Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000001J2J0C9X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: Charging Failure; 2016 MY Tacoma [08/2015 -]		

Charging Failure

INSPECTION PROCEDURE

PROCEDURE

1.	**CHECK GENERATOR PULLEY WITH CLUTCH (ON-VEHICLE INSPECTION)**

(a) Start the engine and visually check if the fan of the generator rotor assembly located inside the generator assembly is operating.

OK:

The fan of the generator rotor assembly is operating.

NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▼

2.	**CHECK GENERATOR PULLEY WITH CLUTCH (UNIT INSPECTION)**

(a) Remove the generator assembly INFO .

(b) Check the installation condition of the generator pulley cap.

OK:

The generator pulley cap is not loose or missing.

(c) Check for grease leaks (for wet pulley) or particle formation due to friction (for dry pulley).

OK:

No grease leaks (for wet pulley) or large build-up of particles (for dry pulley).

(d) Check the generator pulley with clutch for misalignment (interference with the generator assembly).

OK:

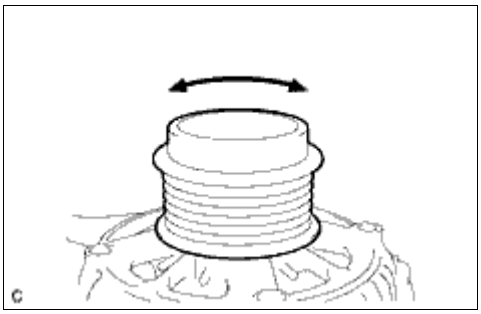
The generator pulley with clutch is correctly aligned (no interference with the generator assembly).

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(e) Turn the generator pulley with clutch clockwise and counterclockwise by hand and check for noise.

OK:

Noise does not occur when turned in both directions.

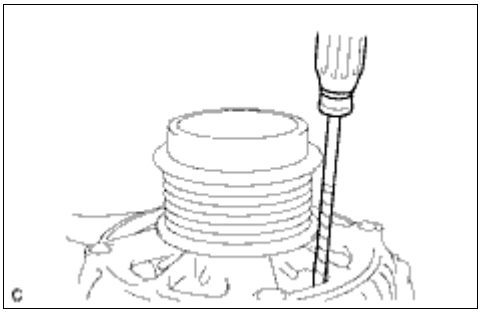


(f) Turn the generator pulley with clutch clockwise and counterclockwise by hand and visually check for runout.

OK:

The generator pulley with clutch does not have runout.

(g) Using a screwdriver, hold the fan of the generator rotor assembly located inside the generator assembly in place and check that the generator with clutch pulley locks when turned clockwise and turns freely when turned counterclockwise.



OK:

The generator pulley with clutch locks when turned clockwise and turns freely when turned counterclockwise.

NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▶ **REPAIR OR REPLACE GENERATOR ASSEMBLY**

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000XI50H8X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: DATA LIST / ACTIVE TEST; 2016 MY Tacoma [08/2015 -]		

DATA LIST / ACTIVE TEST

1. READ DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List.

(e) Check the values by referring to the table below.

Engine and ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE
Battery Voltage	Battery voltage/0.000 to 66.000 V	11 to 14 V	When the value is outside of the specified range, there may be a problem with the battery
Alternator Output Duty	LIN1 terminal output (charge control signal)/0.0 to 399.9%	Changes in response to generator power generation amount during charging control	If the value does not change as specified, there may be a malfunction in the charging control system
Alt Vol - Non Active Test	Request voltage when regulator not under forced activation/0.000 to 79.998 V	-	Malfunction of the charging control system can be the cause of malfunction
Alt Vol - Active Test	Request voltage when regulator under forced activation/0.000 to 79.998 V	-	Malfunction of the charging control system can be the cause of malfunction
Previous Trip Alternator Max Output Time	Generator maximum generating time during previous drive/0 to 65535 sec.	-	-
Initial Engine Battery Minimum Voltage	Minimum battery voltage at engine start/0.0 to 26.0 V	-	-

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2. PERFORM ACTIVE TEST

HINT:

Using the Techstream to perform Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List.

(e) Perform the Active Test according to the display on the Techstream.

Engine and ECT

TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTE
Control the Voltage of Alternator	Forced generator power generation voltage command	12.5 to 14.6 V	This Active Test requires the engine to be running





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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000YEG0F9X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: DIAGNOSIS SYSTEM; 2016 MY Tacoma [08/2015 -]		

DIAGNOSIS SYSTEM

1. CHECK DLC3

(a) Check the DLC3 INFO .

2. INSPECT BATTERY VOLTAGE

Standard voltage:

11 to 14 V

If the voltage is below 11 V, replace or recharge the battery.

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Last Modified: 11-13-2015	6.6 S	**Doc ID:** RM000000XIZ0KVX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: DIAGNOSTIC TROUBLE CODE CHART; 2016 MY Tacoma [08/2015 -]		

DIAGNOSTIC TROUBLE CODE CHART

Charging System

DTC CODE	DETECTION ITEM	CHARGE WARNING	MEMORY	SEE PAGE
P161A	LIN Communication Error with Alternator	-	DTC stored	INFO

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000YEH0HDX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: DTC CHECK / CLEAR; 2016 MY Tacoma [08/2015 -]		

DTC CHECK / CLEAR

1. CHECK DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

HINT:

When freeze frame data is stored, check the freeze frame data INFO .

(e) Check the DTC(s).

2. CLEAR DTC

NOTICE:

- Do not clear DTCs until the cause of the malfunction is determined.
- After inspecting and repairing the charging system and clearing DTCs, be sure to recheck for DTCs and make sure that no DTCs are output.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

NOTICE:

DTCs and freeze frame data are cleared at the same time.

(e) Clear the DTC(s).

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000XHX0EMX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: FAIL-SAFE CHART; 2016 MY Tacoma [08/2015 -]		

FAIL-SAFE CHART

1. FAIL SAFE OPERATION

If any of the following DTCs are stored, the ECM enters fail-safe mode.

Charging System

DTC	FAIL-SAFE OPERATION	FAIL-SAFE DEACTIVATION CONDITION
P161A	Generator command is fixed	Ignition switch is turned to ON after returning to normal operation

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000XHY0NKX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: FREEZE FRAME DATA; 2016 MY Tacoma [08/2015 -]		

FREEZE FRAME DATA

1. FREEZE FRAME DATA

(a) The ECM stores the vehicle condition when a DTC is output, and this information can be displayed using the Techstream.

(b) Freeze frame data when a DTC is output.

(1) When a DTC is output, the freeze frame data at the time the DTC is output is stored.

(2) When freeze frame data is stored when a DTC is output, the data is not updated or deleted until DTCs are cleared.

2. CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Select a DTC to display the freeze frame data.

(f) Check the freeze frame data for the output DTC.

3. LIST OF FREEZE FRAME DATA

HINT:

The chart below indicates the items related to the charging system from the freeze frame data recorded by the SFI system.

Powertrain / Engine and ECT / Data List

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE
Battery Voltage	Battery voltage/0.000 to 66.000 V	11 to 14 V	-
Alternator Output Duty	LIN1 terminal output (charge control signal)/0.0 to 399.9%	Changes in response to generator power generation amount during charging control	-
Alt Vol - Non Active Test	Request voltage when regulator not under forced activation/0.000 to 79.998 V	-	-
Alt Vol - Active Test	Request voltage when regulator under forced activation/0.000 to 79.998 V	-	-

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000YEF0NJX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: HOW TO PROCEED WITH TROUBLESHOOTING; 2016 MY Tacoma [08/2015 -]		

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

*: Use the Techstream.

1.	**VEHICLE BROUGHT TO WORKSHOP**

NEXT

2.	**CUSTOMER PROBLEM ANALYSIS CHECK**

HINT:

- In troubleshooting, confirm that the problem symptoms have been accurately identified. Preconceptions should be discarded in order to make an accurate judgment. To clearly understand what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time the malfunction occurred.
- Gather as much information as possible for reference. Past problems that seem unrelated may also help in some cases.
  - The following 5 items are important points in the problem analysis:

What	Vehicle model, system name
When	Date, time, occurrence frequency
Where	Road conditions
Under what conditions?	Running conditions, driving conditions, weather conditions
How did it happen?	Problem symptoms

NEXT

3.	**INSPECT BATTERY VOLTAGE**

(a) Measure the battery voltage.

Standard voltage:
11 to 14 V

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If the voltage is below 11 V, recharge or replace the battery before proceeding to the next step.

NEXT

4.	**INSPECT COMMUNICATION FUNCTION OF CAN COMMUNICATION SYSTEM***

(a) Use the techstream to check if the CAN communication system is functioning normally.

See page (INFO)

RESULT	PROCEED TO
CAN communication system DTC is not output	A
CAN communication system DTC is output	B

B ▶ **GO TO CAN COMMUNICATION SYSTEM**

A

5.	**CHECK DTC AND FREEZE FRAME DATA***

(a) Check for DTCs INFO .

(b) Check for freeze frame data INFO .

HINT:

Record or print DTCs and freeze frame data if necessary.

NEXT

6.	**CLEAR DTC AND FREEZE FRAME DATA***

(a) Clear the DTCs and freeze frame data INFO .

NEXT

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7.	**PROBLEM SYMPTOMS TABLE** INFO

RESULT	PROCEED TO
Malfunctioning parts are not confirmed	A
Malfunctioning parts are confirmed	B

B ▶ **Go to step 13**

A ▼

8.	**OVERALL ANALYSIS AND TROUBLESHOOTING***

(a) Data List / Active Test INFO .

RESULT	PROCEED TO
Malfunctioning parts are not confirmed	A
Malfunctioning parts are confirmed	B

B ▶ **Go to step 13**

A ▼

9.	**CHECK ECM CIRCUIT**

HINT:

Refer to Terminals of ECM INFO .

NG ▶ **Go to step 13**

OK ▼

10.	**CHECK FOR INTERMITTENT PROBLEMS**

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HINT:

Refer to Symptom Simulation INFO .

NEXT

11.	**CONDUCT PARTS INSPECTION**

NEXT

12.	**IDENTIFY PROBLEM**

NEXT

13.	**ADJUST AND/OR REPAIR**

NEXT

14.	**CONDUCT CONFIRMATION TEST**

NEXT **END**

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000001J2K0CLX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: Noise Occurs from V-ribbed Belt or Generator Assembly; 2016 MY Tacoma [08/2015 -]		

Noise Occurs from V-ribbed Belt or Generator Assembly

INSPECTION PROCEDURE

PROCEDURE

1.	**CONFIRM PROBLEM SYMPTOM**

(a) Confirm the problem symptom.

SYMPTOM	PROCEED TO
Noise occurs from fan and generator V belt	A
Noise occurs from generator assembly	B

B ▶ **GO TO STEP 6**

A

▼

2.	**CHECK FAN AND GENERATOR V BELT FOR WEAR**

(a) Check the fan and generator V belt for wear or damage.

OK:

The fan and generator V belt is not worn or damaged.

NG ▶ **REPLACE FAN AND GENERATOR V BELT**

OK

▼

3.	**CHECK GENERATOR PULLEY WITH CLUTCH FOR WEAR**

(a) Check the generator pulley with clutch grooves for wear or damage.

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OK:

The generator pulley with clutch grooves are not worn or damaged.

NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▼

4.	**CHECK FOR NOISE WHILE CLUTCH PULLEY IS OPERATING**

(a) Start the engine and check the generator pulley with clutch for looseness.

OK:

The generator pulley with clutch is not loose.

NG ▶ **TIGHTEN GENERATOR PULLEY WITH CLUTCH TO SPECIFIED TORQUE**

OK ▼

5.	**INSPECT GENERATOR PULLEY WITH CLUTCH (UNIT INSPECTION)**

(a) Remove the generator assembly INFO .

(b) Check the installation condition of the generator pulley cap.

OK:

The generator pulley cap is not loose or missing.

(c) Check for grease leaks (for wet pulley) or particle formation due to friction (for dry pulley).

OK:

No grease leaks (for wet pulley) or large build-up of particles (for dry pulley).

(d) Check the generator pulley with clutch for misalignment (interference with the generator assembly).

OK:

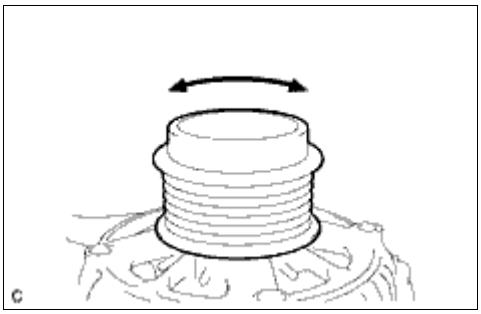
The generator pulley with clutch is correctly aligned (no interference with the generator assembly).

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(e) Turn the generator pulley with clutch clockwise and counterclockwise by hand and check for noise.

OK:

Noise does not occur when turned in both directions.



(f) Turn the generator pulley with clutch clockwise and counterclockwise by hand and visually check for runout.

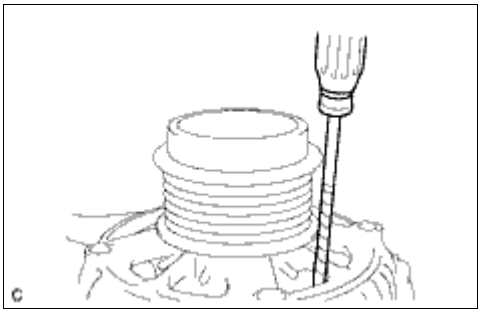
OK:

The generator pulley with clutch does not have runout.

(g) Using a screwdriver, hold the fan of the generator rotor assembly located inside the generator assembly in place and check that the generator pulley with clutch locks when turned clockwise and turns freely when turned counterclockwise.

OK:

The generator pulley with clutch locks when turned clockwise and turns freely when turned counterclockwise.



NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▶ **INSPECT PULLEY OTHER THAN GENERATOR ASSEMBLY PULLEY**

6.	**CHECK FOR NOISE WHEN ROTOR IS TURNING FREELY**

(a) Perform a road test and check that noise does not occur when decelerating.

OK:

Noise does not occur.

(b) Turn the engine off and check that no noise is produced by the generator pulley with clutch as the engine stops.

OK:

Noise does not occur.

NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▼

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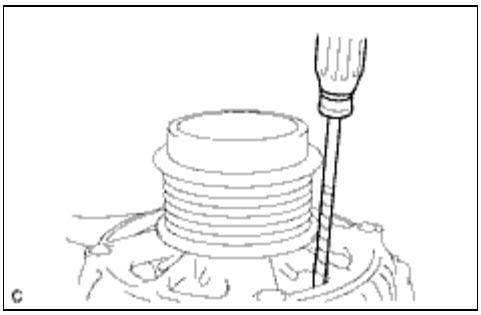
7.	CHECK ENGAGEMENT OF GENERATOR PULLEY WITH CLUTCH

(a) Remove the generator assembly INFO .

(b) Using a screwdriver, hold the fan in the generator rotor assembly located inside the generator assembly in place and check that the generator pulley with clutch locks when turned clockwise (locking direction).

OK:

The generator pulley with clutch locks.



NG ▶ **REPLACE GENERATOR PULLEY WITH CLUTCH**

OK ▶ **REPAIR OR REPLACE GENERATOR ASSEMBLY**

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000001AR90CGX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. CHECK BATTERY CONDITION

NOTICE:

If the battery is weak or if the engine is difficult to start, perform the following procedures.

(a) Check the battery for damage and deformation. If severe damage, deformation or leakage is found, replace the battery.

(b) Check the electrolyte quantity of each cell.

(1) For maintenance-free batteries:

- If the electrolyte quantity is below the lower line, replace the battery.
- If the electrolyte quantity is above the lower line, check the battery voltage when cranking the engine. If the voltage is below 9.6 V, recharge or replace the battery.

HINT:

Before checking the battery voltage, turn off all the electrical systems (headlights, blower motor, rear defogger, etc.).

(2) For non-maintenance-free batteries:

- If the electrolyte quantity is below the lower line, add distilled water to each cell. Then, recharge the battery and check the electrolyte's specific gravity.

  Standard specific gravity:

  1.25 to 1.29 at 20°C (68°F)
- If the electrolyte quantity is above the lower line, check the battery voltage when cranking the engine. If the voltage is below 9.6 V, recharge or replace the battery.

HINT:

Before checking the battery voltage, turn off all the electrical systems (headlights, blower motor, rear defogger, etc.).

(c) Turn the ignition switch off and turn on the headlights for 20 to 30 seconds. This removes the surface charge from the battery.

(d) Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

Standard voltage:

12.5 to 12.9 V at 20°C (68°F)

If the voltage is less than the specification, recharge the battery.

2. INSPECT BATTERY TERMINAL AND FUSE

(a) Check that the battery terminals are not loose or corroded.

Torque:

Positive (+) battery terminal -

5.4 N·m {55 kgf·cm, 48in·lbf}

Negative (-) battery terminal -

5.4 N·m {55 kgf·cm, 48in·lbf}

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If the terminals are corroded, clean the terminals.

(b) Measure the resistance of the fuses.

Standard resistance:
Below 1 Ω

If the result is not as specified, replace the fuses.

3. INSPECT FAN AND GENERATOR V BELT INFO

4. INSPECT GENERATOR WIRING

(a) Visually check the generator wiring.

(1) Check that the wiring is in good condition.

5. CHECK FOR ABNORMAL NOISES

(a) Listen for abnormal noises from the generator.

(1) Check that no abnormal noises are heard from the generator while the engine is running.

6. INSPECT CHARGE WARNING LIGHT CIRCUIT

(a) Turn the ignition switch to ON. Check that the charge warning light comes on.

(b) Start the engine and check that the light goes off.

If the light does not operate as specified, troubleshoot the charge warning light circuit.

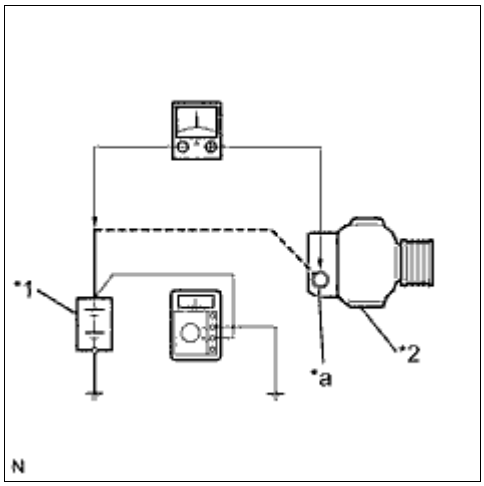
7. INSPECT CHARGING CIRCUIT WITHOUT LOAD

(a) Connect a voltmeter and ammeter to the charging circuit as follows.

(1) Disconnect the wire from terminal B of the generator, and then connect it to the negative (-) lead of an ammeter.

Text in Illustration

*1	Battery
*2	Generator
*a	Terminal B



(2) Connect the positive (+) lead of the ammeter to terminal B of the generator.

(3) Connect the positive (+) lead of a voltmeter to the positive (+) terminal of the battery.

(4) Ground the negative (-) lead of the voltmeter.

(b) Check the charging circuit.

(1) Maintain the engine speed at 2000 rpm and check the reading on the ammeter and voltmeter.

Standard current:
10 A or higher
Standard voltage:
13.2 to 14.8 V

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If the voltmeter reading is higher than the standard voltage, replace the generator assembly.

HINT:

If the battery is not fully charged, the ammeter reading will sometimes be higher than the standard current.

8. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2000 rpm, turn the high beam headlights on and turn the heater blower switch to the HI position.

(b) Check the reading on the ammeter.

Standard current:

30 A or higher

If the ammeter reading is below the standard current, repair the generator.

HINT:

If the battery is fully charged, the indication will sometimes be less than the standard current. If this is the case, add more electrical load (operate the wipers, rear window defogger, etc.) and check the reading on the ammeter again.





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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000XEM0BYX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: P161A; LIN Communication Error with Alternator; 2016 MY Tacoma [08/2015 -]		

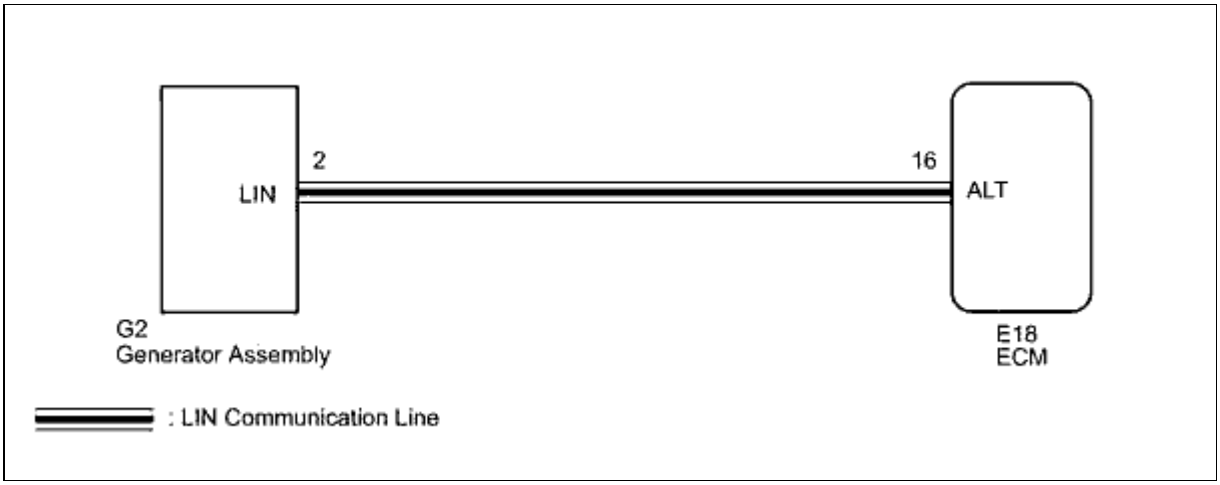
DTC	**P161A**	**LIN Communication Error with Alternator**

DESCRIPTION

The ECM and generator assembly each detect reception malfunctions. A generator assembly reception malfunction detected by the generator assembly is sent to the ECM via LIN communication. If there is a malfunction in either the ECM or generator assembly, the ECM determines that there is a LIN communication malfunction and outputs a DTC.

DTC CODE	DTC DETECTION CONDITION	TROUBLE AREA
P161A	Diagnosis condition: Ignition switch ON When the ECM cannot receive LIN communication, the generator assembly cannot receive LIN communication for approximately 17 minutes or more Other: 1 trip	• Harness or connector • Generator assembly • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	**CHECK CHARGING SYSTEM**

(a) Check the charging system INFO .

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NG ▶ REPAIR OR REPLACE CHARGING SYSTEM

OK ▼

2.	CHECK HARNESS AND CONNECTOR (ECM - GENERATOR ASSEMBLY)

(a) Disconnect the E18 ECM connector.

(b) Disconnect the G2 generator assembly connector.

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

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E18-16 (ALT) - G2-2 (LIN)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E18-16 (ALT) or G2-2 (LIN) - Body ground	Ignition switch off (while LIN communication is stopped)	10 kΩ or higher

(d) Reconnect the G2 generator assembly connector.

(e) Reconnect the E18 ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	INSPECT GENERATOR ASSEMBLY

(a) Inspect the generator assembly INFO .

NG ▶ REPLACE GENERATOR ASSEMBLY

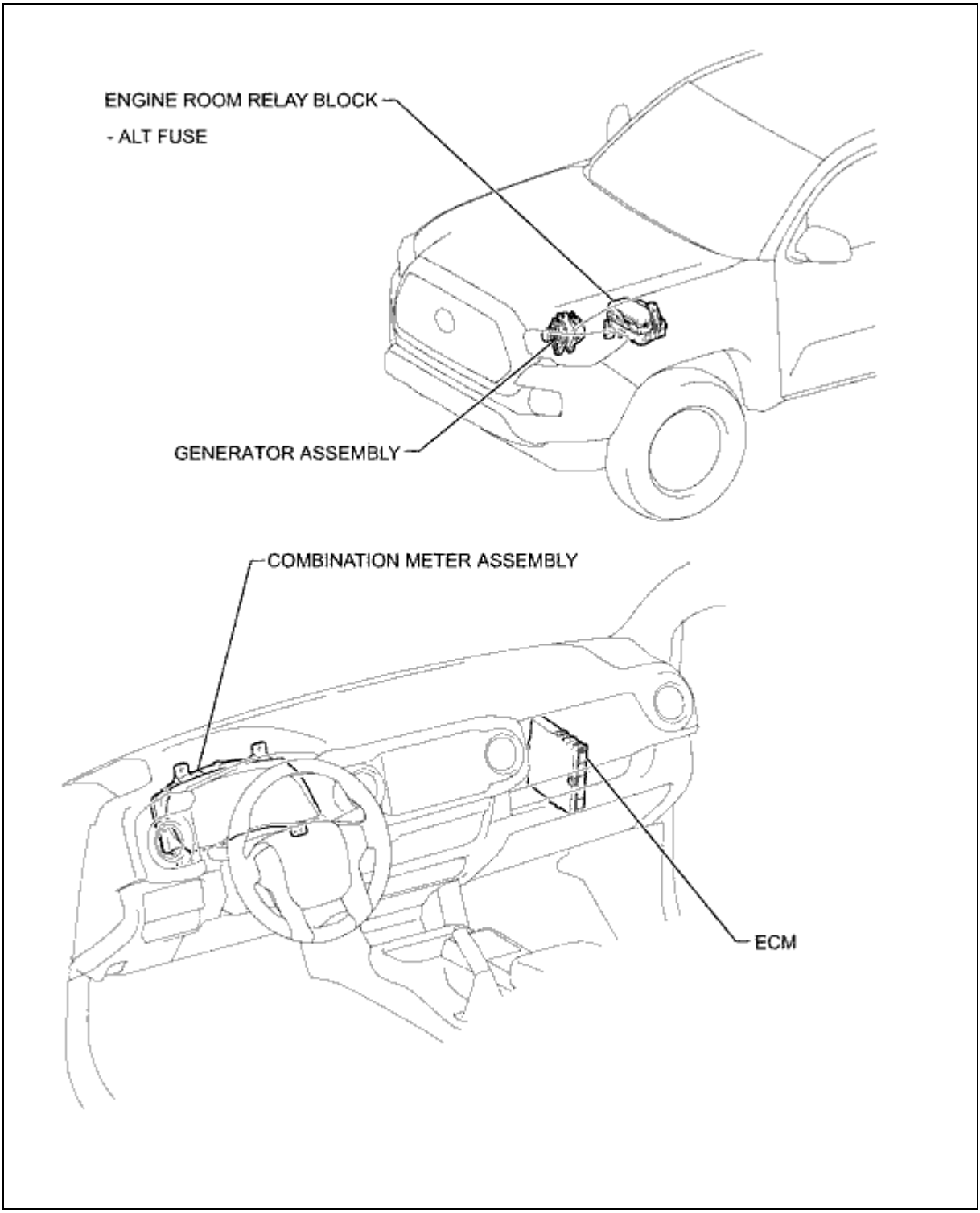
OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM000004Z69007X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

PARTS LOCATION

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 L	**Doc ID:** RM0000017AO00MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: PRECAUTION; 2016 MY Tacoma [08/2015 -]		

PRECAUTION

1. **Check that the battery cables are connected to the correct terminals.**

2. **Disconnect the battery cables when the battery is given a quick charge.**

3. **Do not perform tests with a high voltage insulation resistance tester.**

4. **Never disconnect the battery while the engine is running.**

5. **Check that the charging cable nut is tightened on terminal B of the generator and the engine room relay block.**

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Last Modified: 11-13-2015	6.6 T	**Doc ID:** RM000001J3Y09FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: PROBLEM SYMPTOMS TABLE; 2016 MY Tacoma [08/2015 -]		

PROBLEM SYMPTOMS TABLE

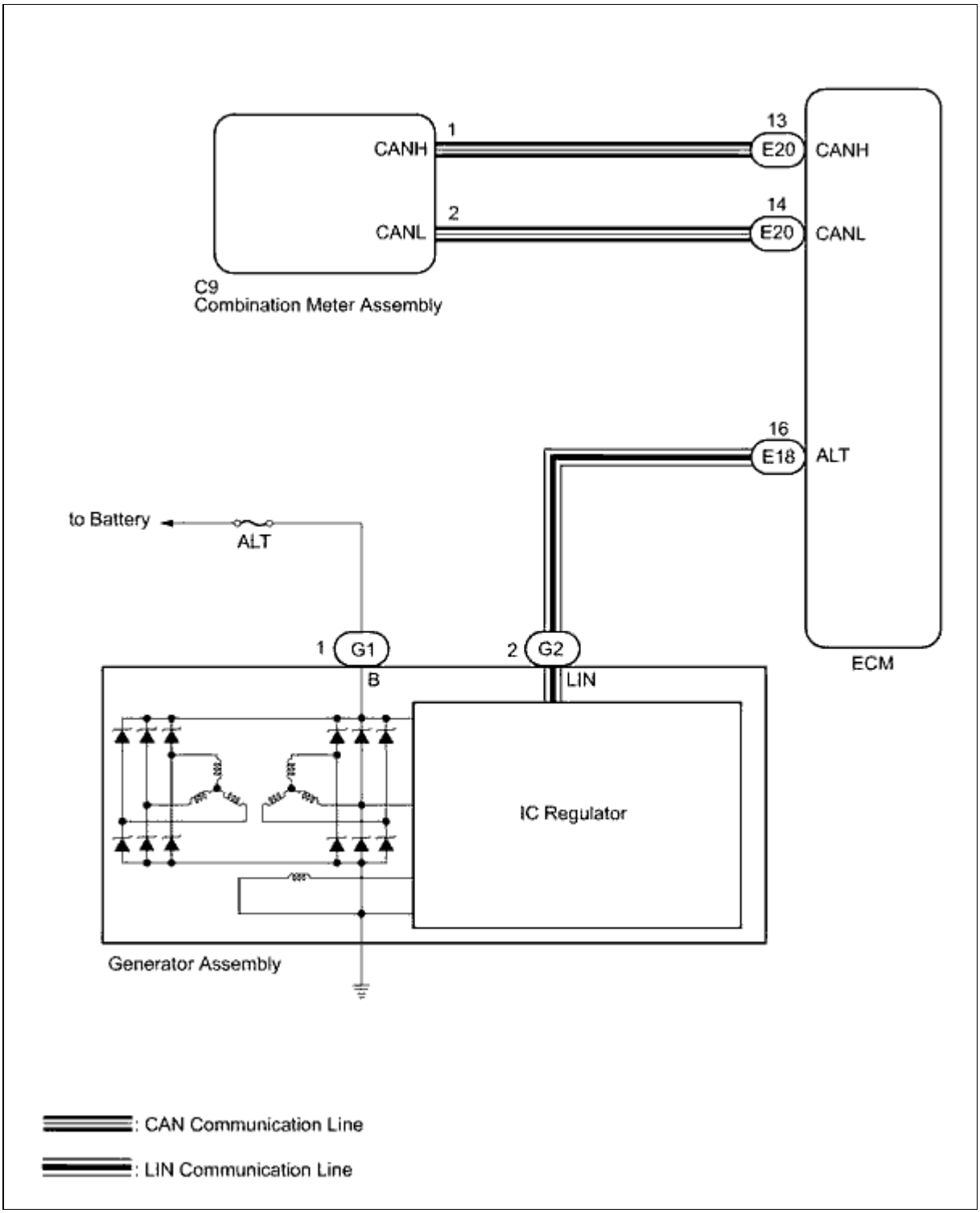
Charging System

SYMPTOM	SUSPECTED AREA	SEE PAGE
Charging System Warning Displayed	Battery	INFO
	Generator assembly	INFO
	Charging system	INFO
Charging Failure	Generator pulley with clutch	INFO
	Generator assembly	INFO
Noise Occurs from V-ribbed Belt or Generator Assembly	V-ribbed belt	INFO
	Generator pulley with clutch	INFO
	Generator assembly	INFO

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM0000017AQ00OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM

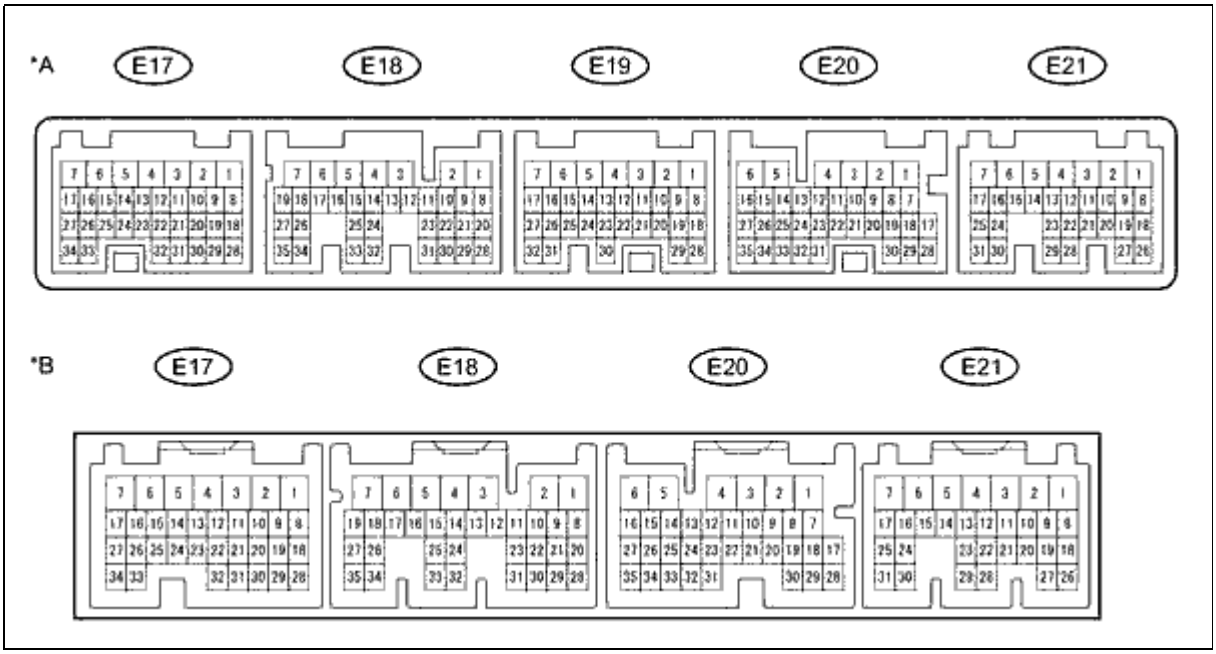


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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000XI20GAX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: CHARGING SYSTEM: TERMINALS OF ECM; 2016 MY Tacoma [08/2015 -]		

TERMINALS OF ECM

1. CHECK ECM



Text in Illustration

*A	for Automatic Transmission	*B	for Manual Transmission

(a) Disconnect the E18 ECM connectors.

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

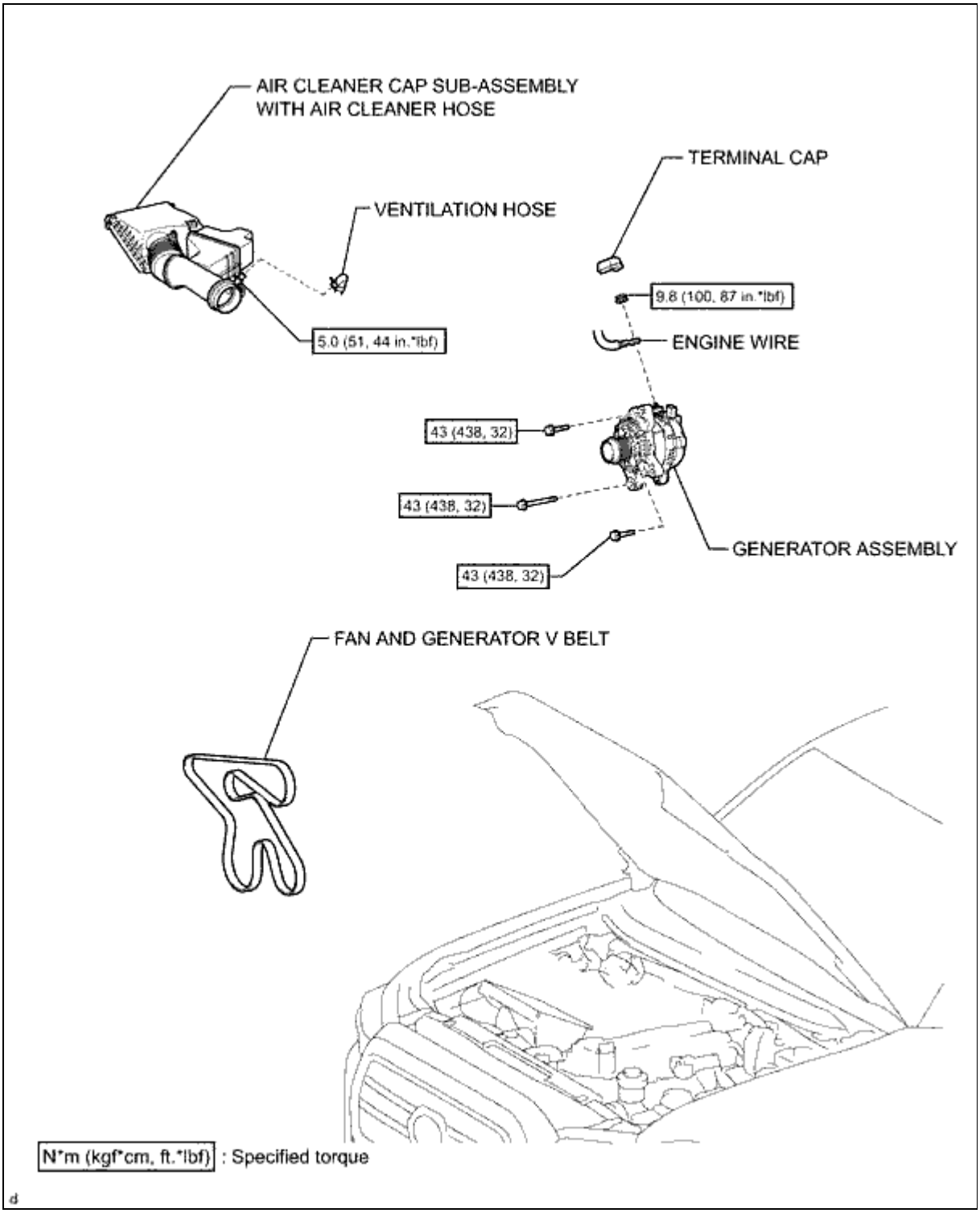
TERMINAL NO. (SYMBOL)	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E18-16 (ALT) - Body ground	L - Body ground	LIN communication line	Ignition switch off (while LIN communication is stopped)	10 kΩ or higher

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000017AU00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

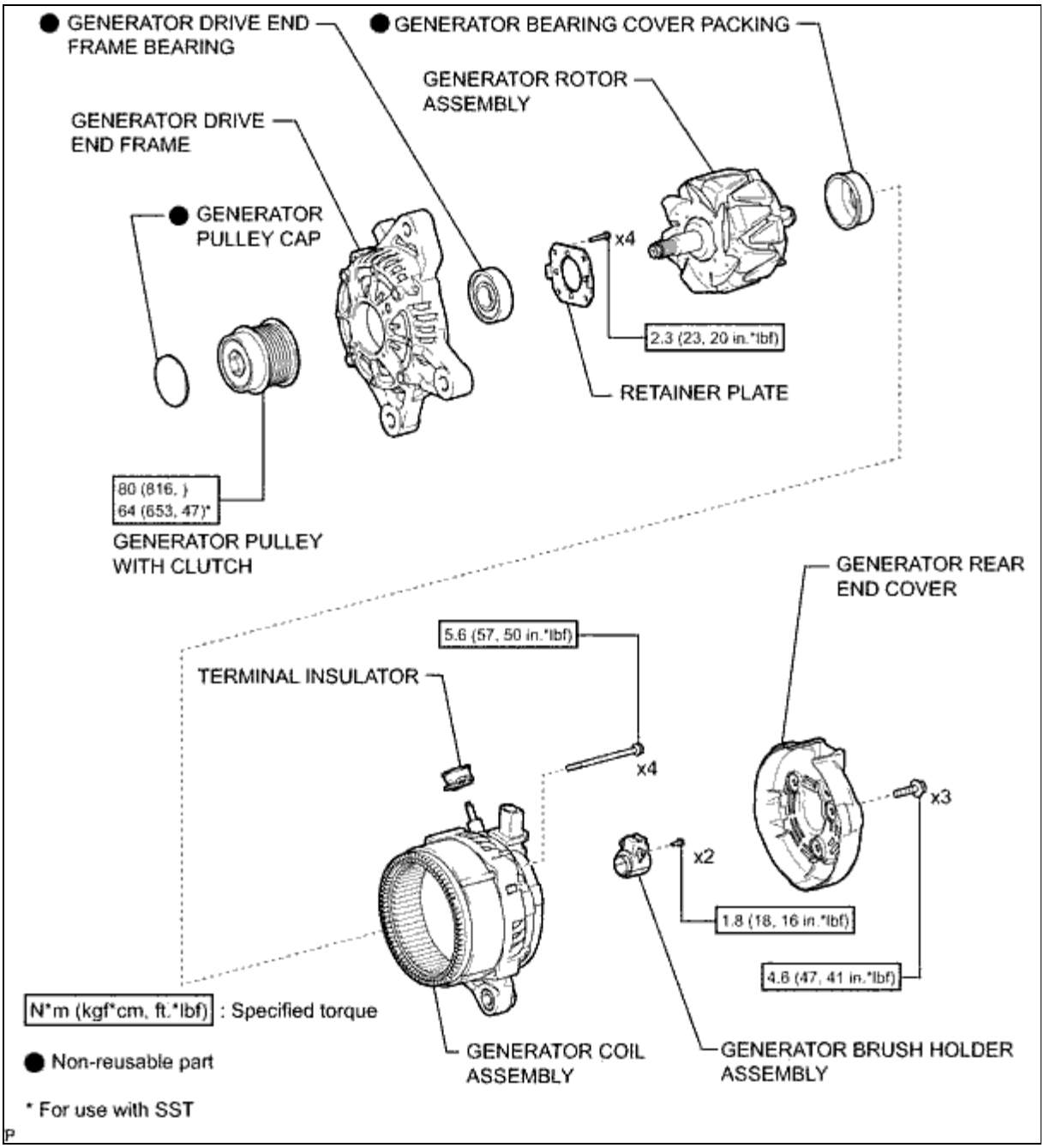
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



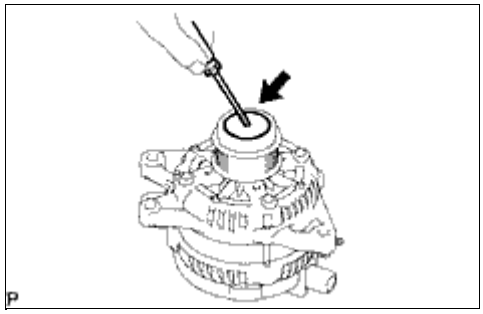
cardiagn.com

Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017AW00NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: DISASSEMBLY; 2016 MY Tacoma [08/2015 -]		

DISASSEMBLY

1. REMOVE GENERATOR PULLEY CAP

(a) Using a screwdriver, puncture the center of the generator pulley cap and pry it off.



NOTICE:

Do not reuse the generator pulley cap.

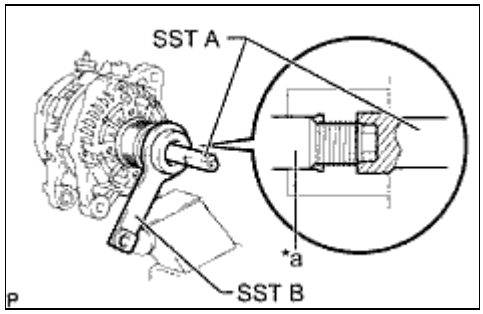
2. REMOVE GENERATOR PULLEY WITH CLUTCH

(a) Mount the generator assembly in the vise between aluminum plates.

