

1999 Toyota RAV4

1999 MANUAL A/C-HEATER SYSTEMS RAV4

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RAV4

SPECIFICATIONS

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Application	Specification
Compressor Type	Nippondenso 10PA15 10-Cyl.
Compressor Clutch Clearance	.014-.026" (.35-.65 mm)
Compressor Belt Tension ⁽¹⁾	
New Belt ⁽²⁾	135-185 lbs. (61-84 kg)
Used Belt	80-120 lbs. (36-54 kg)
Compressor Oil Capacity ⁽³⁾	4.1 ozs.
Refrigerant (R-134a) Capacity	22.9-26.5 ozs.
System Operating Pressures ⁽⁴⁾	
Low Side	22-37 psi (1.5-2.5 kg/cm ²)
High Side	206-235 psi (14-16 kg/cm ²)
<p>(1) Using a belt tension gauge, measure at longest run of belt.</p> <p>(2) A new belt is one that has been used less than 5 minutes.</p> <p>(3) Use ND-Oil 8 (Part No. 08885-09109).</p> <p>(4) When ambient temperature is 86-95°F (30-35°C).</p>	

DESCRIPTION

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**.

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.

RAV4 manual A/C-heater system uses a Nippondenso 10-cylinder compressor. The compressor only operates in normal operating temperatures and pressures set for this model. An electric condenser fan is used and operates at 2 speeds, depending on system pressure, engine coolant temperature and A/C switch position.

System components used are: fan switch, A/C amplifier, evaporator, thermistor, dual-pressure switch, engine coolant temperature switch, compressor, condenser, receiver-drier, and all the necessary pipes and hoses. Air

door operation is controlled through cable connections. Compressor operation and associated A/C modes are electrically controlled.

OPERATION

SYSTEM CONTROLS

A/C functions are controlled by sliding levers and A/C on-off switch. A/C controls operate air supply selection (fresh or recirculating air), mode and temperature selection and blower speeds. Temperature control lever operates blend air door in A/C-heater unit, mixing both cooled and heated air so desired air temperature can be obtained.

System will provide cooled air when A/C switch is in the ON position and blower motor is in any position except OFF. Temperature control lever should be in the far left (maximum cooling) side of temperature selection scale when maximum A/C operation is desired.

SYSTEM COMPONENTS

A/C Switch

When A/C switch is pushed, A/C will operate if blower motor control lever is in any position except OFF. When activated, A/C switch allows compressor clutch to engage, operating compressor. A light will illuminate on A/C push button when switch is activated.

Idle Air Control (IAC) Valve

The IAC valve is an air by-pass valve that is controlled by the Powertrain Control Module (PCM). The IAC valve is used to provide smooth engine operation during compressor on cycle. When A/C system is operating, the PCM signals the IAC valve to raise engine idle speed. When A/C system is off, the PCM signals the IAC valve to resume normal idle position.

Thermistor

This thermocouple is mounted in front of evaporator (air outlet side) to monitor airflow temperature. A/C amplifier will de-energize compressor clutch when thermistor signal indicates low evaporator output temperature. Evaporator thermistor is used to prevent evaporator from freezing up. A/C amplifier uses information received from thermistor for proper on-off cycling of compressor clutch.

Dual-Pressure Switch

Dual-pressure switch function controls cycling of compressor clutch. Dual-pressure switch cuts voltage signal to A/C amplifier when refrigerant pressures are greater than or less than control point of switch. As refrigerant pressures return to normal operating range, voltage is supplied to compressor clutch to resume operation. A/C condenser fan will operate at high or low speed according to system pressure.

ADJUSTMENTS

NOTE: For control cable adjustments, see **HEATER SYSTEMS - RAV4, TACOMA & 4RUNNER** article.

TROUBLE SHOOTING

A/C INDICATOR BLINKS

Check for faulty compressor, A/C switch or A/C amplifier. Check for faulty wiring harness, grounds or connectors.

BLOWER MOTOR DOES NOT OPERATE

Check for blown HTR fuse, heater main relay or blower resistor. Check for faulty A/C controls, blower switch or blower motor. Check for faulty wiring harness, grounds or connectors.

COMPRESSOR DOES NOT OPERATE

Check for incorrect refrigerant charge. Check for blown A/C fuse. Check for faulty heater main relay, compressor clutch, compressor, dual-pressure switch, A/C switch, blower switch, A/C amplifier, thermistor, wiring harnesses, grounds or connectors.

COMPRESSOR OPERATES INTERMITTENTLY

Check for incorrect refrigerant charge. Check for faulty dual-pressure switch. Check for bent or dented refrigerant lines. Check for faulty A/C amplifier, thermistor, wiring harness, grounds or connectors.

INSUFFICIENT COOLING

Check for incorrect refrigerant charge or incorrect system pressures. Check for slipping A/C drive belt. Check for clogged condenser. Check for plugged receiver-drier. Check for bent or dented refrigerant lines. Check for faulty compressor clutch, A/C compressor, A/C amplifier, thermistor, evaporator or expansion valve.

