A/C-HEATER SYSTEM - AUTOMATIC (CS)

Article Text

1992 Audi 100

For chip

Monday, October 18, 1999 05:38PM

ARTICLE BEGINNING

1992 AUTOMATIC A/C-HEATER SYSTEMS
Audi

100 CS

*** PLEASE READ THIS FIRST ***

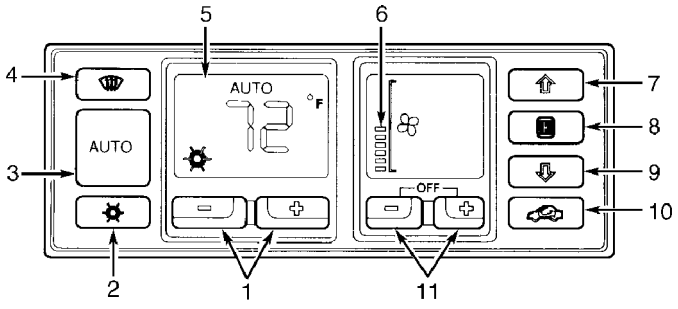
WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAGS article in ACCESSORIES & SAFETY EQUIPMENT.

DESCRIPTION

The A/C-heater control panel has buttons to control system. Blower speed is controlled automatically according to difference between selected temperature and interior temperature. Blower speed can also be controlled manually. The A/C-heater control panel left side display shows selected temperature and automatic functions. See Fig. 1. The right side display indicates manual functions.

The climate control system automatically maintains temperatures from 64øF (18øC) to 85øF (29øC). If a temperature greater than 85øF (29øC) is selected, the word HI appears in temperature display. If a temperature less than 64øF (18øC) is selected, the word LO is displayed. Selection of these temperatures overrides automatic climate control system.

Climate control system has a microprocessor, which is located within the A/C-heater control panel and has self-diagnostic capabilities.



1. Temperature Control Buttons
2. Compressor On/Off Button
3. Automatic Mode Button
4. Defrost Button
5. Display
6. Fan Speed Indicator
7. Air Distribution Button (Directs Air To Windows)
8. Air Distribution Button (Directs Air To Dashboard Outlets & Rear Of Center Console)
9. Air Distribution Button (Directs Air To Footwells)
10. Air Recirculation Button
11. Fan Speed Button

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Fig. 1: Identifying A/C-Heater Control Panel
Courtesy of Audi of America, Inc.

OPERATION

A/C COMPRESSOR SPEED SENSOR

Sensor is located on compressor and determines A/C compressor speed. A/C-heater control panel then compares compressor speed to engine speed and calculates belt slippage (as a percentage). If slippage is excessive, control panel switches compressor off.

A/C SYSTEM

If vehicle interior is hot and climate control system is programmed to maintain a temperature of 75øF (24øC), system will open recirculation doors. Fresh air door will close and 85 percent of inside air will be recirculated. Heater control valve will close and air will flow from registers. Temperature control door should be closed. No air should flow through heater core. Blower speed will increase from lowest to highest over a 10-second period. As interior cools down, recirculation door will close as fresh air door begins to open.

If needed, heater control valve will open, temperature control door will begin to open and blower speed will decrease. Air flowing from registers will warm slightly. System operation is controlled by outside temperature, inside temperature and temperature setting.

HEATER SYSTEM

If vehicle is very cold and climate control system is programmed to maintain a temperature of 75øF (24øC), system will close recirculation door and outside air will flow into system. Heater control valve will open, allowing coolant to flow through heater core. Air will flow from floor vents. Temperature control door will open, and all air will flow through heater core. Blower speed can be controlled manually, regardless of heater setting, by pushing plus (+) or minus (-) blower speed buttons.

A/C-HEATER CONTROL PANEL & AIR DISTRIBUTION

A/C-Heater Control Panel

A/C-heater control panel has a digital microprocessor that compares values from various sensors. Microprocessor then activates appropriate adjustment motor and A/C compressor clutch to maintain desired temperature. A/C clutch, blower speed, temperature/blend air door position, and mode doors are all controlled by A/C-heater control panel.

