1992 BRONCO / F150-F350 F-SUPER DUTY

DEMO

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Electrical & Vacuum Trouble-Shooting Manual

1992 Bronco/F150-F350/F-Super Duty Electrical & Vacuum Trouble-Shooting Manual (EVTM)

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ELECTRICAL AND VACUUM TROUBLESHOOTING MANUAL
FPS-12129-92

FORD PARTS and SERVICE DIVISION

Quality is Job 1

Ford Parts and Service Division has developed a new format for the EVTM for the 1992 Bronco F. Our goal is to provide accurate and timely electrical and vacuum service information.

1992 EVTM FEATURES

- **"HOW THE CIRCUIT WORKS"** descriptions that explain how each circuit works. These descriptions are designed to be used in conjunction with the Electrical Schematic.
- **Schematic pages** now contain **COMPONENT LOCATION** references to full-view illustrations.
- **"COMPONENT TESTING"** procedures (CELL 149) that tell the user how to perform diagnostic tests on various circuits.
- **Connector End Views** (**"COMPONENT CONNECTOR FACES"** CELL 150) are shown for connectors with five or more cavities; and for connectors with ten or more cavities, a circuit function chart is provided.
- **NOTES, CAUTIONS and WARNINGS** that contain important safety information.
- Full view **"COMPONENT LOCATION VIEWS"** (CELL 151) to help locate on-vehicle components.
- **Component Base Part Numbers** and **Harness Base Part Numbers** to aid in ordering parts.
- **Cellular Pagination:** A specific section (or cell) in all EVTMs is numbered by cell and starts with page 1. For example: **"HOW TO USE THIS MANUAL"** is CELL 2 and begins with page 2-1.
- **"C"** numbers have been assigned for all electrical connectors. **"C"** numbers are listed with the system cell, and all are listed in numerical order in the **"LOCATION INDEX"** (CELL 152).
- **"We Want To Hear From You"** – A feedback sheet is provided on the last page.

ORDERING INFORMATION

Information about how to order additional copies of this publication or other Ford publications may be obtained by writing to Helm Incorporated at the address shown below or by calling 1-800-782-4356. Other publications available include:

- Shop Manuals
- Service Specification Books
- Car/Truck Wiring Diagrams
- Powertrain Control/Emissions Diagnosis Manuals

Helm Incorporated
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1-1 TABLE OF CONTENTS/INDEX

Table Of Contents

Index

2–1 HOW TO USE THIS MANUAL

The purpose of this manual is to show electrical and vacuum circuits in a clear and simple fashion to make troubleshooting easier. **NOTES, CAUTIONS** and **WARNINGS** containing important information appear in boxes on text pages.

- **NOTES** describe how switches and other components operate to help complete a particular procedure.
- **CAUTIONS** provide information that could prevent making an error that may damage the vehicle.
- **WARNINGS** provide information to prevent personal injury.

The **WARNINGS** list on page 2-2 contains general warnings to follow when servicing a vehicle.

Components that work together are shown together. All electrical components used in a specific system are shown on one diagram. The circuit breaker or fuse is shown at the top of the page. All wires, connectors, components and splices are shown in the flow of current to ground at the bottom of the page. If a component is used in several different systems, it is shown in several places. For example, the Main Light Switch is electrically a part of many systems and is repeated on many pages.

In some cases, a component may seem (by its name) to belong to a system where it has no electrical connection. For example, Radio Illumination is electrically part of Instrument Illumination, but because it has no electrical connection to the Radio system, it is not shown on the Radio diagram.

Schematic pages now contain references to full-view illustrations. These references are reverse–text blocks located next to each component and connector and refer the user to the appropriate illustration page and zone.

Schematic pages now contain circuit voltages to help simplify troubleshooting hints. 12V is used to imply battery voltage on a component connector terminal, and 0V is used to show that there should be continuity to ground on that particular terminal. Conditional voltages such as "12V with the ignition switch in RUN" will also be provided. Troubleshooting hints that can't be simplified with circuit voltages will be shown at the end of each cell.

Connector face information specific to a certain cell is now found at the end of that cell. A Connector Face Reference List is provided to locate connector faces that are shown in different cells. Component connectors with five or more terminals are illustrated. Component connectors with ten or more terminals are accompanied by a pinout chart that lists the function of all circuitry associated with that component.

"CIRCUIT OPERATION" (Cell 7) contains descriptions of HOW THE CIRCUIT WORKS for each system as well as reference to the appropriate diagnostic section of the Service Manual. The beginning of each section has a reverse–text block identifying the page on which the corresponding schematic appears.

"GROUNDS"(Cell 10) contains ground circuitry shown in complete detail. This information is useful for checking interconnections of the ground circuits of different systems.

"POWER DISTRIBUTION" (Cell 13) contains power distribution circuitry shown in complete detail. This section displays how the various fuses are powered and in turn, how each system is powered.

"COMPONENT TESTING" (Cell 149) contains testing procedures for various switches. This information includes schematics, component terminal locations and step–by–step procedures.

"COMPONENT LOCATION VIEWS" (Cell 151) contains full–view illustrations which show the location of all components and connectors in the vehicle.

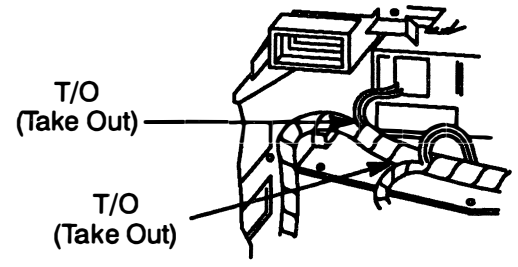
The **"LOCATION INDEX"** (Cell 152) provides the base part numbers, locations, connector face references and illustration references for all components, connectors, splices and grounds.

HELPFUL REMINDERS

Before using the EVTM for troubleshooting, refer to the HELPFUL REMINDERS;

1. The abbreviation T/O, for take out, used in the Location Index (Cell 152), refers to the point at which a group of wires branch off the harness trunk. Refer to the wiring harness illustration.

Wiring harness at back of Instrument Panel, showing typical T/O (Take Out) locations



2. If a connector serves the same purpose in two separate versions (e.g., EFI/Carb), but is physically different, *two* connector numbers are used. However, if a connector serves the same purpose in two separate versions (e.g., EFI/Carb) and is physically the same, but the wire colors are different, only *one* connector number is used. If the same physical connector is used more than once, then more than *one* connector number is used.

HELPFUL REMINDERS (CONTINUED)

are different, only *one* connector number is used. If the same physical connector is used more than once, then more than *one* connector number is used.

3. Wiring diagrams provide a schematic picture of how and under what conditions the circuit is powered, of the current path to circuit components, and of how a circuit is grounded. Each circuit component is named (underlined titles). Wire and connector colors are listed (standard Ford color abbreviations are used):

COLOR ABBREVIATIONS

BL	**Blue**	**N**	**Natural**
BK	**Black**	**O**	**Orange**
BR	**Brown**	**PK**	**Pink**
DB	**Dark Blue**	**P**	**Purple**
DG	**Dark Green**	**R**	**Red**
GR	**Green**	**T**	**Tan**
GY	**Gray**	**W**	**White**
LB	**Light Blue**	**Y**	**Yellow**
LG	**Light Green**		

Note: Whenever a wire is labeled with two colors, the first color listed is the basic color of the wire, and the second color listed is the stripe marking of the wire.

4. When reporting Vehicle Repair Location Codes to Ford Parts and Service Division, refer to Cell 160 (beginning on page 160-1). Note: Do *not* use the illustrations in Cell 151 (beginning on page 151-1) for reporting Vehicle Repair Location Codes.

5. **WARNINGS**

- *Always wear safety glasses for eye protection.*
- *Use safety stands whenever a procedure requires being under a vehicle.*
- *Be sure that the* **Ignition Switch** *is always in the OFF position, unless otherwise required by the procedure.*
- *Set the park brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.*
- *Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.*
- *Keep away from moving parts, especially the fan and belts, when the engine is running.*
- *To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.*
- *Do not allow flame or sparks near the battery. Gases are always present in and around the battery cell. An explosion could occur.*
- *Do not smoke.*
- *To avoid injury, always remove rings, watches, loose hanging jewelry and loose clothing.*

HOW TO FIND ELECTRIAL CONCERNS

TROUBLESHOOTING STEPS

These six steps present an orderly method of troubleshooting.

Step 1. Verify the concern.
- Operate the complete system to check the accuracy and completeness of the customer's complaint.

Step 2. Narrow the concern.
- Using the EVTM, narrow down the possible causes and locations of the concern to pinpoint the exact cause.
- Read the description of *How the Circuit Works* and study the wiring diagram. You should then know enough about the circuit operation to determine where to check for the trouble. Further information can be found in the Shop Manual pages listed after *How the Circuit Works.*

Step 3. Test the cause.
- Use electrical test procedures to find the specific cause of the symptoms.
- *Troubleshooting Hints* will give you helpful ideas.
- The *Component Location Charts* and the pictures will help you find components. Following each chart, there is a reference to the Location Index at the end of the manual. This index gives component location information for connectors, diodes, resistors, splices and grounds.

Step 4. Verify the cause.
- Confirm that you have found the correct cause by connecting jumper wires and/or temporarily installing a known good component and operating the circuit.

HOW TO FIND ELECTRICAL CONCERNS

Step 5. Make the repair.

- Repair or replace the inoperative component.

Step 6. Verify the repair.

- Operate the system as in Step 1 and check that your repair has removed all symptoms without creating any new symptoms.

Some engine circuits may need special test equipment and special procedures. See the *Shop Manual* and other service books for details. You will find these circuits in this manual to be helpful with these special tests.

TROUBLESHOOTING TOOLS

JUMPER WIRE

This is a test lead used to connect two points of a circuit. A Jumper Wire can complete a circuit, bypassing an open.

WARNING

Never use a jumper wire across loads (motors, etc.) connected between hot and ground. This direct battery short may cause injury or fire.

VOLTMETER

A DC Voltmeter measures circuit voltage. Connect negative (- or black) lead to ground, and positive (+ or red) lead to voltage measuring point.

OHMMETER

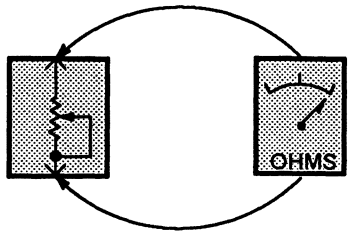


Figure 1–Resistance Check

An Ohmmeter shows the resistance between two connected points (Figure 1).

TEST LAMP

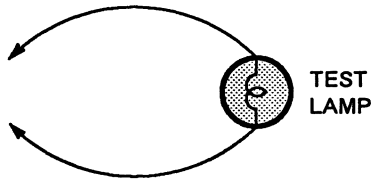


Figure 2–Test Lamp

A Test Light is a 12-volt bulb with two test leads (Figure 2).

Uses: Voltage Check, Short Check.

SELF-POWERED TEST LAMP

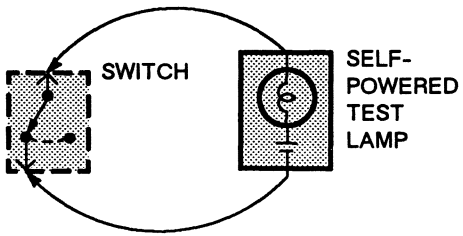


Figure 3–Continuity Check

The Self-Powered Test Lamp is a bulb, battery and set of test leads wired in series (Figure 3). When connected to two points of a continuous circuit, the bulb glows.

Uses: Continuity Check, Ground Check.

CAUTION

When using a self-powered test lamp or ohmmeter, be sure power is off in circuit during testing. Hot circuits can cause equipment damage and false readings.

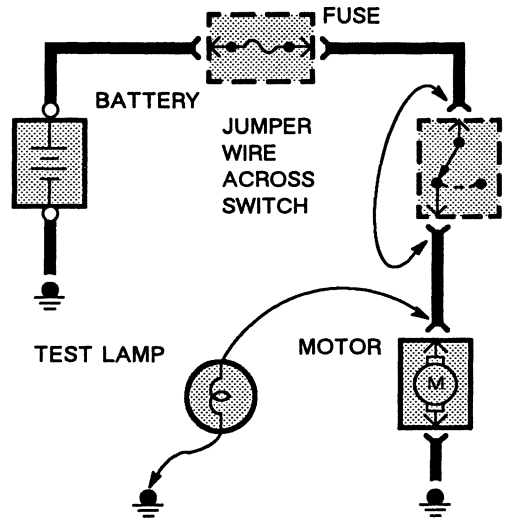


Figure 4—Switch Circuit Check and Voltage Check

In an inoperative circuit with a switch in series with the load, jumper the terminals of the switch to power the load. If jumpering the terminals powers the circuit, the switch is inoperative (Figure 4).

HOW TO FIND ELECTRICAL CONCERNS (CONTINUED)

CONTINUITY CHECK (Locating open circuits)

Connect one lead of Self-Powered Test Lamp or Ohmmeter to each end of circuit (Figure 3). Lamp will glow if circuit is closed. Switches and fuses can be checked in the same way.

VOLTAGE CHECK

Connect one lead of test lamp to a known good ground or the negative (-) battery terminal. Test for voltage by touching the other lead to the test point. Bulb goes on when the test point has voltage (Figure 4).

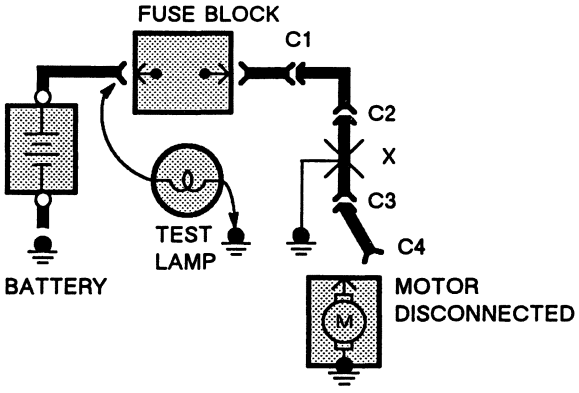


Figure 5—Short Check

A fuse that repeatedly blows is usually caused by a short to ground. It's important to be able to locate such a short quickly (Figure 5).

1. Turn off everything powered through the fuse.
2. Disconnect other loads powered through the fuse:
   - Motors: disconnect motor connector (Connector C4 in Figure 5).
   - Lights: remove bulbs.
3. Turn Ignition Switch to RUN (if necessary) to power fuse.
4. Connect one Test Lamp lead to hot end of blown fuse. Connect other lead to ground. Bulb should glow, showing power to fuse. *(This step is just a check to be sure you have power to the circuit.)*
5. Disconnect the test lamp lead that is connected to ground, and reconnect it to the load side of the fuse at the connector of the disconnected component. (In Figure 5, connect the test lamp lead to connector C4.)
   - If the Test Lamp is off, the short is in the disconnected component.
   - If the Test Lamp goes on, the short is in the wiring. You must find the short by disconnecting the circuit connectors, one at a time, until the Test Lamp goes out. For example, in Figure 5 with a ground at X, the bulb goes out when C1 or C2 is disconnected, but after disconnecting C3. This means the short is between C2 and C3.

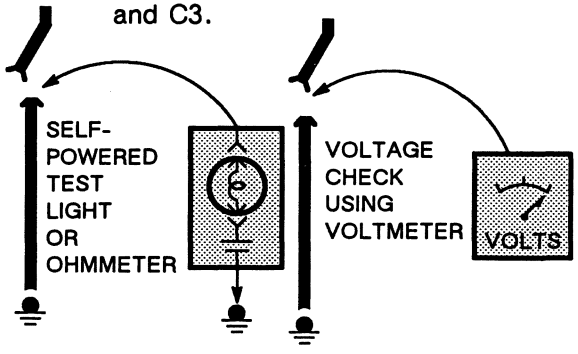


Figure 6—Ground Check

Turn on power to the circuit. Perform a Voltage Check between the suspected inoperative ground and the frame. Any indicated voltage means that the ground is inoperative (Figure 6).

Turn power to the circuit. Connect one lead of a Self-Powered Test Lamp or Ohmmeter to the wire in question and the other lead to a known ground. If the bulb glows, the circuit ground is OK (Figure 6).

TROUBLESHOOTING HINTS

The circuit schematics in this manual make it easy to identify common points in circuits. This knowledge can help narrow the concern to a specific area. For example, if several circuits fail at the same time, check for a common power or ground connection (see *Power Distribution* or *Grounds*). If part of a circuit fails, check the connections between the part that works and the part that doesn't work.

For example, if lo beam headlamps work, but high beams and the indicator lamp don't work, then power and ground paths must be good. Since the dimmer switch is the component that switches this power to the high beam lights and indicator, it is most likely the cause of failure.

Troubleshooting Hints unique to a particular circuit are given in a three column format. Included in the charts are conditions that may develop, possible causes, and one or more tests that can be done quickly to determine the cause of the condition.

HOW TO FIND THE VACUUM CONCERNS

These six steps present an orderly method of troubleshooting.

Step 1. Verify the concern.

- Operate the system and observe all symptoms to check the accuracy and completeness of the customer's complaint.

Step 2. Narrow the concern.

- Using the EVTM, narrow down the possible causes and locations of the concern to pinpoint the exact cause.

Step 3. Test the cause.

- Use test procedures to find the specific cause of the symptoms.

Step 4. Verify the cause.

- Confirm that you have found the right cause by operating the parts of the circuit you think are good.

Step 5. Make the repair.

- Repair or replace the inoperative component.

Step 6. Verify the repair.

- Operate the system as in Step 1. Check that your repair has removed all symptoms without creating any new symptoms.

NOTE: Vacuum system problems fall into three groups.

1. Leaks in hoses, connectors or motor diaphragms.
2. Pinched lines or clogged valves.
3. Inoperative parts driven by vacuum motors.

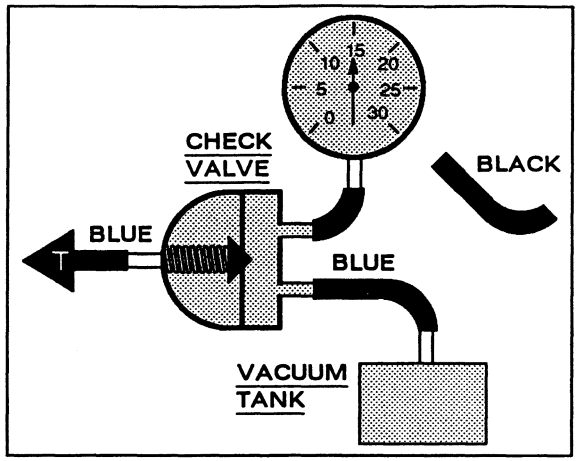


Figure 1 – System Supply Test

Vacuum Supply Test

1. Connect Vacuum Tester to system side of Check Valve (Figure 1).
2. Start engine. Gauge should show approximately 15 inches of vacuum.
3. Turn off engine, and observe gauge:
   - If vacuum holds, supply OK.
   - If vacuum fails, replace Check Valve or Tank.

Leak Test

1. Connect Vacuum Gauge and Vacuum Pump (Figure 2) to system hose in place of tank.
2. Open valve and start pump. Operate control in all modes.
3. Listen for hiss and observe gauge.

NOTE: Hissing is normal at Function Control when changing modes.

If system hisses or loses vacuum, find system leak as follows:

1. Turn on Vacuum Pump and check vacuum build-up.
2. Stop pump; vacuum should drop.
3. Clamp supply hoses with needlenose pliers, one at a time, until vacuum stops dropping (Figure 2).
4. Check vacuum schematic to find components in that line.
5. Clamp hoses through circuit to find leak.

Component Test

1. Connect Vacuum Tester to component.
2. Pump Vacuum Tester. Check that all components operate correctly and vacuum holds.
3. Replace component if vacuum does not hold.

