

# A/C-HEATER SYSTEM - AUTOMATIC

1995 Volvo 850

1995-96 Auto. A/C-Heater Systems

Volvo 850

## \* PLEASE READ THIS FIRST \*

**WARNING:** To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

**CAUTION:** When battery or radio is disconnected, radio will go into anti-theft protection mode. Obtain radio code anti-theft protection code from owner prior to servicing vehicle.

## A/C SYSTEM SPECIFICATIONS

### SPECIFICATIONS

Application	Specification
Compressor Type .....	Zexel DKS-15CH 6-cyl.
Compressor Belt Tension (1)	
Compressor Oil Capacity .....	(2) 6.8 ozs.
Refrigerant Capacity (R-134a) .....	26.4 ozs.
System Operating Pressures (3)	
High Side .....	406-450 psi (28.5-31.6 kg/cm <sup>2</sup> )
Low Side .....	25-33 psi (1.8-2.3 kg/cm <sup>2</sup> )

(1) - Belt tension is maintained by automatic belt tensioner.

(2) - Use PAG Oil (Part No. 11 61 407-0)

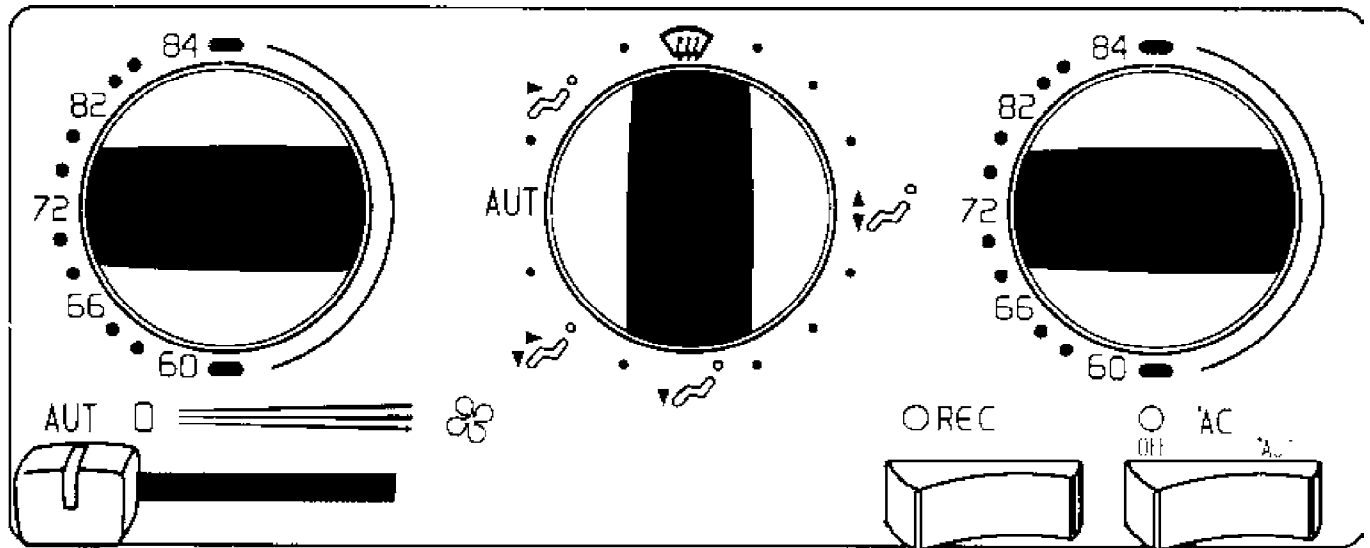
(3) - Pressure switch cut-out points.

## DESCRIPTION

The Electronic Climate Control (ECC) module (A/C-heater control panel) contains a function selector dial, driver's and passenger's temperature dials, a REC (recirculated air) switch, A/C OFF switch, and a fan speed (blower motor) control lever. See Fig. 1. The heater (blower motor) fan is controlled by ECC output (power) stage. Air conditioning system will only operate above 32°F (0°C). Blower switch must not be in zero position to allow compressor to engage.

Other system components include an A/C relay, A/C compressor, low-pressure switch (pressostat), A/C safety and high-pressure switch, engine coolant temperature sensor, outside temperature sensor, interior temperature sensors, and duct temperature sensors.

In addition, driver's and passenger's temperature control damper motors, recirculation damper motor, floor/defroster damper motor, ventilation damper motor, and diagnostic connectors (units) complete system.



95J10255

Fig. 1: Identifying ECC Control Panel  
 Courtesy of Volvo Cars of North America.

## OPERATION

### A/C COMPRESSOR CLUTCH CONTROL

The A/C compressor electromagnetic clutch is powered by the A/C relay. Compressor operation requires that the A/C relay be activated by both Electronic Climate Control (ECC) module and Engine Control Module (ECM). The ECM turns A/C compressor off when engine is at full acceleration, at high engine temperature, and for 5-10 seconds after starting engine.

The ECC control module normally supplies voltage to A/C relay, except when heater (blower motor) fan is off and vehicle speed is less than 20 MPH, when heater fan is off and recirculation is on, or momentarily when under full acceleration.

If A/C is switched off using the AC OFF switch, ECC control module will cut supply voltage to relay, turning off compressor. However, this does not apply when air distribution control is in defrost setting, since A/C is always on in this case.

### A/C PRESSURE SWITCHES

The A/C compressor is connected in series with the low-pressure switch, high-pressure switch, and safety switch. The high-pressure and safety switch cut power to the A/C compressor if pressure in the A/C high-pressure circuit becomes excessive, supplying a signal to ECM to start cooling fan.

The low-pressure switch (pressostat) turns A/C compressor on and off to maintain pressure within limits.

### AIR DISTRIBUTION CONTROL

Air distribution control is based on signals from ECC control module, which controls the ventilation damper motor and floor/defroster damper motor. When set to AUT (automatic) mode, the air distribution control circuit computes air distribution based on outside (ambient) temperature, the position of driver's side

temperature control dial, and engine coolant temperature.

At low outside temperatures, the ECC control module selects floor/defrost setting, with a slight amount of bi-level air if sunshine is present. If outside temperature is between 50–66°F (10–19°C), a varying degree of bi-level air is selected. At temperatures greater than 68°F (20°C), all air is directed to instrument panel vents.

The ventilation air distribution setting is selected if driver's side control panel is set for maximum cooling. The floor/defrost setting is selected if maximum heating is selected.

The defrost air distribution setting is selected if engine is cold and outside and interior temperatures are also low. This changes to varying degrees of floor/defrost air distribution as engine coolant temperature increases. The transition from defroster to floor/defroster setting takes place more quickly in sunshine.

## AIR TEMPERATURE SENSORS & SOLAR SENSOR

Two interior temperature sensors and 2 duct temperature sensors are required for individual temperature control of driver's and passenger's sides. Each interior temperature sensor incorporates a fan which draws air through sensor.

The resistance of the air temperature sensors decreases as temperature increases. The solar sensor, combined with the theft alarm diode, is a photodiode which generates a current when exposed to solar radiation.

## DAMPER MOTORS

The temperature control damper motors, recirculation damper motor, floor/defroster damper motor, and ventilation damper motor are all identical, but their control range varies according to the damper being controlled.

The damper motors have a position sensor to enable the ECC control module to determine damper position, learn the damper limit positions, and to detect any fault in damper motor. The ventilation damper is operated by damper motor through 2 gear segments; one fitted to damper motor shaft and the other on ventilation damper shaft.

## FAN CONTROL

Heater (blower motor) fan speed is variably controlled by ECC output (power) stage in response to signals from ECC control module. The ECC control module digital control signals vary in length according to required fan speed.

The ECC output stage has an electronic unit which receives the digital control signals and converts them to voltage. If there is no control signal or the fan is disabled, the ECC output stage sends a diagnostic signal to inform the ECC control module of the fault.

If fan speed control lever is set to AUT (automatic) mode, fan speed is influenced by the position of driver's side temperature control dial, driver's side interior temperature sensor, vehicle speed, and engine coolant temperature.

The highest fan speed is selected if driver's side temperature control dial is set to maximum or minimum cooling or heating. The greater the difference between the desired and actual temperatures, as sensed by the driver's side temperature sensor, the higher the fan speed.

As vehicle speed increases, the fan speed will be reduced to maintain a constant airflow throughout the passenger compartment. When heating the passenger compartment after starting a cold engine, the fan speed is gradually increased as engine coolant temperature rises.

## RECIRCULATED AIR MODE

The ECC control module selects recirculated air mode only for a combination of cooling and high outside temperature, provided that:

- \* There is a considerable difference between the desired and actual temperature on driver's side. The quantity of recirculated air will vary between 70-100 percent, depending on difference in temperature.
- \* A high fan speed is manually selected. In this case, the recirculation damper will be set to a mid-position (50 percent of the air will be recirculated).

### Recirculation Motor

This motor operates the recirculation damper by means of a mechanical linkage in response to signals from ECC control module.

### Recirculation Switch

The off position of REC (recirculation) switch corresponds to automatic operation, the ECC control module determines whether recirculation is required.

### Air Distribution Switch

With air distribution switch in defroster position, recirculated air mode always cuts out, as humidity in passenger compartment will normally be higher than that of outside air.

### Recirculation Damper

In AUT (automatic) mode, recirculation damper movement is limited to fractions of a second. It takes about half a minute from full recirculation to take effect if outside temperature is high.

## TEMPERATURE CONTROL

Individual temperature control is provided by the driver's and passenger's side temperature control damper motors in response to signals from ECC control module.

The ECC control module computes temperature control damper motors based on inputs from temperature dial settings, duct temperature sensors, interior temperature sensors, solar sensor, engine coolant temperature sensor, and outside (ambient) temperature sensor.

The air temperature is monitored downstream of temperature control dampers by the duct temperature sensors. The difference between the desired and actual interior temperature, as monitored by interior temperature sensors, has a direct effect on temperature control damper positions.

In direct sunlight, the temperature control dampers are positioned to provide a lower temperature, as determined by solar sensor input. If the engine is cold and outside temperature is low, the temperature control dampers are set for more heat to reach the desired temperature faster.

## TROUBLE SHOOTING

### SELF-DIAGNOSTICS

The Electronic Climate Control (ECC) control module can detect faults in the system and store Diagnostic Trouble Codes (DTCs). If a fault is present, system informs driver by flashing AC OFF and REC switch LEDs for 20 seconds.

A fault warning is given when a fault is discovered or

present each time ignition is turned on or engine started. DTCs will remain stored until cleared by an input code.

NOTE: Test Unit (981 3190) and Adapter (981 3194) are required for DTC diagnosis. The Volvo Diagnostic Key (998 8670) may be used to perform self-diagnostics. Follow tool manufacturer's instructions.

There are 3 different test modes/settings which can be selected for reading off DTCs. TEST MODE 1 may be used for reading off DTCs detected by control unit (up to 47 codes can be stored). TEST MODE 2 checks signals from speedometer and solar sensor.

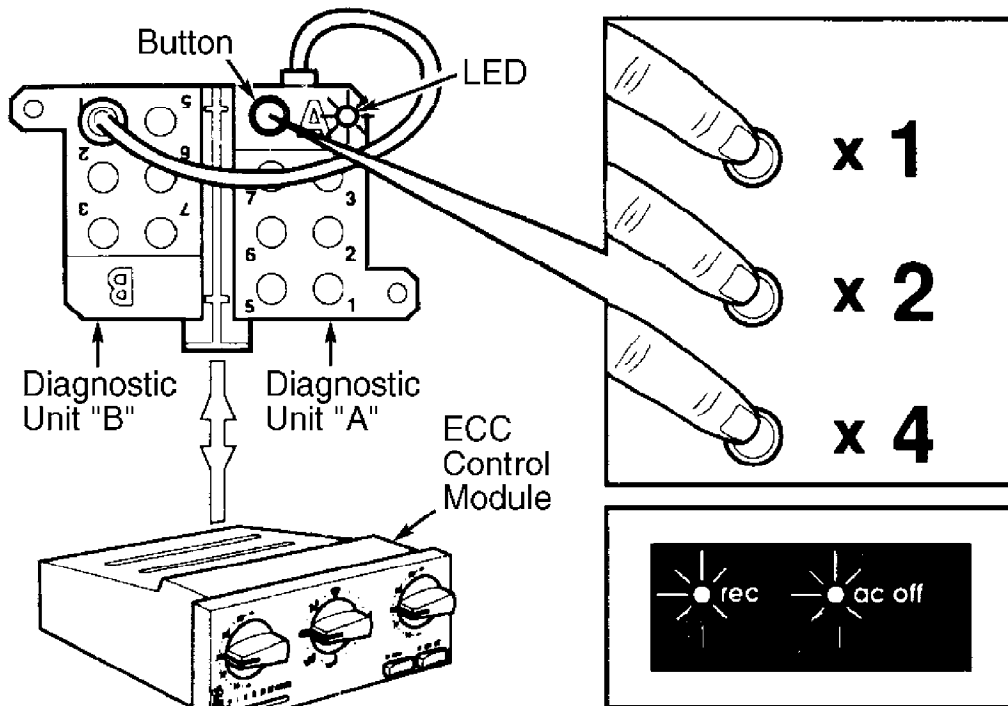
TEST MODE 4 is used to check electrical circuits in A/C system, reset information on damper motor limit positions and change data transmission speed from ECC control module to on-board diagnostic unit.

NOTE: Ignition must be turned off before switching from one test mode to another.

### ENTERING SELF-DIAGNOSTICS

1) Connect selector cable from diagnostic unit "A" to terminal No. 1 of diagnostic unit "B", located behind right headlight. See Fig. 2.

2) Turn ignition on. LED on diagnostic unit "A" should start flashing. Each DTC (3-digits) consists of a series of flashes with a short break between each series. DTCs are displayed in ascending order. See AUTOMATIC A/C-HEATER SYSTEM DIAGNOSTIC TROUBLE CODES table.



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Fig. 2: Identifying Diagnostic Units  
Courtesy of Volvo Cars of North America.

Code #	Condition/Affected Circuit
1-1-1	No Fault Found By Diagnostic System
1-2-1	Outside Temp. Sensor Circuit Shorted To Ground
1-2-2	Outside Temp. Sensor Circuit Open Or Shorted To Power
1-2-3	Driver's Side Temp. Sensor Circuit Shorted To Ground
1-2-4	Driver's Side Temp. Sensor Circuit Open Or Shorted To Power
1-2-5	Pass. Side Temp. Sensor Circuit Shorted To Ground
1-2-6	Pass. Side Temp. Sensor Circuit Open Or Shorted To Power
1-3-1	Driver's Side Duct Temp. Sensor Shorted To Ground
1-3-2	Driver's Side Duct Temp. Sensor Circuit Open Or Shorted To Power
1-3-3	Pass. Side Duct Temp. Sensor Shorted To Ground
1-3-4	Pass. Side Duct Temp. Sensor Circuit Open Or Shorted To Power
1-3-5	No Engine Temp. Frequency Signal
1-4-1	Driver's Side Temp. Switch Faulty Control Signal
1-4-3	Pass. Side Temp. Switch Faulty Control Signal
1-4-5	Air Distribution Switch Faulty Control Signal
1-5-1	Fan Speed Sensor Control Signal Missing Or Too High
1-5-2	Fan Speed Sensor Control Signal Shorted to Ground
2-1-1	Driver's Side Damper Motor Position Sensor Circuit Open Or Shorted To Power
2-1-2	Driver's Side Damper Motor Position Sensor Shorted To Ground
2-2-1	Pass. Side Damper Motor Position Sensor Circuit Open Or Shorted To Power
2-2-2	Pass. Side Damper Motor Position Sensor Shorted To Ground
2-3-1	Ventilation Damper Motor Position Sensor Circuit Open Or Shorted To Power
2-3-2	Ventilation Damper Motor Position Sensor Shorted To Ground
2-3-3	Floor/Defrost Damper Motor Position Sensor Circuit Open Or Short To Power
2-3-4	Floor/Defrost Damper Motor Position Sensor Shorted To Ground
2-3-5	Recirculation Damper Motor Position Sensor Circuit Open Or Short To Power
2-3-6	Recirculation Damper Motor Position Sensor Shorted To Ground
3-1-1	Driver's Side Damper Motor Shorted To Ground Or Power
3-1-2	Pass. Side Damper Motor Shorted To Ground Or Power
3-1-3	Ventilation Damper Motor Shorted To Ground Or Power
3-1-4	Floor/Defrost Damper Motor Shorted To Ground Or Power
3-1-5	Recirculation Damper Motor Shorted To Ground Or Power
3-2-1	Driver's Side Damper Motor Active Too Long
3-2-2	Pass. Side Damper Motor Active Too Long
3-2-3	Ventilation Damper Motor Active Too Long
3-2-4	Floor/Defrost Damper Motor Active Too Long
3-2-5	Recirculation Damper Motor Active Too Long
4-1-1	Pass. Compartment Fan Overcurrent Or Seized Fan
4-1-2	Driver's Side Temp. Sensor Intake Fan Shorted To Ground
4-1-3	Driver's Side Temp. Sensor Intake Fan, No Control Voltage
4-1-4	Driver's Side Temp. Sensor Intake Fan Seized
4-1-5	Pass. Side Temp. Sensor Intake Fan Shorted To Ground
4-1-6	Pass. Side Temp. Sensor Intake Fan, No Control Voltage
4-1-7	Pass. Side Temp. Sensor Intake Fan Seized



(10 seconds on, 10 seconds off), switch A/C compressor on and off, and turn control panel A/C indicator on and off. If A/C relay does not respond as indicated, check A/C relay. See A/C RELAY CHECK under TESTING.