NOTICE:

Do not overtighten the vise.

(b) Install SST A and SST B to the generator pulley with clutch as shown in the illustration.



Text in Illustration

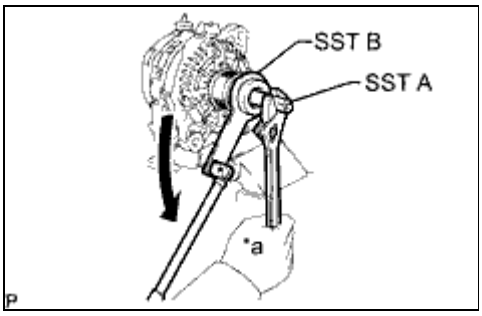
*a	Generator Rotor Shaft

SST: 09820-63021

NOTICE:

Securely attach SST to the generator pulley with clutch and generator rotor shaft.

(c) Using a wrench to hold SST A and turn SST B counterclockwise to loosen the generator pulley with clutch.



Text in Illustration

*a	Hold

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➡	Turn

NOTICE:

Be careful as the generator pulley with clutch or generator rotor shaft may be damaged if the position of SST is not securely maintained while performing this operation.

(d) Remove SST from the generator pulley with clutch.

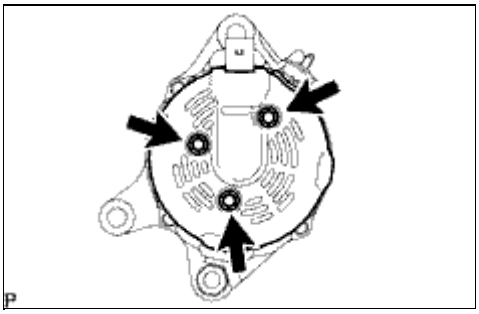
(e) Remove the generator pulley with clutch from the generator rotor shaft.

(f) Remove the generator assembly from the vise.

3. REMOVE GENERATOR REAR END COVER

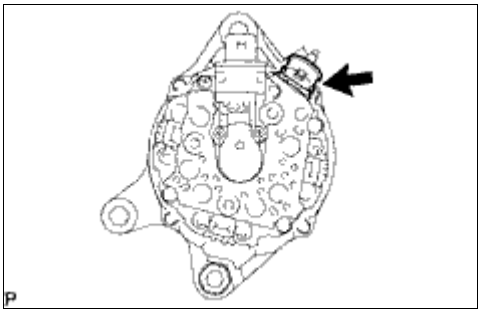
(a) Place the generator assembly on the generator pulley with clutch.

(b) Remove the 3 bolts and generator rear end cover from the generator coil assembly.



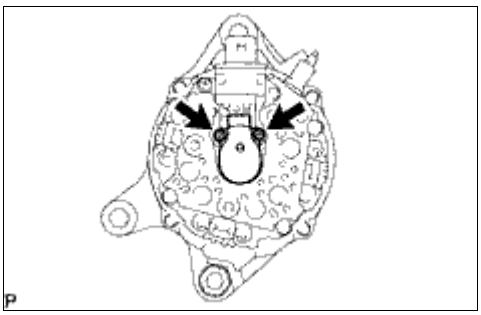
4. REMOVE TERMINAL INSULATOR

(a) Remove the terminal insulator from the generator coil assembly.



5. REMOVE GENERATOR BRUSH HOLDER ASSEMBLY

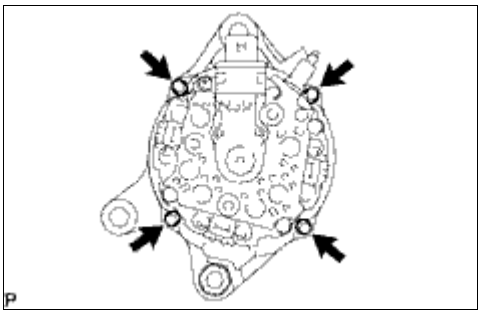
(a) Remove the 2 screws and generator brush holder assembly from the generator coil assembly.



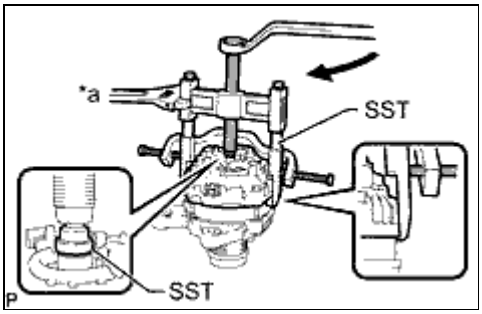
6. REMOVE GENERATOR COIL ASSEMBLY

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(a) Remove the 4 through bolts.



(b) Using SST, remove the generator coil assembly.



Text in Illustration

*a	Hold
➡	Turn

SST: 09950-40011

09951-04020
09952-04010
09953-04020
09954-04010
09955-04071
09957-04010
09958-04011

7. REMOVE GENERATOR BEARING COVER PACKING

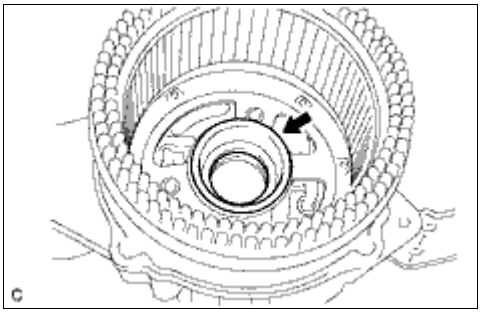
(a) Remove the generator bearing cover packing.

NOTICE:

If the generator bearing cover packing breaks, remove all broken pieces.

HINT:

The generator bearing cover packing may be installed on the generator rotor assembly.



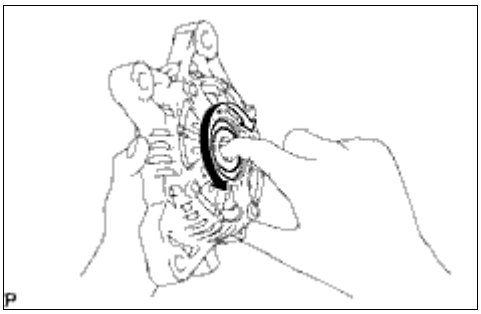
8. REMOVE GENERATOR ROTOR ASSEMBLY

(a) Remove the generator rotor assembly from the generator drive end frame.

9. INSPECT GENERATOR DRIVE END FRAME BEARING

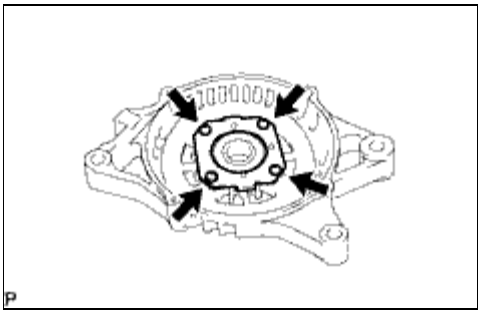
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(a) Check that the generator drive end frame bearing is not rough or worn and that it rotates smoothly. If necessary, replace the generator drive end frame bearing.



10. REMOVE GENERATOR DRIVE END FRAME BEARING

(a) Remove the 4 screws and retainer plate from the generator drive end frame.



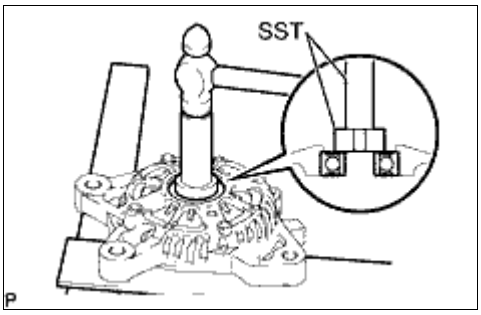
(b) Using SST and a hammer, tap out the generator drive end frame bearing from the generator drive end frame.

SST: 09950-60010

09951-00250

SST: 09950-70010

09951-07100



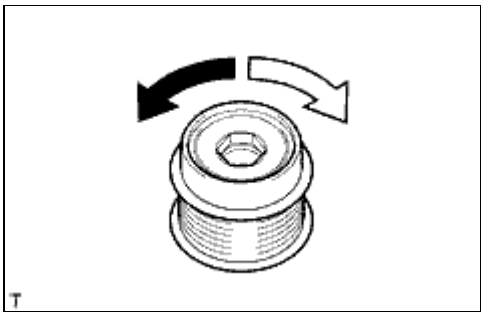
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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017AT00NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT GENERATOR PULLEY WITH CLUTCH

(a) Hold the center of the generator pulley with clutch and confirm that the outer ring turns counterclockwise and does not turn clockwise.



Text in Illustration

➡	Free
⇨	Lock

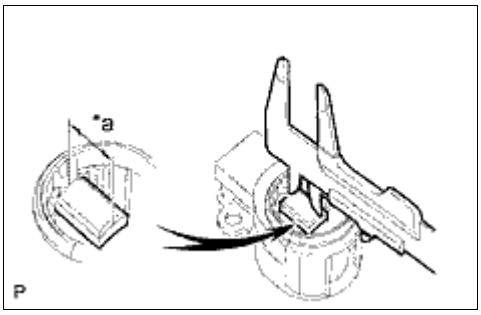
If the result is not as specified, replace the generator pulley with clutch.

2. INSPECT GENERATOR BRUSH HOLDER ASSEMBLY

(a) Using a vernier caliper, measure the exposed brush length.

Text in Illustration

*a	Length



Standard exposed brush length:
9.5 to 11.5 mm (0.374 to 0.453 in.)
Minimum exposed brush length:
4.5 mm (0.177 in.)

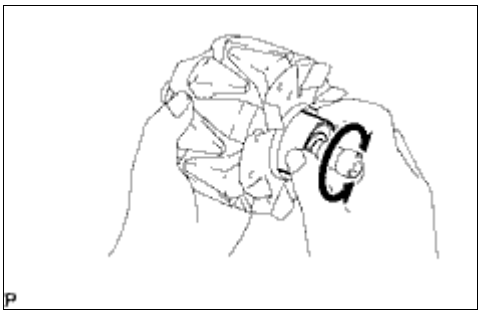
If the exposed brush length is less than the minimum, replace the generator brush holder assembly.

3. INSPECT GENERATOR ROTOR ASSEMBLY

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(a) Check that the generator rotor bearing is not rough or worn and that it rotates smoothly.

If necessary, replace the generator rotor assembly.

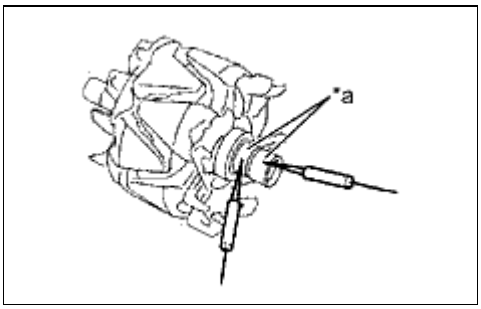


(b) Check the generator rotor assembly for an open circuit.

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

Text in Illustration

*a	Slip Ring



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Slip ring - Slip ring	20°C (68°F)	1.8 to 2.2 Ω

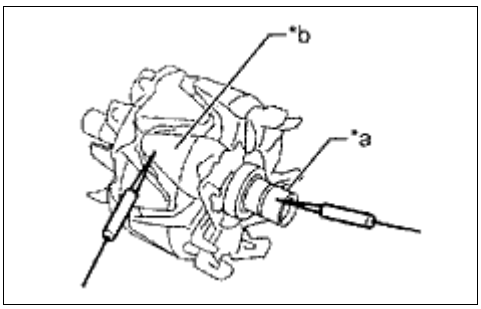
If the result is not as specified, replace the generator rotor assembly.

(c) Check the generator rotor assembly for a short to ground.

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

Text in Illustration

*a	Slip Ring
*b	Rotor Core



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Slip ring - Rotor core	Always	10 MΩ or higher

If the result is not as specified, replace the generator rotor assembly.

(d) Using a vernier caliper, measure the slip ring diameter.

(1) Check that the slip rings are not rough or scored.

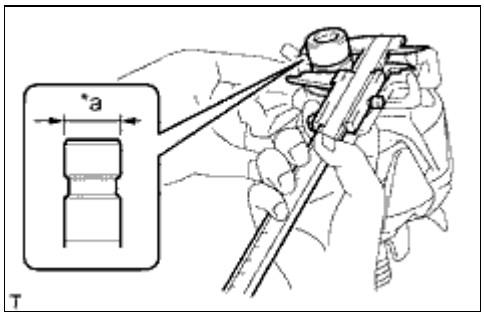
If the slip rings are rough or scored, replace the generator rotor assembly.

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(2) Using a vernier caliper, measure the slip ring diameter.

Text in Illustration

*a	Diameter



Standard diameter:
14.2 to 14.8 mm (0.559 to 0.583 in.)
Minimum diameter:
14.0 mm (0.551 in.)

If the diameter is less than the minimum, replace the generator rotor assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017AS00NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL GENERATOR ASSEMBLY

(a) Install the generator assembly with the 3 bolts.

Torque:

43 N·m {438 kgf·cm, 32ft·lbf}

(b) Connect the engine wire to the terminal B with the nut.

Torque:

9.8 N·m {100 kgf·cm, 87in·lbf}

(c) Install the terminal cap.

(d) Connect the connector to the generator assembly.

2. INSTALL FAN AND GENERATOR V BELT INFO

3. INSTALL AIR CLEANER CAP SUB-ASSEMBLY WITH AIR CLEANER HOSE INFO

4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017AX00OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: REASSEMBLY; 2016 MY Tacoma [08/2015 -]		

REASSEMBLY

1. INSTALL GENERATOR DRIVE END FRAME BEARING

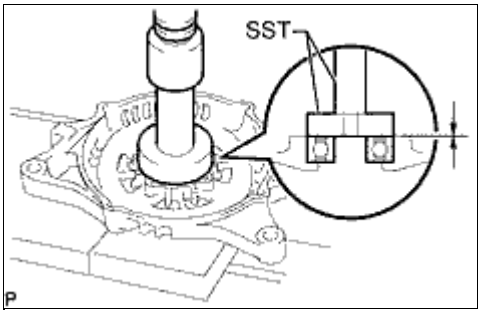
(a) Using SST and a press, press in a new generator drive end frame bearing.

SST: 09950-60010

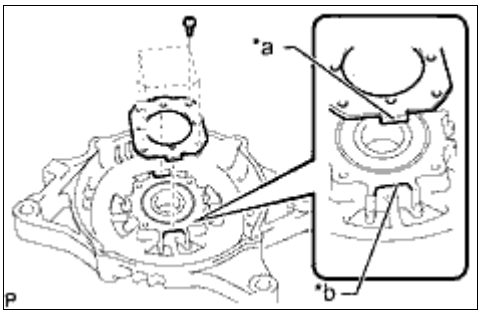
09951-00470

SST: 09950-70010

09951-07100



(b) Fit the tabs on the retainer plate into the cutouts on the drive end frame to install the retainer plate with the 4 screws.



Text in Illustration

*a	Tab
*b	Cutout

Torque:

2.3 N·m {23 kgf·cm, 20in·lbf}

2. INSTALL GENERATOR ROTOR ASSEMBLY

(a) Place the generator drive end frame on the generator pulley with clutch.

(b) Install the generator rotor assembly to the generator drive end frame.

3. INSTALL GENERATOR BEARING COVER PACKING

NOTICE:

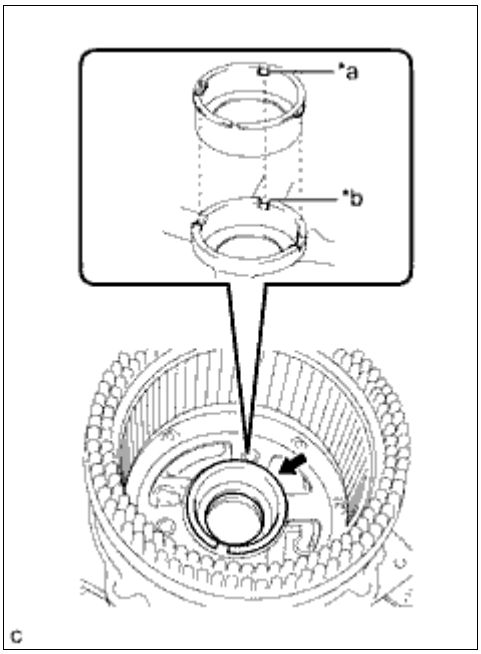
A new generator coil assembly comes with a generator bearing cover packing. Therefore, it is not necessary to install a new generator bearing cover packing when installing a new generator coil assembly.

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(a) Install a new generator bearing cover packing to the generator coil assembly.

Text in Illustration

*a	Protrusion
*b	Groove



NOTICE:

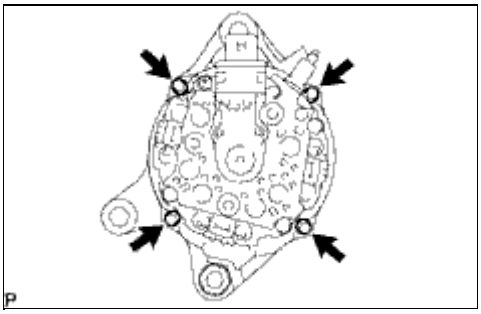
Align the protrusion of the generator bearing cover packing with the groove of the generator coil assembly when installing.

4. INSTALL GENERATOR COIL ASSEMBLY

(a) Temporarily install the generator coil assembly to the generator drive end frame with the 4 through bolts.

NOTICE:

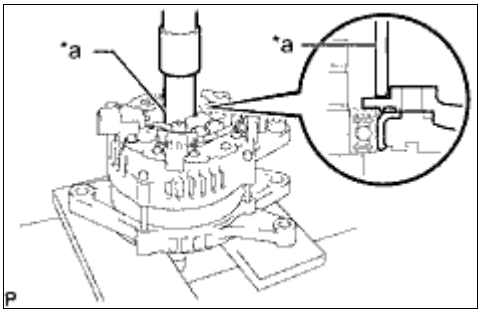
Because the generator coil assembly must be installed with a press after the through bolts have first been temporarily tightened, do not attempt



(b) Using a 21 mm deep socket wrench and press, slowly press on the generator coil assembly.

Text in Illustration

*a	21 mm Deep Socket Wrench



(c) Tighten the 4 through bolts.

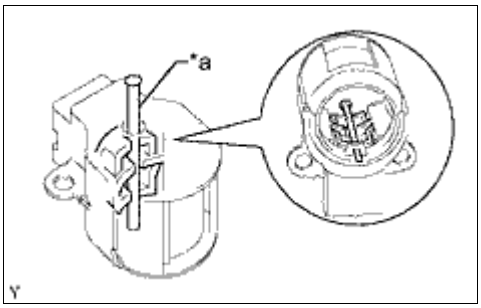
Torque:

5.6 N·m {57 kgf·cm, 50in·lbf}

5. INSTALL GENERATOR BRUSH HOLDER ASSEMBLY

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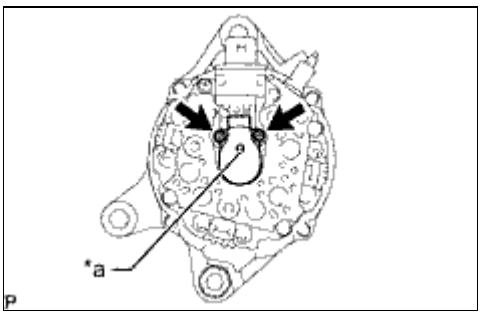
(a) While pushing the 2 brushes into the generator brush holder assembly, insert a pin with a diameter of 1.0 mm (0.0394 in.) into the brush holder hole.



Text in Illustration

*a	Pin

(b) Install the generator brush holder assembly to the generator coil assembly with the 2 screws.



Text in Illustration

*a	Pin

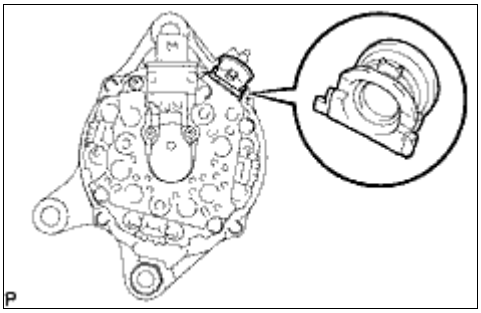
Torque:

1.8 N·m {18 kgf·cm, 16in·lbf}

(c) Pull out the pin from the generator brush holder assembly.

6. INSTALL TERMINAL INSULATOR

(a) Install the terminal insulator to the generator coil assembly.

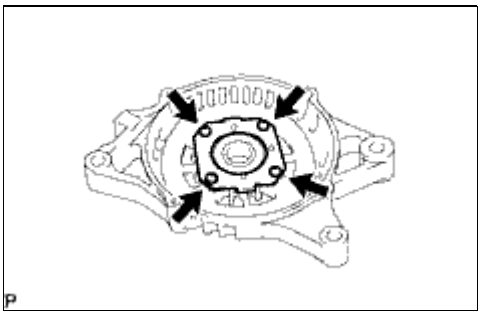


NOTICE:

Make sure that the terminal insulator is installed with the correct orientation.

7. INSTALL GENERATOR REAR END COVER

(a) Install the generator rear end cover to the generator coil assembly with the 3 bolts.



Torque:

4.6 N·m {47 kgf·cm, 41in·lbf}

8. INSTALL GENERATOR PULLEY WITH CLUTCH

(a) Mount the generator assembly in the vise between aluminum plates.

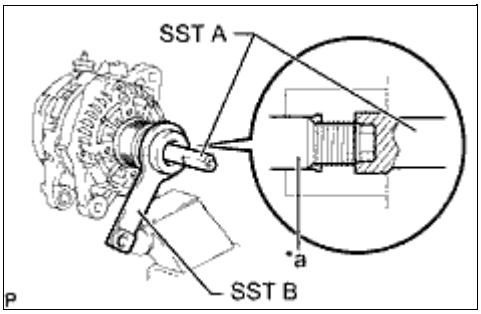
NOTICE:

Do not overtighten the vise.

(b) Temporarily install the generator pulley with clutch by hand.

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(c) Install SST A and SST B to the generator pulley with clutch as shown in the illustration.



Text in Illustration

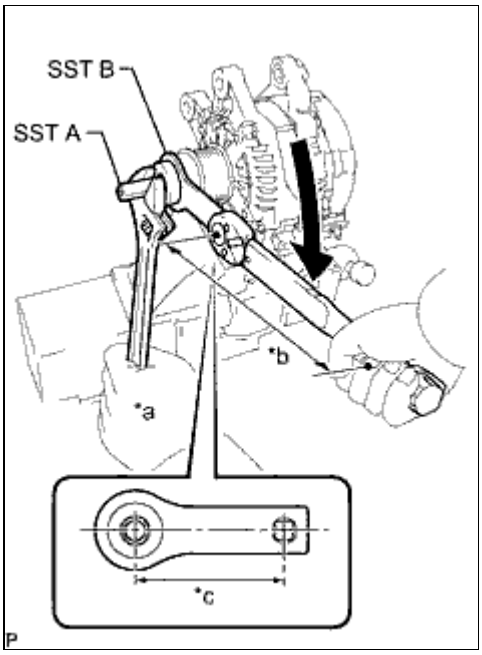
*a	Generator Rotor Shaft

SST: 09820-63021

NOTICE:

Securely attach SST to the generator pulley with clutch and generator rotor shaft.

(d) Using a wrench to hold SST A, turn SST B clockwise to tighten the generator pulley with clutch.



Text in Illustration

*a	Hold
*b	Torque Wrench Fulcrum Length
*c	SST Fulcrum Length
➡	Turn

Torque:

Specified tightening torque -

80 N·m {816 kgf·cm, 59ft·lbf}

NOTICE:

Be careful as the generator pulley with clutch or generator rotor shaft may be damaged if the position of SST is not securely maintained while performing this operation.

HINT:

- Calculate the torque wrench reading when changing the fulcrum length of the torque wrench

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INFO .

- When using SST (fulcrum length of 100 mm (3.94 in.)) + torque wrench (fulcrum length of 400 mm (15.8 in.)):

  64 N*m (653 kgf*cm, 47 ft.*lbf)

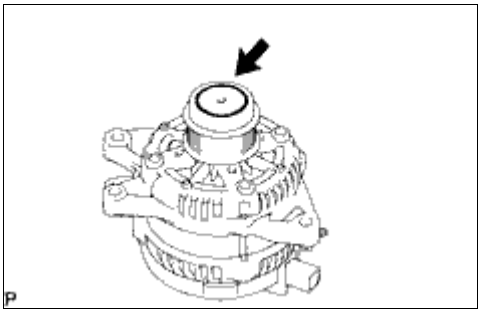
(e) Remove SST from the generator pulley with clutch.

(f) Check that the generator pulley with clutch rotates smoothly.

(g) Remove the generator assembly from the vise.

9. INSTALL GENERATOR PULLEY CAP

(a) Install a new generator pulley cap to generator pulley with clutch.



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017AV00NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE CHARGING: GENERATOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. PRECAUTION

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

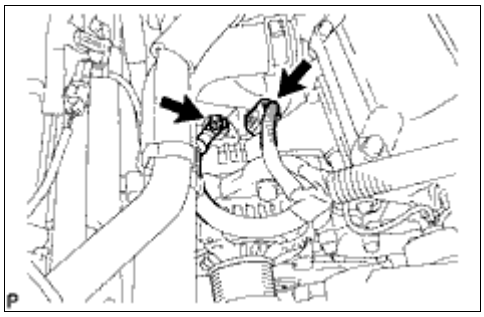
3. REMOVE AIR CLEANER CAP SUB-ASSEMBLY WITH AIR CLEANER HOSE INFO

4. REMOVE FAN AND GENERATOR V BELT INFO

5. REMOVE GENERATOR ASSEMBLY

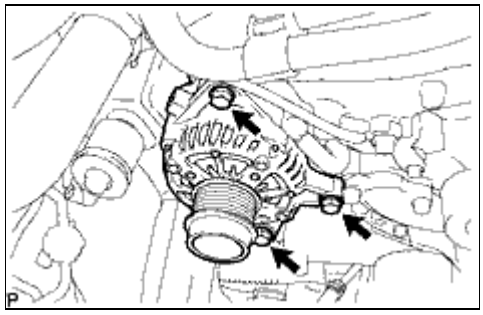
(a) Remove the terminal cap.

(b) Disconnect the connector from the generator assembly.



(c) Remove the nut and disconnect the engine wire from terminal B.

(d) Remove the 3 bolts and generator assembly.



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017H5012X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: COOLANT: REPLACEMENT; 2016 MY Tacoma [08/2015 -]		

REPLACEMENT

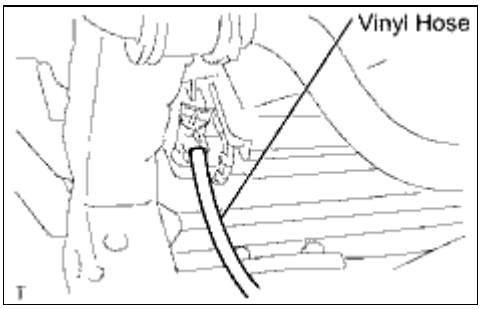
1. DRAIN ENGINE COOLANT

CAUTION:

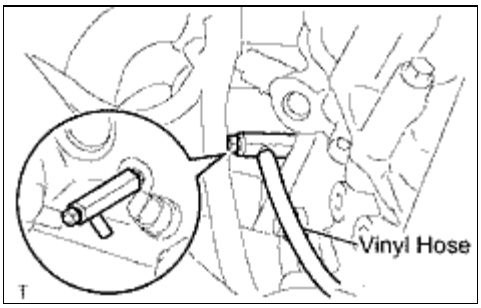
To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot. Thermal expansion will cause hot engine coolant and steam to blow out from the radiator.

(a) Remove the 4 bolts, then remove the No. 1 engine under cover.

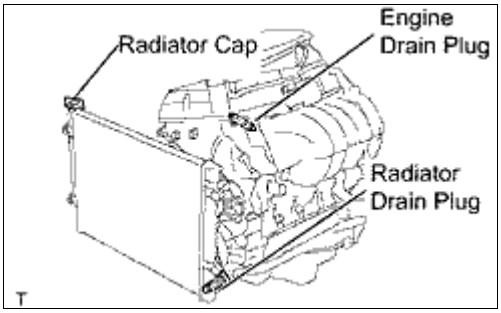
(b) Install a vinyl hose onto the radiator side.



(c) Install a vinyl hose onto the engine side.



(d) Loosen the engine drain plug.



(e) Loosen the radiator drain plug.

(f) Remove the radiator cap and drain coolant.

(g) Drain the coolant from the reservoir tank.

2. ADD ENGINE COOLANT

(a) Tighten the engine drain plug.

Torque:

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13 N·m {130 kgf·cm, 9ft·lbf}

(b) Tighten the radiator drain plug.

(c) Disconnect the 2 vinyl hoses.

(d) Slowly fill the system with engine coolant.

Capacity:

M/T: 8.7 liters (9.2 US qts, 7.7 lmp. qts)

A/T: 8.6 liters (9.1 US qts, 7.6 lmp. qts)

HINT:

- Use of improper coolants may damage the engine cooling system.
- Use only 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 (coolant with long-life hybrid organic acid technology consists of a combination of low phosphates and organic acids.)
- New Toyota vehicles are filled with Toyota Super Long Life Coolant. When replacing the coolant, Toyota Super Long Life Coolant (color is pink, premixed ethylene glycol concentration is approximately 50 % and freezing temperature is -35°C (-31°F)) is recommended.

NOTICE:

Do not substitute plain water for engine coolant.

(e) Check the coolant level inside the radiator by squeezing the inlet and outlet radiator hoses several times by hand. If the coolant level goes down, add coolant.

(f) Install the radiator cap securely.

(g) Slowly pour coolant into the radiator reservoir until it reaches the FULL line.

(h) Warm up the engine until the cooling fan operates.

- Set the air conditioning as follows while warming up the engine.

ITEM	CONDITION
Fan speed	Any setting except OFF
Temperature	Toward warm
Air condition switch	OFF

(i) Squeeze the inlet and outlet radiator hoses several times by hand while warming up the engine.

(j) Stop the engine and wait until the coolant cools down.

(k) Remove the radiator cap and check the coolant level inside the radiator.

(l) If the coolant level is below the full level, perform the steps from (d) through (k) and repeat the operation until the coolant level remains at the full level.

(m) Check the coolant level inside the radiator reservoir tank again. If it is below the full level, add coolant.

(n) Install the No. 1 engine under cover with the 4 bolts.

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

3. INSPECT FOR COOLANT LEAK INFO

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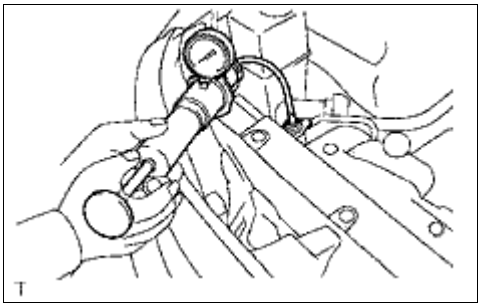
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000V1Q0GJX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: COOLING SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT COOLING SYSTEM FOR LEAKAGE

CAUTION:

To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot. Fluid and steam could be blown out under pressure.



(a) Fill the radiator with coolant and attach a radiator cap tester.

(b) Warm up the engine.

(c) Pump it up to 118 kPa (1.2 kgf/cm 2 , 17.1 psi) and check that the pressure does not drop.

HINT:

If the pressure drops, check the hose, radiator and water pump for leakage. If no external leakage is found, check the heater core, cylinder block and cylinder head.

2. CHECK ENGINE COOLANT LEVEL AT RESERVOIR

(a) Check that the coolant level in the reservoir tank is between the FULL and LOW lines when the engine is cold.

If low, check for leakage 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 up to the FULL line.

3. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

CAUTION:

To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot. Fluid and steam could be blown out under pressure.

(b) Check that there are no excessive deposits of rust or scale around the radiator cap or radiator filler hole.

If excessively dirty, replace the coolant.

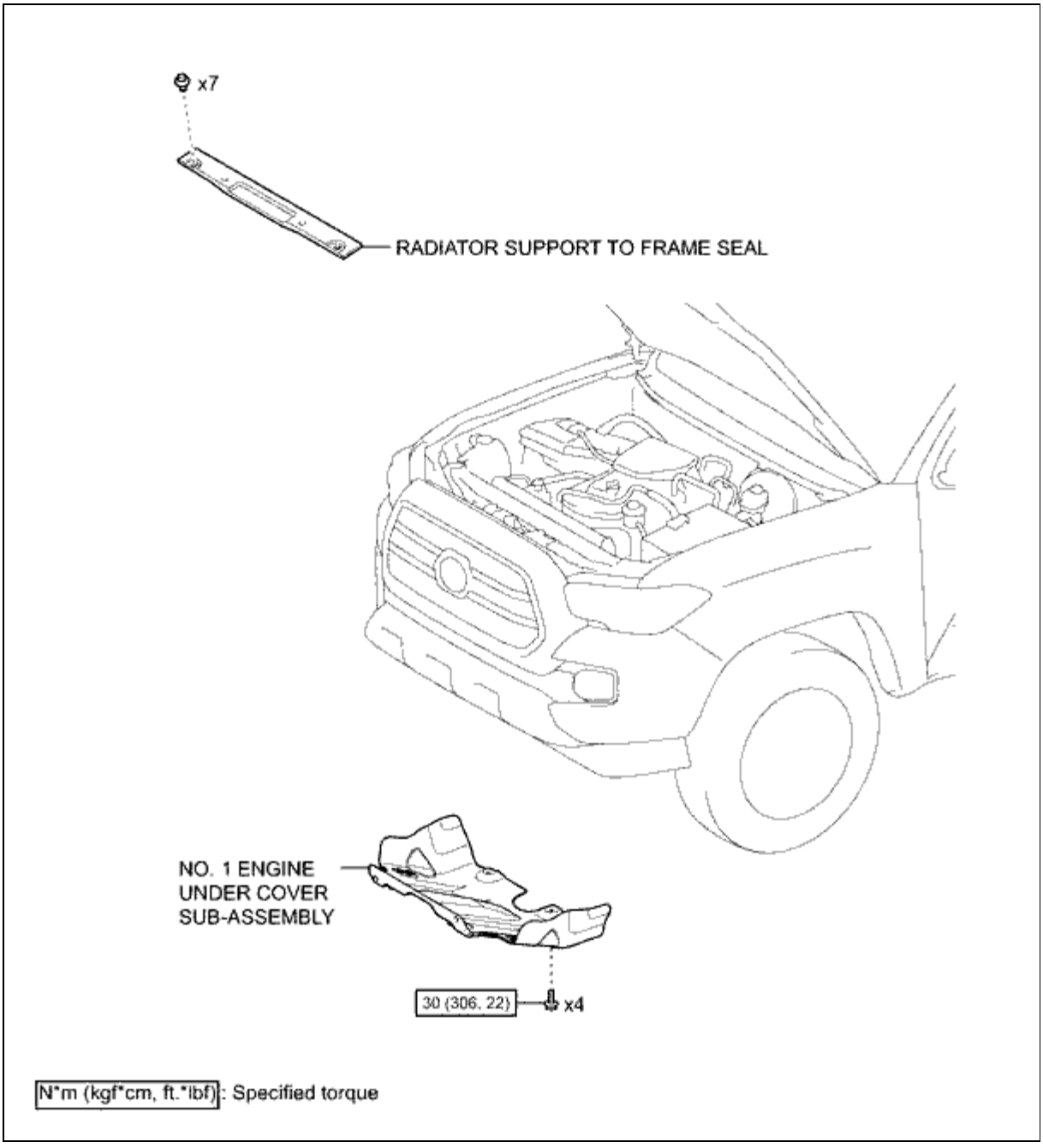
(c) Attach the radiator cap.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000005UXO002X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

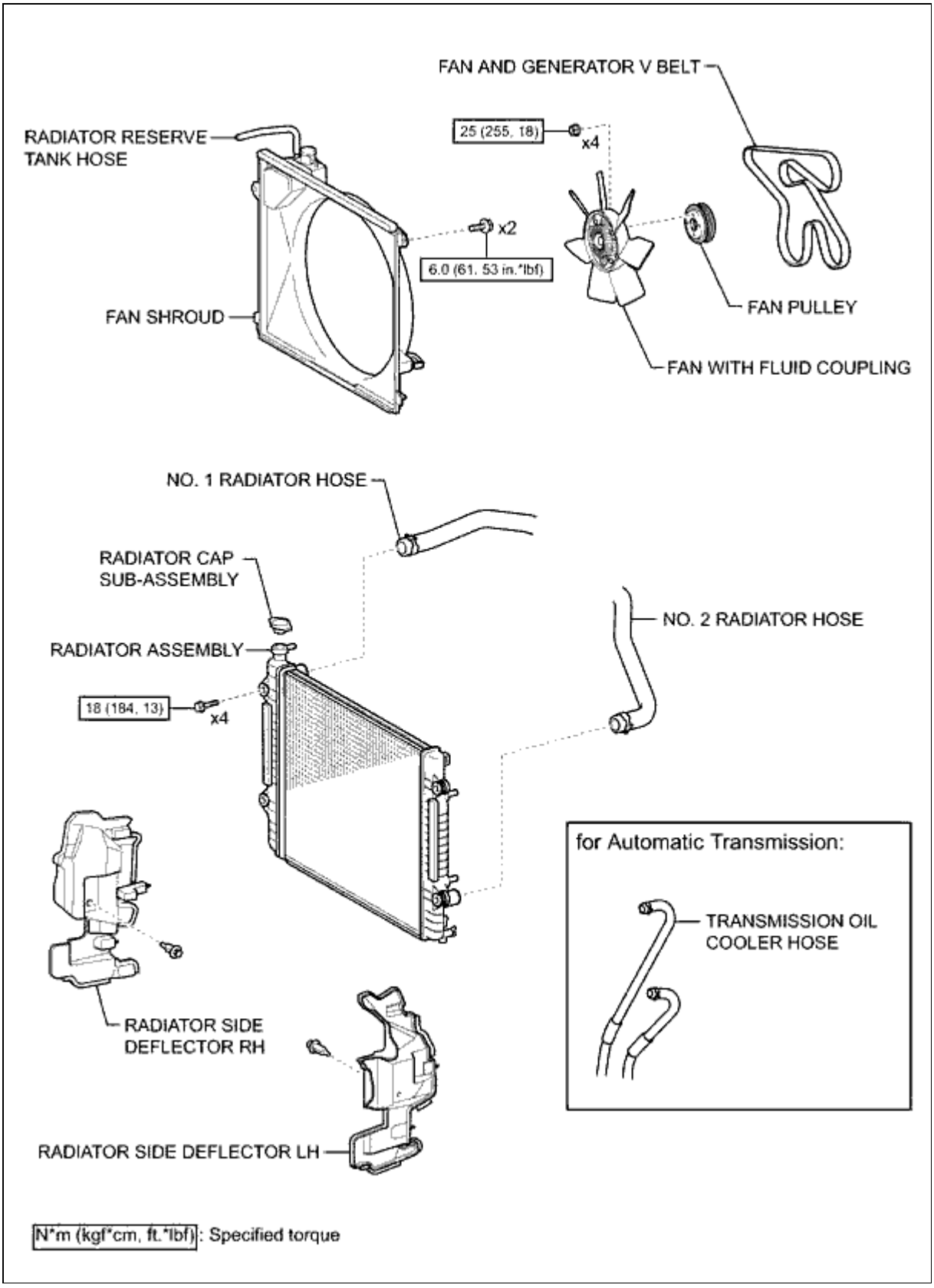
COMPONENTS

ILLUSTRATION



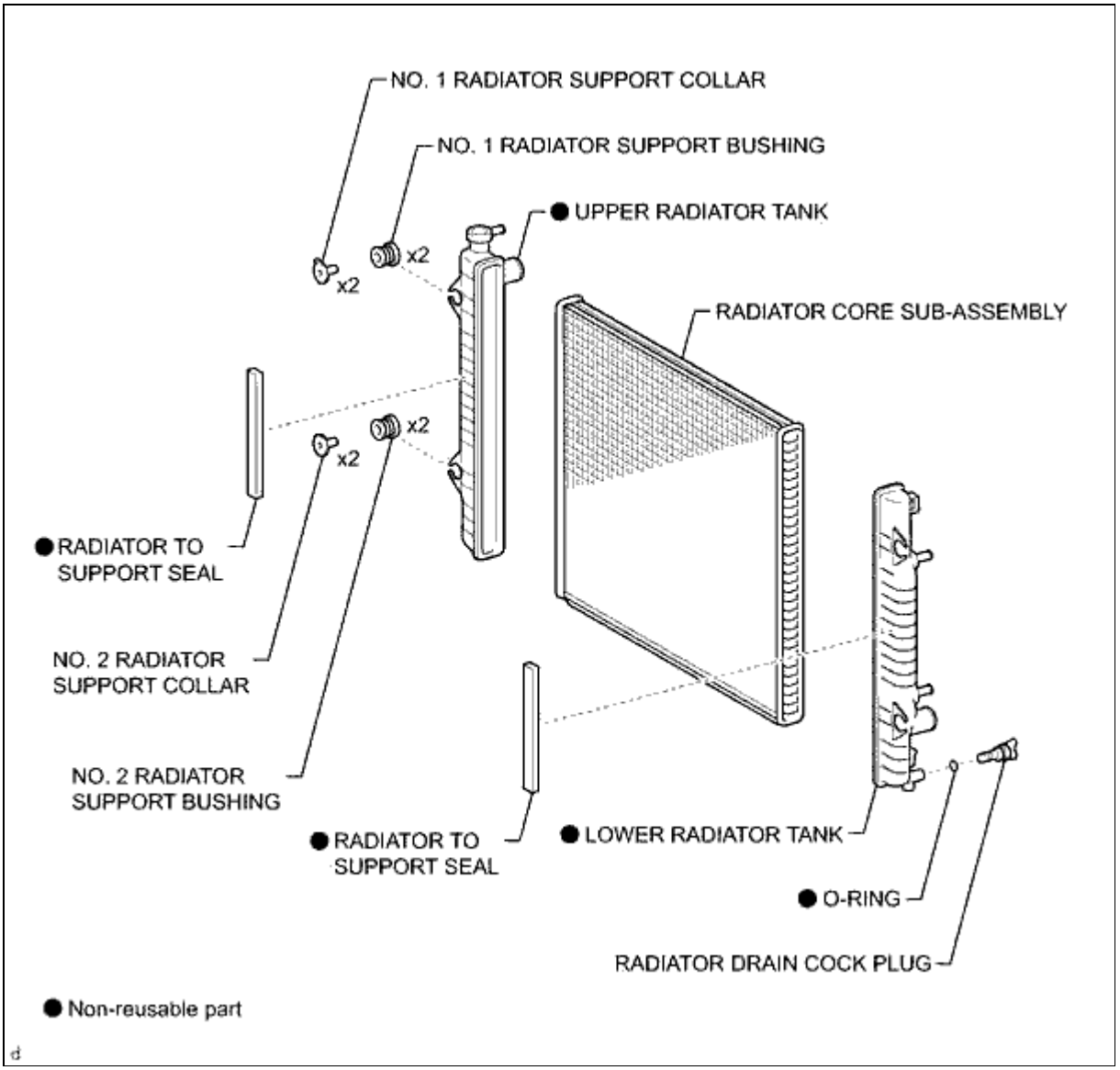
ILLUSTRATION

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ILLUSTRATION

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017DY00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: DISASSEMBLY; 2016 MY Tacoma [08/2015 -]		

DISASSEMBLY

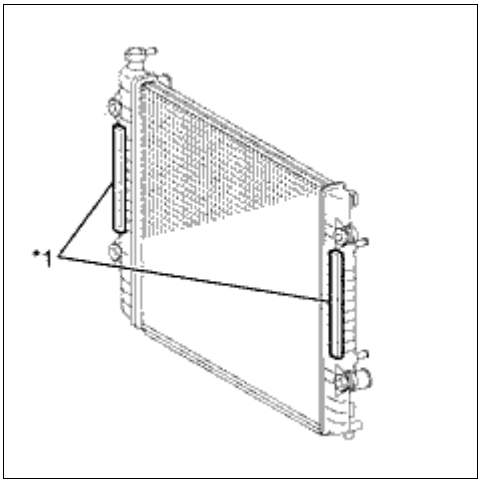
1. REMOVE RADIATOR DRAIN COCK PLUG

(a) Remove the radiator drain cock plug from the radiator assembly.

