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CHASSIS ELECTRICAL

UNDERSTANDING AND TROUBLESHOOTING ELECTRICAL SYSTEMS

Basic Electrical Theory

See Figure 1

For any 12 volt, negative ground, electrical system to operate, the electricity must travel in a complete circuit. This simply means that current (power) from the positive (+) terminal of the battery must eventually return to the negative (-) terminal of the battery. Along the way, this current will travel through wires, fuses, switches and components. If, for any reason, the flow of current through the circuit is interrupted, the component fed by that circuit will cease to function properly.

Perhaps the easiest way to visualize a circuit is to think of connecting a light bulb (with two wires attached to it) to the battery—one wire attached to the negative (-) terminal of the battery and the other wire to the positive (+) terminal. With the two wires touching the battery terminals, the circuit would be complete and the light bulb would illuminate. Electricity would follow a path from the battery to the bulb and back to the battery. It's easy to see that with longer wires on our light bulb, it could be mounted anywhere. Further, one wire could be fitted with a switch so that the light could be turned on and off.

The normal automotive circuit differs from this simple example in two ways. First, instead of having a return wire from the bulb to the battery, the current travels through the frame of the vehicle. Since the negative (-) battery cable is attached to the frame (made of electrically conductive metal), the frame of the vehicle can serve as a ground wire to complete the circuit. Secondly, most automotive circuits contain multiple components which receive power from a single circuit. This lessens the amount of wire needed to power components on the vehicle.

HOW DOES ELECTRICITY WORK: THE WATER ANALOGY

Electricity is the flow of electrons—the subatomic particles that constitute the outer shell of an atom. Electrons spin in an orbit around the center core of an atom. The center core is comprised of protons (positive charge) and neutrons (neutral charge). Electrons have a negative charge and balance out the positive charge of the protons. When an outside force causes the number of electrons to unbalance the charge of the protons, the electrons will split off the atom and look for another atom to balance out. If this imbalance is kept up, electrons will continue to move and an electrical flow will exist.

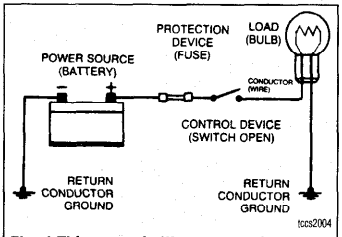

Fig. 1 This example illustrates a simple circuit. When the switch is closed, power from the positive (+) battery terminal flows through the fuse and the switch, and then to the light bulb. The light illuminates and the circuit is completed through the ground wire back to the negative (-) battery terminal. In reality, the two ground points shown in the illustration are attached to the metal frame of the vehicle, which completes the circuit back to the battery

Many people have been taught electrical theory using an analogy with water. In a comparison with water flowing through a pipe, the electrons would be the water and the wire is the pipe.

The flow of electricity can be measured much like the flow of water through a pipe. The unit of measurement used is amperes, frequently abbreviated as amps (a). You can compare amperage to the volume of water flowing through a pipe. When connected to a circuit, an ammeter will measure the actual amount of current flowing through the circuit. When relatively few electrons flow through a circuit, the amperage is low. When many electrons flow, the amperage is high.

Water pressure is measured in units such as pounds per square inch (psi); The electrical pressure is measured in units called volts (v). When a voltmeter is connected to a circuit, it is measuring the electrical pressure.

The actual flow of electricity depends not only on voltage and amperage, but also on the resistance of the circuit. The higher the resistance, the higher the force necessary to push the current through the circuit. The standard unit for measuring resistance is an ohm. Resistance in a circuit varies depending on the amount and type of components used in the circuit. The main factors which determine resistance are:

- Material—some materials have more resistance than others. Those with high resistance are said to be insulators. Rubber materials (or rubber-like plastics) are some of the most common insulators used in vehicles as they have a very high resistance to electricity. Very low resistance materials are said to be conductors. Copper wire is among the best conductors. Silver is actually a superior conductor to copper and is used in some relay contacts, but its high cost prohibits its use as common wiring. Most automotive wiring is made of copper.
- Size—the larger the wire size being used, the less resistance the wire will have. This is why components which use large amounts of electricity usually have large wires supplying current to them.
- Length—for a given thickness of wire, the longer the wire, the greater the resistance. The shorter the wire, the less the resistance. When determining the proper wire for a circuit, both size and length must be considered to design a circuit that can handle the current needs of the component.
- Temperature—with many materials, the higher the temperature, the greater the resistance (positive temperature coefficient). Some materials exhibit the opposite trait of lower resistance with higher temperatures (negative temperature coefficient). These principles are used in many of the sensors on the engine.

OHM'S LAW

There is a direct relationship between current, voltage and resistance. The relationship between current, voltage and resistance can be summed up by a statement known as Ohm's law.

Voltage (E) is equal to amperage (I) times resistance (R): E=I x R

Other forms of the formula are R=E/I and I=E/R

In each of these formulas, E is the voltage in volts, I is the current in amps and R is the resistance in ohms. The basic point to remember is that as the resistance of a circuit goes up, the amount of current that flows in the circuit will go down, if voltage remains the same.

The amount of work that the electricity can perform is expressed as power. The unit of power is the watt (w). The relationship between power, voltage and current is expressed as:

Power (w) is equal to amperage (I) times voltage (E): W=I x E

This is only true for direct current (DC) circuits; The alternating current formula is a tad different, but since the electrical circuits in most vehicles are DC type, we need not get into AC circuit theory.

Electrical Components

POWER SOURCE

Power is supplied to the vehicle by two devices: The battery and the alternator. The battery supplies electrical power during starting or during periods when the current demand of the vehicle's electrical system exceeds the output capacity of the alternator. The alternator supplies electrical current when the engine is running. Just not does the alternator supply the current needs of the vehicle, but it recharges the battery.

The Battery

In most modern vehicles, the battery is a lead/acid electrochemical device consisting of six 2 volt subsections (cells) connected in series, so that the unit is capable of producing approximately 12 volts of electrical pressure. Each subsection consists of a series of positive and negative plates held a short distance apart in a solution of sulfuric acid and water.

The two types of plates are of dissimilar metals. This sets up a chemical reaction, and it is this reaction which produces current flow from the battery when its positive and negative terminals are connected to an electrical load. The power removed from the battery is replaced by the alternator, restoring the battery to its original chemical state.

The Alternator

On some vehicles there isn't an alternator, but a generator. The difference is that an alternator supplies alternating current which is then changed to direct current for use on the vehicle, while a generator produces direct current. Alternators tend to be more efficient and that is why they are used.

Alternators and generators are devices that consist of coils of wires wound together making big electromagnets. One group of coils spins within another set and the interaction of the magnetic fields causes a current to flow. This current is then drawn off the coils and fed into the vehicles electrical system.

GROUND

Two types of grounds are used in automotive electric circuits. Direct ground components are grounded to the frame through their mounting points. All other components use some sort of ground wire which is attached to the frame or chassis of the vehicle. The electrical current runs through the chassis of the vehicle and returns to the battery through the ground (-) cable; if you look, you'll see that the battery ground cable connects between the battery and the frame or chassis of the vehicle.

➡It should be noted that a good percentage of electrical problems can be traced to bad grounds.

PROTECTIVE DEVICES

See Figure 2

It is possible for large surges of current to pass through the electrical system of your vehicle. If this surge of current were to reach the load in the circuit, the surge could burn it out or severely damage it. It can also overload the wiring, causing the harness to get hot and melt the insulation. To prevent this, fuses, circuit breakers and/or fusible links are connected into the supply wires of the electrical system. These items are nothing more than a built-in weak spot in the system. When an abnormal amount of current flows through the system, these protective devices work as follows to protect the circuit:

- Fuse—when an excessive electrical current passes through a fuse, the fuse "blows" (the conductor melts) and opens the circuit, preventing the passage of current.
- Circuit Breaker—a circuit breaker is basically a self-repairing fuse. It will open the circuit in the same fashion as a fuse, but when the surge subsides, the circuit breaker can be reset and does not need replacement.

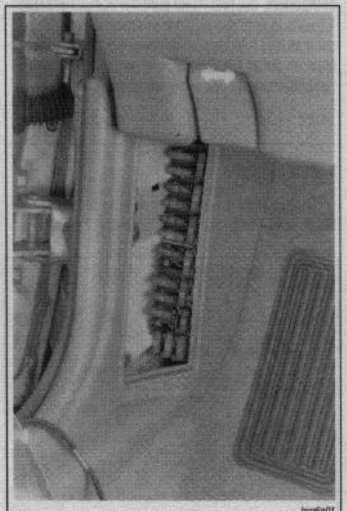

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Fig. 2 Most vehicles use one or more fuse panels. This one is located on the driver's side kick panel

- Fusible Link—a fusible link (fuse link or main link) is a short length of special, high temperature insulated wire that acts as a fuse. When an excessive electrical current passes through a fusible link, the thin gauge wire inside the link melts, creating an intentional open to protect the circuit. To repair the circuit, the link must be replaced. Some newer type fusible links are housed in plug-in modules, which are simply replaced like a fuse, while older type fusible links must be cut and spliced if they melt. Since this link is very early in the electrical path, it's the first place to look if nothing on the vehicle works, yet the battery seems to be charged and is properly connected.

CAUTION

Always replace fuses, circuit breakers and fusible links with identically rated components. Under no circumstances should a component of higher or lower amperage rating be substituted.

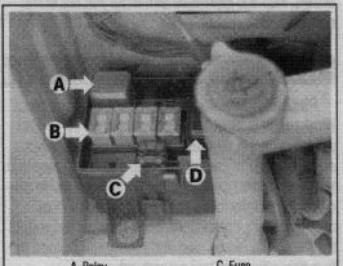
SWITCHES & RELAYS

See Figures 3 and 4

Switches are used in electrical circuits to control the passage of current. The most common use is to open and close circuits between the battery and the various electric devices in the system. Switches are rated according to the amount of amperage they can handle. If a sufficient amperage rated switch is not used in a circuit, the switch could overload and cause damage.

Some electrical components which require a large amount of current to operate use a special switch called a relay. Since these circuits carry a large amount of current, the thickness of the wire in the circuit is also greater. If this large wire were connected from the load to the control switch, the switch would have to carry the high amperage load and the fairing or instrument panel would be twice as large to accommodate the increased size of the wiring harness. To prevent these problems, a relay is used.

Relays are composed of a coil and a set of contacts. When the coil has a current passed though it, a magnetic field is formed and this field causes the contacts to move together, completing the circuit. Most relays are normally open, preventing current from passing through the circuit, but they can take any electrical form depending on the job they are intended to do. Relays can be considered "remote control switches." They allow a smaller current to operate devices that require higher amperages. When a small current operates the coil, a larger current is allowed to pass by the contacts. Some common circuits which may use relays are the horn, headlights, starter, electric fuel pump and other high draw circuits.



A. Relay
B. Fusible link
C. Fuse
D. Flasher

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Fig. 3 The underhood fuse and relay panel usually contains fuses, relays, flashers and fusible links

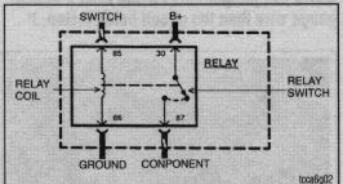

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Fig. 4 Relays are composed of a coil and a switch. These two components are linked together so that when one operates, the other operates at the same time. The large wires in the circuit are connected from the battery to one side of the relay switch (B+) and from the opposite side of the relay switch to the load (component). Smaller wires are connected from the relay coil to the control switch for the circuit and from the opposite side of the relay coil to ground

LOAD

Every electrical circuit must include a "load" (something to use the electricity coming from the source). Without this load, the battery would attempt to deliver its entire power supply from one pole to another. This is called a "short circuit." All this electricity would take a short cut to ground and cause a great amount of damage to other components in the circuit by developing a tremendous amount of heat. This condition could develop sufficient heat to melt the insulation on all the surrounding wires and reduce a multiple wire cable to a lump of plastic and copper.

WIRING & HARNESSES

The average vehicle contains meters and meters of wiring, with hundreds of individual connections. To protect the many wires from damage and to keep them from becoming a confusing tangle, they are organized into bundles, enclosed in plastic or taped together and called wiring harnesses. Different harnesses serve different parts of the vehicle. Individual wires are color coded to help trace them through a harness where sections are hidden from view.

Automotive wiring or circuit conductors can be either single strand wire, multi-strand wire or printed circuitry. Single strand wire has a solid metal core and is usually used inside such components as alternators, motors, relays and other devices. Multi-strand wire has a core made of many small strands of wire twisted together into a single conductor. Most of the wiring in an automotive electrical system is made up of multi-strand wire, either as a single conductor or grouped together in a harness. All wiring is color coded on the insulator, either as a solid color or as a colored wire with an identification stripe. A printed circuit is a thin film of copper or other conductor that is printed on an insulator backing. Occasionally, a

printed circuit is sandwiched between two sheets of plastic for more protection and flexibility. A complete printed circuit, consisting of conductors, insulating material and connectors for lamps or other components is called a printed circuit board. Printed circuitry is used in place of individual wires or harnesses in places where space is limited, such as behind instrument panels.

Since automotive electrical systems are very sensitive to changes in resistance, the selection of properly sized wires is critical when systems are repaired. A loose or corroded connection or a replacement wire that is too small for the circuit will add extra resistance and an additional voltage drop to the circuit.

The wire gauge number is an expression of the cross-section area of the conductor. Vehicles from countries that use the metric system will typically describe the wire size as its cross-sectional area in square millimeters. In this method, the larger the wire, the greater the number. Another common system for expressing wire size is the American Wire Gauge (AWG) system. As gauge number increases, area decreases and the wire becomes smaller. An 18 gauge wire is smaller than a 4 gauge wire. A wire with a higher gauge number will carry less current than a wire with a lower gauge number. Gauge wire size refers to the size of the strands of the conductor, not the size of the complete wire with insulator. It is possible, therefore, to have two wires of the same gauge with different diameters because one may have thicker insulation than the other.

It is essential to understand how a circuit works before trying to figure out why it doesn't. An electrical schematic shows the electrical current paths when a circuit is operating properly. Schematics break the entire electrical system down into individual circuits. In a schematic, usually no attempt is made to represent wiring and components as they physically appear on the vehicle; switches and other components are shown as simply as possible. Face views of harness connectors show the cavity or terminal locations in all multi-pin connectors to help locate test points.

CONNECTORS

See Figures 5 and 6

Three types of connectors are commonly used in automotive applications—weatherproof, molded and hard shell.

- Weatherproof—these connectors are most commonly used where the connector is exposed to the elements. Terminals are protected against moisture and dirt by sealing rings which provide a weathertight seal. All repairs require the use of a special terminal and the tool required to service it. Unlike standard blade type terminals, these weatherproof terminals cannot be straightened once they are bent. Make certain that the connectors are properly seated and all of the sealing rings are in place when connecting leads.
- Molded—these connectors require complete replacement of the connector if found to be defective. This means splicing a new connector assembly into the harness. All splices should be soldered to insure proper contact. Use care when probing the connections or replacing terminals in them, as it is possible to create a short circuit between opposite terminals. If this happens to the wrong terminal pair, it is possible to damage certain components. Always use jumper wires between connectors for circuit checking and NEVER probe through weatherproof seals.
- Hard Shell—unlike molded connectors, the terminal contacts in hard-shell connectors can be replaced. Replacement usually involves the use of a special terminal removal tool that depresses the locking tangs (barbs) on the connector terminal and allows the connector to be removed from the rear of the shell. The connector shell should be replaced if it shows any evidence of burning, melting, cracks, or breaks. Replace individual terminals that are burnt, corroded, distorted or loose.

Test Equipment

Pinpointing the exact cause of trouble in an electrical circuit is most times accomplished by the use of special test equipment. The following describes different types of commonly used test equipment and briefly explains how to use them in diagnosis. In addition to the information covered below, the tool manufacturer's instructions booklet (provided with the tester) should be read and clearly understood before attempting any test procedures.

JUMPER WIRES

CAUTION

Never use jumper wires made from a thinner gauge wire than the circuit being tested. If the jumper wire is of too small a gauge, it may overheat and possibly melt. Never use jumpers to bypass high resistance loads in a circuit. Bypassing resistances, in effect, creates a short circuit. This may, in turn, cause damage and fire. Jumper wires should only be used to bypass lengths of wire or to simulate switches.

Jumper wires are simple, yet extremely valuable, pieces of test equipment. They are basically test wires which are used to bypass sections of a circuit. Although jumper wires can be purchased, they are usually fabricated from lengths of standard automotive wire and whatever type of connector (alligator clip, spade connector or pin connector) that is required for the particular application being tested. In cramped, hard-to-reach areas, it is advisable to have insulated boots over the jumper wire terminals in order to prevent accidental grounding. It is also advisable to include a standard automotive fuse in any jumper wire. This is commonly referred to as a "fused jumper". By inserting an in-line fuse holder between a set of test leads, a fused jumper wire can be used for bypassing open circuits. Use a 5 amp fuse to provide protection against voltage spikes.

Jumper wires are used primarily to locate open electrical circuits, on either the ground (-) side of the circuit or on the power (+) side. If an electrical component fails to operate, connect the jumper wire between the component and a good ground. If the component operates only with the jumper installed, the ground circuit is open. If the ground circuit is good, but the component does not operate, the circuit between the power feed and component may be open. By moving the jumper wire successively back from the component toward the power source, you can isolate the area of the circuit where the open is located. When the component stops functioning, or the power is cut off, the open is in the segment of wire between the jumper and the point previously tested.

You can sometimes connect the jumper wire directly from the battery to the "hot" terminal of the component, but first make sure the component uses 12 volts in operation. Some electrical components, such as fuel injectors or sensors, are designed to operate on about 4 to 5 volts, and running 12 volts directly to these components will cause damage.

TEST LIGHTS

See Figure 7

The test light is used to check circuits and components while electrical current is flowing through

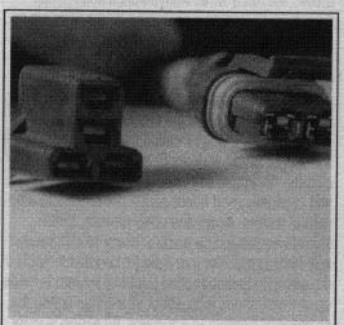

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Fig. 5 Hard shell (left) and weatherproof (right) connectors have replaceable terminals

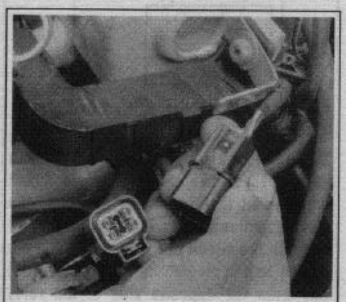

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Fig. 6 Weatherproof connectors are most commonly used in the engine compartment or where the connector is exposed to the elements

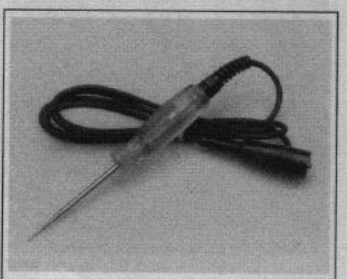

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Fig. 7 A 12 volt test light is used to detect the presence of voltage in a circuit

them. It is used for voltage and ground tests. To use a 12 volt test light, connect the ground clip to a good ground and probe wherever necessary with the pick. The test light will illuminate when voltage is detected. This does not necessarily mean that 12 volts (or any particular amount of voltage) is present; it only means that some voltage is present. It is advisable before using the test light to touch its ground clip and probe across the battery posts or terminals to make sure the light is operating properly.

⁂ WARNING

Do not use a test light to probe electronic ignition, spark plug or coil wires. Never use a pick-type test light to probe wiring on computer controlled systems unless specifically instructed to do so. Any wire insulation that is pierced by the test light probe should be taped and sealed with silicone after testing.

Like the jumper wire, the 12 volt test light is used to isolate opens in circuits. But, whereas the jumper wire is used to bypass the open to operate the load, the 12 volt test light is used to locate the presence of voltage in a circuit. If the test light illuminates, there is power up to that point in the circuit; if the test light does not illuminate, there is an open circuit (no power). Move the test light in successive steps back toward the power source until the light in the handle illuminates. The open is between the probe and a point which was previously probed.

The self-powered test light is similar in design to the 12 volt test light, but contains a 1.5 volt penlight battery in the handle. It is most often used in place of a multimeter to check for open or short circuits when power is isolated from the circuit (continuity test).

The battery in a self-powered test light does not provide much current. A weak battery may not provide enough power to illuminate the test light even when a complete circuit is made (especially if there is high resistance in the circuit). Always make sure that the test battery is strong. To check the battery, briefly touch the ground clip to the probe; if the light glows brightly, the battery is strong enough for testing.

➨A self-powered test light should not be used on any computer controlled system or component. The small amount of electricity transmitted by the test light is enough to damage many electronic automotive components.

MULTIMETERS

Multimeters are an extremely useful tool for troubleshooting electrical problems. They can be purchased in either analog or digital form and have a price range to suit any budget. A multimeter is a voltmeter, ammeter and ohmmeter (along with other features) combined into one instrument. It is often used when testing solid state circuits because of its high input impedance (usually 10 megaohms or more). A brief description of the multimeter main test functions follows:

- Voltmeter—the voltmeter is used to measure voltage at any point in a circuit, or to measure the voltage drop across any part of a circuit. Voltmeters usually have various scales and a selector switch to allow the reading of different voltage ranges. The voltmeter has a positive and a negative lead. To avoid damage to the meter, always connect the negative lead to the negative (-) side of the circuit (to ground or nearest the ground side of the circuit) and connect the positive lead to the positive (+) side of the circuit (to the power source or the nearest power source). Note that the negative voltmeter lead will always be black and that the positive voltmeter will always be some color other than black (usually red).
- Ohmmeter—the ohmmeter is designed to read resistance (measured in ohms) in a circuit or component. Most ohmmeters will have a selector switch which permits the measurement of different ranges of resistance (usually the selector switch allows the multiplication of the meter reading by 10, 100, 1,000 and 10,000). Some ohmmeters are "auto-ranging" which means the meter itself will determine which scale to use. Since the meters are powered by an internal battery, the ohmmeter can be used like a self-powered test light. When the ohmmeter is connected, current from the ohmmeter flows through the circuit or component being tested. Since the ohmmeter's internal resistance and voltage are known values, the amount of current flow through the meter depends on the resistance of the circuit or component being tested. The ohmmeter can also be used to perform a continuity test for suspected open circuits. In using the meter for making continuity checks, do not be concerned with the actual resistance readings. Zero resistance, or any ohm reading, indicates continuity in the circuit. Infinite resistance indicates an opening in the circuit. A high resistance reading where there should be none indicates a problem in the circuit. Checks for short circuits are made in the same manner as checks for open circuits, except that the circuit must be isolated from both power and normal ground. Infinite resistance indicates no continuity, while zero resistance indicates a dead short.

⁂ WARNING

Never use an ohmmeter to check the resistance of a component or wire while there is voltage applied to the circuit.

- Ammeter—an ammeter measures the amount of current flowing through a circuit in units called amperes or amps. At normal operating voltage, most circuits have a characteristic amount of amperes, called "current draw" which can be measured using an ammeter. By referring to a specified current draw rating, then measuring the amperes and comparing the two values, one can determine what is happening within the circuit to aid in diagnosis. An open circuit, for example, will not allow any current to flow, so the ammeter reading will be zero. A damaged component or circuit will have an increased current draw, so the reading will be high. The ammeter is always connected in series with the circuit being tested. All of the current that normally flows through the circuit must also flow through the ammeter; if there is any other path for the current to follow, the ammeter reading will not be accurate. The ammeter itself has very little resistance to current flow and, therefore, will not affect the circuit, but it will measure current draw only when the circuit is closed and electricity is flowing. Excessive current draw can blow fuses and drain the battery, while a reduced current draw can cause motors to run slowly, lights to dim and other components to not operate properly.

Troubleshooting Electrical Systems

When diagnosing a specific problem, organized troubleshooting is a must. The complexity of a modern automotive vehicle demands that you approach any problem in a logical, organized manner. There are certain troubleshooting techniques, however, which are standard:

- Establish when the problem occurs. Does the problem appear only under certain conditions? Were there any noises, odors or other unusual symptoms? Isolate the problem area. To do this, make some simple tests and observations, then eliminate the systems that are working properly. Check for obvious problems, such as broken wires and loose or dirty connections. Always check the obvious before assuming something complicated is the cause.
- Test for problems systematically to determine the cause once the problem area is isolated. Are all the components functioning properly? Is there power going to electrical switches and motors. Performing careful, systematic checks will often turn up most causes on the first inspection, without wasting time checking components that have little or no relationship to the problem.
- Test all repairs after the work is done to make sure that the problem is fixed. Some causes can be traced to more than one component, so a careful verification of repair work is important in order to pick up additional malfunctions that may cause a problem to reappear or a different problem to arise. A blown fuse, for example, is a simple problem that may require more than another fuse to repair. If you don't look for a problem that caused a fuse to blow, a shorted wire (for example) may go undetected.

Experience has shown that most problems tend to be the result of a fairly simple and obvious cause, such as loose or corroded connectors, bad grounds or damaged wire insulation which causes a short. This makes careful visual inspection of components during testing essential to quick and accurate troubleshooting.

Testing

OPEN CIRCUITS

See Figure 8

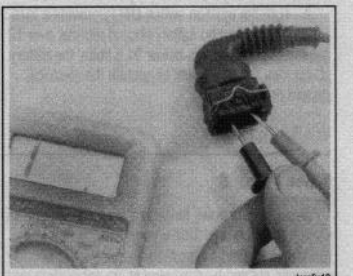

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Fig. 8 The infinite reading on this multimeter indicates that the circuit is open

This test already assumes the existence of an open in the circuit and it is used to help locate the open portion.

1. Isolate the circuit from power and ground.
2. Connect the self-powered test light or ohmmeter ground clip to the ground side of the circuit and probe sections of the circuit sequentially.
3. If the light is out or there is infinite resistance, the open is between the probe and the circuit ground.
4. If the light is on or the meter shows continuity, the open is between the probe and the end of the circuit toward the power source.

SHORT CIRCUITS

➡Never use a self-powered test light to perform checks for opens or shorts when power is applied to the circuit under test. The test light can be damaged by outside power.

1. Isolate the circuit from power and ground.
2. Connect the self-powered test light or ohmmeter ground clip to a good ground and probe any easy-to-reach point in the circuit.
3. If the light comes on or there is continuity, there is a short somewhere in the circuit.
4. To isolate the short, probe a test point at either end of the isolated circuit (the light should be on or the meter should indicate continuity).
5. Leave the test light probe engaged and sequentially open connectors or switches, remove parts, etc. until the light goes out or continuity is broken.
6. When the light goes out, the short is between the last two circuit components which were opened.

VOLTAGE

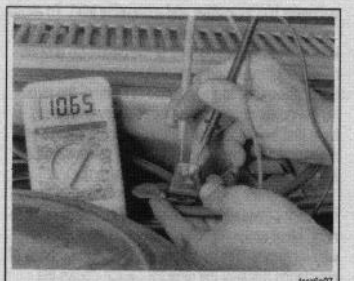
This test determines voltage available from the battery and should be the first step in any electrical troubleshooting procedure after visual inspection. Many electrical problems, especially on computer controlled systems, can be caused by a low state of charge in the battery. Excessive corrosion at the battery cable terminals can cause poor contact that will prevent proper charging and full battery current flow.

1. Set the voltmeter selector switch to the 20V position.
2. Connect the multimeter negative lead to the battery's negative (-) post or terminal and the positive lead to the battery's positive (+) post or terminal.
3. Turn the ignition switch **ON** to provide a load.
4. A well charged battery should register over 12 volts. If the meter reads below 11.5 volts, the battery power may be insufficient to operate the electrical system properly.

VOLTAGE DROP

➧ See Figure 9

When current flows through a load, the voltage beyond the load drops. This voltage drop is due to the resistance created by the load and also by small resistances created by corrosion at the connectors and damaged insulation on the wires. The maximum allowable voltage drop under load is critical, especially if there is more than one load in the circuit, since all voltage drops are cumulative.



tccae6p07

Fig. 9 This voltage drop test revealed high resistance (low voltage) in the circuit

1. Set the voltmeter selector switch to the 20 volt position.
2. Connect the multimeter negative lead to a good ground.
3. Operate the circuit and check the voltage prior to the first component (load).
4. There should be little or no voltage drop in the circuit prior to the first component. If a voltage drop exists, the wire or connectors in the circuit are suspect.
5. While operating the first component in the circuit, probe the ground side of the component with the positive meter lead and observe the voltage readings. A small voltage drop should be noticed. This voltage drop is caused by the resistance of the component.
6. Repeat the test for each component (load) down the circuit.
7. If a large voltage drop is noticed, the preceding component, wire or connector is suspect.

RESISTANCE

➧ See Figures 10 and 11

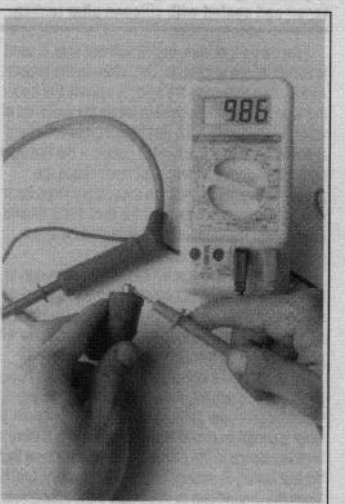
⁂ WARNING

Never use an ohmmeter with power applied to the circuit. The ohmmeter is designed to operate on its own power supply. The normal 12 volt electrical system voltage could damage the meter!

1. Isolate the circuit from the vehicle's power source.
2. Ensure that the ignition key is **OFF** when disconnecting any components or the battery.
3. Where necessary, also isolate at least one side of the circuit to be checked, in order to avoid reading parallel resistances. Parallel circuit resistances will always give a lower reading than the actual resistance of either of the branches.
4. Connect the meter leads to both sides of the circuit (wire or component) and read the actual measured ohms on the meter scale. Make sure the selector switch is set to the proper ohm scale for the circuit being tested, to avoid misreading the ohmmeter test value.

tccae6p08

Fig. 10 Checking the resistance of a coolant temperature sensor with an ohmmeter. Reading is 1.04 kilohms



tccae6p09

Fig. 11 Spark plug wires can be checked for excessive resistance using an ohmmeter

Wire and Connector Repair

Almost anyone can replace damaged wires, as long as the proper tools and parts are available. Wire and terminals are available to fit almost any need. Even the specialized weatherproof, molded and hard shell connectors are now available from aftermarket suppliers.

Be sure the ends of all the wires are fitted with the proper terminal hardware and connectors. Wrapping a wire around a stud is never a permanent solution and will only cause trouble later. Replace wires one at a time to avoid confusion. Always route wires exactly the same as the factory.

➡If connector repair is necessary, only attempt it if you have the proper tools. Weatherproof and hard shell connectors require special tools to release the pins inside the connector. Attempting to repair these connectors with conventional hand tools will damage them.

BATTERY CABLES

Disconnecting the Cables

When working on any electrical component on the vehicle, it is always a good idea to disconnect the negative (-) battery cable. This will prevent potential damage to many sensitive electrical components such as the Powertrain Control Module (PCM), radio, alternator, etc.

➡Any time you disengage the battery cables, it is recommended that you disconnect the negative (-) battery cable first. This will prevent your accidentally grounding the positive (+) terminal to the body of the vehicle when disconnecting it, thereby preventing damage to the above mentioned components.

Before you disconnect the cable(s), first turn the ignition to the **OFF** position. This will prevent a draw on the battery which could cause arcing (electricity trying to ground itself to the body of a vehicle, just like a spark plug jumping the gap) and, of course, damaging some components such as the alternator diodes.

When the battery cable(s) are reconnected (negative cable last), be sure to check that your lights, windshield wipers and other electrically operated safety components are all working correctly. If your vehicle contains an Electronically Tuned Radio (ETR), don't forget to also reset your radio stations. Ditto for the clock.

AIR BAG (SUPPLEMENTAL RESTRAINT SYSTEM)

General Information

SERVICE PRECAUTIONS

See Figures 12, 13, and 14

93156p38

Fig. 12 To prevent personal injury, ALWAYS carry a live air bag facing away from you in case of accidental deployment

93156p37

Fig. 13 To prevent personal injury, ALWAYS place a live airbag with the cover facing up in case of accidental deployment

93156p81

Fig. 14 Be sure to observe any precaution labels on the vehicle regarding the air bag system

⁂ CAUTION

Some vehicles are equipped with an air bag system, also known as the Supplemental Inflatable Restraint (SIR) or Supplemental Restraint System (SRS). The system must be disabled before performing service on or around system components, steering column, instrument panel components, wiring and sensors. Failure to follow safety and disabling procedures could result in accidental air bag deployment, possible personal injury and unnecessary system repairs.

Several precautions must be observed when handling the inflator module to avoid accidental deployment and possible personal injury.

- Never carry the inflator module by the wires or connector on the underside of the module.
- When carrying a live inflator module, hold securely with both hands, and ensure that the bag and trim cover are pointed away.
- Place the inflator module on a bench or other surface with the bag and trim cover facing up.
- With the inflator module on the bench, never place anything on or close to the module which may be thrown in the event of an accidental deployment.

DISARMING

See Figure 15

1. Before servicing the vehicle, refer to the precautions in the beginning of this section.
2. Position the front wheels in the straight-ahead position and place the key in the **LOCK** position. Remove the key from the ignition lock cylinder.
3. Disconnect the negative battery cable and insulate the cable end with high-quality electrical tape or similar non-conductive wrapping.
4. Wait at least one minute before working on the vehicle. The air bag system is designed to retain enough voltage to deploy the air bag for a short period of time after the battery has been disconnected.

REARMING

1. Connect the negative battery cable, turn the ignition switch to the **ON** position and check the SRS warning light for proper operation.

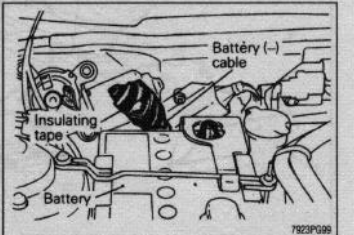


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Fig. 15 Insulate the negative battery cable to prevent accidental deployment of the air bag

HEATING AND AIR CONDITIONING

Blower Motor

REMOVAL & INSTALLATION

Mirage

See Figures 16, 17, and 18

1. Disconnect the negative battery cable.
2. Remove the right side instrument panel undercover panel.
3. Remove the glove box panel and frame.
4. Detach the blower motor electrical connection.
5. Disconnect and remove the resistor.
6. Disconnect the blower motor ventilation tube.
7. Remove the blower motor mounting bolts, remove the blower motor.

To install:

8. Position the blower motor and install the mounting bolts.
9. Attach the blower motor electrical connection.
10. Connect the blower motor ventilation tube.