#### Self-Adjustment Of Damper Motor Limit Positions

1) Turn ignition on. Place fan (blower motor) lever in manual mode. Turn function selector to AUT (automatic). Ensure system is in TEST MODE 4.

2) Enter control code 9-9-9 by pressing button on diagnostic unit 9 times in quick succession. Enter each of the 9 series 3 times, with a short pause in-between to allow LED to come on again. ECC control module is now ready to adjust damper motor limit positions automatically.

3) Wait about 10 seconds for fan to start. Turn ignition off to exit TEST MODE 4. Turn ignition on. AC OFF and REC indicator on A/C control panel should flash. Drive car for a few minutes at speeds greater than 20 MPH.

4) Stop car and turn engine off, but leave ignition on for at least 2 minutes to enable ECC control module to store all values. Start TEST MODE 1 and record DTCs. If DTC 1-1-1 appears, self-adjustment is complete. If DTC 5-1-1 appears, self-adjustment is not complete.

#### Changing Data Transmission Speed/Rate From ECC Control Module To On-Board Diagnostic Unit

Enter desired control code (3-1-1 or 3-1-2) by pressing button on diagnostic unit "A", with a short pause in-between to allow LED to come on again. System always starts at normal speed unless another option is selected. If another option was selected, system will revert to normal speed each time ignition is turned off.

### ERASING CODES

1) All codes must be displayed at least once before they can be erased. To erase codes, ensure selector cable is connected to terminal No. 1 of diagnostic unit "B". See Fig. 2. Press and hold diagnostic button for at least 5 seconds. LED should illuminate 3 seconds after button is released.

2) Press and hold diagnostic button for a minimum of 5 seconds more. When button is released, LED should go out. Ensure codes have been erased by pressing diagnostic button once. If display shows 1-1-1, codes have been erased/cleared. If a DTC will not erase/clear, perform that particular code's diagnosis again.

### DTC 1-2-1 OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND

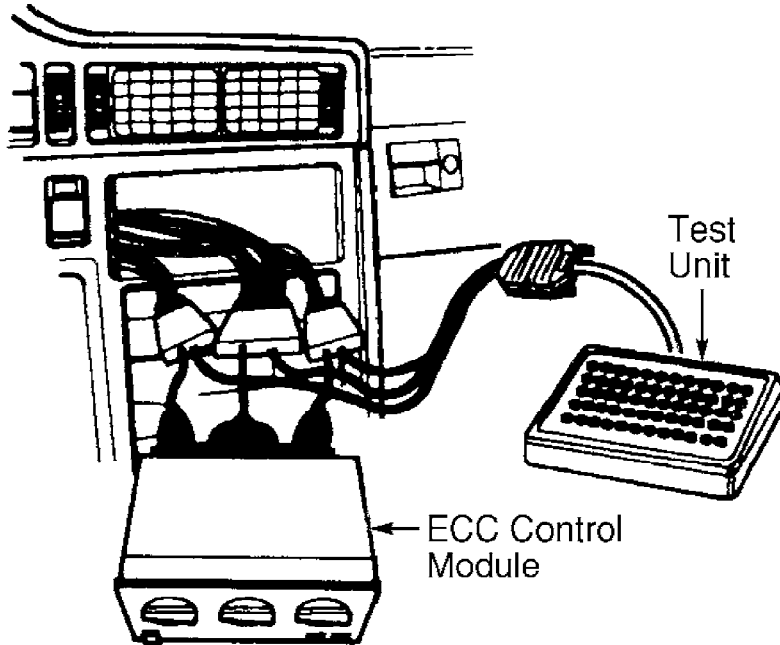
1) Turn ignition off. Install Test Unit (981 3190) and Adapter (981 3194) between ECC control module and harness connector. See Fig. 3. Using ohmmeter, connect test leads between ground and test unit pins No. 6, 9, 10 and 56. Ohmmeter should read zero ohms in each terminal. If resistance is as specified, go to next step. If resistance is not as specified, check for open circuit.

2) Disconnect Adapter (981 3194) from ECC control module. Disconnect outside temperature sensor (located on right rear of engine compartment). See Figs. 4 and 5. Connect ohmmeter leads between test unit pins No. 10 and 14. Ohmmeter should read infinity. If reading is as specified, go to next step. If reading is not as specified, check for shorted circuit between sensor harness connector and ECC control module.

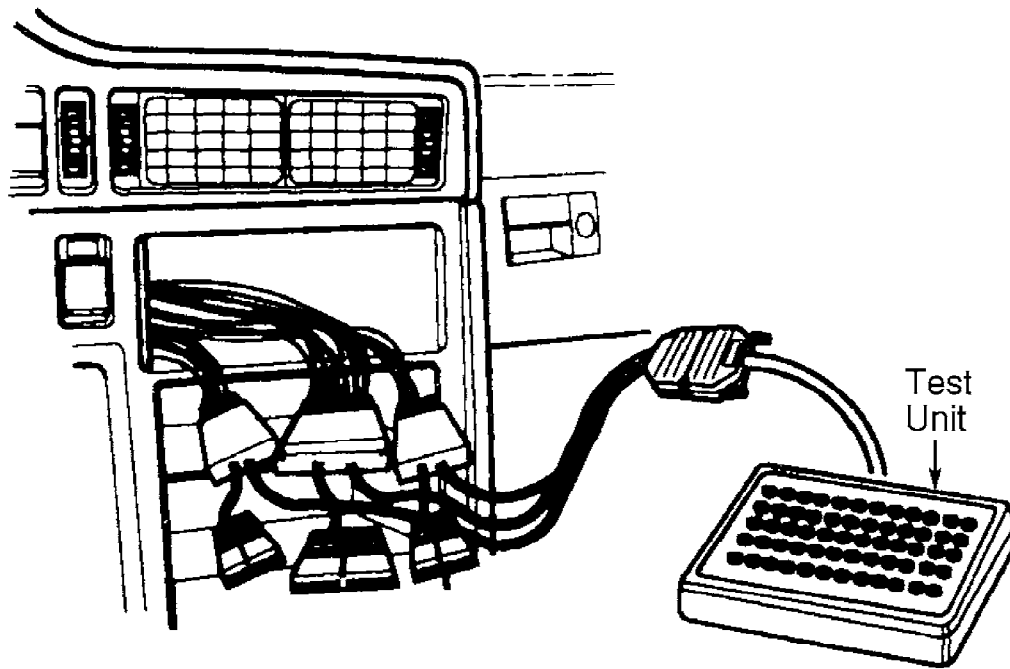
3) Connect ohmmeter leads between outside temperature sensor terminals. Resistance should be 8000-12,000 ohms. If resistance is not as specified, replace outside temperature sensor. Clear and recheck



for codes.



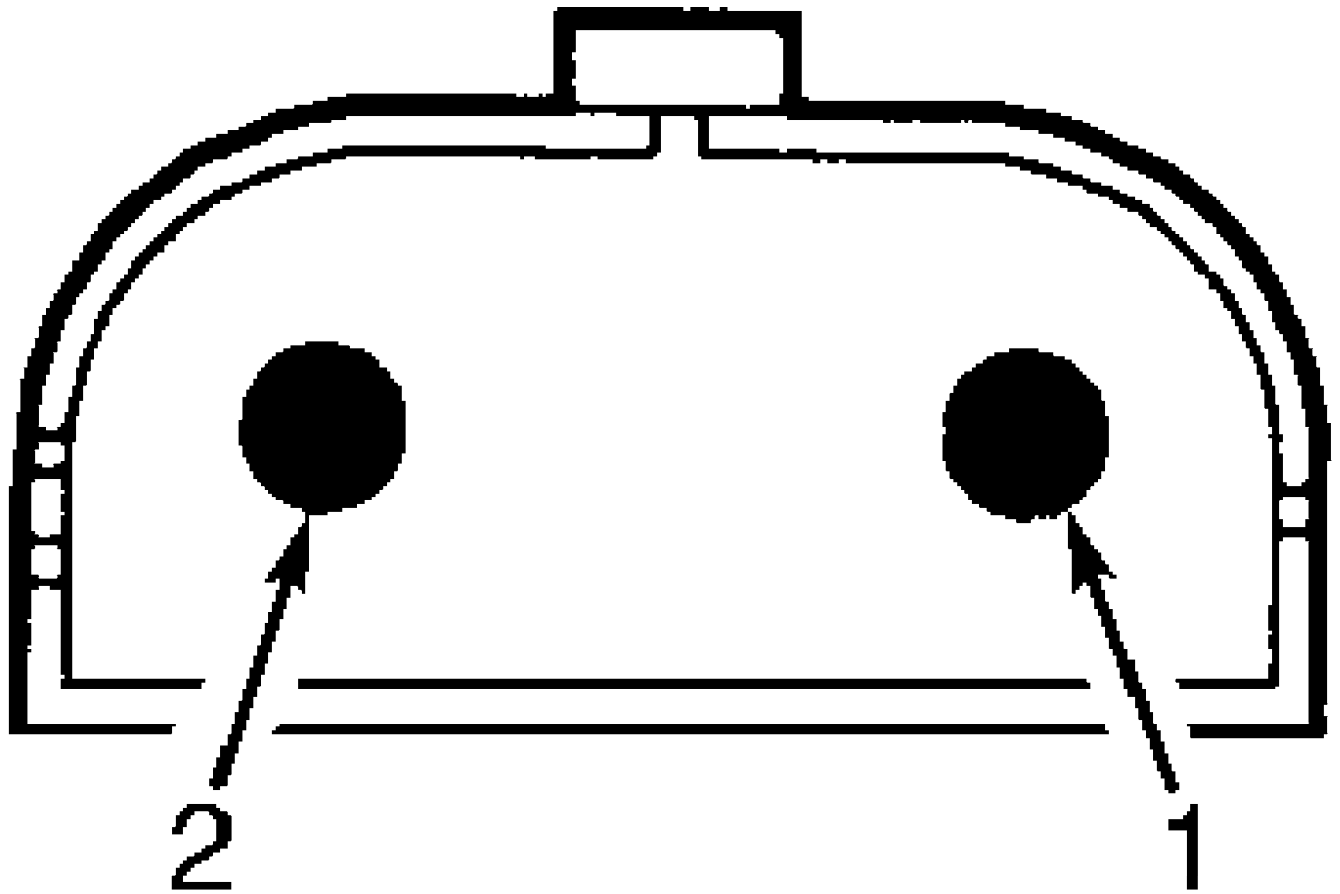
TEST UNIT CONNECTED TO ECC CONTROL MODULE



TEST UNIT NOT CONNECTED TO ECC CONTROL MODULE

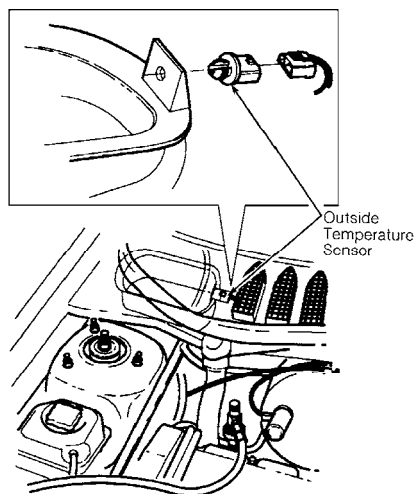
94J10545

Fig. 3: Using Test Unit To Diagnose ECC System  
Courtesy of Volvo Cars of North America.



# 94G10633

Fig. 4: Identifying Outside Temperature Sensor Terminals  
Courtesy of Volvo Cars of North America.



<sup>94B10547</sup>  
Fig. 5: Locating Outside Temperature Sensor  
Courtesy of Volvo Cars of North America.

## DTC 1-2-2 OUTSIDE TEMP. SENSOR CIRCUIT OPEN OR SHORTED TO POWER

1) Ensure DTCs 1-2-2, 1-2-4, 1-2-6, 2-1-1, 2-2-1, 2-3-1, 2-3-3 or 2-3-5 are not present at the same time. If any of these codes are present at the same time, check for an open circuit in the common ground wire. If only DTC 1-2-2 is present, go to next step.

2) Turn ignition off. Install test unit and adapter between ECC control module and harness connector. Using ohmmeter, connect test leads between ground and test unit pins No. 6, 9, 10 and 56. Ohmmeter should read zero ohms in each terminal. If resistance is as specified, go to next step. If resistance is not as specified, check for open circuit.

3) Turn ignition on. Connect voltmeter between test unit pins No. 10 and 14. Check voltage to outside temperature sensor. Voltage should be about 2.6 volts at 68°F (20°C). If voltage reading is 5 volts, check for open in circuit or in outside temperature sensor. If voltage reading is 12 volts, check for open in circuit between sensor harness terminal No. 1 and ECC control module.

4) Turn ignition off. Disconnect Adapter (981 3194) from ECC control module. Disconnect outside temperature sensor connector (located on right rear of engine compartment). See Figs. 4 and 5. Install jumper wire between sensor harness terminals. Connect ohmmeter between test unit pins No. 10 and 14. If ohmmeter reads zero ohms, wire is okay. Check for faulty sensor. If ohmmeter reads infinity, sensor is okay. Check for open circuit.

## DTC 1-2-3 & 1-2-5 DRIVER'S OR PASSENGER'S SIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND

1) Turn ignition off. Install test unit and adapter between ECC control module and harness connector. Using ohmmeter, connect test leads between ground and test unit pins No. 6, 9, 10 and 56. Ohmmeter should read zero ohms in each terminal. If resistance is as specified, go to next step. If resistance is not as specified, check for open circuit.

2) Disconnect adapter from ECC control module. Disconnect appropriate side temperature sensor connector. See Figs. 6 and 7. Connect ohmmeter to test unit pins No. 10 and 12 to check driver's side temperature sensor and terminals No. 10 and 13 to check passenger's side temperature sensor.