(b) Remove the O-ring from the radiator drain cock plug.

2. REMOVE RADIATOR TO SUPPORT SEAL

(a) Remove the 2 radiator to support seals from the radiator assembly.

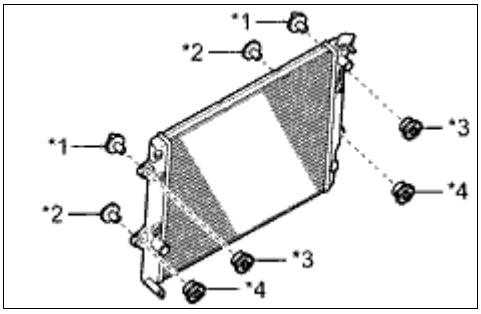


Text in Illustration

*1	Radiator to Support Seal

3. REMOVE RADIATOR SUPPORT BUSHING

(a) Remove the 2 No. 1 radiator support collars and 2 No. 1 radiator support bushings from the radiator assembly.



Text in Illustration

*1	No. 1 Radiator Support Collar
*2	No. 2 Radiator Support Collar
*3	No. 1 Radiator Support Bushing
*4	No. 2 Radiator Support Bushing

(b) Remove the 2 No. 2 radiator support collars and 2 No. 2 radiator support bushings from the radiator assembly.

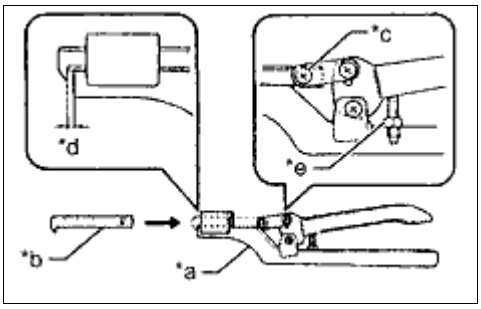
4. ASSEMBLE SST

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(a) Engage the claw with the overhaul handle by inserting it into the hole in part A as shown in the illustration.

Text in Illustration

*a	SST (Overhaul Handle)
*b	SST (Claw)
*c	Part A
*d	Dimension B
*e	Stopper Bolt



SST: 09230-01010

09231-01010

09231-01030

(b) While gripping the handle, adjust dimension B to between 0.2 and 0.3 mm (0.00787 and 0.0118 in.), using the stopper bolt.

Dimension B:
0.2 to 0.3 mm (0.00787 to 0.0118 in.)

NOTICE:

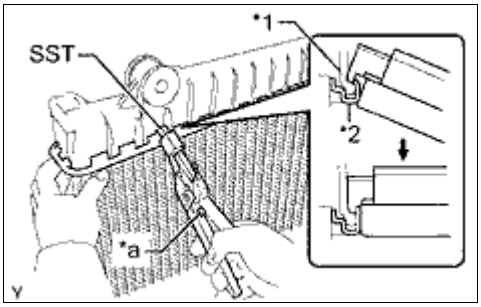
If the stopper bolt cannot be adjusted, the claw may be damaged.

5. UNCAULK CORE PLATE

(a) Straighten the core plate by gripping it with SST until stopped by the stopper bolt.

Text in Illustration

*1	Radiator Tank
*2	Core Plate
*a	Stopper Bolt



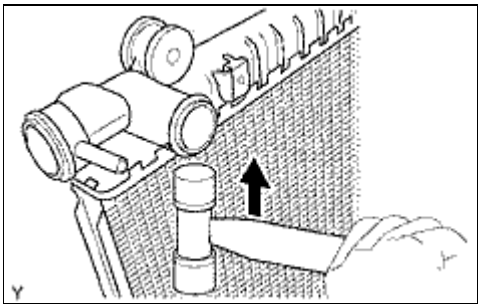
SST: 09230-01010

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6. REMOVE UPPER RADIATOR TANK

(a) Lightly tap the radiator tank bracket (or radiator tank pipe) with a plastic hammer to remove the upper radiator tank.



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7. REMOVE LOWER RADIATOR TANK

HINT:

Perform the same procedures as for the upper radiator tank.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017DX00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

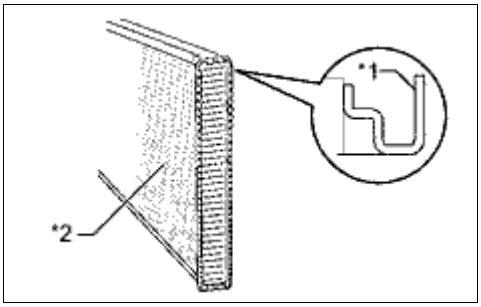
INSPECTION

1. INSPECT RADIATOR CORE SUB-ASSEMBLY

Check the core plate for damage.

Text in Illustration

*1	Core Plate
*2	Radiator Core



- If the sides of the core plate groove are deformed, it is impossible to reassemble the radiator tank. Therefore, first correct any deformation using pliers or a similar tool.
- Water leakage will occur if the bottom of the core plate groove is damaged or dented. Repair or replace the core plate if necessary.

NOTICE:

The radiator assembly can only be caulked twice. After being caulked twice, the radiator assembly must be replaced.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V2H00TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL RADIATOR ASSEMBLY

(a) Engage the 2 hooks and temporarily install the radiator assembly to the radiator support sub-assembly.

(b) Install the radiator assembly with the 4 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

(c) Connect the No. 2 radiator hose to the radiator assembly and slide the hose clip to secure it.

(d) Connect the No. 1 radiator hose to the radiator assembly and slide the hose clip to secure it.

2. INSTALL FAN SHROUD

(a) Install the fan pulley to the engine water pump assembly.

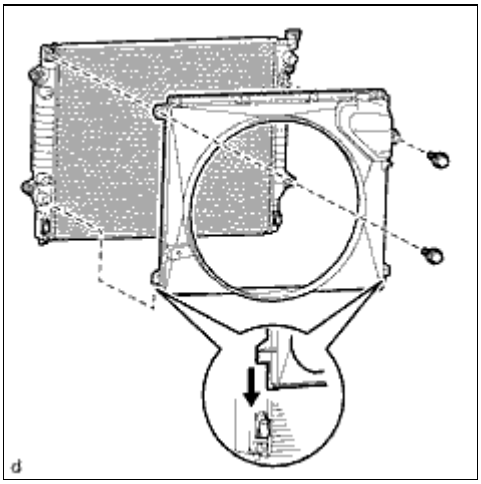
(b) Place the fan shroud together with the fan with fluid coupling between the radiator assembly and engine assembly.

NOTICE:

Be careful not to damage the radiator core.

(c) Temporarily install the fan with fluid coupling to the engine water pump assembly with the 4 nuts. Tighten the nuts as much as possible by hand.

(d) Engage the 2 guides of the fan shroud to the radiator assembly as shown in the illustration.



(e) Install the fan shroud to the radiator assembly with the 2 bolts.

Torque:

6.0 N·m {61 kgf·cm, 53in·lbf}

(f) Install the fan and generator V belt INFO .

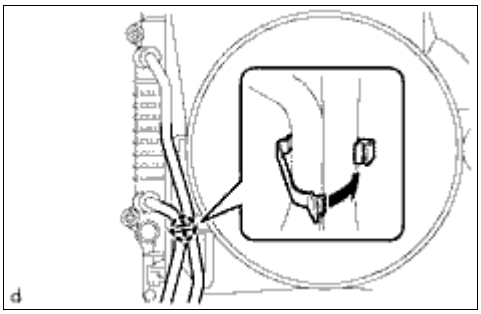
(g) Tighten the 4 nuts of the fan with fluid coupling.

Torque:

25 N·m {255 kgf·cm, 18ft·lbf}

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(h) Connect the 2 transmission oil cooler hoses to the radiator assembly with the paint marks facing upward, and slide the 2 hose clips to secure them. (for Automatic Transmission)



(i) Engage the clamp to install the 2 transmission oil cooler hoses to the fan shroud. (for Automatic Transmission)

(j) Connect the radiator reserve tank hose to the radiator assembly.

3. INSTALL RADIATOR SIDE DEFLECTOR LH

(a) Engage the 3 claws and install the radiator side deflector LH.

(b) Install the clip.

4. INSTALL RADIATOR SIDE DEFLECTOR RH

(a) Engage the 3 claws and install the radiator side deflector RH.

(b) Install the clip.

5. INSTALL RADIATOR SUPPORT TO FRAME SEAL INFO

6. INSTALL RADIATOR GRILLE

INFO

7. ADD ENGINE COOLANT INFO

8. INSPECT FOR COOLANT LEAK INFO

9. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Install the No. 1 engine under cover sub-assembly with the 4 bolts.

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000XYW0B8X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

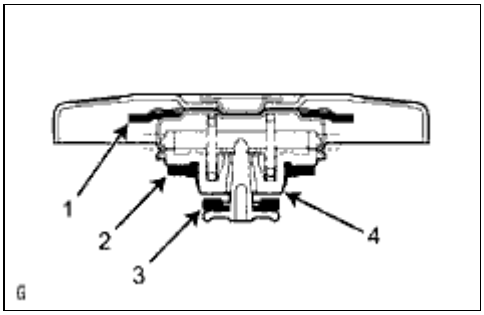
ON-VEHICLE INSPECTION

1. INSPECT RADIATOR CAP SUB-ASSEMBLY

CAUTION:

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

(a) Measure the valve opening pressure.



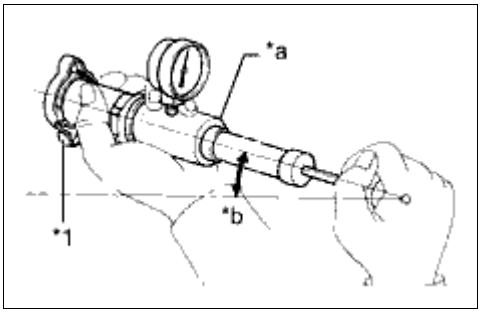
(1) If there are water stains or foreign matter on rubber packing 1, 2 or 3, clean it by using water and finger scouring.

(2) Check that rubber packing 1, 2 and 3 are not deformed, cracked or swollen.

(3) Check that rubber packing 3 and 4 are not stuck together.

(4) Apply engine coolant to rubber packing 2 and 3.

(5) When using the radiator cap tester, tilt it 30° or more.



Text in Illustration

*1	Radiator Cap Sub-assembly
*a	Radiator Cap Tester
*b	More than 30°

(6) Pump the radiator cap tester several times and check the maximum pressure.*1

Pumping speed:

1 pump per second

HINT:

*1: Even if the radiator cap sub-assembly cannot maintain the maximum pressure, it is not necessarily defective.

Standard Judgment Criterion:

ITEM	SPECIFIED CONDITION
Standard value	93 to 123 kPa (1.0 to 1.3 kgf/cm ^{2} , 14 to 18 psi)

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ITEM	SPECIFIED CONDITION
(for brand-new cap)	
Minimum standard value (for used cap)	79 kPa (0.8 kgf/cm ^{2} , 11 psi)

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

2. INSPECT FINS FOR BLOCKAGE

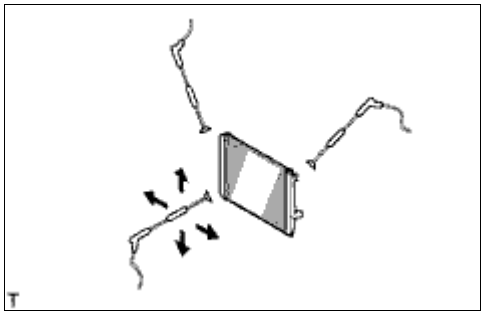
(a) If the fins are clogged, wash them with water or a steam cleaner and dry them with compressed air.

NOTICE:

- To avoid damaging the fins, the injection direction should be at right angles to the core surface.
- If the steam cleaner is too close to the core, there is a possibility of damaging the fins, so keep the following injection distances.

Standard Injection Distance:

INJECTION PRESSURE	SPECIFIED CONDITION
2942 to 4903 kPa (30.0 to 50.0 kgf/cm ^{2} , 427 to 711 psi)	300 mm (11.8 in.)
4903 to 7845 kPa (50.0 to 80.0 kgf/cm ^{2} , 711 to 1138 psi)	500 mm (19.7 in.)



- If the fins are bent, straighten them with a screwdriver or pliers.
- Do not expose electronic components to water.

(b) Dry the fins with compressed air.

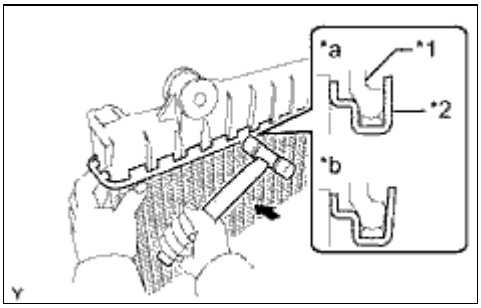
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017DZ00DX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: REASSEMBLY; 2016 MY Tacoma [08/2015 -]		

REASSEMBLY

1. INSTALL UPPER RADIATOR TANK

(a) Install a new upper radiator tank.



Text in Illustration

*1	Upper Radiator Tank
*2	Core Plate
*a	Correct
*b	Incorrect

(b) Tap the core plate with a plastic hammer until there is no gap between the core plate and upper radiator tank.

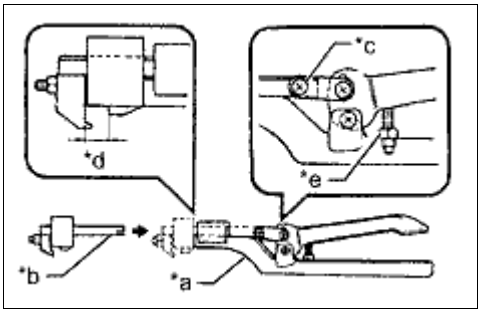
2. INSTALL LOWER RADIATOR TANK

HINT:

Perform the same procedures as for the upper radiator tank.

3. ASSEMBLE SST

(a) Install the punch assembly into the overhaul handle by inserting it into the hole in part A as shown in the illustration.



Text in Illustration

*a	SST (Overhaul Handle)
*b	SST (Punch Assembly)
*c	Part A
*d	Dimension B
*e	Stopper Bolt

SST: 09230-01010

09231-01010

09231-01020

(b) While gripping the handle, adjust the stopper bolt so that dimension B is as shown in the illustration.

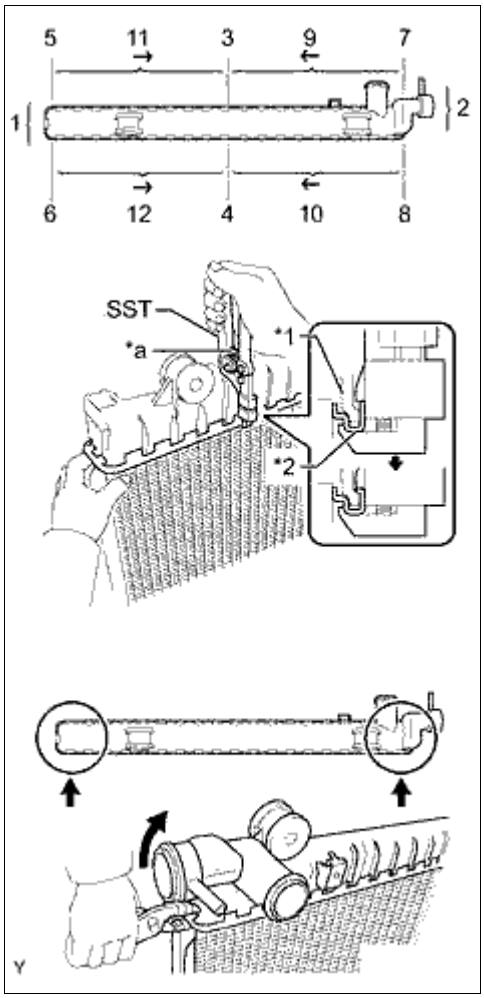
Dimension B:

8.4 mm (0.331 in.)

4. CAULK CORE PLATE

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(a) Gently press SST against the core plate in the order shown in the illustration. After repeating this a few times, fully caulk the core plate by gripping the handle until stopped by the stopper bolt.



Text in Illustration

*1	Radiator Tank
*2	Core Plate
*a	Stopper Bolt

SST: 09230-01010

09231-01010

09231-01020

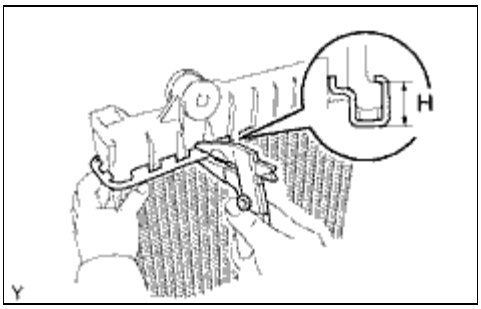
NOTICE:

- Do not tap the portions indicated in the illustration or the oil cooler using SST. Use pliers or a similar tool.
- Be careful not to damage the core plate.

(b) Check the core plate height (H) after completing the caulking.

Plate height (H):
8.7 to 9.1 mm (0.343 to 0.358 in.)

If the height is not as specified, readjust the stopper bolt of the handle, then caulk it again.



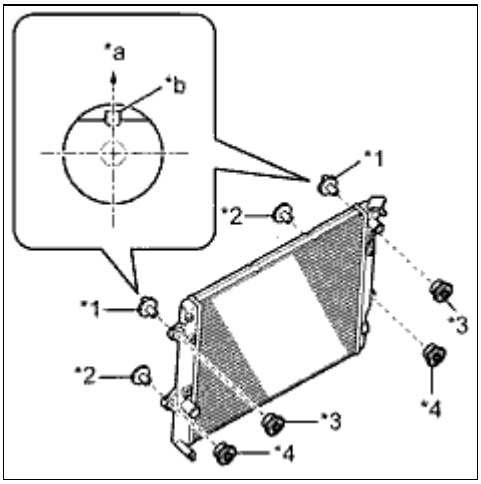
5. INSTALL RADIATOR SUPPORT BUSHING

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(a) Install the 2 No. 1 radiator support collars and 2 No. 1 radiator support bushings to the radiator assembly.

Text in Illustration

*1	No. 1 Radiator Support Collar
*2	No. 2 Radiator Support Collar
*3	No. 1 Radiator Support Bushing
*4	No. 2 Radiator Support Bushing
*a	Top of Vehicle
*b	Hook



NOTICE:

With the hook of the No. 1 radiator support collar facing towards the top of the vehicle, install the No. 1 radiator support collar.

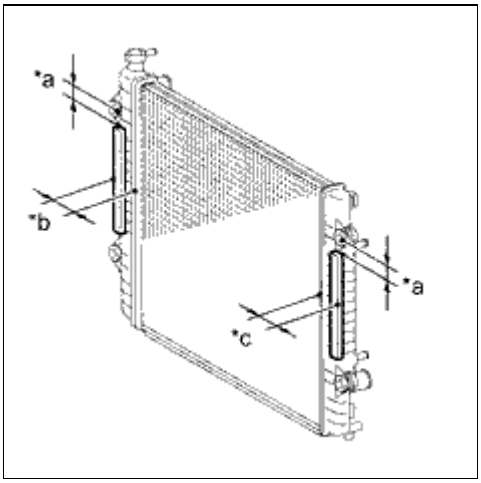
(b) Install the 2 No. 2 radiator support collars and 2 No. 2 radiator support bushings to the radiator assembly.

6. INSTALL RADIATOR TO SUPPORT SEAL

(a) Install 2 new radiator to support seals to the radiator assembly as shown in the illustration.

Text in Illustration

*a	34 mm (1.34 in.)
*b	38 mm (1.50 in.)
*c	54 mm (2.13 in.)



7. INSTALL RADIATOR DRAIN COCK PLUG

(a) Install a new O-ring to the radiator drain cock plug.

(b) Install the radiator drain cock plug to the radiator assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V2L00SX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: RADIATOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Remove the 4 bolts and No. 1 engine under cover sub-assembly.

2. DRAIN ENGINE COOLANT INFO

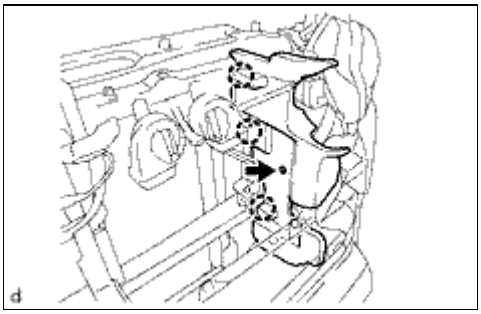
3. REMOVE RADIATOR GRILLE

INFO

4. REMOVE RADIATOR SUPPORT TO FRAME SEAL INFO

5. REMOVE RADIATOR SIDE DEFLECTOR LH

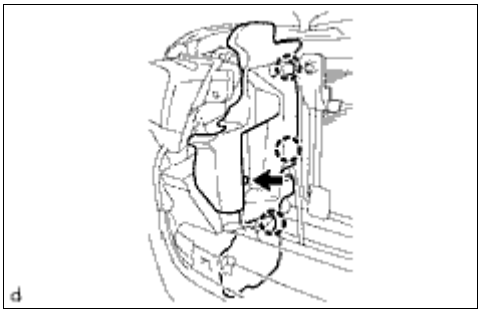
(a) Remove the clip.



(b) Disengage the 3 claws and remove the radiator side deflector LH.

6. REMOVE RADIATOR SIDE DEFLECTOR RH

(a) Remove the clip.

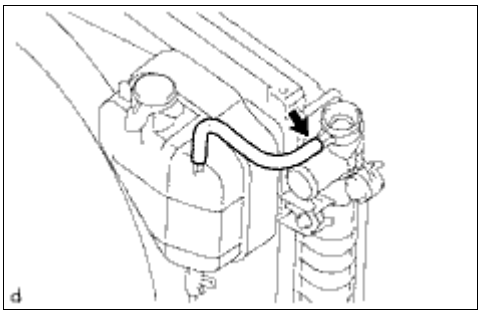


(b) Disengage the 3 claws and remove the radiator side deflector RH.

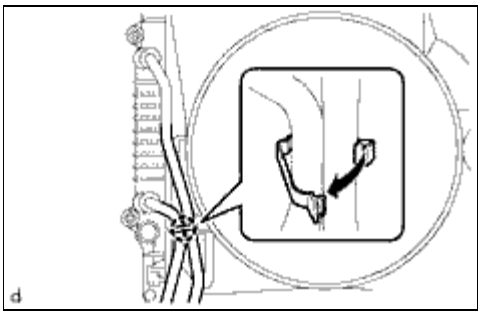
7. REMOVE FAN SHROUD

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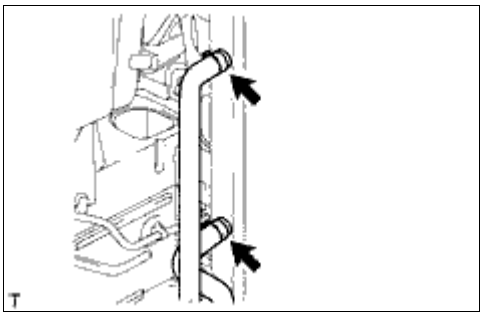
(a) Disconnect the radiator reserve tank hose from the radiator assembly.



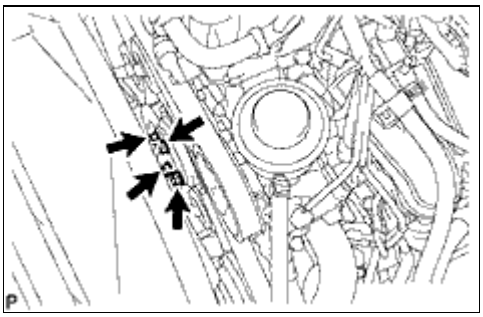
(b) Disengage the clamp to separate the 2 transmission oil cooler hoses from the fan shroud. (for Automatic Transmission)



(c) Slide the 2 hose clips and disconnect the 2 transmission oil cooler hoses from the radiator assembly. (for Automatic Transmission)



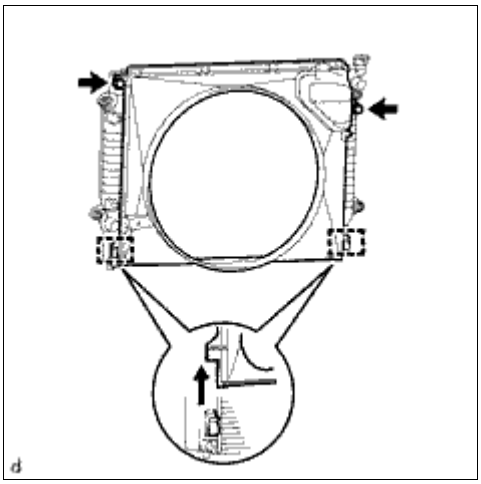
(d) Loosen the 4 nuts holding the fan with fluid coupling.



(e) Remove the fan and generator V belt INFO .

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(f) Remove the 2 bolts holding the fan shroud.

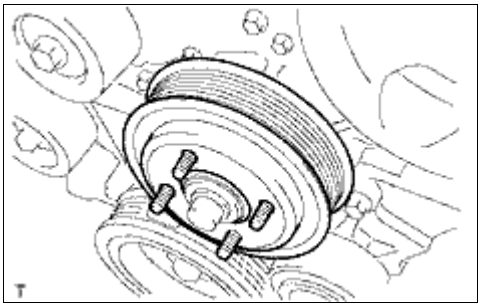


(g) Remove the 4 nuts of the fan with fluid coupling, and then remove the fan shroud together with the fan with fluid coupling.

NOTICE:

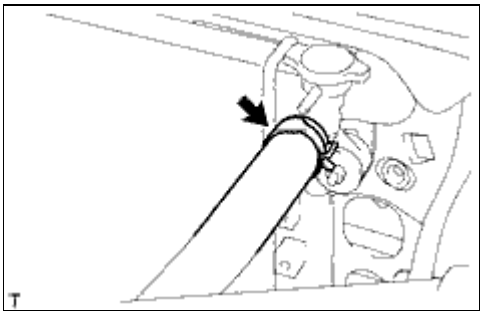
Be careful not to damage the radiator core.

(h) Remove the fan pulley from the engine water pump assembly.

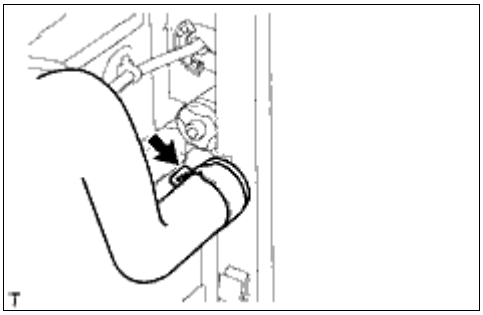


8. REMOVE RADIATOR ASSEMBLY

(a) Slide the hose clip and disconnect the No. 1 radiator hose from the radiator assembly.

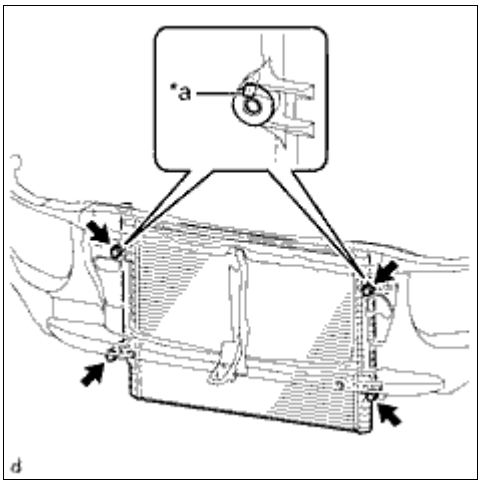


(b) Slide the hose clip and disconnect the No. 2 radiator hose from the radiator assembly.



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(c) Remove the 4 bolts.



Text in Illustration

*a	Hook

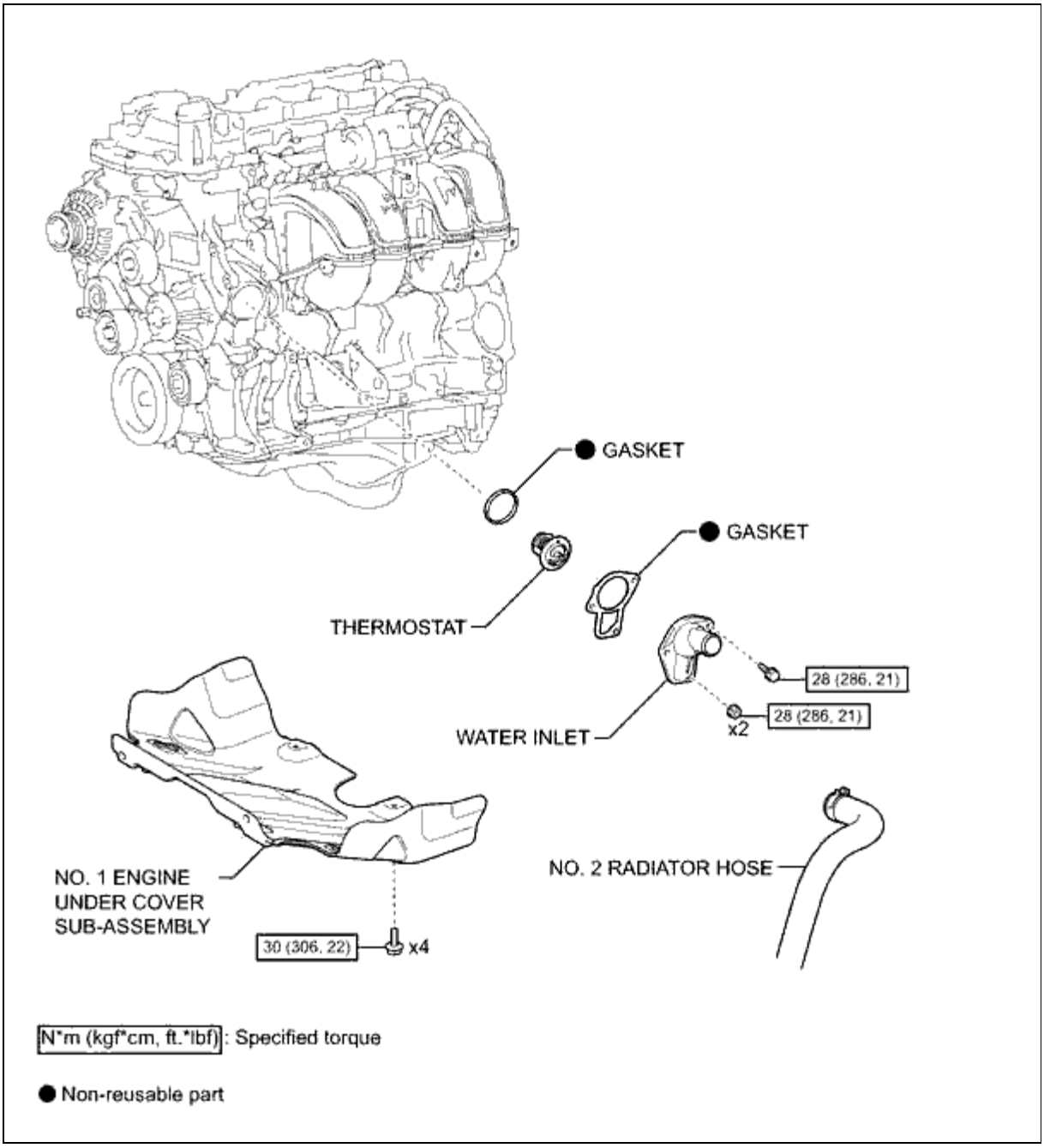
(d) Disengage the 2 hooks and remove the radiator assembly from the radiator support sub-assembly.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000044IM00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: THERMOSTAT: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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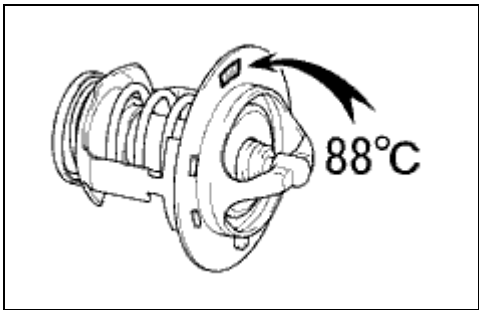
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000V2A010X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: THERMOSTAT: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

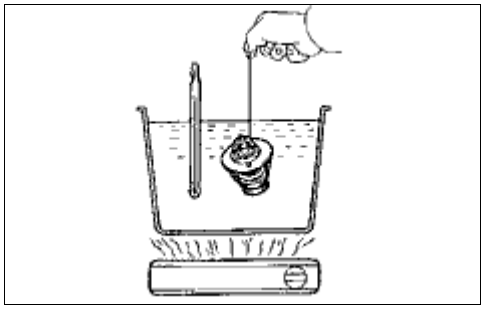
1. INSPECT THERMOSTAT

HINT:

The valve opening temperature is inscribed on the thermostat.



(a) Immerse the thermostat in water, and then gradually heat the water.



(b) Check the valve opening temperature of the thermostat.

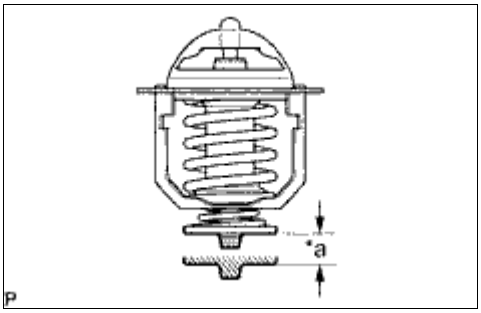
Standard valve opening temperature:
86 to 90°C (187 to 194°F)

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

(c) Check the valve lift.

Text in Illustration

*a	Valve Lift



Standard valve lift:
10.0 mm (0.394 in.) or more at 100°C (212°F)

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

(d) Check that the valve is fully closed when the thermostat is at low temperatures (below 83°C (181°F)).

If not fully closed, replace the thermostat.

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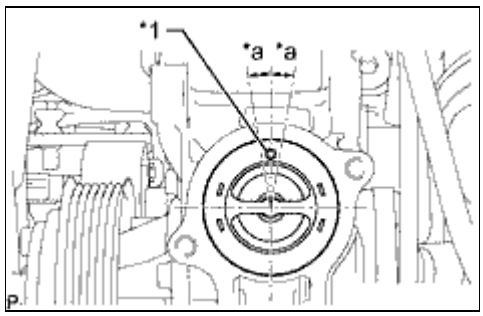
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V29013X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: THERMOSTAT: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL THERMOSTAT

(a) Install a new gasket to the thermostat.

(b) Install the thermostat with the jiggle valve upward.



Text in Illustration

*1	Jiggle Valve
*a	10°

HINT:

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

2. INSTALL WATER INLET

(a) Install the water inlet and a new gasket to the timing chain cover sub-assembly with the bolt and 2 nuts.

Torque:

28 N·m {286 kgf·cm, 21ft·lbf}

3. CONNECT NO. 2 RADIATOR HOSE

(a) Connect the No. 2 radiator hose to the water inlet and slide the hose clip to secure it.

4. ADD ENGINE COOLANT INFO

5. INSPECT FOR COOLANT LEAK INFO

6. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Install the No. 1 engine under cover sub-assembly with the 4 bolts.

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V2C012X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: THERMOSTAT: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

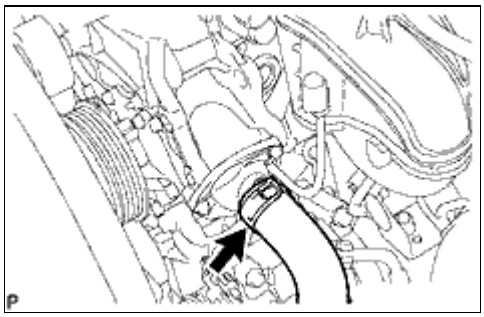
1. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Remove the 4 bolts and No. 1 engine under cover sub-assembly.

2. DRAIN ENGINE COOLANT INFO

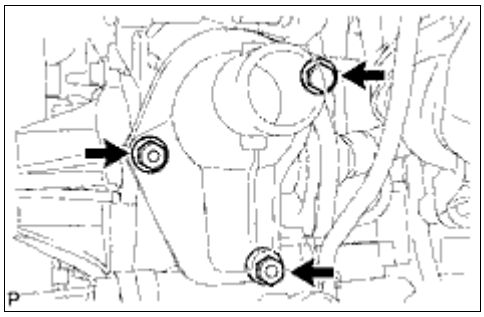
3. DISCONNECT NO. 2 RADIATOR HOSE

(a) Slide the hose clip and disconnect the No. 2 radiator hose from the water inlet.



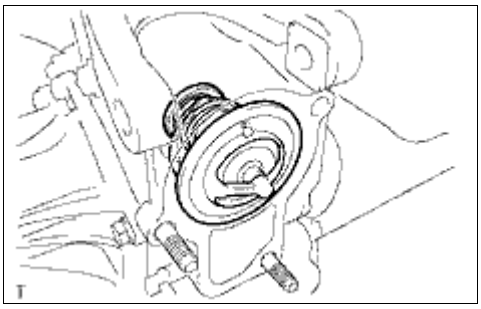
4. REMOVE WATER INLET

(a) Remove the bolt, 2 nuts, water inlet and gasket from the timing chain cover sub-assembly.



5. REMOVE THERMOSTAT

(a) Remove the thermostat from the timing chain cover sub-assembly.



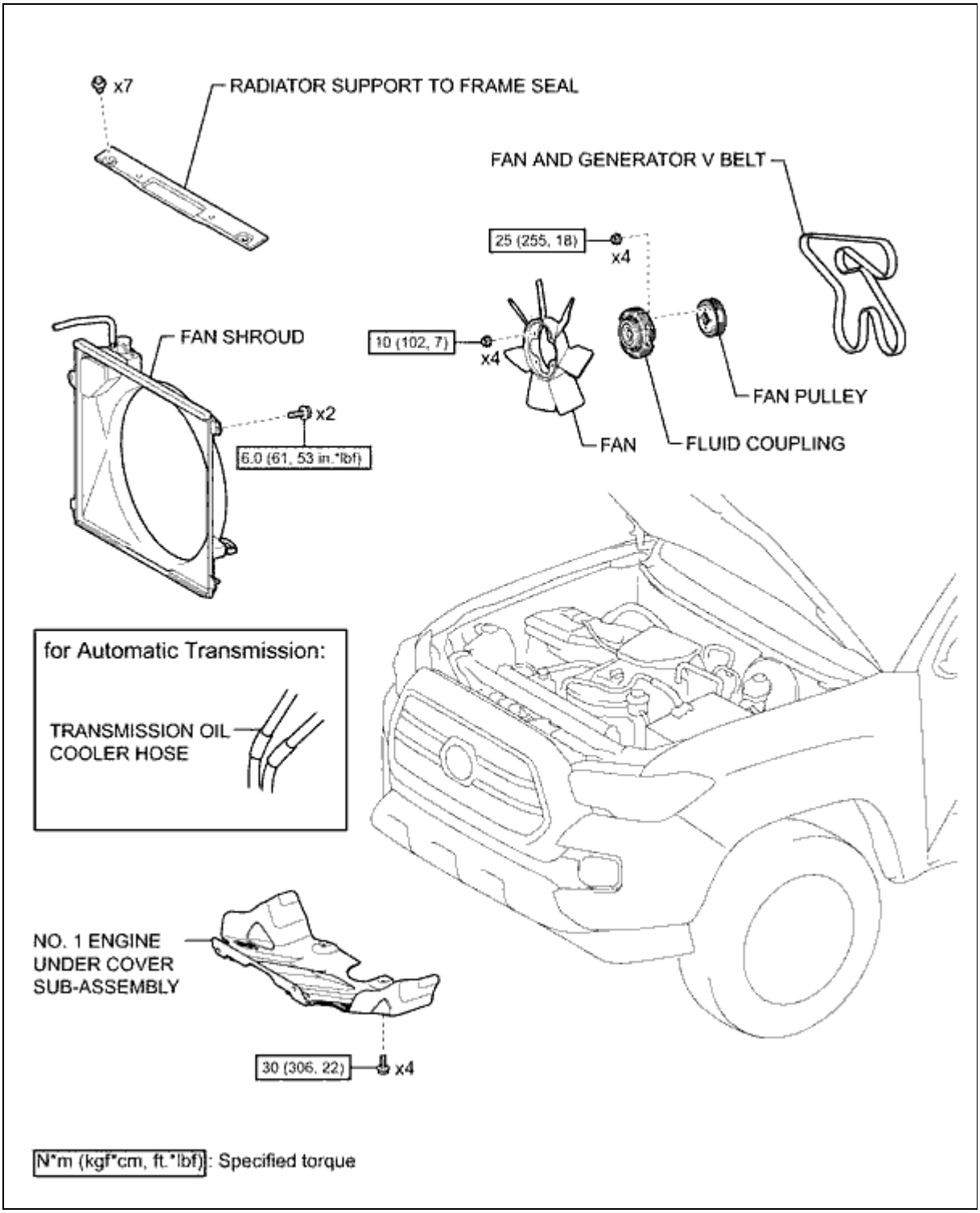
(b) Remove the gasket from the thermostat.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000044IL00NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: WATER PUMP: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

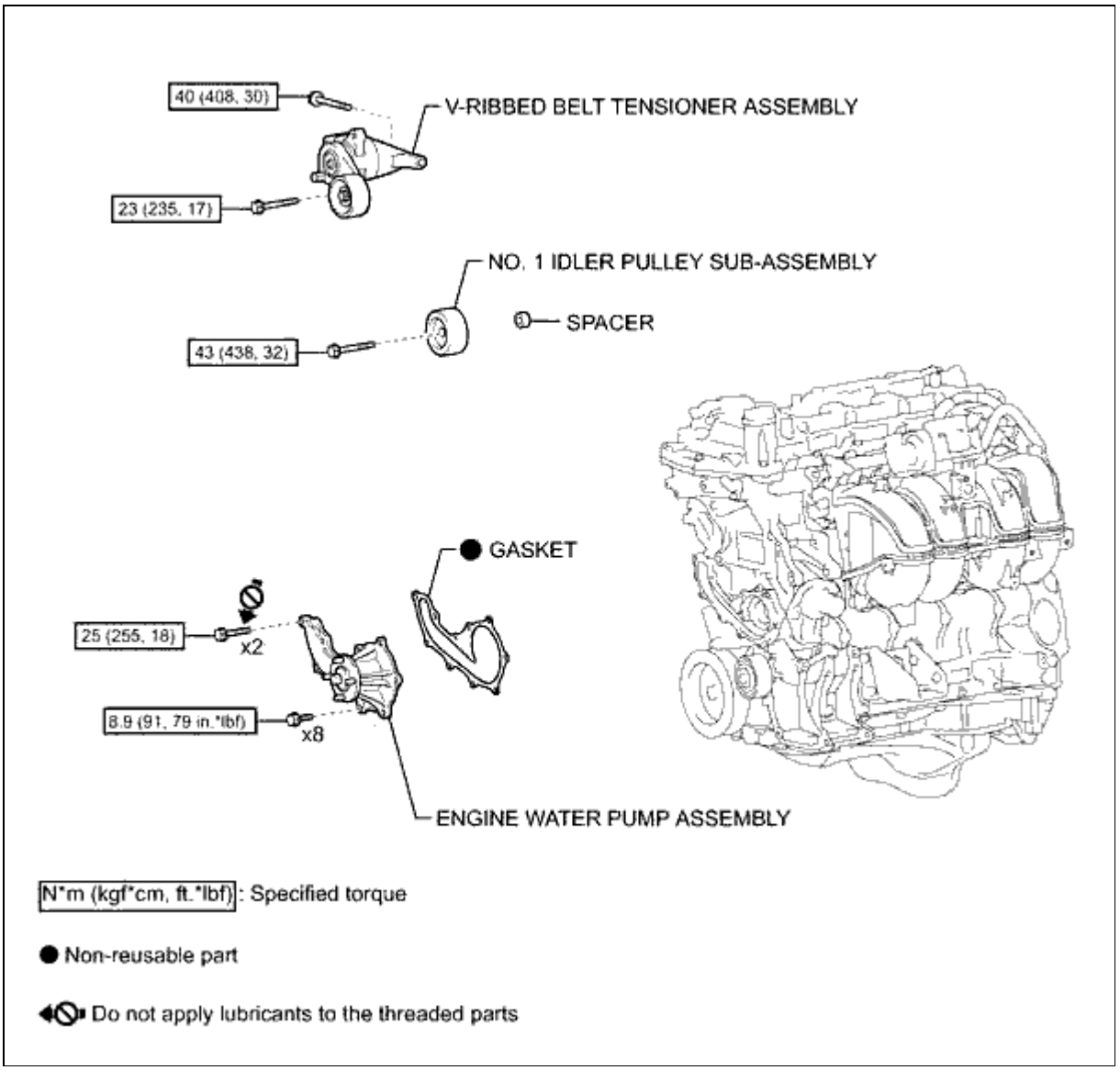
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



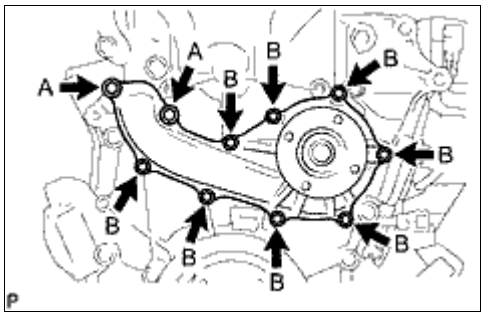
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V2501OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: WATER PUMP: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL ENGINE WATER PUMP ASSEMBLY

(a) Install the engine water pump assembly and a new gasket to the timing chain cover sub-assembly with the 10 bolts.



