

A/C-HEATER SYSTEM - AUTOMATIC

1993 Toyota Celica

1993 Automatic A/C-Heater Systems

Celica

SPECIFICATIONS

SPECIFICATIONS TABLE

Application	Specification
Compressor Type	
1.6L	Nippondenso 10PA15C 10-Cyl.
2.0L & 2.2L	Nippondenso 10PA17C/VC 10-Cyl.
Compressor Belt Tension (1)	
1.6L	
New	135-185 Lbs. (61.2-83.9 kg)
Used	80-120 Lbs. (36.3-54.4 kg)
2.0L	
New	155-175 Lbs. (70.3-79.4 kg)
Used	69-99 Lbs. (31.3-44.9 kg)
2.2L	
New	155-175 Lbs. (70.3-79.4 kg)
Used	100-120 Lbs. (45.4-54.4 kg)
System Oil Capacity	3.4-4.1 ozs.
Refrigerant (R-12) Capacity	24-27 ozs.
System Operating Pressures (2)	
High Side	206-213 psi (14.5-15.0 kg/cm ²)
Low Side	21-28 psi (1.5-2.0 kg/cm ²)
(1) - Using a belt tension gauge, measure at longest run of belt.	
(2) - Specification is with ambient temperature at 86-95°F (30-35°C) and engine speed at 2000 RPM.	

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

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

DESCRIPTION

Automatic temperature control system is a cycling clutch type with an expansion valve. See Fig. 1.

OPERATION

AMPLIFIERS & SENSORS

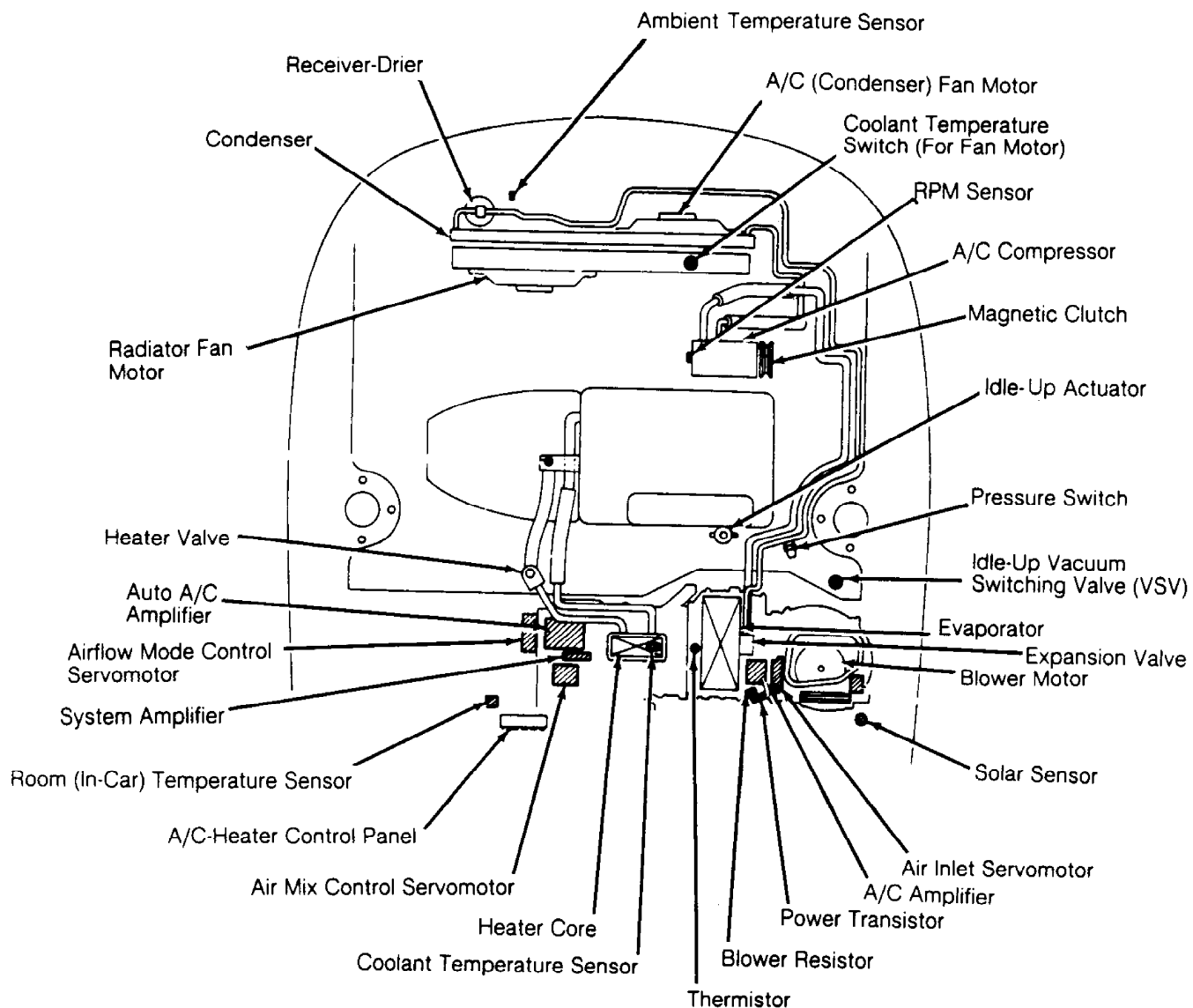
Amplifiers monitor system conditions through sensors. Based on signals from sensors, amplifiers control operation of compressor clutch and air control servomotors.

