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Electrical & Vacuum Trouble-Shooting Manual

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1982 Mustang / Capri Electrical & Vacuum Trouble-Shooting Manual (EVTM)

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INDEX

IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

The **Purpose** of this manual is to show electrical and vacuum circuits of this vehicle in a clear and simple fashion to make troubleshooting easier. With each circuit is a description of *How the Circuit Works*, and some *Troubleshooting Hints*. A *Component Location* chart lists components, connectors and grounds in that circuit. The chart includes a description of where each item is located, and references to pictures in the manual.

Wiring Diagrams give a schematic picture of when and how the circuit is powered, what the current path is to circuit components, and how the circuit is grounded. Each circuit component is named (underlined titles) and wire colors are listed (standard Ford color abbreviations are used):

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

Where two colors are shown for a wire, the first color is the basic color of the wire. The second color is the dot, hash, or stripe marking. If **D** or **H** is given, the second color is dots or hash marks. If there is no letter after the second color, the wire has a stripe.

For example:

BR/O is a brown wire with an orange stripe.

is a red wire with yellow dots.

e hash

Connector end views of switches and other components are shown to help with bench testing. The views show the harness wire colors that connect to the mating terminals. Connector colors and locations are shown in the *Component Location* chart. Two-color listings indicate separate colors for each connector half.

Components which work together are shown together. For example, all electrical components used in any circuit are shown on one diagram. The circuit breaker or fuse is shown at the top of the page. All wires, connectors, splices, switches, and motors are shown in the flow of current to ground at the bottom of the page. Notes are included which describe how switches and other components work. If a component is used in several different circuits, it is shown in several places. For example, the **Light Switch** is an electrical part of many circuits, and is repeated on many pages. In some cases, however, a component may seem by its name to belong on a page where it has no electrical connection. For example, **Radio Illumination** is electrically part of **Instrument Illumination**. Since it has no electrical connection at all with the actual **Radio** circuit, it is not shown on the Radio page.

Troubleshooting Hints point the technician in a general direction, but are not intended as a step-by-step procedure. Ignition troubleshooting is an exception to this. It includes a step-by-step procedure of basic quick checks to locate some of the more common **Ignition System** problems. Read the Shop Manual for more detailed repair procedures.

The **Grounds** pages show detailed views of multiple component ground points. This is useful for checking interconnections among the ground circuits of different diagrams.

Notes, Cautions and **Warnings** appear in boxes on text pages and contain important car and mechanic safety information.

Notes give added information to help complete a particular procedure. Cautions are included to prevent making an error that could damage the vehicle. Warnings highlight areas where carelessness can cause personal injury. The following list contains some general **Warnings** that should be followed when working on a vehicle.

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

TROUBLESHOOTING STEPS

These six steps present an orderly method of troubleshooting:

Step 1. Verify the problem.

- Operate the complete system and see all symptoms for yourself in order to:
  - —check the accuracy and completeness of the customer's complaint.
  - —learn more that might give a clue to the nature and location of the problem.

Step 2. Narrow the problem.

- Using the EVTM, narrow down the possible causes and locations of the problem in order to more quickly find the exact cause.
- Read the description of *How the Circuit Works* and study the wiring diagram. You should then know enough about the circuit operation to figure out where to check for this trouble.

Step 3. Test the cause.

- Use electrical test procedures to find the specific cause of the symptoms.
- *Troubleshooting Hints* will give some helpful ideas.
- The *Component Location* charts and the pictures will help you find components, grounds, and connectors.

Step 4. Verify the cause.

- Confirm the fact that you have found the correct cause through operating the parts of the circuit you think are good.

Step 5. Make the repair.

- Repair or replace the faulty component.

Step 6. Verify the repair.

- Operate the system as in Step 1 and check at your repair has removed all symptoms, any new

l special test res. See the books for details. You will find the circuits in this manual to be helpful with these special tests.

TROUBLESHOOTING TOOLS

JUMPER WIRE

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

Uses: Bypassing Switches or Open Circuits

WARNING

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

VOLTMETER

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

OHMMETER

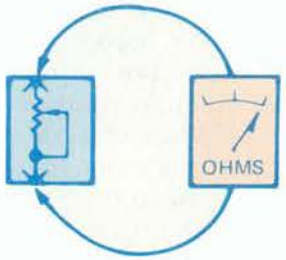


Figure 1— Resistance Check

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

TEST LIGHT

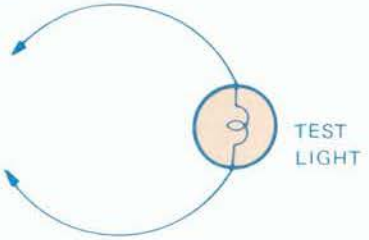


Figure 2 — Test Light

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

Uses: Voltage Check, Short Check

SELF-POWERED TEST LIGHT

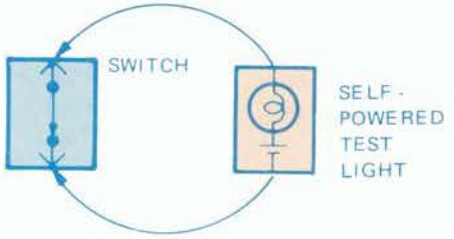


Figure 3—Continuity Check

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

Uses: Continuity Check, Ground Check

CAUTION

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

TROUBLESHOOTING CHECKS

SWITCH CIRCUIT CHECK

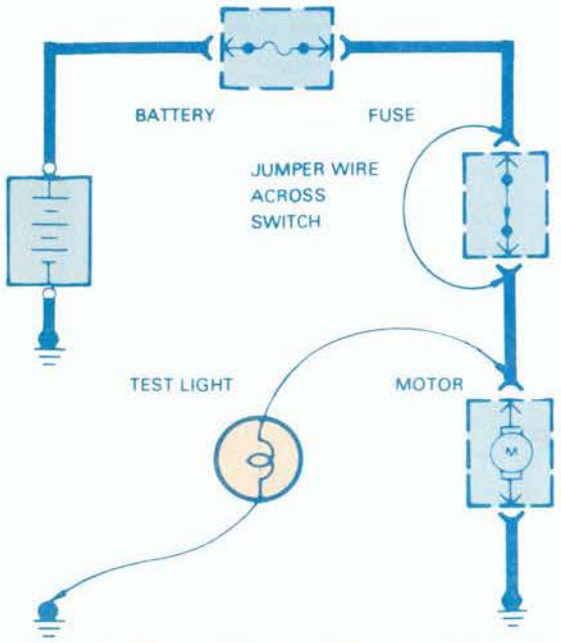


Figure 4—Switch Circuit Check and Voltage Check

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

CONTINUITY CHECK (Locating open circuits)

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

VOLTAGE CHECK

...nect one lead of **Test Light** to a known ... battery ... the other ... when the ...

SHORT CHECK (short to ground)

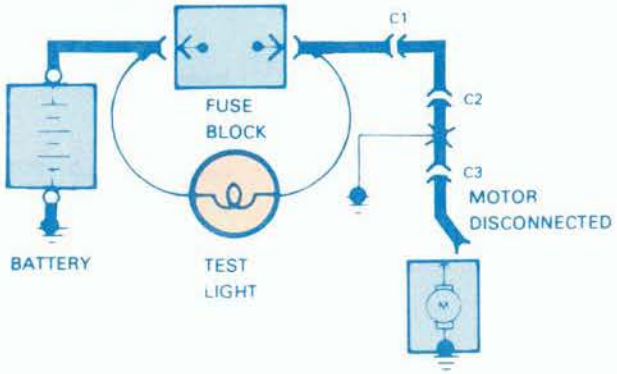


Figure 5— Short Check

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

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

"GOOD GROUND" CHECK

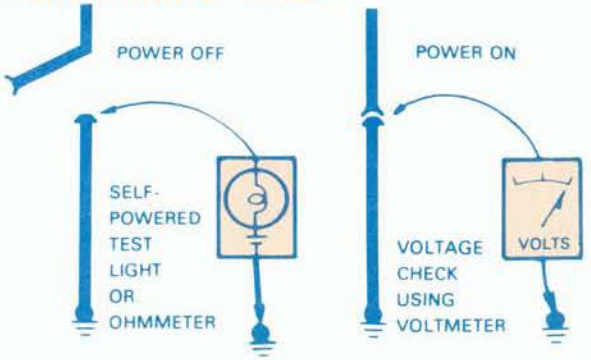


Figure 6 — Grounds Checks

Turn on power to circuit. Perform Voltage Check between suspected bad ground and frame. Any voltage means ground is bad.