NO ENGINE IDLE UP WHEN A/C SWITCH IS ON

Check for faulty A/C amplifier, IAC system, wiring and/or wiring connections.

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 **AIR BAG SYSTEM SAFETY** article in **GENERAL SERVICING**.

NOTE: For testing procedures not covered in this article, see **HEATER SYSTEMS - RAV4, TACOMA & 4RUNNER** article.

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A/C SYSTEM PERFORMANCE

1. Park vehicle out of direct sunlight. Install manifold gauge set and turn A/C controls to recirculated air position, with inlet air temperature at 86-95°F (30-35°C). Start engine and allow to run at 1500 RPM.
2. Set blower/fan on high speed and temperature control switch to maximum cooling. Verify high-side and low-side pressures are within specification. See **SPECIFICATIONS** table.

A/C AMPLIFIER

1. Disconnect negative battery cable and wait at least 90 seconds. Disconnect A/C amplifier 14-pin connector. A/C amplifier is located on top of A/C cooling unit (evaporator housing) behind glove box. Test wire harness side of connector. See **Fig. 1** . Ensure circuit tests as specified in **A/C AMPLIFIER CIRCUIT TEST (DISCONNECTED)** table. If circuits do not test as specified, repair as necessary.
2. Connect A/C amplifier 14-pin connector. Install manifold gauge set. Start engine and let idle. Turn A/C on. Set temperature control lever to MAX COOL position and blower position to HI. Backprobe at A/C amplifier connector as specified. See **A/C AMPLIFIER CIRCUIT TEST (CONNECTED)** table. If tests are not as specified, replace A/C amplifier. If circuits test as specified, system is okay at this time.

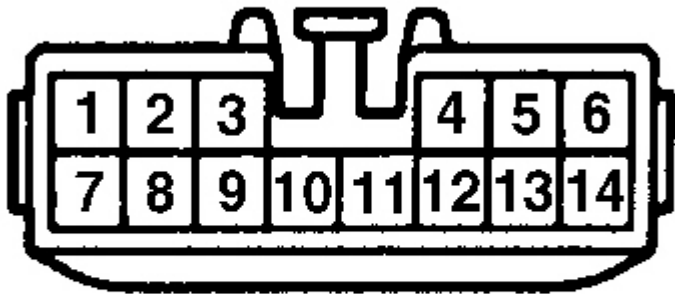
A/C AMPLIFIER CIRCUIT TEST (DISCONNECTED)

Terminal No. & Test Condition ⁽¹⁾	Specification
5 & Ground	Continuity
14 & 13	⁽²⁾ 115 Ohms
9 & 13	⁽³⁾ 1500 Ohms
8 & Ground	
A/C Switch ON	Battery Voltage
A/C Switch OFF	No Voltage
12 & Ground	Battery Voltage
10 & Ground	
A/C Switch ON	Less Than 4 Volts
A/C Switch OFF	No Voltage
Defrost Position	Battery Voltage
(1) Ensure ignition switch is on, temperature control lever is at the maximum cool position, and blower switch is on HI position.	
(2) Test with air temperature at 68°F (20°C).	
(3) Test with evaporator temperature at 77°F (25°C).	

A/C AMPLIFIER CIRCUIT TEST (CONNECTED)

Terminal No. & Test Condition ⁽¹⁾	Specification
1 & Ground	
Engine Speed At Idle	Less Than 0.7 Volts
Engine Speed At Idle-Up Speed	Zero Volts

2 & Ground	
Refrigerant Pressure At 28-495 psi (1.97-34.8 kg/cm ²)	Battery Voltage
Refrigerant Pressure Less Than 28 psi (1.97 kg/cm ²) Or More Than 495 psi (34.8 kg/cm ²)	No Voltage
7 & Ground	
Magnetic Clutch Disengaged	Battery Voltage
Magnetic Clutch Engaged	Less Than 1 Volt
12 & Ground	
Magnetic Clutch Disengaged	Less Than 1 Volt
Magnetic Clutch Engaged	Zero Volts
(1) Engine running at idle, temperature control lever is at the MAX COOL position, and blower switch is on HI position.	



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Fig. 1: Identifying A/C Amplifier Connector Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

A/C SWITCH

Disconnect negative battery cable and wait at least 90 seconds. Remove glove box and lower instrument finish panel. Disconnect control cables. Remove A/C switch and disconnect wire harness connector. Check continuity at specified terminals. See **A/C SWITCH CONTINUITY** table. See **Fig. 2** . A/C switch has a diode, check continuity in both directions before replacing switch.

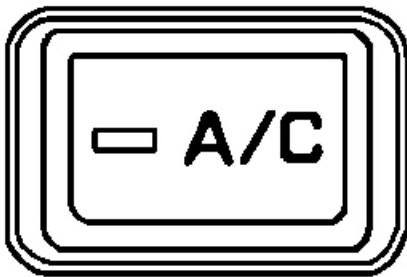
A/C SWITCH CONTINUITY

Switch Position	Continuity Between Terminal No.