Ambient temperature sensor monitors outside air temperature.

Coolant temperature sensor monitors engine coolant temperature. Room (in-car) temperature sensor monitors passenger compartment air temperature. Solar (sunload) sensor monitors sunlight load. Thermistor monitors evaporator temperature. RPM sensor monitors compressor speed.

ENGINE IDLE-UP CONTROL

When A/C compressor clutch is engaged, Vacuum Switching Valve (VSV) solenoid is energized, allowing vacuum to idle-up actuator. See Fig. 1. Idle-up actuator rod opens throttle slightly, increasing engine speed.



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Fig. 1: Locating Automatic A/C-Heater System Components
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

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 appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For testing of components not listed in this article, see A/C-HEATER SYSTEM - MANUAL article in the AIR CONDITIONING & HEAT section.

A/C SYSTEM PERFORMANCE

Start engine and allow it to idle at 2000 RPM. Turn A/C on. Select recirculated air. Ensure temperature of inlet air is 86-95°F (30-35°C). Turn blower to highest speed. Select maximum cool temperature setting. Allow several minutes for system to stabilize. Ensure high side and low side pressures are within specification. See SPECIFICATIONS table at beginning of article.

A/C COMPRESSOR CLUTCH TEST

1) Ensure compressor clutch pressure plate, rotor and bearings are okay, and air gap is .002-.006" (.05-.15 mm). Disconnect compressor connector. Check resistance between Black/White wire terminal of compressor connector and compressor body (ground).

2) If resistance is not 3.4-3.8 ohms at 68°F (20°C), replace clutch coil. If resistance is as specified, connect positive battery lead to Black/White wire terminal, and negative lead to compressor body (ground). Clutch is okay if it engages. Replace clutch if it does not engage.

A/C-HEATER CONTROL PANEL ILLUMINATION

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 18, and negative lead to terminal No. 17 of connector "A". If illumination lights DO NOT come on, check bulbs. If bulbs are okay, replace A/C-heater control panel.

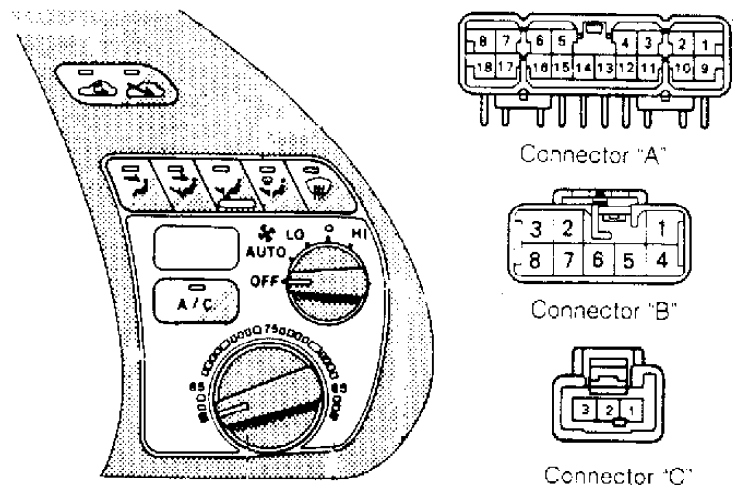


Fig. 2: Identifying A/C-Heater Control Panel Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

A/C-HEATER CONTROL PANEL INDICATORS

Air Inlet & Airflow Mode Indicators Test

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 2 of connector "A". If indicator lights on air inlet (fresh and recirculated) buttons and airflow mode buttons DO NOT come on when respective button is pressed, replace A/C-heater control panel.

