A/C-HEATER SYSTEM - AUTOMATIC

Article Text

1990 Audi 200

For chip

Monday, October 18, 1999 02:00PM

ARTICLE BEGINNING

1989-90 AIR CONDITIONING & HEAT
Audi Automatic A/C-Heater Systems

100, 200

*** PLEASE READ THIS FIRST ***

CAUTION: When discharging air conditioning system, use only approved refrigerant recovery/recycling equipment. Make every attempt to avoid discharging refrigerant into the atmosphere.

To avoid accidental air bag deployment, see AIR BAG DEACTIVATION SERVICING PRECAUTIONS in this article.

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. Depressing the HI or LO buttons will raise or lower blower speed. The WARMER or COOLER buttons are used to raise or lower temperature as desired.

The digital climate control system automatically maintains temperatures set between 64øF (18øC) and 85øF (29øC). If a temperature above 85øF (29øC) is selected, the word HI appears in temperature display. If a temperature below 64øF (18øC) is selected, the word LO is displayed. Selection of these temperatures overrides automatic climate control system.

OPERATION

A/C SYSTEM

If the vehicle interior is hot and the climate control system is programmed to maintain a temperature of 75øF (24øC), the system will operate as follows. Recirculation doors will open. Fresh air door will close and 85% 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 low to high 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 slow down. Air flowing from registers will warm slightly. There are 3 factors controlling operation of system: 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), the system will operate as follows. Recirculation door will close, 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 HI or LO button.

NOTE: The blower delay feature is overridden when the DEFROST button is depressed. Hot air does not flow from registers in DEFROST mode. If system is in BI-LEV (bi-level) mode, warm air flows out floor vents and cooler air flows out registers.

A/C-HEATER CONTROL PANEL & AIR DISTRIBUTION

The A/C-heater control panel receives input from driver and system components. It processes input signals and operates system accordingly. See Fig. 1.

OFF Mode

When the OFF button is pressed, the system is switched off. See Fig. 1. Fresh air intake is closed and temperature display is turned off. Outside temperature is shown on display.

NOTE: If vacuum system fails, climate control automatically switches to maximum defrost.

ECON Mode

In ECON (economy) mode, the A/C compressor is turned off. See Fig. 1. Temperature, blower speed and air distribution are automatically regulated. Air distribution is determined by difference between actual interior temperature and selected temperature.

AUTO Mode

When the AUTO button is pressed, the A/C compressor is turned on. See Fig. 1. Temperature, blower speed and air distribution are automatically regulated. Air distribution is determined by difference between actual interior temperature and selected temperature.

BI-LEV (bi-level) Mode

When BI-LEV (bi-level) button is pressed, the A/C compressor is turned on. See Fig. 1. Temperature, blower speed and air distribution are automatically regulated. Air distribution is fixed at center and footwell outlets.

DEFROST Mode

In this setting, temperature and blower speed are automatically regulated. See Fig. 1. All air is directed toward windshield.

HI & LO Settings

These settings are used to raise or lower blower speed in all operating modes. The HI or LO settings are canceled by pressing another mode button. See Fig. 1.

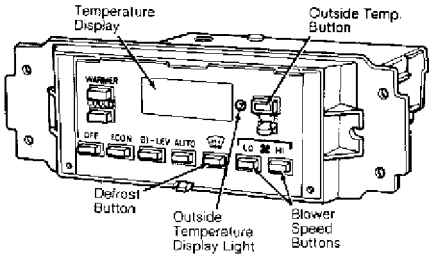


Fig. 1: Identifying A/C-Heater Control Panel
Courtesy of Audi of America, Inc.

A/C PROGRAMMER

The A/C programmer receives input signals from A/C-heater control panel. The programmer contains 5 solenoids which operate the vacuum servos for air distribution and heater valve. Based on input signals, the programmer also switches on the A/C compressor, radiator fan and controls the servomotor for temperature regulation. The programmer is located behind right side of glove box.

A/C BLOWER CONTROL UNIT

The A/C blower control unit receives signal from A/C-heater control panel, and regulates the amount of power supplied to the fresh air blower motor accordingly. The A/C blower control unit is located on top of evaporator assembly. See Fig. 2.