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OFF	(1)
ON	5 & 6
(1) With A/C switch in either position, continuity should exist between terminals No. 1 and 3 for A/C switch illumination. With A/C switch off, continuity should not exist between any other terminals.	



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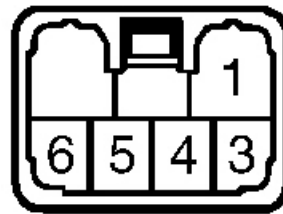


Fig. 2: Identifying A/C Switch Terminals

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CONDENSER FAN MOTOR

1. Install manifold gauge set. Start engine and turn blower switch to HI position. Set temperature to cool. Turn A/C on. Fan should not operate below 181°F (83°C). Fan should operate at or above 199°F (93°C). Fan should operate at low speed with refrigerant pressure less than 220 psi (15.5 kg/cm²). Fan should operate at high speed with refrigerant pressure above 220 psi (15.5 kg/cm²). If fan does not operate as specified, go to next step.
2. Disconnect fan motor 3-pin connector. Apply battery voltage to fan motor side of connector. Fan motor should rotate smoothly and current draw should be 9.1-11.1 amps. If operation is not as specified, replace condenser fan motor.

CONDENSER FAN & COMPRESSOR CLUTCH RELAYS

Compressor Clutch Relay & Condenser Fan Relay No. 3

Remove appropriate relay. See **WIRING DIAGRAMS**. Check continuity between terminals No. 1 and 2. See **Fig. 3**. Ensure continuity exists. If continuity does not exist, replace relay. Apply battery voltage between terminals No. 1 and 2. Continuity should exist between terminals No. 3 and 5. If continuity does not exist, replace relay.

Condenser Fan Relay No. 1

Disconnect negative battery cable and wait at least 90 seconds. Remove relay. See **WIRING DIAGRAMS** . Check continuity between terminals No. 1 and 2, and between terminals No. 3 and 4. See **Fig. 4** . Ensure continuity exists. If continuity does not exist, replace relay. Apply battery voltage between terminals No. 1 and 2. Check continuity between terminals No. 3 and 4. Continuity should not exist. If continuity exists, replace relay.

Condenser Fan Relay No. 2

Remove relay. See **WIRING DIAGRAMS** . Check continuity between terminals No. 1 and 2, and between terminals No. 3 and 4. See **Fig. 5** . Ensure continuity exists. If continuity does not exist, replace relay. Apply battery voltage between terminals No. 1 and 2. Continuity should exist between terminals No. 3 and 5. If continuity does not exist, replace relay.

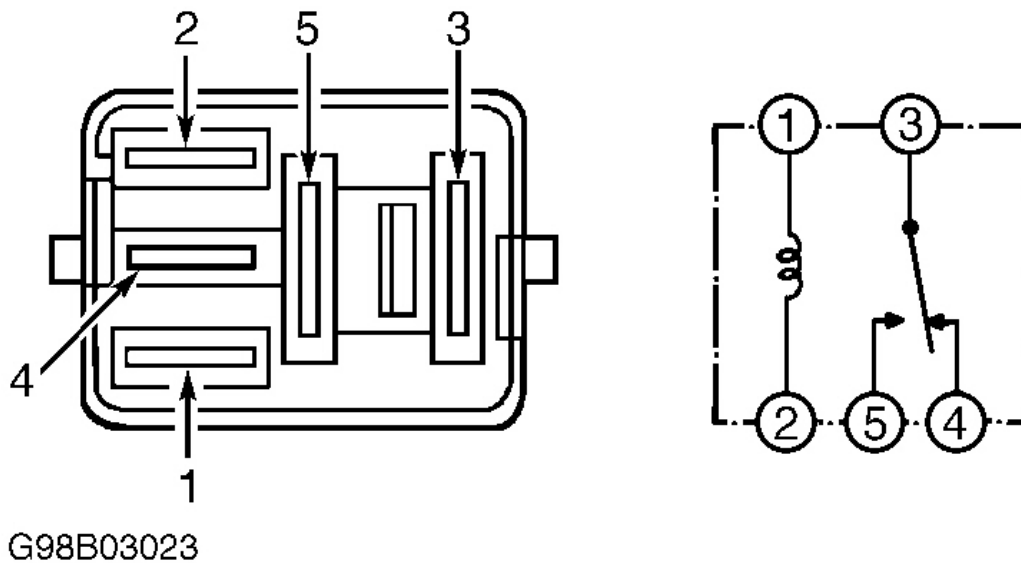


Fig. 3: Identifying Compressor Clutch Relay Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

