FORD Service Handbook 13001

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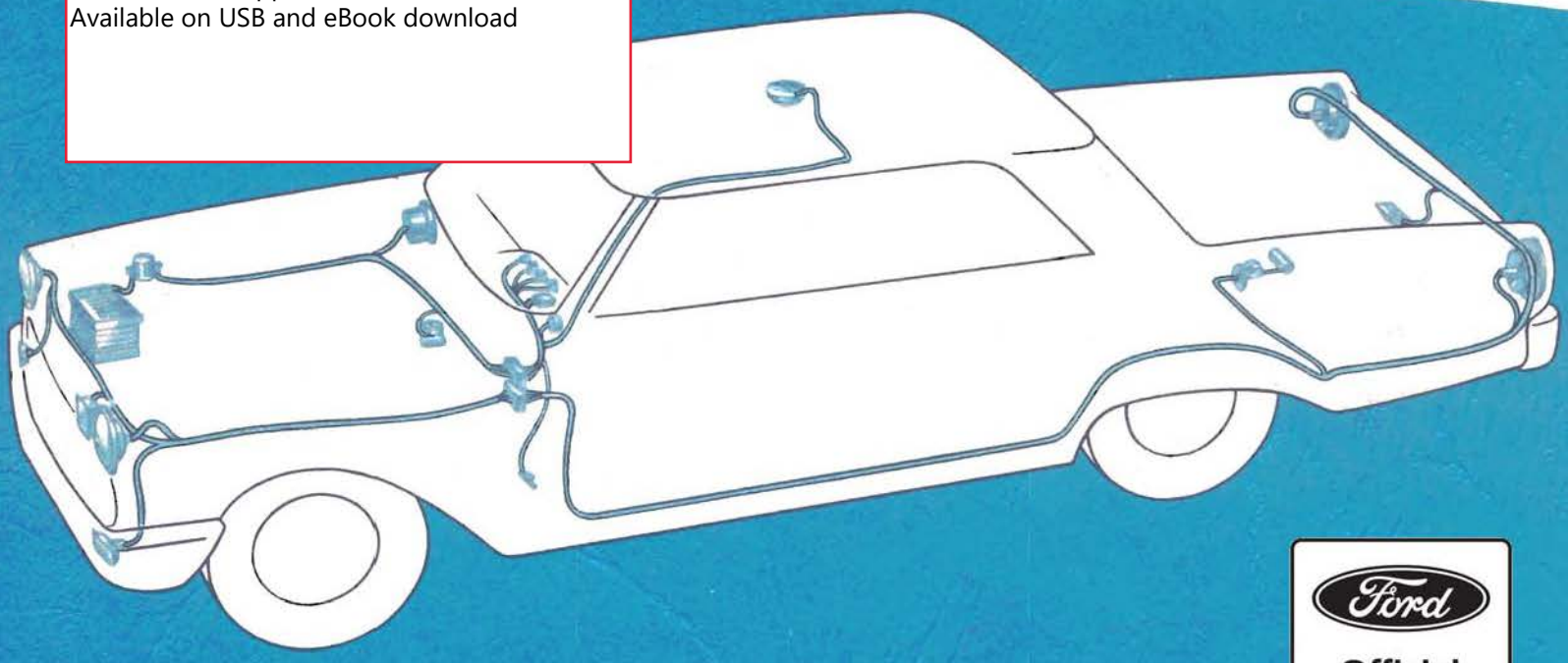

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BODY and CHASSIS
ELECTRICAL CIRCUITS
DIAGNOSIS

1963 Ford Body and Chassis Electrical Circuits Diagnosis
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TABLE OF CONTENTS

