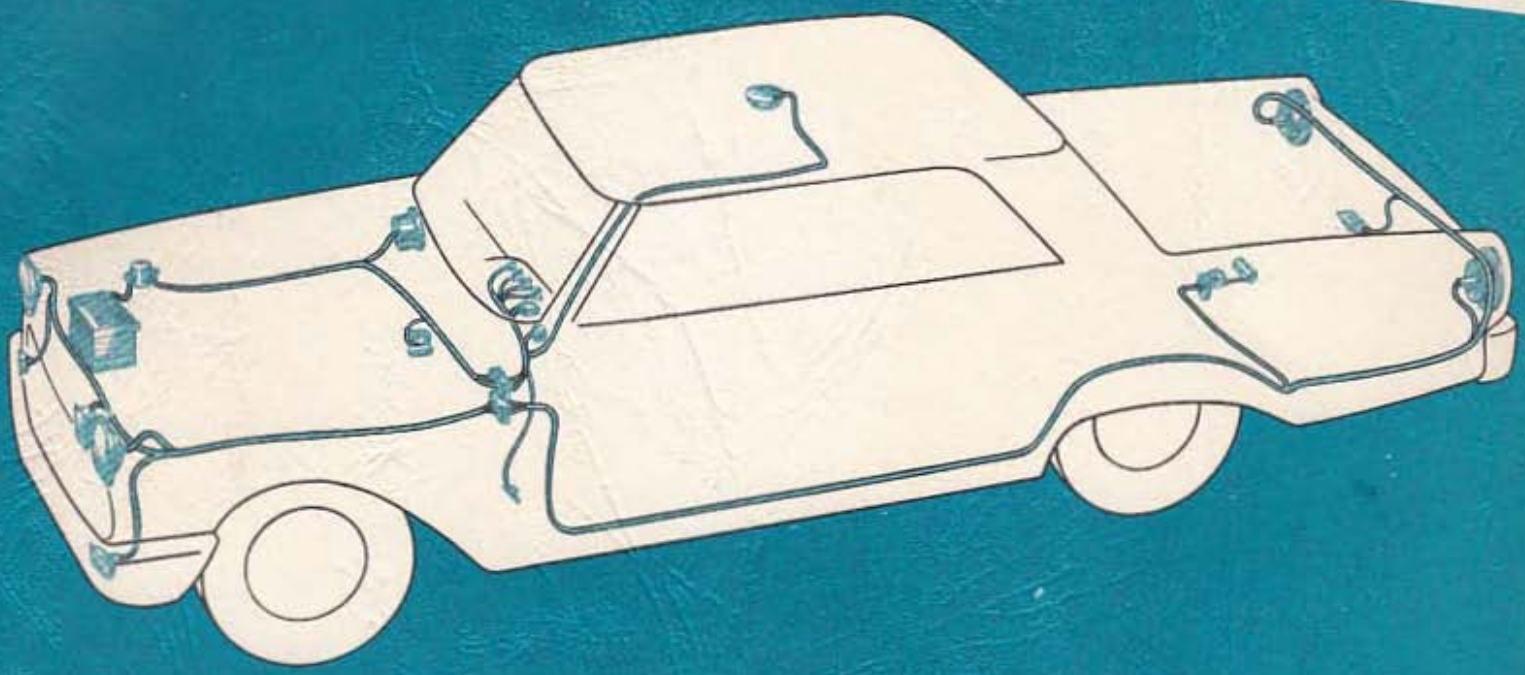
FORD *Service Handbook* 13001



BODY and CHASSIS ELECTRICAL CIRCUITS DIAGNOSIS

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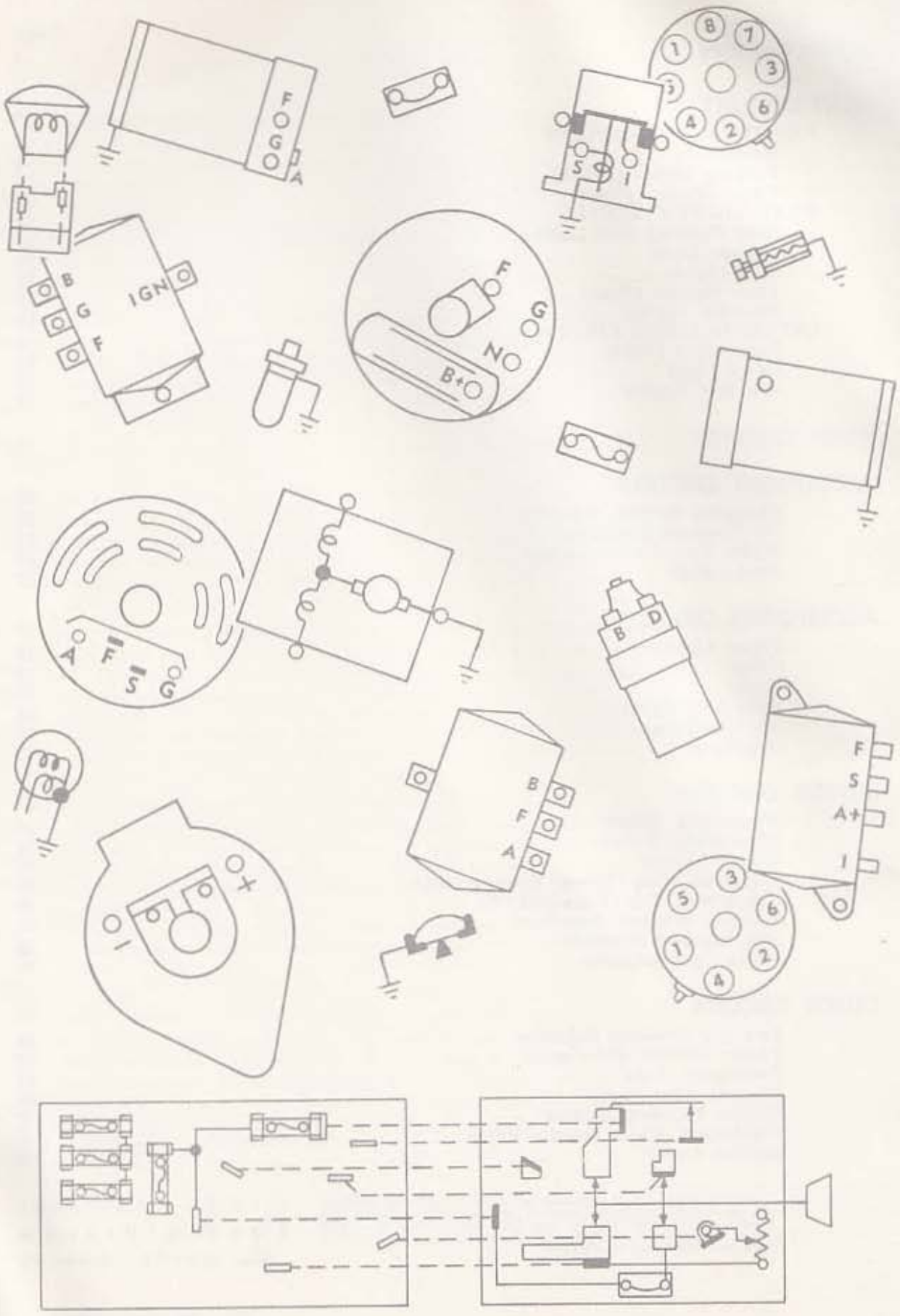
SERVICE DEPARTMENT
FORD DIVISION
Ford MOTOR COMPANY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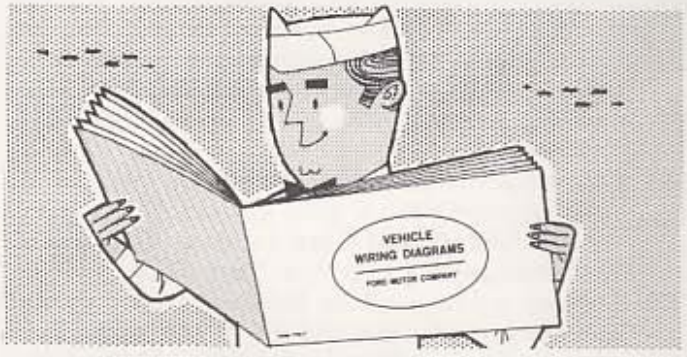
INTRODUCTION

This handbook is divided into six groups covering the conventional and Regular Production Option electrical circuits on Ford Division cars and trucks. The first five groups, as listed in the **Table of Contents,** are common to car and truck; the sixth group deals with circuits which are exclusive truck applications.

Each group is divided into sections which deal with the particular circuit in the group. For example: the lighting circuit group is broken down into front light circuits, rear light circuits and interior light circuits; the lighting sections are broken down into the separate light circuits such as turn signal light circuits, headlight circuits, etc.

Each circuit under consideration is treated as follows: **first,** the type of problem which may exist; **second,** the possible causes of the problem; **third,** the tests which will pinpoint the exact nature and location of the problem.

This handbook covers diagnosis and testing only, and is designed to be used in conjunction with the **Vehicle Wiring Diagrams Manual Form 7795-P, Shop Manuals,** and other applicable **Service Handbooks.** Adjustment, repair, removal and installation procedures are covered in the appropriate **Shop Manual.**



To use this handbook, open it to the group and section dealing with the indicated complaint. For example: oil pressure indicator light circuit troubles will be found in the third group, second section.

The specific troubles are listed on the left side of the DIAGNOSIS GUIDE in a column headed **Complaint.** The possible causes for the complaint are listed on the right side in a column headed **Possible Causes.**

Each complaint is numbered. The possible causes for the complaint are assigned this same number followed by a second number. The first digit in the **Possible Causes** column is the complaint number and the second digit identifies one of the possible causes of the complaint. The same series of digits is used to tie the tests to the complaint and the possible causes for this complaint. The test series for a particular complaint is listed in a logical testing sequence to enable the technician to find the cause of the complaint in the shortest possible time and with a minimum amount of effort.

Example:

HORNS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One horn does not operate.	1-1. Defective horn. 1-2. Defective horn lead or lead connectors. 1-3. Poor ground connection at horn.
2. Both horns do not operate.	2-1. A defect in that part of the circuit between the battery terminal of the voltage regulator and the horn relay. 2-2. A defect in that part of the circuit between the horn relay and the horns. 2-3. Defective horn relay. 2-4. Defective horn button.

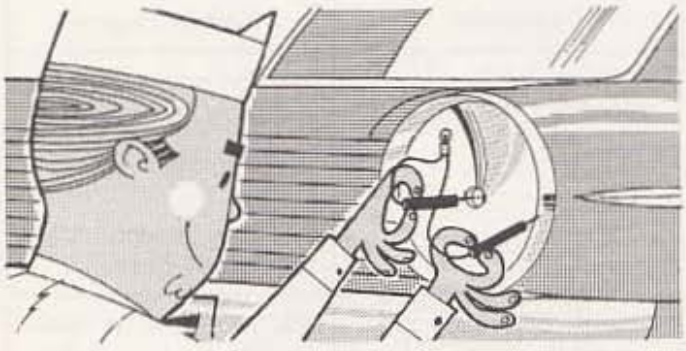
IMPORTANT NOTE

To eliminate unnecessary repetition throughout the contents of this handbook, the following will apply:

a. It is understood that the technician will refer to the **Vehicle Wiring Diagrams Manual—Form 7795-P,** for the location of components, for wiring harness routings and methods of attachment, and for the location of junctions and connections.

b. When reference is made to **"Test for Power"** or **"Check for Power",** it is understood that the test will be performed using a 12-volt test light or a voltmeter. When one test light lead is connected to a good ground and the other lead is connected to a point in the circuit, there is power from the battery to that point if the test lamp lights. If the

test lamp does not light, there is no power to the point being checked. When making this test, always start at a point (terminal or connection) farthest from the current source (battery) and work back toward the current source to the next terminal or connection in the circuit. **If the test lamp lights (indicating power) at one point but does not light (indicating no power) at another point, the trouble is in the circuit between these two points.** This test also can be made using a



voltmeter in place of the test light if it is desirable to know the amount of power to any given point in a circuit.

HOW TO USE the VEHICLE WIRING DIAGRAMS MANUAL–Form 7795-P

Typical Situation: A 1963 Falcon with horns that will not operate.

1. Open the Manual to the first page and note the following:

   a. Falcon, being in the passenger car line, is in **GROUP I**

   b. Falcon-Comet is **PART 1** within the group

   c. A Master Wiring layout of the vehicle is indicated as **SECTION A**

2. The next step is to turn to the diagram symbolized **I-1-A-1.** These symbols are interpreted as **GROUP I–PART 1–SECTION A–PLATE (Page) 1.**
3. On this diagram, locate the horns. Prefixing the word **HORNS** is the number **"9"** within a circle (⑨). The horns are number **"9"** in all diagrams. Under **HORNS** are four or more symbols **(I-1-D-1, 2 & 3)** indicating the pages on which the horn installation and circuit diagrams will be found.
4. Turn to page **I-1-D-1.** This shows a wiring layout of the horn system harness routings and methods of attachment as well as all junctions and connections.
5. In the **EXAMPLE,** under **Complaint 2,** refer to **Test 2-3.** To perform this test, locate the **HORN RELAY.** The **HORN RELAY** is prefixed by the number **"25"** on all diagrams. Turn to page **I-1-D-2** and locate number **"25".** This diagram will show where to make the connections for performing the test.

Tests for Complaint 1

1-1. Check for power at the horn wire connector. Push the horn button. If there is power, make Test 1-2. **If there is no power, the circuit between the two horns is defective.**

1-2. Scrape a spot on the horn bracket until it is clean and bright. Connect a jumper wire to the bright metal spot and a good ground and push the horn button. **If the horn does not operate, it is defective. If it does operate, the ground connection is bad.**

Tests for Complaint 2

2-1. Check for power at the hot lead at the horn relay. **If there is no power, the trouble is in that part of the circuit between the horn relay and the regulator battery terminal.** If there is power, go on to **Test 2-2.**

2-2. Connect a jumper wire between the hot lead and the horn wire lead at the horn relay connector. **If the horns do not operate, the trouble is in that part of the circuit between the horn relay and the horns.** If the horns operate, go on to **Test 2-3.**

2-3. Connect a jumper wire between the horn button relay terminal and a good ground. **If the horns do not operate, the horn relay is defective.** If the horns operate, perform **Test 2-4.**

2-4. Connect a jumper wire between a good ground and the horn button contact. **If the horns operate, the horn button is defective.** If the horns do not operate, proceed to **Test 2-5.**

DEFINITIONS

Amperes–The unit of quantity used to measure current flow.

Circuit–An electrical circuit is the path electricity follows from the time it leaves the battery or source until it returns to the battery or source. An automotive electrical circuit is composed of wires, fuses or other protective devices, switches or controls, and the body, frame and engine or a ground which completes the circuit back to the battery cable to battery. Most automotive electrical circuits are single-wire circuits with the current returning to the source through the body or frame.

INTRODUCTION

Circuit Breaker–A device that automatically opens or breaks the circuit when more than a safe amount of current goes through the circuit. It usually closes again automatically.

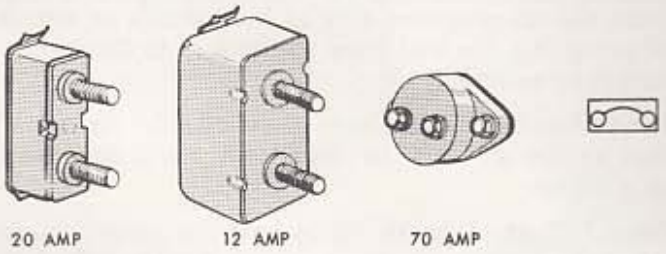


Fig. 1–Typical Circuit Breakers

Component–That part in the circuit where the electricity is to do its work, i.e. a light bulb or motor.

Connections–The places in the circuit where the parts of the circuit are joined together.

Continuity–Continuous path for electricity to travel from one place to another.

Fuse–A device to protect the parts of the circuit from damage if more than a specified amount of current passes through the circuit. It must be replaced each time it "blows".

