

2009 Toyota Highlander Limited

2009 ENGINE Cooling (2GR-FE) - Highlander

2009 ENGINE**Cooling (2GR-FE) - Highlander****COOLING SYSTEM****ON-VEHICLE INSPECTION****1. INSPECT FOR COOLANT LEAK**

CAUTION: Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

NOTE: Before performing each inspection, turn the A/C switch off.

- Fill the radiator with coolant and attach a radiator cap tester.
- Warm up the engine.
- Using the radiator cap tester, increase the pressure inside the radiator to 118 kPa (1.2 kgf/cm², 17 psi), and check that the pressure does not drop.

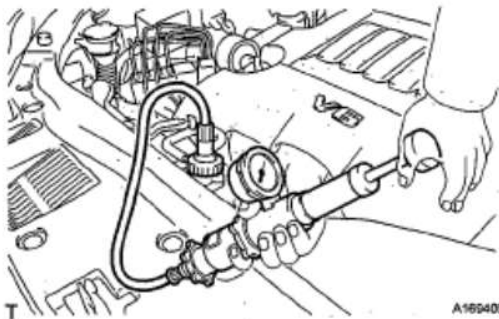


Fig. 1: Applying Pressure Into Radiator

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

If the pressure drops, check the hoses, radiator and water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

2. INSPECT ENGINE COOLANT LEVEL IN RESERVOIR

- Check that the engine coolant level is between the LOW and FULL lines when the engine is cold. If the engine coolant level is low, check for leaks and add "TOYOTA Super Long Life Coolant" or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite and non-borate coolant with long-life hybrid organic acid technology to the FULL line.

NOTE: Do not substitute plain water for engine coolant.

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3. INSPECT ENGINE COOLANT QUALITY

- a. Remove the radiator cap.

CAUTION: Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

- b. Check if there are any excessive deposits of rust or scales around the radiator cap and radiator filler hole. Also, the coolant should be free of oil.

If excessively dirty, clean the coolant passage and replace the coolant.

- c. Install the radiator cap.

COOLING FAN SYSTEM**PRECAUTION**

- CAUTION:**
- When the ignition switch is turned off and the engine temperature is high, the cooling fans may operate for approximately 3 minutes.
 - After turning the ignition switch off, keep hands and objects away from the fans when they are operating.

HINT:

If all of the following are met for a certain period of time during a few minute period immediately before the engine is stopped, the electric fans will continue to operate for 3 minutes after the engine is stopped. This is performed to ensure restartability and stabilize idle speed.

- Techstream indicates a very high coolant temperature.
- Techstream indicates a high outside air temperature.
- The vehicle has been driven under high load (driving on an uphill or equivalent).

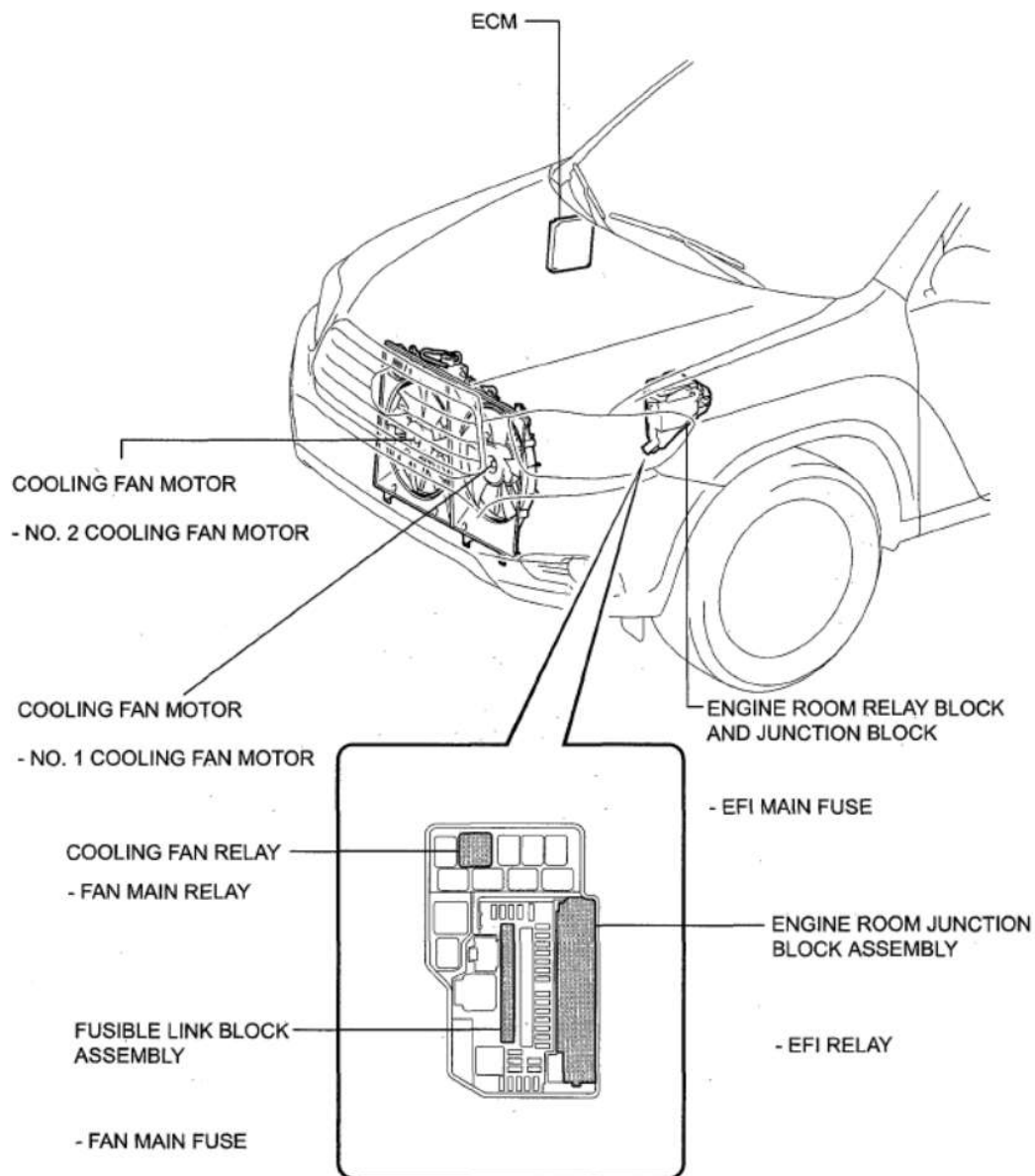
The following sensors are used for this control:

- Coolant temperature sensor
- Outside air temperature sensor
- MAF sensor
- Vehicle speed sensors

PARTS LOCATION

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Fig. 2: Identifying Cooling Fan System Parts Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DIAGRAM

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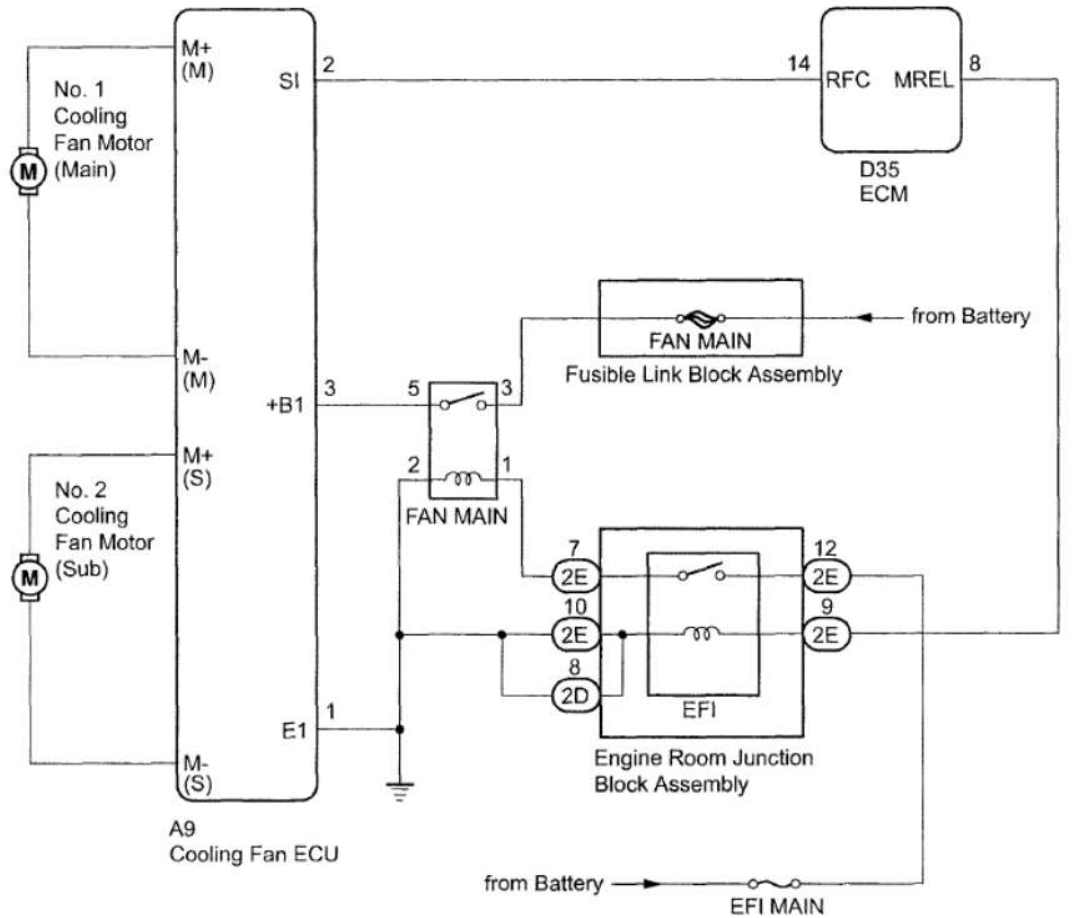


Fig. 3: Cooling Fan System - System Diagram

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

ON-VEHICLE INSPECTION

1. INSPECT COOLING FAN SYSTEM

- Connect Techstream to the DLC3.
- Turn the ignition switch on (IG).
- Enter the following menus: Powertrain/Engine/Active Test/Control the Cooling Fan.
- Check the operation of the cooling fan while operating it using Techstream.

If the cooling fan motor does not operate, check the cooling fan circuit (See **COOLING FAN CIRCUIT**).

COOLING FAN CIRCUIT

DESCRIPTION

The ECM calculates an appropriate cooling fan speed based on the engine coolant temperature, air conditioning

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switch condition, refrigerant pressure, engine speed, and vehicle speed and sends the signals to the cooling fan ECU to regulate the cooling fan. The cooling fan ECU controls the cooling fan speed based on the duty ratio signal sent from the ECM. By basing its control on the operating conditions, the ECM can control the fan speed optimally using the cooling fan ECU, achieving both high cooling performance and quietness. The cooling fan speed is determined based on engine coolant temperature, air conditioner operating conditions, engine speed, and vehicle speed.

INSPECTION PROCEDURE

1. PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE COOLING FAN)

- a. Connect Techstream to the DLC3.
- b. Turn the ignition switch on (IG).
- c. Enter the following menus: Powertrain/Engine and ECT/Active Test/Control the Cooling Fan.
- d. Check the operation of the cooling fan while operating it using Techstream.

OK:

The cooling fan rotates.

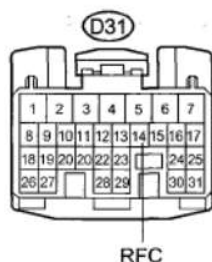
NG: Go to step 2

OK: REPLACE ECM (See REMOVAL)

2. CHECK HARNESS AND CONNECTOR (ECM - COOLING FAN ECU)

- a. Disconnect the D31 connector from the ECM.

Front view of wire harness connector:
(to ECM)



Front view of wire harness connector:
(to Cooling Fan ECU)

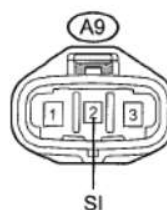


Fig. 4: Identifying D31 And A9 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the cooling fan ECU connector.
- c. Measure the resistance according to the value(s) in the table below.

Standard resistance

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TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
D31-14 (RFC) - A9-2 (SI)	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

3. INSPECT NO. 1 COOLING FAN MOTOR

- a. Disconnect the No. 1 cooling fan motor connector.
- b. Connect the battery positive terminal to terminal 2 of the cooling fan connector, and connect the battery negative terminal to terminal 1 of the No. 1 cooling fan motor connector.

OK:

The No. 1 cooling fan rotates.

NG: REPLACE NO. 1 COOLING FAN MOTOR (See ON-VEHICLE INSPECTION)

Front view of wire harness connector:
(to Cooling Fan Motor)



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Fig. 5: Identifying No. 1 Cooling Fan Motor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

4. INSPECT NO. 2 COOLING FAN MOTOR

- a. Disconnect the No. 2 cooling fan motor connector.
- b. Connect the battery positive terminal to terminal 2 of the cooling fan connector, and connect the battery negative terminal to terminal 1 of the No. 2 cooling fan motor connector.

OK:

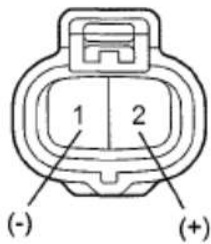
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The No. 2 cooling fan rotates.

NG: REPLACE NO. 2 COOLING FAN MOTOR (See ON-VEHICLE INSPECTION)

Front view of wire harness connector:
(to No. 2 Cooling Fan Motor)



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Fig. 6: Identifying No. 2 Cooling Fan Motor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

5. CHECK COOLING FAN ECU (POWER SOURCE)
- a. Disconnect the cooling fan ECU connector.

b. Turn the ignition switch on (IG).

c. Measure the voltage according to the value(s) in the table below.

Standard voltage

TESTER CONNECTION SPECIFIED CONDITION CHART

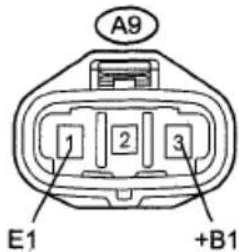
Tester Connection	Switch Condition	Specified Condition
A9-3 (+B1) - A9-1 (E1)	Ignition switch on (IG)	11 to 14 V

NG: Go to step 6

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Front view of wire harness connector:
(to Cooling Fan ECU)



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Fig. 7: Identifying A9 Cooling Fan ECU Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: REPLACE COOLING FAN ECU (See REMOVAL)

6. **CHECK HARNESS AND CONNECTOR (COOLING FAN ECU - BODY GROUND)**
- a. Disconnect the cooling fan ECU connector.
 - b. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

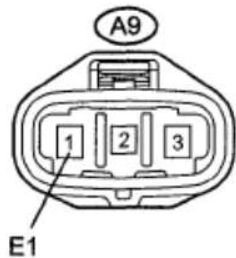
Tester Connection	Condition	Specified Condition
A9-1 (E1) - Body ground	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

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Front view of wire harness connector:
(to Cooling Fan ECU)



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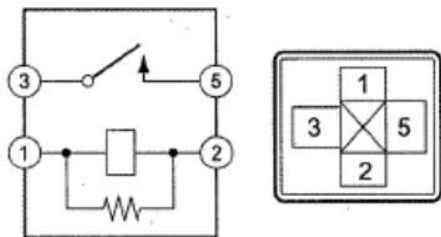
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Fig. 8: Identifying A9 Cooling Fan ECU Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

7. INSPECT FAN MAIN RELAY

- a. Remove the FAN MAIN relay from the engine room relay block and junction block.
- b. Measure the resistance according to the value(s) in the table, below.



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Fig. 9: FAN MAIN Relay Circuit Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
3 - 5	Battery voltage is not applied between terminals 1 and 2	10 kohms or higher
3 - 5	Apply battery voltage between terminals 1 and 2	Below 1 ohms

NG: REPLACE FAN MAIN RELAY

OK: Go to next step

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8. CHECK HARNESS AND CONNECTOR (COOLING FAN ECU - FAN MAIN RELAY)

- a. Disconnect the cooling fan ECU connector.
- b. Remove the FAN MAIN relay from the engine room relay block and junction block.
- c. Measure the resistance according to the value(s) in the table below.

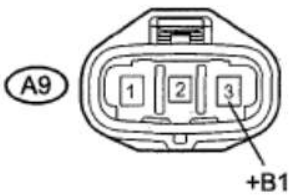
Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

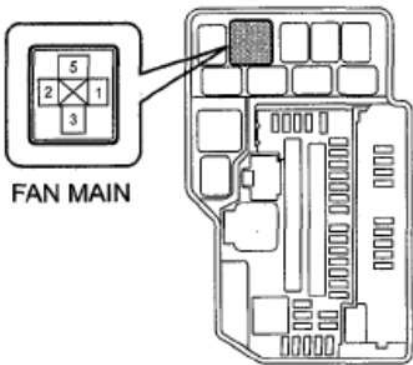
Tester Connection	Condition	Specified Condition
A9-3 (+B1) - 5 (FAN MAIN relay)	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

Front view of wire harness connector:
(to Cooling Fan ECU)



Engine Room Relay Block
and Junction Block:



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Fig. 10: Identifying FAN MAIN Relay And Cooling Fan ECU Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

9. CHECK HARNESS AND CONNECTOR (FAN MAIN RELAY - BODY GROUND)

- a. Remove the FAN MAIN relay from the engine room relay block and junction block.