Air Distribution

Three buttons control air distribution. See Fig. 1. When selected, uppermost air distribution button directs air to windows. When middle air distribution button is selected, air is directed to dashboard outlets and rear of center console. When lowermost air

distribution button is selected, air is directed to footwells.

Automatic Mode

In this setting, air temperature, air delivery and air distribution are regulated automatically to achieve and maintain desired interior temperature. All previously selected settings are canceled.

Blower Speed Settings

Blower speed buttons can be used to raise or lower blower speed in all operating modes. Blower speed plus (+) button is used to raise blower speed. Minus (-) button lowers blower speed. If minus (-) button is pushed after blower speed is set at its lowest setting, climate control system will be deactivated.

Climate control system will also be deactivated if minus (-) and plus (+) buttons are pushed simultaneously. To reactivate system, press AUTO button, defrost button, one of temperature control buttons or blower speed plus (+) button.

Compressor On/Off Button

This button controls compressor operation.

Defrost Mode

In this setting, recirculation door is open. Blower runs at highest speed and temperature is automatically regulated. All air is directed toward windshield.

A/C HIGH PRESSURE CUT-OUT SWITCH

Switch is identified by Red housing and located on left side of condenser. Cut-out switch cycles A/C compressor clutch off when refrigerant pressure exceeds 409 psi (28.8 kg/cmý). Switch can be replaced without discharging system.

AMBIENT TEMPERATURE SENSORS

Two sensors measure outside air temperature and send input signals to A/C-heater control panel. A/C-heater control panel measures sensor readings and lowest temperature value to calculate correction factor for interior temperature regulation. One sensor is located in front of vehicle behind lower air grille and a second sensor is located in evaporator, next to fresh air flap.

FAN CONTROL UNIT

Air to passenger compartment is supplied and regulated by fan control unit. Fan control unit is mounted to evaporator box in air plenum and is cooled by air flow through evaporator housing. See Fig. 2.

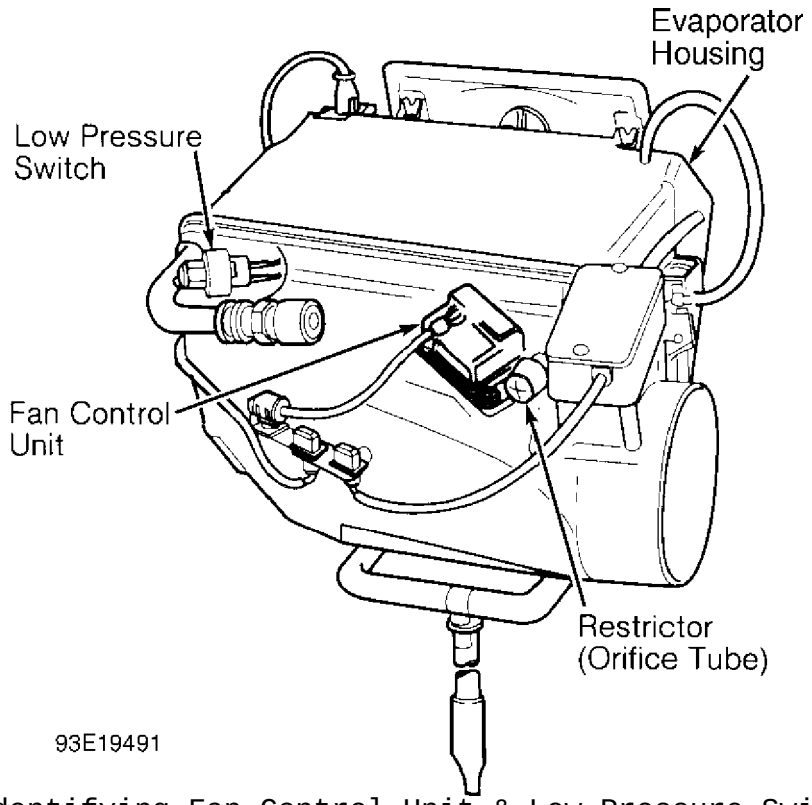


Fig. 2: Identifying Fan Control Unit & Low Pressure Switch
Courtesy of Audi of America, Inc.