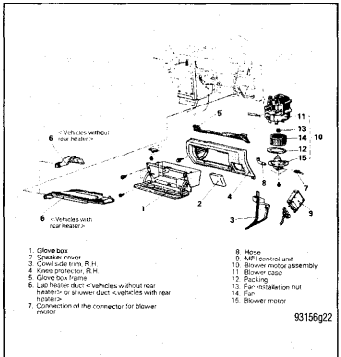


Fig. 16 Exploded view of the blower motor and related components—1990–92 Mirage

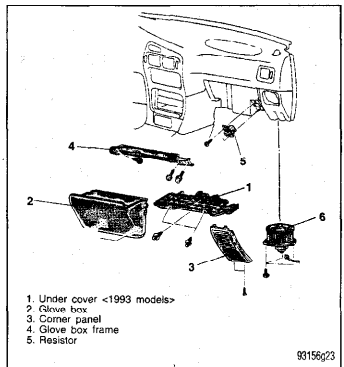


Fig. 17 Exploded view of the blower motor and related components—1993–96 Mirage

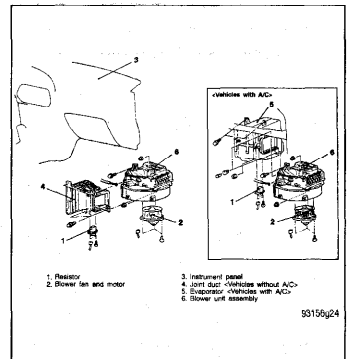


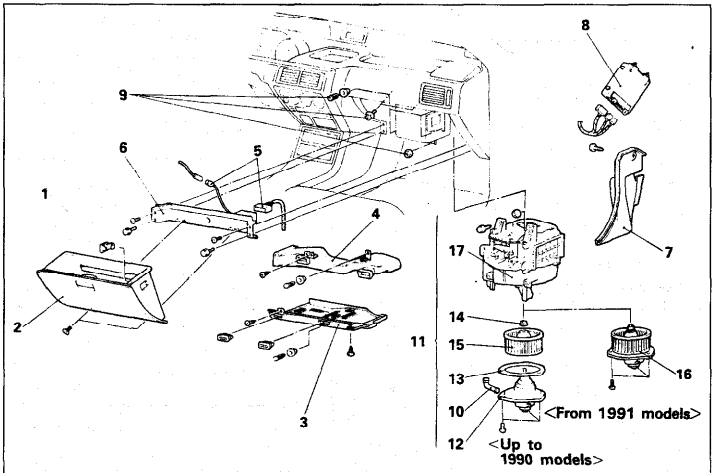
Fig. 18 Exploded view of the blower motor and related components—1997–00 Mirage

11. Install the resistor and the glove box assembly.
12. Install the right side instrument panel undercover panel.
13. Connect the negative battery cable.

1990–93 Galant

♦ See Figure 19

1. Disconnect the negative battery cable.
2. Remove the glove box stopper.
3. Swing the glove box door open all the way and remove the bottom retaining screws. Remove the glovebox.
4. Remove the dash undercover. Note that some of the screws and retainers are concealed behind small covers which must be removed.
5. Remove the heater duct for the passenger's feet.
6. Carefully detach the 10-pin connector running to the back of the glove box frame. Disconnect the single wire (glove box switch) running to the back of the glove box frame.
7. Remove the four bolts holding the glove box frame and remove the frame.
8. Disconnect the small air hose running from the fan motor to the fan housing.



1. Stopper
2. Glove box
3. Under cover
4. Foot shower duct
5. Connector for MFI control relay and connector for glove box switch
6. Glove box frame
7. Cowl side trim
8. Engine control module
9. Evaporator installation bolts, nuts and clips <Vehicles with air conditioning> or duct mounting clips <Vehicles without air conditioning>
10. Hose
11. Blower assembly
12. Blower motor assembly
13. Packing
14. Fan installation nut
15. Fan
16. Blower motor and fan assembly
17. Blower case

Fig. 19 Exploded view of the blower motor and related components—1990–93 Galant

9. Detach the electrical connector from the fan motor.
10. Remove the three small bolts holding the motor to the housing, then remove the motor and fan.

To install:

11. Check the inside of the case carefully; any debris can snag the fan and cause noise or poor airflow.
12. Inspect the gasket (packing) under the motor and replace it if cracked or damaged. Reinstall the fan and motor to the case and install the retaining bolts.
13. Attach the air hose and electrical connector.
14. Install the glove box frame and connect both the 10-pin and single pin connectors properly.
15. Install the heater duct
16. Install the undercover, taking care to insure it is in place and all the fasteners are secure.
17. Install the glove box and its stopper.
18. Connect the negative battery cable.

1994–00 Galant

♦ See Figures 20 and 21

1. Disconnect the negative battery cable.
2. Remove the three instrument panel undercover mounting screws and remove the cover.
3. If equipped with A/C, unplug and remove the compressor module.
4. Detach the electrical connector from the fan motor.
5. Remove the three small bolts holding the motor to the housing and remove the motor and fan.

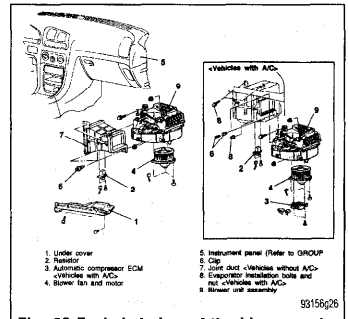


Fig. 20 Exploded view of the blower motor and related components—1994–98 Galant

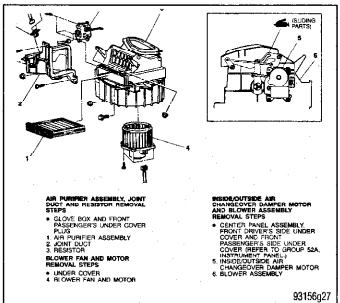


Fig. 21 Exploded view of the blower motor and related components—1999–00 Galant

To install:

6. Check the inside of the case carefully; any debris can snag the fan and cause noise or poor airflow.
7. Install the blower motor, in the blower case and secure with the three mounting bolts.
8. Attach the blower motor electrical connector.
9. Install the compressor module, if removed.
10. Install the undercover, taking care to insure it is in place and all the fasteners are secure.
11. Connect the negative battery cable.

Diamante

▶ See Figures 22 and 23

1. Disarm the air bag, as outlined earlier in this section.

⁂ CAUTION

Wait at least 1 minute before working on the vehicle. The air bag system is designed to retain enough voltage to deploy the air bag for a short period of time even after the battery has been disconnected.

2. Remove the passenger side lower instrument panel and shower duct.
3. Remove the glove box striker, glove box, glove box outer casing and the screw below the assembly.
4. Remove the evaporator case mounting bolt and nut.
5. Remove the inside/outside air changeover damper motor assembly.
6. Remove the PCM, mounting bracket and MFI control relay.
7. Remove the instrument panel passengers side lower bracket.
8. Remove the molded hose from the blower assembly.
9. Remove the blower motor assembly.
10. Remove the fan retaining nut and fan in order to replace the motor.

To install:

11. Check that the blower motor shaft is not bent and that the packing is in good condition. Clean all parts of dust, etc.
12. Assemble the motor and fan. Install the blower motor then attach the connector.
13. Install the molded hose. Install the duct or undercover.
14. Install the evaporator case mounting bolt and nut.
15. Install the instrument panel passengers side lower bracket.
16. Install the PCM, mounting bracket and MFI control relay.
17. Install the inside/outside air changeover damper motor assembly.
18. Install the screw below the glove box assembly, and the entire glove box unit.
19. Install the lower instrument panel and shower duct.
20. Connect the negative battery cable and check the entire climate control system for proper operation.

Heater Core

REMOVAL & INSTALLATION

Diamante

▶ See Figures 24 and 25

1. Disarm the air bag. Refer to the procedure earlier in this section.
2. Drain the cooling system and disconnect the heater hoses from the core tubes. Plug the hoses.
3. Remove the passenger side undercover.
4. Remove the right side foot shower duct.
5. To remove the console, remove the ashtray and remove the revealed screw. Then remove the 4 screws from the sides of the assembly and remove.
6. Remove the decorative plugs from the driver's knee protector. Remove the revealed screws, the knee protector assembly and the protector support bracket.
7. Remove the steering column covers.
8. Remove the glove box striker, glove box, glove box outer casing and the screw below the assembly.
9. Remove the radio bezel and the stereo entertainment system.
10. Remove the climate control system control head.
11. Remove the cup holder.
12. Remove the speakers from the top of the instrument panel.
13. Remove the instrument cluster bezel and the instrument cluster.
14. To remove the speedometer cable adapter from the instrument panel, first disconnect the speedometer cable from the transaxle. Then unlock the adapter from the instrument panel, pull the speedometer cable slightly inwards, and remove the adapter.
15. Detach all steering column connectors, remove the column mounting bolts, and allow the steering column to rest on the front seat. Be very

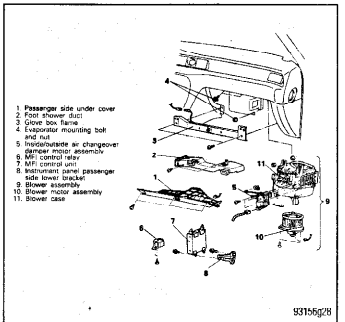


Fig. 22 Exploded view of the blower motor and related components—1992–96 Diamante

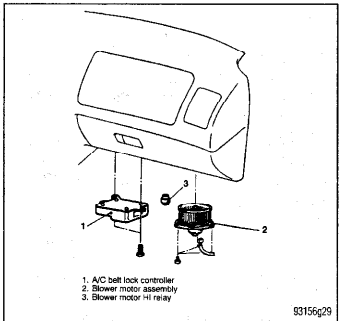


Fig. 23 Exploded view of the blower motor and related components—1997–00 Diamante

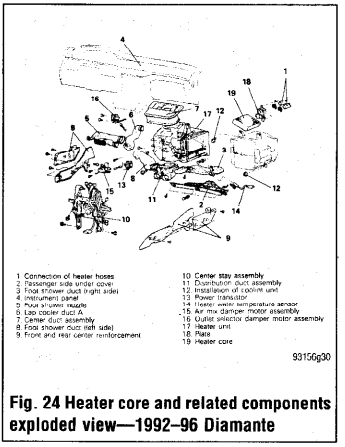


Fig. 24 Heater core and related components exploded view—1992–96 Diamante

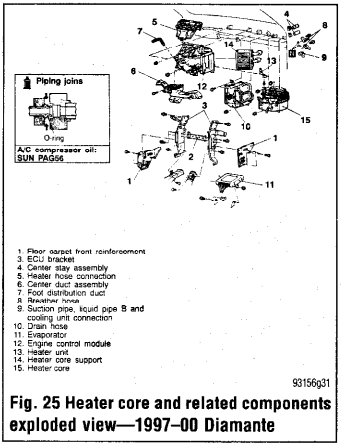


Fig. 25 Heater core and related components exploded view—1997–00 Diamante

careful not to allow anything to come in contact with the air bag unit.

16. Remove the glove box lamp assembly.

17. Remove the remaining instrument panel mounting screws and remove the instrument panel from the vehicle.

18. Remove the left side foot shower ductwork, lap cooler duct and center duct.

19. Remove the front and center reinforcements and center stay assembly.

20. Remove the air distribution duct assembly.

21. Detach all connectors from heater-box-mounted items.

22. Remove the heater box mounting screws and nut, then remove the unit from the vehicle.

23. Disassemble on a workbench. Remove the heater core from the heater case.

To install:

24. Thoroughly clean and dry the inside of the case and install the heater core and all related parts.

25. Install the heater unit to the vehicle and install the mounting screws and nut. Be sure the evaporator case and heater case are fitted together properly. Attach all connectors to heater-box-mounted items.

26. Install the air distribution duct assembly. Install the front and center reinforcements and center stay assembly.

27. Install the center duct, lap cooler duct and left side foot shower duct.

28. Install the instrument panel and mounting screws.

29. Install the glove box lamp assembly.

30. Secure the steering column and attach all steering column connectors.

31. Install the speedometer cable adapter to the instrument panel.

32. Install the instrument cluster and the instrument cluster bezel.

33. Install the speakers to the top of the instrument panel.

34. Install the cup holder.

35. Install the climate control system control head.

36. Install the stereo entertainment system and bezel.

37. Install the screw below the glove box assembly, and the entire glove box unit.

38. Install the steering column covers.

39. Install the knee protector support bracket, the protector and the decorative plugs.

40. Install the console and the ashtray.

41. Install the right side foot shower duct.

42. Install the passenger side undercover.

43. Connect the heater hoses to the core tubes.

44. Fill the cooling system.

45. Connect the negative battery cable and check the entire climate control system for proper operation and leaks.

Galant

See Figures 26, 27, and 28

1. Disconnect the negative battery cable.

2. Disarm the air bag. Refer to the procedure earlier in this section.

3. With the engine cold, set the temperature control lever to the FULL HOT position. Drain the engine coolant.

4. Disconnect the coolant hoses running to the heater pipes at the firewall.

5. Remove the center console.

6. Remove the heater cover.

7. Remove the steering wheel.

8. Remove the small steering column panel.

9. Remove the undercover.

10. Remove the upper and lower steering column covers and detach the wiring connectors.

11. Remove the instrument cluster hood.

12. Remove the mounting screws for the instrument cluster.

13. Pull the cluster out and disconnect the speedometer adapter behind the cluster. Remove the cluster.

14. Remove the floor console and the underframe.

15. Disconnect and remove the air duct, lap heater duct, side defroster duct and the vertical defroster duct.

16. Remove the glove box.

17. Remove the ashtray and its mount. Disconnect the light wiring before removing.

18. Remove the heater control faceplate.

19. Remove the heater control panel and disconnect its harness.

20. Remove the right side undercover from the instrument panel and remove the underframe.

21. On the left side of the instrument panel, remove the fuse box cover and unbolt the fusebox from the instrument panel.

22. Remove the front pillar (windshield pillar trim) from each pillar.

23. Remove the kick panel trim from each side.

24. Loosen the defroster garnish, disconnect the photo sensor wiring and remove the garnish and defroster grille.

25. Remove the grille for the center air outlet.

26. Remove the bolts holding the steering column bracket to the instrument panel.

27. Remove the center reinforcement bracket.

28. On the left side, remove the retaining nuts holding the instrument panel underframe to the body.

29. On the right side, remove the underframe retaining bolts. Note that the bolts are different; the flanged bolt must be correctly reinstalled.

30. Remove the remaining nuts and bolts holding the instrument panel. As the instrument panel comes loose, label and disconnect the wiring harnesses. Carefully remove the instrument panel.

31. If equipped with automatic climate control, remove the power control unit on the lower front of the heater unit.

32. Remove the duct joint between the heater unit and evaporator case (with air conditioning) or blower assembly (heater only).

33. Carefully separate the vacuum hose harness at the connector.

34. Remove the heater unit from the vehicle.

35. To remove the heater core, first remove the cover from the water valve. Disconnect the links and remove the vacuum actuator.

36. Remove the clamps and slide the heater core out of the case. Remove the water valve after the core is removed.

37. With the case removed, the heater core may be changed after the water valve is removed. Remove the plastic cover, remove the clamps and hose and remove the water valve.

To install:

38. Thoroughly clean and dry the inside of the case. Install the core and the water valve, using new hose or clamps.

39. Install the vacuum actuator and the connecting link. Put the cover on the water valve.

40. Install the heater unit and tighten the mounting bolts.

41. Carefully attach the vacuum hose connector to the vacuum harness. Make certain the hoses mate firmly and securely.

42. Install the heater cover, then install the center console.

43. Install the duct joint between heater and evaporator or blower.

44. Install the power control unit and carefully connect the links and rods.

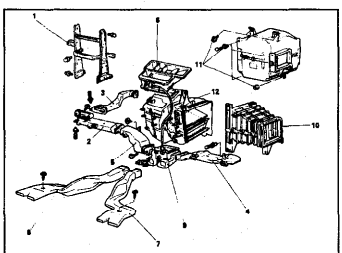


Fig. 26 Exploded view of the heater core and related components—1990–93 Galant

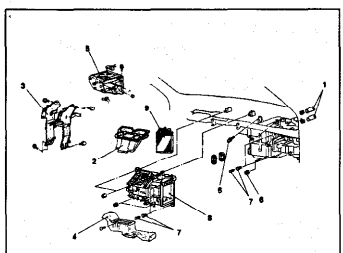


Fig. 27 Exploded view of the heater core and related components—1994–98 Galant

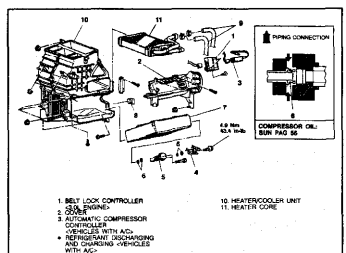


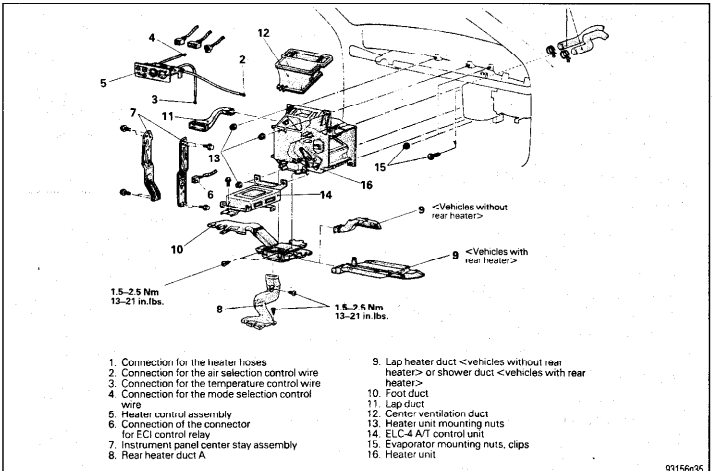
Fig. 28 Exploded view of the heater core and related components—1999–00 Galant

45. Install the heater hoses under the hood.
46. Install the instrument panel by reversing its removal procedure.
47. Install the center console.
48. Install the upper and lower steering column covers.
49. Install the center panel undercover.
50. Install the small column panel.
51. Install the steering wheel.
52. Fill the cooling system.
53. Connect the negative battery cable and check the entire climate control system for proper operation and leaks.

Mirage

See Figures 29, 30, and 31

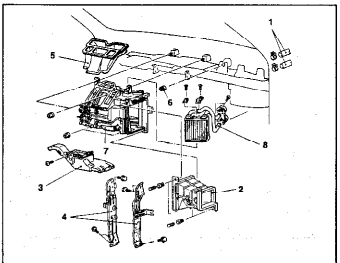
1. Disconnect the negative battery cable.
2. Drain the cooling system and disconnect the heater hoses.
3. Remove the front seats by removing the covers over the anchor bolts, the underseat tray, the seat belt guide ring, the seat mounting nuts and bolts and disconnect the seat belt switch wiring harness from under the seat. Then lift out the seats.
4. Remove the floor console by first taking out the coin holder and the console box tray. Remove the remote control mirror switch or cover. All of these items require only a plastic trim tool to carefully pry them out.
5. Remove the rear half of the console.
6. Remove the shift lever knob on manual transmission vehicles.
7. Remove the front console box assembly.
8. A number of the instrument panel pieces may be retained by pin type fasteners. They may be removed using the following procedure:
   a. Press down on the center pin with a suitable blunt pointed tool. Press down a little more than $1/16$ in. (2mm) to release the clip. Pull the clip outward to remove it.
   b. Do not push the pin inward more than necessary because it may damage the grommet or the pin may fall in if pushed in too far. Once the clips are removed, use a plastic trim stick to pry the piece loose.
9. Remove both lower cowl trim panels (kick panels).
10. Remove the ashtray.
11. Remove the center panel around the radio.
12. Remove the sunglass pocket at the upper left side of panel and the side panel into which it mounts.
13. Remove the driver's side knee protector and the hood release handle.
14. Remove the steering column top and bottom covers.
15. Remove the radio.
16. Remove the glove box striker and box assembly.
17. Remove the instrument panel lower cover, 2 small pieces in the center, by pulling forward.
18. Remove the heater control assembly screw.
19. Remove the instrument cluster bezel and pull out the gauge assembly.
20. Remove the speedometer adapter by disconnecting the speedometer cable at the transaxle pulling the cable sightly towards the vehicle interior and giving a slight twist on the adapter to release it.
21. Insert a small flat-tipped tool to open the tab on the gauge cluster connector. Remove the harness connectors.



1. Connection for the heater hoses
2. Connection for the air selection control wire
3. Connection for the temperature control wire
4. Connection for the mode selection control wire
5. Heater control assembly
6. Connection of the connector for ECI control relay
7. Instrument panel center stay assembly
8. Rear heater duct A
9. Lap heater duct <Vehicles without rear heater> or shower duct <Vehicles with rear heater>
10. Foot duct
11. Lap duct
12. Center ventilation duct
13. Heater unit mounting nuts
14. ELC-4 A/T control unit
15. Evaporator mounting nuts, clips
16. Heater unit

93156g35

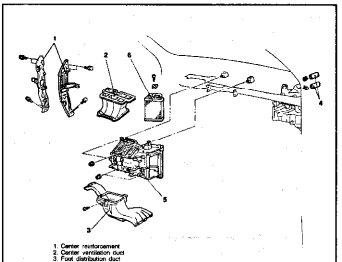
Fig. 29 Exploded view of the heater core and related components—1990–92 Mirage



1. Heater hose connection
2. Joint duct <Vehicles without air conditioning>
3. Foot duct
4. Center reinforcement
5. Center ventilation duct
6. Evaporator installation nut <Vehicles with air conditioning>
7. Heater unit
8. Heater core

93156g36

Fig. 30 Heater core and related components—1993–96 Mirage



1. Center reinforcement
2. Center ventilation duct
3. Foot distribution duct
4. Heater hose connection
5. Heater unit
6. Heater core

93156g37

Fig. 31 Exploded view of the heater core and related components—1997–00 Mirage

22. Remove, by prying with a plastic trim tool, the right side speaker cover and the speaker, the upper side defroster grilles and the clock or plug to gain access to some of the instrument panel mounting bolts.
23. Lower the steering column by removing the bolt and nut.
24. Remove the instrument panel bolts and the instrument panel.
25. Disconnect the air selection, temperature and mode selection control cables from the heater box and remove the heater control assembly.
26. Remove the connector for the MFI control relay.
27. Remove both stamped steel instrument panel supports.
28. Remove the heater ductwork.
29. Remove the heater box mounting nuts.
30. Remove the automatic transmission ELC control box.
31. Remove the evaporator mounting nuts and clips.
32. With the evaporator pulled toward the vehicle interior, remove the heater unit. Be careful not to damage the heater tubes or to spill coolant.
33. Remove the cover plate around the heater tubes and the core fastener clips. Pull the heater core from the heater box, being careful not to damage the fins or tank ends.

To install:

34. Thoroughly clean and dry the inside of the case. Install the heater core to the heater box. Install the clips and cover.
35. Install the evaporator and the automatic transmission ELC box.
36. Install the heater box and connect the duct work.
37. Connect all wires and control cables.
38. Install the instrument panel assembly and the console by reversing their removal procedures.
39. Install the seats.
40. Refill the cooling system.
41. Connect the negative battery cable and check the entire climate control system for proper operation. Check the system for leaks.

Air Conditioning Components

REMOVAL & INSTALLATION

Repair or service of air conditioning components is not covered by this manual, because of the risk of

personal injury or death, and because of the legal ramifications of servicing these components without the proper EPA certification and experience. Cost, personal injury or death, environmental damage, and legal considerations (such as the fact that it is a federal crime to vent refrigerant into the atmosphere), dictate that the A/C components on your vehicle should be serviced only by a Motor Vehicle Air Conditioning (MVAC) trained, and EPA certified automotive technician.

➡If your vehicle's A/C system uses R-12 refrigerant and is in need of recharging, the A/C system can be converted over to R-134a refrigerant (less environmentally harmful and expensive). Refer to Section 1 for additional information on R-12 to R-134a conversions, and for additional considerations dealing with your vehicle's A/C system.

Control Cables

ADJUSTMENT

1. Disconnect the negative battery cable. Remove the glove box, if necessary.
2. Move the mode selection lever to the DEFROST position. Move the mode selection damper lever FULLY INWARD and connect the cable to the lever. Adjust as required.
3. Move the temperature control lever to its HOTTEST position. Move the blend air damper lever FULLY DOWNWARD and connect the cable to the lever. Adjust as required.
4. Move the air selection control lever to the RECIRC position. Move the air selection damper FULLY INWARD and connect the cable to the lever. Adjust as required.

Control Panel

REMOVAL & INSTALLATION

◗ See Figures 32 thru 45

1. Disconnect the negative battery cable.
2. Unfasten the retaining clips and remove the center trim panel.
3. Remove the radio/tape and/or CD player assembly.
4. Remove the control assembly as follows:
   a. Remove the retaining screw(s).
   b. Press the lever pin to disconnect the air outlet changeover damper cable.

➡The boss and clamp are needed for the assembly line during factory installation, however they are not necessary for service procedures.

   c. Snap the boss and clamp with a pair of nippers, to remove the heater control assembly from the vehicle.

To install:

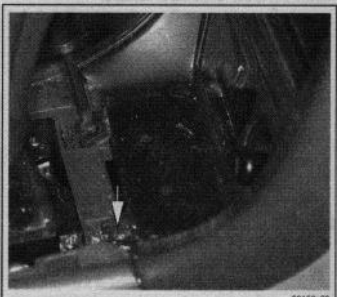
5. Install the control panel, as follows:
   a. Set the temperature control knob on the panel to MAX HOT.
   b. Set the air mix damper lever at the upper part of the heater unit to the MAX HOT position, then attach the cable to the lever pin.
   c. Push the outer cable in the direction of the arrow so that there is no looseness, then secure with the clip.
   d. Set the knob for the air outlet changeover on the control to the DEF position.
   e. Set the air outlet changeover damper lever of the heater unit to the DEF position, then attach the cable to the lever pin.
   f. Push the outer cable in the direction of the arrow so there is no looseness, then secure it with the clip.
   g. Set the lever for the inside/outside air changeover on the heater control assembly to the air recirculation position.
   h. Set the inside/outside air changeover damper lever of the blower unit to the air recirculation position (with the inside/outside air changeover damper lever touched to the stopper of the blower case), then attach the cable to the lever pin.
   i. Push the outer cable in the direction of the arrow so that there is no looseness, then secure it with the clip.
   j. Properly position the control assembly and secure with the retaining screw(s).
6. Install the stopper.
7. Connect the negative battery cable and check the climate control system for proper operation before installing the remaining components.
8. Install the radio/tape and/or CD player assembly.
9. Install the center trim panel, making sure the clips are engaged properly.
10. Connect the negative battery cable.

93156p30

Fig. 32 Using a suitable prytool, release the shifter trim plate retaining tabs . . .

93156p29

Fig. 33 . . . then remove the shifter trim plate (automatic transaxles only)—1994–98 Galant shown



93156p28

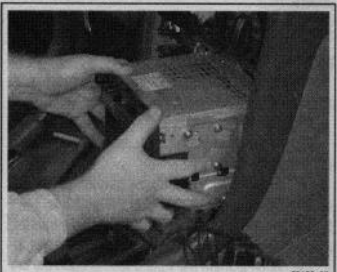
Fig. 34 Remove the two center trim panel retaining screws . . .

93156p27

Fig. 35 . . . then remove the center trim panel from the vehicle

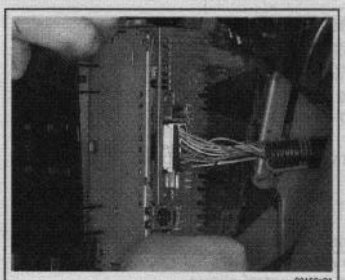
93156p26

Fig. 36 Remove the radio retaining screws (two per side) . . .



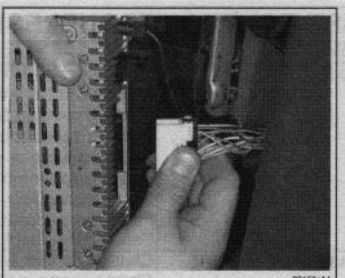
93156p25

Fig. 37 . . . then slide the radio chassis and bracket out of the instrument panel



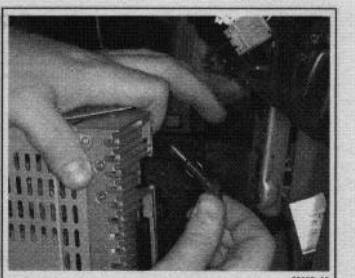
93156p21

Fig. 38 Pull the radio far enough out to access the electrical connectors . . .



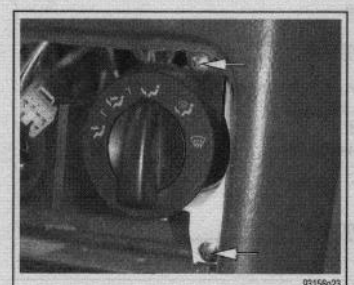
93156p14

Fig. 39 . . . then detach the connectors from the rear of the radio



93156p15

Fig. 40 Finally, detach the antenna cable and remove the radio from the vehicle



93156p23

Fig. 41 Remove the heater control panel retaining screws

93156p20

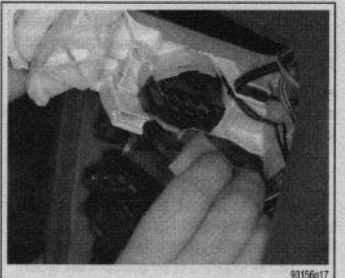
Fig. 42 Remove the control cable from the selector knob

93156p19

Fig. 43 Remove the control cable from the blend door

93156p18

Fig. 44 Remove the cable retaining clips from the back of the control panel



93156p17

Fig. 45 Detach the electrical connectors for the control panel, then remove the panel from the instrument panel

CRUISE CONTROL

Cruise control is a speed control system that maintains a desired vehicle speed under normal driving conditions. However, steep grades up or down may cause variations in the selected speeds. The electronic cruise control system has the capability to cruise, coast, resume speed, accelerate, "tap-up" and "tap-down".

The main parts of the cruise control system are the functional control switches, speed control assembly, actuator, intermediate link, auto-cruise control module assembly, speed sensor, and the release switches.

Depending upon the year and/or model of your vehicle, the cruise control system is either vacuum or electronically controlled. The cruise control module assembly contains a low speed limit which will prevent system engagement below 25 mph (40 km/h). The module is controlled by the functional switches located on a lever on the steering column or steering wheel and on the instrument panel.

The release switches are mounted on the brake/clutch/accelerator pedal bracket. When the brake or clutch pedal is depressed, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

CRUISE CONTROL TROUBLESHOOTING

Problem	Possible Cause
Will not hold proper speed	Incorrect cable adjustment
	Binding throttle linkage
	Leaking vacuum servo diaphragm
	Leaking vacuum tank
	Faulty vacuum or vent valve
	Faulty stepper motor
	Faulty transducer
	Faulty speed sensor
	Faulty cruise control module
Cruise intermittently cuts out	Clutch or brake switch adjustment too tight
	Short or open in the cruise control circuit
	Faulty transducer
	Faulty cruise control module
Vehicle surges	Kinked speedometer cable or casing
	Binding throttle linkage
	Faulty speed sensor
	Faulty cruise control module
Cruise control inoperative	Blown fuse
	Short or open in the cruise control circuit
	Faulty brake or clutch switch
	Leaking vacuum circuit
	Faulty cruise control switch
	Faulty stepper motor
	Faulty transducer
	Faulty speed sensor
	Faulty cruise control module

Note: Use this chart as a guide. Not all systems will use the components listed.

tcca6c01

ENTERTAINMENT SYSTEMS

Radio Receiver/Amplifier/Tape Player/CD Player

REMOVAL & INSTALLATION

See Figures 32 thru 40, 46 and 47

1. Disconnect battery negative cable.

If equipped with an air bag, be sure to disarm it before entering the vehicle.

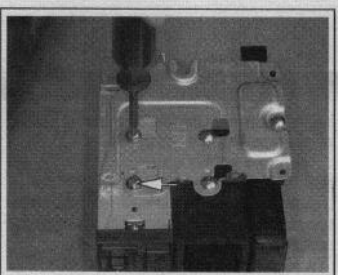
2. Remove the panel from around the radio. On some models the panel is retained with screws. On others, use a plastic trim tool to pry the lower part of the radio panel loose.
3. Remove the radio/tape/CD player mounting bracket retaining screws.
4. Slide the radio chassis out of the instrument panel and disconnect the radio wiring harness and antenna cable.

Depending on the speaker installation, it may save time at installation to identify and tag all wires before they are disconnected.

5. Remove the mounting brackets from the radio.

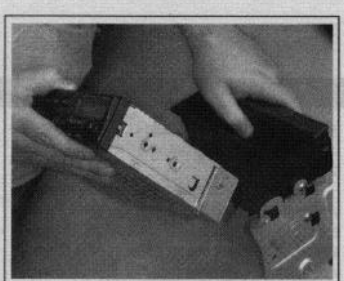
To install:

6. The installation is the reverse of the removal procedure. Make all electrical and antenna connections before fastening the radio assembly in place.
7. Test all functions of the entertainment system prior to final installation. If all are satisfactory, install the unit and center panel.
8. Connect the negative battery cable and recheck the entire system for proper operation.



93156p24

Fig. 46 Remove the radio-to-bracket retaining screws . . .



93156p22

Fig. 47 . . . then separate the radio chassis from the bracket assembly

CD Changer

1. Disconnect the negative battery cable.
2. Open the trunk lid.
3. Remove any necessary trim to access the CD changer.
4. Remove the CD-changer-to-bracket retaining screws.
5. Lift the changer from the bracket and detach the electrical connectors.
6. Remove the changer from the vehicle.

To install:

7. The installation is the reverse of removal.

Speakers

REMOVAL & INSTALLATION

Front (Instrument Panel Mounted) Speaker

See Figure 48

1. Disconnect the negative battery cable.
2. Remove the front speaker garnish.
3. Remove the retainers, detach the harness connector and remove the front speaker.

WARNING

Handle the speaker carefully to avoid damaging the cone during removal and installation.

4. Installation is the reverse of the removal procedure

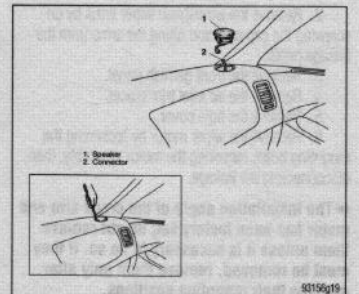


Fig. 48 Typical front (instrument panel mounted) speaker mounting

Door Mounted Tweeters

See Figure 49

1. Disconnect the negative battery cable.
2. Remove the delta cover (triangular shaped cover behind the side mirror and above the door panel.
3. Remove the speaker retaining screws.
4. Lift the speaker out of the cavity.
5. Detach the electrical and remove the speaker.
6. The installation is the reverse of removal.

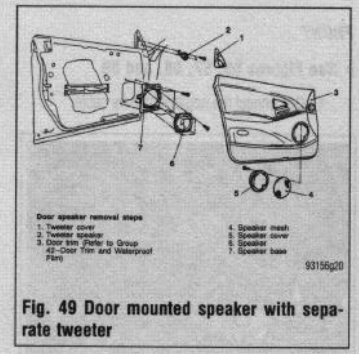


Fig. 49 Door mounted speaker with separate tweeter

Door Speakers

See Figures 50, 51, and 52

1. Disconnect the negative battery cable.
2. Remove the door trim panel. Refer to the procedure in Section 10.
3. Remove the mounting screws, detach the harness connector and remove the front speaker.