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b. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
2 (FAN MAIN relay) - Body ground	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

Engine Room Relay Block
and Junction Block:

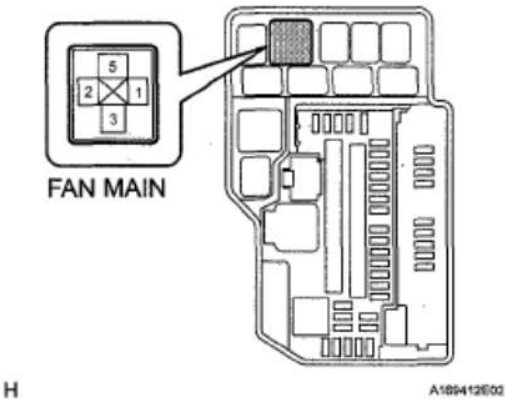


Fig. 11: Identifying FAN MAIN Relay Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

10. CHECK HARNESS AND CONNECTOR (FAN MAIN RELAY - FAN MAIN FUSE)
- a. Remove the FAN MAIN relay from the engine room relay block and junction block.

b. Remove the fusible link block assembly from the engine room relay block and junction block.

c. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

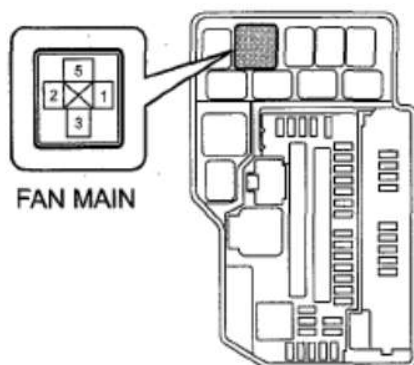
Tester Connection	Condition	Specified Condition
3 (FAN MAIN relay) - 1 (FAN MAIN fuse)	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

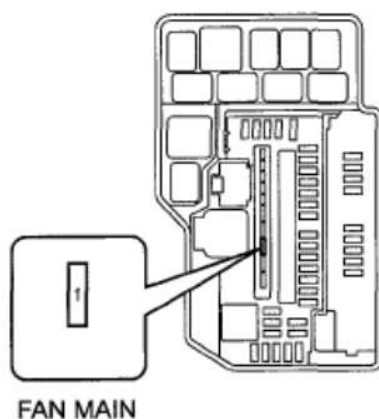
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Engine Room Relay Block
and Junction Block:



Engine Room Relay Block
and Junction Block:



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Fig. 12: Identifying FAN MAIN Relay Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

11. INSPECT FUSIBLE LINK BLOCK ASSEMBLY (FAN MAIN FUSE)

- Remove the fusible link block assembly from the engine room relay block and junction block.
- Measure the resistance according to the value(s) in the table below.

Standard resistance

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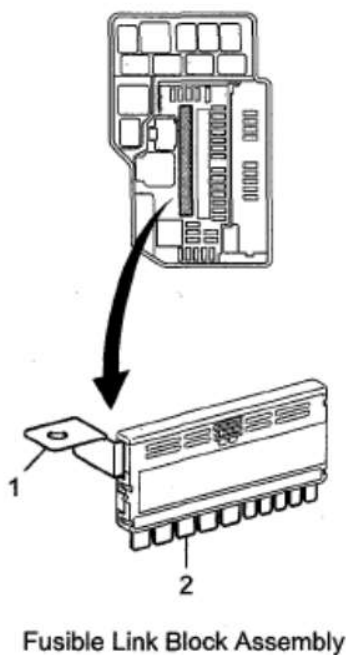
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TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
1 - 2 (FAN MAIN fuse)	Always	Below 1 ohms

NG: REPLACE FUSIBLE LINK BLOCK ASSEMBLY

Engine Room Relay Block
and Junction Block:



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Fig. 13: Identifying Fusible Link Block Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

12. CHECK FUSE (EFI MAIN)

- a. Remove the EFI MAIN fuse from the engine room relay block and junction block.
 1. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
EFI MAIN fuse	Always	Below 1 ohms

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NG: REPLACE FUSE

Engine Room Relay Block
and Junction Block:

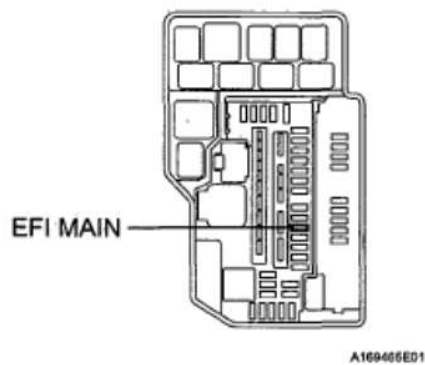


Fig. 14: Identifying EFI MAIN Fuse Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

13. **CHECK HARNESS AND CONNECTOR (EFI MAIN FUSE - ENGINE ROOM JUNCTION BLOCK ASSEMBLY)**
 - a. Remove the EFI MAIN fuse from the engine room relay block and junction block.
 - b. Remove the engine room junction block assembly from the engine room relay block and junction block.

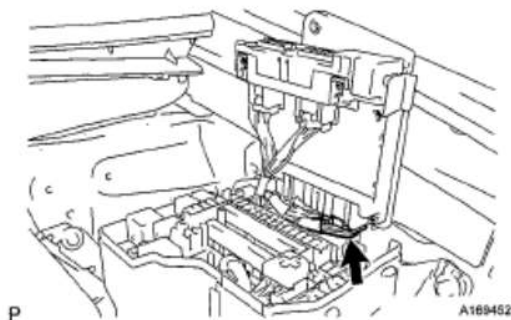


Fig. 15: Locating EFI MAIN Fuse
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Disconnect the 2E connector from the engine room junction block assembly.
- d. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

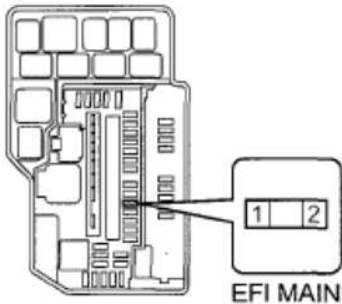
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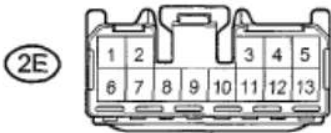
Tester Connection	Condition	Specified Condition
2 (EFI MAIN fuse) - 2E-12	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

Engine Room Relay Block
and Junction Block:



Front view of wire harness connector:
(to Engine Room Junction Block Assembly)



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Fig. 16: Identifying 2E Connector And EFI Main Fuse
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

14. CHECK HARNESS AND CONNECTOR (FAN MAIN RELAY - ENGINE ROOM JUNCTION BLOCK ASSEMBLY)
- a. Remove the FAN MAIN relay from the engine room relay block and junction block.

b. Remove the engine room junction block assembly from the engine room relay block and junction block.

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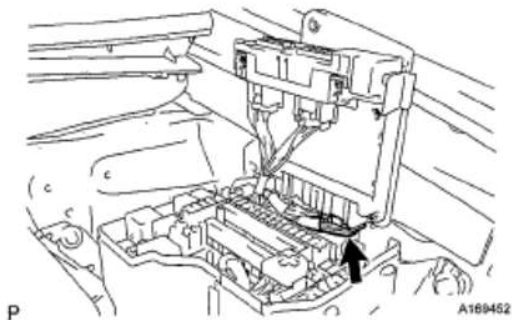


Fig. 17: Locating EFI MAIN Fuse
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Disconnect the 2E connector from the engine room junction block assembly.
- d. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

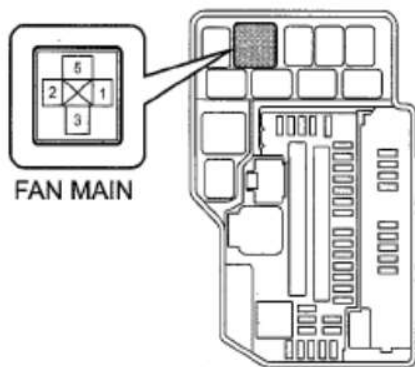
Tester Connection	Condition	Specified Condition
1 (FAN MAIN reray) - 2E-7	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

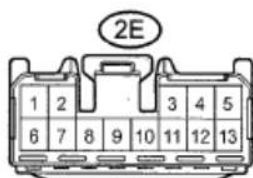
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Engine Room Relay Block
and Junction Block:



Front view of wire harness connector: (to
Engine Room Junction Block Assembly)



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Fig. 18: Identifying 2E Connector And FAN MAIN Relay
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

15. CHECK HARNESS AND CONNECTOR (ENGINE ROOM JUNCTION BLOCK ASSEMBLY - BODY GROUND)

- Remove the engine room junction block assembly from the engine room relay block and junction block.

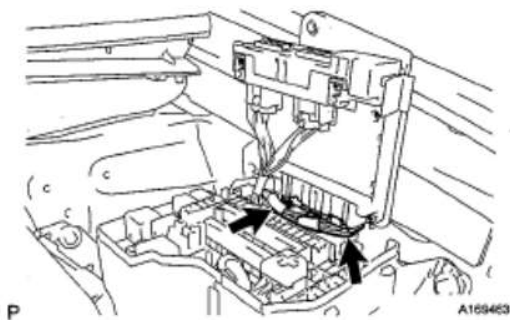


Fig. 19: Locating Engine Room Junction Block Assembly

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

- b. Disconnect the 2D and 2E connectors from the engine room junction block assembly.
- c. Measure the resistance according to the value(s) in the table below.

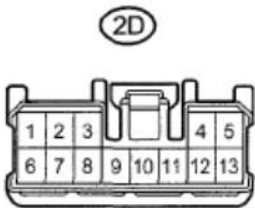
Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

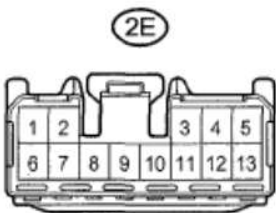
Tester Connection	Condition	Specified Condition
2D-8 - Body ground	Always	Below 1 ohms
2E-10 - Body ground	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

Front view of wire harness connector:
(to Engine Room Junction Block Assembly)



Front view of wire harness connector:
(to Engine Room Junction Block Assembly)



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Fig. 20: Identifying 2D And 2E Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

16. **CHECK HARNESS AND CONNECTOR (ECM - ENGINE ROOM JUNCTION BLOCK ASSEMBLY)**

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- a. Disconnect the D31 connector from the ECM.
- b. Remove the engine room junction block assembly from the engine room relay block and junction block.
- c. Disconnect the 2E connector from the engine room junction block assembly.

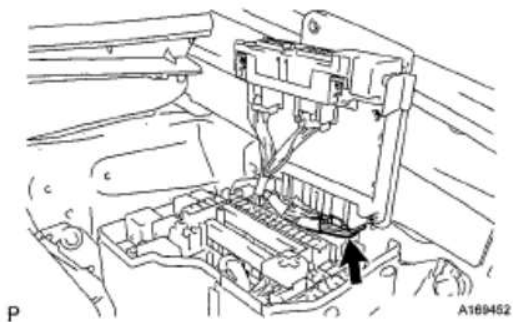


Fig. 21: Locating EFI MAIN Fuse
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

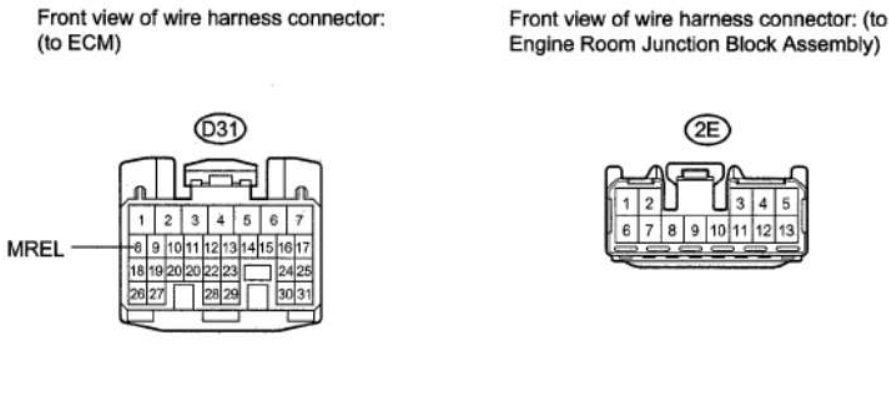


Fig. 22: Identifying D31 And 2E Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
D31-8 (MREL) - 2E-9	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

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17. INSPECT ENGINE ROOM JUNCTION BLOCK ASSEMBLY (EFI RELAY)

- a. Remove the engine room junction block assembly from the engine room relay block and junction block.

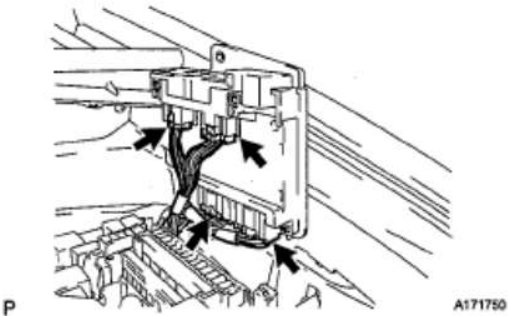


Fig. 23: Locating Engine Room Junction Block Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
2E-12 - 2E-7	Battery voltage is not applied between terminals 2E-9 and 2E-10	10 kohms or higher
2E-12 - 2E-7	Apply battery voltage between terminals 2E-9 and 2E-10	Below 1 ohms

Component without wire harness connected:
(Engine Room Junction Block Assembly)

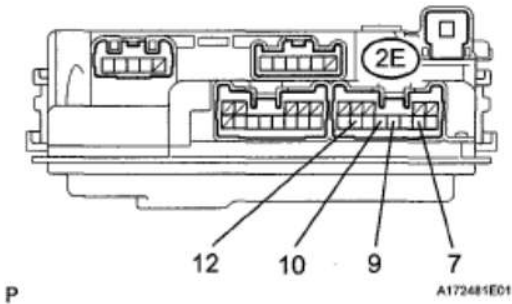


Fig. 24: Identifying 2E Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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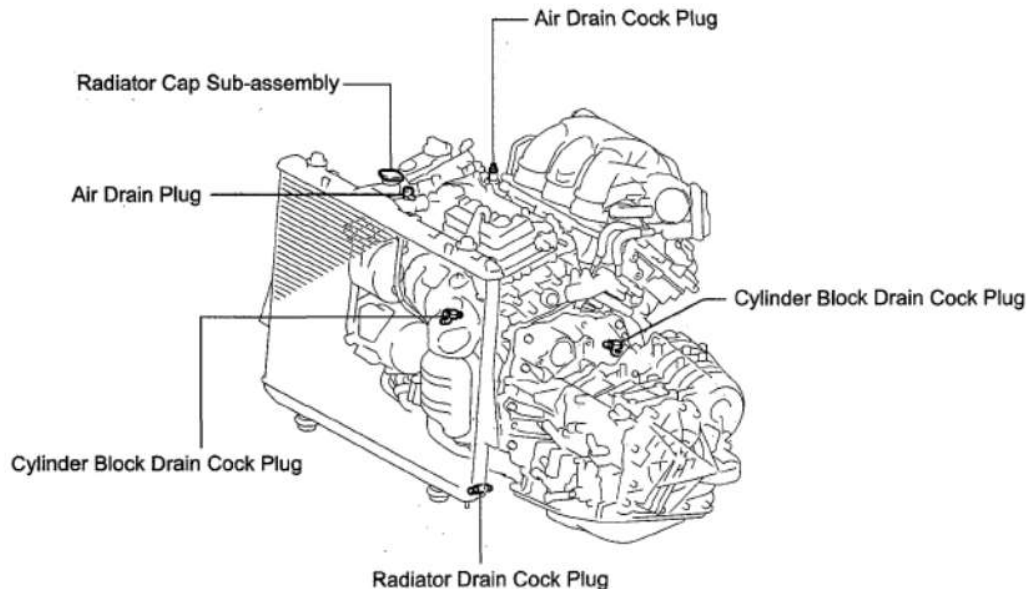
NOTE: While using the battery for the inspection, do not bring the positive and negative tester probes too close to each other as a short circuit may occur.

NG: REPLACE ENGINE ROOM JUNCTION BLOCK ASSEMBLY (See REMOVAL)

OK: REPLACE ECM (See REMOVAL)

COOLANT**REPLACEMENT**

1. REMOVE V-BANK COVER SUB-ASSEMBLY (See REMOVAL)
2. REMOVE ENGINE UNDER COVER ASSEMBLY (See REMOVAL)
3. REMOVE NO. 1 ENGINE UNDER COVER (See REMOVAL)
4. DRAIN ENGINE COOLANT
 - a. Loosen the radiator drain cock plug.



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Fig. 25: Identifying Radiator Drain Cock Plug, Cylinder Block Drain Cock Plug And Air Drain Cock Plug

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

HINT:

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Collect the coolant in a container and dispose of it according to the regulations in your area.

- b. Remove the radiator cap sub-assembly from the radiator assembly.

NOTE: Do not remove the radiator cap sub-assembly while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

- c. Loosen the 2 cylinder block drain cock plugs.

5. ADD ENGINE COOLANT

- a. Tighten the radiator drain cock plug by hand.
- b. Tighten the 2 cylinder block drain cock plugs.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf) for cylinder block drain cock plugs

- c. Loosen the air drain cock plug from the water inlet housing.
- d. Loosen the air drain plug at the top of the radiator 3 or 4 turns.
- e. Add TOYOTA Super Long Life Coolant (SLLC) to the radiator inlet opening until coolant overflows from the engine air drain cock hole. Then tighten the air drain cock plug to the water inlet housing.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf) for air drain cock plug

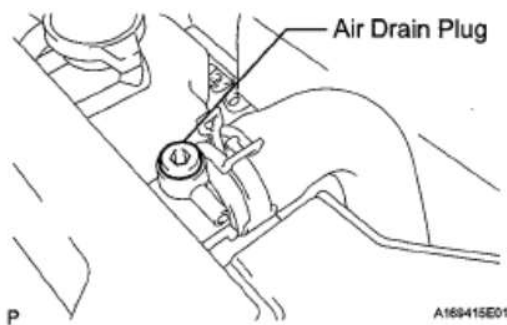


Fig. 26: Identifying Air Drain Plug

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

- f. Continue to add TOYOTA Super Long Life Coolant (SLLC) to the radiator inlet opening until coolant overflows from the radiator air drain hole. Then close the air drain plug at the top of the radiator.

Torque: 1.5 N*m (15 kgf*cm, 13 in.*lbf) for air drain plug

HINT:

If the coolant level at the radiator inlet opening drops after squeezing the No. 1 and No. 2 radiator hoses, add coolant.

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2009 ENGINE Cooling (2GR-FE) - Highlander

- g. Slowly fill the radiator with TOYOTA Super Long Life Coolant (SLLC).