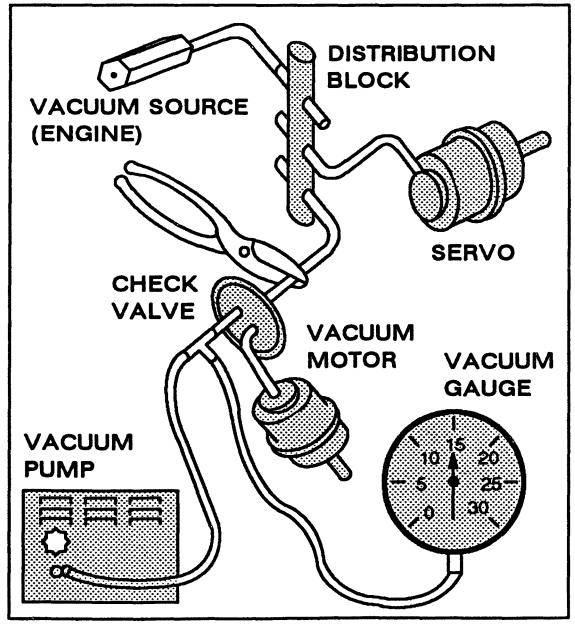
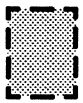
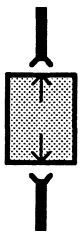


Figure 2 – Testing For Leaks In Typical Vacuum System

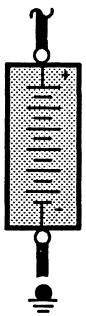
ELECTRICAL SYMBOLS



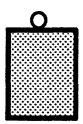
DASHED COMPONENT BOX
ONLY PART OF THE COMPONENT IS SHOWN ON THE PAGE; THE COMPONENT IS SHOWN COMPLETE IN ANOTHER LOCATION



COMPONENT WITH CONNECTORS



BATTERY



SCREW TERMINAL ON COMPONENT

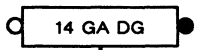
SOLID STATE

SEALED ELECTRONIC COMPONENT
ANY CIRCUITRY SHOWN INSIDE THE BOX IS A FUNCTIONAL EQUIVALENT ONLY AND IS NOT EXACT

GROUND CONNECTION

FUSE

CURRENT RATING

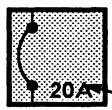


FUSIBLE LINK

WIRE SIZE AND COLOR

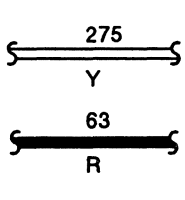
FUSIBLE LINK CARTRIDGE

CARTRIDGE CURRENT RATING

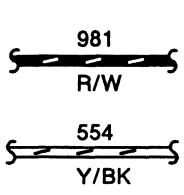


CIRCUIT BREAKER

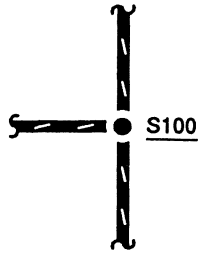
CURRENT RATING



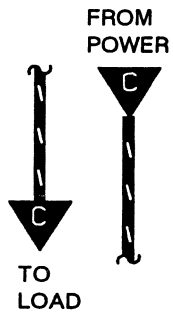
SOLID WIRES



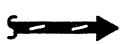
STRIPED WIRES



SPLICE OR CRIMP TERMINAL

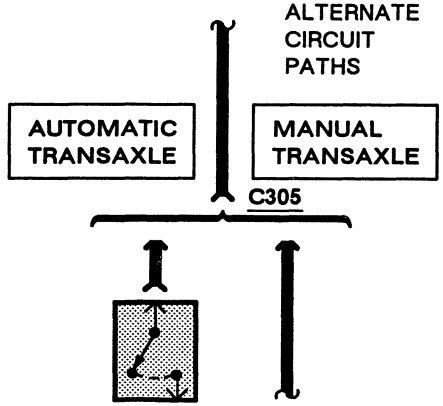


"CUT" WIRES REFERENCED BETWEEN PAGES
ARROWS SHOW CURRENT FLOW FROM POWER TO GROUND



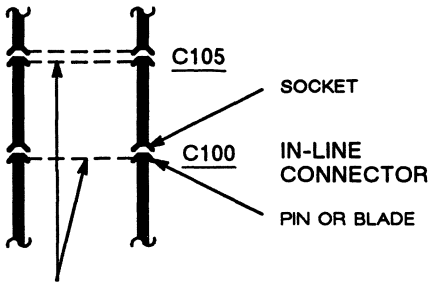
BACKUP LIGHTS

"REFERENCE" WIRES
COMPLETE WIRING SHOWN ON ANOTHER PAGE

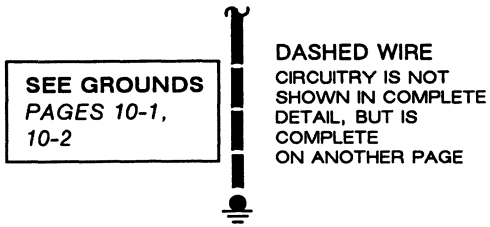


ALTERNATE CIRCUIT PATHS

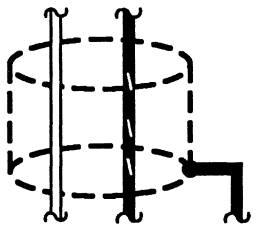
ELECTRICAL SYMBOLS



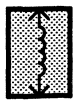
SINGLE OR DOUBLE DASHED LINE INDICATES THAT WIRE ON LEFT ALSO PASSES THROUGH THE SAME CONNECTOR



DASHED WIRE
CIRCUITRY IS NOT SHOWN IN COMPLETE DETAIL, BUT IS COMPLETE ON ANOTHER PAGE



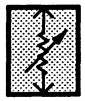
SHIELD
WIRES ARE COVERED BY A SHIELD



FIELD COIL OR CHOKE

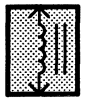
MOTOR

HEATING ELEMENT

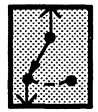


THERMISTOR

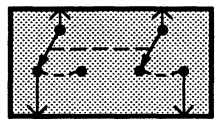
RHEOSTAT OR POTENTIOMETER



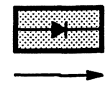
SOLENOID



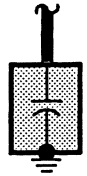
SWITCH



GANGED SWITCHES
CONTACTS MOVE AT THE SAME TIME

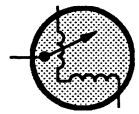


DIODES
CURRENT FLOWS IN DIRECTION OF ARROW ONLY



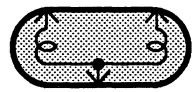
CAPACITOR

TRANSISTOR

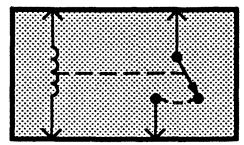


GAUGE

LIGHT BULB



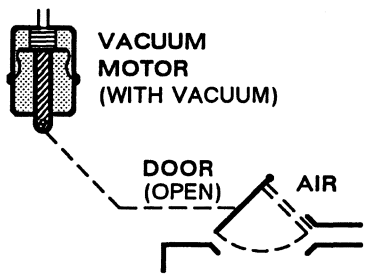
DUAL FILAMENT LIGHT BULB



RELAY
CONTACTS CHANGE POSITION WITH CURRENT THROUGH COIL

VACUUM SYMBOLS

"T" JUNCTION

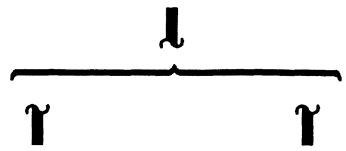


VACUUM ON VACUUM MOTOR PULLS DOOR OPEN TO LET AIR PASS THROUGH

TO SYSTEM

"CUT" HOSES REFERENCED BETWEEN PAGES
ARROW SHOWS FROM MANIFOLD FITTING TO COMPONENT

FROM VACUUM DISTRIBUTION

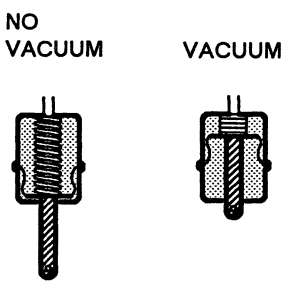


ALTERNATE VACUUM PATHS

NOTE
Other vacuum symbols used on vacuum system diagrams are fully explained on those pages.

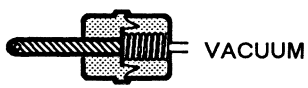
VACUUM MOTOR OPERATION

SINGLE DIAPHRAGM MOTOR



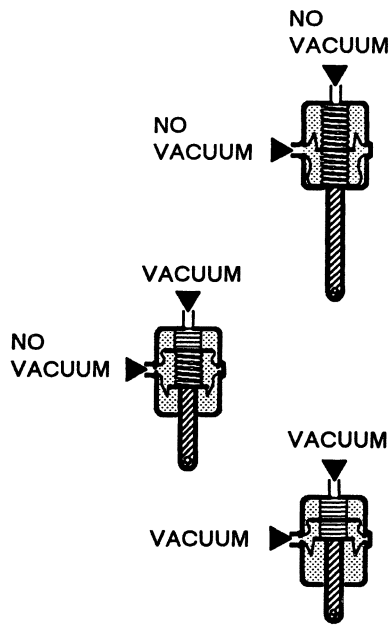
Vacuum motors operate like electrical solenoids, mechanically pushing or pulling a shaft between two fixed positions. When vacuum is applied, the shaft is pushed all the way out by a spring.

SERVO MOTOR



Some vacuum motors, such as the Servo Motor in the Speed Control, can position the actuating arm at any position between fully extended and fully retracted. The Servo is operated by a control valve that applies varying amounts of vacuum to the motor. The higher the vacuum level, the greater the retraction of the motor arm. Servo Motors work nearly the same way as two-position motors, except for the way the vacuum is applied. Servo Motors are generally larger and provide a calibrated control.

DOUBLE DIAPHRAGM MOTOR



A double diaphragm motor has three positions (it is actually two motors in one housing). When the top port gets vacuum, the shaft pulls halfway in. When both ports get vacuum, the shaft pulls all the way in.

SECTION 10

GROUNDS

HOW THE CIRCUIT WORKS

The ground circuits show how many different systems may share a common ground point.

While all of the ground circuits are shown complete, additional ground circuits may exist in the vehicle. Any ground circuit not shown in cell 10 is shown complete in the appropriate system schematic.

All wires are 57 (BK) unless otherwise noted.

SECTION 12

CHARGING SYSTEM

HOW THE CIRCUIT WORKS

With Integral Regulator

The Alternator is belt-driven by the engine and generates power to keep the Battery fully charged and to operate electrical systems in the vehicle.

Alternator output is variable and depends on the speed at which the alternator rotor spins, as well as the amount of current passing through the rotor winding. Current flow through the rotor winding is controlled by a Regulator that is built into the Alternator.

The Alternator generates alternating current, which is passed through a series of rectifier diodes and converted to direct current.

Without Integral Regulator

The Battery, Alternator and Voltage Regulator make up the Charging System. With the Ignition Switch in RUN, battery voltage is applied through the solid-state electronic control of the Voltage Regulator. The electronic control applies battery voltage to the Alternator field.

With current in the field and the rotor turning, the Alternator stator produces a DC voltage at B+ terminals (to Battery). If the Alternator output voltage is greater than the Battery terminal voltage, current will flow from the Alternator to the Battery, as well as to the vehicle electrical load.

If the Alternator voltage is less than the battery terminal voltage, current will flow from the Battery to supplement the alternator output in supplying the vehicle electrical load.

Charge Indicator

With the Ignition Switch in START or RUN, battery voltage is present at the Charge Indicator.

If the Alternator is not generating power, the Regulator inside the Alternator grounds the Charge Indicator through circuit 904 (LG/R). The Charge Indicator illuminates.

When the Alternator is generating power, the Regulator inside the Alternator applies battery voltage to the Charge Indicator through circuit 904 (LG/R). With battery voltage present at both ends of the Charge Indicator, there is no current flow and the Charge Indicator does not illuminate.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Battery doesn't stay charged.	• Open or poor connection at Alternator output.	• Check that connectors or terminals on Alternator are clean and tight. • Check Fuse Link J.

SECTION 12 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Charge Indicator is always on.	• Loose alternator drive belt.	• Check alternator drive belt tension.
	• Corroded battery terminals.	• Check that battery post terminals are clean. Check that terminals on battery posts cannot be easily turned by hand.
	• Inoperative Voltage Regulator.	• Refer to Section 31-01 of the Shop Manual for alternator testing procedures.

For further diagnostic information, refer to Section 14-00 of the Shop Manual.

SECTION 13

POWER DISTRIBUTION

HOW THE CIRCUIT WORKS

The Power Distribution circuits show how several systems receive power through the same fuse, circuit breaker or fuse link cartridge.

The circuits shown also indicate whether a particular fuse, circuit breaker or fuse link cartridge receives power directly from the Battery or through the Ignition Switch contacts.

For further diagnostic information, refer to Section 18-01 of the Shop Manual.

SECTION 20

STARTING SYSTEM

HOW THE CIRCUIT WORKS

Gasoline

Voltage is present at the Ignition Switch and Starter Relay contacts at all times.

With the Ignition Switch in START (and the Clutch Interlock Switch, Backup/Neutral Safety Switch or Manual Lever Position Sensor closed), current flows through the Ignition Switch, the appropriate transmission switch (mentioned above) and the Starter Relay coil to ground. The Starter Relay coil is energized and its contacts close. Current now flows from the Battery directly through the Starter Relay contacts and Starter Motor to ground; the Motor runs to crank the engine.

The TFI Ignition Module also receives a start signal with the Ignition Switch in START (and the appropriate transmission switch closed).

Diesel

The Starting System for the 7.3L diesel engine is similar to that of the gasoline engine.

With the Ignition Switch in START, voltage is applied to the Wait To Start Indicator, which is grounded by the Glow Plug Controller. See Section 26 for Glow Plug Control's circuit operation.

SECTION 21

IGNITION SYSTEM

HOW THE CIRCUIT WORKS

The Distributor contains no centrifugal or vacuum advance mechanisms. All spark advance/retard is accomplished electronically by the Electronic Engine Control (EEC) Module.

During engine cranking (and after the engine starts), a Hall Effect Switch inside the Distributor assembly sends a variable voltage signal to the Thick Film Integrated (TFI) Ignition Module, which is mounted on the left fender wall.

The TFI Ignition Module passes this Profile Ignition Pickup (PIP) signal to the Electronic Engine Control (EEC) Module, which uses it to determine crankshaft position and engine speed. Using the signal and information provided by other engine control sensors, the EEC Module determines the appropriate ignition timing. The EEC Module then sends a Spark Output (SPOUT) timing signal back to the TFI Ignition Module.

The TFI Ignition Module turns the Ignition Coil primary circuit on and off, according to the SPOUT signal from the EEC Module. Each interruption of the Ignition Coil primary circuit causes the Ignition Coil secondary circuit to produce an open circuit high voltage pulse of up to 40,000 volts. These high voltage pulses are routed to the Distributor, which sends them to the spark plugs.

The EEC Module monitors the TFI Ignition Module's control of the Ignition Coil through the Ignition Diagnostic Monitor (IDM) circuit.

If the TFI Ignition Module does not receive a SPOUT signal from the EEC Module, the Ignition Module will set timing at a fixed value.

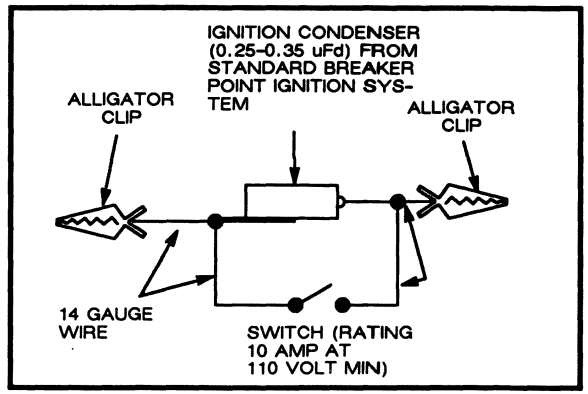


Figure 1

Make up a test jumper as shown in Figure 1. It is important to use only this test jumper when making these checks. Solid wire jumpers will not work for the quick checks.

CAUTION

Do not leave test jumper closed for more than one second at a time.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Starter cranks engine, but engine doesn't start.	• No voltage at TFI Ignition Module or Distributor. • Inoperative TFI Ignition Module.	• Check that TFI Ignition Module is securely attached to Distributor. • Check for loose or damaged spark plug wires or coil wires. If any boots or nipples are removed, reapply new silicone dielectric compound. • Make sure all ignition wires are connected correctly. • VOLTAGE TEST Disconnect connector at TFI Ignition Module. Check for battery voltage between each pin (+) and ground (-) as follows (use a straight pin in connector socket hole to make contact):

SECTION 21 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Starter cranks engine, but engine doesn't start.	• No voltage at TFI Ignition Module or Distributor. • Inoperative TFI Ignition Module.	a. With Ignition Switch in OFF position, check for 0 volts at each terminal. – If voltage is present, check Ignition Switch. b. Turn Ignition Switch to RUN. Check for battery voltage at 16 (R/LG) wire. Check for 0 volts at 32 (R/LB) wire. – If voltage is present, check Ignition Switch. c. Disconnect 32 (R/LB) wire plug at Starter Relay. Turn Ignition Switch to START. Check for battery voltage at both above-mentioned wires. – Check continuity of Ignition Switch and 32 (R/LB) wire if inoperative. d. Reconnect 32 (R/LB) wire at Starter Relay. • RUN-MODE SPARK TEST a. Remove coil wire from Distributor cap. Install spark tester in coil wire terminal. b. Unplug connector at TFI Ignition Module. In the harness side of the connector, connect the special test jumper (Figure 1) between ground and the 11 (T/Y) lead. Use a straight pin in connector socket hole to make contact. c. With the Ignition Switch in RUN, close the test jumper switch. Leave closed for about one second, then open. Repeat this several times. There should be a spark each time this switch is opened. – If there is no spark, the problem is in the primary circuit. Check coil for internal shorts or opens. Check primary resistance (0.5 ohm) and secondary resistance (8000 to 11,500 ohms). – If the coil is good and there is no spark, check TFI Ignition Module.

For further diagnostic information, refer to Section 23 of the Shop Manual and Section 13 of the Powertrain Control/Emissions Diagnosis Manual.

ELECTRONIC ENGINE CONTROL (EFI) (4.9L)

HOW THE CIRCUIT WORKS

The Electronic Engine Control System includes an Electronic Engine Control (EEC) Module that receives inputs from various sensors, and uses the input information to control (1) Fuel Flow, (2) Exhaust Gas Recirculation (EGR), (3) Ignition and (4) Evaporative Emission. These four systems and the EEC Module work together to provide improved fuel economy and performance, and lower exhaust emissions.

EEC Power Relay

The EEC Power Relay supplies power to the EEC Module and EEC System-related components. When the Ignition Switch is turned to START or RUN, voltage is applied to the EEC Power Relay coil, and the Relay's contacts close.

Voltage is also applied through the EEC Power Relay contacts to the Fuel Pump Relay, the Fuel injectors, the EEC Module, the EGR Solenoid, Thermactor Solenoids, Idle Speed Control, and Canister Purge Solenoid.

Fuel Flow

The 4.9L Electronic Fuel Injection (EFI) engine uses Fuel Injectors, mounted in the intake manifold at the intake port, to meter fuel into the engine.

The Fuel Injectors are divided into two groups of three. With each crankshaft revolution, one group of Fuel Injectors is energized. The next crankshaft revolution energizes the second group of Fuel Injectors.

The EEC Module controls the injectors' "on time" or pulse width. The EEC Module determines the appropriate injector pulse width and outputs a command to the injector to meter the exact quantity of fuel.

The electric Fuel Pump supplies fuel under pressure to the fuel rail and the Fuel Injectors. When the Ignition Switch is in START or RUN, voltage is applied from the EEC Power Relay to the Fuel Pump Relay coil. The coil is grounded by the EEC Module, the relay contacts close and voltage is applied to the electric Fuel Pump.

