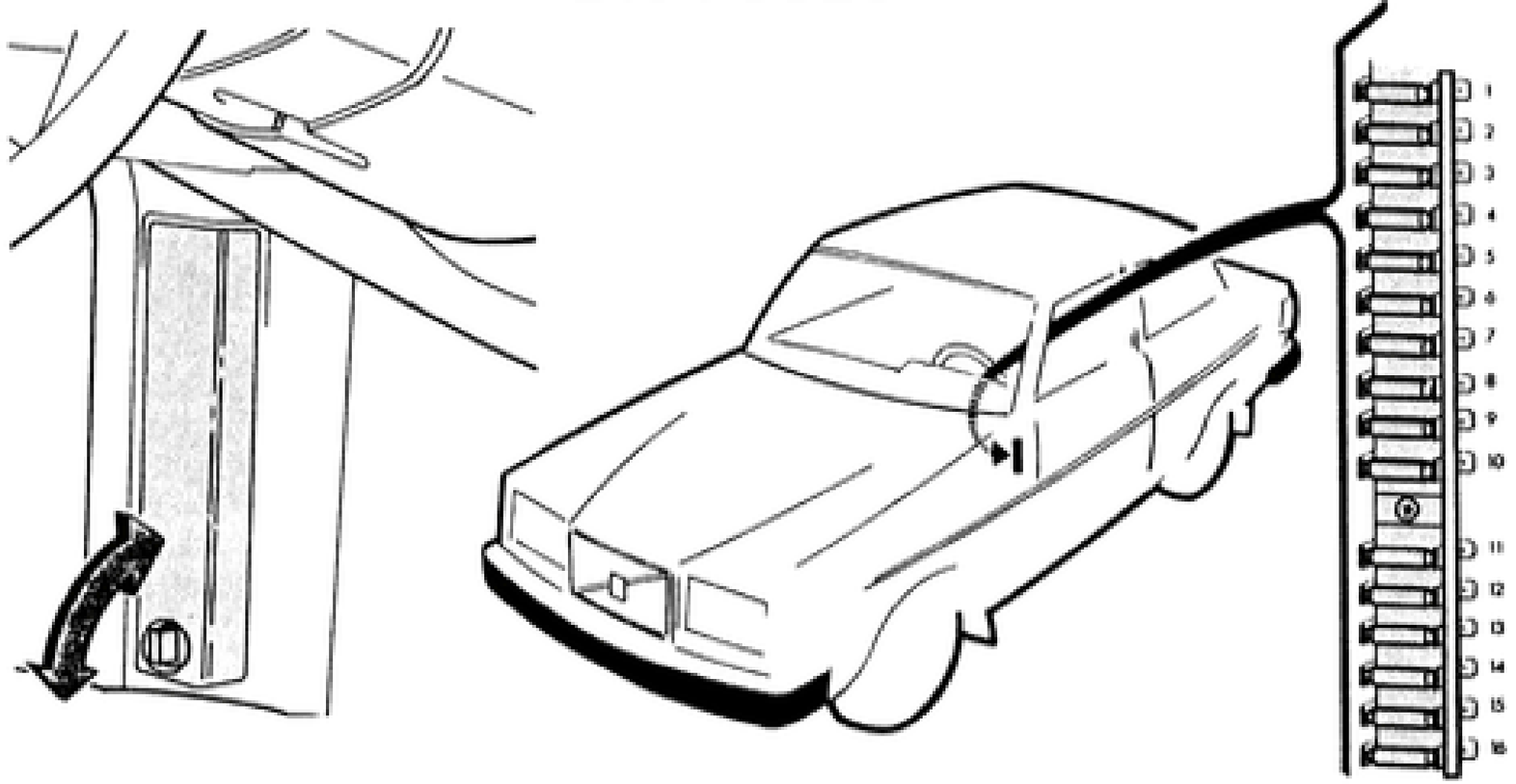
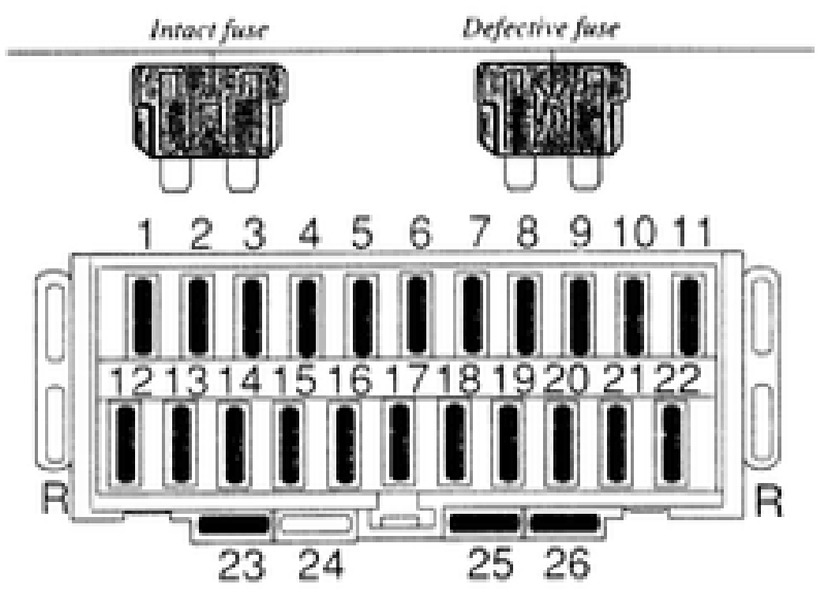


Some of the equipment listed below is optional

1 Cigarette lighter, Power mirrors, Radio, Tailgate wiper/washer ..... 8 A
2 Windshield wiper/washer, Horn ..... 16 A
3 Heater blower ..... 25 A
4 Fuel feed (in-tank) pump, Lambda-sond heating element ..... 8 A
5 Turn signals, Tail lights, Heated mirrors ..... 16 A
6 Main fuel pump relay, Lambda-sond, Fuel injection system ..... 16 A
7 Brake lights, Shiftlock, ABS ..... 8 A
8 Central locking, Interior and glove compartment lights, Trunk compartment lights, Radio, Power antenna, Clock, Daytime running lights (Canada) ..... 8 A
9 Hazard warning flasher ..... 8 A
10 Interior lights, Courtesy lights, Clock ..... 8 A
11 Heated rear window, 4th gear (automatic transmission) ..... 16 A
12 Air conditioning (with blower control), Power windows (relay), Heated rear window (relay), Seat belt reminder, Cruise control, Shiftlock ..... 8 A
13 Heated front seats, Daytime running lights – relay (Canada) ..... 16 A
14 Rear fog lights ..... 8 A
15 Parking lights (left side), License plate light ..... 8 A
16 Parking lights (right side), Instruments and control panel lights, Shift indicator light ..... 8 A
ABS-equipped vehicles: this system is protected by a separate 10A fuse located under the front seat on the passenger's side.