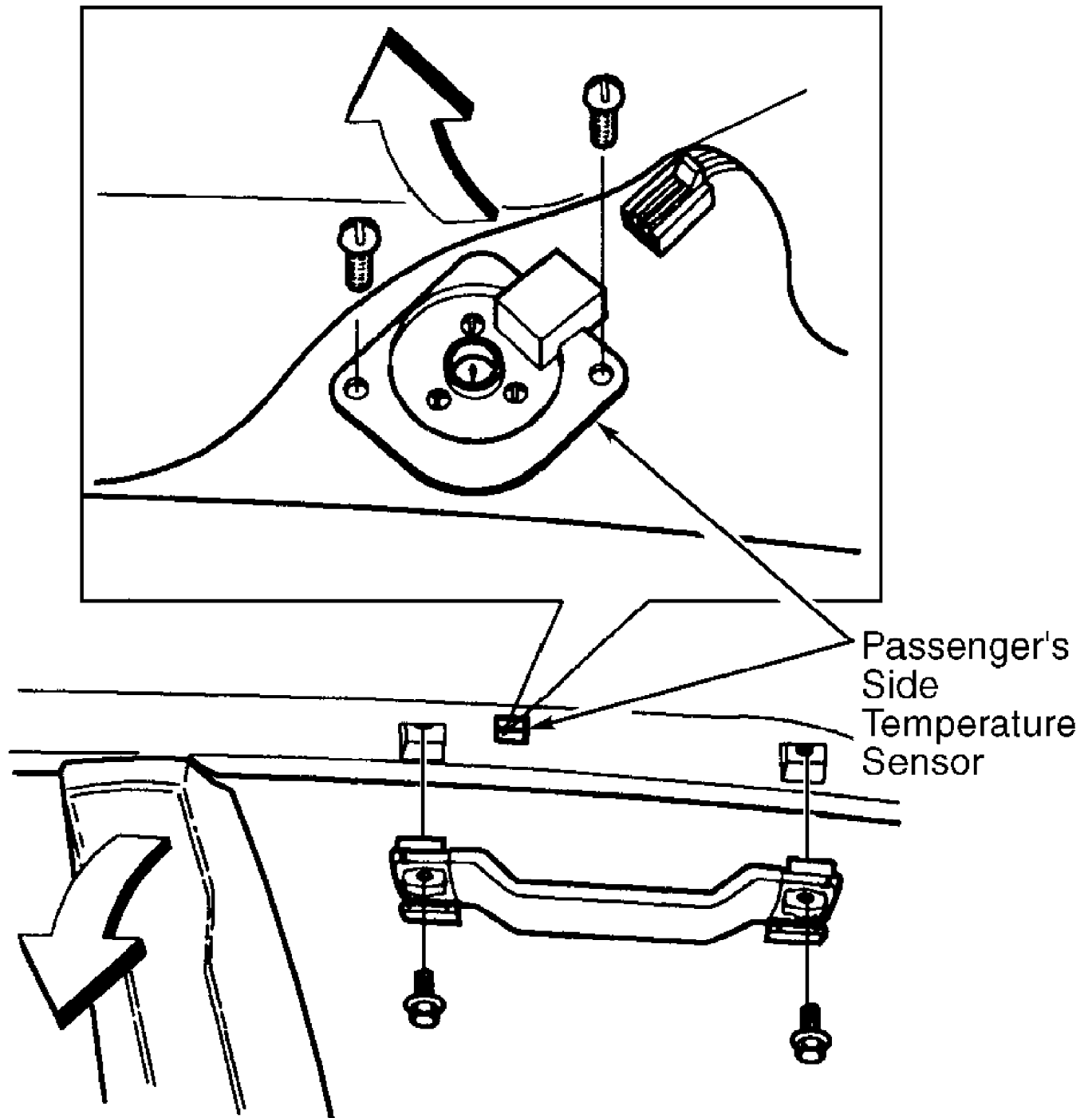
3) If ohmmeter reads zero ohms, check for short circuit between driver's or passenger's side temperature sensor and ECC control module. See WIRING DIAGRAMS.

4) To check driver's or passenger's side temperature sensor, ensure harness connector from sensor is disconnected. Connect ohmmeter between temperature sensor terminal No. 3 (Brown wire) and terminal No. 5 (Green or Yellow wire). Resistance should be 8000-12,000 ohms. If resistance is not as specified, replace faulty temperature sensor.



94A10546

Fig. 6: Identifying Passenger Compartment Temperature Sensor Connector & Component Terminals  
Courtesy of Volvo Cars of North America.



94C10548

Fig. 7: Locating Passenger's Side Temperature Sensor  
 Courtesy of Volvo Cars of North America.

**DTC 1-2-4 & 1-2-6 DRIVER'S OR PASSENGER'S SIDE TEMP.  
 SENSOR CIRCUIT OPEN OR SHORTED TO POWER**

1) Ensure DTCs 1-2-2, 1-2-4, 1-2-6, 2-1-1, 2-2-1, 2-3-1, 2-3-3 or 2-3-5 are not present at the same time. If any of these codes are present at the same time, check for an open circuit in the common

ground wire. If only DTC 1-2-4 or 1-2-6 is present, go to next step.

2) Turn ignition off. Install test unit and adapter between ECC control module and wiring harness. Turn ignition on. Connect voltmeter to test unit pins No. 10 and 12 to check driver's side temperature sensor and terminals No. 10 and 13 to check right side temperature sensor.

3) Voltage should be about 2.6 volts at 68°F (20°C). If voltage reading is 5 volts, check for open circuit in passenger's side temperature sensor then go to next step. If voltage reading is 12 volts, repair short circuit between sensor harness terminal No. 5 (Green or Yellow wire) and ECC control module.

4) Turn ignition off. Disconnect Adapter (981 3194) from ECC control module. Disconnect temperature sensor connector. Install jumper wire between sensor harness terminals No. 3 (Brown wire) and No. 5 (Green or Yellow wire).

5) Connect ohmmeter between test unit pins No. 10 and 12 for driver's side temperature sensor or pins No. 10 and 13 for passenger's side temperature sensor. If ohmmeter reads zero ohms, wire is okay. Check for faulty sensor. If ohmmeter reads infinity, sensor is okay. Check for open circuit.

6) To check sensor resistance, disconnect sensor harness connector. Connect ohmmeter between sensor terminals No. 3 (Brown wire) and No. 5 (Green or Yellow wire). Resistance should be 8000-12,000 ohms. If resistance is not as specified, replace faulty sensor. Clear and recheck for DTC.

## **DTC 1-3-1 & 1-3-3 DRIVER'S OR PASSENGER'S SIDE DUCT**

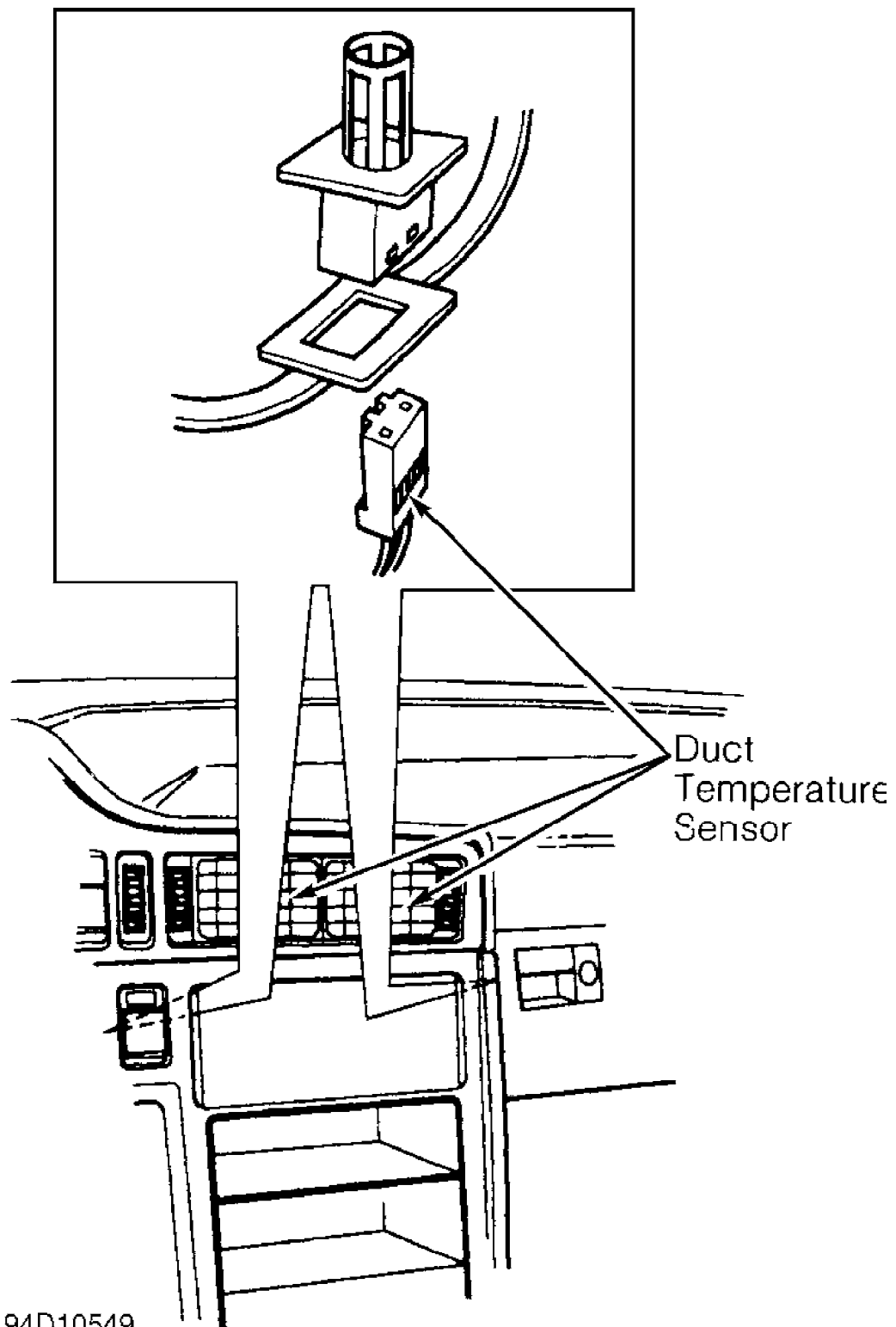
### **TEMP. SENSOR CIRCUIT SHORTED TO GROUND**

1) Ensure ignition is off. Connect test unit to ECC control module. Check ground circuits and repair as necessary. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

2) Ensure ignition is off. Disconnect A/C control unit, but leave test unit connected to A/C control unit connector. Disconnect driver's and passenger's side duct temperature sensor connectors. See Fig. 8.

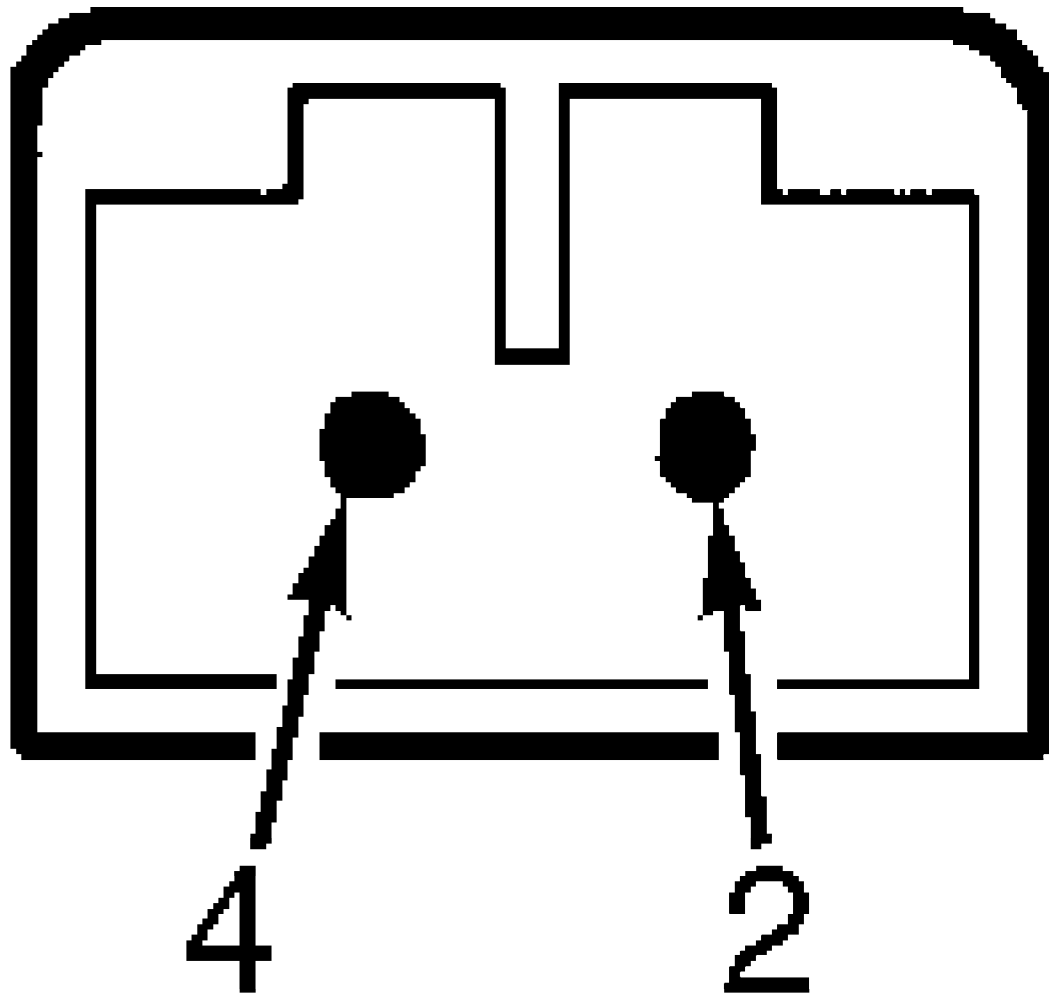
3) Check wiring resistance for driver's side duct temperature sensor by measuring between test unit pins No. 56 and 47. Check wiring resistance for passenger's side duct temperature sensor by measuring between test unit pins No. 56 and 48. If ohmmeter indicates no continuity, go to next step. If ohmmeter indicates continuity, check wiring for short to ground.

4) Ensure ignition is off. Ensure driver's and passenger's side duct temperature sensors are still disconnected. Measure resistance directly between duct temperature sensor terminals. See Fig. 9. Resistance should be about 8000-12,000 ohms. If resistance is not 8000-12,000 ohms, replace duct temperature sensor(s).



94D10549

Fig. 8: Locating Duct Temperature Sensor  
Courtesy of Volvo Cars of North America.



94E10631

Fig. 9: Identifying Duct Temperature Sensor Terminals  
 Courtesy of Volvo Cars of North America.

**DTC 1-3-2 & 1-3-4 DRIVER'S OR PASSENGER'S SIDE DUCT  
 TEMP. SENSOR CIRCUIT OPEN OR SHORTED TO POWER**

1) If DTC 1-3-2 and 1-3-4 are both present, check for open circuit in duct temperature sensor common ground (Brown wire). If DTC 1-3-2 and 1-3-4 are not both present, there is an open or short circuit in wiring between ECC control module and duct temperature sensor. Go to next step.

2) Ensure ignition is off. Connect test unit between ECC control module and A/C system connector. Check ground circuit and repair as necessary. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

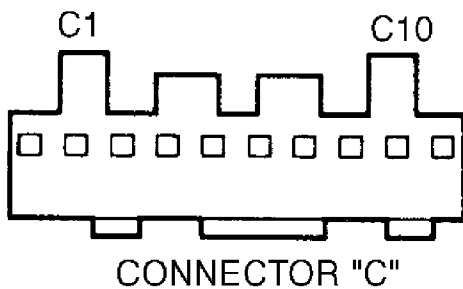
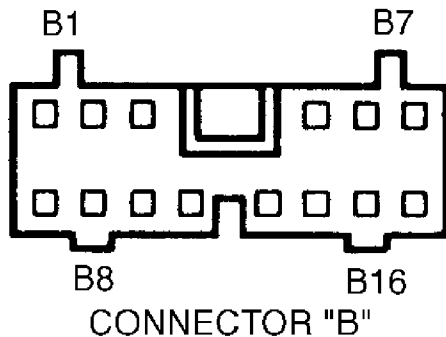
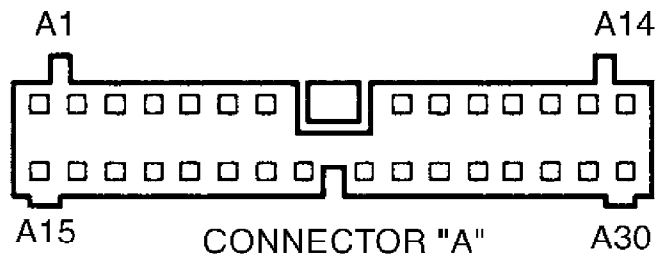
3) Turn ignition on. Check driver's side duct temperature sensor wiring by checking voltage between test unit pins No. 56 and 47. Check passenger's side duct temperature sensor wiring by checking voltage between test unit pins No. 56 and 48. Voltage will vary with duct temperature, but generally should be in 0-3 volt range.