The Inertia Switch is a safety device that cuts voltage to the Electric Fuel Pump in the event of a collision. Once the Inertia Switch opens it must be reset manually.

Exhaust Gas Recirculation (EGR)

The EEC Module controls exhaust gas recirculation by varying the voltage applied to the EGR Valve Position Sensor. This Valve, in turn, regulates the amount of vacuum applied to the EGR valve. The EGR Valve Position Sensor indicates valve position to the EEC Module by providing a voltage signal proportional to the EGR position, depending on engine operating conditions.

Thermactor Air System

The efficiency of the catalytic converter depends upon the temperature and chemical composition of the exhaust gases.

A Thermactor Air System, including a Thermactor Air Bypass (TAB) and Diverter Solenoid (TAD), controls the flow of secondary air to the exhaust manifold, catalytic converter, or to the atmosphere, depending on engine operating conditions.

When the Thermactor Air Bypass (TAB) Solenoid is OFF (deenergized), Thermactor Air is dumped into the atmosphere. When the Thermactor Air Bypass (TAB) Solenoid is (ON) energized, and the Thermactor Air Diverter (TAD) Solenoid is off (deenergized), Thermactor Air is routed to the catalytic converter. When the Thermactor Air Bypass (TAB) Solenoid and the Thermactor Air (TAD) Solenoid are both on (energized), Thermactor Air is routed to the exhaust manifold.

EEC Power Relay

The EEC Power Relay supplies power to the EEC Module and EEC System-related components. When the Ignition Switch is turned to START or RUN, voltage is applied to the EEC Power Relay coil, and the Relay's contacts close.

Voltage is also applied through the EEC Power Relay contacts to the Fuel Pump Relay, the Fuel Injectors, the EEC Module, the EGR Solenoid and the Thermactor Solenoids.

Fuel Flow

The 5.0L and 5.8L Electronic Fuel Injection (EFI) Engine uses Fuel Injectors, mounted in the Intake Manifold at the Intake Port, to meter fuel into the engine.

The Fuel Injectors are divided into two groups of four. With each crankshaft revolution, one group of Fuel Injectors is energized. The next crankshaft revolution energizes the second group of Fuel Injectors.

The EEC Module controls the injectors' "on time" or pulse width. The EEC Module determines the appropriate injector pulse width and outputs a command to the injector to meter the exact quantity of fuel.

The electric Fuel Pump supplies fuel under pressure to the fuel rail and the Fuel Injectors. When the Ignition Switch is in START or RUN, voltage is applied from the EEC Power Relay to the Fuel Pump Relay coil. The coil is grounded by the EEC Module, the Relay's contacts close and voltage is applied to the electric Fuel Pump.

The Inertia Switch is a safety device that cuts voltage to the electric Fuel Pump in the event of a collision. Once the Intertia Switch opens it must be reset manually.

Exhaust Gas Recirculation (EGR)

The EEC Module controls exhaust gas recirculation by varying the voltage applied to the EGR Valve Position Sensor. This Valve, in turn, regulates the amount of vacuum applied to the EGR Valve. The EGR Valve Position Sensor indicates Valve position to the EEC Module by providing a voltage signal proportional to the EGR position, depending on engine operating conditions.

Thermactor Air System

The efficiency of the Catalytic Converter depends upon the temperature and chemical composition of exhaust gases.

A Thermactor Air System, including a Thermactor Air Bypass (TAB) and Diverter Solenoid (TAD), controls the flow of secondary air to the Exhaust Manifold, Catalytic Converter, or the atmosphere, depending on engine operating conditions.

When the Thermactor Air Bypass (TAB) Solenoid is off (deenergized), Thermactor Air is dumped into the atmosphere. When the Thermactor Air Bypass (TAB) Solenoid is on (energized) and the Thermactor Air Diverter(TAD) Solenoid is off (deenergized), Thermactor Air is routed to the Catalytic Converter. When the Thermactor Air Bypass (TAB) Solenoid and the Thermactor Air Diverter(TAD) Solenoid are both on (energized), Thermactor Air is routed to the Exhaust Manifold.

Canister Purge Solenoid

The EEC Module controls the Canister Solenoid. When the EEC Module grounds the Canister Purge Solenoid, fuel vapors collected by the carbon canister are released and burned by the engine.

Idle Air Bypass Valve

The Idle Air Bypass Valve regulates engine idle speed by controlling the amount of air allowed to flow around the throttle plates.

Knock Sensor (5.0L Only)

The Knock Sensor signals the EEC Module to retard timing if the engine knocks during operation.

Power Steering Pressure Switch (5.0L Without E4OD Only)

The Power Steering Pressure Switch signals the EEC Module when power steering pressure exceeds 350 psi $\pm$50. The engine then increases idle speed to compensate for the additional load.

Throttle Position Sensor

The Throttle Position Sensor (TPS) is a potentiometer with a DC voltage output that varies with throttle plate angle. By monitoring the Throttle Position Sensor (TPS) output, the EEC Module calculates fuel delivery requirements based on driver demand.

SECTION 24 (cont'd)

EGR Valve Position Sensor

The EEC Module uses the EGR Position Sensor to check the position of the EGR Vacuum Regulator Solenoid. The EEC Module also uses the EGR Position Sensor to calculate the proper amount of EGR flow necessary to reduce NO_2 emissions. The EEC Module then determines the proper operating cycle for the EGR Vacuum Regulator Solenoid.

Manifold Absolute Pressure (MAP) Sensor

The Manifold Absolute Pressure (MAP) Sensor measures the pressure in the intake manifold and provides this information as a variable frequency signal to the EEC Module. With the Ignition Switch in the KEY ON/ENGINE OFF position, the MAP Sensor measures the barometric pressure in the intake manifold.

Engine Coolant Temperature Sensor

The Engine Coolant Temperature (ECT) Sensor is a thermistor in which resistance decreases as engine coolant temperature increases. The EEC Module detects the voltage drop across the Engine Coolant Temperature (ECT) Sensor and uses this information to help calculate fuel delivery, spark timing and EGR control.

Air Charge Temperature Sensor

The Air Charge Temperature (ACT) Sensor is a thermistor in which resistance decreases as intake air temperature increases. The EEC Module detects the voltage drop across the Air Charge Temperature (ACT) Sensor and uses this information to help calculate fuel delivery, spark timing and EGR control.

Heated Exhaust Gas Oxygen (HEGO) Sensor

The Heated Exhaust Gas Oxygen (HEGO) Sensor provides to the EEC Module a voltage that regulates the air fuel ratio by sensing the oxygen content of the exhaust gases. Too much oxygen indicates a lean mixture, while too little oxygen indicates a rich mixture.

For further diagnostic information, refer to the Powertrain Control/Emissions Diagnosis Manual.

SECTION 25

ELECTRONIC ENGINE CONTROL (7.5L)

HOW THE CIRCUIT WORKS

The Electronic Engine Control System includes an Electronic Engine Control (EEC) Module that receives inputs from various sensors. The EEC Module uses the input information to control (1) Fuel Flow, (2) Exhaust Gas Recirculation (EGR), (3) Ignition and (4) Evaporative Emissions. These four systems and the EEC Module work together to provide improved fuel economy and performance, and lower exhaust emissions.

EEC Power Relay

The EEC Power Relay supplies power to the EEC Module and EEC System-related components. When the Ignition Switch is turned to START or RUN, voltage is applied to the EEC Power Relay coil, and the Relay's contacts close.

Voltage is applied through the EEC Power Relay contacts to the Fuel Pump Relay, the Fuel Injectors, the EEC Module, the EGR Solenoid and the Thermactor Solenoids.

Fuel Flow

The 7.5L Electronic Fuel Injection (EFI) engine uses Fuel Injectors, mounted in the intake manifold at the intake port, to meter fuel into the engine.

The Fuel Injectors are divided into two groups of four. With each crankshaft revolution, one group of Fuel Injectors is energized. The next crankshaft revolution energizes the second group of Fuel injectors.

The EEC Module controls the injectors' "on time" or pulse width. The EEC Module determines the appropriate injector pulse width and outputs a command to the injector to meter the exact quantity of fuel.

The electric Fuel Pump supplies fuel under pressure to the fuel rail and the Fuel Injectors. When the Ignition Switch is in START or RUN, voltage is applied from the EEC Power Relay to the Fuel Pump Relay coil. The coil is grounded by the EEC Module, the Relay's contacts close, and voltage is applied to the electric Fuel Pump.

The Inertia Switch is a safety device that cuts voltage to the Electric Fuel Pump in the event of a collision. Once the Inertia Switch opens it must be reset manually.

Exhaust Gas Recirculation (EGR)

The EEC Module controls exhaust gas recirculation by varying the voltage applied to the EGR Valve Position Sensor. This Valve, in turn, regulates the amount of vacuum applied to the EGR Valve. The EGR Valve Position Sensor indicates Valve position to the EEC Module by providing a voltage signal proportional to the EGR position, depending on engine operating conditions.

Canister Purge Solenoid

The EEC Module controls the Canister Purge Solenoid. When the EEC Module grounds the Canister Purge Solenoid, fuel vapors collected by the carbon canister are released and burned by the engine.

Idle Air Bypass Valve

The Idle Air Bypass Valve controls engine idle speed by regulating the amount of air allowed to pass around the throttle plates. This permits the EEC Module to make idle speed corrections to prevent engine stall during cold engine warm-ups. As engine load changes, the diode provides voltage spike suppression.

Thermactor Air Bypass Solenoid

A Thermactor Air System supplies secondary air to the exhaust manifold(s), to the catalytic converter or to the atmosphere, depending on engine conditions sensed by the EEC Module through the system inputs.

When the Thermactor Air Bypass (TAB) Solenoid is off (deenergized), Thermactor Air is dumped into the atmosphere rather than routed to the catalytic converter or exhaust manifold.

When the Thermactor Air Bypass (TAB) Solenoid is on (energized), the Thermactor Air is routed to the catalytic converter.

Ignition System

The EEC System has a special Distributor and Ignition Module. The EEC Distributor has no vacuum advance mechanism. Instead, all ignition timing is controlled by the EEC Module.

The EEC Module receives engine timing information from the Distributor through the TFI Ignition Module. The EEC Module uses this information to determine spark timing and advance.

Electronic Control Assembly Inputs

The EEC Module uses information from various sensors to determine engine operating conditions.

Air Charge Temperature Sensor

The Air Charge Temperature (ACT) Sensor is a thermistor in which resistance decreases as intake air temperature increases. The EEC Module detects the voltage drop across the Air Charge Temperature (ACT) Sensor and uses this information to help calculate fuel delivery, spark timing, and EGR control.

Throttle Position Sensor

The Throttle Position Sensor is a potentiometer with a DC voltage output that varies with throttle plate angle. By monitoring the Throttle Position Sensor (TPS) output, the EEC Module calculates fuel delivery requirements based on driver demand.

Engine Coolant Temperature Sensor

The Engine Coolant Temperature (ECT) Sensor is a thermistor in which resistance decreases as engine coolant temperature decreases. The EEC Module detects the voltage drop across the Engine Coolant Temperature (ECT) Sensor and uses this information to help calculate fuel delivery, spark timing and EGR control.

Manifold Absolute Pressure (MAP) Sensor

The Manifold Absolute Pressure (MAP) Sensor measures the pressure in the intake manifold and provides this information as a variable frequency signal to the EEC Module. With the Ignition Switch in the KEY ON/ENGINE OFF position, the MAP Sensor measures the barometric pressure in the intake manifold.

SECTION 26 (cont'd)

The Engine Temperature Switch provides voltage to the Cold Timing Advance Solenoid and the Cold Idle Solenoid. When the engine temperature is below 112°F (44°C), the Engine Temperature Switch is closed. When the Ignition Switch is turned to START or RUN, the solenoids are energized, advancing injection pump timing and engine idle, allowing the engine to run more smoothly when cold. When the engine temperature reaches 112°F (44°C), the Engine Temperature Switch opens. This deenergizes the solenoids, returning the timing and idle to normal.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• No Glow Plugs operate.	• No voltage at Glow Plug Controller.	• Check Maxi-fuse K and Fuse Links C and D. • Check 16 (R/LG) and 37 (Y) wires for open.
• One Glow Plug doesn't operate.	• No voltage at BR wire of Glow Plug.	• Check for open in BR wire.

For further diagnostic information, refer to the Powertrain Control/Emissions Diagnosis Manual.

SECTION 29

E4OD TRANSMISSION CONTROL (DIESEL)

HOW THE CIRCUIT WORKS

The Transmission Electronic Control System includes a Transmission Electronic Control Assembly (TECA). The TECA receives various inputs from sensors. The TECA uses data supplied by these sensors to control: (1) transmission capacity, (2) up and down shift scheduling, (3) the Converter Clutch Solenoid, and (4) the Coast Clutch Control. The TECA and these four systems work together to provide improved transmission function and performance.

TECA Power Relay

When the TECA Power Relay is energized (Ignition Switch turned to START or RUN), the TECA and TECA-related components receive power.

Manual Lever Position Sensor

The Manual Lever Position Sensor provides the TECA with an input signal that indicates the position of the manual lever and gear selector.

Fuel Injection Pump Lever (FIPL) Sensor

The Fuel Injection Pump Lever (FIPL) Sensor is a potentiometer that provides a DC output voltage proportional to the throttle plate angle. The TECA uses the FIPL Sensor's output to control shifting and converter engagement based on driver demand.

Overdrive Cancel Switch

The Overdrive Cancel Switch supplies an input signal to the TECA when an E4OD overdrive cancel request has been made.

4X4 Indicator Switch

The 4X4 Hi/Low Indicator Switch informs the TECA Module of a 4X4/Low selection.

SECTION 29 (cont'd)

For further diagnostic information, refer to the Powertrain Control/Emissions Diagnosis Manual.

SECTION 30

E4OD TRANSMISSION (GASOLINE)

HOW THE CIRCUIT WORKS

The E4OD Transmission is an electronically controlled automatic transmission. The EEC Module uses inputs from various sensors to control the operation of the E4OD Transmission. The Overdrive Cancel Switch disables the overdrive operation and enables automatic operation through the first three gears.

For further diagnostic information, refer to the Powertrain Control/Emissions Diagnosis Manual.

SECTION 31

SPEED CONTROL

HOW THE CIRCUIT WORKS

The Speed Control Amplifier controls vacuum to the Speed Control Servo Motor through the Modulating Valve. The Servo Motor moves the throttle through the Actuator cable.

To operate the Speed Control System, the engine must be running and vehicle speed must be greater than 30 mph. The System is turned on by pressing the Speed Control Switch ON.

Pressing and releasing SET/ACCEL or COAST sends a command to the Speed Control Amplifier. This command makes the vehicle's current speed the set speed. The Programmable Speedometer/Odometer Module (located in the Instrument Cluster) sends a speed signal to the input of the Speed Control Amplifier through the 679 (GY/BK) wire. This signal tells the Amplifier to increase or decrease the vacuum at the Servo Motor to keep the vehicle at the set speed.

Pressing and holding SET/ACCEL increases the vehicle's speed as long as SET/ACCEL is depressed. Releasing SET/ACCEL gives the System a new set speed to maintain. Vehicle speed may also be increased by depressing the accelerator until the higher speed is reached, then depressing and releasing SET/ACCEL.

Pressing and holding COAST decreases the vehicle's speed as long as COAST is depressed. Releasing COAST gives the system a new set speed to maintain.

Pressing OFF turns off the System (grounds LB/BK wire). The System is also turned off when the brake pedal is depressed or the Ignition Switch is turned OFF. The Vacuum Dump Valve also operates when the brake pedal is depressed. This is a backup device that releases the servo. In vehicles with manual transaxle, the Clutch Switch opens when the clutch pedal is depressed and turns off the System.

SECTION 31 (cont'd)

For further diagnostic information, refer to Section 10-03 of the Shop Manual.

SECTION 34

ELECTRONIC SHIFT CONTROL

HOW THE CIRCUIT WORKS

The Electronic Shift Control Module is powered at all times through Circuit Breaker 12 of the Fuse Panel to retain its memory capability. Fuse 18 provides power for the switches and the Electric Shift Motor when the Ignition Switch is in RUN. Fuse 10 provides power for nighttime illumination of the Electronic Shift Control Switch.

When the Electronic Shift Control Switch is placed in the 4x4 or LO position, the Electronic Shift Control Module analyzes information from the Shift Position Sensors to determine their current positions. The Module also analyzes information inputs from the Transfer Case Speed Sensor and the Automatic Transmission Switch. The Electronic Shift Control Module then activates the Transfer Case Motor to produce the desired shift, and the 4x4 Indicator lights up.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Electronic Shift doesn't operate.	• No voltage at 517 (BK/W) or 296 (W/P) wires of Electronic Shift Module.	• Check Circuit Breaker 12, Fuse 18 and 517 (BK/W) and 296 (W/P) circuits for an open.
	• Inoperative Electronic Shift Control Switch.	• Check Switch.
	• Inoperative Transfer Case Shift Motor.	• Check Motor.
	• Inoperative Electronic Shift Control Module.	• Self-Diagnostic Test a. Remove connectors C221 and C223 from the Electronic Shift Control Module. b. Turn the Ignition Switch to RUN. c. Activate the self-test switch and note the result: A flashing indicator lamp (approximately one flash per second for a total of 4 flashes) indicates that the Control Module is functioning properly. A steady indicator light indicates that the Control Module is inoperative and must be checked.

SECTION 34 (cont'd)

For further diagnostic information, refer to Section 07-07A of the Shop Manual.

SECTION 42

ANTI-LOCK BRAKES

HOW THE CIRCUIT WORKS

Operation

The Rear Anti-lock Brake System (RABS) continuously monitors rear wheel speed with a sensor mounted on the rear axle. When the teeth on an excitor ring (mounted on the ring gear) pass the sensor pole piece, an AC voltage with a frequency proportional to the average rear wheel speed is induced in the sensor circuit. If an impending lockup condition occurs during braking, the RABS modulates hydraulic pressure to the rear brakes to inhibit rear wheel lockup.

When the brake pedal is applied, the RABS Module senses the drop in rear wheel speed. If the rate of deceleration is too great (indicating an impending rear wheel lockup) the RABS Module activates the RABS Valve Assembly Isolation Solenoid, causing the isolation valve to close. With the isolation valve closed, the rear wheel cylinders are isolated from the master cylinder and the rear brake pressure cannot increase. If the rate of deceleration is still too great, the RABS Module will energize the dump solenoid with a series of rapid pulses to bleed off rear wheel cylinder fluid into an accumulator built into the RABS valve. This reduces the rear wheel cylinder pressure and allows the rear wheels to spin back up to vehicle speed.

When the driver releases the brake pedal at the end of a stop, the isolation valve deenergizes, and any fluid in the accumulator is returned to the master cylinder. Normal brake operation then resumes.

System Self-Test

The Rear Anti-lock Brake System has self-test capabilities similar to those in other electronic control systems. Two warning lamps, located in the instrument panel, alert the driver to a System malfunction. The red Brake Warning Lamp indicates a low fluid level or that the parking brake is on. The yellow Anti-lock Brake Indicator lights up for approximately two seconds when the Ignition Switch is first moved to ON or START for circuit prove out. The Indicator also lights up when the RABS Module detects a malfunction in the System.

The self-test feature contains thirteen codes that indicate the area of the malfunction. When a malfunction is detected, the RABS Control Module shuts down the System and the yellow Anti-lock Warning Lamp comes on. This permits normal braking. A code that can be retrieved by momentarily grounding the diagnostic pigtail and counting the flashes of the yellow light is then set in the system memory. If the key is turned off before the diagnostic test is performed, the code will be lost, and the light will remain out until another malfunction is detected. If more than one fault exists, only the first code recorded will be displayed. Additional codes will be output only after the first fault is corrected.