AMBIENT TEMPERATURE SENSORS

Two sensors measure the outside air temperature and send input signals to the A/C-heater control panel. The A/C-heater control panel measures both sensor readings and uses the lowest temperature value to calculate correction factor for interior temperature regulation. One sensor is located in front of radiator, and the other is located in evaporator plenum chamber. See Fig. 2.

IN-CAR TEMPERATURE SENSORS

The in-car temperature sensors measure interior air temperature and send signals to the 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 the other is located next to front dome light.

REFRIGERANT LOW PRESSURE SWITCH

The refrigerant low pressure switch disengages A/C compressor clutch if refrigerant pressure drops below 15 psi (1.1 kg/cmý). Switch is located in suction line from A/C accumulator. See Fig. 2.

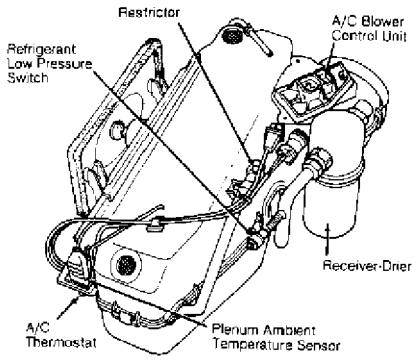


Fig. 2: View of Evaporator Assembly
Courtesy of Audi of America, Inc.

REFRIGERANT HIGH PRESSURE SWITCH

This switch controls operation of cooling fan 2nd stage. Switch closes when pressure reaches 200 psi (14.1 kg/cmý). Switch is located in high pressure line to A/C compressor and is identified by Yellow or Green housing.

A/C HIGH PRESSURE CUT-OUT SENSOR

Sensor measures refrigerant pressure and sends resistance signal to A/C-heater control panel. If refrigerant pressure goes above 435 psi (30.6 kg/cmý), the A/C-heater control panel will shut A/C compressor off to prevent system damage. The A/C high pressure cut-out sensor, located next to refrigerant high pressure switch, is identified by Red housing.

NOTE: Low pressure switch and both high pressure switches can be removed without discharging the system.

A/C THERMOSTAT

The A/C thermostat controls power supply to A/C compressor clutch relay to prevent ice from forming on evaporator. If evaporator temperature falls below 32øF (0øC), A/C thermostat switch opens, A/C compressor clutch relay opens, and A/C compressor clutch disengages. The A/C thermostat is located on evaporator housing, with its capillary tube inserted in evaporator.

ENGINE COOLANT OVERHEAT SWITCH

When coolant temperature is greater than 247øF (120øC), switch sends a ground signal to terminal No. 20 of A/C-heater control panel. The A/C-heater control panel then sends a signal to A/C programmer, which in turn disengages the A/C compressor clutch. The engine coolant overheat switch is part of the electronic thermoswitch, located on cylinder head coolant flange.

AIR BAG DEACTIVATION SERVICING PRECAUTIONS

DISABLING SYSTEM

Disconnect negative battery cables and shield terminals. Locate Red single-pin connector below instrument panel, near steering column. Connector is labeled AIR BAG. Disconnect Red single-pin connector.

SYSTEM FUNCTIONAL CHECK

When all service work is completed, reconnect Red single-pin connector below instrument panel near steering column. Place ignition switch in RUN position. Ensure AIR BAG indicator light on instrument cluster comes on for about 10 seconds and then goes out. If light does not operate as indicated, air bag system needs to be serviced.

HEATER FLAP ADJUSTMENT

1) Remove windshield wiper assembly. Remove heater box cover. Remove 5 screws and servomotor cover with gasket attached. Turn ignition switch on. Set A/C control panel to HI. Select diagnosis channel 8. A value of 9-14 will be displayed. The correct value is 12. See ACCESSING MEMORY FAULT CHANNEL under TROUBLE SHOOTING.

2) To adjust, insert screwdriver through hole in servomotor housing. Turn screwdriver clockwise to decrease value or counterclockwise to increase value. See Fig. 3.