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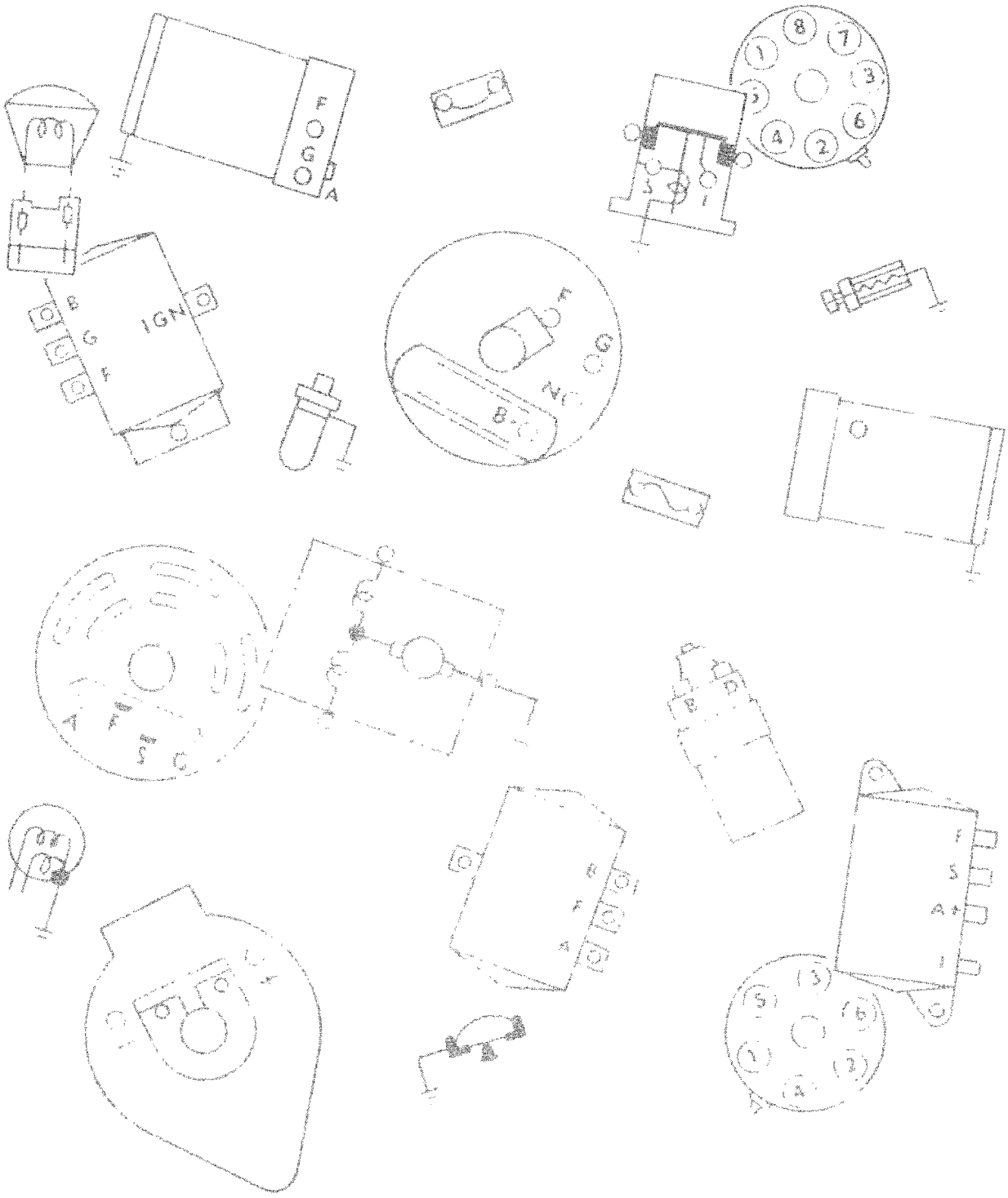
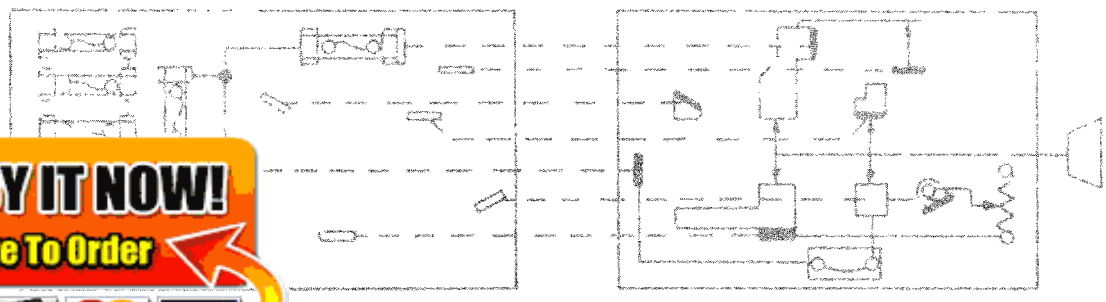