Refer to the fuse location chart at fuse box for

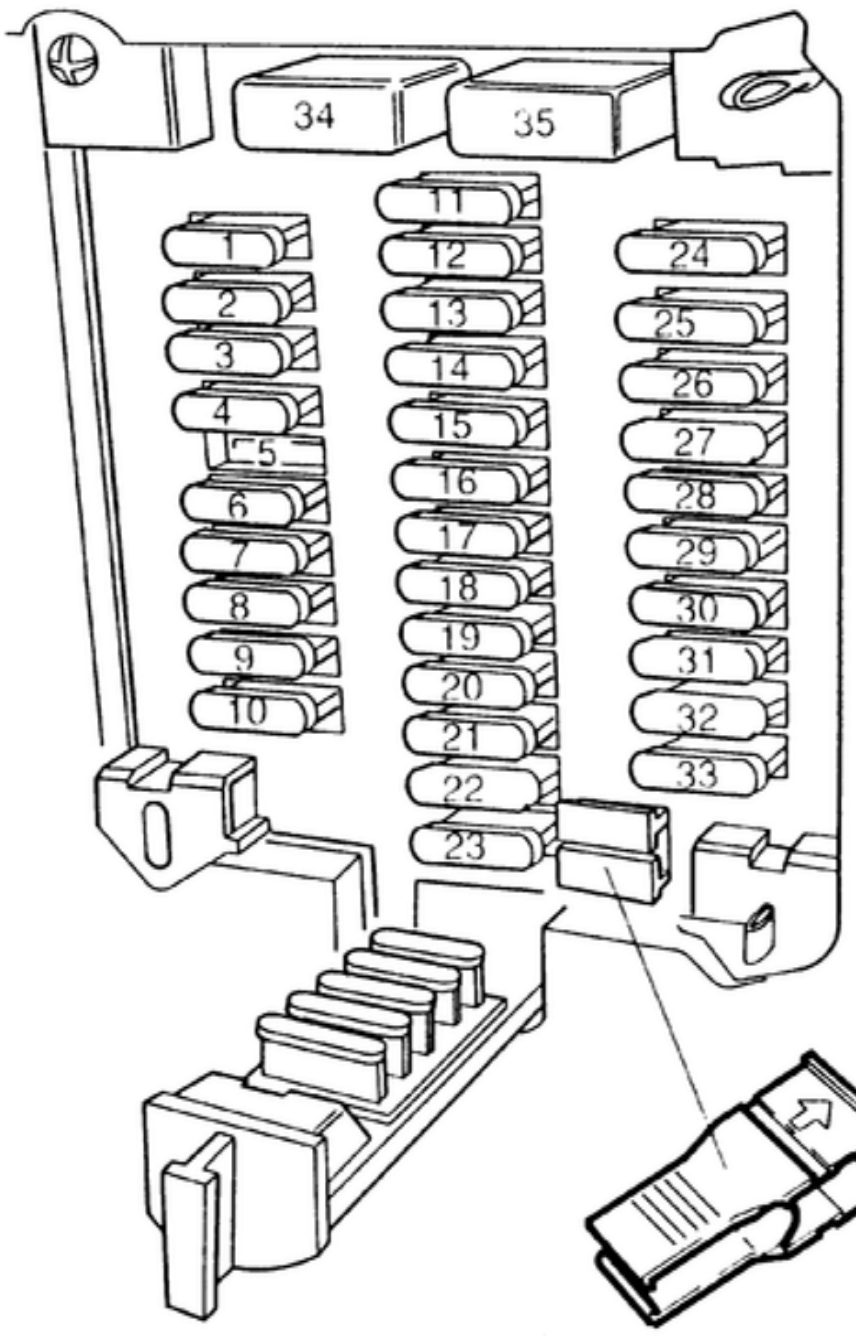


Location*	Amperage
1 Fuel pump, fuel injection system	25
2 Central locking, hazard warning flashers, headlight flashers	25
3 Spare	-
4 Brake lights, shift-lock	30
5 Glove compartment light, clock, radio, interior light, trunk light, door open warning, power antenna	15
6 Heater fan MCC	30
7 Extra lights	
8 Electrically operated windows	30
9 Warning light, seat belt, turn signals, air conditioning relay, heated front seats, electrically-operated windows, shift-lock	15
10 Heated rear window Power-operated sunroof	30
11 Tank pump, Lambda-sond	15
12 Back-up lights, cruise control, overdrive (manual transmission), disengagement of 4th gear on automatic transmission, bulb failure warning lamp	15
13 Hot start valve	15
14 Electrically-operated side view mirrors, cigarette lighter, radio, rear wiper (wagon)	15
16 Heater blower, air conditioning	30
17 High beam (left)	15
18 High beam (right), extra lights	15
19 Low beam (left)	15
20 Low beam (right)	15
21 LH parking lights (front and rear), license plate light, lighting for: ash tray, heater, control panel, switch for heated rear window, sunroof switch, left instrument panel, radio	15
22 Seat belt light,RH parking lights (front and rear), center console compartment, foglight relay, lighting for: Heated seat switch, gear selector panel, rear ash tray	15
23 Heated front seats	25
24 SRS test socket	
25 Rear fog light/lights	15
26 Radio	15

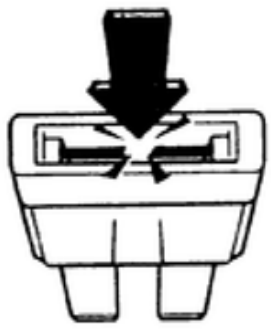
*Some of the equipment/systems listed may be available on certain models only and/or as optional items only.

NOTE: On cars equipped with ABS, the system is protected by an additional 10A fuse located under the instrument panel to the left of the steering wheel.

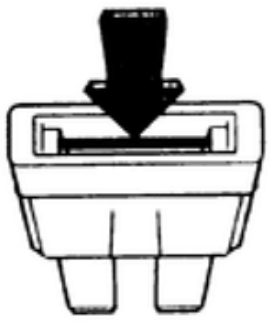
940 FUSES



Fuse removal tool



Defective fuse



Intact Fuse

	Amperage
ng lights, license plate light,	
g lights	10
ing lights	10
beam	15
beam	15
eam	15
beam	15
ights	15
ghts	10
illumination: ashtray front and rear,	
rol panel, switches and seat belt light	5
ghts, turn signals, cruise control	15
r window, heated door mirrors	25
relay for electrically operated	
lectrically operated windows	10
ette tape player	5
rically operated side door mirrors,	
w wiper/washer (wagons)	15
l wipers/washers, horn	25
dle speed system	5

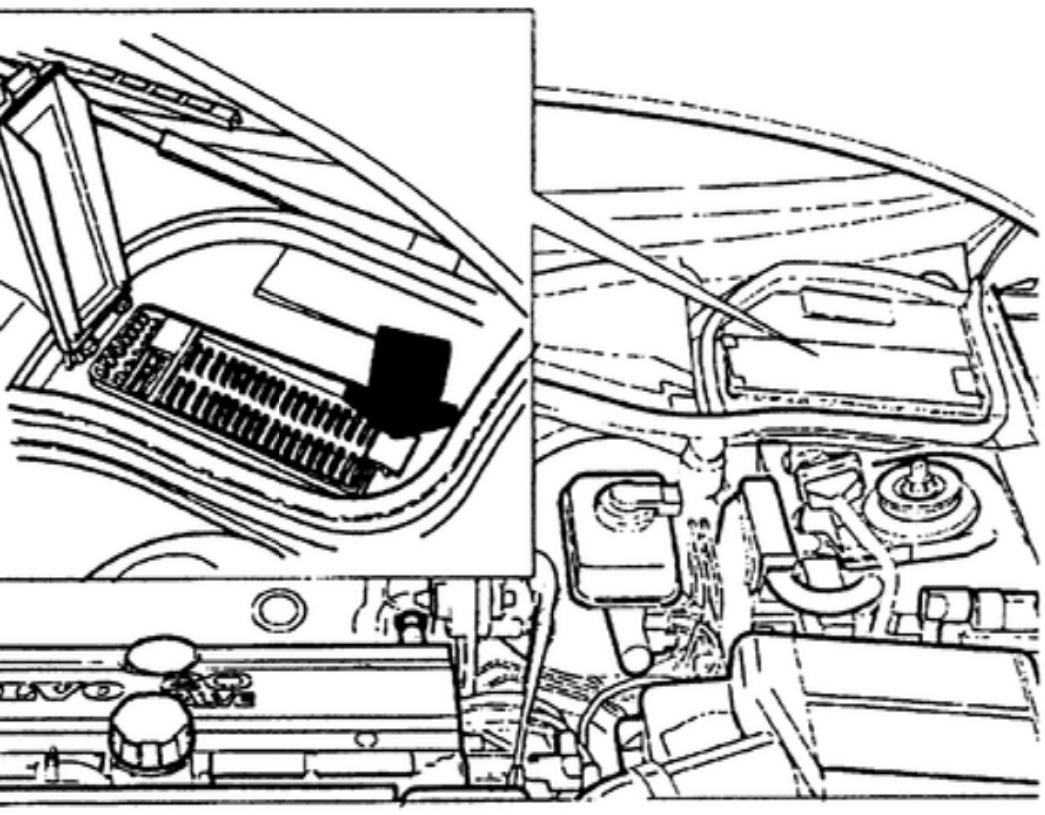
	Location
25	Hazard warning flashers, central locking system
26	Clock, interior lighting, door open warning lights, glove box, cargo space and vanity mirro
27	Brake lights, shiftlock release
28	Heater fan, air conditioning
29	Electrically operated antenna, electrical connector for trailer
30	Fuel pump (tank), electrically heated Lambda sond
31	Fuel injection, fuel pump (main)
32	Radio/amplifier
33	Radio/cassette tape player
34	Electrically operated windows, electrically operated sun roof
35	Electrically heated front seats, electrically operated front seats