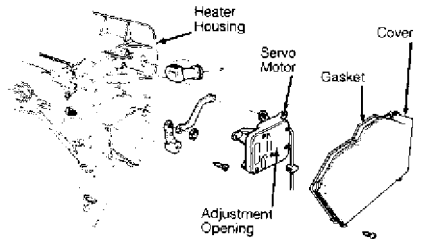


Fig. 3: Adjusting Heater Flap
Courtesy of Audi of America, Inc.

TROUBLE SHOOTING

ACCESSING MEMORY FAULT CHANNEL

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

1) Start engine and operate A/C-heater system in AUTO mode. Simultaneously press and hold OUTSIDE TEMP and OFF buttons. Release OUTSIDE TEMP button then release OFF button. Display panel should read 01. Fault channel numbers are displayed with a short vertical line before first fault channel number.

2) Pressing the WARMER button will advance display of fault channel by one. Each time WARMER button is pressed, system will advance to next fault channel until last number is reached, and then return to 01. Pressing the COOLER button decreases fault channel number by one. Memory fault channels are not trouble codes, but do identify individual circuits. See Figs. 4 and 5.

3) To exit fault display, turn ignition off or push any one of the mode buttons.

ACCESSING FAULT CODE

Access memory fault channel numbers. See ACCESSING MEMORY FAULT CHANNEL under TROUBLE SHOOTING. While display is in any channel number, press OUTSIDE TEMP button. If no fault code is present in memory, display panel will change to previous channel number. If a fault code is present, fault code (a number other than previous channel number) will be displayed. Circuit or sensor of that channel number is faulty. See Fig. 6.

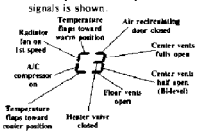
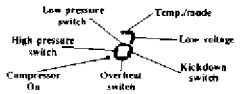
CHANNEL NUMBER	COMPONENT CHECKED	INFORMATION DISPLAYED
1	System faults	
2	Inside temperature sensor #2 (next to dome light)	Number will change based on temperature. The display number may stay at 128 if the memory has registered a fault with the sensor.
3	Inside temperature sensor #1 (in dashboard)	Same as channel #2
4	Outside temperature sensor on evaporator	Same as channel #2
5	Outside temperature sensor behind grille	Same as channel #2
6	Coolant temperature sensor	Some models will have a coolant temperature sensor in the small coolant hose between the cylinder head and the heat exchanger. Vehicles without the sensor will display 255.
7	Output signals from control panel head	A graphic display of the control panel head output signals is shown. 
8	Position of temperature regulation servo	A numerical value for the position of the servo motor is shown.
9	The specified position of the temperature regulation servo	The position of the servo motor specified by the control head is shown. The actual position measured in channel #8 must not differ by more than 3. If so, the servo motor potentiometer adjustment should be checked. This check should only be made when the value in channel #8 is between 30 and 200.

Fig. 4: Memory Fault Channel Codes (1 of 2)
Courtesy of Audi of America, Inc.

CHANNEL NUMBER	COMPONENT CHECKED	INFORMATION DISPLAYED
10	Specified blower motor voltage	The specified voltage for the blower motor is shown. By multiplying the coded number times 0.3 then subtracting 2, the approximate blower voltage specified by the control head can be calculated. See channel #15.
11	Vehicle electrical system voltage	The vehicle's system voltage will be shown. Only values between 9.5 to 16 volts will be shown.
12	Low voltage incidents	The number of times that vehicle voltage drops below 9.5 volts will be shown.
13	Not used	Any values shown in this channel are not used.
14	A/C high pressure switch	Position of high pressure switch is shown. 0 to 5 is closed, higher value means switch is open.
15	Blower voltage	The actual voltage that should be present at the blower motor is shown.
16	Not used	Any values shown in this channel are not used.
17	A/C compressor shut-off conditions	A graphic display of conditions that could cause the A/C compressor to be shut-off is shown. 
18	Output signals from programmer	A graphic display of the electrical output signals from the programmer is shown. 
19	A/C compressor shut off	Number of times compressor has shut off because of excessive pressure.
20	A/C compressor shut off	Number of times compressor has shut off because of excess pressure since ignition has been turned on.
21+22	Not used	Any values shown in these channels are not used.