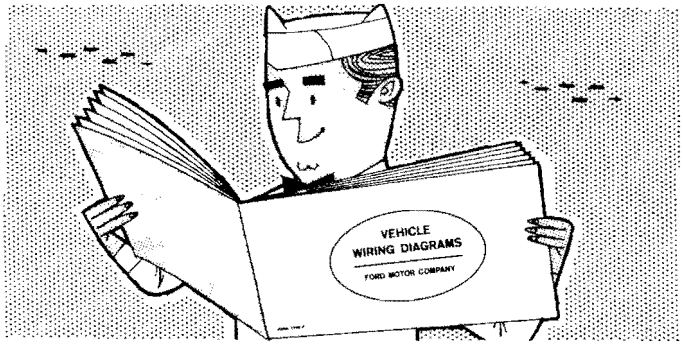
INTRODUCTION

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 the complaint are assigned this same number The first digit in the complaint number one of the possible ne series of digits is int 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.

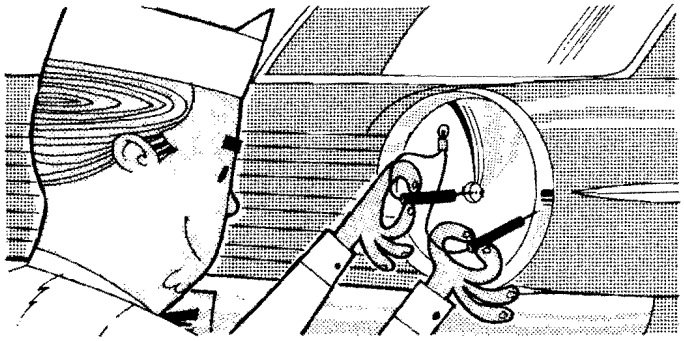
IMPORTANT NOTE

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-** 2 & 3) indicating the pages on which the iagrams will be

a wiring layout ngs and methods tions and con-

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.