IN-CAR TEMPERATURE SENSORS

In-car temperature sensors measure interior air temperature and send signals to A/C-heater control panel. A small fan drives air over instrument panel sensor to ensure accurate measurement. One sensor is mounted on top of instrument panel and a second sensor is located next to front dome light.

REFRIGERANT LOW PRESSURE SWITCH

Refrigerant low pressure switch disengages A/C compressor clutch if refrigerant pressure drops below 23-25 psi (1.6-1.8 kg/cmý). Switch is located in suction line from A/C accumulator and can be removed without discharging system. See Fig. 2.

REFRIGERANT HIGH PRESSURE SWITCH

Switch controls cooling fan high speed operation. Switch closes when pressure reaches 190 psi (13 kg/cmý). Switch is located in high pressure line to A/C compressor and identified by Yellow or Green housing. Switch can be removed without discharging system.

TROUBLE SHOOTING

ACCESSING MEMORY DIAGNOSTIC CHANNEL

NOTE: While information is being displayed on A/C-heater control panel, A/C system will run in last mode selected.

1) Turn ignition switch on or start engine. Simultaneously press and hold down air recirculation and uppermost air distribution buttons. See Fig. 1. Release both buttons. Display panel should read 01c, indicating Diagnostic Channel No. 1.

2) Pressing temperature plus (+) button will advance display of diagnostic channel by one. Display panel should read 02c, indicating Diagnostic Channel No. 2. Each time plus (+) button is pressed, system will advance to next diagnostic channel until last number is reached; display will then return to Channel No. 1.

3) Memory diagnostic channels identify individual circuits, and are not fault codes. See MEMORY DIAGNOSTIC CHANNELS table. To retrieve information about a particular channel, select desired channel then press air recirculation button.

4) If Channel No. 52 is selected and an A/C compressor switch-off condition exists, a segment of "88.8" display will illuminate indicating cause of condition. See Fig. 3.

5) Channel No. 53 is used to identify which A/C electrical components (outputs) are activated. When Channel No. 53 is selected, a segment of "88.8" display will illuminate. See Fig. 3.

6) On both Channels No. 52 and 53, segments 7, 14 and 21 of "88.8" display must illuminate simultaneously to indicate system function is okay. To exit memory diagnostic sequence display, press AUTO button or turn ignition off.

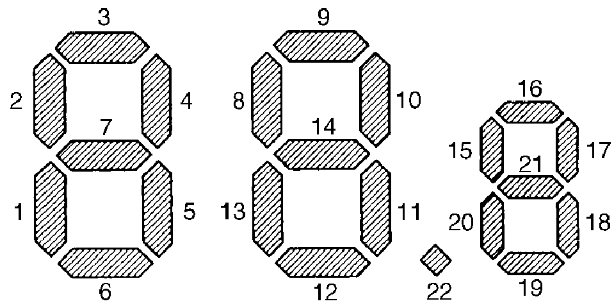
MEMORY DIAGNOSTIC CHANNELS

Diagnostic Channel No.	Display
1	System Malfunction - Displayed As Diagnostic Trouble Code.
2	Digital Value Of Interior Temperature Sensor, In Headliner.
3	Digital Value Of Interior Temperature Sensor, In Instrument Panel.
4	Digital Value Of Fresh Air Intake Duct Sensor, In Headliner.
5	Digital Value Of Outside Air (Ambient) Temperature Sensor, Front.
6	Digital Value Of Outside Air (Ambient) Temperature Sensor.
7	Digital Value Of Ambient Temperature Sensor At Fresh Air Blower.
8	Digital Value Of Temperature Regulator Flap Motor Potentiometer.
9	Digital Value Of Temperature Regulator Flap.
10	Non-Corrected Specified Value Of Temperature