For further diagnostic information, refer to Section 06-09 of the Shop Manual.

SECTION 44 (cont'd)

For further diagnostic information, refer to Sections 13-06, 13-07 and 18-04 of the Shop Manual.

SECTION 49

FUEL TANK SELECTOR

HOW THE CIRCUIT WORKS

Diesel Engine

Voltage from Fuse 6 is supplied to the Fuel Tank Selector Switch when the Ignition Switch is in START or RUN. The position of the Fuel Tank Selector Switch determines the direction in which the Fuel Tank Selector Valve Motor will move. This determines which Fuel Tank Sender will control the Fuel Gauge position. Vehicles with diesel engines use mechanical fuel pumps.

Gasoline Engine

Voltage is supplied to the Fuel Tank Selector Switch whenever the Fuel Pump relay is energized (contacts closed).

When the Fuel Tank Selector Switch is placed in the FRONT position, power is supplied from the 786 (R) terminal of the Switch to the Front Tank Fuel Pump Motor. Fuel is pumped from the front tank. The signal from the Front Tank Fuel Gauge Sender is carried through the 673 (DB/Y) wire to the Fuel Tank Selector Switch, and then through the 29 (Y/W) wire to the Fuel Gauge in the Instrument Cluster.

When the Fuel Tank Selector Switch is in the REAR position, power is supplied to the Rear Tank Fuel Pump Motor through the 789 (BR/W) wire from the Fuel Tank Selector Switch. The Rear Tank Fuel Gauge Sender signal is transmitted to the Switch through the 675 (Y/LB) wire, and then to the Instrument Cluster through the 29 (Y/W) wire.

TROUBLESHOOTING HINTS - DIESEL ENGINE

CONDITION	POSSIBLE CAUSE	ACTION
• Fuel Tank Selector Valve will not change position.	• Inoperative Fuel Tank Selector Valve.	• With Fuel Tank Selector Switch in FRONT, check for battery voltage between 786 (R) (+) and 789 (BR/W) (–) terminals of Fuel Tank Selector Valve.
	• Inoperative Fuel Tank Selector Switch.	• With Fuel Tank Selector Switch in REAR, check for battery voltage between 786 (R) (–) and 789 (BR/W) (+) terminals of the Fuel Tank Selector Valve.
	• No power or ground to Fuel Tank Selector Switch.	• If both voltages are correct, check Fuel Tank Selector Valve. • If any voltage is not correct, check for battery voltage between 973 (R) (+) and 57 (BK) (–) terminals of Fuel Tank Selector Switch and verify continuity of 789 (BR/W) and 786 (R) wires before checking Fuel Tank Selector Switch.

SECTION 49 (cont'd)

TROUBLESHOOTING HINTS - GASOLINE ENGINE

CONDITION	POSSIBLE CAUSE	ACTION
• Both Fuel Pumps inoperative.	• No power to Fuel Pumps. • Poor or no ground.	• Check 238 and 298 (DG/Y) wires to Inertia Switch for open. • Check Inertia Switch for open. • Check 57 (BK) ground wires for open.
• Front or Rear Fuel Pump inoperative.	• Inoperative Fuel Tank Selector Switch. • Inoperative Fuel Pump.	• With the Fuel Tank Selector Switch in FRONT position, check for continuity between 670 (R/Y) and 786 (R) terminals of the Switch. • With the Fuel Tank Selector Switch in REAR, check for continuity between 670 (R/Y) and 789 (BR/W) terminals of the Switch. • Check for an open in wires from Fuel Tank Selector Switch to suspect pump motor.

For further diagnostic information, refer to Section 10-01 of the Shop Manual.

SECTION 53

HEATER

HOW THE CIRCUIT WORKS

With the Ignition Switch in RUN and the Heater Control Assembly in any position except OFF, voltage is applied to the Blower Motor. With the Blower Motor Switch in LO, current flows through the Blower Motor and three resistors. In MED-LO, current flows through two resistors. In MED-HI, current flows through one resistor. In HI, current does not flow through a resistor. With the A/C-Heater Function Selector Switch in OFF, the Blower Motor does not run.

Lever Position and Operation

OFF - Vacuum is applied to the Outside-Recirculate Door Vacuum Motor, closing that door to outside air. The Panel Door closes the instrument panel outlets. The Floor-Defrost Door opens the floor outlets. The Blower does not operate and air does not pass through the system.

VENT - Outside air comes through the Outside-Recirculate Air Door. The Panel Door sends air to the instrument panel outlets (vacuum on motor). The Temperature Blend Door controls the air through the Heater Core.

FLOOR - Outside air controlled by the Temperature Control Lever passes through or around the Heater Core. The Panel Door closes and air is sent to the floor outlets (vacuum at ports A and B of the Floor-Defrost Door Vacuum Motor).

FLR/DEF - The Outside-Recirculate Air Door lets in outside air (no vacuum at motor). Vacuum is applied to port A of the Floor-Defrost Door. The door moves to mid-position and air is split between the floor and defrost outlets. The Panel Door closes.

DEFROST - With no vacuum at any Vacuum Motor, air passes through the outlets.

SECTION 54 (cont'd)

With the Ignition Switch in RUN and the Function Selector Switch in any position except OFF, voltage is applied to the Blower Motor.

The speed of the Blower Motor is regulated by the Blower Switch and Blower Motor Resistor. With the front Blower Switch in LO, current flows through the Blower Motor and three resistors. In MED-LO, current flows through two resistors. In MED-HI, current flows through one resistor. In HI, current does not flow through any resistors. With the Function Selector Switch in OFF, the Blower Motor does not run.

With the Ignition Switch in RUN and the Function Selector Switch in MAX, NORM (A/C), FLR/DEF or DEFROST, the A/C Clutch Field Coil is activated, and the Compressor starts.

Lever Position and Operation

OFF - Vacuum is applied to the Outside Recirculate Door Vacuum Motor, closing that door to outside air. The Panel Door closes the instrument panel outlets. The Floor-Defrost Door opens the floor outlets. The Blower does not operate and air does not pass through the system.

A/C MAX - The Outside Recirculate Door closes to outside air. The Panel Door sends air to the instrument panel outlets (vacuum on motor). With the Temperature Control Lever in the Cool position, the Temperature Blend Door prevents air flow through the Heater Core.

A/C NORM - Outside air comes through the Outside Recirculate Door. The Panel Door sends air to the instrument panel outlets (vacuum on motor). The Temperature Blend Door controls the air through the Heater Core.

VENT - Air flow is the same as in A/C NORM. The compressor is OFF.

FLOOR - Outside air, controlled by the Temperature Control Lever, is passed through or around the Heater Core. The Panel Door is closed and air is sent to the floor outlets (vacuum at ports A and B of the Floor-Defrost Door Vacuum Motor). The compressor is OFF.

FLR/DEF- The Outside-Recirculate Door lets in outside air (no vacuum at motor). Vacuum is applied at port A of the Floor-Defrost Door. The door moves to mid-position and air is split between the floor and defrost outlets. The Panel Door closes and the A/C compressor operates to dehumidify the air.

DEFROST - With no vacuum at any Vacuum Motor, air passes through the outlets. The compressor operates to dehumidify the air.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Blower runs only in HI.	• Open Thermal Limiter in Blower Motor Resistors.	• Check continuity of Blower Motor Resistors. Check Blower Motor Resistors if Thermal Limiter is open, and check 57 (BK) and 261 (O/BK) wires.
• Hissing sound or air flow from wrong outlets.	• Vacuum leak or pinched vacuum tube.	• Refer to the Vacuum schematic and "How to Find the Vacuum Problem" Section.
• Compressor Clutch doesn't operate.	• Open A/C Clutch Field Coil.	• With the Function Selector Switch in A/C NORM, remove the connector from the A/C Clutch Field Coil and check for battery voltage between the 347 (BK/Y) and 57 (BK) wires on the connector. If voltage is present, check A/C Clutch Field Coil.
	• Open A/C Clutch Cycling Pressure Switch.	• Remove connector from A/C Clutch Cycling Pressure Switch and check continuity of Switch. If Switch is open and refrigerant charge is normal, check the A/C Clutch Cycling Pressure Switch.

SECTION 54 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• No cooling or not enough cooling (compressor operates).	• Loose A/C Compressor drive belt.	• Check drive belt tension.
	• Temperature Blend Door out of adjustment.	• Check operation of temperature control cable (refer to Shop Manual).
• Blower runs only in LO.	• Inoperative Blower Switch.	• Check continuity of Blower Switch. Refer to Cell 149 for switch testing procedures.
	• Loose connection at connector C260.	• Clean and tighten the connection at connector C260.
	• Open 261 (O/BK) wire.	• Check 261 (O/BK) wire of Blower Switch.
• Blower doesn't run in any mode.	• Inoperative Blower Motor.	• Set Function Selector Switch to any position except OFF and set Blower Switch to HI. Disconnect the Blower Motor connector and check for battery voltage between the 181 (BR/O) and 261 (O/BK) wires of the harness connector. If voltage is present, check Blower Motor.
	• Inoperative Blower Switch.	• Check Fuse 1. If fuse is blown, check for a short to ground, or check for a jammed Blower Motor or fan.

For further diagnostic information, refer to Sections 12-00 and 12-03 of the Shop Manual.

SECTION 56

REAR WINDOW DEFROST

HOW THE CIRCUIT WORKS

With the Ignition Switch in RUN, the Rear Window Defrost Control is powered through Fuse 7.

Pressing the momentary defrost switch ON closes the contacts of the Rear Window Defrost Relay and starts the ten minute (approximate) timing cycle. Current then flows to the Rear Window Defrost Grid. When the Rear Window Defrost Control is released from ON, the solid state circuitry keeps the defrost relay coil energized.

Pressing the Rear Window Defrost Control OFF turns off the defrost relay. This removes power from the Rear Window Defrost circuit.

If the OFF switch is not pressed, power will remain on until the time delay runs out. Then the coil will turn off and remove power from the Rear Window Defrost Grid.

SECTION 56 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Rear Window Defrost Grid doesn't defrost window and ON indicator doesn't light.	• No voltage to Rear Window Defrost Control.	• Check Maxi-fuse M. • With Ignition Switch in RUN, check for voltage at Rear Window Defrost Control, 8 (O/Y) and 37 (Y) wires. • Check for continuity to ground G201.
• Rear Defrost Indicator lights but defroster doesn't remove frost.	• No voltage to Rear Window Defrost Grid.	• With Rear Window Defrost Switch ON, check for voltage at connector C310. • Check for continuity to ground G400 from Rear Window Defrost Grid.

For further diagnostic information, refer to Section 01-11 the Shop Manual.

SECTION 60

INSTRUMENT CLUSTER

HOW THE CIRCUIT WORKS

When the Ignition Switch is in START or RUN, the gasoline and diesel engine gauges and several indicators are powered by Fuse 17 through the 640 (R/Y) wires.

The Instrument Cluster gauges include the following: Fuel, Oil, Temperature, and Tachometer (optional). Each gauge consists of a coil, a magnet and a pointer, which moves in direct proportion to the output of its sender.

The Instrument Cluster in vehicles with diesel engines use gauges (except Tachometer) that include two coils. When the gauges are powered, a magnetic field is produced. The field varies in direction and strength according to the resistance of the sender.

Fuel Gauge and Fuel Gauges Sender

The Fuel Gauge Sender's resistance controls the magnetic Fuel Gauge's pointer position. The Sender has a resistance of 145 ohms when the fuel tank is full and 22.5 ohms when the fuel tank is empty.

Coolant Temperature Gauge and Sender

The Coolant Temperature Sender's resistance controls the Coolant Temperature Gauge's pointer position. The Sender provides 74 ohms of resistance when the engine coolant is cold and 9.7 ohms when the engine is hot.

The diesel engine's Coolant Temperature Gauge uses an overheat switch that closes at approximately 247°F.

Oil Pressure Gauge and Oil Pressure Switch

The Oil Pressure Switch controls the magnetic Oil Pressure Gauge's pointer position. The Oil Pressure Switch closes under normal engine operating conditions; the Oil Pressure Switch opens with the engine off and no oil pressure.

SECTION 60 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• A warning indicator won't light when proper conditions are met (except High Beam and Fasten Seat Belt Warning Indicators).	• Inoperative switch. • Open ground path. • Open indicator bulb.	• Ground the terminal to the suspect switch. If the indicator lights, check the switch. If the indicator doesn't light, check the lamp and related circuit for an open.
• Voltmeter indicates low voltage/no voltage.	• Battery voltage low. • Wiring and/or connectors. • Printed circuit. • Blown fuse. • Inoperative Voltmeter.	• Service battery and/or charging system as required. • Check wiring for breaks. Check connectors for tightness and corrosion (battery feed and ground circuits). • Check for cracks/breaks in printed circuit. • Service circuit short and check fuse. • Check Voltmeter.
• Voltmeter indicates high voltage.	• Battery voltage high. • Inoperative Voltmeter.	• Service charging system as required. • Check Voltmeter.

For further diagnostic information, refer to Section 13-00 of the Shop Manual.

SECTION 64

VEHICLE SPEED SIGNAL

HOW THE CIRCUIT WORKS

The Programmable Speedometer/Odometer Module receives a speed signal input from the Differential Speed Sensor (DSS), and uses a programmed conversion constant to convert the signal to the standard 8000 pulses per mile speed signal output. The speed signal output is proportional to the road speed of the vehicle. The Programmable Speedometer/Odometer Module supplies this signal to all components that require vehicle speed information including the Speed Control Amplifier, the Transmission Electronic Control Assembly (TECA) (with diesel engine), and the Electronic Engine Control (EEC) Module (with gasoline engine).

SECTION 64 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Speedometer inoperatve; CHECK ENGINE light illuminated and/or Speed Control is inoperative.	• No power to Programmable Speedometer/Odometer Module.	• Check for voltage at 54 (LG/Y) and 296 (W/P) wires.
	• No vehicle speed input.	• Check for approximatly 3.5 volts AC between pins 4 and 5 of Programmable Speedometer/Odometer Module with vehicle speed approximately 30 mph.
	• Open ground.	• Check continuity of 676 (PK/O) wire to ground.
	• Inoperative Programmable Speedometer/Odometer Module.	• Check Module.

For further diagnostic information, refer to the Powertrain Control/Emissions Diagnosis Manual.

SECTION 65

WARNING INDICATORS

HOW THE CIRCUIT WORKS

When the Ignition Switch is in START or RUN, the Warning Indicators are powered through Fuse 17.

The Plugged Fuel Filter Indicator illuminates when fuel pressure in the engine exceeds operational limits.

The Wait-to-Start Indicator illuminates for 1 to 15 seconds after the Ignition Switch is placed in the START or RUN position, indicating that the diesel engine is not ready to be started.

The Water-In-Fuel Indicator illuminates when the Ignition Switch is in START or RUN and the Fuel Water Switch senses water in the fuel/water separator sediment bowl.

When water is detected in the fuel/water separator sediment bowl, the bowl must be drained to prevent damage to the fuel injectors. Refer to Shop Manual for draining instructions.

The Engine Warning Indicator illuminates with the Ignition Switch in START as a bulb test and when there is a high coolant temperature condition.

SECTION 65 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• A warning indicator is always on.	• Inoperative switch or Glow Plug Controller.	• Disconnect suspect switch. If indicator goes out, check the switch. If indicator stays on, check continuity of the wire from switch to indicator. Check for a short in the printed circuit board.
	• Shorted wire or glow plug(s).	• Disconnect connector from Glow Plug Controller. If indicator goes out, check resistance of glow plugs. If within tolerance, check Controller. If indicator stays on, check continuity of wiring from Controller to indicator.
• An indicator is not illuminated when it should be.	• Open bulb. • Open circuit to controlling component. • Open power circuit.	• Check bulb. • Check continuity of wire from indicator to fuse or Ignition Switch. If good, check fuse and Ignition Switch. • Check continuity of wire from indicator to controlling component. If good, check resistance of controlling component.

For further diagnostic information, refer to Sections 13-03, 13-04, 13-05, 13-09 and 13-10 of the Shop Manual.

SECTION 66

WARNING CHIME

HOW THE CIRCUIT WORKS

Seat Belt Warning

When the Ignition Switch is turned to START or RUN, power is supplied to the Warning Chime Module through circuit 640 (R/Y). Power is then supplied through circuit 450 (DG/LG) to illuminate the Fasten Seat Belt Indicator for six seconds, whether or not the driver's seat belt is fastened. If the driver's seat belt is NOT fastened during this time, ground is supplied from the Seat Belt Switch through circuit 85 (BR/LB) to the Warning Chime Module, causing it to sound for six seconds.

Key-in-Ignition Warning

The warning chime sounds when the driver's door is open and the key is in the Ignition Switch. It continues to sound until the key is removed or the door is closed. When the key is in the ignition, ground is supplied to the Warning Chime Module through circuit 158 (BK/PK). When the driver's door is open, power is supplied to the Warning Chime Module through circuit 159 (R/PK).

Headlamps-On Warning

The warning chime sounds when the Main Light Switch is in PARK or HEAD and the driver's door is open, and continues to sound until the switch is moved to OFF or the door is closed. When the Main Light Switch is in PARK or HEAD, power is supplied through circuit 14 (BR) to the Warning Chime Module. When the driver's door is open, power is supplied to the Module through circuit 159 (R/PK).

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Warning does not sound for any condition.	• Warning Chime Module not properly installed to connector. • Open circuit in 57 (BK) wire between Warning Chime Module connector and ground G201.	• Clean and properly reinstall Warning Chime Module terminals in connector. • Remove connector from Warning Chime Module and check for ground at terminal of 57 (BK) wire. If ground is not present, repair 57 (BK) wire.
• Warning sounds intermittently for no apparent reason with all doors closed.	• Inoperative Left Front Courtesy Lamp Switch.	• Remove connector from Warning Chime Module and measure voltage at terminal of 159 (R/PK) wire while the left door is closed. If voltage is 2V or higher, or if switch appears damaged, check switch.
• Warning sounds for no apparent reason with left door open (key out of Ignition Switch, Main Light Switch OFF).	• Inoperative Ignition Key Warning Switch. • Inoperative Main Light Switch.	• Remove connector from Warning Chime Module and check for ground at terminal of 158 (BK/PK) wire when key is out of Ignition Switch. If ground is present, check Ignition Key Warning Switch. • With Main Light Switch in OFF position, verify 12V is not present at terminal of 14 (BR) wire at Warning Chime Module. If voltage is present, check Main Light Switch.
• No fasten belts chime, but Fasten Seat Belt Indicator works normally.	• Inoperative Driver's Seat Belt Switch. • Open circuit in 85 (BR/LB) wire between Warning Chime Module and Seat Belt Switch. • Open circuit in 57 (BK) wire between Seat Belt Switch and ground G201.	• Remove connector from Warning Chime Module and check that ground is present at terminal of the 85 (BR/LB) wire when the driver's seat belt is unbuckled. If ground is not present, check Seat Belt Switch, 85 (BR/LB) wire and 57 (BK) wire for an open.

SECTION 66 (cont'd)

For further diagnostic information, refer to Section 13-09 of the Shop Manual.

SECTION 71

INSTRUMENT ILLUMINATION

HOW THE CIRCUIT WORKS

Battery voltage is applied to the Main Light Switch at all times through Fuse 4. When the Main Light Switch is turned to PARK or HEAD, voltage is applied through the switch to the Instrument Illumination Lamps. The amount of voltage that controls the intensity of the lamps can be adjusted by rotating the Dimmer Switch of the Main Light Switch.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• No Instrument Lamps light up.	• No voltage at 195 (T/W) wire of Main Light Switch. • No voltage at 19 (LB/R) wire of lamps. • Inoperative Dimmer Switch of Main Light Switch.	• Check Fuse 4 and 195 (T/W) wire. • Check Fuse 10, wiring, and Main Light Switch.
• One lamp doesn't light up.	• Blown bulb. • Socket corrosion. • Open in 19 (LG/R) wire. • Open to ground.	• Check bulb as required. • Clean or check socket. • Check 19 (LB/R) wire going to the Lamp in question. • Check 57 (BK) wire for a clean path to ground for the suspect lamp.