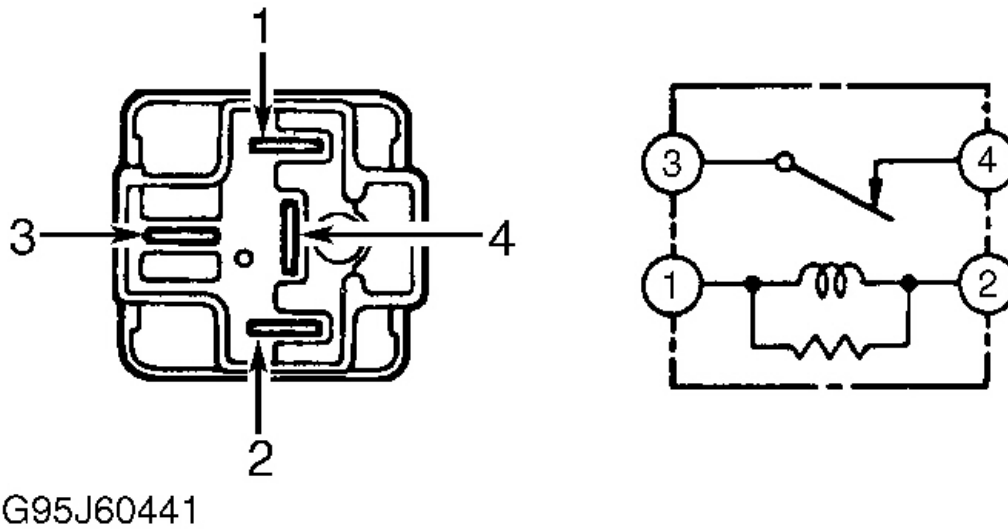


Fig. 4: Identifying Condenser Fan Relay No. 1 Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

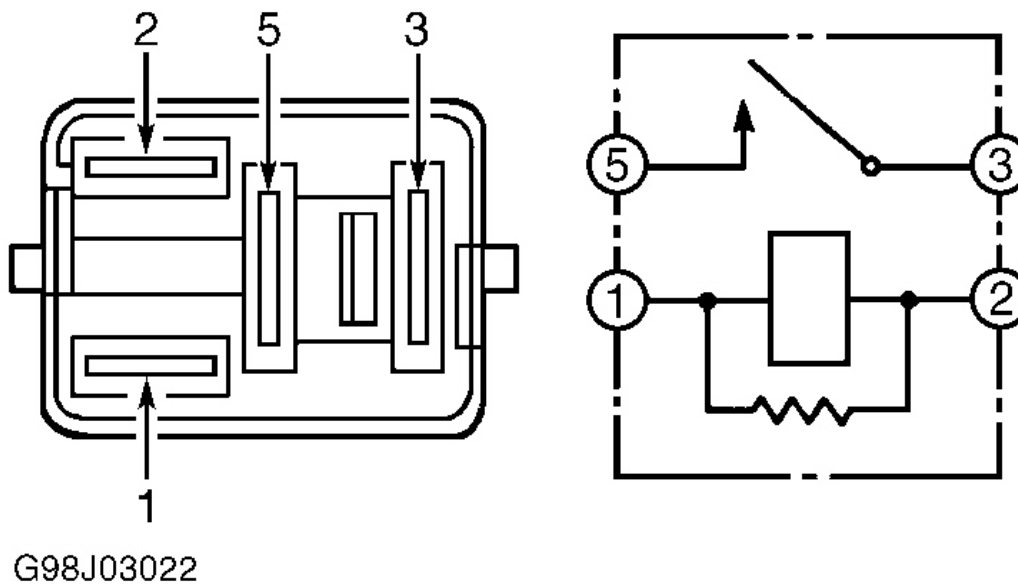


Fig. 5: Identifying Condenser Fan Relay No. 2 Terminals

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

IDLE AIR CONTROL (IAC) VALVE

Start engine and bring to normal operating temperature. Turn A/C switch on, set blower switch to high position and adjust temperature control lever to maximum cooling. Ensure compressor clutch is engaged. Using tachometer, ensure when compressor clutch engages, idle RPM increases 100-200 RPM and decreases a similar amount when clutch is disengaged. If idle does not react as specified, check IAC valve and air intake system.