Regulator Flap.
11 ..... Digital Value Of Central Flap Motor Potentiometer.
12 ..... Specified Value Of Central Flap.
13 ..... Digital Value Of Footwell/Defroster Flap Motor Potentiometer.
14 ..... Specified Value Of Footwell/Defroster Flap.
15 ..... Digital value Of Air Flow Flap Motor Potentiometer.
16 ..... Specified Value Of Air Flow Flap.
17 ..... Vehicle Speed (km/h).
18 ..... Actual Fresh Air Blower Voltage (volts).
19 ..... Specified Fresh Air Blower Voltage (volts).
20 ..... A/C Compressor (A/C Clutch) Voltage (volts).
21 ..... Number Of Low Voltage Occurrences, Non-Transient.
22 ..... Cycle Condition Of A/C Refrigerant High Pressure Switch.
23 ..... Cyclings Of The A/C Refrigerant High Pressure Switch.
24 ..... Cyclings Of The Switches, Absolute Non-Fluctuating.
25 ..... Analog/Digital Value, Kick-Down Switch.
26 ..... Analog/Digital Value, Engine Coolant Temperature (ECT) Warning Light.
27 ..... Coding Value.
28 ..... Engine Speed (RPM).
29 ..... A/C Compressor Speed In RPM (Equals Engine Speed x 1.28).
30 ..... Software Version.
31 ..... Display Check (All Segments Of A/C Control Head Display Light Up).
32 ..... Potentiometer Malfunction Counter, Temperature Regulator Flap.
33 ..... Potentiometer Malfunction Counter, Central Flap.
34 ..... Potentiometer Malfunction Counter, Footwell/Defroster Flap.
35 ..... Potentiometer Malfunction Counter Air Flow Flap.
36 ..... Feedback Value, Cold End-Stop, Temperature Regulator Flap Motor Potentiometer.
37 ..... Feedback Value, Hot End-Stop, Temperature Flap Motor Potentiometer, Max. Stop.
38 ..... Feedback Value, Cold End-Stop, Central Flap Motor Potentiometer.
39 ..... Feedback Value, Hot End-Stop, Central Flap Motor Potentiometer.
40 ..... Feedback Value, Cold End-Stop, Footwell/Defroster Flap Motor Potentiometer.
41 ..... Feedback Value, Hot End-Stop, Footwell/Defroster Flap Motor Potentiometer.
42 ..... Feedback Value, Cold End-Stop, Air Flow Flap Motor Potentiometer.
43 ..... Feedback Value, Hot End-Stop, Air Flow Flap Motor Potentiometer.
44 ..... Vehicle Operation Cycle Counter.
45 ..... Calculated Interior Temperature

(Internal Software, In Digits).
46 ..... Outside (Ambient) Temperature, Filtered, For Regulation (Internal Software).
47 ..... Outside (Ambient) Temperature, Unfiltered, (Internal Software, In øC).
48 ..... Outside (Ambient) Temperature, Unfiltered, In Digits).
49 ..... Malfunction Counter For Speedometer (Vehicle Speed) Signal.
50 ..... Standing Time (In Minutes).
51 ..... Engine Coolant Temperature (ECT), In øC.
52 ..... Graphics Channel 1 = 88.8 (1).
53 ..... Graphics Channel 2 = 88.8 (2).
54 ..... Control Characteristics.
55 ..... Outside (Ambient) Temperature, In øC Or øF Setting On A/C Control Head.
56 ..... Temperature In øC From Interior Temperature Sensor, In Instrument Panel.
57 ..... Temperature In øC, From Interior Temperature Sensor, In Instrument Panel.
58 ..... Temperature In øC, From Fresh Air Intake Duct Temperature Sensor.
59 ..... Temperature In øC, From Outside Air (Ambient) Temperature Sensor, Front.
60 ..... Temperature In øC, From Ambient Temperature Sensor At Fresh Air Blower.
61 ..... Software Version (Latest).

(1) - When diagnostic Channel 52 is selected, "--.-" is displayed first. A/C compressor switch-off conditions are identified by illuminated segments of the "88.8" display. See Fig. 3.
(2) - When diagnostic Channel 53 is selected, "--.-" is displayed first. A/C system electrical outputs are identified by illuminated segments of the "88.8" display. See Fig. 3.



