5.3 NO PUBLISHED DIAGNOSTICS

5.4 INTERMITTENT

5.5 OPERATING AS DESIGNED

6. NO

ISOLATE THE ROOT CAUSE?

7. REPAIR AND VERIFY FIX

YES

RE-EXAMINE THE CONCERN

Figure 12-1
# ASE 6 - Electrical Electronic Systems
## Module 12 - Strategy Based Diagnostics

### Figure 12-2

**1. VERIFY CUSTOMER CONCERN**
- Operate system to duplicate concern; read Operation, Owner’s Manual section(s) or Service Manual section(s).
- Compare identical vehicle.
- Call customer for more details; Diagnostic Worksheet Bulletin #56-01-01.

**2. MAKE QUICK CHECKS**
- Do visual inspection; Component locations, Service Manual section(s).
- Look for loose or corroded connections, broken fuses, unusual noises, smells, vibrations or movements.
- Check vehicle history file.
- Look for Hints; Troubleshooting hints, Service Manual section(s).
- Look for aftermarket accessories.

**3. FOLLOW DIAGNOSTIC SYSTEM CHECKS**
- Use published procedures; System checks, Service Manual section(s).
- Check for Diagnostic Trouble Codes (DTCs); On-Board Diagnostics, TECH 1 or TECH 2.
- TECH 1 requires VM for Class II data communication.

**4. CHECK BULLETINS/DCS**
- Check bulletins based on defined symptoms.
- Check In-Dark Communication System (IDCS) for latest information (Pls or most recent bulletin). Requires phone line and Techline terminal.

### 5.1 DIAGNOSE STORED DTCs (CODES)
- Use published steps for DTCs; Procedures, Service Manual section(s).
- Use special tools, as needed.

### 5.2 DIAGNOSE SYMPTOMS
- Use published steps for closest matching symptom(s); Procedures, Service Manual section(s).
- Use special tools, as needed.

### 5.3 NO PUBLISHED DIAGNOSTICS
- Develop own diagnostics; Schematics to locate power, ground, input and output circuits.
- Compare measurements to identical vehicle, if possible.
- Check wiring, connectors and terminals.
- Check controls (switches and relays).
- Check components (unplug to eliminate good parts).
- View and analyze data and override system operation; On-Board Diagnostics, TECH 1 or TECH 2.
- Check other systems for shared power, ground or inputs.
- Call for help; Technical Assistance.

### 5.4 DIAGNOSE INTERMITTENTS
- Use published steps for closest matching symptom(s) while duplicating fault conditions; Procedures, Service Manual section(s).
- Hints for intermittents, Service Manual section(s).
- Wiggle wires, apply heat or cold, apply moisture or road test.
- Use digital multimeter (J9200C) MINI-MAK function.
- Make data snapshot; On-Board Diagnostics, TECH 1 or TECH 2.

### 5.5 OPERATES AS DESIGNED
- Check identical vehicle.
- Explain operation to customer; Operation, Owner’s Manual section(s) or Service Manual section(s).
- Report customer concern; Technical Assistance.

### ISOLATE THE CAUSE?
- YES
- NO

### 6. RE-EXAMINE CONCERN
- Check for any skipped procedures.
- Use published steps for closest matching symptom(s); Procedures, Service Manual section(s).
- Check for WHAT IS NOT BROKEN.

### 7. REPAIR AND VERIFY
- Make wire repair; Procedures, Service Manual section(s).
- Replace or repair component(s); Procedures, Service Manual section(s).
- Obtain or order replacement part(s).
- Operate system to verify repair.
- Report need for Service Manual or labor time guide changes; 1-800-650-0000.
- Call to close case; Technical Assistance.
Figure 12-3, Verify Customer Concern
Step 1 - Verify Customer Concern

What the Technician Should Do:

To verify the customer concern, the technician will need to know the correct (normal) operating behavior of the system and verify that the customer concern is a valid failure of the system. As the system is operated to duplicate the concerns, it may be necessary to refer to either the Owner’s Manual or the Service Information for operating information. You may be familiar with similar systems on other vehicles or model years, but it is important to refer to the information for the specific vehicle you are diagnosing.

Another way to verify the customer concern is to operate an identical vehicle and observe its operation. Compare the operation of the two vehicles.

A very important part of diagnosing a customer concern is obtaining as much information as possible from the customer. A Diagnostic Worksheet is available. (See Service Information) The Diagnostic Worksheet is completed by the customer and provides information related to the following areas:

- Engine Drivability
- Automatic Transmission Drivability
- Electrical-Radio-Tape/CD Player
- Brakes-Steering-Suspension

If you have not received enough customer information to efficiently diagnose and repair the vehicle, it may be necessary for you to contact the customer.