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

TROUBLESHOOTING HINTS

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

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

4 ELECTRICAL SYMBOLS

COMPONENT SHOWN IN TWO PLACES OR PART OF A COMPONENT

COMPONENT WITH CONNECTORS

POSITION NUMBER

FUSE

AMPERAGE VALUE

POSITION NUMBER

CIRCUIT BREAKER

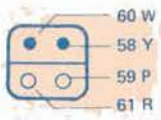
AMPERAGE VALUE

SCREW TERMINAL ON COMPONENT

SOLID STATE

SEALED ELECTRONIC COMPONENT

ANY CIRCUITRY SHOWN INSIDE THE BOX IS A FUNCTIONAL EQUIVALENT ONLY.



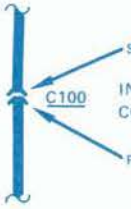
COMPONENT CONNECTOR END VIEW

SHOWS PINS OR SOCKETS ON A COMPONENT TO AID IN BENCH TESTING

WIRE COLORS ARE LABELED

PIN TERMINAL TYPES

SOCKET TYPES



SOCKET

IN-LINE CONNECTOR

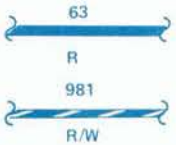
PIN

SPLICE OR CRIMP TERMINAL

GROUND CONNECTION

20 GA BLUE

FUSE LINK

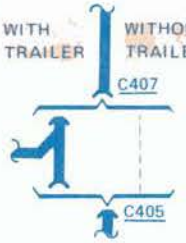


SOLID WIRE

STRIPED WIRE

DOTTED WIRE

HASHED WIRE



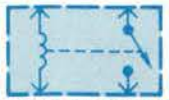
ALTERNATE CIRCUIT PATH OR OPTIONAL WIRING BRACKETS

DASHED LINE MEANS C405 CONNECTS DIRECTLY TO C407 WITHOUT TRAILER

CANDELABRA CONNECTOR

ACCEPTS SINGLE-PIN CONNECTORS

JUNCTION BLOCK



RELAY

CONTACTS CLOSE WITH CURRENT THROUGH COIL

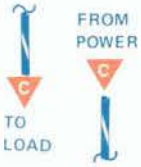
DASHED LINE SHOWS MECHANICAL CONNECTIONS

DIODES

CURRENT FLOWS IN DIRECTION OF ARROW ONLY

OPTIONAL WIRING RUBY

BR WIRE IS ON ALL VEHICLES BUT WIRE W IS NOT



"CUT" WIRES REFERENCED BETWEEN PAGES

ARROWS SHOW CURRENT FLOW FROM POWER TO GROUND

BACKUP LIGHTS

"REFERENCE" WIRES

COMPLETE WIRING SHOWN ON ANOTHER PAGE

REFERENCE NUMBER

REPEATED AT EACH POINT CIRCUITRY REPEATS OR OVERLAPS

SEE GROUNDS, PAGE 6, 7

A DASHED WIRE INDICATES THAT THE CIRCUITRY IS NOT SHOWN IN COMPLETE DETAIL, BUT IS COMPLETE ON ANOTHER PAGE.