Standard capacity

w/o Trailer Towing System

SPECIFIED CONDITION CHART

Condition	Specified Condition
w/ Rear Heater	11.0 liters (11.6 US qts, 9.7 imp. qts)
w/o Rear Heater	8.8 liters (9.3 US qts, 7.7 imp. qts)

w/ Trailer Towing System

SPECIFIED CONDITION CHART

Condition	Specified Condition
w/ Rear Heater	11.7 liters (12.4 US qts, 10.3 imp. qts)
w/o Rear Heater	9.5 liters (10.1 US qts, 8.4 imp. qts)

HINT:

- TOYOTA vehicles are filled with TOYOTA SLLC at the factory. In order to avoid damage to the engine cooling system and other technical problems, only use TOYOTA SLLC or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, non-borate coolant with long-life hybrid organic acid technology (coolant with long-life hybrid organic acid technology consists of a combination of low phosphates and organic acids).
- Contact your TOYOTA dealer for further details.

NOTE: **Never use water as a substitute for engine coolant.**

- h. Slowly pour coolant into the radiator reservoir tank until it reaches the FULL line.
- i. Squeeze the No. 1 and No. 2 radiator hoses several times by hand, and then check the level of the coolant.

If the coolant level is low, add coolant.

- j. Bleed air from the cooling system.
1. Warm up the engine until the thermostat opens. While the thermostat is open, circulate the coolant for several minutes.

HINT:

The thermostat open timing can be confirmed by squeezing the inlet radiator hose by hand, and checking when the engine coolant starts to flow inside the hose.

2. Maintain the engine speed at 2500 to 3000 rpm.

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2009 ENGINE Cooling (2GR-FE) - Highlander

3. Squeeze the inlet and outlet radiator hoses several times by hand to bleed air.

CAUTION: When squeezing the radiator hoses:

- Wear protective gloves.
- Be careful as the radiator hoses are hot.
- Keep your hands away from the radiator fan.

NOTE:

- Make sure that the radiator reservoir still has some coolant in it.
- If the coolant temperature gauge indicates an excessive temperature, turn off the engine and let it cool.
- If there is not enough coolant, the engine may overheat or be seriously damaged.
- If the radiator reservoir does not have enough coolant, perform the following: 1) stop the engine, 2) wait until the coolant has cooled down, and 3) add coolant until the reservoir is filled to the FULL line.

k. Stop the engine and wait until the engine coolant cools down.

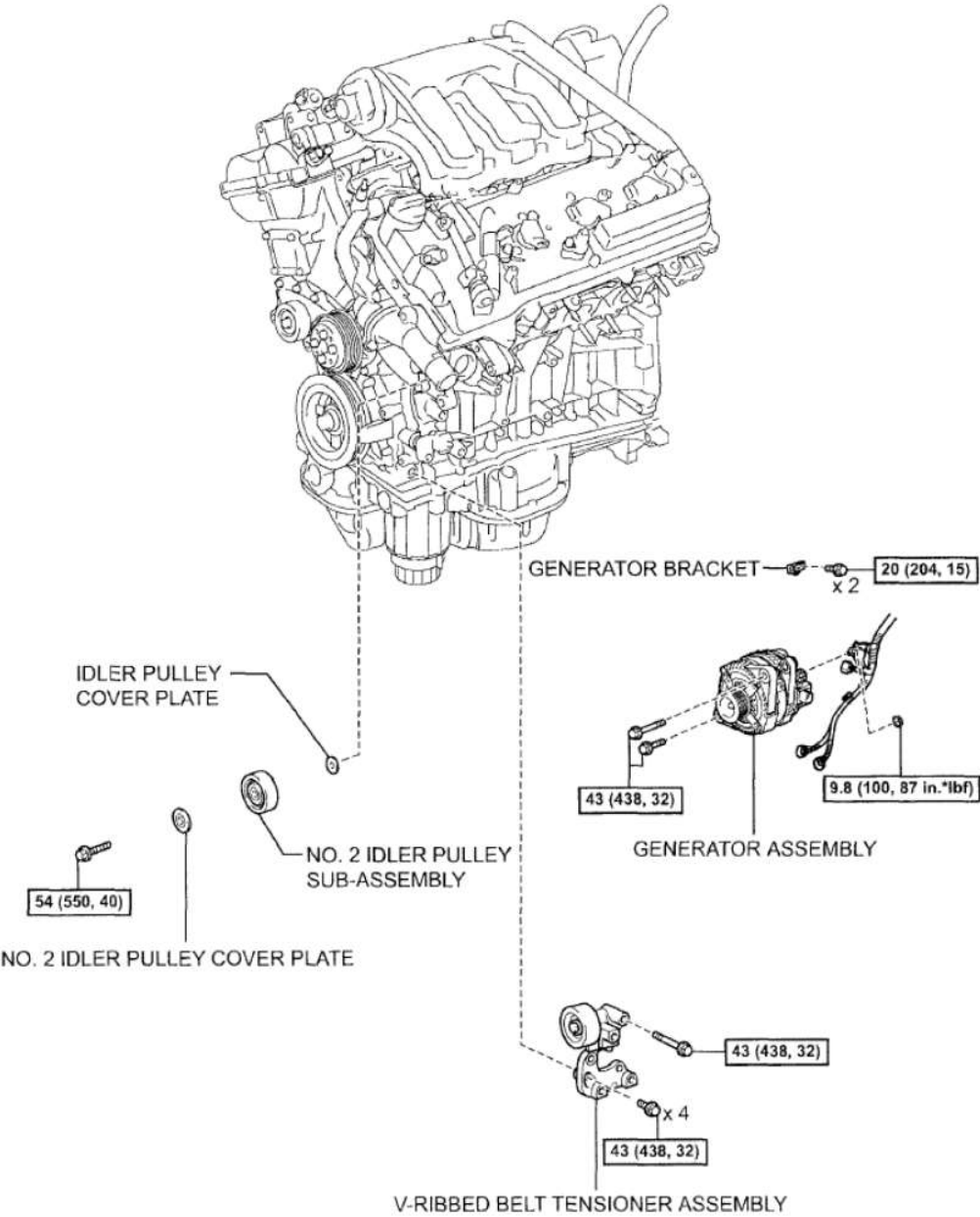
l. Add engine coolant to the FULL line on the radiator reservoir.

6. **INSPECT FOR COOLANT LEAK** (See COOLING SYSTEM)
7. **INSTALL NO. 1 ENGINE UNDER COVER** (See INSTALLATION)
8. **INSTALL ENGINE UNDER COVER ASSEMBLY** (See INSTALLATION)
9. **INSTALL V-BANK COVER SUB-ASSEMBLY** (See INSTALLATION)

WATER PUMP**COMPONENTS**

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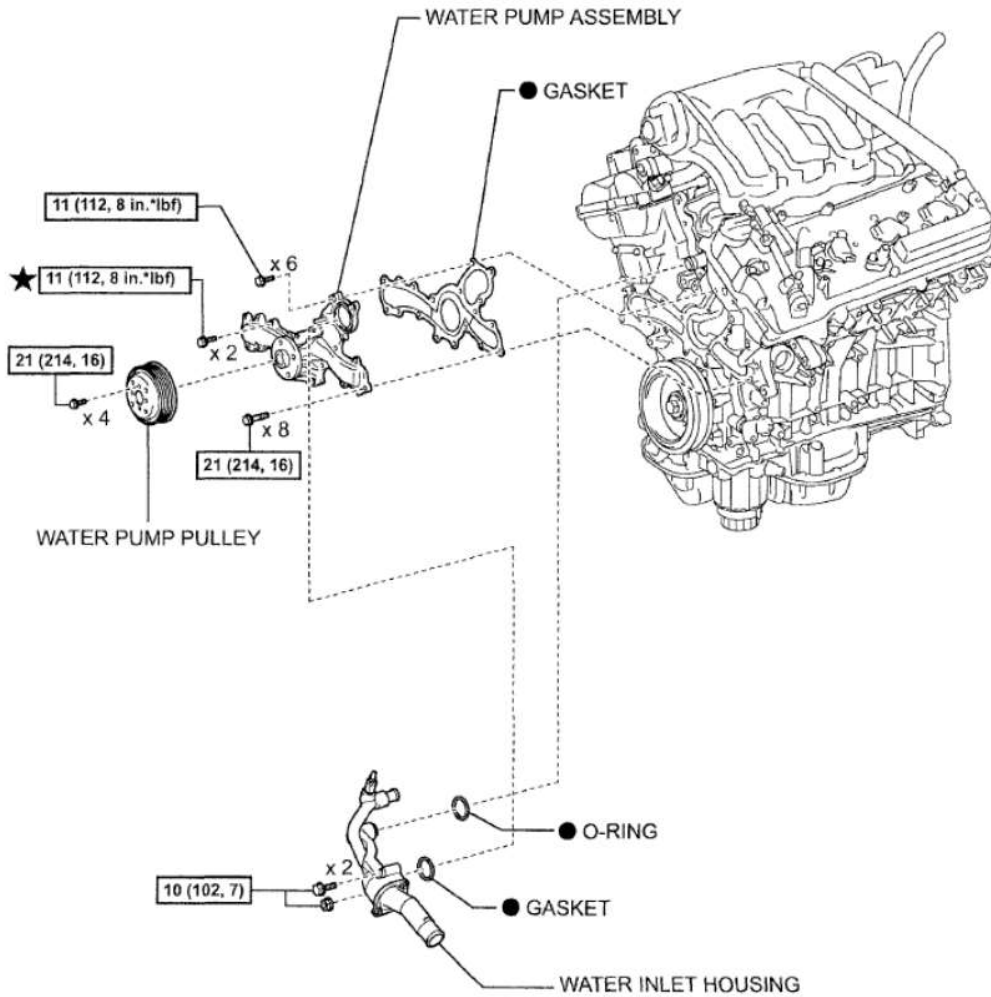
N*m (kgf*cm, ft.*lbf): Specified torque

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Fig. 27: Identifying Water Pump Components And Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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2009 ENGINE Cooling (2GR-FE) - Highlander



N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

★ Precoated part

A109458E02

Fig. 28: Identifying Water Pump Components And Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. REMOVE FRONT WHEEL RH
2. REMOVE ENGINE UNDER COVER ASSEMBLY (See REMOVAL)
3. REMOVE NO. 1 ENGINE UNDER COVER (See REMOVAL)
4. REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY RH

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HINT:

Use the same procedures for the RH side and LH side (See **REMOVAL**).

5. **REMOVE FRONT FENDER LINER RH** (See **REMOVAL**)
6. **REMOVE FRONT FENDER APRON SEAL RH** (See **REMOVAL**)
7. **REMOVE V-RIBBED BELT** (See **INSPECTION**)
8. **INSPECT WATER PUMP ASSEMBLY**
 - a. Turn the pulley and check that the water pump bearing moves smoothly and quietly.

If necessary, replace the water pump assembly.
 - b. Make sure that there are no drops of coolant on the water pump housing.

If necessary, replace the water pump assembly.

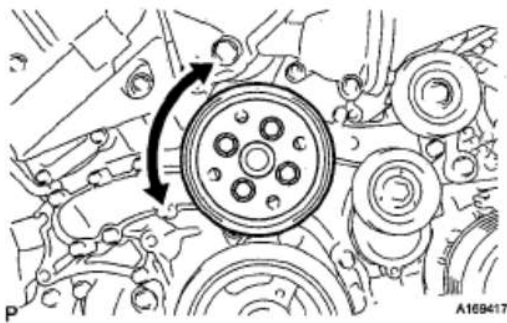


Fig. 29: Turning Pulley

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

9. **INSTALL V-RIBBED BELT** (See **INSTALLATION**)
10. **INSTALL FRONT FENDER APRON SEAL RH** (See **INSTALLATION**)
11. **INSTALL FRONT FENDER LINER RH** (See **INSTALLATION**)
12. **INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY RH**

HINT:

Use the same procedures for the RH side and LH side (See **INSTALLATION**).

13. **INSTALL NO. 1 ENGINE UNDER COVER** (See **INSTALLATION**)
14. **INSTALL ENGINE UNDER COVER ASSEMBLY** (See **INSTALLATION**)
15. **INSTALL FRONT WHEEL RH**

Torque: 103 N*m (1050 kgf*cm, 76 ft.*lbf)

REMOVAL

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2009 ENGINE Cooling (2GR-FE) - Highlander

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

See **REMOVAL** .**2. SECURE ENGINE (See **REMOVAL**)****3. REMOVE GENERATOR ASSEMBLY (See **REMOVAL**)****4. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY**

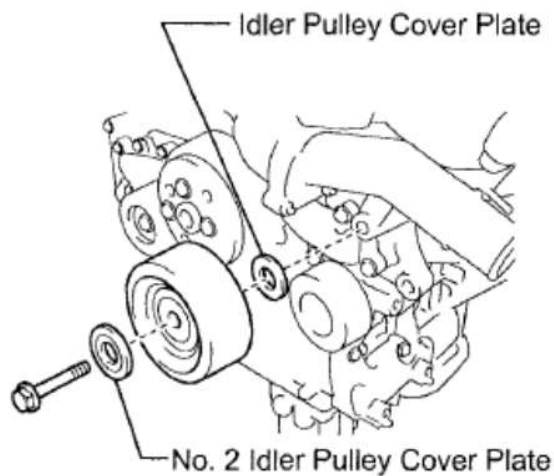
- a. Remove the bolt, idler pulley cover plate, No. 2 idler pulley cover plate and No. 2 idler pulley sub-assembly.

HINT:

Plate diameter:

Idler pulley cover plate: 33.6 mm (1.32 in.)

No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)



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Fig. 30: Identifying Bolt, Idler Pulley Cover Plate, No. 2 Idler Pulley Cover Plate And No. 2 Idler Pulley Sub-Assembly

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

5. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the 5 bolts and V-ribbed belt tensioner assembly.

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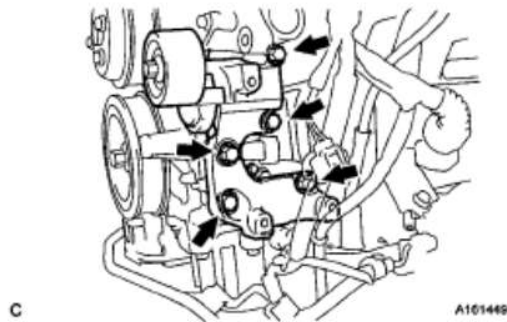


Fig. 31: Locating Bolts And V-Ribbed Belt Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE WATER PUMP PULLEY

- a. Using SST, hold the water pump pulley.

SST 09960-10010 (09962-01000, 09963-00700)

- b. Remove the 4 bolts and water pump pulley.

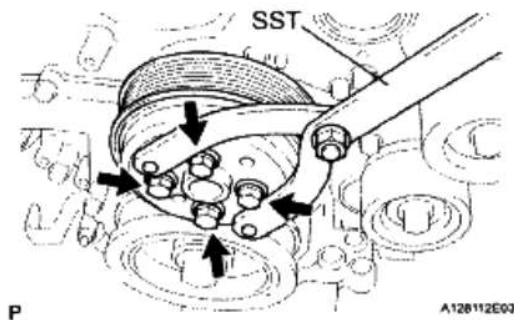


Fig. 32: Holding Water Pump Pulley With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE WATER INLET HOUSING

- a. Disconnect the water hose.
- b. Remove the 2 bolts, nut and water inlet housing.

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2009 ENGINE Cooling (2GR-FE) - Highlander

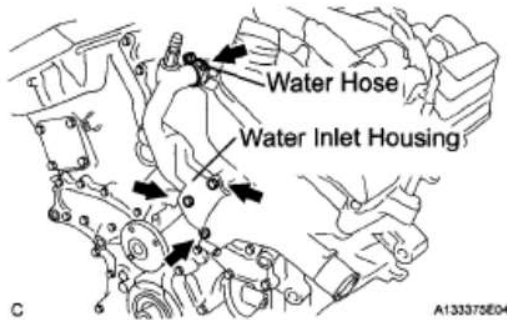


Fig. 33: Locating Water Inlet Housing And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the water inlet housing gasket and water outlet pipe O-ring.

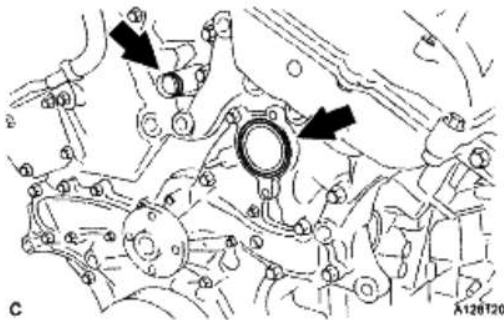


Fig. 34: Locating Water Inlet Housing Gasket And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE WATER PUMP ASSEMBLY

- a. Remove the 16 bolts, water pump assembly and water pump gasket.

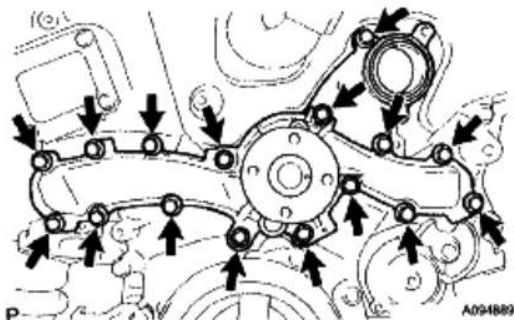


Fig. 35: Locating Water Pump Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL WATER PUMP ASSEMBLY

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- a. Install a new water pump gasket and the water pump assembly with the 16 bolts.

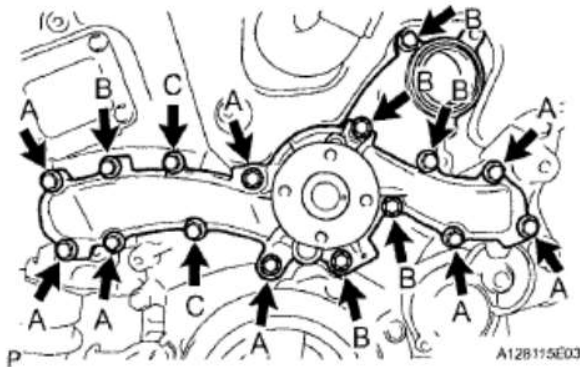
Torque: Bolt A**21 N*m (214 kgf*cm, 16 ft.*lbf)****Bolts B and C****11 N*m (112 kgf*cm, 8 in.*lbf)**

Fig. 36: Locating Water Pump Assembly Bolts

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

NOTE:

- Make sure that there is no oil on the threads of bolts A.
- Be sure to replace 2 bolts C with new ones or reuse them after applying adhesive 1344.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

2. INSTALL WATER INLET HOUSING

- a. Install a new water inlet housing gasket and water outlet pipe O-ring.