Torque:

for Bolt A -

25 N·m {255 kgf·cm, 18ft·lbf}

for Bolt B -

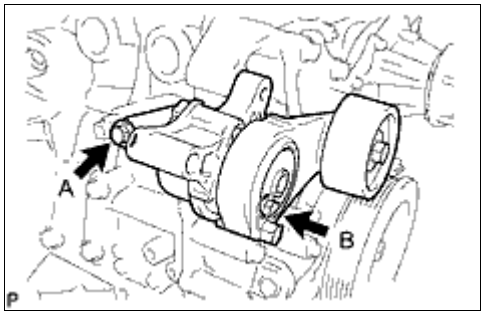
8.9 N·m {91 kgf·cm, 79in·lbf}

NOTICE:

Make sure that there is no oil on the threads of the bolts (A).

2. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

(a) Temporarily install the V-ribbed belt tensioner assembly to the timing chain cover sub-assembly with the 2 bolts.



NOTICE:

Make sure that the V-ribbed belt tensioner assembly is in contact with the timing chain cover sub-assembly.

(b) Fully tighten the bolt (A).

Torque:

40 N·m {408 kgf·cm, 30ft·lbf}

(c) Fully tighten the bolt (B).

Torque:

23 N·m {235 kgf·cm, 17ft·lbf}

3. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY INFO

4. INSTALL GENERATOR ASSEMBLY

INFO

5. INSTALL FAN SHROUD INFO

6. INSTALL RADIATOR SUPPORT TO FRAME SEAL

(a) Install the radiator support to frame seal with the 7 clips.

7. ADD ENGINE COOLANT INFO

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8. INSPECT FOR COOLANT LEAK INFO

9. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Install the No. 1 engine under cover sub-assembly with the 4 bolts.

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000046DB00RX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: WATER PUMP: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT FOR COOLANT LEAK

HINT:

- The sliding surface inside the engine water pump assembly is lubricated by engine coolant. As some engine coolant is discharged during normal operation, engine coolant residue (solids) may be found on the drain plug or the bottom of the engine water pump assembly. Also, engine coolant may leak if foreign matter enters the engine water pump assembly, however the sealing performance will recover when the foreign matter is pushed out or breaks into fine pieces. In this case, check the area around the engine water pump assembly.
- Before performing this inspection, check that there is no coolant leaking from any parts other than the water pump. If there are leaks, inspect those areas.
- Perform this inspection when the engine is cold.

(a) Visually check the engine water pump assembly.

(1) Check that engine coolant is not dripping from the engine water pump assembly.

HINT:

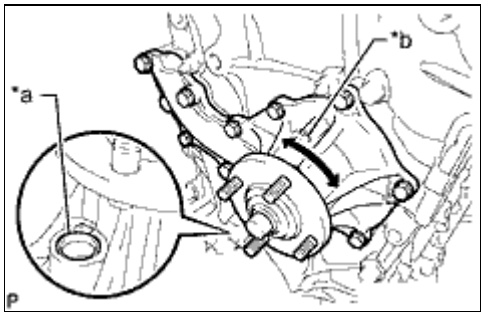
- If engine coolant is dripping, replace the engine water pump assembly.
- If engine coolant is not dripping, perform the following check.

2. REMOVE FAN SHROUD

INFO

3. INSPECT ENGINE WATER PUMP ASSEMBLY

(a) Visually check the air hole and water hole for coolant leakage.



Text in Illustration

*a	Water Hole
*b	Air Hole

If any leakage is found, replace the engine water pump assembly.

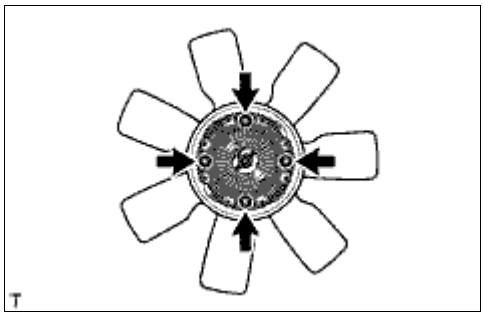
(b) Turn the pulley and check that the engine water pump assembly bearing moves smoothly and does not make a noise.

If necessary, replace the engine water pump assembly.

4. INSPECT FLUID COUPLING ASSEMBLY

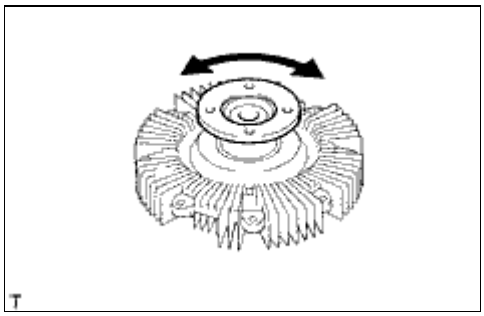
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(a) Remove the 4 nuts and fan.



(b) Check the fluid coupling assembly for damage or silicon oil leaks.

If necessary, replace the fluid coupling assembly.



(c) Install the fan with the 4 nuts.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}

5. INSTALL FAN SHROUD

INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000V2801MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE COOLING: WATER PUMP: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

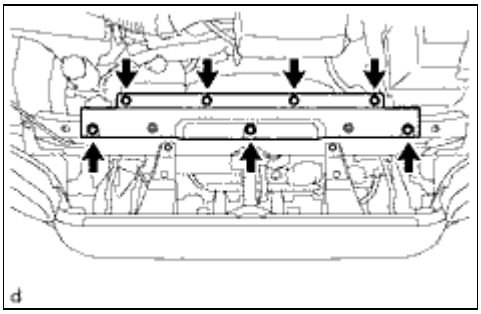
1. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

(a) Remove the 4 bolts and No. 1 engine under cover sub-assembly.

2. DRAIN ENGINE COOLANT INFO

3. REMOVE RADIATOR SUPPORT TO FRAME SEAL

(a) Remove the 7 clips and radiator support to frame seal.



4. REMOVE FAN SHROUD INFO

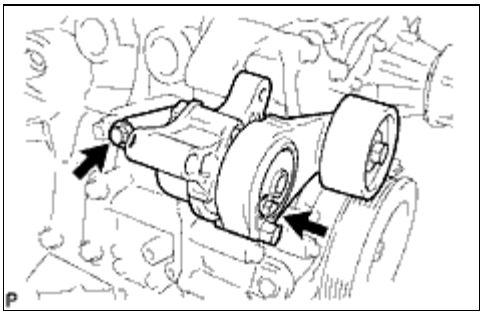
5. REMOVE GENERATOR ASSEMBLY

INFO

6. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY INFO

7. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

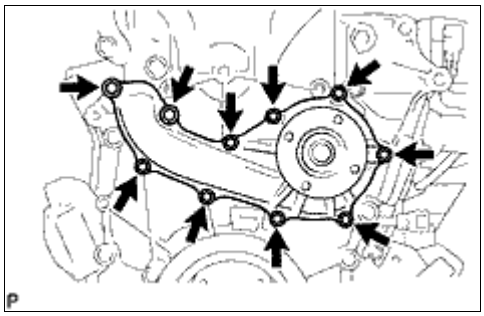
(a) Remove the 2 bolts and V-ribbed belt tensioner assembly from the timing chain cover sub-assembly.



8. REMOVE ENGINE WATER PUMP ASSEMBLY

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(a) Remove the 10 bolts, engine water pump assembly and gasket from the timing chain cover sub-assembly.



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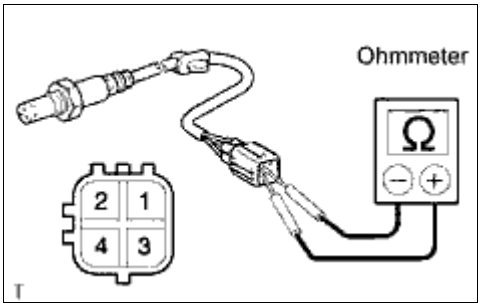
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000001758000X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR FUEL RATIO SENSOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT AIR FUEL RATIO SENSOR

(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.



Standard:

TESTER CONNECTION	SPECIFIED CONDITION
1 (HA1A) - 2 (+B)	1.8 to 3.4 Ω at 20°C (68°F)
1 (HA1A) - 4 (A1A-)	10 kΩ or higher

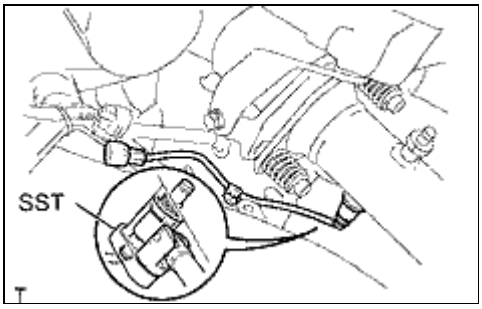
If the result is not as specified, replace the air fuel ratio sensor.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175700PX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR FUEL RATIO SENSOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL AIR FUEL RATIO SENSOR



(a) Using SST, install the air fuel ratio sensor.

SST: 09224-00010

Torque:

44 N·m {449 kgf·cm, 33ft·lbf}

40 N·m {408 kgf·cm, 30ft·lbf} with SST

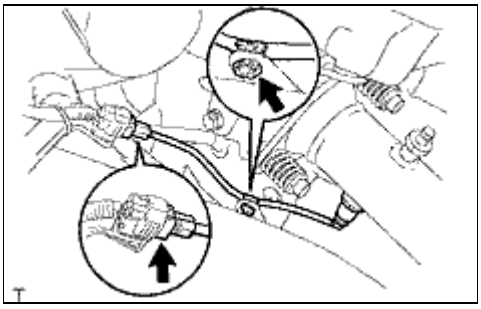
NOTICE:

Use a torque wrench with a fulcrum length of 300 mm (11.81 in.).

HINT:

Perform "Inspection After Repairs" after replacing the air fuel ratio sensor INFO .

(b) Connect the wire harness clamp.



(c) Connect the air fuel ratio sensor connector.

2. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

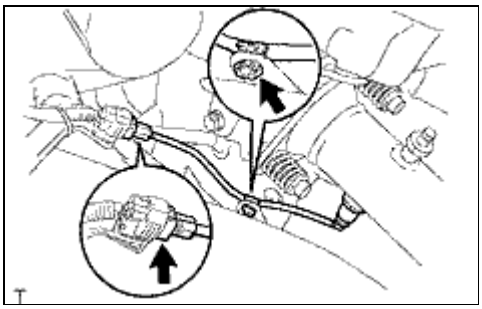
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000175900PX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR FUEL RATIO SENSOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

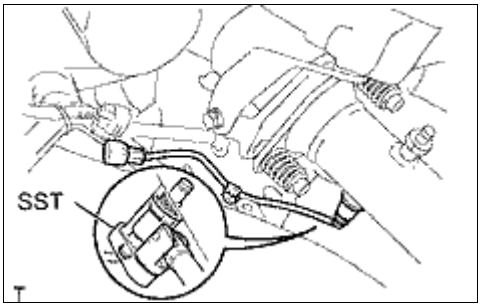
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

2. REMOVE AIR FUEL RATIO SENSOR



(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the wire harness clamp.



(c) Using SST, remove the air fuel ratio sensor.

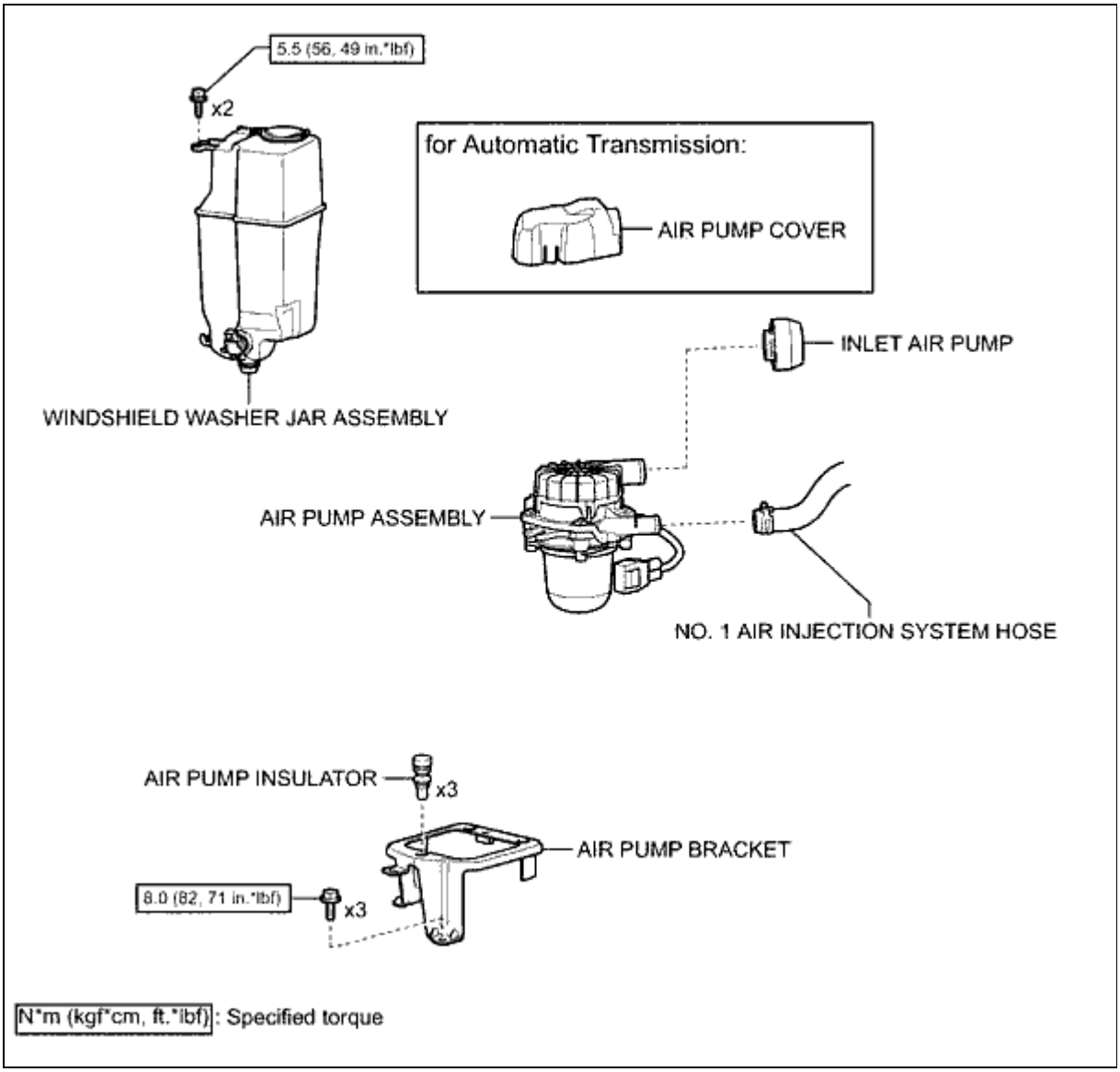
SST: 09224-00010

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000005DQ1003X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR PUMP: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000005DQ2004X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR PUMP: INSPECTION; 2016 MY Tacoma [08/2015 -]		

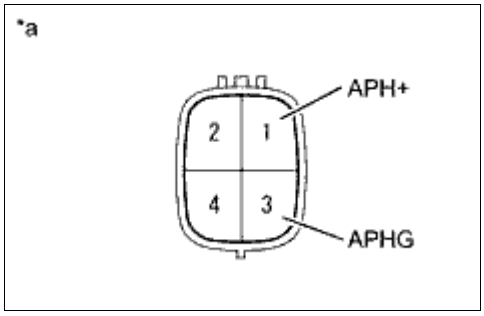
INSPECTION

1. INSPECT AIR PUMP HEATER (for Automatic Transmission)

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

Text in Illustration

*a	Component without harness connected (Air Pump Assembly)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (APH+) - 3 (APHG)	-20°C (-4°F)	3.6 to 17.6 Ω
	-10°C (14°F)	3.4 to 16.5 Ω
	0°C (32°F)	3.1 to 15.4 Ω
	10°C (50°F)	2.8 to 14.3 Ω
	20°C (68°F)	2.7 to 13.2 Ω

If the result is not as specified, replace the air pump assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175M01FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR PUMP: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL INLET AIR PUMP

(a) Engage the 4 claws and install the inlet air pump to the air pump assembly.

2. INSTALL AIR PUMP INSULATOR

(a) Install the 3 air pump insulators to the air pump bracket.

3. INSTALL AIR PUMP ASSEMBLY

(a) Engage the 3 fittings of the air pump insulator to install the air pump assembly to the air pump bracket.

(b) Engage the air pump assembly connector clamp and install the air pump assembly connector to the air pump bracket.

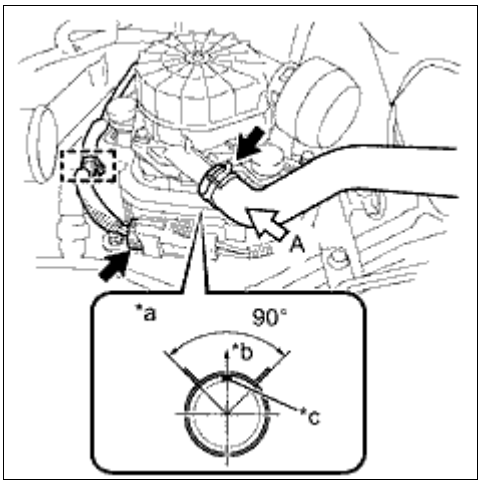
(c) Install the air pump assembly with air pump bracket to the engine room compartment with the 3 bolts.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(d) Engage the wire harness clamp and install the wire harness to the air pump bracket.

(e) Connect the air pump assembly connector.



(f) Connect the No. 1 air injection system hose to the air pump assembly as shown in the illustration with the clip.

Text in Illustration

*a	View A
*b	Upper of Vehicle
*c	Paint Mark

4. INSTALL AIR PUMP COVER (for Automatic Transmission)

(a) Engage the 3 claws and install the air pump cover to the air pump assembly.

HINT:

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Make sure the inlet air pump is oriented correctly and completely attached when installing the air pump cover.

5. INSTALL WINDSHIELD WASHER JAR ASSEMBLY

(a) Install the windshield washer jar assembly to the engine room compartment with the 2 bolts.

Torque:

5.5 N·m {56 kgf·cm, 49in·lbf}

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000460300BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR PUMP: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

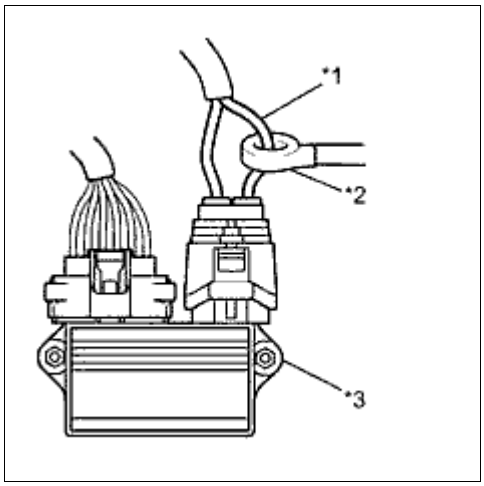
ON-VEHICLE INSPECTION

1. INSPECT AIR PUMP ASSEMBLY

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the 400 A probe of an ammeter to the (+) wire of the air pump.



Text in Illustration

*1	Air Pump Wire (+)
*2	400A Probe of Ammeter
*3	Air Injection Control Driver

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP : ON, ASV : OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Measure the current while the air pump assembly is operating.

Standard Current:

CONDITION	SPECIFIED CONDITION
20°C (68°F)	10 to 40 A

If the result is not as specified, replace the air pump assembly.

(h) Turn the ignition switch off.

NOTICE:

- Secondary Air Injection Check only allows technicians to operate the AIR system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

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While AIR system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

If an ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.

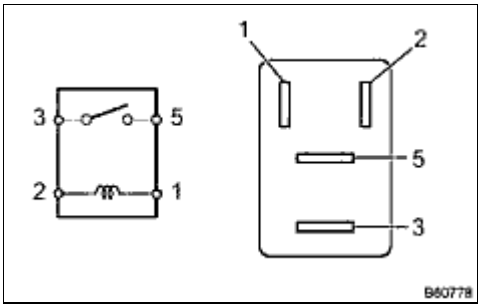
- Performing the Secondary Air Injection Check repeatedly may cause damage to the AIR system. If necessary, leave an interval of several minutes between Air Injection Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

2. INSPECT AIR PUMP HEATER RELAY (for Automatic Transmission)

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied	10 kΩ or higher
	Battery voltage is applied to terminals 1 and 2	Below 1 Ω

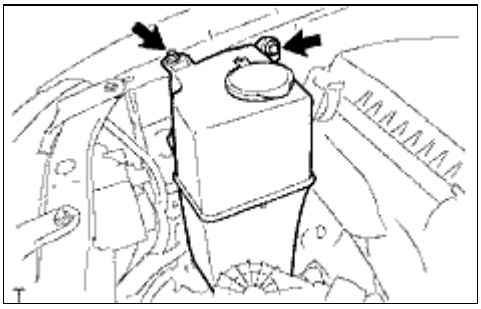


If the result is not as specified, replace the air pump heater relay.

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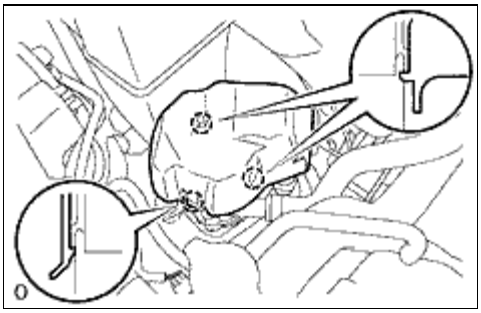
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175O01FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR PUMP: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL



1. SEPARATE WINDSHIELD WASHER JAR ASSEMBLY

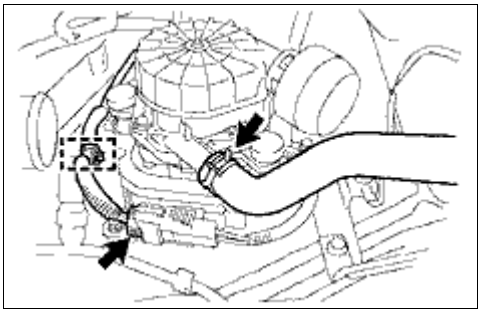
(a) Remove the 2 bolts and separate the windshield washer jar assembly from the engine room compartment.



2. REMOVE AIR PUMP COVER (for Automatic Transmission)

(a) Disengage the 3 claws and remove the air pump cover from the air pump assembly.

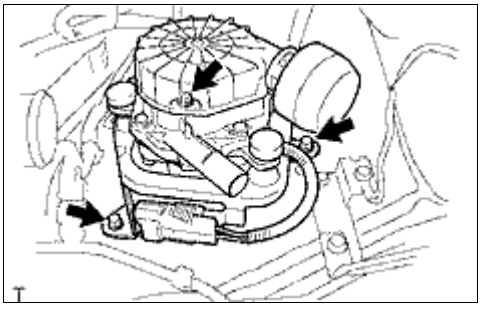
3. REMOVE AIR PUMP ASSEMBLY



(a) Loosen the hose clip and disconnect the No. 1 air injection system hose from the air pump assembly.

(b) Disconnect the air pump assembly connector.

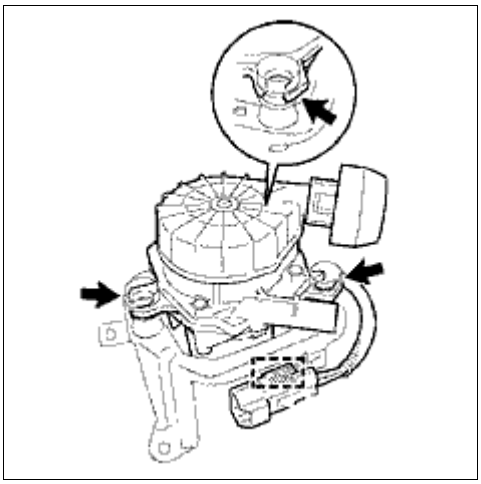
(c) Disengage the wire harness clamp and separate the wire harness from the air pump bracket.



(d) Remove the 3 bolts and the air pump assembly with air pump bracket from the engine room compartment.

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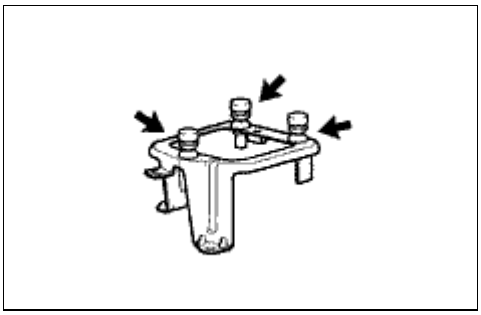
(e) Disengage the air pump assembly connector clamp and separate the air pump assembly connector from the air pump bracket.



(f) Disengage the 3 fittings of the air pump insulator and remove the air pump assembly from the air pump bracket.

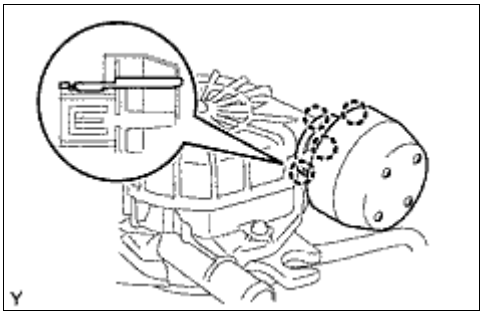
4. REMOVE AIR PUMP INSULATOR

(a) Remove the 3 air pump insulators from the air pump bracket.



5. REMOVE INLET AIR PUMP

(a) Disengage the 4 claws and remove the inlet air pump from the air pump assembly.

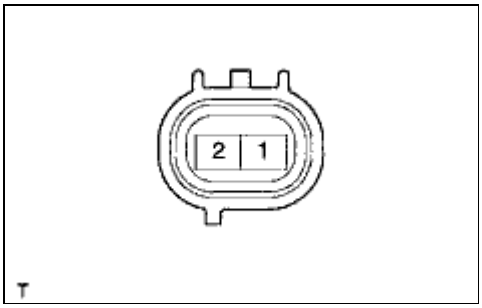


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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175Q00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR SWITCHING VALVE: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT AIR SWITCHING VALVE ASSEMBLY



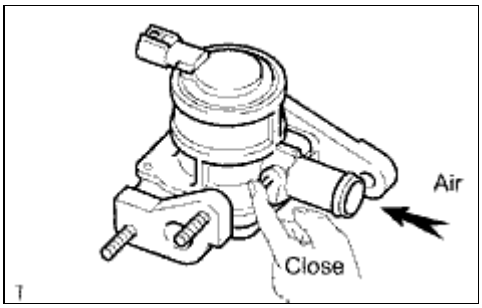
(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.

Resistance:
4.5 to 5.5 Ω at 20°C (68°F)

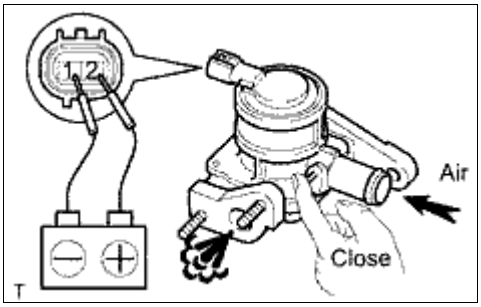
If the result is not as specified, replace the air switching valve.

(b) Check the operation.



(1) Check that air does not flow from the port.

(2) Apply battery positive voltage across the terminals.



(3) Check that air flows from the port.

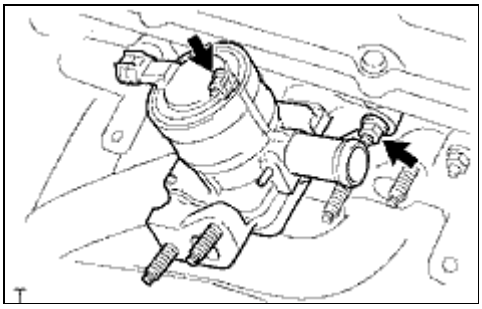
If the operation is not as specified, replace the air switching valve.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175P00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR SWITCHING VALVE: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL AIR SWITCHING VALVE ASSEMBLY



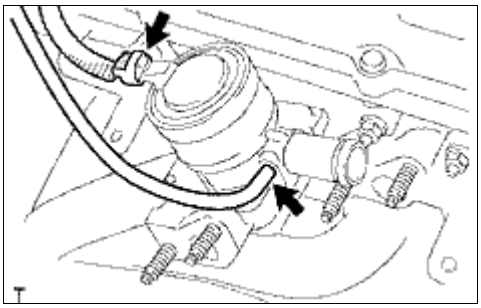
(a) Install a new gasket onto the cylinder head.

(b) Install the air switching valve with the 2 nuts.

Torque:

20 N·m {204 kgf·cm, 15ft·lbf}

(c) Connect the air switching valve connector.



(d) Connect the vacuum hose.

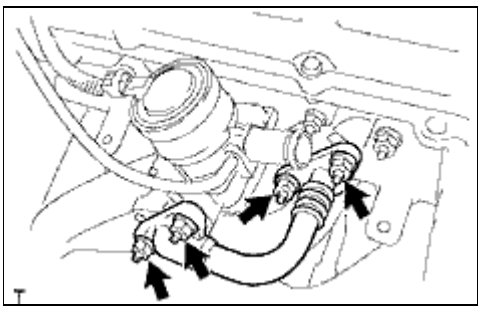
2. INSTALL INTAKE PIPE INSULATOR

(a) Install 2 new gaskets onto the cylinder head and air switching valve.

(b) Install the intake pipe insulator with the 4 nuts.

Torque:

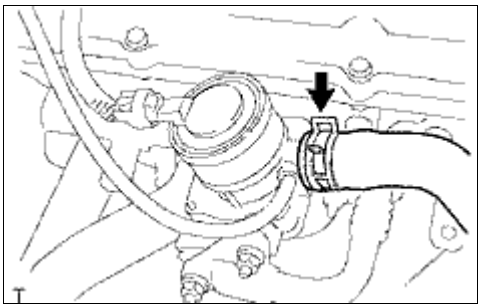
20 N·m {204 kgf·cm, 15ft·lbf}



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3. CONNECT AIR INJECTION SYSTEM NO.1 HOSE

(a) Connect the air injection system No. 1 hose to the air switching valve.

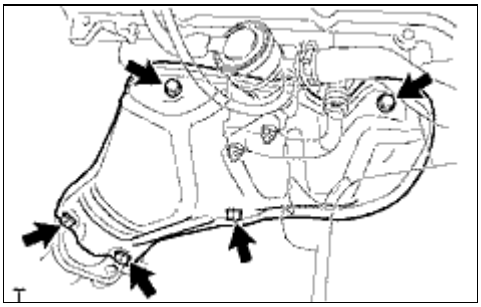


4. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.1

(a) Install the exhaust manifold heat insulator No. 1 with the 5 bolts.

Torque:

12 N·m {122 kgf·cm, 9ft·lbf}



5. INSTALL AIR CLEANER CAP SUB-ASSEMBLY

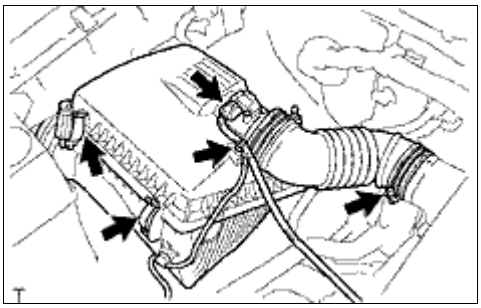
(a) Install the air cleaner cap together with the air cleaner hose No. 1.

(b) Connect the 2 air cleaner clamps.

(c) Tighten the hose clamp bolt, then connect the air cleaner hose No. 1.

(d) Connect the wire harness clamp.

(e) Connect the mass air flow meter connector.



6. INSTALL INTAKE AIR CONNECTOR INFO

7. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175R00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: AIR SWITCHING VALVE: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

2. REMOVE INTAKE AIR CONNECTOR INFO

3. REMOVE AIR CLEANER CAP SUB-ASSEMBLY

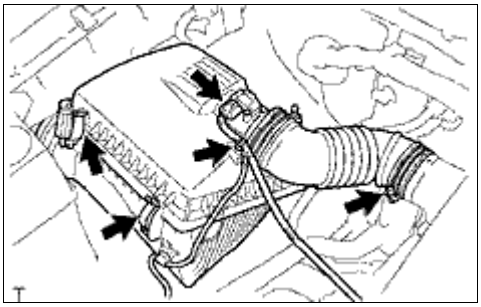
(a) Disconnect the mass air flow meter connector.

(b) Disconnect the wire harness clamp.

(c) Loosen the hose clamp bolt, then disconnect the air cleaner hose No. 1.

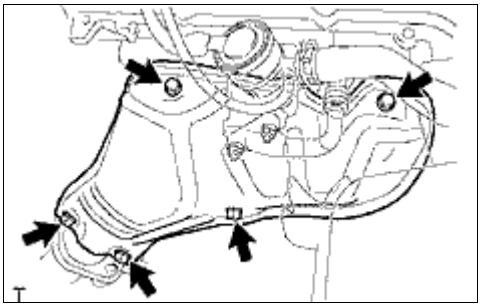
(d) Disconnect the 2 air cleaner clamps.

(e) Remove the air cleaner cap together with the air cleaner hose No. 1.



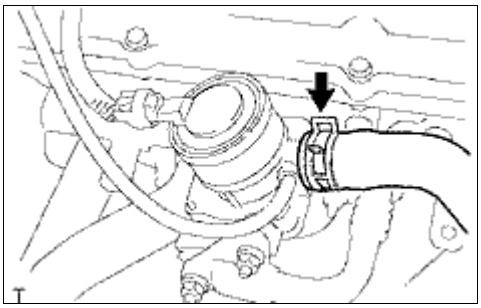
4. REMOVE NO.1 EXHAUST MANIFOLD HEAT INSULATOR

(a) Remove the 5 bolts, then remove the exhaust manifold heat insulator No. 1.



5. DISCONNECT AIR INJECTION SYSTEM NO.1 HOSE

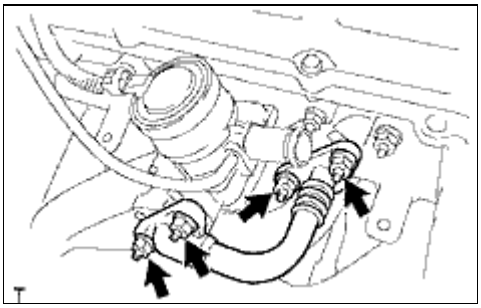
(a) Disconnect the air injection system No. 1 hose from the air switching valve.



6. REMOVE INTAKE PIPE INSULATOR

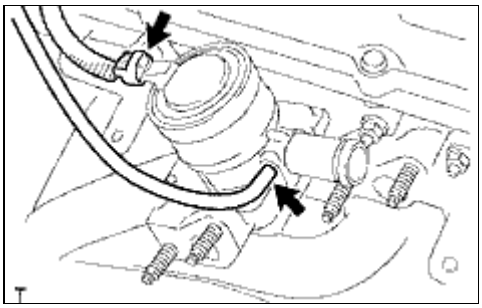
(a) Remove the 4 nuts, then remove the intake pipe insulator.

(b) Remove the 2 gaskets.



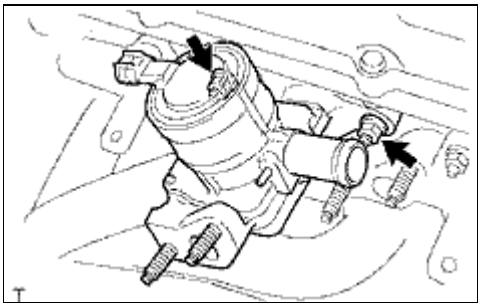
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7. REMOVE AIR SWITCHING VALVE ASSEMBLY



(a) Disconnect the vacuum hose.

(b) Disconnect the air switching valve connector.



(c) Remove the 2 nuts, then remove the air switching valve.

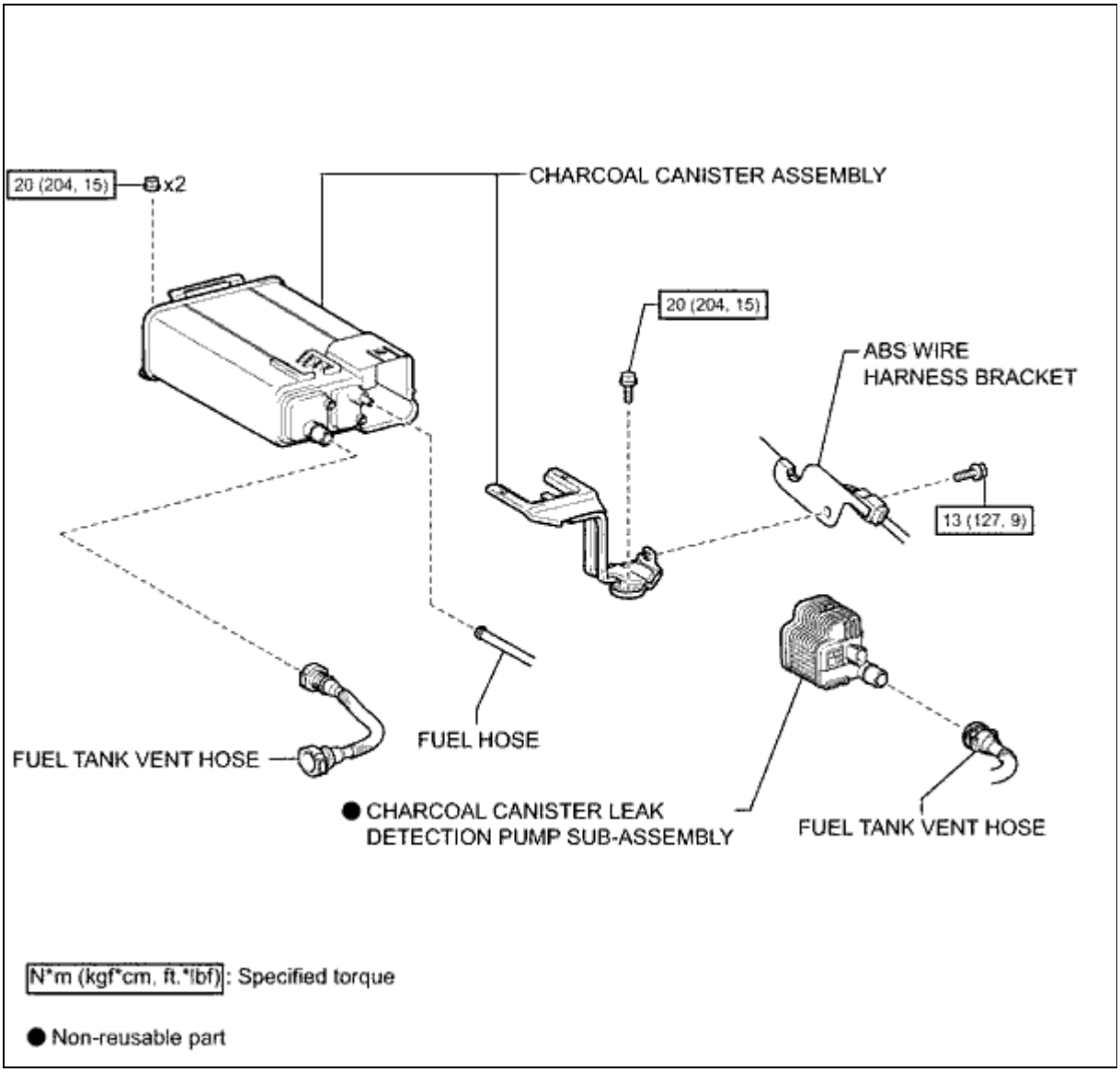
(d) Remove the gasket.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000050KW004X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: CANISTER: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION

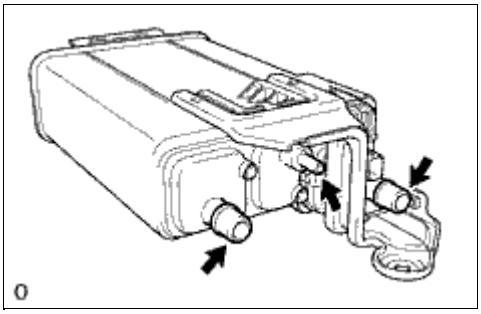


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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175J00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: CANISTER: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT CHARCOAL CANISTER ASSEMBLY

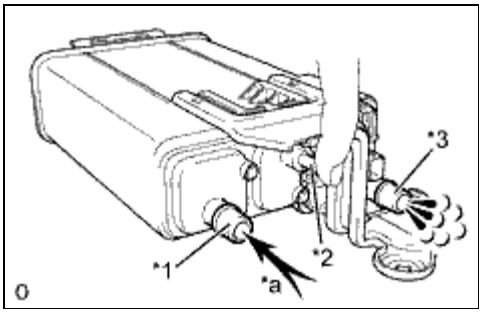


(a) Visually check the charcoal canister assembly.