COMPRESSOR CLUTCH & COMPRESSOR LOCK SENSOR

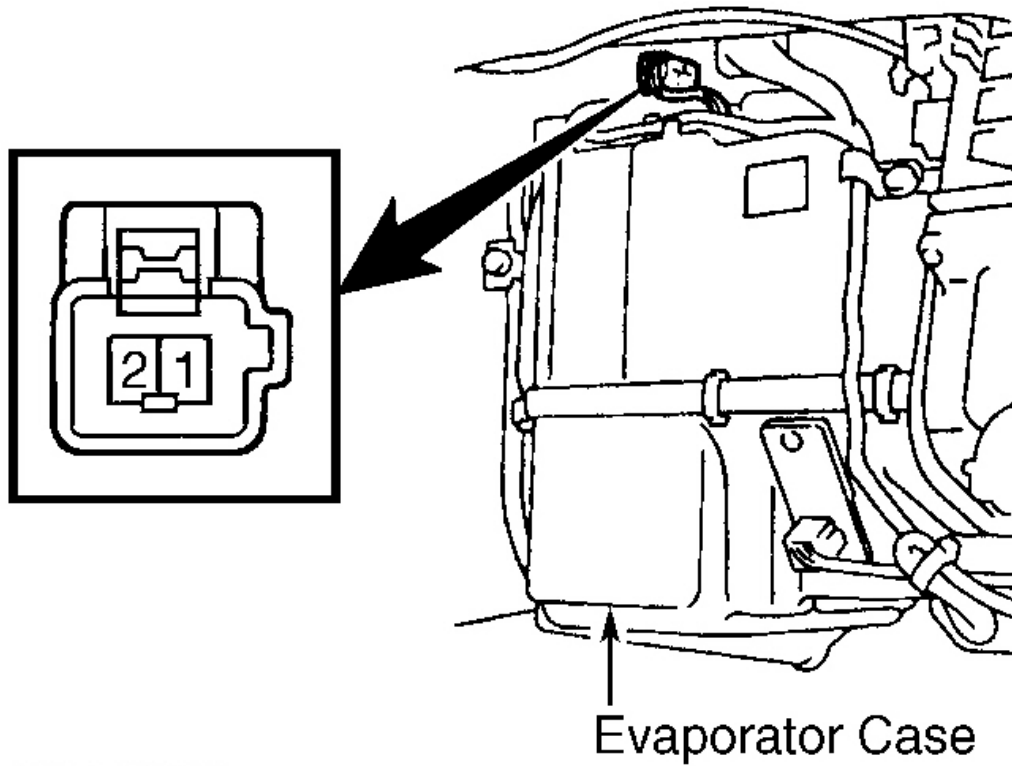
Inspect pressure plate and rotor for signs of oil contamination. Check clutch bearing for noisy operation and grease leakage. Check compressor lock sensor resistance. Disconnect compressor clutch/lock sensor 3-pin connector. Measure resistance between terminals No. 1 (White wire) and No. 2 (Blue wire). Resistance should be 65-125 ohms at 68°F (20°C). Replace as necessary. Check magnetic clutch operation. Apply battery voltage to compressor clutch connector terminal No. 3 (Black wire). Connect negative battery lead to ground. Ensure compressor clutch is energized. If compressor clutch is not energized, replace compressor clutch.

THERMISTOR

1. Disconnect negative battery cable and wait at least 90 seconds. Remove lower trim panel and glove box. Disconnect thermistor 2-pin connector from top of evaporator case. See **Fig. 6** . Measure resistance of thermistor while still installed.
2. Resistance should be 1500 ohms at 77°F (25°C) ambient temperature. If resistance is not within specification, replace thermistor. If resistance is as specified, go to next step.
3. Remove evaporator case. See **EVAPORATOR ASSEMBLY** under REMOVAL & INSTALLATION. Disassemble evaporator case and remove thermistor. Check thermistor operation. Submerge thermistor at least 3.94" (100 mm) deep in cold water. See **Fig. 7** .
4. Place thermometer in water and measure resistance of thermistor at various temperatures. Use ice or hot water to vary water temperature. If readings are not within specification, replace thermistor. See **THERMISTOR RESISTANCE VALUES** table.

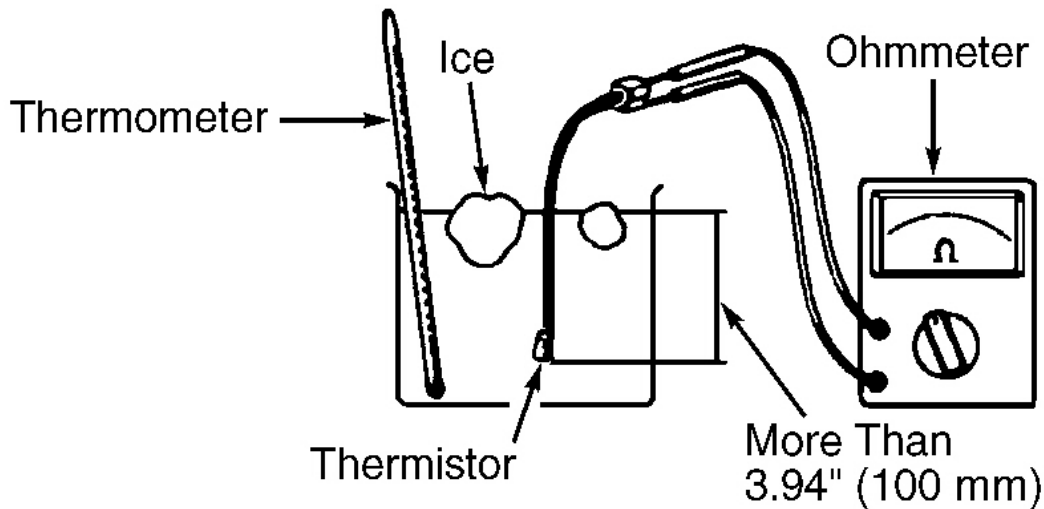
THERMISTOR RESISTANCE VALUES

Water Temperature °F (°C)	Ohms
77 (25)	1300-1800
68 (20)	1700-2200
59 (15)	2200-2600
50 (10)	2800-3300
41 (5)	3700-4200
32 (0)	4600-5300