Answers to the following questions will help the technician to verify the concern:

- What vehicle model/options?
- What aftermarket and dealer-installed accessories exist?
- What related systems operate properly?
- When does the problem occur?
- Where does the problem occur?
- How long does the problem occur?
- How long has the condition existed? Did it ever work?
- How often does the problem occur?
- Has the severity of the problem increased, decreased, or stayed the same?
Resources:
Whenever possible and appropriate, the technician should use the resources listed below to assist with the customer concern verification process:

- The theory or circuit description sections in Service Information
- Service Information “System Performance Check”
- Owner’s Manual operational description
- The technician’s experience
- Identical vehicle for comparison
- Circuit testing tools
- Vehicle road tests
- Diagnostic Worksheet
- Customer contact
Figure 12-4, Preliminary Checks
Step 2 - Preliminary Checks

(Represents an estimated 10 percent of successful shop repairs)

What the Technician Should Do:
The preliminary checks are done for three main reasons:
• To determine if the cause of the complaint is visually obvious
• To identify parts of the system that work properly
• To accumulate enough data to properly search for a bulletin

The preliminary checks may vary depending on the complexity of the system and may include:
• Operating the suspect system
• Visually inspecting the harness routing and accessible/visible power and ground circuits
• Checking for blown fuses
• Visually inspecting for unplugged connectors
• Visually inspecting the condition of the connectors (may include checking terminals for damage and tightness)
• Observing unusual conditions:
  – Noise
  – Vibration/Feel
  – Smell
• Investigating the vehicle service history (call other dealerships if appropriate)

Resources:
Whenever appropriate, the technician should use the resources listed below for assistance in performing preliminary checks:
• Service Information
  – Component locations
  – Harness routing
  – Wiring schematics
  – Diagnostic Trouble Code retrieval procedures
• Dealership service history
• Vehicle road tests
• Identical vehicle/system checks
Figure 12-5, Perform Published Diagnostic System Checks
Step 3 - Perform Published Diagnostic System Checks

What the Technician Should Do:
System Checks exist in most sections of the Service Manual. System checks:

- Provide a systematic approach to narrowing down the possible causes of a system fault
- Are designed to direct the technician to specific diagnostic procedures within the Service Manual
- Assist the technician in identifying which systems operate properly
- Access DTCs from vehicle computers correctly

Resources:
The technician should use the resources listed to perform a system check whenever applicable:

- Service Information
- Scan Tool for data analysis and code readout
- Digital multi-meter and/or circuit testing tools
STRATEGY BASED DIAGNOSTICS

1 VERIFY CUSTOMER CONCERN
- Operate system to duplicate concern (Operation, Owner’s Manual section(s) or Service Manual section(s))
- Compare identical vehicle
- Call customer for more details: Diagnostic Wanshaud Bulletin #58.01-01

2 MAKE QUICK CHECKS
- Do visual inspection (Component locations, Service Manual sections)
- Look for loose or corroded connections, blown fuses, unusual noises, smells, vibrations or movements
- Check vehicle history file
- Look for hints: Troubleshooting hints, Service Manual section(s)
- Look for aftermarket accessories

3 FOLLOW DIAGNOSTIC SYSTEM CHECKS
- Use published procedures: System checks, Service Manual section(s)
- Check for Diagnostic Trouble Codes (DTCs) On-Board Diagnostics, TECH 1 or TECH 2; TECH 1 requires VIM for Class II data communication

4 CHECK BULLETINS/IDCS
- Check bulletins based on defined symptoms
- Check In-Distributor Communication System (IDCS) for latest information (Pls or most recent bulletins): requires phone line and Techline terminal

5.1 DIAGNOSE STORED DTCs (CODES)
- Published steps for DTCs
- Procedures, Service Manual section(s)
- Use special tools, as needed

5.2 DIAGNOSE SYMPTOMS
- Use published steps for closest matching symptom(s)
- Procedures, Service Manual section(s)
- Use special tools, as needed

5.3 NO PUBLISHED DIAGNOSTICS
- Develop own diagnosis
- Schematics to locate power, ground, input and output circuits
- Compare measurements to identical vehicle if possible
- Check wiring, connections
- Check components

5.4 DIAGNOSE INTERMITTENTS
- Use published steps for closest matching symptom(s) while replicating fault conditions
- Procedures, Service Manual section(s)

7 REPAIR AND VERIFY
- Make wire repair: Procedures, Service Manual section #6A.5
- Replace or repair component(s): Procedures, Service Manual section(s)
- Obtain or order replacement part(s)
- Operate system to verify repair
- Report need for Service Manual or labor time guide changes: 1.800.326.6860
- Call to close case: Technical Assistance

Figure 12-6, Check for Bulletins
Step 4 - Check for Bulletins

(Represents an estimated 30 percent of successful shop repairs)

What the Technician Should Do:
The technician should have enough information from the last step to accurately search for a bulletin or other service related information. (Refer to information listed under Resources for further assistance.)