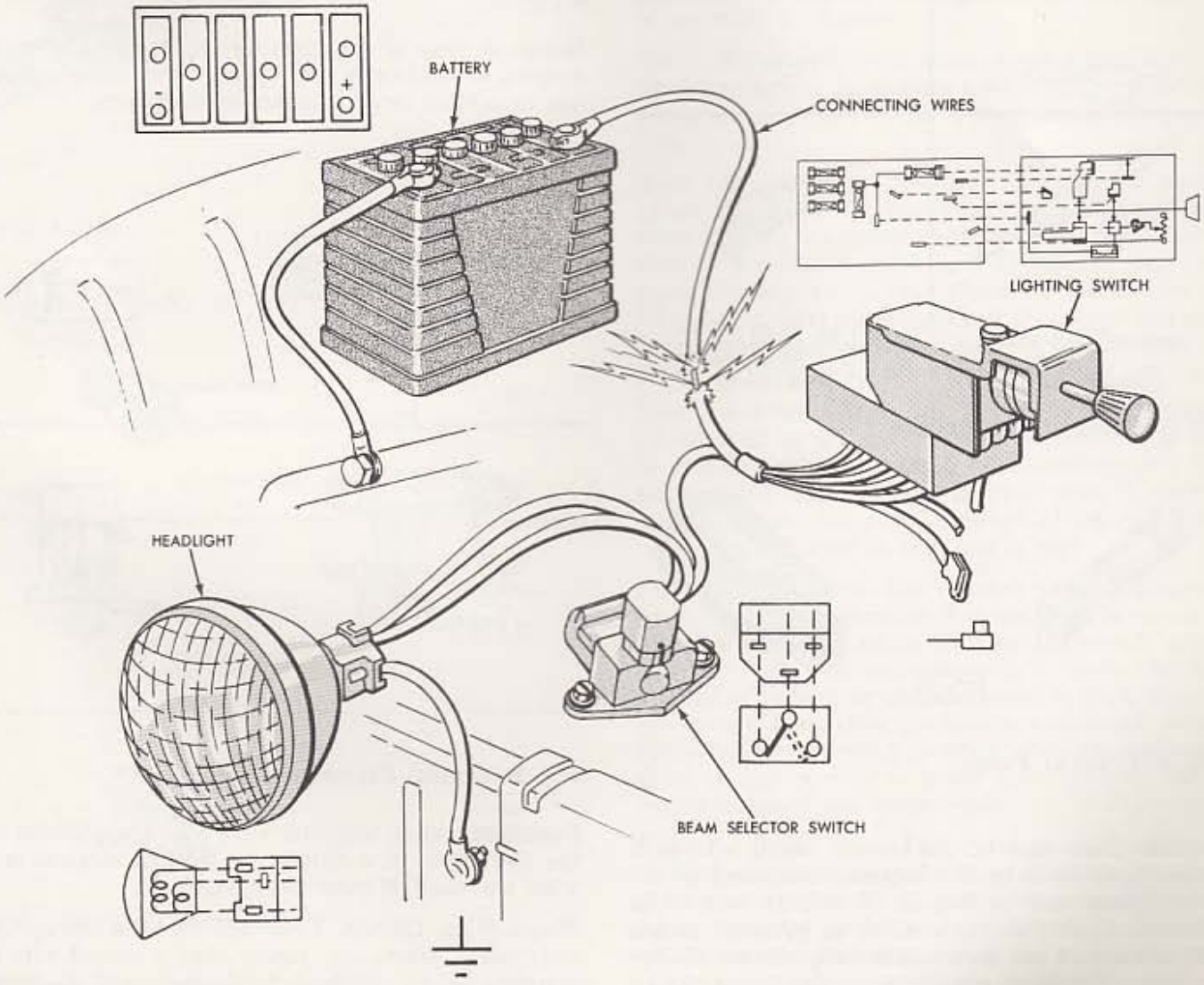


Fig. 2–Components of a Circuit

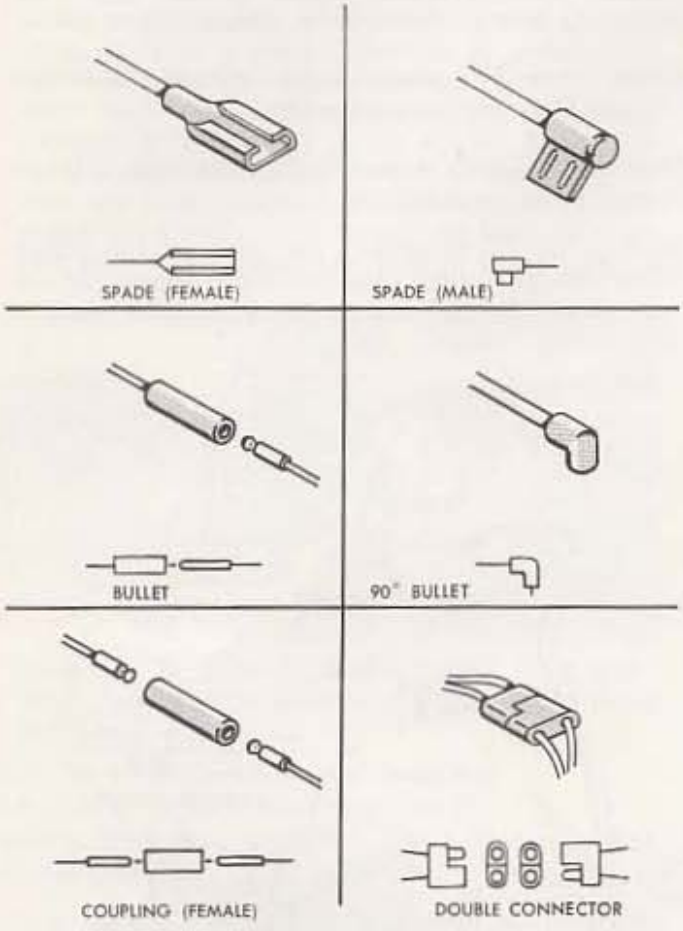


Fig. 3–Types of Connections

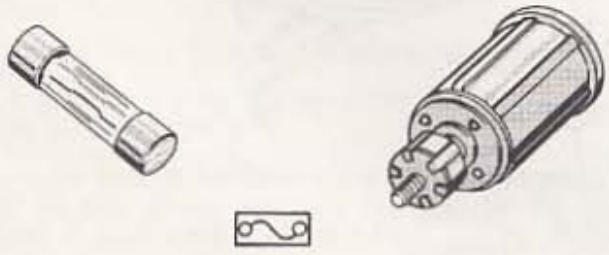


Fig. 4–Types of Fuses

Ground–That part of the circuit which acts as a return path back to the battery; composed of the body, frame and/or engine. A circuit said to be "grounded" or "short-circuited to ground" means that the circuit has been accidentally shortened. For example, if a bared wire between the battery and a light were to touch the body metal, current would flow from the battery, through the body metal and back to the battery instead of to the light.
See **Short.**

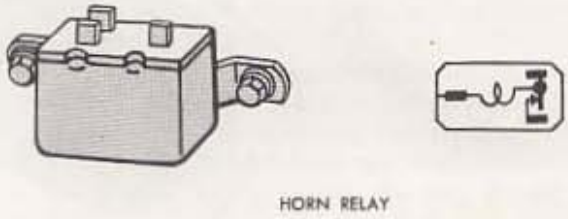
Hot–A term used to describe a lead or connection from the un-grounded side of the battery or source of power, i.e. the lead from the battery to the starter switch or solenoid.

Load–Any device that uses electricity for its operation applies a "load" in the circuit, i.e. a light bulb or a motor.

Open Circuit–A break in the path for electricity to follow in the circuit, i.e. an open switch, a broken wire, separated connection, etc.

Power–The ability of the electrical current to do its work.

Relay–A type of electrical switch in which a small amount of electricity will operate a switch mechanism to control large amounts of electricity.



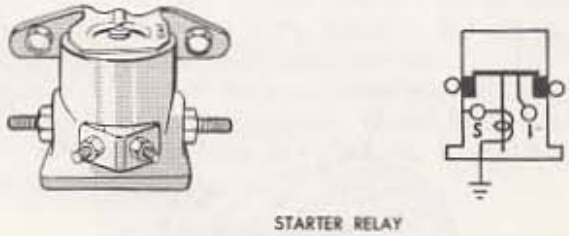


Fig. 5–Typical Electrical Relays

Resistance–Any material that offers opposition to the electricity in a circuit, i.e. broken strands in a wire, corroded or loose connections.

Single-Wire Circuit–Electrical circuits using the body metal, frame etc., rather than a second wire to complete the circuit back to the source of electrical power.

INTRODUCTION

Short–A short is an undesired connection between wires. Generally considered as a wire-to-wire contact. A short takes place between circuits whereas a ground takes place between the wires in a circuit and some grounded part of the vehicle. See **Ground.**

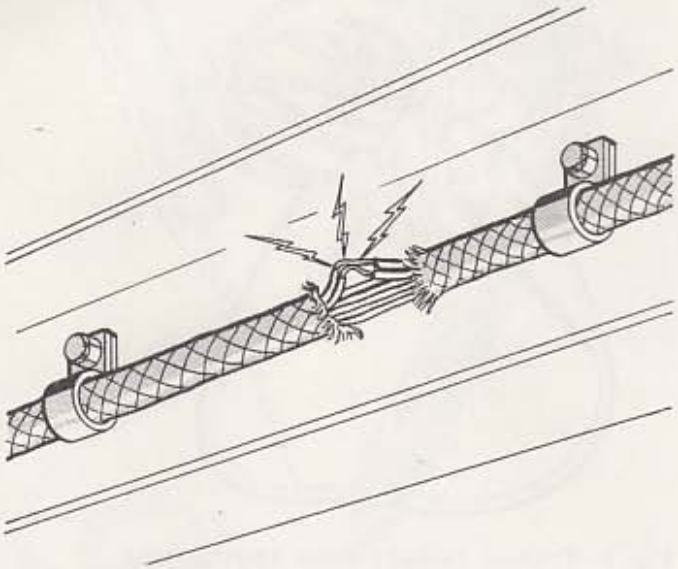


Fig. 6–Short

Switch–A device for opening or closing a circuit.

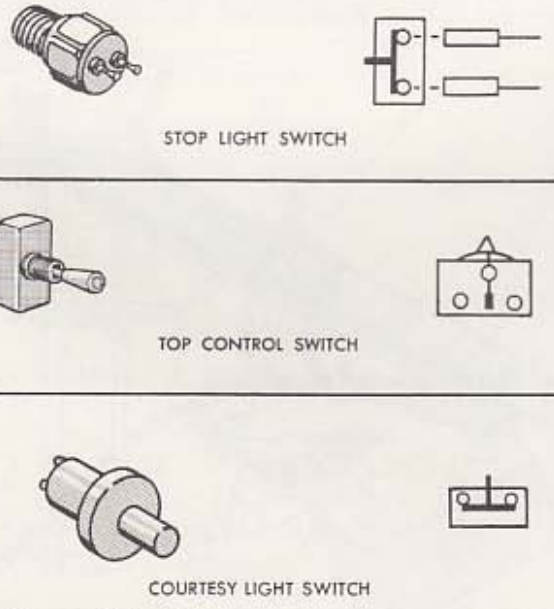


Fig. 7–Typical Switches

Voltage–The electrical "pressure" which forces the current around the circuit.

TYPES OF TESTS

Why Test?

The purpose of testing is to find the defective part. This may be done by:

- a visual inspection
- the substitution of a known good part
- checking for power at different points in the circuit
- checking for complete circuits

Visual Inspection–A visual inspection of the wiring and the parts in the circuit will often reveal the cause of the trouble without the use of testing equipment. Loose or corroded connections, bare wires, or worn insulation may be found by observation. Visual inspection is usually accompanied by movement of wires with the fingers.

Parts Substitution–In some applications such as lighting circuits, it is more convenient to substitute a *known good* bulb to see if that corrects the problem.

Test for Complete Circuits–This test is accomplished by applying power to the circuit to determine if there is a complete path for the power in the part of the circuit under test. The power may come from the battery in the vehicle, in which case the 12-volt test light can be used, or the power can come from a self-powered test light in which case the power is supplied by a battery in the test light unit.

Test for Power–This test is usually made with a 12-volt test light. In some cases a voltmeter is used to give an accurate reading of the voltage at a particular point in the circuit. In other cases it is necessary to know the exact amount of current being used, in which case an ammeter is used.

Current Draw Test–The current draw is indicated by the use of an ammeter. The ammeter is connected into the circuit in series between the supply source and the load. The ammeter will indicate the total amount of current or amperes which is going through the circuit. More than the normal amount of current for which the circuit was designed would indicate a short in the circuit. A lower than normal reading would indicate too much resistance in the circuit.

Voltage Drop Test–The voltage drop test is a method of determining the resistance in a circuit by the use of a voltmeter. A voltmeter connected to any two points of a circuit will read a voltage according to the amount of resistance in the circuit between the two voltmeter connections. If there is little resistance, the voltage reading will be small. If the

resistance is high, the voltage reading will be higher. As a rule, any circuit should have a low voltage drop (0 to .2).

COMMONLY USED TESTING EQUIPMENT

Ammeter–An instrument for measuring the amount of current flowing in a circuit. Sometimes it is necessary to know how much electricity is being used in a circuit. An ammeter is used to provide this information. Connect the ammeter in the circuit so

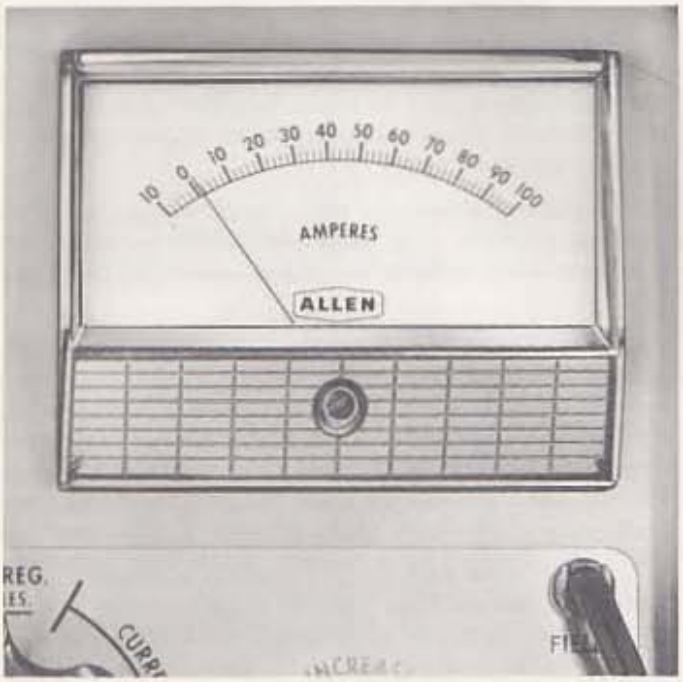


Fig. 8–An Ammeter

that all the electricity goes through the meter. An ammeter is also used to detect shorts or grounds by indicating current flow where it should not exist or by showing excessive current draw.

Jumper Wire–A wire temporarily connected between two connections in a circuit. A switch, lead, relay or fuse can be tested by placing a jumper wire in the circuit to by-pass the part being tested. If the circuit functions satisfactorily with the jumper wire used in place of the part in question, the part is defective.

Test Light–There are two types of test lights. One type includes a battery in its circuit to light the bulb when the leads are connected together or when they complete a circuit. The other type has no battery and depends upon the electricity in the circuit being

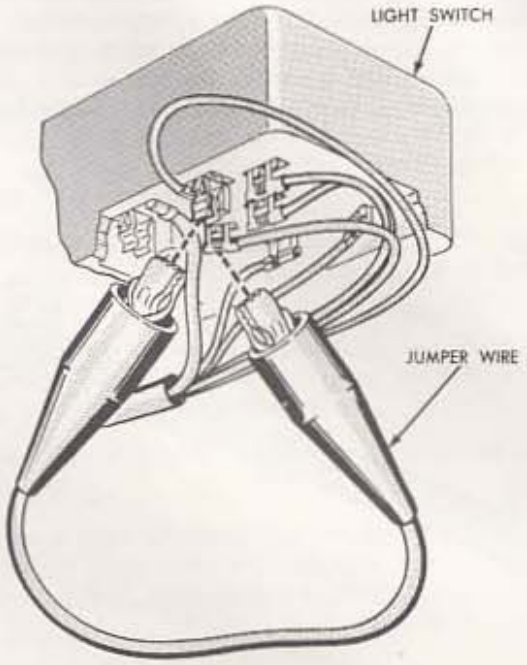


Fig. 9–Typical Jumper Wire Applications

tested to light the bulb. The use of lights is explained under **Test Conclusions**.

12-Volt Test Light–A 12-volt bulb and socket with attached leads is used primarily to determine if

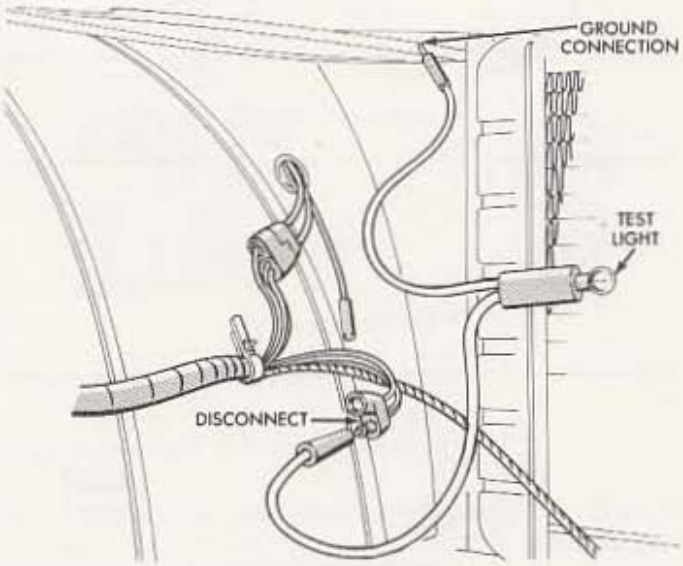


Fig. 10–12-Volt Test Light

there is electrical power at any given point in the circuit. This test is made by connecting the test light between the point in question and a good ground.

Self-Powered Test Light–A device similar to a flashlight with two leads attached to it. When a circuit is completed between the leads, the bulb will light.

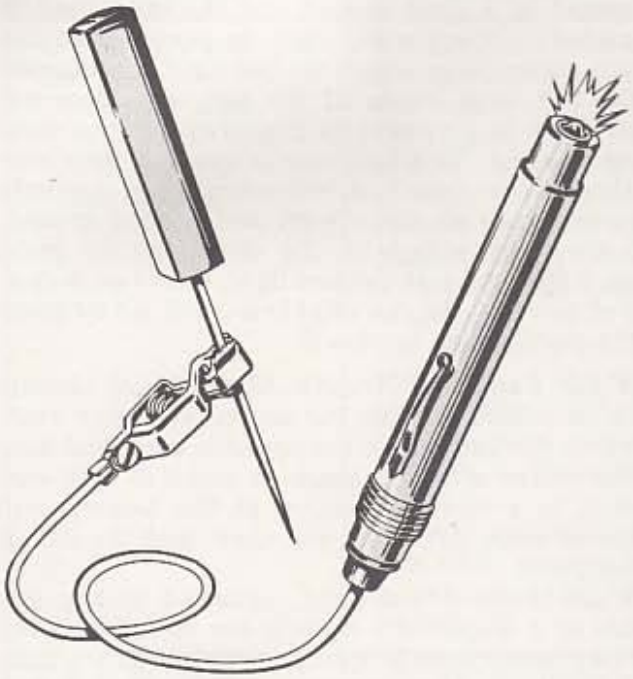


Fig. 11–Self-Powered Test Light

A self-power test light is used to test for complete circuits or continuity (continuous path) between points in a circuit.