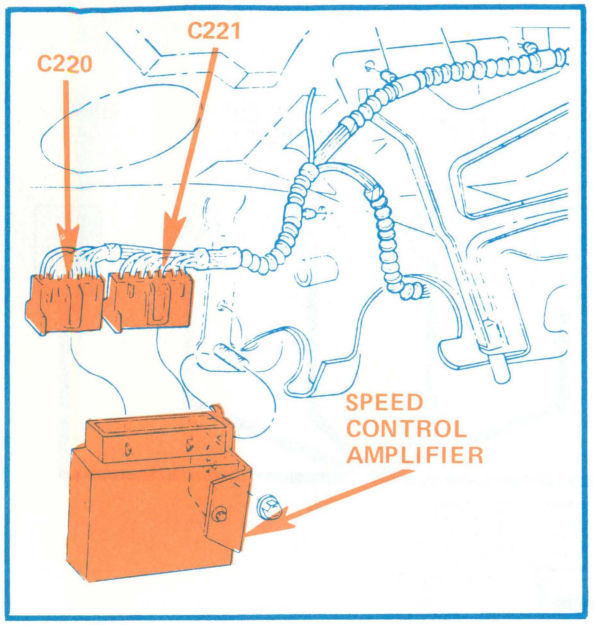


Figure 1 — LH Cowl Area

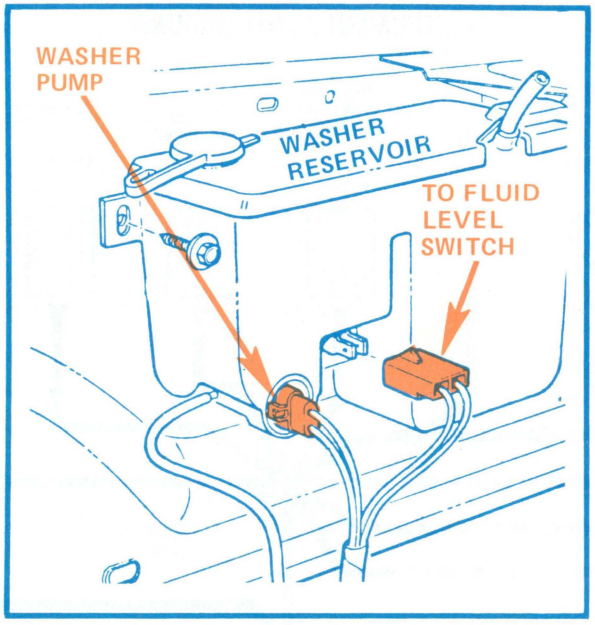


Figure 2 — LH Engine Cowl

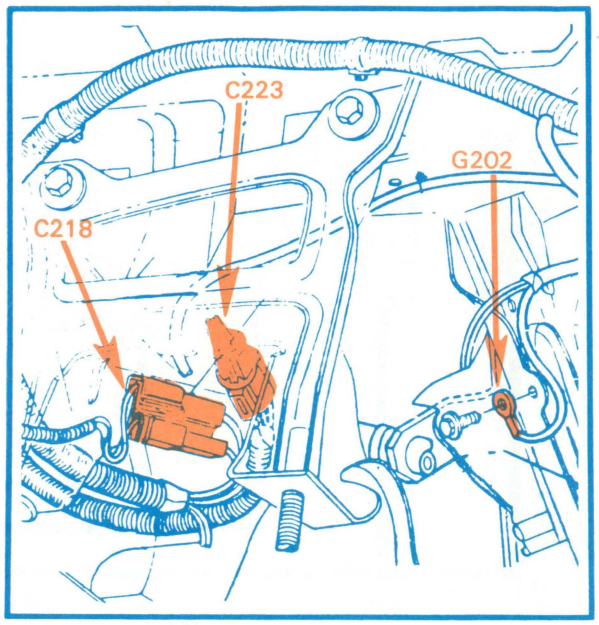


Figure 3 - Under LH Side of I/P

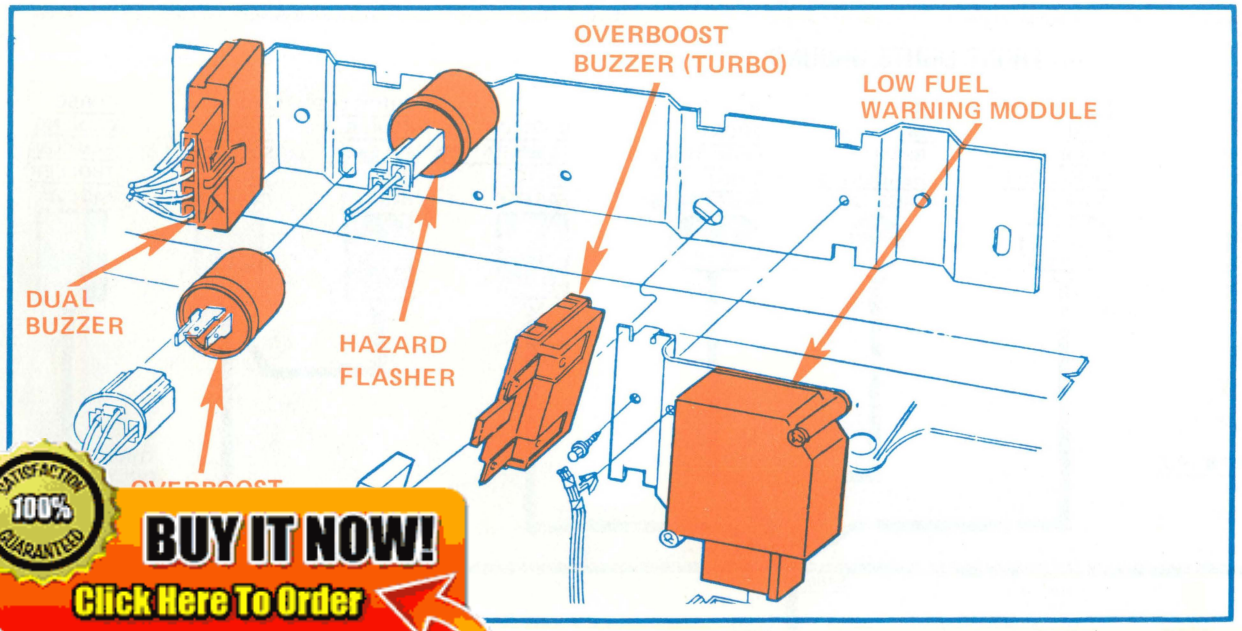


Fig 4 — Behind RH Side of I/P

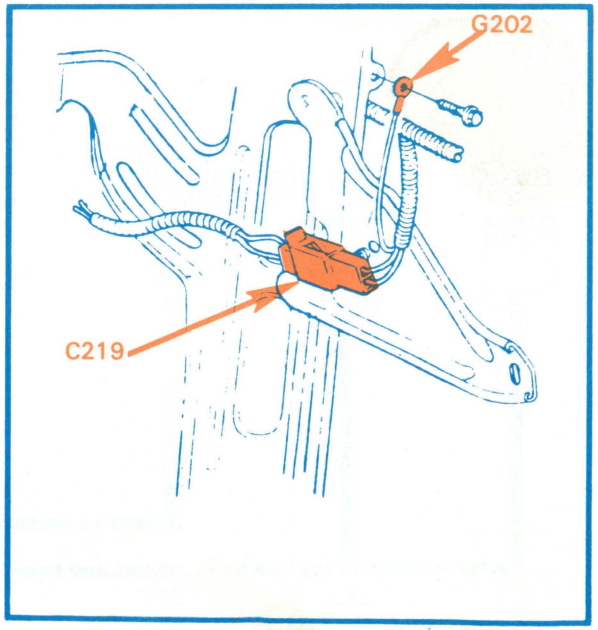
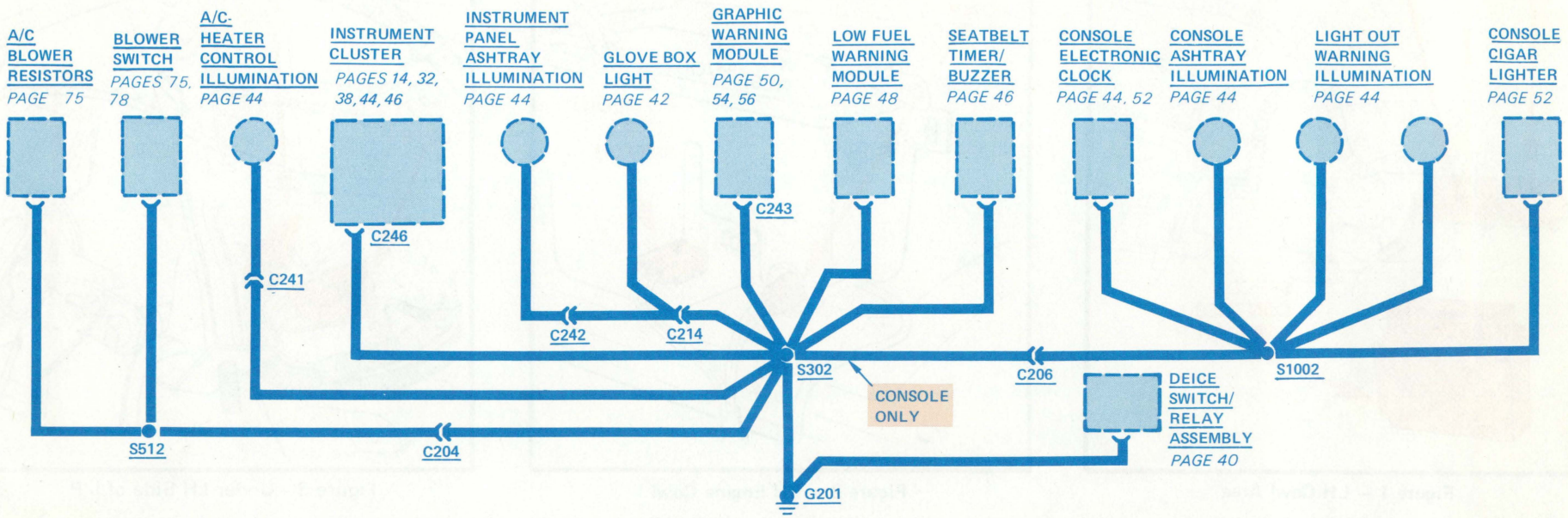
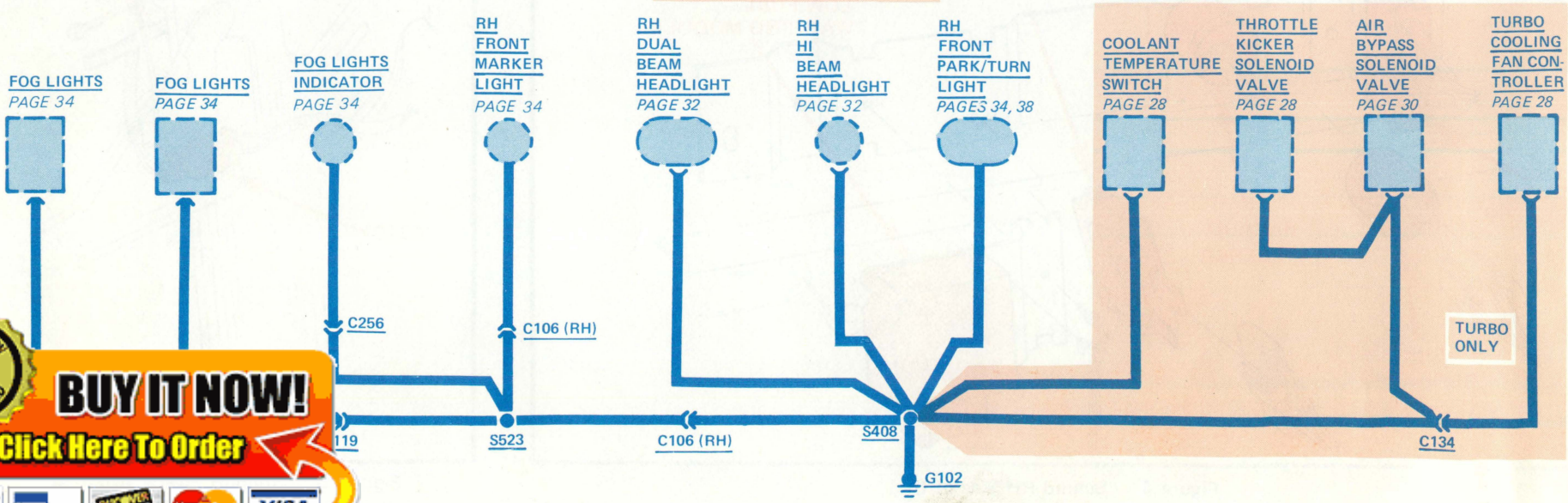