For further diagnostic information, refer to Section 13-01 of the Shop Manual.

SECTION 81

INTERVAL WIPER/WASHER

HOW THE CIRCUIT WORKS

The Interval Wiper/Washer System allows the driver to select LO speed, HI speed, or interval (INT) wiping action. In INT, the wipes can be spaced one to fifteen seconds apart.

During washer operation, with the Wiper Switch in the LO or HI position during washer operation, normal wiping action occurs. If the Wiper Switch is in the OFF or INT position during washer operation, the wipers operate in LO speed. The wipers will continue to operate in LO speed for a few cycles after the washer button is released to dry off the windshield. The wipers then return to OFF or INT operation.

During Interval operation, the wipers make single low speed wipes separated by a variable length pause of one to fifteen seconds.

When parking is complete, the wiper motor is braked to a stop by shunting the L and C terminals of the motor through the park switch. Braking takes place when the wiper motor switch moves to the PARK position. The wiper motor L terminal is connected to terminal C through the PARK contact of the wiper motor switch and the deenergized contact of the module relay.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Windshield Wipers don't operate.	• No voltage to Interval Governor.	• Check Circuit Breaker 2. • Check 65 (DG) wire for an open to the Interval Governor and Windshield Wiper Motor.
• Wipers operate in interval mode with wiper switch in OFF position, but operate normally in all other positions.	• Open condition in wiper switch. • Open condition in 589 (O) wire.	• Check wiper switch. • Check 589 (O) wire. If wire is OK, check Interval Governor.
• Wipers won't park.	• No voltage to park switch. • Open condition in park switch.	• Check 65 (DG) wire for voltage at Windshield Wiper Motor connector C152. • Check 57 (BK) ground wire to ground G100. • If above conditions prove acceptable, check park switch.
• Windshield Washer Pump Motor inoperative; wipers operate when washer switch is depressed.	• Open condition between Interval Governor and Windshield Washer Pump Motor. • Inoperative Windshield Washer Pump motor. • Open condition in 57 (BK) wire to ground G100.	• Check 941 (BK/W) wire and Windshield Washer Pump motor. • Check Windshield Washer Pump motor ground wire.

SECTION 85 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• All Right Headlamps light dimly or don't light; Left headlamps are OK.	• Open ground circuit.	• Check continuity to ground.
• All Left Headlamps light dimly or don't light.	• Open ground circuit.	• Check continuity to ground.

For further diagnostic information, refer to Section 17-01 of the Shop Manual.

SECTION 89

COURTESY LAMPS

HOW THE CIRCUIT WORKS

Voltage is applied at all times through Fuse 8 to the Main Light Switch, Door Jamb Switches, Glove Compartment Lamp, Map Lamps, and the Cargo Lamp.

When the Main Light Switch is turned fully counterclockwise, or if the left or right doors are opened, the Dome Lamp is energized and lights up.

The Map Lamps are energized independently of the Dome Lamp by two switches--one located at each Map Lamp housing.

F Series with Cargo Lamp

The Cargo Lamp can be turned on in several ways. It can be turned on manually. It can be turned on when the Main Light Switch is turned fully counterclockwise, or it can be turned on when either the left or right door is opened.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Any one lamp doesn't light up.	• Open bulb. • Open ground circuit. • No power to bulb.	• Check bulb continuity. • Check for voltage on bulb socket. • Check for continuity from bulb socket to ground.
• Lamps with common power supply don't light up.	• No voltage at common point. • Open power circuit.	• Check for an open Fuse 8. • Check continuity of wiring from Fuse 8 to Dome Lamps.
• Dome Lamps don't light up when either the right or left door is opened.	• Inoperative Courtesy Lamp Switch.	• Check continuity of wiring from Fuse 8 to Courtesy Lamp Switch. • Check continuity of Courtesy Lamp Switch in OPEN and CLOSED positions.

SECTION 89 (cont'd)

For further diagnostic information, refer to Sections 01-05 and 17-02 of the Shop Manual.

SECTION 90

TURN/STOP/HAZARD LAMPS

HOW THE CIRCUIT WORKS

Turn Signals

With the Ignition Switch in RUN, current flows through Fuse 7, the Turn Flasher, the Multi-function Switch, and on to the Turn Lamps and Indicators.

The Turn Switch sends power to either the Left or Right Turn Lamps.

Hazard Flasher

Current flows through Fuse 13 to the Turn Lamps and Indicators when the Hazard Switch is pulled out.

The Hazard Switch sends pulsing current to both the Right and Left Turn Lamps at the same time.

Stop Lamps

Current flows through Fuse 13 to the Rear Park/Stop/Turn Lamps and the High Mount Stop Lamp when the Stop Lamp Switch is closed.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Some turn lamps work and all hazard lamps work; some hazard lamps work and all turn lamps work; hazard lamps don't turn off.	• Inoperative switch or wire in Multi-function Switch.	• Check Multi-function Switch.
• One of the turn indicators goes on when the park lamps are on.	• Inoperative lamp or ground.	• Check the front turn lamp on that side.
• All stop lamps stay on without the brake pedal depressed.	• Inoperative Stop Lamp Switch.	• Check Stop Lamp Switch. • Check vacuum dump valve adjustment. • Check brake pedal pivot for binding condition (must move freely when not connected to booster).

SECTION 92

EXTERIOR LAMPS

HOW THE CIRCUIT WORKS

The Exterior lamps are powered through Fuse 4 and the Main Light Switch. The Exterior Lamps light when the Main Light Switch is moved to the PARK or HEAD position. Fuse 4 is hot at all times, which allows the driver to leave the Exterior Lamps on whenever necessary.

The Engine Lamp is powered directly from Fuse 8 in the Fuse Panel.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Any one lamp doesn't light.	• Open bulb.	• Check bulb socket for voltage with Main Light Switch in PARK or HEAD. • Check bulb continuity.
	• Open ground circuit.	• Check bulb socket contact for continuity to ground.
• Lamps with common power supply don't light.	• No voltage to common point.	• Check fuse and switch supplying common circuit. • Check wiring to common point.
• Lamps with common ground supply don't light.	• High resistance ground circuit.	• Check for continuity between common point and ground.
• All lamps are inoperative.	• Blown Fuse 4. • Open in 195 (T/W) wire. • Inoperative Main Light Switch.	• Check Fuse 4. • Check 195 (T/W) wire for a break or a short to ground. • Check the Main Light Switch according to Component Testing Procedures in cell 149.

For further diagnostic information, refer to Section 17-01 of the Shop Manual.

SECTION 93

BACKUP LAMPS

HOW THE CIRCUIT WORKS

With the Ignition Switch in RUN, voltage is applied from Fuse E, in the Engine Compartment Fuse Box, to the Manual Lever Position Sensor (E4OD), Backup/Neutral Safety Switch (C6 or AOD) or Backup Lamp Switch (MTX). With the switch closed, voltage is applied to the Backup Lamps through the 140 (BK/PK) wires.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Backup Lamps are inoperative.	• No voltage to lamps.	• Check for voltage at the Backup Lamp 140 (BK/PK) circuit and 298 (P/O) circuit.
	• Open ground circuit.	• Check continuity of 57 (BK) circuit to ground. • With vehicle in RUN, attach a jumper across the Backup/Neutral Safety Switch (C6 or AOD), Manual Lever Position Sensor (E4OD) or Backup Lamp Switch (MTX). If Backup Lamps work, check switch or sensor. **CAUTION:** Connect jumper to backup lamp circuit only. Accidental connection to other circuits may cause damage to the EEC System.
• Backup Lamps stay on.	• Short in circuit.	• Check switch or sensor.

For further diagnostic information, refer to Section 17-01 of the Shop Manual.

SECTION 95

TRAILER ADAPTER

HOW THE CIRCUIT WORKS

Fuses for the Trailer circuits and all the trailer relays are located in the Engine Compartment Fuse Box. Trailer Marker Lamps and Trailer Backup Lamps are powered through Fuse D. Trailer brakes are powered through Maxi-fuse T. The Turn/Stop/Hazard Lamps are powered through Fuse F and Fuse G. The trailer battery charge circuit is powered through Maxi-fuse Q.

SECTION 97 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Daytime Running Lamps don't operate.	• Blown fuse. • Open ground connection. • 22 (LB/BK) wire shorted to ground. • Inoperative Daytime Running Lamps (DRL) Module.	• Check Fuse A and Fuse E. • Check ground connections. • With Park Brake disengaged, check for a short between the 22 (LB/BK) wire and ground. If there is a short, repair 22 (LB/BK) wires. • With the ignition in RUN, check for voltage at the 38 (BK/O) and 298 (P/O) wires. • Check for voltage at the 12 (LG/BK) wire with the Ignition Switch in RUN, Brake disengaged and Headlamps off. If no voltage is present, check Module. If voltage is OK, repair 12 (LG/BK) wire.
• Daytime Running Lamps won't turn off with Main Light Switch in HEAD.	• Open in 13 (R/BK) park wire. • Inoperative Daytime Running Lamps Module.	• With Main Light Switch in HEAD and Dimmer Switch in LO, check for voltage on the 13 (R/BK) wire. If voltage is present, check Module. If voltage is not present, check 13 (R/BK) for shorts to ground or an open.

For further diagnostic information, refer to Section 17-01 of the Shop Manual.

SECTION 100

POWER WINDOWS

HOW THE CIRCUIT WORKS

Power Windows

When the Ignition Switch is in ACC or RUN, the Master and Right Window Control Switches are powered.

When the Control Switch is placed in either the UP or DN position, current from Circuit Breaker 14 causes the window motor(s) to operate in a clockwise or counterclockwise direction, raising or lowering the window(s).

In the REST position, both motor wires are grounded through separate switch contacts.

When the DN switch is pushed, power flows to the DN motor lead. The UP lead acts as ground.

When the UP switch is pushed, power flows to the UP motor lead. The DN lead acts as ground.

The Power Windows are protected by Circuit Breaker 14. Each motor assembly also has a self-resetting circuit breaker to cut off power if a switch is held too long in the UP or DN position.

Tailgate Power Window (Bronco Only)

The Master Tailgate Window Switch, located on the Instrument Panel, is powered by Circuit Breaker 14 when the Ignition Switch is in ACC or RUN. The Tailgate Power Window can also be controlled by a key-operated Tailgate Window Switch, powered at all times by Circuit Breaker 12.

Either switch assembly can send current through the Tailgate Power Window Motor, causing the Motor to turn in a clockwise or counterclockwise direction, raising or lowering the window in a manner identical to that of the Right and Left Power Window Motors. In the REST position, both wires are grounded through separate contacts.

The Tailgate Power Window Motor includes an internal circuit breaker to cut off power if a switch is held too long in the UP or DN position. The Tailgate Latch Switch prevents the Tailgate Power Window Motor from operating when the tailgate is open.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• The Left and Right Power Windows don't operate.	• No voltage on 400 (LB/BK) wires to Master Window Control Switch. • Loose or open ground G201. • Inoperative Master Window Control Switch.	• Check for battery voltage at 400 (LB/BK) wires of Master Window Control Switch connector. If voltage isn't present, check Circuit Breaker 14 and continuity of 400 (LB/BK) wires. • Check that ground G201 is clean and tight. Perform continuity checks on 57 (BK) wires. • Place a test lamp between 227 (Y) and 226 (R) wires at the Master Window Control Switch connector while Left Window Switch is in UP and DN positions. If lamp doesn't light, check Master Window Control Switch.
• Circuit Breaker 14 opens when one window is operated.	• Excessive current drawn by Window Motor.	• Perform current draw test in Section 42-08 of the Shop Manual.
• One Window Motor doesn't operate.	• Inoperative Window Control Switch or Window Motor.	• Check for voltage at Window Motor. Using a test lamp, check for operation with switch in UP and DN positions. If voltage isn't present, check wiring from motor to Control Switch and operation of switch. • Check for power to switch. If voltage isn't present, check circuit Breaker 14 and continuity of related wiring.

SECTION 110 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Power Door Locks work from one Door Lock Control Switch only.	• Inoperative Door Lock Control Switch. • Open power feed to Door Lock Control Switch.	• Check for voltage on 171 (BK/W) wire at suspect Door Lock Control Switch.
• Power Door Locks are completely inoperative.	• No voltage to Right and Left Door Lock Control Switches. • Open in Door Lock Motor circuit.	• Check Circuit Breaker 12. • Check for voltage on 171 (BK/W) wire at Right and Left Door Lock Control Switches. • Check continuity of the 117 (PK/BK) and 118 (PK/O) wires.
• Locks work in LOCK or UNLOCK, but not in both positions.	• Open in 57 (BK) wires. • Open in 120 (PK/LG) and 627 (BK/O) wires.	• Check continuity of 57 (BK) wires. • Check continuity of 120 (PK/LG) and 119 (PK/Y) wires.
• Only one Door Lock Motor does not work.	• Inoperative Door Lock Motor. • Open in 117 (PK/BK) or 118 (PK/O) wires.	• Place test lamp across motor. Test lamp should light up in LOCK and UNLOCK switch positions. If OK, check motor. • Check continuity of 117 (PK/BK) and 118 (PK/O) wires.

For further diagnostic information, refer to Section 01-14A of the Shop Manual.

SECTION 122

POWER LUMBAR SEATS

HOW THE CIRCUIT WORKS

With Circuit Breaker 12 hot at all times, voltage is applied to the Power Lumbar Switch.

Each Lumbar Seat has a switch that changes cushion shape by operating an air pump. Operating the switch in one direction causes the compressor to inflate the bladder; operating the switch in the other direction causes a bleeder valve to deflate the bladder.

SECTION 122 (cont'd)

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• One Lumbar Seat is inoperative.	• Open in power feed to Lumbar Switch. • Open feed wire from switch to compressor. • Inoperative Power Lumbar Switch.	• Measure voltage at 171 (BK/W) wire of Power Lumbar Switch connector.
	• Open ground feed to Compressor Motor.	• Check continuity of 57 (BK) wire to ground.
	• Inoperative Compressor Motor.	• Measure voltage across disconnected Power Lumbar Compressor Motor connector with Power Lumbar Switch in ON position. If battery voltage is present, check the Power Lumbar Compressor Motor. If voltage is not present, check continuity of the Power Lumbar Switch.
• Both Lumbar Seats are inoperative.	• No voltage at Power Lumbar Switches.	• Check Circuit Breaker 12 for an open. • Check 171 (BK/W) wires for an open.

For further diagnostic information, refer to Section 01-10 of the Shop Manual.

SECTION 124

POWER MIRRORS

HOW THE CIRCUIT WORKS

Each Power Mirror is equipped with two motors operated by a single joystick–type Directional Control Switch. The Directional Control Switch directs current to the motors. By reversing current flow, each motor operates horizontally (left and right) and vertically (up and down).

The Left And Right Mirror Switch connects the Directional Control Switch to either the Left or Right Power Mirror.

SECTION 124 (cont'd)

For further diagnostic information, refer to Section 01-09 of the Shop Manual.

SECTION 130

RADIO

HOW THE CIRCUIT WORKS

With the Ignition Switch in ACC or RUN, voltage is applied through Fuse 11 to operate the Radio.

Fuse 8 applies voltage to the Radio at all times to power the memory-related functions, which retain the memory portions with the Radio turned off.

Panel dimming is controlled by the instrument panel dimming switch. A variable voltage is applied through the 19 (LB/R) wire to control the brightness of the panel lamps.

The display's brightness is controlled by the Main Light Switch. When the park lamps are turned on, battery voltage is applied to the Radio through the 484 (O/BK) wire. The display will dim. When the park lamps are turned off, voltage is no longer reduced by the dimmer resistor and the display will brighten.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Panel dimming lamps don't light or dim properly.	• Open 19 (LB/R) wire. • Inoperative Radio.	• Check for voltage in 19 (LB/R) wire at Radio connector with headlamps on and dimming switch set at maximum. • If voltage isn't present, check 19 (LB/R) for an open. If voltage is present, remove Radio for service.
• Display doesn't light with headlamps on or off.	• Open 484 (O/BK) wire. • Inoperative Radio.	• Check for voltage in 484 (O/BK) wire at Radio connector with headlamps ON (with Headlamps ON, voltage is reduced with dimming switch). • If voltage isn't present, repair 484 (O/BK) for an open. If voltage is present, remove Radio for service.

TROUBLESHOOTING HINTS

CONDITION	POSSIBLE CAUSE	ACTION
• Radio doesn't appear to work. No sound from any Speaker.	• Speaker connection. • Antenna or cable. • Loss of power or ground. • Inoperative Radio.	• Check Speaker connection at Radio. • Check Antenna and Antenna cable for clean and tight connections. Refer to Section 35-01 of the Shop Manual for Antenna testing procedures. • Check for battery voltage in 54 (LG/Y) wire at Radio. • Check for battery voltage in 137 (Y/BK) wire at Radio (and amplifier if so equipped) with Ignition Switch in RUN. • Check 694 (R) wire continuity to ground. • Remove Radio for service if above checks don't correct condition.
• One Speaker doesn't work.	• Open Speaker. • Open or shorted Speaker leads.	• Disconnect Speaker leads from Radio. Connect an analog ohmmeter across suspect Speaker terminals. If Speaker pops, Speaker is OK. Remove Radio for Service. If Speaker doesn't pop, repeat procedure at Speaker. If Speaker now pops, check for open or short in Speaker wires.
• LCD display is erratic.	• Low voltage to Radio. • Poor ground connection.	• Check 54 (LG/Y) wire for 12 volts. If less than 12 volts, check/charge Battery. • Check 694 (R) wire for good continuity to ground.
• AM works; FM doesn't work.	• Inoperative Radio.	• Compare to a known good radio for FM operation. If Radio doesn't work as well, remove Radio for service.
• FM works; AM doesn't work.	• Inoperative Antenna or Antenna cable. • Inoperative Radio.	• Check Radio with a test Antenna. If reception improves, check/repair Antenna if necessary. If reception doesn't improve, remove Radio for service.
• Tape Deck sounds distorted or doesn't work.	• Foreign materials in Tape Deck. • Dirty Tape Deck heads.	• Remove foreign materials and/or clean Tape Deck heads.
• Popping sound that changes with engine RPM.	• Ignition circuits.	• Check for loose spark plug wire. • Check for inoperative spark plug. • Move all wiring away from ignition and spark plug wires.