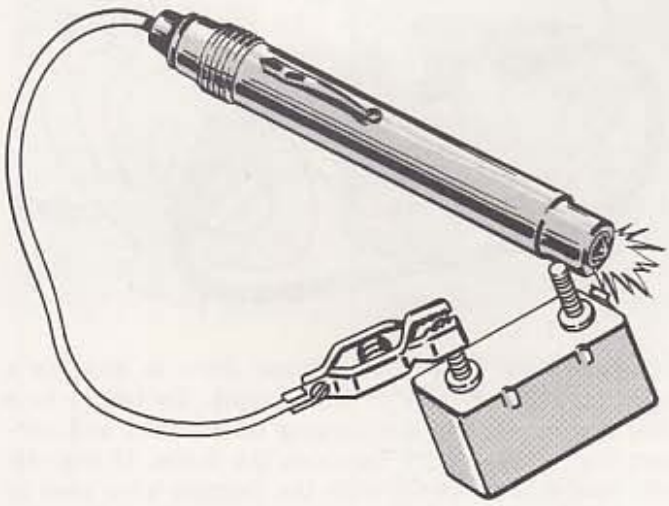


Fig. 12–Testing with Self-Powered Test Light

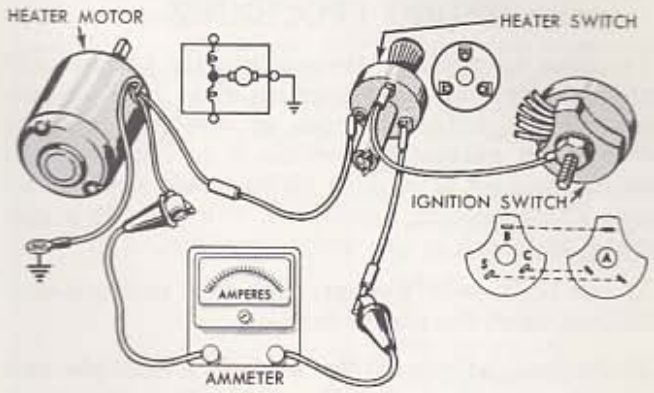


Fig. 13–Testing with an Ammeter

Voltmeter–An instrument for measuring the electrical pressure between two points in a circuit.

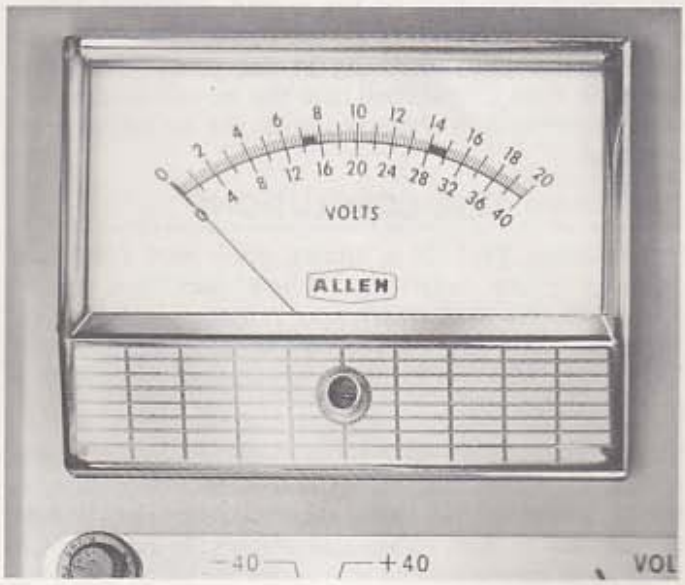


Fig. 14–A Voltmeter

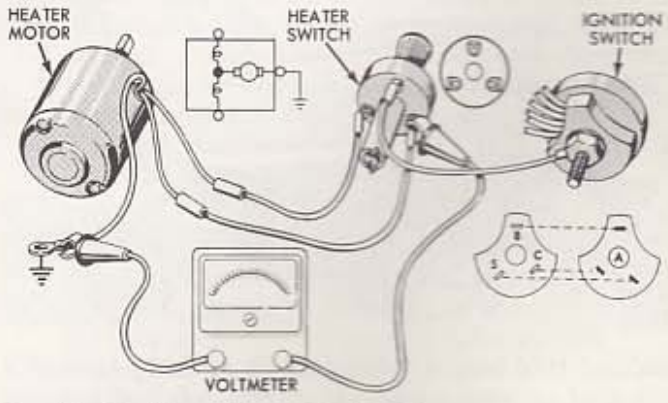


Fig. 15–Testing with a Voltmeter

TESTING PROCEDURES

In order to perform tests efficiently and quickly some definite plan or procedure must be followed. With all the different types of electrical circuits found in an automotive vehicle it is impossible to establish one set procedure which would apply in all cases. The following procedures will provide a systematic approach to any testing problem.

- If the fault is in a single unit in a multiple-unit circuit, start the test at the unit.
- If the fault affects all the units in a multiple-unit circuit, start the test at the point where the circuit gets its power.

An example of this procedure is found in the lighting circuit. If only one lamp in the circuit will not operate, start checking at the light bulb and check back along each part of the circuit until the defective element is found. If all the lights in a circuit do not operate, start checking at the point where the power is first introduced into the circuit and check each connection in sequence until the defective part is found.

TEST CONCLUSIONS

Substitution Test–If a known good part functions properly when substituted for a part that is not operating, the part which was removed is defective. If the part is a fuse or a circuit breaker and the part fails repeatedly, look for an overloaded circuit or a grounded circuit.

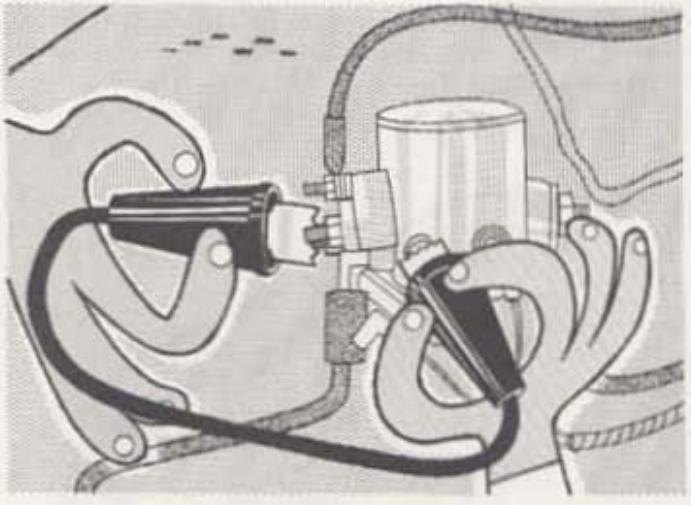
Visual Inspection–The most common problem revealed by visual inspection is a loose connection. A loose connection can cause intermittent operation of the circuit or can cause the circuit to be open. A loose fit or corrosion can also cause the same problem. The wires should be moved around by hand when

making this test. A wire may be rubbing against a sharp sheet metal edge or on the point of a screw and the insulation may be cut or worn through to the wire. If the bare wire comes in contact with the sheet metal or screw, the circuit will be "grounded".

Test for Power–When one 12-volt test light lead is connected to a good ground and the other lead is connected to the circuit, there is power from the battery to the point where the test light is connected if the test lamp lights. If the test lamp does not light, there is no power in the circuit at the point being checked. This test can be made at any connection in the circuit. A voltmeter, when properly connected between the circuit and a good ground, will show the voltage in the circuit at the point being tested. As with the test light, this is an indication of power in the circuit at this point. All switches in the circuit must be closed.

Test for Complete Circuits–All electrical circuits must be complete from the source of power (battery), to the unit where the power is used, and back to the source of power again. A check at each connection in a circuit, starting at the battery, will locate an open circuit or will show that the circuit is complete.

A self-powered test light connected at any two points of a circuit will show if the circuit between the two connections is open or complete. If the lamp does not light, the circuit is open. If the lamp lights, the circuit is complete.



Jumper Wire Test–The jumper wire is used as a substitute for a part in the circuit. To use it in a test, disconnect the leads going to the part and connect the jumper wire between the leads. If the circuit operates properly with the jumper wire used in place of the part, the part which was removed from the circuit is defective. A defective switch, fuse, circuit breaker, relay or similar part may be quickly found by substituting a jumper wire for the part.

LIGHT CIRCUITS

HEADLIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One light will not operate: a. on low beam. b. on high beam. c. either high or low beams.	1-1. Burned out or broken filament in the bulb. 1-2. Loose, dirty or broken connection(s) in that part of the circuit between the bulb and the main wiring harness to the other light. 1-3. Broken wire in that part of the circuit between the bulb and the main wiring harness to the other light. 1-4. Poor ground from the bulb socket to ground part of the circuit.
2. Both headlights will not operate on: a. low beam. b. high beam.	2-1. Loose, dirty or broken connection(s) in that part of the circuit between the lights and the beam selector switch. 2-2. Broken wire in that part of the circuit between the lights and the beam selector switch. 2-3. Defective beam selector switch.
3. Headlights blink or flicker.	3-1. Loose connections at the headlight switch or the beam selector switch. 3-2. Broken wire between the headlight switch and the beam selector switch. 3-3. Defective beam selector switch. 3-4. Defect in the generator regulator. 3-5. Circuit breaker operating because of short or ground.
4. All headlights do not operate, but all other lights do operate.	4-1. Poor connection at the headlight switch or the beam selector switch. 4-2. Broken wire from the headlight switch to the beam selector switch. 4-3. Defective beam selector switch. 4-4. Defective headlight switch.
5. Headlights are dim: a. all the time. b. when engine is idling.	5-1. Low battery voltage. 5-2. Poor connections in the circuit causing high resistance. 5-3. Poor ground connection. 5-4. Short in the circuit. 5-5. A defect in the charging system.

Tests for Complaint 1

1-1. Substitute a good bulb. Turn the headlight switch ON. If the good bulb operates properly, the problem has been solved. If the bulb does not operate, inspect the connections and leads with the switch ON. Be sure the switch is ON when making the following tests.

1-2. Visually inspect for loose or dirty connections. If the cause of the trouble is not found, go to **Test 1-3.**

1-3. Check for power at the low beam terminal in the disconnect (Fig. 16). If there is power, move the ground connection to the disconnect ground terminal. **If there is no power, the ground is bad.** Continue the test for power.

1-4. Test for power.

Tests for Complaint 2

2-1. Visually inspect the wiring and connections.

2-2. Check for power in that part of the circuit from the bulb socket to the beam selector switch.

2-3. **If the cause of the trouble is not found in this part of the circuit, the beam selector switch is defective.**

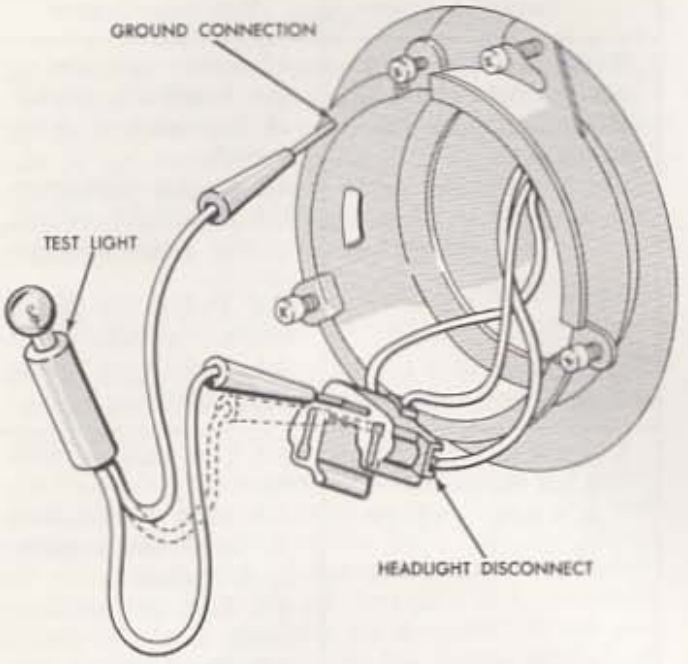


Fig. 16–Headlight Disconnect

Tests for Complaint 3

3-1. Visually inspect wiring and connections between the beam selector switch and the headlight switch. If the visual check does not reveal the cause of the trouble, go on to **Test 3-2.**

3-2. Check for power at the connectors from the headlight connections back to the headlight switch.

3-3. If **Tests 3-1 and 3-2** do not reveal the cause of the complaint, substitute a good beam selector switch for the original switch.

3-4. When the circuit has been thoroughly checked and no cause for the complaint is found, the cause may be in the charging circuit. See Charging Systems in the appropriate Shop Manual.

3-5. Check for voltage at the battery terminal of the headlight switch. If the voltage reading is proper and constant, take a voltage reading at the headlight terminal of the switch. **If the voltage fluctuates, the circuit breaker is operating.** Disconnect the various parts of the headlight circuit. When the defective part is disconnected, the meter will show constant voltage. Connect the circuits.

Tests for Complaint 4

4-1. Visually inspect that part of the circuit between the main wiring harness and the headlight switch. Bad connections, loose or broken wires may be responsible for the complaint. If no trouble is indicated, proceed with **Test 4-2.**

4-2. With the headlight switch in the ON position, check for power at the connections between the main wiring harness and the beam selector switch. If there is no power, perform **Test 4-3.**

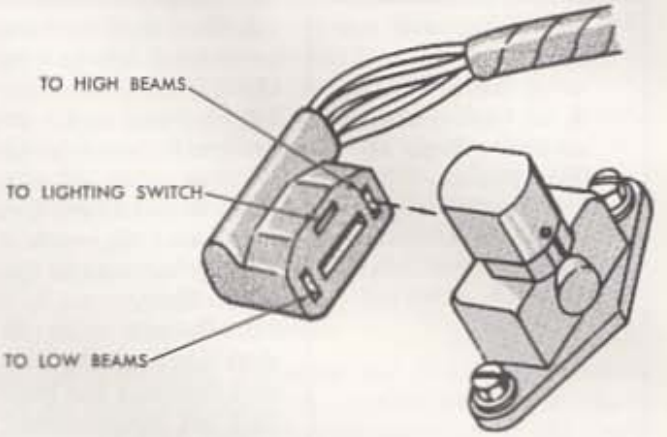


Fig. 17–Beam Selector Switch Disconnect

4-3. Leave the switch ON and check between a good ground and the hot terminal on the beam selector switch. **If there is power, the beam selector switch is defective.** If there is no power, go on to **Test 4-4.**

4-4. Leave the light switch ON and check between a good ground and the hot terminal on the headlight switch (Fig. 17). **If there is power, the switch is defective.**

Tests for Complaint 5

5-1. Make a battery voltage test. Refer to Charging Systems in the appropriate Shop Manual.

5-2. Visually inspect the wiring and connections. If the visual check does not show up any problem areas, connect a voltmeter to a good ground and to the bulb socket connection. Turn the headlight switch ON. A full battery voltage reading at this point **indicates a poor bulb socket ground.** If the reading is less than battery voltage, check at the next connection in the circuit. **If the meter shows full battery voltage at this connector, the trouble is in the circuit between that point and the bulb socket.** If the reading is less than battery voltage, go on to the next connector in the circuit. Go on in this manner until a full battery voltage reading is indicated at a connector. **The trouble will be in that part of the circuit between the point last checked and the point where the full battery voltage is indicated.**

5-3. Check the ground connection (**Test 1-3**).

5-4. If the headlight circuit is shorted, some other electrical system may operate along with the headlights when the switch is turned ON. If this condition exists, follow the procedure used for **Test 5-2. When the voltmeter shows battery voltage at a connector, the short is between that point and the point previously checked.**

5-5. If the cause of dim headlights cannot be found in the headlight circuit, the trouble is probably in the charging system. Refer to the appropriate Shop Manual for the charging system service procedures.

FRONT PARKING LIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One front parking light will not operate.	1-1. Broken or burned out bulb filament. 1-2. Poor connection between the bulb and the socket. 1-3. Poor connection between the bulb socket and ground. 1-4. Open circuit between the bulb socket and main wiring harness.
2. Both front parking lights do not operate.	2-1. Defective headlight switch. 2-2. A defect in that part of the circuit between the switch and the socket connections.

Tests for Complaint 1

1-1. Substitute a known good bulb. If a good bulb does not remedy the condition, proceed with **Test 1-2.**

1-2. Check to see that the bulb is properly seated in the socket. Make a visual check of the connection between the bulb and the socket to make certain it is clean and tight. If no trouble is found here, go on to **Test 1-3.**

1-3. With the headlight switch in the parking light position, check for power between a good ground and the other bulb socket connection. ***If there is power, the socket is not properly grounded.*** If there is no power, proceed with **Test 1-4.**

1-4. Check for power starting at the bulb socket and working toward the switch.

Tests for Complaint 2

2-1. Connect a jumper wire between the headlight switch battery wire connector and the parking light switch wire connection (Fig. 9). **If the parking lights operate with the jumper connected, the switch is defective.** If the lights do not operate, go on to **Test 2-2.**

2-2. Check for power starting at the switch and working toward the socket as in Fig. 18.