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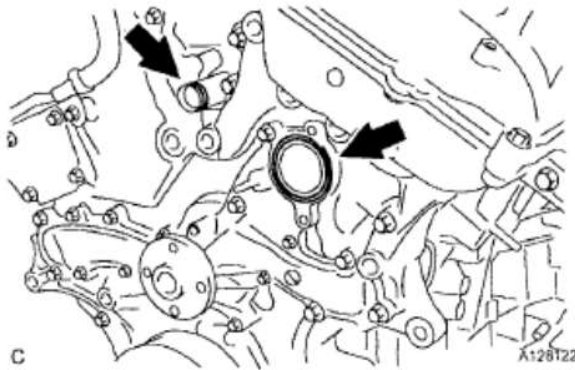


Fig. 37: Locating Water Inlet Housing Gasket And Water Outlet Pipe O-Ring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the water inlet housing with the 2 bolts and nut.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

NOTE: Be careful not to allow the O-ring to get caught between the parts.

- c. Connect the water hose.

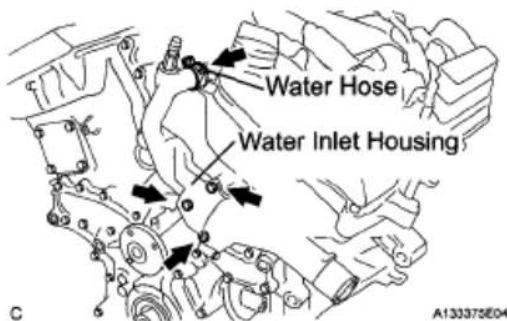


Fig. 38: Locating Water Inlet Housing And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL WATER PUMP PULLEY

- a. Temporarily install the water pump pulley with the 4 bolts.
- b. Using SST, hold the water pump pulley.

SST 09960-10010 (09962-01000, 09963-00700)

- c. Tighten the 4 bolts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

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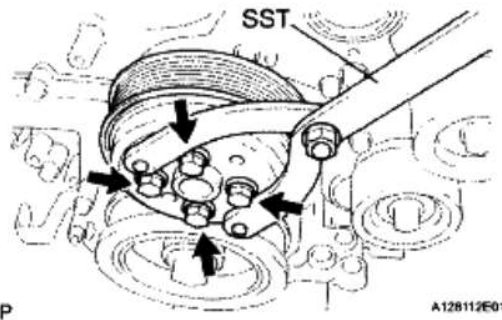


Fig. 39: Locating Water Pump Pulley Bolts

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

4. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- Install the V-ribbed belt tensioner assembly with the 5 bolts.

Torque: 43 N*m (438 kgf*cm, 32 ft.*lbf)

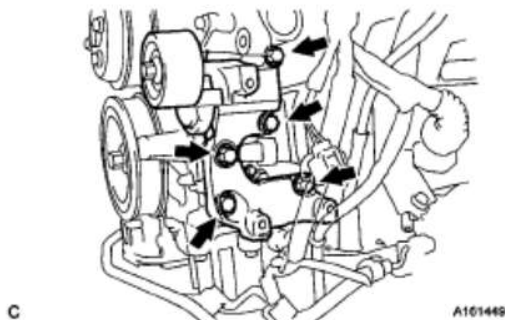


Fig. 40: Locating V-Ribbed Belt Tensioner Assembly

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

5. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

- Install the idler pulley cover plate, No. 2 idler pulley cover plate and No. 2 idler pulley sub-assembly with the bolt.

Torque: 54 N*m (550 kgf*cm, 40 ft.*lbf)

HINT:

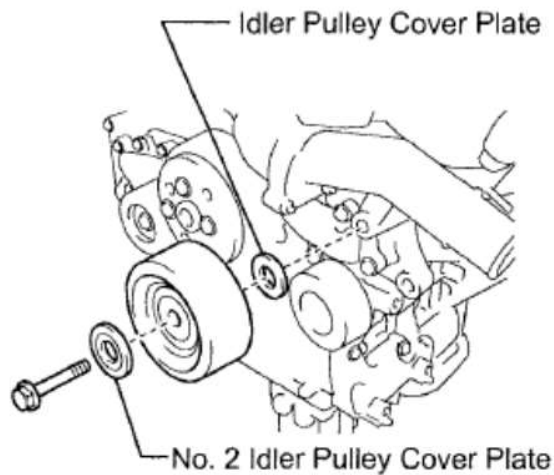
Plate diameter:

Idler pulley cover plate: 33.6 mm (1.32 in.)

No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)

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2009 ENGINE Cooling (2GR-FE) - Highlander



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Fig. 41: Identifying Bolt, Idler Pulley Cover Plate, No. 2 Idler Pulley Cover Plate And No. 2 Idler Pulley Sub-Assembly

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

6. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION)
7. **INSTALL ENGINE HANGERS** (See INSTALLATION)
8. **REMOVE ENGINE STAND**
9. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**

HINT:

See INSTALLATION .

THERMOSTAT

COMPONENTS

2009 Toyota Highlander Limited

2009 ENGINE Cooling (2GR-FE) - Highlander

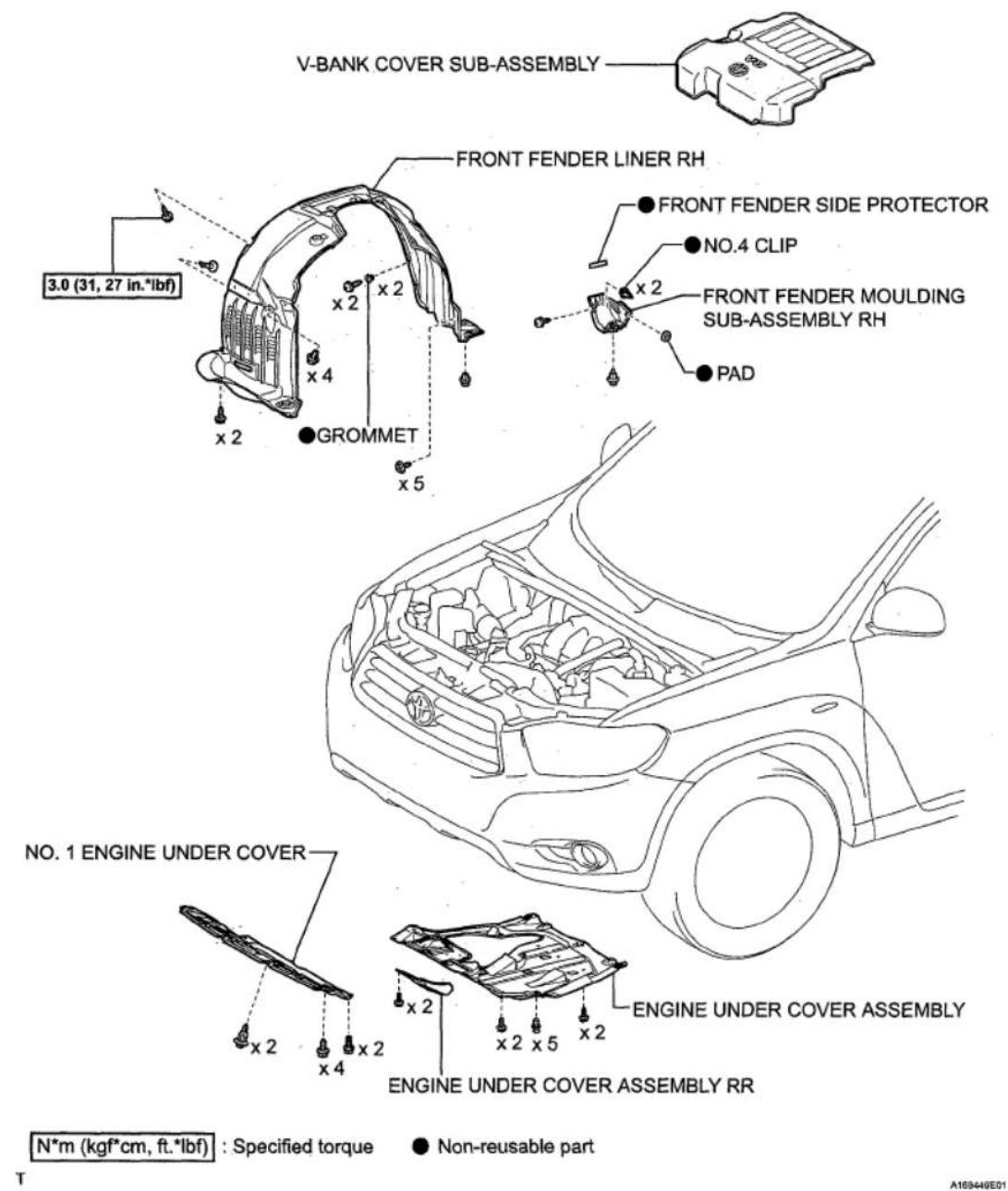
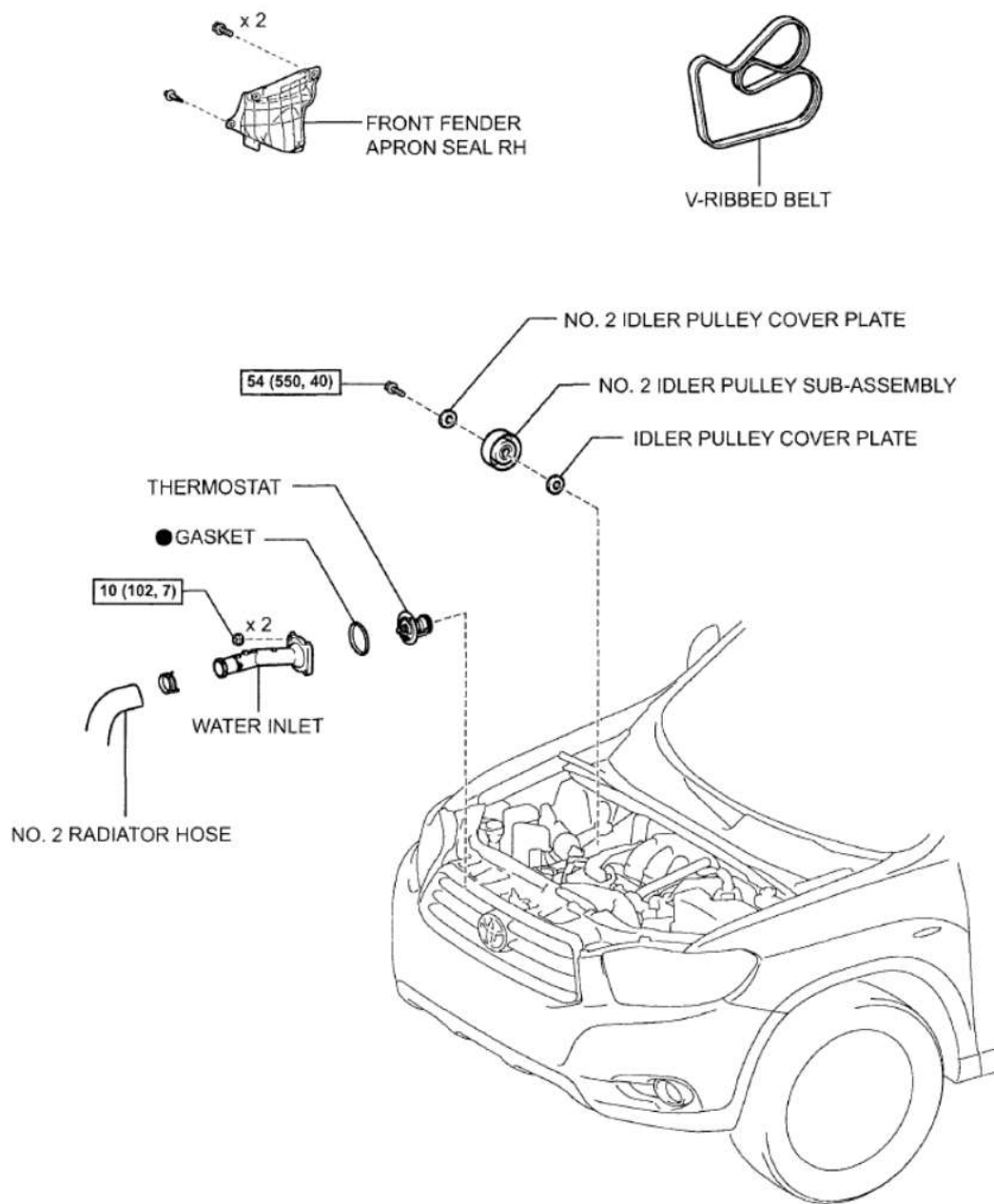


Fig. 42: Identifying Thermostat Components And Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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2009 ENGINE Cooling (2GR-FE) - Highlander



[N*m (kgf*cm, ft.*lbf)]: Specified torque

● Non-reusable part

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Fig. 43: Identifying Thermostat Components And Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE V-BANK COVER SUB-ASSEMBLY (See [REMOVAL](#))
2. REMOVE ENGINE UNDER COVER ASSEMBLY (See [REMOVAL](#))

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2009 ENGINE Cooling (2GR-FE) - Highlander

3. **REMOVE NO. 1 ENGINE UNDER COVER** (See **REMOVAL**)
4. **REMOVE FRONT WHEEL RH**
5. **REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY RH**

HINT:

Use the same procedures for the RH side and LH side (See **REMOVAL**).

6. **REMOVE FRONT FENDER LINER RH** (See **REMOVAL**)
7. **REMOVE FRONT FENDER APRON SEAL RH** (See **REMOVAL**)
8. **DRAIN ENGINE COOLANT** (See **COOLANT**)
9. **REMOVE V-RIBBED BELT** (See **INSPECTION**)
10. **DISCONNECT NO. 2 RADIATOR HOSE**
 - a. Disconnect the No. 2 radiator hose from the engine.

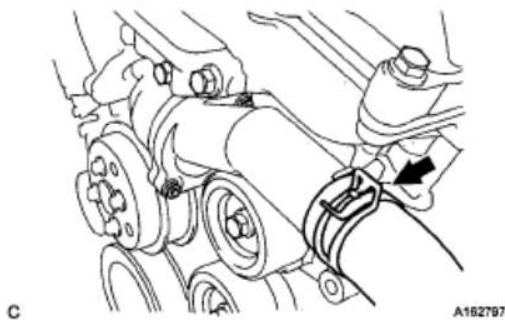


Fig. 44: Locating Radiator Hose

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

11. **REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the bolt, idler pulley cover plate, No. 2 idler pulley cover plate and No. 2 idler pulley sub-assembly.

HINT:

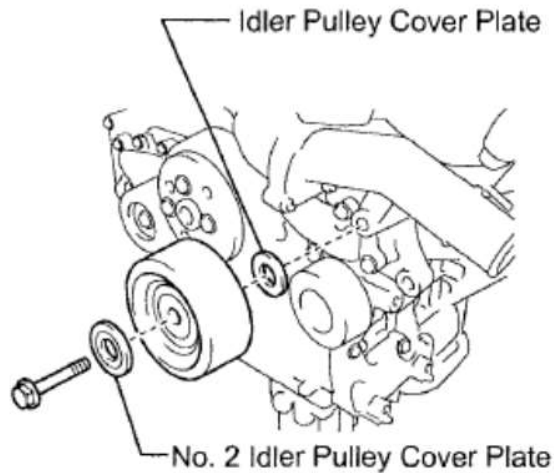
Plate diameter:

Idler pulley cover plate: 33.6 mm (1.32 in.)

No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)

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Fig. 45: Identifying Bolt, Idler Pulley Cover Plate, No. 2 Idler Pulley Cover Plate And No. 2 Idler Pulley Sub-Assembly

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

12. REMOVE WATER INLET

- Remove the 2 nuts and water inlet.

13. REMOVE THERMOSTAT

- Remove the thermostat from the water inlet housing
- Remove the gasket from the thermostat.

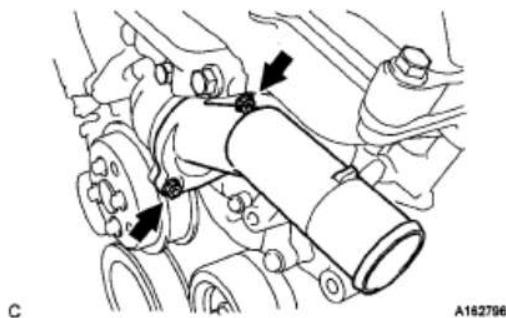


Fig. 46: Locating Water Inlet And Nuts

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

INSPECTION

1. INSPECT THERMOSTAT

- Inspect the thermostat.

HINT:

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2009 ENGINE Cooling (2GR-FE) - Highlander

The valve opening temperature is inscribed on the thermostat.



Fig. 47: Identifying Thermostat

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

- b. Immerse the thermostat in water and gradually heat the water.
- c. Check the valve opening temperature.

Valve opening temperature:

80 to 84°C (176 to 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

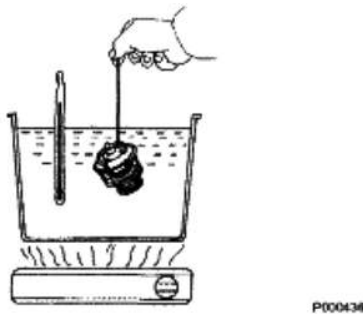


Fig. 48: Checking Valve Opening Temperature

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

- d. Check the valve lift.

Valve lift:

10 mm (0.39 in.) or more at 95°C (203°F)

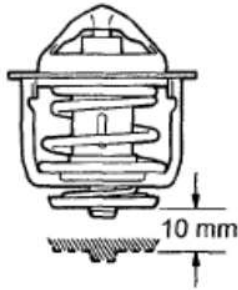
If the valve lift is not as specified, replace the thermostat.

- e. Check that the valve is fully closed when the thermostat is at low temperatures (below 40°C (104°F)).

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If it is not fully closed, replace the thermostat.