CHANNEL 52

1. High Pressure Occurrences More Than 30 Times
2. Ambient Temperature Sensor At Fresh Air Blower Less Then 27° (-3C°)
3. ECON Mode Selected
4. Off Selected
5. Ambient Temperature Too Low
6. Engine Management System (Compressor Will Remain Off For 3-12 Seconds)
7. * System Function Okay
8. A/C Refrigerant High Pressure Cut-Out Switch
9. A/C Manually Switched Off (A/C Standby Cancelled)
10. Low Voltage
11. Kickdown Switch (Via Transmission Control Module, Compressor Off For 12 Seconds Maximum)
12. Engine Coolant Temperature Warning Light Switch
13. A/C Refrigerant Low Pressure Switch
14. * System Function Okay
15. Not Used
16. Slippage Or Blockage
17. Engine Speed Less Than 200-500 RPM
18. Not Used
19. Engine Speed Greater Than 6000 RPM
20. Not Used
21. * System Function Okay
22. Visible With A/C Compressor On Not Visible With A/C Compressor Off

CHANNEL 53

1. Temperature Flap In Cold Air Position
2. Temperature Flap In Warm Air Position
3. Not Used
4. Central Flap In Instrument Panel Outlet Position
5. Central Flap In Footwell/Defrost Outlet Position
6. Not Used
7. * System Function Okay
8. Footwell/Defroster Flap In Defrost Position
9. Not Used
10. Airflow Flap Open
11. Airflow Flap Closed
12. Not Used
13. Footwell/Defroster Flap In Footwell Position
14. * System Function Okay
15. First Speed Of Coolant Fan On
16. Fan For In-Car Temperature Sensor
17. Fresh Air/Recirculation Flap Closed
18. Heater Valve Closed
19. Bi-Directional Wiring Harness
20. A/C Compressor On
21. * System Function Okay
22. Not Used

* Segments 7, 14 and 21 must illuminate simultaneously to indicate system function is okay.

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Fig. 3: Identifying Diagnostic Channels No. 52 & 53
Courtesy of Audi of America, Inc.

RETRIEVING FAULT CODES

1) To retrieve fault codes using A/C-heater control panel, access memory diagnostic channel numbers. See ACCESSING MEMORY DIAGNOSTIC CHANNEL. If a diagnostic fault code exists, fault code will be displayed in Channel No. 1. If no fault code exists, "00.0" will be displayed.

2) If a fault code exists, repair malfunction indicated. See FAULT CODES table. After malfunction is corrected, clear fault codes. Climate control system has permanent fault memory that requires use of a VAG 1551 scan tester to clear codes. To clear fault codes, use manufacturer tester instructions.

FAULT CODES
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Fault Code	Malfunction
00.0	No Malfunctions
02.1-02.4	In-Car Temperature Sensor Open Or Shorted
03.1-03.4	Intermittent In-Car Temperature Sensor
04.1-04.4	Fresh Air Intake Duct Temperature Sensor Open Or Shorted
05.1-05.4	Front Ambient Temperature Sensor Open Or Shorted
06.1-06.4	Engine Coolant Temperature Sensor Open Or Shorted
07.1-07.4	Ambient Temperature Sensor (At Evaporator) Open Or Shorted
08.1-08.7	Temperature Regulator Flap Motor Potentiometer Open Or Shorted
11-1-11.7	Central Flap Motor Potentiometer Open Or Shorted
13.1-13.7	Footwell/Defroster Flap Motor Potentiometer Open Or Shorted
15.1-15.7	Air Flow Flap Motor Potentiometer Open Or Shorted
17.0	Faulty Vehicle Speed Signal
18.1-18.3	Fresh Air Blower Voltage Incorrect
20.1-20.3	A/C Compressor Voltage Incorrect
22.1-22.5	A/C High Pressure Switch Open
29.1-29.4	A/C Belt Slip

INSUFFICIENT COOLING

NOTE: Always use approved refrigerant recovery/recycling equipment when servicing A/C system.