WARNING

Handle the speaker carefully to avoid damaging the cone during removal and installation.

4. Installation is the reverse of the removal procedure

Rear Deck Speakers

See Figure 53

1. Disconnect the negative battery cable.
2. Remove the speaker cover.
3. Remove the speaker retaining screws.
4. Lift the speaker out of the cavity.
5. Detach the electrical and remove the speaker.
6. The installation is the reverse of removal.

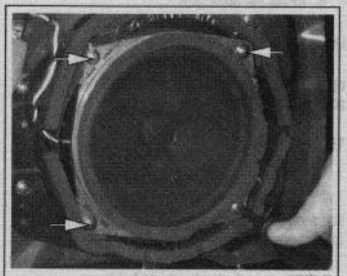


Fig. 50 Remove the four speaker retaining screws

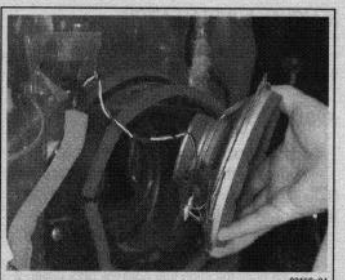


Fig. 51 Lift the speaker from the door cavity . . .

Fig. 52 . . . then detach the connector from the back of the speaker

Fig. 53 Typical rear deck mounted speaker

WINDSHIELD WIPERS AND WASHERS

Windshield Wiper Blade and Arm

REMOVAL & INSTALLATION

See Figures 54 and 55

This procedure also applies to rear wiper arms on the Diamante Wagon and Mirage Hatchbacks.

1. Disconnect the negative battery cable.
2. Remove the windshield wiper arms by removing the cap, unscrewing the cap nuts then lifting the arms from the linkage posts.

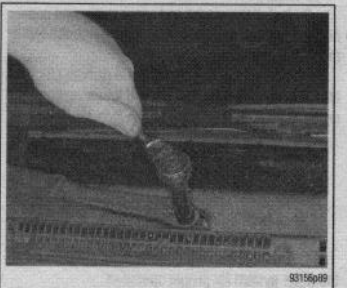


Fig. 54 Remove the wiper arm retaining nut cap, then loosen the windshield wiper arm retaining nut

Fig. 55 Remove the wiper arm by lifting it from the linking posts

To install:

3. Install the wiper blade and arm assemblies. Tighten the retaining nuts to 7–12 ft. lbs. (10–16 Nm).

4. Note that the driver's side wiper arm should be marked **D** or **Dr** and the passenger's side wiper arm should be marked **A** or **As**. The identification marks should be located at the base of the arm, near the pivot. Install the arms so the blades are 1 inch from the garnish molding when parked.

5. Connect the negative battery cable and check the wiper system for proper operation.

Windshield Wiper Motor

REMOVAL & INSTALLATION

1990–92 Mirage

FRONT

1. Disconnect the negative battery cable.
2. Remove the windshield wiper arms by unscrewing the cap nuts and lifting the arms from the linkage posts.
3. Remove the front deck garnish panel.
4. Remove both windshield holders.
5. Remove the clips that hold the deck cover. If they are the pin type, they may be removed using the following procedure:
   a. Remove the clip by pressing down on the center pin with a suitable blunt pointed tool. Press down a little more than $^1/_{16}$ in. (2mm). This releases the clip. Pull the clip outward to remove it.
   b. Do not push the pin inward more than necessary because it may damage the grommet, or if pushed too far, the pin may fall in. Once the clips are removed, use a plastic trim stick to pry the deck cover loose.
6. On Mirage, remove the air intake screen.
7. Loosen the wiper motor assembly mounting bolts and remove the windshield wiper motor. Disconnect the linkage from the motor assembly. If necessary, remove the linkage from the vehicle.

➡The installation angle of the crank arm and motor has been factory set, do not remove them unless it is necessary to do so. If arm must be removed, remove them only after marking their mounting positions.

To install:

8. Install the windshield wiper motor and connect the linkage. Connect the electrical harness to the motor.
9. When installing the trim and garnish pieces and reusing pin type clips, use the following procedure:
   a. With the pin pulled out, insert the trim clip into the hole in the trim.
   b. Push the pin inward until the pin's head is flush with the grommet.
   c. Check that the trim is secure.
10. Install the wiper arms and tighten nuts to 17 ft. lbs. (24 Nm).
11. Connect the negative battery cable and check the wiper system for proper operation.

REAR

1. Disconnect the negative battery cable.
2. Remove the rear wiper arm by removing the cap nut cover, unscrewing the cap nut and lifting the arm from the linkage post.
3. Remove the large interior trim panel. Use a plastic trim stick to unhook the trim clips of the liftgate trim. There will be a row of metal liftgate clips across the top. There will be 2 rows of trim clips that retain the rest of the panel.
4. Disconnect the electrical harness at the wiper motor. Remove the rear wiper assembly. Do not loosen the grommet for the wiper post.

To install:

5. Install the motor and grommet. Mount the grommet so the arrow on the grommet is pointing downward.
6. Install the wiper arm.
7. Connect the negative battery cable and check rear wiper system for proper operation.
8. If operation is satisfactory, fit the tabs on the upper part of the liftgate trim into the liftgate clips and secure the liftgate trim.

1993–00 Mirage

1. Disconnect the negative battery cable.
2. Remove the windshield wiper arms by unscrewing the cap nuts and lifting the arms from the linkage posts.
3. Remove the front deck garnish panel.
4. Remove both windshield holders.
5. Remove the clips that hold the deck cover. If they are the pin type, they may be removed using the following procedure:
   a. Remove the clip by pressing down on the center pin with a suitable blunt pointed tool. Press down a little more than $^1/_{16}$ in. (2mm). This releases the clip. Pull the clip outward to remove it.
   b. Do not push the pin inward more than necessary because it may damage the grommet or if pushed too far, the pin may fall in. Once the clips are removed, use a plastic trim stick to pry the deck cover loose.
6. Remove the air intake screen.
7. Loosen the wiper motor assembly mounting bolts and remove the windshield wiper motor. Disconnect the linkage from the motor assembly. If necessary, remove the linkage from the vehicle.

➡The installation angle of the crank arm and motor has been factory set. Do not remove unless necessary. If arm must be removed, remove only after marking mounting positions.

To install:

8. Install the windshield wiper motor and connect the linkage. Connect the electrical harness to the motor.
9. When installing the trim and garnish pieces and reusing pin type clips, use the following procedure:
   a. With the pin pulled out, insert the trim clip into the hole in the trim.
   b. Push the pin inward until the pin's head is flush with the grommet.
   c. Check that the trim is secure.
10. Install the wiper arms and tighten the nuts.
11. Connect the negative battery cable and check the wiper system for proper operation.

1990–93 Galant

1. Disconnect the negative battery cable.
2. Remove the windshield wiper arms by unscrewing the cap nuts and lifting the arms from the linkage posts.
3. Remove the front garnish panel.
4. Remove the air inlet trim pieces.
5. Remove the hole cover.
6. Remove the wiper motor by loosening the mounting bolts, removing the motor assembly, then disconnecting the linkage.

➡The installation angle of the crank arm and motor has been factory set; do not remove them unless it is necessary to do so. If they must be removed, remove them only after marking their mounting positions.

To install:

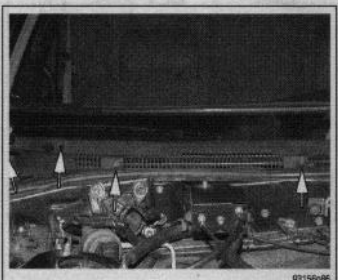
7. Install the windshield wiper motor and connect the linkage.
8. Reinstall all trim pieces.
9. Reinstall the wiper blades. Note that the driver's side wiper arm should be marked **D** or **Dr** and the passenger's side wiper arm should be marked **A** or **As**. The identification marks should be located at the base of the arm, near the pivot. Install the arms so the blades are 1 inch from the garnish molding when parked.
10. Connect the negative battery cable and check the wiper system for proper operation.

Diamante and 1994–00 Galant

FRONT

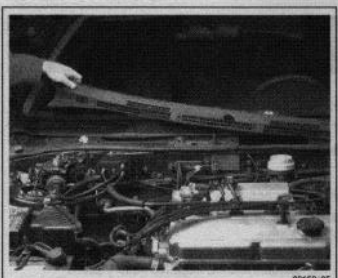
See Figures 56, 57, 58, and 59

1. Disconnect the negative battery cable.



93156p86

Fig. 56 Remove the retaining clips from the front garnish panel

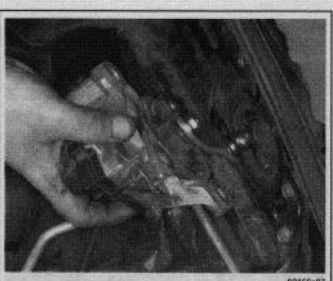


93156p85

Fig. 57 Lift the panel up and remove it from the vehicle

93156p90

Fig. 58 Detach the connector and remove the three wiper motor retaining bolts



93156p87

Fig. 59 Pull the motor from the firewall and detach the linkage

2. Matchmark the wiper arms to the shaft and mark the arms to the proper side for reinstallation purposes.

3. Remove the windshield wiper arms by unscrewing the cap nuts and lifting the arms from the linkage posts.
4. Remove the front deck garnish assembly.
5. Remove the air inlet cover.
6. Disconnect the electrical harness plug from the wiper motor.
7. Remove the access hole cover.
8. Remove the wiper motor mounting bolts.
9. Detach the motor crank arm from the wiper linkage and remove the motor.

➡The installation angle of the crank arm and motor has been factory set. Do not remove them unless necessary. If they must be removed, remove them only after marking their mounting positions.

To install:

10. Install the windshield wiper motor and connect the linkage.
11. Attach the electrical harness plug.
12. Install the access hole cover.
13. Install the air inlet cover.
14. Install the front deck garnish assembly.
15. Reinstall the wiper arm and tighten the mounting nuts to 14 ft. lbs. (19 Nm). Install the arms so the blades are parallel to the garnish molding when parked.
16. Connect the negative battery cable and check the wiper system for proper operation.

REAR

1. Disconnect the negative battery cable.
2. Remove the liftgate lower trim.
3. Lift the small cover, remove the retaining nut and remove the wiper arm.
4. Remove the mounting bolts and remove the wiper motor.

To install:

5. Install the motor and install the retaining bolts.
6. Install the wiper arm so that the arm is 3.35 inches (85mm) between the measurement points, when parked. Secure the wiper arm with the retaining nut.

➡Before proceeding, connect the battery and check the operation of the motor. If satisfactory, disconnect the cable and complete the installation.

7. Install the interior trim piece.
8. Connect the negative battery cable and recheck the system for proper operation.

Windshield Washer Pump

REMOVAL & INSTALLATION

Front and Rear

1. Disconnect the negative battery cable.
2. Remove the windshield washer fluid reservoir.
3. Drain any washer fluid in the reservoir into an appropriate container.
4. Remove the pump from the reservoir by either removing the retaining hardware or twisting gently until it is free from the reservoir.

To install:

5. Inspect the pump seal on the reservoir, replace if necessary.
6. Install the pump into place until seated on the seal.
7. Install the windshield washer fluid reservoir.
8. Refill the washer fluid reservoir.
9. Connect the negative battery cable.

INSTRUMENTS AND SWITCHES

Instrument Cluster

REMOVAL & INSTALLATION

Mirage

1. Disconnect the negative battery cable. Remove the center trim panel.
2. Remove the knee protector. If pin type clips are used, they may be removed using the following procedure:
   a. Press down on the center pin with a suitable blunt pointed tool. Press down a little more than $^1/_{16}$ in. (2mm). This releases the clip. Pull the clip outward to remove it.
   b. Do not push the pin inward more than necessary because it may damage the grommet or the pin may fall in, if pushed in too far. Once the clips are removed, use a plastic trim stick if necessary to pry the knee protector loose.
3. Remove the instrument cluster bezel.
4. Remove the instrument cluster. Disassemble and remove gauges or the speedometer as required.

➡If the speedometer cable adapter requires service, disconnect the cable at the transaxle end. Pull the cable slightly toward the vehicle interior, release the lock by turning the adapter to the right or left and remove the adapter.

5. The installation is the reverse of the removal procedure. Use care not to damage the printed circuit board or any gauge components.
6. Connect the negative battery cable and check all cluster-related items for proper operation.

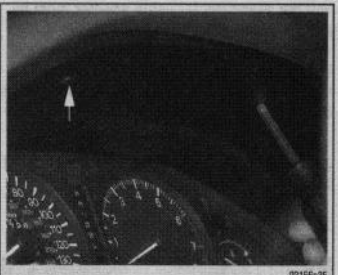
Galant

➧ See Figures 60 thru 66

1. Disconnect negative battery cable.
2. Remove the 2 retainer screws from the lower surface of the meter hood.
3. Remove the retainer screws from the underside top portion of the meter hood.
4. Carefully remove the meter hood from the face of the combination meter.
5. Remove the 4 retainer screws and the combination meter assembly with the bezel attached. Remove the front bezel and remove gauges or the speedometer as required.

➡If the speedometer cable adapter requires service, disconnect the cable at the transaxle end. Pull the cable slightly toward the vehicle interior, release the lock by turning the adapter to the right or left and remove the adapter.

6. The installation is the reverse of the removal procedure. Use care not to damage the printed circuit board or any gauge components.
7. Connect the negative battery cable and check all cluster-related items for proper operation.

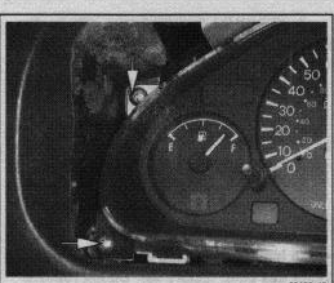


93156p35

Fig. 60 Remove the retainer screws from the underside top portion of the meter hood . . .

93156p35

Fig. 61 . . . then remove the hood from the instrument panel



93156p13

Fig. 62 Remove the retaining screws from the driver's side . . .

93156p12

Fig. 63 . . . and also from the passenger side of the instrument cluster

93156p11

Fig. 64 Grasp the instrument cluster and carefully pull it out of the instrument panel

93156p10

Fig. 65 On some models, the instrument cluster requires no connections to be detached; the cluster has sockets on the back . . .

93156p09

Fig. 66 . . . these sockets engage connectors solidly mounted behind the cluster

Diamante

1. Disconnect the negative battery cable.

➡If equipped with an air bag, be sure to disarm it before entering the vehicle.

2. Remove the hood lock release handle and switches from the knee protector below the steering column. Then remove the exposed retaining screws and remove the knee protector.
3. Remove the upper and the lower steering column covers.
4. Remove the instrument cluster bezel.
5. Remove the instrument cluster. Disassemble and remove gauges or the speedometer as required.

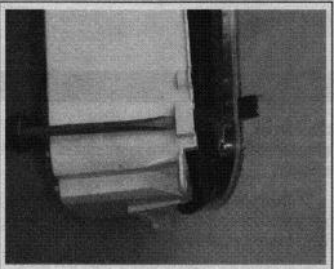
➡If the speedometer cable adapter must be serviced, disconnect the cable at the transaxle end. Pull the cable slightly toward the vehicle interior, release the lock by turning the adapter to the right or left and remove the adapter.

6. The installation is the reverse of the removal procedure. Use care not to damage the printed circuit board or any gauge components.
7. Connect the negative battery cable and check all cluster-related items for proper operation.

Gauges

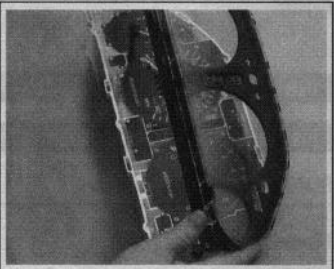
REMOVAL & INSTALLATION

◆ See Figures 67, 68, 69, and 70



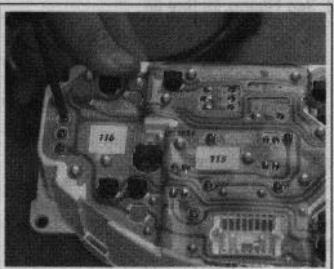
93156p08

Fig. 67 Release the cluster lens retaining tabs . . .



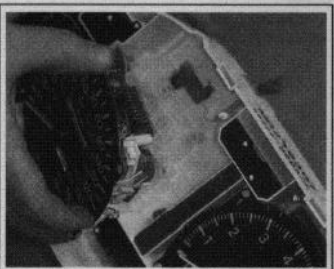
93156p07

Fig. 68 . . . then remove the instrument cluster lens and cover assembly



93156p06

Fig. 69 Remove the gauge retaining screws . . .



93156p05

Fig. 70 . . . then carefully lift the gauges from the instrument cluster to remove them

1. Disconnect the negative battery cable.
2. Remove the instrument cluster, as outlined earlier in this section.
3. Remove the retaining screws for the instrument cluster lens and cover assembly. Remove the cover and lens.
4. Remove the retaining screws for the gauge or warning lamp to be replaced, then remove the gauge or warning lamp.

To install:

5. Place the gauge or warning lamp into place and tighten the retaining screws.
6. Install the instrument cluster lens and cover assembly.
7. Install the instrument cluster.
8. Connect the negative battery cable.

Windshield Wiper Switch

REMOVAL & INSTALLATION

➡The headlights, turn signals, dimmer switch, horn switch, windshield wiper/washer, intermittent wiper switch and on some models, the cruise control function are all built into 1 multi-function combination switch that is mounted on the steering column. Refer to Section 8 for procedures regarding the combination switch.

Rear Window Wiper Switch

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Using a suitable prytool, disengage the switch retaining tabs.
3. Gently pull the switch from the instrument panel.
4. Detach the electrical connector and remove the switch.
5. The installation is the reverse of removal.

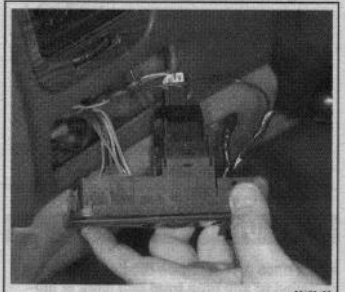
Dimmer Switch

REMOVAL & INSTALLATION

◗ See Figures 71, 72, and 73

93156p33

Fig. 71 Using a suitable tool, carefully pry the retaining clips from either side of the switch trim plate . . .



93156p32

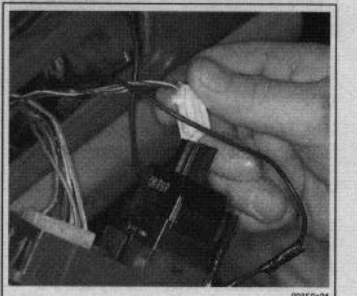
Fig. 72 . . . then carefully pull the switch and trim plate out of the instrument panel

1. Disconnect the negative battery cable.
2. Using a small screwdriver or other suitable tool, carefully pry the retaining clips from either side of the switch trim plate.
3. Carefully pull the switch and trim plate out of the instrument panel.
4. Detach the electrical connectors and remove the switch.
5. The installation is the reverse of removal.

Headlight Switch

REMOVAL & INSTALLATION

➡On all models the headlights, turn signals, and on some models, the cruise control function are all built into 1 multi-function combination switch that is mounted on the steering column. Refer to Section 8 for procedures regarding the combination switch.



93156p31

Fig. 73 Detach the electrical connectors and remove the switch

LIGHTING

Headlights

REMOVAL & INSTALLATION

Sealed Beam Headlights

1. Raise the headlights using the pop-up switch.
2. Disconnect the negative battery cable.
3. Unfasten the retaining screws, then remove the upper and the lower headlight bezels.
4. Remove the headlight retaining ring screws, and the headlight retaining ring.
5. Pull the headlight partially out, detach the connector, then remove headlight assembly from the vehicle.

To install:

6. Attach the headlight electrical connector.
7. Properly position the headlight and the retaining ring, then install the retaining screws.
8. Install the headlight bezels and secure with the retaining screws.
9. Connect the negative battery cable.

Composite Headlights

◗ See Figures 74, 75, 76, 77, and 78

⁂ CAUTION

Halogen bulbs contain gas under pressure. Handling the bulb incorrectly could cause it to shatter into flying glass fragments. Do NOT leave the light switch ON. Always allow the bulb to cool before removal. Handle the bulb only by the base; avoid touching the glass itself. Whenever handling a halogen bulb, ALWAYS follow these precautions:

- Turn the headlight switch OFF and allow the bulb to cool before changing it. Leave the switch OFF until the change is complete.
- ALWAYS wear eye protection when changing a halogen bulb.
- Handle the bulb only by its base. Avoid touching the glass.
- DO NOT drop or scratch the bulb.
- Keep dirt and moisture away from the bulb.
- Place the used bulb in the new bulb's carton and dispose of it properly.

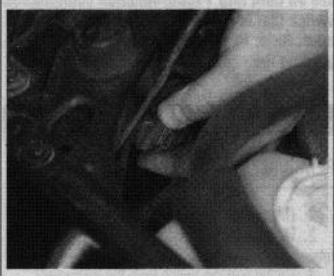
1. Open the vehicle's hood and secure it in an upright position.
2. Disconnect the negative battery cable.
3. Remove the socket cover by pulling it straight off, or turning it clockwise then pulling it off.
4. Carefully twist the bulb and socket counterclockwise, then pull the assembly from the headlight housing.
5. Holding the base of the bulb, detach it from the connector harness.

To install:

6. Holding the base of the bulb, install it securely in the connector.
7. Install the connector and bulb assembly in the housing and twist to lock into position.
8. Install the sealing cover by pushing it on

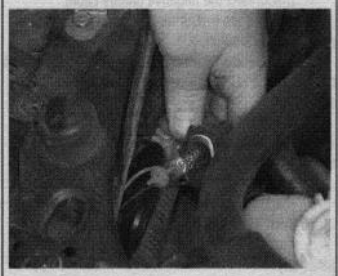
93156p67

Fig. 74 Twist and pull on the cover to unlock it in order to access the headlight bulb and socket assembly



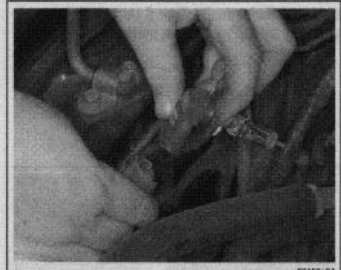
93156p66

Fig. 75 Turn the inner head light bulb and socket . . .



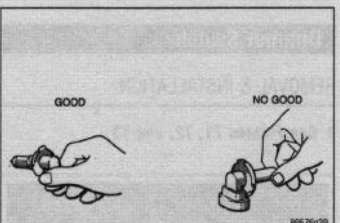
93156p65

Fig. 76 . . . then carefully pull it from the headlight housing assembly



93156p64

Fig. 77 Unplug the bulb from the socket, being careful not to touch the glass portion of the bulb



89576g39

Fig. 78 NEVER hold the halogen bulb by the glass, ALWAYS hold it with the base

and/or turning it counterclockwise. Make sure the cover is installed securely or the lens will be out of focus, or water may get into the light unit.

9. Disconnect the negative battery cable and check the headlight operation.

AIMING THE HEADLIGHTS

See Figures 79, 80, 81, 82, and 83

The headlights must be properly aimed to provide the best, safest road illumination. The lights should be checked for proper aim and adjusted as necessary. Certain state and local authorities have requirements for headlight aiming; these should be checked before adjustment is made.

CAUTION

About once a year, when the headlights are replaced or any time front end work is performed on your vehicle, the headlight should be accurately aimed by a reputable repair shop using the proper equipment. Headlights not properly aimed can make it virtually impossible to see and may blind other drivers on the road, possibly causing an accident. Note that the following procedure is a temporary fix, until you can take your vehicle to a repair shop for a proper adjustment.

Headlight adjustment may be temporarily made using a wall, as described below, or on the rear of another vehicle. When adjusted, the lights should not glare in oncoming car or truck windshields, nor should they illuminate the passenger compartment of vehicles driving in front of you. These adjustments are rough and should always be fine-tuned by a repair shop which is equipped with headlight aiming tools. Improper adjustments may be both dangerous and illegal.

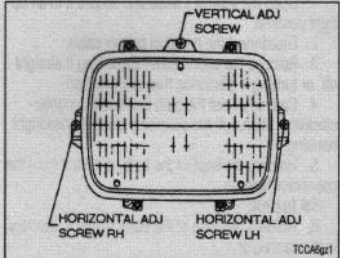
For most of the vehicles covered by this manual, horizontal and vertical aiming of each sealed beam unit is provided by two adjusting screws which move the retaining ring and adjusting plate against the tension of a coil spring. There is no adjustment for focus; this is done during headlight manufacturing.

Because the composite headlight assembly is bolted into position, no adjustment should be necessary or possible. Some applications, however, may be bolted to an adjuster plate or may be retained by adjusting screws. If so, follow this procedure when adjusting the lights, BUT always have the adjustment checked by a reputable shop.

Before removing the headlight bulb or disturbing the headlamp in any way, note the current settings in order to ease headlight adjustment upon reassembly. If the high or low beam setting of the old lamp still works, this can be done using the wall of a garage or a building:

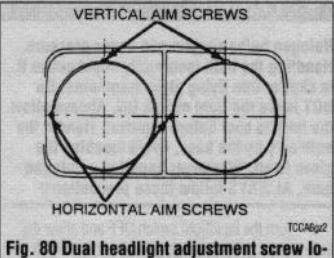
1. Park the vehicle on a level surface, with the fuel tank about 1/2 full and with the vehicle empty of all extra cargo (unless normally carried). The vehicle should be facing a wall which is no less than 6 feet (1.8m) high and 12 feet (3.7m) wide. The front of the vehicle should be about 25 feet from the wall.

2. If aiming is to be performed outdoors, it is advisable to wait until dusk in order to properly see the



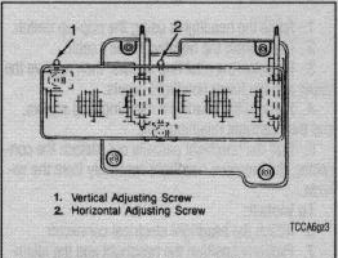
TCCA6gz1

Fig. 79 Location of the aiming screws on most vehicles with sealed beam headlights



TCCA6gz2

Fig. 80 Dual headlight adjustment screw locations—one side shown here (other side should be mirror image)



TCCA6gz3

Fig. 81 Example of headlight adjustment screw location for composite headlamps

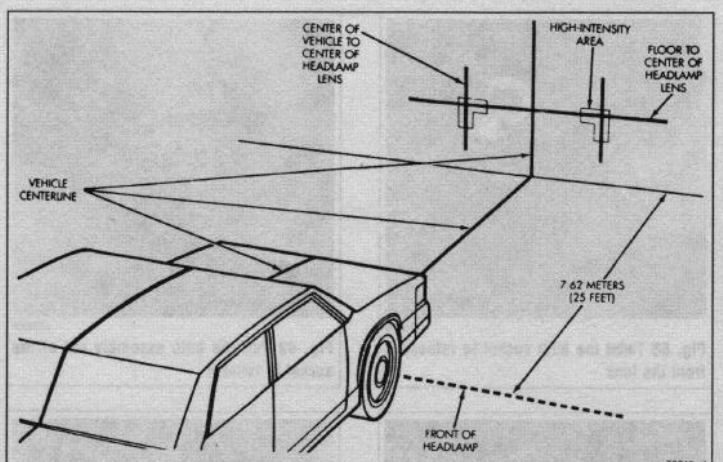


Fig. 82 Low-beam headlight pattern alignment

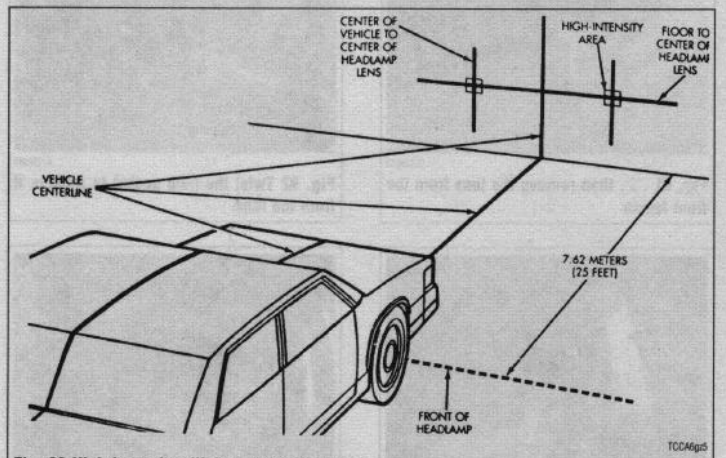


Fig. 83 High-beam headlight pattern alignment

headlight beams on the wall. If done in a garage, darken the area around the wall as much as possible by closing shades or hanging cloth over the windows.

3. Turn the headlights **ON** and mark the wall at the center of each light's low beam, then switch on the brights and mark the center of each light's high beam. A short length of masking tape which is visible from the front of the vehicle may be used. Although marking all four positions is advisable, marking one position from each light should be sufficient.

4. If neither beam on one side is working, and if another like-sized vehicle is available, park the second one in the exact spot where the vehicle was and mark the beams using the same-side light. Then switch the vehicles so the one to be aimed is back in the original spot. It must be parked no closer to or farther away from the wall than the second vehicle.

5. Perform any necessary repairs, but make sure the vehicle is not moved, or is returned to the exact spot from which the lights were marked. Turn the headlights **ON** and adjust the beams to match the marks on the wall.

6. Have the headlight adjustment checked as soon as possible by a reputable repair shop.

Signal and Marker Lights

REMOVAL & INSTALLATION

Parking And Side Marker Lights

♦ See Figures 84, 85, 86, 87, 88, and 89

1. Disconnect the negative battery cable.
2. Remove any necessary components to access the bulbs.
3. Rotate the bulb sockets and rotate them counterclockwise to remove them.
4. Grasp the bulb and remove it from the socket by pulling it straight out.

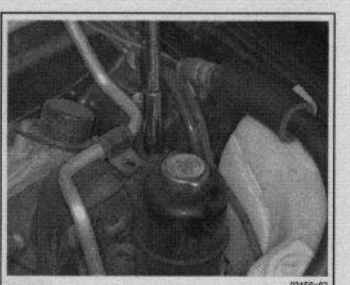


Fig. 84 On 1994–98 Galant models, remove the power steering reservoir mounting bolts, and position the reservoir to the side

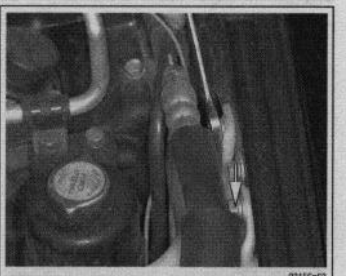


Fig. 85 Remove the washer fluid reservoir retaining screws . . .

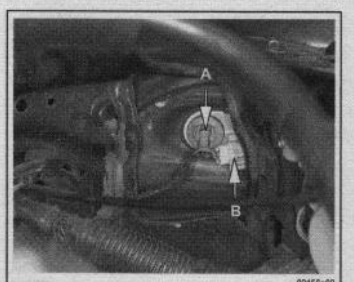
Fig. 86 . . . then move the reservoir out of the way to access the parking and side marker lamp bulbs on 1994–98 Galant models

5. The installation is the reverse of removal.

Front Turn Signal

♦ See Figures 90, 91, 92, and 93

1. Disconnect the negative battery cable.
2. Remove the two retaining screws from the lens.
3. Remove the lens from the front fascia.
4. Grasp the bulb socket and rotate it counterclockwise to remove it from the lamp.
5. Pull the bulb out to remove it from the socket.
6. Installation is the reverse of removal.

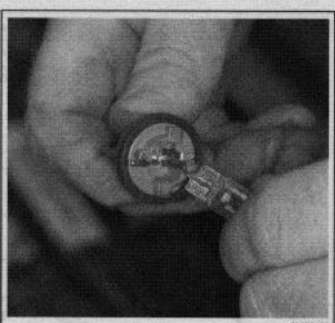


93156p60

Fig. 87 After the washer fluid reservoir is removed, the parking lamp bulb (B) and the side marker lamp (A) are accessible on 1994–98 Galant models

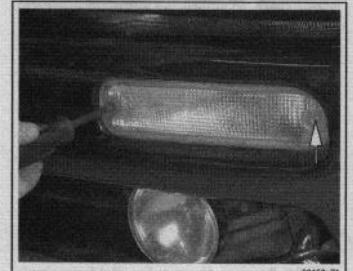
93156p58

Fig. 88 Twist the bulb socket to release it from the lens



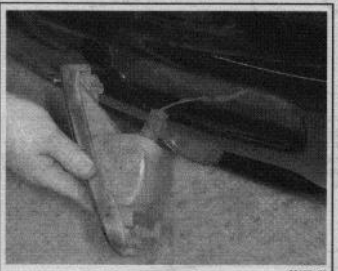
93156p59

Fig. 89 Pull the bulb assembly out of the socket to remove



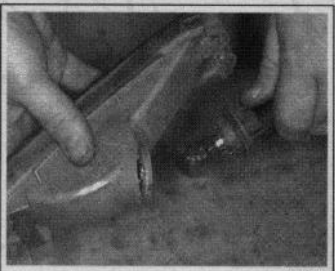
93156p71

Fig. 90 Remove the turn signal lens retaining screw . . .



93156p70

Fig. 91 . . . then remove the lens from the front fascia



93156p69

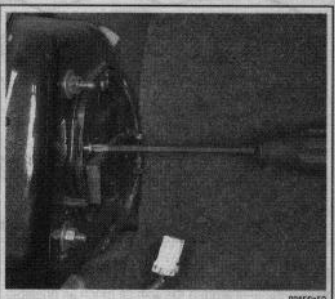
Fig. 92 Twist the bulb socket to release it from the lens

93156p68

Fig. 93 Pull the bulb assembly out of the socket to remove

93156p51

Fig. 94 The back-up lamp socket assembly is located on the underside of the trunk lid. Detach the electrical connector . . .



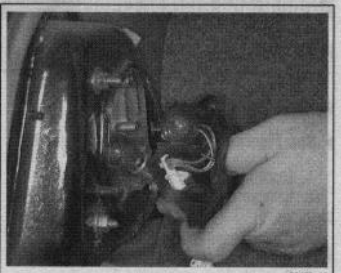
93156p50

Fig. 95 . . . then unfasten the trim panel retaining screws for access to the bulb(s)

Rear Turn Signal, Brake and Tail Lights

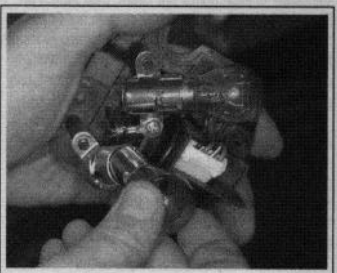
See Figures 94, 95, 96, and 97

1. Disconnect the negative battery cable.
2. Open the trunk lid, hatch, or tailgate and remove the retainers, then remove the inner trim panel in order to get to the rear lamp assembly.
3. Turn the necessary bulb and socket assembly to unlock it from the housing, then pull it from the housing.
4. Depress and twist the bulb $^1/_8$ turn counterclockwise. Pull the bulb from the socket and replace with a new one of the same type.
5. Installation is the reverse of the removal procedure.



