

A/C-HEATER SYSTEM - MANUAL

1993 Toyota Celica

1993 Manual A/C-Heater Systems

Celica

A/C SYSTEM SPECIFICATIONS

SPECIFICATIONS TABLE

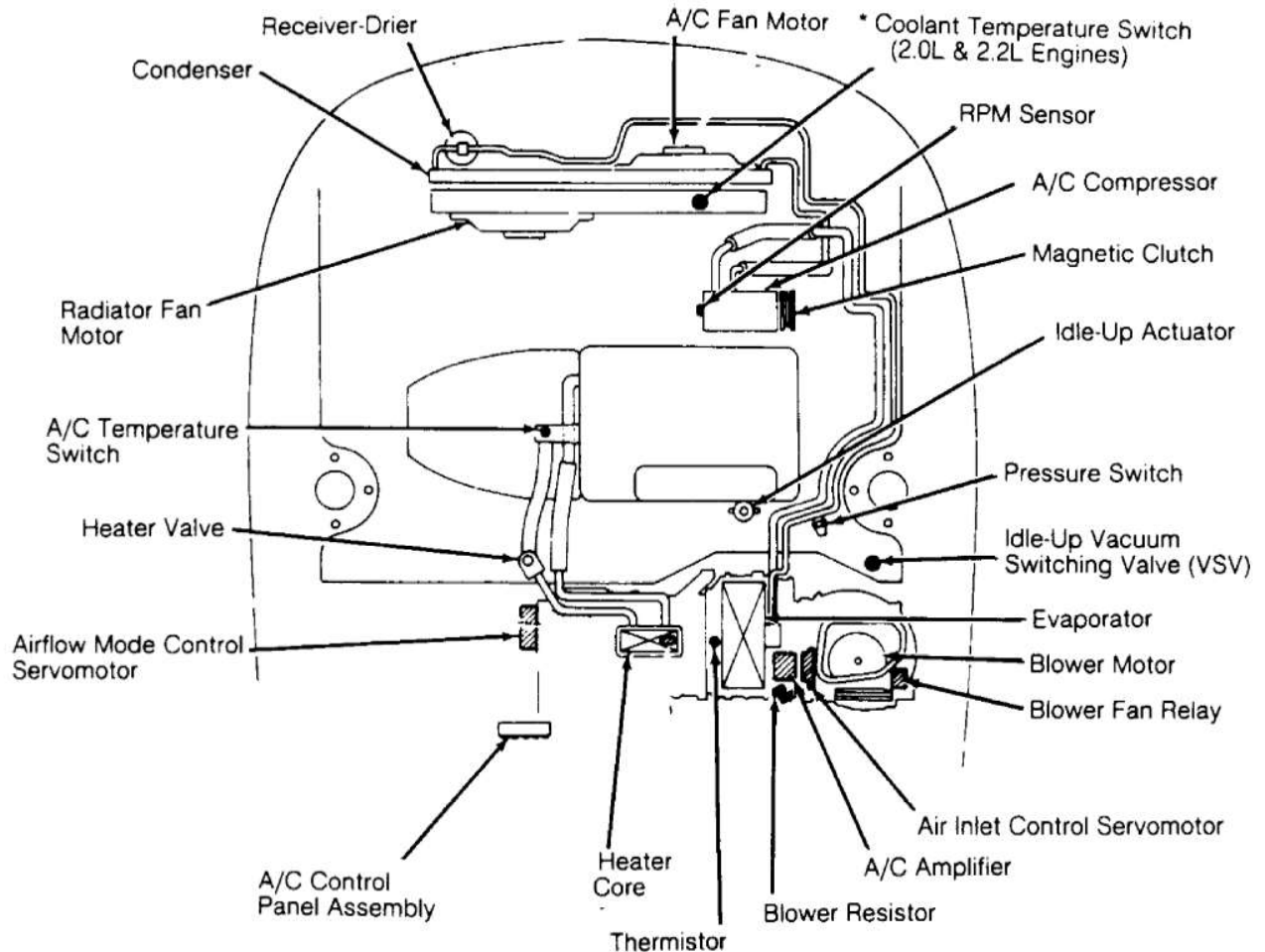
Application	Specification
Compressor Type	
4A-FE Engine	Nippondenso 10PA15C 10-Cyl.
3S-GTE & 5S-FE Engine	Nippondenso 10PA17C/VC 10-Cyl.
Compressor Belt Tension (1)	
1.6L Engine	
New	135-185 lbs. (61.2-83.9 kg)
Used	80-120 lbs. (36.2-54.4 kg)
2.0L Engine	
New	155-175 lbs. (70.3-79.4 kg)
Used	69-99 lbs. (31.3-44.9 kg)
2.2L Engine	
New	155-175 lbs. (70.3-79.4 kg)
Used	100-120 lbs. (45.4-54.4 kg)
System Oil Capacity	3.4-4.7 ozs.
Refrigerant (R-12) Capacity	24-27 ozs.
System Operating Pressures	
High Side	206-213 psi (14.5-15 kg/cm ²)
Low Side	21-28 psi (1.5-2.0 kg/cm ²)
(1) - Using belt tension gauge, measure at longest run of belt.	

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 & ELECTRICAL section.

DESCRIPTION

The 2.0L and 2.2L A/T equipped models use a Nippondenso 10-cylinder variable displacement compressor. All other models use a Nippondenso 10-cylinder fixed displacement compressor. An electric condenser fan operates at 2 speeds, depending on coolant temperature and A/C switch position.

System components include A/C amplifier, evaporator, thermistor, triple-pressure switch, engine coolant temperature switch, A/C compressor, condenser, receiver-drier and pipes and hoses. See Fig. 1. Air door operation is controlled through cables or servomotors. A/C compressor operation and A/C modes are electrically controlled.



NOTE: Coolant Temperature Switch (for cooling fan control) on 1.6L engine is located on thermostat housing.

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

OPERATION

SYSTEM CONTROLS

A/C modes are controlled by push buttons and an A/C on-off switch. A dial type switch is used to control fan speed functions. See Fig. 2. A/C controls operate air supply selection (fresh or recirculating air), mode, temperature selection and blower speeds.

Temperature control knob operates the blend-air door in the A/C-heater unit. This mixes cooled and heated air so the selected air temperature can be obtained. The system will provide cooled air when A/C switch is on and blower motor is in any position other than OFF. The temperature control knob should be rotated counterclockwise (maximum cooling) when maximum A/C operation is desired.