A/C Switch Indicator Test

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 15 of connector "A". Turn A/C switch on. If A/C switch indicator light does not come on, replace A/C-heater control panel.

Indicator Light Dimming Test

Disconnect negative battery cable. Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 2 of connector "A". Connect another positive battery lead to terminal No. 3. If indicator lights DO NOT dim, replace A/C-heater control panel.

A/C SWITCH TEST

Disconnect negative battery cable. Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Check continuity between terminals No. 14 and 16 of connector "A". With A/C switch turned off, there should be no continuity. With A/C switch turned on, there should be continuity. If continuity is not as specified, replace A/C-heater control panel.

AIR INLET SWITCHES TEST

NOTE: Air inlet switches contain diodes. Check continuity in both directions (polarity) before assuming switch is faulty.

Disconnect connector "A" from A/C-heater control panel. See Fig. 2. With recirculated air button pressed, continuity should exist between terminals No. 2 and 7 of connector "A". With fresh air button pressed, continuity should exist between terminals No. 2 and 8. If continuity is not as specified, replace A/C-heater control panel.

AIRFLOW MODE CONTROL SWITCHES TEST

Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Check continuity between specified terminals of connector "A". See AIRFLOW MODE CONTROL SWITCHES CONTINUITY TEST table. If continuity is not as specified, replace A/C-heater control panel.

AIRFLOW MODE CONTROL SWITCHES CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals
Face	2 & 9
Bi-Level	2 & 10
Foot	2 & 11
Foot/Defrost	2 & 12
Defrost	2 & 13

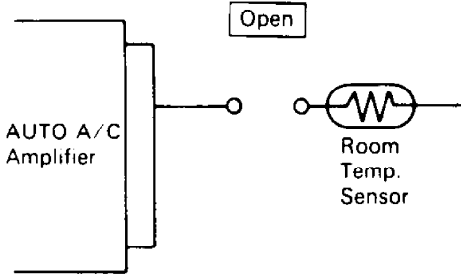
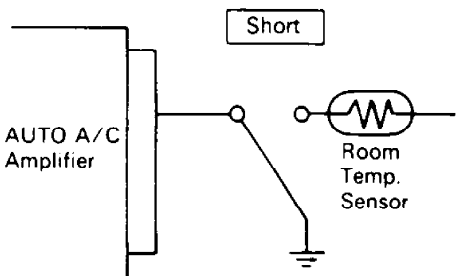
A/C AMPLIFIER CIRCUIT TEST

Disconnect A/C amplifier connector. Turn ignition on. Turn temperature control dial to maximum cool position. Turn blower switch to HI position. At harness side of A/C amplifier connector, check continuity, resistance and voltage at specified terminals. See A/C AMPLIFIER CIRCUIT TEST table. See Fig. 4. If continuity, resistance or voltage is not as specified, repair appropriate circuit.

A/C AMPLIFIER CIRCUIT TEST TABLE

Terminals & Test Condition	Specification
2 & Ground (1)	
Coolant Temp. Less Than 203°F (95°C)	Continuity
Coolant Temp. Greater Than 212°F (100°C) .	No Continuity
15 & Ground	Continuity
10 & Ground	
1.6L	No Continuity
2.2L	Continuity
5 & Ground (1)	Approx. 12 Ohms
9 & 14	Approx. 115 Ohms
16 & 14	
Air Temp. @ 77°F (25°C)	Approx. 15,000 Ohms
1 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
3 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
6 & Ground	
A/C Switch On	No Voltage
A/C Switch Off	Battery Voltage
8 & Ground	Battery Voltage
13 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
18 & Ground	
Engine Running	Approx. 10-14 Volts
Engine Off	No Voltage

(1) - Vehicles with variable displacement compressor only.