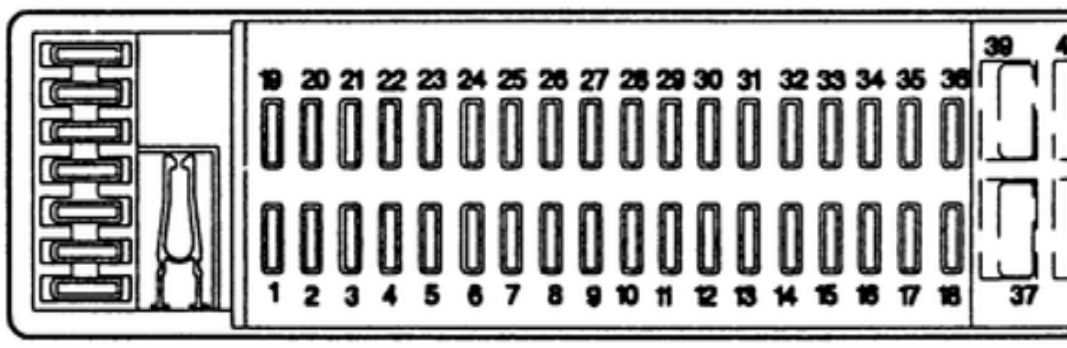
Note: The ABS system is protected by an additiona fuse which is located under the instrument panel to left of the steering wheel.

Note: Refer to fuse box cover label for your vehicle's spe usage.

Note: Fuses No. 34 and 35 are circuit breakers which act overloaded. After 20 seconds, the circuits should have co and function normally.

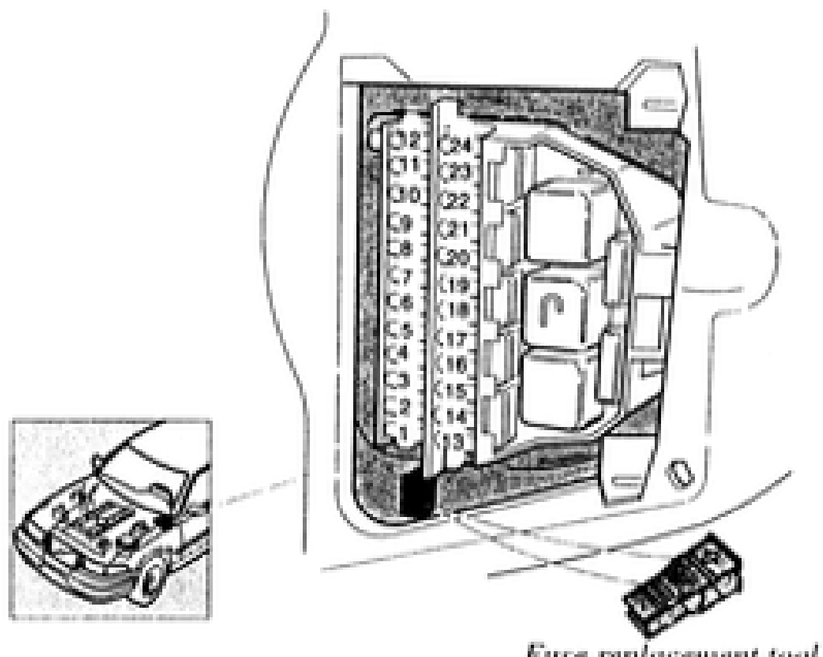
850, C70, S70 AND V70 FUSES





	Function	Amps
	Control units, Automatic transmission, Fuel and Ignition systems	15
	Fuel pump	15
	Courtesy light, Oil gauge, Exhaust temperature gauge (Japan), Speed warning	10
	Spare	-
	Passenger compartment fan, speed 4	30
	Central locking system and Alarm	25
	Audio	15
	Power antenna and Towing hook (-93), Air pump (94-)	40
	ABS , TRACS (93-)	30
	Spare (-93), Heated rear seat (94-)	15
	Heated rear window & wing mirrors	30
	Brake light	10
	Hazard blinkers + High beam flash and Alarm	15
	ABS , TRACS (93-)	30
	Radio, Courtesy light, Door warning lights, Oil level-/pressure sensor and Remote-controlled central locking (-93), Seatbelt reminder and OBD-socket (94-)	10
	Power antenna, Towing bracket contact and Accessories	30
	Spare (-92), Key reminder (94-), Seatbelt reminder (-93)	10
	Heated seats (-93), Power door mirrors (93), Spare (94-)	-
	High beam, LH	15
	High beam, RH + high beam check light	15

No.	Function	Amp
21	Low beam, LH	15
22	Low beam, RH	15
23	Parking -/tail light, LH, License plate light	10
24	Parking-/tail light, RH	10
25	Dipped rear light + indicator light	10
26	Spare (-93), Heated front seat and heated wing mirrors (94-)	25
27	Flashers and rear light, TRACS (93-)	15
28	Heated rear window, Seatbelt reminder, Cruise control, Shift-lock, Bulb failure warning sensor (Germany), Heated door mirrors (93-)	10
29	ABS , TRACS (93-)	15
30	Cigarette lighter	10
31	Passenger compartment fan, speeds 1 - 3 and AC system	25
32	Radio, Remote-controlled central locking system (93-)	10
33	Diagnostic unit, power seats, Light control motors, Rear window wiper and washer pump (94-)	15
34	Horn, windshield wipers, Headlight wipers and washer pump	25
35	Rheostat, Instrument lighting (94-), Power sunroof (93-)	10
36	Spare	-
37	Power window winders and Sunroof	autom 20
38	Spare	-
39	Power seat, LH	autom 20
40	Power seat, RH	autom 20



Fuse replacement tool

Location **	Amperage
1 Heated rear window	25
2 Central locking	20
3 Brake light, Light switch	15
4 Ignition switch, SRS	10
5 Spare	
6 Windshield wiper/washer, Headlight wiper, horn relay	25
7 Climate unit	20
8 Power seats, Power side door mirrors Tailgate wiper/washer (wagons) Instrument lighting, Ambient temp. sensor	15
9 Audio system	15
10 Cigarette lighter,	15
11 Interior lighting, Transmission mode selector	5
12 ABS	5
13 Clock, Interior/glove compartment lighting, Door open warning lights, Cargo space lighting, Vanity mirror	10

Location **	Amperage
15 Power antenna, Headlight flasher, Trailer	20
16 Accessories	20
17 Hazard warning flasher, Direction indicator, Alarm hazard indication	20
18 Audio/amplifier, CD changer	15
19 Backup lights, Turn indicators, Cruise control	15
20 Light switch, High/low beam relay	15
21 Seat belt reminder, Timer- electrically heated rear window	5
22 Heated driver's seat	15
23 Heated passenger's seat	15
24 Rear foglights	5
25 Power seats *	30
26 Power windows, Power sunroof *	30

* Automatic circuit breakers

** Some of the equipment/systems listed may

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.