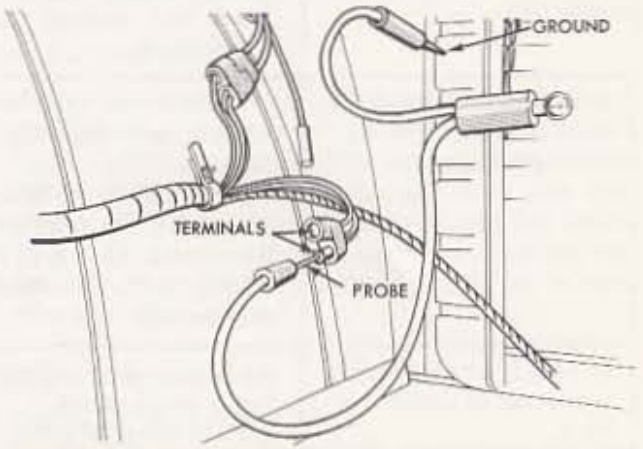


Fig. 18—Test Lamp between Connection and Ground

TURN SIGNAL LIGHTS & STOP LIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One front turn signal light will not operate. Dash panel indicator light operates. Parking light operates.	1-1. Burned out or broken light bulb filament. 1-2. A defect in that part of the circuit between the light socket and the lead disconnect.
2. One set of turn signal lights will not operate. The other set of lights operate. Indicator lights do not operate.	2-1. Defective turn signal switch.
3. One rear turn signal light does not operate. Stop light	3-1. Bulb filament burned out or broken. 3-2. A defect in that

Complaint	Possible Causes
does not operate. Tail lights operate.	part of the circuit between the turn signal switch and the bulb socket. 3-3. Defective turn signal switch.
4. Turn signal lights do not operate.	4-1. Defective fuse. 4-2. Defective flasher. 4-3. A defect in that part of the circuit from the flasher to the switch.
5. Indicator light does not operate. Turn signal lights operate.	5-1. Burned out or broken light bulb filament. 5-2. A defect in that part of the circuit between the bulb socket and the lead disconnect.
6. Indicator light comes on but does not flash.	6-1. One turn signal lamp inoperative. 6-2. Wrong flasher unit.
7. Flasher slows down and stops when engine is idling.	7-1. Defective flasher. 7-2. Low power from the charging circuit. 7-3. Engine idle slow.

Tests for Complaint 1

1-1. Substitute a good bulb. If the bulb does not light, go on to **Test 1-2.**

1-2. Check for power at the turn signal light socket terminal (Fig. 19). If there is no power, check for power at the connections in the circuit between the light socket and the terminal block.

Test for Complaint 2

2-1. Disconnect the turn signal switch leads at the disconnect nearest the turn signal switch. Connect a jumper wire between the turn signal flasher terminal and the turn signal light terminal. **If both the front and rear turn signal lights operate, the switch is defective. If the turn signal lights do not operate, the wires connected to the terminals are loose or broken.**

Tests for Complaint 3

3-1. Substitute a known good bulb. If the bulb does not light, go on to **Test 3-2.**

3-2. Disconnect the bulb socket from the wiring harness. Check for power at the wiring harness connector (Fig. 18). **If there is power, the socket assembly is defective.** If there is no power, check for power at each disconnect starting at the light socket and going toward the switch.

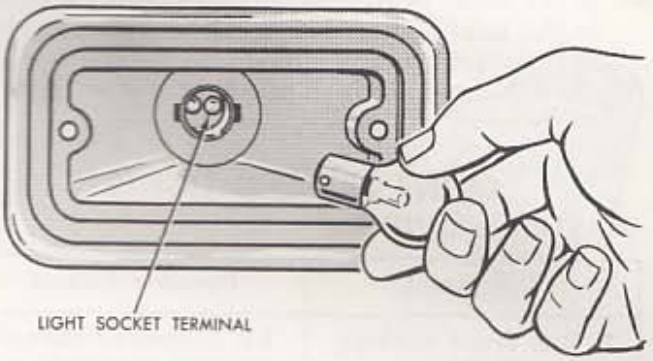


Fig. 19–Light Socket Terminal

Tests for Complaint 4

4-1. Substitute a good fuse. If the lights do not operate with a good fuse installed, go on to **Test 4-2.**

4-2. Substitute a known good flasher. If the lights do not operate with a good flasher installed, go on to **Test 4-3.**

4-3. Check for power at all circuit disconnects between the flasher and the ignition switch. Check for power at each connector between the ignition switch and the turn signal switch disconnect.

Tests for Complaint 5

5-1. Substitute a known good bulb. If the bulb does not light, make **Test 5-2.**

5-2. Check for power at each connection in that part of the circuit between the bulb socket and the terminal block.

Tests for Complaint 6

6-1. Visually inspect the front and rear turn signal lights with the indicator selector turned on. One or the other will probably not light. Substitute a known good bulb. If the good bulb does not light, check for an open in the circuit to the bulb. Check for power at each connection starting at the bulb socket. **The defective part will be found between the connections where the bulb does not light and the next connection where it does light.** If the bulb does not light at any point, the

flasher is not operating properly. Go on to **Test 6-2.**

6-2. Substitute the correct flasher.

Tests for Complaint 7

7-1. Substitute a known good flasher. If the good flasher does not remedy the complaint, go on to **Test 7-2.**

7-2. Low power from the charging system may be determined by a test of the charging system. Refer to the appropriate Shop Manual for proper service procedures.

7-3. Slow engine idle may cause a no-charging condition and slow flasher operation. Refer to the appropriate Shop Manual for proper engine idle adjustment procedures.

REAR PARKING—TAIL LIGHTS & LICENSE LIGHT

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One tail (parking) light does not operate.	1-1. Bulb filament burned out or broken. 1-2. A defect in that part of the circuit between the bulb socket terminal and the wiring harness. 1-3. Poor ground connection between the bulb and the body sheet metal.
2. Both tail (parking) lights and license plate light do not operate.	2-1. Defective headlight switch. 2-2. A defect in that part of the circuit from the headlight switch to the rear lights.
3. License plate light does not operate.	3-1. Bulb filament burned out or broken. 3-2. Poor bulb-to-socket contact. 3-3. Broken lead. 3-4. Loose lead connection to the wiring harness.

Tests for Complaint 1

1-1. Substitute a good bulb. If the substitute bulb does not remedy the complaint, go on to **Test 1-2.**

1-2. With the headlight switch in the parking light position, check for power starting at the socket connection. If there is power, make a visual check to be certain that the bulb contacts the socket connections when it is installed.

1-3. Make a jumper wire check between the bulb socket (with the bulb in place) and a good ground. **If the bulb lights when the headlight switch is in the parking light position, the bulb socket to ground connection is bad.**

Tests for Complaint 2

2-1. Connect a jumper wire between the taillight wire and the main power wire (Fig. 9). **If the taillights operate, the switch is defective. If the lights do not operate, the trouble is in that part of the circuit between the switch and the lights.**

2-2. Check for power starting at the wiring harness connection nearest the rear lights. Work toward the source of current.

Tests for Complaint 3

3-1. Check the bulb **(Test 1-1).**

3-2. Check the bulb-to-socket fit. Check for the correct bulb installation. If the incorrect bulb is used, it may not fit the socket.

3-3. Check for power at the socket.

3-4. Check for power at the lead connection in the wiring harness.

BACK-UP LIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One light does not operate.	1-1. Broken or burned out light bulb filament. 1-2. Defective bulb socket ground connection. 1-3. Poor connections in that part of the circuit between the light bulb and the feed wire from the back-up light switch.

Complaint	Possible Causes
2. Both lights fail to operate.	2-1. Poor connections or broken wires in that part of the circuit between the switch and the bulb leads. 2-2. Defective back-up light switch. 2-3. A defect in that part of the circuit between the headlight switch and the back-up light switch. 2-4. Switch operating linkage improperly adjusted.

Tests for Complaint 1

1-1. Substitute a good bulb for the existing bulb. Turn the ignition switch ON and put the selector in reverse. If the bulb does not light, leave the switch ON and proceed to **Test 1-2.**

1-2. Check for power at the bulb socket connection. If there is power, connect a jumper wire between the bulb socket and the base of the back-up light bulb. **If the bulb lights, the bulb base to bulb socket connection is bad.** If the back-up light bulb does not light, remove the jumper wire connection from the back-up light bulb base and connect it to a good ground. **If the back-up light bulb lights, the bulb socket to ground connection is bad.** If the bulb does not light, go on to **Test 1-3.**

1-3. Check for power starting at the next connector in the circuit.

Tests for Complaint 2

2-1. **If both lights do not operate, the trouble must be in that part of the circuit which is connected to both lights.** Visually inspect all the connections between the lighting switch and the bulb socket lead connections. If the connections appear to be good and are clean and tight, turn the ignition switch ON and move the selector lever to the reverse position. If the lights do operate, leave the switch ON and proceed with **Test 2-2.**

2-2. Check for power at either bulb socket connection. **If there is power, the bulb socket ground connection is defective.** If there is no power at this point, continue the test for power. If there is no power at any connector up to the back-up light switch, leave the ignition switch ON and the selector lever in reverse. Connect a jumper wire between the two switch terminal leads. **If the back-up lights go on, the switch is defective or maladjusted.** If the lights do not go on, leave the ignition switch ON, the selector lever in reverse, and proceed with **Test 2-3.**

2-3. Check for power at the switch hot lead connector nearest the switch. **If there is power, the trouble is in the switch.** If there is no power at this point, continue the test for power.

2-4. Refer to the appropriate Shop Manual for proper switch actuating adjustment procedures.

INSTRUMENT LIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. A single light will not light.	1-1. Burned out or broken light bulb filament. 1-2. A defect in that part of the circuit from the feed wire to the bulb socket.
2. All lights do not light.	2-1. Defective fuse. 2-2. Defective switch. 2-3. A defect in that part of the circuit from the switch to the light.

Tests for Complaint 1

1-1. Substitute a known good bulb. If the good bulb does not light, go to **Test 1-2.**

1-2. Check for power at the socket terminal. **If there is no power, the bulb lead is defective. If there is power, the bulb-to-socket contact is defective.**

Tests for Complaint 2

2-1. Subsitute a good fuse. If the lights do not operate, go to **Test 2-2.**

2-2. Check for power at the panel lights lead connection at the headlight switch. Operate the panel light switch by turning the headlight switch knob. **If there is no power, the switch is defective.** If there is power, go on to **Test 2-3.**

2-3. Check for power at each connection starting at the switch and working to the light sockets.

INTERIOR , DOME & COURTESY LIGHTS

Courtesy lights, pillar lights, and dome lights, all

HORN CIRCUITS

operate on similar circuits. The tests described for checking the dome light will apply to the courtesy lights and pillar lights.

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Dome light does not operate from any switch.	1-1. Bulb filament burned or broken. 1-2. A defect in that part of the circuit between the bulb socket and the operating switches.
2. Dome light does not operate from the right door-operated switch.	2-1. A defect in the power supply circuit to the right door-operated switch. 2-2. Defective right door-operated switch. 2-3. A defect in that part of the light circuit between the right door-operated switch and the headlight switch.
3. Dome light does not operate from the left door-operated switch.	3-1. Defective connections at the switch or defective switch.
4. Dome light does not operate from the dome light switch at the headlight switch.	4-1. Defective dome light switch.
5. Dome light does not turn off.	5-1. Defective right or left door-operated switch or defective dome light switch.

Tests for Complaint 1

1-1. Substitute a known good bulb and turn all switches ON. **If the bulb lights, the old bulb is defective.** If the bulb does not light, go on to **Test 1-2.**

1-2. Check for power at each connection in that part of the circuit between the dome light and the left door-operated switch, starting at the switch.

Tests for Complaint 2

2-1. With the right door-operated switch in the ON position, check for power at the switch hot lead wire. If there is power, go to **Test 2-2.** If there is no power, check for power at each connection in the hot part of the circuit, starting at the door switch.

2-2. Connect a jumper wire between the leads at the door-operated switch. **If the dome light operates, the switch is defective.** If the dome light does not operate, go to **Test 2-3.**

2-3. With the switch in the ON position, check for power at the connections between the switch and the dome light, starting at the door switch and going to the dome light.

Tests for Complaint 3

3-1. Check the connection at the switch. Make sure that they are clean and tight. **If the dome light still does not operate with the switch in the ON position, the switch is defective.**

Tests for Complaint 4

4-1. Check the operation of the dome light at each switch. **If the door switches operate the dome light, the dome light switch at the headlight switch is defective.**

Tests for Complaint 5

5-1. With the right door closed and the dome light switch at the headlight switch OFF, operate the left door-operated switch. If the light does not go out, remove one of the leads from the switch. **If the light goes out, the switch is defective.** If the light does not go out, leave the switch disconnected and remove one of the leads from the right door switch. **If the light goes out, that switch is defective. If the light does not go out, the dome light switch at the headlight switch is defective.**

* * *

HORNS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One horn does not operate.	1-1. Defective horn. 1-2. Defective horn lead or lead connectors. 1-3. Poor ground connection at horn.

HORN CIRCUITS

Complaint	Possible Causes
2. Both horns do not operate.	2-1. A defect in that part of the circuit between the battery terminal of the voltage regulator and the horn relay. 2-2. A defect in that part of the circuit between the horn relay and the horns. 2-3. Defective horn relay. 2-4. Defective horn button. 2-5. Defects in the horn button-to-relay leads.
3. Horns blow continuously.	3-1. Defective horn relay. 3-2. Shorted horn button. 3-3. Short in that part of the circuit between the horn button and the relay.
4. Horns do not sound right; have poor tone quality.	4-1. One or both horns out of adjustment. 4-2. Resistance in the circuit.

Tests for Complaint 1

1-1. Check for power at the horn wire connector. Push the horn button. If there is power, make **Test 1-2. If there is no power, that part of the circuit between the two horns is defective.**

1-2. Scrape a spot on the horn bracket until it is clean and bright. Connect a jumper wire to the bright metal spot and a good ground and push the horn button. **If the horn does not operate, it is defective. If it does operate, the ground connection is bad.**

Tests for Complaint 2

2-1. Check for power at the hot lead at the horn relay. **If there is no power, the trouble is in that part of the circuit between the horn relay and the regulator battery terminal.** If there is power, go on to **Test 2.2.**

2-2. Connect a jumper wire between the hot lead and the horn wire lead at the horn relay connector (Fig. 20). **If the horns do not operate, the trouble is in that part of the circuit between the horn relay and the horns.** If the horns operate, go on to **Test 2-3.**

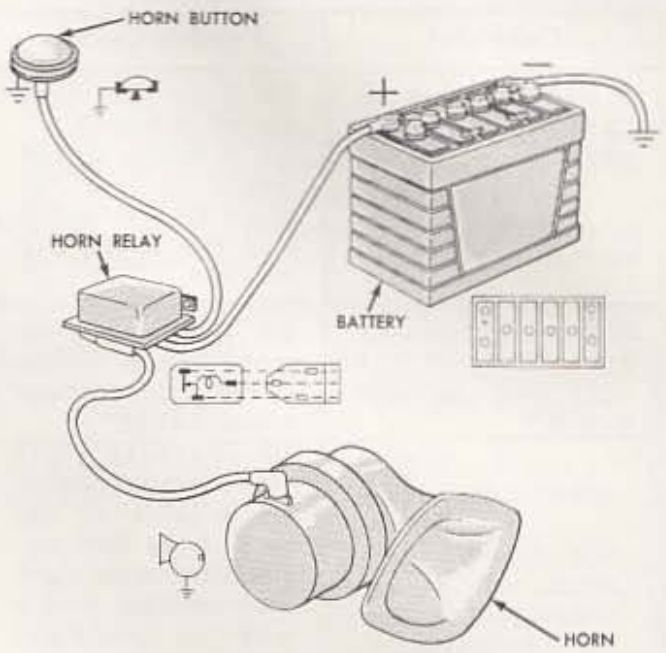


Fig. 20 Horn Circuit

2-3. Connect a jumper wire between the horn button relay terminal and a good ground. **If the horns do not operate, the horn relay is defective.** If the horns operate, perform **Test 2-4.**

2-4. Connect a jumper wire between a good ground and the horn button contact. **If the horns operate, the horn button is defective.** If the horns do not operate, proceed to **Test 2-5.**

2-5. Starting at the connector nearest the horn button, connect a jumper wire between each connector and ground. **The trouble is in that part of the circiut between the connector where the horn operates and the last connector checked.**

Tests for Complaint 3

3-1. Remove the horn button or horn ring. **If the horns stop operating, the trouble is in the horn button.** If the horns do not stop operating, go on to **Test 3-2.**

3-2. Disconnect the horn button lead from the horn relay. **If the horn does not stop operating, the relay is defective.**

3-3. Locate the lead connector nearest the horn button. Starting at this point, disconnect each con-

nector in turn until the horns stop operating. **The trouble is in that part of the circuit between that connector and the last point checked.**

Tests for Complaint 4

4-1. Refer to the appropriate Shop Manual for proper adjustment procedures.
4-2. The tests for this complaint are same as **Test 2-1, 2-2, and 2-3.**

* * *

INDICATORS & GAUGES

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Charge indicator light does not light with the ignition switch ON the engine not running.	1-1. Burned out or broken light bulb filament. 1-2. A defect in that part of the circuit between the ignition switch and the generator regulator. 1-3. Defects in the charging system.
2. Charge indicator light stays on with the ignition switch ON and the engine running.	2-1. Charging system malfunction. 2-2. A short in that part of the circuit from the light to the generator regulator.
3. Oil pressure indicator light does not light with the ignition switch ON and the engine running.	3-1. Light bulb filament burned out or broken. 3-2. Defective oil pressure indicator switch (sending unit). 3-3. A defect in that part of the circuit between the switch and the wiring harness.
4. Oil pressure indicator light stays on with the ignition switch ON and the engine running.	4-1. No engine oil pressure. 4-2. Defective oil pressure indicator switch. 4-3. A defect in that part of the circuit between the light and the oil pressure indicator switch.
5. Temperature gauge does not register with the engine hot and the ignition switch ON. Fuel level gauge operates properly.	5-1. Defective temperature gauge. 5-2. Defective temperature indicator switch (sending unit). 5-3. A defect in that part of the circuit between the sending unit and the constant voltage regulator. 5-4. A defect in that part of the circuit between the constant voltage regulator and the temperature indicator. 5-5. Sending unit not properly grounded.
6. Temperature gauge registers hot with the engine cold.	6-1. Defective temperature indicator sending unit. 6-2. Defective gauge or a defect in that part of the circuit between the gauge and the sending unit.
7. Fuel gauge does not register.	7-1. Defective gauge. 7-2. Sending unit not properly grounded. 7-3. Defective sending unit. 7-4. A defect in that part of the circuit between the gauge and the sending unit.
8. Fuel gauge registers full all the time.	8-1. Defective gauge. 8-2. Defective fuel gauge sending unit. 8-3. A defect in that part of the circuit between the fuel gauge and the fuel gauge sending unit.
9. Both fuel and temperature gauges do not register properly.	9-1. Defective constant voltage regulator.