4) If voltmeter indicates 5 volts, check duct temperature sensor wiring for an open circuit. Go to next step. If voltmeter indicates 12 volts, check wiring for short to voltage between connector terminal No. 2 (Green or Yellow wire) and ECC control module terminal C1 (driver's side) or C2 (passenger's side). See Figs. 8 and 10.

5) Ensure ignition is off. Disconnect ECC control module, but leave test unit connected to control module connector. Disconnect connector from each duct temperature sensor. Connect jumper wire between duct temperature sensor connector terminals.

6) Check driver's side duct temperature sensor wiring by measuring resistance between test unit pins No. 56 and 47. Check passenger's side duct temperature sensor wiring by measuring resistance between test unit pins No. 56 and 48.

7) If continuity is present, wiring is okay but duct temperature sensor has an open circuit. Replace duct temperature sensor. If continuity is not present, duct temperature sensor is okay but an open circuit is present in wiring. Repair wiring for an open circuit.



94H10550

Fig. 10: Identifying ECC Control Module Terminals  
 Courtesy of Volvo Cars of North America.

DTC 1-3-5 NO ENGINE TEMPERATURE FREQUENCY SIGNAL



1) Run engine and check whether temperature gauge in instrument cluster works. If temperature gauge works, engine temperature signal is reaching instrument panel, but Green/Gray wire between ECC control module terminal A23 and instrument cluster has an open circuit. See Fig. 10.

2) If temperature gauge does not work, temperature sensor wiring may be shorted or engine temperature signal may be absent from engine management system.

3) To check wiring, turn ignition off. Check Green/Gray wire between ECC control module terminal A23 and instrument cluster for a short to ground or voltage. If no fault is found, problem may be in engine management system. See the G - TESTS W/CODES article in the ENGINE PERFORMANCE section.

### **DTC 1-4-1 & 1-4-3 DRIVER'S OR PASSENGER'S SIDE TEMP.**

#### **SWITCH FAULTY CONTROL SIGNAL**

These codes may be caused by an internal fault in ECC control module, temperature switch, or internal wiring. Erase DTCs. Turn ignition off, then on. Test ECC system. See TEST MODE 1 through 4 under TROUBLE SHOOTING. Check if DTCs return. If DTCs return, replace ECC control module. Perform self-adjustment of damper motor limit positions under TEST MODE 4.

### **DTC 1-4-5 AIR DISTRIBUTION SWITCH FAULTY CONTROL SIGNAL**

Code may be caused by an internal fault in ECC control module, air distribution switch, or internal wiring. Erase DTCs. Turn ignition off, then on. Test ECC system. See TEST MODE 1 through 4 under TROUBLE SHOOTING. Check if DTCs return. If DTCs return, replace ECC control module. Perform self-adjustment of damper motor limit positions under TEST MODE 4.

### **DTC 1-5-1 & 1-5-2 FAN SPEED SENSOR CONTROL SIGNAL MISSING,**

#### **SIGNAL TOO HIGH OR SIGNAL SHORTED TO GROUND**

Codes may be caused by an internal fault in ECC control module, fan speed switch, or internal wiring. Erase DTCs. Turn ignition off, then on. Test ECC system. See TEST MODE 1 through 4 under TROUBLE SHOOTING. Check if DTCs return. If DTCs return, replace ECC control module. Perform self-adjustment of damper motor limit positions under TEST MODE 4.

### **DTC 2-1-1, 2-2-1, 2-3-1, 2-3-3 & 2-3-5 DRIVER'S OR**

#### **PASSENGER'S SIDE DAMPER MOTOR POSITION SENSOR CIRCUIT OPEN OR SHORTED TO POWER**

1) Check if DTCs 1-2-2, 1-2-4, 1-2-6, 2-1-1, 2-2-1, 2-3-1, 2-3-3 and 2-3-5 are present. If all DTCs are not present, there is an open or short circuit in a wire between ECC control unit and damper motor which applies to DTC. See AUTOMATIC A/C-HEATER SYSTEM DIAGNOSTIC TROUBLE CODES table, then go to next step. If all DTCs are present, an open circuit is present in common ground at ECC terminals A9 and A10. See Fig. 10.

2) Ensure ignition is off. Connect test unit between ECC control unit and control unit connector. Check ECC grounds. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. Also check power supply to damper motor position sensor. See TEST MODE 2 under TROUBLE SHOOTING. If ECC grounds and power supply to damper motor position sensor are okay, go to next step.

3) Turn ignition on. Connect voltmeter between test unit pins No. 10 and No. 17 (driver's side damper motor), No. 18 (passenger's

side damper motor), No. 20 (ventilation damper motor), No. 19 (floor/defrost damper motor), or No. 21 (recirculation damper motor).

4) If voltmeter indicates 12 volts, check wiring and ECC control unit terminals for a short to voltage. See PIN VOLTAGE TESTS under TESTING. If voltmeter indicates 5 volts, an open circuit is present in wire. Go to next step.

5) Ensure ignition is off. Disconnect ECC control module, but leave test unit connected to ECC connector. Disconnect 6-pin damper motor connector and install a jumper wire between connector terminals No. 1 and 2. See Figs. 11-13. Connect an ohmmeter between test unit pins No. 10 and 8. If ohmmeter indicates continuity, go to next step. If ohmmeter indicates no continuity, check for open circuit in Brown ground wire.

6) Connect jumper wire between damper motor connector terminals No. 2 and 3. Connect ohmmeter between test unit pins to test respective damper motor. See DAMPER MOTOR TEST UNIT PIN NUMBERS (RESISTANCE CHECK) table.

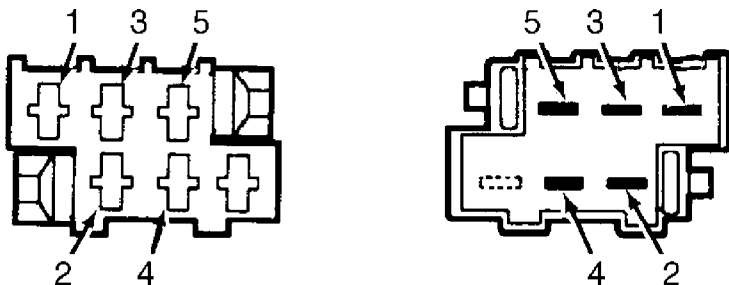
DAMPER MOTOR TEST UNIT PIN NUMBERS (RESISTANCE CHECK)

Pin No.	Damper Motor
8 & 17	Driver's Side
8 & 18	Passenger's Side
8 & 20	Ventilation
8 & 19	Floor/Defrost
8 & 21	Recirculation

7) If ohmmeter indicates continuity, wiring to damper motor terminal No. 3 is okay, but an open circuit is present in damper motor position sensor. Go to next step. If ohmmeter indicates no continuity, damper motor position sensor is okay, but open circuit is present in wire between damper motor connector terminal No. 3 and ECC control module connector "A".

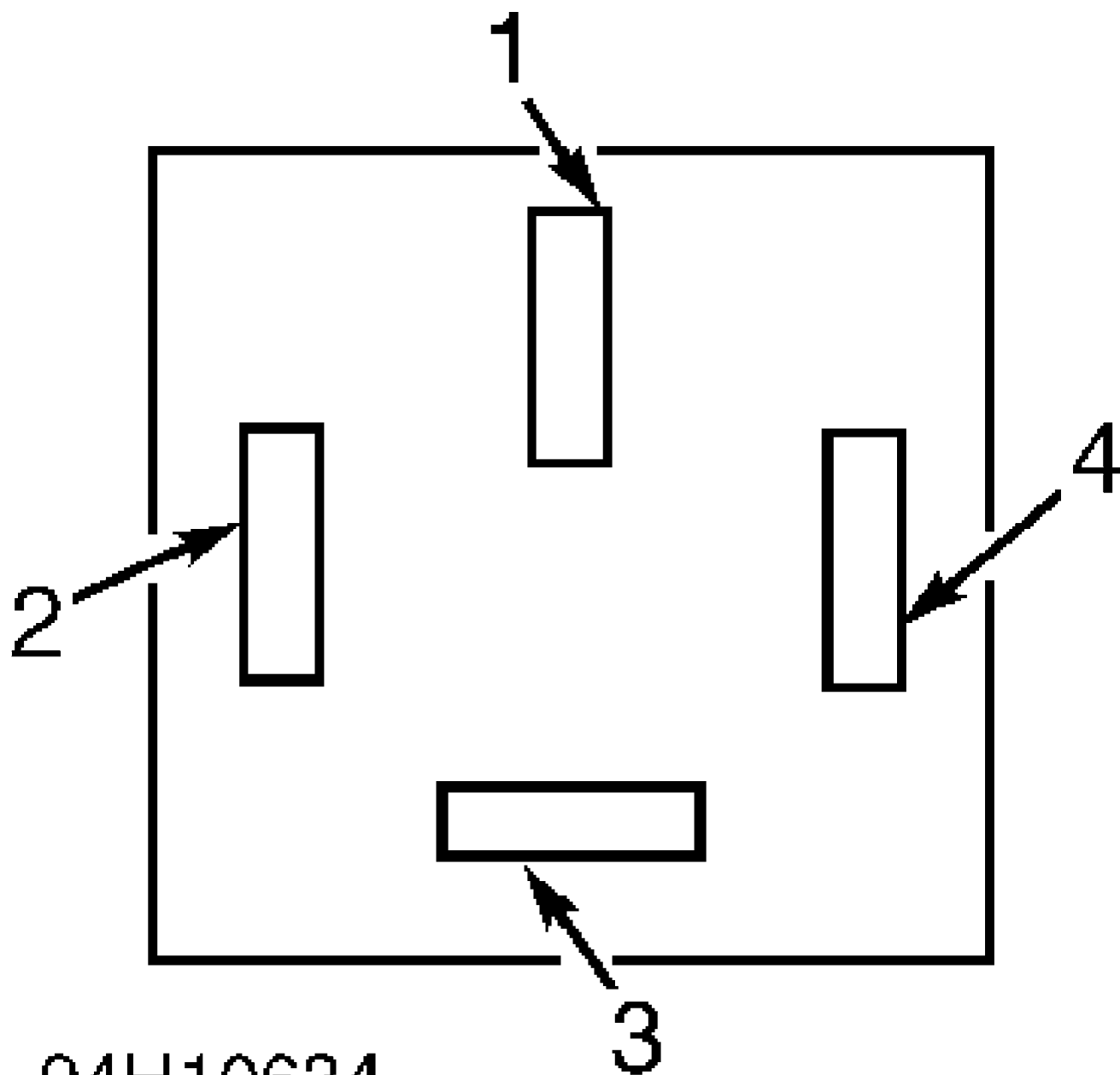
8) Ensure ignition is off. Disconnect damper motor connector. Connect ohmmeter between terminals No. 1 and 3. See Fig. 11. Turn damper motor output shaft. Ohmmeter should vary between 0-12,000 ohms. If resistance is to specification, go to next step. If resistance is not to specification, there is an open circuit in damper motor position sensor.

9) Connect ohmmeter between damper motor terminals No. 2 and 3. Turn damper motor output shaft. Ohmmeter should vary between 0-12,000 ohms. See Fig. 11. If ohmmeter indicates no continuity, there is an open circuit in damper motor position sensor. Replace damper motor.



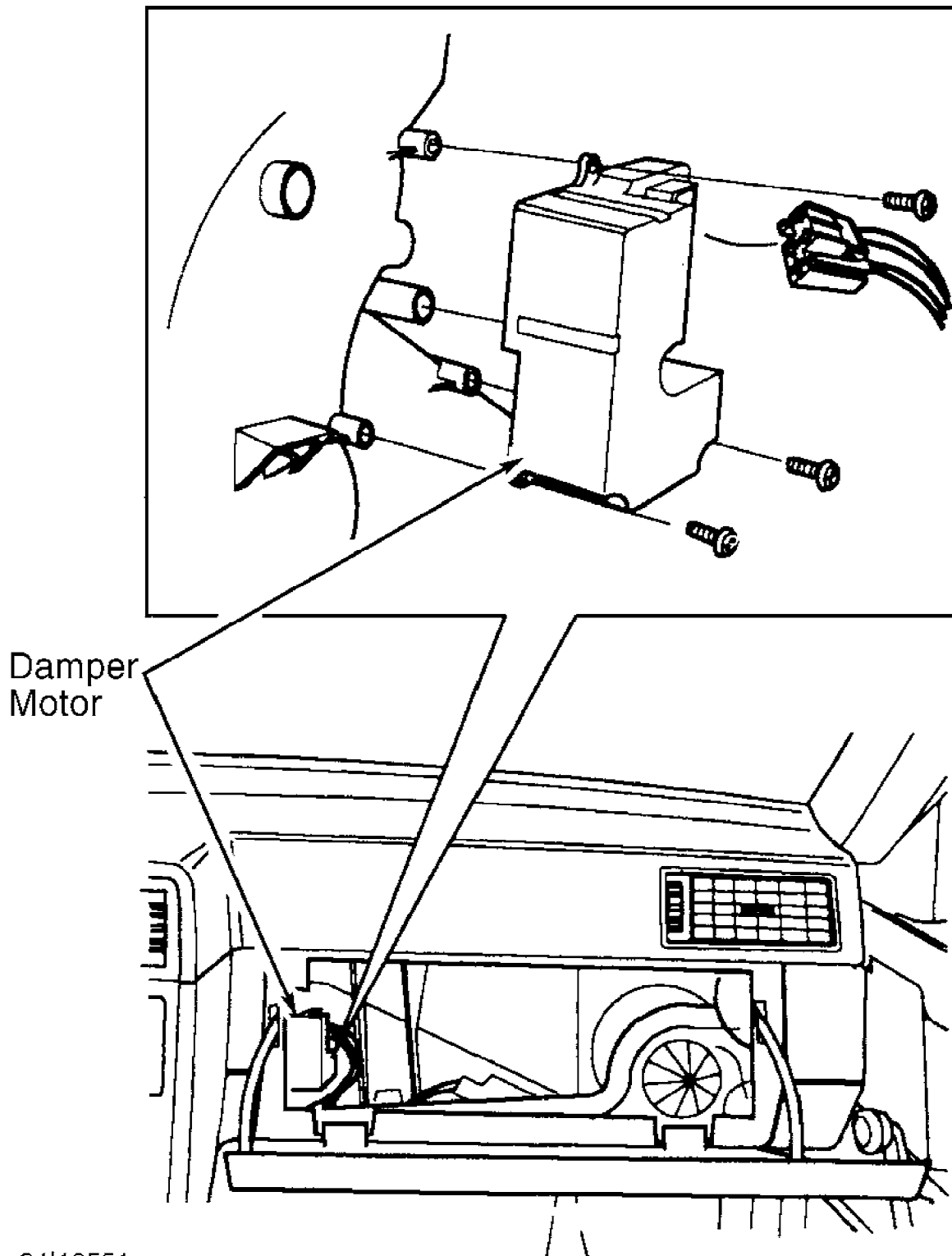
94D10630

Fig. 11: Identifying Damper Motor Connector & Component Terminals  
 Courtesy of Volvo Cars of North America.



94H10634

Fig. 12: Identifying A/C Relay Connector Terminals  
Courtesy of Volvo Cars of North America.