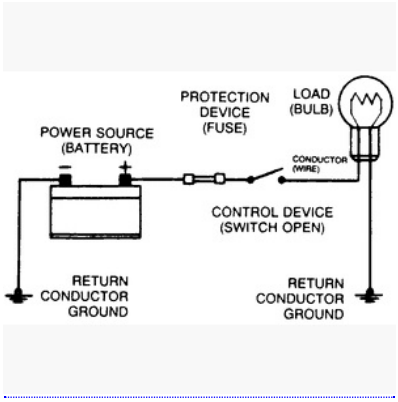
1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

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



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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

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.

1992 Volvo 940

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Fuel Delivery: FI | **Fuel:** GAS

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1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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 Engine Control Module (ECM), radio, alternator, etc.

NOTE: 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.

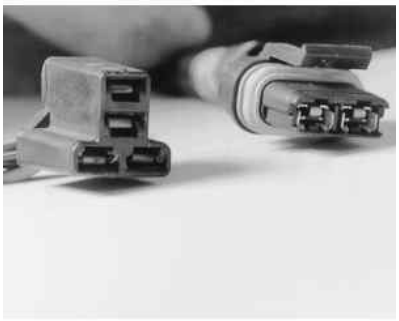
When the battery cable(s) are reconnected (negative cable last), be sure to check that your lights, windshield wipers and other electrically operated safety components are all working correctly. If your vehicle contains an Electronically Tuned Radio (ETR), don't forget to also reset your radio stations.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

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

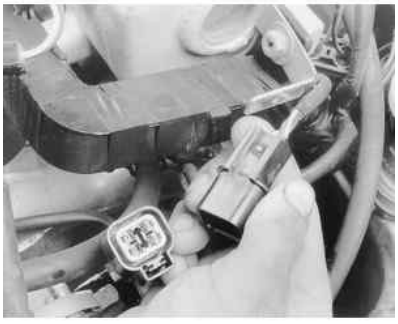
Three types of connectors are commonly used in automotive applications — weatherproof, molded and hard shell.

Fig. 1: Hard shell (left) and weatherproof (right) connectors have replaceable terminals



- 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.

Fig. 2: Weatherproof connectors are most commonly used in the engine compartment or where the connector is exposed to the elements



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

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

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

Fig. 1: Most vehicles use one or more fuse panels. This one is located on the driver's side kick panel

- 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.
- 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.

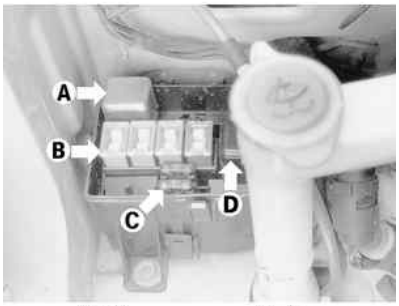
CAUTION
Always replace fuses, circuit breakers and fusible links with identically rated components. Under no circumstances should a component of higher or lower amperage rating be substituted.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

Fig. 1: The underhood fuse and relay panel usually contains fuses, relays, flashers and fusible links

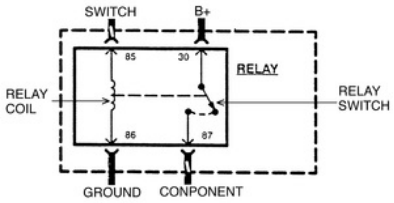


A. Relay
B. Fusible link
C. Fuse
D. Flasher

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 dash 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.

Fig. 2: 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



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

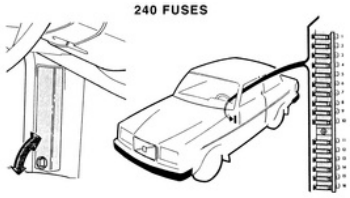
It is essential to understand how a circuit works before trying to figure out why it doesn't. An electrical schematic shows the electrical current paths when a circuit is operating properly. Schematics break the entire electrical system down into individual circuits. In a schematic, usually no attempt 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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The flasher is self-contained in the turn signal/windshield wiper and washer combination switch. If the flasher becomes inoperative, the switch assembly must be replaced. Refer to the Turn Signal (Combination) Switch removal and installation procedure in Section 8.

240 FUSES

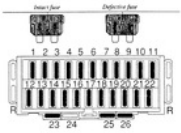


Some of the equipment listed below is optional

1 Cigarette lighter, Power mirrors, Radio, Tailgate wiper/washer ..... 8 A
2 Windshield wiper/washer, Horn ..... 16 A
3 Heater blower ..... 25 A
4 Fuel feed (in-tank) pump, Lambda-sond heating element ..... 8 A
5 Turn signals, Tail lights, Heated mirrors ..... 16 A
6 Main fuel pump relay, Lambda-sond, Fuel injection system ..... 16 A
7 Brake lights, Shiftlock, ABS ..... 8 A
8 Central locking, Interior and glove compartment lights, Trunk compartment lights, Radio, Power antenna, Clock, Daytime running lights (Canada) ..... 8 A
9 Hazard warning flashers ..... 8 A
10 Power windows ..... 16 A
11 Heated rear window, 4th gear (automatic transmission) ..... 16 A
12 Air conditioning (with blower control), Power windows (relay), Heated rear window (relay), Seat belt reminder, Cruise control, Shiftlock ..... 8 A
13 Heated front seats, Daytime running lights - relay (Canada) ..... 16 A
14 Rear fog lights ..... 8 A
15 Parking lights (left side), License plate light ..... 8 A
16 Parking lights (right side), Instruments and control panel lights, Shift indicator light ..... 8 A
ABS-equipped vehicles: this system is protected by a separate 10A fuse located under the front seat on the passenger's side.

Refer to the fuse location chart at fuse box for fuses specific to your car.

700 SERIES FUSES

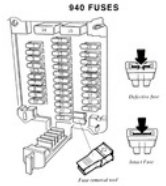


Location*	Amperage	Location*	Amperage
1 Fuel pump, fuel injection system	25	16 Heater blower, air conditioning	30
2 Central locking, hazard warning flashers, headlight flashers	25	17 High beam (left)	15
3 Spare	-	18 High beam (right), extra lights	15
4 Brake lights, shift-lock	30	19 Low beam (left)	15
5 Glove compartment light, clock, radio, interior light, trunk light, door open warning, power antenna	15	20 Low beam (right)	15
6 Heater fan MCC	30	21 LH parking lights (front and rear), license plate light, lighting for: ash tray, heater, control panel, switch for heated rear window, sunroof switch, left instrument panel, radio	15
7 Extra lights		22 Seat belt light,RH parking lights (front and rear), center console compartment, foglight relay, lighting for: Heated seat switch, gear selector panel, rear ash tray	15
8 Electrically operated windows	30	23 Heated front seats	25
9 Warning light, seat belt, turn signals, air conditioning relay, heated front seats, electrically-operated windows, shift-lock	15	24 SRS test socket	
10 Heated rear window Power-operated sunroof	30	25 Rear fog light/lights	15
11 Tank pump, Lambda-sond	15	26 Radio	15
12 Back-up lights, cruise control, overdrive (manual transmission), disengagement of 4th gear on automatic transmission, bulb failure warning lamp	15		
13 Hot start valve	15		
14 Electrically-operated side view mirrors, cigarette lighter, radio, rear wiper (wagon)	15		
15 Horn, windshield wash/wipe	25		

*Some of the equipment/systems listed may be available on certain models only and/or as optional items only.