Resources:

• Paper bulletins
• Service Information to locate bulletins
• Divisional technical information (non-technical assistance)
  – Newsletters
  – Service Guild letters
• Service Know How Videos
• IDL programs, CBT
STRATEGY BASED DIAGNOSTICS

1. VERIFY CUSTOMER CONCERN
   - Operate system to duplicate concern
   - Operation, Owner's Manual section(s)
   - or Service Manual section(s)
   - Compare identical vehicle
   - Call customer for more details
   - Diagnostic Worksheet Bulletin #58-01-01

2. MAKE QUICK CHECKS
   - Do visual inspection
   - Component locations, Service Manual section(s)
   - Check for loose or corroded connections, blown fuses, smelly noises, rattles, vibrations or movements
   - Check vehicle history file
   - Look for hints, troubleshooting hints, Service Manual section(s)
   - Look for aftermarket accessories

3. FOLLOW DIAGNOSTIC SYSTEM CHECKS
   - Use published procedures:
   - System checks, Service Manual section(s)
   - Check for Diagnostic Trouble Codes (DTCs)
   - On-Board Diagnostics, TECH 1 or TECH 2
   - TECH 2 requires TCM for Check Engine light communication

4. CHECK BULLETINS/DSCS
   - Check bulletins based on defined symptoms
   - Check In-Driver Communication System (IDCS) for latest information (Ps or most recent bulletin)
   - Requires phone line and Techline terminal

5.1 Diagnose stored DTCs (Codes)
   - Use published steps for DTCs:
   - Procedures, Service Manual section(s)
   - Use special tools, as needed

5.2 Diagnose Symptoms
   - Use published steps for closest matching symptom(s):
   - Procedures, Service Manual section(s)
   - Use special tools, as needed

5.3 No Published Diagnoses
   - Develop own diagnosis
   - Schematics to locate power, ground, input and output circuits
   - Compare measurements to identical vehicle, if possible
   - Check wiring, connectors and terminals
   - Check controls (switches and relays)
   - Check components (unplug to eliminate good parts
   - View and analyze data and examine system operation
   - On-Board Diagnostics, TECH 1 or TECH 2
   - Check other systems that could affect (service bulletin)

5.4 Diagnose Intermittents
   - Use published steps for closest matching symptom(s)
   - While duplicating fault conditions
   - Troubleshooting procedures, Service Manual
   - TECH 2
   - TECH 2 requires TCM for Check Engine light communication
   - Wiring, fuses, relays
   - Wires, harnesses, connectors
   - Inspection, repair
   - Check EMR/DSCS
   - Check other systems that could affect
   - Techline terminal

5.1 Diagnose stored DTCs (Codes)
   - Use published steps for DTCs:
   - Procedures, Service Manual section(s)
   - Use special tools, as needed

5.2 Diagnose Symptoms
   - Use published steps for closest matching symptom(s):
   - Procedures, Service Manual section(s)
   - Use special tools, as needed

Replace or repair component(s)
Obtain or order replacement part(s)
Operate system to verify repair
Report need for Service Manual or labor time guide changes 1-800-628-6860
Call to close case 1-800-628-6860

Figure 12-7, Service Information Diagnostics: Stored DTCs or Symptom, No DTCs
Steps 5.1 and 5.2 - Service Manual Diagnostics: Stored DTC(s) or Symptom, No DTC(s)

(Represents an estimated 40 percent of successful shop repairs)

What the Technician Should Do:
The technician must carefully and accurately perform the Service Manual diagnostic steps while using the resources listed, whenever appropriate.

Resources:

• Service Information
• Scan Tool for data analysis
• Digital multi-meter and circuit testing tools
• Essential and special tools
Figure 12-8, Service Information Diagnostics: No Published Diagnostics
Step 5.3 - Service Manual Diagnostics: No Published Diagnostics

What the Technician Should Do:
When there is no DTC stored and no matching symptom for the condition in the Service Manual, the technician must begin with a thorough understanding of how the circuit(s) operates. Efficient use of the Service Manual combined with experience and a good process of elimination will result in accurate diagnosis of the condition.

Identify and Understand the Suspect Circuit(s)
Having gone through the details in Steps 1 through 4 of the SBD diagnostic flow, the technician should have enough information to identify the system(s) or the sub-system(s) involved. Using Service Manual information, the technician should determine and investigate the following circuit characteristics:

Electrical
- How is the circuit powered? (Power Distribution Charts and/or Fuse Block Details)
- How is the circuit grounded? (Ground Distribution Charts)
- How is the circuit controlled or sensed?
  - If it is a switched circuit, is it normally open or normally closed?
  - Is the power switched or the ground switched?
  - Is it a variable resistance circuit (for example, engine coolant temperature [ECT] or throttle position sensor [TPS])?
  - Is it a signal-generating device (for example, mass airflow [MAF] vehicle speed sensor [VSS] or wheel speed sensor [WSS])?
  - Does it rely on a mechanical/vacuum device to operate?
Physical

• Where are the circuit components? (Component Locators and Wire Harness Routing Diagrams)
  – Areas where wires could be chaffed or pinched (brackets, frames)
  – Areas subject to extreme temperatures
  – Areas subject to vibration or movement (engine, transmission, suspension)
  – Areas exposed to moisture, road salt or other corrosives (battery compartment, oil, or other fluid leaks)
  – Common mounting areas with other systems/components

• Previous repairs to wiring, connectors, components or mounting. Any area that has been worked on recently should be considered suspect. (Wires inadvertently get pinched between panels and drive train or suspension components without causing an immediate problem.)