93156p49

Fig. 96 Twist the bulb socket to release it from the lens

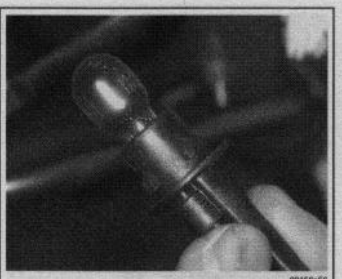


93156p48

Fig. 97 Depress and turn the bulb assembly, then pull it out of the socket to remove

93156p57

Fig. 98 The back-up lamp socket assembly is located on the underside of the trunk lid



93156p56

Fig. 99 Twist the bulb socket to release the locking tabs from the lens

93156p55

Fig. 100 Pull the bulb assembly straight out of the socket to remove it

Back-up Light

See Figures 98, 99, and 100

1. Disconnect the negative battery cable.
2. Open the trunk lid.
3. If equipped, remove the trim on the underside of the trunk lid.
4. Turn the socket counterclockwise 1/4 of a turn to release it from the lens.
5. Pull the bulb out to remove it from the socket.
6. The installation is the reverse of removal.
7. Connect the negative battery cable.
8. Verify the operation of the lamp.

Side Marker Light

See Figures 101, 102, 103, and 104

1. Remove the two retaining screws from the lens.
2. Remove the lens from the rear fascia.
3. Grasp the bulb socket and rotate it counterclockwise to remove it from the lamp.
4. Pull the bulb out to remove it from the socket.
5. Installation is the reverse of removal.

High-mount Brake Light

1994–98 GALANT

See Figures 105, 106, 107, 108, and 109

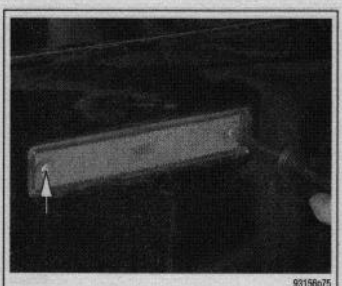
1. Disconnect the negative battery cable.

➡The lamp assembly is accessible from the trunk underneath the package shelf.

2. Open the trunk lid and detach the electrical connector from the lamp assembly.
3. Remove the retaining screw holding the lamp assembly.
4. Lower the lamp assembly from the lamp lens.
5. Rotate the bulb clockwise while pushing it gently inward to remove it from the socket.
6. The installation is the reverse of removal.

1990–96 MIRAGE, 1990–93 GALANT, AND 1992–96 DIAMANTE

1. Disconnect the negative battery cable.
2. On the Mirage and Galant, remove the square retainer clips or bolts from the high-mount brake light cover and remove the cover.
3. On the Diamante, press gently inward on the sides of the light cover and remove it from the lamp.



93156p75

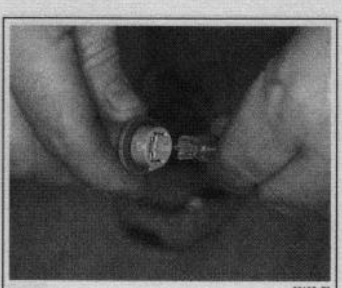
Fig. 101 Remove the side marker light retaining screw . . .

93156p74

Fig. 102 . . . then pull the lens away from the rear fascia

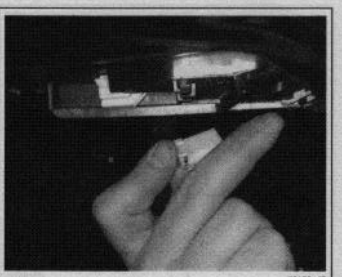
93156p73

Fig. 103 Twist the bulb socket to release it from the lens



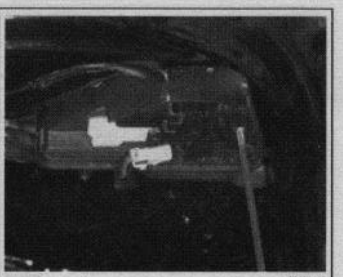
93156p72

Fig. 104 Pull the bulb assembly straight out of the socket to remove



93156p47

Fig. 105 Detach the high-mount brake light electrical connector



93156p45

Fig. 106 Remove the lamp retaining screws . . .

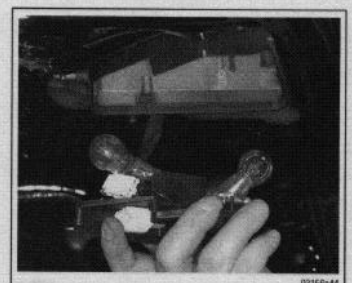

93156p44

Fig. 107 . . . then lower the lamp assembly for access to the bulbs


93156p43

Fig. 108 Rotate the bulb assembly. . .


93156p42

Fig. 109 . . . then pull it from the socket

4. Rotate the bulb clockwise while pushing it gently inward to remove it from the socket.
5. The installation is the reverse of removal.

1997–00 MIRAGE, 1999–00 GALANT, AND 1997–00 DIAMANTE

1. Disconnect the negative battery cable.

➡The bulb socket is accessible from the trunk underneath the package shelf.

2. Open the trunk lid and detach the electrical connector from the bulb socket.
3. Rotate the socket counterclockwise and remove it from the lamp assembly.
4. Rotate the bulb clockwise while pushing it gently inward to remove it from the socket.
5. The installation is the reverse of removal.

License Plate Lights

◗ See Figures 110, 111, and 112

1. Disconnect the negative battery cable.
2. Remove the two retaining screws for the lamp lens.
3. Lower the lens from the trunk lid.
4. Grasp the bulb and remove it from the terminals on the lens.

To install:

5. Place the bulb into place on the lens and lightly press into the terminals on the lens.
6. Place the lens into position on the trunk lid and tighten the two retaining screws.
7. Connect the negative battery cable.
8. Verify the operation of the lamp.

Dome/ Passenger Area Lamps

◗ See Figures 113, 114, and 115

1. Using a small prytool, carefully remove the cover lens from the lamp assembly.
2. Remove the bulb from its retaining clip contacts. If the bulb has tapered ends, gently depress the spring clip/metal contact and disengage the light bulb, then pull it free of the two metal contacts.

To install:

3. Before installing the light bulb into the metal contacts, ensure that all electrical conducting surfaces are free of corrosion or dirt.
4. Position the bulb between the two metal contacts. If the contacts have small holes, be sure that the tapered ends of the bulb are situated in them.

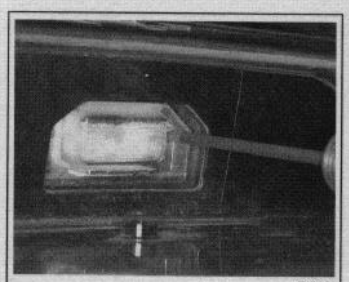

93156p54

Fig. 110 Remove the two lamp lens retaining screws . . .


93156p53

Fig. 111 . . . then lower the lens to access the bulb

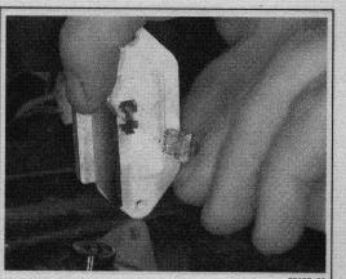

93156p52

Fig. 112 Remove the bulb by pulling it from the terminals on the lens


93156p41

Fig. 113 Using a suitable tool, carefully pry the lamp lens loose . . .

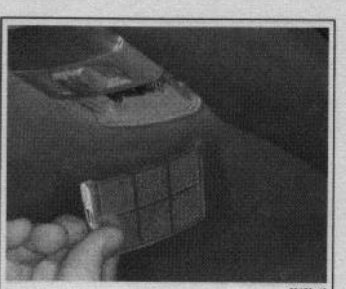

93156p40

Fig. 114 . . . then remove the lens from the dome lamp assembly

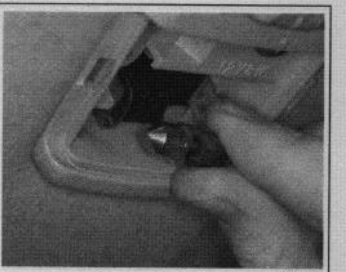
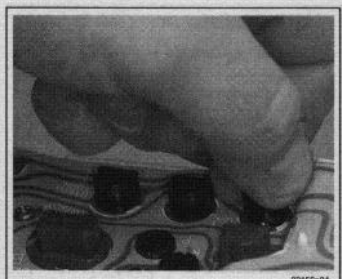

93156p39

Fig. 115 Pull the bulb straight out to remove it



93156p04

Fig. 116 With the cluster removed, turn the socket counterclockwise . . .

93156p03

Fig. 117 . . . and remove the socket from the instrument cluster

93156p02

Fig. 118 Pull the bulb straight out to remove it

93156p01

Fig. 119 On some of the bulbs, it is necessary to transfer the colored bulb cover to the new bulb

5. To ensure that the replacement bulb functions properly, activate the applicable switch to illuminate the bulb which was just replaced. If the replacement light bulb does not illuminate, either it is faulty or there is a problem in the bulb circuit or switch. Correct as necessary.

6. Install the cover lens until its retaining tabs are properly engaged.

Instrument Cluster Light bulbs

See Figures 116, 117, 118, and 119

1. Disconnect the negative battery cable.
2. Remove the instrument cluster as outlined in this section.
3. Turn the desired bulb socket counterclockwise to remove it from the cluster.
4. Grasp the bulb and pull it straight out to remove it from the socket.

To install:

5. If necessary, transfer the colored bulb cover to the new bulb.
6. Place a new bulb into the socket and lightly press it into place.
7. Place the socket into the cluster and turn the socket clockwise to engage it into the cluster.
8. Install the instrument cluster.
9. Connect the negative battery cable.

Light bulb application chart—1990–92 Mirage

Bulb Chart – Outside

Specification	Wattage	SAE trade No.
Headlights	Outboard 55W	9006
	Inboard 65W	9005
Front turn-signal lights	27W	1156
Position lights	5W	–
Front side-marker lights	3cp	168
High-mounted stoplights	21cp	–
Stop and taillights	32/2cp	2057
Rear turn-signal lights	32cp	1156
Rear side-marker lights	3cp	168
Backup lights	27W	1156
Licence plate lights		
Sedan	3cp	168
Hatchback	10W	–

Bulb Chart – Inside

Specification	Wattage	SAE Trade No.
Dome light	10W	–
Luggage compartment light	5W	–
Heater control panel light	1.4W	74
Cigarette lighter illumination light	1.4W	74
Shift indicator light (automatic transaxle)	1.4W	74
Overdrive indicator light (automatic transaxle)	1.4W	74

93156g01

Light bulb application chart—1993–96 Mirage

Description	Wattage	SAE Trade No.
1 - Headlights	65/45W	9004
2 - Front turn-signal light/ Parking and front side- marker light	32/3cp	1157
3 - High-mounted stop light	21cp	921
4 - Stop and tail light	32/2cp	2057
5 - Stop and tail light	32/2cp	2057
6 - License plate light	3cp	168
7 - Back up light	32cp	1156
8 - Rear turn-signal light	32cp	1156
9 - Rear side-marker light	3cp	168

Inside

Description	Wattage	SAE Trade No.
Dome light	10w	-
Luggage compartment light	5w	-
Cigarette lighter illumination light	1.4W	74
Shift indicator light (automatic transaxle)	3.4W	158

93156g02

Light bulb application chart—1997–00 Mirage

Outside

Description	Wattage	SAE Trade No.
1 - Headlights (inside)	65W	9005
2 - Headlights (outside)	55W	9006
3 - Position light	3cp	168
4 - Front side-marker light	3cp	168
5 - Front turn signal light	27W	1156NA
6 - Front fog light	55W	—
7 - High-mounted stop light (on rear shelf)	21cp	921
8 - Stop and tail light	32/2cp	2057
9 - Stop and tail light	32/2cp	2057
10 - License plate light	3cp	168
11 - Back up light	45cp	3497
12 - Rear turn signal light	45cp	3497
13 -Rear side-marker light	3cp	168

Inside

Description	Wattage	SAE Trade No.
Dome light	8W	—
Dome light (for sunroof)	7.5W	—
Reading light	7.5W	—
Trunk light	5W	—
Vanity mirror light	1.4W	—
Ashtray light	1.4W	74
Cigarette lighter illumination light	1.4W	74

93156g03

Light bulb application chart—1990–93 Galant

Outside

Description		Wattage	SAE Trade No.
1 - Headlights		60/55W	HB2
2 - Front turn signal and position and front side-marker lights	2-door models	27/8W	—
	4-door models	32/3cp	1157
3 - Front fog light		55W	H3
4 - Rear turn signal light		32cp	1156
5 - Stop and tail light		32/2cp	2057
6 - Back up light		32cp	1156
7 - Rear side-marker light		3cp	168
8 - High-mounted stop light (On rear shelf)		21W	—
9 - License plate light		3cp	168

Inside

Description		Wattage	SAE Trade No.
Dome light		8W	—
Reading light	Car with sunroof	8W	—
	Except for car with sunroof	7.5W	—
Trunk light		5W	—

93156g03

Light bulb application chart—1994–98 Galant

Outside

Description	Wattage	SAE Trade No.
1 - Headlights	60/55W	HB2
2 - Front turn signal and position light (Side marker light)	27/8W	1157
3 - Front fog light	37.5W	893
4 - Back up light	32cp	1156
5 - Rear turn signal light and tail light (Side marker light)	32/2cp	2057
6 - High-mounted stop light (on rear shelf)	21cp	921
7 - License plate light	3cp	168
8 - Stop and tail light	32/2cp	2057

Inside

Description	Wattage	SAE Trade No.
Dome light	8W	—
Trunk light	5W	—

93156g06

Light bulb application chart—1999–00 Galant

Light Bulbs – Outside

Description	Wattage	SAE Trade No.
Headlight (outside)	55W	9006
Headlight (inside)	65W	9005
Front turn-signal lights	27/8W	1157NA
Front side-marker lights	2cp	194
Parking lights	3cp	168
Stop and taillights	32/2cp	2057
Rear turn-signal lights	32cp	1156
Backup lights	32cp	1156
Rear side-marker lights	3cp	168
High-mounted stoplights (On rear shelf)	21cp	–
License plate lights	3cp	168

Light Bulbs – Inside

Description	Wattage	SAE Trade No.
Reading lights	8W	–
Reading lights (for sunroof)	8W	–
Dome lights	8W	–
Dome lights (for sunroof)	10W	–
Door lights	5W	–
Luggage compartment light	5W	–
Glove compartment light	1.4W	–
Vanity mirror light	1.4W	–
Heater control panel light	1.4W	–
Cigarette lighter illumination light	1.4W	–
Ashtray light	1.4W	–
Shift indicator light (automatic transaxle)	1.4W	–
Overdrive indicator light (automatic transaxle)	1.4W	–

93156g04

Light bulb application chart—1992–96 Diamante

Outside

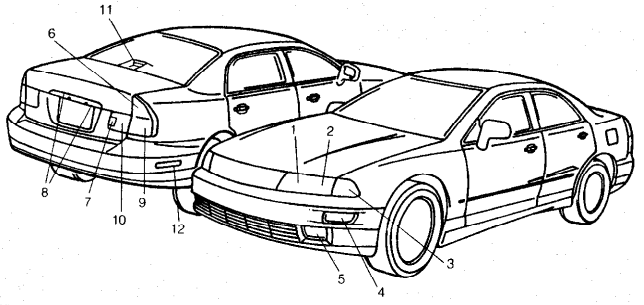
Description	Wattage	SAE trade No.
1 – Headlight (inside)	65W	9005
2 – Headlight (outside)	55W	9006
3 – Parking and front side marker light	3cp	168
4 – Front turn-signal light	24cp	1156NA
5 – High-mounted stop light	21cp	921
6 – Back up light	21cp	921
7 – Stop/tail light	32/2cp	2057
8 – Rear side-marker light	3cp	168
9 – License plate light	3cp	168
10 – Rear turn-signal light	32cp	1156

Inside

Description	Wattage	SAE trade No.
Reading light	7.5W	–
Dome light	10W	–
Door light	5W	–
Luggage compartment light	5W	–
Rear personal light	7.5W	–
Glove compartment light	3.4W	158
Vanity mirror light	1.4W	74
Air conditioner control panel light	1.4W	74
Cigarette lighter illumination light	1.4W	74
Ashtray light	1.4W	74
Overdrive indicator light	1.4W	74

93156g07

Light bulb application chart—1997–00 Diamante



Exterior
1 — Headlights (inner) - 12V 65W (HB3)
2 — Headlights (outer) - 12V 55W (HB4)
3 — Parking and front - 12V 3cp side marker light
4 — Front turn-signal lights - 12V 32cp
5 — Front fog light - 12V 55W (H3)
6 — Rear turn-signal lights - 12V 45cp
7 — Reversing light - 12V 32cp
8 — License plate light - 12V 3cp
9 — Stop / tail lights - 12V 43/3cp
10 — Stop / tail lights - 12V 32/2cp
11 — High mounted stop - 12V 21W light
12 — Rearside-marker light - 12V 3cp

Interior
Roomlights - 12V 6W
Spot lights - 12V 8W
Rear personal lights - 12V 8W
Door lights (clear) - 12V 3.4W
Trunk light - 12V 5W

93156g08

CIRCUIT PROTECTION

Fuses

REPLACEMENT

See Figures 120 thru 127

Fuses are located either in the engine compartment or passenger compartment fuse and relay panels. If a fuse blows, at least one, but possibly several components/circuits will not function properly.

1. Remove the fuse box cover.
2. Inspect the fuses to determine which is faulty.
3. Grasp the fuse and remove it from the fuse box.
4. Inspect the box terminals and clean if corroded. If any terminals are damaged, replace the terminals.
5. Plug in a new fuse of the same amperage rating.

WARNING

Never exceed the amperage rating of a blown fuse. If the replacement fuse also blows, check for a problem in the circuit.

6. Check for proper operation of the affected component or circuit.

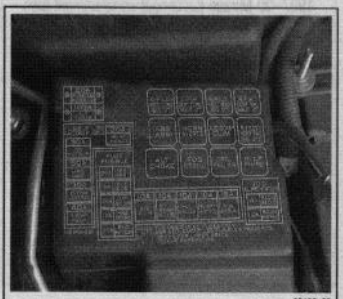
Fusible Links

CAUTION

Do not replace blown fusible links with standard wire. Only fusible type wire with Hypalon insulation can be used, or damage to the electrical system will occur!

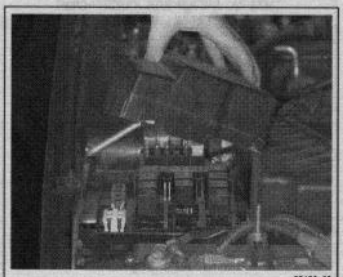
A number of fusible links are used on these vehicles to protect wiring and electrical components. There is a collection of fusible links located near the battery. These are referred to as the main fuse links. A second group of links are located in the box with the dedicated fuses. If replacement of a fuse link is required, use the exact same link as removed.

When a fusible link blows it is very important to find out why. They are placed in the electrical system for protection against dead shorts to ground, which can be caused by electrical component failure or various wiring failures.



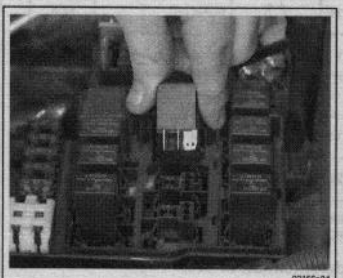
93156p82

Fig. 120 The engine compartment fuse box is typically located adjacent to the battery



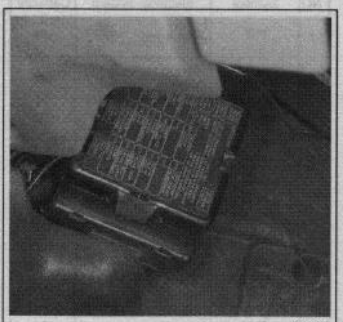
93156p83

Fig. 121 Grasp the engine compartment fuse box cover and pull it straight up to remove it



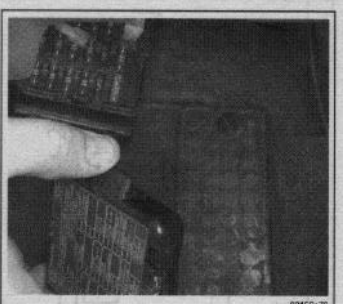
93156p84

Fig. 122 The engine compartment fuse box contains a combination of fuses, maxifuses, relays, and diodes. Most can be removed by simply pulling upward



93156p77

Fig. 123 The interior fuse box is located under the driver's side of the instrument panel



93156p76

Fig. 124 Grasp the interior fuse box cover, depress the retaining tabs and lift up to remove

93156p79

Fig. 125 Typically a fuse removal tool is located in the fuse box to aid in removing the fuses

93156p80

Fig. 126 Grasp the fuse with the removal tool and pull it straight out to remove it

93156p78

Fig. 127 There are usually spare fuses located in the interior fuse box cover

⁂ CAUTION

Do not just replace the fusible link to correct a problem!

When replacing all fusible links, they are to be replaced with the same type of prefabricated link available from your vehicle manufacturer.

Circuit Breakers

RESETTING AND/OR REPLACEMENT

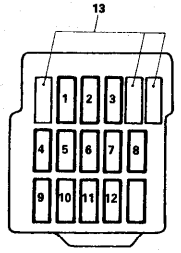
Circuit breakers are located inside the fuse panel. They are automatically reset when the problem corrects itself, is repaired, or the circuit cools down to allow operation again.

Flashers

REPLACEMENT

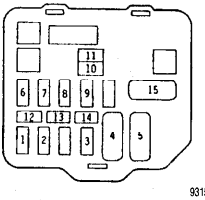
The turn signal and hazard flasher unit is located in the interior fuse panel located under the driver's left side knee protector. They are replaced by simply pulling them straight out. Note that the prongs are arranged in such a way that the flasher must be properly oriented before attempting to install it. Turn the flasher until the orientation of the prongs is correct and simply push it firmly in until the prongs are fully engaged.

1990–92 Mirage fuse location chart



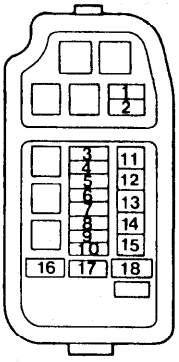
1993–96 Mirage fuse location chart

1997–00 Mirage passenger compartment fuse location chart

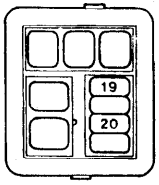


1997–00 Mirage engine compartment fuse location chart

Engine compartment
Right side



Left side



Engine compartment

NO	Symbol	Electrical system	Capacity
1	STOP	Stop lights	15A
2		Hazard warning flashers	10A
3		Fog lights	15A
4		Tail lights	10A
5		Tail lights	10A
6		Air conditioning	10A
7		Headlight upper beam	10A
8		Horn	10A
9		Radio	10A
10		Dome light	10A
11		Engine control	20A
12		Power window control	30A
13		Radiator fan motor	30A
14		Headlights	40A
15		Ignition switch	30A

NO	Symbol	Electrical system	Capacity
16		Fuse(+B)	60A
17		Air conditioning	25A
18		Alternator	100A
19		Air conditioning	10A
20		Condensor fan motor	20A

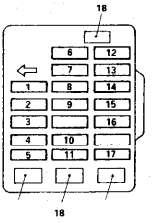
Some fuses may not be installed on your vehicle, depending on the vehicle model or specifications.

Identification of fuse

10A	Red
15A	Light blue
20A	Yellow
30A	Green

93156g11

1990–93 Galant fuse location chart



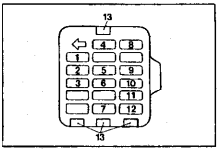
Fuse Load Capacities

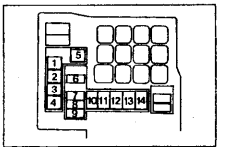
1–15A Cigarette lighter
2–10A Radio
3–10A Heater relay
4–10A (E.P.S.)
5–10A Belt
6–10A Turn signals
7–10A Meters
8–10A Horn
9–15A Wiper
10–10A (4 A/T)
11–15A (Door locks)
12–10A Dome light, clock
13–10A Backup lights
14–15A Stop lights
15–30A Heater
16–20A (Sunroof)
17–20A (E.C.S.)
18– Spare fuse

Identification of fuse
10A Red
15A Light blue
20A Yellow
30A Green

93156g13

1994–98 Galant fuse location chart





Passenger compartment

1- 15A Stoplights
2- 10A Turn signals
3- 10A Backup lights
4- 30A Heater
5- 15A Wiper
6- 10A Meters
7- 30A Rear window defogger
8- 20A (Sunroof)
9- 10A 4 A/T
10- 15A Cigarette lighter
11- 10A Heater relay
12- 10A Horn
13- Spare fuse

( ): if so equipped
A/T : Automatic transaxle

Engine compartment
Fusible links

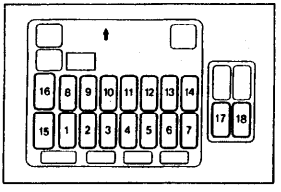
1- 30A Ignition switch
2- 50A (ABS)
3- 30A Radiator fan
4- 40A Headlights
5- 30A Power window

Fuse

6- 30A (ABS)
7- 30A Condenser fan
8- 10A Hazard
9- 20A Engine
10- 10A (Air conditioning)
11- 10A High beam
12- 10A Tail lights
13- 10A (Theft)
14- 15A Fog lights
( ): if so equipped

93156g14

1999–00 Galant fuse location chart

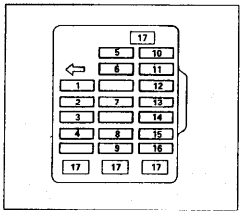


Passenger compartment

N O	Symbol	Electrical system	Capacity
1		Theft	10A
2		Door lock	15A
3		Ignition switch	10A
4		Gauge	10A
5		Horn	10A
6	—	—	—
7		Relay	10A
8	STOP	Stop lamps	15A
9	—	—	—
10		Back up lamps	10A
11	—	—	—
12		Cigarette lighter	15A
13		Wiper	20A
14		ABS	10A
15		Heater	30A
16		Rear window defogger	30A
17		Door mirror heater	10A
18		Sunroof	20A

93156g15

1992–96 Diamante fuse location chart



Fuse load capacities

1 – 15A Cigarette lighter
2 – 10A Radio
3 – 10A Heater relay, (Power window relay)
4 – 10A (E.P.S)
5 – 10A Turn signals, SRS
6 – 10A Meters, SRS
7 – 15A Wiper
8 – 10A (4 A/T)
9 – 15A Steering handle lock, (Door locks)
10 – 10A Dome light, Clock
11 – 10A Backup lights
12 – 20A Stoplights
13 – 30A Heater
14 – 20A (Sunroof)
15 – 20A Horn
16 – 20A (E.C.S.)
17 – Spare fuse

( ) indicates optional equipment
E.P.S.: Electronic Control Power Steering
E.C.S.: Electronic Control Suspension
SRS: Supplement Restraint System
A/T: Automatic Transaxle

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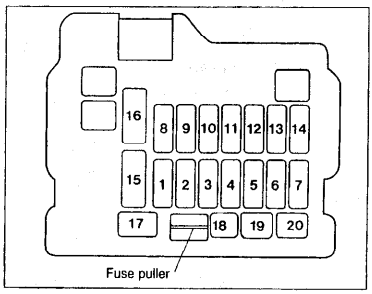
1997–00 Diamante passenger compartment fuse location chart

No.	Symbol	Electrical System	Capacity
1			
2		Trunk lid opener	15A
3		Ignition switch	10A
4		Instrument cluster	10A
5		Antiglare mirror	10A
6		SWS	10A
7		Demister, heater relay	10A
8	STOP	Stop lights	15A
9		Turn-signal lights (SRS)	10A
10		Reversing lights	10A
11		Radio	10A
12		Cigarette lighter	15A
13		Wiper/Washer	20A
14		Sunroof	10A
15		Heater	30A
16		Demister	30A
17		Spare fuse	30A
18		Spare fuse	10A
19		Spare fuse	15A
20		Spare fuse	20A



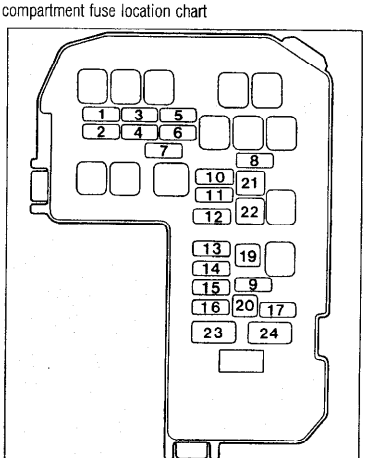
NOTE: Spare fuses are contained in the fuse housing. Always use a fuse of the same capacity for replacement.

93156g17

1997 00 Diamante engine compartment fuse location chart

Engine Compartment —

No.	Symbol	Electrical System	Capacity
1		Tail lights (left)	10A
2		Tail lights (right)	10A
3		Headlights (lower beam-left)	15A
4		Headlights (lower beam-right)	15A
5		Headlights (upper beam-left)	10A
6		Headlights (upper beam-right)	10A
7		Fog lamps	15A
8		Condenser fan	20A
9		Audio	20A
10		Audio	10A
11		Room light	15A
12		ECU	10A
13		Hazard warning flashers	10A
14		—	—
15		Engine control	20A
16		Alternator	10A
17		A/C compressor	10A
18	—	—	—
19		Ignition switch	30A
20		Power windows	40A
21		Radiator fan	40A
22		ABS brakes	60A
23		Main fuse	120A
24		Fuse (+B)	60A



93156g18

WIRING DIAGRAMS

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SAMPLE DIAGRAM: HOW TO READ & INTERPRET WIRING DIAGRAMS

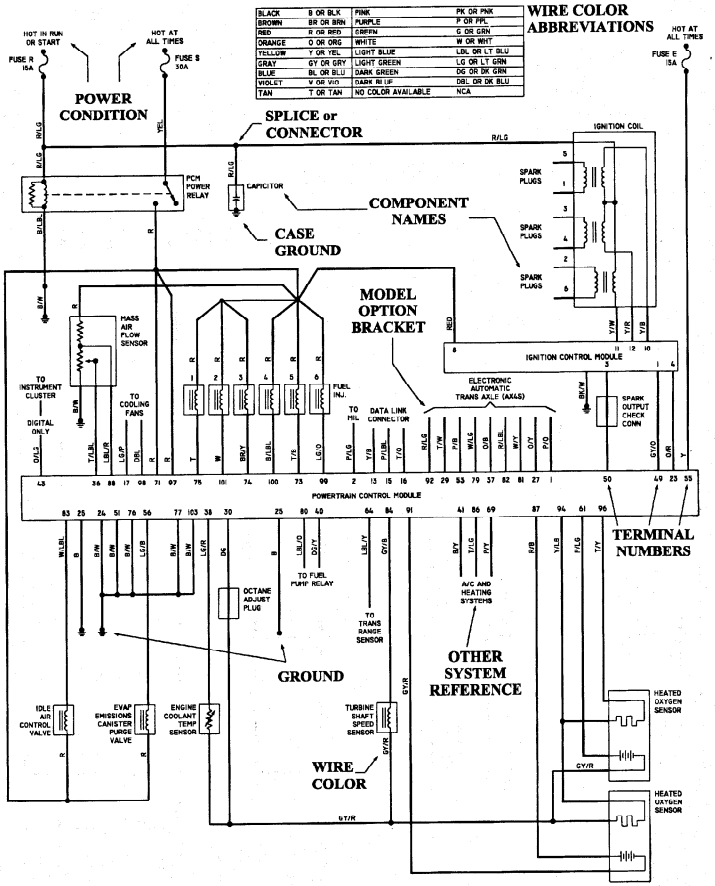


DIAGRAM 1

Tcca6W01

WIRING DIAGRAM SYMBOLS

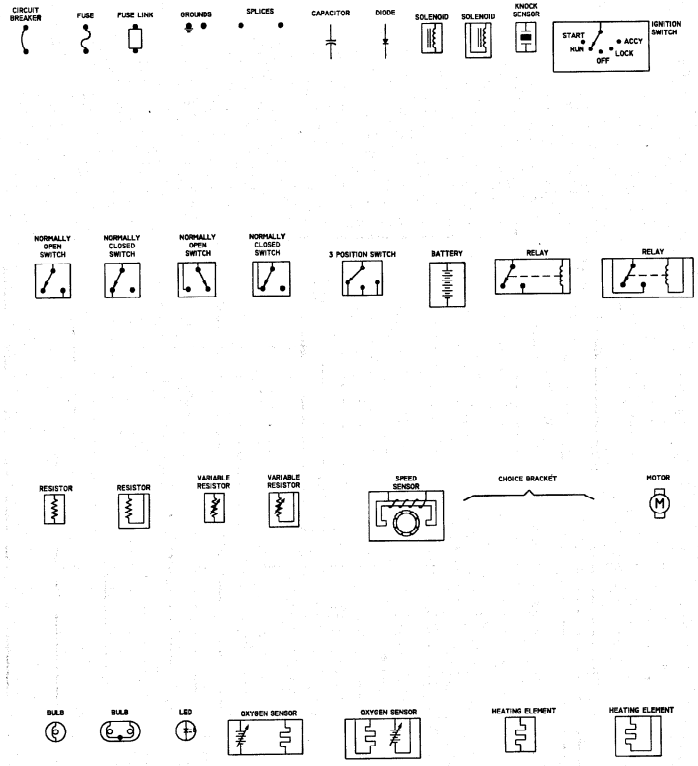
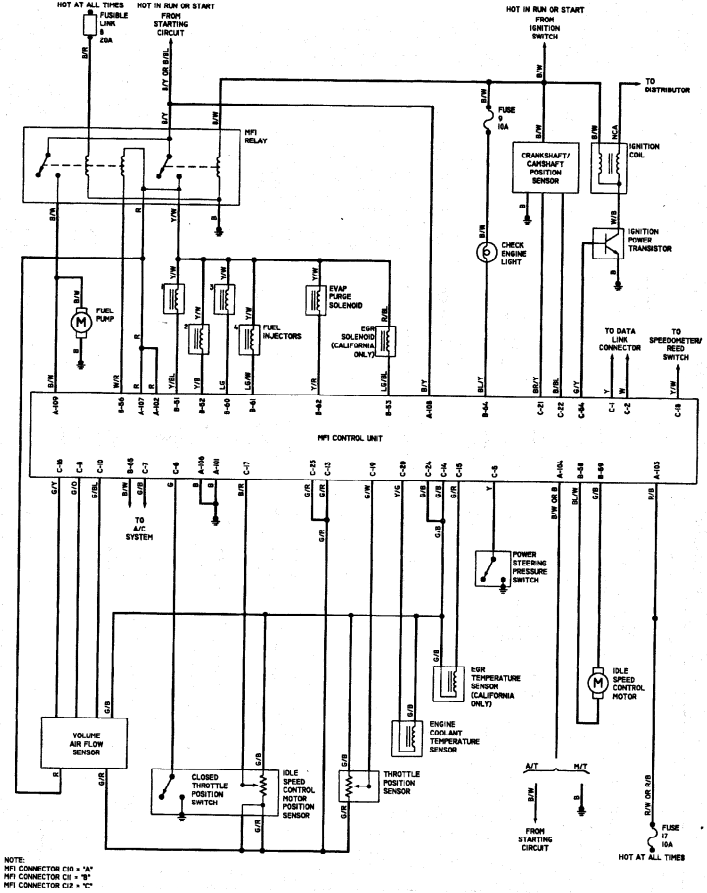