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Fig. 13: Removing Damper Motor  
Courtesy of Volvo Cars of North America.

DTC 2-1-2, 2-2-2, 2-3-2, 2-3-4 & 2-3-6 DRIVER'S OR  
PASSENGER'S SIDE DAMPER MOTOR POSITION SENSOR

## SHORTED TO GROUND

1) Check if DTCs 2-1-2, 2-2-2, 2-3-2, 2-3-4, and 2-3-6 are all present together. If all DTCs are not present, there is a short circuit in ground wire between ECC control unit and damper motor which applies to DTC. See AUTOMATIC A/C-HEATER SYSTEM DIAGNOSTIC TROUBLE CODES table, then go to next step. If all DTCs are present, an open circuit is present in common voltage circuit at ECC terminal A8. See Fig. 10.

2) Ensure ignition is off. Connect test unit between ECC control module and control unit connector. Check ECC grounds. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. Also check power supply to damper motor position sensor. See TEST MODE 2 under TROUBLE SHOOTING. If ECC grounds and power supply to damper motor position sensor are okay, go to next step.

3) Turn ignition off. Disconnect ECC control module, but leave test unit connected to ECC control module connector. Disconnect 6-pin damper motor connector. See Figs. 11-13. Connect ohmmeter between test unit pin No. 10 and pin indicated in DAMPER MOTOR TEST UNIT PIN NUMBERS (RESISTANCE CHECK) table.

### DAMPER MOTOR TEST UNIT PIN NUMBERS (RESISTANCE CHECK)

Pin No.	Damper Motor
10 & 17	Driver's Side
10 & 18	Passenger's Side
10 & 20	Ventilation
10 & 19	Floor/Defrost
10 & 21	Recirculation

4) If ohmmeter indicates continuity, short circuit is present in wiring at terminal No. 3. If ohmmeter indicates no continuity, wiring is okay. Go to next step.

5) Ensure ignition is off. Disconnect damper motor connector. Connect ohmmeter between damper motor terminals No. 1 and 3. See Fig. 11. Turn damper motor output shaft. Ohmmeter reading should vary between 0-12,000 ohms.

6) If resistance is to specification, check voltage supply circuit between motor connector terminal No. 2 and ECC control module terminal A8. If resistance is a constant zero ohms, a short is present in damper motor position sensor. Replace damper motor.

### DTC 3-1-1, 3-1-2, 3-1-3, 3-1-4 & 3-1-5 DAMPER MOTOR SHORTED TO GROUND OR POWER

1) Turn ignition off. Connect test unit between ECC control module and ECC control module connector. Check system ground circuits. See DTC 1-2-1, OUTSIDE TEMP SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

2) Turn ignition on. Connect one voltmeter lead to test unit pin No. 10 and other lead to test unit pin No. 31 (driver's damper motor), No. 33 (passenger's side damper motor), No. 37 (ventilation damper motor), No. 35 (floor/defrost damper motor), or No. 39 (recirculation damper motor). Voltmeter should vary from 0-4 volts.

3) If voltmeter indicates zero volts, wire is shorted to ground. If voltmeter indicates battery voltage, wire is shorted to voltage. Turn ignition off. Disconnect suspect damper motor connector. Check wiring between motor connector and ECC control module.

### DTC 3-2-1, 3-2-2, 3-2-3, 3-2-4 & 3-2-5 DAMPER MOTOR ACTIVE TOO LONG

1) Check if DTCs 3-2-1, 3-2-2, 3-2-3, 3-2-4, and 3-2-5 are also present. If all DTCs are present, vehicle may be equipped with an ECC control module for a right-hand-drive vehicle, or vice versa. Check ECC terminal A28. See Fig. 10. ECC control module for left-hand-drive vehicles should not have terminal A28 grounded.

2) If terminal is okay, perform self-adjustment of damper motor limit positions under TEST MODE 4. If motor limit positions are adjusted correctly, check ECC system ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits check okay, go to next step.

3) Ensure test unit is connected to ECC control module. Turn ignition on. Connect one voltmeter lead to test unit pin No. 10 and other lead to test unit pin No. 31 (driver's side damper motor), No. 33 (passenger's side damper motor), No. 37 (ventilation damper motor), No. 35 (floor/defrost damper motor), or No. 39 (recirculation damper motor).

4) Rotate air circulation knob to and from different settings while observing voltmeter. Voltmeter should show control voltage of about 0-12 volts while damper is moving to its new setting. If voltmeter shows about 0-12 volts for longer than about 12 seconds, check if damper is stuck in position. Replace damper if not stuck.

#### **DTC 4-1-1 PASSENGER COMPARTMENT FAN OVERCURRENT OR SEIZED FAN**

1) Turn ignition off. Disconnect passenger compartment (blower) fan electrical connector. Check if fan turns freely by hand. If fan does not turn freely, replace fan. Check fan location for anything that could cause blockage and clear as necessary.

2) If fan is okay, erase DTC. If DTC returns, there may be a fault in power stage surge protector. See DTC 4-1-9, ECC POWER STAGE EMITTING FAULTY DIAGNOSTIC SIGNAL.

#### **DTC 4-1-2 & 4-1-5 DRIVER'S OR PASSENGER'S SIDE TEMP.**

SENSOR INTAKE FAN SHORTED TO GROUND

1) Ensure ignition is off. Connect test unit to ECC control module. Check ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, turn ignition off. Disconnect test unit from ECC control module, but leave it connected to ECC control module connector. Disconnect passenger compartment temperature sensor connector.

2) Check driver's side fan by connecting an ohmmeter between test unit pins No. 6 and 45. Check passenger's side fan by connecting an ohmmeter between test unit pins No. 6 and 46. If ohmmeter indicates continuity, wiring is shorted to ground or voltage. If ohmmeter indicates no continuity, wiring is okay.

3) Ensure ignition is off. Disconnect passenger compartment temperature sensor connector. Connect an ohmmeter between passenger compartment temperature sensor connector terminals No. 2 and 4. See Fig. 6. Ohmmeter should indicate about 50,000 ohms. If ohmmeter indicates continuity, intake fan is shorted. Replace fan and temperature sensor.

#### **DTC 4-1-3 & 4-1-6 DRIVER'S OR PASSENGER'S SIDE TEMP.**

SENSOR INTAKE FAN, NO CONTROL VOLTAGE

1) Ensure ignition is off. Connect test unit to ECC control module. Check ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

2) Ensure ignition is off. Disconnect test unit from ECC control module, but leave it connected to ECC control module

connector. Disconnect passenger compartment temperature sensor connector. Connect jumper wire between temperature sensor connector terminals No. 2 and 4.

3) Connect an ohmmeter between test unit pins No. 6 and 45 (driver's side), and between test unit pins No. 6 and 46 (passenger's side). If ohmmeter indicates continuity, wiring is okay but intake fan may have an open circuit. Go to next step. If ohmmeter indicates no continuity, intake fan is okay but wiring has an open circuit. Repair wiring as necessary.

4) Ensure ignition is off. Ensure connector from passenger compartment temperature sensor is disconnected. Connect an ohmmeter between temperature sensor terminals No. 2 and 4. See Fig. 6. Ohmmeter should indicate 50,000 ohms. If ohmmeter indicates no continuity, intake fan has an open circuit. Replace passenger compartment temperature sensor.

#### DTC 4-1-4 & 4-1-7 DRIVER'S OR PASSENGER'S SIDE TEMP. SENSOR INTAKE FAN SEIZED

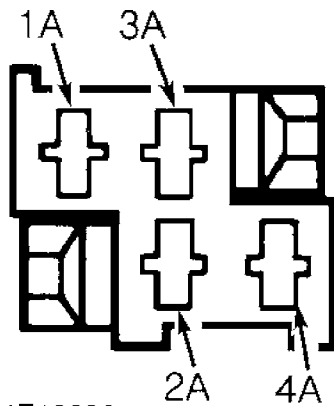
Turn ignition off. Uncover passenger compartment temperature sensor. Check if fan turns freely by hand. If fan does not turn freely, replace fan. Check fan for anything that could cause blockage and clear as necessary. If fan is okay, replace passenger compartment temperature sensor.

#### DTC 4-1-8 NO CONTROL SIGNAL TO ECC POWER STAGE

1) Ensure ignition is off. Connect test unit to ECC control module. Check ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

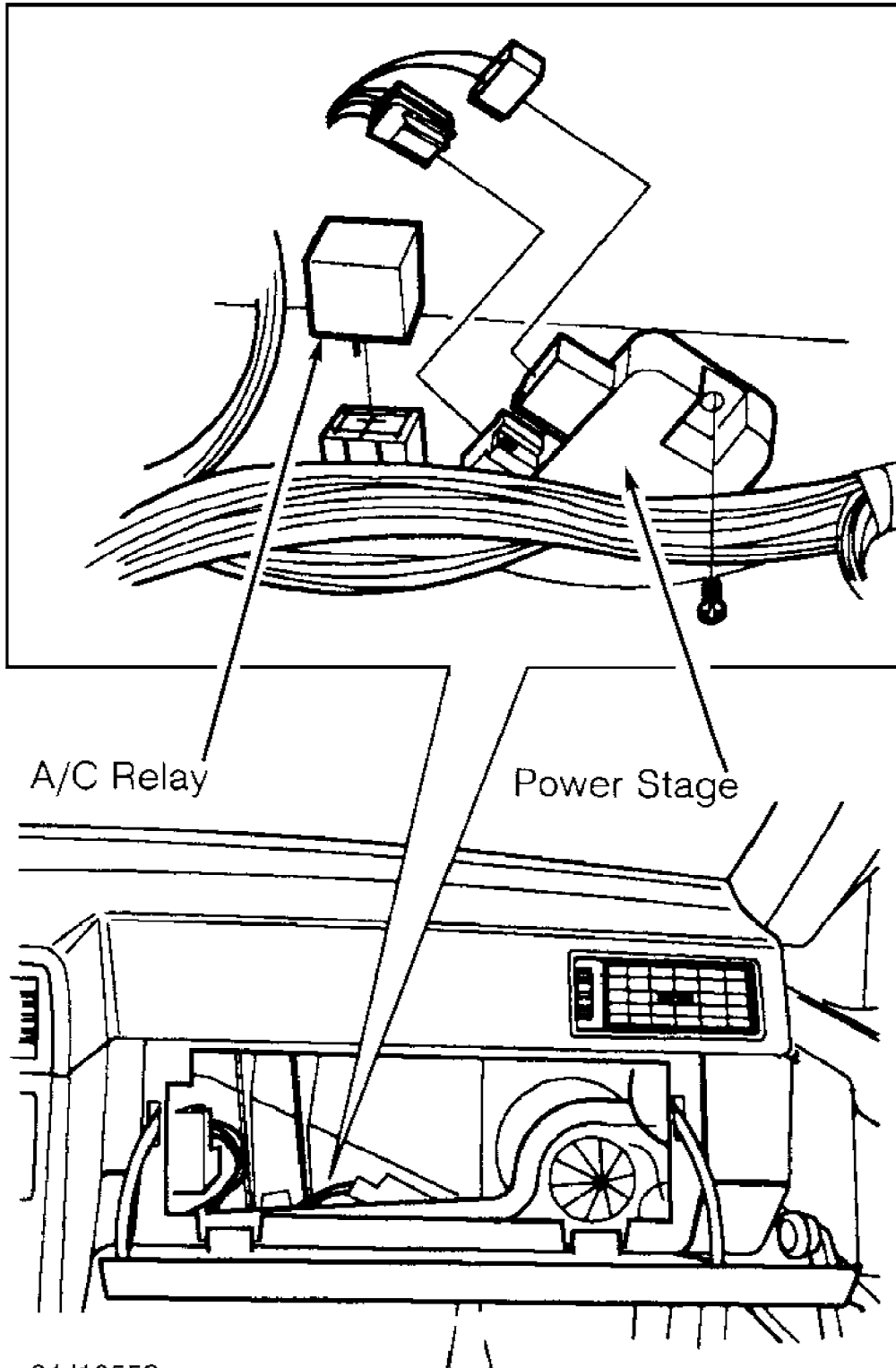
2) Turn ignition on. Place fan control lever to maximum speed. Connect voltmeter between test unit pins No. 6 and 42. If 6-8 volts are present, go to next step. If voltmeter indicates zero volts, wiring is shorted to ground. If voltmeter indicates 12 volts, wiring is shorted to voltage. Repair wiring as necessary.

3) Ensure ignition is off. Disconnect power stage 4-pin connector. See Figs. 14 and 15. Connect an ohmmeter between test unit pin No. 42 and power stage connector terminal 1A. Ohmmeter should indicate continuity. If no continuity is present, check wiring for an open circuit.



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Fig. 14: Identifying Power Stage Connector Terminals  
Courtesy of Volvo Cars of North America.



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Fig. 15: Locating Power Stage & A/C Relay  
Courtesy of Volvo Cars of North America.

DTC 4-1-9 ECC POWER STAGE EMITTING FAULTY DIAGNOSTIC SIGNAL



1) Ensure ignition is off. Connect test unit to ECC control module. Check ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

2) Turn ignition on. Connect voltmeter between test unit pins No. 6 and 27. Voltmeter should indicate 3 volts. If voltmeter indicates one volt, there is no control signal to power stage. See DTC 4-1-8, NO CONTROL SIGNAL TO ECC POWER STAGE. If voltmeter indicates 4 volts, there is excessive voltage from power stage. See DTC 4-1-1, PASSENGER COMPARTMENT FAN OVERCURRENT OR SEIZED FAN.

3) If voltmeter indicates 12 volts, check wire at ECC control module terminal A27 (Violet/White wire) for a short to voltage. See Fig. 10. If voltmeter indicates zero volts, wire has an open circuit or is shorted to ground. Go to next step.

4) Ensure ignition is off. Disconnect power stage 4-pin connector. See Figs. 14 and 15. Check Violet/White wire between power stage connector terminal 2A and ECC control module terminal A27 for a short to ground or open circuit. If wire is okay, go to next step.

5) Reconnect power stage 4-pin connector. Turn ignition on. Connect voltmeter between test unit pins No. 6 and 5. If battery voltage is present, go to next step. If zero volts are present, wire is shorted to ground.

6) Ensure ignition is off. Disconnect power stage 4-pin connector. Connect ohmmeter between test unit pin No. 5 and power stage connector terminal 3A. If ohmmeter indicates continuity, replace power stage. If ohmmeter indicates no continuity, check wiring for an open circuit and repair as necessary.

## DTC 4-2-0 ECC CONTROL MODULE FAULT, PROGRAM MEMORY

Erase DTC. Start and run engine. Turn engine off, leaving ignition on. Check if DTC returns. If DTC returns, replace ECC control module. Perform damper motor limit self-adjustment under TEST MODE 4.

## DTC 5-1-1 SELF-ADJUSTMENT OF DAMPER MOTOR

LIMIT POSITIONS NOT CARRIED OUT

Erase DTC. ECC control module is programmed to carry out self-adjustment of damper motor limit positions. Drive vehicle over 20 MPH for a few minutes. ECC control module will carry out self-adjustment while driving. Stop vehicle and leave ignition on at least 2 minutes to enable ECC control module to store all values.

## TESTING

**WARNING:** To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

## A/C SYSTEM PERFORMANCE

1) Ensure compressor drive belt is okay, fan motor runs at all speeds, and that temperature vents shut completely with temperature switch in full cooling position.

2) Ensure that all air comes from panel vents with mode control on vent position, recirculation motor is working, and condenser fan and cooling fan are working.

3) Start and warm engine to normal operating temperature. Ensure compressor clutch engages when A/C is turned on. Set temperature switch to full cold position, place mode control to vent position, turn on recirculate air switch and blower fan switch high

speed.

4) Close engine hood, doors and windows. Run engine at 1500-1600 RPM. Place thermometer in one of the center panel vents. Allow system to stabilize for at least 8 minutes. Check temperature in center panel vent. See A/C SYSTEM PERFORMANCE SPECIFICATIONS table.