Figure 5 - Support Brace (Manual Shown, Automatic Similar)

INSTRUMENT PANEL GROUND



RH FRONT LIGHTS GROUND



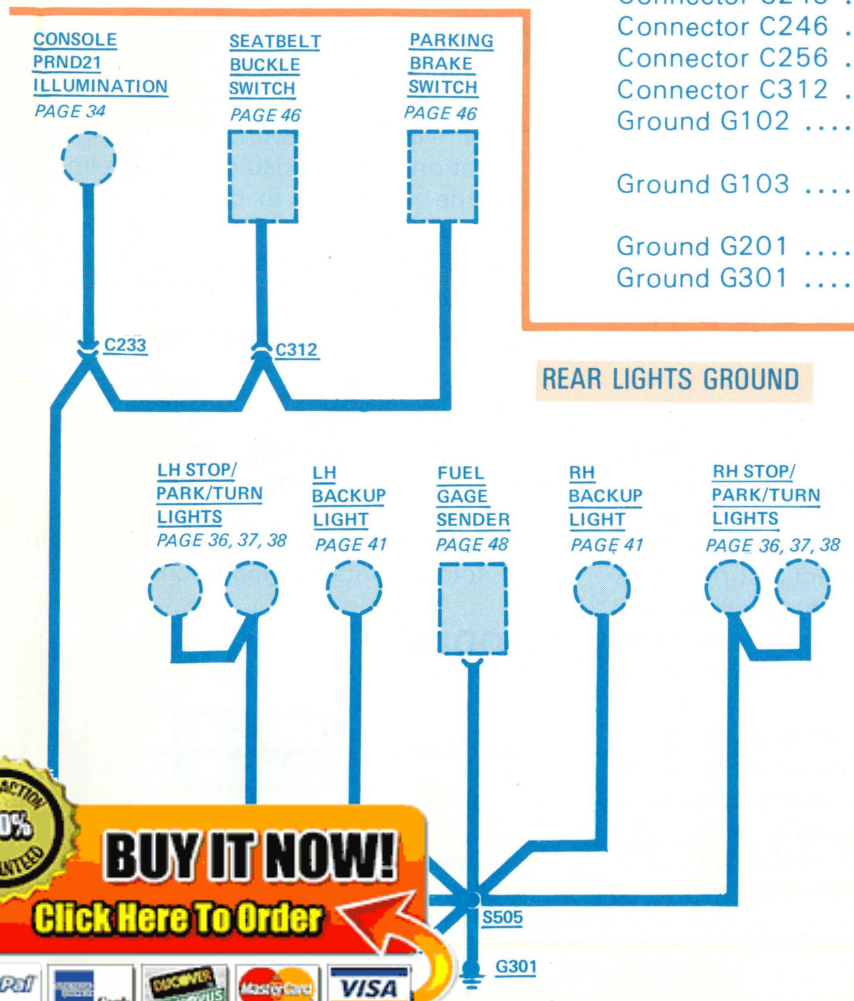
The ground circuits shown here are complete, and connect several components together to screw terminal ground points. On other pages only parts of these circuits may be shown. Partial ground circuits are shown dashed on those pages.

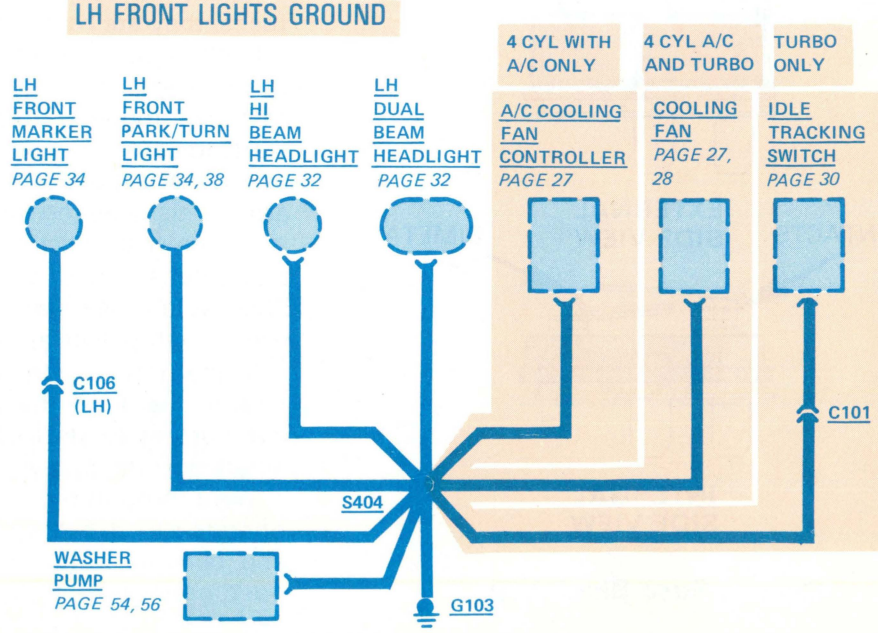
All simple or component ground circuits are shown on the individual circuit pages, and are complete on those pages.

All wires are **57 BK** unless otherwise noted.

COMPONENT LOCATION

		Page-Figure	Color	Terminals
Connector C101	Near ignition coil	25-3		
Connector C106	Near both RH and LH side markers	33-1	BR	2
Connector C119	Under RH front bumper below headlight	35-1	BR	2
Connector C204	Behind RH side of I/P above glove box	78-1	GY	4
Connector C206	Attached behind graphic warning module	51-1	GY	4
Connector C214	Clipped to LH I/P support brace	45-3	GY	
Connector C233	Near transmission selector switch	47-1	GY	2
Connector C241	Behind center of I/P above radio	78-1	BR	2
Connector C242	Under center of I/P near ash tray assembly			2
Connector C243	Attached to graphic warning module	51-1	GY	8
Connector C246	Behind LH side of I/P on instrument cluster	89-1	GY	14
Connector C256	Behind I/P near fog lights indicator	86-5		2
Connector C312	LH side of transmission hump	47-1	GY	2
Ground G102	Top RH side of radiator support above headlight	33-1		
Ground G103	Top LH side of radiator support above headlight	33-1		
Ground G201	Behind LH side glove box	45-1		
Ground G301	LH side of trunk lid striker	35-2		