* Only occurs when high cooling or heating is needed.

Fig. 5: Memory Fault Channel Codes (2 of 2)
Courtesy of Audi of America, Inc.

CODE DISPLAYED	FAULT	RESULT
00	No faults in system	
01	Interior sensor in dashboard open circuit	Display in channel #3 is 128
02	Interior sensor in dashboard short circuit	Display in channel #3 is 128
03	Outside sensor on evaporator open circuit	Other sensor is used
04	Outside sensor on evaporator short circuit	Other sensor is used
05	Outside sensor behind radiator open circuit	Other sensor is used. If both sensors are faulty, 128 is shown in channels #4 and #5.
06	Outside sensor behind radiator short circuit	Same as above
07	Temp. regulation servo potentiometer open circuit	250 or greater shown in channel #8. Channel #9 shows 128.
08	Temp. regulation servo potentiometer shorted	4 or less shown in channel #8. Channel #9 shows 128.
09	Coolant sensor open	Early production cars without this sensor will show this code.
10	Coolant sensor shorted	
11	Interior sensor in headliner open circuit	Channel #2 shows 128
12	Outside sensor in headliner short circuit	Same as above
13	Battery voltage below 10.5 volts	Code remains until ignition is turned off
14	Excess system pressure	High pressure switch has opened 8 times. A/C compressor switched off until engine restarted.
15	Temp. regulation servo position incorrect	
16	High pressure open	A/C compressor off

Fig. 6: Channel 1 Fault Codes
Courtesy of Audi of America, Inc.

A/C-HEATER CONTROL PANEL R & I

WARNING: To avoid accidental air bag deployment, see AIR BAG DEACTIVATION SERVICING PRECAUTIONS in this article.

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 A/C-heater control panel electrical connectors and contacts for damage.

BLOWER MOTOR R & I

FRESH AIR BLOWER REMOVAL

Remove heater box, see Heater/Evaporator Box Removal & Installation below. Remove blower cooling hose. Remove lock ring, stop washer and grommet.

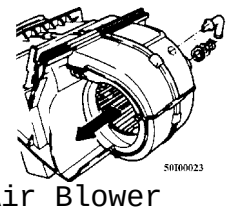


Fig. 7: Air Blower
Courtesy of Audi of America, Inc.

FRESH AIR BLOWER INSTALLATION

NOTE: Before installing fresh air blower guides, lubricate w/Vaseline.

To install simply follow the same steps as Removing, but in reverse order.

HEATER/EVAPORATOR BOX REMOVAL

Remove water box cover under hood. Remove windshield wiper assembly. Remove center console. Remove cap from engine coolant overflow bottle. Remove heater retaining band (arrow 1) in Fig. 8. Clamp off heater hoses to heater core and remove (arrows in Fig. 8. Remove all retainers between body and heater. Remove heater box.