DIAGRAM 2

Tcca6W02

1990-92 GALANT 2.0L SOHC ENGINE SCHEMATIC

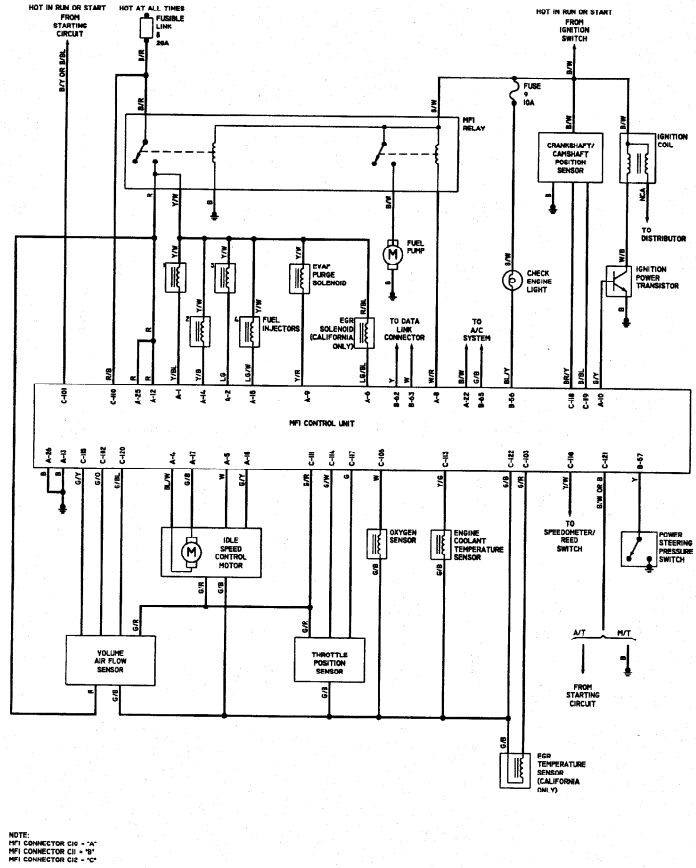


NOTE:
MFI CONNECTOR C10 = "A"
MFI CONNECTOR C11 = "B"
MFI CONNECTOR C12 = "C"

DIAGRAM 3

93156E01

1993 GALANT 2.0L SOHC ENGINE SCHEMATIC

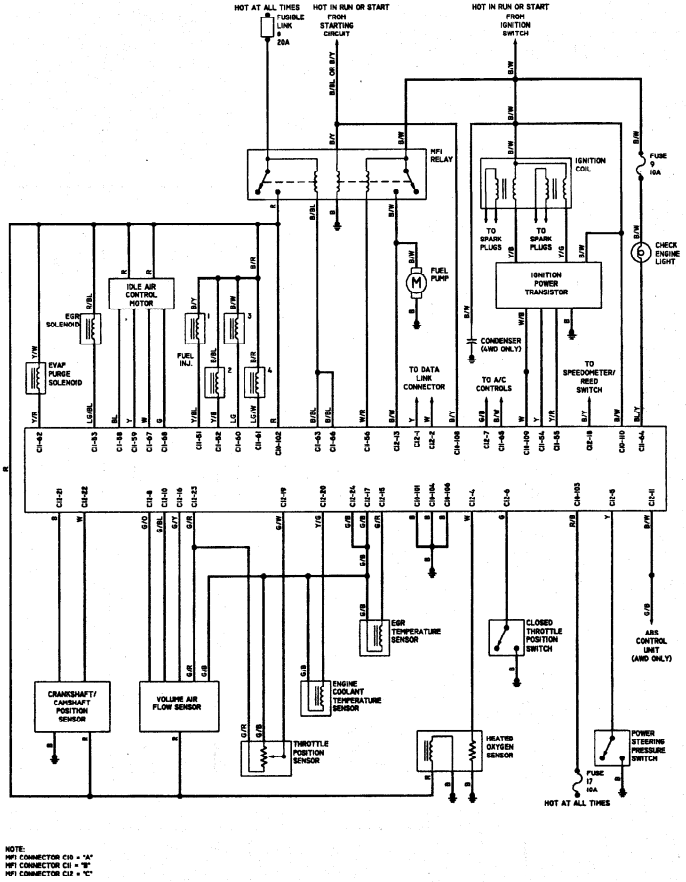


NOTE:
MFI CONNECTOR C10 = "A"
MFI CONNECTOR C11 = "B"
MFI CONNECTOR C12 = "C"

DIAGRAM 4

93156E02

1990 GALANT 2.0L DOHC ENGINE SCHEMATIC



NOTE:
MFI CONNECTOR C10 = "A"
MFI CONNECTOR C11 = "B"
MFI CONNECTOR C12 = "C"

DIAGRAM 5

93156E03

1991-93 GALANT 2.0L DOHC ENGINE SCHEMATIC

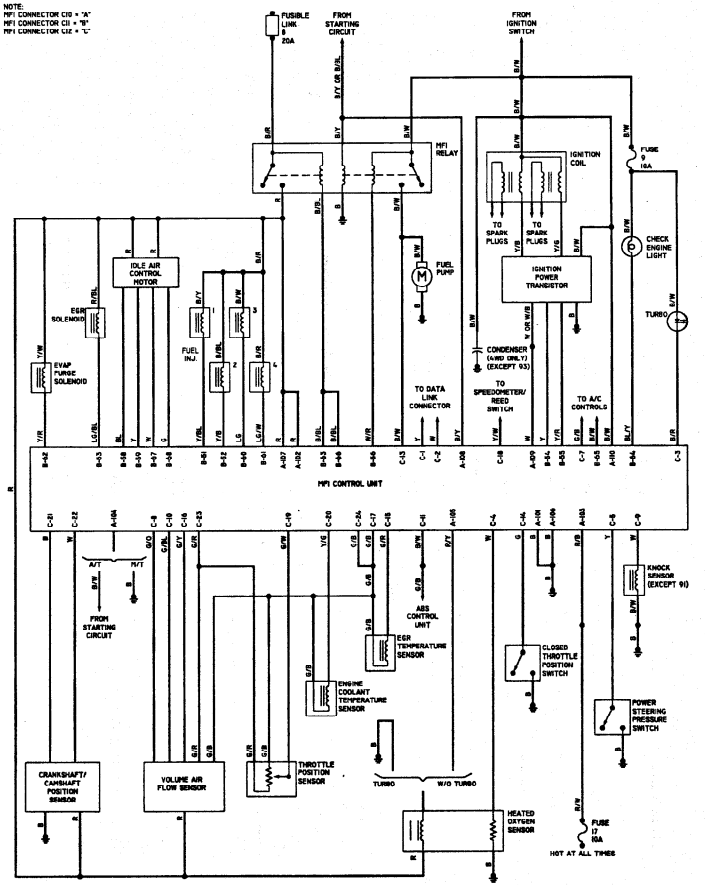


DIAGRAM 6

91356E04

1994 GALANT 2.4L SOHC ENGINE SCHEMATIC

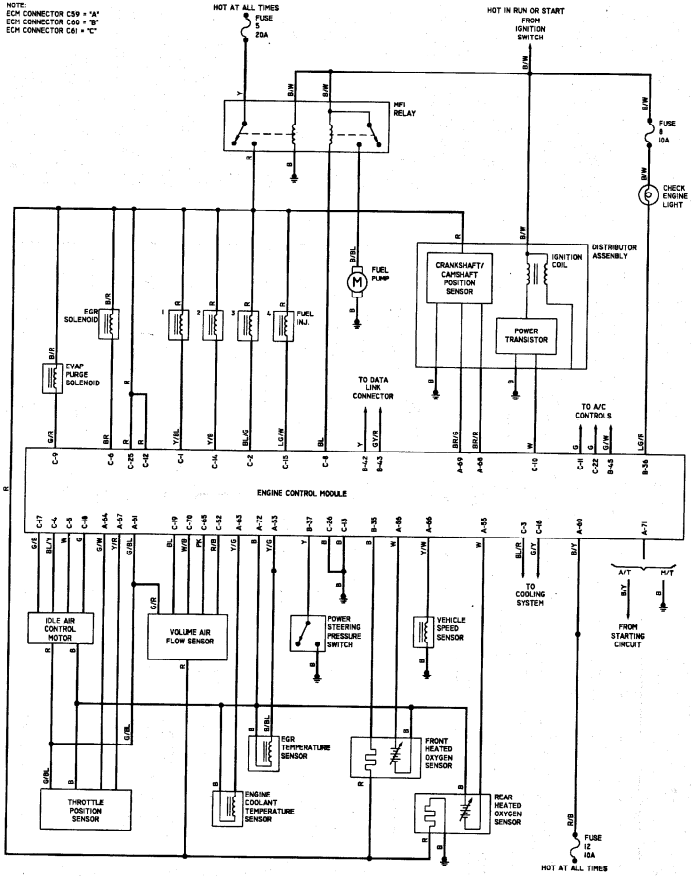


DIAGRAM 7

93156E05

1994 GALANT 2.4 DOHC ENGINE SCHEMATIC

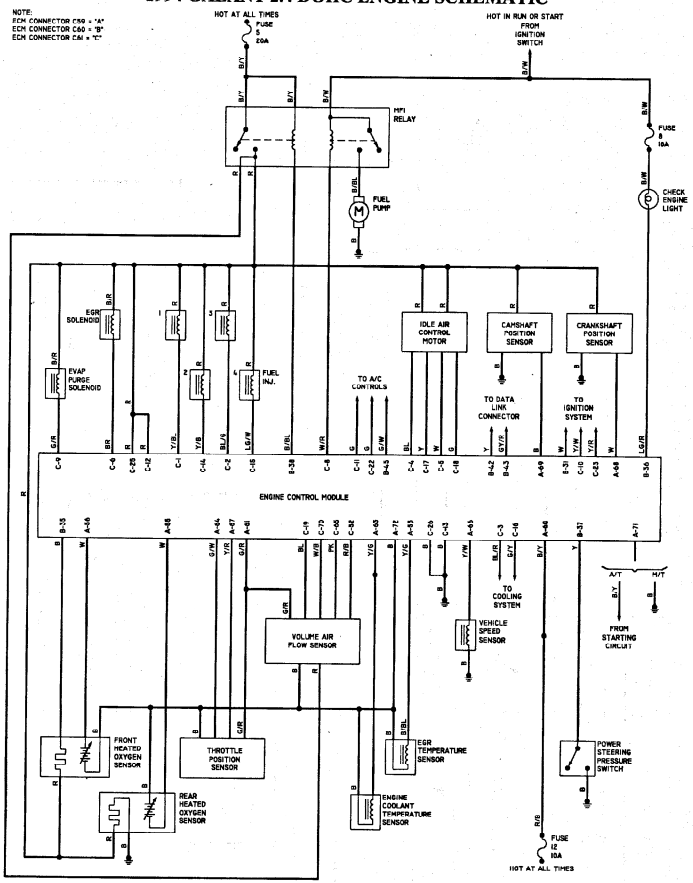


DIAGRAM 8

93156E06

1996-00 GALANT 2.4L ENGINE SCHEMATIC

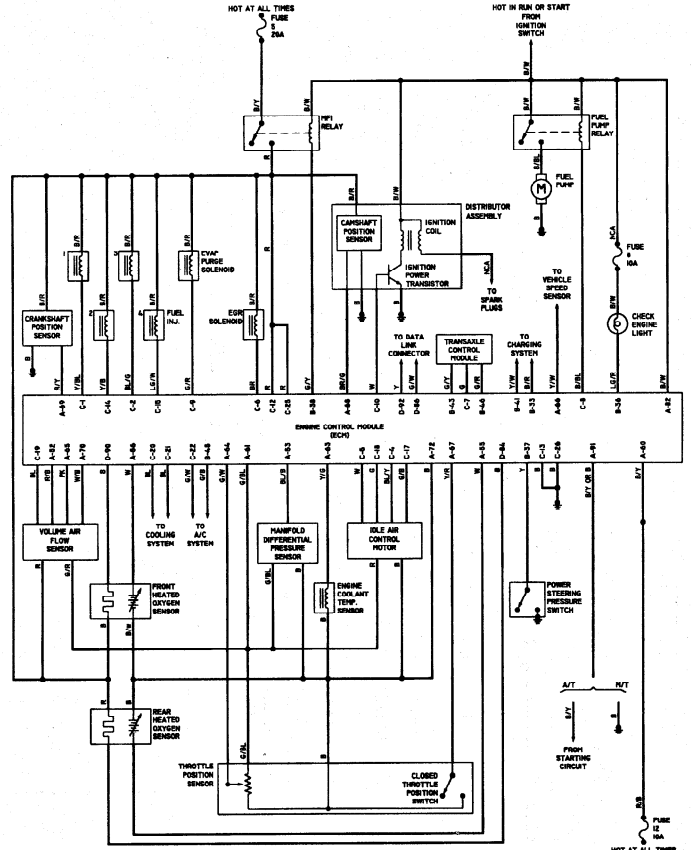


DIAGRAM 9

93156E17

1993-96 MIRAGE 1.5L ENGINE SCHEMATIC

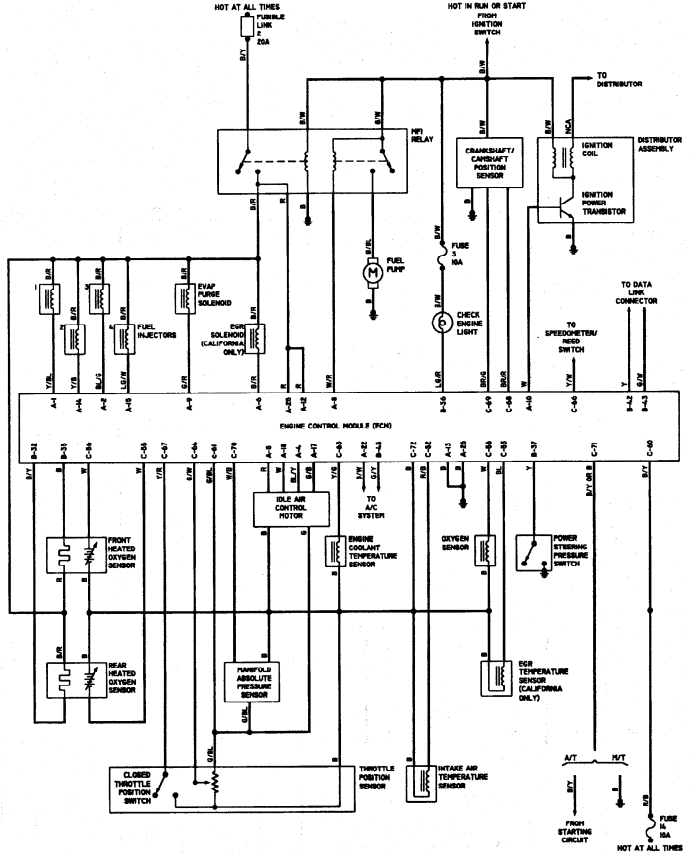
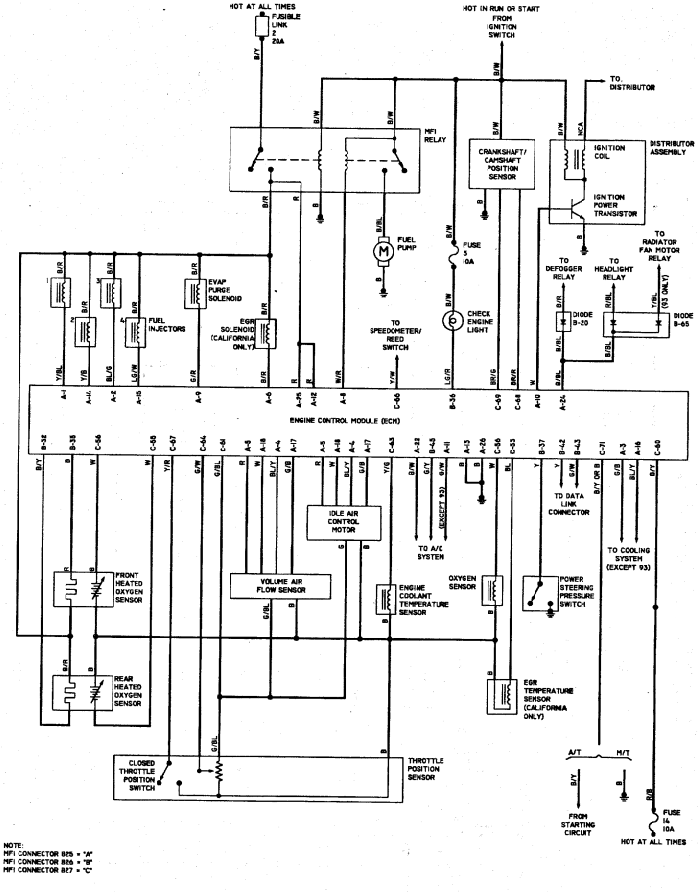


DIAGRAM 10

93156E12

1993-96 MIRAGE 1.8L ENGINE SCHEMATIC

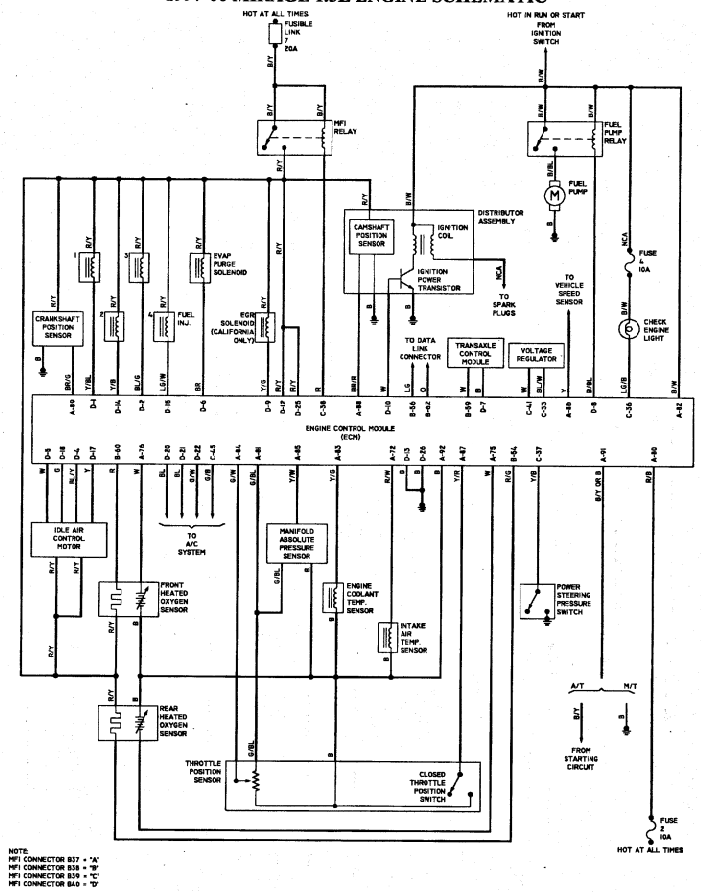


NOTE:
MFI CONNECTOR B29 = "A"
MFI CONNECTOR B30 = "B"
MFI CONNECTOR B27 = "C"

DIAGRAM 11

93156E13

1997-00 MIRAGE 1.5L ENGINE SCHEMATIC



NOTE:
MFI CONNECTOR B37 = "A"
MFI CONNECTOR B38 = "B"
MFI CONNECTOR B39 = "C"
MFI CONNECTOR B40 = "D"