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Fig. 49: Identifying Valve Lift Dimension

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

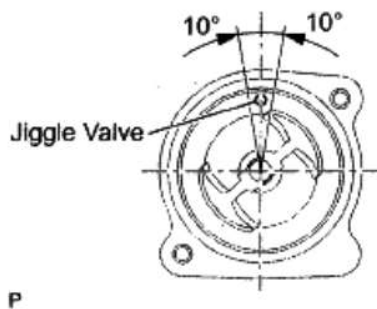
INSTALLATION

1. INSTALL THERMOSTAT

- Install a new gasket to the thermostat.
- Install the thermostat with the jiggle valve facing up.

HINT:

The jiggle valve may be set within 10° on either side of the prescribed position.



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Fig. 50: Identifying Thermostat With Jiggle Valve Facing Up

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

2. INSTALL WATER INLET

- Install the water inlet with the 2 nuts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

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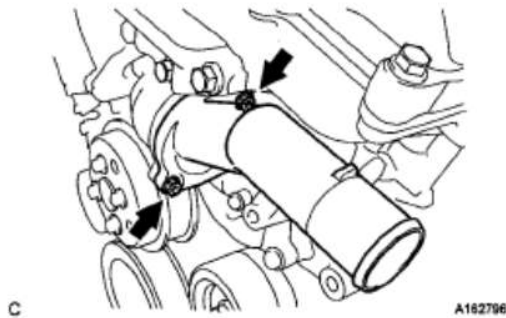


Fig. 51: Locating Water Inlet And Nuts

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

3. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

- Install the idler pulley cover plate, No. 2 idler pulley cover plate and No. 2 idler pulley sub-assembly with the bolt.

Torque: 54 N*m (550 kgf*cm, 40 ft.*lbf)

HINT:

Plate diameter:

Idler pulley cover plate: 33.6 mm (1.32 in.)

No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)

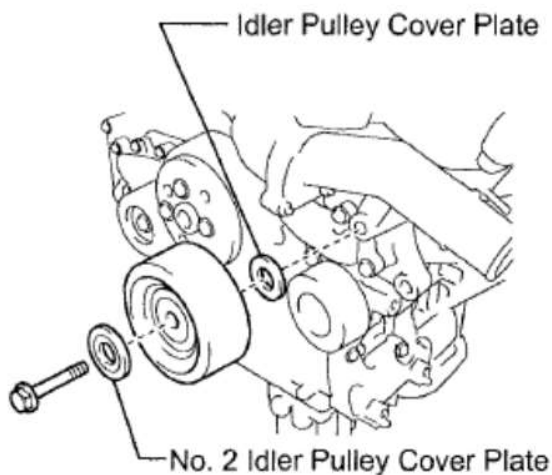


Fig. 52: Identifying Bolt, Idler Pulley Cover Plate, No. 2 Idler Pulley Cover Plate And No. 2 Idler Pulley Sub-Assembly

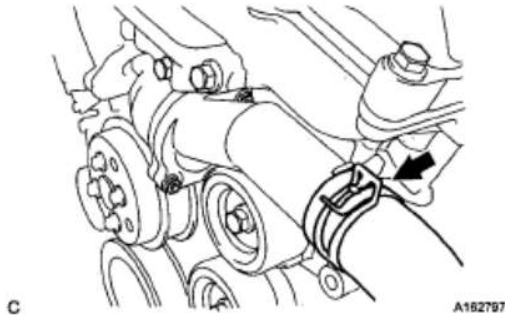
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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2009 ENGINE Cooling (2GR-FE) - Highlander

4. CONNECT NO. 2 RADIATOR HOSE

- a. Connect the No. 2 radiator hose to the engine.

5. INSTALL V-RIBBED BELT (See INSTALLATION)**6. INSTALL FRONT FENDER APRON SEAL RH (See INSTALLATION)****7. INSTALL FRONT FENDER LINER RH (See INSTALLATION)****Fig. 53: Locating Radiator Hose**

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

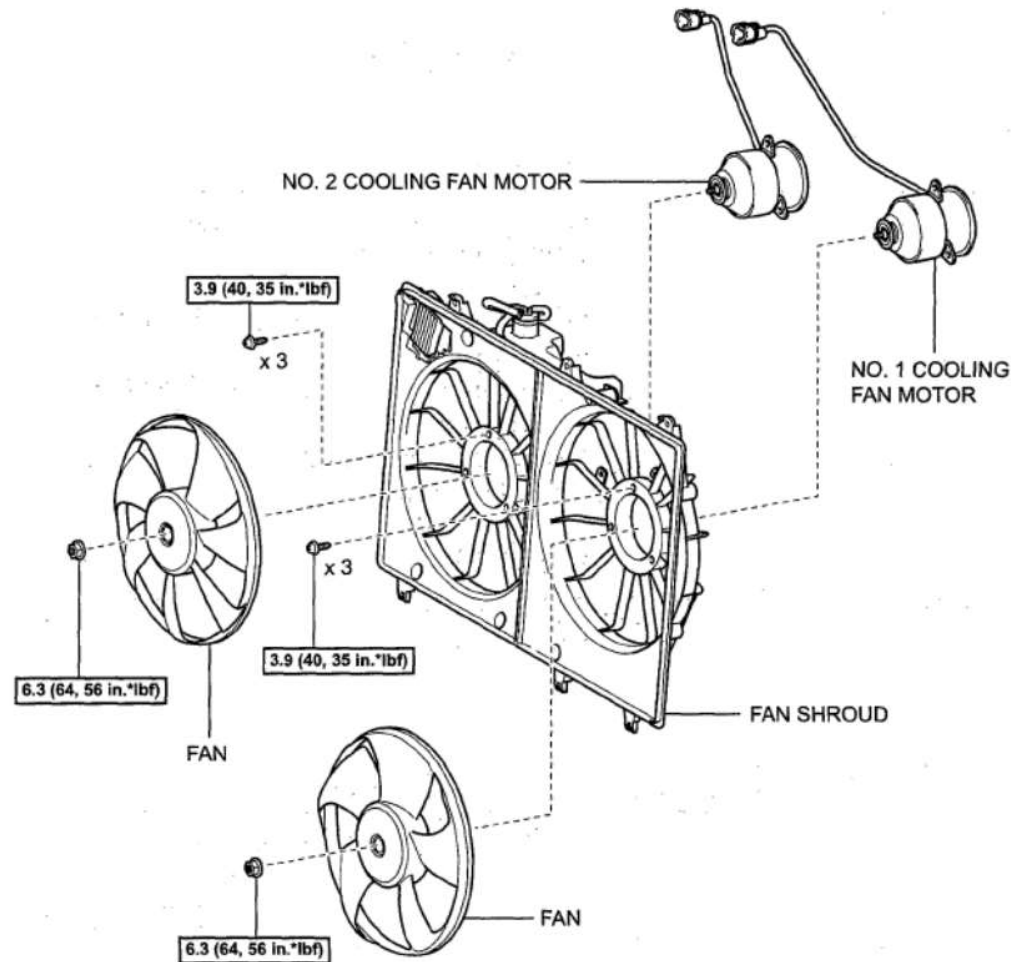
8. INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY RH

HINT:

Use the same procedures for the RH side and LH side (See INSTALLATION).**9. INSTALL FRONT WHEEL RH****Torque: 103 N*m (1050 kgf*cm, 76 ft.*lbf)****10. ADD ENGINE COOLANT (See WATER PUMP)****11. INSPECT FOR COOLANT LEAK (See COOLING SYSTEM)****12. INSTALL NO. 1 ENGINE UNDER COVER (See INSTALLATION)****13. INSTALL ENGINE UNDER COVER ASSEMBLY (See INSTALLATION)****14. INSTALL V-BANK COVER SUB-ASSEMBLY (See INSTALLATION)****COOLING FAN MOTOR****COMPONENTS**

2009 Toyota Highlander Limited

2009 ENGINE Cooling (2GR-FE) - Highlander



H $\boxed{\text{N}\cdot\text{m (kgf}\cdot\text{cm, ft.}\cdot\text{lbf)}}$: Specified torque

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Fig. 54: Identifying Cooling Fan Motor Components And Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. CHECK NO. 1 COOLING FAN MOTOR

- Disconnect the No. 1 fan connector.
- Connect the battery and an ammeter to the No. 1 fan motor connector.
- Check that the No. 1 fan rotates smoothly, and then check the reading on the ammeter.

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2009 ENGINE Cooling (2GR-FE) - Highlander

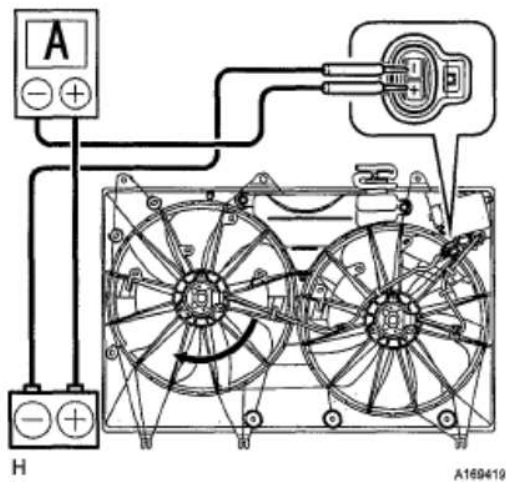


Fig. 55: Checking No. 1 Fan Rotates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard current

SPECIFIED CONDITION CHART

Condition	Specified Condition
w/o Trailer Towing System	6.8 to 9.8 A at 12 V
w/ Trailer Towing System	14.6 to 18.7 A at 12 V

HINT:

- Refer to the indication mark illustration for the indication mark location.
 - If the result is not as specified, replace the No. 1 cooling fan motor.
- d. Reconnect the No. 1 fan motor connector.

2. CHECK NO. 2 COOLING FAN MOTOR

- a. Disconnect the No. 2 fan connector.
- b. Connect the battery and an ammeter to the No. 2 fan motor connector.
- c. Check that the No. 2 fan rotates smoothly, and then check the reading on the ammeter.

Standard current

SPECIFIED CONDITION CHART

Condition	Specified Condition
w/o Trailer Towing System	6.8 to 9.8 A at 12 V
w/ Trailer Towing System	14.6 to 18.7 A at 12 V

- Refer to the indication mark illustration for the indication mark location.
- If the result is not as specified, replace the No. 2 cooling fan motor.

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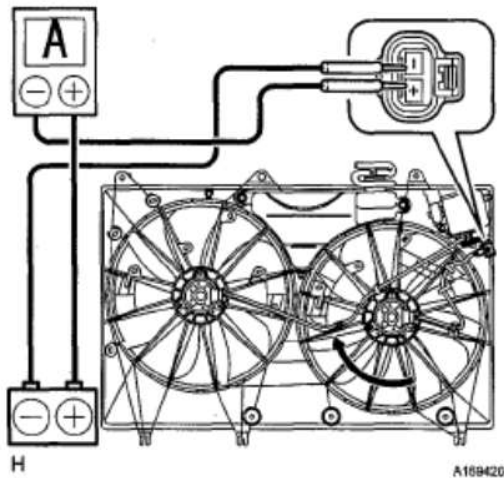


Fig. 56: Checking No. 2 Fan Rotates

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

- d. Reconnect the No. 2 fan motor connector.

REMOVAL

1. REMOVE RADIATOR ASSEMBLY AND FAN ASSEMBLY WITH MOTOR

HINT:

See **REMOVAL**

2. REMOVE FAN ASSEMBLY WITH MOTOR (See **INSTALLATION**)

3. REMOVE FAN

- a. Remove the 2 nuts and 2 fans.

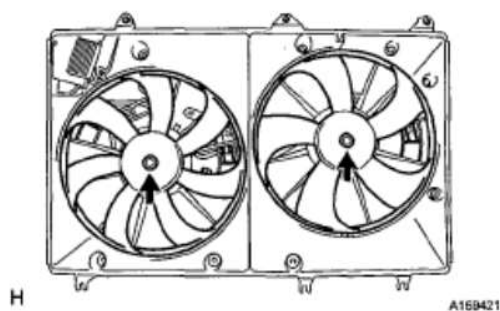


Fig. 57: Locating Nuts And Fans

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

4. DISCONNECT COOLING FAN MOTOR CONNECTORS

- a. Disconnect the cooling fan motor connectors.

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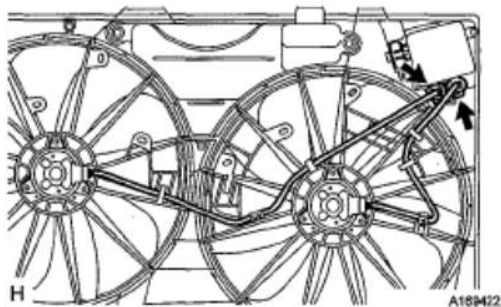


Fig. 58: Locating Cooling Fan Motor Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE NO. 1 COOLING FAN MOTOR

- a. Remove the 3 screws and fan motor.

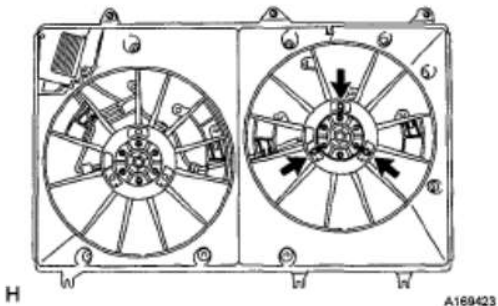


Fig. 59: Locating Screws And Fan Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE NO. 2 COOLING FAN MOTOR

- a. Remove the 3 screws and fan motor.

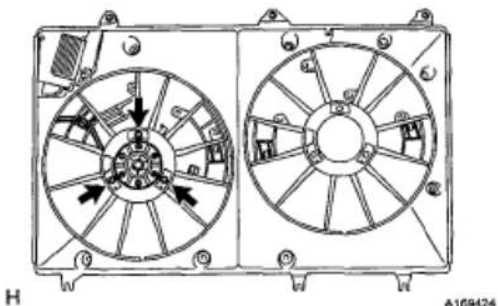


Fig. 60: Locating Screws And Fan Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL NO. 2 COOLING FAN MOTOR

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- a. Install the fan motor with the 3 screws.

Torque: 3.9 N*m (40 kgf*cm, 35 in.*lbf)

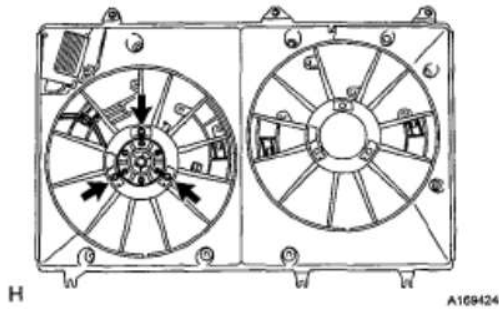


Fig. 61: Locating Screws And Fan Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL NO. 1 COOLING FAN MOTOR

- a. Install the fan motor with the 3 screws.

Torque: 3.9 N*m (40 kgf*cm, 35 in.*lbf)

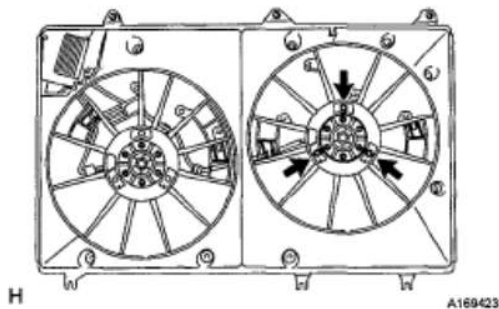


Fig. 62: Locating Screws And Fan Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. CONNECT COOLING FAN MOTOR CONNECTORS

- a. Connect the cooling fan motor connectors.

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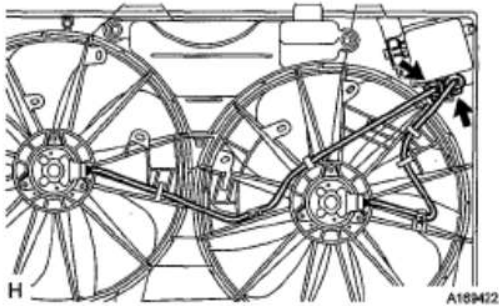


Fig. 63: Locating Cooling Fan Motor Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL FAN

- a. Install the 2 fans with the 2 nuts.