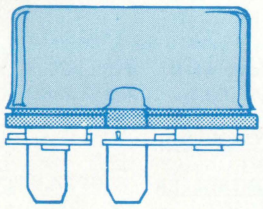


REPLACEMENT OF FUSES/ CIRCUIT BREAKERS

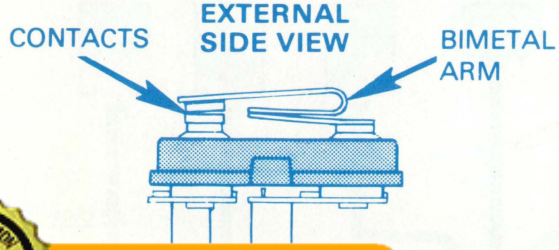
GOOD FUSE BLOWN FUSE

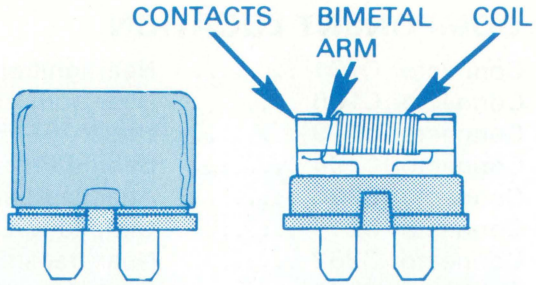
Fuses are mounted either in the **Fuse Block** or in-line. They are identified by the numbered value in amperes, and by a color code. Some positions may have either a fuse with adapter or a circuit breaker. Be sure to replace a fuse or circuit breaker with the same kind of unit and with the same ampere rating. Remove fuses in order to check them.

CIRCUIT BREAKER OPERATION



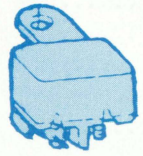
EXTERNAL SIDE VIEW





EXTERNAL SIDE VIEW INTERNAL SIDE VIEW

Non-Cycling Fuse Block Type



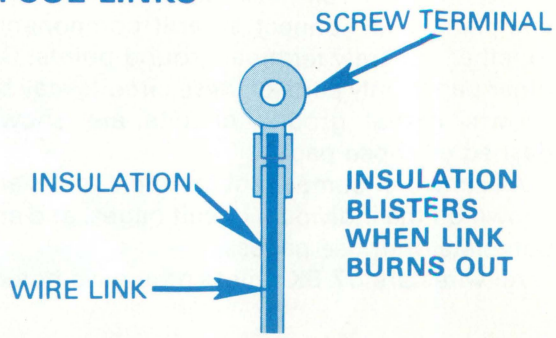
Cycling In-Line Type

Some circuits are protected by circuit breakers. (Abbreviated "c.b." in fuse chart.) They can be **Fuse Block** mounted or in-line. Like fuses, they are rated in amperes.

Each circuit breaker conducts current through an arm made of two types of metal fastened together (bimetal arm). If the arm starts to carry too much current, it heats up. As one metal expands faster than the other the arm bends, opening the contacts. Current flow is broken. In the cycling type, the arm cools and straightens out. This closes the circuit again. This cycle repeats as long as the overcurrent exists, with power applied.

In the non-cycling type, there is also a coil wrapped around the bimetal arm. When an overcurrent exists and the contacts open, a small current passes through the coil. This current through the coil is not large enough to operate a load, but it does heat up both the coil and bimetal arm. This keeps the arm in the open position until power is removed.

FUSE LINKS

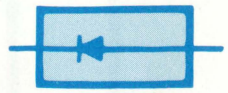


The fuse link is a short length of wire smaller in gage than the wire in the protected circuit. The wire is covered with a thick non-flammable insulation. An overload causes the link to heat and the insulation to blister. If the overload remains, the link will melt, causing an open circuit. The links are color coded for wire size as follows:

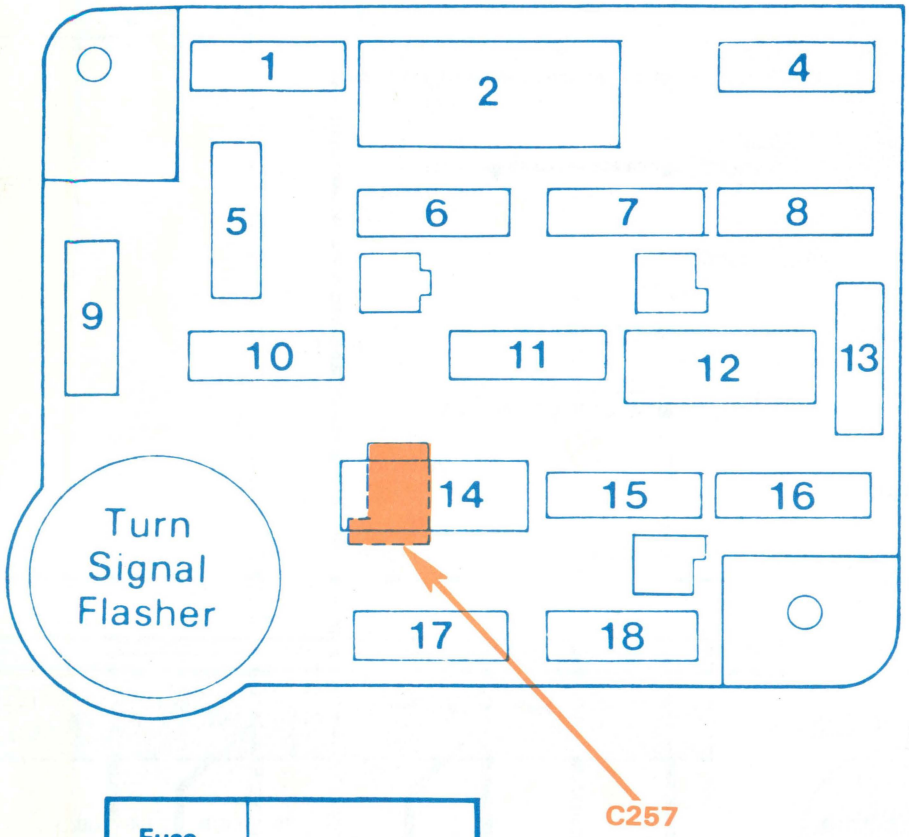
COLOR CODE	
BLUE	20 GA
RED	18 GA
ORANGE	16 GA
GREEN	14 GA

When replacing, make tight crimp joints or hot solder joints for good connections.

DIODES



Diodes are electrical devices that permit current to flow in one direction only. The current flows in the direction indicated by the arrow.



Fuse Value Amps	Color Code
4	Pink
5	Tan
10	Red
15	Light Blue
20	Yellow

Fuse Position	Amps	Circuits Protected
1	15	Stop/Hazard Lights; Speed Control
2	6 c.b.	Windshield Wiper/Washer; Interval Wiper
4	15*	Exterior Lights; Instrument Illumination
5	15	Turn Lights; Backup Lights
6	20	A/C Clutch; Liftgate Wiper/Washer; Speed Control; Rear Window Deice; Trunk Release; Digital Clock; Light Out Warning; Liftgate Wiper/Washer
7	—	(Not used)
8	15	Courtesy Lights; Clock; Key Warning
9	15 or 30	Heater Blower (15 amps); A/C Blower (30 amps)
10	20	Passing Beam
11	15	Radio, Premium Sound
12	—	(Not used)
13	5	Instrument Illumination
14	20c.b.	Power Windows
15	—	(Not used)
16	20	Horn; Cigar Lighter; Digital Clock
17	—	(Not Used)
18	10	Seatbelt Buzzer; Warning Indicators; Carburetor Solenoids; Tachometer; Low Fuel Warning