1) With engine running, turn A/C on. Compressor clutch should engage. If clutch engages, go to next step. If clutch does not engage, Check for fault codes. See RETRIEVING FAULT CODES. If no fault codes are present, check voltage at compressor clutch. If voltage is okay, replace compressor clutch. If voltage is not present, check and repair wiring as necessary.

2) If clutch engages but does not drive compressor, replace compressor clutch. If clutch engages and compressor is driven, install pressure gauges, and test high side and low side pressure at idle with A/C setting at maximum cooling output.

3) High side pressure should be 190-254 psi (13-18 kg/cmý) at idle. Low side pressure should be 25-30 psi (1.8-2.1 kg/cmý) at idle. If high side and low side pressures are too low, check system for a low or no refrigerant condition. Evacuate and recharge system. Check refrigerant system for leaks.

4) If high side pressure is too low and low side pressure is too high, check for defective compressor, and replace if necessary. Evacuate and recharge system. Check refrigerant system for leaks.

5) If high side pressure is too high and low side pressure is

too low, check for blocked restrictor. Restrictor is located in evaporator line. If system high side is blocked, go to step 7). If restrictor is dirty or blocked, replace restrictor. Evacuate and recharge system. Check refrigerant system for leaks.

6) If pressure is normal at first, and then high side pressure is too high and low side pressure is too low, moisture has entered A/C system. Evacuate system. Replace accumulator and restrictor. Recharge system. Check refrigerant system for leaks.

7) If high side is blocked, manually check high side pressure refrigerant lines by hand for temperature change. If high side pressure line is restricted, line will be hot on side with restriction and cool on other side. Replace restricted hoses. Evacuate and recharge system. Check refrigerant system for leaks.

TESTING

* 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 AIR BAGS article in ACCESSORIES & SAFETY EQUIPMENT.

NOTE: Audi VAG 1551 scan tester may be used to diagnose A/C system. Use manufacturer instructions for scan tester operation.

A/C COMPRESSOR SPEED SENSOR

1) Turn ignition switch off. Remove sensor connector. Using an ohmmeter, measure resistance between sensor terminals. If resistance is 1000-1500 ohms, go to next step. If resistance is not 1000-1500 ohms, replace sensor.

2) Check for continuity between ground and each sensor terminal. If continuity exists between ground and either sensor terminal, replace sensor.

A/C SYSTEM PERFORMANCE

1) Ensure compressor drive belt is tight. Ensure condenser, radiator and air ducts are clear. Ensure car is not parked in direct sunlight and engine is at normal operating temperature. Measure and record outside air temperature. Close hood, doors, windows and sunroof. Start engine.

2) Turn ignition switch on. Press AUTO button and place temperature setting to low. Press air recirculation button. See Fig. 1. Ensure instrument panel air outlets are open and compressor is switched on (compressor symbol "ice crystal" lights up in display).

3) After completing test conditions in steps 1) and 2), the following should occur:

* Coolant fan should be on.

* Fresh air blower should operate at high speed.
* Recirculating/fresh air flap should be in recirculating air position.
* Air should flow from instrument panel air outlets.
* Coolant cut-off valve should be closed.
* Temperature flap should be in cooling position.
* Compressor should run with compressor clutch engaged.

4) If one or more of the specified results in step 3) did not occur, check for fault codes and correct malfunction indicated. See RETRIEVING FAULT CODES under TROUBLE SHOOTING. If no fault codes exist, insert thermometer in center vent. Operate engine for about 30 seconds, then raise idle speed to 2000 RPM to start test time.

5) Note and record center vent temperature at one minute intervals for 5 minutes. Using outside air temperature recorded in step 1) and center vent outlet air temperature readings, ensure temperatures are within range. See A/C SYSTEM PERFORMANCE table.

6) If temperature readings are okay, test is complete. If readings are not within range, ensure radiator cooling fan is operating correctly. If cooling fan is operating correctly, check refrigerant low and high pressure switches.