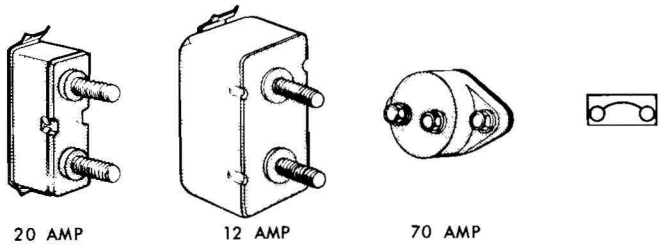


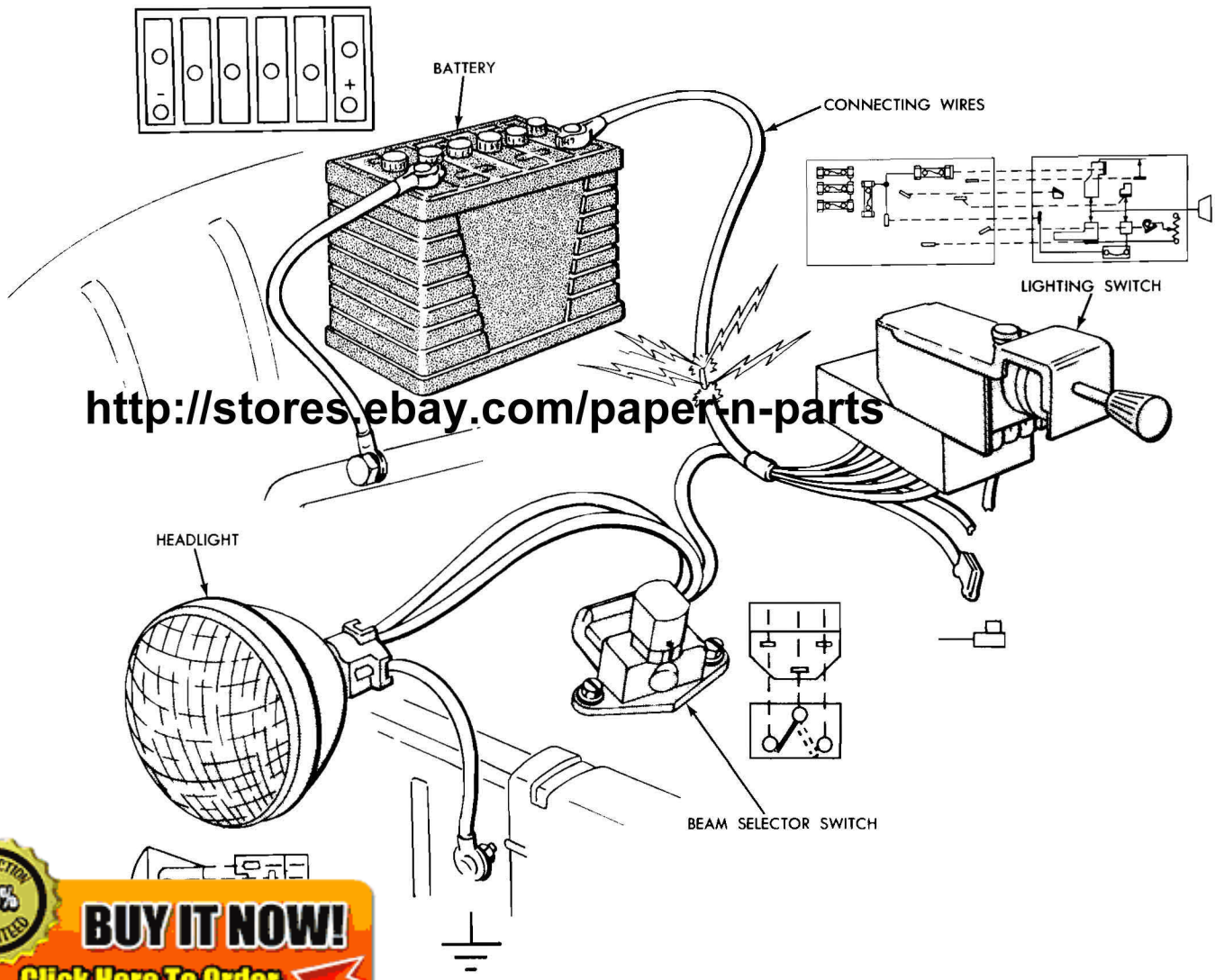
Fig. 1–Typical Circuit Breakers

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".



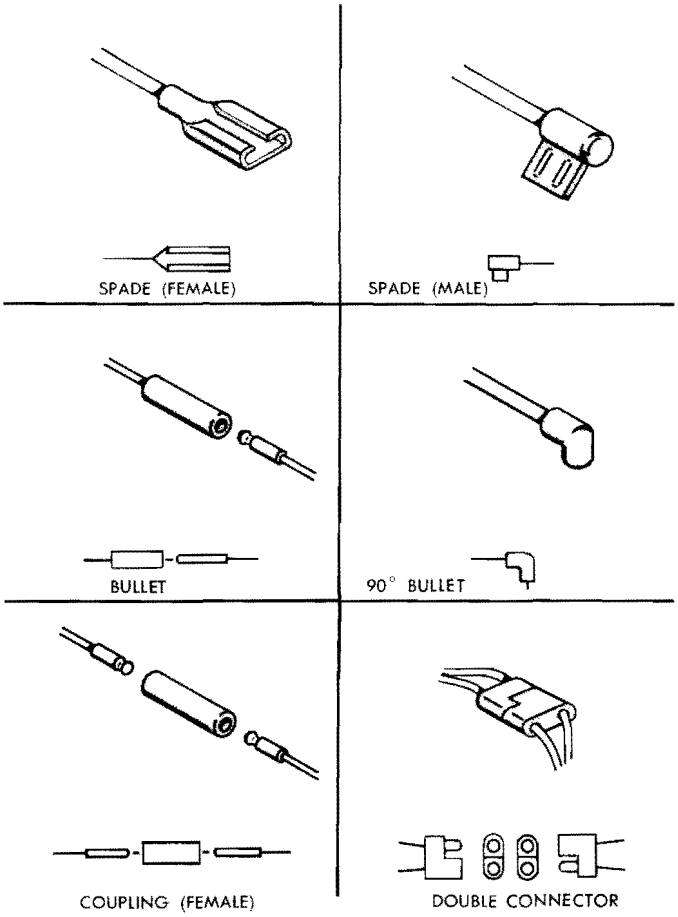


Fig. 3–Types of Connections

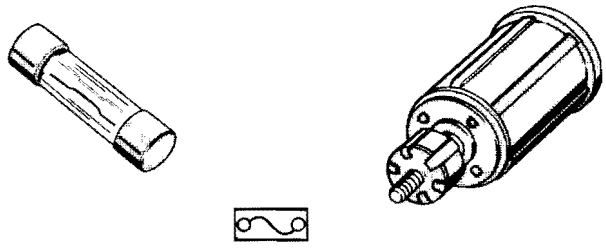


Fig. 4–Types of Fuses

...und–That part of the circuit which acts as a ...n path back to the battery; composed of the ... circuit said to be ... to ground" means ...ally shortened. For ...n the battery and a ...al, current would flow from the battery, through the body metal and back to the battery instead of to the light.
See **Short.**