DIAGRAM 12

93156E14

1997-00 MIRAGE 1.8L ENGINE SCHEMATIC

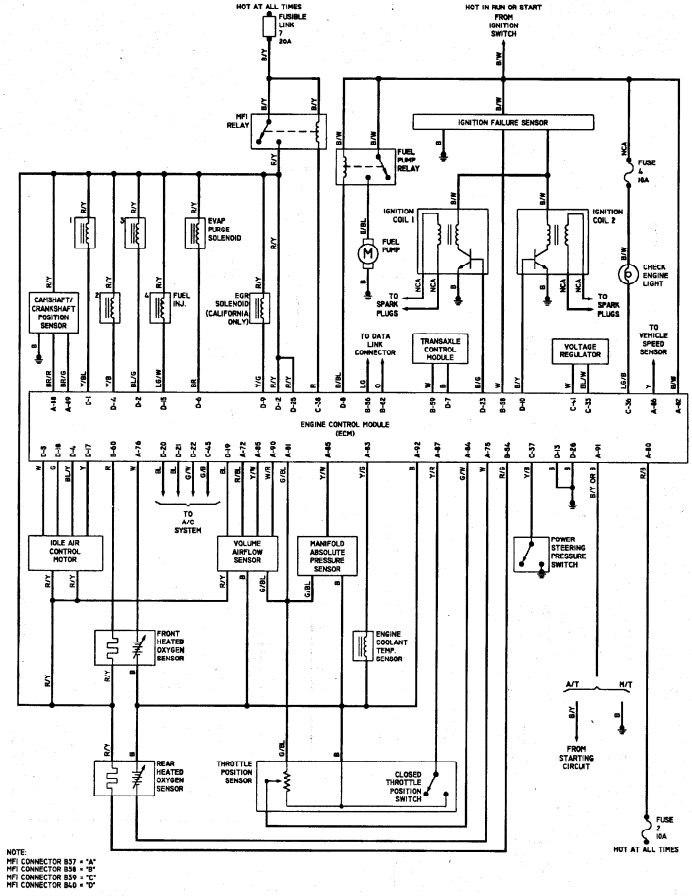


DIAGRAM 13

93156E15

1992-93 DIAMANTE 3.0L SOHC ENGINE SCHEMATIC

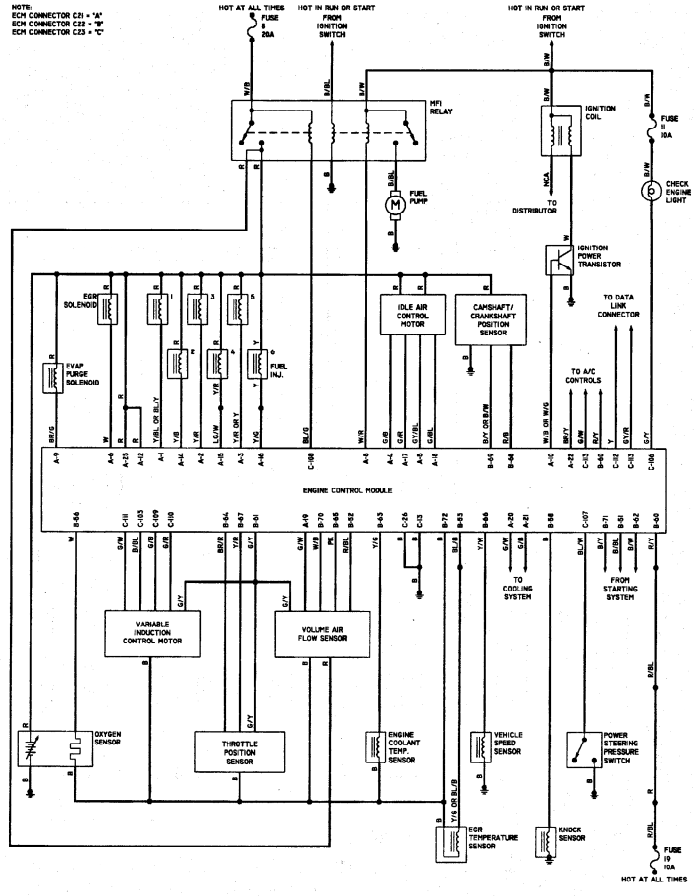


DIAGRAM 14

93156E08

1994-95 DIAMANTE 3.0L SOHC ENGINE SCHEMATIC

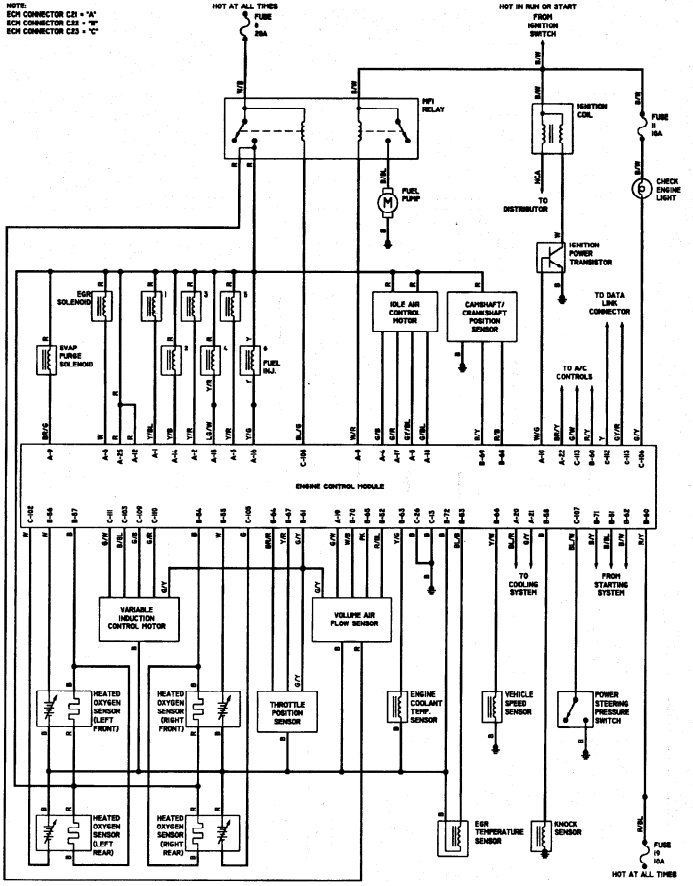


DIAGRAM 15

93156E09

1992-93 DIAMANTE 3.0L DOHC ENGINE SCHEMATIC

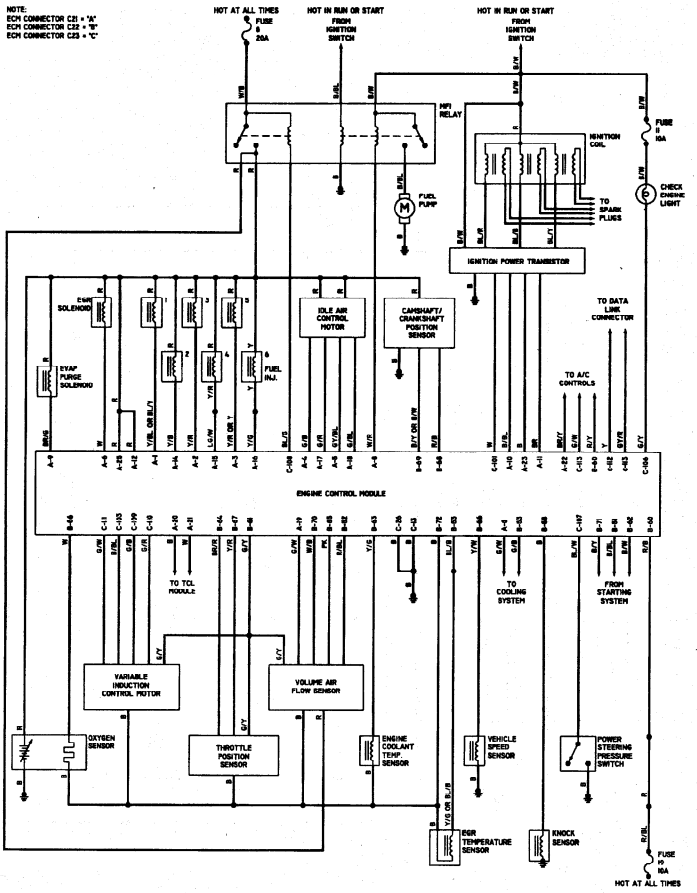


DIAGRAM 16

93156E10

1994-95 DIAMANTE 3.0L DOHC ENGINE SCHEMATIC

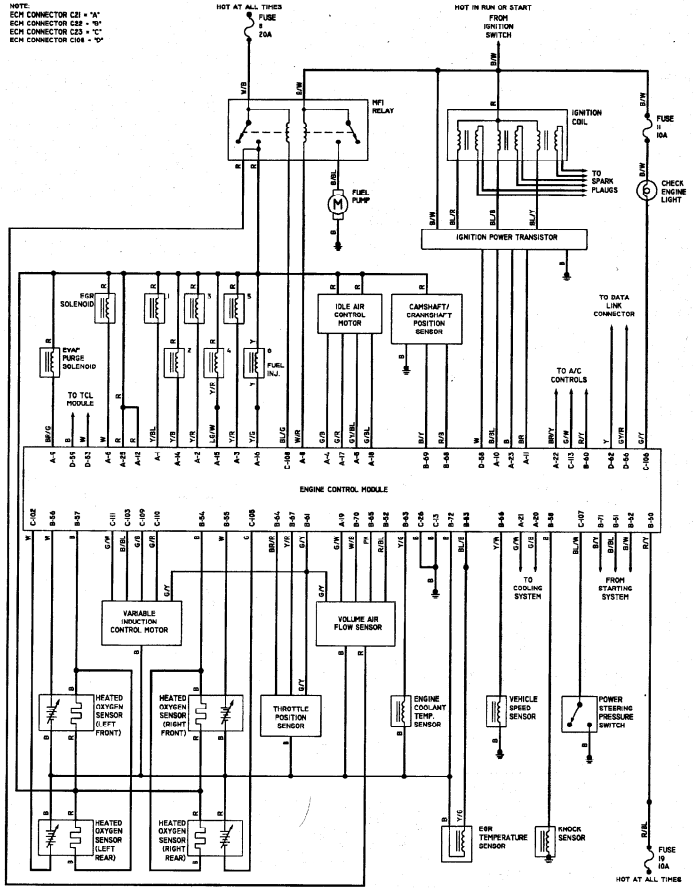


DIAGRAM 17

93156E11

1996-00 DIAMANTE 3.5L ENGINE SCHEMATIC

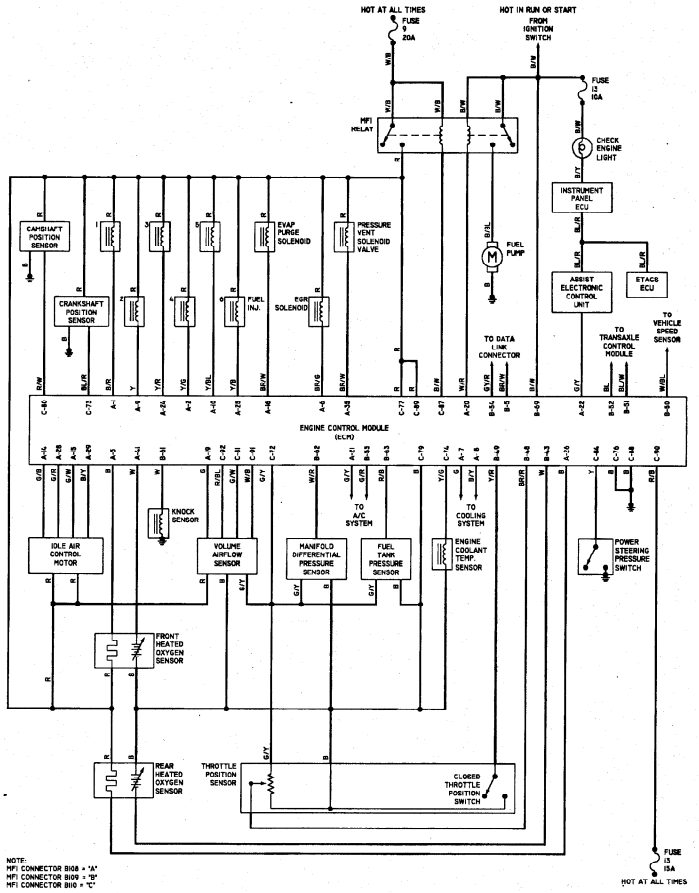


DIAGRAM 18

93156E16

1990-95 GALANT/MIRAGE CHASSIS SCHEMATIC

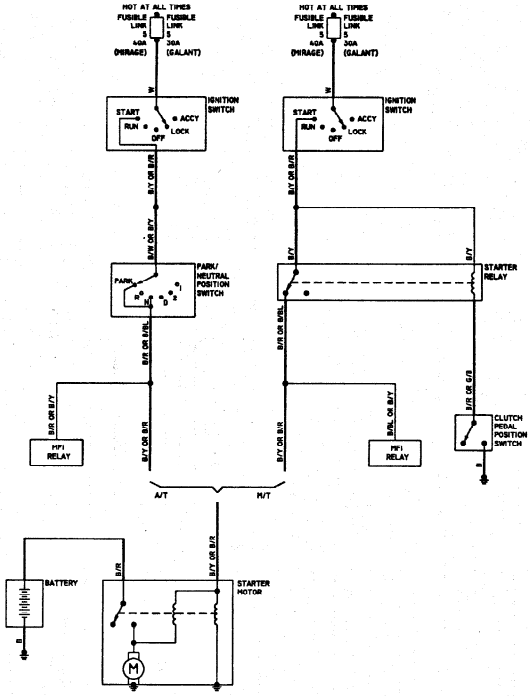


DIAGRAM 19

93156B01

1990-93 GALANT CHASSIS SCHEMATIC

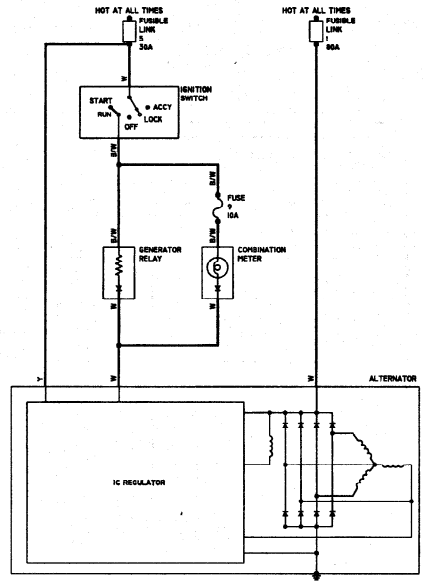


DIAGRAM 20

93156B02

1990-93 GALANT CHASSIS SCHEMATIC

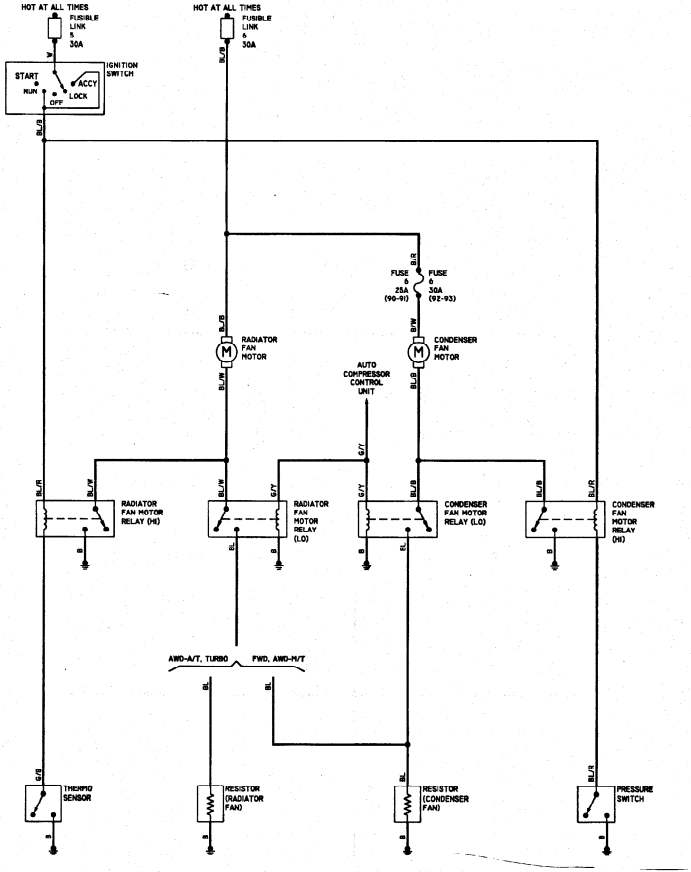


DIAGRAM 21

93156B03

1990-93 GALANT CHASSIS SCHEMATIC

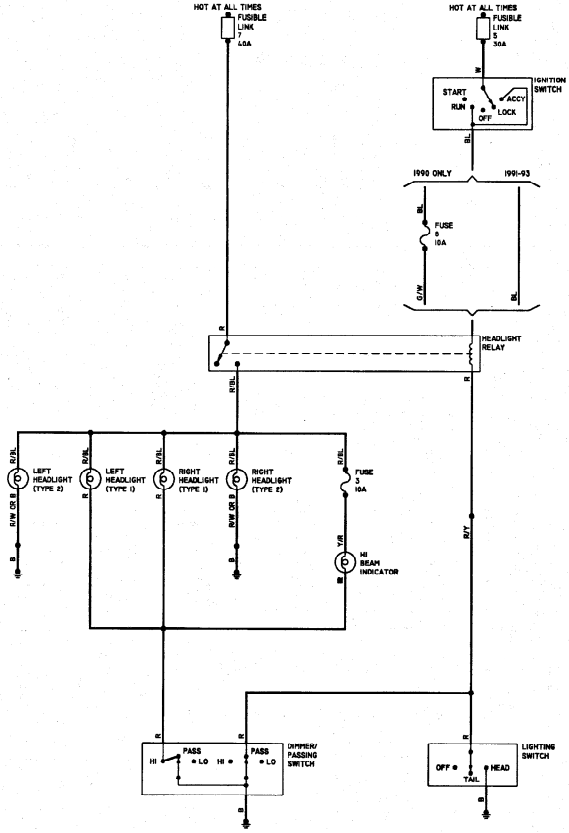


DIAGRAM 22

93156B04

1990-93 GALANT CHASSIS SCHEMATIC

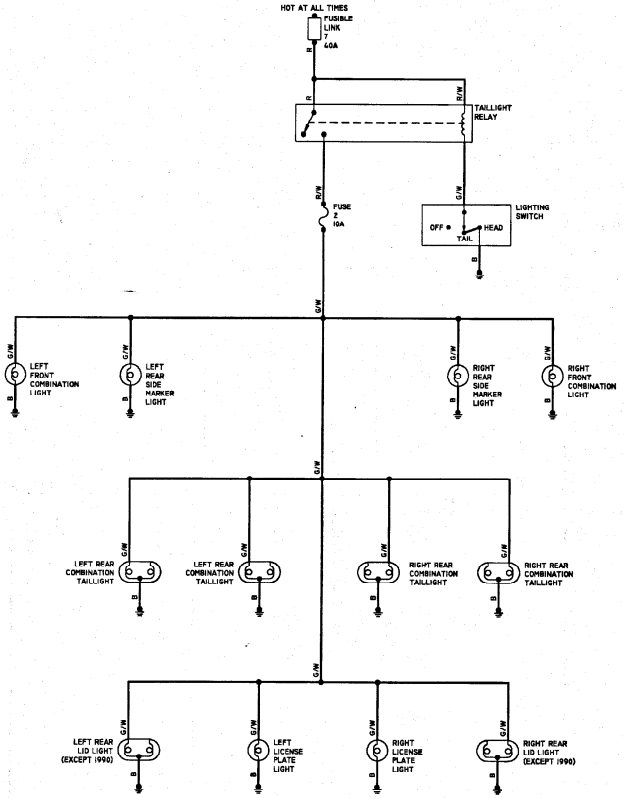


DIAGRAM 23

93156B05

1990-93 GALANT CHASSIS SCHEMATIC

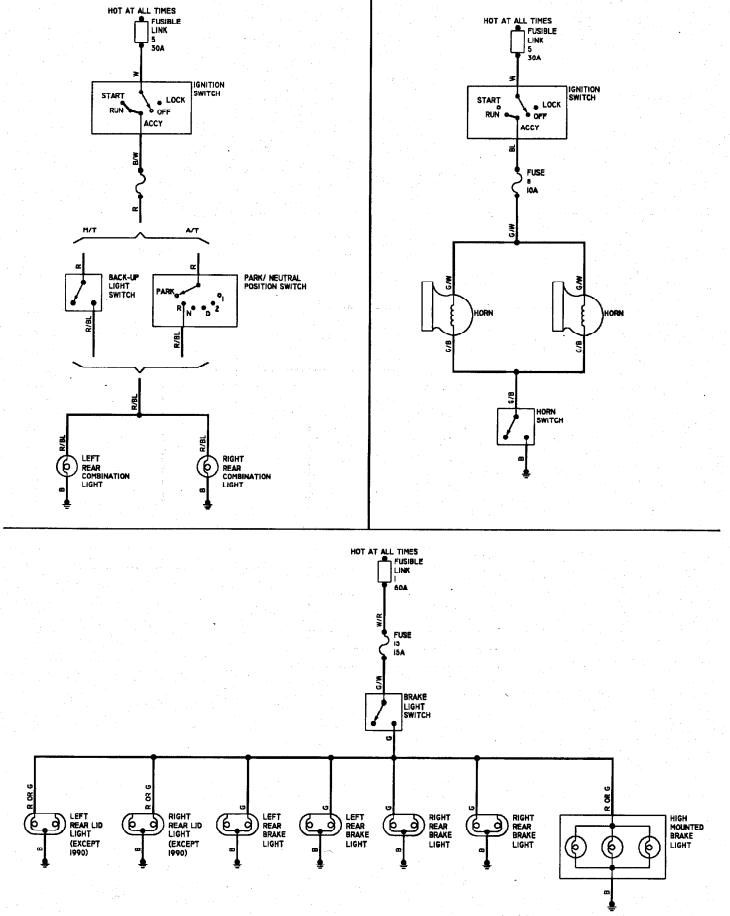


DIAGRAM 24

93156B06

1990-93 GALANT CHASSIS SCHEMATIC

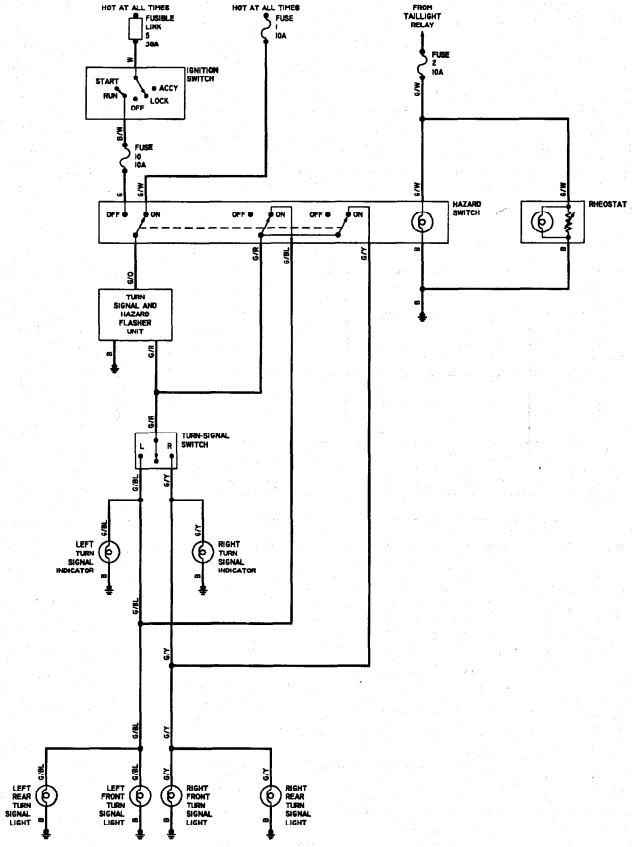


DIAGRAM 25

93156B07

1990-93 GALANT CHASSIS SCHEMATIC

W/O ETACS

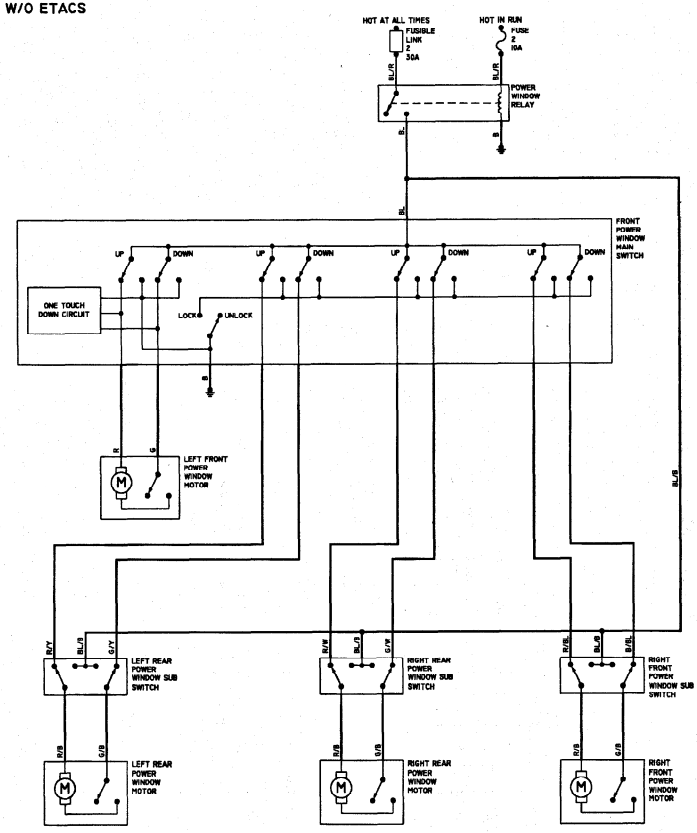


DIAGRAM 26

93156B10

1990-93 GALANT CHASSIS SCHEMATIC

w/ ETACS

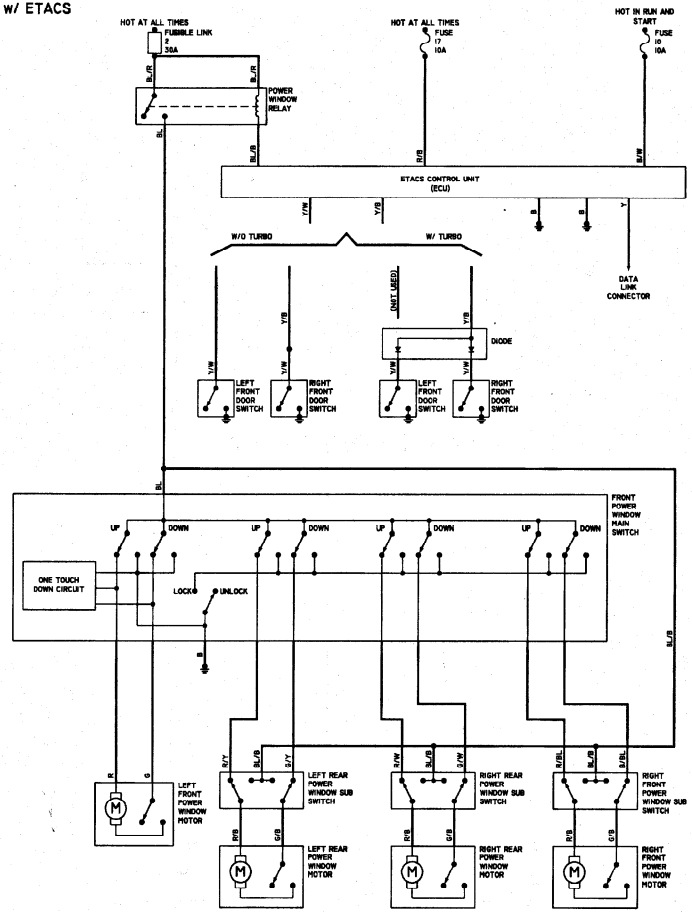


DIAGRAM 27

93156B11

1990-93 GALANT CHASSIS SCHEMATIC

w/o ETACS

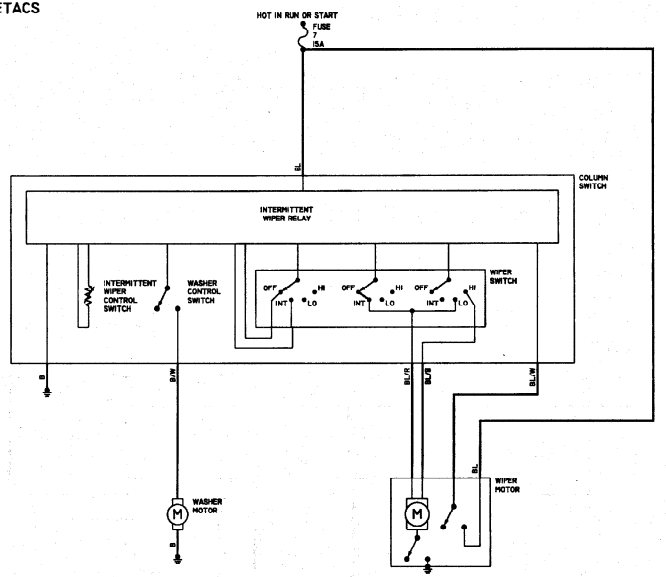


DIAGRAM 28

93156B12

1990-93 GALANT CHASSIS SCHEMATIC

W/ ETACS

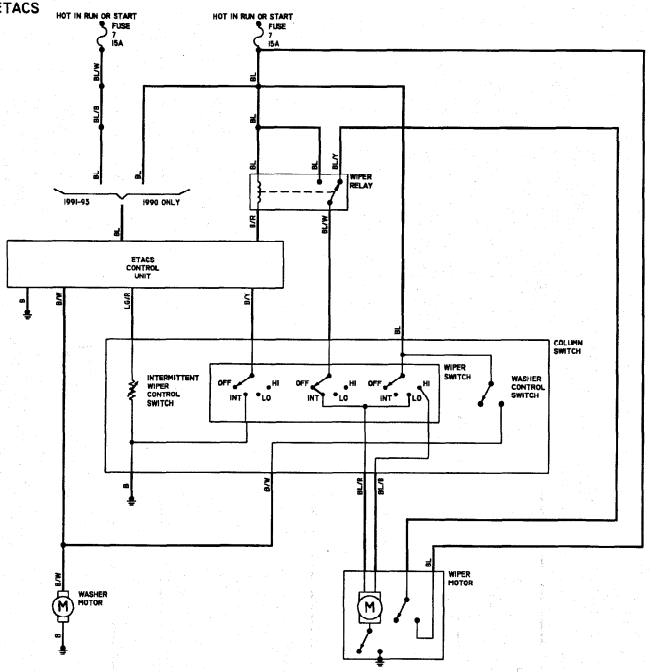


DIAGRAM 29

93156B13

1990-93 GALANT CHASSIS SCHEMATIC

W/O ETACS

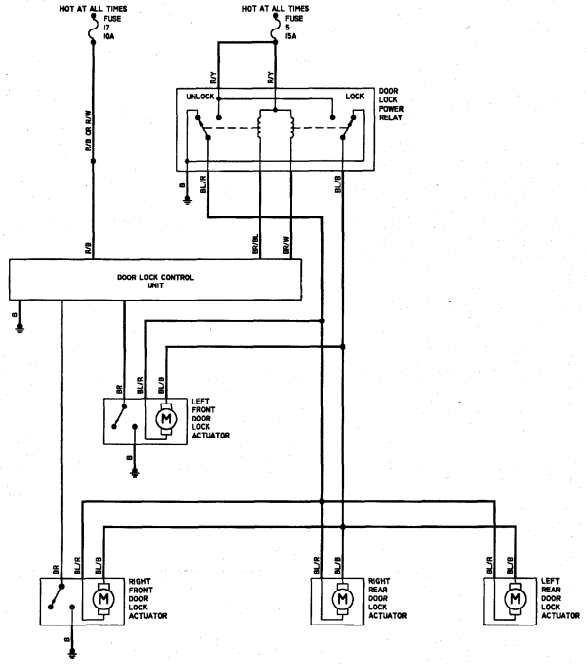


DIAGRAM 30

93156B14

1990-93 GALANT CHASSIS SCHEMATIC

w/ ETACS

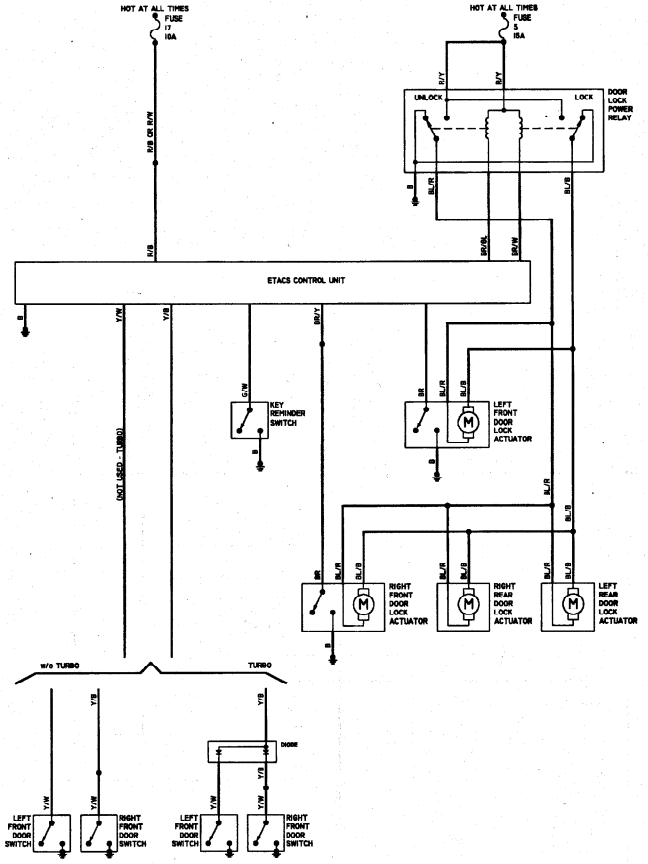
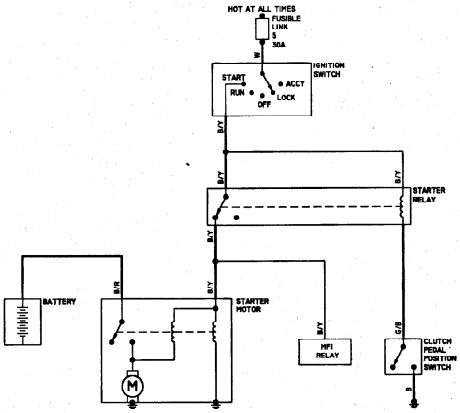


DIAGRAM 31

93156B15

1996-00 GALANT CHASSIS SCHEMATIC

MANUAL TRANSMISSION



AUTOMATIC TRANSMISSION

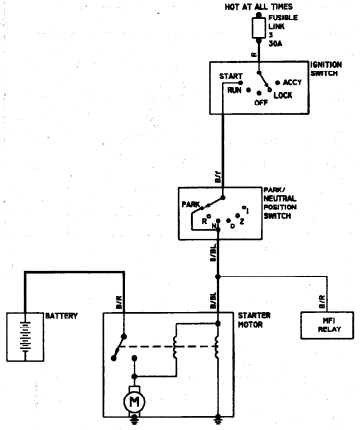


DIAGRAM 32

93156B16

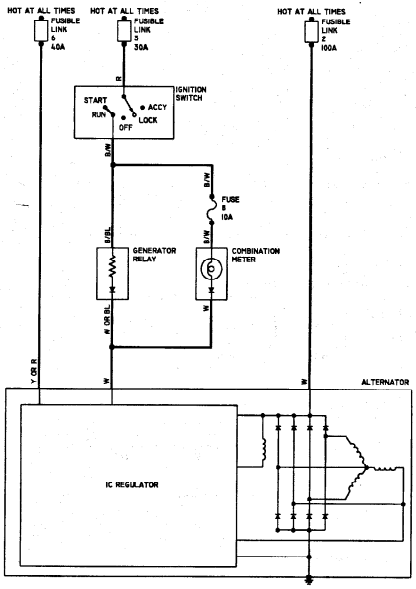


DIAGRAM 33

93156B17

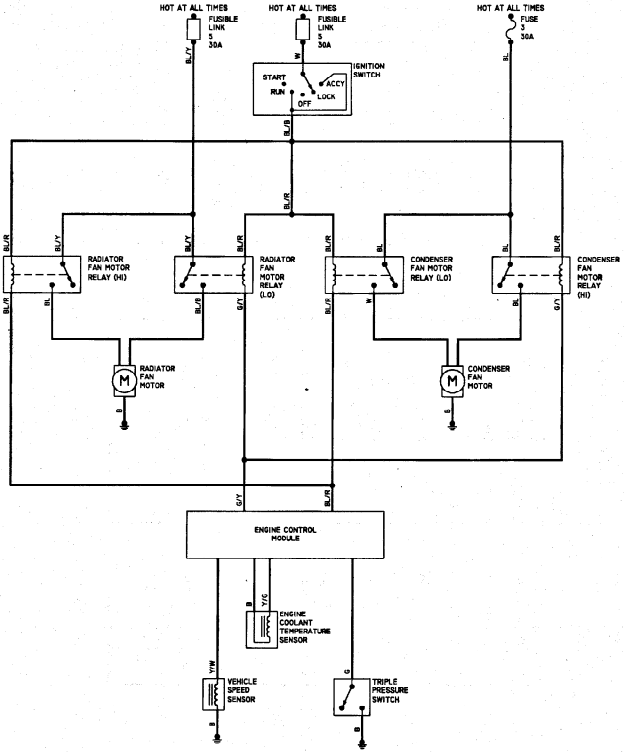


DIAGRAM 34

93156B18

1994-00 GALANT CHASSIS SCHEMATIC

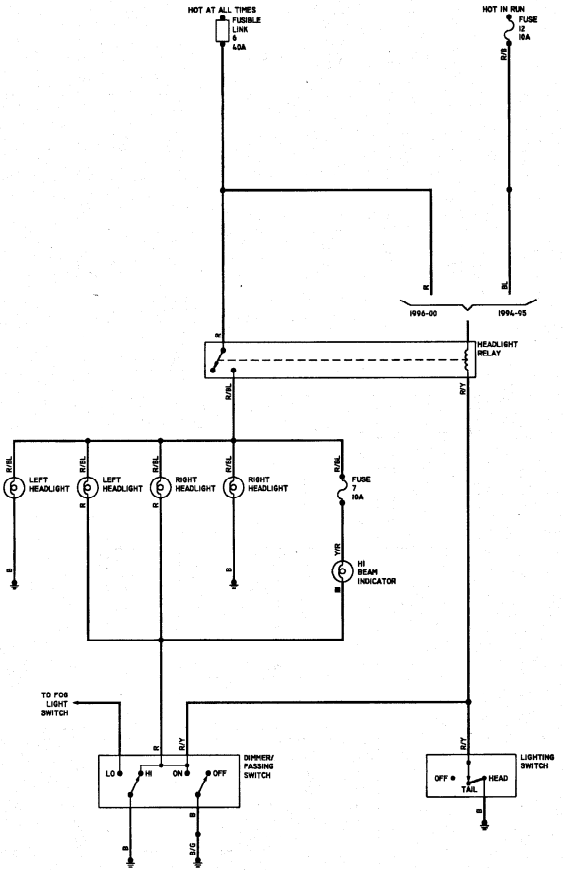


DIAGRAM 35

93156B19

1994-00 GALANT CHASSIS SCHEMATIC

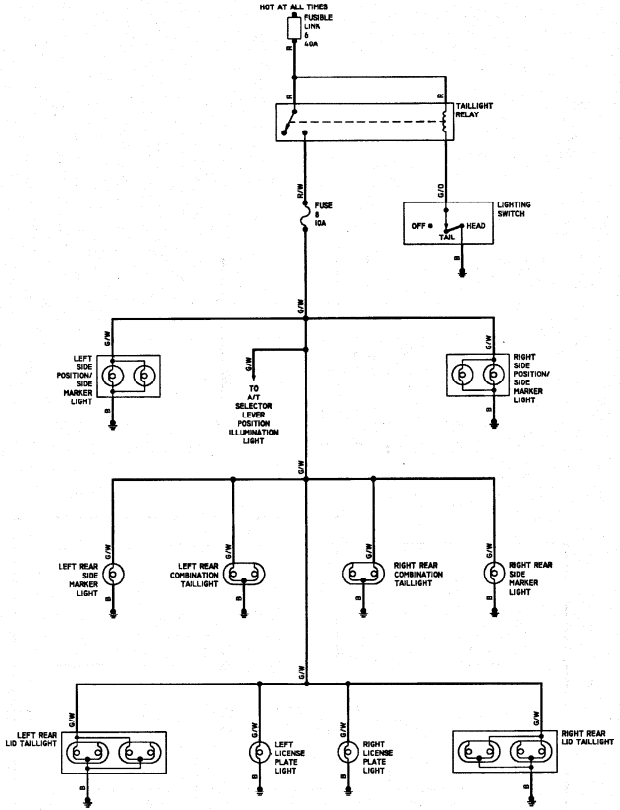


DIAGRAM 36

93156B20

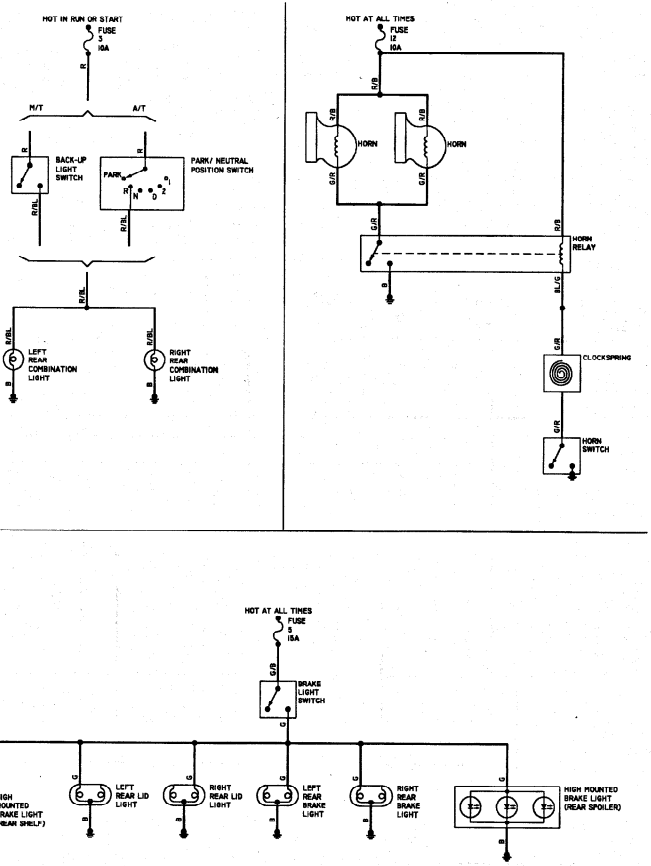


DIAGRAM 37

93156B21

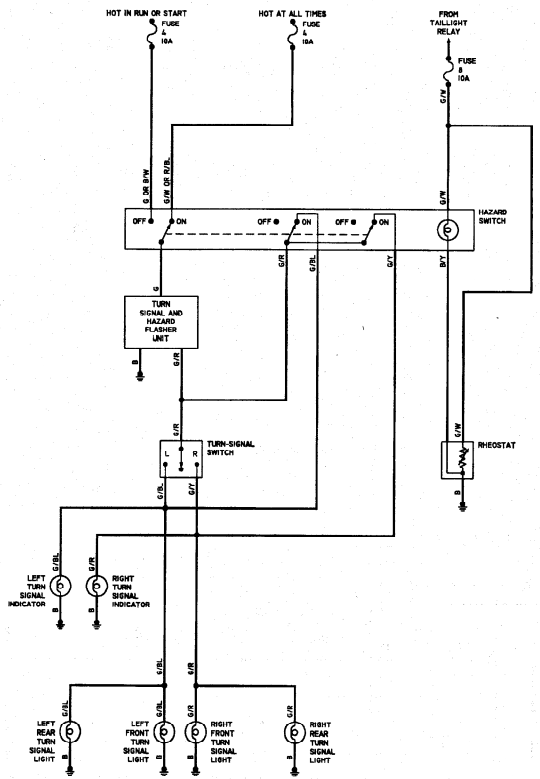


DIAGRAM 38

93156B22

1994-00 GALANT CHASSIS SCHEMATIC

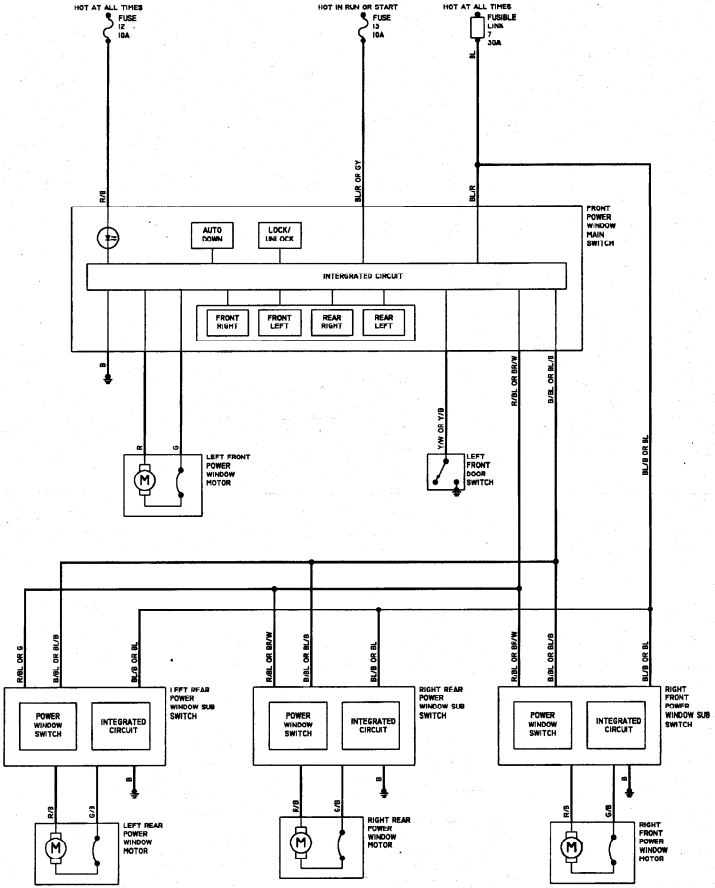


DIAGRAM 39

93156B25

1994-00 GALANT CHASSIS SCHEMATIC

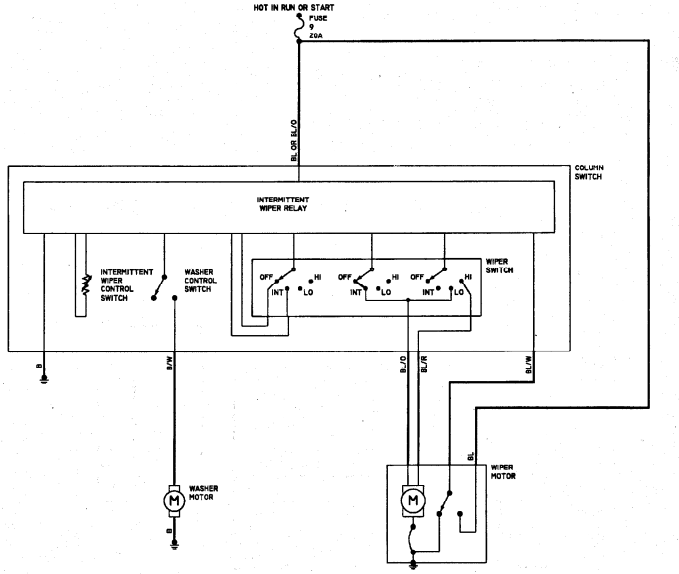


DIAGRAM 40

93156B26

1994 GALANT CHASSIS SCHEMATIC

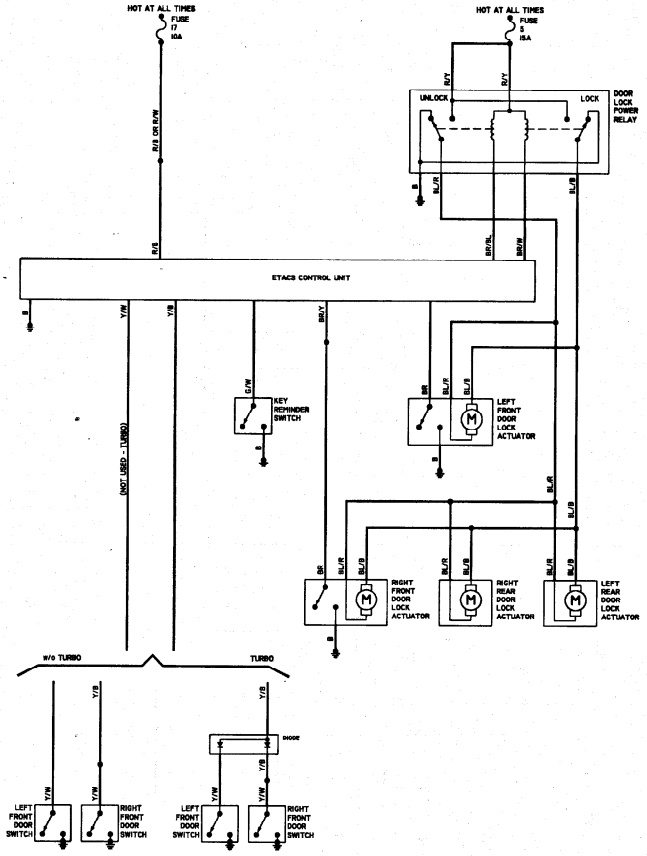


DIAGRAM 41

93156B27

1994-00 GALANT CHASSIS SCHEMATIC

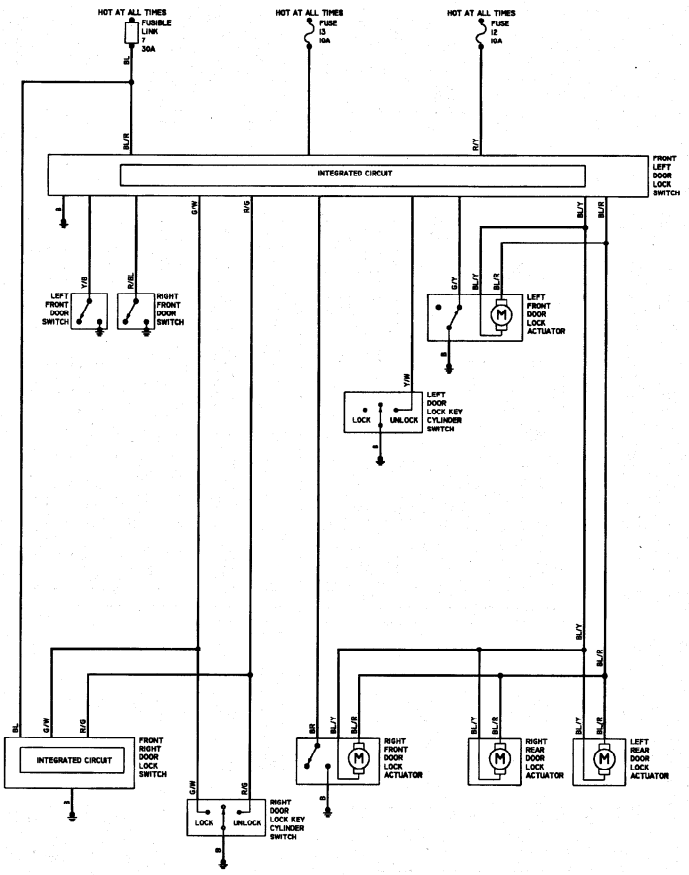
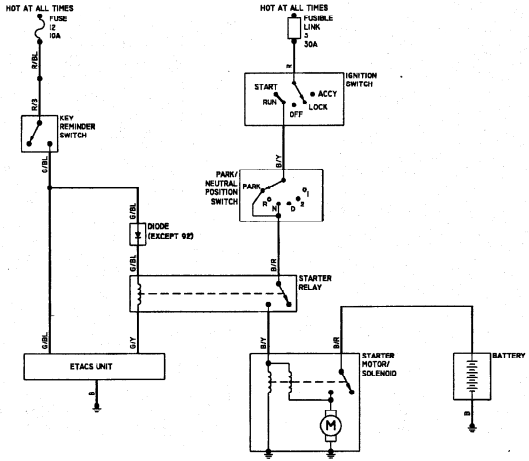