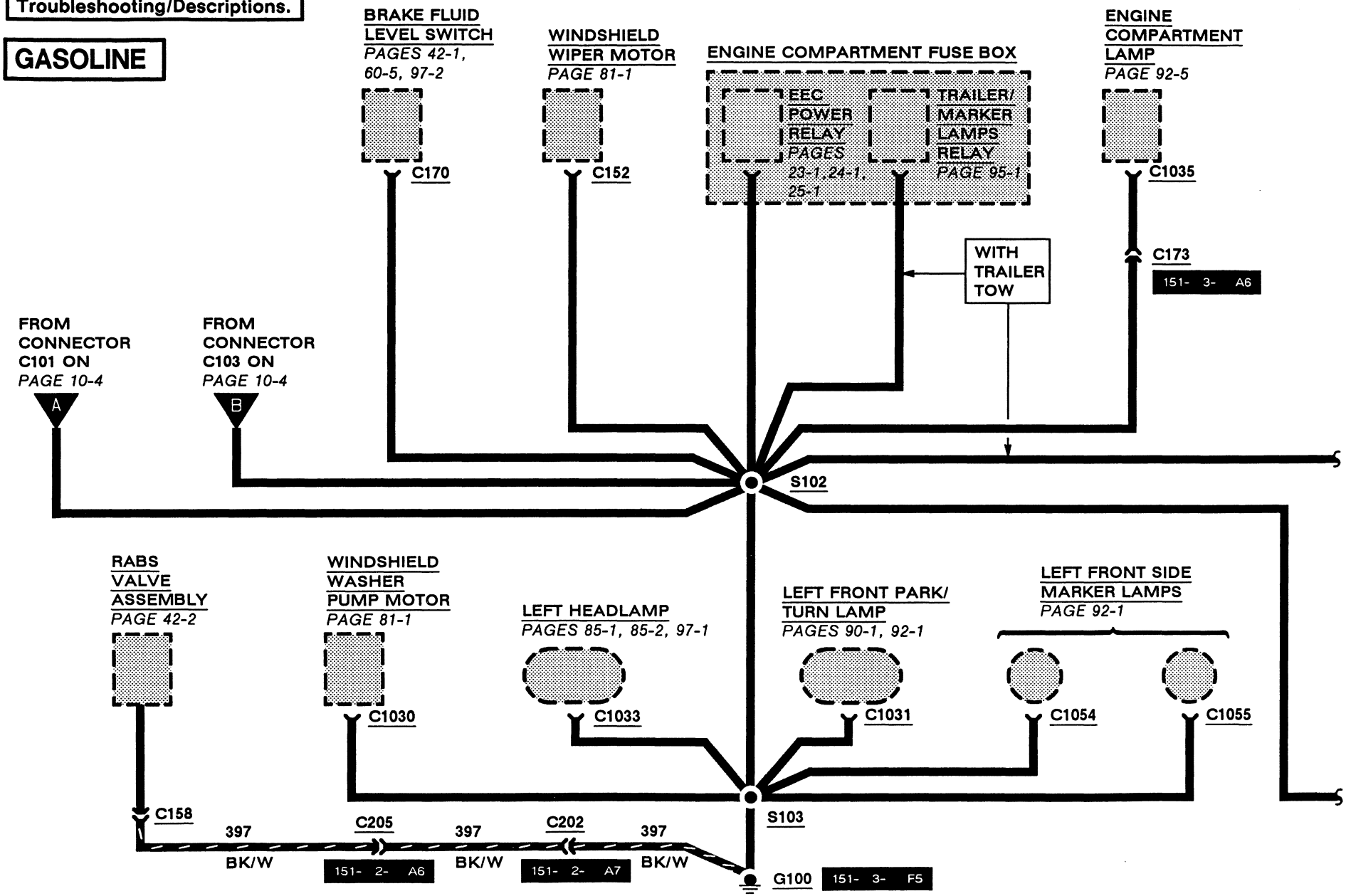
SECTION 130 (cont'd)

For further diagnostic information, refer to Sections 15-00, 15-01, 15-02 and 15-03 of the Shop Manual.

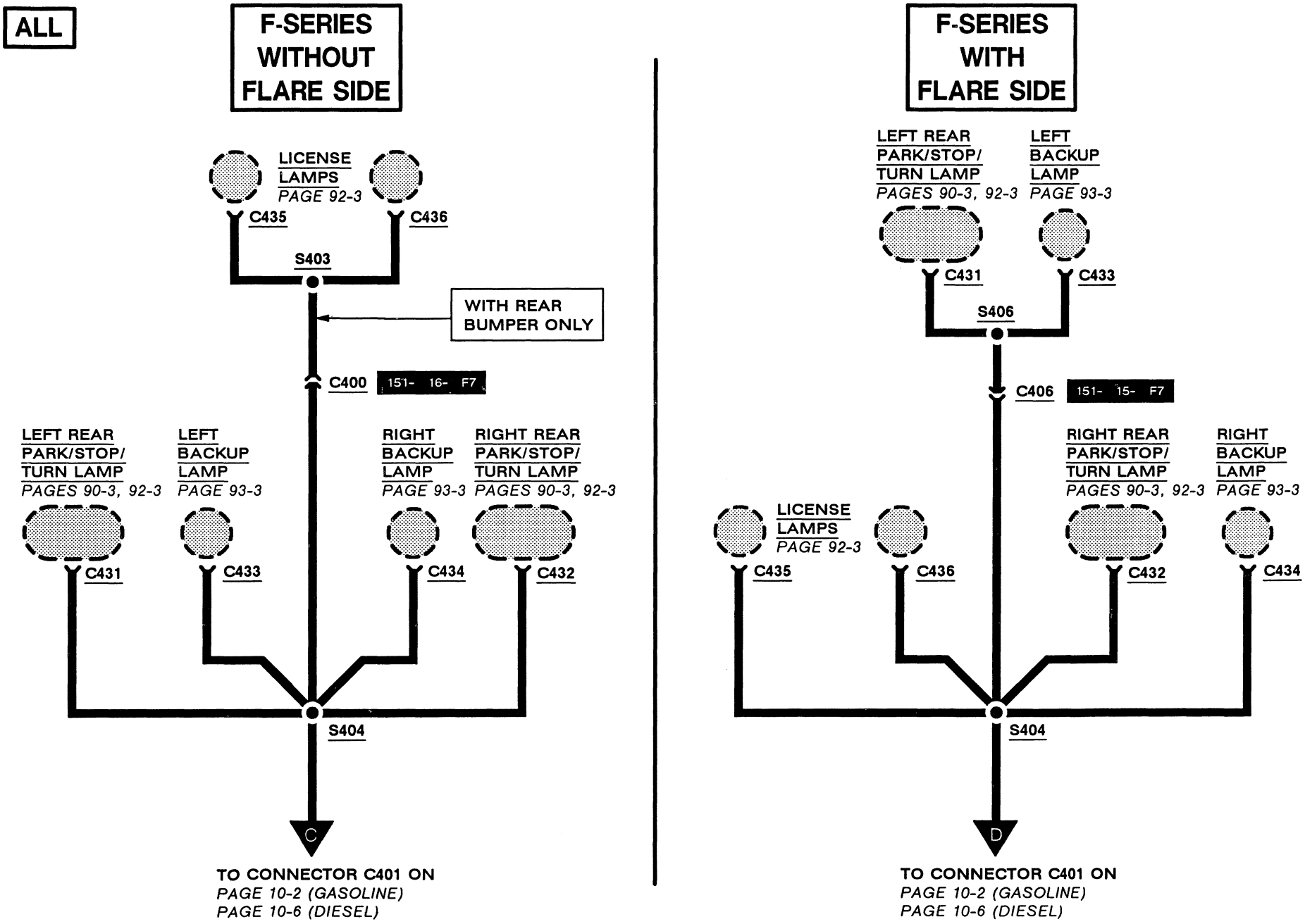
10-1 GROUNDS

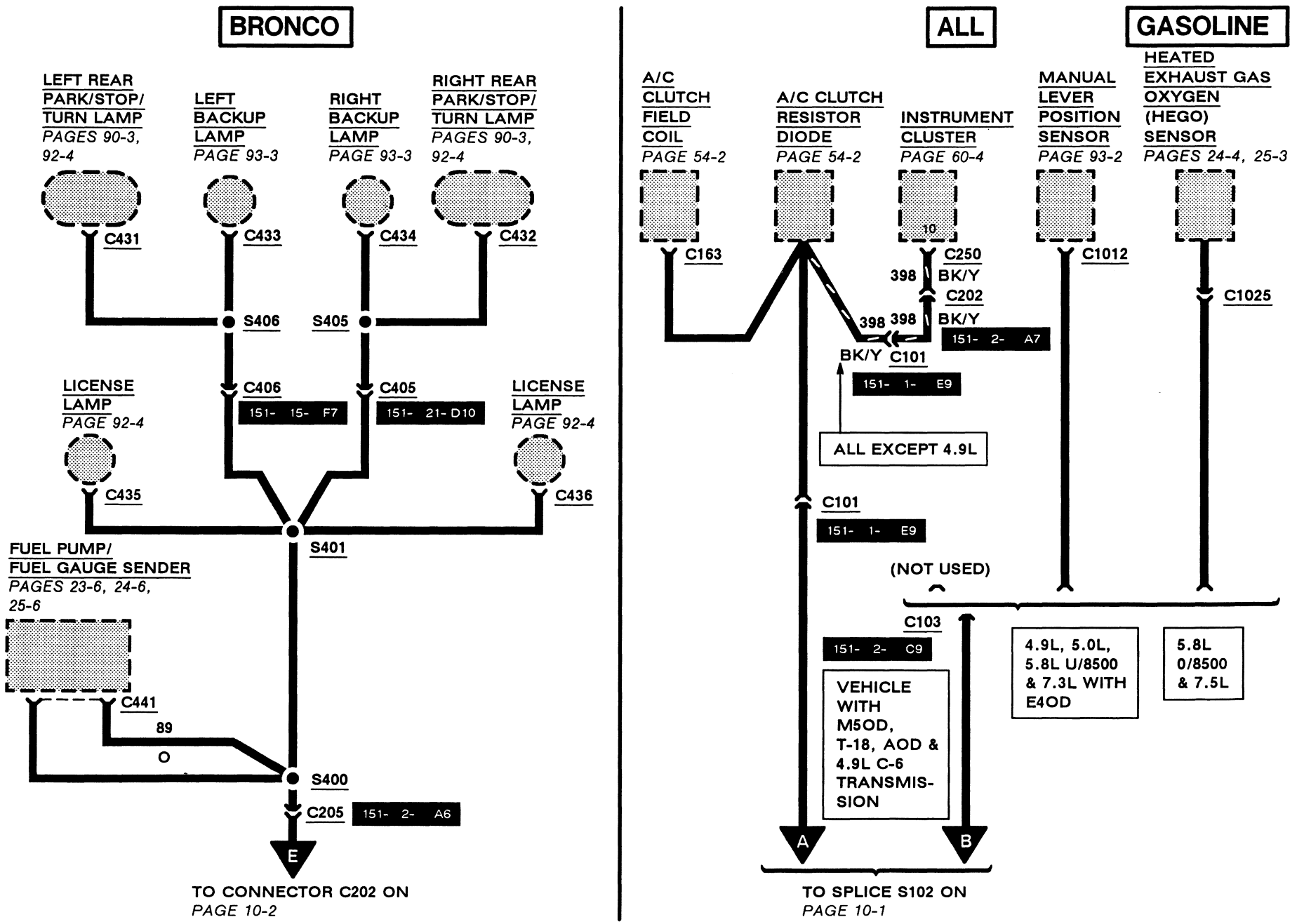
Refer to page 7-1 for Troubleshooting/Descriptions.

GASOLINE

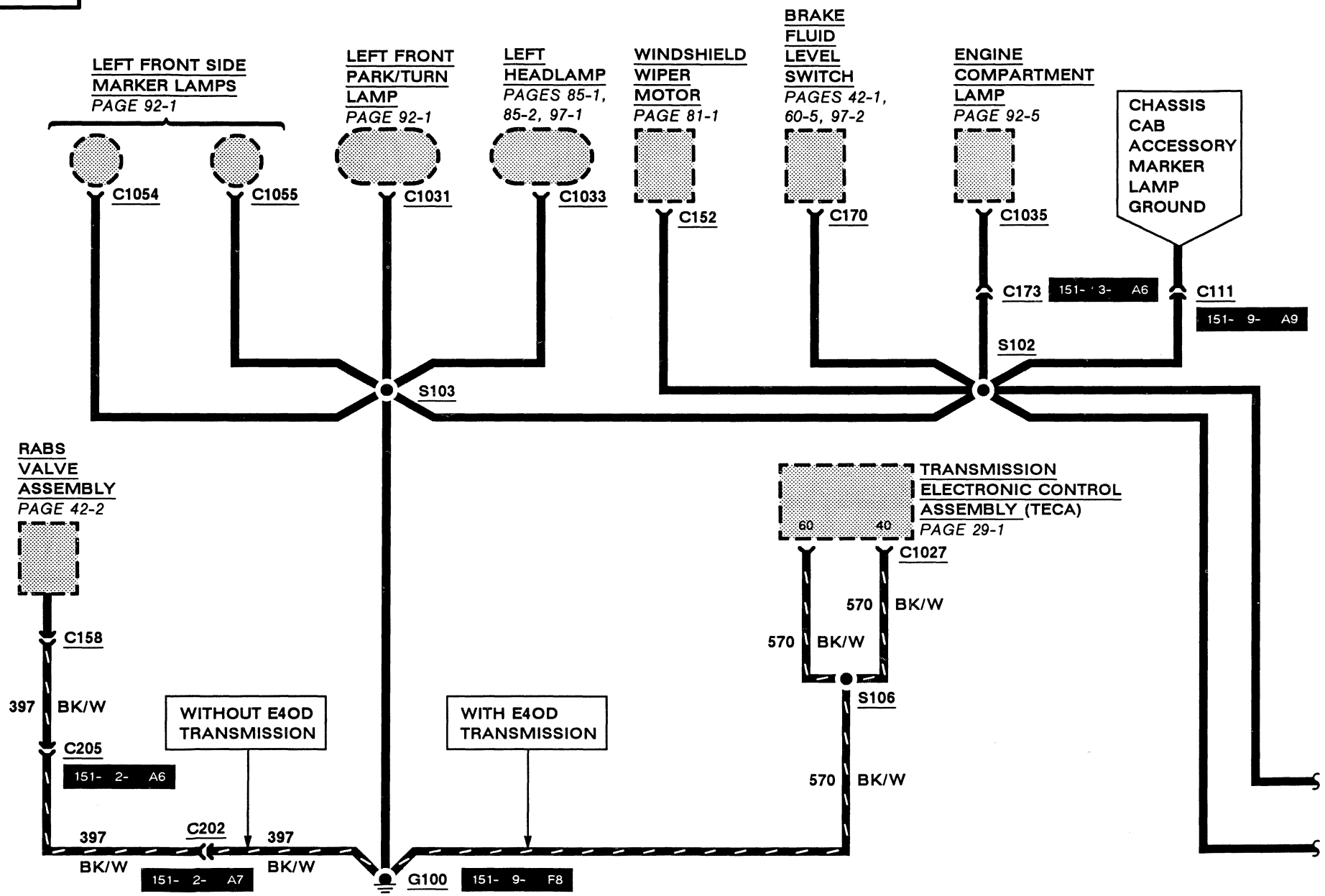


ALL

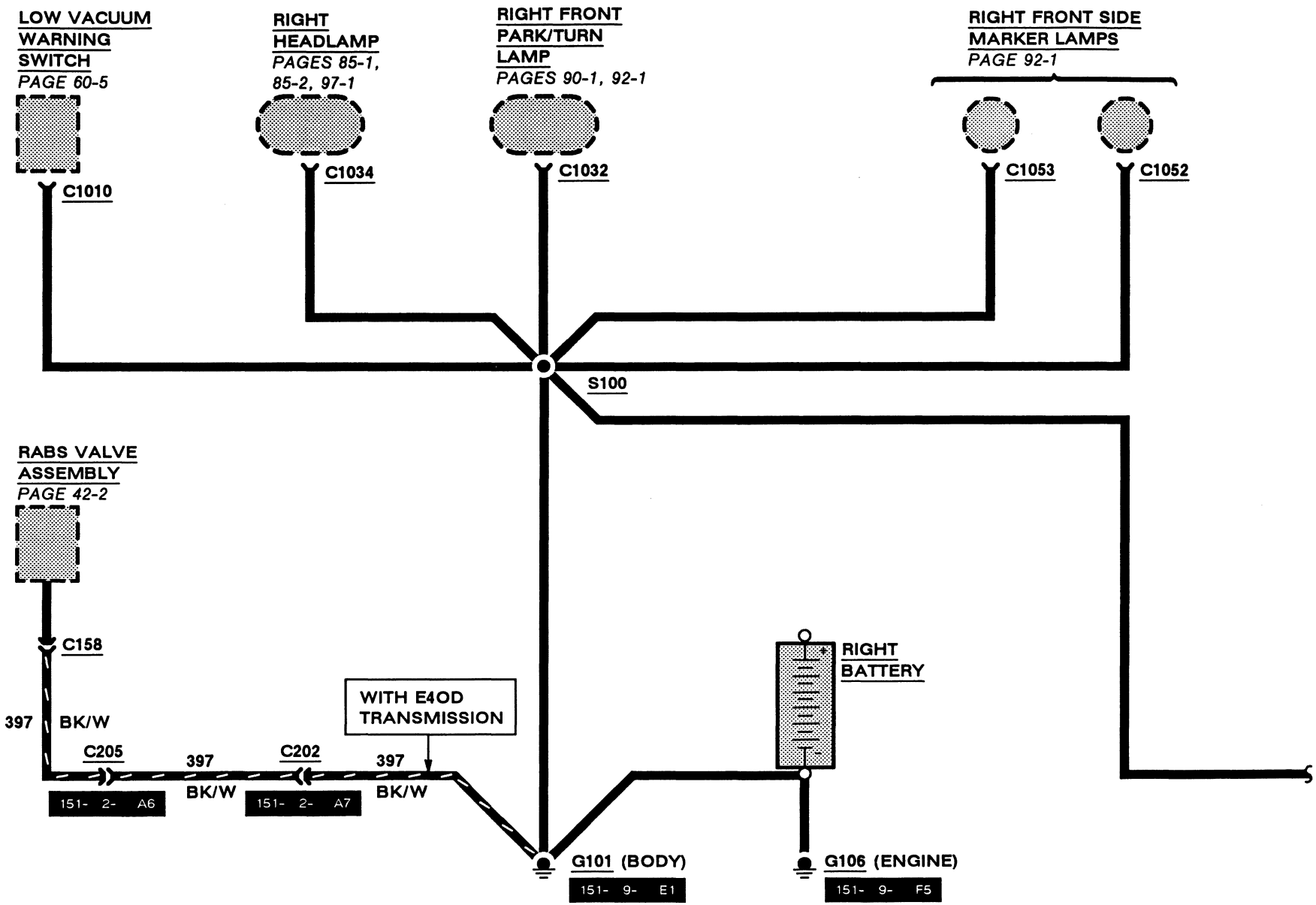

F-SERIES WITHOUT FLARE SIDE
LICENSE LAMPS PAGE 92-3
C435
C436
S403
WITH REAR BUMPER ONLY
C400
151- 16- F7
LEFT REAR PARK/STOP/ TURN LAMP PAGES 90-3, 92-3
LEFT BACKUP LAMP PAGE 93-3
RIGHT BACKUP LAMP PAGE 93-3
RIGHT REAR PARK/STOP/ TURN LAMP PAGES 90-3, 92-3
C431
C433
C434
C432
S404
C
TO CONNECTOR C401 ON PAGE 10-2 (GASOLINE) PAGE 10-6 (DIESEL)
F-SERIES WITH FLARE SIDE
LEFT REAR PARK/STOP/ TURN LAMP PAGES 90-3, 92-3
LEFT BACKUP LAMP PAGE 93-3
C431
C433
S406
C406
151- 15- F7
RIGHT REAR PARK/STOP/ TURN LAMP PAGES 90-3, 92-3
RIGHT BACKUP LAMP PAGE 93-3
LICENSE LAMPS PAGE 92-3
C435
C436
C432
C434
S404
D
TO CONNECTOR C401 ON PAGE 10-2 (GASOLINE) PAGE 10-6 (DIESEL)