A/C SYSTEM PERFORMANCE SPECIFICATIONS (1)

Ambient Temp. °F (°C)	Outlet Air Temp. °F (°C)
68 (20)	41-48 (5-8)
86 (30)	41-48 (5-8)
104 (40)	46-54 (8-12)

(1) - Based on a relative humidity of 40-60%.

**A/C RELAY CHECK**

Remove relay. Connect battery positive lead to relay terminal No. 1 and negative lead to relay terminal No. 3. Continuity should be present between relay terminals No. 2 and 4. See Figs. 12 and 15. If continuity is not present, replace relay.

**ON-BOARD DIAGNOSTIC UNIT CHECK**

1) Turn ignition on. Press button on diagnostic unit "A". See Fig. 2. LED should illuminate. If LED does not illuminate, go to next step. If LED illuminates, but no code(s) is present, go to step 4).

2) Turn ignition off. Remove connector from underside of diagnostic unit "A". Connect voltmeter between terminal No. 4 of diagnostic unit "A" and ground. Turn ignition on. Battery voltage should be present. If battery voltage is present, go to next step. If battery voltage is not present, check for blown fuse No. 33 or for open circuit between fuse block and terminal No. 4.

3) Turn ignition off. Connect ohmmeter between terminal No. 8 of diagnostic unit "A" and ground. Continuity should exist. If continuity exists, replace diagnostic unit and retest. If continuity does not exist, check ground connection.

4) Turn ignition off. Disconnect selector cable from diagnostic unit "B". Turn ignition on. Connect voltmeter between terminal No. 1 of diagnostic unit "B" and ground. Voltage should be about 10 volts. If voltage is as specified, replace diagnostic unit. If voltage is not as specified, check for open or shorted circuit between ECC control module and terminal No. 1 of diagnostic unit "B".

**PIN VOLTAGE TESTS**

NOTE: Perform all voltage tests using Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance.

Pin voltage chart is supplied to reduce diagnostic time. Checking pin voltage at ECC control module determines whether it is receiving or transmitting proper voltage signals. Charts may also help determine if control unit wiring harness has short or open circuit.

ECC CONTROL MODULE PIN ASSIGNMENTS CONNECTOR "A"

(1) Pin No.	Function/Description	Voltage Value
1	Power Supply To ECC Control Module	Battery Voltage

2	Digital Timer (Parking Heater)	12 Volts (On); 0 Volts (Off)
3	Rheostat	12 Volts (On); 0 Volts (Off)
5	Power Supply To Power Stage	Battery Voltage
6	Power Ground	0 Volts
8	Damper Motor Position Sensors	5 Volts
9	Signal Ground	0 Volts
10	Signal Ground	0 Volts
12	Driver's Side Temp. Sensor	About 2.5 Volts At Room Temperature
13	Passenger's Side Temp. Sensor	About 2.5 Volts At Room Temperature
14	Outside Temperature Sensor	About 2.5 Volts At Room Temperature
17	Driver's Side Damper Motor Position Sensor	About 0.5-5.0 Volts
18	Passenger's Side Damper Motor Position Sensor	About 0.5-5.0 Volts
19	Floor/Defrost Damper Motor Position Sensor	About 0.5-5.0 Volts
20	Ventilation Damper Motor Position Sensor	About 0.5-5.0 Volts
21	Recirculation Damper Motor Position Sensor	About 0.5-5.0 Volts
23	Engine Coolant Temperature	5 Volts (Square Wave) Variable Frequency
24	Vehicle Speed Signal	12 Volts (Square Wave) Variable Frequency
25	A/C Relay Control Signal (From Ignition System)	0-2 Volts (On); About 12 Volts (Off)
27	Diagnostic Signal From Power Stage	3 Volts (Normal); 4 Volts (Overcurrent); 1 Volt (No Signal)
28	Logic Signal	Open (Left); 0 Volts (Right)

30	Signal To/From Diagnostic Unit	Battery Voltage
(1) - Pin assignments not listed are not used.		

ECC CONTROL MODULE PIN ASSIGNMENTS CONNECTOR "B"

(1) Pin No.	Function/Description	Voltage Value
31	Driver's Side Damper Motor Positive Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
32	Driver's Side Damper Motor Negative Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
33	Passenger Side Damper Motor Positive Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
34	Passenger Side Damper Motor Negative Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
35	Floor/Defrost Damper Motor Positive Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
36	Floor/Defrost Damper Motor Negative Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
37	Ventilation Damper Motor Positive Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
38	Ventilation Damper Motor Negative Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
39	Recirculation Damper Motor Positive Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
40	Recirculation Damper Motor Negative Control Signal	About 0.4 Volts (Off), Zero Volts Or Battery Voltage (On With Control)
41	Control Signal To A/C Relay	About 0 Volts Or Battery Voltage
42	Control Signal To Power Stage	12 Volts (Square Wave) Constant Frequency With Varying Duty Cycle
45	Driver's Side Passenger Compartment	0 Volts Or Battery Voltage Temp. Sensor Intake Fan Control Signal
46	Passenger's Side Passenger Compartment	0 Volts Or Battery Voltage Temp. Sensor Intake Fan Control Signal

(1) - Pin assignments not listed are not used.

ECC CONTROL MODULE PIN ASSIGNMENTS CONNECTOR "C"

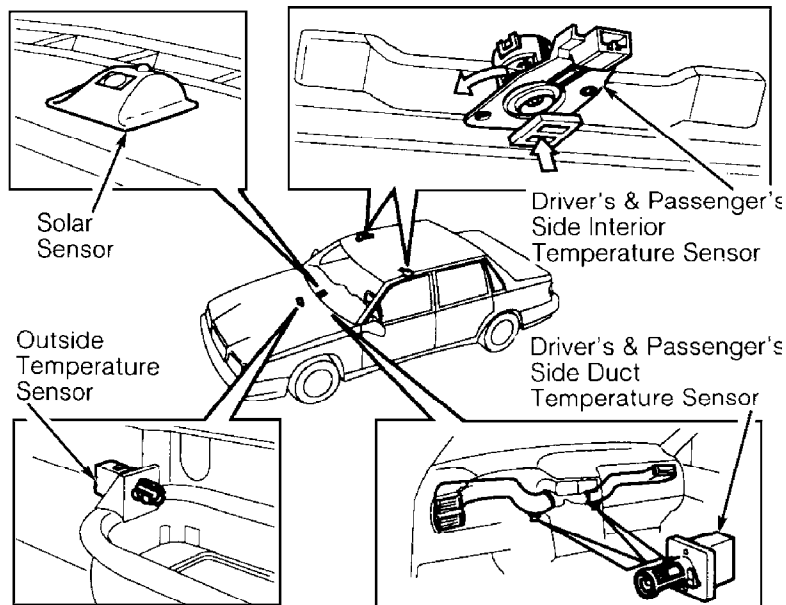
(1) Pin No.	Function/Description	Voltage Value
47	Driver's Side Duct Temp. Sensor Signal	About 2.5 Volts At Room Temperature
48	Passenger's Side Duct Temp. Sensor Signal	About 2.5 Volts At Room Temperature
51	Signal From Solar Sensor	2-40 Millivolts
56	Signal Ground	0 Volts

(1) - Pin assignments not listed are not used.

SOLAR SENSOR

1) Connect test unit to ECC control module. Check ground circuits. See DTC 1-2-1, OUTSIDE TEMP. SENSOR CIRCUIT SHORTED TO GROUND. If ground circuits are okay, go to next step.

2) Turn ignition on. Aim a light source at solar sensor. Connect voltmeter between test unit pins No. 51 and 56 and record voltage. Cover solar sensor and read voltage again. See Fig. 16. Voltage should vary by a few millivolts. The higher the intensity, the lower the voltage. If sensor does not operate as specified, there is an open circuit or short to ground in wire or solar sensor.



94A10553

Fig. 16: Locating ECC System Sensors  
 Courtesy of Volvo Cars of North America.

SPEEDOMETER SIGNAL

1) Raise and support front of vehicle. Perform TEST MODE 2 under TROUBLE SHOOTING. ECC control module should respond to vehicle speed signal with Code 1-1-3. ECC control module will continue to flash code even once TEST MODE 2 is activated. If Code 1-1-3 does not appear, turn ignition off. Cover solar sensor. Turn ignition on. Start TEST MODE 2. Let car wheels turn freely. Open throttle.

2) If no acknowledgment code appears after several attempts, there may be a problem with vehicle speed signal impulse sensor in ignition system, instrument panel, or wiring.

3) Check if speedometer operates. If speedometer does not operate, a fault may be present in vehicle speed signal impulse sensor, ignition system, instrument cluster, or wiring. If speedometer does operate, check for open circuit in instrument cluster wiring.

## REMOVAL & INSTALLATION

**WARNING:** To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

### A/C RELAY & POWER STAGE

#### Removal & Installation

Turn ignition off. The A/C relay and power stage are located on A/C climate control unit, behind glove compartment. Remove glove compartment. Remove A/C relay. Disconnect connector from power stage. Hold catches in and pull connector straight out from power stage. See Fig. 15. To install, reverse removal procedure.

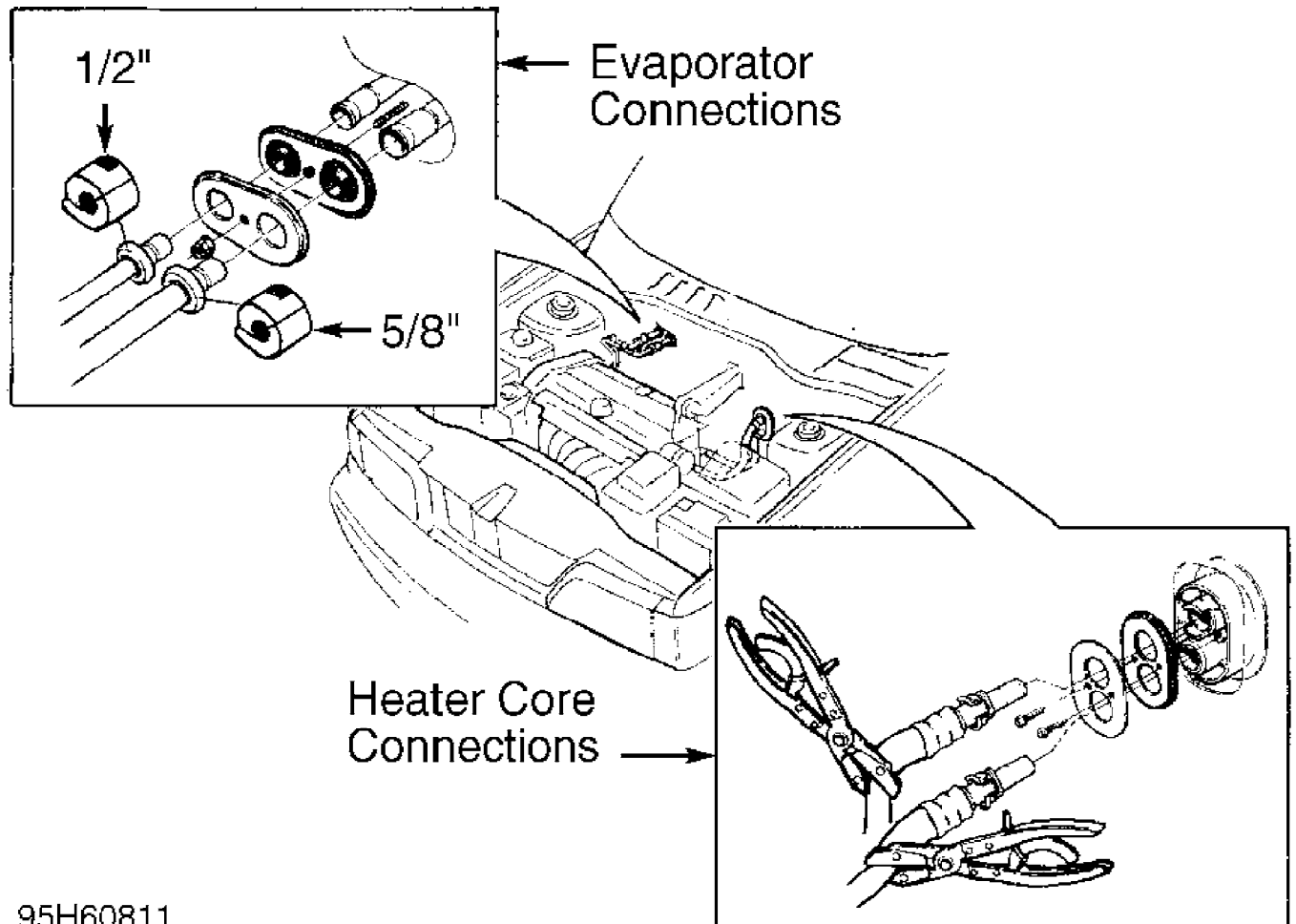
### CLIMATE CONTROL UNIT

#### Removal & Installation

1) Disconnect negative battery cable. Remove dashboard assembly. See DASHBOARD. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect evaporator inlet and outlet pipes, and cap both ends. Remove evaporator cover plate and gasket from firewall. See Fig. 17.

2) Disconnect heater hose quick-disconnect couplings. Remove heater hose cover plate and gasket from firewall. Inside vehicle, disconnect A/C-heater control cables and all electrical connectors from climate control unit. Remove relay shelf. See Fig. 15.

3) Remove tunnel console. Remove kick panels next to tunnel. Remove rear floor ducts connection hose. Remove radio amplifier bracket. Disconnect cruise control vacuum cylinder, if equipped. Remove climate control unit. To install, reverse removal procedure. Lubricate NEW "O" rings with compressor oil. Evacuate and charge system.



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Fig. 17: Identifying Evaporator & Heater Core Connections  
 Courtesy of Volvo Cars of North America.

## COMPRESSOR

### Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove air intake hose and hose connection to fan cover. Remove control box air intake hoses and Electronic Control Units (ECUs) from control box.

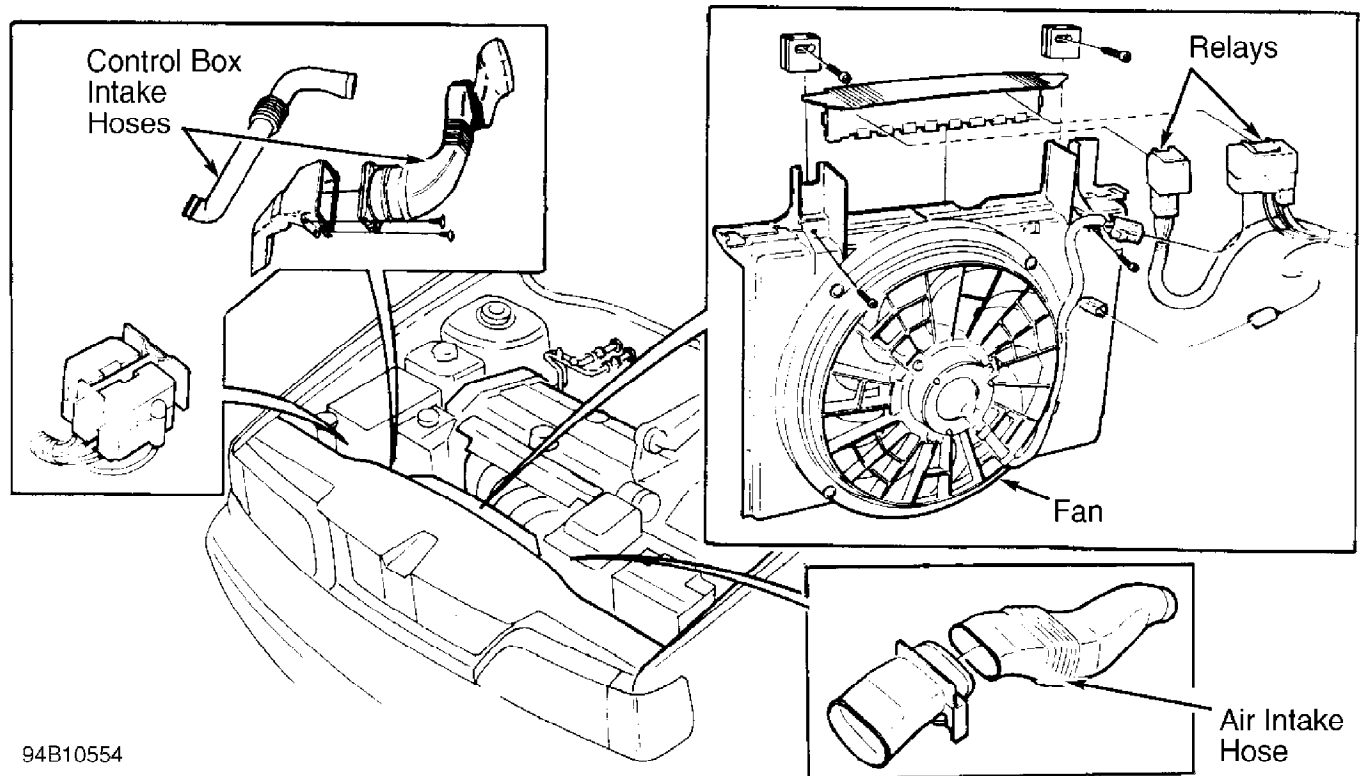
2) Remove control box air intake hoses and disconnect inlet hose connection from fan cover. Remove fan cover. Disconnect relays and cables from fan cover (2 tie straps).