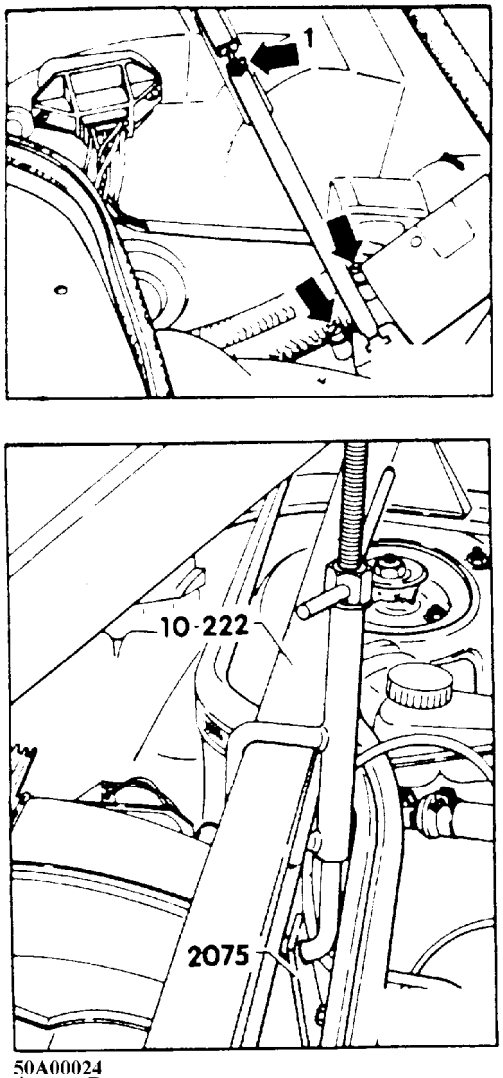


Fig. 8: Heater Box
Courtesy of Audi of America, Inc.

HEATER/EVAPORATOR BOX INSTALLATION

NOTE: Before installing heater box, always replace self-adhesive gasket. When connecting water hoses, the lower connection on heater core is connected to the hose going to the water pump.

To install simply follow the same steps as Removing, but in reverse order.

EVAPORATOR ASSEMBLY R & I

REMOVAL

1) From engine compartment, loosen water drain hose retainer and push hose into plenum chamber. Disconnect vacuum unit hose and thermostat wires. Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove refrigerant hoses and plug openings.
2) From inside vehicle, remove lower dash panel. Remove 4 evaporator housing screws around air vent on evaporator unit.
3) From engine compartment, carefully loosen assembly. Pull evaporator assembly up toward center of vehicle to remove. Separate housing halves to service evaporator.

INSTALLATION

Assemble evaporator case. Insert assembly into plenum chamber. Place drain hose through hole without kinking it, and clamp hose into place. Attach refrigerant lines loosely, and cement gasket into place around opening. Install screws. Tighten hoses, and recharge system. See Fig. 9.

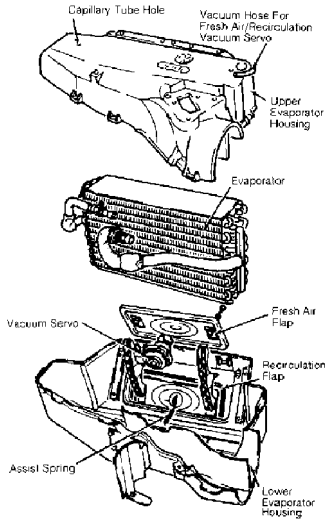


Fig. 9: Exploded View of Evaporator Assembly
Courtesy of Audi of America, Inc.

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HEATER ASSEMBLY R & I

REMOVAL

1) Disconnect battery cable and thermostat wiring. Remove windshield wiper assembly and evaporator-heater duct clamp.
2) Remove electrical wiring. Loosen restraining strap, and remove coolant reservoir cap. Clamp heater hoses closed near heater core. Disconnect hoses from core. Upper hose goes to water pump, and lower hose goes to cylinder head.
3) From inside vehicle, disconnect vacuum lines. Disconnect air ducts and electrical wiring. Remove 4 screws around evaporator housing opening. Lift heater assembly up into engine compartment. Remove grommet and control cable. Loosen clips and wiring harness.

INSTALLATION

To install, reverse removal procedure. Seal all air duct connections carefully to prevent air leaks.

TEMPERATURE FLAP SERVO R & I

Remove windshield wiper assembly. Remove heater box cover. Remove 5 screws and servomotor cover with gasket attached. Disconnect electrical connector. Release linkage and note position of spacers for reassembly. Remove servomotor. To install, reverse removal procedure.

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Nippondenso 10-Cyl.
Compressor Oil Capacity	2.7 oz.
Compressor Belt Tension	
New	100 lbs.
Used	80-90 lbs.
Refrigerant (R-12) Capacity (1)	37 oz.
System Operating Pressures (2)	
High	154-255 psi (11-18 kg/cmý)
Low	19-46 psi (1.3-3.2 kg/cmý)

(1) - When recharging system, add at least 18 oz. of refrigerant to low side port BEFORE operating compressor.
(2) - Measure operating pressures with temperature at 77øF (25øC).