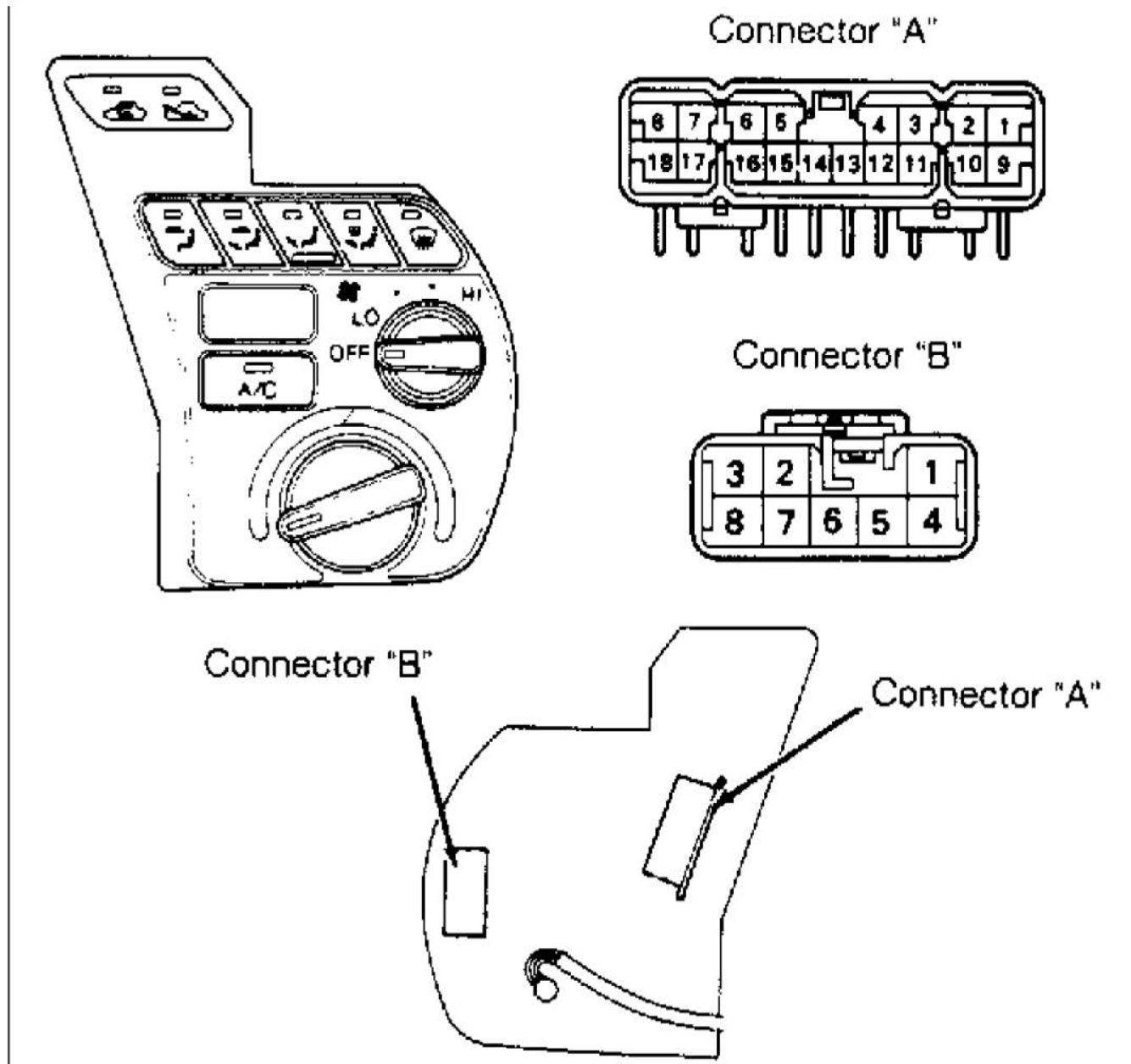


Fig. 2: Identifying A/C-Heater Control Panel Terminals
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

SYSTEM COMPONENTS

A/C Switch

When A/C switch is pushed, A/C will operate if the blower motor control is in any position other than off. When activated, the A/C switch allows the compressor (magnetic) clutch to engage and operate the compressor. When activated, a light will illuminate on the A/C push button.

Triple-Pressure Switch

The triple-pressure switch is located on the liquid line, and

is wired in series with the compressor (magnetic) clutch and the electric fan motor. The compressor clutch control portion of the switch cuts off electrical power to the clutch when refrigerant pressures have gone above or below the control point of the switch. When pressures have returned to normal operating ranges, compressor clutch receives power to resume operation.

The fan control portion of the switch cuts off electrical power to the condenser fan motor when refrigerant pressures have gone above the control point of the switch. When pressures have returned to normal operating ranges, condenser fan receives power to resume operation.

Thermistor

The thermistor is a thermocouple, mounted in front of the evaporator (air outlet side) to sense airflow temperature. The thermistor is electronically wired in series with the compressor clutch. The evaporator thermistor is used to prevent the evaporator from freezing up. The amplifier uses value received from thermistor to send appropriate electrical signal to compressor clutch for proper on-off cycling.

Vacuum Switching Valve (VSV)

A solenoid valve is used to assist in smooth engine operation during compressor on cycle. The VSV holds the throttle at slightly above idle (spring loaded to this position) when A/C system is operating. When system is off, vacuum is directed to VSV diaphragm, allowing throttle to return to normal idle position.

ADJUSTMENTS

AIR MIX DAMPER

With control cable of air mix damper removed, set air mix damper and temperature control switch to cool position. See Fig. 3. Install control cable and clamp.

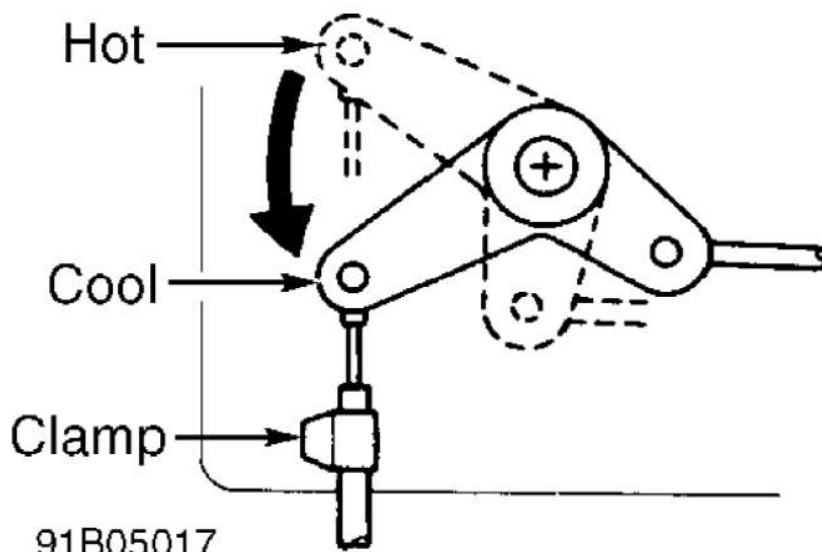
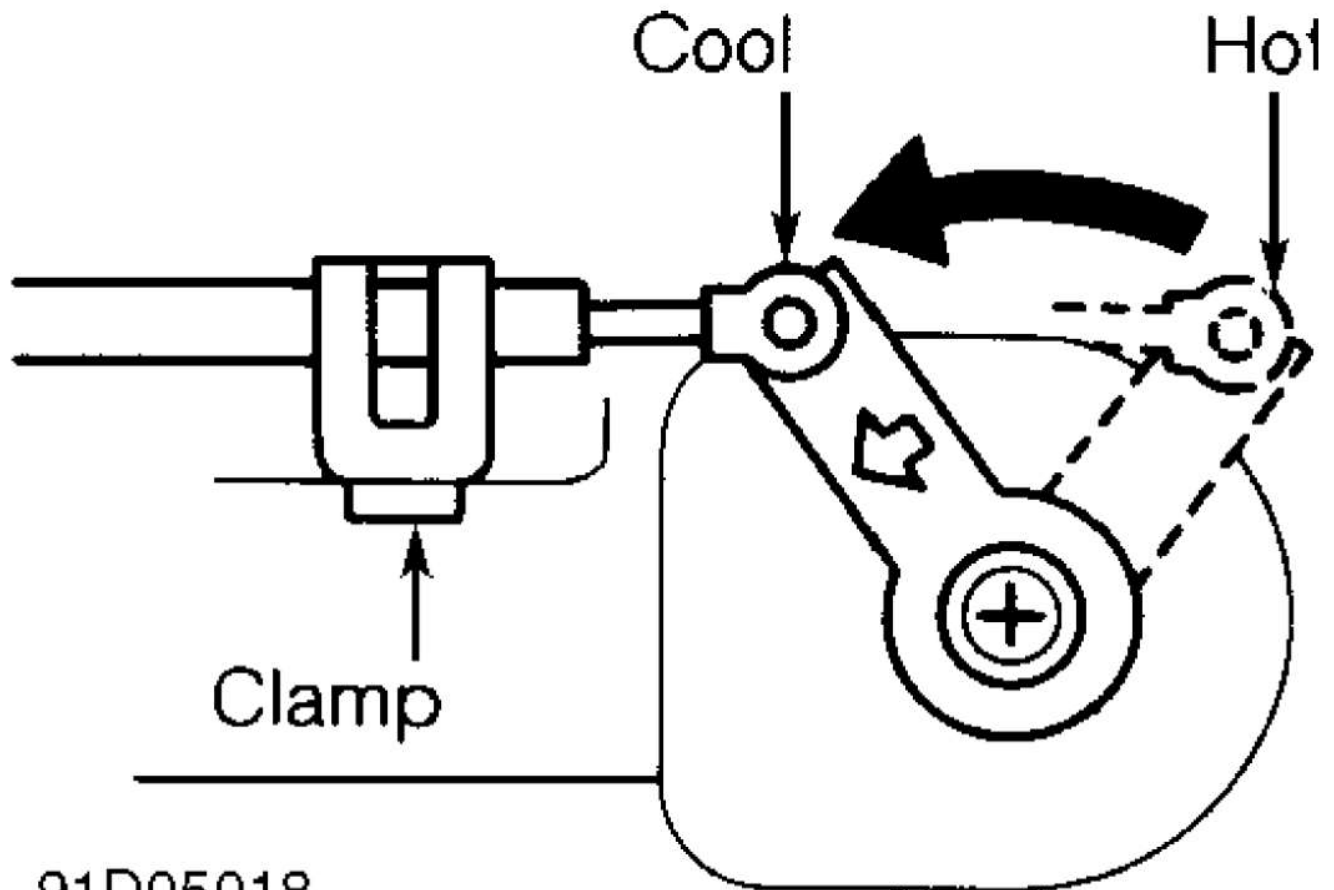


Fig. 3: Adjusting Air Mix Damper
Courtesy of Toyota Motor Sales, U.S.A., Inc.