3) Remove 4 screws and fan cover. Remove relay shelf and spacers. Disconnect 2-pin connector from fan relay and connector from fan motor. Remove fan cover. See Fig. 18.

4) Shield radiator. Disconnect harness connectors from compressor. Disconnect snap-on connectors on receiver-drier. Remove right side headlight casing. Remove receiver-drier bracket screw.

5) Remove air guide. With bracket hooked onto side member, lift receiver/drier out. Plug receiver-drier pipe ends. Disconnect drive belt.

6) Disconnect compressor connector and temperature sensor. Remove compressor. To install, reverse removal procedure. Lubricate NEW "O" rings with compressor oil.



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Fig. 18: Removing Cooling Fan Components  
 Courtesy of Volvo Cars of North America.

## CONDENSER

**NOTE:** When replacing condenser, always replace "O" rings and snap-on connections.

### Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect air intake hose. Remove hose connector to fan cover.

2) Remove Electronic Control Units (ECUs) from control unit box. Disconnect control unit box air intake hoses. Remove inlet hose connector to fan cover. Disconnect relays from relay casing. Remove 4 screws to disconnect fan cover, and fold cover back towards engine. Remove relay shelf and spacers. See Fig. 18.

3) Disconnect pipes from condenser. Disconnect high-pressure sensor connector. Remove high pressure sensor. Disconnect condenser screws. Lift condenser out.

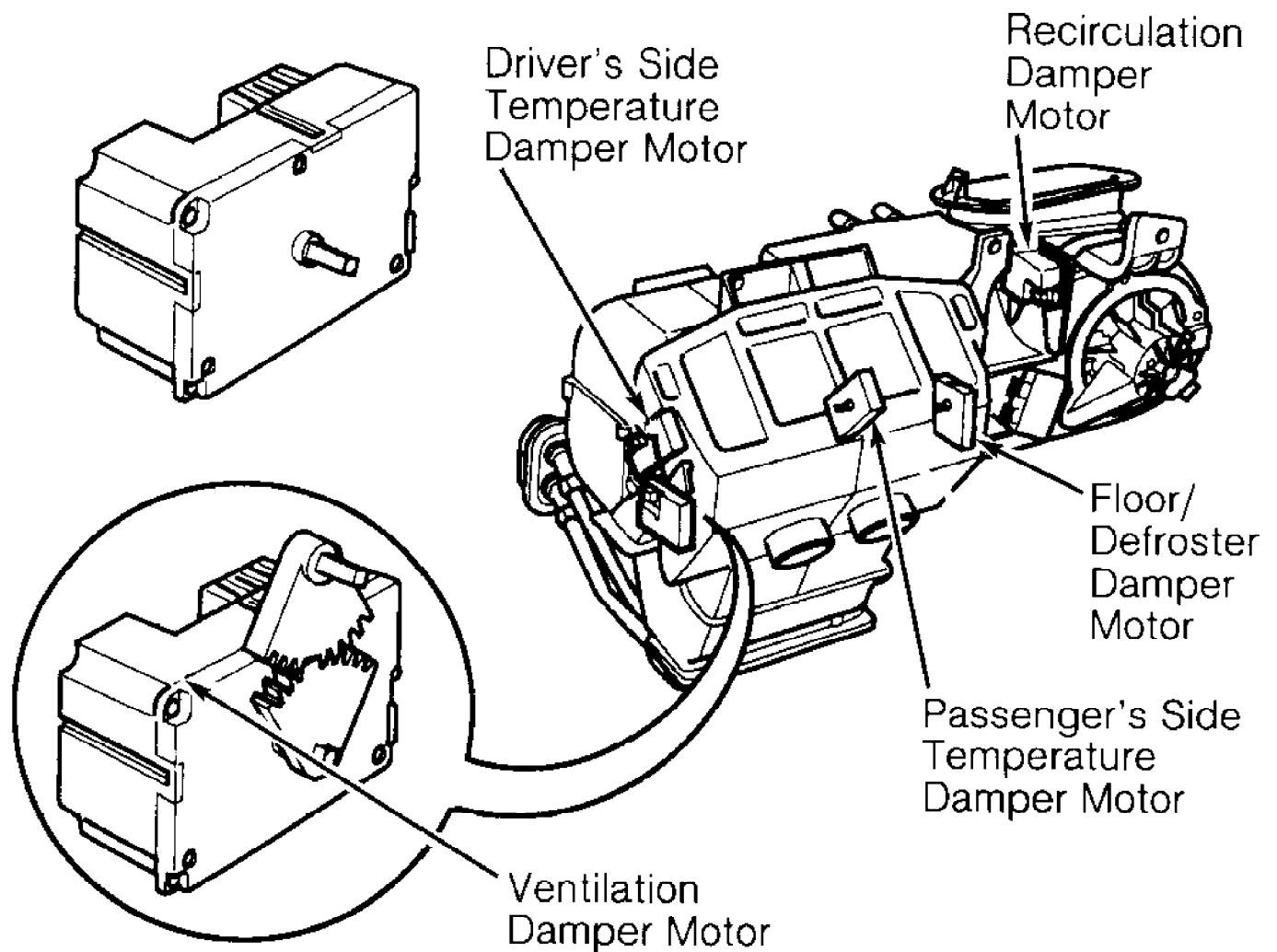
4) To install, reverse removal procedure. Transfer high-pressure sensor and rubber gasket to NEW condenser. Lubricate NEW "O" rings with compressor oil.

## DAMPER MOTOR

### Removal & Installation

Turn ignition off. Remove soundproofing from center console. Remove glove compartment. Disconnect connector from damper motor (located on A/C control unit). Hold catches in on both sides of damper motor and pull motor straight out. See Fig. 19. To install, reverse removal procedure.





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Fig. 19: Removing Damper Motor  
 Courtesy of Volvo Cars of North America.

## DASHBOARD

**NOTE:** Dashboard consists of 5 main sections: upper frame, lower frame (left and right), defroster duct and dashboard cover. Except for dashboard cover, all the main sections are glued together and cannot be separated.

### Removal & Installation

1) Disconnect negative battery cable. Disable air bag system. See AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section. From engine compartment, remove windshield wiper nuts, windshield wiper well cover panel screws and wiper well. Remove wiper motor mountings.

2) From passenger compartment, remove air bag module. Mark steering wheel position relative to steering wheel shaft. Remove steering wheel nuts and steering wheel. Remove steering wheel stalks.

3) Remove steering wheel stalk connector. Remove left and right side sound proofing, side defroster, left and right side speaker covers, and speakers.

4) Remove dashboard mounting screws and glove box. Remove

radio. Reach underneath ECC control module, and push up on locking button to release ECC control module. Remove ECC control module from dashboard. Remove cigarette lighter connector. Lift off dashboard. To install, reverse removal procedure.

## DASHBOARD COVER

**NOTE:** When adjusting air-mix damper, only the dashboard cover needs to be removed.

### Removal & Installation

1) Remove side defroster cover plate screws. Remove dash panel vents by rolling vents down and pulling out. Both vents and air duct on right side must be removed.

2) Remove left and right side speakers. Remove dashboard cover screws and lift off dashboard cover. To install, reverse removal procedure. Ensure hook on right side of dashboard cover plate engages into upper frame section.

## DUCT TEMPERATURE SENSOR

### Removal & Installation

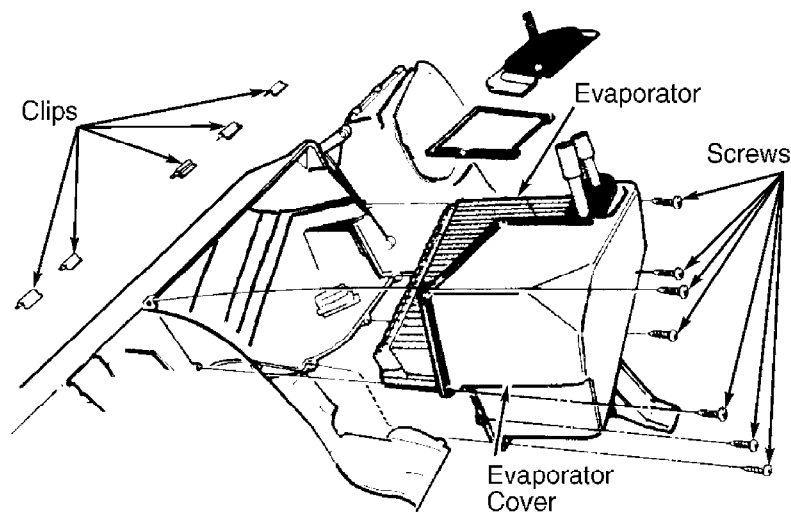
1) Turn ignition off. Remove radio. Reach under ECC control module, push up on locking button, and release ECC control module. Remove ECC control module from dashboard.

2) Remove left and right side sound insulation from center console. Remove glove box. Remove duct temperature sensor connector and pull down on duct temperature sensor. To install, reverse removal procedure.

## EVAPORATOR

### Removal & Installation

Disconnect negative battery cable. Remove dashboard assembly. See DASHBOARD. Remove climate control unit. See CLIMATE CONTROL UNIT. Remove evaporator cover screws and clips. Lift out evaporator. See Fig. 20. To install, reverse removal procedure.



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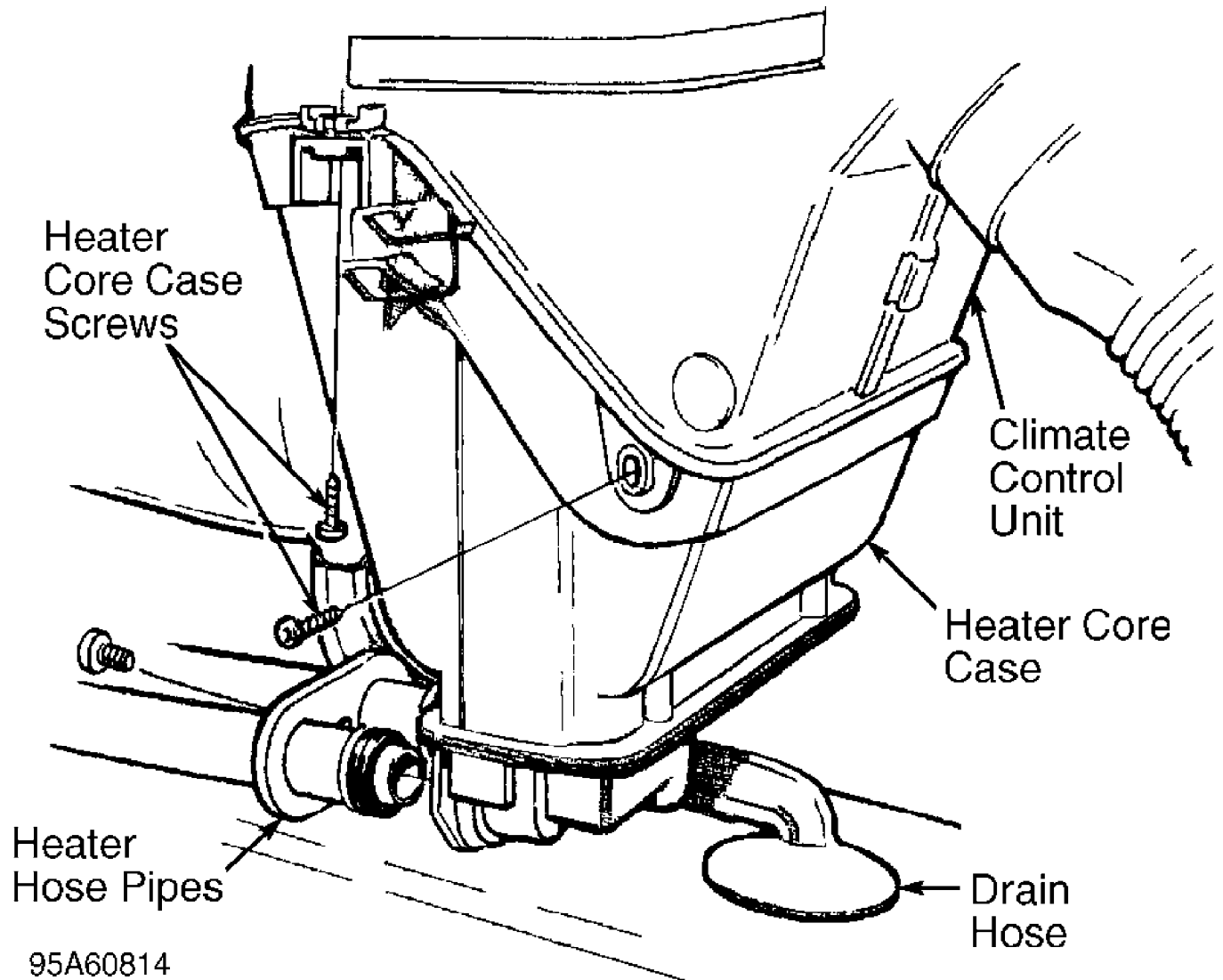
Fig. 20: Removing Evaporator  
Courtesy of Volvo Cars of North America.

## HEATER CORE

#### Removal & Installation

1) Clamp off hoses to heater core in engine compartment at firewall. Remove center console kick panels. Remove underdash trim panels. Remove radio amplifier bracket.

2) Remove drain hose. See Fig. 21. Remove heater core case screws. Disconnect heater hose pipes. Remove heater core and heater core case as an assembly by pulling towards rear of vehicle. Remove heater core from heater core case. To install, reverse removal procedure.



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Fig. 21: Removing Heater Core  
Courtesy of Volvo Cars of North America.

#### RECEIVER-DRIER

##### Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect air intake hose and remove hose connector to fan cover. Remove control unit air intake hoses and Electronic Control Units (ECUs) from control unit box.

2) Remove control unit box air intake hoses and remove inlet

hose connector to fan cover. Remove fan cover. Disconnect relays and wires from fan cover. Remove 4 screws from fan cover and remove relay casing and spacers. Disconnect 2-pin connector from fan relay and connector from fan motor. Remove fan cover. See Fig. 18.

3) Shield radiator. Disconnect suction pipe from compressor. Disconnect snap-on connectors from receiver-drier. Remove right side headlight cover. Remove screw from receiver-drier bracket.

4) Remove air guide. Remove receiver-drier and bracket. With bracket suspended from side member, lift receiver/drier out. Remove receiver-drier from bracket.