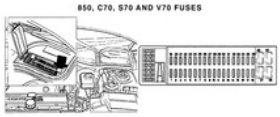
NOTE: On cars equipped with ABS, the system is protected by an additional 10A fuse located under the instrument panel to the left of the steering wheel.

940 FUSES



Location*	Amperage	Location	Amperage
1 Left parking lights, license plate light, rear parking lights	10	25 Heated warning flashers, central locking system	25
2 Right parking lights	10	26 Clock, interior lighting, door open warning lights, glove box, cargo space and vanity mirror	10
3 Left high beam	15	27 Brake lights, shiftlock release	15
4 Right high beam	15	28 Heater fan, air conditioning	30
5 SRS test		29 Electrically operated antenna, electrical connector for trailer	30
6 Left low beam	15	30 Fuel pump (tank), electrically heated Lambda sond	10
7 Right low beam	15	31 Fuel injection, fuel pump (main)	15
8 Front fog lights	15	32 Radioamplifier	15
9 Rear fog lights	10	33 Radiocassette tape player	10
10 Instrument illumination: ashtray front and rear, heater control panel, switches and seat belt light	5	34 Electrically operated windows, electrically operated sun roof	30
11 Back-up lights, turn signals, cruise control	15	35 Electrically heated front seats, electrically operated front seats	30
12			
13 Heated rear window, heated door mirrors	25	Note: The ABS system is protected by an additional 10 A fuse which is located under the instrument panel to the left of the steering wheel.	
14 Overdrive, relay for electrically operated sun roof, electrically operated windows	10	Refer to fuse box cover label for your vehicle's specific fuse usage.	
15 -		Note: Fuses No. 34 and 35 are circuit breakers which activate when overloaded. After 20 seconds, the circuits should have cooled down and function normally.	
16 -			
17 -			
18 Radiocassette tape player	5		
19 ECC, electrically operated side door mirrors, rear window wiper/washer (wagons)	15		
20 Windshield wipers/washers, horn	25		
21 Constant idle speed system	5		
22			
23			
24			

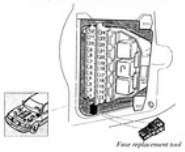
850, C70, S70 AND V70 FUSES



No.	Function	Amps
1	Control units, Automatic transmission, Fuel and ignition systems	15
2	Fuel pump	15
3	Courtesy light, Oil gauge, Exhaust temperature gauge (Japan), Speed warning	10
4	Spare	-
5	Passenger compartment fan, speed 4	30
6	Central locking system and Alarm	25
7	Audio	15
8	Power antenna and Towing hook (-93), Air pump (94-)	40
9	ABS , TRACS (93-)	20
10	Spare (-93), Heated rear seat (94-)	15
11	Heated rear window & wing mirrors	30
12	Brake light	10
13	Hazard blinkers + High beam flash and Alarm	15
14	ABS , TRACS (93-)	30
15	Radio, Courtesy light, Door warning lights, Oil level-/pressure sensor and Remote-controlled central locking (-93), Seatbelt reminder and OBD-socket (94-)	10
16	Power antenna, Towing bracket contact and Accessories	30
17	Spare (-92), Key reminder (94-), Seatbelt reminder (-93)	10
18	Heated seats (-93), Power door mirrors (93-), Spare (94-)	-
19	High beam, LH	15
20	High beam, RH + high beam check light	15

No.	Function	Amps
21	Low beam, LH	15
22	Low beam, RH	15
23	Parking -tail light, LH, License plate light	10
24	Parking-tail light, RH	10
25	Dipped rear light + indicator light	15
26	Spare (-93), Heated front seat and heated wing mirrors (94-)	25
27	Flashers and rear light, TRACS (93-)	15
28	Heated rear window, Seatbelt reminder, Cruise control, Shift-lock, Bulb failure warning sensor (Germany), Heated door mirrors (93-)	10
29	ABS , TRACS (93-)	15
30	Cigarette lighter	15
31	Passenger compartment fan, speeds 1 - 3 and AC-system	25
32	Radio, Remote-controlled central locking system (93-)	10
33	Diagnostic unit, power seats, Light control module, Rear window wiper and washer pump (94-)	15
34	Horn, windshield wipers, Headlight wipers and washer pump	25
35	Rheostat, Instrument lighting (94-), Power sunroof (93-)	10
36	Spare	-
37	Power window winders and Sunroof	automat. 20
38	Spare	-
39	Power seat, LH	automat. 20
40	Power seat, RH	automat. 20

960, S90 AND V90 FUSES



Fuse replacement tool

Location **	Amperage
1 Heated rear window	25
2 Central locking	20
3 Brake light, Light switch	15
4 Ignition switch, SRS	10
5 Spare	
6 Windshield wiper/washer, Headlight wiper, horn relay	25
7 Climate unit	20
8 Power seats, Power side door mirrors Tailgate wiper/washer (wagons) Instrument lighting, Ambient temp. sensor	15
*9 Audio system	15
10 Cigarette lighter	15
11 Interior lighting, Transmission mode selector	5
12 ABS	5
13 Clock, Interior/glove compartment lighting, Door open warning lights, Cargo space lighting, Vanity mirror	10
14 Alarm, Horn	10
15 Power antenna, Headlight flasher, Trailer	20
16 Accessories	20
17 Hazard warning flasher, Direction indicator, Alarm hazard indication	20
18 Audio/amplifier, CD changer	15
19 Backup lights, Turn indicators, Cruise control	15
20 Light switch, High/low beam relay	15
21 Seat belt reminder, Timer- electrically heated rear window	5
22 Heated driver's seat	15
23 Heated passenger's seat	15
24 Rear foglights	5
25 Power seats *	30
26 Power windows, Power sunroof *	30

* Automatic circuit breakers

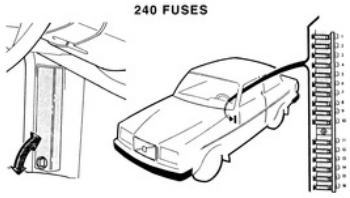
** Some of the equipment/systems listed may be available on certain models only and/or as optional items only.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The flasher is self-contained in the turn signal/windshield wiper and washer combination switch. If the flasher becomes inoperative, the switch assembly must be replaced. Refer to the Turn Signal (Combination) Switch removal and installation procedure in Section 8.

240 FUSES

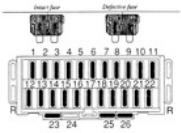


Some of the equipment listed below is optional

1 Cigarette lighter, Power mirrors, Radio, Tailgate wiper/washer ..... 8 A
2 Windshield wiper/washer, Horn ..... 16 A
3 Heater blower ..... 25 A
4 Fuel feed (in-tank) pump, Lambda-sond heating element ..... 8 A
5 Turn signals, Tail lights, Heated mirrors ..... 16 A
6 Main fuel pump relay, Lambda-sond, Fuel injection system ..... 16 A
7 Brake lights, Shiftlock, ABS ..... 8 A
8 Central locking, Interior and glove compartment lights, Trunk compartment lights, Radio, Power antenna, Clock, Daytime running lights (Canada) ..... 8 A
9 Hazard warning flashers ..... 8 A
10 Power windows ..... 16 A
11 Heated rear window, 4th gear (automatic transmission) ..... 16 A
12 Air conditioning (with blower control), Power windows (relay), Heated rear window (relay), Seat belt reminder, Cruise control, Shiftlock ..... 8 A
13 Heated front seats, Daytime running lights - relay (Canada) ..... 16 A
14 Rear fog lights ..... 8 A
15 Parking lights (left side), License plate light ..... 8 A
16 Parking lights (right side), Instruments and control panel lights, Shift indicator light ..... 8 A
ABS-equipped vehicles: this system is protected by a separate 10A fuse located under the front seat on the passenger's side.