(1) Visually check the charcoal canister assembly for cracks or damage.

If cracks or damage are found, replace the charcoal canister assembly.

(b) Check charcoal canister assembly operation.



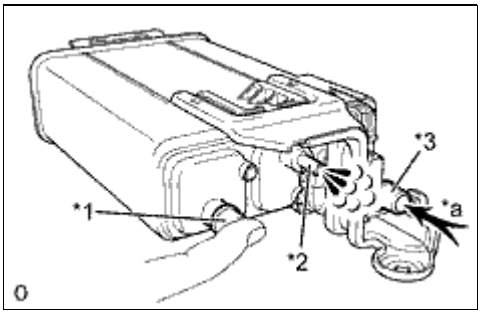
(1) With the purge port closed, blow 5 kPa (0.05 kgf*cm ^{2} , 0.7 psi) of air into the vent port, and check that air flows from the air inlet port.

Text in Illustration

*1	Vent Port
*2	Purge Port
*3	Air Inlet Port
*a	Air

If the result is not as specified, replace the charcoal canister assembly.

(2) With the vent port closed, blow 5 kPa (0.05 kgf*cm 2 , 0.7 psi) of air into the air inlet port, and check that air flows from the purge port.



Text in Illustration

*1	Vent Port
*2	Purge Port
*3	Air Inlet Port

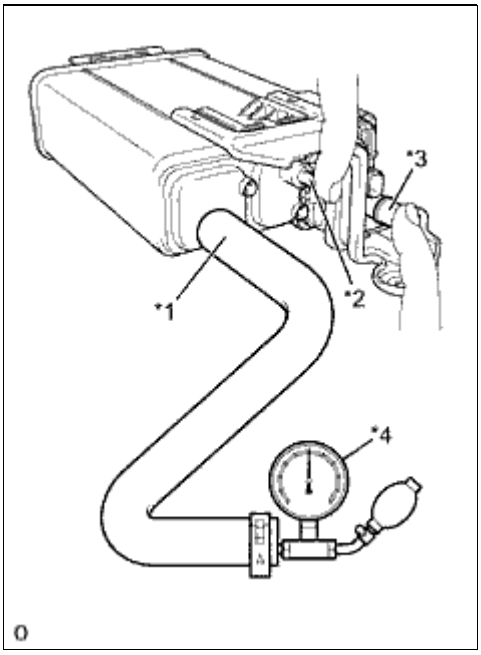
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*a	Air

If the result is not as specified, replace the charcoal canister assembly.

(c) Check for air leaks.

(1) Connect a pressure gauge to the vent port of the charcoal canister assembly.



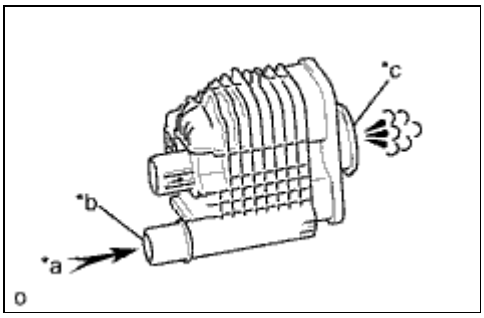
Text in Illustration

*1	Vent Port
*2	Purge Port
*3	Air Inlet Port
*4	Pressure Gauge

(2) With the purge port and the air inlet port closed, apply 20 kPa (150 mmHg, 5.91 in.Hg) of pressurized air into the vent port, then confirm that pressure is retained for 1 minute.

If the result is not as specified, replace the charcoal canister assembly.

(d) Check the charcoal canister leak detection pump sub-assembly.



(1) Check that air flows from port A to port B.

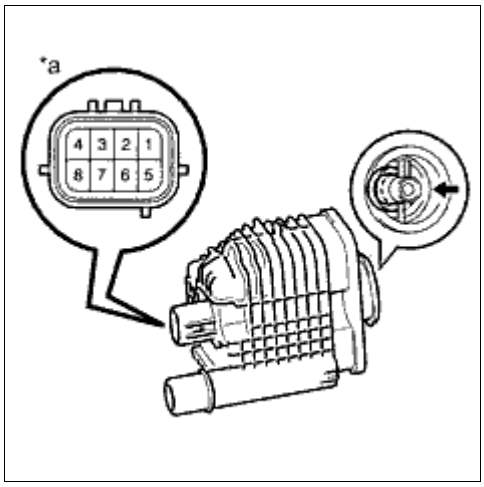
Text in Illustration

*a	Air
*b	Port A
*c	Port B

If the result is not as specified, charcoal canister leak detection pump sub-assembly.

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(2) Connect the positive (+) lead of the battery to terminal 5 and the negative (-) lead to terminal 1.



Text in Illustration

*a	Component without harness connected (Leak Detection Pump Sub-assembly)

(3) Check that the valve is closed.

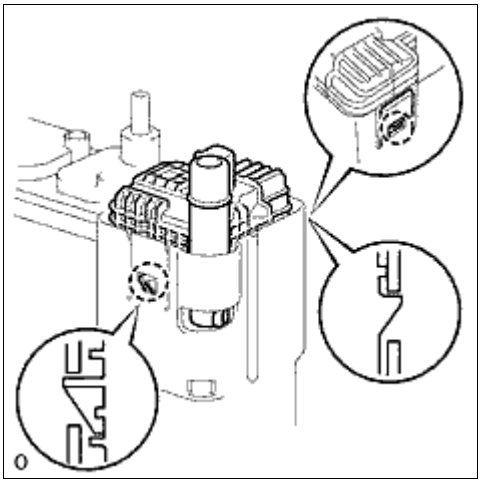
If the result is not as specified, replace the charcoal canister leak detection pump sub-assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175I00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: CANISTER: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL CHARCOAL CANISTER LEAK DETECTION PUMP SUB-ASSEMBLY



(a) Engage the 2 claws to install a new charcoal canister leak detection pump sub-assembly to the charcoal canister assembly.

NOTICE:

- Do not allow foreign matter such as grease, oil or water to adhere to the O-rings.
- Ensure that the claws are engaged properly.

(b) Engage the claw and install the No. 2 charcoal canister bracket to the charcoal canister assembly.

2. INSTALL CHARCOAL CANISTER ASSEMBLY

(a) Connect the fuel tank vent hose to the charcoal canister assembly.

(1) Align the fuel tank vent hose connector with the charcoal canister assembly, then push in the fuel tank vent hose until the retainer makes a "click" sound to connect the fuel tank vent hose to the charcoal canister assembly.

NOTICE:

- Check that there are no scratches or foreign objects on the disconnected parts of the fuel tank vent hose and charcoal canister assembly before performing the work.
- After connecting the fuel tank vent hose, check that the fuel tank vent hose is securely connected by pulling the quick connector.

(b) Install the charcoal canister assembly to the frame sub-assembly with the bolt and 2 nuts.

Torque:

20 N·m {204 kgf·cm, 15ft·lbf}

(c) Connect the fuel hose to the charcoal canister assembly with hose clip.

(d) Connect the charcoal canister leak detection pump sub-assembly connector.

3. CONNECT FUEL TANK VENT HOSE

(a) Connect the fuel tank vent hose to the charcoal canister assembly.

(1) Align the fuel tank vent hose connector with the charcoal canister assembly, then push in the fuel tank vent hose until the retainer makes a "click" sound to connect the fuel tank vent hose to the charcoal canister assembly.

NOTICE:

- Check that there are no scratches or foreign objects on the disconnected parts of the fuel tank vent hose

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and charcoal canister assembly before performing the work.

- After connecting the fuel tank vent hose, check that the fuel tank vent hose is securely connected by pulling the quick connector.

(b) Install the ABS wire harness bracket to the charcoal canister assembly with the bolt.

Torque:

13 N·m {127 kgf·cm, 9ft·lbf}

4. INSTALL FUEL TANK ASSEMBLY

INFO

5. INSPECT FOR FUEL LEAK INFO

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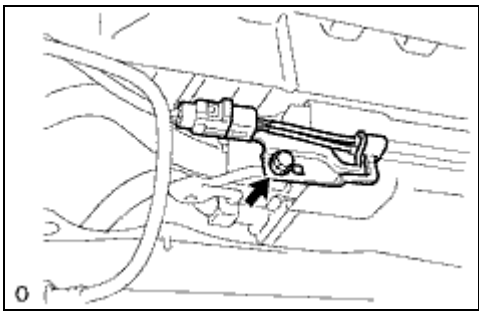
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175K00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: CANISTER: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE FUEL TANK ASSEMBLY

INFO

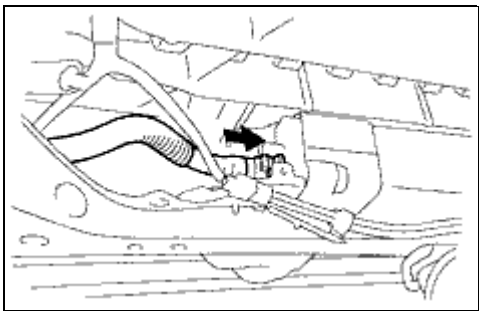
2. REMOVE FUEL TANK VENT HOSE



(a) Remove the bolt and separate the ABS wire harness bracket from the charcoal canister assembly.

(b) Disconnect the fuel tank vent hose from the charcoal canister assembly.

(1) Push the fuel tank vent hose deep inside.

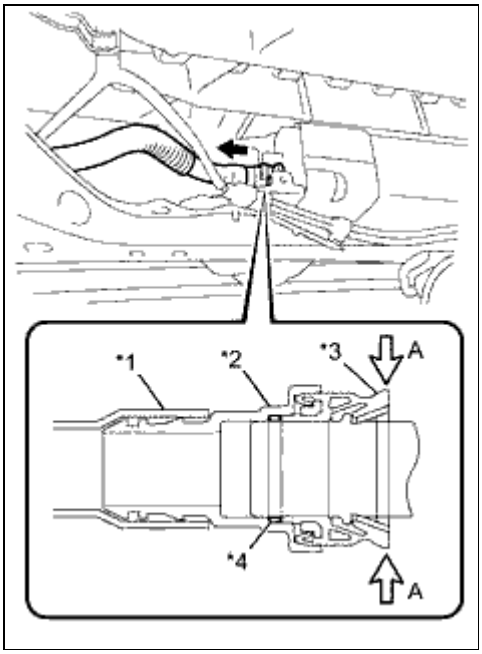


Text in Illustration

➡	Push

(2) Pinch portion A, as shown in the illustration.

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Text in Illustration

*1	Nylon Tube
*2	Fuel Tank Vent Hose Retainer
*3	Fuel Tank Vent Hose Connector
*4	O-ring
➡	Pull
⇨	Pinch

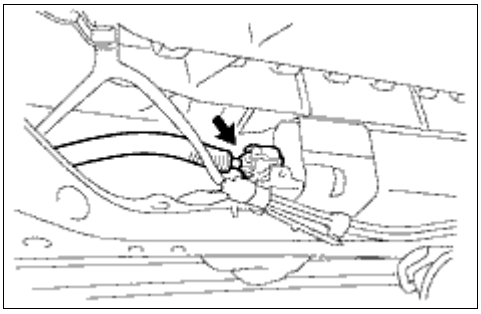
(3) Pull out the fuel tank vent hose from the charcoal canister assembly.

NOTICE:

- Remove any dirt and foreign objects from the fuel tank vent hose connector before performing the work.
- Do not allow any scratches or foreign objects on the parts when disconnecting, as the fuel tank vent hose connector has the O-ring that seals the pipe.
- Perform the work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tank vent hose.
- If the fuel tank vent hose connector and pipe are stuck, push and pull them to release.

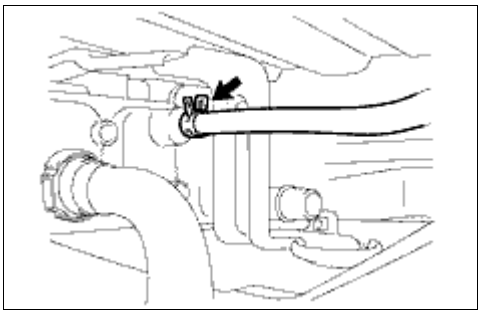
3. REMOVE CHARCOAL CANISTER ASSEMBLY

(a) Disconnect the charcoal canister assembly connector.

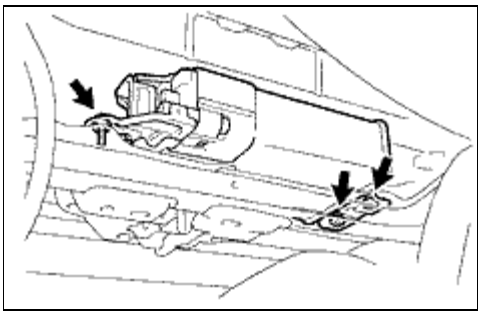


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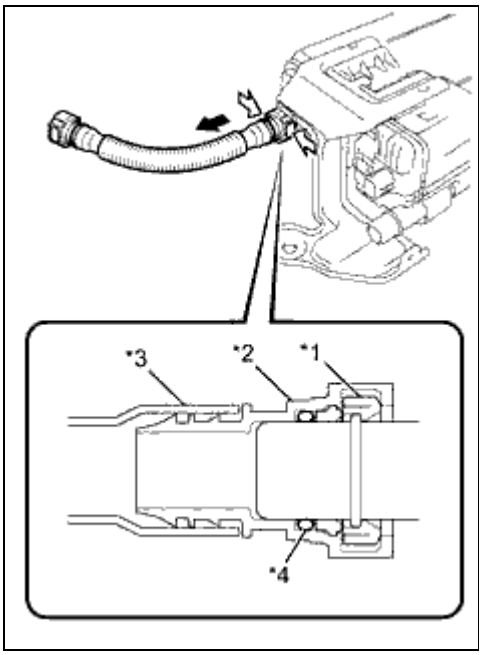
(b) Loosen the hose clip and disconnect the fuel hose from the charcoal canister assembly.



(c) Remove the bolt, 2 nuts and the charcoal canister assembly from the frame sub-assembly.



(d) Disconnect the fuel tank vent hose.



(1) Pinch the retainer and pull the fuel tank vent hose connector out of the charcoal canister to disconnect the fuel tank vent hose from the charcoal canister assembly.

Text in Illustration

*1	Fuel Tank Vent Hose Connector Retainer
*2	Fuel Tank Vent Hose Connector
*3	Nylon Tube
*4	O-ring
➡	Pull

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⇨	Pinch

NOTICE:

- Remove any dirt and foreign objects from the fuel tank vent hose connector before performing the work.
- Do not allow any scratches or foreign objects on the parts when disconnecting, as the fuel tank vent hose connector has the O-ring that seals the pipe.
- Perform the work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tank vent hose.
- If the fuel vent connector and pipe are stuck, push and pull them to release.

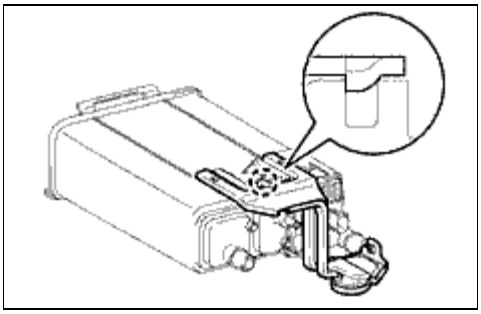
4. REMOVE CHARCOAL CANISTER LEAK DETECTION PUMP SUB-ASSEMBLY

(a) Before removing the leak detection pump subassembly, clean the canister by blowing air into it to ensure that the canister is free of foreign matter.

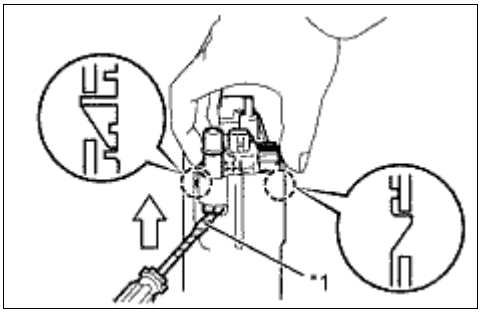
NOTICE:

- Make sure to clean the canister using only air.
- Do not use gasoline, thinners or solvents.

(b) Disengage the claw and remove the No. 2 charcoal canister bracket from the charcoal canister assembly.



(c) While disengaging the 2 claws as shown in the illustration, push the charcoal canister leak detection pump sub-assembly upwards using a screwdriver to remove charcoal canister leak detection pump sub-assembly.



Text in Illustration

*1	Protective Tape

(d) Check if the charcoal canister assembly contains foreign matter such as mud or water.

(1) Visually check that the inside of the charcoal canister assembly is free of foreign matter.

(2) Hold the charcoal canister assembly upside down to make sure that the charcoal canister assembly is free of foreign matter. If the charcoal canister assembly contains foreign matter, replace the charcoal canister assembly.

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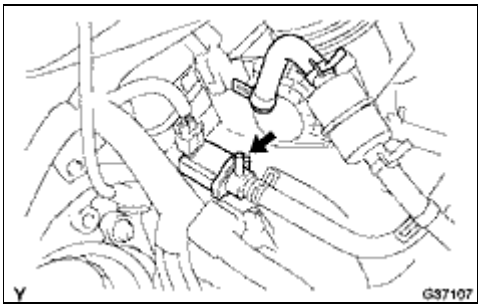
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175C00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: EMISSION CONTROL SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. REMOVE PURGE VSV

(a) Connect the Techstream to the DLC3.

(b) Disconnect the No. 1 fuel vapor feed hose from the purge VSV.



(c) Start the engine and turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for EVAP Control.

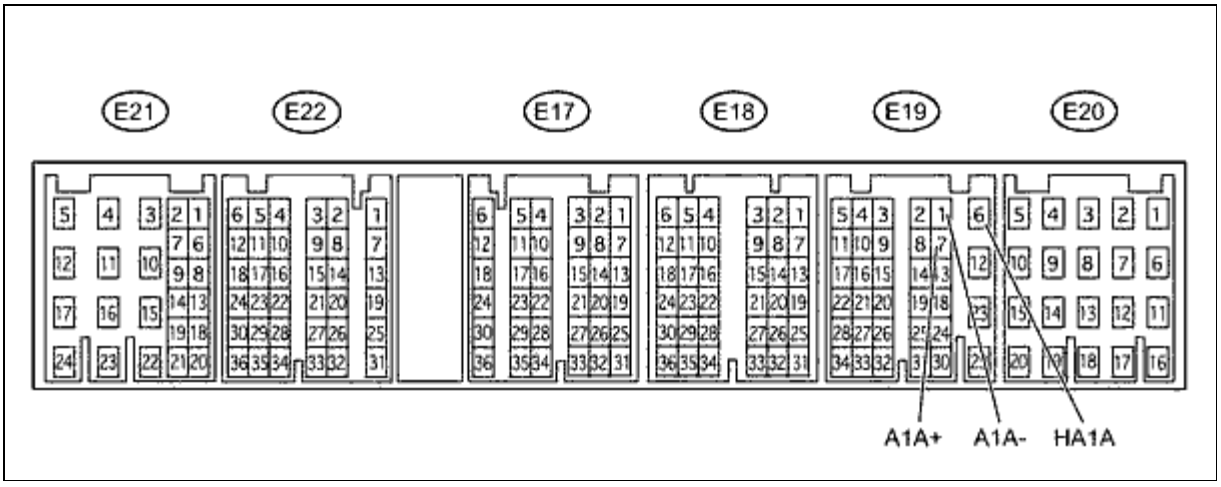
OK:

TESTER OPERATION	SPECIFIED CONDITION
EVAP VSV: OFF	Purge VSV has no suction
EVAP VSV: ON	Purge VSV has suction

(e) Connect the No. 1 fuel vapor feed hose to the purge VSV.

2. INSPECT AIR FUEL RATIO COMPENSATION SYSTEM

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



Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION

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TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E19-7 (A1A+) - E19-6 (HA1A)	Ignition switch ON	3.3 V
E19-1 (A1A-) - E19-6 (HA1A)	Ignition switch ON	2.9 V

NOTICE:

Connect test leads from the back side of the connector. Do not disconnect the connectors from the ECM.

HINT:

Voltage between the terminals of the ECM is kept constant regardless of the voltage of the air fuel ratio sensor.

(b) Start the engine and warm it up.

(c) Turn the ignition switch to off.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / AFS Voltage B1 S1 and O2S B1 S2.

(g) Warm up the air fuel ratio sensor with the engine speed at 2500 rpm for approximately 2 minutes.

(h) Rev the engine several times and confirm that the value of "Short FT #1" changes in response to the value of "AFS Voltage B1S1".

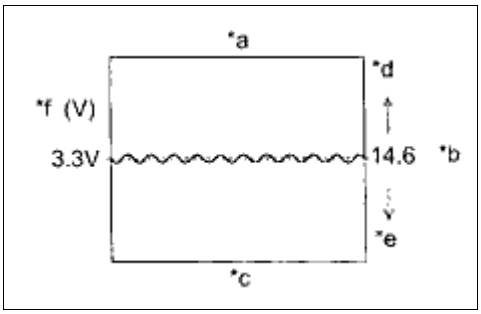
OK:

The "Short FT #1" changes in response to the "AFS Voltage B1S1)".

(i) Maintain the engine speed at 2500 rpm and confirm that the display on the Techstream, when AFS Voltage B1S1 is selected, is as shown in the illustration.

Text in Illustration

*a	Keep Engine Speed
*b	Air Fuel Ratio
*c	Time
*d	Lean
*e	Rich
*f	Air Fuel Ratio Sensor Output



HINT:

- The illustration may slightly differ from the display on the Techstream.
- Only the Techstream displays the waveform of the air fuel ratio sensor.

CAUTION:

- Perform the check immediately after warming up the engine.
- If the voltage variation could not be verified, warm up the air fuel ratio sensor again. If it could not be verified even after warming up the sensor again, check the DTC No. INFO .

3. INSPECT FUEL CUT OFF RPM

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(a) Start the engine and warm it up.

(b) Increase the engine speed to at least 3500 rpm.

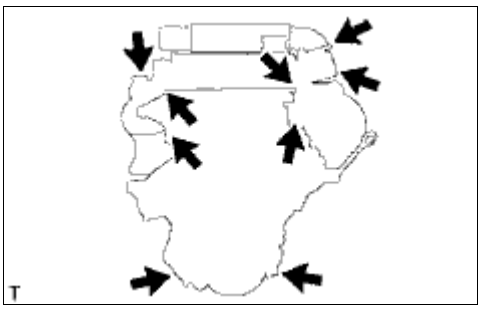
(c) Use a sound scope to check for injector operation noise.

(d) Check that when the accelerator pedal is released, injector operation noise stops momentarily, and then resumes.

If the result is not as specified, check the fuel injector assembly, wiring and ECM.

4. VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

(a) Check that there are no cracks, leaks or damage.



NOTICE:

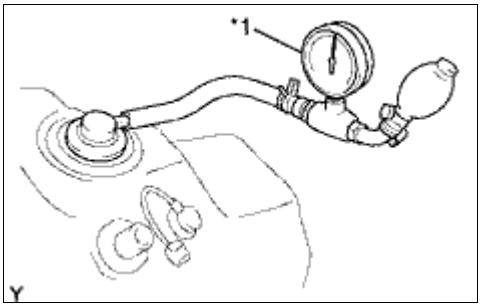
- Detachment or other problems with the engine oil dipstick, filler cap sub-assembly, ventilation hose and other components may cause the engine to run improperly.
- Air suction caused by disconnections, looseness or cracks in the parts of the air induction system between the throttle with motor body assembly and cylinder head sub-assembly will cause engine failure or engine malfunctions.

If the result is not as specified, replace parts as necessary.

5. INSPECT FUEL CUTOFF VALVE AND FILL CHECK

(a) Remove the fuel tank assembly INFO .

(b) Connect the pressure gauge to the vent hose port.



Text in Illustration

*1	Pressure Gauge

(c) Install the fuel tank assembly with the fuel tank vent hose disconnected.

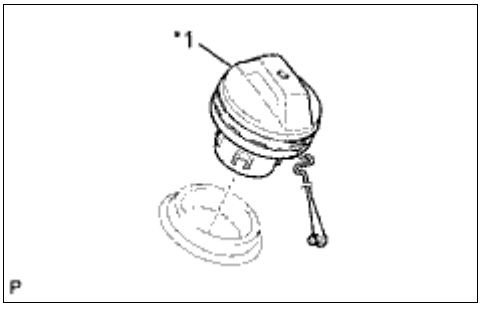
(d) Fill the fuel tank assembly with fuel.

(e) Apply pressure of 4 kPa (41 gf/cm ^{2} , 0.58 psi) to the vent port of the fuel tank assembly.

HINT:

Check the amount of fuel left in the fuel tank assembly.

(f) Remove the fuel tank cap assembly, and check that the pressure decreases.



Text in Illustration

*1	Fuel Tank Cap Assembly

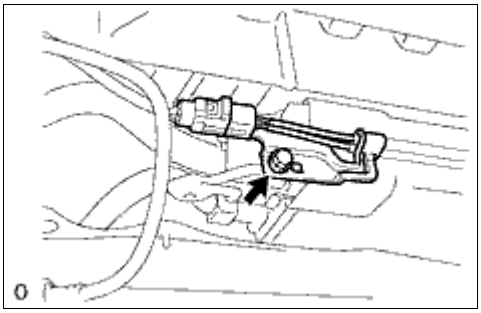
If the pressure does not decrease, replace the fuel tank assembly.

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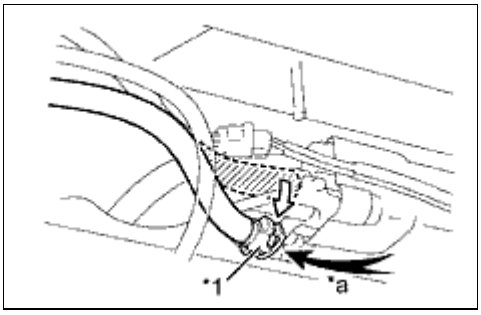
(g) Reconnect the fuel tank vent hose to the fuel tank assembly.

6. INSPECT AIR INLET LINE

(a) Remove the bolt and separate the ABS wire harness bracket from the charcoal canister assembly.



(b) Disconnect the fuel tank vent hose from the charcoal canister assembly.



Text in Illustration

*1	Fuel Tank Vent Hose
*a	Air

(c) Check that there is ventilation in the fuel tank vent hose.

If air cannot flow freely into the fuel tank vent hose, repair or replace the fuel tank vent hose.

(d) Reconnect the fuel tank vent hose to the charcoal canister assembly.

(e) Install the ABS wire harness bracket to the charcoal canister assembly with the bolt.

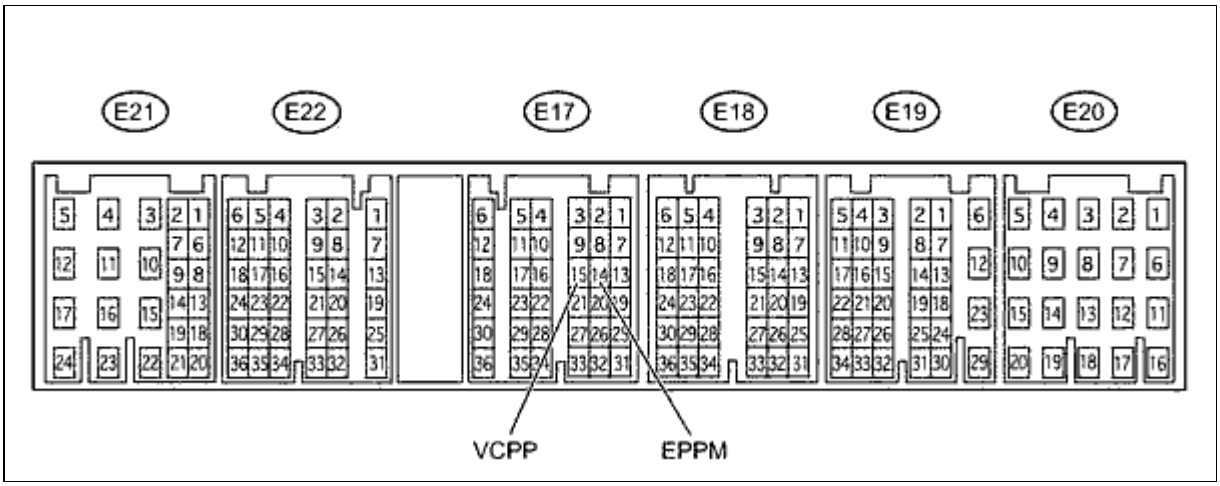
Torque:

13 N·m {127 kgf·cm, 9ft·lbf}

7. INSPECT CHARCOAL CANISTER ASSEMBLY (Pressure Sensor)

(a) Check the power source voltage for pressure sensor.

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



Standard Voltage:

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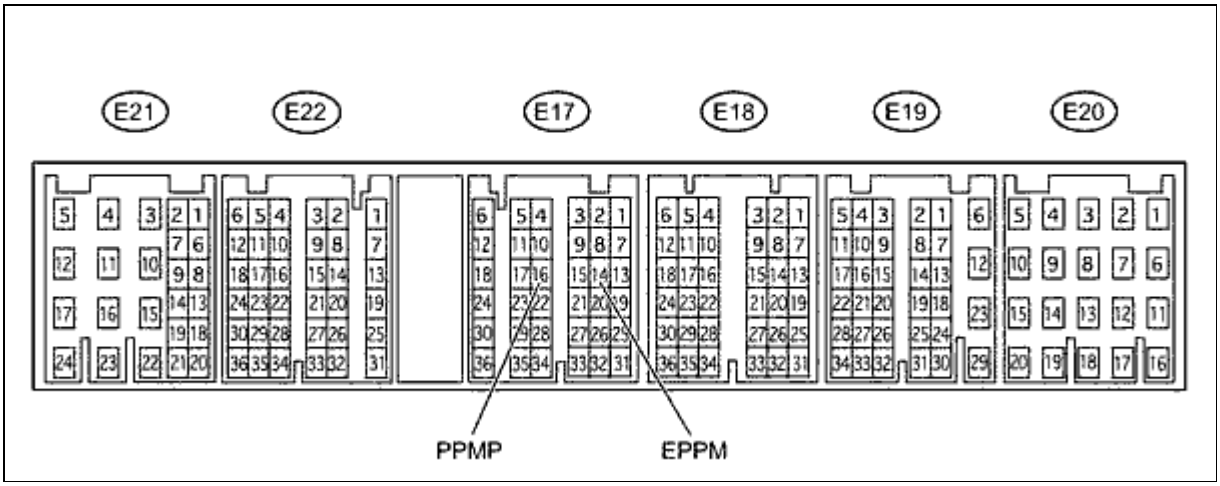
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E17-15 (VCPP) - E17-14 (EPPM)	Ignition switch ON	4.5 to 5.5 V

If the voltage is not as specified, check the ECM, charcoal canister assembly and wire harness.

(b) Check the output voltage of pressure sensor.

(1) Remove the fuel tank cap.

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



Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E17-16 (PPMP) - E17-14 (EPPM)	Ignition switch ON	3.0 to 3.6 V

If the voltage is not as specified, check the ECM, charcoal canister assembly and wire harness.

(3) Install the fuel tank cap assembly.

8. INSPECT MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Check the power source voltage.

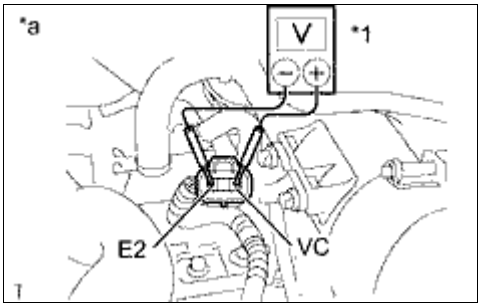
(1) Disconnect the manifold absolute pressure sensor connector.

(2) Turn the ignition switch to ON.

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

Text in Illustration

*1	Voltmeter
*a	Front view of wire harness connector (to Manifold Absolute Pressure Sensor)

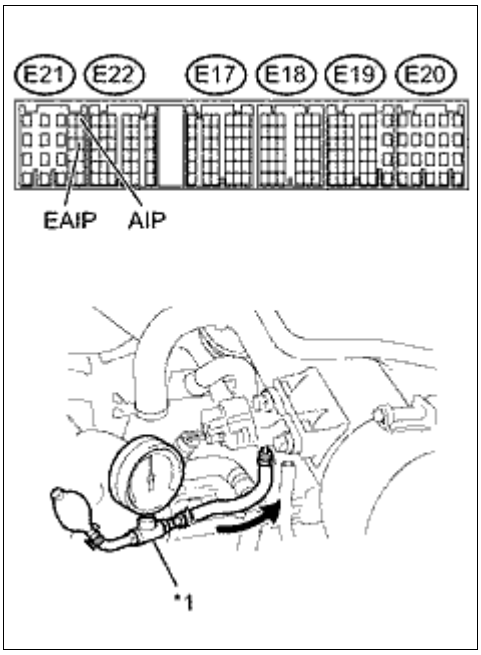


Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A8-3 (VC) - A8-1 (E2)	Ignition switch ON	4.5 to 5.5 V

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(b) Check the supply power.



(1) Apply air to the manifold absolute pressure sensor at the pressures shown in the table below.

(2) Connect a voltmeter to terminals AIP (E21-1) and EAIP (E21-8) of the ECM and measure the output voltage under ambient atmospheric pressure.

Text in Illustration

*1	Pressure Gauge

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-1 (AIP) - E21-8 (EAIP)	Applied positive pressure of 19.6 kPa (0.20 kgf/cm ^{2} , 2.84 psi)	0.1 to 0.4 V
	Applied positive pressure of 39.2 kPa (0.40 kgf/cm ^{2} , 5.69 psi)	0.4 to 0.7 V
	Applied positive pressure of 58.8 kPa (0.60 kgf/cm ^{2} , 8.53 psi)	0.7 to 1.0 V
	Applied positive pressure of 78.5 kPa (0.80 kgf/cm ^{2} , 11.4 psi)	1.0 to 1.3 V
	Applied positive pressure of 98.0 kPa (1.00 kgf/cm ^{2} , 14.2 psi)	1.3 to 1.6 V

9. INSPECT SECONDARY AIR INJECTION SYSTEM OPERATION

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON and turn the Techstream on.

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(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN, AIR PUMP: OFF, ASV: CLOSE.

HINT:

When Manual Mode is selected, Techstream initialization (atmospheric pressure measurement) is performed automatically. Initialization takes 10 seconds. After initialization, AIR PUMP and ASV operation can be selected.

(f) Start the engine.

(g) Perform the secondary air injection system forced operation while the engine is idling.

(h) Check that the status of the air pump (AIR PUMP), ASV and pressure in the secondary air injection system passage (PRESSURE) displayed on the Techstream matches the conditions shown in the table below.

Standard:

TESTER OPERATION	AIR PUMP	AIR SWITCHING VALVE	PRESSURE*1	PULSATION*2
AIR PUMP: ON, ASV: OPEN	ON	OPEN	1 kPa or higher	15 kPa or higher
AIR PUMP: OFF, ASV: CLOSE	OFF	CLOSE	Below 3 kPa	Below 25 kPa

*1: Average pumping pressure (gauge pressure). The pressure should be 1 kPa or higher when the secondary air injection system operates.

*2: The cumulative exhaust pulsation calculated by the ECM. If the calculated value exceeds a certain level, the ECM determines that the exhaust pulsation is in the secondary air injection system.

(i) Turn the ignition switch off.

NOTICE:

- The Secondary Air Injection Check operation only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates this (WAIT or ERROR).

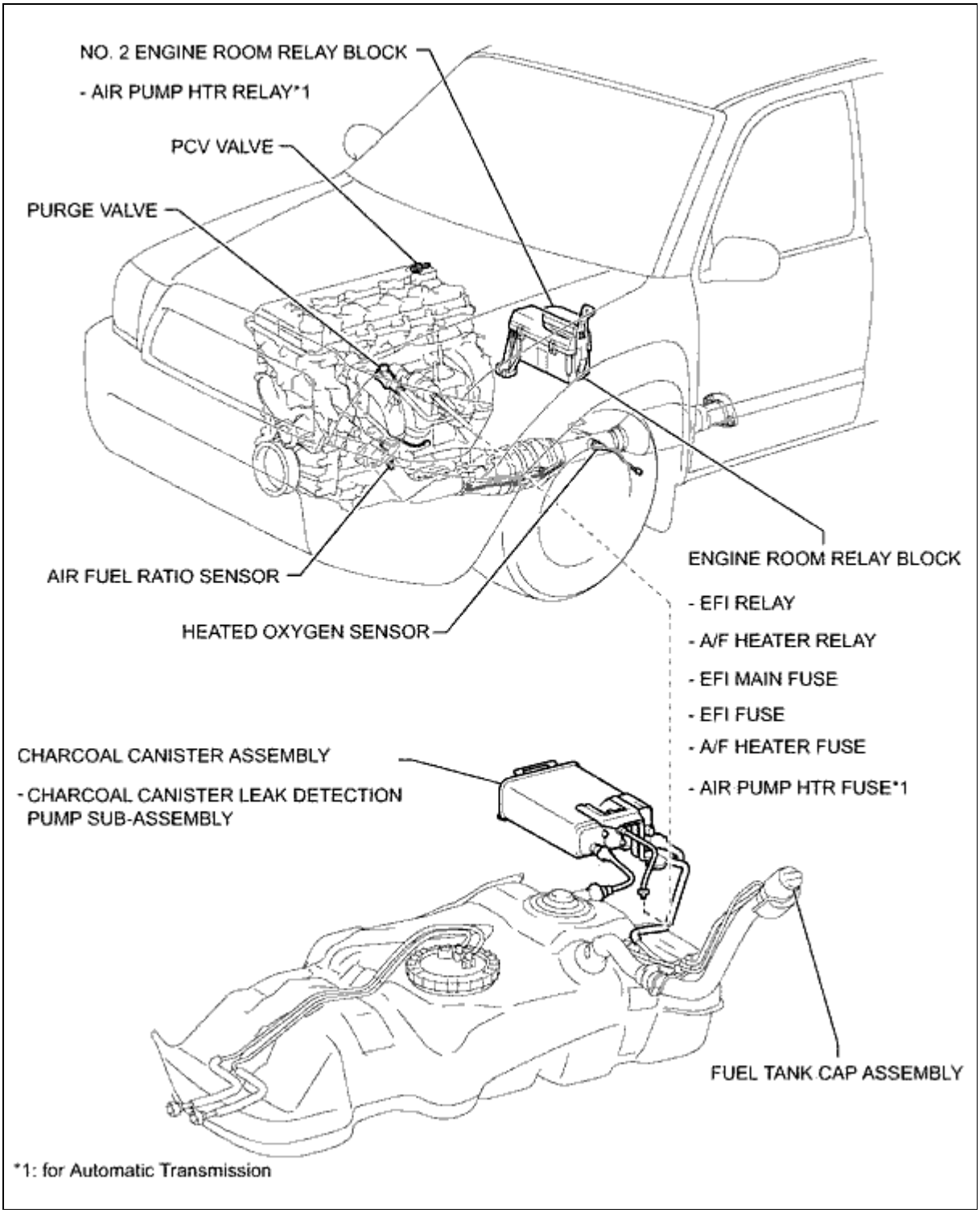
  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check operation repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between Secondary Air Injection Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM00000175A00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: EMISSION CONTROL SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

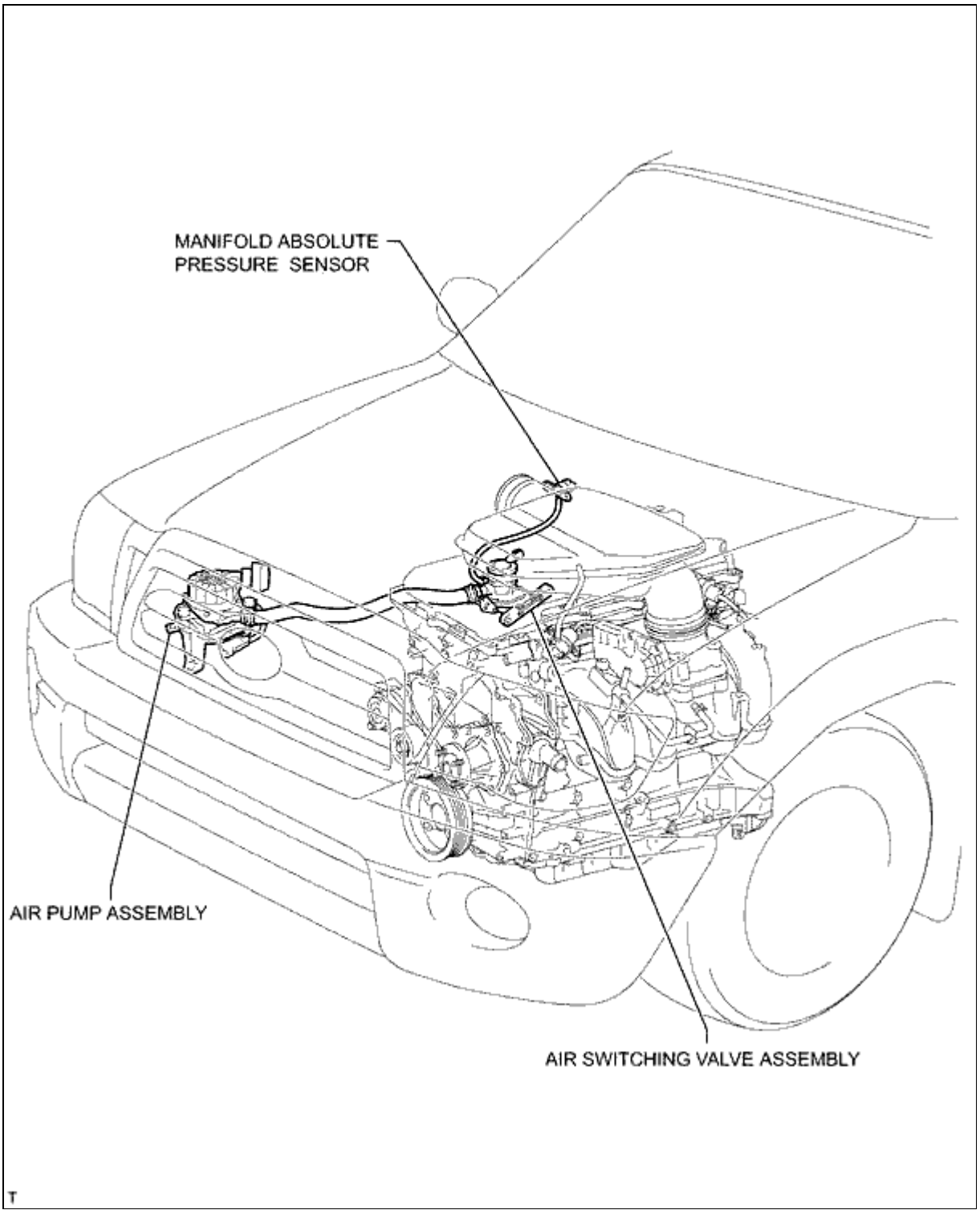
PARTS LOCATION

ILLUSTRATION



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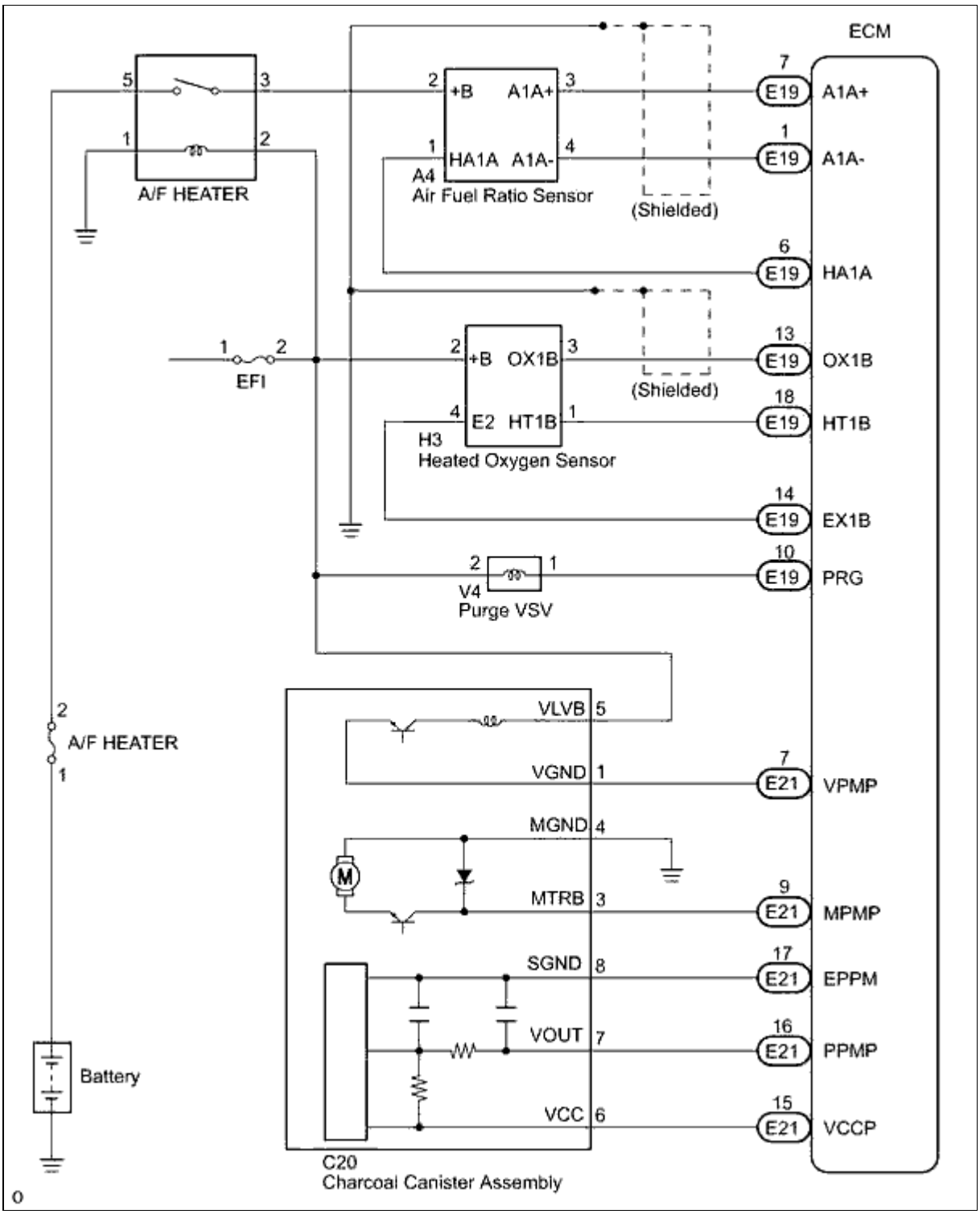
ILLUSTRATION