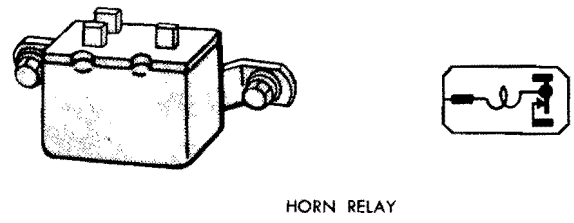
Hot–A term used to describe a lead or connection from the un-grounded side of the battery or source of power, i.e. the lead from the battery to the starter switch or solenoid.

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.



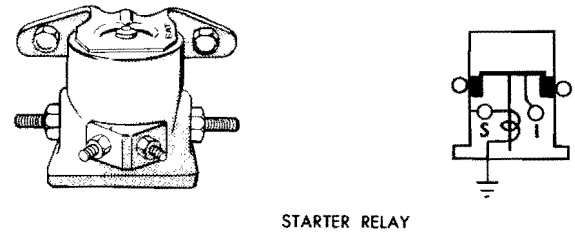


Fig. 5–Typical Electrical Relays

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.**

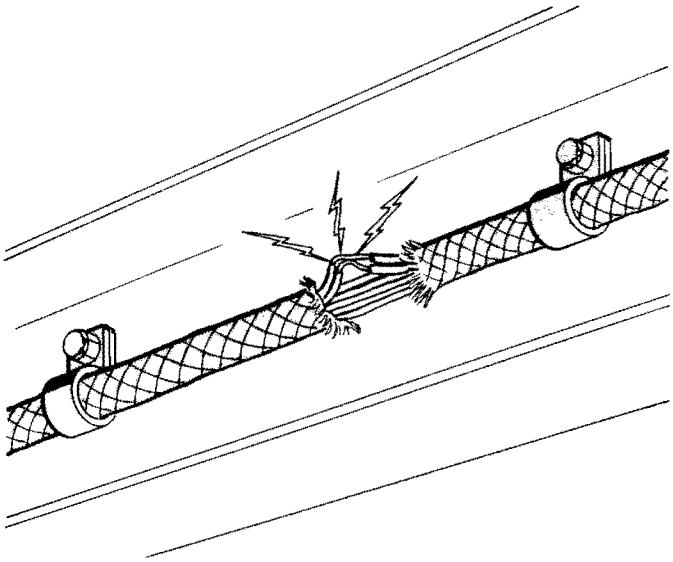


Fig. 6–Short

Switch–A device for opening or closing a circuit.

STOP LIGHT SWITCH

TOP CONTROL SWITCH

ITCH

e" which forces the

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

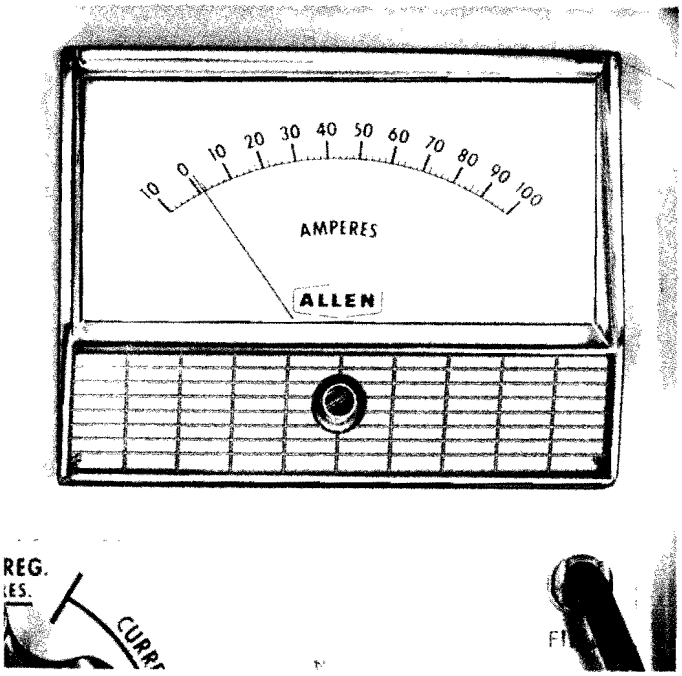


Fig. 8–An Ammeter

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 ...tive.