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Fig. 6: Identifying Thermistor Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 7: Testing Thermistor

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

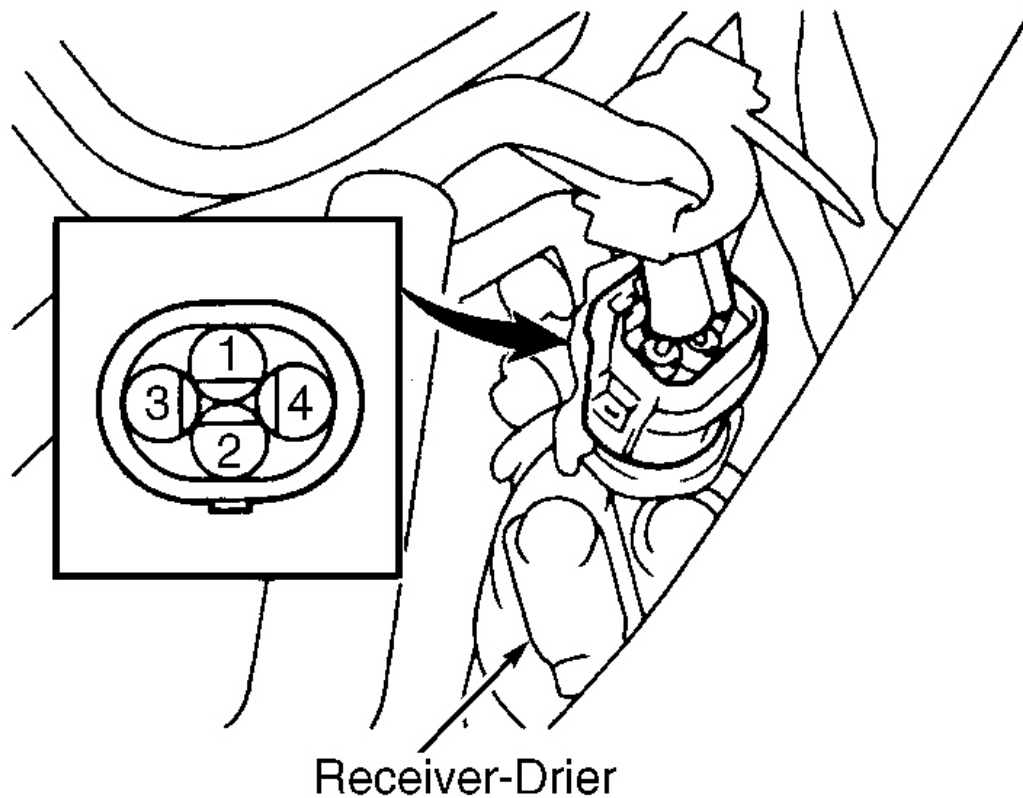
PRESSURE SWITCH

Compressor Clutch Control

Install manifold gauge set. Start and run engine at 2000 RPM. Turn A/C on. Observe system pressure. Disconnect pressure switch connector. Connect ohmmeter positive lead to terminal No. 4 of pressure switch and negative lead to terminal No. 1. See **Fig. 8**. Continuity should not exist when high-side pressure is more than 455 psi (32.0 kg/cm²) or low-side pressure is less than 28 psi (2.0 kg/cm²). Replace switch if continuity is not as specified.

Condenser Fan Control

Install manifold gauge set. Start and run engine at 2000 RPM. Turn A/C on. Observe system pressure. Disconnect pressure switch connector. Connect ohmmeter positive lead to terminal No. 2 of pressure switch and negative lead to terminal No. 3. See **Fig. 8**. Continuity should not exist when system pressure exceeds 220 psi (15.5 kg/cm²). Continuity should exist when system pressure drops to 178 psi (12.5 kg/cm²). Replace switch if it does not function as specified.



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Fig. 8: Identifying Dual-Pressure Switch Connector Terminals

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

IDLE AIR CONTROL (IAC) VALVE

Start engine and bring to normal operating temperature. Turn A/C switch on, set blower switch to high position and adjust temperature control lever to maximum cooling. Ensure compressor clutch is engaged. Using tachometer, ensure when compressor clutch engages, idle RPM increases 100-200 RPM and decreases a similar amount when clutch is disengaged. If idle does not react as specified, check IAC valve and air intake system.

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 **AIR BAG SYSTEM SAFETY** article in **GENERAL SERVICING**.

NOTE: For removal and installation procedures not covered in this article, see **HEATER SYSTEMS - RAV4, TACOMA & 4RUNNER** article.