• Dealer or aftermarket installed equipment (radios, phones, cruise controls or security devices)

Problem Isolation

At this point, the technician should have a good idea of what could cause the present condition, and just as importantly (in most cases), what could not cause the condition.

• Divide (and where possible separate) the system or circuit into smaller sections

• Confine the problem to a smaller area of the vehicle
  – Start with main harness connections, such as bulkhead connection points, while removing panels and trim only as necessary (eliminating large sections of the vehicle from further investigation)

• For two or more circuits that do not share a common power or ground, concentrate on areas where harnesses are routed together or connectors are shared. (Also, see Hints.)
Hints

Though the symptoms may vary, basic electrical failures are generally caused by:

- Loose connections: Causes opens or high resistance in terminals, splices, connectors, and grounds
- Improper connector or harness routing during assembly (usually in new cars): Causes opens, shorts and high resistance in terminals and splices
- Corrosion and wire damage: Causes opens, shorts and high resistance in terminals, splices, connectors, and grounds
- Components failure: Causes opens, shorts and high resistance in relays, modules, switches, and loads
- Aftermarket equipment: Installation of aftermarket equipment may affect the normal operation of other electrical systems.

Circuit isolation may be achieved by:

- Unplugging connectors or removing a fuse to isolate one part of a circuit from another.
- Beginning tests at the component, if only one component fails to operate.
- Beginning tests at the area of commonality (power sources, ground circuits, switches, bulkheads, or major connectors) if a number of components do not operate.

Important: It is recommended that you use the listed resources whenever appropriate to assist you in the diagnostic process. (Circuit testing procedures are documented in the troubleshooting section of the Service Information.)

Resources:

- Service Information
- Scan Tool for data analysis
- The technician’s experience
- Technical Assistance
Figure 12-9, Service Information Diagnostics: Intermittent
Step 5.4 - Service Manual Diagnostics: Intermittent

By definition, an intermittent problem is one that does not occur continuously and will occur when certain conditions are met. All these conditions, however, may not be obvious or currently known. Generally, intermittents are caused by:

- Faulty electrical connections and wiring
- Malfunctioning components, such as sticking relays, solenoids, etc.
- Electromagnetic interference (EMI), radio frequency interference (RFI)
- Aftermarket equipment

Diagnosis of an intermittent requires careful analysis of suspected systems to prevent you from replacing good parts. It may involve using creativity and ingenuity to interpret customer complaints and simulating all external and internal system conditions to duplicate the intermittent.

What the Technician Should Do:

Acquisition of Information

The GM Diagnostic Worksheet: A thorough and comprehensive check sheet is critical to intermittent problem analysis. This will assist the technician in determining the proper starting point in his diagnosis.

Vehicle Service History: The vehicle service history is another source of accumulating information about the complaint.

Intermittent Problem Analysis

Analyze the diagnostic worksheet and service history to determine conditions relevant to the suspect system(s). For example, identify conditions requiring simulation.

Using Service Information (wiring diagrams, component locators, and harness routing), identify, trace and locate all electrical circuits related to the malfunctioning system(s).

If there is more than one system failure, it is necessary that the technician identify, trace and locate common areas (components, connectors, harness routing, etc.) shared by the suspect circuits. (Shared circuits are shown on Power Distribution, Fuse Block, and Light Switch Details of the Service Information.)

Symptom Simulation & Problem Isolation

Simulation/System Isolation: Beginning with the most logical circuit/component, reproduce all possible conditions suggested in Step 1, while monitoring suspected circuits, components, and systems to isolate the problem.
Vibration
This method is useful when the customer complaint indicates that the problem occurs when the vehicle/system is subjected to vibration. Connectors/Wire Harness: Slightly shake the wire harness or connectors vertically and horizontally. Also, inspect the connector joint and body for damage. Additionally, tapping lightly along a suspected circuit may be helpful.
Parts and Sensors: Slight vibration may be applied with a light tap of the finger to the part while monitoring the system for a malfunction.

Heat
This method is important when the complaint suggests that the problem occurs in a heated environment. Apply moderate heat from a hair dryer or similar tool to the component and monitor the system for malfunction.

Caution:
Care must be taken to avoid overheating.

Water and Moisture
This may be used when the complaint suggests that the malfunction occurs on a rainy day or under conditions of high humidity. In this case, water may be lightly sprayed on the vehicle to duplicate the problem.

Caution:
Water must not be sprayed directly on exposed electrical connections.

Electrical Loads
This condition may be simulated by simultaneously turning on systems such as the blower, lights, and the rear window defogger.