HEATER VALVE

On servomotor type temperature control switch, turn ignition on, set temperature control switch to cool position, and turn blower motor on. Set heater valve and temperature control switch to cool position. See Fig. 4. Install control cable and clamp.



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Fig. 4: Adjusting Heater Valve Control Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TROUBLE SHOOTING

NO BLOWER OPERATION

Problem may be due to blown fuses, faulty heater relay, or faulty blower motor or resistor. Also check for faulty blower fan relay or blower switch, faulty A/C-heater control panel, faulty wiring or bad ground.

NO COOL AIR

Problem may be due to blown fuses, incorrect refrigerant charge, incorrect A/C compressor belt tension, faulty compressor (magnetic) clutch relay, or faulty pressure switch or A/C compressor. Check for plugged receiver-drier, condenser, expansion valve or evaporator. Also check for faulty A/C-heater control panel, faulty thermistor or A/C amplifier, faulty wiring or bad ground.

INTERMITTENT COOL AIR

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or faulty compressor clutch. Check for plugged expansion valve.

COOL AIR ONLY AT HIGH SPEED

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or faulty A/C compressor. Check for plugged condenser, faulty A/C fan motor or faulty fan relay.

INSUFFICIENT COOLING

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or A/C control cable out of adjustment. Check for clogged condenser, faulty A/C compressor, or faulty A/C fan or relay. Also check for faulty expansion valve, faulty A/C-heater control panel, faulty air mix servomotor or faulty wiring.

INSUFFICIENT COOL AIR VELOCITY

Problem may be caused by faulty blower motor, blocked air inlet, clogged/frosted evaporator, or air leakage from evaporator case or air duct.

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 & ELECTRICAL section.

A/C SYSTEM PERFORMANCE

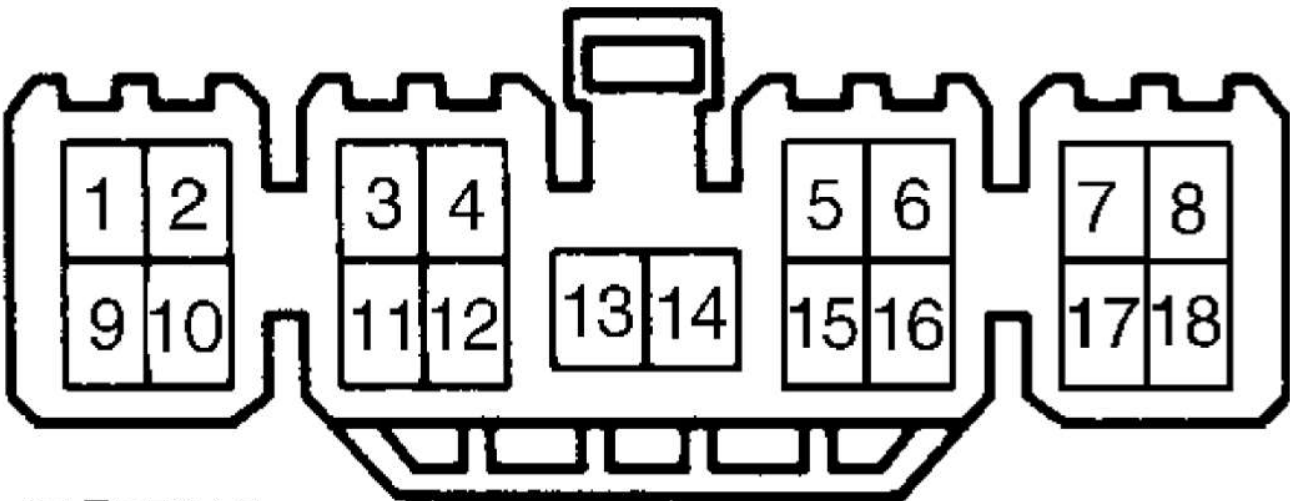
Connect manifold gauge set. Operate engine at 2000 RPM. Place blower fan on high speed. Place temperature control switch on maximum cooling. Set A/C-heater control panel in recirculated air mode. Ensure air inlet temperature is between 86-95°F (30-35°C). Ensure system operating pressures are within specification. See SPECIFICATIONS table at beginning of article.

A/C SWITCH

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

A/C AMPLIFIER

Disconnect A/C amplifier connector. See Fig. 1. Test wiring harness side of connector. See Fig. 5. Ensure circuit tests as specified in A/C AMPLIFIER CIRCUIT TEST table. If circuit is not as specified, repair as necessary.



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Fig. 5: Identifying A/C Amplifier Harness Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

A/C AMPLIFIER CIRCUIT TEST TABLE

Terminal No. & Test Condition (1)	Specification
2 & Ground (2)	
Coolant Temp. Less Than 203°F (95°C)	Continuity
Coolant Temp. Greater Than 212°F (100°C) ...	No Continuity
15 & Ground	Continuity
10 & Ground	
3S-GTE (2.0L)	No Continuity
5S-FE (2.2L)	Continuity
5 & Ground (2)	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	Voltage
A/C Switch Off	No Voltage
3 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
6 & Ground	Battery Voltage
8 & Ground	Battery Voltage
13 & Ground	Battery Voltage
18 & Ground	
Start Engine	Approx. 10-14 Volts
Stop Engine	No Voltage
(1) - Basic test condition: ignition on, temperature control in max. cool position and blower switch on HI position.	
(2) - Models with variable displacement compressor only.	

BLOWER MOTOR

Disconnect wiring harness connector. Apply battery voltage to motor connector. See Fig. 6. Motor should operate smoothly. If motor does not operate smoothly, replace motor.