BRONCO
LEFT REAR PARK/STOP/ TURN LAMP
PAGES 90-3, 92-4
LEFT BACKUP LAMP
PAGE 93-3
RIGHT BACKUP LAMP
PAGE 93-3
RIGHT REAR PARK/STOP/ TURN LAMP
PAGES 90-3, 92-4
C431
C433
C434
C432
S406
S405
C406
151- 15- F7
C405
151- 21- D10
LICENSE LAMP
PAGE 92-4
LICENSE LAMP
PAGE 92-4
C435
C436
S401
FUEL PUMP/ FUEL GAUGE SENDER
PAGES 23-6, 24-6, 25-6
C441
89
O
S400
C205
151- 2- A6
E
TO CONNECTOR C202 ON
PAGE 10-2
ALL
GASOLINE
A/C CLUTCH FIELD COIL
PAGE 54-2
A/C CLUTCH RESISTOR DIODE
PAGE 54-2
INSTRUMENT CLUSTER
PAGE 60-4
MANUAL LEVER POSITION SENSOR
PAGE 93-2
HEATED EXHAUST GAS OXYGEN (HEGO) SENSOR
PAGES 24-4, 25-3
C163
10
C250
398 BK/Y
C202
398 398 BK/Y
151- 2- A7
BK/Y C101
151- 1- E9
ALL EXCEPT 4.9L
C1012
C1025
C101
151- 1- E9
(NOT USED)
C103
151- 2- C9
VEHICLE WITH M5OD, T-18, AOD & 4.9L C-6 TRANSMIS-SION
4.9L, 5.0L, 5.8L U/8500 & 7.3L WITH E4OD
5.8L 0/8500 & 7.5L
A
B
TO SPLICE S102 ON
PAGE 10-1

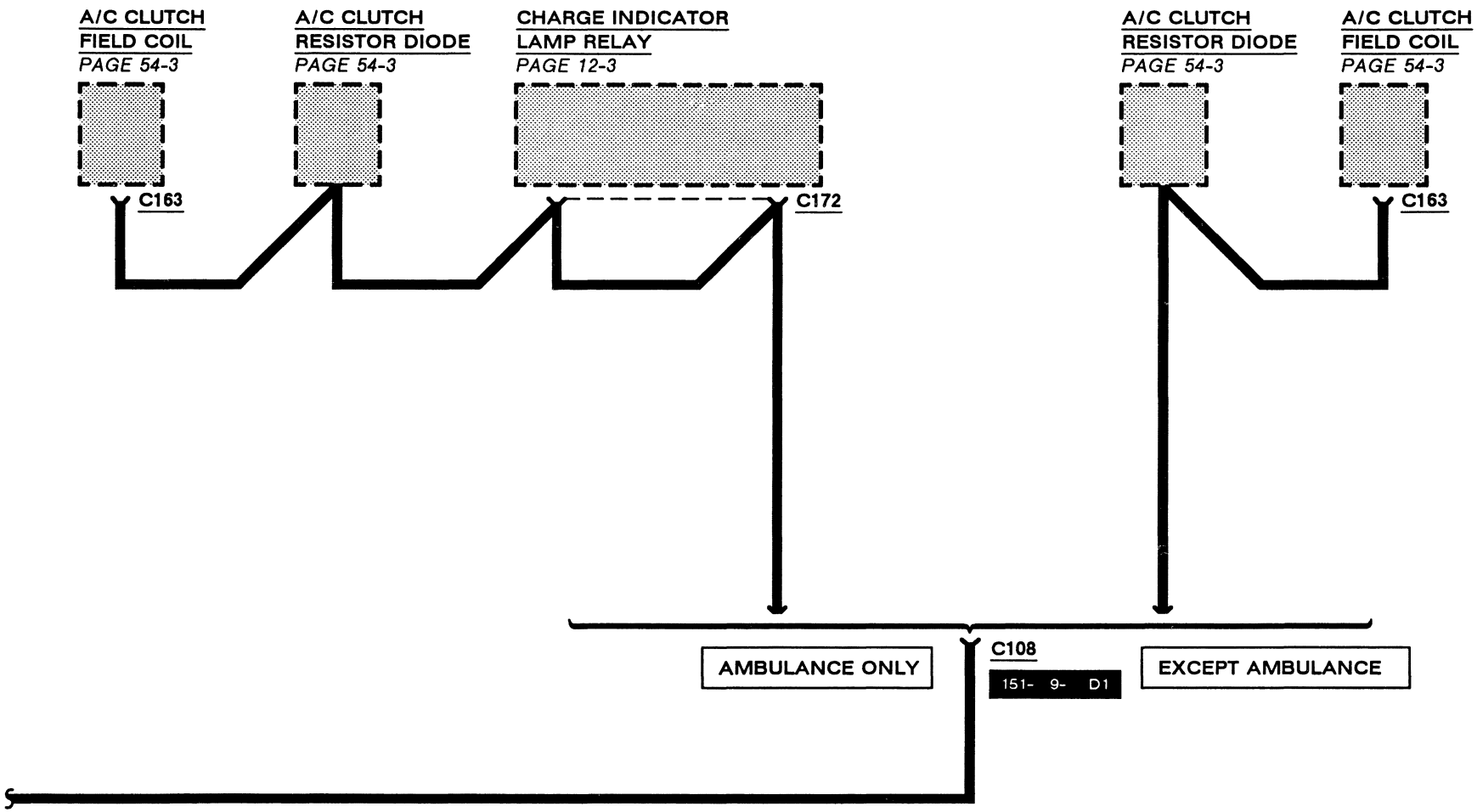
DIESEL


LEFT FRONT SIDE MARKER LAMPS
PAGE 92-1
C1054
C1055
LEFT FRONT PARK/TURN LAMP
PAGE 92-1
C1031
LEFT HEADLAMP
PAGES 85-1, 85-2, 97-1
C1033
WINDSHIELD WIPER MOTOR
PAGE 81-1
C152
BRAKE FLUID LEVEL SWITCH
PAGES 42-1, 60-5, 97-2
C170
ENGINE COMPARTMENT LAMP
PAGE 92-5
C1035
CHASSIS CAB ACCESSORY MARKER LAMP GROUND
C173
151- 3- A6
C111
151- 9- A9
S102
S103
RABS VALVE ASSEMBLY
PAGE 42-2
C158
397 BK/W
C205
151- 2- A6
WITHOUT E4OD TRANSMISSION
WITH E4OD TRANSMISSION
TRANSMISSION ELECTRONIC CONTROL ASSEMBLY (TECA)
60 40
PAGE 29-1
C1027
570 BK/W
570 BK/W
S106
570 BK/W
C202
397 BK/W
397 BK/W
151- 2- A7
G100
151- 9- F8

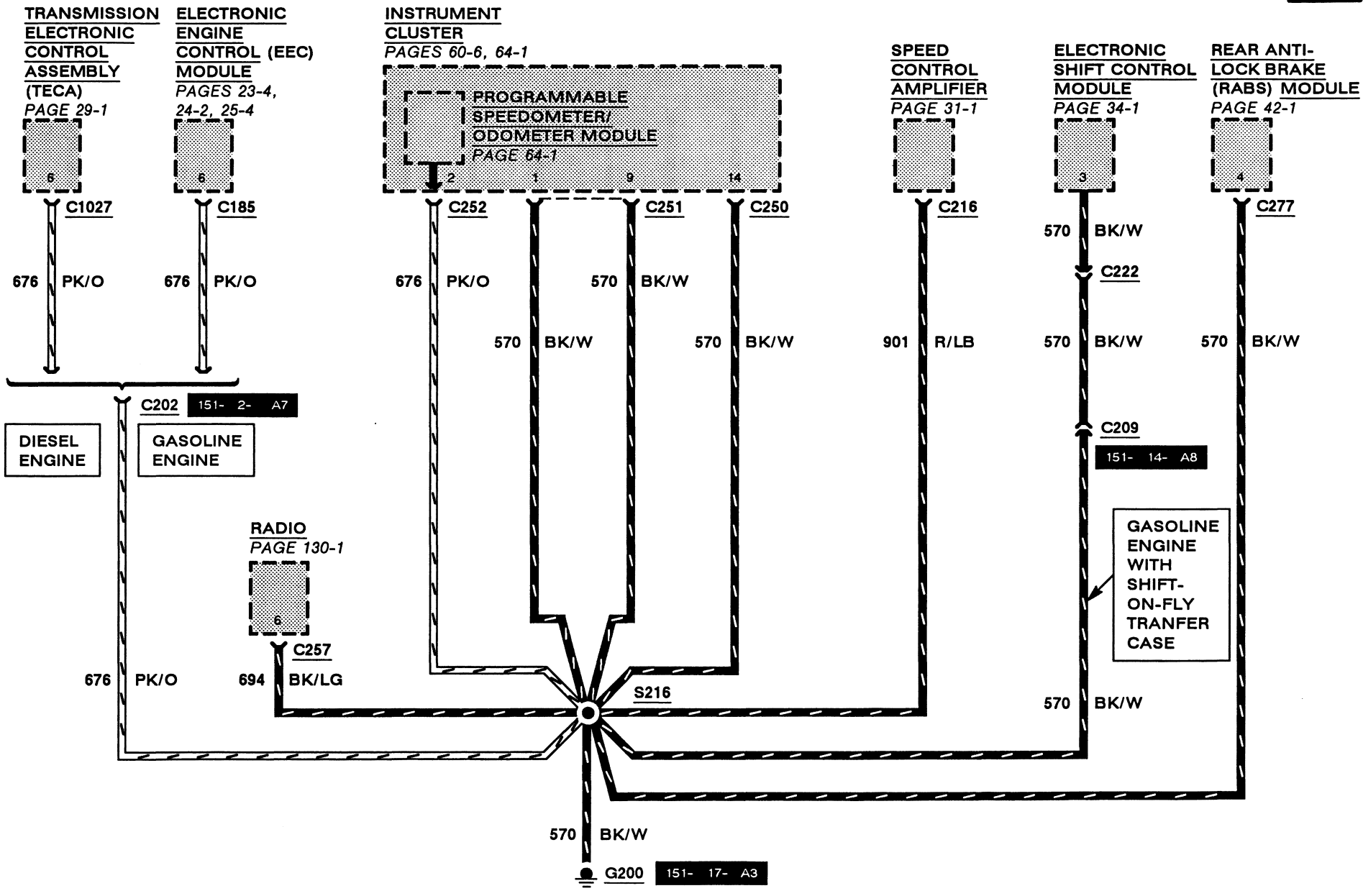
DIESEL

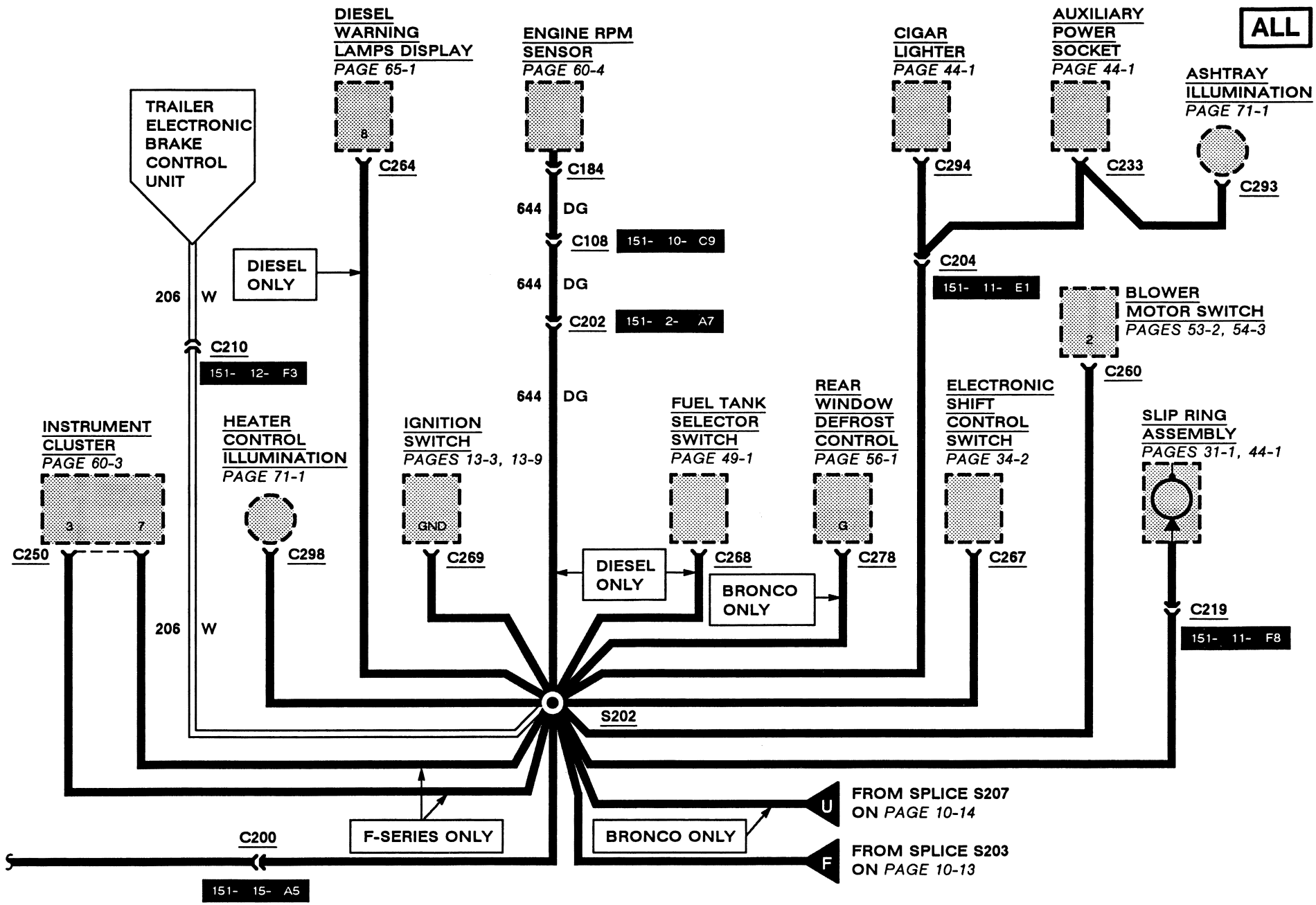

LOW VACUUM WARNING SWITCH
PAGE 60-5
C1010
RIGHT HEADLAMP
PAGES 85-1, 85-2, 97-1
C1034
RIGHT FRONT PARK/TURN LAMP
PAGES 90-1, 92-1
C1032
RIGHT FRONT SIDE MARKER LAMPS
PAGE 92-1
C1053
C1052
S100
RABS VALVE ASSEMBLY
PAGE 42-2
C158
397 BK/W
C205
151- 2- A6
397 BK/W
C202
151- 2- A7
397 BK/W
WITH E4OD TRANSMISSION
RIGHT BATTERY
G101 (BODY)
151- 9- E1
G106 (ENGINE)
151- 9- F5

DIESEL


A/C CLUTCH FIELD COIL
PAGE 54-3
A/C CLUTCH RESISTOR DIODE
PAGE 54-3
CHARGE INDICATOR LAMP RELAY
PAGE 12-3
A/C CLUTCH RESISTOR DIODE
PAGE 54-3
A/C CLUTCH FIELD COIL
PAGE 54-3
C163
C172
C163
C108
151- 9- D1
AMBULANCE ONLY
EXCEPT AMBULANCE

ALL


TRANSMISSION ELECTRONIC CONTROL ASSEMBLY (TECA)
PAGE 29-1
6
C1027
676 PK/O
ELECTRONIC ENGINE CONTROL (EEC) MODULE
PAGES 23-4, 24-2, 25-4
6
C185
676 PK/O
C202
151- 2- A7
DIESEL ENGINE
GASOLINE ENGINE
INSTRUMENT CLUSTER
PAGES 60-6, 64-1
PROGRAMMABLE SPEEDOMETER/ ODOMETER MODULE
PAGE 64-1
2
1
9
14
C252
676 PK/O
C251
570 BK/W
C250
570 BK/W
570 BK/W
SPEED CONTROL AMPLIFIER
PAGE 31-1
C216
901 R/LB
ELECTRONIC SHIFT CONTROL MODULE
PAGE 34-1
3
570 BK/W
C222
570 BK/W
C209
151- 14- A8
570 BK/W
GASOLINE ENGINE WITH SHIFT-ON-FLY TRANFER CASE
REAR ANTI-LOCK BRAKE (RABS) MODULE
PAGE 42-1
4
C277
570 BK/W
RADIO
PAGE 130-1
6
C257
694 BK/LG
676 PK/O
S216
570 BK/W
G200
151- 17- A3


ALL
DIESEL WARNING LAMPS DISPLAY
PAGE 65-1
ENGINE RPM SENSOR
PAGE 60-4
CIGAR LIGHTER
PAGE 44-1
AUXILIARY POWER SOCKET
PAGE 44-1
ASHTRAY ILLUMINATION
PAGE 71-1
TRAILER ELECTRONIC BRAKE CONTROL UNIT
C264
C184
C294
C233
C293
644 DG
C108
151- 10- C9
DIESEL ONLY
206 W
644 DG
C204
151- 11- E1
C202
151- 2- A7
BLOWER MOTOR SWITCH
PAGES 53-2, 54-3
C210
151- 12- F3
C260
644 DG
INSTRUMENT CLUSTER
PAGE 60-3
HEATER CONTROL ILLUMINATION
PAGE 71-1
IGNITION SWITCH
PAGES 13-3, 13-9
FUEL TANK SELECTOR SWITCH
PAGE 49-1
REAR WINDOW DEFROST CONTROL
PAGE 56-1
ELECTRONIC SHIFT CONTROL SWITCH
PAGE 34-2
SLIP RING ASSEMBLY
PAGES 31-1, 44-1
C250
C298
C269
C268
C278
C267
DIESEL ONLY
BRONCO ONLY
206 W
C219
151- 11- F8
S202
C200
151- 15- A5
F-SERIES ONLY
BRONCO ONLY
FROM SPLICE S207 ON PAGE 10-14
FROM SPLICE S203 ON PAGE 10-13

Connector	Location	Page Zone	Connector Page	Color	Terminal
C153 (7.5L)	RH front of engine, on integral alternator regulator (IAR)	151- 7- F4	150-13	BK	3
C154 (4.9L)	RH front of engine, on integral alternator regulator (IAR)	151- 2- F5	150-13	BK	3
C154 (5.0L)(5.8L)	RH front of engine, on integral alternator regulator (IAR)	151- 5- F5	150-13	BK	3
C154 (7.5L)	RH front of engine, on integral alternator regulator (IAR)	151- 7- F5	150-13	BK	3
C158	On LH frame rail, near RABS valve assembly	151- 14- C1		BK	4
C159 Anti-lock Test Connector	Behind RH side of I/P, near rear anti-lock (RABS) module	151- 12- C1		BK	1
C161 (AOD Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 14- B9		BK	2
C161 (Borg-Warner T-18 Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 17-B10		BK	2
C161 (C6 Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 14- F2		BK	2
C161 (E4OD Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 14- D1		BK	2
C161 (Mazda M5OD Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 17- D1		BK	2
C161 (S5-42 ZF Transmission)	Front of transfer case, near 4x4 hi/low indicator switch	151- 17- F3		BK	2
C162 (4.9L)	RH rear of engine compartment, on A/C clutch cycling pressure switch	151- 3- A3		GY	3
C162 (5.0L)(5.8L)	RH rear of engine compartment, on A/C clutch cycling pressure switch	151- 5- A1		GY	3
C162 (7.3L)	RH rear of engine compartment, on A/C clutch cycling pressure switch	151- 9- A2		GY	3
C162 (7.5L)	RH rear of engine compartment, on A/C clutch cycling pressure switch	151- 7- A3		GY	3
C163 (4.9L)	LH front of engine, on A/C clutch field coil	151- 3- F4		BK	2
C163 (5.0L)(5.8L)	LH front of engine, on A/C clutch field coil	151- 5- F5		BK	2
C163 (7.3L)	LH front of engine, on A/C clutch field coil	151- 9- D9		BK	2
C163 (7.5L)	LH front of engine, on A/C clutch field coil	151- 7- F5		BK	2
C164 (4.9L)	RH front of engine, on air charge temperature (ACT) sensor	151- 1- F4		BK	2
C164 (5.0L)(5.8L)	Top center front of engine, on air charge temperature (ACT) sensor	151- 4- D9		BK	2
C164 (7.5L)	Top center of engine, on air charge temperature (ACT) sensor	151- 6- F4		BK	2
C165	Top RH front of engine, on alternator	151- 9- F6		BK	2
C166 (Borg-Warner T-18 Transmission)	Top of transmission, on backup lamp switch	151- 17-A10		BK	2
C166 (Mazda M5OD Transmission)	Top LH side of transmission, on backup Lamp Switch	151- 17- B1		BK	2
C166 (S5-42 ZF Transmission)	Top LH side of transmission, on backup lamp switch	151- 17- E1		BK	2