WIRING DIAGRAMS

A/C-HEATER SYSTEM - AUTOMATIC

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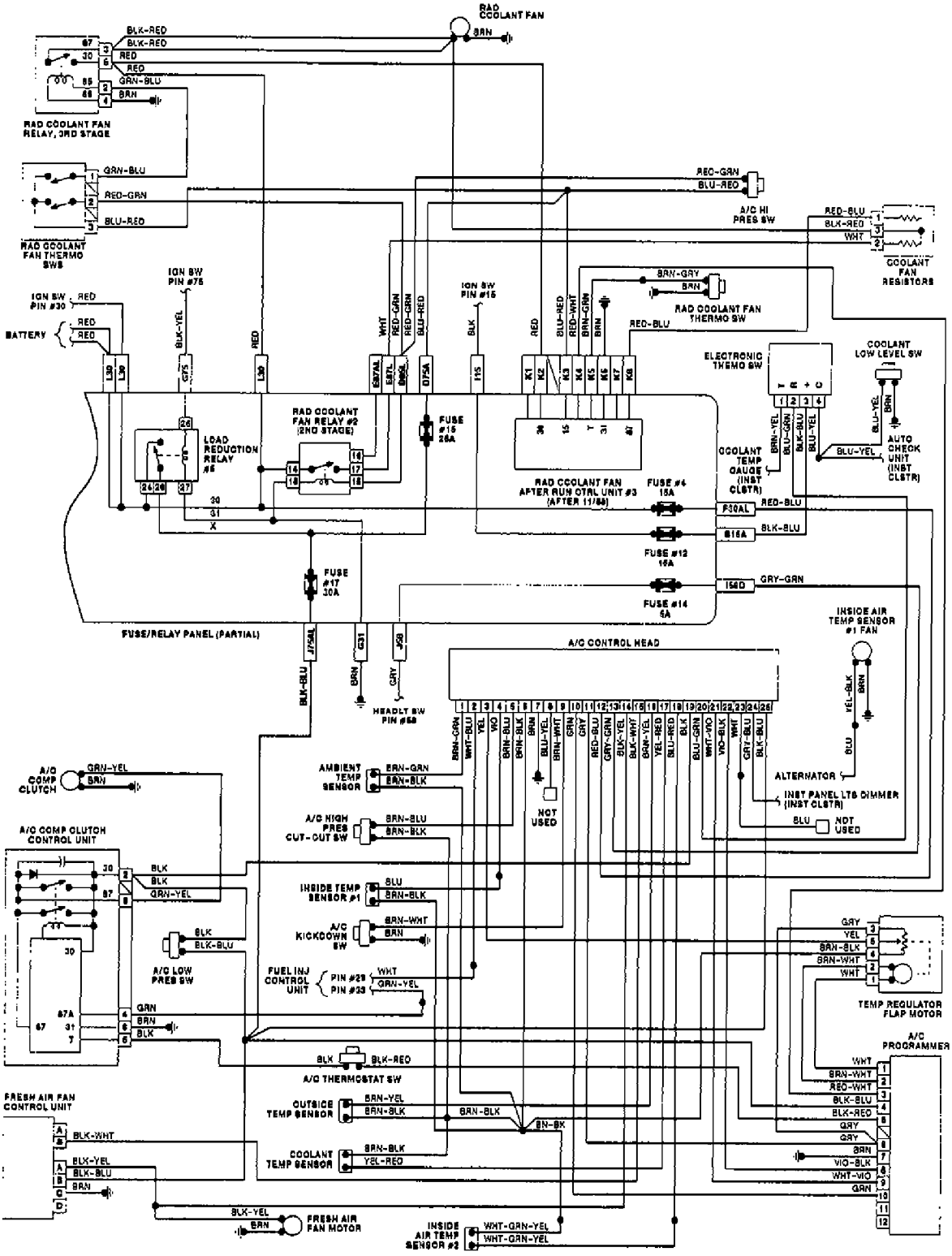