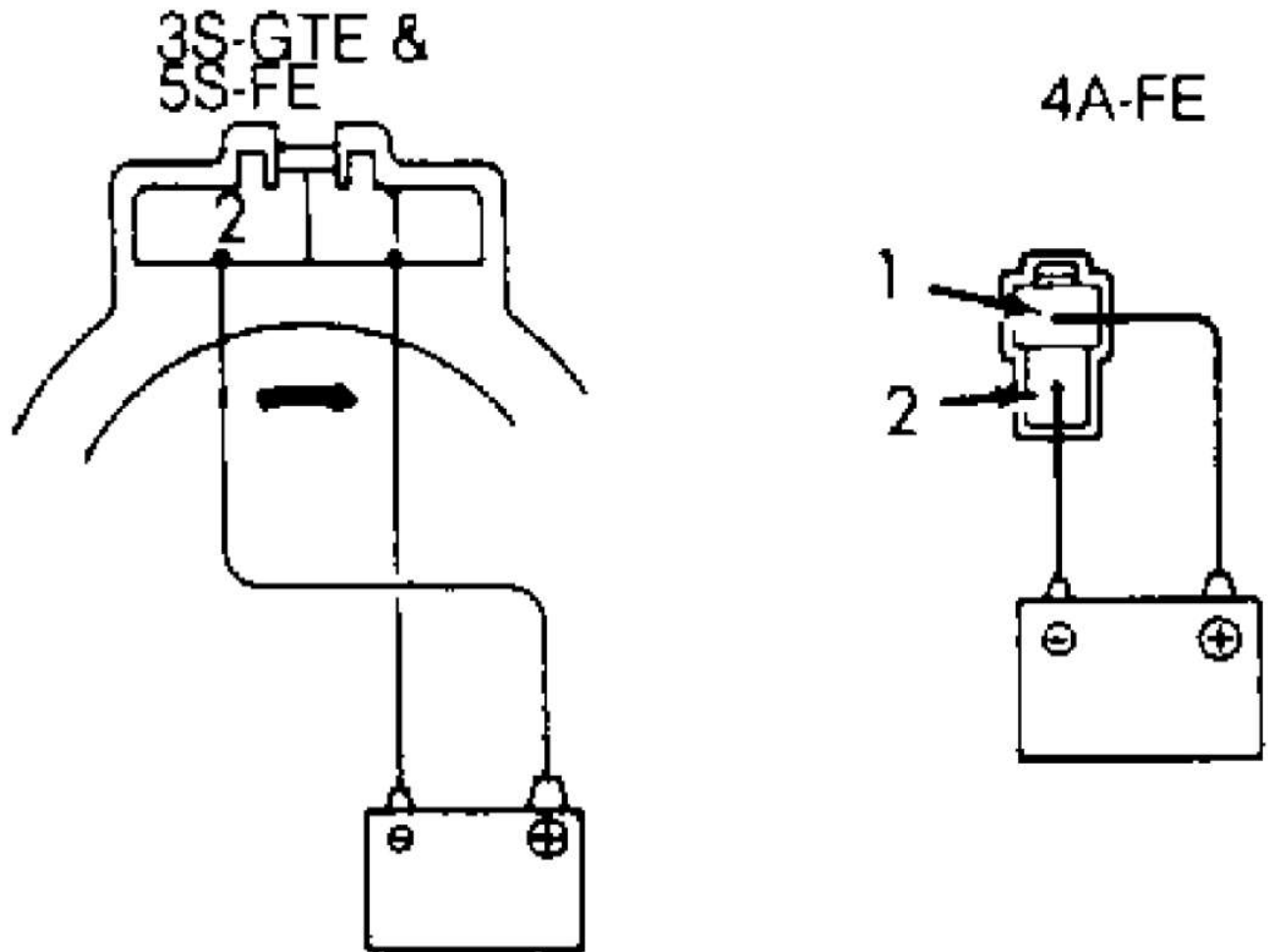


Fig. 6: Identifying Blower Motor Connector Terminals
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

COOLANT TEMPERATURE SWITCH

When coolant temperature reaches 212°F (100°C), switch opens and breaks continuity. When coolant temperature drops to approximately 203°F (95°C), switch closes and restores continuity. If switch does not function as specified, replace switch.

CONDENSER FAN MOTOR

Disconnect fan motor 2-pin connector. Apply battery voltage to fan motor connector. Fan motor should rotate smoothly and current draw should be 6.0-7.4 amps. If operation is not as specified, replace condenser fan motor.

INDICATOR & ILLUMINATION LIGHTS

A/C Indicator

Disconnect harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground

terminal No. 15. Depress A/C switch and ensure indicator light comes on. If indicator light does not come on, replace A/C-heater control panel.

Air Inlet Indicator

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Ensure recirculated and fresh air indicator lights come on each time air inlet control switch is pressed. If operation is not as specified, replace A/C-heater control panel.

Illumination Light Operation

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 18, and ground terminal No. 17. Illumination light should come on. If illumination light does not come on, remove and check bulb.

Indicator Light Dimming Operation

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Apply battery voltage to terminal No. 3. Indicator lights should dim. If operation is not as specified, replace A/C-heater control panel.

Mode Indicator

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Press each mode button and ensure proper indicator light comes on. If any light fails to come on, replace A/C-heater control panel.

MAGNETIC CLUTCH

1) Inspect pressure plate and rotor for oil contamination. Check clutch bearing for noisy operation and grease leakage. Using an ohmmeter, measure resistance of stator coil between compressor connector terminal No. 1 and ground. See Fig. 7.

2) Resistance should be 3.4–3.8 ohms at 68°F (20°C). If reading is not as specified, replace stator coil. Apply 12 volts to coil side of A/C compressor connector. If clutch does not energize, replace stator coil.

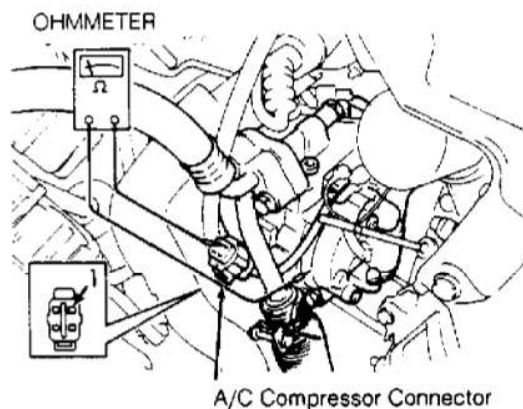


Fig. 7: Identifying A/C Compressor Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

RELAYS

Magnetic Clutch Relay

Remove relay. Using an ohmmeter, ensure continuity exists between terminals No. 1 and 2. See Fig. 8. Apply battery voltage to terminals No. 1 and 2. Continuity should exist between terminals No. 3 and 4. If continuity is not as specified, replace relay.

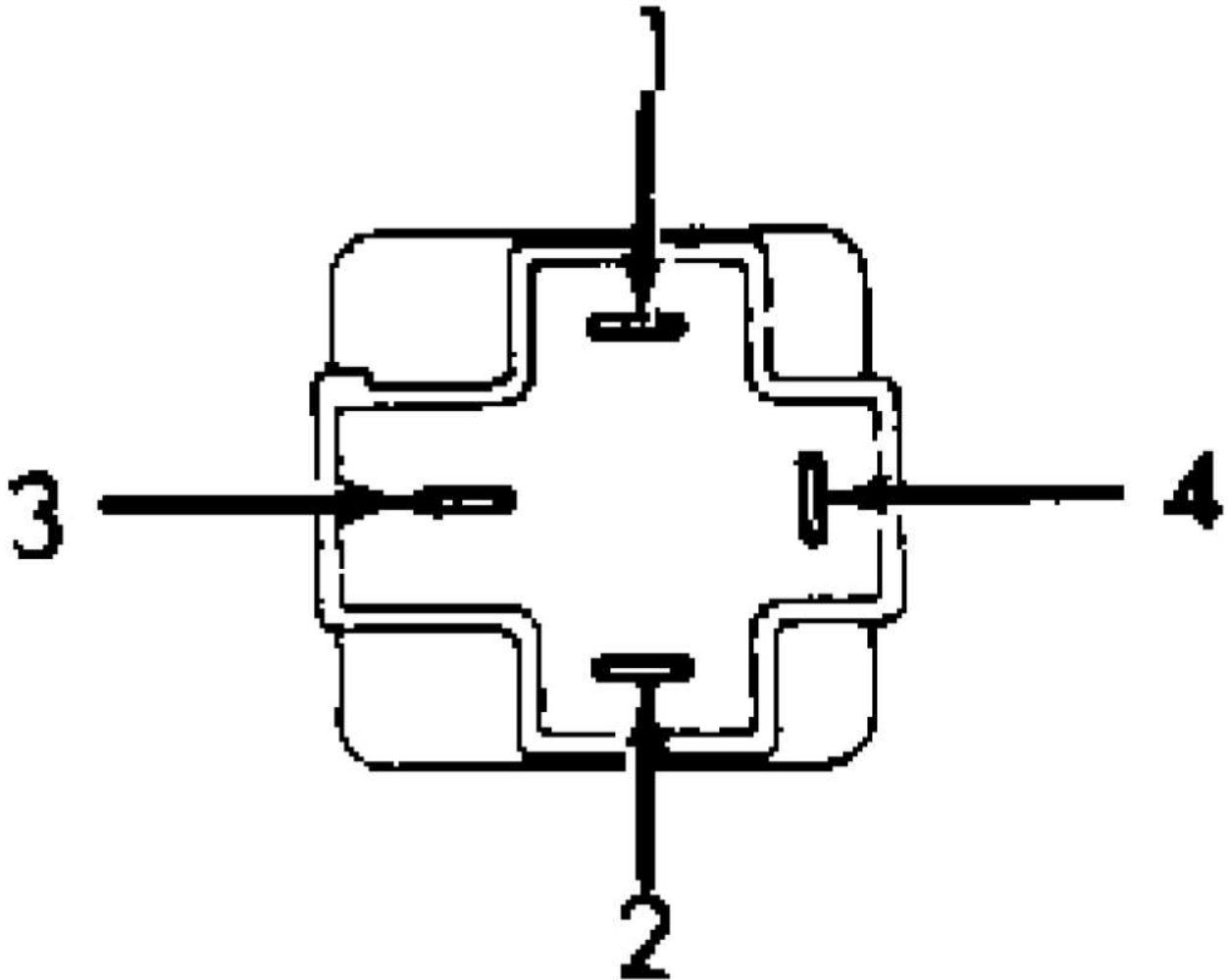


Fig. 8: Identifying Magnetic Clutch Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fan Relay No. 1

Remove relay. Using ohmmeter, ensure continuity exists between terminals No. 1 and 2 and terminals No. 3 and 4. See Fig. 9. Apply battery voltage between terminals No. 1 and 2. Continuity should not exist between terminals No. 3 and 4. If continuity is not as

specified, replace relay.