Torque: 6.3 N*m (64 kgf*cm, 56 in.*lbf)

5. **INSTALL FAN ASSEMBLY WITH MOTOR** (See INSTALLATION)
6. **INSTALL RADIATOR ASSEMBLY AND FAN ASSEMBLY WITH MOTOR**

HINT:

See INSTALLATION

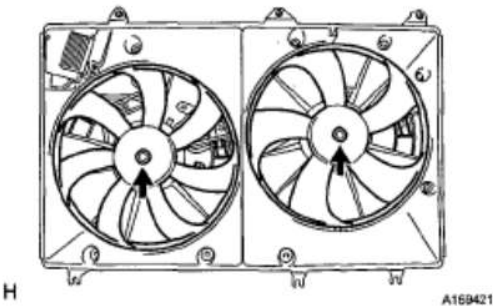


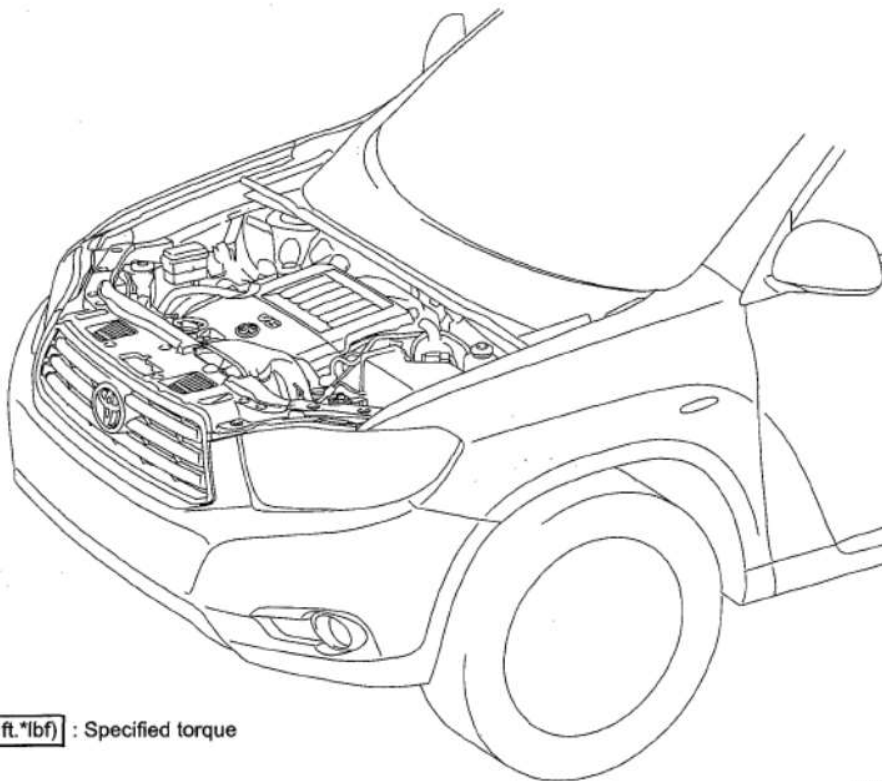
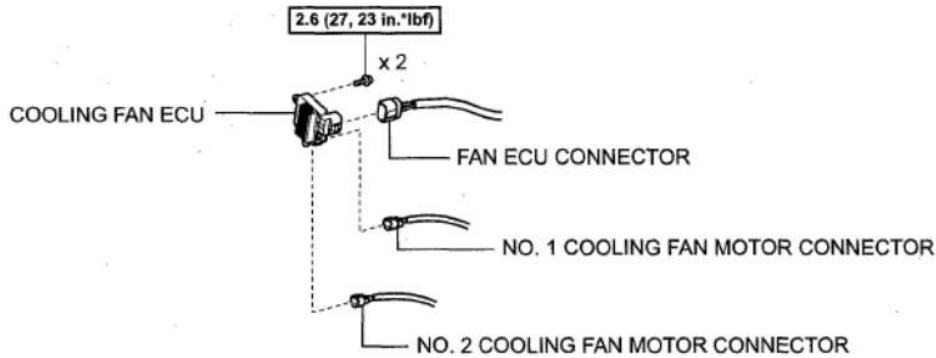
Fig. 64: Locating Nuts And Fans
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

COOLING FAN ECU

COMPONENTS

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[N*m (kgf*cm, ft.*lbf)] : Specified torque

Fig. 65: Identifying Cooling Fan ECU Components And Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. INSPECT COOLING FAN ECU

- a. Put the vehicle in the following conditions:
 1. The ignition switch is off.
 2. The coolant temperature is less than 95°C (203°F).
 3. The battery voltage is between 11 to 14 V.
 4. The A/C switch is off.

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- b. Clamp the 400 A probe of an ammeter over the M+ wire of each cooling fan motor.
- c. Turn the ignition switch on (IG) and wait for approximately 10 seconds. Check that the fan stops.
- d. Start the engine. Check that the fan stops with the engine idling.

HINT:

- Make sure that the radiator engine coolant temperature is less than 95°C (203°F).
 - Turn the A/C switch off.
- e. Check that the fan operates when the A/C switch is turned on (MAX COOL and the magnetic clutch is operating).

Standard current

w/o Trailer Towing System

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 cooling fan motor	4.7 to 6.9 A
No. 2 cooling fan motor	4.7 to 6.9 A

w/ Trailer Towing System

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 cooling fan motor	10.2 to 13.1 A
No. 2 cooling fan motor	10.2 to 13.1 A

HINT:

The coolant temperature is less than 95°C (203°F).

- f. Check that the fan operates when the engine coolant temperature sensor connector is disconnected.

Standard current

w/o Trailer Towing System

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 cooling fan motor	6.8 to 9.8 A
No. 2 cooling fan motor	6.8 to 9.8 A

w/ Trailer Towing System

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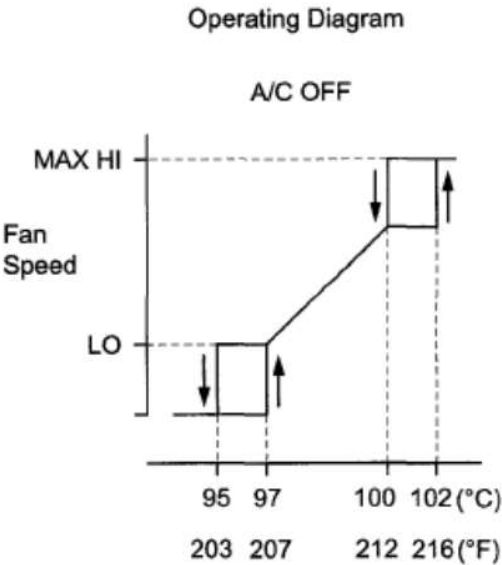
ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 cooling fan motor	14.6 to 18.7 A
No. 2 cooling fan motor	14.6 to 18.7 A

g. After the engine is warmed up, check that the fan operates as shown in the illustration.

HINT:

- The coolant temperature at which the fan starts operating is approximately 97°C (207°F).
- This system can also be checked using Techstream.
- Select the following menu items: Powertrain/Engine/Data List/Initial Engine Coolant Temp.



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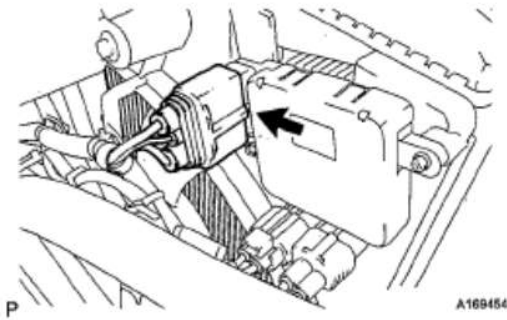
Fig. 66: Fan Operation Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE COOLING FAN ECU
 - a. Disconnect the FAN ECU connector.

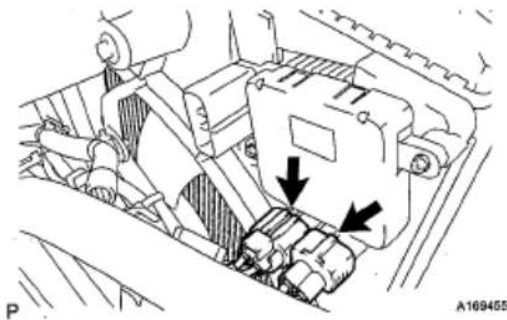
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**Fig. 67: Locating Fan ECU Connector**

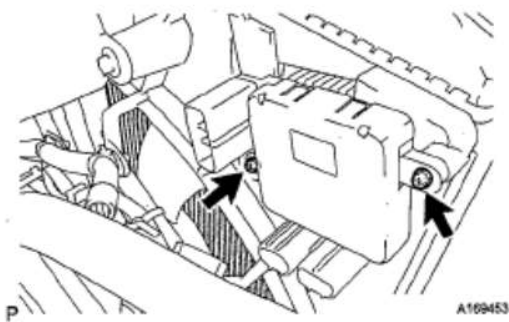
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the No. 1 cooling fan motor and No. 2 cooling fan motor connectors.

**Fig. 68: Locating No. 1 Cooling Fan Motor And No. 2 Cooling Fan Motor Connectors**

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

- c. Remove the 2 screws and ECU.

**Fig. 69: Locating Screws And ECU**

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

INSTALLATION**1. INSTALL COOLING FAN ECU**

- a. Install the ECU with the 2 screws.

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Torque: 2.6 N*m (27 kgf*cm, 23 in.*lbf)

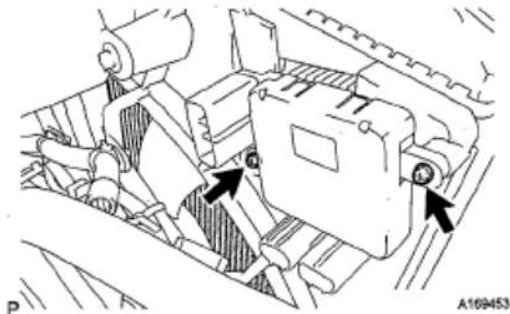


Fig. 70: Locating Screws And ECU

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

- b. Connect the No. 1 cooling fan motor and No. 2 cooling fan motor connectors.

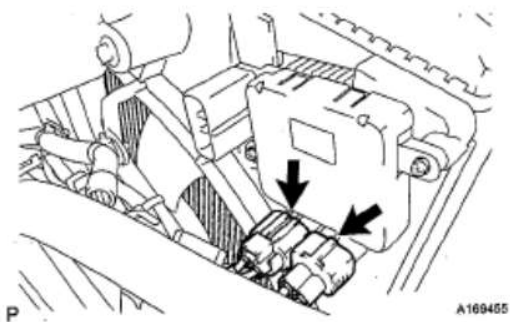


Fig. 71: Locating No. 1 Cooling Fan Motor And No. 2 Cooling Fan Motor Connectors

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

- c. Connect the FAN ECU connector.

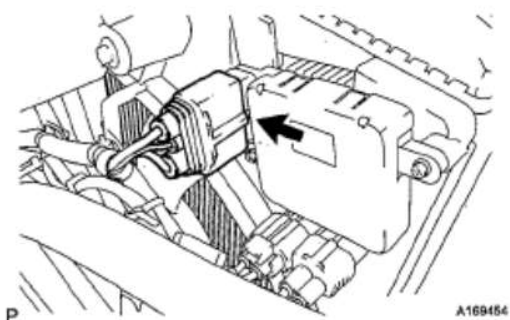


Fig. 72: Locating Fan ECU Connector

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

COOLING FAN RELAY

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2009 ENGINE Cooling (2GR-FE) - Highlander

ON-VEHICLE INSPECTION

1. INSPECT FAN MAIN RELAY

- a. Remove the FAN MAIN relay from the engine room relay block and junction block.
- b. Measure the resistance of the relay.

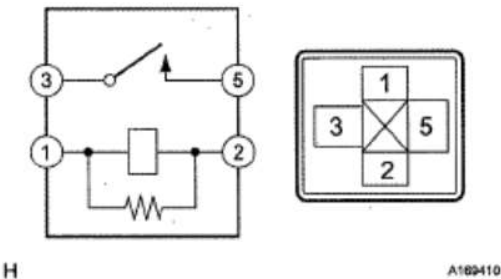


Fig. 73: FAN MAIN Relay Circuit Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
3 - 5	Battery voltage is not applied between terminals 1 and 2	10 kohms or higher
3 - 5	Apply battery voltage between terminals 1 and 2	Below 1 ohms

If the result is not as specified, replace the FAN MAIN relay.

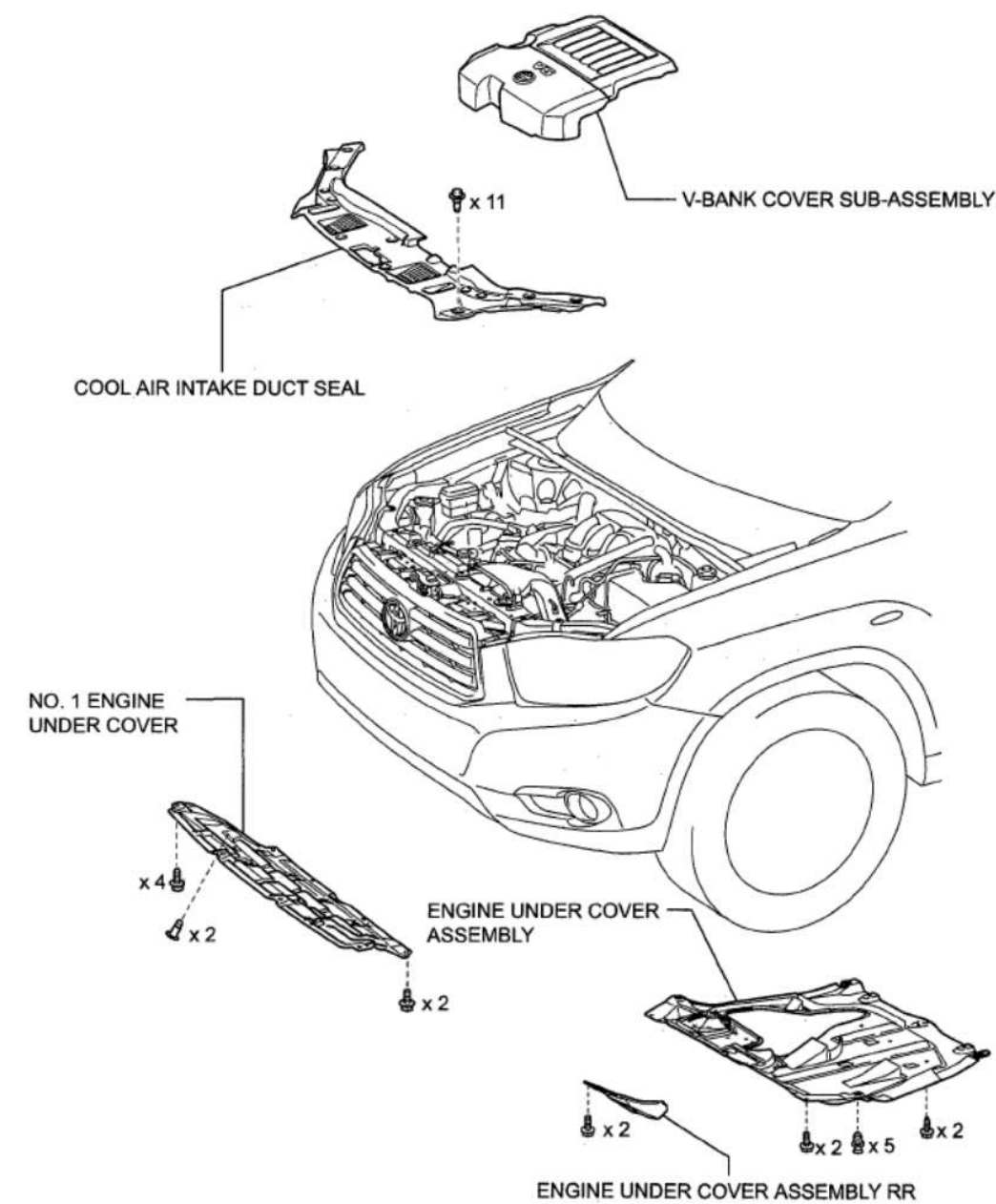
- c. Install the FAN MAIN relay to engine room relay block and junction block.

RADIATOR

COMPONENTS

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Fig. 74: Identifying Radiator Components And Torque Specifications (1 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