False Signal	A	B
Condition	Interior room temperature is very low. 	Interior room temperature is very high. 
Your Work	Disconnect room temperature sensor connector.	Disconnect room temperature sensor connector. Ground appropriate terminal of room temperature sensor female connector.

System Main Parts	False Signal	Motion			
Air Mix Control Servomotor	A	Air mix control servo motor shaft moves towards max-hot side.			
	B	Air mix control servo motor shaft moves towards max-cool side.			
Airflow Mode Control Servomotor		Airflow Mode Door Position			
		VENT	BI-LEVEL	HEAT	DEF
	A	Close	Close	Open	Close
	B	Open	Close	Close	Close

System Main Parts	False Signal	Motion
Blower Motor	A	Blower motor rotates at high speed.
	B	
Heater Water Valve	A	OPEN
	B	CLOSE
Air Inlet Control Servomotor	FRE Switch ON	Fresh air is ventilated.
	REC Switch ON	Recirculated air is ventilated.

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Fig. 3: Testing Auto A/C Amplifier
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Wiring Harness Connector

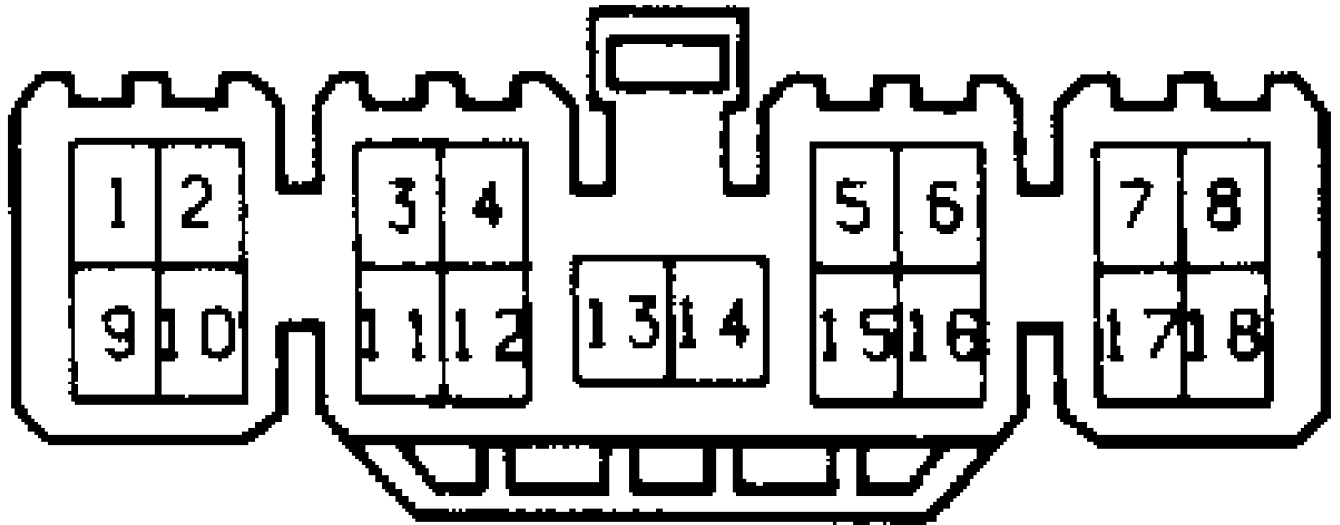


Fig. 4: Identifying A/C Amplifier Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AIR MIX CONTROL SERVOMOTOR

Servomotor

1) Disconnect air mix control servomotor wiring harness connector. Apply battery voltage to terminal No. 2, and ground terminal No. 6. See Fig. 5. Ensure arm rotates smoothly from hot to cool position.

2) Apply battery voltage to terminal No. 6, and ground terminal No. 2. Ensure arm rotates smoothly from cool to hot position. If operation is not as specified, replace servomotor.

Position Sensor

Measure resistance between terminals No. 1 and 3. See Fig. 5. Reading should be about 6000 ohms. Set arm to cool position. While rotating arm to hot position, measure resistance between terminals No. 1 and 4. Resistance should decrease from about 4800 ohms to 1200 ohms. If readings are not as specified, replace air mix control servomotor.