COMPRESSOR

Removal

1. If possible, run A/C system for 10 minutes. Disconnect negative battery cable and wait at least 90 seconds. Disconnect compressor clutch electrical connector.
2. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect compressor hoses and cap hose ends to keep moisture out of system. Remove right side engine undercover, if necessary. Loosen lock nut and belt adjusting bolt at generator. Remove compressor drive belt. Remove compressor mounting bolts. Remove compressor.

Installation

To install, reverse removal procedure. Tighten mounting bolts and compressor hoses to specification. See **TORQUE SPECIFICATIONS** . Evacuate, charge and leak test system.

CONDENSER

Removal

Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect negative battery cable and wait at least 90 seconds. Disconnect A/C lines from condenser. Plug all openings. Remove 2 condenser mounting bolts and condenser.

Installation

To install, reverse removal procedure. Tighten condenser hoses to specification. See **TORQUE SPECIFICATIONS** . If installing a new condenser, add 1.4 ounces of refrigerant oil to compressor. Evacuate, charge and leak test system.

EVAPORATOR ASSEMBLY

Removal

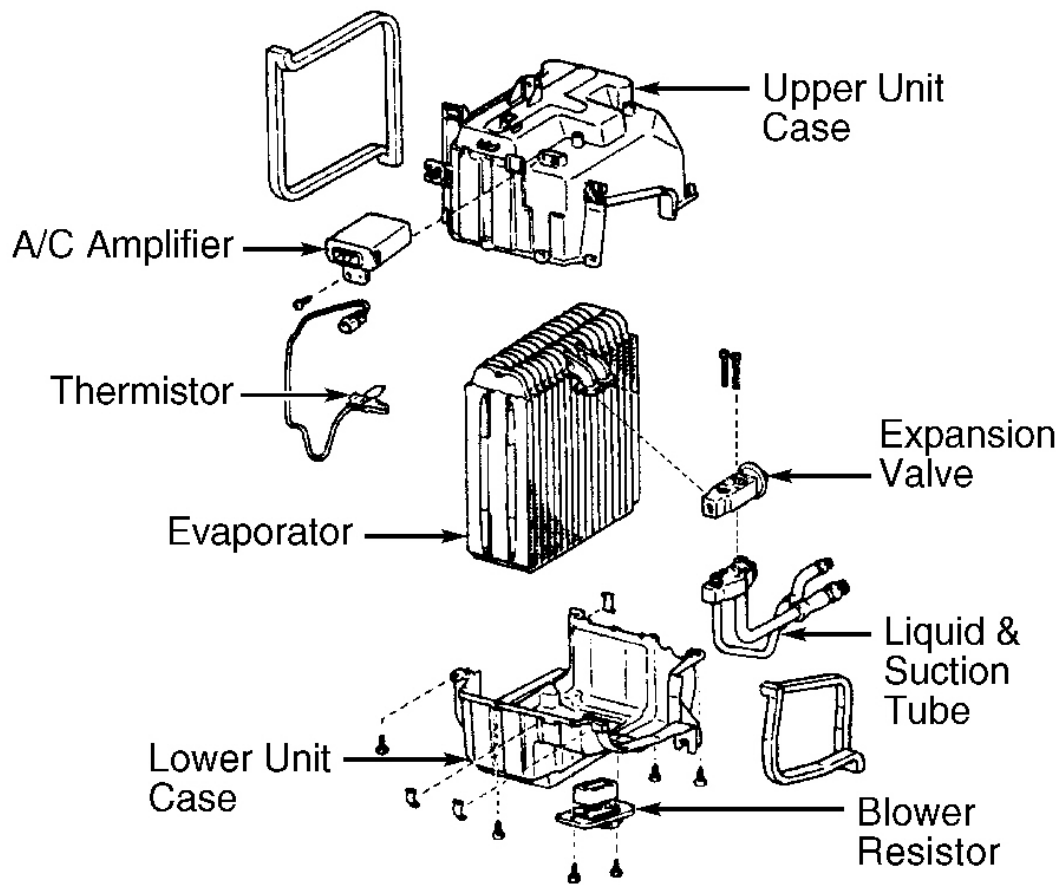
Disconnect negative battery cable and wait at least 90 seconds. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove glove box assembly. Using knife, cut off glove compartment reinforcement. Disconnect inlet lines, outlet lines and grommets from evaporator. Plug openings. Disconnect electrical leads from evaporator. Remove 3 attaching screws and 3 nuts. Remove evaporator assembly.

Disassembly

Remove blower resistor and A/C amplifier. Release spring clips holding covers together. Remove 4 screws at case joints. Separate upper and lower cases from evaporator core. Remove evaporator from lower case. Remove thermistor and expansion valve. See **Fig. 9** .

Reassembly & Installation

To reassemble and install evaporator assembly, reverse disassembly and removal procedures. Install glove compartment door reinforcement (55558-42010). If installing a new evaporator core, add 1.4 ounces of refrigerant oil to compressor. Evacuate, charge and leak test system.



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Fig. 9: Exploded View Of Evaporator Assembly

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

EXPANSION VALVE

Removal & Installation

Evaporator must be removed in order to remove expansion valve. See **EVAPORATOR ASSEMBLY**.