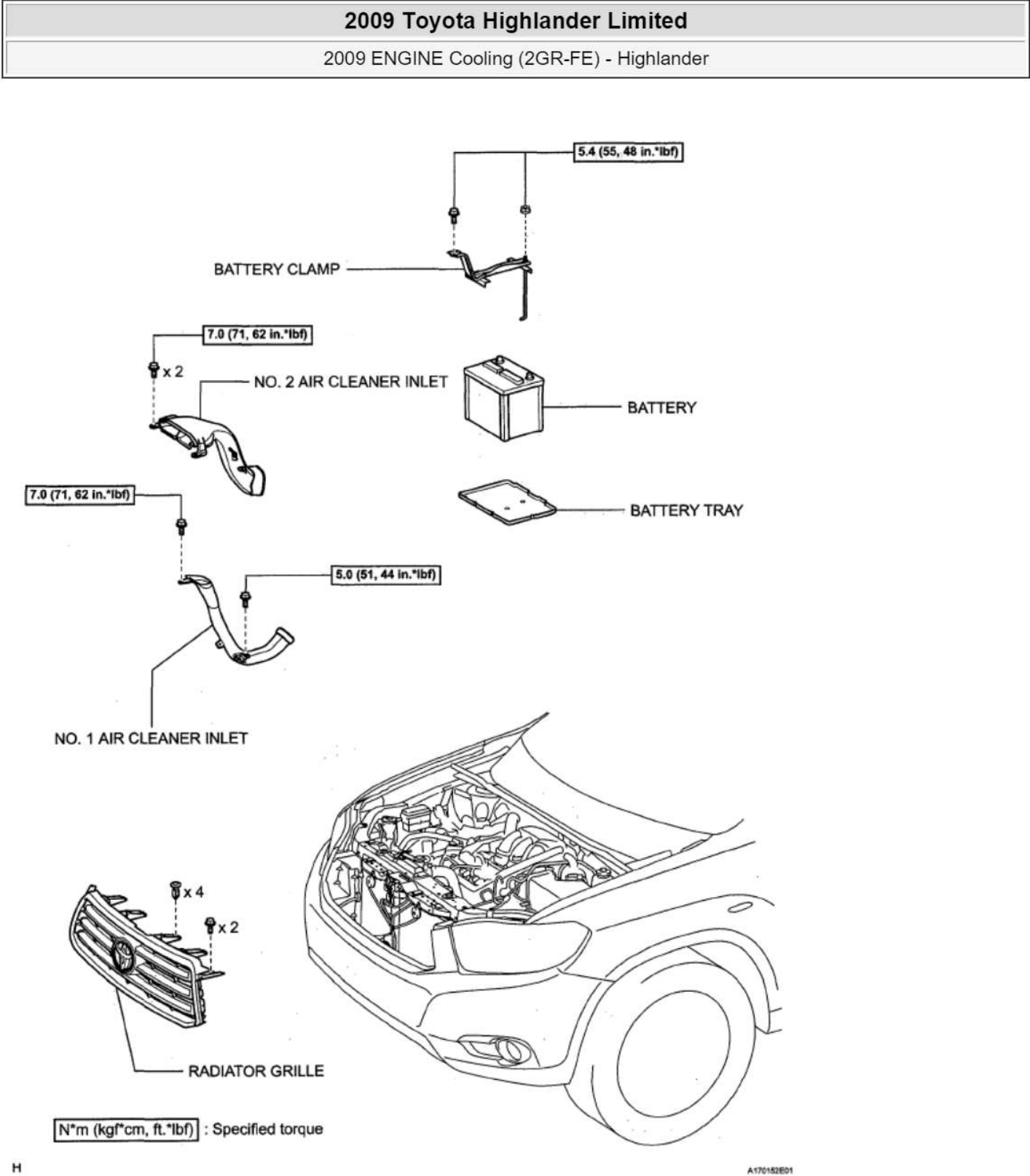


Fig. 75: Identifying Radiator Components And Torque Specifications (2 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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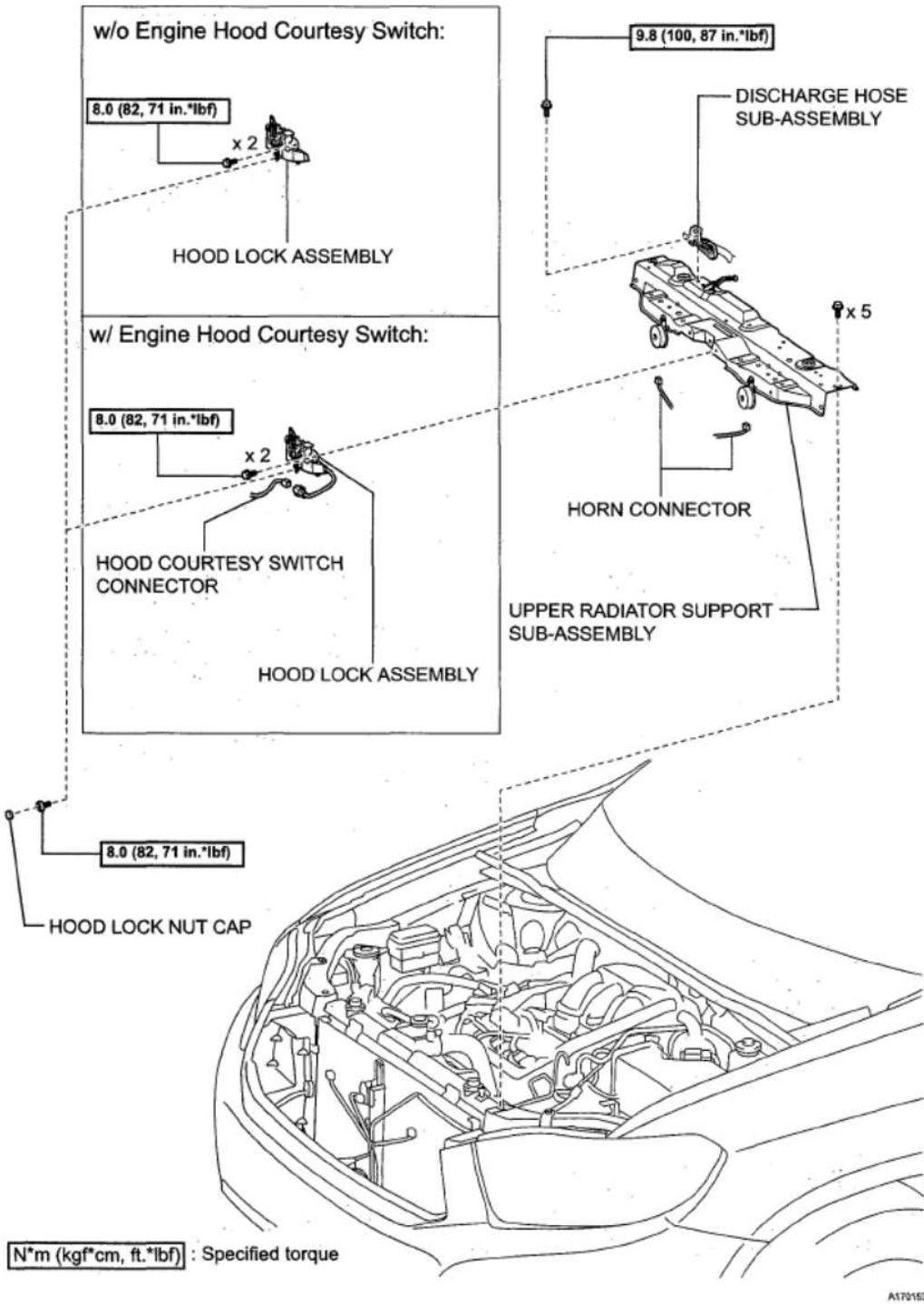


Fig. 76: Identifying Radiator Components And Torque Specifications (3 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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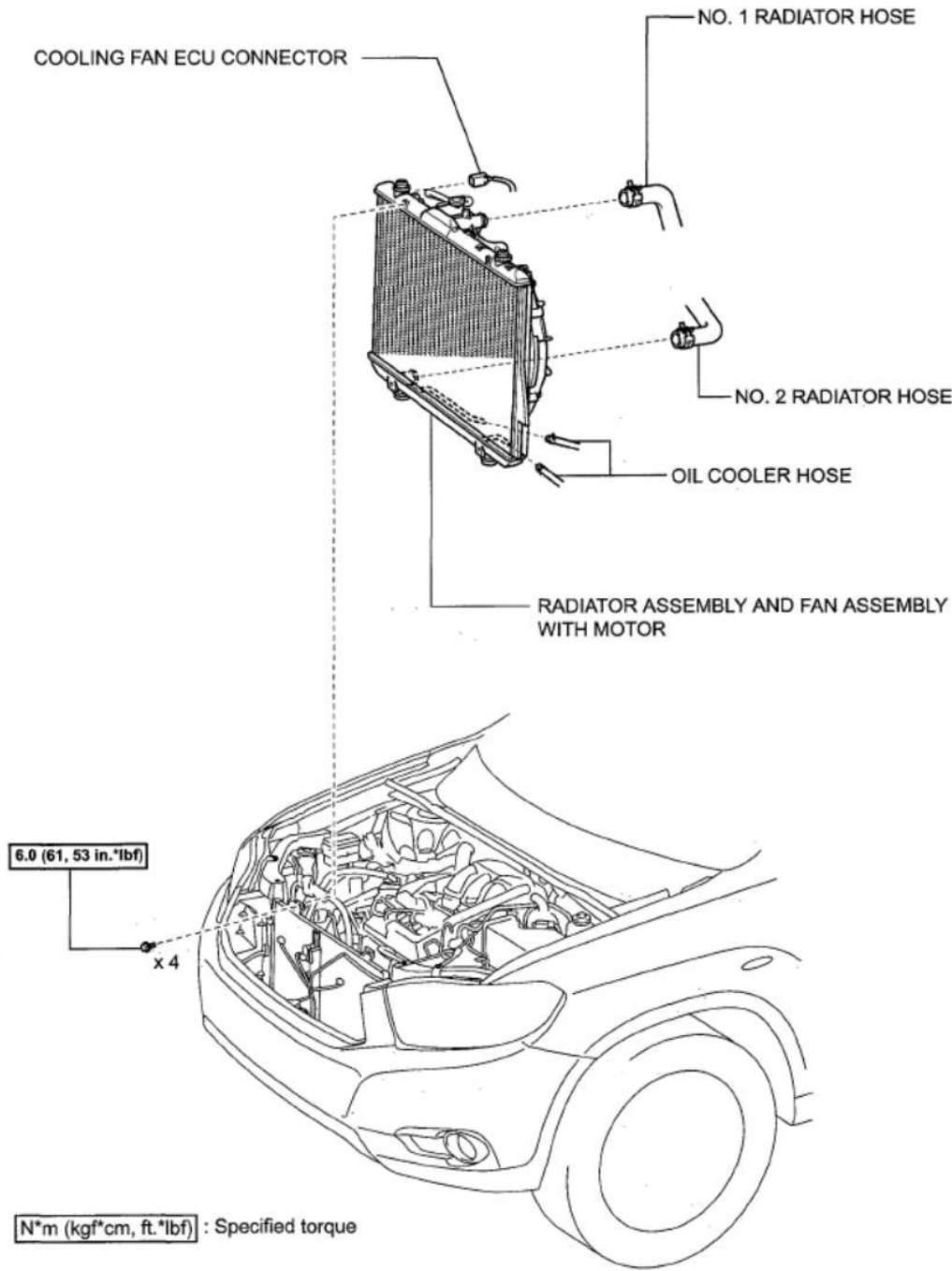
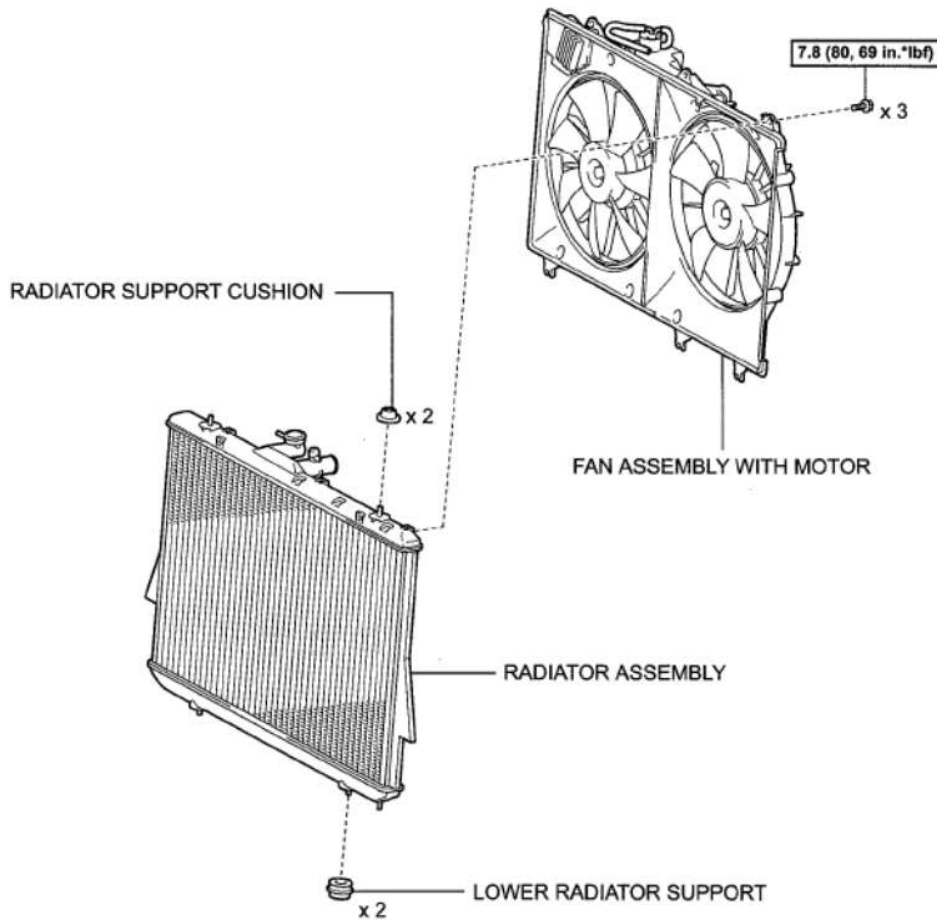


Fig. 77: Identifying Radiator Components And Torque Specifications (4 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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2009 ENGINE Cooling (2GR-FE) - Highlander



N*m (kgf*cm, ft.*lbf) : Specified torque

P

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Fig. 78: Identifying Radiator Components And Torque Specifications (5 Of 5)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

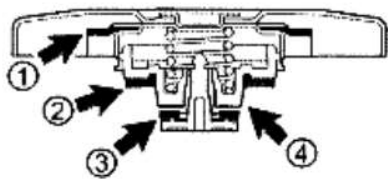
ON-VEHICLE INSPECTION

1. CHECK RADIATOR CAP SUB-ASSEMBLY

- a. Measure the valve opening pressure.
 1. If there are water stains or foreign matter on rubber packings 1, 2 or 3, clean the part(s) with water and finger scouring.
 2. Check that rubber packings 1, 2 and 3 are not deformed, cracked or swollen.

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Fig. 79: Locating Rubber Packings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 3. Check that 3 and 4 are not stuck together.
- 4. Apply engine coolant to rubber packings 2 and 3 before using the radiator cap tester.
- 5. When using the cap tester, tilt it to 30° or more above the horizontal.
- 6. Pump the cap tester several times, and check the maximum pressure*.

Pump speed:

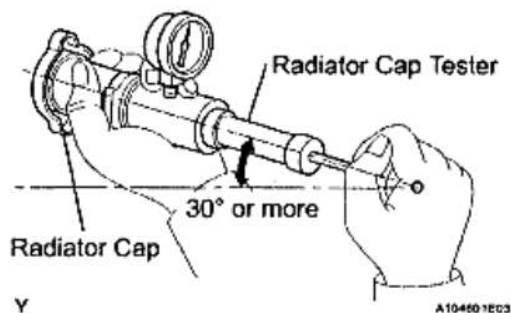
1 pump per second

*: Even if the cap cannot maintain the maximum pressure, it is not a defect.

Judgment criterion

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Standard value (for brand-new cap)	93.3 to 122.7 kPa (0.95 to 1.25 kgf/cm ² , 13.5 to 17.8 psi)
Minimum standard value (for used cap)	78.5 kPa (0.8 kgf/cm ² , 11.4 psi)



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Fig. 80: Checking Radiator Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the maximum pressure is less than the minimum standard value, replace the radiator cap sub-assembly.

ON-VEHICLE CLEANING

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2009 ENGINE Cooling (2GR-FE) - Highlander

1. INSPECT RADIATOR ASSEMBLY

- a. Check that the radiator and condenser are not blocked with leaves, dirt, or insects. Clean the hose connections.

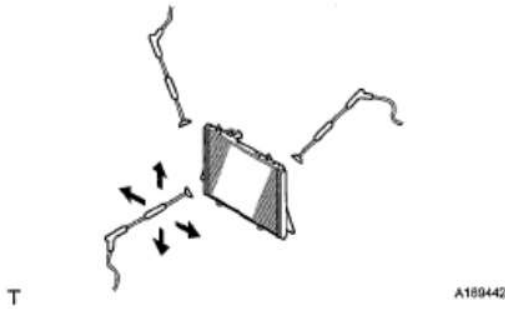


Fig. 81: Checking Radiator And Condenser

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

If the fins are blocked, wash them with water or a steam cleaner.

NOTE:

- If the distance between the steam cleaner and core is too close, the fins may be damaged.
- Keep the following injection distance.

Standard injection distance

INJECTION PRESSURE SPECIFICATIONS

Injection Pressure	Specified Condition
2942 to 4903 kPa (30 to 50 kgf/cm ² , 427 to 711 psi)	300 mm (11.81 in.)
4903 to 7845 kPa (50 to 80 kgf/cm ² , 711 to 1138 psi)	500 mm (19.69 in.)

- If the fins are bent, straighten them with a screwdriver or pliers.
- Never apply water directly onto the electronic components.

- b. Dry the fins with compressed air.

REMOVAL

1. REMOVE ENGINE UNDER COVER ASSEMBLY (See REMOVAL)
2. REMOVE NO. 1 ENGINE UNDER COVER (See REMOVAL)
3. DRAIN ENGINE COOLANT (See COOLANT)
4. REMOVE V-BANK COVER SUB-ASSEMBLY (See REMOVAL)

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5. **REMOVE COOL AIR INTAKE DUCT SEAL** (See REMOVAL)
6. **REMOVE BATTERY** (See REMOVAL)
7. **REMOVE NO. 2 AIR CLEANER INLET** (See REMOVAL)
8. **REMOVE NO. 1 AIR CLEANER INLET** (See REMOVAL)
9. **DISCONNECT NO. 1 RADIATOR HOSE**
 - a. Disconnect the No. 1 radiator hose from the radiator.

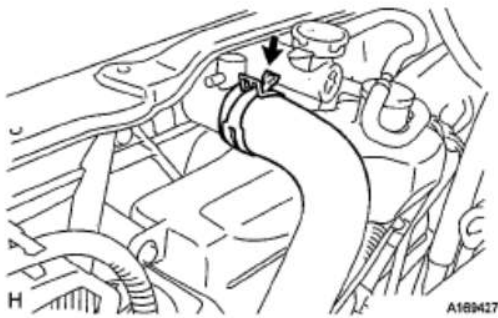


Fig. 82: Locating No. 1 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **DISCONNECT NO. 2 RADIATOR HOSE**
 - a. Disconnect the No. 2 radiator hose from the radiator.

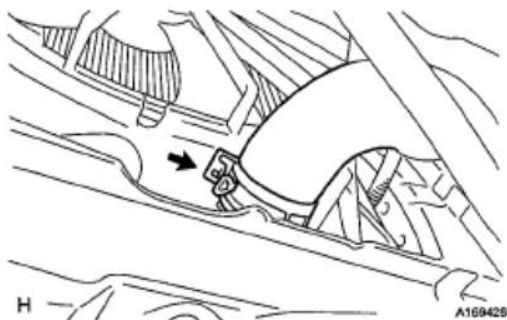


Fig. 83: Locating No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **DISCONNECT OIL COOLER HOSE**
 - a. Disconnect the oil cooler hoses from the radiator.

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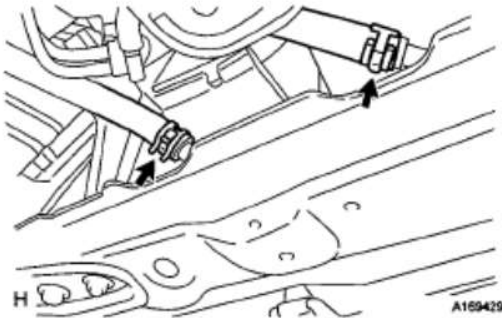


Fig. 84: Locating Oil Cooler Hoses

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

12. DISCONNECT COOLING FAN ECU CONNECTOR

- a. Detach the wire harness clamps from the fan shroud LH side.

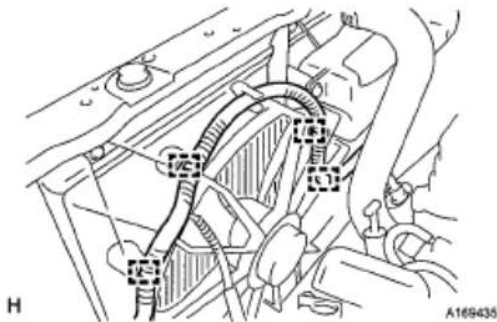


Fig. 85: Identifying Wire Harness Clamps

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

- b. Detach the wire harness clamps from the fan shroud RH side and disconnect the cooling fan ECU connector.