*10 Amps with Light Out Warning

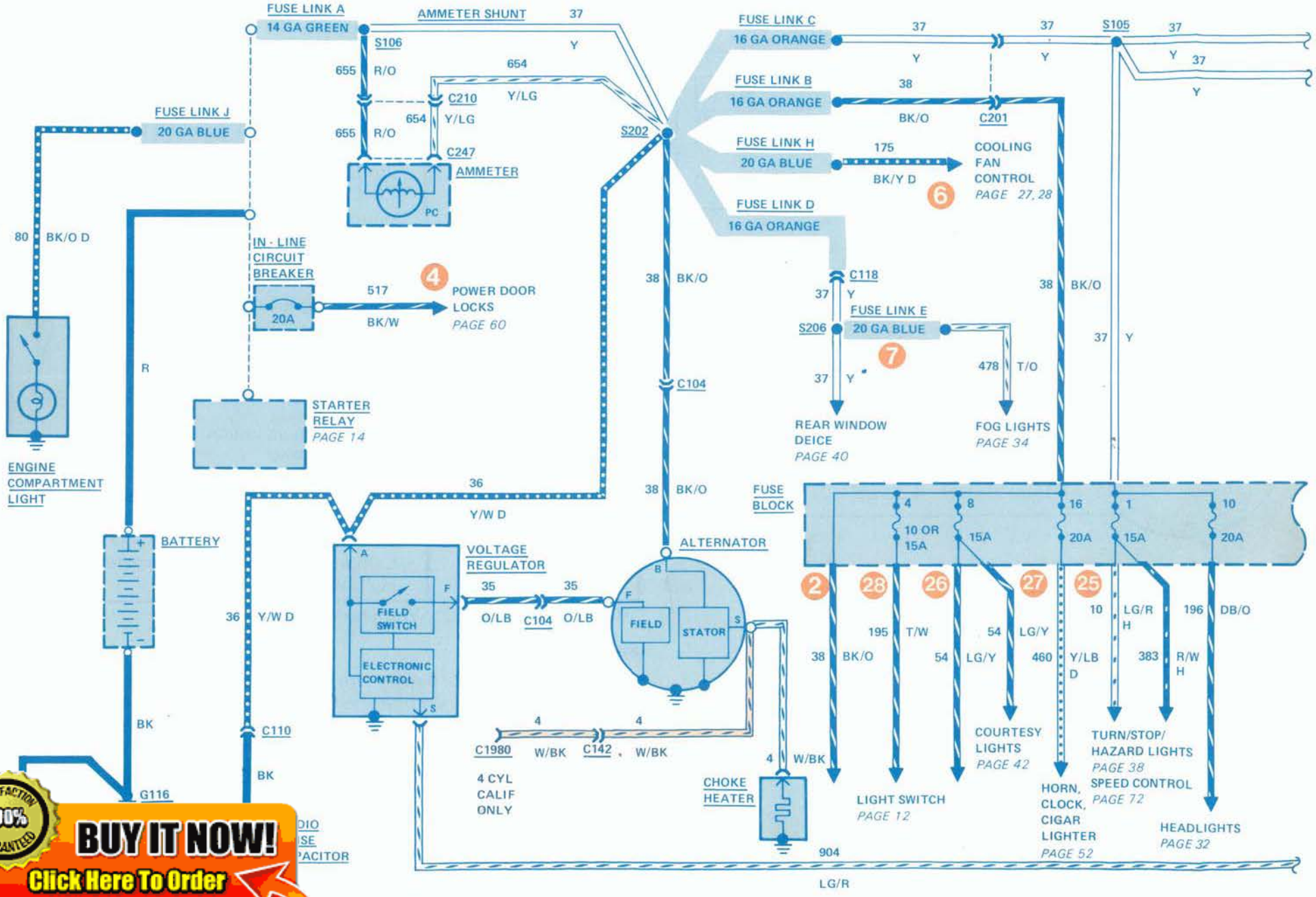
Power Distribution

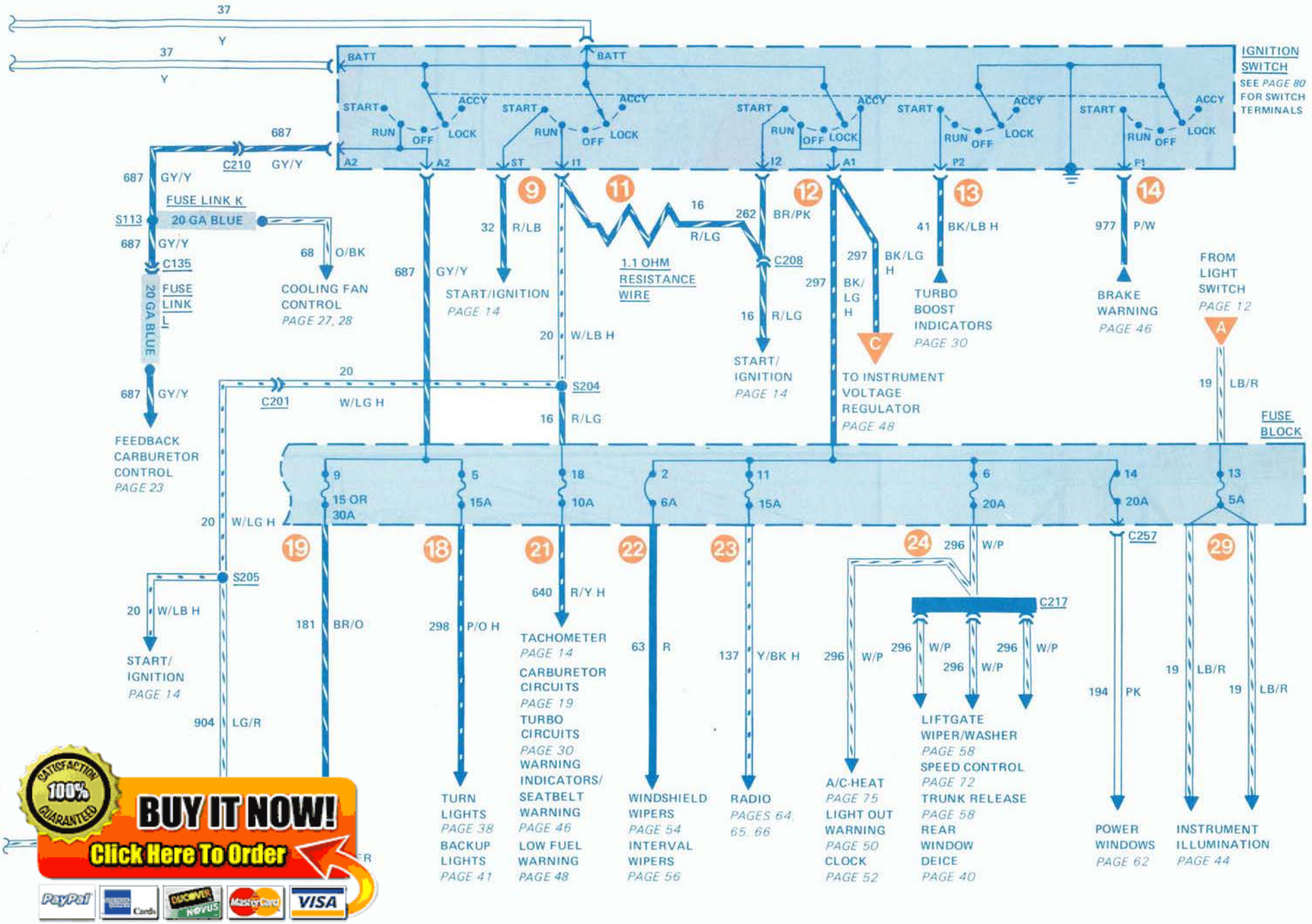
The **Alternator** and **Battery** are connected together at the **Starter Relay**hot terminal and are protected by fuse links. Low power circuits are also hot terminal. Other circuits originate at the **Starter Relay** protector by fuses.