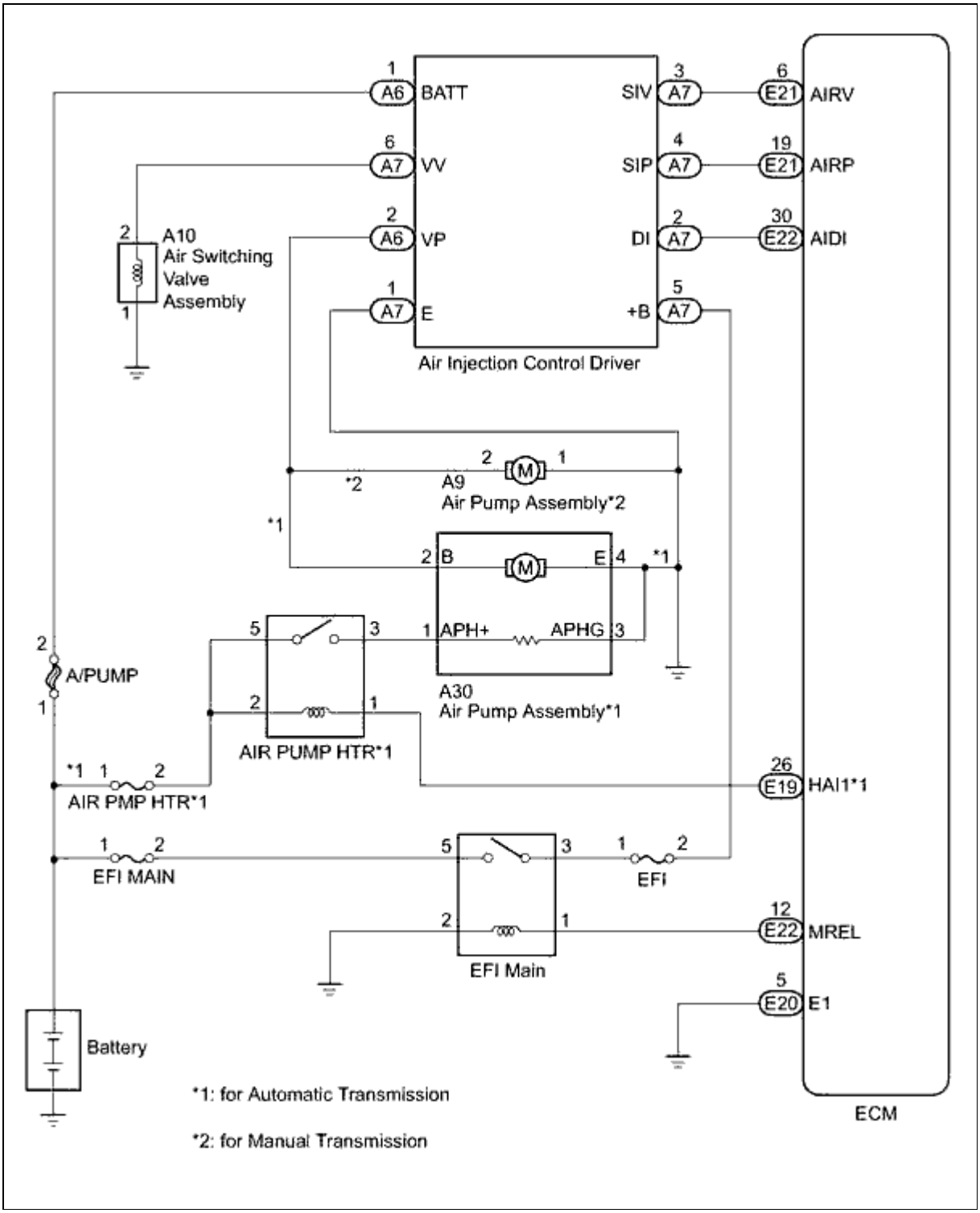
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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM00000175B00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: EMISSION CONTROL SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM



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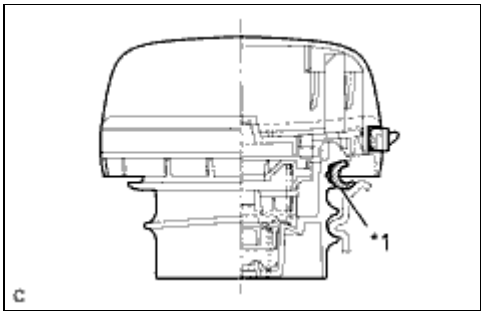
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175H00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: FUEL TANK CAP: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT FUEL TANK CAP ASSEMBLY

(a) Check the appearance of the fuel tank cap assembly.

(1) Check that there is no deformation or damage to the fuel tank cap assembly or fuel tank cap gasket.



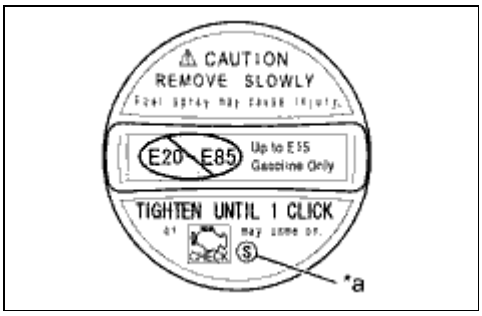
Text in Illustration

*1	Fuel Tank Cap Gasket

If there is any deformation or damage, replace the fuel tank cap assembly or fuel tank cap gasket.

NOTICE:

Confirm that ID mark S is printed on the replacement fuel tank cap assembly.



Text in Illustration

*a	ID Mark

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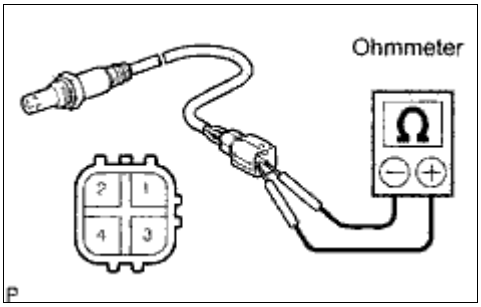
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175E00VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: HEATED OXYGEN SENSOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT HEATED OXYGEN SENSOR

(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.



Standard:

TESTER CONNECTION	SPECIFIED CONDITION
1 (HT1B) - 2 (+B)	11 to 16 Ω at 20°C (68°F)
1 (HT1B) - 4 (E2)	10 kΩ or higher

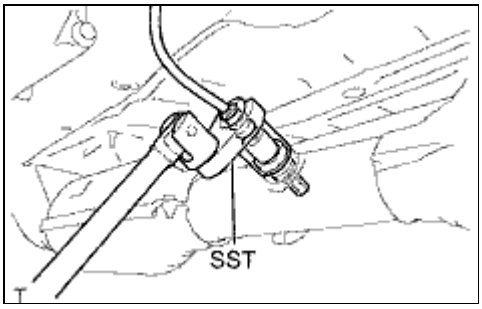
If the result is not as specified, replace the heated oxygen sensor.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175D00VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: HEATED OXYGEN SENSOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL HEATED OXYGEN SENSOR



(a) Using SST, install the heated oxygen sensor.

SST: 09224-00010

Torque:

44 N·m {449 kgf·cm, 33ft·lbf}

40 N·m {408 kgf·cm, 30ft·lbf} with SST

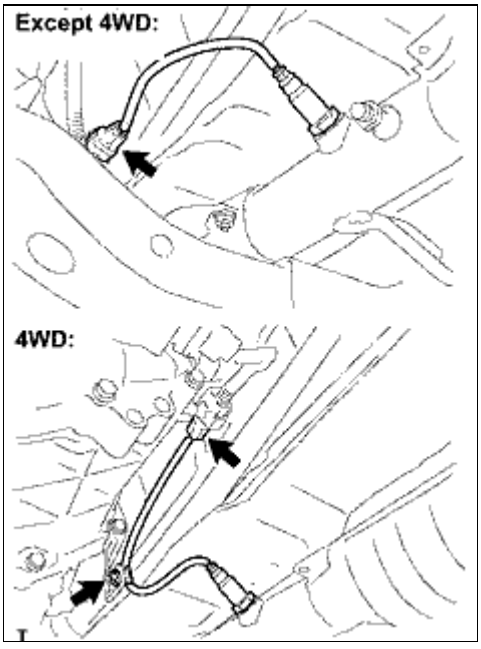
NOTICE:

Use a torque wrench with a fulcrum length of 300 mm (11.81 in.).

HINT:

Perform "Inspection After Repairs" after replacing the heated oxygen sensor INFO .

(b) Connect the wire harness clamp. (4WD DRIVE TYPE)



(c) Connect the oxygen sensor connector.

2. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

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Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

3. CHECK FOR EXHAUST GAS LEAKAGE

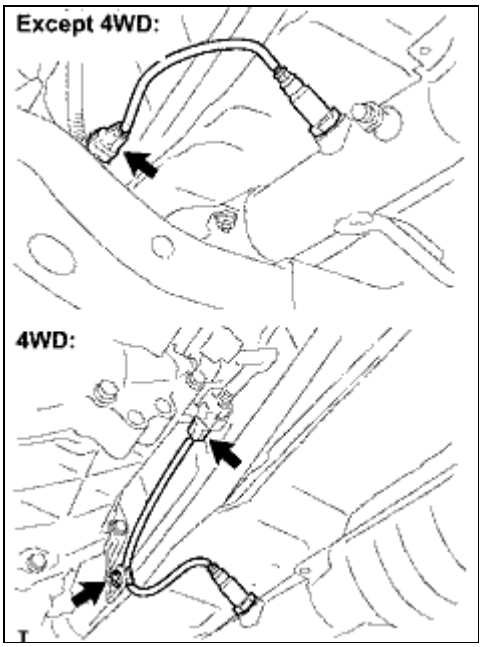
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000175F00VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: HEATED OXYGEN SENSOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

2. REMOVE HEATED OXYGEN SENSOR

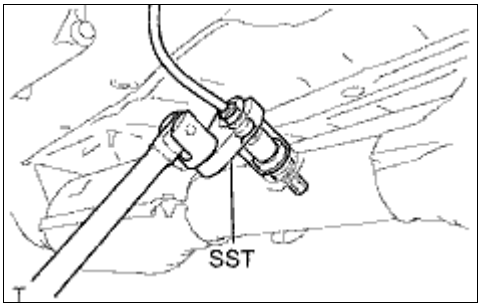


(a) Disconnect the heated oxygen sensor connector.

(b) Disconnect the wire harness clamp. (4WD DRIVE TYPE)

(c) Using SST, remove the heated oxygen sensor.

SST: 09224-00010



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000W9K00KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: PCV VALVE: INSPECTION; 2016 MY Tacoma [08/2015 -]		

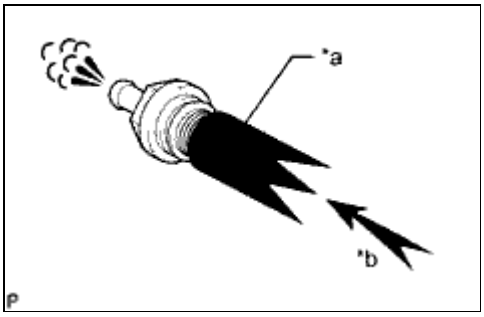
INSPECTION

1. INSPECT PCV VALVE

(a) Install a clean hose to the PCV valve.

(b) Check the PCV valve operation.

(1) Blow air into the cylinder head side, and check that air passes through easily.



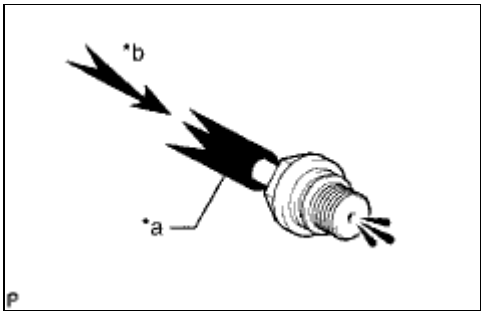
Text in Illustration

*a	Clean Hose
*b	Cylinder Head Sub-assembly Side
➡	Air

CAUTION:

Do not suck air through the PCV valve. Petroleum substances inside the PCV valve are hazardous to your health.

(2) Blow air into the intake manifold side, and check that air passes through with difficulty.



Text in Illustration

*a	Clean Hose
*b	Intake Manifold Side
➡	Air

If the result is not as specified, replace the PCV valve.

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(c) Remove the clean hose from the PCV valve.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000175L00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EMISSION CONTROL: PURGE VALVE: INSPECTION; 2016 MY Tacoma [08/2015 -]		

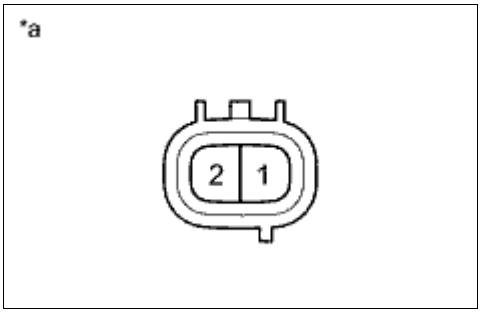
INSPECTION

1. INSPECT PURGE VSV

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

Text in Illustration

*a	Component without harness connected (Purge VSV)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	23 to 26 Ω

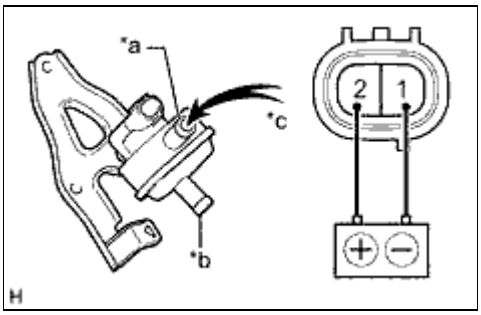
If the result is not as specified, replace the purge VSV.

(b) Check the operation of the purge VSV.

(1) Apply battery voltage between the terminals of the purge VSV and check that the following occurs when blowing air into the port (E).

Text in Illustration

*a	Port (E)
*b	Port (F)
*c	Air



OK:

MEASUREMENT CONDITION	SPECIFIED CONDITION
Battery voltage applied between terminals 1 and 2	Air flows from port (F)
Battery voltage not applied between terminals 1 and 2	Air does not flow

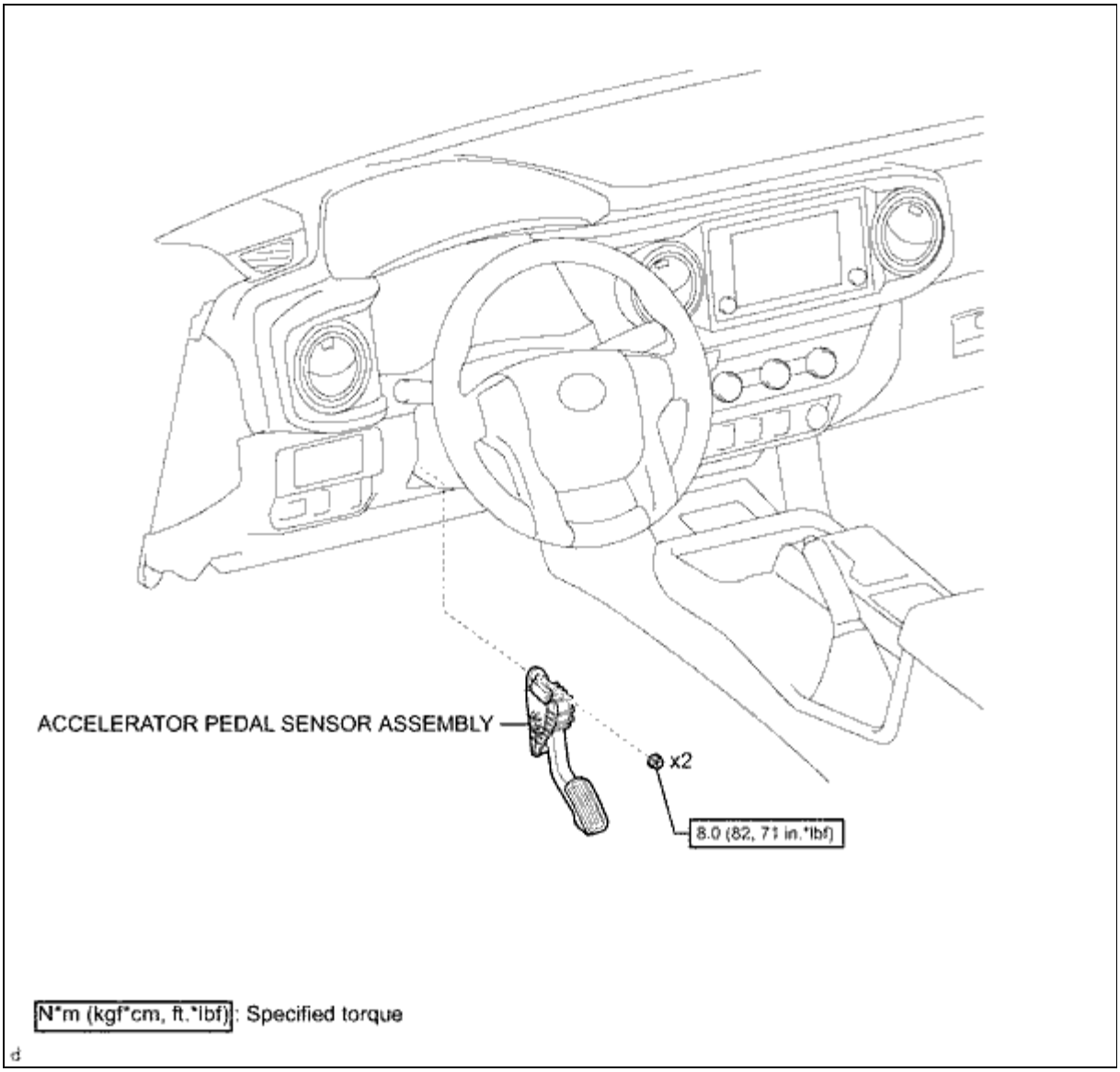
If the result is not as specified, replace the purge VSV.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000028B101JX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ACCELERATOR PEDAL: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000016M800AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ACCELERATOR PEDAL: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL ACCELERATOR PEDAL SENSOR ASSEMBLY

NOTICE:

This accelerator pedal sensor assembly does not require lubrication. Do not apply oil or other lubrication to the accelerator pedal sensor assembly. If applied, the accelerator pedal sensor assembly must be replaced.

(a) Install the accelerator pedal sensor assembly to the vehicle body with the 2 bolts.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

NOTICE:

- Avoid any physical impact to the accelerator pedal sensor assembly.
- Do not disassemble the accelerator pedal sensor assembly.

(b) Connect the accelerator pedal sensor assembly connector.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000WQ802IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ACCELERATOR PEDAL: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT ACCELERATOR PEDAL SENSOR ASSEMBLY

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) When depressing or releasing the accelerator pedal, check that the values of Accel Sensor Out No. 1 and Accel Sensor Out No. 2 are within the specification.

Standard Voltage:

ITEM	CONDITION	SPECIFIED CONDITION
Accel Sensor Out No. 1	Released	0.5 to 1.1 V
	Depressed	2.6 to 4.5 V
Accel Sensor Out No. 2	Released	1.2 to 2.0 V
	Depressed	3.4 to 4.75 V

If the result is not as specified, check the accelerator pedal sensor assembly, wire harness and ECM.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000016M900AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ACCELERATOR PEDAL: REMOVAL; 2016 MY Tacoma [08/2015 -]		

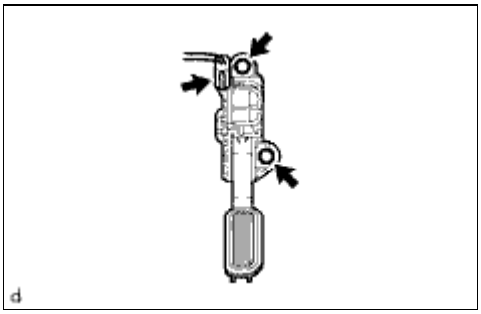
REMOVAL

1. REMOVE ACCELERATOR PEDAL SENSOR ASSEMBLY

NOTICE:

This accelerator pedal sensor assembly does not require lubrication. Do not apply oil or other lubrication to the accelerator pedal sensor assembly. If applied, the accelerator pedal sensor assembly must be replaced.

(a) Disconnect the accelerator pedal sensor assembly connector.



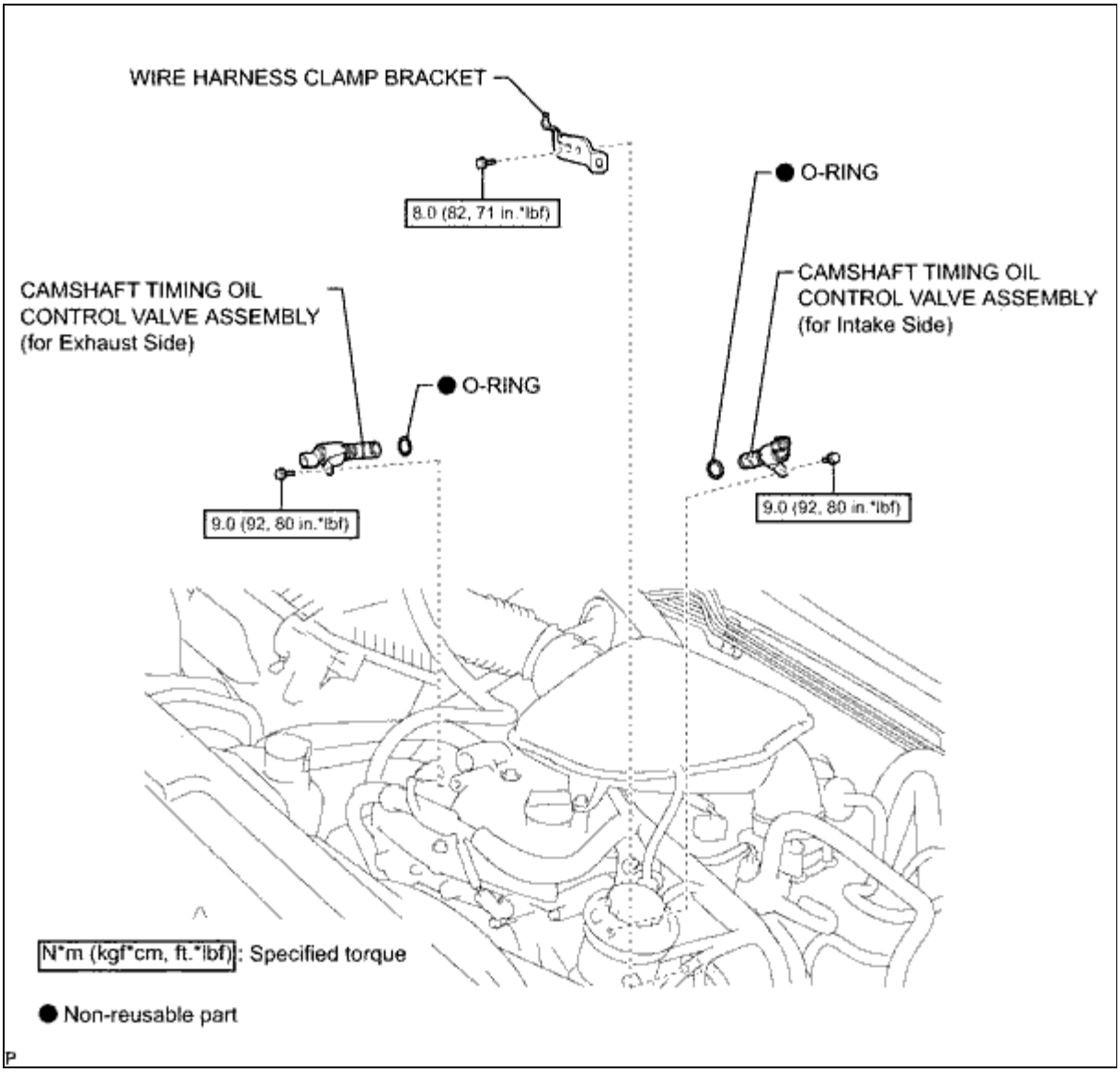
(b) Remove the 2 bolts and accelerator pedal sensor assembly from the vehicle body.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000045FG00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT OIL CONTROL VALVE: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000Q7405KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT OIL CONTROL VALVE: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

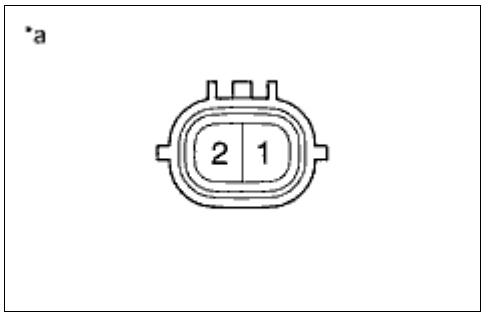
1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Check the resistance.

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

Text in Illustration

*a	Component without harness connected (Camshaft Timing Oil Control Valve Assembly)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

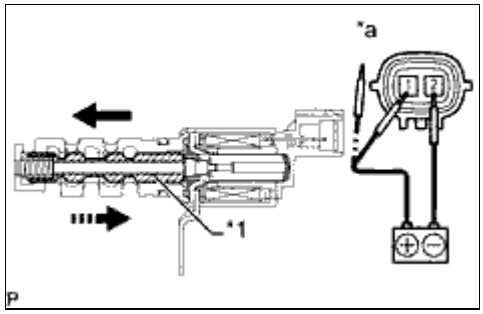
If the result is not as specified, replace the camshaft timing oil control valve assembly.

(b) Check the operation.

(1) Connect a battery positive (+) lead to terminal 1 and negative (-) lead to terminal 2, and check the movement of the spool valve.

Text in Illustration

*1	Spool Valve
*a	Component without harness connected (Camshaft Timing Oil Control Valve Assembly)



OK:

MEASUREMENT CONDITION	SPECIFIED CONDITION
Battery positive (+) voltage is applied	Valve moves in left arrow direction shown in illustration
Battery positive (+) voltage is cut off	Valve moves in right arrow direction shown in illustration

HINT:

Problems in the spool valve returning caused by sticking of sludge or foreign objects sometimes cause slight pressure leaks

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to the advanced side and result in detection of DTCs.

If the spool valve is struck, replace the camshaft timing oil control valve assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000111E00MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT OIL CONTROL VALVE: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)

(a) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve assembly.

NOTICE:

Do not damage the O-ring when installing.

HINT:

An O-ring is already installed in a new camshaft timing oil control valve assembly. So, the O-ring only needs to be coated with engine oil when the assembly is replaced with a new one.

(b) Install the camshaft timing oil control valve assembly to the cylinder head sub-assembly with the bolt.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

NOTICE:

- Replace with a new part if it is dropped or if it receives a strong impact.
- Make sure that the O-ring is not cracked or jammed when installing.

(c) Connect the camshaft timing oil control valve assembly connector.

(d) Install the wire harness clamp bracket to the intake manifold with the bolt.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(e) Engage the 2 clamps to install the wire harness.

2. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)

(a) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve assembly.

NOTICE:

Do not damage the O-ring when installing.

HINT:

An O-ring is already installed in a new camshaft timing oil control valve assembly. So, the O-ring only needs to be coated with engine oil when the assembly is replaced with a new one.

(b) Install the camshaft timing oil control valve assembly to the cylinder head cover sub-assembly with the bolt.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

NOTICE:

- Replace with a new part if it is dropped or if it receives a strong impact.
- Make sure that the O-ring is not cracked or jammed when installing.

(c) Connect the camshaft timing oil control valve assembly connector.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000013JV00MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT OIL CONTROL VALVE: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) for Intake Side:

(1) Connect the Techstream to the DLC3.

(2) Start the engine.

(3) Turn the Techstream on.

(4) Warm up the engine.

(5) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Linear (Bank 1).

(6) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Specified Condition:

CONTROL RANGE	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

If the result is not as specified, check the camshaft timing oil control valve assembly, wire harness and ECM.

(b) for Exhaust Side:

(1) Connect the Techstream to the DLC3.

(2) Start the engine.

(3) Turn the Techstream on.

(4) Warm up the engine.

(5) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Exhaust Linear (Bank 1).

(6) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Specified Condition:

CONTROL RANGE	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

If the result is not as specified, check the camshaft timing oil control valve assembly, wire harness and ECM.

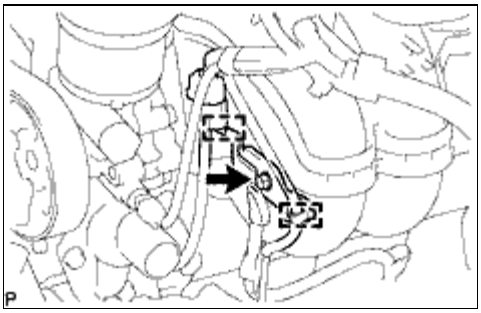
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000111G00MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT OIL CONTROL VALVE: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

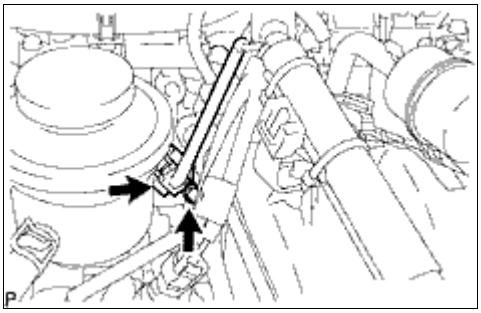
1. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)

(a) Disengage the 2 clamps to separate the wire harness.



(b) Remove the bolt and wire harness clamp bracket from the intake manifold.

(c) Disconnect the camshaft timing oil control valve assembly connector.

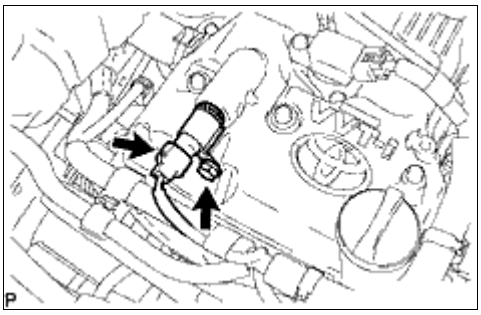


(d) Remove the bolt and camshaft timing oil control valve assembly from the cylinder head sub-assembly.

(e) Remove the O-ring from the camshaft timing oil control valve assembly.

2. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)

(a) Disconnect the camshaft timing oil control valve assembly connector.



(b) Remove the bolt and camshaft timing oil control valve assembly from the cylinder head cover sub-assembly.

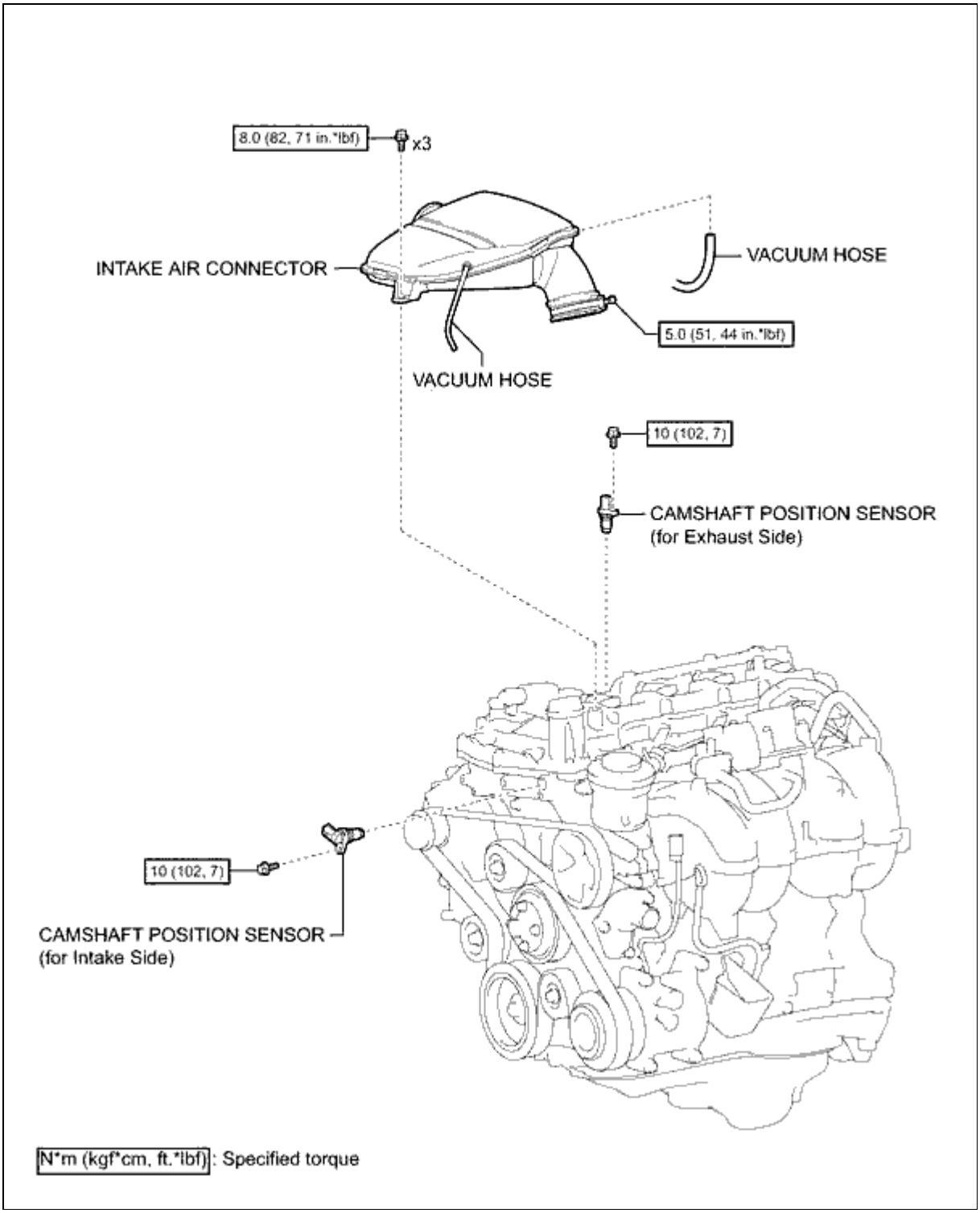
(c) Remove the O-ring from the camshaft timing oil control valve assembly.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000045FL00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT POSITION SENSOR: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017EA00OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT POSITION SENSOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side)

(a) Apply a light coat of engine oil to the O-ring of the camshaft position sensor.

(b) Install the camshaft position sensor to the timing chain cover sub-assembly with the bolt.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}

NOTICE:

- When reusing the camshaft position sensor, inspect the O-ring.
- Make sure that the O-ring is not cracked or jammed when installing the camshaft position sensor.

(c) Connect the camshaft position sensor connector.

2. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side)

(a) Apply a light coat of engine oil to the O-ring of the camshaft position sensor.

(b) Install the camshaft position sensor to the cylinder head cover sub-assembly with the bolt.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}

NOTICE:

- When reusing the camshaft position sensor, inspect the O-ring.
- Make sure that the O-ring is not cracked or jammed when installing the camshaft position sensor.

(c) Connect the camshaft position sensor connector.

3. INSTALL INTAKE AIR CONNECTOR INFO

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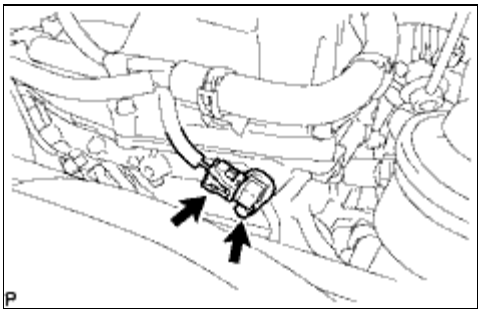
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017EC00OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CAMSHAFT POSITION SENSOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE INTAKE AIR CONNECTOR INFO

2. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side)

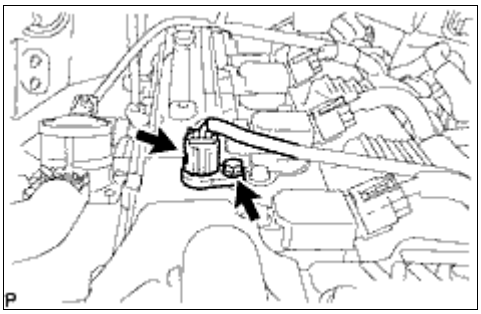
(a) Disconnect the camshaft position sensor connector.



(b) Remove the bolt and camshaft position sensor from the timing chain cover sub-assembly.

3. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side)

(a) Disconnect the camshaft position sensor connector.



(b) Remove the bolt and camshaft position sensor from the cylinder head cover sub-assembly.

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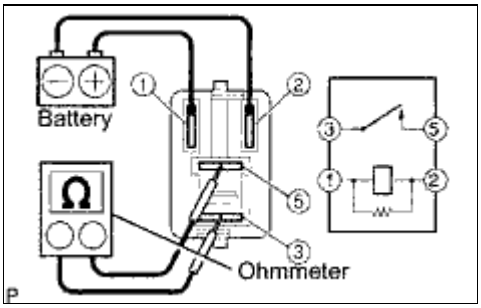
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000016ZH00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CIRCUIT OPENING RELAY: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT CIRCUIT OPENING RELAY ASSEMBLY

(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.



Standard:

TESTER CONNECTION	SPECIFIED CONDITION
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

If the result is not as specified, replace the circuit opening relay assembly.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017E800MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CRANKSHAFT POSITION SENSOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT CRANKSHAFT POSITION SENSOR

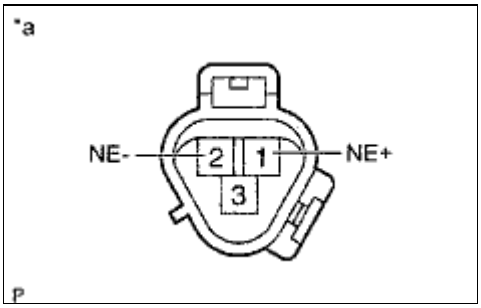
(a) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*a	Component without harness connected (Crankshaft Position Sensor)

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (NE+) - 2 (NE-)	Cold	1630 to 2740 Ω
	Hot	2065 to 3225 Ω



HINT:

In the table above, the terms "Cold" and "Hot" refer to the temperature of the sensor. "Cold" means approximately -10 to 50°C (14 to 122°F). "Hot" means approximately 50 to 100°C (122 to 212°F).

If the result is not as specified, replace the crankshaft position sensor.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017E700NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CRANKSHAFT POSITION SENSOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL CRANKSHAFT POSITION SENSOR

(a) Apply a light coat of engine oil to the O-ring of the crankshaft position sensor.

(b) Install the crankshaft position sensor to the timing chain cover sub-assembly with the bolt.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

NOTICE:

- When reusing the crankshaft position sensor, inspect the O-ring.
- Make sure that the O-ring is not cracked or jammed when installing the crankshaft position sensor.

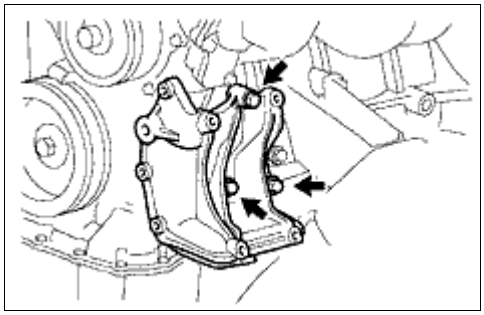
(c) Engage the 2 wire harness clamps and connect the crankshaft position sensor connector.

2. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET

NOTICE:

Install the No. 1 compressor mounting bracket exactly as described in the procedures below to properly secure and prevent damage to the fan and generator V belt.

(a) Temporarily install the No. 1 compressor mounting bracket to the engine assembly with the 3 bolts.