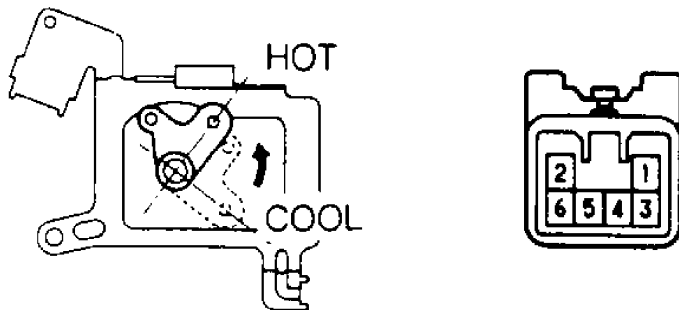


Fig. 5: Testing Air Mix Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AUTO A/C AMPLIFIER TEST

1) Set temperature control dial to 77°F (25°C). Disconnect room temperature sensor connector. This simulates very low room temperature (FALSE SIGNAL "A"). See Fig. 3. System should operate at maximum heating, and components indicated in chart should operate as specified.

2) Ground appropriate terminal of room temperature sensor connector. This simulates very high room temperature (FALSE SIGNAL "B"). System should operate at maximum cooling, and components indicated in chart should operate as specified.

3) If system and components operate as specified, replace room temperature sensor. If system and components DO NOT operate as specified, replace auto A/C amplifier.

BLOWER SPEED CONTROL SWITCH TEST

Disconnect connector "B" from A/C-heater control panel. See Fig. 2. Check continuity between specified terminals of connector "B". See BLOWER SPEED CONTROL SWITCH CONTINUITY TEST table. If continuity is not as specified, replace A/C-heater control panel.

BLOWER SPEED CONTROL SWITCH CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals
OFF	None
AUTO	1, 3 & 7
LO	2, 3 & 6
f	2, 3 & 4
HI	2, 3 & 5

TEMPERATURE CONTROL DIAL TEST

1) Disconnect connector "C" from A/C-heater control panel. See Fig. 2. Measure resistance between terminals No. 2 and 3 of connector "C". Resistance should be approximately 3000 ohms.

2) Measure resistance between terminals No. 1 and 3 while rotating temperature control dial from cool position to hot position. If resistance does not vary from zero to about 3000 ohms, replace A/C-heater control panel.

AMBIENT TEMPERATURE SENSOR TEST

Disconnect electrical connector from ambient temperature sensor, located at front grille, near horns. Check resistance across ambient temperature sensor terminals. If resistance is not as specified, replace sensor. See AMBIENT TEMPERATURE SENSOR RESISTANCE TEST table.

AMBIENT TEMPERATURE SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	Ohms
77 (25)	1700
122 (50)	620

COOLANT TEMPERATURE SENSOR TEST

Remove coolant temperature sensor. Submerge sensing portion of sensor in container of water. Monitor water temperature with thermometer, and measure resistance between sensor terminals. See

COOLANT TEMPERATURE SENSOR RESISTANCE TEST table. Use ice or hot water to change temperature of water. Replace sensor if resistance is not as specified.

COOLANT TEMPERATURE SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	Ohms
34 (1)	15,000-19,000
104 (40)	2500-2700
158 (70)	800-1000

ROOM (IN-CAR) TEMPERATURE SENSOR TEST

NOTE: If room temperature sensor circuit is open, system will operate at maximum heating. If circuit is shorted, system will operate at maximum cooling.

Disconnect electrical connector from room temperature sensor, located under driver knee bolster. Measure resistance across sensor terminals. If resistance is not as specified, replace the sensor. See ROOM TEMPERATURE SENSOR RESISTANCE TEST table.

ROOM TEMPERATURE SENSOR RESISTANCE TEST TABLE

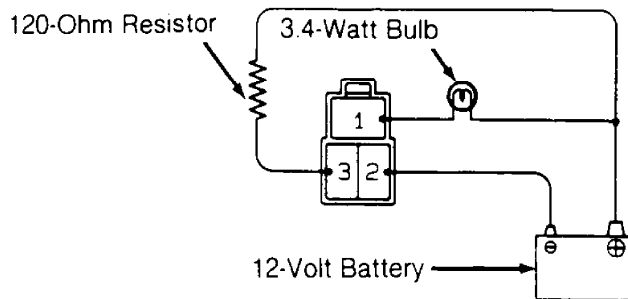
Temperature °F (°C)	Ohms
77 (25)	1700
122 (50)	620

RPM SENSOR TEST

Disconnect compressor connector. Measure resistance between White/Blue wire and White/Red wire terminals of compressor connector. If resistance is not 100-130 ohms at 68°F (20°C), replace RPM sensor.