...of test lights. One ...it to light the bulb ...ether or when they ...has no battery and ...e circuit being ...

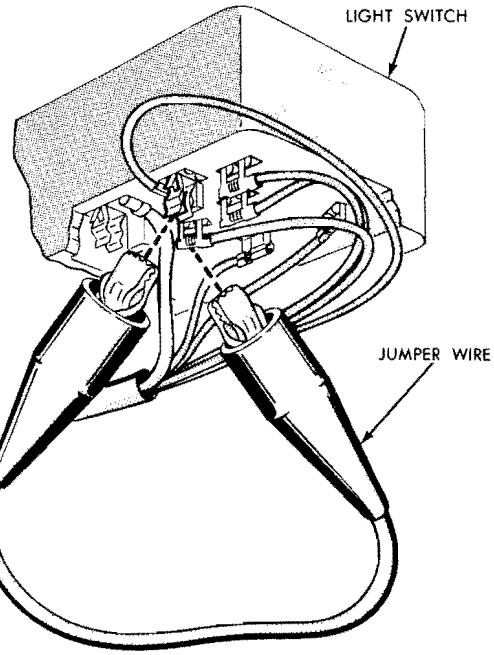


Fig. 9–Typical Jumper Wire Applications

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

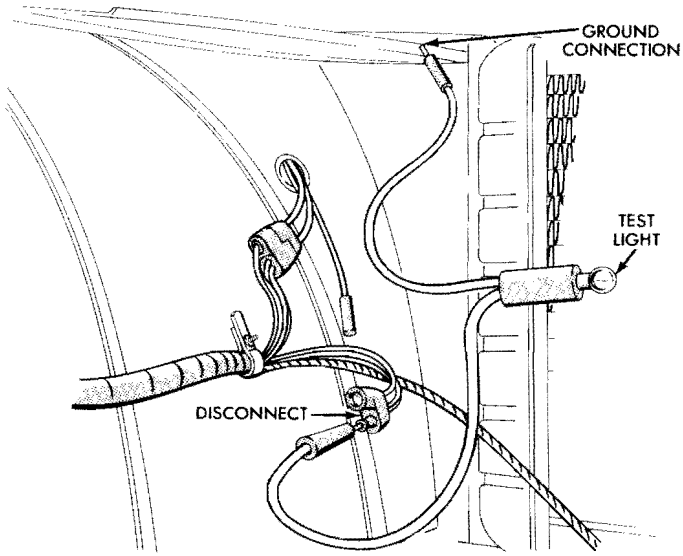


Fig. 10–12-Volt Test Light

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.