Fan Relay No. 2
Remove relay. Using ohmmeter, check continuity between terminals No. 1 and 2 and terminals No. 3 and 4. See Fig. 9. If continuity does not exist, replace relay. Apply battery voltage between terminals No. 1 and 2. Check continuity between terminals No. 3 and 5. If continuity does not exist, replace relay.

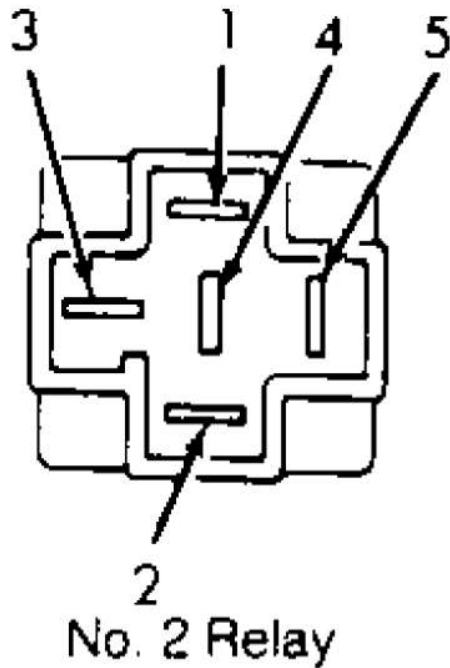
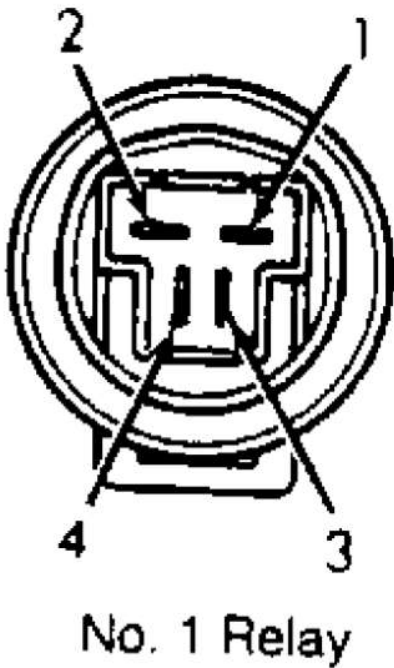


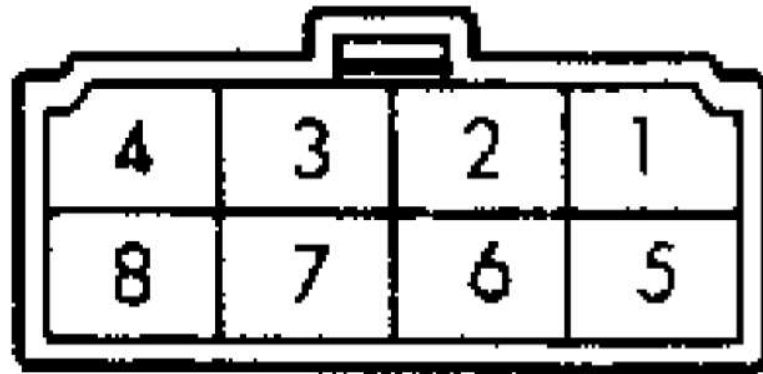
Fig. 9: Identifying A/C Fan Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Blower Fan Relay
Disconnect blower fan relay wiring harness connector. Test relay as specified in TESTING BLOWER FAN RELAY table. See Fig. 10. If relay fails any test, replace relay.

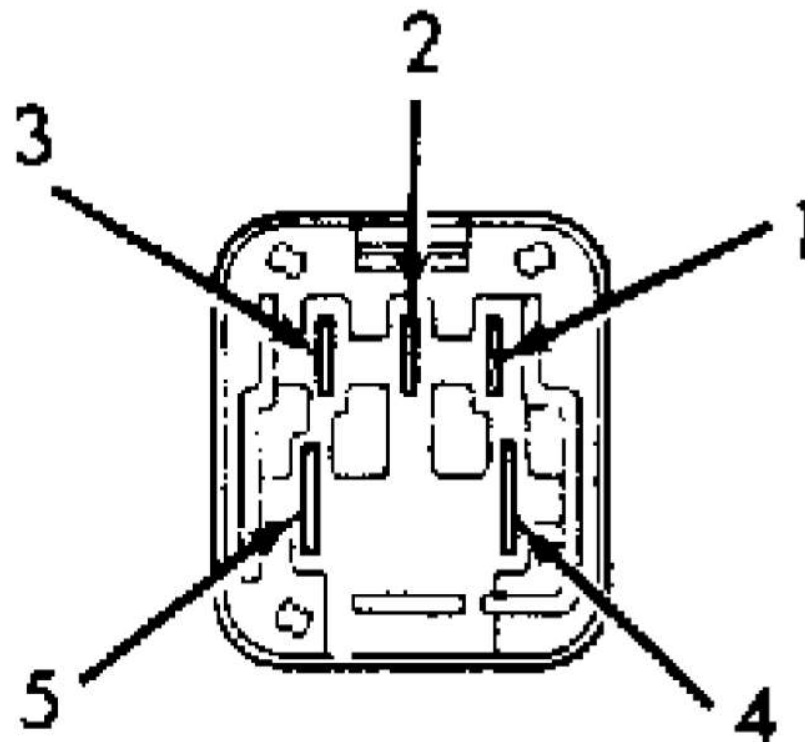
TESTING BLOWER FAN RELAY TABLE

Terminal No. & Test Condition		Specification
5 & 6, 5 & 7, 5 & 8		Constant Continuity
5 & 6 (1)	Continuity Between Terminal No. 1 & 3	
5 & 7 (1)	Continuity Between Terminal No. 3 & 4	
5 & 8 (1)	Continuity Between Terminal No. 2 & 3	

(1) - Apply battery voltage between terminals specified.



BLOWER FAN RELAY CONNECTOR



HEATER MAIN RELAY CONNECTOR

Fig. 10: A/C Blower Fan & Heater Main Relay Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Heater Main Relay

Disconnect heater main relay wiring harness connector. Test.

relay as specified in TESTING HEATER MAIN RELAY table. See Fig. 10. If relay fails any test, replace relay.

TESTING HEATER MAIN RELAY TABLE

Terminal No. & Test Condition	Specification
1 & 3, 2 & 4	Constant Continuity
1 & 3 (1)	Continuity Between Terminal No. 4 & 5
(1) - Apply battery voltage between terminals specified.	

RPM SENSOR

Disconnect wiring harness connector from A/C compressor. Using an ohmmeter, measure resistance between RPM sensor terminals No. 2 and 3. See Fig. 11. Resistance should be 100-130 ohms at 68°F (20°C). If resistance is not within specification, replace RPM sensor.