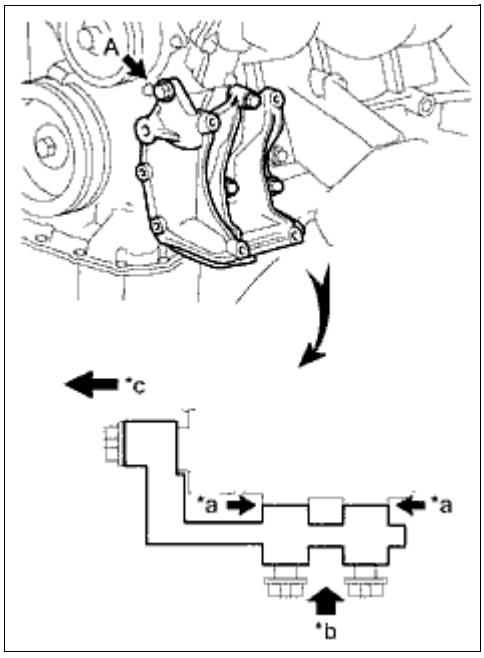


HINT:

Temporarily install the No. 1 compressor mounting bracket with the 3 bolts so that the bracket can be moving by hand.

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(b) Push the No. 1 compressor mounting bracket toward the cylinder block as shown in the illustration and tighten the bolt (A).



Text in Illustration

*a	No Clearance
*b	Push
*c	Front of Vehicle

Torque:

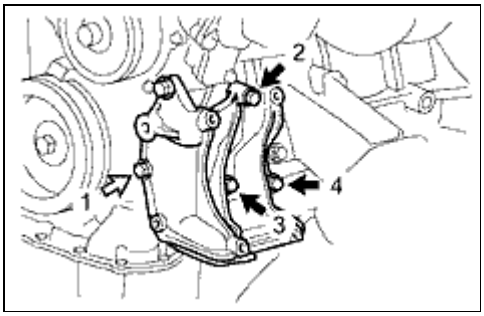
for Bolt A -

43 N·m {438 kgf·cm, 32ft·lbf}

HINT:

Make sure there is no clearance between the cylinder block and No. 1 compressor mounting bracket as shown in the illustration.

(c) Uniformly tighten the 4 bolts in the order shown in the illustration.



Text in Illustration

➡	Bolt B
⇨	Bolt C

Torque:

for Bolt B -

43 N·m {438 kgf·cm, 32ft·lbf}

for Bolt C -

21 N·m {214 kgf·cm, 15ft·lbf}

3. INSTALL COOLER COMPRESSOR ASSEMBLY INFO

4. INSTALL FAN AND GENERATOR V BELT INFO

5. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017E900NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: CRANKSHAFT POSITION SENSOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

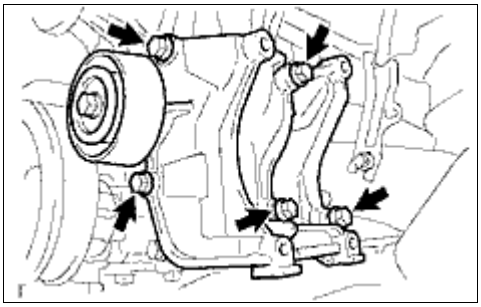
1. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

2. REMOVE FAN AND GENERATOR V BELT INFO

3. SEPARATE COOLER COMPRESSOR ASSEMBLY INFO

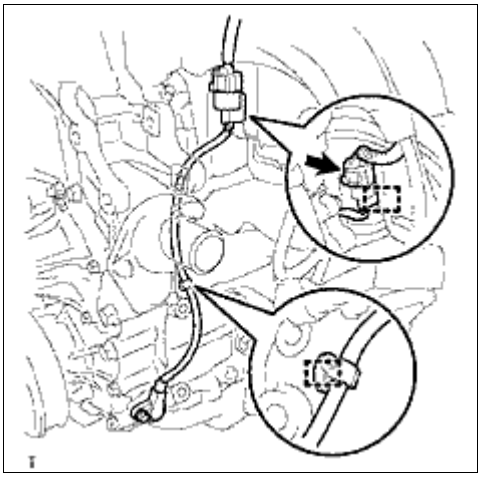
4. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET

(a) Remove the 5 bolts and No. 1 compressor mounting bracket from the engine assembly.

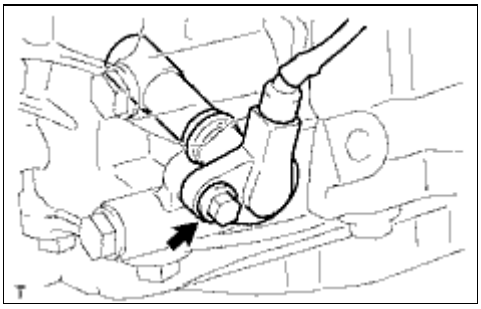


5. REMOVE CRANKSHAFT POSITION SENSOR

(a) Disconnect the crankshaft position sensor connector and disengage the 2 wire harness clamps.



(b) Remove the bolt and crankshaft position sensor from the timing chain cover sub-assembly.

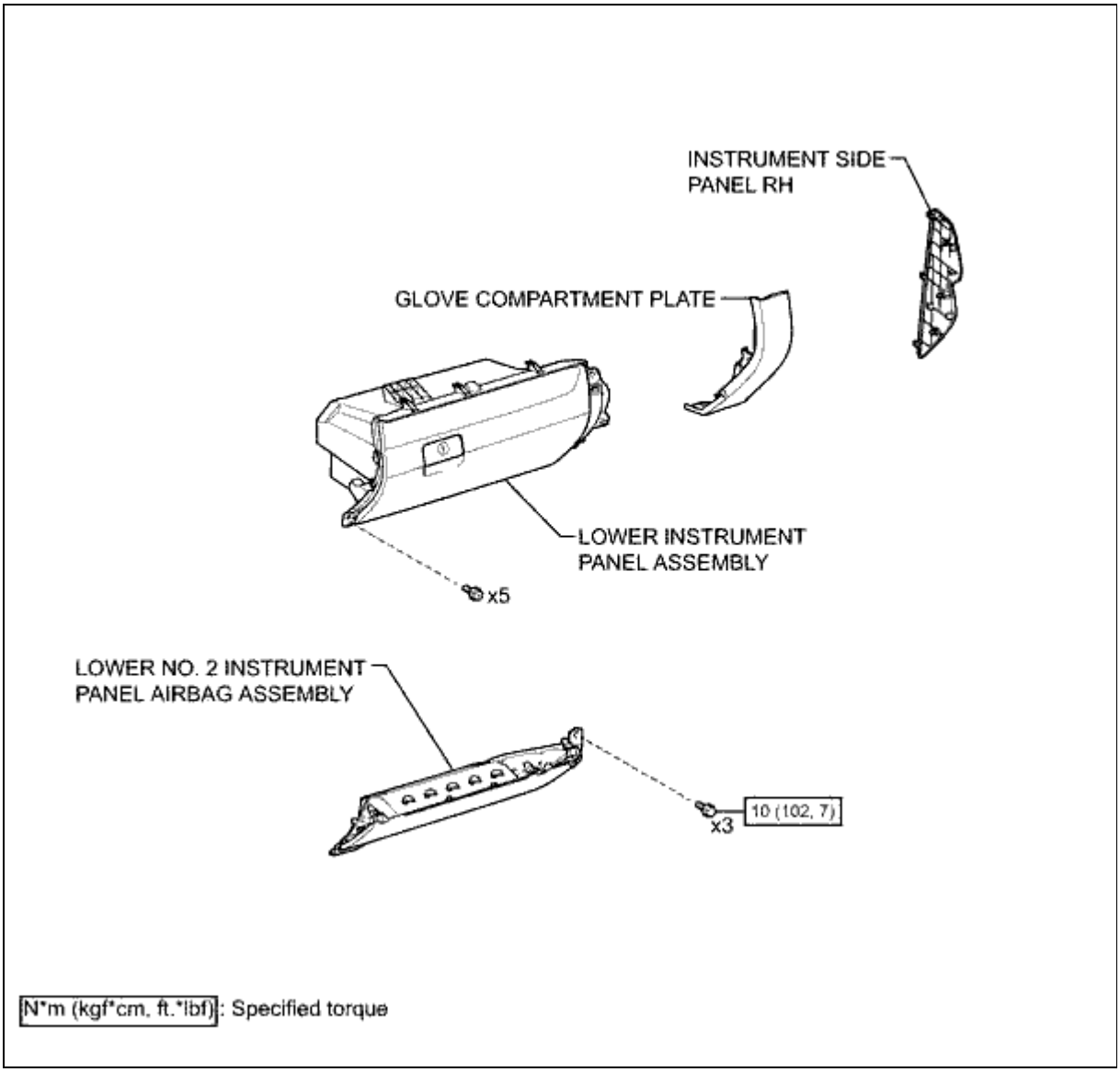


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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000004Z61007X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ECM: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

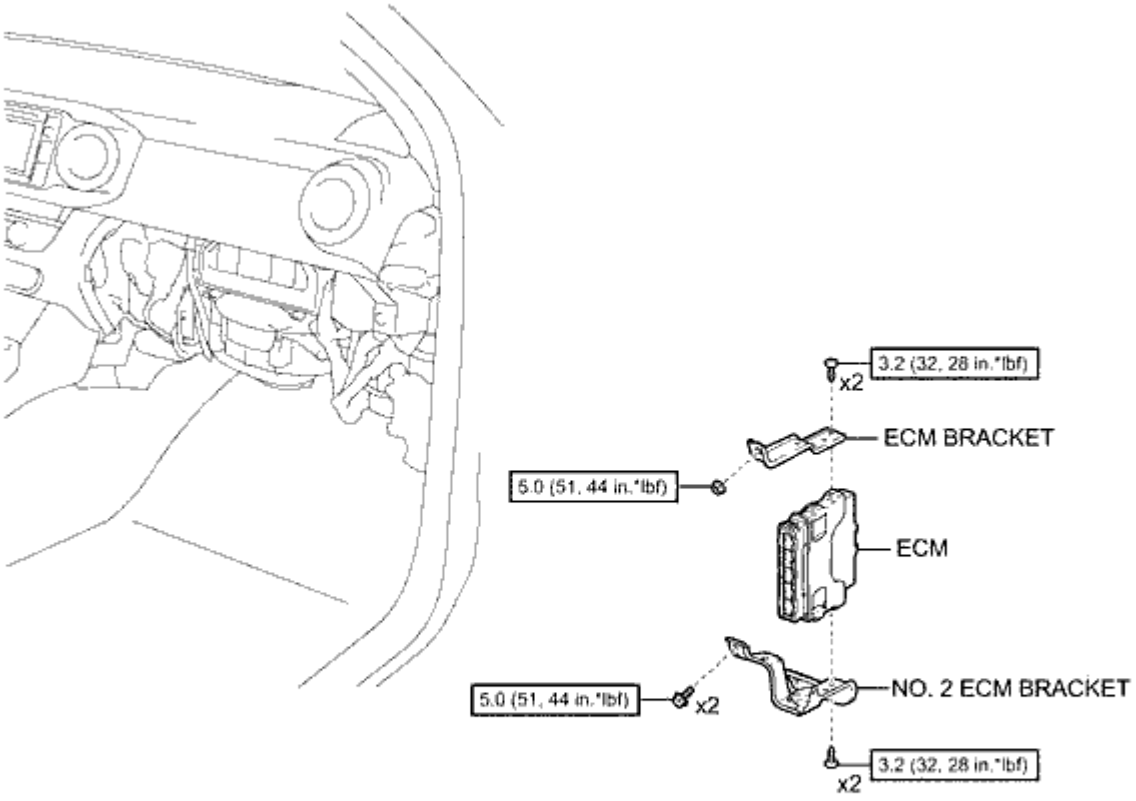
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VW0045X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ECM: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL NO. 2 ECM BRACKET

(a) Install the No. 2 ECM bracket to the ECM with the 2 screws.

Torque:

3.2 N·m {33 kgf·cm, 28in·lbf}

2. INSTALL ECM BRACKET

(a) Install the ECM bracket to the ECM with the 2 screws.

Torque:

3.2 N·m {33 kgf·cm, 28in·lbf}

3. INSTALL ECM

(a) Install the ECM to the instrument panel reinforcement assembly with the 2 bolts and nut.

Torque:

5.0 N·m {51 kgf·cm, 44in·lbf}

(b) Connect the 5 connectors.

(c) Engage the clamp to install the wire harness.

4. INSTALL LOWER INSTRUMENT PANEL ASSEMBLY INFO

5. REMOVE LOWER NO. 2 INSTRUMENT PANEL AIRBAG ASSEMBLY INFO

6. REMOVE GLOVE COMPARTMENT PLATE INFO

7. REMOVE INSTRUMENT SIDE PANEL RH INFO

8. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

9. PERFORM SRS WARNING LIGHT

INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VW203IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ECM: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. PRECAUTION

CAUTION:

Be sure to read Precaution thoroughly before servicing INFO .

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

3. REMOVE INSTRUMENT SIDE PANEL RH INFO

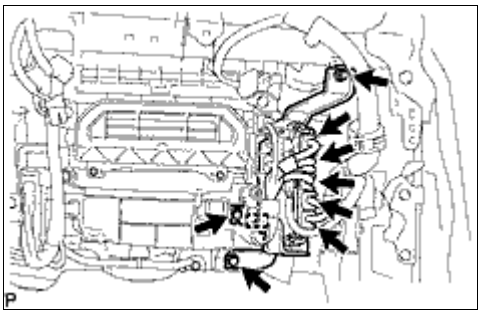
4. REMOVE GLOVE COMPARTMENT PLATE INFO

5. REMOVE LOWER NO. 2 INSTRUMENT PANEL AIRBAG ASSEMBLY INFO

6. REMOVE LOWER INSTRUMENT PANEL ASSEMBLY INFO

7. REMOVE ECM

(a) Disengage the clamp to separate the wire harness.

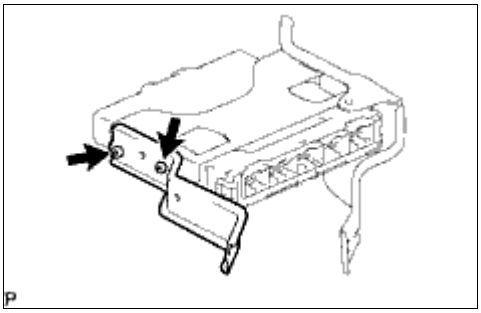


(b) Disconnect the 5 connectors.

(c) Remove the 2 bolts, nut and ECM from the instrument panel reinforcement assembly.

8. REMOVE ECM BRACKET

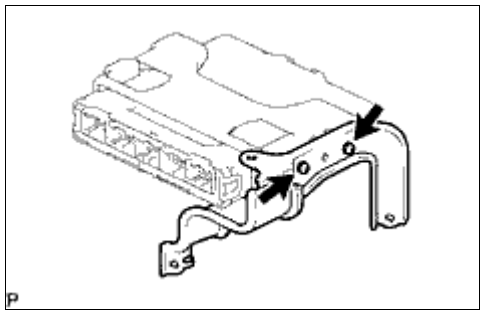
(a) Remove the 2 screws and ECM bracket from the ECM.



9. REMOVE NO. 2 ECM BRACKET

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(a) Remove the 2 screws and No. 2 ECM bracket from the ECM.



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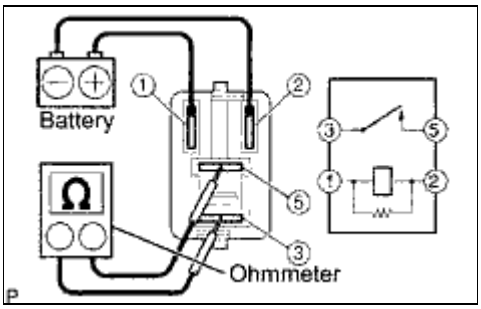
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000016ZG00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: EFI RELAY: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT EFI RELAY

(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.



Standard:

TESTER CONNECTION	SPECIFIED CONDITION
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

If the result is not as specified, replace the E.F.I. relay.

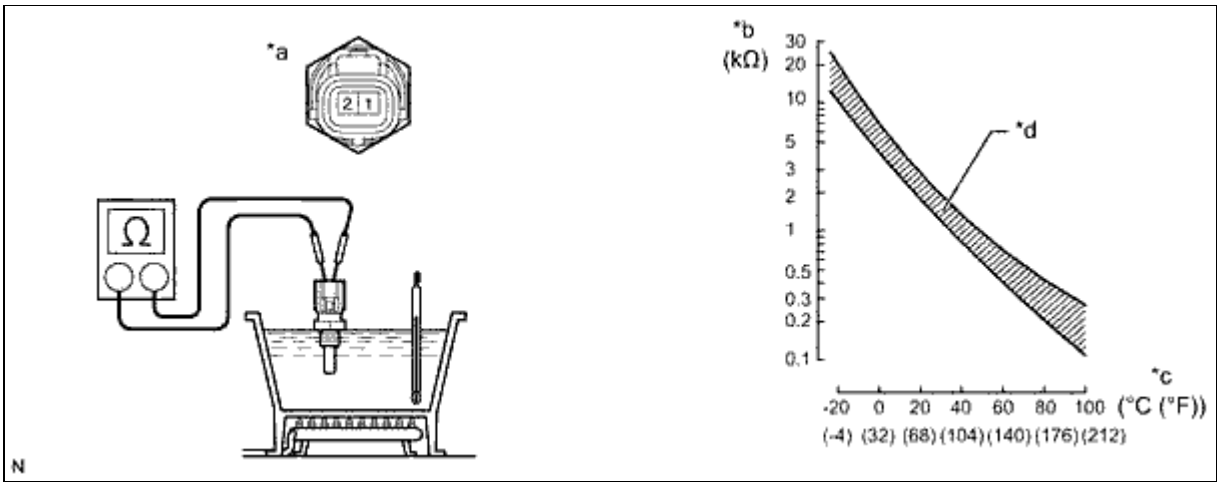
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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000VW801OX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: ENGINE COOLANT TEMPERATURE SENSOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT ENGINE COOLANT TEMPERATURE SENSOR

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



Text in Illustration

*a	Component without harness connected (Engine Coolant Temperature Sensor)	*b	Resistance
*c	Temperature	*d	Acceptable Range

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (E2) - 2 (THW)	20°C (68°F)	2.32 to 2.59 kΩ
	80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:

If checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After checking, clean off any water on the engine coolant temperature sensor.

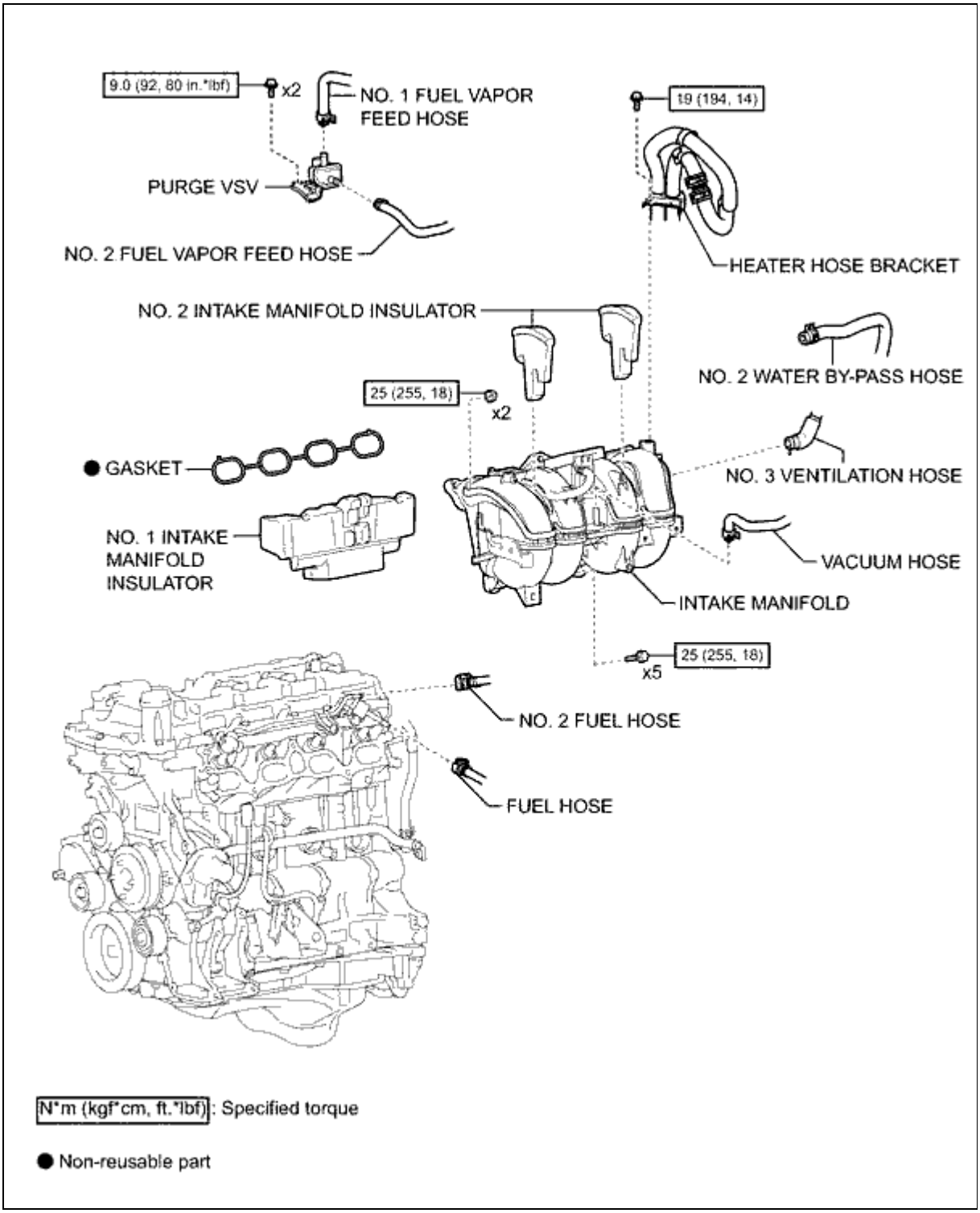
If the result is not as specified, replace the engine coolant temperature sensor.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000VWG027X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: KNOCK SENSOR: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

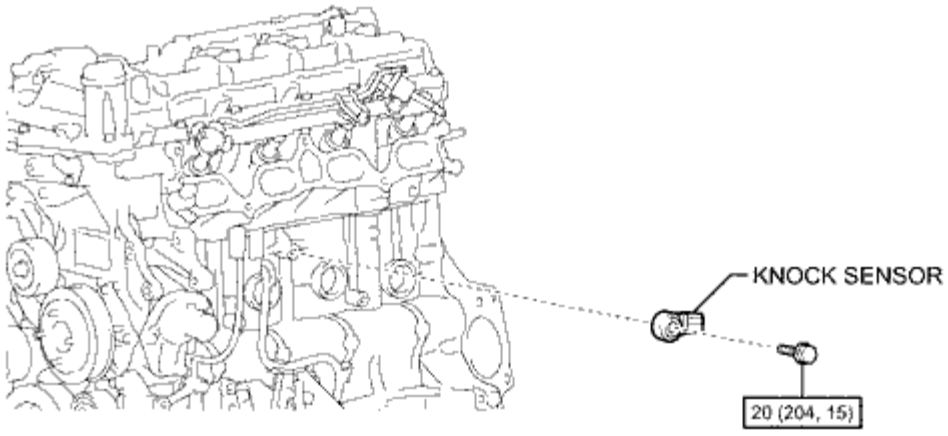
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



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

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000VWF02EX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: KNOCK SENSOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

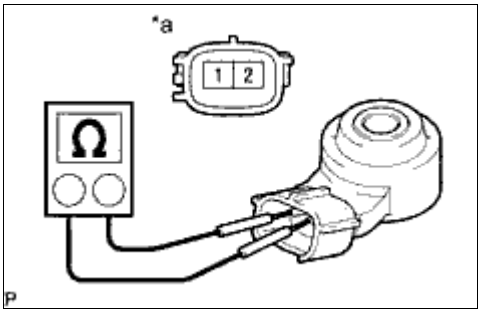
INSPECTION

1. INSPECT KNOCK SENSOR

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

Text in Illustration

*a	Component without harness connected (Knock Sensor)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	120 to 280 kΩ

If the result is not as specified, replace the knock sensor.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VWE03JX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: KNOCK SENSOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

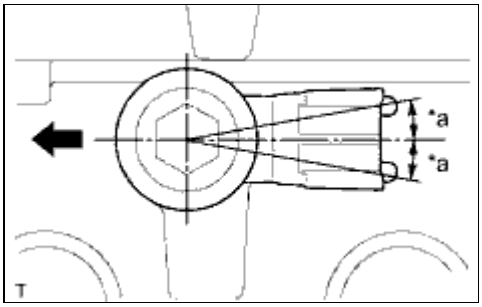
INSTALLATION

1. INSTALL KNOCK SENSOR

HINT:

Perform "Inspection After Repair" after replacing the knock sensor INFO .

(a) Install the knock sensor to the cylinder block sub-assembly with the bolt.



Text in Illustration

*a	10°
➡	Front of Vehicle

Torque:

20 N·m {204 kgf·cm, 15ft·lbf}

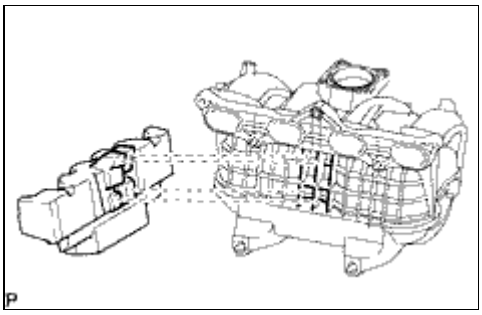
NOTICE:

Make sure that the knock sensor is at the correct angle when installing.

(b) Connect the knock sensor connector.

2. INSTALL INTAKE MANIFOLD

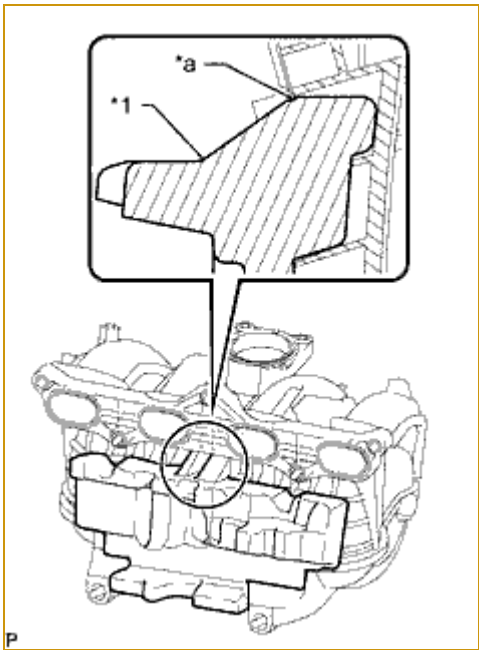
(a) Install the No. 1 intake manifold insulator to the intake manifold.



NOTICE:

- Insert the protrusions of the No. 1 intake manifold insulator into the grille of the intake manifold.
- Insert the No. 1 intake manifold insulator until the position of the line as shown in the illustration.

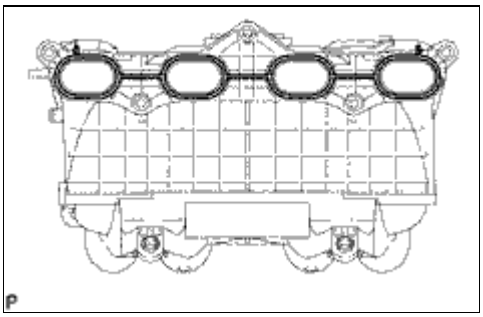
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Text in Illustration

*1	No. 1 Intake Manifold Insulator
*a	Line

(b) Install a new gasket to the intake manifold.



(c) Install the intake manifold with the 5 bolts and 2 nuts.

Torque:

25 N·m {255 kgf·cm, 18ft·lbf}

(d) Install the 2 No. 2 intake manifold insulators to the intake manifold.

(e) Install the heater hose bracket to the intake manifold with the bolt.

Torque:

19 N·m {194 kgf·cm, 14ft·lbf}

(f) Connect the vacuum hose and slide the hose clip to secure it.

(g) Connect the No. 3 ventilation hose and slide the hose clip to secure it.

(h) Install the No. 2 water by-pass hose.

(i) Engage the 2 clamps to install the wire harness.

3. INSTALL PURGE VSV

(a) Install the purge VSV to the intake manifold with the 2 bolts.

Torque:

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9.0 N·m {92 kgf·cm, 80in·lbf}

(b) Connect the No. 2 fuel vapor feed hose and slide the hose clip to secure it.

(c) Connect the No. 1 fuel vapor feed hose and slide the hose clip to secure it.

(d) Engage the clamp to install the wire harness.

(e) Connect the purge VSV connector.

4. CONNECT NO. 2 FUEL HOSE

(a) Install the No. 2 fuel hose to the fuel pipe clamp.

(b) Connect the No. 2 fuel hose INFO .

5. CONNECT FUEL HOSE

(a) Install the fuel hose to the fuel pipe clamp.

(b) Connect the fuel hose INFO .

6. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

7. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

8. INSPECT FOR FUEL LEAK INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VWH03AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: KNOCK SENSOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. PRECAUTION

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

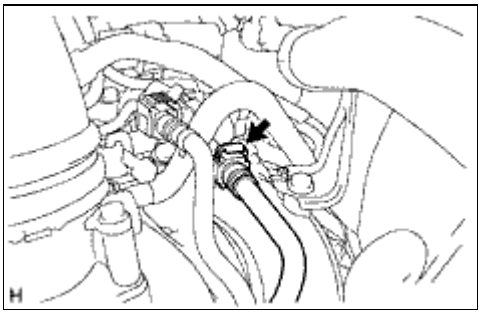
3. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

4. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

5. DISCONNECT FUEL HOSE

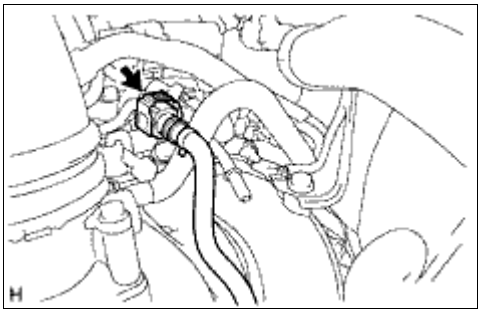
(a) Disconnect the fuel hose INFO .



(b) Separate the fuel hose from the fuel pipe clamp.

6. DISCONNECT NO. 2 FUEL HOSE

(a) Disconnect the No. 2 fuel hose INFO .

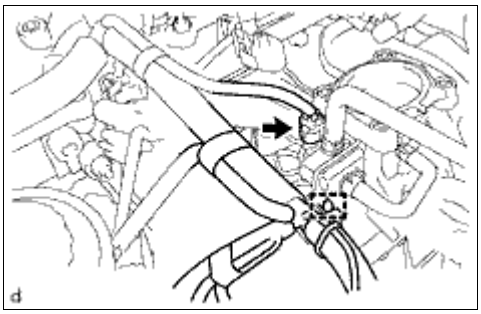


(b) Separate the No. 2 fuel hose from the fuel pipe clamp.

7. REMOVE PURGE VSV

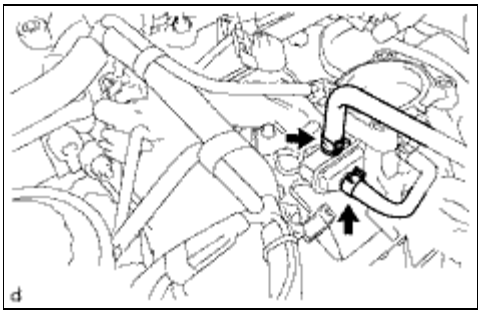
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(a) Disconnect the purge VSV connector.



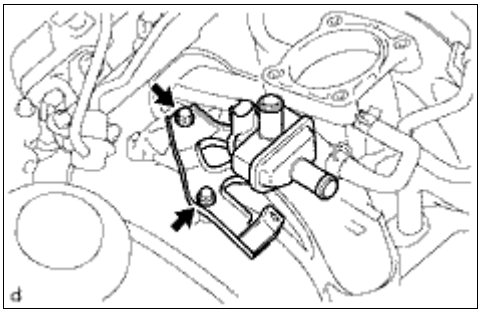
(b) Disengage the clamp to separate the wire harness.

(c) Slide the hose clip and disconnect the No. 1 fuel vapor feed hose.



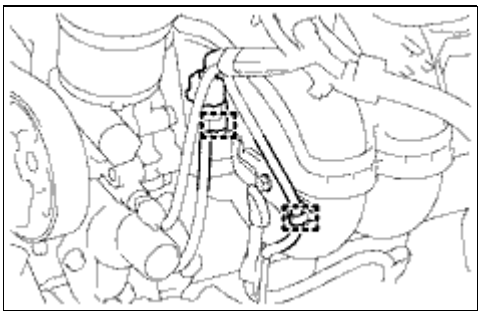
(d) Slide the hose clip and disconnect the No. 2 fuel vapor feed hose.

(e) Remove the 2 bolts and purge VSV from the intake manifold.



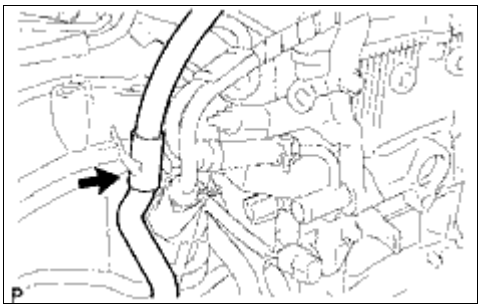
8. REMOVE INTAKE MANIFOLD

(a) Disengage the 2 clamps to separate the wire harness.

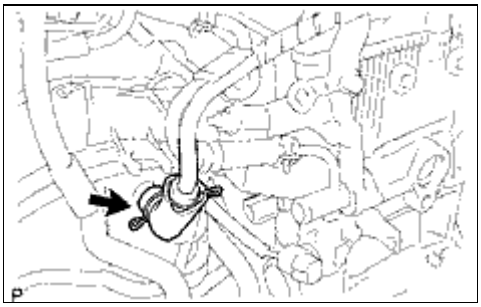


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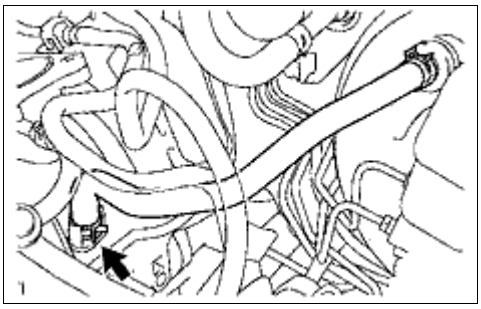
(b) Separate the No. 2 water by-pass hose.



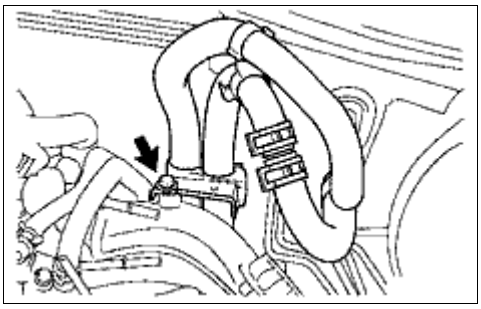
(c) Slide the hose clip and disconnect the No. 3 ventilation hose.



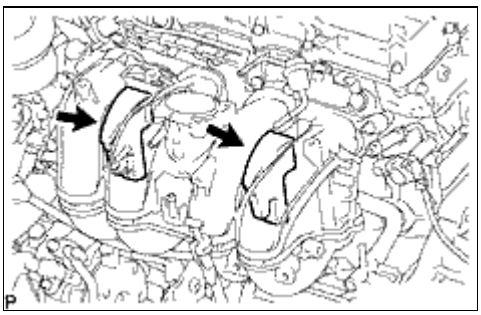
(d) Slide the hose clip and disconnect the vacuum hose.



(e) Remove the bolt to separate the heater hose bracket from the intake manifold.

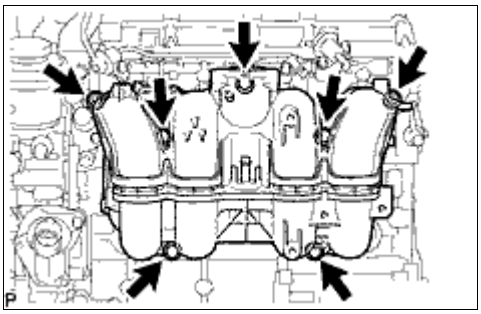


(f) Remove the 2 No. 2 intake manifold insulators from the intake manifold.



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(g) Remove the 5 bolts, 2 nuts and intake manifold from the cylinder block sub-assembly.

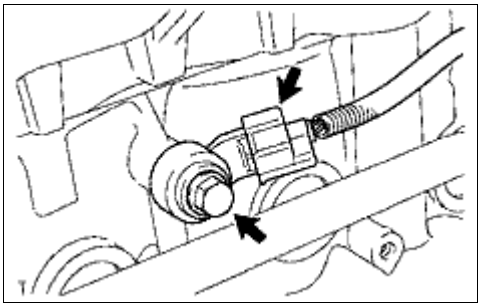


(h) Remove the gasket from the intake manifold.

(i) Remove the No. 1 intake manifold insulator from the intake manifold.

9. REMOVE KNOCK SENSOR

(a) Disconnect the knock sensor connector.



(b) Remove the bolt and knock sensor from the cylinder block sub-assembly.

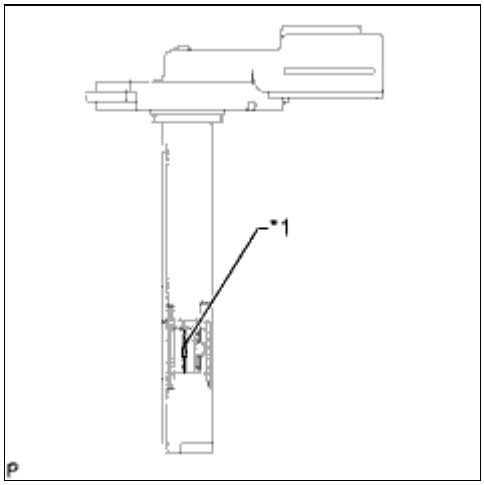
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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000046LM006X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: MASS AIR FLOW METER: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT MASS AIR FLOW METER

(a) Perform a visual check for any foreign matter on the platinum hot wire (heater) of the mass air flow meter shown in the illustration.



Text in Illustration

*1	Platinum Hot Wire (Heater)

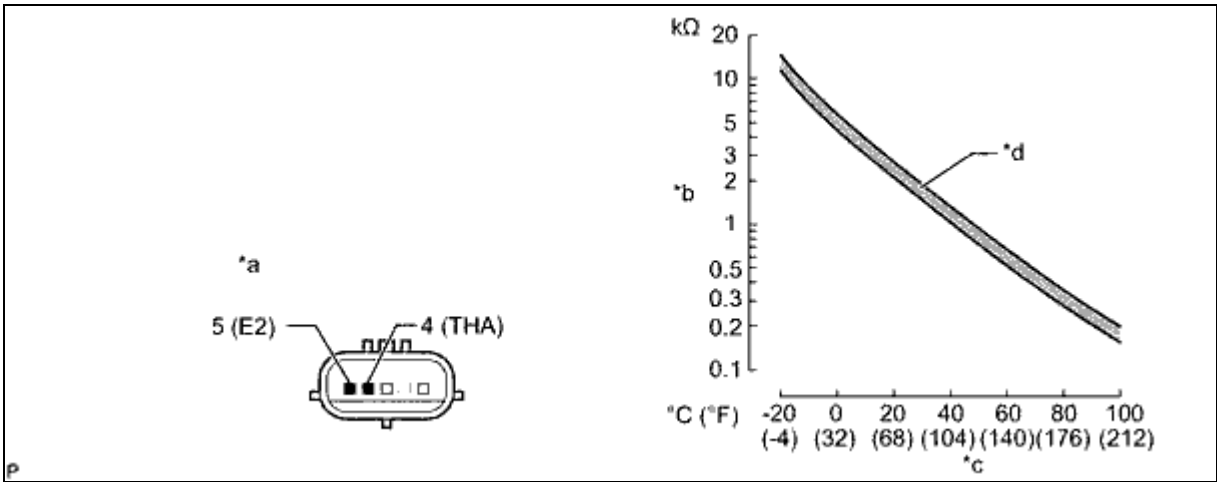
OK:

There is no foreign matter.

If the result is not as specified, replace the mass air flow meter.

(b) Check the intake air temperature sensor.

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



Text in Illustration

*a	Component without harness connected (Mass Air Flow Meter)	*b	Resistance
*c	Temperature	*d	Acceptable Range

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
4 (THA) - 5 (E2)	-20°C (-4°F)	12.5 to 16.9 kΩ
	20°C (68°F)	2.19 to 2.67 kΩ
	60°C (140°F)	0.50 to 0.68 kΩ

If the result is not as specified, replace the mass air flow meter.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000020G700AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: MASS AIR FLOW METER: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT MASS AIR FLOW METER

(a) Check the mass air flow value.

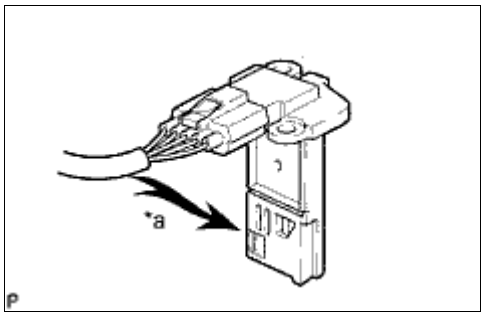
(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON.

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(5) Blow air into the mass air flow meter and check that the mass air flow value fluctuates.



Text in Illustration

*a	Air

If the result is not as specified, check the mass air flow meter INFO , or wire harness and ECM INFO .

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000PDM0UZX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: BASIC INSPECTION; 2016 MY Tacoma [08/2015 -]		

BASIC INSPECTION

When a malfunction is not confirmed by the DTC check, troubleshooting should be carried out in all circuits considered to be possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following procedure, the location of the problem can be found quickly and efficiently. Therefore, using this check is essential when engine troubleshooting.

1.	**CHECK BATTERY VOLTAGE**

NOTICE:

Carry out this check with the engine stopped and ignition switch off.

Result

RESULT	PROCEED TO
11 V or higher	OK
Below 11 V	NG

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▼

2.	**CHECK WHETHER ENGINE CRANKS**

NG ▶ **PROCEED TO PROBLEM SYMPTOMS TABLE**

OK ▼

3.	**CHECK WHETHER ENGINE STARTS**

NG ▶ **GO TO STEP 6**

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OK

4.	**CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

(a) Visually check that the air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

NG → **REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

OK

5.	**CHECK IDLING SPEED**

(a) Check the engine idling speed INFO .

NG → **TROUBLESHOOT IDLING SPEED AND PROCEED TO NEXT STEP**

OK

6.	**CHECK FUEL PRESSURE**

(a) Check the fuel pressure INFO .

NG → **PROCEED TO FUEL SYSTEM AND CONTINUE TROUBLESHOOTING**

OK

7.	**CHECK FOR SPARK**

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(a) Perform a spark test INFO .