Tests for Complaint 1

1-1. Substitute a good bulb. If the bulb does not operate, go on to **Test 1-2.**

1-2. Check for voltage at the bulb terminal. **No voltage reading at this point indicates a defect in that part of the circuit from the ignition switch to the light bulb.** If there is voltage at the bulb socket, go on to **Test 1-3.**

1-3. Check for voltage at the generator voltage regulator "A" terminal wire, with the wire removed from the voltage regulator. **If there is no voltage reading at this point, the trouble is in that part of the circuit between the regulator "A" terminal and the indicator light. Voltage at the wire terminal indicates that the trouble is in the charging system.** Refer to the appropriate Shop Manual for charging system service.

Tests for Complaint 2

2-1. Check for voltage at the voltage regulator "A" terminal. With the engine running, the output voltage of the generator will show on the meter. **If the voltmeter shows less than 12 volts with the engine running, the trouble is in the charging system.** Refer to the appropriate Shop Manual for charging system service. If the voltmeter indicates 12 volts or more, go on to **Test 2-2.**

2-2. Start at the voltage regulator and disconnect each connection in turn, until the indicator light goes out. **The trouble is in that part of the circuit between the point where the light goes out and the connection previously disconnected.**

Tests for Complaint 3

3-1. Substitute a good bulb. If the light does not operate, go on to **Test 3-2.**

3-2. Remove the wire from the oil pressure indicator and connect the wire to a good ground. **If the light operates, the switch is defective.** If the light does not operate, go on to **Test 3-3.**

3-3. Disconnect and ground each connection in turn, starting at the oil pressure switch (sending unit). **The trouble is in that part of the circuit between the point where the light goes on and the point previously grounded.**

Tests for Complaint 4

4-1. **STOP THE ENGINE AT ONCE.** Go on to **Test 4-2.**

4-2. Remove the wire from the oil pressure sending unit terminal. If the light does not go out, go on to **Test 4-3.** If the light goes out, substitute a known good sending unit and start the engine. **If the light goes out, the sending unit was defective.** If the light stays on, **SHUT OFF THE ENGINE.** There is no oil pressure. Refer to the appropriate Shop Manual for the proper engine service procedures.

4-3. Disconnect the circuit connections, starting at the oil pressure sending unit and going back along the circuit to the oil pressure indicator light. **When the light goes out, the defect is in the portion of the circuit last disconnected.**

Tests for Complaint 5

5-1. Remove the wire connectors from the gauge terminals. Connect a 3-volt current across the gauge terminals. **If the gauge does not read HOT, it is defective.** If the gauge indicates approximately full scale, go on to **Test 5-2.**

5-2. Connect a voltmeter between the wire connection at the sending unit and a good ground. If any voltage is indicated with the ignition switch ON, go to **Test 5-4.** If no voltage is indicated, go on to **Test 5-3.**

5-3. Check for voltage at each connection, starting at the sending unit and working toward the constant voltage regulator. **The defective portion of the circuit is located between the connectors where voltage is indicated and the point where voltage is not indicated.**

5-4. Remove the sending unit and clean the threads. Replace the sending unit and check it for proper operation. **If the sending unit operates properly, the ground connection was poor. If the gauge does not operate, the sending unit is defective.**

Tests for Complaint 6

6-1. Remove the wire from the sending unit. **If the gauge returns to normal, the sending unit is defective.** If the gauge stays in the hot position, go on to **Test 6-2.**

6-2. Open each disconnect in that part of the circuit between the sending unit and the gauge, starting at the sending unit and working back toward the gauge. Watch the gauge for a minute or two after each disconnect to allow the gauge reading to become stabilized. **The section disconnected prior to obtaining a normal gauge reading is the defective section. If the gauge reading does not return to normal with the sending unit wire disconnected from the gauge, the gauge is defective.**

Tests for Complaint 7

7-1. Apply a 3-volt current to the terminals of the gauge. **If the gauge does not register almost full scale, the gauge is defective.** If the gauge registers approximately full scale, go on to **Test 7-2.**

7-2. Connect a jumper wire between the sending unit and a good ground. **If the gauge registers, the sending unit-to-ground connection is poor.** If the gauge does not register, go on to **Test 7-3.**

7-3. Disconnect the fuel sending unit wire from the sending unit and connect it to a good ground. **If the gauge now registers full scale, the sending unit is defective.** If the gauge does not register, go on to **Test 7-4.**

7-4. Connect a jumper wire to a good ground; start at the gauge and ground each connection between the gauge and fuel tank. As each connection is grounded, the gauge should indicate a full-scale reading. **The trouble is in that part of the circuit between the last connection where the gauge registers and the point where it does not register.**

Tests for Complaint 8

8-1. Disconnect the sending unit wire from the gauge. **If the gauge still registers full, the gauge is defective.** If the gauge registers empty, go on to **Test 8-2.**

8-2. Connect the gauge wire to the gauge and disconnect the wire at the sending unit. **If the gauge registers empty, the sending unit is defective.** If the gauge still registers full, go on to **Test 8-3.**

8-3. Starting at the fuel tank sending unit, disconnect the connections in that part of the circuit between the gauge and the sending unit. **The trouble in the circuit is between the connection where the gauge registers and the last point where it does not register.**

Test for Complaint 9

9-1. Connect the voltmeter negative lead to a good ground and the other lead to the gauge feed wire terminal. With the ignition switch ON, the voltage should oscillate between zero and about 10 volts. **If no voltage is indicated on the voltmeter, the constant votage regulator is defective. If a voltage is indicated, that part of the circuit between the constant voltage regulator and the gauge has a defect.**

CIGAR LIGHTER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Cigar lighter will not operate.	1-1. A defect in that part of the circuit between the cigar lighter and the main wiring harness. 1-2. Defective fuse. 1-3. Defective lighter.

Tests for Complaint 1

1-1. Check for power at the cigar lighter lead at the lighter. **If there is no power, the trouble is in that part of the circuit between the main wiring harness and the cigar lighter.** If there is power, go on to **Test 1-2.**

1-2. Replace the fuse (Fig. 21) with a known good fuse. **If the lighter does not operate, the lighter is defective.** If the lighter is protected with a manual reset type circuit breaker, reset the circuit breaker and check for lighter operation. **If the lighter does not operate, replace the circuit breaker. If the lighter operates, the circuit breaker was defective; if it does not operate, the lighter is defective.**

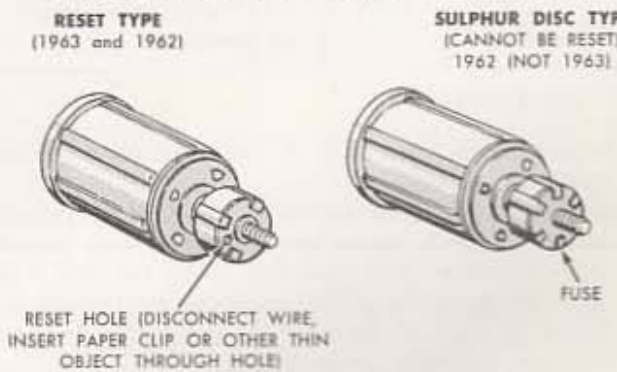


Fig. 21 Cigar Lighter Fuse and Circuit Breaker.

ELECTRIC CLOCK

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Clock will not run.	1-1. Fuse blown. 1-2. A defect in that part of the circuit from the fuse to the clock. 1-3. Defective clock.

Tests for Complaint 1

1-1. Replace the fuse. If the clock does not run, go on to **Test 1-2.**

1-2. Check for power at the clock lead terminal. **If there is power, the clock is defective. If there is no power, the trouble is in that part of the circuit between the fuse block and the clock.**

RADIO & REAR SEAT SPEAKER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. No reception.	1-1. Defective fuse. 1-2. Defects in the antenna circuit or a defective radio.
2. Noisy or erratic reception.	2-1. Loose connection. 2-2. Defective suppression equipment. 2-3. A defect in that part of the circuit from the antenna to the receiver or a defective receiver.
3. Distorted or garbled sound.	3-1. Defective speaker or receiver.

Tests for Complaint 1

1-1. Substitute a good fuse. If the radio does not operate, go to **Test 1-2.**

1-2. Substitute a good antenna. Disconnect the old antenna from the receiver, plug in a known good antenna, and hold the wand out the window. If the radio performs properly, the old antenna or lead is defective. If the radio does not operate, the radio is defective.
See the appropriate Shop Manual for the proper removal and installation procedures. Radio repair work is to be performed by a competent radio repairman.

Tests for Complaint 2

2-1. Check for loose wiring connections or loose attachment of the receiver to the dash. With the radio turned on, try moving the antenna and other wire connections. **If the noise level changes, the connections are loose.** If the noise cannot be located in this manner, the trouble may be in the suppression equipment. See **Test 2-2.**

2-2. See the appropriate Shop Manual for the location and type of suppression equipment.

2-3. Check the antenna connection at the receiver. Push the antenna lead into the radio chassis and try to move it with the fingers. Check the antenna fender installation and visually inspect the antenna for cracks at the base, corrosion or looseness. If these checks do not indicate the cause of the complaint, the receiver is defective.

Tests for Complaint 3

3-1. Substitute a known good speaker. If the good speaker does not remedy the condition, the trouble is in the receiver.

AIR CONDITIONER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Air conditioner blower will not operate.	1-1. A defect in that part of the circuit between the ignition switch and blower motor including the circuit breaker or fuse. 1-2. Defective switch. 1-3. Defective motor.
2. Air conditioner blower will not operate on LO.	2-1. Defective switch.
3. Air conditioner blower will not operate on LO or MED.	3-1. Defective switch.
4. Air conditioner blower will not operate on HI.	4-1. Defective switch.
5. Air conditioning does not get cold. Blower motor is okay.	5-1. A defect in the compressor clutch circuit including the thermostatic switch.

Tests for Complaint 1

1-1. Connect one 12-volt test light lead to a good ground and the other lead to the ignition switch side of the fuse or circuit breaker. **If the lamp does not light, the circuit from the ignition**

switch to the circuit breaker is defective. If the lamp lights, move the test light lead from the ignition switch side of the circuit breaker or fuse to the other side of the circuit breaker or fuse. **If the test lamp does not light, the fuse or circuit breaker is defective.** If the test lamp lights, go on to **Test 1-2.**

1-2. Move the test light lead from ground to the motor terminal of the blower switch. With the test light connected between the fuse to motor lead terminal of the switch, operate the switch through all the positions. With the switch on LO, the light should be dim. With the switch on MED, the light should be brighter. With the switch on HI, the light should be at full brilliance. **If the light does not operate as indicated, the switch is defective.** If the switch is operating properly, go to **Test 1-3.**

1-3. Connect one test light lead to a good ground and the other lead to the circuit breaker lead at the motor. If the lamp does not light, go back to **Test 1-1.** If the lamp lights, connect the motor, disconnect to switch lead at the motor and ground the motor connection. **If the motor does not operate, it is defective.**

Test for Complaint 2

2-1. If the blower operates with the switch in the MED and HI positions but not in the LO position, the switch is defective.

Test for Complaint 3

3-1. If the blower operates with the switch in the HI position but not in LO or MED positions, the switch is defective.

Test for Complaint 4

4-1. If the blower operates with the switch in both the LO and MED positions but will not operate in the HI position, the switch is defective.

Test for Complaint 5

5-1. Connect one test light lead to a good ground. Disconnect the circuit breaker lead wire at the thermostatic switch. Connect the other test light lead to the circuit breaker lead wire. **If the test lamp does not light, that part of the circuit between the thermostatic switch and the blower switch has a defect.** If the test lamp lights, connect the lead wire and continue with the test. With the thermostatic switch and the blower motor switch set in their maximum positions, connect one test light lead to the compressor terminal of the switch and the other lead to a good ground. **If the test lamp does not operate, the thermostatic switch is defective.** If the test lamp lights, the switch is okay. Connect one test light lead to a good ground and the other lead to the wire connection at the compressor. **If the test lamp does not light, the lead to the thermostatic switch is defective. If the test lamp lights, the compressor clutch is defective.** If the tests do not indicate any electrical system malfunction and the unit does not cool properly, refer to the appropriate Shop Manual for the proper service procedures.

OVERDRIVE

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Overdrive will not engage.	1-1. Fuse burned out. 1-2. A defect in that part of the circuit from the ignition switch to the relay. 1-3. Defective relay. 1-4. Defective governor. 1-5. Defective kickdown switch or a defect in that part of the circuit from kickdown switch to the governor. 1-6. Defective solenoid.
2. Transmission will not shift into reverse with the ignition switch ON.	2-1. Overdrive relay-to-governor circuit grounded. 2-2. Defective overdrive relay. 2-3. Defective governor. 2-4. Defective solenoid.
3. Overdrive will not kick down or engine stops when kickdown is attempted.	3-1. Kickdown switch not properly adjusted. 3-2. Overdrive-ignition circuit not properly connected. 3-3. Defective sole-

Complaint	Possible Causes
	noid, kickdown switch or lead.
4. Engine stops when kickdown is attempted.	4-1. A defect in the kickdown circuit or a defective solenoid. 4-2. Defective kickdown switch.

Tests for Complaint 1

1-1. Substitute a known good fuse. If a good fuse does not remedy the trouble, go to **Test 1-2.**

1-2. Turn the ignition switch ON and test for power starting at the ignition terminal (Fig. 22 and 23) of the overdrive relay and working back toward the ignition switch.

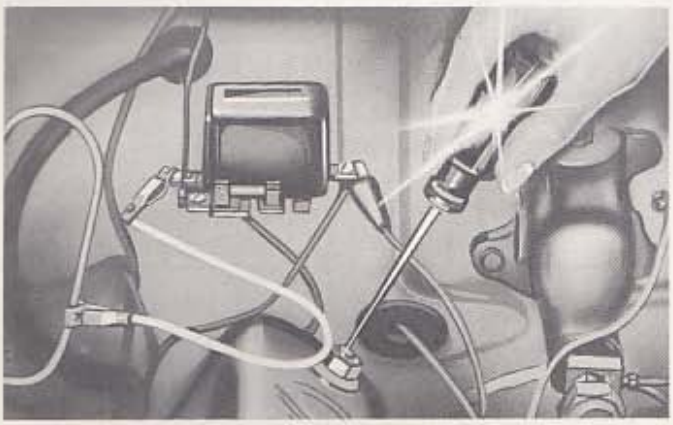


Fig. 22 Checking Overdrive Circuit–Voltage

1-3. Check for power at the solenoid terminal of the overdrive relay Fig. 24. Connect a jumper wire to the kickdown switch terminal on the relay and momentarily ground the other end of the jumper wire. **If the relay does not click or if there is no power, the relay is defective.** If the relay clicks each time the jumper wire is grounded, go to **Test 1-4.**

1-4. Raise the rear wheels off the floor. Remove the the relay and connect a test light between this wire and the ignition terminal at the relay. Start the engine and, with the transmission in high gear, bring the speed up through 28 miles per hour. The lamp should light at or about this speed. Throttle the engine down through 20 miles per hour; at or about this speed, the lamp should go out. If the lamp does not light in the proper speed range, stop the engine, turn

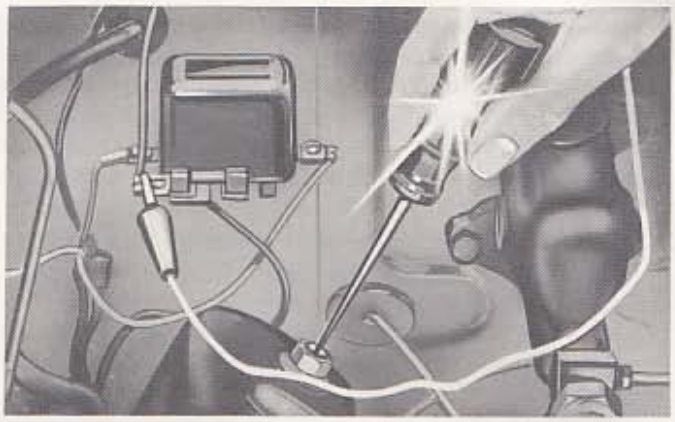


Fig. 23 Checking Overdrive Circuit–Fuse

the ignition switch ON and connect the relay in the circuit. Disconnect the governor wire at the connector and ground it. If the relay cicks, that part of the circuit between the governor and the connector is good. **The trouble must be in the governor or the governor lead wire.** If the relay does not click, go on to **Test 1-5.**

1-5. Disconnect the kickdown switch, turn the ignition switch ON and ground the lead from the relay. **If the relay does not click when the wire is grounded, the lead wire is defective.** If the relay clicks when the wire is grounded, connect the wire to the switch and ground the kickdown switch governor terminal. **If the relay does not click, the kickdown switch is defective. If the relay clicks, the wire from the kickdown switch to the governor connector is defective.** If no trouble is discovered up to this point, go on to **Test 1-6.**

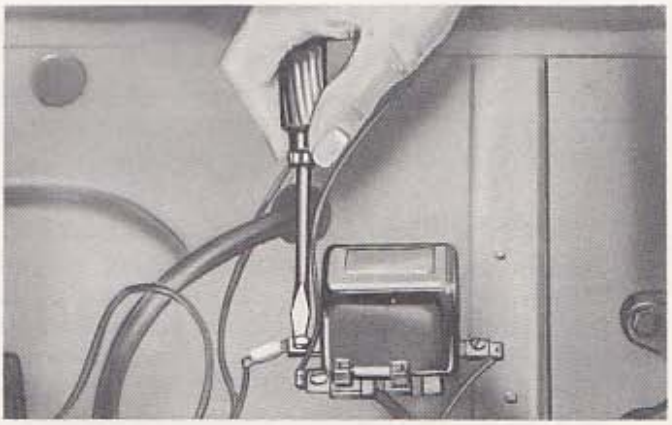


Fig. 24 Checking Overdrive Circuit–Relay

1-6. Turn the ignition switch ON, ground the kickdown switch to governor terminal and listen

for the solenoid to click, indicating that the part of the circuit through the solenoid is good. If it does not click, disconnect the relay lead wire at the solenoid and attach a test light between the disconnected lead wire and a good ground. Momentarily ground the governor lead wire. **If the test lamp does not light when the governor lead wire is grounded, the lead between the relay terminal and the solenoid connection is defective.** If the lamp lights, make a visual inspection of the wire from the connector to the solenoid. If the lead is okay, insert it in the connector. The solenoid should click when the connection is made. **If the solenoid does not click it is defective.** If the electrical system is working properly but the overdrive does not engage, the problem is caused by mechanical trouble. Refer to the appropriate Shop Manual for the proper service procedures.