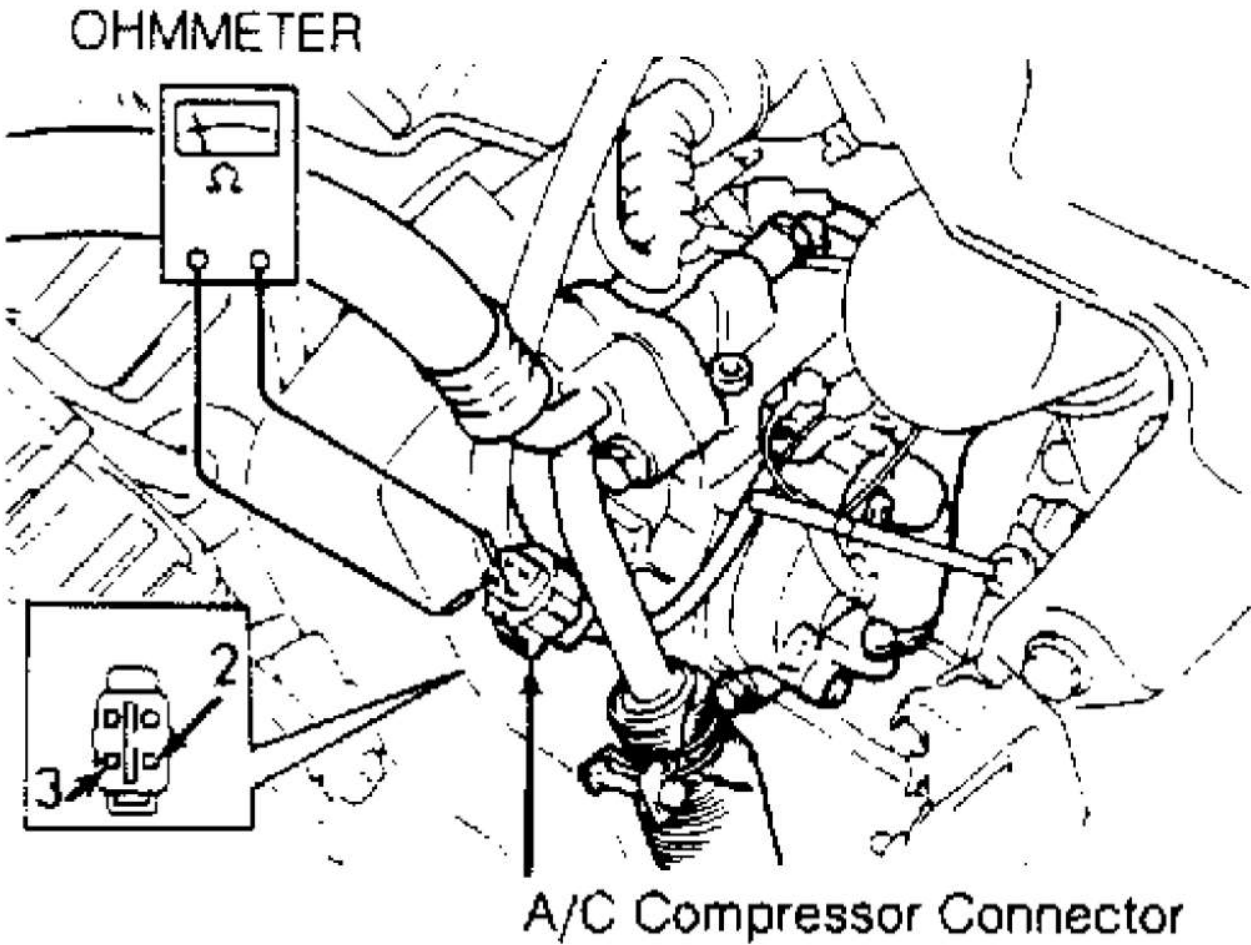


Fig. 11: Identifying RPM Sensor Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SERVOMOTORS

Air Inlet Control Servomotor

1) Disconnect servomotor connector. See Fig. 1. Apply battery voltage to terminal No. 1, and ground terminal No. 3. See Fig. 12. Ensure arm rotates smoothly to fresh air side.

2) Apply battery voltage to terminal No. 1, and ground terminal No. 2. See Fig. 12. Ensure arm rotates smoothly to recirculated air side. If operation is not as specified, replace servomotor.

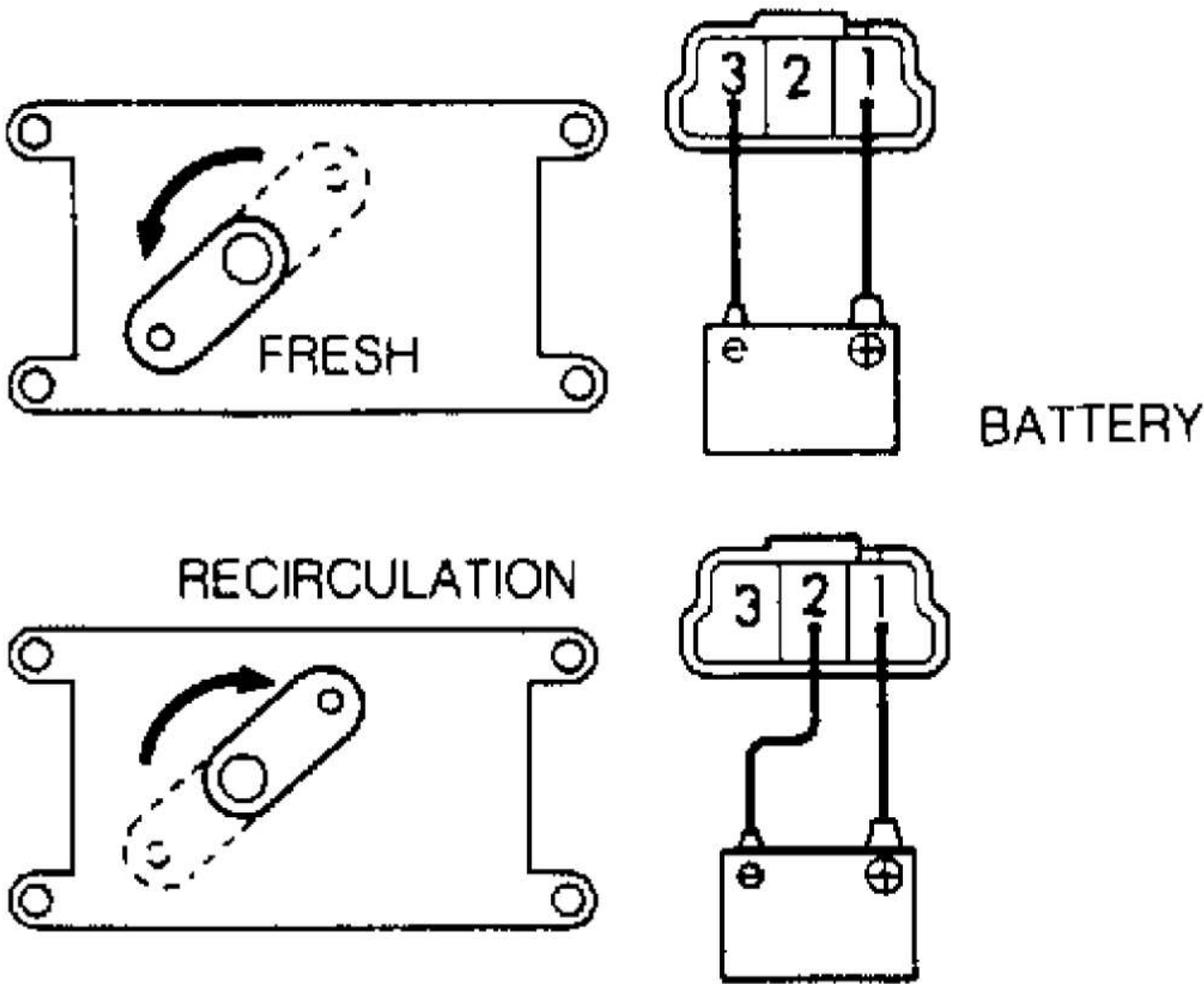


Fig. 12: Testing Air Inlet Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Airflow Mode Control Servomotor

Disconnect servomotor connector. See Fig. 1. Apply battery voltage to terminal No. 5, and ground terminal No. 6. See Fig. 13. Ground each specified terminal and ensure arm rotates smoothly to correct position. See TESTING AIRFLOW CONTROL SERVOMOTOR table.