POWER TRANSISTOR TEST

Disconnect power transistor connector. Connect battery, 120-ohm resistor and 3.4-watt light bulb to terminals as shown. See Fig. 5. If light bulb does not come on, replace power transistor.



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Fig. 6: Testing Power Transistor
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

SOLAR (SUNLOAD) SENSOR TEST

Disconnect solar sensor connector. Check continuity across solar sensor terminals. If there is no continuity, replace solar sensor.

SYSTEM AMPLIFIER TEST

1) Disconnect system amplifier connector. Turn ignition on. Turn temperature control dial to maximum cool position. At system amplifier connector, check continuity and voltage at specified terminals. See SYSTEM AMPLIFIER TEST (PART 1 OF 2) table. See Fig. 7.

SYSTEM AMPLIFIER TEST (PART 1 OF 2) TABLE

Terminal No.	Specified Value
1 & 6	Continuity
9 & Ground	Continuity
7 & Ground	Battery Voltage

2) If continuity and voltage are not as specified, repair appropriate circuit. If continuity and voltage are as specified, turn off ignition. Reconnect system amplifier connector. Start engine. Turn A/C on. Turn blower switch to HI position.

3) Set temperature dial in appropriate position, and check voltage at specified terminals of system amplifier connector (backprobe terminals). See SYSTEM AMPLIFIER TEST (PART 2 OF 2) table. If voltage is as specified, system amplifier is okay. If voltage is not as specified, replace system amplifier.

SYSTEM AMPLIFIER TEST (PART 2 OF 2) TABLE

Terminals & Test Condition	Specification
3 & Ground	
Maximum Hot	Approximately Zero Volts
Maximum Cool	(1) Approximately 5 Volts
4 & Ground	
Maximum Hot	(1) Approximately 5 Volts
Maximum Cool	Approximately Zero Volts

(1) - When temperature control dial is turned, reading may drop to zero volts and then slowly return to 5 volts.

WIRING HARNESS CONNECTOR

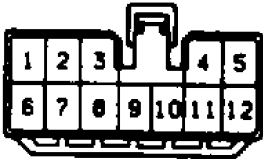


Fig. 7: Identifying System Amplifier Connector Terminals
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

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COMPRESSOR

Removal

Run engine with A/C on for at least 10 minutes (if possible). Turn engine off. Remove battery. Disconnect A/C wire harness connector. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect A/C hoses from service valves. Plug all openings. Remove compressor drive belt. Remove compressor bolts and compressor.

Installation

To install, reverse removal procedure. Evacuate and charge A/C system.

EVAPORATOR, EXPANSION VALVE & THERMISTOR

Removal

1) Disconnect negative battery cable. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect inlet and outlet lines and grommets from evaporator at engine compartment firewall. Plug openings.

2) Disconnect electrical connectors from evaporator case as necessary. Remove glove box and reinforcement. In passenger compartment, remove 3 nuts and 4 bolts securing evaporator case to firewall. Remove evaporator case.

Disassembly

Remove evaporator case clips and screws. See Fig. 8. Separate evaporator case halves. Remove thermistor, evaporator and expansion valve.

Reassembly & Installation

To reassemble and install evaporator assembly, reverse disassembly and removal procedures. If installing new evaporator core, add 1.4-1.7 ounces of refrigerant oil to system. Evacuate and charge A/C system.