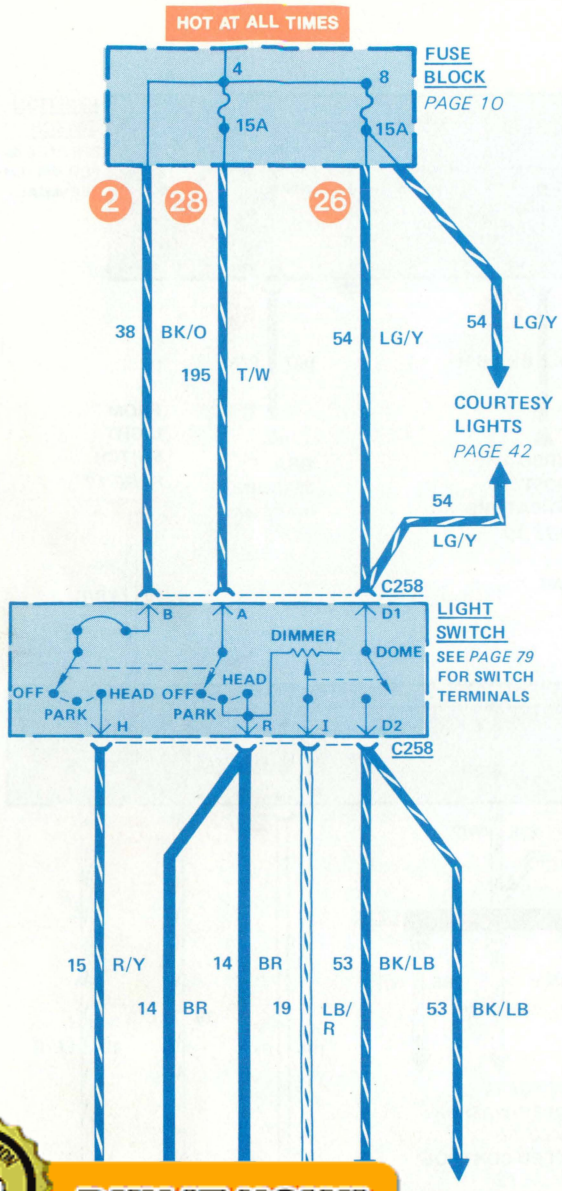
The **Ignition Switch** and **Light Switch** are powered at all times as are **Fuses 1, 4, 8, 10** and **16.** The other fuses are powered through the **Ignition Switch** or the **Light Switch.**

Position 3 is not used, and is covered by **Circuit Breaker 2.**

10 CHARGE/POWER DISTRIBUTION







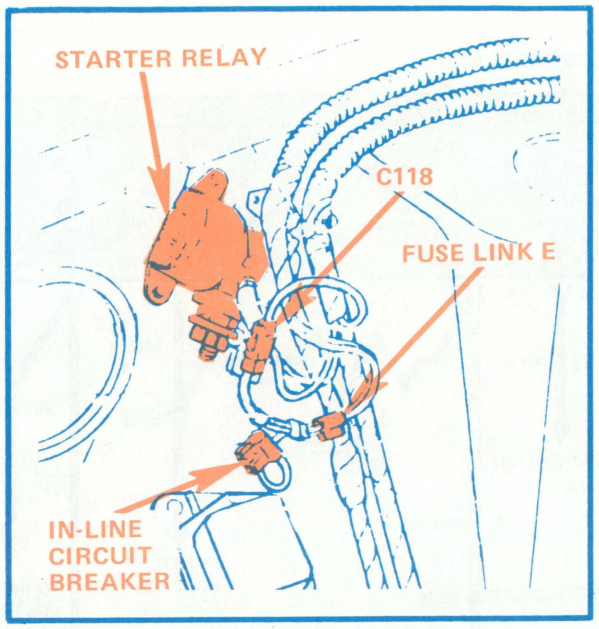


Figure 1 - RH Fender

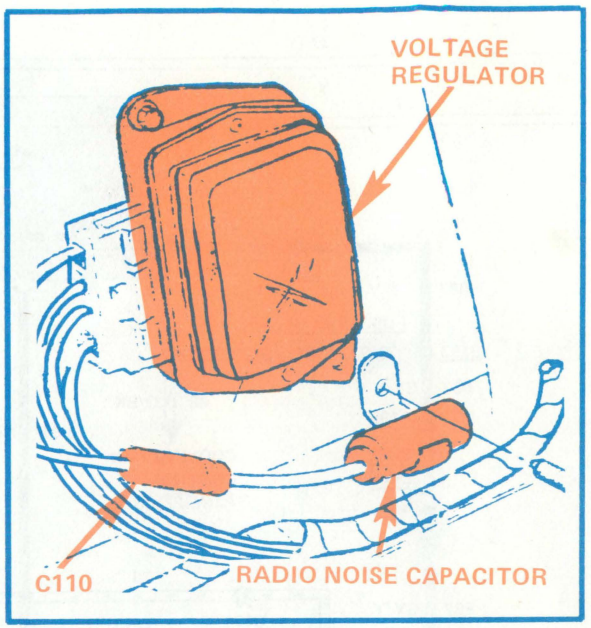


Figure 3 - Forward Of RH Shock Tower

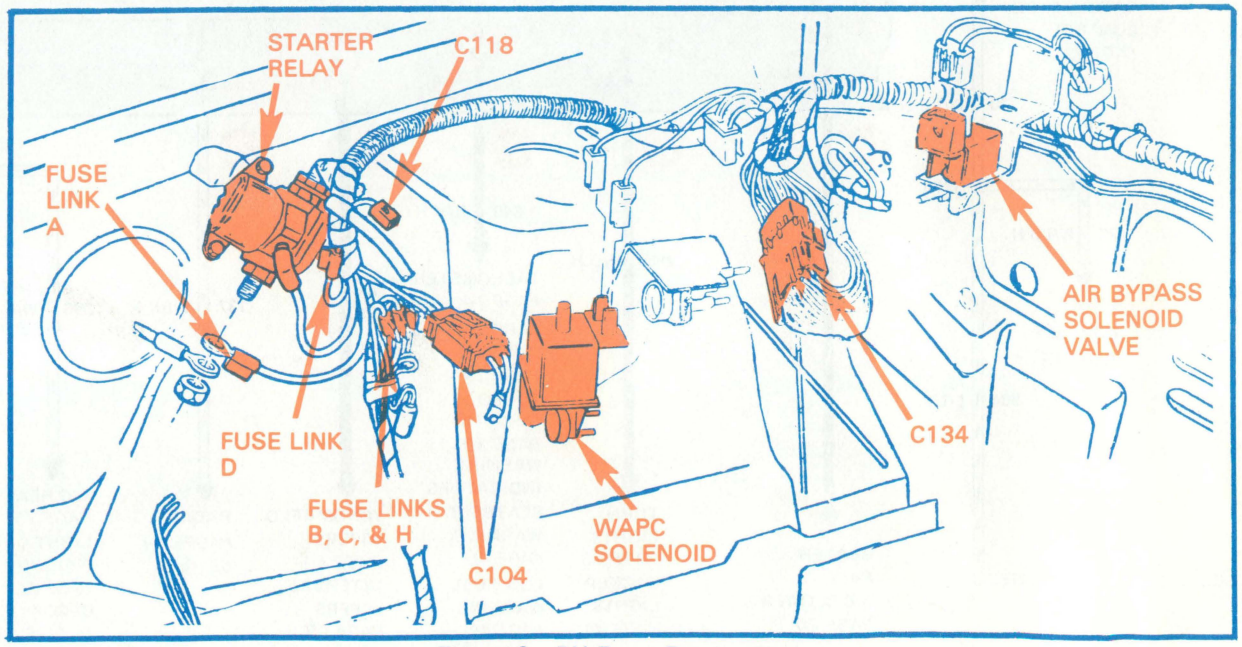


Figure 2 - RH Front Fender (Turbo)

CHARGE

HOW THE CIRCUIT WORKS

The **Battery**, **Alternator**, and **Voltage Regulator** make up the **Charging System**.