A/C SYSTEM PERFORMANCE

Outside (Ambient) Temperature øF (øC)	Center Vent Temperature øF (øC)
59 (15)	37-43 (2.7-6.1)
68 (20)	37-43 (2.7-6.1)
77 (25)	37-43 (2.7-6.1)
86 (30)	37-43 (2.7-6.1)
95 (35)	38-44 (3.3-6.7)
104 (40)	41-46 (5.0-7.8)

VACUUM SERVO

Remove glove box undercover. Apply vacuum to vacuum servo using a hand-held vacuum pump. Fresh air/recirculation door must close. If fresh air/recirculation door does not close, replace vacuum servo.

REMOVAL & INSTALLATION

* 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 AIR BAG SYSTEM SAFETY article in GENERAL SERVICING.

NOTE: For removal and installation of components not covered in

this article, see appropriate MANUAL A/C-HEATER SYSTEMS article.

A/C-HEATER CONTROL PANEL

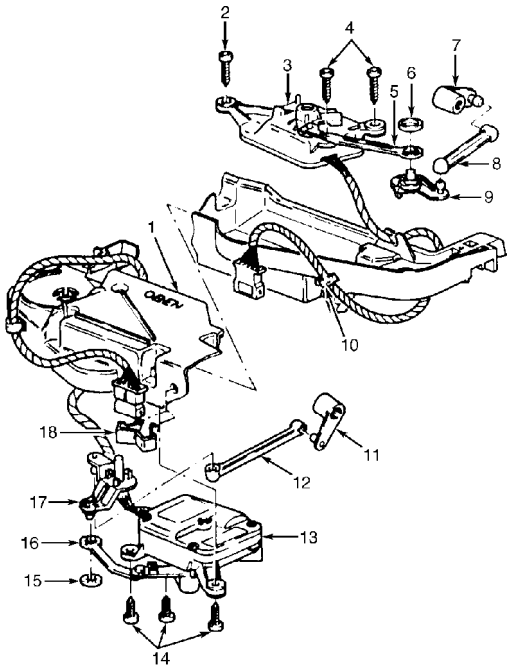
Removal & Installation

Pry off A/C heater control panel cover. Remove 2 A/C control panel-to-console screws. Remove A/C control panel from console. To install, reverse removal procedure. Inspect control panel electrical connectors and contacts for damage.

FOOTWELL/DEFROSTER & CENTRAL FLAP MOTORS

Removal & Installation

Disconnect negative battery cable. Remove A/C-heater control panel. See A/C-HEATER CONTROL PANEL. Remove glove box. Remove driver-side tray. Disconnect defroster hoses from heater box. Remove flap motor mounting screws. Note color of flap motor connectors. Disconnect connectors. Remove support tray. Remove flap motors from support tray. See Fig. 4. To install, reverse removal procedure.



1. Support Tray
2. Screw
3. Central Flap Motor With Potentiometer (Blue Connector)
4. Screw
5. Connecting Arm
6. Retaining Washer
7. Lever (Blue)
8. Connecting Arm
9. Relay Lever
10. Clip
11. Lever (Red)
12. Connecting Arm
13. Footwell/Defroster Flap Motor With Potentiometer (Red Connector)
14. Screw
15. Retaining Washer
16. Connecting Arm
17. Relay Lever
18. Retaining Clip

Fig. 4: Removing Footwell/Defroster & Central Flap Motors
Courtesy of Audi of America, Inc.