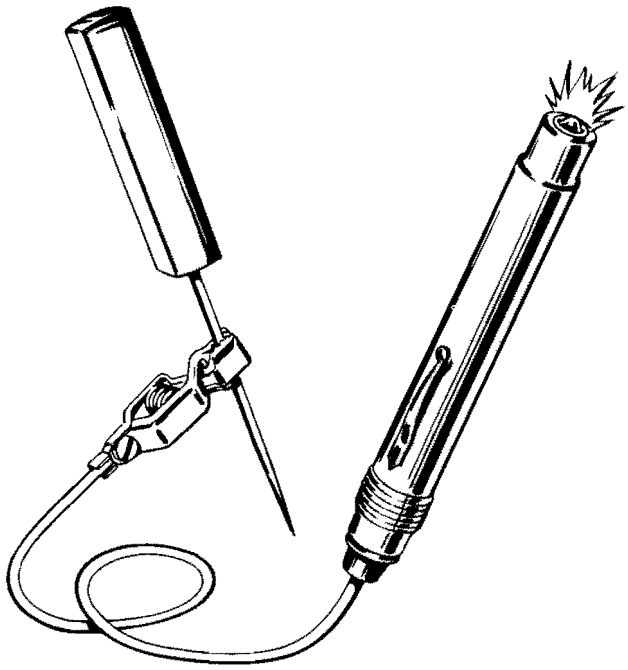


Fig. 11–Self-Powered Test Light

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

Test Light

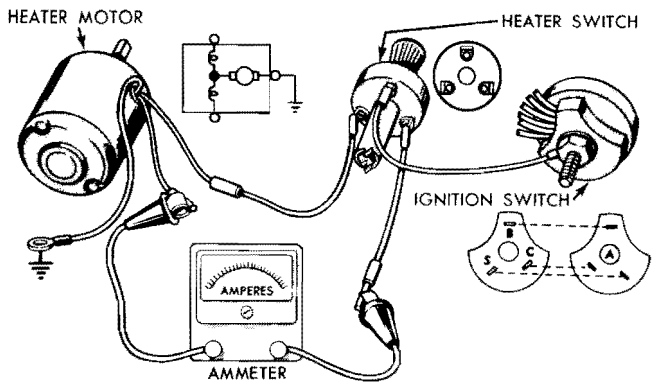


Fig. 13–Testing with an Ammeter

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

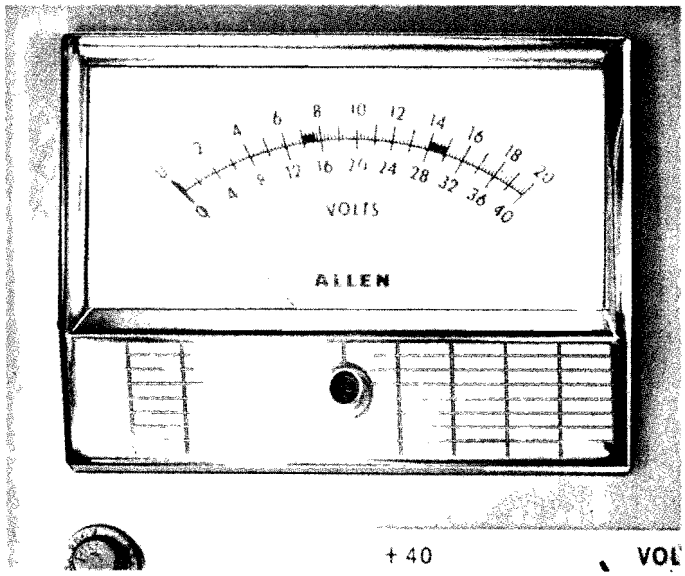


Fig. 14–A Voltmeter

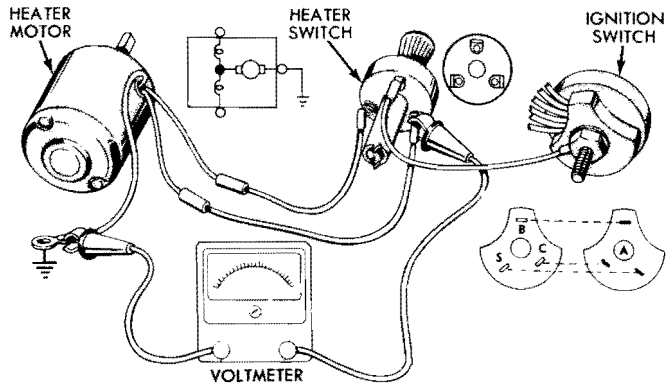


Fig. 15–Testing with a Voltmeter

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.

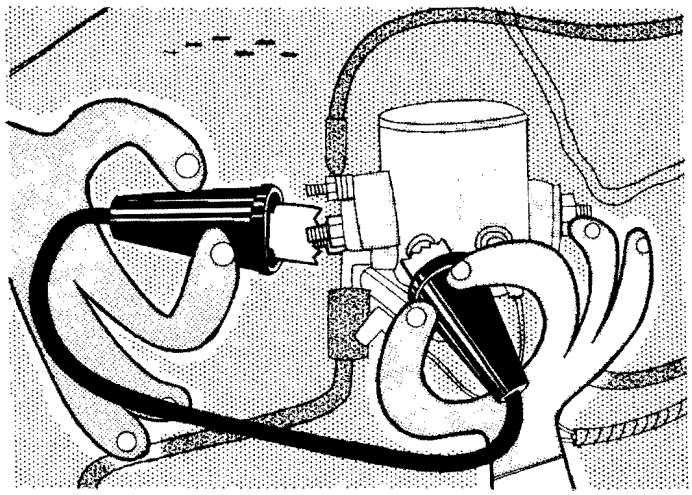
Visual Inspection–The most common problem revealed by visual inspection is a loose connection. A loose connection can cause intermittent operation of the circuit or can cause the circuit to be open. A loose fit or corrosion can also cause the same problem. The wires should be moved around by hand when

rubbing against a point of a screw 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. Defect in the generator regulator. 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.