TESTING AIRFLOW CONTROL SERVOMOTOR TABLE

Ground Terminal No.	Arm Position
1	Vent
2	Bi-Level

3		Foot 2
4		Foot/Defrost
7		Defrost
8		Foot 1

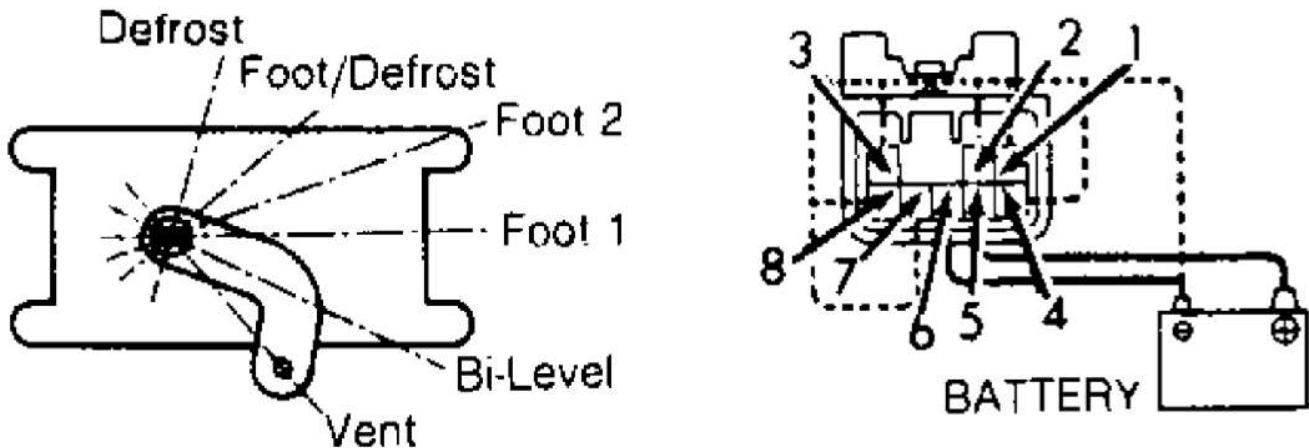


Fig. 13: Testing Airflow Mode Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SWITCHES

Air Inlet Control Switch

- 1) Disconnect wire harness connector "A" of A/C-heater control panel. See Fig. 2. With recirculated air button depressed, continuity should exist between terminals No. 2 and 7.
- 2) With fresh air button depressed, continuity should exist between terminals No. 2 and 8. Switch contains diodes. Check continuity in both directions before assuming switch is faulty. Continuity should exist in one direction only. If continuity does not exist or exists in both directions, replace A/C-heater control panel.

Blower Speed Control Switch

Disconnect wire harness connector "B" of A/C-heater control panel. See Fig. 2. Check continuity at specified terminals. See TESTING BLOWER SPEED CONTROL SWITCH table. If continuity is not as specified, replace A/C-heater control panel.

TESTING BLOWER SPEED CONTROL SWITCH TABLE

Switch Position	Continuity Between Terminals
OFF	No Continuity
LO	1, 3 & 7
(f) (1)	2, 3 & 6
(f) (2)	2, 3 & 4
HI	2, 3 & 5

- (1) - Square (f) closest to LO switch position.
- (2) - Square (f) closest to HI switch position.

Mode Control Switch

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Check continuity at specified terminals. See

TESTING MODE CONTROL SWITCH table. If continuity is not as specified, replace A/C-heater control panel.

TESTING MODE CONTROL SWITCH TABLE

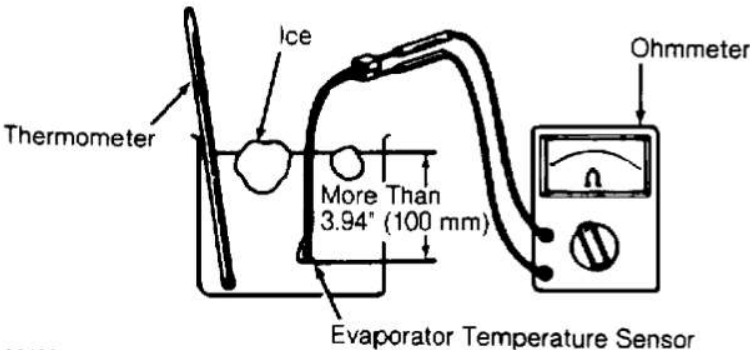
Switch Position	Continuity Between Terminals
Face	2 & 9
Bi-Level	2 & 10
Foot	2 & 11
Foot/Defrost	2 & 12
Defrost	2 & 13

THERMISTOR

- 1) Disconnect negative battery cable. Remove lower trim panel and glove box. Check thermistor installed operation. Using an ohmmeter, measure resistance of thermistor. Resistance should be 1500 ohms at 77°F (25°C). If resistance is not as specified, go to next step.
- 2) Remove evaporator case. See EVAPORATOR ASSEMBLY under REMOVAL & INSTALLATION. Disassemble evaporator case, and remove thermistor. Check thermistor operation. Place thermistor at least 3.94" (100 mm) deep in cold water.
- 3) Measure resistance at connector while measuring temperature of water using thermometer. See Fig. 14. Compare readings with THERMISTOR RESISTANCE VALUES table. Use ice or hot water to change temperature of water. If readings are not within specification, replace thermistor.

THERMISTOR RESISTANCE VALUES TABLE

Temperature °F (°C)	Ohms
41 (5)	3500-4100
39 (4)	3800-4300
37 (3)	3900-4500
36 (2)	4100-4800
34 (1)	4300-4900
32 (0)	4500-5200
30 (-1)	4700-5400



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Fig. 14: Testing Thermistor Resistance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TRIPLE-PRESSURE SWITCH

Magnetic Clutch Control

1) Install A/C manifold gauges. Start engine, turn A/C on and observe gauge readings. If low side pressure is less than 30 psi (2.1 kg/cm²), system pressure is too low and pressure switch (terminals No. 3 and 4) should be open and clutch disengaged.

2) If low side pressure is greater than 33 psi (2.4 kg/cm²), switch should be closed and clutch engaged. If pressure drops below 33 psi (2.4 kg/cm²), switch will open and disengage clutch.

3) During system operation, switch opens and disengages clutch if high side pressure becomes greater than 384 psi (27 kg/cm²). Switch remains open until high side pressure drops to less than 299 psi (21 kg/cm²). If switch does not operate as specified, replace switch. If switch is okay, proceed to ELECTRIC FAN CONTROL.

Electric Fan Control

If high side pressure becomes greater than 220 psi (15.5 kg/cm²), switch closes and condenser fan operates at high speed. When pressure drops to approximately 178 psi (12.5 kg/cm²), switch opens (terminals No. 1 and 2) and condenser fan returns to low speed operation. If switch does not function as specified, replace switch.

VACUUM SWITCHING VALVE (VSV)

1) Remove vacuum connections from fittings "A" and "B" on VSV. See Fig. 15. Connect VSV terminal connector to battery. Blow air through fitting "A". Air should pass from fitting "A" out through fitting "B". Air should not be felt at "C" (atmospheric port).

2) Disconnect battery from VSV terminal connector. Blow air through fitting "A". Air should pass from fitting "A" out through "C" (atmospheric port). Air should not come out of fitting "B".

3) Use ohmmeter to check for short between each terminal and VSV body. Also check resistance between terminals. Reading should be 38-43 ohms at 68°F (20°C).