Refer to the fuse location chart at fuse box for fuses specific to your car.

700 SERIES FUSES

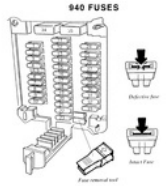


Location*	Amperage	Location*	Amperage
1 Fuel pump, fuel injection system	25	16 Heater blower, air conditioning	30
2 Central locking, hazard warning flashers, headlight flashers	25	17 High beam (left)	15
3 Spare	-	18 High beam (right), extra lights	15
4 Brake lights, shift-lock	30	19 Low beam (left)	15
5 Glove compartment light, clock, radio, interior light, trunk light, door open warning, power antenna	15	20 Low beam (right)	15
6 Heater fan MCC	30	21 LH parking lights (front and rear), license plate light, lighting for: ash tray, heater, control panel, switch for heated rear window, sunroof switch, left instrument panel, radio	15
7 Extra lights		22 Seat belt light,RH parking lights (front and rear), center console compartment, foglight relay, lighting for: Heated seat switch, gear selector panel, rear ash tray	15
8 Electrically operated windows	30	23 Heated front seats	25
9 Warning light, seat belt, turn signals, air conditioning relay, heated front seats, electrically-operated windows, shift-lock	15	24 SRS test socket	
10 Heated rear window Power-operated sunroof	30	25 Rear fog light/lights	15
11 Tank pump, Lambda-sond	15	26 Radio	15
12 Back-up lights, cruise control, overdrive (manual transmission), disengagement of 4th gear on automatic transmission, bulb failure warning lamp	15		
13 Hot start valve	15		
14 Electrically-operated side view mirrors, cigarette lighter, radio, rear wiper (wagon)	15		
15 Horn, windshield wash/wipe	25		

*Some of the equipment/systems listed may be available on certain models only and/or as optional items only.

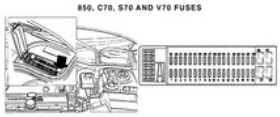
NOTE: On cars equipped with ABS, the system is protected by an additional 10A fuse located under the instrument panel to the left of the steering wheel.

940 FUSES



Location*	Amperage	Location	Amperage
1 Left parking lights, license plate light, rear parking lights	10	25 Heated warning flashers, central locking system	25
2 Right parking lights	10	26 Clock, interior lighting, door open warning lights, glove box, cargo space and vanity mirror	10
3 Left high beam	15	27 Brake lights, shiftlock release	15
4 Right high beam	15	28 Heater fan, air conditioning	30
5 SRS test		29 Electrically operated antenna, electrical connector for trailer	30
6 Left low beam	15	30 Fuel pump (tank), electrically heated Lambda sond	10
7 Right low beam	15	31 Fuel injection, fuel pump (main)	15
8 Front fog lights	15	32 Radioamplifier	15
9 Rear fog lights	10	33 Radiocassette tape player	10
10 Instrument illumination: ashtray front and rear, heater control panel, switches and seat belt light	5	34 Electrically operated windows, electrically operated sun roof	30
11 Back-up lights, turn signals, cruise control	15	35 Electrically heated front seats, electrically operated front seats	30
12			
13 Heated rear window, heated door mirrors	25	Note: The ABS system is protected by an additional 10 A fuse which is located under the instrument panel to the left of the steering wheel.	
14 Overdrive, relay for electrically operated sun roof, electrically operated windows	10	Refer to fuse box cover label for your vehicle's specific fuse usage.	
15 -		Note: Fuses No. 34 and 35 are circuit breakers which activate when overloaded. After 20 seconds, the circuits should have cooled down and function normally.	
16 -			
17 -			
18 Radiocassette tape player	5		
19 ECC, electrically operated side door mirrors, rear window wiper/washer (wagons)	15		
20 Windshield wipers/washers, horn	25		
21 Constant idle speed system	5		
22			
23			
24			

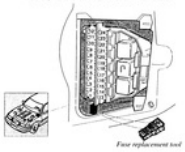
850, C70, S70 AND V70 FUSES



No.	Function	Amps
1	Control units, Automatic transmission, Fuel and ignition systems	15
2	Fuel pump	15
3	Courtesy light, Oil gauge, Exhaust temperature gauge (Japan), Speed warning	10
4	Spare	-
5	Passenger compartment fan, speed 4	30
6	Central locking system and Alarm	25
7	Audio	15
8	Power antenna and Towing hook (-93), Air pump (94-)	40
9	ABS , TRACS (93-)	20
10	Spare (-93), Heated rear seat (94-)	15
11	Heated rear window & wing mirrors	30
12	Brake light	10
13	Hazard blinkers + High beam flash and Alarm	15
14	ABS , TRACS (93-)	30
15	Radio, Courtesy light, Door warning lights, Oil level-/pressure sensor and Remote-controlled central locking (-93), Seatbelt reminder and OBD-socket (94-)	10
16	Power antenna, Towing bracket contact and Accessories	30
17	Spare (-92), Key reminder (94-), Seatbelt reminder (-93)	10
18	Heated seats (-93), Power door mirrors (93-), Spare (94-)	-
19	High beam, LH	15
20	High beam, RH + high beam check light	15

No.	Function	Amps
21	Low beam, LH	15
22	Low beam, RH	15
23	Parking -tail light, LH, License plate light	10
24	Parking-tail light, RH	10
25	Dipped rear light + indicator light	15
26	Spare (-93), Heated front seat and heated wing mirrors (94-)	25
27	Flashers and rear light, TRACS (93-)	15
28	Heated rear window, Seatbelt reminder, Cruise control, Shift-lock, Bulb failure warning sensor (Germany), Heated door mirrors (93-)	10
29	ABS , TRACS (93-)	15
30	Cigarette lighter	15
31	Passenger compartment fan, speeds 1 - 3 and AC-system	25
32	Radio, Remote-controlled central locking system (93-)	10
33	Diagnostic unit, power seats, Light control module, Rear window wiper and washer pump (94-)	15
34	Horn, windshield wipers, Headlight wipers and washer pump	25
35	Rheostat, Instrument lighting (94-), Power sunroof (93-)	10
36	Spare	-
37	Power window winders and Sunroof	automat. 20
38	Spare	-
39	Power seat, LH	automat. 20
40	Power seat, RH	automat. 20

960, S90 AND V90 FUSES



Fuse replacement tool

Location **	Amperage
1 Heated rear window	25
2 Central locking	20
3 Brake light, Light switch	15
4 Ignition switch, SRS	10
5 Spare	
6 Windshield wiper/washer, Headlight wiper, horn relay	25
7 Climate unit	20
8 Power seats, Power side door mirrors Tailgate wiper/washer (wagons) Instrument lighting, Ambient temp. sensor	15
*9 Audio system	15
10 Cigarette lighter	15
11 Interior lighting, Transmission mode selector	5
12 ABS	5
13 Clock, Interior/glove compartment lighting, Door open warning lights, Cargo space lighting, Vanity mirror	10
14 Alarm, Horn	10
15 Power antenna, Headlight flasher, Trailer	20
16 Accessories	20
17 Hazard warning flasher, Direction indicator, Alarm hazard indication	20
18 Audio/amplifier, CD changer	15
19 Backup lights, Turn indicators, Cruise control	15
20 Light switch, High/low beam relay	15
21 Seat belt reminder, Timer- electrically heated rear window	5
22 Heated driver's seat	15
23 Heated passenger's seat	15
24 Rear foglights	5
25 Power seats *	30
26 Power windows, Power sunroof *	30

* Automatic circuit breakers

** Some of the equipment/systems listed may be available on certain models only and/or as optional items only.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

All electrical equipment is protected from overloading by fuses. Each fuse has an amperage rating that will allow it to transmit a predetermined amount of current before its filament melts, thereby stopping the excessive current flow. By providing this engineered "weak spot" in the circuit, the first failure will occur at a known location (the fuse), eliminating hours of tracing wiring harnesses to locate a problem.