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Zexel 5-Cyl.
Compressor Belt Deflection	
Compressor Belt Tension	
New	100 lbs. (45 kg)
Used	80-90 lbs. (36-40 kg)
Compressor Oil Capacity	9.4-10.8 ozs.
Refrigerant (R-12) Capacity	37-41 ozs.
System Operating Pressures	
Low Side	25-30 psi (1.8-2.1 kg/cmý)
High Side	190-254 psi (13-18 kg/cmý)

WIRING DIAGRAM

A/C-HEATER SYSTEM - AUTOMATIC (CS)

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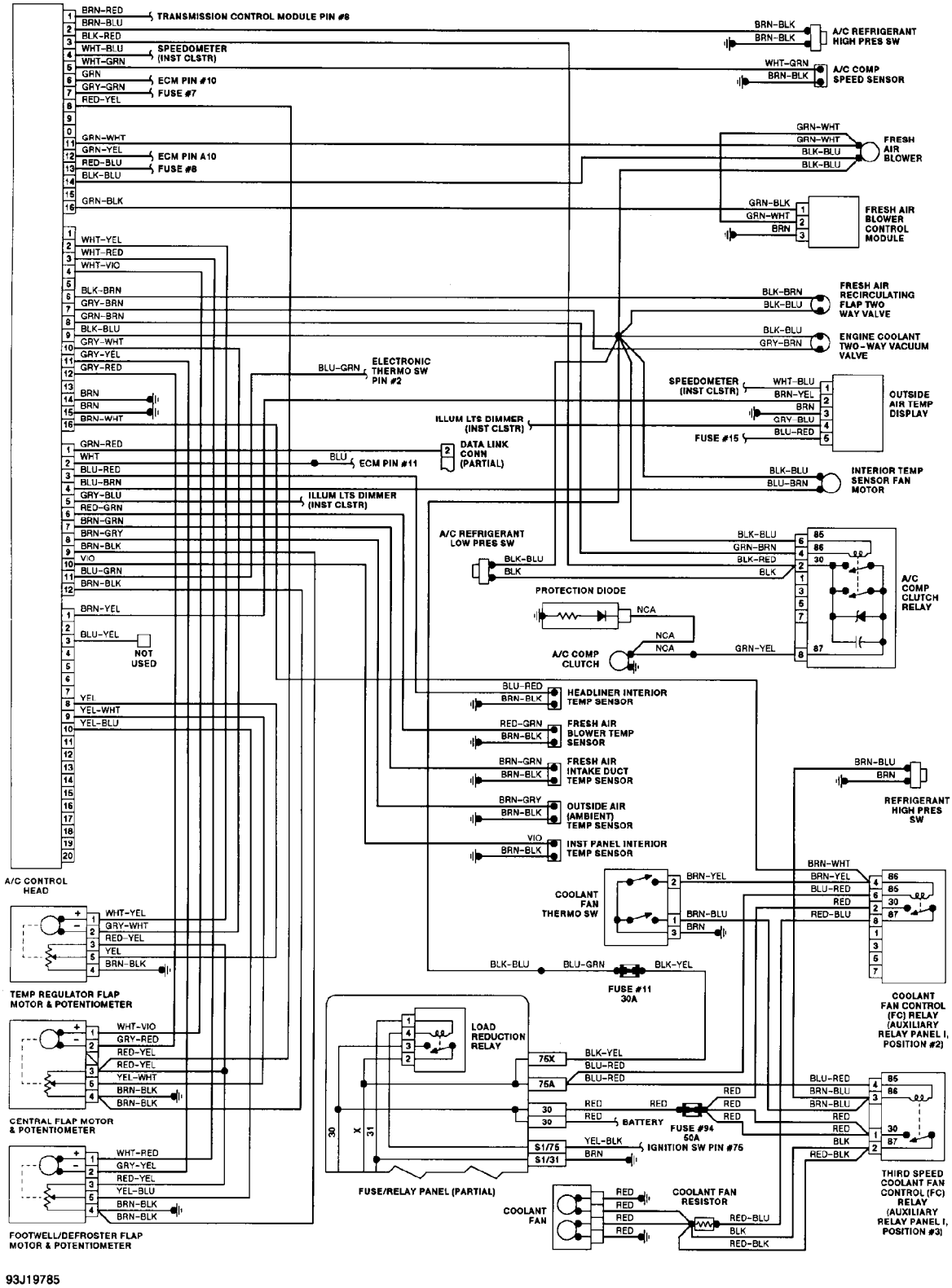

Fig. 5: Automatic A/C-Heater System Wiring Diagram (100CS)

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