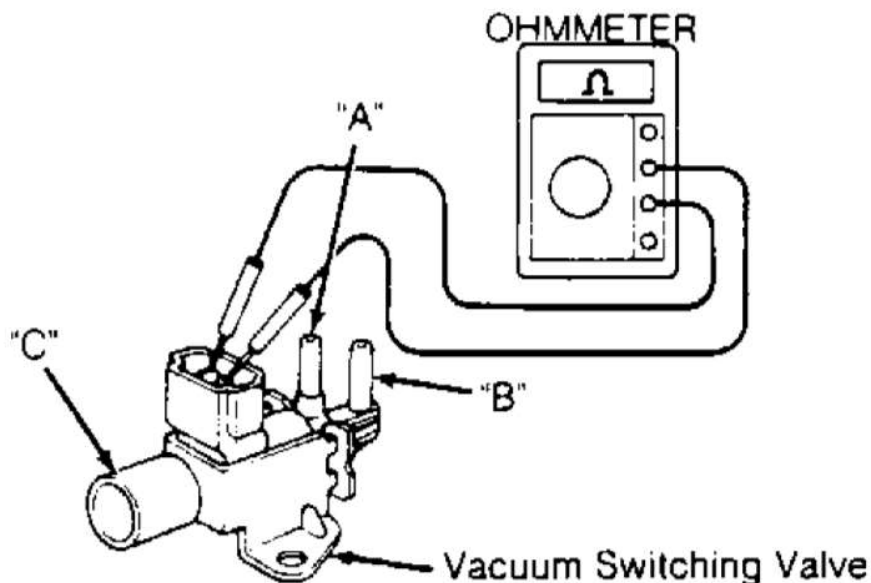


Fig. 15: Testing Vacuum Switching Valve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

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 appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

COMPRESSOR

Removal

1) If possible, run system longer than 10 minutes before starting removal procedure. Disconnect battery cables and remove battery. Disconnect A/C wiring harness connectors. Discharge A/C system using approved refrigerant recovery/recycling equipment.
2) Disconnect hoses from service valves. Plug all openings. Loosen and remove compressor belt from pulley. Remove bolts and compressor.

Installation

To install, reverse removal procedure. Evacuate, recharge and leak test system.

EVAPORATOR ASSEMBLY

Removal

Disconnect negative battery cable. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect inlet and outlet lines and grommets from evaporator. Plug openings. Disconnect electrical leads from evaporator. Remove glove box and reinforcement. Remove nuts, bolts and evaporator assembly.

Disassembly

Release spring clips holding covers together. See Fig. 16. Remove any screws at case joints. Separate upper and lower cases from evaporator core. Remove thermistor with holder. Remove heat insulator from outlet tube. Remove high side (inlet) line from expansion valve, and remove 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 core before installing. Evacuate, recharge and leak test system.

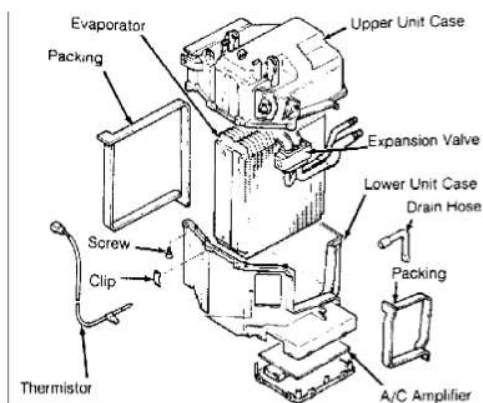


Fig. 16: Exploded View Of Evaporator Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONDENSER

Removal

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

Installation

To install, reverse removal procedure. If installing new condenser, add 1.4-1.7 ounces of refrigeration oil before installing. Evacuate, recharge and leak test system.

RECEIVER-DRIER

Removal

Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove lines from receiver-drier. Plug all openings. Remove bolts and receiver-drier.

Installation

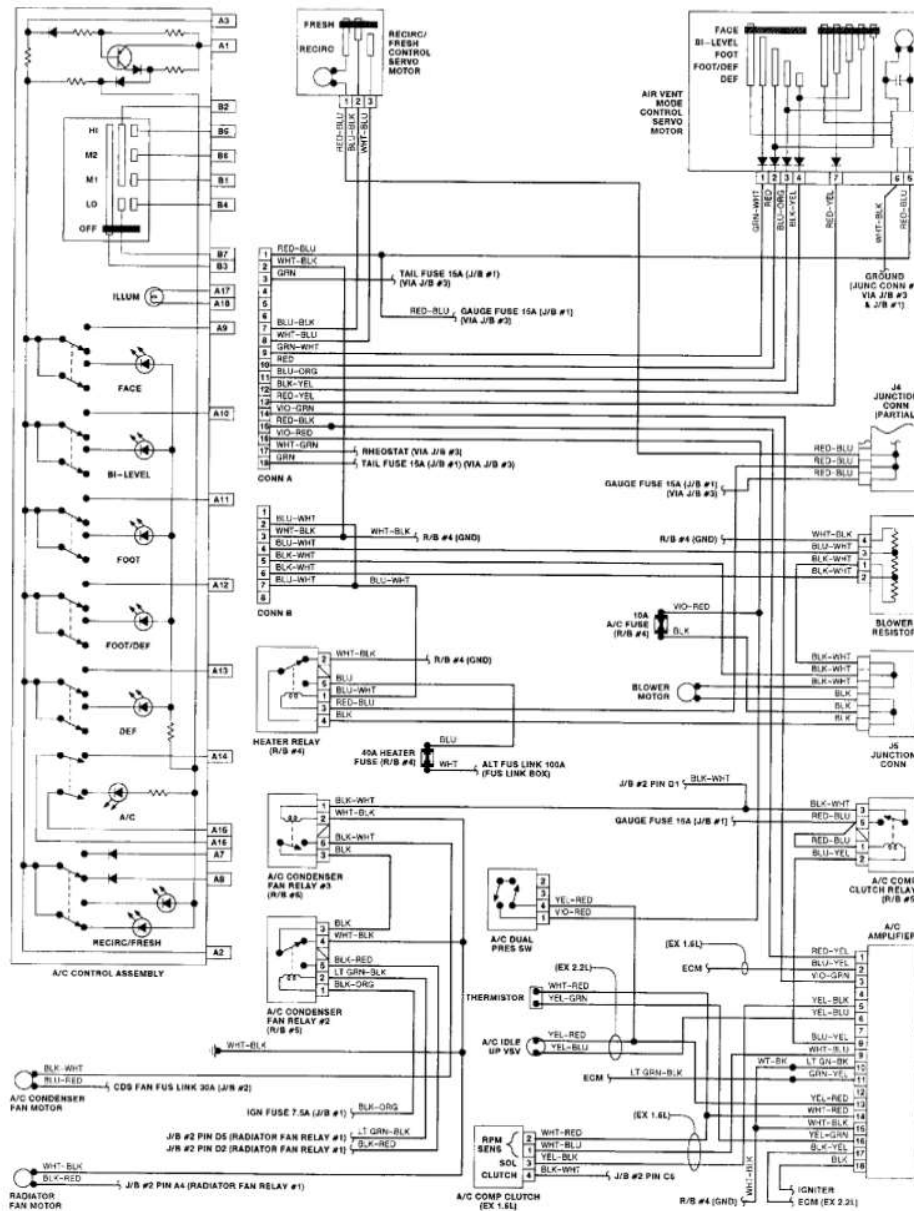
To install, reverse removal procedure. Add 0.7 ounce of refrigerant oil. Evacuate, recharge and leak test system.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor	18 (25)
A/C Compressor Bracket (1.6L)	35 (47)
Condenser	
Discharge Hose	17 (23)
Liquid Tube	10 (14)
Evaporator Suction Tube	24 (32)
	INCH Lbs. (N.m)
Evaporator Liquid Tube	115 (13)
Expansion Valve Allen Bolt	48 (5.4)
Receiver-Drier	115 (13)

WIRING DIAGRAMS



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Fig. 17: Manual A/C-Heater System Wiring Diagram (1 Of 2)

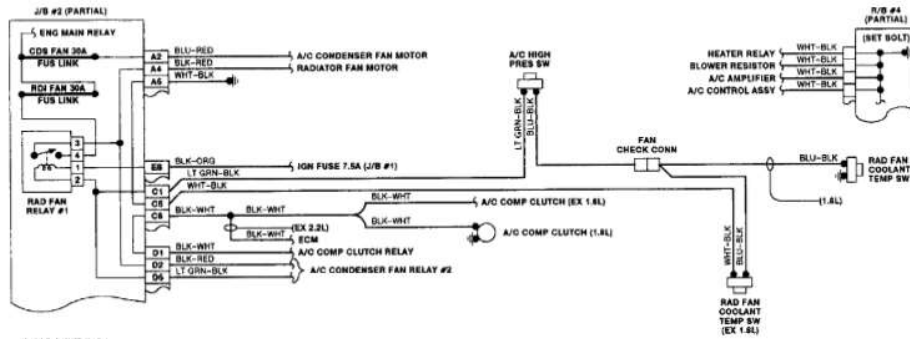


Fig. 18: Manual A/C-Heater System Wiring Diagram (2 Of 2)