DIAGRAM 42

93156B28

1992-00 DIAMANTE CHASSIS SCHEMATIC

1992-1995



1996-2000

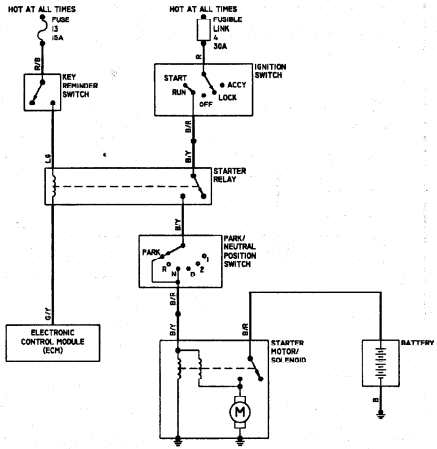
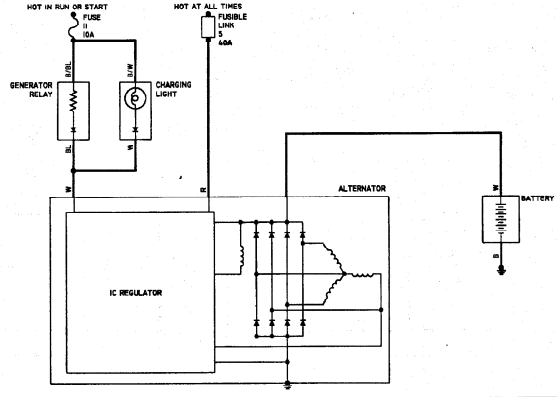


DIAGRAM 43

93156B29

1992-95 DIAMANTE CHASSIS SCHEMATIC

1992-1995



1996-2000

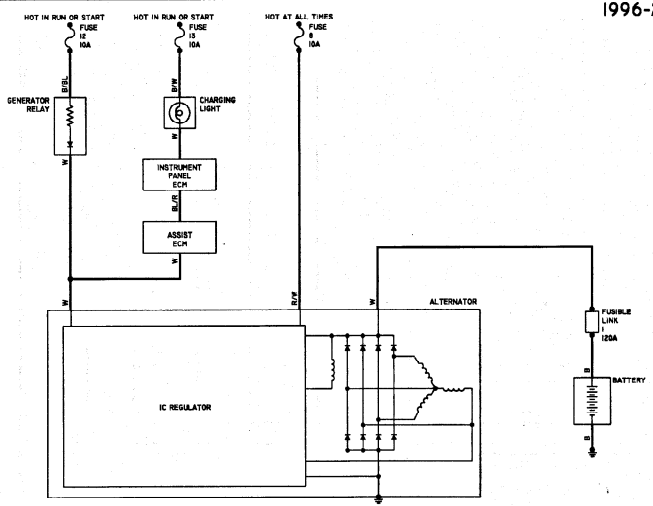


DIAGRAM 44

93156B30

1992-93 DIAMANTE CHASSIS SCHEMATIC

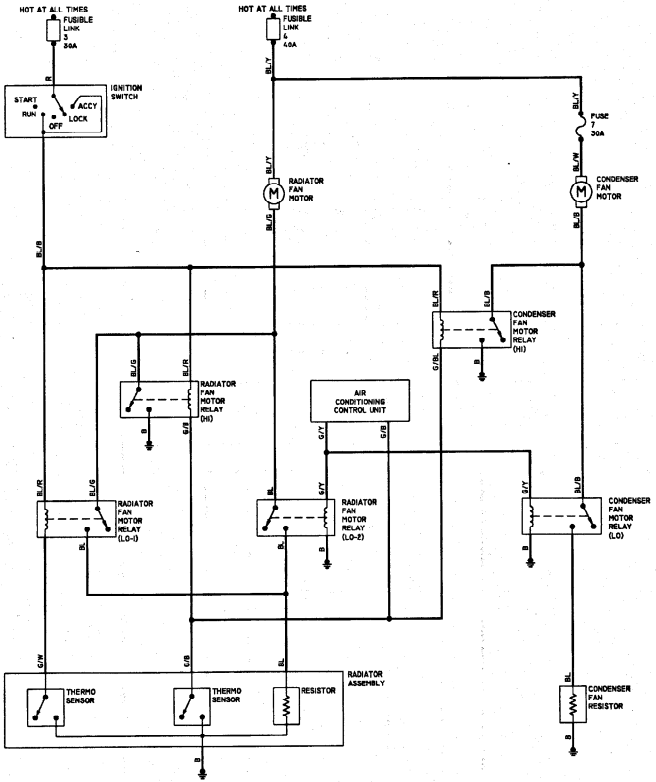


DIAGRAM 45

93156B31

1994-95 DIAMANTE CHASSIS SCHEMATIC

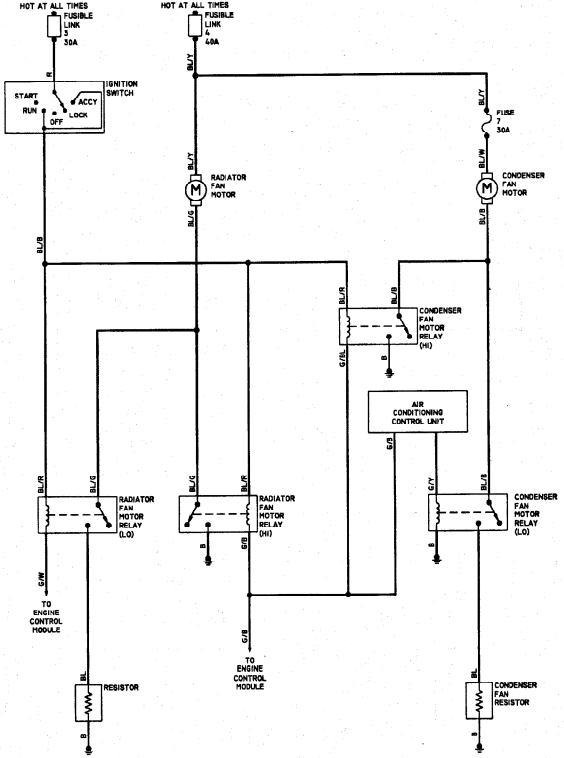


DIAGRAM 46

93156B32

1992-95 DIAMANTE CHASSIS SCHEMATIC

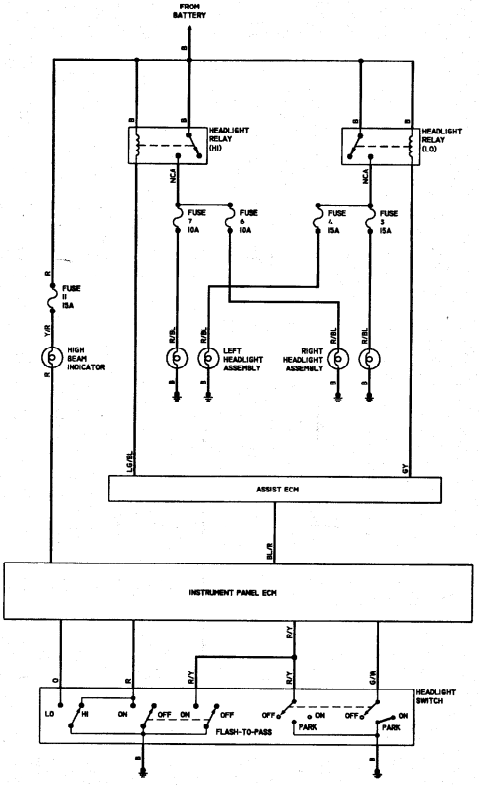


DIAGRAM 47

93156B33

1992-95 DIAMANTE CHASSIS SCHEMATIC

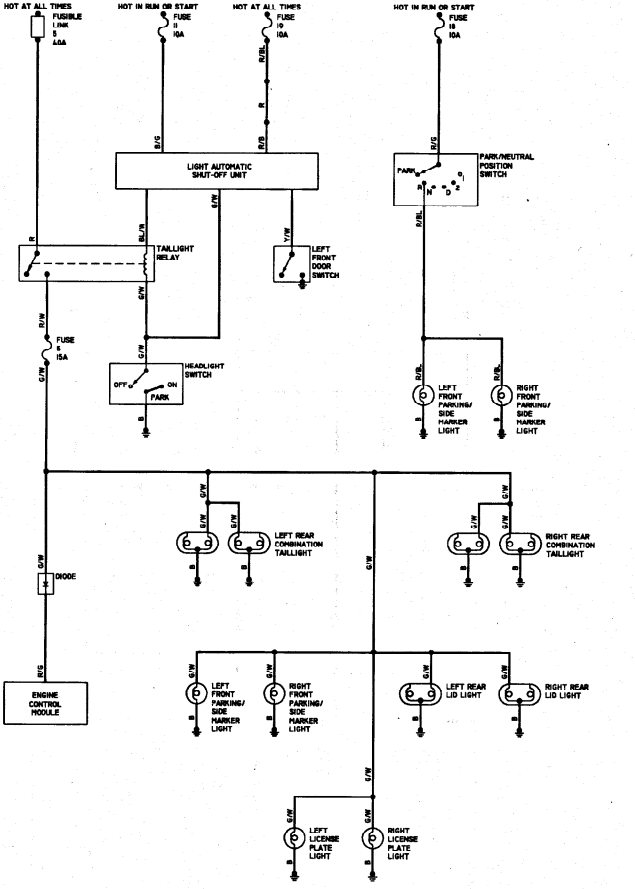


DIAGRAM 48

93156B34

1992-95 DIAMANTE CHASSIS SCHEMATIC

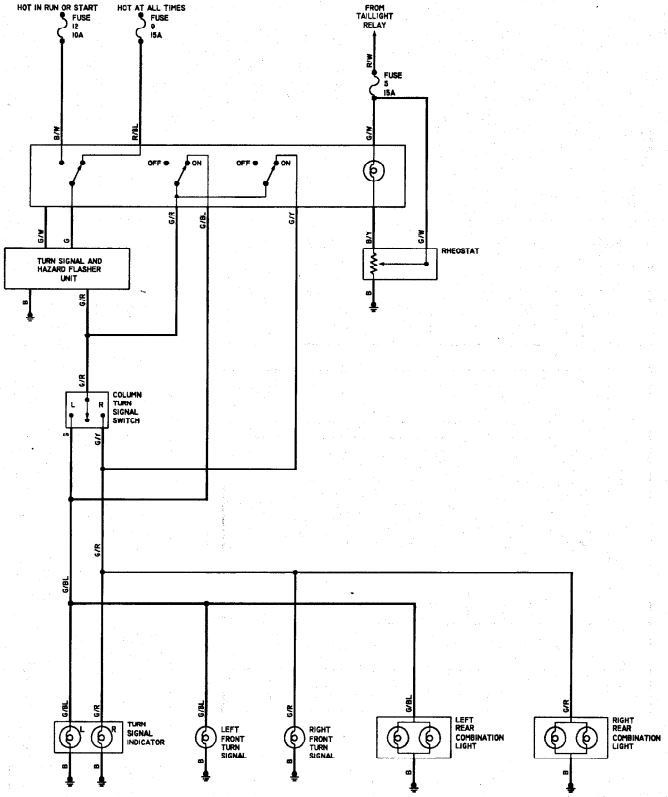
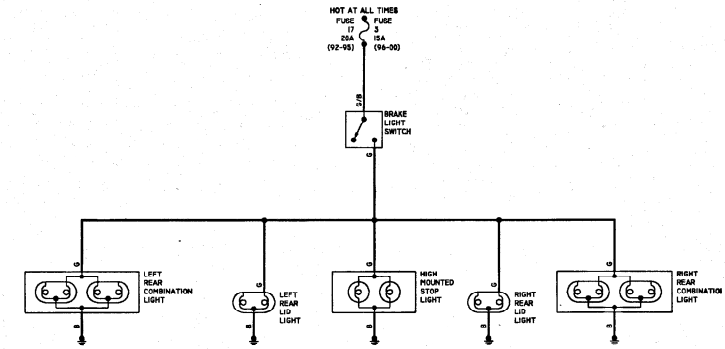
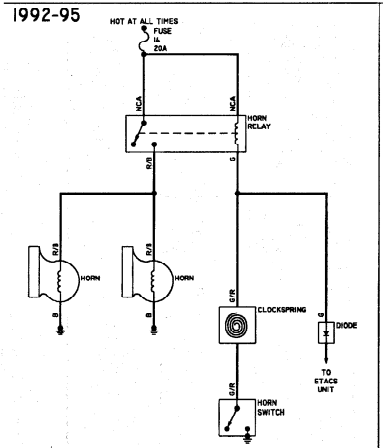


DIAGRAM 49

93156B35

1992-00 DIAMANTE CHASSIS SCHEMATIC





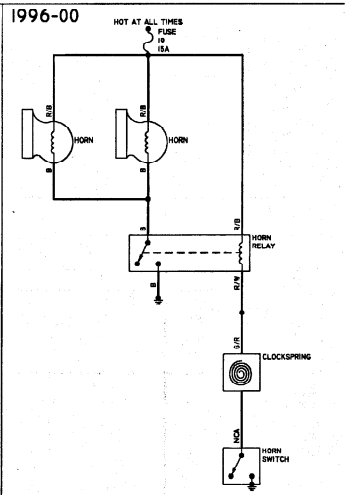


DIAGRAM 50

93156B36

1992-95 DIAMANTE CHASSIS SCHEMATIC

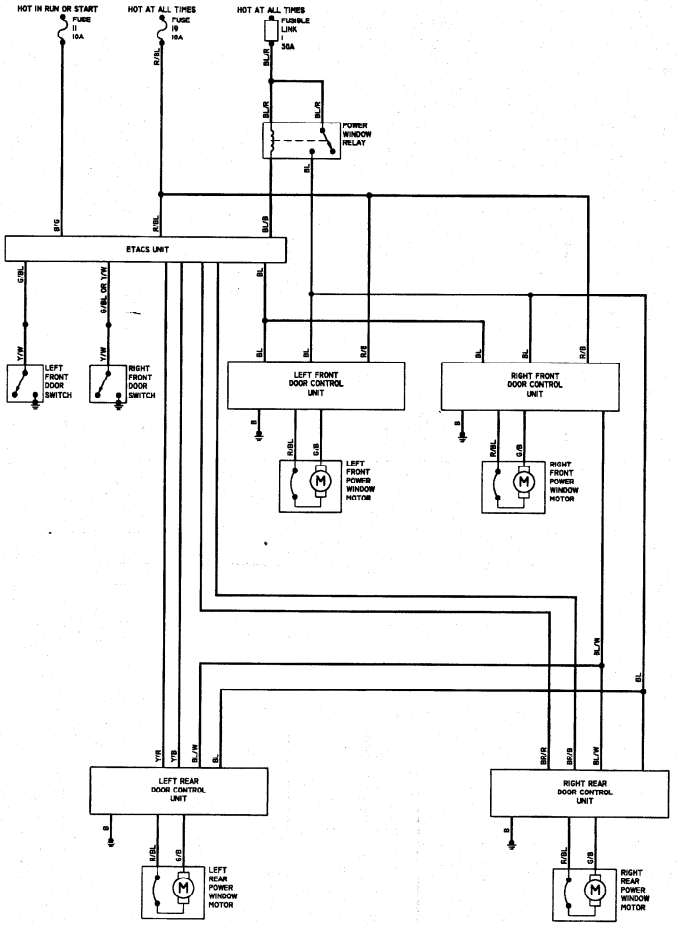


DIAGRAM 51

93156B37

1992-95 DIAMANTE CHASSIS SCHEMATIC

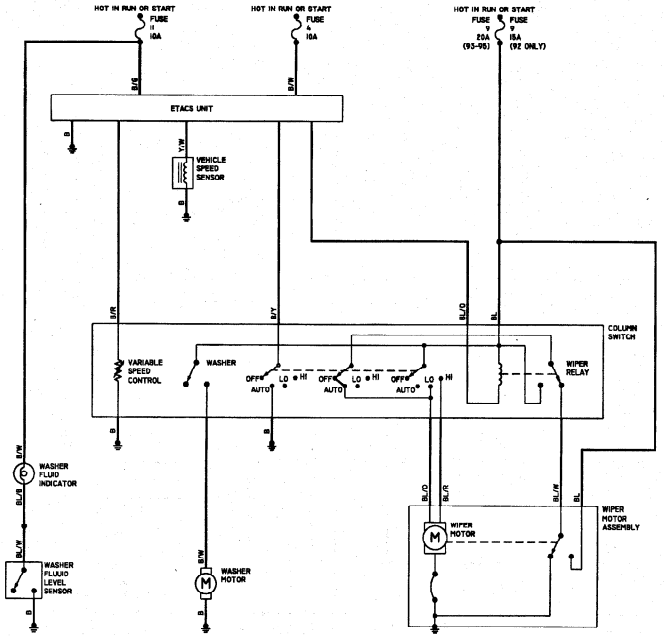


DIAGRAM 52

93156B38

1992-93 DIAMANTE CHASSIS SCHEMATIC

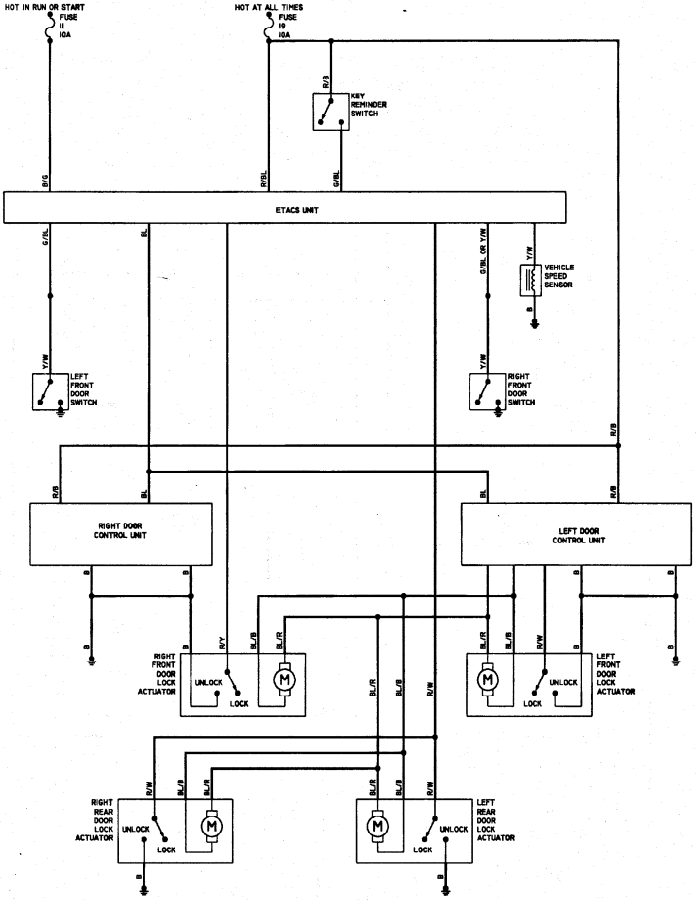


DIAGRAM 53

93156B39

1994-95 DIAMANTE CHASSIS SCHEMATIC

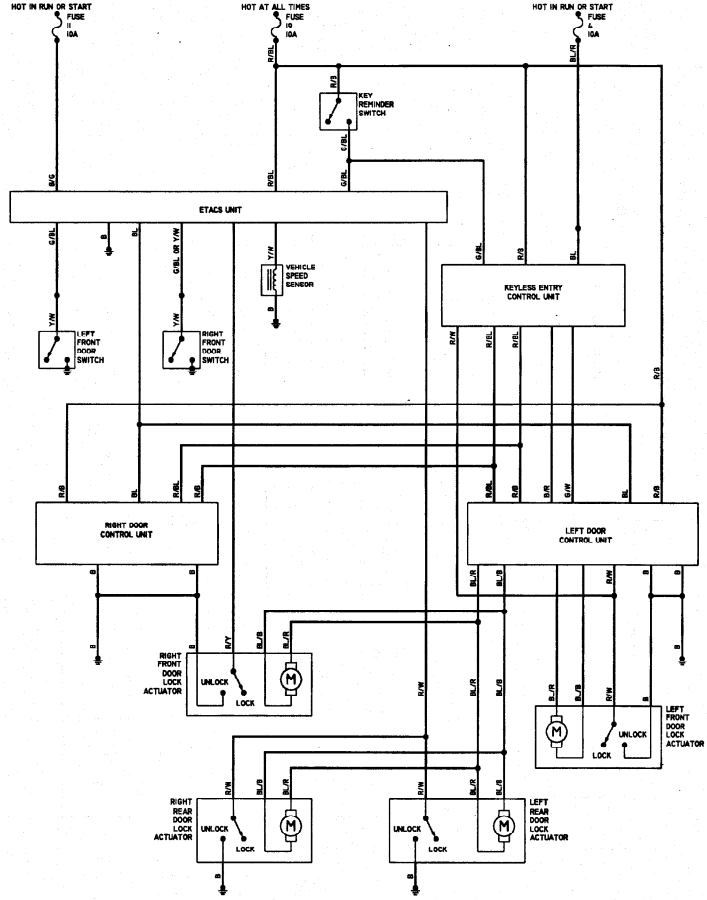


DIAGRAM 54

93156B40

1996-00 DIAMANTE CHASSIS SCHEMATIC

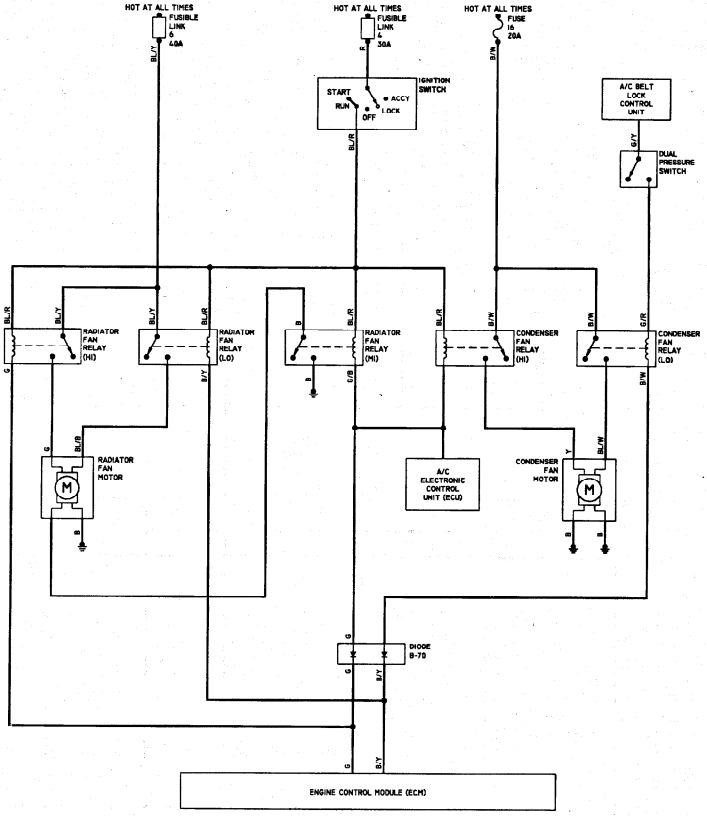


DIAGRAM 55

93156B65

1996-00 DIAMANTE CHASSIS SCHEMATIC

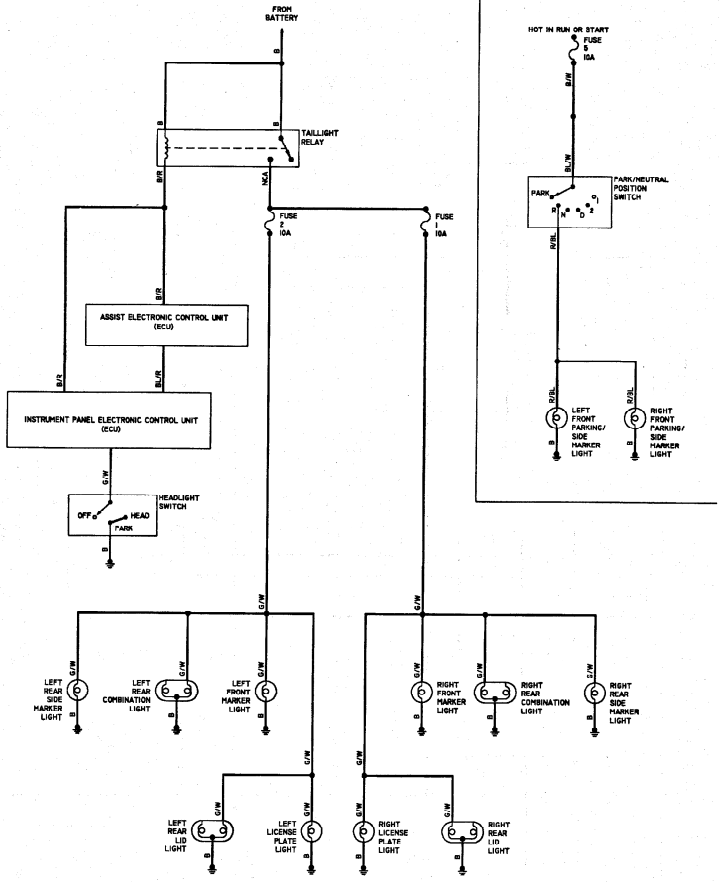


DIAGRAM 56

93156B66

1996-00 DIAMANTE CHASSIS SCHEMATIC

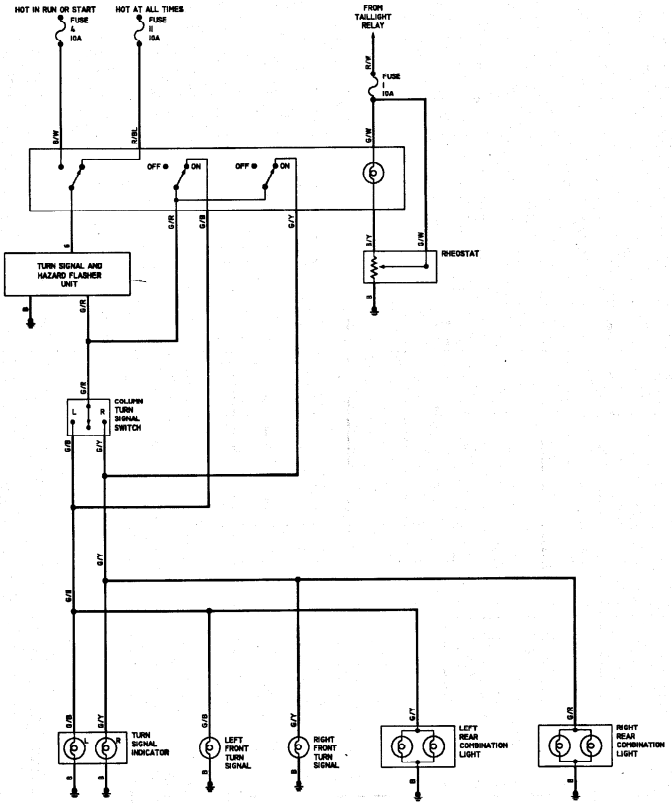


DIAGRAM 57

93156B67

1996-00 DIAMANTE CHASSIS SCHEMATIC

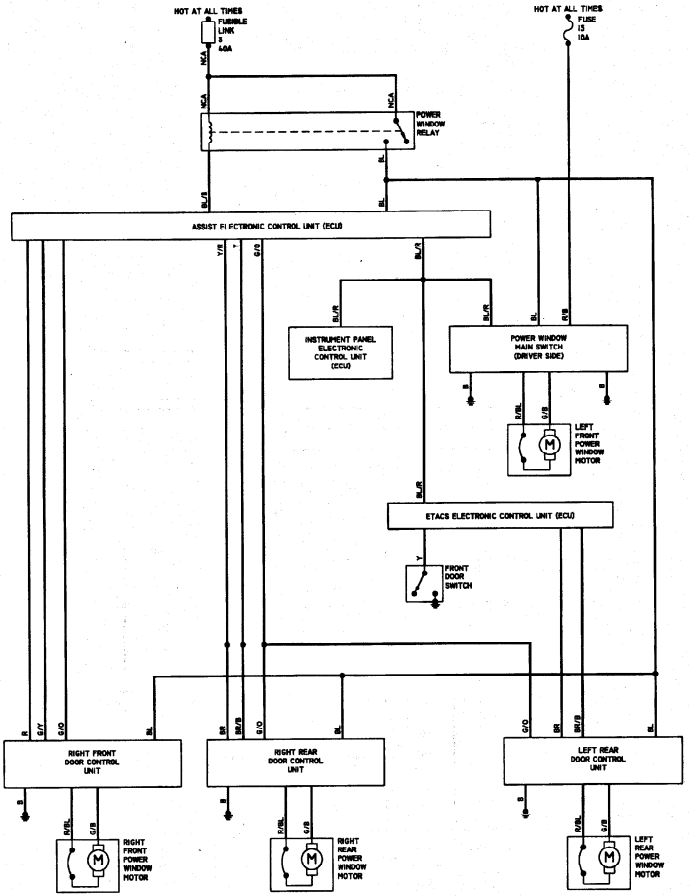


DIAGRAM 58

93156B68

1996-00 DIAMANTE CHASSIS SCHEMATIC

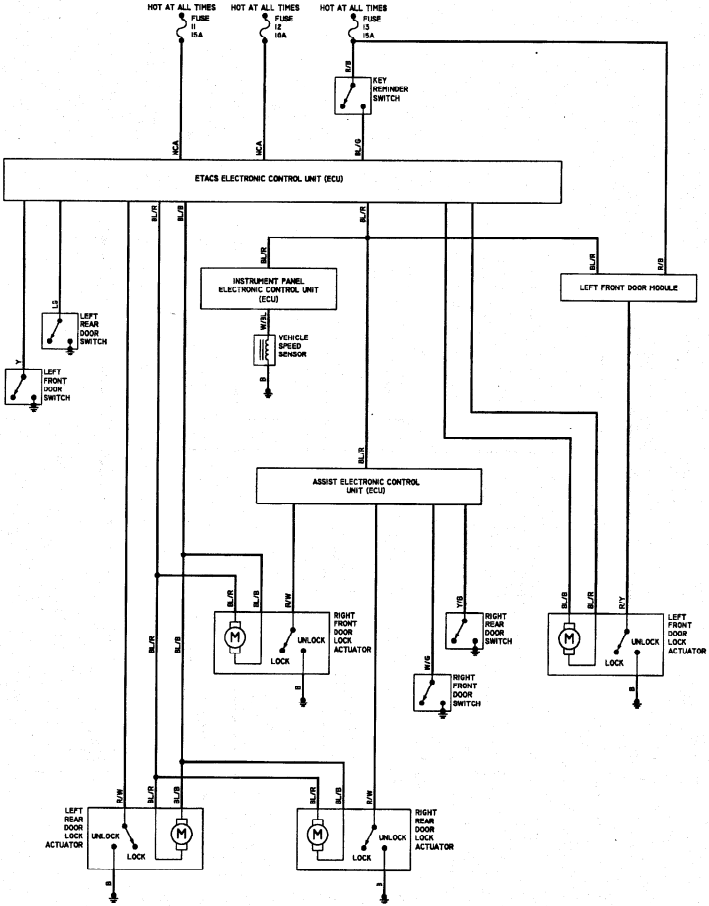


DIAGRAM 59

93156B69

1992-95 DIAMANTE CHASSIS SCHEMATIC

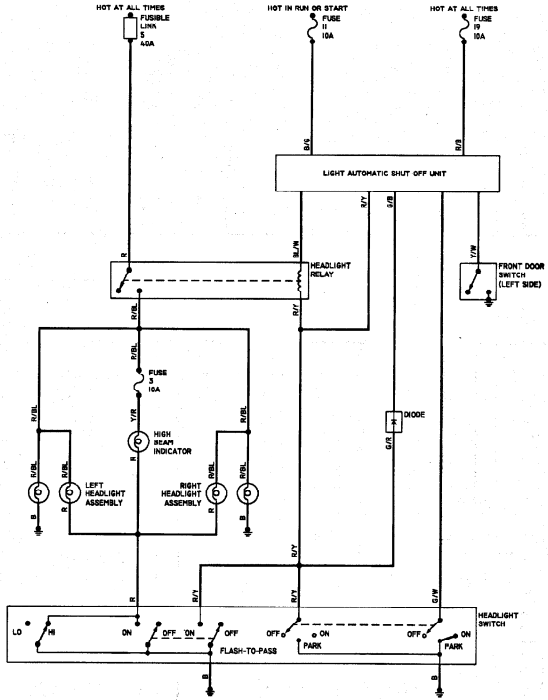


DIAGRAM 60

93156B70

1996-00 DIAMANTE CHASSIS SCHEMATIC

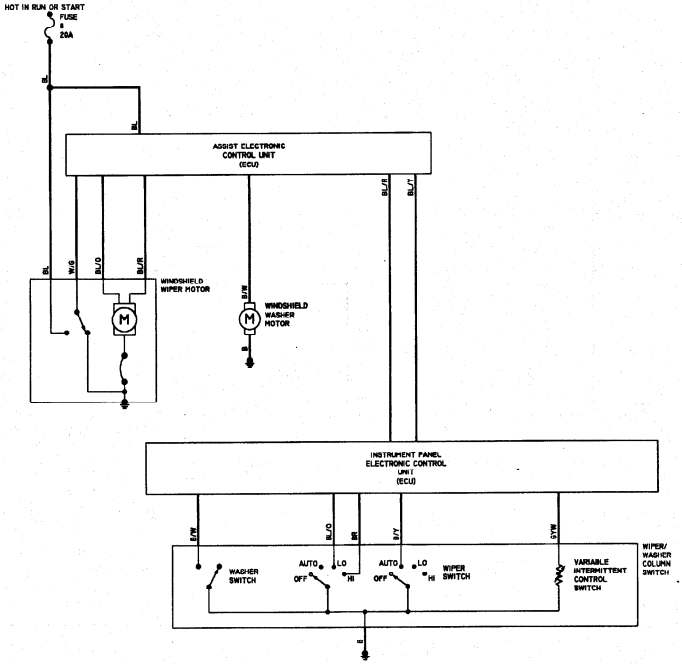


DIAGRAM 61

93156B71

1993-96 MIRAGE CHASSIS SCHEMATIC

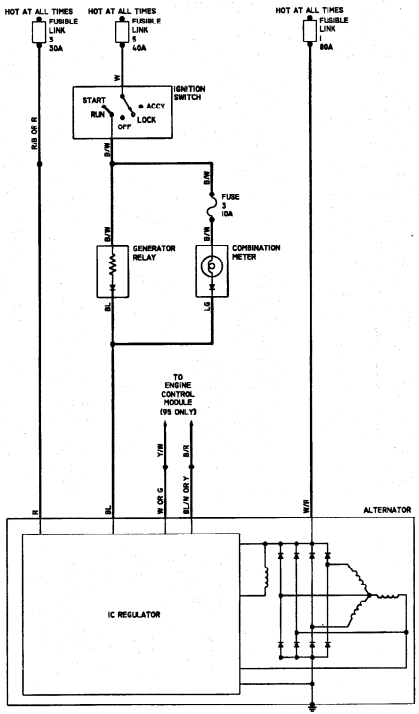
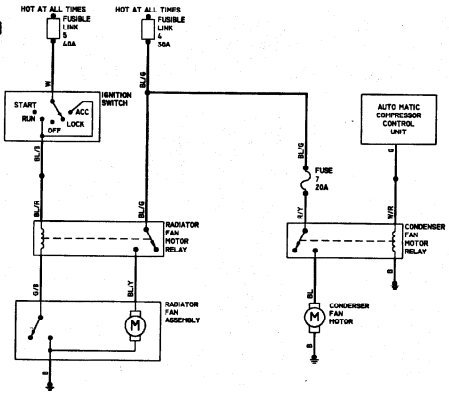