If a fuse blows repeatedly, the trouble is probably in the electrical component that the fuse protects. NEVER replace a fuse with another of a higher ampere rating. Sometimes a fuse will blow when all of the electrical equipment protected by the fuse is operating, especially under severe weather conditions. For this reason, it is wise to carry a few spare fuses of each type in the car.

When tracking down an inoperative electrical circuit, follow a logical pattern. Wiring itself is rarely the problem. Remember that, in some cases, a fuse can look good but not be capable of passing an electrical load. Either remove the fuse and check it with an ohmmeter or simply replace it with a new one. Always have the ignition switched **OFF** when removing and replacing fuses. On all models, the circuit that each fuse protects is listed either on the fuse box cover or in the owner's manual.

A blown fuse is indicated by the failure of all units protected by it. It is caused by overloading the circuits. Examine the curved metal wire, on the inside of the fuse, to see if it is broken. If so, replace with a new fuse of the same color and amperage.

Fig. 1: Fuse box location on 240 models

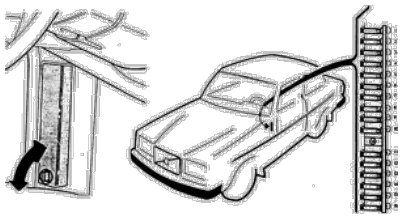


Fig. 2: Fuse box location on the 700 series and 940 models

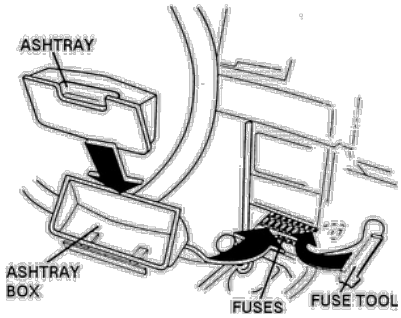
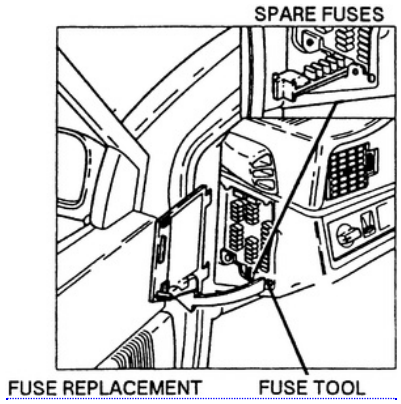


Fig. 3: Fuse box location on 960 models



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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240 and Coupe Models

The fuses and relays on 240 and Coupe models are positioned in the front of the left front door pillar. When installing fuse No. 1, be certain to use an 8 amp fuse.

Fuses and relays on the 760, 780 and 940 models are located in the central electrical unit behind the ashtray in the center console. In addition, a fuse for the ABS braking system is located under the instrument panel, to the left of the steering wheel. When installing fuse No. 5, be certain to use a 15 amp fuse.

Fuses and relays on 740, 850, 960 and all 1998 models are located on the far left side of the dashboard. When installing fuses No. 26 and 33, be certain to use 10 amp fuses.

All vehicles are equipped with a fuse removal tool, located in the fuse box. Grasp the blown fuse with the tool and remove it.

NOTE: Care must be exercised when replacing fuses. Check to ensure that the ignition switch is OFF.

700 Series and 940 Models

1. To obtain access to the central electrical unit, remove the ashtray. Pull out and depress the tongue.
2. Press the section marked "electrical fuses-press" and remove the unit.
3. Remove the fuse using the special fuse tool clipped in the fuse box. Pull the fuse straight out.

Except Coupe, 240, 700 and 940 Series

1. Remove the cover to gain access to the fuses.
2. Remove the fuse using the special fuse tool clipped in the fuse box. Pull the fuse straight out.
3. Replace the fuse with the proper amperage rating fuse.
4. When replacing the cover, push in the front edge first and then press into place.

Fig. 1: Lift the lid on the fuse box

Fig. 2: The fuse location and rating chart is located on the underside of the lid

Fig. 3: A fuse removal tool is included in the fuse box


Grasp, then
pull

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

WARNING

DO NOT replace blown fusible links with standard wire. Use only fusible type wire with Hypalon® insulation, or damage to the electrical system could occur. Also, be sure to use the correct gauge of wire.

NOTE: Not all vehicles have fusible links. Most later models use Maxi-fuses in the underhood fuse box to provide circuit protection. An easy way to determine if your vehicle has fusible links is to verify the type of charging system voltage regulator; those models with an external voltage regulator are protected by fusible links, while those models without an external regulator utilize Maxi-fuses.

When a fusible link blows, it is very important to find out the cause. Do not just replace the link to correct the problem. The fusible links are placed in the system for protection against dead shorts to ground.

In some instances, the link may be blown and it will not show through the insulation. Check the entire length of the fusible wire when the link is suspected of failure.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The cruise control system maintains the vehicle speed at a setting selected by the driver by means of mechanical, electrical, and vacuum operated devices.

The cruise control unit receives an immediate electrical input from the ignition switch; therefore, the cruise circuit is ready for operation whenever the ignition switch is turned on. Actual activation of the cruise control is accomplished by lifting up and holding the control switch in the direction of ACCEL/SET or DECEL/SET until the desired speed is attained. The control unit also receives information about operating conditions from the brake switch, distributor, speed sensor, clutch switch (with manual transmission), or shift lever position switch (with automatic transmission). The cruise control unit, in turn, sends operational signals to the devices that regulate the throttle position. The throttle position maintains the selected vehicle speed. The cruise control compares the actual speed of the vehicle to the selected speed. Then, the control unit uses the result of that comparison to open or close the throttle.

The control unit will disengage the instant the driver depresses the brake pedal. The brake switch sends an electronic signal to the control unit when the brake pedal is depressed; the control unit responds by allowing the throttle to close. The shift lever position switch (automatic transmission) or clutch switch (manual transmission) sends a disengage signal input to the control unit that also allows the throttle to close.

NOTE: The use of the speed control is not recommended when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered or slippery.

The cruise control system will set and automatically maintain any speed above 25 mph (40 kph). When the desired speed is attained, a brief tapping against the switch toward the ACCEL/SET or DECEL/SET, will keep the speed constant until a new speed is selected or if the brake pedal is depressed. To match this set speed, hold the switch in direction of ACCEL/SET or DECEL/SET until the desired speed is attained. Upon releasing the switch, the new speed is held constant.

Short tapping against the switch towards the OFF position, or depressing the brake or clutch pedal, will switch off the cruise control system. However, the system remains ready for operation until the ignition switch is turned off. If the system is disengaged temporarily by the brake switch, clutch switch or deceleration, and the vehicle speed is still above 25 mph, tap the switch toward RESUME. The vehicle will automatically return to the previous set speed retained in memory.

If the vehicle is accelerated above the set speed, the vehicle will return to the set speed when the pedal is released. While driving with the cruise control system, do not engage the selector lever in **N** position, on vehicles with an automatic transmission, since this will speed up the engine.