Circuit Isolation (also see Hints): Circuit isolation requires that the technician:
• Divide the suspect system into simpler circuits.
• Confine the problem to a smaller area of the system.
• Begin at the most logical point, or easiest to access area, and thoroughly check the isolated circuit for the fault, using basic circuit tests.
Hints

Circuit isolation may be achieved as follows:

• Unplug connectors or remove a fuse to separate one part of the circuit from another.
• If only one component fails to operate, begin testing at that component.
• If a number of components do not operate, begin tests at common areas, such as power sources, ground circuits, switches, bulkheads, or major components.
• Substitute a known good part from the parts department or a known good vehicle.
• Try the suspect part on a known good vehicle.

Resources:
• Diagnostic Worksheet
• Service Information
• Bulletin and manual information
• Fluke 87 with MIN/MAX feature
• Scan Tool
• Circuit testing tools
• Terminal repair kit
• Vehicle road tests
• The technician’s experience
• Intermittent problem-solving simulation methods
Figure 12-10, Operating as Designed
Step 5.5 - Operating as Designed

This condition refers to instances where a system operating as designed is perceived to be unsatisfactory or undesirable. In general, this is due to:

• A lack of understanding by the customer
• A conflict between customer expectations and vehicle design intent
• A system performance unacceptable to the customer

What the Technician Should Do:

You can verify that a system is operating as designed by:

• Reviewing Service Manual functional/diagnostic checks
• Examining bulletins and other service information for supplementary information
• Comparing system performance to a like vehicle

Hints

If the condition is due to a customer misunderstanding or there is a conflict of customer expectations, the technician should explain the system operation to the customer.

• If the complaint is due to a case of unsatisfactory system performance, the technician should call Technical Assistance for the latest information.
STRATEGY BASED DIAGNOSTICS

1 VERIFY CUSTOMER CONCERN
- Operate system to duplicate concern. 
- Operation, Owner’s Manual section(s) or Service Manual section(s)
- Record customer information
- Service customer for more details, Diagnostic Worksheet Bulletin 550-01-01

2 MAKE QUICK CHECKS
- Do visual inspection. Component locations, Service Manual section(s)
- Look for loose or corroded connections, blown fuses, unusual noises, smells, vibrations or movements
- Check vehicle history file
- Look for hints, Troubleshooting hints, Service Manual section(s)
- Look for aftermarket, accessories

6 RE-EXAMINE CONCERN
- Check for any skipped procedures
- Use published steps for closest matching symptom(s): Procedures, Service Manual section(s)
- Check for WHAT IS NOT BROKEN

5.5 OPERATES AS DESIGNED
- Check identical vehicle
- Explain operation to customer. Operation, Owner’s Manual section(s), or Service Manual section(s)
- Report customer concern: Technical Assistance

7 REPAIR AND VERIFY
- Replace or repair component(s). Procedures, Service Manual section(s)
- Obtain or order replacement part(s)
- Operate system to verify repair
- Report need for Service Manual or labor time guide change: 1-800-628-6800
- Call to close case: Technical Assistance

Figure 12-11, Re-examine the Concern
Step 6- Re-Examine the Concern

If you cannot find the problem after executing a diagnostic path within Step 5, re-examine the problem.

What the Technician Should Do:

Backtrack and review information accumulated in Steps 1 through 4. Repeat any steps or procedures that require additional attention. Vehicle history and the listed resources can be used to obtain additional information.

The previous path may be eliminated from consideration only if the technician is certain that all steps were executed as directed earlier. The technician must then select another diagnostic path within Step 5.

If all possible options have been explored, the technician may call Technical Assistance or seek field service assistance.

Resources:

- Service Information
- Accumulated information from previous diagnostic path
- Service information/publications
- Technical Assistance
STRATEGY BASED DIAGNOSTICS

1 VERIFY CUSTOMER CONCERN
- Operate system to duplicate concern
- Operation, Owner's Manual section(s)
- Compare identical vehicle
- Call customer for more details
- Diagnostic Worksheet Bulletin 58-01-01

2 MAKE QUICK CHECKS
- Do visual inspection
- Component locations, Service Manual section(s)
- Look for loose or corroded connections, broken hoses, unusual noises, smokes, vibrations or movements
- Check vehicle history file
- Look for hints
- Troubleshooting hints, Service Manual section(s)
- Look for aftermarket accessories

3 FOLLOW DIAGNOSTIC SYSTEM CHECKS
- Use published procedures
- System checks, Service Manual section(s)
- Check for Diagnostic Trouble Codes (DTCs)
- On-Board Diagnostics, TECH 1 or TECH 2
- TECH 1 requires VIN for Class II data communication

4 CHECK BULLETINS/SOCs
- Check bulletin based on defined symptoms
- Check In-Dealer Communication System (IDCS) for latest information (PIDs or most recent bulletin)
- SOC requires phone line and Techline terminal

5.1 Diagnose stored DTCs (codes)
- Use published procedures
- Diagnose based on matching symptom(s)
- Use list of symptoms