Fig. 10: Automatic A/C-Heater System Wiring Diagram (100)

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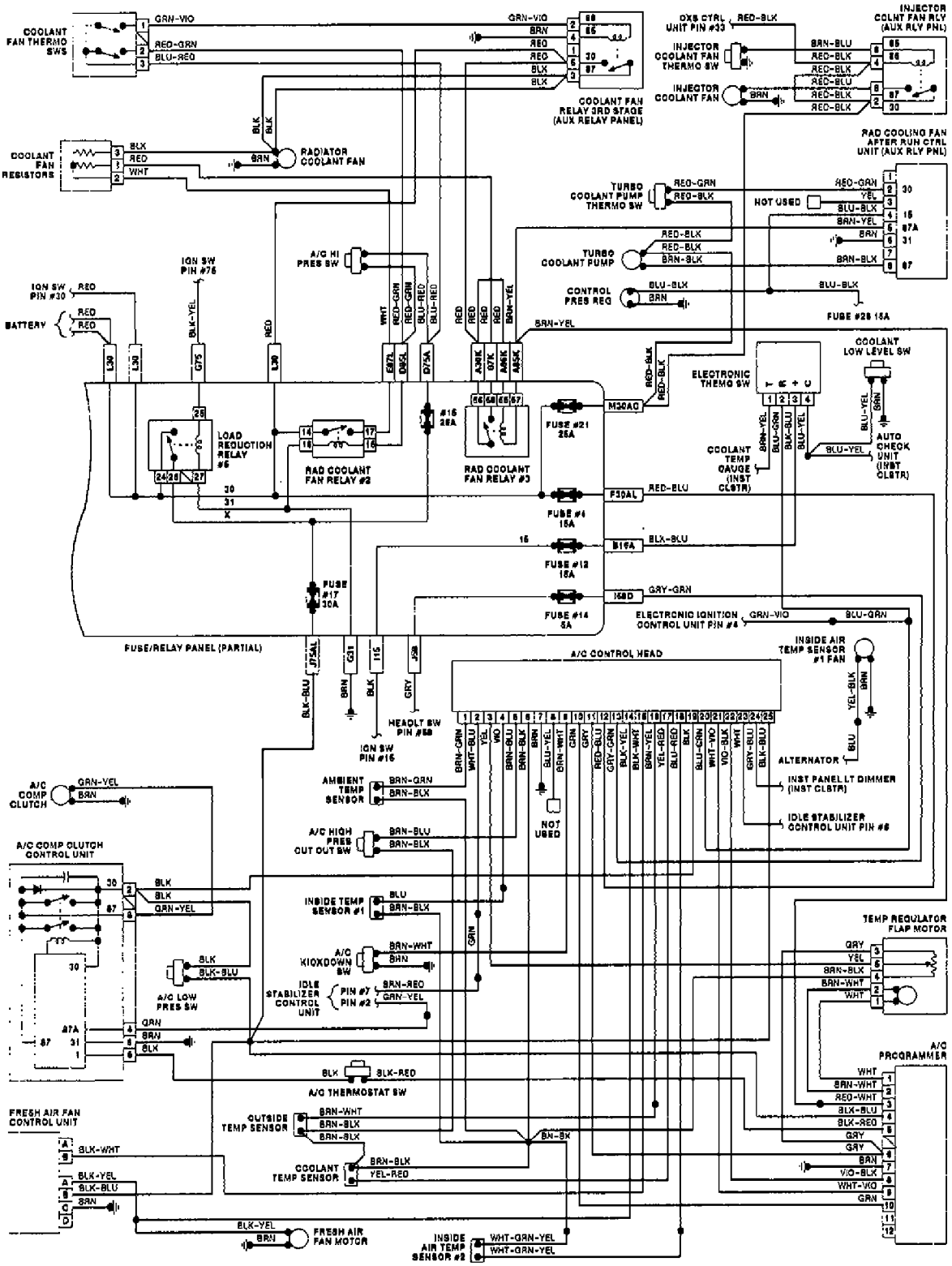

Fig. 11: Automatic A/C-Heater System Wiring Diagram (200)

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