RECEIVER-DRIER

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Removal

Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect negative battery cable and wait at least 90 seconds. Remove engine coolant reservoir and air cleaner case and duct. Disconnect A/C lines from receiver-drier and plug all openings. Remove mounting bolts and receiver-drier.

Installation

To install, reverse removal procedure. If installing a new receiver-drier, add 0.3 ounce of refrigerant oil before reassembly. Evacuate, charge and leak test system.

TORQUE SPECIFICATIONS

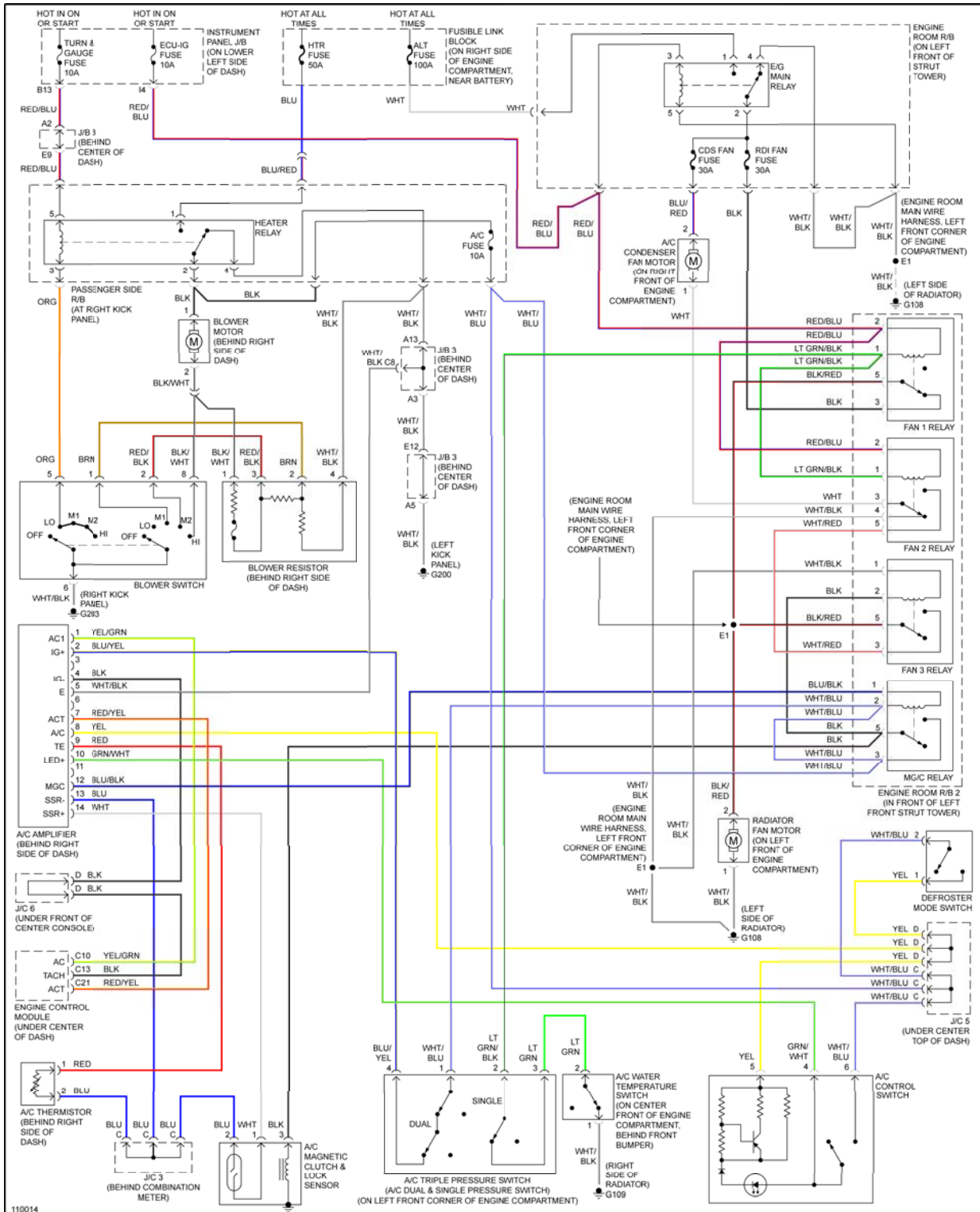
TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Compressor Mounting Stud	35 (47)
Compressor Mounting Stud Nut	20 (27)
Compressor-To-Engine Bolts	27 (37)
Evaporator Hose Fittings	
Inlet Fitting	10 (14)
Outlet Fitting	24 (33)
INCH Lbs. (N.m)	
Refrigerant Hoses	
To Compressor	89 (10)
To Condenser	89 (10)
To Expansion Valve	48 (5.4)
To Receiver-Drier	89 (10)

WIRING DIAGRAMS

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Fig. 10: Manual A/C-Heater System Wiring Diagram (RAV4)