DIAGRAM 62

93156B41

1993 MIRAGE 1.5L CHASSIS SCHEMATIC

MANUAL TRANSMISSION



AUTOMATIC TRANSMISSION

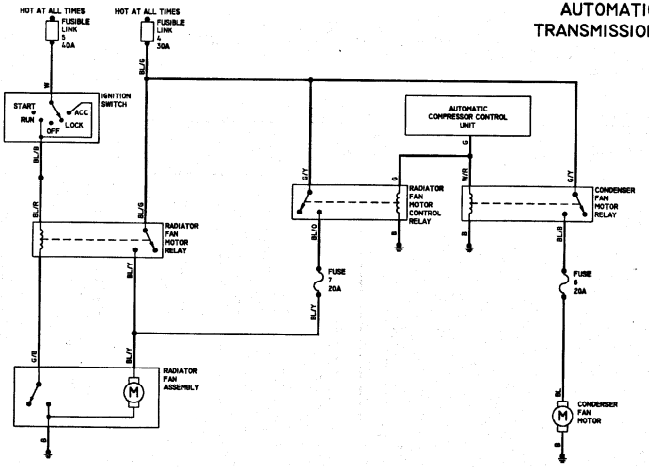


DIAGRAM 63

93156842

1994-96 MIRAGE 1.5L CHASSIS SCHEMATIC

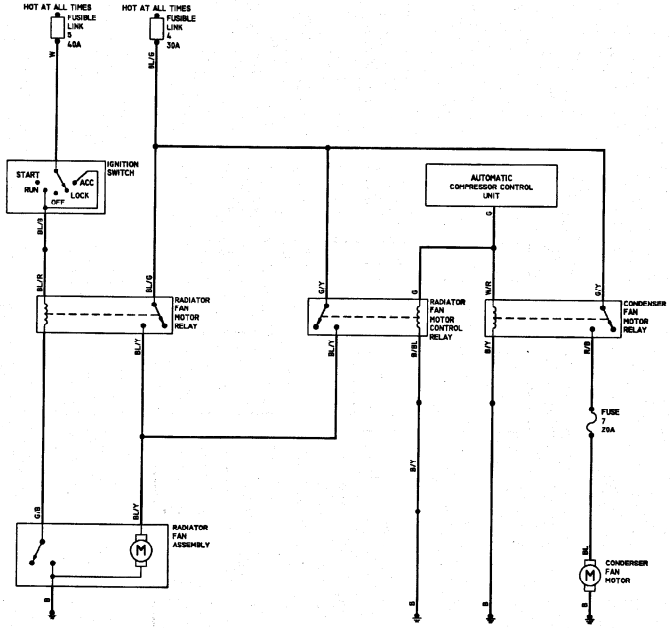


DIAGRAM 64

93156843

1993 MIRAGE 1.8L CHASSIS SCHEMATIC

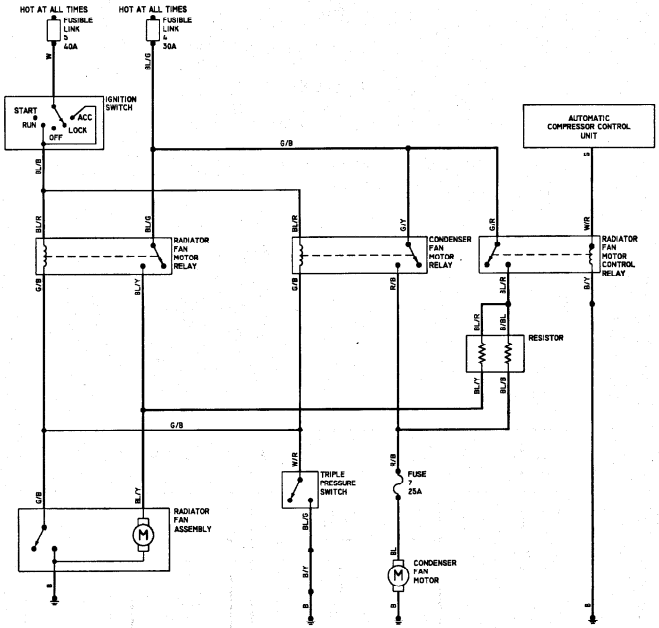


DIAGRAM 65

93156B44

1994-96 MIRAGE 1.8L CHASSIS SCHEMATIC

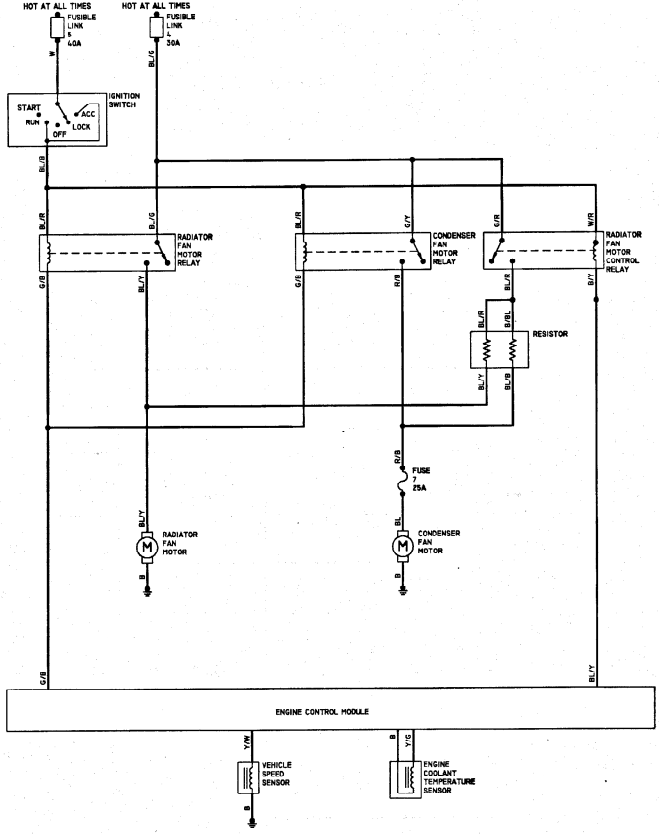


DIAGRAM 66

93156B45

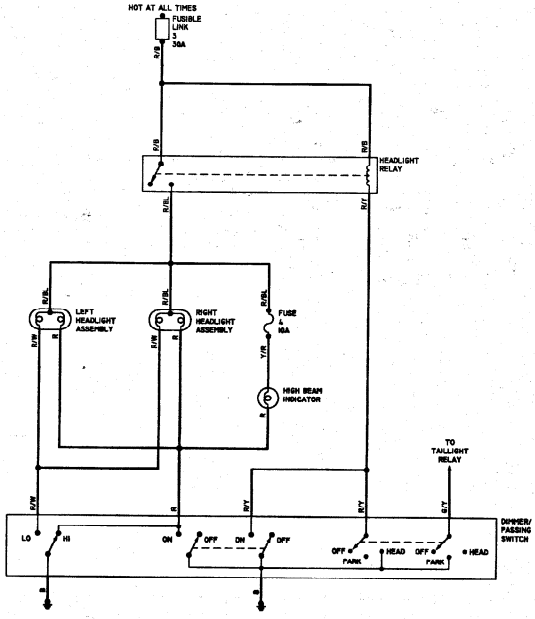


DIAGRAM 67

93156B46

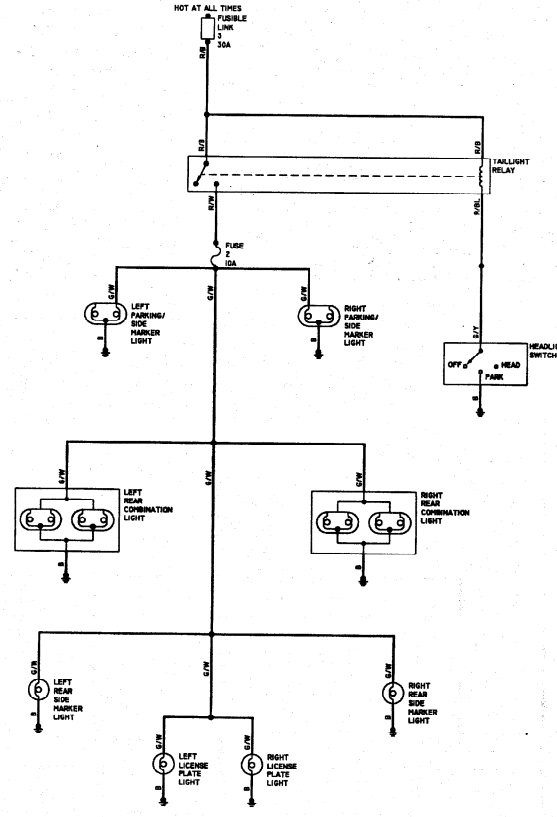


DIAGRAM 68

93156B47

1993-96 MIRAGE CHASSIS SCHEMATIC

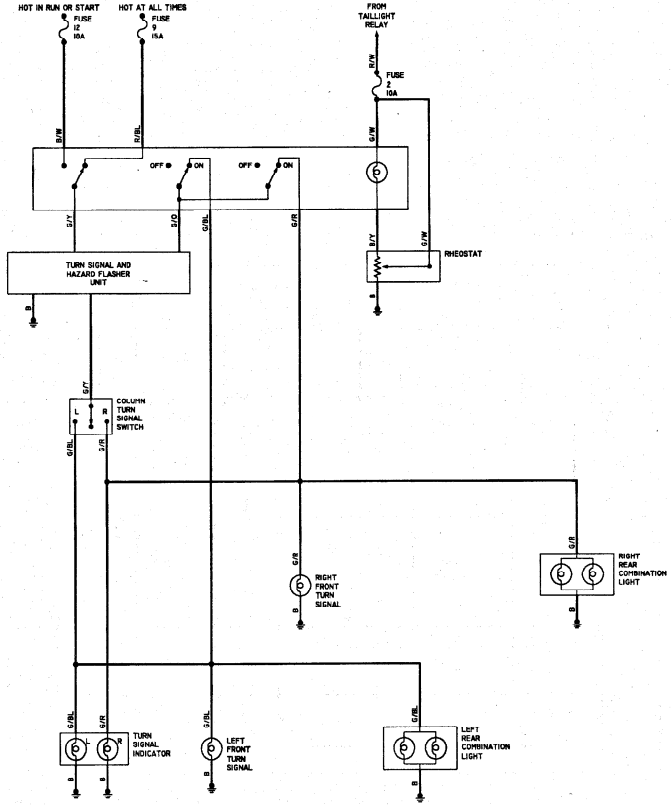


DIAGRAM 69

93156B48

1993-96 MIRAGE CHASSIS SCHEMATIC

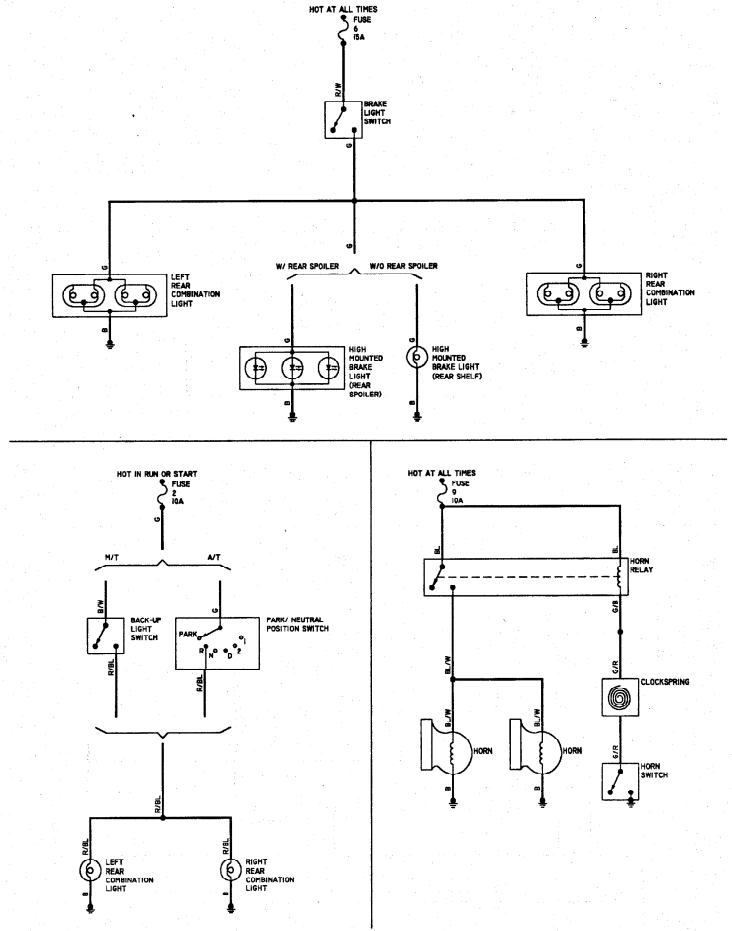


DIAGRAM 70

93156B50

1993-96 MIRAGE CHASSIS SCHEMATIC

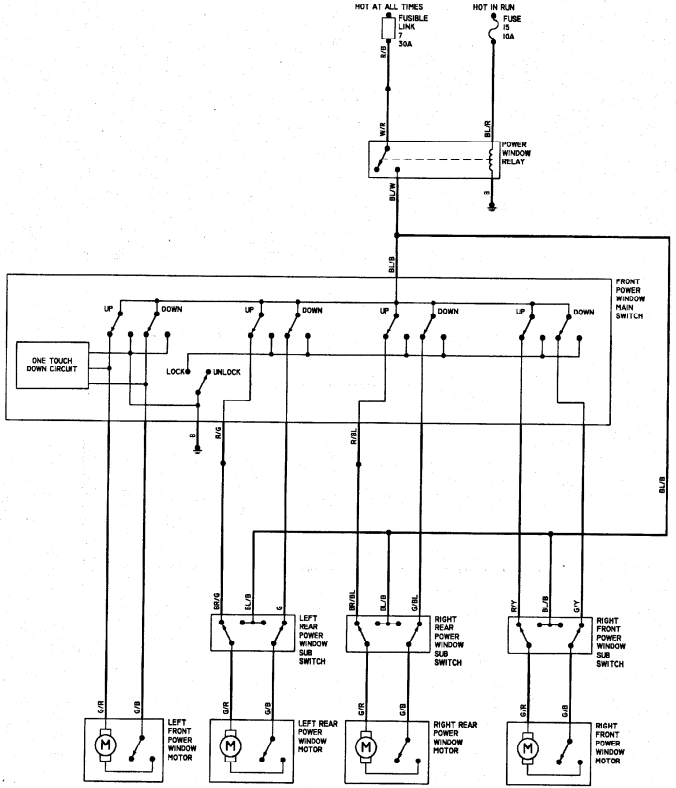
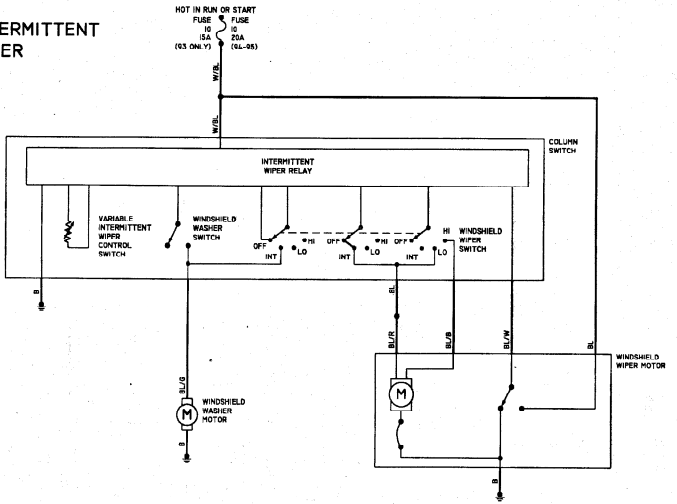


DIAGRAM 71

93156B52

1993-96 MIRAGE CHASSIS SCHEMATIC

W/ INTERMITTENT WIPER



W/O INTERMITTENT WIPER

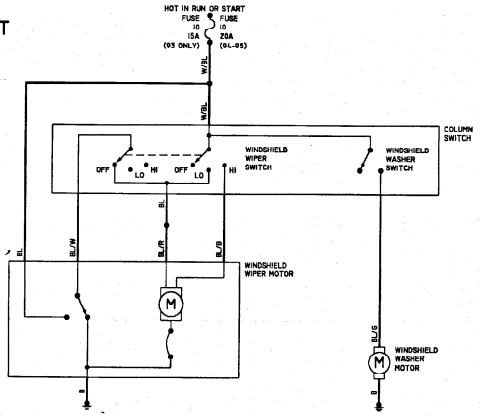
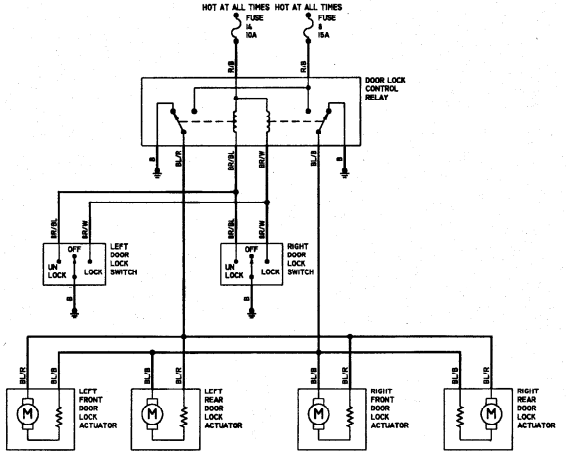


DIAGRAM 72

93156B53

1993-96 MIRAGE CHASSIS SCHEMATIC

1993



1994-96

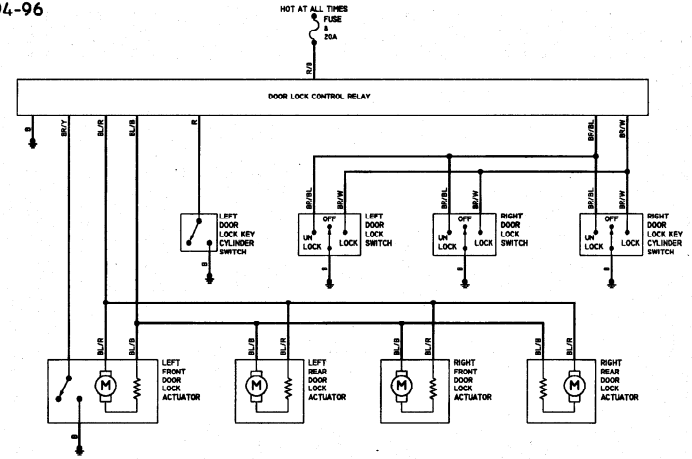


DIAGRAM 73

93156B54

1997-00 MIRAGE CHASSIS SCHEMATIC

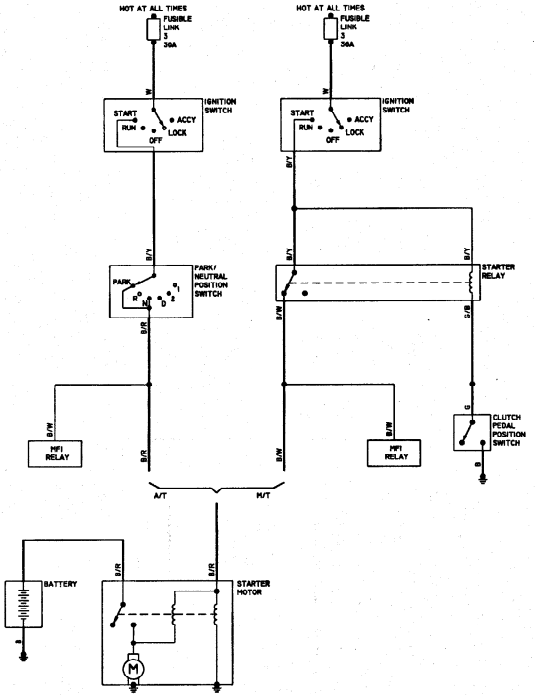


DIAGRAM 74

93156B55

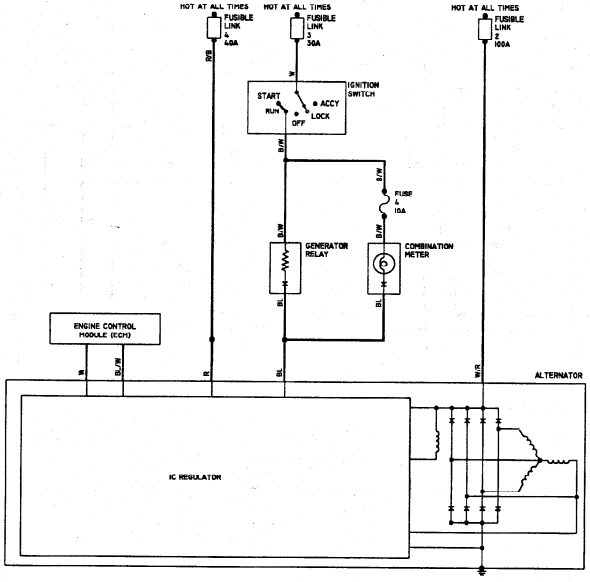


DIAGRAM 75

93156B56

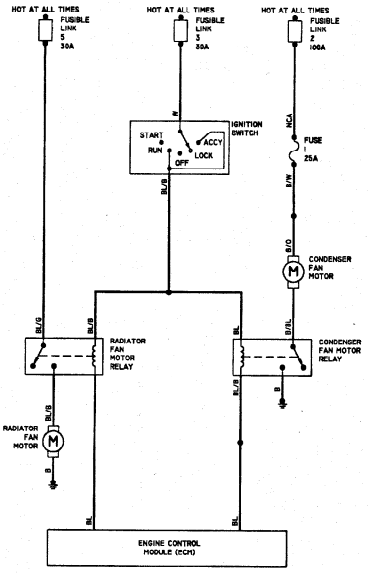


DIAGRAM 76

93156B57

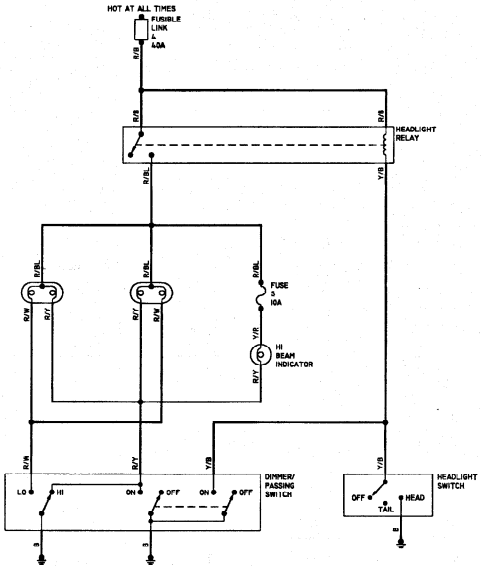


DIAGRAM 77

93156B58

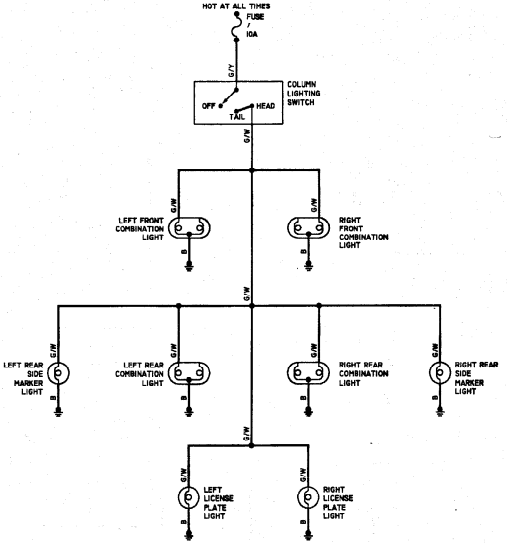


DIAGRAM 78

93156B59

1997-00 MIRAGE CHASSIS SCHEMATIC

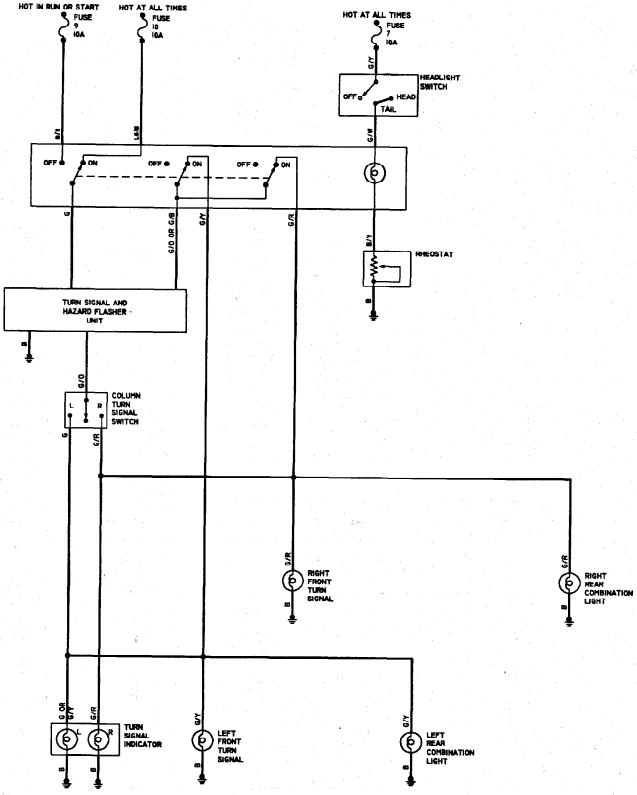
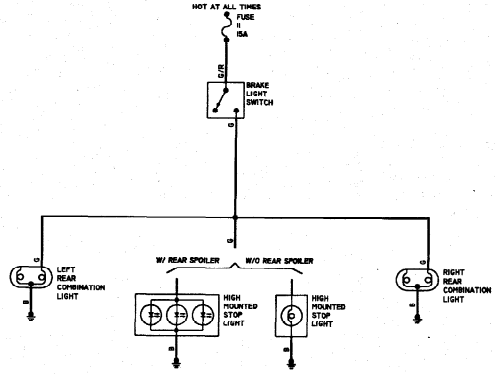
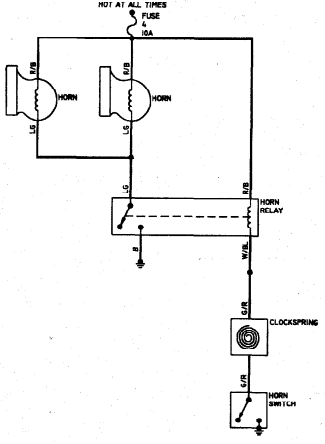


DIAGRAM 79

93156B60

1997-00 MIRAGE CHASSIS SCHEMATIC





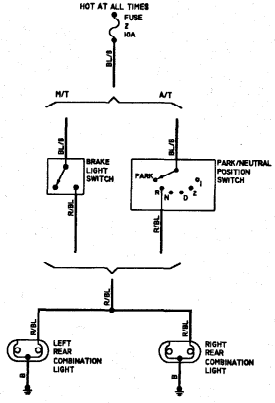


DIAGRAM 80

93156B61

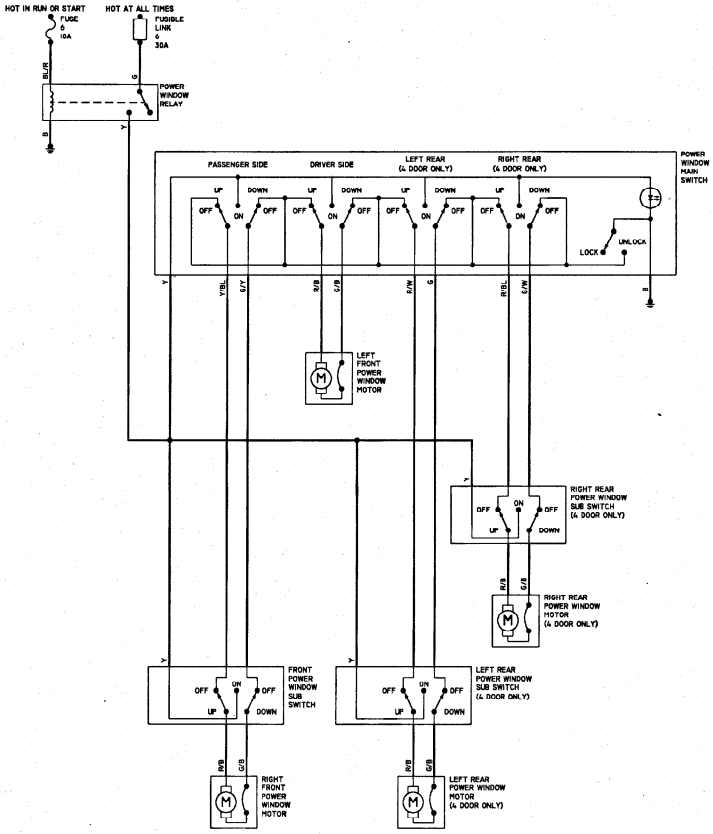
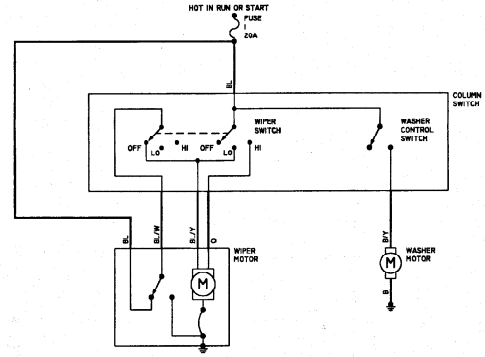


DIAGRAM 81

93156B62

W/O INTERMITTENT CONTROL



W/ INTERMITTENT CONTROL

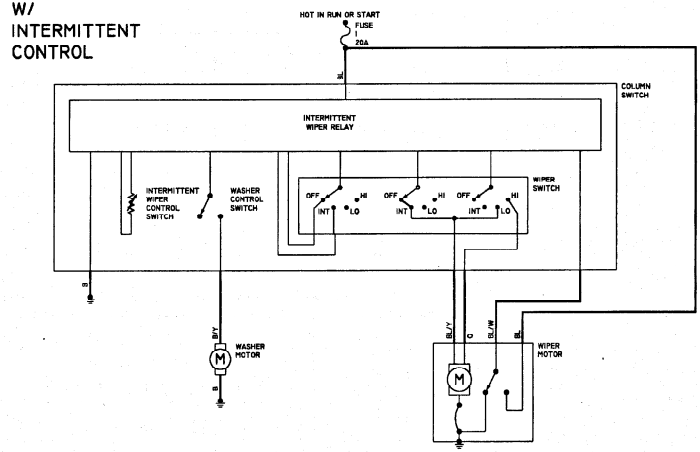


DIAGRAM 82

93156B63

1997-00 MIRAGE CHASSIS SCHEMATIC

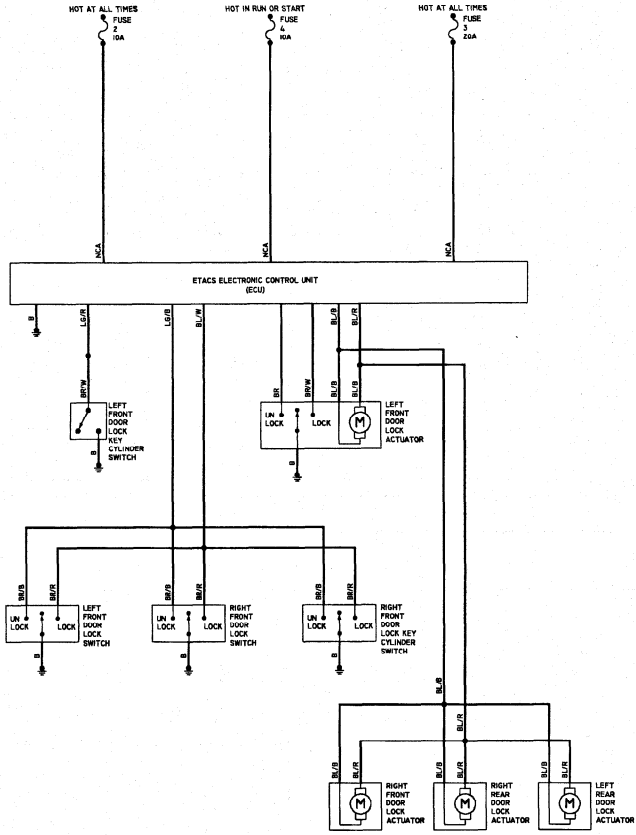


DIAGRAM 83

93156B64