Fig. 1: Examples of different cruise control switches on Volvo cars

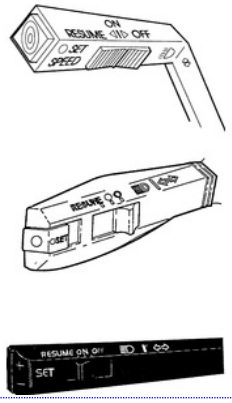
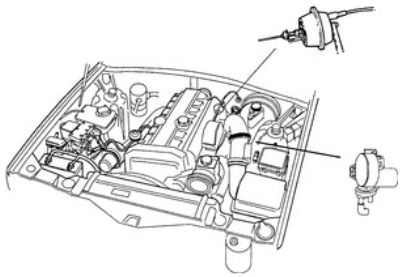


Fig. 2: The servo and vacuum valve location on a 960



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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Radio/Tape Deck/CD Player

On most models, the radio is held in by 2 clips in the console. Remove the side covers and locate the 2 access holes (one on each side) in line with the radio case. Insert a small probe or very small screwdriver into each hole and push gently. This releases the clips and the radio may be removed from the front of the console.

Other models have the same style clips, but they are released by inserting a thin, flat probe down each side of the radio from the front. Again, release the clips and slide the radio free. Disconnect the wiring before pulling the radio too far from the dash.

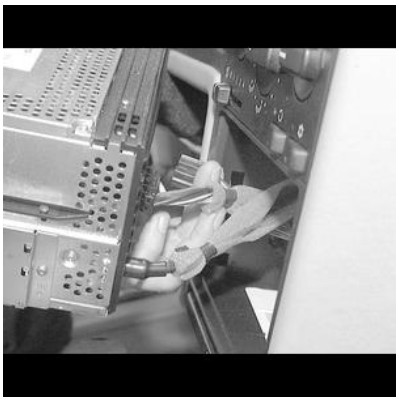
The radios on some models are designed with the releases built into the front of the case. Simply push the tabs with your fingers and remove the radio.

NOTE: Although these radios are relatively simple to remove, many have a security code programmed into the circuitry. Once reinstalled, the radio will not work if the correct code is not entered. The radio should not be removed or disconnected if the user code is not available.

Fig. 1: Use a small screwdriver or another suitable tool to gently depress and release the retaining tabs

Fig. 2: Grasp the tabs and pull the radio out; be careful not to pull so far that the radio falls

Fig. 3: When the connectors are accessible, unplug them. Once the connectors are unplugged, the radio will lose its memory



Amplifier

1. Disconnect the negative battery cable.

2. Remove the retaining screws from the mounting bracket.
3. Detach the electrical connectors from the amplifier.
4. Remove the amplifier.

To install:

5. Attach the connectors to the amplifier.
6. Place the amplifier in the mounting bracket.
7. Tighten the retaining screws.
8. Connect the negative battery cable.
9. Check the operation of the amplifier.

CD Changer

The CD changer is located under the package shelf on sedans, above the spare tire on wagons with no third row of seats, and in the well between the second and third row of seats on wagons equipped with a third row.

1. Remove any necessary trim to access the bracket retaining screws.
2. Remove the bracket retaining hardware.
3. Disconnect any wiring attached to the changer.
4. Remove the CD changer from the vehicle.

To install:

5. Attach the wiring to the CD changer.
6. Place the changer into position and tighten the retaining hardware.
7. Install any removed trim.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Door Speakers

1. Remove the door panel(s).
2. Remove the four retaining screws on the speaker assembly.
3. Pull the speaker out and remove the electrical connector from the back.

To install:

4. Install the electrical connector onto the back of the speaker.
5. Place the speaker in the opening in the door.
6. Tighten the four retaining screws.
7. Verify the proper operation of the speaker.
8. Install the door panel.

Fig. 1: When the grille is removed, the speaker mounting screws are exposed

Fig. 2: Unfasten the mounting screws and remove the speaker from the door

Fig. 3: Unplug the speaker connection and set the speaker aside in a safe place

Dashboard Speakers

1. Remove the speaker cover on the top of the dashboard by removing the retaining screws.
2. Remove the speaker retaining screws.
3. Pull the speaker out and remove the electrical connector from the back.

To install:

4. Install the electrical connector onto the back of the speaker.
5. Place the speaker in the opening in the dashboard.
6. Tighten the retaining screws.
7. Verify the proper operation of the speaker.
8. Install the speaker cover on the dashboard and tighten the retaining screws.

Fig. 4: Carefully pry up the speaker grille and . . .

Fig. 5: . . . remove it from the dashboard

Fig. 6: Remove the speaker retainers; some models have screws while others have plastic push-in type "buttons"

Fig. 7: On this button type retainer, simply depress the center portion so that it pops up before removal

Fig. 8: After the retainers are removed, pull the speaker from the dashboard

Fig. 9: Unplug the electrical connector and remove the speaker

Rear Roof Pillar Speakers (Wagon)

1. Unfasten the grille retaining screws and remove the grille.
2. Remove the speaker retaining screws.
3. Pull the speaker out of the opening and unplug the electrical connector.

To install:

4. Plug in the electrical connector.
5. Install the speaker in the opening and tighten the retaining screws.
6. Install the speaker grille and tighten the retaining screws.

Rear Deck Speakers (Sedan)

1. From under the package tray, remove the grille retaining screws and remove the grille.
2. Remove the speaker retaining screws.
3. Pull the speaker out of the opening and unplug the electrical connector.

To install:

4. Plug in the electrical connector.
5. Install the speaker in the opening and tighten the retaining screws.
6. Install the speaker grille and tighten the retaining screws.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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 resistance, 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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: A 12 volt test light is used to detect the presence of voltage in a circuit

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

NOTE: 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.

Fig. 1: The infinite reading on this multimeter (1 .) 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.

Fig. 1: Checking the resistance of a coolant temperature sensor with an ohmmeter. Reading is 1.04 kilohms

Fig. 2: Spark plug wires can be checked for excessive resistance using an ohmmeter

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 resistance. Parallel circuit resistance 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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

NOTE: 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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Fig. 1: This voltage drop test revealed high resistance (low voltage) in the circuit

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 resistance 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.

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Wiring the vehicle for towing is fairly easy. There are a number of good wiring kits available and these should be used, rather than trying to design your own.

All trailers will need brake lights and turn signals as well as tail lights and side marker lights. Most areas require extra marker lights for overwide trailers. Also, most areas have recently required back-up lights for trailers, and most trailer manufacturers have been building trailers with back-up lights for several years.

Additionally, some Class I, most Class II and just about all Class III and IV trailers will have electric brakes. Add to this number an accessories wire, to operate trailer internal equipment or to charge the trailer's battery, and you can have as many as seven wires in the harness.

Determine the equipment on your trailer and buy the wiring kit necessary. The kit will contain all the wires needed, plus a plug adapter set which includes the female plug, mounted on the bumper or hitch, and the male plug, wired into, or plugged into the trailer harness.

When installing the kit, follow the manufacturer's instructions. The color coding of the wires is usually standard throughout the industry. One point to note: some domestic vehicles, and most imported vehicles, have separate turn signals. On most domestic vehicles, the brake lights and rear turn signals operate with the same bulb. For those vehicles without separate turn signals, you can purchase an isolation unit so that the brake lights won't blink whenever the turn signals are operated.

One, final point, the best kits are those with a spring loaded cover on the vehicle mounted socket. This cover prevents dirt and moisture from corroding the terminals. Never let the vehicle socket hang loosely; always mount it securely to the bumper or hitch.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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.

NOTE: 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.