5.2 Diagnose symptoms
- Use list of symptoms

7 REPAIR AND VERIFY
- Make wire repair
- Procedures, Service Manual section 8A-5
- Replace or repair component(s)
- Procedures, Service Manual section(s)
- Obtain or order replacement part(s)
- Operate system to verify repair
- Report need for Service Manual or labor time guide changes: 1-800-828-6860
- Call to close case

8 RE-ELECT CONCERN
- Check for any skipped procedures
- Use published steps for closest matching symptom(s)
- Procedures, Service Manual section(s)
- Check for WHAT IS NOT BROKEN

7 REPAIR AND VERIFY
- Make wire repair
- Procedures, Service Manual section 8A-5
- Replace or repair component(s)
- Procedures, Service Manual section(s)
- Obtain or order replacement part(s)
- Operate system to verify repair
- Report need for Service Manual or labor time guide changes: 1-800-828-6860
- Call to close case

Figure 12-12, Repair and Verify the Repair
Step 7- Repair and Verify the Fix

What the Technician Should Do:

After the cause of the problem is located, repairs must be performed following recommended procedures in the Service Manual.

Upon completion of repairs, verify that the system works by performing the system checks under the conditions documented in the customer complaint. Carry out preventative measures to avoid comebacks.

NOTE:

It is recommended that technicians use the listed resources whenever possible to facilitate repairs.

Resources:

• Electrical repair kits/procedures
• Service Information/publications
• Repair videos
**Exercise 12-1**

Read and answer each question carefully.

1. “SBD” is an abbreviation for ___________________ ___________________ ___________________

2. An effective diagnosis process will help you work better by reducing the time you spend on diagnosing each problem.
   a. True
   b. False

3. Why is it important to verify the reported symptom?
   a. The problem may be intermittent.
   b. There may be related symptoms not reported by the customer.
   c. The service advisor may have misunderstood the problem.
   d. All of the above are correct.

4. Part of Step 2, Preliminary Checks, is a quick inspection for obvious problems.
   a. True
   b. False

5. Part of Step 2, Preliminary Checks, is checking for Diagnostic Trouble Codes.
   a. True
   b. False

6. Part of Step 2, Preliminary Checks, is gathering enough information so that you can effectively search for a related bulletin.
   a. True
   b. False
7. List four resources that you can use in performing the Preliminary Checks.
   1. __________________________________________
   2. __________________________________________
   3. __________________________________________
   4. __________________________________________

8. List three resources for additional information to help you in Step 3.
   1. __________________________________________
   2. __________________________________________
   3. __________________________________________

   a. True
   b. False

10. What do Steps 5.1 and 5.2 have in common?
    a. They are most often used by “good” technicians.
    b. They use “directed” diagnostics from the Service Manual.
    c. You can bypass the previous steps and go straight to one of these steps.
    d. These two steps are usually skipped.

11. About what percentage of cars get fixed using Steps 4 and 5.1 or 5.2?
    a. 10%
    b. 20%
    c. 30%
    d. 40%
12. If you get to Step 5.3, it means the Service Manual contains no procedure for the symptom you are working on.
   a. True
   b. False

13. In Step 5.3, you will need to use:
   a. The Diagnostic Thought Process
   b. The schematics and other information in the Service Manual
   c. Both a and b are correct
   d. Neither a nor b are correct

14. List three common causes of intermittent electrical problems.
   1. ________________________________________
   2. ________________________________________
   3. ________________________________________

15. If a system is operating as designed, it may be helpful to:
   a. Call TAS
   b. Talk to other experienced technicians
   c. Compare to an identical vehicle or system
   d. All of the above are correct

16. Part of making any repair is to determine how the fault was created and, if possible, taking steps to prevent the same thing from happening again. This is called addressing the ________________.
   a. root cause
   b. obvious problem
   c. preliminary check
   d. customer concern

17. After a repair is made, you should ________________.
   a. immediately move on to another job
   b. start over on the SBD chart
   c. verify that the system is operating as it should
   d. take a coffee break
Strategy Based Diagnostic Worksheet

Step 1: Verity the Customer Concern

Are you certain that the system is not working properly? Y N
If “Y,” how did you determine this?
______________________________________________________
______________________________________________________

Step 2: Make Quick Checks

Are there any visual clues as to the source of the problem? Y N
If “Y,” describe: _________________________________________

Are there any unusual noises or smells? Y N
If “Y,” describe: _________________________________________

Step 3: Follow Diagnostic System Checks

On what Service Information page(s) are the diagnostics for the symptom the customer has reported? ____________

Are there any stored DTCs? ________________________________

Step 4: Check Bulletins and Other Service Information

Because these are systems that are disabled for the purposes of this class, there will, in most instances, be no bulletins or material relating to the repair. If you were to search for bulletins, what strategy would you use to find such material?
______________________________________________________

Step 5: Diagnosis-Which Diagnostic Path(s) best suits this concern? How did you determine how to proceed?
______________________________________________________
Step 5.1: Diagnose Stored DTCs using Service Manual procedures.