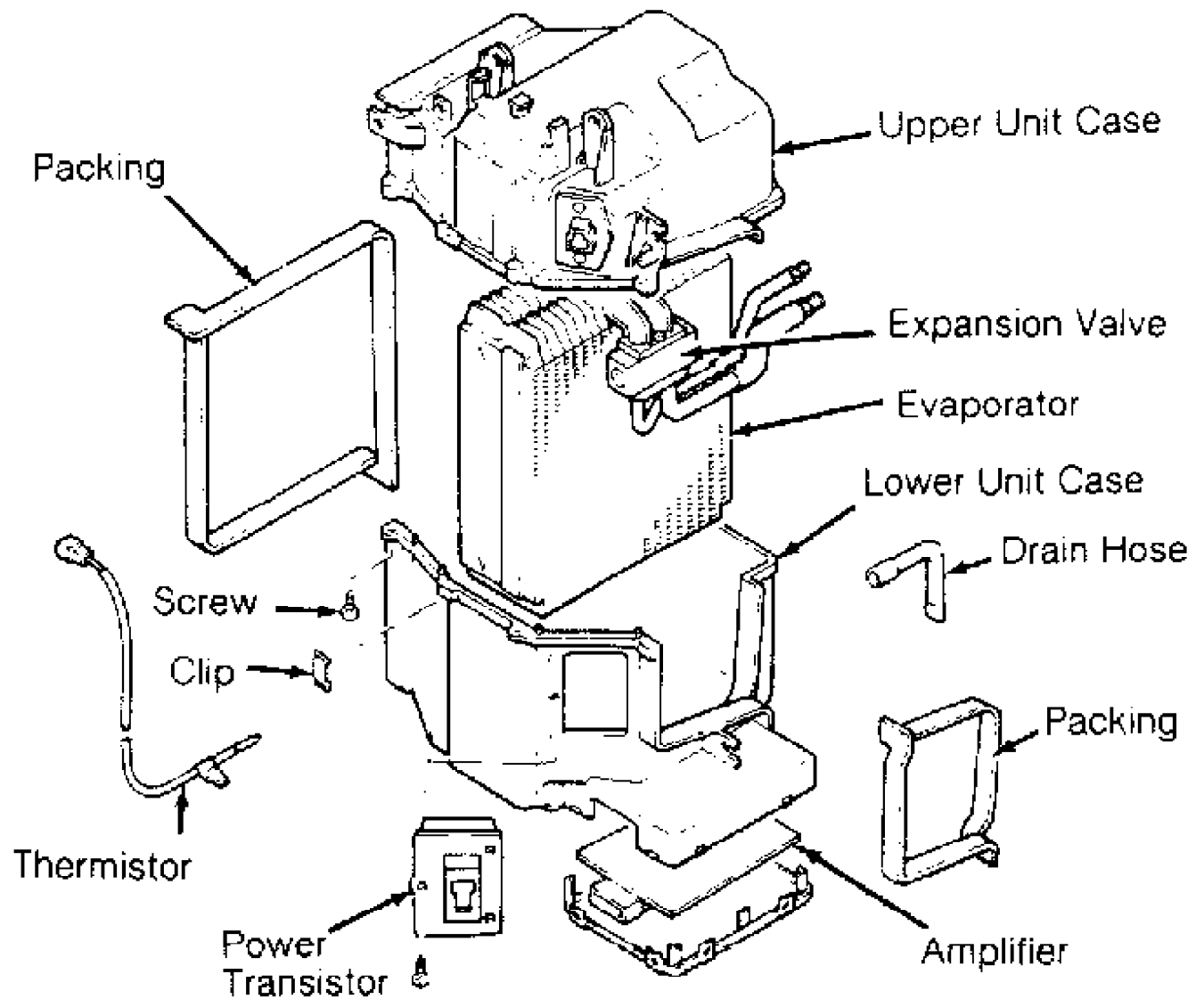


Fig. 8: Exploded View Of Evaporator Case
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONDENSER

Removal

Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove lower engine cover. Remove grille and hood lock brace. Remove horns. Disconnect A/C lines from condenser. Plug all openings. Remove mounting bolts and condenser.

Installation

To install, reverse removal procedure. If installing new condenser, add 1.4-1.7 ounces of refrigeration oil to system. Evacuate and charge A/C system.

RECEIVER-DRIER

Removal

Discharge A/C system using approved refrigerant

recovery/recycling equipment. Disconnect A/C hoses from receiver-drier. Plug all openings. Remove receiver-drier bolts and receiver-drier.