13. REMOVE RADIATOR GRILLE (See REMOVAL)

14. REMOVE HOOD LOCK ASSEMBLY (w/o Engine Hood Courtesy Switch) (See REMOVAL)

15. REMOVE HOOD LOCK ASSEMBLY (w/ Engine Hood Courtesy Switch) (See REMOVAL)

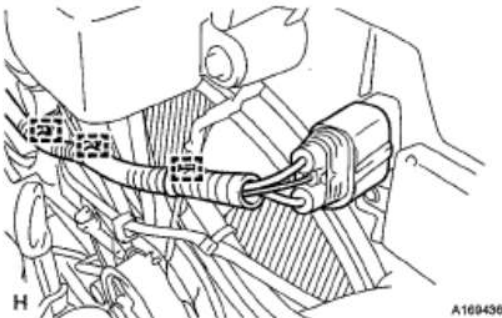


Fig. 86: Identifying Wire Harness Clamps

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

16. REMOVE UPPER RADIATOR SUPPORT SUB-ASSEMBLY

- a. Disconnect the low pitched horn and high pitched horn connectors.

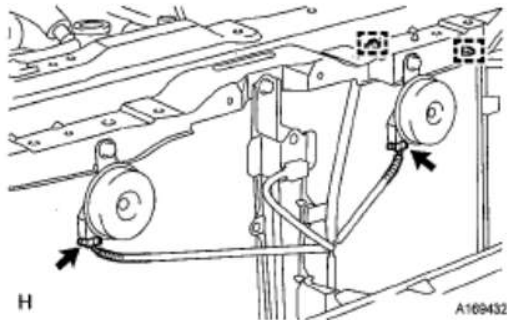


Fig. 87: Locating Low Pitched Horn And High Pitched Horn Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Detach the hood lock control cable clamp and remove the 6 bolts and upper radiator support sub-assembly.

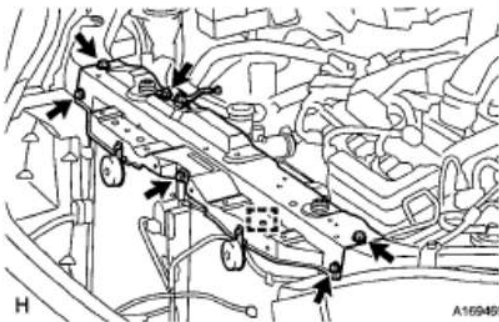


Fig. 88: Locating Bolts And Upper Radiator Support Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. SEPARATE COOLER CONDENSER ASSEMBLY

- a. Remove the 4 bolts and move the cooler condenser assembly to remove the radiator assembly and fan assembly with motor.

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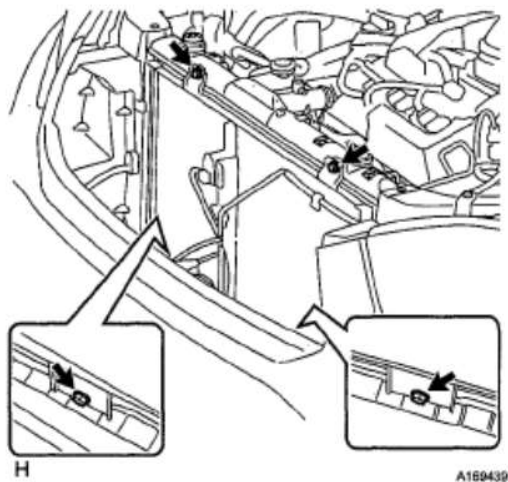


Fig. 89: Locating Bolts And Cooler Condenser Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. REMOVE RADIATOR ASSEMBLY AND FAN ASSEMBLY WITH MOTOR

- a. Remove the radiator assembly and fan assembly with motor.

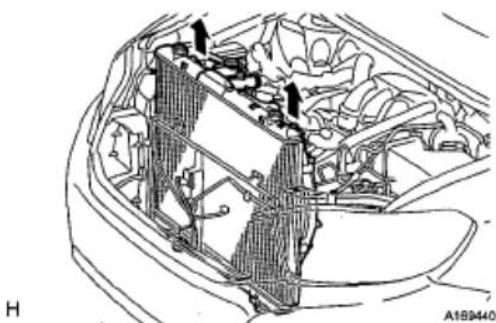
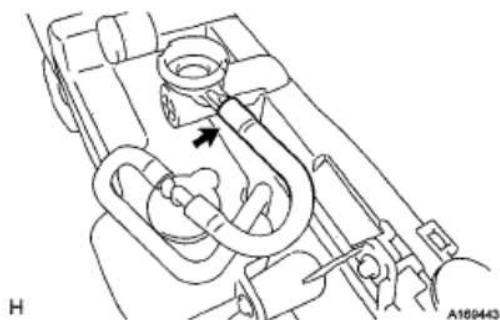


Fig. 90: Removing Radiator Assembly And Fan Assembly With Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. REMOVE FAN ASSEMBLY WITH MOTOR

- a. Disconnect the radiator reserve tank hose or pipe from the radiator assembly.



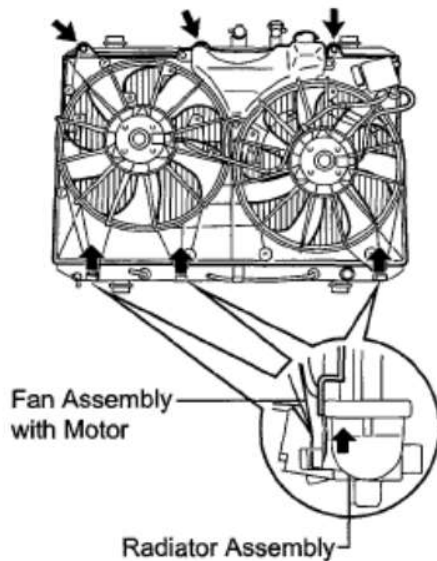
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Fig. 91: Locating Radiator Reserve Tank Hose

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

- b. Remove the 3 bolts.
- c. Pull up the fan assembly with motor from the radiator assembly to remove the fan assembly with motor.



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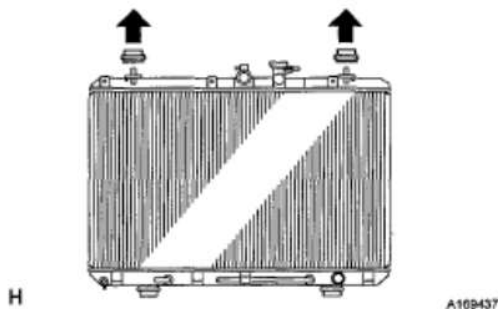
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Fig. 92: Locating Fan Assembly With Motor And Bolts

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

20. REMOVE RADIATOR SUPPORT CUSHION

- a. Remove the 2 radiator support cushions.



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Fig. 93: Removing Radiator Support Cushions

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

21. REMOVE LOWER RADIATOR SUPPORT

- a. Remove the 2 lower radiator supports.

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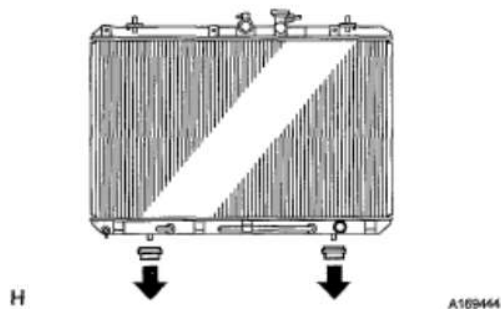


Fig. 94: Removing Lower Radiator Supports
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION**1. INSTALL LOWER RADIATOR SUPPORT**

- Install the 2 lower radiator supports.

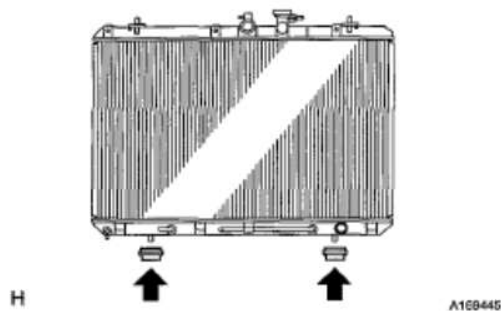


Fig. 95: Installing Lower Radiator Supports
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL RADIATOR SUPPORT CUSHION

- Install the 2 radiator support cushions.

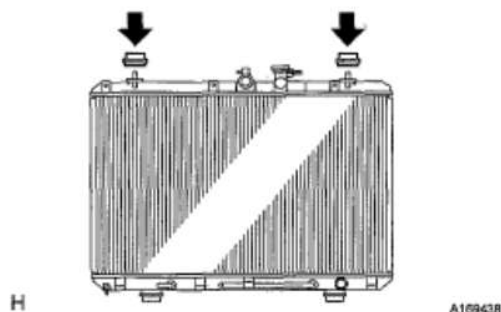


Fig. 96: Installing Radiator Support Cushions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

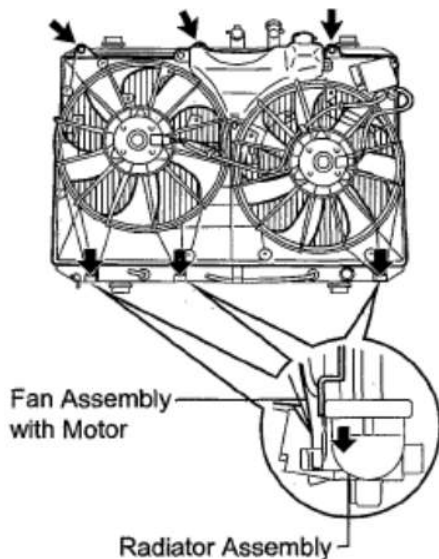
3. INSTALL FAN ASSEMBLY WITH MOTOR

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- a. Put in the fan assembly with motor to the radiator assembly.
- b. Install the fan assembly with motor with the 3 bolts.

Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)

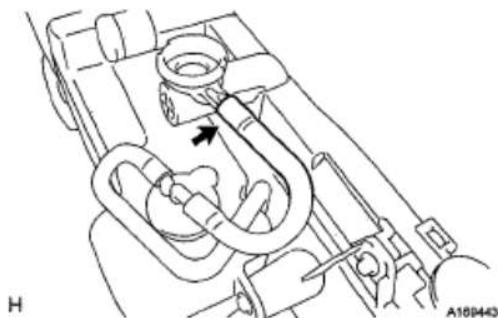


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Fig. 97: Locating Fan Assembly With Motor And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the radiator reserve tank hose or pipe to the radiator assembly.



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Fig. 98: Locating Radiator Reserve Tank Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL RADIATOR ASSEMBLY AND FAN ASSEMBLY WITH MOTOR**
 - a. Install the radiator assembly and fan assembly with motor.

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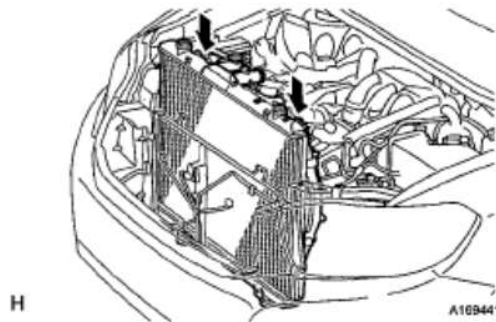


Fig. 99: Installing Radiator Assembly And Fan Assembly With Motor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL COOLER CONDENSER ASSEMBLY

- Install the cooler condenser assembly with the 4 bolts.

Torque: 6.0 N*m (61 kgf*cm, 53 in.*lbf)

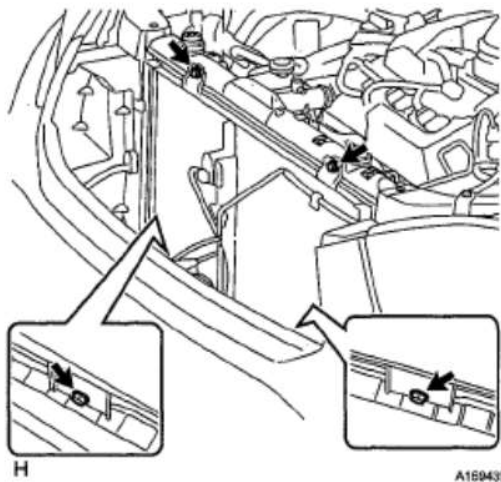


Fig. 100: Locating Bolts And Cooler Condenser Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL UPPER RADIATOR SUPPORT SUB-ASSEMBLY

- Install the upper radiator support sub-assembly with the 6 bolts and attach the hood lock control cable clamp to the radiator support.

Torque: Bolt A

9.8 N*m (100 kgf*cm, 87 in.*lbf)

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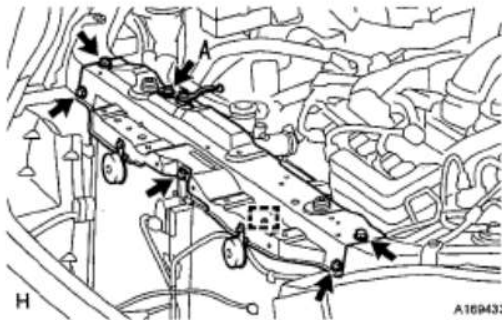


Fig. 101: Locating Upper Radiator Support Sub-Assembly And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the low pitched horn and high pitched horn connectors.
7. **INSTALL HOOD LOCK ASSEMBLY (w/o Engine Hood Courtesy Switch)** (See **INSTALLATION**)
8. **INSTALL HOOD LOCK ASSEMBLY (w/ Engine Hood Courtesy Switch)** (See **INSTALLATION**)
9. **INSTALL RADIATOR GRILLE** (See **INSTALLATION**)

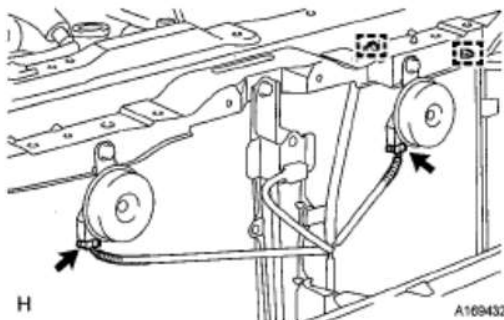
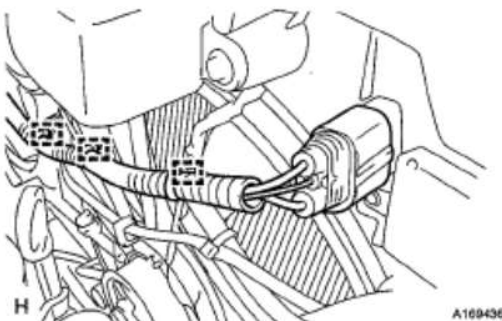


Fig. 102: Locating Low Pitched Horn And High Pitched Horn Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. CONNECT COOLING FAN ECU CONNECTOR

- a. Connect the cooling fan ECU connector and attach the wire harness clamps to the fan shroud RH side.



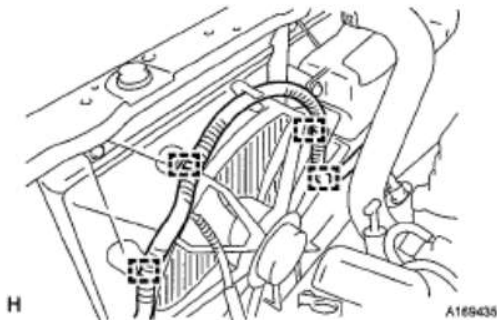
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Fig. 103: Identifying Wire Harness Clamps

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

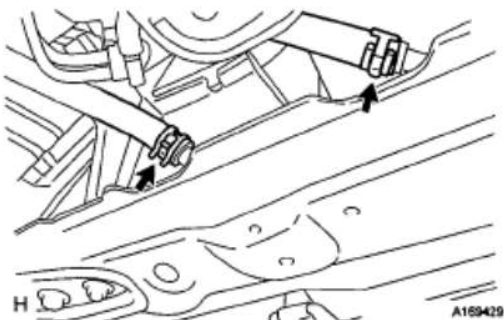
- b. Attach the wire harness clamps to the fan shroud LH side.

**Fig. 104: Identifying Wire Harness Clamps**

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

11. CONNECT OIL COOLER HOSE

- a. Connect the oil cooler hoses to the radiator.

**Fig. 105: Locating Oil Cooler Hoses**

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

12. CONNECT NO. 2 RADIATOR HOSE

- a. Connect the No. 2 radiator hose to the radiator.

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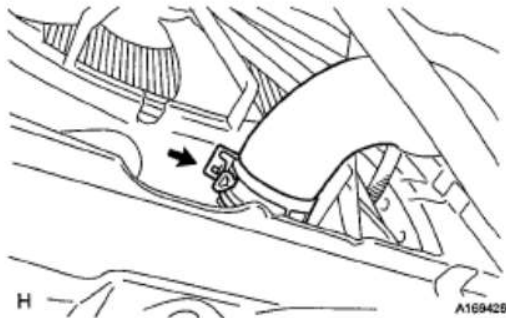


Fig. 106: Locating No. 2 Radiator Hose

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

13. CONNECT NO. 1 RADIATOR HOSE

- a. Connect the No. 1 radiator hose to the radiator.

14. INSTALL NO. 1 AIR CLEANER INLET (See INSTALLATION)

15. INSTALL NO. 2 AIR CLEANER INLET (See INSTALLATION)

16. INSTALL BATTERY (See INSTALLATION)

17. INSTALL COOL AIR INTAKE DUCT SEAL (See INSTALLATION)

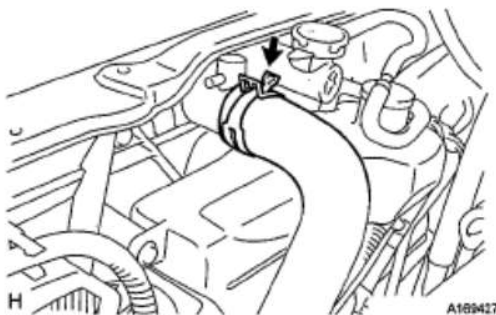


Fig. 107: Locating No. 1 Radiator Hose

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

18. ADD ENGINE COOLANT (See WATER PUMP)

19. INSPECT FOR COOLANT LEAK (See COOLING SYSTEM)

20. INSPECT AUTOMATIC TRANSAXLE FLUID

HINT:

See AUTOMATIC TRANSAXLE FLUID .

21. INSPECT FOR OIL LEAK

22. INSTALL NO. 1 ENGINE UNDER COVER (See INSTALLATION)

23. INSTALL ENGINE UNDER COVER ASSEMBLY (See INSTALLATION)

24. INSTALL V-BANK COVER SUB-ASSEMBLY (See INSTALLATION)