Tests for Complaint 2

2-1. Turn the ignition switch on and off a few times and listen for the relay and the solenoid to click. **If the relay and solenoid do not click, the problem is mechanical.** Refer to the appropriate Shop Manual for the necessary service procedures. **If the relay and solenoid click, it indicates a ground in that part of the circuit between the relay and the governor, or the relay contacts may be stuck together.** Go on to **Test 2-2.**

2-2. Remove the wire from the kickdown switch terminal on the relay and turn the ignition switch on and off. **If the solenoid clicks, the relay is defective. If the solenoid does not click, the governor circuit is grounded.** Go on to **Test 2-3.**

2-3. Attach the kickdown switch lead wire to the relay and disconnect the kickdown switch lead wire at the governor connection. Ground the lead from the kickdown switch. **If a click is heard in the relay, that part of the circuit to the governor connection is okay, and the trouble is in the governor or governor lead. If the relay does not click, the kickdown switch is defective.** If this test procedure has not pointed out a malfunction, go on to **Test 2-4.**

2-4. Remove the solenoid from the overdrive housing. **If the solenoid comes out without rotating it ¼ turn, it has not been installed properly, or it is defective. If the stem turns freely, the solenoid is defective.** If the solenoid seems to be good, ground it against the transmission case and energize it by grounding the lead wire from the kickdown switch to the governor. **If the solenoid operates, the trouble is in the mechanical portion of the overdrive assembly.** Refer to the appropriate Shop Manual for the proper service procedures.

Tests for Complaint 3

3-1. Refer to the appropriate Shop Manual for the adjustment procedures on the kickdown switch.

3-2. Visually check the kickdown switch wire attachment to the coil.

3-3. Ground the governor terminal, start the engine and bottom the kickdown switch stem by hand. **If the engine stops, the kickdown electrical circuit is operating properly, and the complaint is due to a mechanical problem.** Refer to the appropriate Shop Manual for the proper service procedures. If the engine did not stop running when the kickdown switch stem was bottomed, disconnect the kickdown switch lead at the connector, start the engine and bottom the switch stem. **If the engine stops, the solenoid is defective.** If the engine does not stop, ground the kickdown switch terminal where the solenoid lead is connected. **If the engine stops, the lead from the kickdown switch to the solenoid is defective. If the engine does not stop, the kickdown switch is defective.**

Tests for Complaint 4

4-1. Start and run the engine. Depress the kickdown switch stem by hand. If the engine stops, disconnect the kickdown switch wire at the solenoid. Start the engine, and again depress the kickdown switch. **If the engine stops, it indicates a grounded wire in the interrupter circuit or a defective kickdown switch.** Disconnect the solenoid lead wire from the kickdown switch; start the engine and bottom the kickdown switch by hand. **If the engine continues to run, the ignition coil through the kickdown circuit is operating properly, but the solenoid is defective.** If the engine stops running, go to **Test 4-2.**

4-2. Disconnect the kickdown switch-to-solenoid lead at the kickdown switch, start the engine and bottom the kickdown switch stem. **If the engine stops running, the kickdown switch is defective. If the engine continues to run, the problem is mechanical.** Refer to the appropriate Shop Manual for the proper service procedure.

ELECTRIC WINDSHIELD WIPER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Wiper motor will not operate.	1-1. A defect in that part of the circuit from the ignition switch to the wiper motor. 1-2. Defective circuit breaker. 1-3. Defective switch. 1-4. Defective motor.

Tests for Complaint 1

1-1. Make a visual inspection of all the wires and connections in the wiper circuits. Be certain that all the connections are making proper contact. Turn the ignition switch to the ACC position; check for power at the ignition switch terminal on the circuit breaker. **If there is no power, the lead between the ignition switch and the circuit breaker is defective.** If there is power, go on to **Test 1-2.**

1-2. Move the lead from the ignition switch side of the circuit breaker to the other terminal on the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, the circuit breaker is okay. Move the lead from the circuit breaker to the wire lead at the wiper switch. **If there is no power at this point, that part of the circuit between the circuit breaker and the switch has a defect.** If there is power, go on to **Test 1-3.**

1-3. Check for power between the switch lead and the switch ground wire. **If there is no power, the ground connection is bad.** If there is power, check at the switch-to-motor feed wire connector. **If there is no power with the wiper switch on, that part of the circuit through the switch has a defect.** If there is power, connect the motor feed test lead to the motor park lead wire connector. **If there is no power, the park circuit in the switch is defective. If there is no power in each test, the switch is defective.** If there is power, go on to **Test 1-4.**

1-4. **If the previous tests indicate that all circuits are complete to the motor, the motor is defective.** Before replacing the motor, be certain that the wiper blades operating mechanism is not at fault. Refer to the appropriate Shop Manual for the mechanical checking procedures.

WINDSHIELD WASHER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Windshield washers do not operate. Supply bag full of water and hose connections okay.	1-1. Defective fuse. 1-2. A defect in the circuit wiring or the switch. 1-3. Defective washer motor.

Tests for Complaint 1

1-1. Substitute a known good fuse. If the good fuse does not remedy the trouble, go to **Test 1-2.**

1-2. Turn the ignition switch to the ACC position. Check for power at the ignition switch side of the fuse. **If there is no power, the trouble is in that part of the circuit from the ignition switch to the fuse.** If there is power, test the wiper switch side of the fuse. **If there is no power, the trouble is in the fuse.** If there is power, test the circuit wire connection at the wiper switch. **If there is no power at this point, the trouble is in the fuse-to-switch part of the circuit.** If there is power, test for power at the washer motor lead from the wiper switch. **If there is no power with the switch turned on, the switch is defective.** If there is power, test for power at the wire terminal at the washer motor. **If there is no power, that part of the circuit from the wiper switch to the washer motor has a defect. If there is power, the motor is defective.**

1-3. Refer to the appropriate Shop Manual for the proper removal and installation procedures.

HEATER BLOWER MOTOR

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Heater blower motor does not operate in any switch position.	1-1. A defect in that part of the circuit from the headlamp switch to the heater switch including the fuse. 1-2. Defective heater switch.

Complaint	Possible Causes
	1-3. Defective blower motor.
2. Heater blower motor will not operate in all switch positions.	2-1. Defective switch.
3. Fuses blow.	3-1. A defect in that part of the circuit between the fuse and the motor. 3-2. Defective blower motor.

Tests for Complaint 1

1-1. Check for power between the headlamp switch terminal of the fuse and the motor connection.
1-2. Test for power between the motor feed connections and the motor switch connection. Operate the switch in all positions. **There must be power in all positions except OFF or the switch is defective.**
1-3. **If the previous tests indicate that there is no trouble in the portions tested, the trouble is in the blower motor.**

Test for Complaint 2

2-1. Use the same test as given in **Test 1-2.**

Tests for Complaint 3

3-1. Visually inspect the wiring and connectors between the fuse and the motor. Look especially for a wire with the insulation worn or frayed.
3-2. If **Test 3-1** does not reveal the cause of the trouble, check for power at the motor connection of the fuse circuit. See **Test 1-1. Normal power at this connection indicates that the trouble is in the heater motor.**

CONVERTIBLE TOP (EXCEPT THUNDERBIRD)

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Top control will not operate up or down.	1-1. Defective circuit breaker. 1-2. A defect in that part of the circuit from the circuit breaker to the top control switch. 1-3. Defective top control switch. 1-4. A defect in that part of the circuit from the control switch to the control motor. 1-5. Defective top control motor.
2. Top will not go down. Motor runs with switch in up position.	2-1. Defective top control switch. 2-2. A defect in the switch-to-motor part of the circuit. 2-3. Defective motor.
3. Top will not go up. Motor runs with switch in down position.	3-1. Defective top control switch. 3-2. A defect in the switch-to-motor part of the circuit. 3-3. Defective motor.

Tests for Complaint 1

1-1. Check for power at the battery terminal on the circuit breaker. **If there is no power, the battery circuit is defective.** See the appropriate Shop Manual for battery circuit service procedures. If there is power, test at the switch terminal of the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, go on to **Test 1-2.**
1-2. Check for power at the circuit breaker wire connector at the switch. **If there is no power, the wiring or connectors from the circuit breaker to the switch are defective.** If there is power, go on to **Test 1-3.**
1-3. Connect the switch to the circuit breaker. Check for power at the switch up terminal. Place the switch in the up position. **If there is no power, the switch is defective.** If there is power, test at the down terminal of the switch. Turn the switch to the down position. **If there is no power, the switch is defective.** If there is power, go on to **Test 1-4.**

1-4. With the switch connected in the circuits, check for power at the switch lead wire up terminal at the motor. Move the switch to the up position. **If there is no power, the switch-to-motor part of the circuit has a defect.** If there is power, test at the down wire connection. Move the switch to the down position. **If there is no power, that part of the circuit has a defect.** If there is power, go on to **Test 1-5.**

1-5. With the circuit connected to the motor leads and the switch moved to the up or down position, listen for motor operation. If the motor does not operate, turn the switch to the opposite position. If the motor does not operate with the switch in either position, remove the motor ground lead and ground it to another spot on the body. **If the motor still does not operate with the switch in either the up or down position and the rest of the circuits are complete, the motor is defective. If the motor is operating properly the trouble is in either the hydraulic or mechanical systems.** Refer to the appropriate Shop Manual for service procedures on the hydraulic and mechanical systems.

Tests for Complaint 2

2-1. This test and the other **Tests** for **Complaint 2** can be completed by using the portion of **Tests** for **Complaint 1** which will apply to the motor down circuits. See **Tests 1-1, 1-2, 1-3, and 1-4. Test 1-5** will not apply.

Tests for Complaint 3

3-1. This test and the other **Tests** for **Complaint 3** can be completed by using the portion of **Tests** for **Complaint 1** which will apply to the motor up circuits. See **Tests 1-1, 1-2, 1-3, and 1-4. Test 1-5** will not apply.

CONVERTIBLE TOP (THUNDERBIRD)

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Deck lid will not unlock: a. Top up. b. Top down.	1-1. Defect in the top control neutral switch relay circuit between the ignition switch and the ground connection.
	1-2. Defect in the neutral switch circuit between the top control switch and the 50-ampere circuit breaker.
	1-3a. Defect in the top up deck unlock relay circuit between the relay ground and the top control switch.
	1-3b. Defect in the top down deck unlock relay circuit between the relay ground and top control switch.
	1-4. Defect in the deck unlock motor circuit between the motor ground and the power terminal.
	1-5. Maladjusted limit switches.
2. Deck lid will not open: a. Top up. b. Top down.	2-1a. Defect in the deck open relay circuit between the ground connection and the left deck open limit switch.
	2-1b. Defect in the deck open relay circuit between the ground connection and the top retract limit switch.
	2-2. Defect in the motor circuit between the motor ground and the power terminal.
	2-3. Maladjusted limit switches.
3. Package tray will not erect.	3-1. Defect in the tray erect relay circuit between the ground connection and the top control switch.

MOTOR CIRCUITS

Complaint	Possible Causes
	3-2. Defect in the tray motor circuit between the motor ground and the power terminal. 3-3. Maladjusted limit switches.
4. Top will not retract.	4-1. Defect in the top retract relay circuit between the relay ground and the top control switch. 4-2. Defect in the top retract motor circuit between the motor ground and the power terminal. 4-3. Maladjusted limit switches.
5. Deck lid will not close: a. Top up. b. Top down.	5-1a. Defect in the top up deck close relay circuit between the relay ground and the top control switch. 5-1b. Defect in the top down deck close relay circuit between the relay ground and the top control switch. 5-2. Defect in the deck close motor circuit between the motor ground and the power terminal. 5-3. Maladjusted limit switches.
6. Deck lid will not lock: a. Top up. b. Top down.	6-1a. Defect in the top up deck lock relay circuit between the relay ground and the tray retract limit switch. 6-1b. Defect in the top down deck lock relay circuit between the relay ground and the top retract limit switch.
	6-2. Defect in the deck lock motor circuit between the motor ground and the power terminal. 6-3. Maladjusted limit switches.
7. Top will not go up.	7-1. Defect in the top erect relay circuit between the relay ground and the top control switch. 7-2. Defect in the top erect motor circuit between the motor ground and the power terminal. 7-3. Maladjusted limit switches.
8. Package tray will not retract.	8-1. Defect in the package tray retract relay circuit between the relay ground and the top control switch. 8-2. Defect in the package tray retract motor circuit between the motor ground and the power terminal. 8-3. Maladjusted limit switches.

Before making any electrical tests, listen for the operation of the motors. If the motors operate or try

to operate as the circuits are energized, the problem is not electrical but mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

When the deck lid will not open through the use of the top control switch, an alternate electrical method can be used to open the deck lid.

1. Remove the rear seat back to gain access to the deck unlock and open relays (Fig. 25).

2. Remove the multiple plug from the deck unlock relay (Fig. 26).

3. Fabricate a jumper wire as shown in Fig. 27. Energize the deck unlock motor through the disconnected multiple plug and the relay panel bus bar with the jumper wire.

4. **If the deck lid will not unlock, there is either an open wire to the motor or a failed motor.** The deck lid will have to be unlocked manually.

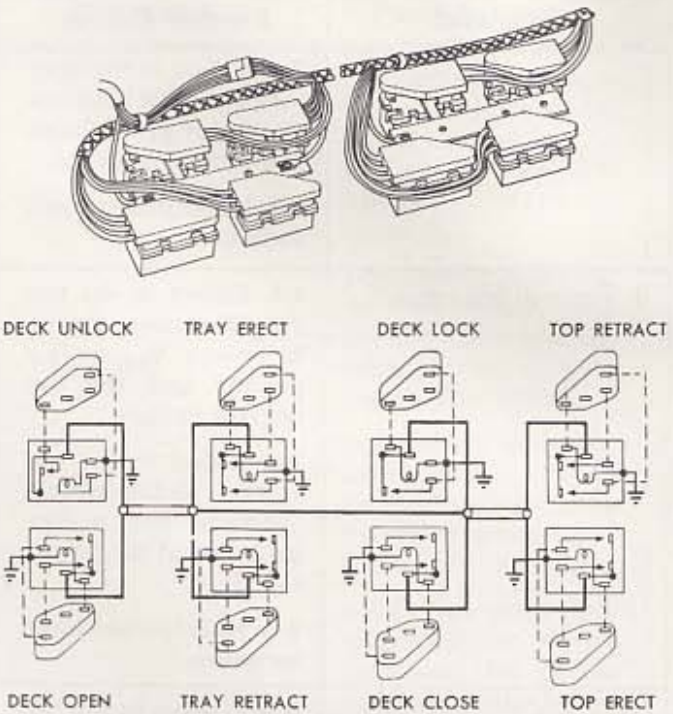


Fig. 25–Control Relay Locations

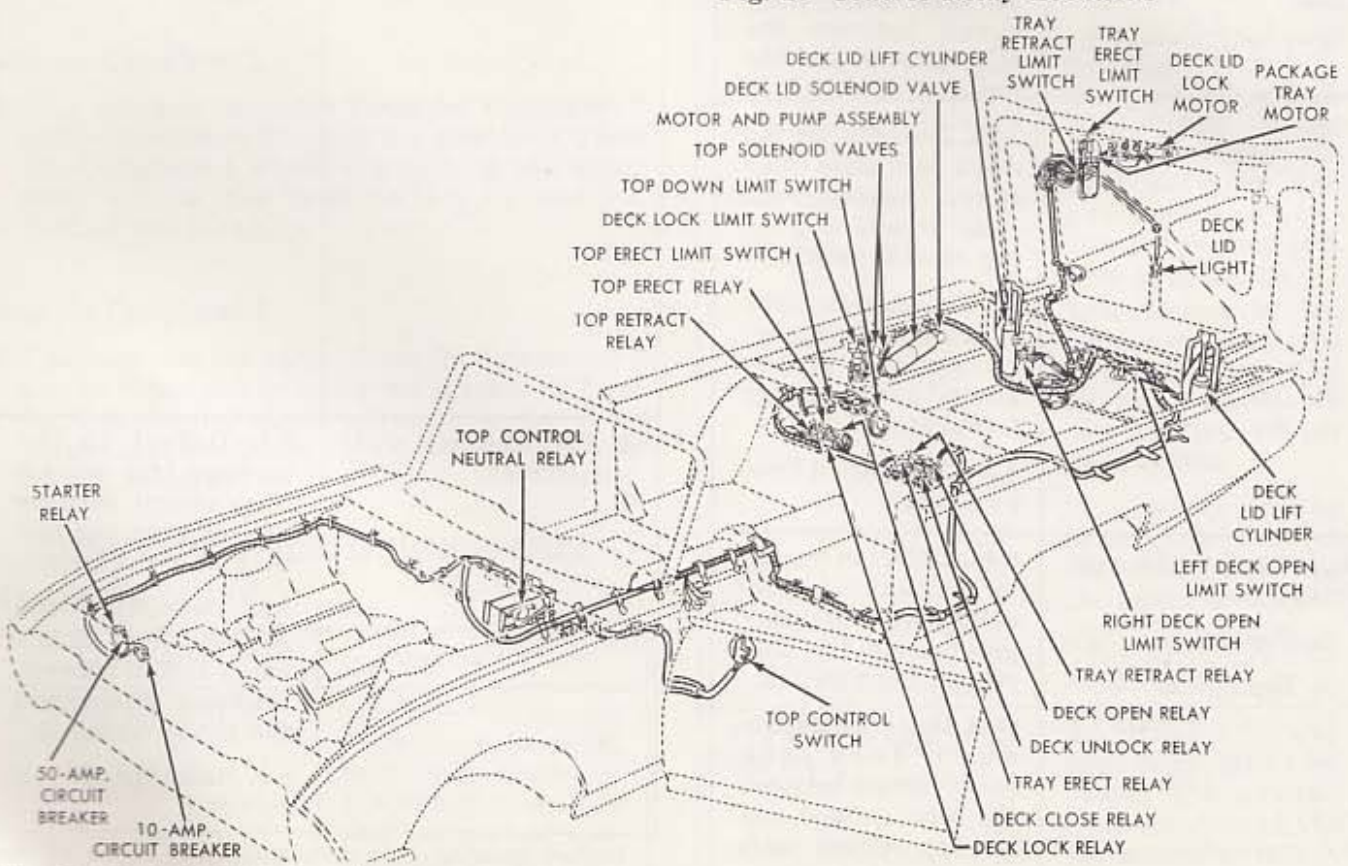


Fig. 26–Limit Switch Locations

5. If the deck lid will not open after being unlocked, remove the multiple plug from the deck open relay located behind the rear seat back. Energize the deck motor and pump assembly through the deck open relay plug with the use of the jumper wire (Fig. 27).