______________________________________________________________________

Step 5.2: Diagnose Symptoms using published steps for closest matching symptoms.

______________________________________________________________________

Step 5.3: No Published Diagnostics. Diagnose the system using diagnostics that you devise after attaining an understanding of the correct function of the circuits and components involved.

______________________________________________________________________

Step 5.4: Diagnose intermittents. After determining the exact conditions under which the intermittent occurs, reproduce the concern and diagnose.

______________________________________________________________________

Step 5.5: Vehicle Operates as Designed. If you believe that the operation of the vehicle is correct, verify by comparing to a like vehicle.

______________________________________________________________________

Step 6: Re-examining the Concern. If at this stage you have not verified the cause of the concern, repeat previous steps with an eye toward making sure that all steps are performed thoroughly, and that all tools are functioning correctly.

______________________________________________________________________

Step 7: Repair and Verify. If you have verified the concern, on a normal repair you would complete the repair and verify that the system is indeed operating properly. Because we need to have the bugs in this system still in place for the next class of diagnosticians, you will not be completing the repair.
Strategy Based Diagnostic Worksheet

Step 1: Verify the Customer Concern

Are you certain that the system is not working properly?  Y  N
If “Y,” how did you determine this?
________________________________________________________
________________________________________________________

Step 2: Make Quick Checks

Are there any visual clues as to the source of the problem?  Y  N
If “Y,” describe: _________________________________________

Are there any unusual noises or smells?  Y  N
If “Y,” describe: _________________________________________

Step 3: Follow Diagnostic System Checks

On what Service Manual page(s) are the diagnostics for the symptom the customer has reported? ____________

Are there any stored DTCs? ________________________________

Step 4: Check Bulletins and Other Service Information

Because these are systems that are disabled for the purposes of this class, there will, in most instances, be no bulletins or material in SI relating to the repair. If you were to search for bulletins or SI material, what strategy would you use to find such material?
________________________________________________________________

Step 5: Diagnosis-Which Diagnostic Path(s) best suits this concern? How did you determine how to proceed?
________________________________________________________________
Step 5.1: Diagnose Stored DTCs using Service Manual procedures.

Step 5.2: Diagnose Symptoms using published steps for closest matching symptoms.

Step 5.3: No Published Diagnostics. Diagnose the system using diagnostics that you devise after attaining an understanding of the correct function of the circuits and components involved.

Step 5.4: Diagnose intermittents. After determining the exact conditions under which the intermittent occurs, reproduce the concern and diagnose.

Step 5.5: Vehicle Operates as Designed. If you believe that the operation of the vehicle is correct, verify by comparing to a like vehicle.

Step 6: Re-examining the Concern. If at this stage you have not verified the cause of the concern, repeat previous steps with an eye toward making sure that all steps are performed thoroughly, and that all tools are functioning correctly.

Step 7: Repair and Verify. If you have verified the concern, on a normal repair you would complete the repair and verify that the system is indeed operating properly. Because we need to have the bugs in this system still in place for the next class of diagnosticians, you will not be completing the repair.
Fault Preparation Worksheet Step 1

Directions: Complete this worksheet while you are preparing to install the fault assigned to your group.

System: _____________________________________________

Area in SBD where the fault will be diagnosed: ________________

________________________________________________________________

Description of fault: __________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

Symptoms with the fault installed: ____________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

Customer concern: ________________________________________
Fault Installer Worksheet Step 2

Directions: Complete this worksheet after your group has installed the fault for this exercise.

Customer concern: ____________________________

Vehicle: ________________________________________

1. Where did your group install the fault? Why?
   ____________________________________________
   ____________________________________________

2. What are the components of the system related to the fault?
   ____________________________________________
   ____________________________________________

3. How did the fault cause the customer concern?
   ____________________________________________
   ____________________________________________

4. Where do you find information to diagnose this fault?
   ____________________________________________
   ____________________________________________

5. What are the unique operation features of the system related to the fault?
   ____________________________________________
   ____________________________________________
Fault Installer Worksheet Step 2 (continued)

**Directions**: Complete this worksheet after your group has installed the fault for the exercise.

Customer concern: ________________________________

Vehicle: ________________________________

What would you expect another student group to do to diagnose the customer complaint related to the fault installed by the instructor? What resources would they use?

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## Work Order Worksheet

### Directions:
As you diagnose and repair the vehicle, write the numbers of the Strategy Based Diagnostics steps you use, along with related results.

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Fault Preparation Worksheet Step 1

Directions: Complete this worksheet while you are preparing to install the fault assigned to your group.

System: ________________________________________________________________

Area in SBD where the fault will be diagnosed: ________________

_____________________________________________________________________

Description of fault: ________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Symptoms with the fault installed: _________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Customer concern: ____________________________________________
Fault Installer Worksheet Step 2

Directions: Complete this worksheet after your group has installed the fault for this exercise.