5) To install, reverse removal procedure. When replacing receiver-drier, fill NEW receiver-drier with 3 ozs. of NEW oil. Lubricate NEW "O" rings with compressor oil.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Compressor Bracket Bolt .....	30 (40)
Compressor Bracket-To-Compressor .....	30 (40)
Compressor Bracket-To-Frame .....	15 (20)
Compressor Inlet Fitting .....	15 (20)
Compressor Outlet Fitting .....	33 (45)
Compressor Pipe Flange Bolt .....	18 (24)
Condenser Inlet & Outlet .....	15 (20)
Expansion Valve .....	22 (30)
Receiver-Drier Connection .....	22 (30)
	INCH Lbs. (N.m)
High Pressure Sensor Connection .....	7 (10)

## WIRING DIAGRAMS

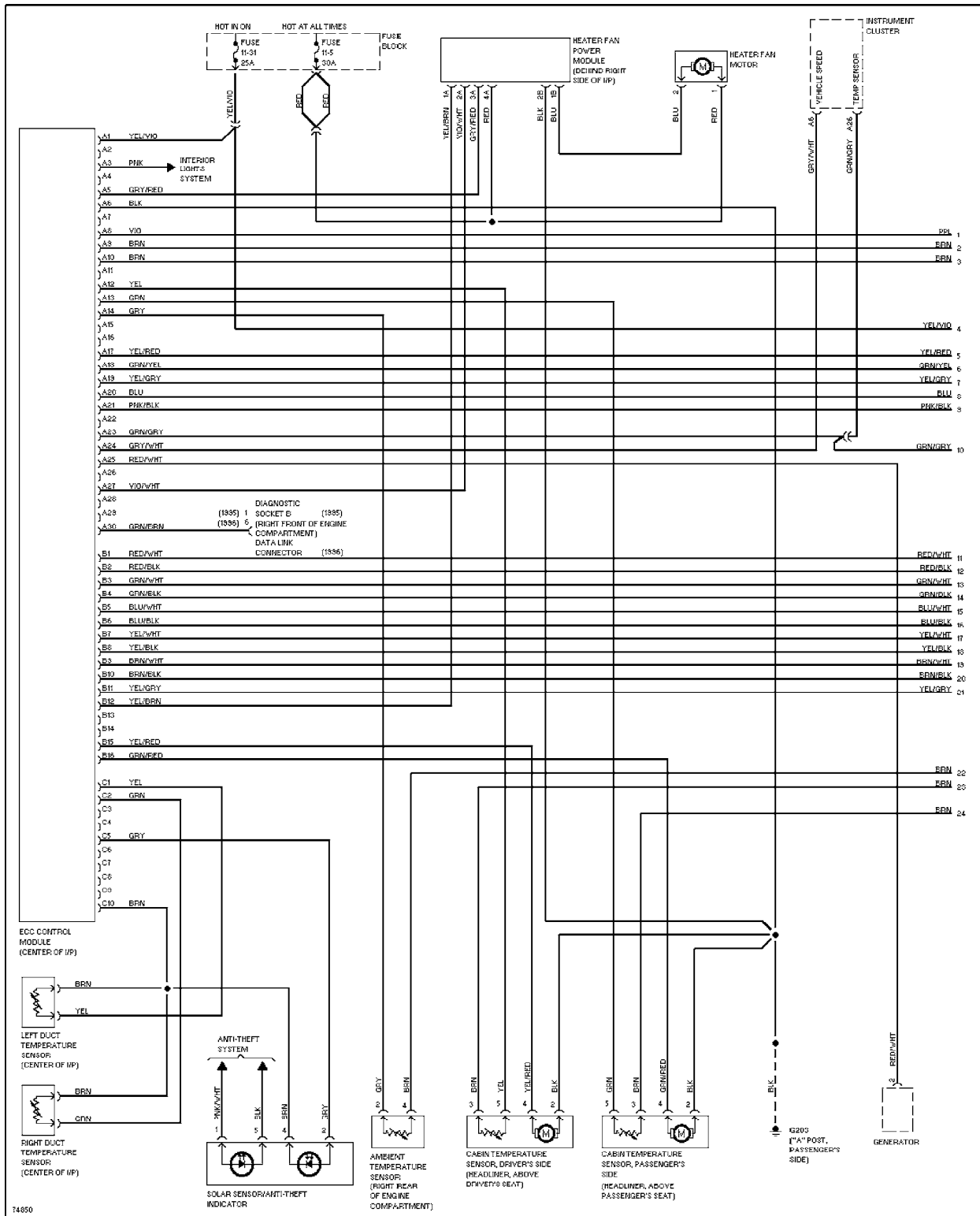


Fig. 22: Wiring Diagram (850 2.3L Turbo - 1 Of 2)

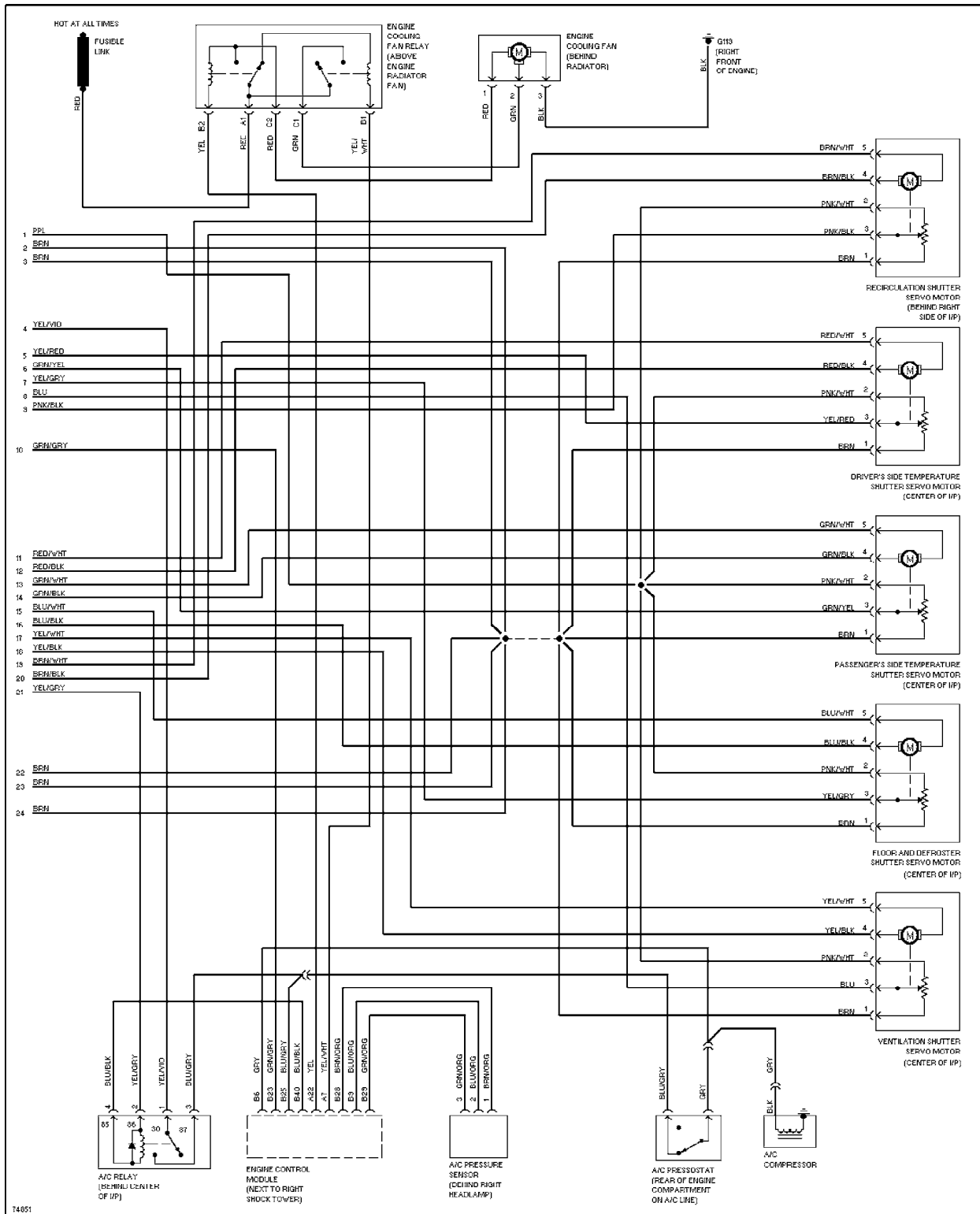


Fig. 23: Wiring Diagram (850 2.3L Turbo - 2 Of 2)

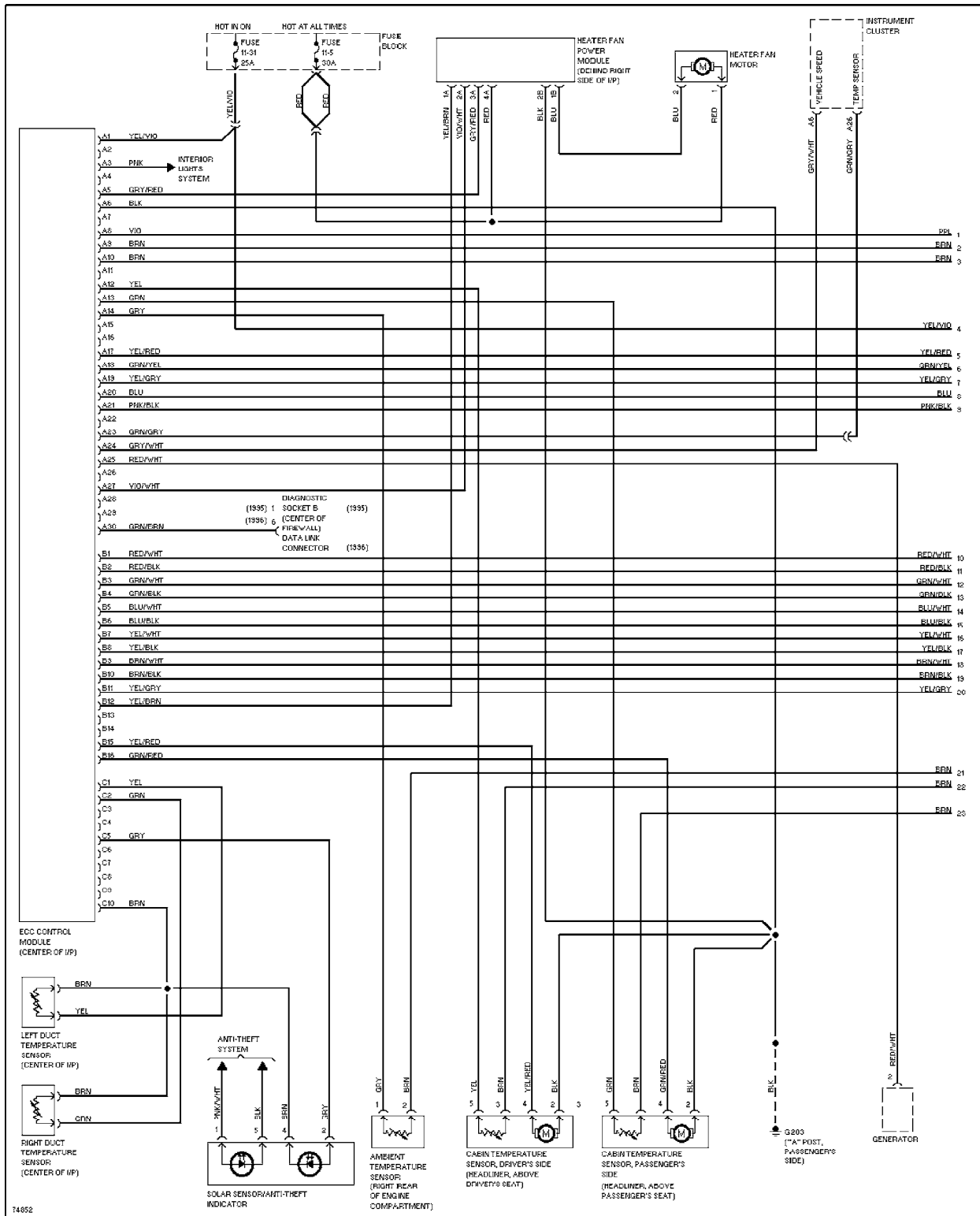


Fig. 24: Wiring Diagram (850 2.4L - 1 Of 2)

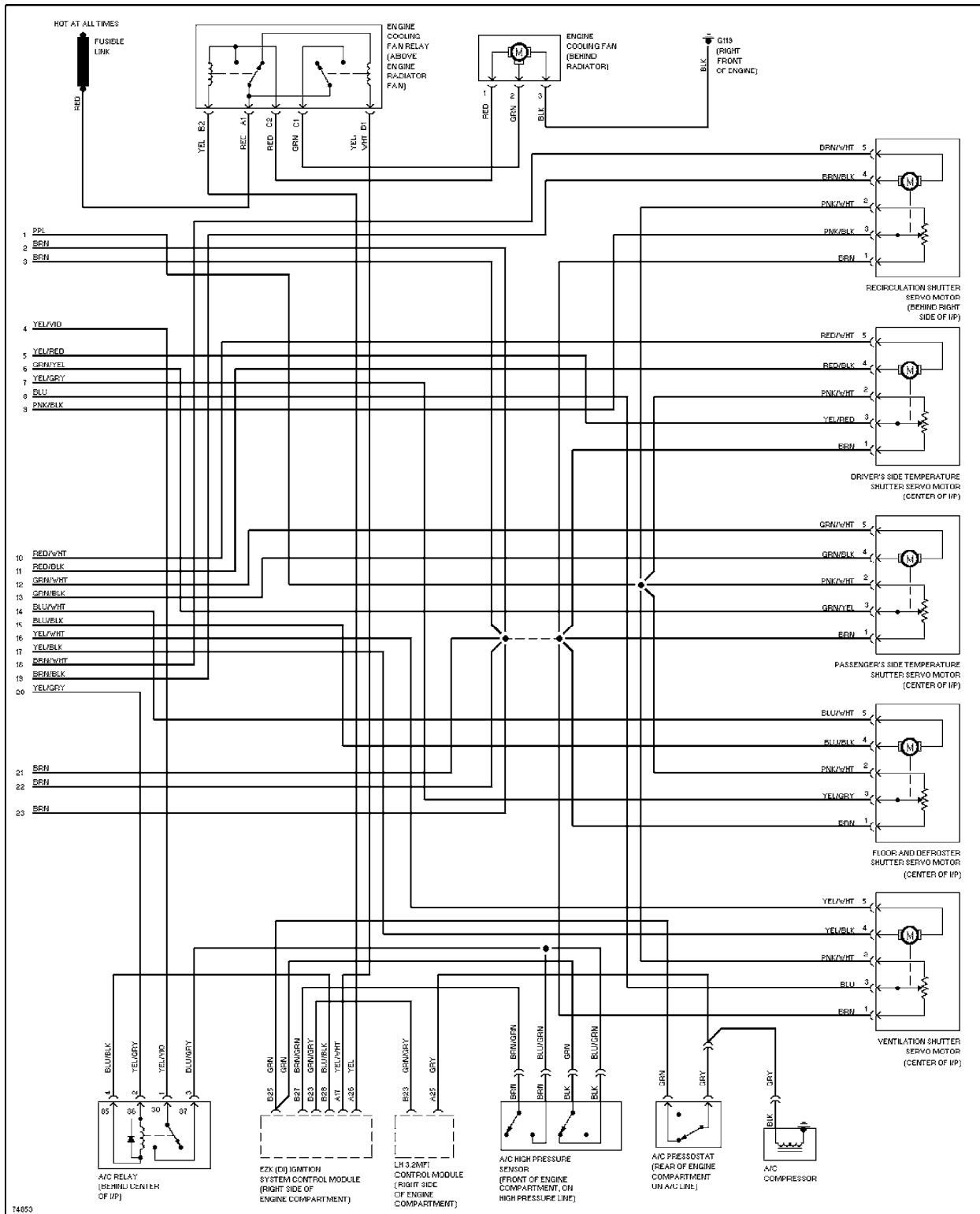


Fig. 25: Wiring Diagram (850 2.4L - 2 Of 2)