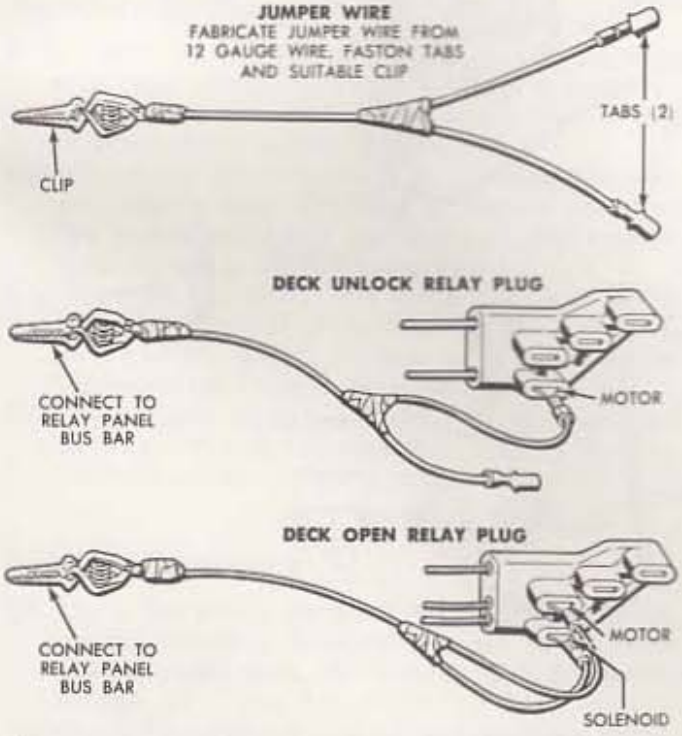


Fig. 27–Jumper Wire for Opening Deck Lid

6. If the deck lid will not open, there is an open wire or a failed motor. If the motor operates but is under a heavy load, the solenoid could not be opening. It will be necessary to manually open the deck lid.

7. Refer to the appropriate Shop Manual for the manual procedures to unlock or raise the deck lid.

Tests for Complaint 1

1-1. Check for power at each connection in the safety relay circuit between the ignition switch and the starting motor relay (Fig. 28). Be sure all switches are closed (Fig. 26). If there is power in this part of the circuit, go to **Test 1-2.**

1-2. Check for power in that part of the circuit from the top control switch to the 50-amp circuit breaker. If there is power at the top control switch (Fig. 29), go to **Test 1-3.**

1-3a. Check for power in the top up deck unlock relay circuit starting at the deck unlock relay ground terminal. **If there is power at the relay ground terminal, a defect exists in the motor circuit.** Go to **Test 1-4.**

1-3b. Check for power starting at the deck unlock relay ground terminal. **If there is power at the ground terminal, the motor circuit is defective.** Go to **Test 1-4.**

1-4. Check for power at the motor connection terminal of the deck unlock relay. **If there is power, the trouble is in the motor circuit. If there is no power, the relay is defective.**

1-5. If no electrical troubles have been found in **Tests 1-1, 1-2, 1-3, and 1-4,** the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

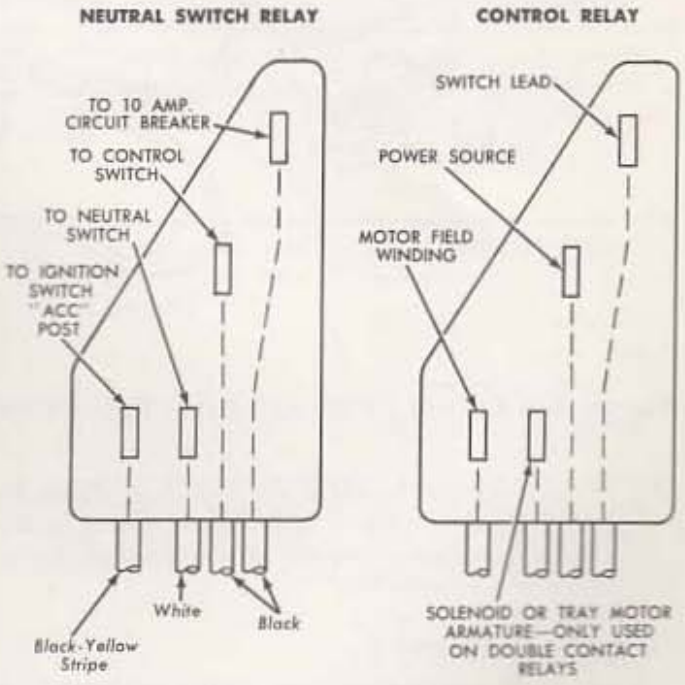


Fig. 28–Relay Wire Connector Identification

Tests for Complaint 2

2-1a. Check for power starting at the deck open relay ground connection. **If there is power at the relay, the trouble is in the motor circuit.** Go to **Test 2-2.**

2-1b. Check for power starting at the deck open relay. **If there is power at the relay, the trouble is in the motor circuit.** Go on to **Test 2-2.**

2-2. Check for power at the motor terminal connections of the deck open relay. **If there is power at the motor terminal, the trouble is in the motor circuit. If there is no power, the solenoid is defective.**

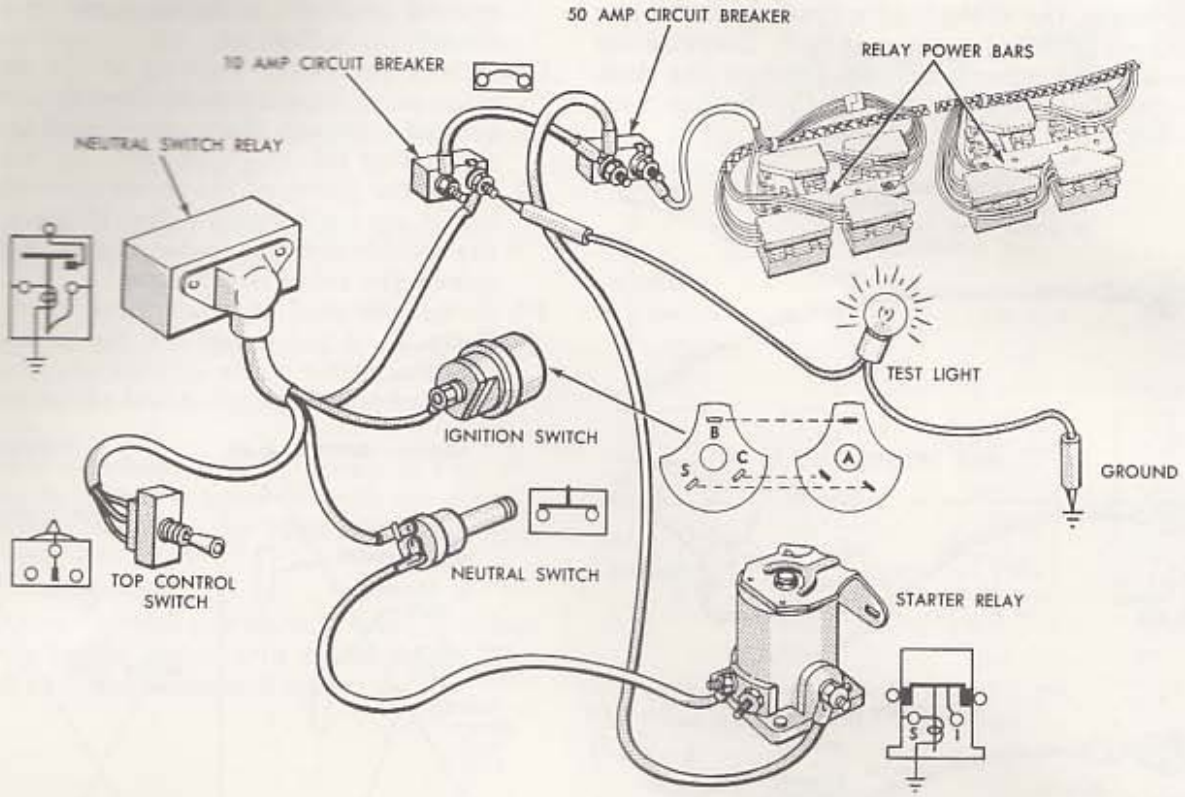


Fig. 29–Top Control Switch and Relay Power Circuits

2-3. If no electrical troubles are found in **Tests 2-1 and 2-2**, the trouble is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

Tests for Complaint 3

3-1. Check for power starting at the package tray erect relay. **If there is power at the relay ground terminal, the trouble is in the motor circuit.** Go on to **Test 3-2.**

3-2. Check for power at the motor connection terminal at the tray erect relay. **If power is found at the relay motor connection, the motor is defective.**

3-3. If no faults are found in the electrical circuits, the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

Tests for Complaint 4

4-1. Check for power starting at the ground connection of the top retract relay. If there is power at the relay ground connection, go to **Test 4-2.**

4-2. Check for power at the motor connection terminal of the top retract relay. **If there is power at the terminal, the trouble is in the motor circuit. If there is no power, the relay is defective.**

4-3. If all the electrical circuits are okay, the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

Tests for Complaint 5

5-1a. Check for power starting at the top up deck lid close relay ground terminal. **If there is power at the relay ground terminal, the trouble is in the motor circuit.** Go to **Test 5-2.**

5-1b. Check for power starting at the top down deck close relay ground terminal. **If there is power at the relay ground terminal, the trouble is in the motor circuit.** Go to **Test 5-2.**

5-2. Check for power at the motor connection of the relay. **If there is power at the motor terminal, the trouble is in the motor circuit. If there is no power, the relay is defective.**

5-3. If no electrical defects have been found in the deck close relay and motor circuits, the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustment.

Tests for Complaint 6

6-1a. Check for power starting at the top up deck lock relay ground terminal. **If there is power at the ground terminal of the relay, the trouble is in the motor circuit.** Go to **Test 6-2.**

6-1b. Check for power starting at the top down deck lock relay ground terminal. **If there is power at the ground terminal of the relay, the trouble is in the motor circuit.** Go to **Test 6-2.**

6-2. Check for power at the motor terminal of the deck lock relay. **If there is power, the trouble is in the motor circuit. If there is no power at the terminal, the relay is defective.**

6-3. If no faults have been found in the electrical circuits, refer to the appropriate Shop Manual for mechanical operation and adjustments.

Tests for Complaint 7

7-1. Check for power starting at the top erect relay ground terminal. **If there is power at the relay ground connection, the trouble is in the motor circuit.** Go to **Test 7-2.**

7-2. Check for power at the motor connection terminal on the relay. **If there is power at the terminal, the trouble is in motor circuit. If there is no power, the relay is defective.**

7-3. If no electrical defects are found in **Tests 7-1 and 7-2,** the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

Tests for Complaint 8

8-1. Check for power starting at the package tray retract relay ground terminal. **If power is found at the ground terminal the trouble is in the motor circuit.** Go to **Test 8-2.**

8-2. Check for power at the motor connection terminal on the relay. **If there is power at the terminal, the trouble is in motor circuit. If there is no power, the relay is defective.**

8-3. If no electrical troubles are found in **Tests 8-1 and 8-2,** the problem is mechanical. Refer to the appropriate Shop Manual for mechanical operation and adjustments.

TAILGATE WINDOW REGULATOR

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Window will not operate from either switch.	1-1. Defective circuit breaker. 1-2. Defect between the safety relay and the circuit breaker. 1-3. Defect between the switch and the motor ground. 1-4. Defective motor.
2. Window will not operate from the key switch.	2-1. Defect between the key switch and the motor ground. 2-2. Defective key switch.
3. Window will not operate from the front switch.	3-1. Defective safety relay. 3-2. Defect between the front switch and the motor ground. 3-3. Defective front switch.
4. Window will not raise from the key switch.	4-1. Defect between the key switch and the wire harness. 4-2. Defective switch. 4-3. Defective limit switch.
5. Window will not lower from the key switch.	5-1. Defect between the key switch and the wiring harness. 5-2. Defective switch.
6. Window will not raise from the front switch.	6-1. Defective switch.
7. Window will not lower from the front switch.	7-1. Defective switch.

Check the tailgate and window alignment before performing any tests on the window operating cir-

cuits. Refer to the appropriate Shop Manual for the proper adjustment procedures. Operate the switches and listen for motor operation. **If the motor operates, the trouble is in the mechanical system.** If the motor does not operate, go on to **Test 1-1.**

Tests for Complaint 1

1-1. Check for power at the battery terminal of the circuit breaker. If there is no power, check the battery and battery circuit. Refer to the appropriate Shop Manual for the proper service procedures. If there is power, test the other terminal on the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, go on to **Test 1-2.**

1-2. Check for power at the circuit breaker lead wire at the window safety relay. **If there is no power, that part of the circuit from the circuit breaker to the safety relay has a defect.** If there is power, go on to **Test 1-3.**

1-3. Refer to the appropriate Shop Manual for lowering the window if it is up and the tailgate cannot be opened. Disconnect the motor from the circuit; check for power at the down wire lead terminal in the disconnect. Turn the key switch to the down position. If the test lamp lights, that part of the circuit to the disconnect is complete. If there is no power, test at the disconnect ground terminal. **If there is no power, the motor ground is defective. If there is power, the motor is defective.**

Tests for Complaint 2

2-1. Check for power at the circuit breaker lead at the key switch. **If there is no power, that part of the circuit from the circuit breaker to the key switch has a defect.** If there is power, go on to **Test 2-2.**

2-2. Check for power at the down circuit connection at the switch. Turn the switch to the down position. **If there is no power, the switch is defective. If there is power, the trouble is in that part of the circuit between the switch and the motor.**

Tests for Complaint 3

3-1. Turn the ignition switch ON. If the relay clicks, the relay and that part of the circuit between the ignition switch and the relay is in good working order. If the relay does not click, check for power at the ignition switch lead on the relay. With the ignition switch on, there should be power. **If there is no power, the ignition switch-to-relay part of the circuit has a defect. If there is power, the relay is defective.** If the relay operates properly, go to **Test 3-2.**

3-2. Check for power at the rear window switch terminal on the relay. Turn the ignition switch ON. **If there is no power, the relay is defective.** If there is power, the relay is operating properly. Check for power at the relay lead at the rear window front switch. Turn the ignition switch ON. **If there is no power, that part of the circuit from the relay to the switch has a defect.** If there is power, go on to **Test 3-3.**

3-3. Check for power at the up terminal on the switch. Turn the switch to the up position with the ignition switch ON. **If there is no power, the switch is defective.** If there is power, move the test lead from the up terminal to the down terminal and move the window switch to the down position. **If there is no power, the switch is defective. If there is power, that part of the circuit from the front switch to the connection in the key switch circuit has a defect.**

Tests for Complaint 4

4-1. Check for power at the circuit breaker wire connection at the key switch. **If there is no power, that part of the circuit between the safety relay and the key switch has a defect.** If there is power, go on to **Test 4-2.**

4-2. Check for power at the up terminal on the key switch. Move the switch to the up position. **If there is no power, the switch is defective.** If there is power, go on to **Test 4-3.**

4-3. Check for power at the key switch wire connection at the limit switch. **If there is no power with the switch in the up position, that part of the circuit from the key switch to the limit switch has a defect.** If there is power, test for power at the motor lead at the limit switch. Close the limit switch and move the key switch to the up posiion. **If there is no power, the limit switch is defective.** If there is power, test the up lead at the motor connection. **If there is no power, that part of the circuit between the limit switch circuit and the motor has a defect. If there is power, the trouble is of a mechanical nature.** Refer to the appropriate Shop Manual for the proper service procedures.

Tests for Complaint 5

5-1. Follow the same procedure as given in **Test 4-1.**

5-2. Follow the same procedure as given in **Test 4-2** but move the switch to the down position instead of to the up position.

Test for Complaint 6

6-1. Follow the same procedure as given in the first part of **Test 3-3.**

Test for Complaint 7

7-1. Follow the same test procedure as given in the second part of **Test 3-3.**

SIDE WINDOW REGULATOR

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One window will not operate from any switch.	1-1. Faulty mechanism. 1-2. Defective motor.
2. One window will not operate from one switch.	2-1. Defective switch. 2-2. Defective switch-to-motor leads or connectors.
3. All windows will not operate.	3-1. Defective window control circuit breaker. 3-2. Defective window safety regulator relay. 3-3. Defects in that part of the circuit from the safety relay to the switch supply system.

Tests for Complaint 1

1-1. Refer to the appropriate Shop Manual for proper procedures to be used in checking the window operating mechanism.