With the **Ignition Switch** in RUN, **Battery** current flows through the solid-state **Electronic Control** of the **Voltage Regulator**. The **Electronic Control** operates the solid-state field switch which applies **Battery** voltage to the **Alternator** field through terminal F.

With current in the field and the rotor turning, the **Alternator** stator produces a DC voltage at terminal B (to **Battery**). This voltage balances the **Battery** voltage. If the voltages are different, the resulting current flow is indicated on the **Ammeter**. The **Choke Heater** operates only when the **Alternator** is generating current (through terminal S). Above 60°F, the heater causes a thermostatic spring to pull the choke plates open within 1 to 1.5 minutes. Below 60°F, the heater does not operate and normal choke action occurs.

NOTE

The Voltage Regulator with BLUE printing on the cover is used with Ammeter; RED printing with either Ammeter or Alternator Warning Indicator.

COMPONENT LOCATION

		Page-Figure	Color	Terminals
Alternator (4 cyl)	LH front of engine assembly			
(6 and 8 cyl)	RH front of engine assembly			
Ammeter	Part of instrument cluster			
Choke Heater	Attached to carburetor	19-1		
Fuse Links A, B, C, D, & H	Near starter relay assembly	12-2		
Fuse Link E	At starter motor	12-1		
Fuse Link J	At starter relay	61-1		
Fuse Links K & L	Near LH shock tower	25-2		
In-Line Circuit Breaker	Attached to starter relay	12-1		
Radio Noise Capacitor	RH fender apron below starter relay	12-3		
Starter Relay	RH fender apron in front of wheel well	12-2		
Voltage Regulator	RH fender apron attached below starter relay	12-3		
Connector C104	Near starter relay	12-2	BR	2
Connector C110	RH fender apron below voltage regulator	12-3	BK	1
Connector C118	LH fender apron below starter relay	12-2	GY	1
Connector C142	Taped in harness, near C1980			1
Connector C201	Under LH side of I/P on shake brace	52-2	GY	8
Connector C208	Under LH side of I/P on shake brace	52-2	GY	4
Connector C210	Under LH side of I/P on shake brace	52-2	BR	6
Connector C217	Behind LH side of I/P above fuse block	52-1	Y	3
Connector C247	Behind LH side of I/P on instrument cluster	89-1	GY	14
Connector C258	Behind LH side of I/P attached to light switch	45-2	GY	7
Ground G101	Lower LH front of engine assembly	13-1		
Ground G116	Inside RH fender behind battery	13-1		

TROUBLESHOOTING HINTS

IMPROPER CHARGING

The most common charge system complaints are dead **Battery**, and **Ammeter** discharging at normal speed.

- Check **Fuse Link A** at **Starter Relay**.
- Check **Alternator** belt tension.
- Check **Battery** terminals and cable clamps.
- Check for clean and tight connections on **Alternator**, **Regulator**, and **Starter Relay**.

Read "Charging System Diagnosis" in Section 31-01 of Shop Manual for detailed **Charging System** tests.

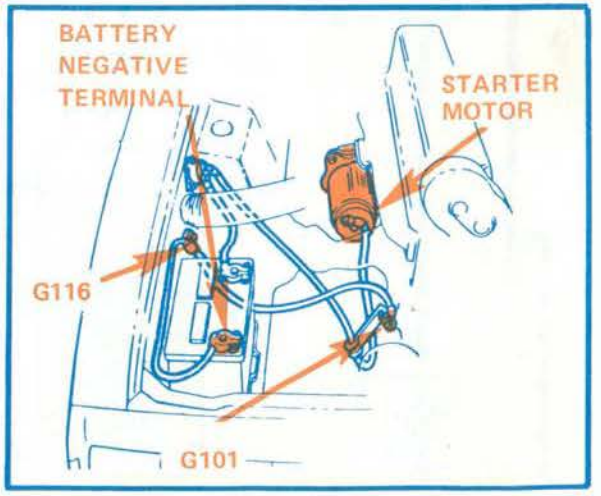
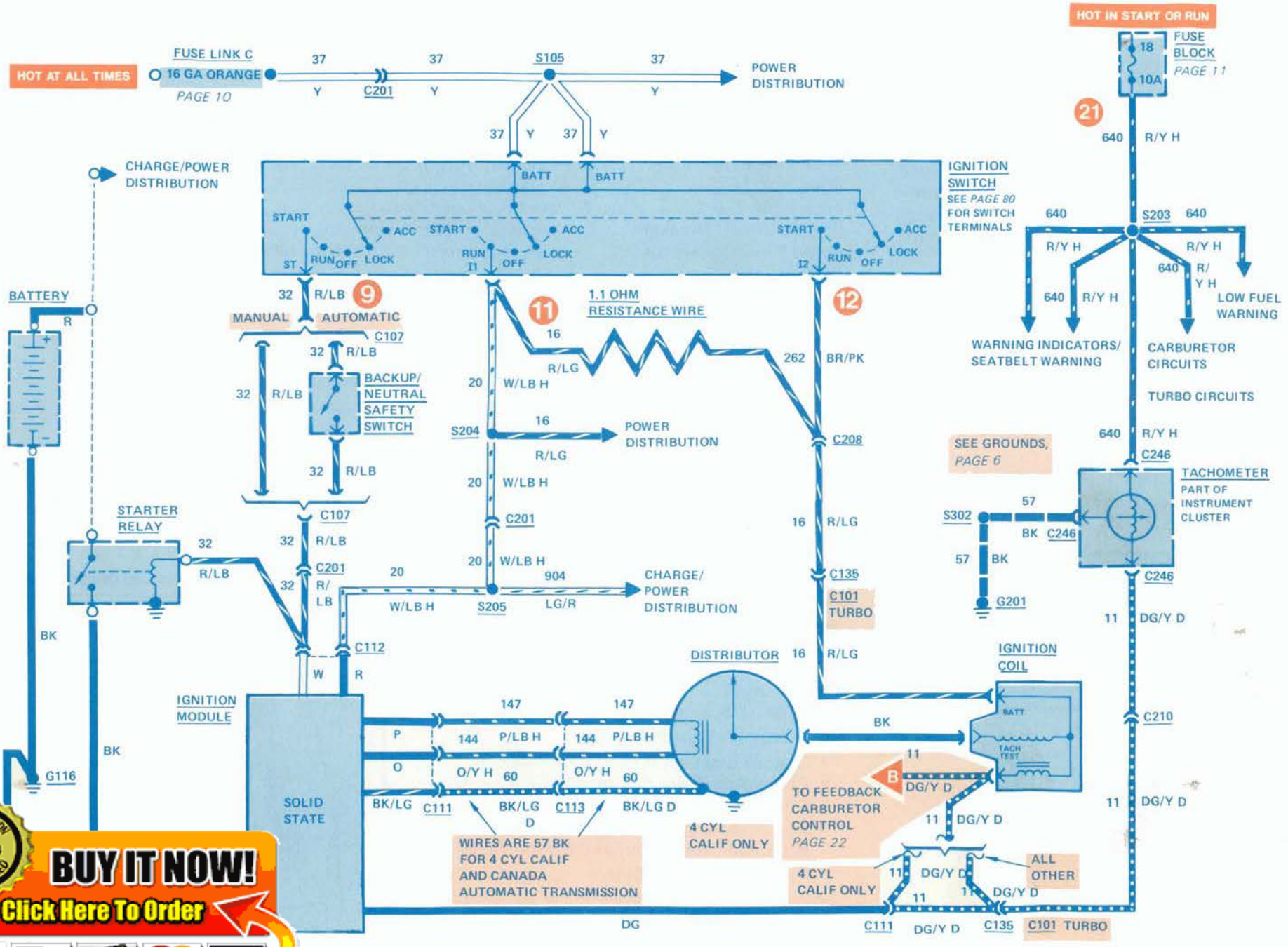


Figure 1 - RH Fender



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