Installation

To install, reverse removal procedure. Add 0.7 ounce of refrigerant oil to system. Evacuate and charge A/C system.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Compressor Bolts	
1.6L	18 (24)
2.0L & 2.2L	25 (34)
Refrigerant Hose Fitting	
At Compressor	18 (24)
At Condenser	
Liquid Line	10 (14)
Discharge Line	17 (23)
At Evaporator	
Liquid Line	10 (14)
Suction Line	24 (32)
At Receiver-Drier	10 (14)

WIRING DIAGRAMS

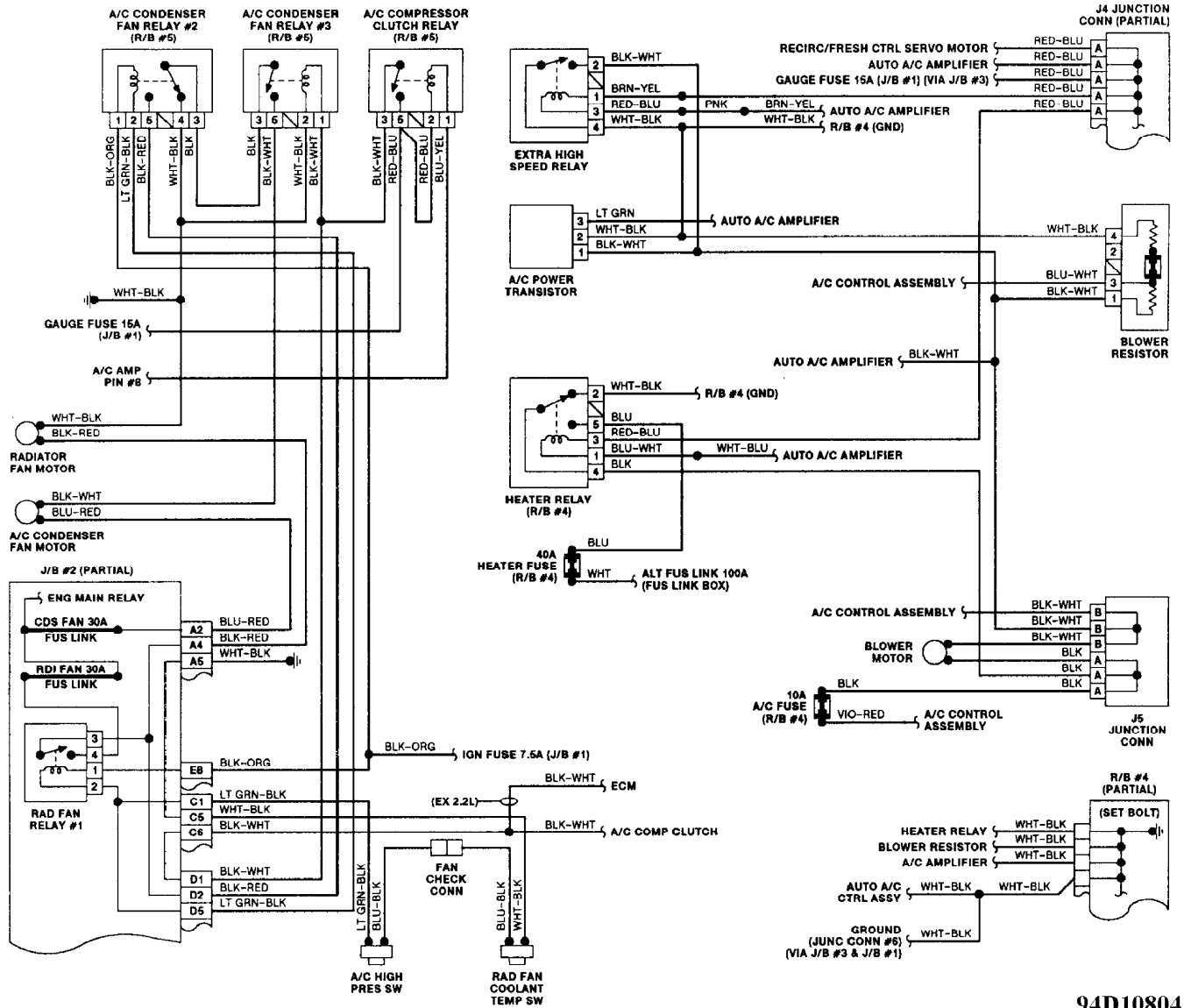


Fig. 10: Automatic A/C-Heater System Wiring Diagram (2 Of 2)