Connector	Location	Page Zone	Connector Page	Color	Terminal
C167	LH side of transmission, on backup/neutral safety switch	151- 14- A9	150- 1	BK	5
C168 (4.9L)	RH side of safety wall, near blower motor	151- 3- C1		BK	2
C168 (5.0L)(5.8L)	RH side of safety wall, near blower motor	151- 5- B1		BK	2
C168 (7.3L)	RH side of safety wall, near blower motor	151- 9- B1		BK	2
C169 (4.9L)	RH side of safety wall, on blower motor resistor	151- 3- B1		W	4
C169 (5.0L)(5.8L)	RH side of safety wall, on blower motor resistor	151- 5- A2		W	4
C169 (7.3L)	RH side of safety wall, on blower motor resistor	151- 9- B1		W	4
C169 (7.5L)	RH side of safety wall, on blower motor resistor	151- 7- A1		W	4
C170 (4.9L)	LH rear of engine compartment, on brake fluid level switch	151- 3- A8		GY	3
C170 (5.0L)(5.8L)	LH rear of engine compartment, on brake fluid level switch	151- 5- A8		GY	3
C170 (7.3L)	LH rear of engine compartment, on brake fluid level switch	151- 9- A4		GY	3
C170 (7.5L)	LH rear of engine compartment, on brake fluid level switch	151- 7- A9		GY	3
C171 (4.9L)	Lower RH side of engine compartment, on canister purge solenoid	151- 1- F3		BK	2
C171 (5.0L)(5.8L)	RH front of engine, on canister purge solenoid	151- 4- F4		BK	2
C171 (7.5L)	RH side of engine, on canister purge solenoid	151- 6- B1		BK	2
C172	RH side of engine compartment, on charge indicator lamp relay	151- 10- F7		BK	4
C173	LH rear of engine compartment, near hood hinge	151- 3- A6		BK	4
C174	Top center front of engine, on cold idle solenoid	151- 8- F5			1
C175	Top center front of engine, on cold timing advance solenoid	151- 8- F7			1
C177 (Without DRL)	Front LH side of lower radiator support, on daytime running lamps (DRL) jumper	151- 3- F8	150- 2	BK	8
C177 (With DRL)	Front LH side of lower radiator support, on daytime running lamps (DRL) module	151- 3- D9	150- 2	BK	8
C178 (4.9L)	LH front of engine, near distributor	151- 2- E9	150- 2		8
C178 (5.0L)(5.8L)	Top center front of engine, near distributor	151- 4- F8	150- 2		8
C178 (7.5L)	Top LH front of engine, to distributor	151- 6- F7			8
C180 (4.9L)	LH rear of engine, on EGR control solenoid	151- 1- D9		BK	2
C180 (5.0L)(5.8L)	Top LH side of engine, on EGR control solenoid	151- 4- A6		BK	2
C181	LH side of engine compartment, on EGR vacuum regulator (EVR) solenoid	151- 6- E9		BK	2
C182 (4.9L)	Top LH rear of engine, on EGR valve position (EVP) sensor	151- 1- A1		BK	4
C182 (5.0L)(5.8L)	Top RH front of engine, on EGR valve position (EVP) sensor	151- 4- D1		BK	4

Connector	Location	Page Zone	Connector Page	Color	Terminal
C182 (7.5L)	LH rear of engine, on EGR valve position (EVP) sensor	151- 6- A5		BK	4
C183 (4.9L)	Center front of engine, on engine coolant temperature (ECT) sensor	151- 1- F5		BR	2
C183 (5.0L)(5.8L)	Center front of engine, on engine coolant temperature (ECT) sensor	151- 4- F5		BR	2
C183 (7.5L)	LH front of engine, on engine coolant temperature (ECT) sensor	151- 6- F5		BR	2
C184	Top LH front of engine, to engine RPM sensor	151- 8- F6		BK	2
C185 (4.9L)	LH side of safety wall, on electronic engine control (EEC) module	151- 1- A8	150- 3	GY	60
C185 (5.0L)(5.8L)	LH side of safety wall, on electronic engine cotrol (EEC) module	151- 4- A9	150- 3	GY	60
C185 (7.5L)	LH side of safety wall, on electronic engine control (EEC) module	151- 6- A8	150- 5	GY	60
C186	Top RH front of engine, on engine temperature switch	151- 8- F4			2
C187	Top LH front of engine, on fuel injection pump lever (FIPL) sensor	151- 8-D10		BK	3
C188	RH side of engine, on fuel heater	151- 8- B1			1
C190 (4.9L)	Top RH front of engine, on fuel injector #1	151- 2- B1		BK	2
C190 (5.0L)(5.8L)	Top RH front of engine, on fuel injector #1	151- 4- F7		BK	2
C190 (7.5L)	Top RH front of engine, on fuel injector #1	151- 6- E1		BK	2
C191 (4.9L)	Top RH front of engine, on fuel injector #2	151- 2- B1		BK	2
C191 (5.0L)(5.8L)	Top RH side of engine, on fuel injector #2	151- 4- F7		BK	2
C191 (7.5L)	Top RH side of engine, on fuel injector #2	151- 6- E1		BK	2
C192 (4.9L)	Top RH side of engine, on fuel injector #3	151- 2- B1		BK	2
C192 (5.0L)(5.8L)	Top RH side of engine, on fuel injector #3	151- 4- F7		BK	2
C192 (7.5L)	Top RH side of engine, on fuel injector #3	151- 6- E1		BK	2
C193 (4.9L)	Top RH rear of engine, on fuel injector #4	151- 2- B1		BK	2
C193 (5.0L)(5.8L)	Top RH rear of engine, on fuel injector #4	151- 4- F7		BK	2
C193 (7.5L)	Top RH rear of engine, on fuel injector #4	151- 6- E1		BK	2
C194 (4.9L)	Top RH rear of engine, on fuel injector #5	151- 2- B1		BK	2
C194 (5.0L)(5.8L)	Top LH front of engine, on fuel injector #5	151- 4- F7		BK	2
C194 (7.5L)	Top LH front of engine, on fuel injector #5	151- 6- E1		BK	2

Connector	Location	Page Zone	Connector Page	Color	Terminal
C195 (4.9L)	Top RH rear of engine, on fuel injector #6	151- 2- B1		BK	2
C195 (5.0L)(5.8L)	Top LH side of engine, on fuel injector #6	151- 4- F7		BK	2
C195 (7.5L)	Top LH side of engine, on fuel injector #6	151- 6- E1		BK	2
C196 (5.0L)(5.8L)	Top RH side of engine, on fuel injector #7	151- 4- F7		BK	2
C196 (7.5L)	Top LH side of engine, on fuel injector #7	151- 6- E1		BK	2
C197 (5.0L)(5.8L)	Top RH rear of engine, on fuel injector #8	151- 4- F7		BK	2
C197 (7.5L)	Top LH rear of engine, on fuel injector #8	151- 6- E1		BK	2
C198 VIP Test Connector (4.9L)	LH rear of engine compartment, on bracket	151- 1- A9	150–22	GY	6
C198 VIP Test Connector (5.0L)(5.8L)	LH rear of engine compartment, on bracket	151- 4- B9	150–22	GY	6
C198 VIP Test Connector (7.3L)	LH rear of engine compartment, on bracket	151- 8-B10	150–22	GY	6
C198 VIP Test Connector (7.5L)	LH rear of engine compartment, on bracket	151- 6- B9	150–22	GY	6
C199 VIP Test Connector (4.9L)	LH rear of engine compartment, on bracket	151- 1- A9	150–22	GY	1
C199 VIP Test Connector (5.0L)(5.8L)	LH rear of engine compartment, on bracket	151- 4- B9	150–22	GY	1
C199 VIP Test Connector (7.3L)	LH rear of engine compartment, on bracket	151- 8-B10	150–22	GY	1
C199 VIP Test Connector (7.5L)	LH rear of engine compartment, on bracket	151- 6- B9	150–22	GY	1
C200	Behind LH cowl panel	151- 15- A5		GY	8
C201	Behind RH cowl panel	151- 15- F7		GY	2
C202	LH rear of engine compartment, in safety wall	151- 2- A7			76
C203	Behind RH cowl panel	151- 15- A7		BR	6
C204	Behind lower center of I/P, near RH side of ashtray assembly	151- 11- E1		BK	4
C205	LH rear of engine compartment, in safety wall	151- 2- A6			24
C207	Behind lower LH side of I/P, on fuse panel	151- 11- D9		W	1
C209	Behind RH cowl panel	151- 14- A8		BK	12
C210	Behind lower center of I/P	151- 12- F3		GY	4
C213	Behind RH cowl panel	151- 15- F6		GR	8
C214	Behind LH cowl panel	151- 15- F3		GY	8
C216	Behind lower center of I/P, on speed control amplifier	151- 11- F4	150–18	GY	6
C217	Behind lower center of I/P, on speed control amplifier	151- 11- F4	150 –1	W	8
C219	RH side of steering column, to slip ring assembly and ignition key warning switch	151- 11- F8		GY	4
C220	Below center of vehicle, near transfer case assembly	151- 14- F4	150–19	BK	10
C221	Behind RH cowl panel, on electronic shift control module	151- 14- A8	150- 7	W	8
C222	Behind RH cowl panel, near electronic shift control module	151- 14- A9	150- 7	GY	8

Connector	Location	Page Zone	Connector Page	Color	Terminal
C223	Behind RH cowl panel, on electronic shift control module	151- 14- A8	150- 7	BR	5
C224	Behind RH side of I/P, on interval governor	151- 12- A2	150–10		14
C228	Behind RH cowl panel	151- 15- A8		GY	8
C229	Behind LH cowl panel	151- 15- F2		GY	8
C230	Top of steering column, on multi–function switch	151- 12- B9	150–15		7
C231	Top of steering column, on multi–function switch	151- 12- B9	150–15	GY	10
C232 Enable PSOM Programming Connector	Behind lower RH side of I/P, below glove compartment	151- 11- D1		BR	1
C233	Behind lower center of I/P, on auxiliary power socket	151- 11- F2			1
C234	Behind LH cowl panel	151- 19- A1		BR	6
C235	Behind lower center of I/P, on auxiliary power socket	151- 11- F2		BK	1
C250 (Diesel Engine)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–12	BK	14
C250 (Gasoline Engines)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–11	BK	14
C251 (Diesel Engine)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–12	GY	14
C251 (Gasoline Engines)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–11	GY	14
C252 (Diesel Engine)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–13	BK	12
C252 (Gasoline Engines)	Behind top LH side of I/P, on instrument cluster	151- 11- A7	150–13	BK	12
C257	Behind top center of I/P, on radio	151- 12- A6	150–16	BK	8
C258	Behind top center of I/P, on radio	151- 12- A6	150–16	BK	8
C260	Behind center of I/P, on blower motor switch	151- 11- A4		GY	4
C261 (Automatic)	Behind LH side of I/P, on clutch interlock switch jumper	151- 12- F5	150- 1	BK	6
C261 (Manual)	Behind LH side of I/P, on clutch interlock switch	151- 12- F5	150- 1	BK	6
C262	In front of RH front door jamb, on right front courtesy lamp switch	151- 16- B1		N	3
C263	In lower rear of LH front door jamb, on left front courtesy lamp switch	151- 16- D1		GY	3
C264	Behind top LH side of I/P, on diesel warning lamps display	151- 11- A6		BK	8
C267	Behind top LH side of I/P, on electronic shift control switch	151- 12- A7	150- 8	GY	8
C268	Behind top LH side of I/P, on fuel tank selector switch	151- 12- F9	150- 9	GY	6
C269	Top RH side of steering column, on ignition switch	151- 12- A8	150–10		15
C271	Behind RH cowl panel, on inertia switch	151- 14- A7		GY	3
C273	Behind top LH side of I/P, on main light switch	151- 12- D9	150–14	GY	9
C274	Behind top LH side of I/P, on master tailgate window switch	151- 12- E9	150–14	GY	5

Connector	Location	Page Zone	Connector Page	Color	Terminal
C275	Top of steering column, near overdrive cancel switch	151-12-C9			3
C276	Behind LH side of I/P, on park brake switch	151-11-E9		BK	1
C277	Behind RH side of I/P, on rear anti-lock brake (RABS) module	151-12-E1	150-17	BK	14
C278	Behind top LH side of I/P, on rear window defrost control	151-11-A5	150-17	N	5
C279	Behind LH side of I/P, on stop lamp switch	151-12-F6		BK	2
C280	Behind lower center of I/P, on warning chime module	151-11-C1	150-22	GY	7
C282	In center of steering wheel, to speed control switch	151-11-B9			
C283	In steering wheel, on horn switch	151-11-A9			
C292	Behind RH side of I/P, on glove compartment lamp	151-11-B1		BR	2
C293	Behind lower center of I/P, on ashtray illumination	151-11-F3		BK	2
C294	Behind lower center of I/P, on cigar lighter	151-11-E1			1
C295	Behind lower center of I/P, on cigar lighter	151-11-E1		BK	1
C296 (With A/C)	Behind center of I/P, on A/C-heater control assembly	151-11-A2		W	4
C296 (Without A/C)	Behind center of I/P, on heater control assembly	151-11-A2		W	4
C298	Behind center of I/P, on heater control illumination	151-11-A3		BK	2
C300	At base of LH "B" pillar	151-16-E1		GY	4
C302	Below RH side of LH front seat, to seat belt switch	151-13-A7		GY	2
C303	At base of RH "B" pillar	151-18-F7		GY	4
C304	At base of LH "B" pillar	151-18-F5		GY	4
C305	Under LH side of LH front seat, to left power lumbar switch	151-13-E9		GY	2
C306	Under RH side of RH front seat, to right power lumbar switch	151-13-D1		GY	2
C310	LH side of tailgate, near rear window, on rear window defrost grid	151-20-A7		BK	1
C311	Center of tailgate, near rear window, on rear window defrost grid	151-20-A7		BK	1
C312 (With Captain Chairs)	Under front of LH front seat, on left power lumbar motor	151-13-F6		BK	2
C312 (Without Captain Chairs)	Under front of front seat, on power lumbar motor	★		BK	2
C313	Below LH front seat	151-13-C9		GY	2
C314	Below RH front seat	151-13-A3		GY	2
C315	At base of LH "B" pillar	151-21-F3		BR	6
C317	Under front of RH front seat, on right power lumbar motor	151-13-F3		BK	2
C318	LH rear of cargo area, near center of "D" pillar	151-21-F6		BR	6

★ No Figure Available

Connector	Location	Page Zone	Connector Page	Color	Terminal
C320	In center of roof	151- 19- A6		BK	2
C321	In front of LH rear door jamb, on left rear courtesy lamp switch	151- 19- D1		N	3
C322	In front of RH rear door jamb, or right rear courtesy lamp switch	151- 19- A8		N	3
C326 (Bronco)	LH side of cargo area, on left rear speaker	151- 21- A4		GY	2
C326 (F-Series)	LH rear of cab, on left rear speaker	151- 15- A6		GY	2
C327 (Bronco)	RH side of cargo area, on right rear speaker	151- 21-B10		GY	2
C327 (F-Series)	RH rear of cab, on right rear speaker	151- 15- E9		GY	2
C400	Under center rear of vehicle, near rear crossmember	151- 16- F7		GY	4
C401	Under LH rear of vehicle, near rear crossmember	151- 16- F6		GY	8
C403	Below LH rear of vehicle, forward of rear fuel tank	151- 14- F8		BK	4
C405	Under LH rear of vehicle, on frame rail, near fuel tank	151- 21-D10		GY	4
C406	Under LH rear of vehicle, near rear crossmember	151- 15- F7		GY	4
C407	Under center rear of vehicle, near rear crossmember	151- 16- F8			4
C408	Under RH rear corner of vehicle	151- 16- E9		BK	4
C409	Under LH rear corner of vehicle	151- 16- F6		BK	4
C410	Under center rear of vehicle, near rear body marker lamps	151- 16- B9		BK	4
C411	In LH rear quarter panel, forward of wheel well, to left rear side body marker lamp	151- 19- F4		BK	4
C412	In LH rear quarter panel, behind wheel well, to left rear side body marker lamp	151- 19- F4		BK	4
C413	In RH rear quarter panel, forward of wheel well, to right rear side body marker lamp	151- 19- B9		BK	4
C417	Under center rear of vehicle, near rear crossmember	151- 16- F9			8
C418	Under LH rear of vehicle, near rear lamp assembly	151- 21- F7		N	4
C420	In RH rear quarter panel, behind wheel well, to right rear side body marker lamp	151- 19- B9		BK	4
C421	Top RH side of front fuel tank, on front tank fuel gauge sender	151- 14- F6		GY	2
C423	Under LH side of vehicle, at frame rail, on fuel tank selector valve	151- 14- F5	150- 9	GY	6
C424	Under center rear of vehicle, near rear crossmember	151- 16- G8		GY	4
C427	Top RH side of rear fuel tank, on rear tank fuel gauge sender	151- 14- E9		GY	2
C428	In LH side of tailgate, on tailgate latch switch	151- 20-E10		BK	2
C429	In lower center of tailgate, to tailgate power window motor	151- 20-D10		GY	2

Connector	Location	Page Zone	Connector Page	Color	Terminal
C431 (With Chassis Cab)	LH rear of vehicle, on left rear park/stop/turn lamp	151- 16- F3		BK	2
C431 (Without Chassis Cab)	LH rear of vehicle, on left rear park/stop/turn lamp	151- 16- F3		BK	3
C432 (With Chassis Cab)	RH rear of vehcile, on right rear park/stop/turn lamp	151- 16- C9		BK	2
C432 (Without Chassis Cab)	RH rear of vehicle, on right rear park/stop/turn lamp	151- 16- C9		BK	3
C433	LH rear of vehicle, on left backup lamp	151- 16- F4		BK	2
C434	RH rear of vehicle, on right backup lamp	151- 16- D9		BK	2
C435	Center rear of vehicle, on license lamp	151- 16- E9		BK	2
C436	Center rear of vehicle, on license lamp	151- 16- E9		BK	2
C440	Top RH side of front fuel tank, on front tank fuel pump/fuel gauge sender	151- 14- F6		BK	4
C441 (Bronco)	Top RH side of fuel tank, on fuel pump/fuel gauge sender	151- 20-C10		BK	4
C441 (F–Series) (All Except Chassis Cab And 185" Wheel Base)	Top RH side of rear fuel tank, on rear tank fuel pump/fuel gauge sender	151- 14- D9		BK	4
C441 (F–Series) (Chassis Cab And 185" Wheel Base)	Top RH side of rear fuel tank, on rear tank fuel pump/fuel gauge sender	151- 14- C9		BK	4
C444	Below rear of vehicle, on differential speed sensor (DSS)	151- 14- F9		BK	2
C446	Lower rear of vehicle, near license plate, on license lamp	★		BK	1
C447	LH rear of vehicle, on left backup lamp	151- 16- F4		BK	1
C448	RH rear of vehicle, on right backup lamp	151- 16- D9		BK	1
C500	In lower front of LH front door, to left front window motor	151- 15- E1		GY	2
C502	In rear of LH front door, on left front door lock motor	151- 15- D1		N	2
C503	In center of LH front door, on master window control switch and left door lock control switch	151- 15- A1	150–23		15
C504	In lower rear of LH front door, on left front door courtesy lamp	151- 16- C1		BK	2
C507	In top front of LH front door, on left front door speaker				
C508	In front of LH front door, to left power mirror				
C509	Behind RH cowl panel				
C550	In center of LH front door, near power mirror switch				
C600	In lower front of RH door, to right front window motor				

★ No Figure Available