Customer concern: ____________________________

Vehicle: ____________________________

1. Where did your group install the fault? Why?

______________________________________________________________________

______________________________________________________________________

2. What are the components of the system related to the fault?

______________________________________________________________________

______________________________________________________________________

3. How did the fault cause the customer concern?

______________________________________________________________________

______________________________________________________________________

4. Where do you find information to diagnose this fault?

______________________________________________________________________

______________________________________________________________________

5. What are the unique operation features of the system related to the fault?

______________________________________________________________________

______________________________________________________________________
Fault Installer Worksheet Step 2 (continued)

Directions: Complete this worksheet after your group has installed the fault for the exercise.

Customer concern: ________________________________

Vehicle: ________________________________

What would you expect another student group to do to diagnose the customer complaint related to the fault installed by the instructor? What resources would they use?

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# Work Order Worksheet

**Directions:** As you diagnose and repair the vehicle, write the numbers of the Strategy Based Diagnostics steps you use, along with related results.

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Fault Preparation Worksheet Step 1

Directions: Complete this worksheet while you are preparing to install the fault assigned to your group.

System: ________________________________

Area in SBD where the fault will be diagnosed: _____________

____________________________________________________

____________________________________________________

Description of fault: ________________________________

____________________________________________________

____________________________________________________

____________________________________________________

____________________________________________________

Symptoms with the fault installed: _______________________

____________________________________________________

____________________________________________________

____________________________________________________

Customer concern: ________________________________
Fault Installer Worksheet Step 2

Directions: Complete this worksheet after your group has installed the fault for this exercise.

Customer concern: _________________________________

Vehicle: _________________________________

1. Where did your group install the fault? Why?

________________________________________________________________________

________________________________________________________________________

2. What are the components of the system related to the fault?

________________________________________________________________________

________________________________________________________________________

3. How did the fault cause the customer concern?

________________________________________________________________________

________________________________________________________________________

4. Where do you find information to diagnose this fault?

________________________________________________________________________

________________________________________________________________________

5. What are the unique operation features of the system related to the fault?

________________________________________________________________________
Fault Installer Worksheet Step 2 (continued)

Directions: Complete this worksheet after your group has installed the fault for the exercise.

Customer concern: ________________________________

Vehicle: ________________________________

What would you expect another student group to do to diagnose the customer complaint related to the fault installed by the instructor? What resources would they use?

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Fault Preparation Worksheet Step 1

Directions: Complete this worksheet while you are preparing to install the fault assigned to your group.

System: _____________________________________________

Area in SBD where the fault will be diagnosed: ________________

Description of fault: _____________________________________

Symptoms with the fault installed: __________________________

Customer concern: ________________________________
Fault Installer Worksheet Step 2

Directions: Complete this worksheet after your group has installed the fault for this exercise.

Customer concern: ________________________________

Vehicle: _______________________________________

1. Where did your group install the fault? Why?
   ______________________________________________________
   ______________________________________________________

2. What are the components of the system related to the fault?
   ______________________________________________________
   ______________________________________________________

3. How did the fault cause the customer concern?
   ______________________________________________________
   ______________________________________________________

4. Where do you find information to diagnose this fault?
   ______________________________________________________
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5. What are the unique operation features of the system related to the fault?
   ______________________________________________________
   ______________________________________________________
Fault Installer Worksheet Step 2 (continued)

**Directions**: Complete this worksheet after your group has installed the fault for the exercise.

Customer concern: ________________________________

Vehicle: ________________________________

What would you expect another student group to do to diagnose the customer complaint related to the fault installed by the instructor? What resources would they use?

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Fault Preparation Worksheet Step 1

Directions: Complete this worksheet while you are preparing to install the fault assigned to your group.

System: _____________________________________________

Area in SBD where the fault will be diagnosed: ______________

__________________________________________________________________________________________

Description of fault: _____________________________________

__________________________________________________________________________________________

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Symptoms with the fault installed: __________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

Customer concern: _____________________________________
Fault Installer Worksheet Step 2

Directions: Complete this worksheet after your group has installed the fault for this exercise.

Customer concern: ________________________________

Vehicle: ______________________________________

1. Where did your group install the fault? Why?
   ______________________________________________
   ______________________________________________

2. What are the components of the system related to the fault?
   ______________________________________________
   ______________________________________________

3. How did the fault cause the customer concern?
   ______________________________________________
   ______________________________________________

4. Where do you find information to diagnose this fault?
   ______________________________________________
   ______________________________________________

5. What are the unique operation features of the system related to the fault?
   ______________________________________________
   ______________________________________________
Fault Installer Worksheet Step 2 (continued)

**Directions**: Complete this worksheet after your group has installed the fault for the exercise.

Customer concern: ________________________________

Vehicle: ________________________________

What would you expect another student group to do to diagnose the customer complaint related to the fault installed by the instructor? What resources would they use?

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**Work Order Worksheet**

**Directions:** As you diagnose and repair the vehicle, write the numbers of the Strategy Based Diagnostics steps you use, along with related results.

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