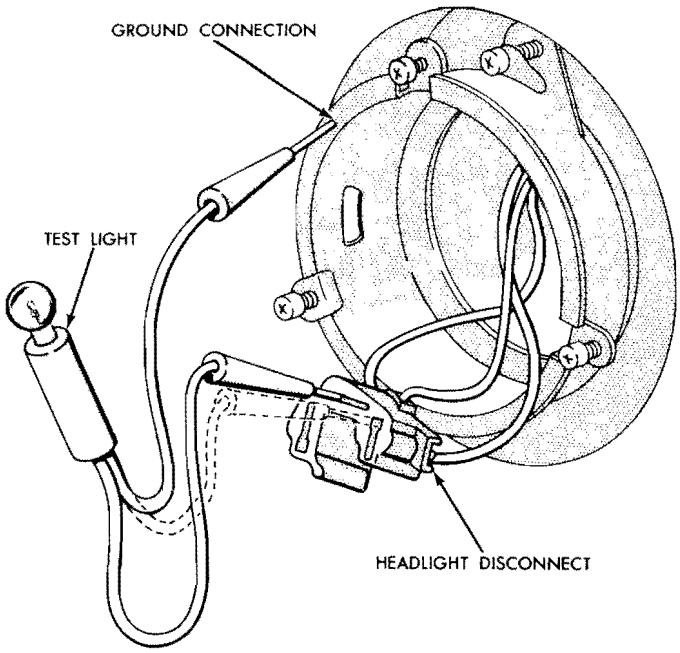


Fig. 16–Headlight Disconnect

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.

the circuit between and the headlight se or broken wires 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.**

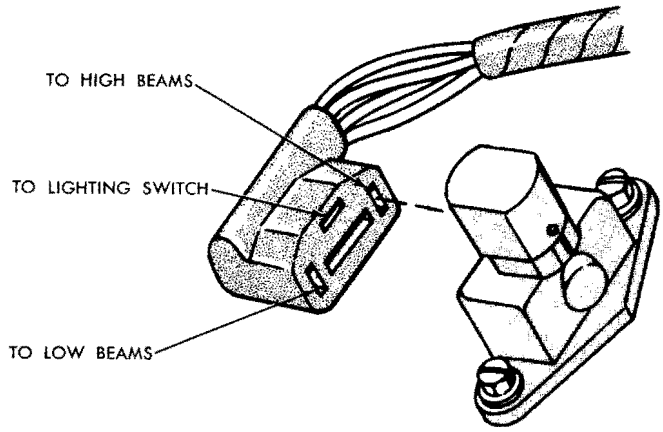


Fig. 17–Beam Selector Switch Disconnect

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. Check the ground connection at the parking light socket. There must be a good ground connection. **If there is** [illegible] **erly grounded.** If [illegible] **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.

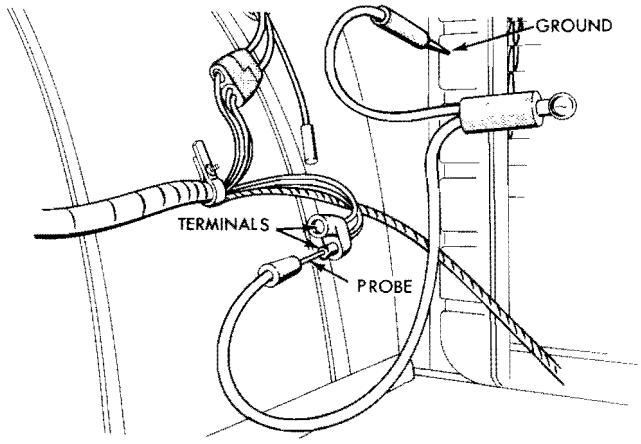


Fig. 18—Test Lamp between Connection and Ground

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