1-2. Some window regulator motors are controlled from two different switches. If the motor does not operate from either switch, the cause of the trouble may be poor motor connections or a defective motor. Visually inspect the connections to make sure they are clean and tight. As a further test to determine the fault is in the motor, check for power between the ground terminal and the switch terminals in the motor disconnect. Operate the window switch up or down according to the connection at the disconnect. If there is no power, connect the ungrounded test lead to the other switch lead connection. If there is no power at this point, connect the ground lead to any good body ground connection. If there is no power in either the up or down circuits, go to **Complaint 3** tests. **If power is available, the motor is defective.**

Tests for Complaint 2

2-1. If the motor operates properly from another switch, it is apparent that the trouble is a defective switch or a defect in the circuit. To check the switch, check for power at the switch feed wire. **If there is no power, the switch feed part of the circuit from the relay has a defect.** If there is power, the feed part of the circuit is okay. Move the ungrounded test lead to the motor terminal on the switch. Move the switch to close the circuit. **If there is no power, the switch is defective.** If there is power, check the other switch terminal. **If there is no power, the switch is defective.** If there is power, go to **Test 2-2.**

2-2. Make certain that the switch is properly connected in the circuit. Check for power at the switch-to-motor lead terminals at the motor connection. **If there is no power with the switch turned on, the switch-to-motor part of the circuit has a defect.** If there is power, test the other circuit. **If there is no power, the switch-to-motor part of the circuit has a defect.**

Tests for Complaint 3

3-1. If all the window regulators do not operate, the trouble is in some part of the system which is common to all circuits, such as the circuit breaker or the window regulator safety relay. Check for power at the battery terminal on the circuit breaker. **If there is no power, the trouble is in the battery circuit.** Refer to the appropriate Shop Manual for proper battery service procedures. If there is power, test for power at the relay terminal of the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, check the window regulator safety relay. See **Test 3-2.**

3-2. Check for power at the circuit breaker lead wire terminal at the relay. **If there is no power, the circuit breaker-to-relay part of the circuit has a defect.** If there is power, the circuit is okay. The relay should click as the ignition switch is turned on and off. If the relay does not click, check for power at the ignition switch lead wire at the relay. Turn the ignition switch on. **If there is no power, the lead wire is defective. If there is power in this test, the relay is defec-**

tive. If the relay clicks when the ignition switch is turned on and off, check for power at the switch terminal on the relay. Turn the ignition switch on and off. There should be power when the ignition switch is turned on and no power when the ignition switch is turned off. **If there is no power, the relay is defective.** If there is power, check the relay-to-switch supply part of the circuit. See **Test 3-3.**

3-3. With the relay connected in the system, check for power at the relay lead connection at the switch junction connectors. Turn the ignition switch on. **If there is no power, the relay-to-switch lead or connectors are defective.** If there is power, test for power starting at the relay-to-switch lead.

4-WAY SEAT ADJUSTER

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Seat adjustment motor will not operate.	1-1. Defective circuit breaker. 1-2. Defect between the circuit breaker and the seat regulator relay. 1-3. Defective switch. 1-4. Defective seat relay. 1-5. Defective motor.
2. Seat will not move up or down. Motor runs.	2-1. Defective switch. 2-2. Defective solenoid.
3. Seat will not move forward or rearward. Motor runs.	3-1. Defective switch. 3-2. Defective solenoid.

Tests for Complaint 1

1-1. Check for power at the battery terminal on the circuit breaker. **If the test lamp does not light, that part of the circuit between the battery and the circuit breaker has a defect.** Refer to the appropriate Shop Manual for battery circuit service procedures. If there is power, move the test lead to the switch terminal on the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, go on to **Test 1-2.**

1-2. Check for power at the circuit breaker wire terminal at the seat regulator relay. **If there is no power, the circuit breaker is defective.** If there is power, make the same test at the circuit breaker wire terminal at the seat control switch. **If there is no power, the circuit breaker-to-switch part of the circuit has a defect.** If there is power, go on to **Test 1-3.**

1-3. Check for power at any seat motor terminal. Be certain the seat adjusting switch is connected properly. Move the switch to any operating position and observe the test power indication. **If there is no power, the switch is defective.** Perform this same test at each of the motor connections and at each solenoid lead. **If there is no power at any of the points checked, the switch is defective.** If there is power, go on to **Test 1-4.**

1-4. Disconnect the relay from the motor and check for power at a motor field lead at the relay. **If there is no power when the switch is operated, that part of the circuit through the relay has a defect.** If there is power, ground the motor field lead that is not connected in the test and move the test lead from the motor field lead to the motor armature lead. **If either the relay does not click or if no power is indicated, the relay is defective.** If there is power, that part of the switch circuit through the relay is operating properly. Perform the same tests using the other part of the switch circuit through the relay. If the tests indicate that the circuits are complete to the motor, go on to **Test 1-5.**

1-5. Connect the motor to the relay, ground the motor-to-ground lead and move the switch through the different positions. **If the motor does not operate properly at each switch position, the motor is defective.**

Tests for Complaint 2

2-1. Check for power at the vertical solenoid terminal of the switch. Move the switch to the raise and lower positions. **If there is no power, the switch is defective. If there is power, the trouble is mechanical.**

2-2. Refer to the appropriate Shop Manual for the correct mechanical service procedures.

Test for Complaint 3

3-1. Check the horizontal switch and solenoid circuits. Use the same test procedures as outlined for **Complaint 2.**

LOW AIR PRESSURE INDICATOR

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Buzzer does not operate. Air pressure low.	1-1. A defect in the ignition switch-to-buzzer part of the circuit. 1-2. Defective buzzer. 1-3. Defective air pressure switch.
2. Buzzer will not shut off. Air pressure normal.	2-1. Grounded buzzer-to-switch part of the circuit. 2-2. Defective air pressure switch.

Tests for Complaint 1

1-1. Connect a jumper wire between the air pressure switch terminal and a good ground. If the buzzer sounds, the circuit is good and the buzzer is good. If the buzzer does not sound, check for power at the ignition switch lead at the buzzer. **If there is no power with the ignition switch on, the trouble is in the ignition switch-to-buzzer part of the circuit.** If there is power, go on to **Test 1-2.**

1-2. Disconnect the air pressure switch lead at the buzzer. Connect a jumper between the buzzer terminal and a good ground. With the buzzer connected to the ignition switch and the switch turned on, the buzzer should sound. **If it does not sound, the buzzer is defective.** If the buzzer sounds, the buzzer is okay. Go on to **Test 1-3.**

1-3. Remove the lead at the air pressure switch. Ground the lead. The buzzer should sound. **If it does not sound, that part of the circuit from the buzzer to the air pressure switch has a defect. If the buzzer sounds and there is no air pressure, the air pressure switch is defective.**

Tests for Complaint 2

2-1. Disconnect the buzzer lead at the air pressure switch. **If the buzzer shuts off, the switch is defective. If the buzzer does not shut off, that part of the circuit from the buzzer to the switch has a defect.** Disconnect the switch lead wire at the buzzer. **If the buzzer shuts off, the lead wire is defective. If the buzzer does not shut off, the buzzer is defective.**

POWER DIVIDER DIFFERENTIAL WARNING LIGHT

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Lamp does not light with differential locked out.	1-1. Burned out or broken bulb filament. 1-2. A defect in that part of the circuit from the ignition switch to the lockout switch. 1-3. Defective lockout switch.

Tests for Complaint 1

1-1. Substitute a good bulb. If the bulb does not light, go on to **Test 1-2.**

1-2. Check for power at the ignition switch lead terminal. If there is power, that part of the circuit from the ignition switch to the lockout switch is okay. Go on to **Test 1-3. If there is no power, that part of the circuit has a defect.**

1-3. Disconnect the leads from the lockout switch. Connect a jumper wire between the wire connectors. **If the lamp operates, the switch is defective. If the lamp does not operate, the trouble is in that part of the circuit from the lockout switch to the lamp.**

TWO-SPEED AXLE

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Motor will not operate. Ignition switch on.	1-1. Defective circuit breaker. 1-2. A defect in the axle switch circuit.
2. Speedometer adapter does not operate.	2-1. Defective adapter. 2-2. A defect in that part of circuit from the switch to the adapter.

Tests for Complaint 1

1-1. Check for power at the ignition terminal of the circuit breaker. **If there is no power, the trouble**

is in that part of the circuit from the ignition switch to the circuit breaker. If there is power to the circuit breaker, check for power at the other terminal of the circuit breaker. **If there is no power, the circuit breaker is defective.** If there is power, the circuit breaker is okay. Go on to **Test 1-2.**

1-2. Disconnect the leads at the motor. Check for power at the switch lead. Operate the switch in the proper position to complete the circuit. **If there is no power, the circuit has a defect.** If there is power, the circuit is okay. Test the other circuit using the same procedure. **If there is power in both circuit tests, the motor is defective.** Refer to the appropriate Shop Manual for proper motor service procedures.

Tests for Complaint 2

2-1. Turn the ignition switch on. Move the 2-speed axle switch to the low speed position; check for power at the speedometer adapter lead connection. **If there is power, the speedometer adapter is defective. If there is no power, the switch-to-adapter part of the circuit has a defect.**

ELECTRIC FUEL PUMP

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Fuel pump does not operate.	1-1. Defective electrical circuit. 1-2. Defective fuse. 1-3. Defective motor. 1-4. Defective safety switch. 1-5. Defective primer switch.

SINGLE PUMP SYSTEM

Tests for Complaint 1

1-1. Disconnect the feed wire at the fuel pump. Check for power at the fuel pump. Turn the ignition switch to the START position. If there is power, the wiring circuit through the primer switch and the safety switch is satisfactory. Release the start switch. If power is still indicated with the engine running, the electrical circuit to the fuel pump motor is satisfactory. **The motor is defective or the ground part of the circuit has a defect.** Go to **Test 1-3. If there is no power, the trouble is in the circuit.** Check the fuse and the safety switch.

1-2. Substitute a good fuse. If the light does not operate, the trouble may be in the safety switch. Go on to **Test 1-4.**

1-3. If in **Test 1-1** the circuit operated properly, the trouble is in the motor or the motor ground part of the circuit. Test the motor ground part of the circuit. Connect a test light between the motor feed wire and the ground lead at the motor disconnect. Turn the ignition and primer switches on. **If the lamp does not light, the trouble is in ground part of the circuit. If the lamp lights, the motor is defective.**

1-4. Check for power at the terminal of the wire from the fuse at the safety switch. Turn the ignition switch on. **If there is no power, that part of the circuit from the fuse to the safety switch has a defect.** If there is power, connect the ungrounded test light lead to the pump terminal of the safety switch. Start the engine. If there is power, the switch is okay. **If there is no power, the switch is defective.**

1-5. Disconnect the terminal plug from the primer switch. Check for power at the ignition switch (coil) lead connection in the terminal plug. Turn the ignition switch on. **If there is no power, that part of the circuit from the ignition switch to the primer switch has a defect.** If there is power, connect the ungrounded test lead to the ignition switch (START) lead connection in the terminal plug. Turn the ignition switch to START. **If there is no power, the trouble in the circuit is between the ignition switch and the primer switch.** If there is power, connect the ungrounded test lead to the safety switch terminal of the primer switch. Connect the primer switch terminals to the proper ignition switch coil connections. Turn the ignition switch to ON and START. If there is power when the key is turned to both positions, the primer switch is okay. **If there is no power with the ignition switch in both positions, the primer switch is defective.**

DUAL PUMP SYSTEM

The dual pump system circuits are identical with the single pump system circuit except that a **SELECTOR SWITCH** has been inserted in the circuit between the safety switch and the fuel pumps.

The test procedures will be the same as those given for a single tank system except that the selector switch will also need to be checked for

satisfactory operation. Test the selector switch as indicated in **Test 1-4.** Connect a jumper wire from the safety switch lead first to one and then to the other motor connections. **If the system operates satisfactorily with the jumper wire substituted in place of the switch, the switch is defective.** If the system does not operate properly, check the circuits and components as described for the **SINGLE PUMP SYSTEM.**

ENGINE WARNING SYSTEM

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Oil pressure warning light does not operate when ignition switch is turned on.	1-1. Burned out or broken filament in the bulb. 1-2. A defect between the ignition switch and ground. 1-3. Defective low oil pressure sending unit switch.
2. Oil pressure warning light does not go out when engine is running.	2-1. No oil pressure. 2-2. Defective low oil pressure sending unit switch.
3. Hot water temperature warning light operates with engine cold.	3-1. Defective hot water temperature sending unit switch. 3-2. Defective hot water temperature relay.

Tests for Complaint 1

1-1. Substitute a known good bulb. If the bulb does not light, go to **Test 1-2.**

1-2. Disconnect the lead wire at the oil pressure sending unit terminal. Check for power at the oil pressure sending unit wire. Turn the ignition switch to the ON position. **If there is power, the circuit is satisfactory, but the oil pressure warning light switch is defective.** See **Test 1-3. If there is no power, that part of the circuit from the ignition switch to the low oil pressure swtch has a defect.**

1-3. Disconnect the lead wire at the oil pressure sending unit terminal. Connect a jumper wire between the wire lead and a good ground. **If the warning light now operates with the ignition switch on, the oil pressure sending unit switch is defective. If the warning light does not light the trouble is in the circuit.** See **Test 1-2.** Before discarding the sending unit switch, clean the threads thoroughly so that there is a good electrical ground connection between the switch and the engine. Install the switch and check it again.

Tests for Complaint 2

2-1. **Stop The Engine!** Do not start the engine until it has been determined that the fault is in the electrical system. See the appropriate Shop Manual for proper engine diagnosis procedure.

2-2. Turn the ignition key on. Disconnect the wire lead from the oil pressure sending unit. **If the light goes out, the oil pressure sending switch is defective. If the light does not go out, that part of the circuit from the bulb to the oil pressure sending unit has a defect.** Before starting the engine, check for oil leaks.

Tests for Complaint 3

3-1. Ground the hot water temperature sending unit lead. **If the warning light goes out, the temperature sending unit is defective.** Substitute a known good temperature sending unit. Be sure the threads are clean and provide a good ground to the engine. Connect the lead wire. Turn the ignition switch ON. **If the warning lamp lights, that part of the circuit from the ignition switch to the sending unit has a defect.** Go to **Test 3-2.** If the warning light does not light, the circuit is okay.

3-2. Check for power at the ignition switch wire at the hot water temperature relay. Turn the ignition switch ON. If there is power, that part of the circuit from the ignition switch to the relay is okay. **If there is no power, the trouble is in that part of the circuit.** If the circuit is okay, connect the ungrounded test lead to the sending unit terminal of the temperature relay. If there is power the solenoid in the relay is okay. **If there is no power, the relay is defective.**

With the ignition switch ON, disconnect the warning light lead at the relay connection. If the light goes out, that part of the circuit from the bulb to the relay is okay. **If the light does not go out, the trouble is in that part of the circuit from the bulb to the relay.** Connect the warning light lead to the relay. Connect the sending unit terminal of the relay to a good ground. If the light goes out, the relay is okay. **If the light does not go out, the relay is defective.**

WINDSHIELD WIPER BOOSTER PUMP

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. Vacuum booster pump does not operate.	1-1. Defective motor. 1-2. Defect between the vacuum switch and the motor portion of the circuit. 1-3. Defective switch.

Tests for Complaint 1

1-1. Turn the ignition switch ON. Turn the vacuum switch ON. Disconnect the lead wire to the motor. Check for power at the lead wire. **If there is power, the motor is defective.** If there is no power, go to **Test 1-2.**

1-2. Disconnect the motor lead wire from the switch. Check for power at the switch terminal. **If there is power with the ignition and VAC switches ON, the lead wire from the VAC switch to the motor is at fault.** If there is no power, check that part of the circuit from the ignition switch to the VAC switch.

1-3. Disconnect the ignition switch lead wire at the VAC switch. Check for power at the lead wire. Turn the ignition switch ON. If there is power, disconnect the tester and connect a jumper wire between the two switch lead wires, bypassing the VAC switch. **If the pump motor operates, the switch is defective.** If there is no power at the VAC switch lead wire, check at the ACC terminal of the ignition switch. Turn the ignition switch ON. If there is power at the ACC terminal, the switch is okay. **If there is no power at the ignition switch terminal, the switch is defective.**

MARKER LIGHTS

DIAGNOSIS GUIDE

Complaint	Possible Causes
1. One marker light does not operate.	1-1. Burned out or broken bulb filament. 1-2. Defect in that part of the circuit from the bulb socket to the feed wire. 1-3. Defect in that part of the circuit between the wire junction and light socket. 1-4. Poor ground.
2. All marker lights do not operate.	2-1. Defects in those parts of the circuits from the marker lights to the ignition switch. 2-2. Defective relay. 2-3. Defective tractor trailer circuit breaker.

Tests for Complaint 1

1-1. Substitute a good bulb. **If the bulb does not light, look for trouble between the bulb and the harness.**

1-2. Check for power at the feed wire connector. **If there is power, the trouble is in the bulb socket lead or socket.** See **Test 1-3.**

1-3. Connect the bulb socket lead to the junction. Remove the bulb from the socket. Turn the lights on and check for power at the wire terminal in the bulb socket. **If there is no power, the lead wire is defective.** If there is power, go on to **Test 1-4.**

1-4. With the bulb in the socket, connect the bulb socket to a good ground. **If the bulb lights, the trouble is in the ground connection. If the bulb does not light, the bulb socket is defective.**

Tests for Complaint 2

2-1. Check for power at each connector in the circuit back to the ignition switch. **That portion of the circuit between the point where there is power and where there is no power has a defect.**

2-2. Connect a jumper wire between the ignition wire connection at the relay and the light wire connection at the relay. With the relay bypassed by the jumper wire, the lights should operate. **If the lights operate, the relay is defective.** If the lights do not operate, go on to **Test 2-3.**

2-3. Connect a jumper wire between the leads at the circuit breaker. **If the lights operate, the circuit breaker is defective.** If the lights do not operate, check for power at the battery terminal lead at the circuit breaker. **If there is no power, that part of the circuit from the junction block to the circuit breaker has a defect.** If there is power, move the ungrounded test lead to the switch terminal of the circuit breaker. If there is power, the circuit breaker is okay. **If there is no power, the circuit breaker is defective.**

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