NG	**TROUBLESHOOT SPARK AND PROCEED TO NEXT STEP**
OK	**PROCEED TO PROBLEM SYMPTOMS TABLE**

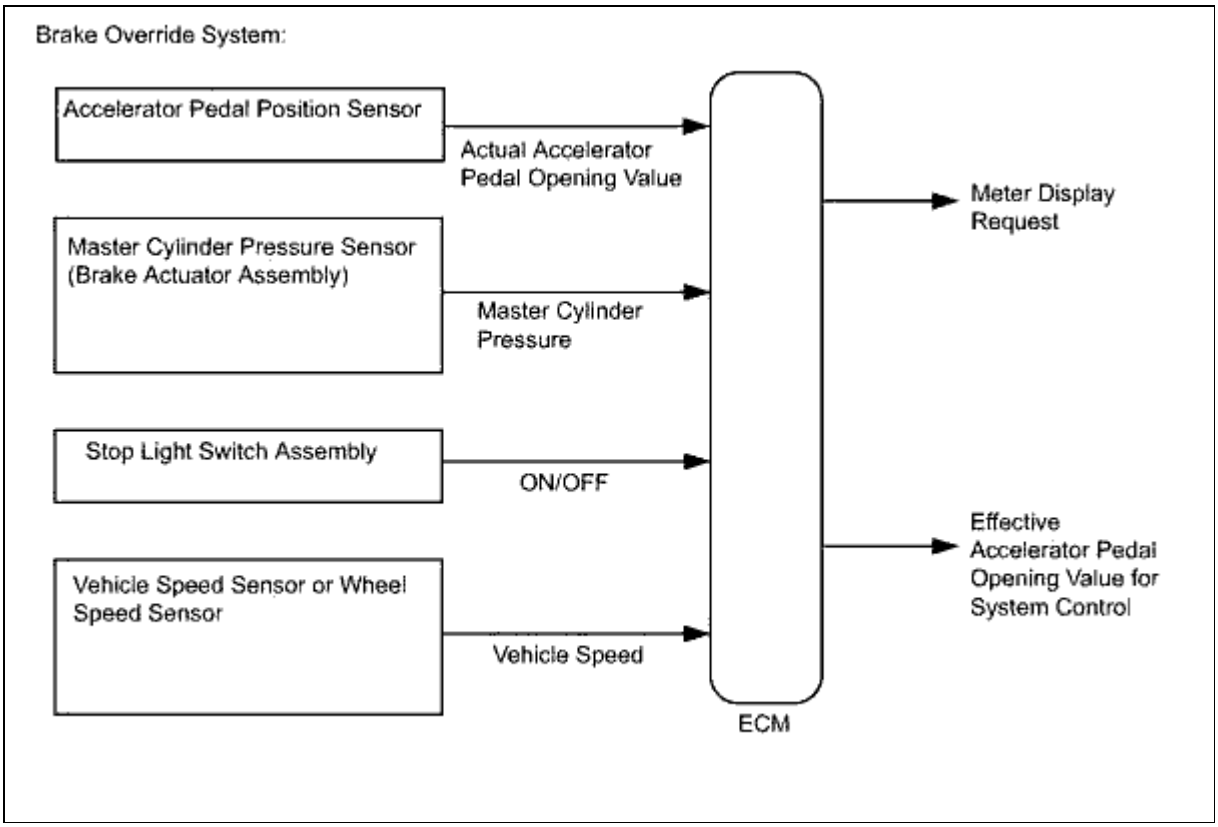
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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000004G8F0WNX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Brake Override System; 2016 MY Tacoma [08/2015 -]		

Brake Override System

DESCRIPTION

When the vehicle is being driven, depressing the accelerator pedal sensor assembly and brake pedal will activate the brake override system to restrict driving torque. The conditions for activating the brake override system as well as the items that are controlled are explained below.



Activation Conditions:

- When the accelerator pedal and brake pedal are depressed.

NOTICE:

The vehicle may not enter the brake override system control due to the relation of the accelerator pedal angle and the vehicle's speed.

Items Controlled:

- When the vehicle speed is extremely low, the accelerator opening value used when controlling the engine is reduced more than normal.

HINT:

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During control, the Accelerator Position value in the Data List will be lower than normal.

- When the vehicle speed is not extremely low, the accelerator opening value is forcibly lowered to a fixed value.

HINT:

- During control, the Accelerator Position value in the Data List is forcibly reduced to a specified value regardless of the actual accelerator opening value (Accel Sens. No. 1 Volt %).
- During brake override system control, the operation indicator is displayed on the meter.

Deactivation Conditions:

- When the brake pedal or the accelerator pedal returns to some degree.

INSPECTION PROCEDURE

Inspection Method

Example:

Drive at 10 km/h (6.25 mph), depress the accelerator pedal by 1/2 to 3/4 and keep it in that position. Under these conditions, if the engine speed decreases to 1000 rpm when the brake pedal is depressed, then the brake override system has been activated.

CAUTION:

When carrying out the inspection, use a place where you are able to carry it out safely and also pay close attention to your surroundings.

Also, when driving make absolutely sure that all road traffic laws, such as speed limits, are observed.

HINT:

- Under normal conditions, the Accelerator Position value changes in response to the Accel Sens. No. 1 Volt % value. For more information on the numerical values, refer to the Data List INFO .
- If the Accelerator Position and Accel Sens. No. 1 Volt % values in the Data List diverge and the Accelerator Position value in the Data List is fixed even though Accel Sens. No. 1 Volt % is changing, check that this control is activated (use the Techstream data saving function to record data while driving the vehicle and then confirm it after driving is completed.)

NOTICE:

The brake override system restricts driving torque if the brake pedal is depressed when driving with the accelerator pedal depressed. If a customer reports experiencing loss of torque after the accelerator and brake pedals have both been intentionally depressed, explain to the customer that this is not a malfunction, and that the customer should avoid depressing both the accelerator and brake pedals at the same time.

Example: While operating the accelerator pedal, the customer uses their left foot to operate the brake pedal.

PROCEDURE

1.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Enter the following menus: System Select / Health Check.

(e) Check DTCs.

Result

RESULT	PROCEED TO
DTCs are not output	A
DTCs are output	B

B ▶ **GO TO DTC CHART**

A ▼

2.	READ VALUE USING TECHSTREAM (MASTER CYLINDER SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Start the engine and turn the Techstream on.

(c) Enter the following menus: Chassis / ABS/VSC/TRAC / Data List / Master Cylinder Sensor.

(d) Read the value displayed on the Techstream.

OK:

TECHSTREAM DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION
Master Cylinder Sensor	Master cylinder pressure sensor reading /Min.: 0.00 V, Max.: 5.00 V	• Brake pedal released: 0.30 to 0.80 V • Reading increases when brake pedal is depressed

(e) Check that the brake fluid pressure value of the "Master Cylinder Sensor" observed on the Techstream changes when the brake pedal is depressed.

OK:

When the pedal is depressed, the pressure displayed on the Techstream increases.

NG ▶ **CHECK BRAKE ACTUATOR ASSEMBLY**

OK ▼

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3.	**READ VALUE USING TECHSTREAM (STOP LIGHT SWITCH AND ST1)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Stop Light Switch and ST1.

(e) Check the Data List indication when the brake pedal is depressed and released.

OK:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Stop Light Switch	Brake pedal released	OFF
	Brake pedal depressed	ON
ST1	Brake pedal released	OFF
	Brake pedal depressed	ON

NG ▶ **INSPECT STOP LIGHT SWITCH ASSEMBLY**

OK ▼

4.	**INSPECT BRAKE PEDAL SUB-ASSEMBLY**

(a) Inspect and adjust the brake pedal sub-assembly INFO .

HINT:

If the stop light switch turns ON too late, the start of brake override system control may be delayed; if it turns ON too soon, brake override system control may begin too early, so conduct inspection of the brake pedal and stop light switch assembly.

NG ▶ **REPAIR OR REPLACE BRAKE PEDAL SUB-ASSEMBLY**

OK ▼

5.	**READ VALUE USING TECHSTREAM (ACCELERATOR PEDAL POSITION SENSOR)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Accel Sens. No. 1 Volt % and Accel Sens. No. 2 Volt %.

(e) Read the value displayed on the Techstream.

OK:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Accel Sens. No. 1 Volt %	Accelerator Pedal Released → Depressed → Released	Values smoothly change following accelerator pedal operation
Accel Sens. No. 2 Volt %		

HINT:

For numerical values of Accel Sens. No. 1 Volt % and Accel Sens. No. 2 Volt %, refer to the Data List INFO .

NG ▶ **REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

OK ▼

6.	READ VALUE USING TECHSTREAM (VEHICLE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Vehicle Speed.

(f) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Vehicle Speed	Vehicle stopped, engine running	0 km/h (0 mph)
	Vehicle running at constant speed between 16.1 to 64.4 km/h (10 to 40 mph)	No large fluctuations when driving at a constant speed

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Data can be captured relatively easily by using the snapshot function in the Data List. Confirm the data after performing the drive test.

NG ▶ **GO TO METER / GAUGE SYSTEM (SPEED SIGNAL CIRCUIT)**

OK ▼

7.	READ VALUE USING TECHSTREAM (FR, FL, RR, RL WHEEL SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Chassis / ABS/VSC/TRAC / Data List / FR Wheel Speed, FL Wheel Speed, RR Wheel Speed and RL Wheel Speed.

(f) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
FR Wheel Speed FL Wheel Speed RR Wheel Speed RL Wheel Speed	Vehicle stopped, engine running	0 km/h (0 mph)
	Vehicle running at constant speed between 16.1 to 64.4 km/h (10 to 40 mph)	No large fluctuations when driving at a constant speed

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Data can be captured relatively easily by using the snapshot function in the Data List. Confirm the data after performing the drive test.

NG ▶ **INSPECT FRONT OR REAR SPEED SENSOR**

OK ▶ **END**

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000PDQ19SX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: CHECK FOR INTERMITTENT PROBLEMS; 2016 MY Tacoma [08/2015 -]		

CHECK FOR INTERMITTENT PROBLEMS

HINT:

Techstream only:

Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect with the Techstream when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which is more sensitive to malfunctions than normal mode (default), which uses 2 trip detection logic.

1. Clear DTCs INFO .
2. Switch the ECM from normal mode to check mode using the Techstream INFO .
3. Perform a simulation test INFO .
4. Check and wiggle the harness(es), connector(s) and terminal(s) INFO .

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000PDL0YYX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: CHECK MODE PROCEDURE; 2016 MY Tacoma [08/2015 -]		

CHECK MODE PROCEDURE

HINT:

Techstream only:

Compared to normal mode, check mode is more sensitive to malfunctions. Therefore, check mode can detect the malfunctions that cannot be detected by normal mode.

NOTICE:

All the stored DTCs and freeze frame data are erased if: 1) the ECM is changed from normal mode to check mode or vice versa; or 2) the ignition switch is turned from ON to ACC or OFF while in check mode.

Before changing modes, always check and make a note of any DTCs and freeze frame data.

1. CHECK MODE PROCEDURE (Using the Techstream)

(a) Check and ensure the following conditions:

(1) Battery voltage 11 V or more

(2) Throttle valve fully closed

(3) Move the shift lever to P or N*1, or neutral*2.

*1: for Automatic Transmission

*2: for Manual Transmission

(4) A/C switched off

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

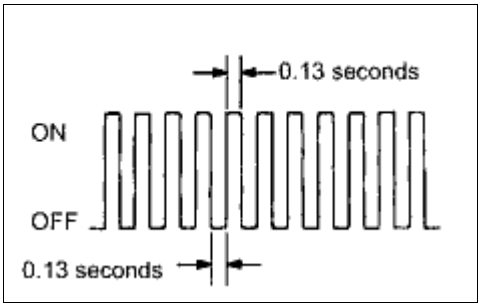
(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Check Mode.

(g) Switch the ECM from normal mode to check mode.

(h) Make sure the MIL flashes as shown in the illustration.



(i) Start the engine.

(j) Make sure the MIL turns off.

(k) Simulate the conditions of the malfunction described by the customer.

(l) Check DTCs and freeze frame data using the Techstream.

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000PDR0GQX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: CHECKING MONITOR STATUS; 2016 MY Tacoma [08/2015 -]		

CHECKING MONITOR STATUS

The purpose of the monitor result (mode 06) is to allow access to the results of on-board diagnostic monitoring tests of specific components/systems that are not continuously monitored. Examples are catalysts and evaporative emissions (EVAP) systems.

The monitor result allows the OBD II scan tool to display the monitor status, test value, minimum test limit and maximum test limit. These data are displayed after the vehicle has been driven to run the monitor.

When the test value is not between the minimum and maximum test limits, the ECM (PCM) interprets this as a malfunction. If the test value is on the borderline of the test limits, the component is likely to malfunction in the near future.

Perform the following procedures to view the monitor status. Although these procedures refer to the Lexus/Toyota Techstream, the monitor status can be checked using a generic OBD II scan tool. Refer to your scan tool operator's manual for specific procedural information.

1. PERFORM MONITOR DRIVE PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and the Techstream on.

(c) Clear DTCs INFO .

(d) Operate the vehicle in accordance with the applicable drive pattern described in Readiness Monitor Drive Pattern INFO . Do not turn the ignition switch off.

HINT:

The test results will be lost if the ignition switch is turned off.

2. ACCESS MONITOR RESULT

(a) Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / Result.

(b) Confirm the monitor status for each component.

HINT:

The monitor status for each component is displayed in the Result column.

- Pass: The component is functioning normally.
- Fail: The component is malfunctioning.

(c) Display the test results and test value for a monitor by selecting the icon in the Details column for that monitor.

3. CHECK COMPONENT STATUS

(a) Compare the Test Value with the minimum test limit (Min Limit) and maximum test limit (Max Limit).

(b) If the test value is between the minimum and maximum test limits, the component is functioning normally. If not, the component is malfunctioning. The test value is usually not near the test limits. If the test value is on the borderline of the test limits, the component is likely to malfunction in the near future.

HINT:

The monitor result might on rare occasions be Pass even if the Malfunction Indicator Lamp (MIL) is

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illuminated. This indicates the system malfunctioned on a previous driving cycle. This might be caused by an intermittent problem.

4. MONITOR RESULT INFORMATION

If you use a generic scan tool, multiply the test value by the scaling value listed below.

Advance/Retarded Intake Side

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$35	$81	Multiply by 0.01	Second	Forced movement of oil control valve time

Advance/Retarded Exhaust Side

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$35	$85	Multiply by 0.01	Second	Forced movement of oil control valve time

Air Fuel Ratio Sensor

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$01	$91	Multiply by 0.004	mA	A/F sensor current
$01	$93	Multiply by 0.00012	V	Rich to Lean response rate deterioration level
$01	$94	Multiply by 0.00012	V	Lean to Rich response rate deterioration level
$01	$95	Multiply by 0.001	Second	Rich to Lean delay level
$01	$96	Multiply by 0.001	Second	Lean to Rich delay level

Heated Oxygen Sensor

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$02	$08	Multiply by 0.001	V	Maximum sensor voltage
$02	$8D	Multiply by 0.001	Seconds	Duration that sensor voltage drops to 0.2 V during fuel-cut
$02	$8F	Multiply by 0.0003	No dimension	Maximum oxygen storage capacity
$02	$90	Multiply by 0.001	No dimension	Response rate during fuel cut from rich condition (Normalization)

Catalyst - Bank 1

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$21	$AF	Multiply by 0.001	No dimension	Oxygen storage capacity of catalyst bank 1 (Normalization)

Rear Oxygen Sensor Heater

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MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$42	$91	Multiply by 0.001	Ohm	Oxygen sensor heater resistance for bank 1 sensor 2

Fuel System

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$81	$81	Multiply by 0.00003	No dimension	Monitoring method using A/F sensor
$81	$82	Multiply by 0.001	No dimension	Monitoring method using crank angle sensor

EVAP

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$3D	$C9	Multiply by 0.001	kPa	Test value for small leak (P0456)
$3D	$CA	Multiply by 0.001	kPa	Test value for gross leak (P0455)
$3D	$CB	Multiply by 0.001	kPa	Test value for leak detection pump OFF stuck (P2401)
$3D	$CD	Multiply by 0.001	kPa	Test value for leak detection pump ON stuck (P2402)
$3D	$CE	Multiply by 0.001	kPa	Test value for vent valve OFF stuck (P2420)
$3D	$CF	Multiply by 0.001	kPa	Test value for vent valve ON stuck (P2419)
$3D	$D0	Multiply by 0.001	kPa	Test value for reference orifice low flow (P043E)
$3D	$D1	Multiply by 0.001	kPa	Test value for reference orifice high flow (P043F)
$3D	$D4	Multiply by 0.001	kPa	Test value for purge VSV closed stuck (P0441)
$3D	$D5	Multiply by 0.001	kPa	Test value for purge VSV open stuck (P0441)
$3D	$D7	Multiply by 0.001	kPa	Test value for purge flow insufficient (P0441)

Secondary Air Injection (AIR) Bank 1

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$71	$E1	Multiply by 0.01	g/sec	Test value for AIR insufficient
$71	$E2	Multiply by 0.01	kPa	Test value for AIR pump ON stuck
$71	$E3	Multiply by 0.01	kPa	Test value for AIR pump OFF stuck
$71	$E4	Multiply by 0.01	kPa	Test value for AIR valve(s) ON stuck
$71	$E5	Multiply by 0.01	kPa	Test value for AIR valve(s) OFF stuck

Misfire

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$A1	$0B	Multiply by 1	Count	Total EWMA* misfire count of all cylinders in last ten driving cycles
$A1	$0C	Multiply by 1	Count	• When ignition switch is ON, total misfire count of all cylinders in last driving cycle is displayed. • While engine is running, total misfire count of all cylinders in

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MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
				current driving cycle is displayed.
$A2	$0B	Multiply by 1	Count	Total EWMA* misfire count of cylinder 1 in last ten driving cycles
$A2	$0C	Multiply by 1	Count	• When ignition switch is ON, total misfire count of cylinder 1 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 1 in current driving cycle is displayed.
$A3	$0B	Multiply by 1	Count	Total EWMA* misfire count of cylinder 2 in last ten driving cycles
$A3	$0C	Multiply by 1	Count	• When ignition switch is ON, total misfire count of cylinder 2 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 2 in current driving cycle is displayed.
$A4	$0B	Multiply by 1	Count	Total EWMA* misfire count of cylinder 3 in last ten driving cycles
$A4	$0C	Multiply by 1	Count	• When ignition switch is ON, total misfire count of cylinder 3 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 3 in current driving cycle is displayed.
$A5	$0B	Multiply by 1	Count	Total EWMA* misfire count of cylinder 4 in last ten driving cycles
$A5	$0C	Multiply by 1	Count	• When ignition switch is ON, total misfire count of cylinder 4 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 4 in current driving cycle is displayed.

HINT:

*: EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated)
Calculation: 0.1x(current counts)+0.9x(previous average) Initial value for (previous average)=0

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000SXS0E6X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: DATA LIST / ACTIVE TEST; 2016 MY Tacoma [08/2015 -]		

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

HINT:

Normal Condition: If no conditions are specifically stated for "idling", the shift lever should be in N or P, the A/C switch should be off and all accessory switches should be off.

(a) Warm up the engine.

(b) Turn the A/C switch off.

(c) Turn the ignition switch off.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON.

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List.

HINT:

- To display the list box, press the pull down menu button next to Primary. Then select a measurement group.
- When you select a measurement group, the ECU data belonging to that group is displayed.
- Measurement Group List / Description
    - All Data / All data
    - Primary / -
    - Engine Control / Engine control system related data
    - Gas General / -
    - Gas AF Control / Air fuel ratio control system related data
    - Gas AF Control (D4) / Air fuel ratio control system related data
    - Gas AF O2 Sensor / Air fuel ratio sensor and heated oxygen sensor related data
    - Gas Throttle / Gasoline throttle system related data
    - Gas Intake Control / Intake control system related data
    - Gas Valve Control / Valve control system related data
    - Gas Misfire / "Misfire" related data
    - Gas Starting / "Difficult to start" related data
    - Gas Rough Idle / "Rough idle" related data
    - Gas Evaporative / Evaporative system related data
    - Gas CAT Converter / Catalyst converter related data
    - Check Mode / Check mode related data

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- Monitor Status / Monitor status related data
- Ignition / Ignition system related data
- Charging Control / Charging control system related data
- Compression / Data used during "Check the Cylinder Compression" Active Test
- AT / Automatic transmission system related data
- Vehicle Information / Vehicle information

(h) According to the display on the Techstream, read the Data List.

HINT:

The title used for each group of Data List items in this repair manual does not appear on the Techstream. However, the name in parentheses after the title, which is a Measurement Group, does appear on the Techstream. When the name shown in parentheses is selected on the Techstream, all the Data List items listed for that group will be displayed.

2. Various Vehicle Conditions 1 (All Data)

Vehicle Speed

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vehicle Speed	Vehicle speed/ Min.: 0 km/h (0 mph), Max.: 255 km/h (158 mph)	Actual vehicle speed	Yes
	Diagnostic Note: • This is the current vehicle speed. • The vehicle speed is detected using the speed sensors. ○ Vehicle speed data is delayed when it is displayed. Therefore, even if the vehicle speed listed in the freeze frame data is 0 km/h (0 mph), this does not always mean that the malfunction occurred when the vehicle was stopped.		

Engine Speed

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed	Engine speed/ Min.: 0 rpm, Max.: 16383 rpm	• 700 to 800 rpm: Idling (for Automatic Transmission) • 600 to 700 rpm: Idling (for Manual Transmission)	Yes
	Diagnostic Note: When the crankshaft position sensor is malfunctioning, "Engine Speed" is approximately 0 or varies greatly from the actual engine speed.		

Calculate Load

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Calculate Load	Load calculated by ECM/ Min.: 0%, Max.: 100%	• 11 to 26%: Idling • 12 to 27%: Running without load	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
		(2500 rpm)	
	Diagnostic Note: This is the engine load calculated based on the estimated intake manifold pressure. Calculate Load = Estimated intake manifold pressure / maximum intake manifold pressure x 100 (%) (For example, when the estimated intake manifold pressure is the same as atmospheric pressure, Calculate Load is 100%.)		

Vehicle Load

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vehicle Load	Vehicle load/ Min.: 0%, Max.: 25700%	Actual vehicle load	Yes
	Diagnostic Note: This is the engine intake air charging efficiency. Vehicle Load = Current intake airflow (g/rev.) / maximum intake airflow Maximum intake airflow = Displacement (L) / 2 x 1.2 (g/rev.) **HINT:** Due to individual engine differences, intake air temperature, etc., the value may exceed 100%. Intake airflow (g/rev.) = Intake airflow (gm/sec) x 60 / Engine speed (rpm) (Intake airflow (gm/sec) is MAF)		

MAF

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MAF	Airflow rate from mass air flow meter/ Min.: 0 gm/sec, Max.: 655.35 gm/sec	• 2.0 to 4.8 gm/sec: Idling • 8.0 to 14.7 gm/sec: Running without load (2500 rpm)	Yes
	Diagnostic Note: This is the intake air amount from the mass air flow meter.		

Atmosphere Pressure

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Atmosphere Pressure	Atmospheric pressure/ Min.: 0 kPa (0 mmHg), Max.: 255 kPa (1912 mmHg)	Equivalent to atmospheric pressure (absolute pressure)	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: • This value is calculated from the intake air amount. • Standard atmospheric pressure: 101 kPa (757 mmHg) • For every 100 m increase in altitude, pressure drops by 1 kPa. This varies by weather.		

Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Coolant Temp	Coolant temperature/ Min.: -40°C (-40°F), Max.: 140°C (284°F)	75 to 100°C (167 to 212°F): After warming up	Yes
	Diagnostic Note: This is the engine coolant temperature. **HINT:** • After warming up the engine, the engine coolant temperature is 75 to 100°C (167 to 212°F). • After a long soak, the engine coolant temperature, intake air temperature and ambient air temperature are approximately equal. • If the value is -40°C (-40°F) or 140°C (284°F), the sensor circuit is open or shorted.		

Intake Air

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Intake Air	Intake air temperature/ Min.: -40°C (-40°F), Max.: 140°C (284°F)	Equivalent to temperature at location of mass air flow meter	Yes
	Diagnostic Note: • After a long soak, the engine coolant temperature, intake air temperature and ambient air temperature are approximately equal. • If the value is -40°C (-40°F) or 140°C (284°F), the sensor circuit is open or shorted.		

Engine Run Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Run Time	Engine run time/ Min.: 0 s, Max.: 65535 s	Time after engine start	Yes
	Diagnostic Note: This is the time elapsed since the engine started. **HINT:** The time is counted only while the engine is running.		

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Initial Engine Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Initial Engine Coolant Temp	Initial engine coolant temperature/ Min.: -40°C (-40°F), Max.: 119.3°C (246.7°F)	-	Yes
	Diagnostic Note: This is the coolant temperature stored when the ignition switch is turned to ON.		

Initial Intake Air Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Initial Intake Air Temp	Initial intake air temperature/ Min.: -40°C (-40°F), Max.: 119.3°C (246.7°F)	-	Yes
	Diagnostic Note: This is the intake air temperature stored when the ignition switch is turned to ON.		

Battery Voltage

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Battery Voltage	Battery voltage/ Min.: 0 V, Max.: 65.535 V	11 to 14 V: Idling	Yes
	Diagnostic Note: If 11 V or less, characteristics of some electrical components may change.		

Glow Indicator Supported

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Glow Indicator Supported	Status of glow indicator supported/ Unsupp or Supp	-	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

Glow Indicator

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Glow Indicator	Glow indicator/ ON or OFF	-	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

3. Throttle Control (Gas Throttle)

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Accelerator Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accelerator Position	Accelerator pedal position/ Min.: 0%, Max.: 399.9%	Actual accelerator pedal position	No
	Diagnostic Note: This is the accelerator pedal position defined using the learned fully released position (sensor output) of accelerator pedal position sensor No. 1 as 0% and the fully depressed position as 100%.		

Accel Sens. No.1 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sens. No.1 Volt %	Accelerator Pedal Position No. 1/ Min.: 0%, Max.: 100%	10 to 22%: Accelerator pedal released 52 to 90%: Accelerator pedal fully depressed	Yes
	Diagnostic Note: The accelerator pedal position sensor No. 1 output is converted using 5 V = 100%. **HINT:** If there are no accelerator pedal position sensor DTCs stored, it is possible to conclude that the accelerator pedal position sensor system is normal.		

Accel Sens. No.2 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sens. No.2 Volt %	Accelerator pedal position No. 2/ Min.: 0%, Max.: 100%	24 to 40%: Accelerator pedal released 68 to 95%: Accelerator pedal fully depressed	Yes
	Diagnostic Note: The accelerator pedal position sensor No. 2 output is converted using 5 V = 100%.		

Accel Sensor Out No.1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sensor Out No.1	Absolute accelerator pedal position sensor No. 1 voltage/ Min.: 0 V, Max.: 4.98 V	0.5 to 1.1 V: Accelerator pedal released 2.6 to 4.5 V: Accelerator pedal fully depressed	No
	Diagnostic Note: This is the raw voltage from the accelerator pedal position sensor No. 1.		

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Accel Sensor Out No.2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sensor Out No.2	Accelerator pedal position sensor No. 2 voltage/ Min.: 0 V, Max.: 4.98 V	1.2 to 2.0 V: Accelerator pedal released 3.4 to 4.75 V: Accelerator pedal fully depressed	No
	Diagnostic Note: This is the raw voltage from the accelerator pedal position sensor No. 2. Accelerator pedal position sensor No. 2 is used to monitor accelerator pedal position sensor No. 1. When there is a malfunction in sensor No. 1, the ECM uses sensor No. 2 to control the engine.		

Accelerator Idle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accelerator Idle Position	Whether or not accelerator pedal position sensor detecting released accelerator pedal/ ON or OFF	ON: Idling	No
	Diagnostic Note: This is a parameter calculated by the ECM which indicates whether the accelerator pedal is in the learned idle position.		

Accel Fully Close Learn #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Fully Close Learn #1	Accelerator fully released learned value No. 1/ Min.: 0 deg, Max.: 124.5 deg	2.5 to 23.75 deg: after learning	No
	Diagnostic Note: This is the value of accelerator pedal position sensor No. 1 learned when the accelerator pedal is released.		

Accel Fully Close Learn #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Fully Close Learn #2	Accelerator fully released learned value No. 2/ Min.: 0 deg, Max.: 124.5 deg	32.5 to 53.75 deg: after learning	No
	Diagnostic Note: This is the value of accelerator pedal position sensor No. 2 learned when the accelerator pedal is released.		

Throttle Sensor Volt %

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sensor Volt %	Absolute throttle position sensor/ Min.: 0%, Max.: 100%	• 10 to 22%: Throttle fully closed • 66 to 98%: Throttle fully open	Yes
	Diagnostic Note: The throttle position sensor No. 1 output is converted using 5 V = 100%. **HINT:** If there are no throttle position sensor DTCs stored, it is possible to conclude that the throttle position sensor system is normal.		

Throttl Sensor #2 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttl Sensor #2 Volt %	Throttle position No. 2 sensor/ Min.: 0%, Max.: 100%	• 42 to 62%: Throttle fully closed • 92 to 100%: Throttle fully open	Yes
	Diagnostic Note: The throttle position sensor No. 2 output is converted using 5 V = 100%.		

ST1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ST1	Brake pedal signal/ ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	No
	Diagnostic Note: This is the stop light switch signal.		

System Guard

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
System Guard	System guard/ ON or OFF	-	No
	Diagnostic Note: When there is a difference between the target and actual throttle valve opening angles, system guard turns off and stops the electronic throttle control system function. OFF: Electronic throttle control is stopped.		

Open Side Malfunction

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Open Side Malfunction	Open malfunction/ ON or OFF	-	No
	Diagnostic Note: This parameter indicates a malfunction in the electronic throttle when the throttle valve is open.		

Throttle Idle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Idle Position	Whether or not throttle position sensor detecting idle/ ON or OFF	• ON: Accelerator pedal released • OFF: Accelerator pedal fully depressed	No
	Diagnostic Note: This is a parameter calculated by the ECM. The value is ON when the throttle is at the idle position and OFF when the throttle is open.		

Throttle Require Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Require Position	Required throttle position/ Min.: 0 V, Max.: 4.98 V	0.5 to 1.1 V: Idling	No
	Diagnostic Note: This is a value calculated by the ECM showing the voltage for the target throttle valve position. It is almost an exact match of the Throttle Position No. 1 value except during very rapid throttle valve movement, such as that used during wheelspin control.		

Throttle Sensor Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sensor Position	Throttle sensor position/ Min.: 0%, Max.: 100%	• 0%: Throttle fully closed • 50 to 80%: Throttle fully open	Yes
	Diagnostic Note: This is the throttle valve opening amount used for engine control. (100% signifies 125° of throttle valve rotation. This does not include the amount the throttle valve is opened to maintain the idling speed during idling.) This value has no meaning when the ignition switch is ON and the engine is stopped. The throttle valve opening amount during idling is indicated by 0%. When the throttle valve is fully open, the value is 68%.		

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Throttle Position No. 1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position No. 1	Throttle position sensor No. 1 output voltage/ Min.: 0 V, Max.: 4.98 V	Almost same as "Throttle Require Position" • 0.5 to 1.1 V: Throttle fully closed • 3.2 to 4.8 V: Throttle fully open • 0.6 to 1.4 V: Fail-safe operating	No
	Diagnostic Note: This is the throttle position sensor No. 1 output voltage.		

Throttle Position No. 2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position No. 2	Throttle position sensor No. 2 output voltage/ Min.: 0 V, Max.: 4.98 V	• 2.1 to 3.1 V: Throttle fully closed • 4.6 to 4.98 V: Throttle fully open • 2.1 to 3.1 V: Fail-safe operating	No
	Diagnostic Note: This is the throttle position sensor No. 2 output voltage.		

Throttle Position Command

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position Command	Throttle position command value/ Min.: 0 V, Max.: 4.98 V	0.5 to 4.8 V	No
	Diagnostic Note: Throttle Position Command is the same value as Throttle Require Position.		

Throttle Sens Open Pos #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sens Open Pos #1	Throttle position sensor No. 1/ Min.: 0 V, Max.: 4.98 V	0.6 to 1.4 V	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This is the throttle position sensor No. 1 output voltage when there is no current supplied to the electronic throttle actuator. The accelerator pedal is released but the throttle valve is kept open by the throttle valve opener with the ignition switch ON.		

Throttle Sens Open Pos #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sens Open Pos #2	Throttle position sensor No. 2/ Min.: 0 V, Max.: 4.98 V	1.7 to 2.5 V	No
	Diagnostic Note: This is the throttle position sensor No. 2 output voltage when there is no current supplied to the electronic throttle actuator. The accelerator pedal is released but the throttle valve is kept open by the throttle valve opener with the ignition switch ON.		

Throttle Motor Current

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor Current	Throttle actuator current/ Min.: 0 A, Max.: 19.9 A	0 to 3.0 A: Idling	No
	Diagnostic Note: • When this value is large but the actual opening angle (Throttle Position No. 1) does not reach the target opening angle (Throttle Require Position), there is an "unable to open" malfunction. • This value normally fluctuates around 1 A.		

Throttle Motor DUTY

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor DUTY	Throttle actuator/ Min.: 0%, Max.: 100%	10 to 22%: Idling	Yes
	Diagnostic Note: This is the output duty ratio of the throttle actuator drive circuit.		

Throttle Motor Duty (Open)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor Duty (Open)	Throttle actuator duty ratio (open)/ Min.: 0%, Max.: 255%	0 to 40%: Idling	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: • This is the duty ratio used to drive the throttle actuator and open the throttle valve. It is an ECM command signal. • When the throttle valve is being opened, Throttle Motor Duty (Open) is 20 to 30%.		

Throttle Motor Duty (Close)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor Duty (Close)	Throttle actuator duty ratio (close)/ Min.: 0%, Max.: 255%	0 to 40%: Idling	No
	Diagnostic Note: This is the duty ratio used to drive the throttle actuator and close the throttle valve. It is an ECM command signal. **HINT:** During idling, the throttle valve opening angle is usually controlled using a duty ratio drive signal which closes the throttle valve. However, when carbon deposits build up, it may be necessary to open the throttle valve more than the throttle valve opener does. In that case, the opening angle is controlled using a "Throttle Motor Duty (Open)" signal which opens the throttle valve.		

Throttle Fully Close Learn

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Fully Close Learn	Throttle valve fully closed position (learned value)/ Min.: 0 V, Max.: 4.98 V	0.4 to 1.0 V: Accelerator pedal released	No
	Diagnostic Note: • The ECM uses this learned value to determine the fully closed (and fully open) position of the throttle valve. This learned value is calculated by the ECM with the throttle valve opener angle (approximately 4 to 7°, the position when the ignition switch is ON, the accelerator pedal is released and the throttle actuator is off). • Learning is performed immediately after the ignition switch is turned to ON.		

+BM Voltage

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
+BM Voltage	+BM voltage/ Min.: 0 V, Max.: 79.998 V	11 to 14 V: Ignition switch ON and system normal	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This is the power supply for the electronic throttle actuator. When the power supply is interrupted for approximately 1 second, DTCs P2118 (open circuit) and P0657 (short circuit, ECU malfunction) are stored and the electronic throttle control system enters fail-safe mode (normal operation is not restored until the ignition switch is turned off).		

Actuator Power Supply

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Actuator Power Supply	Actuator power supply/ ON or OFF	ON: Idling	No
	Diagnostic Note: If +BM power is lost, this item changes to OFF.		

Throttle Air Flow Learning Value (Area 1)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Value (Area 1)	Throttle air flow learning value of area 1/ Min.: 0, Max.: 1.99	-	Yes

Throttle Air Flow Learning Value (Area 2)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Value (Area 2)	Throttle air flow learning value of area 2/ Min.: 0, Max.: 1.99	-	Yes

Throttle Air Flow Learning Value (Area 3)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Value (Area 3)	Throttle air flow learning value of area 3/ Min.: 0, Max.: 1.99	-	Yes

Throttle Air Flow Learning Value (Calculated Value)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Value (Calculated Value)	Throttle air flow learning value (Calculated Value)/ Min.: 0, Max.: 1.99	-	Yes

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Throttle Air Flow Learning Value (Atmosphere Pressure Offset Value)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Value (Atmosphere Pressure Offset Value)	Throttle air flow learning value (Atmosphere Pressure Offset Value)/ Min.: 0, Max.: 2.55	-	Yes

Throttle Air Flow Learning Prohibit (Intake Air Pressure Malfunction)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Prohibit (Intake Air Pressure Malfunction)	Throttle air flow learning prohibit (intake air pressure malfunction)/ OK or NG	OK	Yes

Throttle Air Flow Learning Prohibit (Air Fuel Ratio Malfunction)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Air Flow Learning Prohibit (Air Fuel Ratio Malfunction)	Throttle air flow learning prohibit (air fuel ratio malfunction)/ OK or NG	OK	Yes

Throttle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position	Throttle valve opening angle/ Min.: 0 deg, Max.: 499.99 deg	0 to 84 deg	Yes
	Diagnostic Note: This value has no meaning when the ignition switch is ON and the engine is stopped.		

4. Idle Speed Control (Gas Rough Idle)

ISC Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Flow	Flow rate calculated using information from mass air flow meter/ Min.: 0 L/s, Max.: 79.99 L/s	-	Yes
	Diagnostic Note: This is the total ISC airflow amount (the amount of intake air necessary to maintain idling). **HINT:** ISC Flow (total ISC airflow amount) = ISC Learning Value + ISC Feedback Value + each compensation amount		

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ISC Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Position	Requested throttle opening amount calculated using ISC control/ Min.: 0 deg, Max.: 499.99 deg	0 to 21 deg: Idling	Yes
	Diagnostic Note: This is the electronic throttle valve opening amount necessary to maintain idling. In other words, this is the throttle valve opening amount necessary to provide adequate ISC airflow.		

ISC Feedback Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Feedback Value	ISC feedback amount/ Min.: -40 L/s, Max.: 39.99 L/s	-	Yes
	Diagnostic Note: This is the feedback amount necessary to adjust the airflow amount to maintain the target idling speed. **HINT:** When the idling speed differs from the target, the feedback amount is adjusted. If the feedback amount becomes more than a certain value, this will be reflected in the ISC learned airflow value.		

ISC Learning Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Learning Value	ISC learned airflow value/ Min.: -40 L/s, Max.: 39.99 L/s	0.5 to 6.4 L/s	Yes
	Diagnostic Note: This is the learned value of the airflow amount necessary for engine idling. **HINT:** • If ISC Feedback Value becomes more than a certain value, this will be reflected in ISC Learning Value. • ISC Flow (total ISC airflow amount) = ISC Learning Value + ISC Feedback Value + each compensation amount		

Electric Load Feedback Val

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electric Load Feedback Val	Compensation flow rate according to electrical load/ Min.: -40 L/s, Max.: 39.99 L/s	-	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This is the ISC compensation amount determined according to the electrical load.		

Air Conditioner FB Val

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Conditioner FB Val	Compensation flow rate according to air conditioner load/ Min.: -40 L/s, Max.: 39.99 L/s	-	Yes
	Diagnostic Note: This is the ISC compensation amount determined according to the air conditioner load.		

PS Feedback Val

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
PS Feedback Val	Compensation flow rate according to power steering load/ Min.: -40 L/s, Max.: 39.99 L/s	-	Yes
	Diagnostic Note: This is the ISC compensation amount determined according to the power steering load.		

Low Revolution Control

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Low Revolution Control	Low engine speed control operation state/ ON or OFF	-	Yes
	Diagnostic Note: • This parameter indicates whether the engine speed dropped immediately after starting due to poor combustion, etc. This parameter changes to ON when the engine speed drops to below the following speeds 1 to 7 seconds after the engine is started (when the A/C is on, the engine speed thresholds below increase by 100 to 200 rpm). ○ 900 rpm (when the engine coolant temperature is 10°C (50°F)) ○ 850 rpm (when the engine coolant temperature is 30°C (86°F)) ○ 750 rpm (when the engine coolant temperature is 60°C (140°F)) Before 5 seconds elapse after starting the engine, this parameter indicates the status of the previous trip. After 5 seconds elapse after starting the engine, this parameter indicates the status of the current trip. **HINT:** The engine is considered to have started when the engine speed		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	reaches 400 rpm. When the engine speed decreases immediately after starting the engine, this parameter changes to ON and remains ON for the rest of the trip. ON: The engine speed decreased immediately after starting the engine. OFF: The engine speed did not decrease immediately after starting the engine. • For use when engine stall, starting problems or rough idle is present.		

N Range Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
N Range Status	Shift lever N status/ ON or OFF	-	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

Eng Stall Control FB Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Eng Stall Control FB Flow	Intake air compensation flow rate/ Min.: -40 L/s, Max.: 39.99 L/s	-	Yes
	Diagnostic Note: • The intake air amount and ignition timing are adjusted when there is a large decrease in engine speed (for example, a decrease to 550 rpm or less) in order to prevent engine stall. • For use when engine stall, starting problems or rough idle is present.		

5. Fuel System 1 (Gas General)

Injector (Port)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injector (Port)	Injection period of the No. 1 cylinder/ Min.: 0 µs, Max.: 65535 µs	1000 to 3000 µs: Idling	Yes
	Diagnostic Note: This is the injection period of the No. 1 cylinder (the command value from the ECM).		

Injection Volum (Cylinder 1)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injection Volum (Cylinder 1)	Injection volume (cylinder 1)/ Min.: 0 ml, Max.: 2.047 ml	0 to 0.5 ml: Idling	Yes
	Diagnostic Note: This is the fuel injection volume for 10 injections.		

Fuel Pump/Speed Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Pump/Speed Status	Fuel pump status/ ON or OFF	-	Yes

6. EVAP System 1 (All Data)

Vacuum Pump

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vacuum Pump	Key-off EVAP system pump status/ ON or OFF	-	Yes
	Diagnostic Note: This item changes to ON during the key-off EVAP monitor which is performed approximately 5 hours after the ignition switch is turned off INFO .		

7. Fuel System 2 (Gas General)

Current Fuel Type

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Current Fuel Type	Status of the current fuel type	Gasoline/petrol	Yes

8. EVAP System 2 (Gas Evaporative)

EVAP (Purge) VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
EVAP (Purge) VSV	Purge VSV control duty/ Min.: 0%, Max.: 100%	0 to 100%: Idling, under purge control	Yes
	Diagnostic Note: • This is the command signal from the ECM. • This is the purge VSV control duty ratio. When EVAP (Purge) VSV is any value except 0%, EVAP purge* is being performed. *: Gasoline vapor from the fuel tank is being introduced into the intake system via the purge VSV. • When the engine is cold or immediately after the engine is started, EVAP (Purge) VSV		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	is 0%.		

Evap Purge Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Evap Purge Flow	Purge flow/ Min.: 0%, Max.: 399.9%	0 to 100%: Idling	Yes
	Diagnostic Note: This is the percentage of total engine airflow contributed by EVAP purge operation. (Evap Purge Flow = Purge flow / Engine airflow x 100 (%)) It is based on MAF and a stored value for airflow and controlled by adjusting the duty cycle for the purge VSV.		

Purge Density Learn Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Purge Density Learn Value	Purge density learned value/ Min.: -200, Max.: 199.993	-40 to 0: Idling	Yes
	Diagnostic Note: Purge Density Learn Value is the proportion of the decrease in injection volume (based on the change in the air fuel ratio feedback compensation value) related to a 1% purge flow rate. When Purge Density Learn Value is a large negative value, the purge effect is large. The purge density is determined from the change in the air fuel ratio feedback compensation value when purge flow is introduced. Purge density learning is performed so that the feedback compensation value is 0 +/-2%. **HINT:** • Usually, the value is approximately +/-1%. • 1%: The concentration of HC in the purge gas is relatively low. • 0%: The concentration of HC in the purge gas is approximately equal to the stoichiometric air fuel ratio. • Large negative values indicate that the concentration of HC in the purge gas is relatively high.		

Vapor Pressure Pump

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vapor Pressure Pump	Vapor pressure/ Min.: 0 kPa (0 mmHg), Max.: 1441.77 kPa (10814.17 mmHg)	Nearly atmospheric pressure: Fuel tank cap removed	No
	Diagnostic Note: This is the EVAP system pressure monitored by the canister pressure sensor.		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	HINT: • Except for when the monitor is running, this value should be approximately the same as atmospheric pressure. • As Vapor Pressure Pump is almost the same as Atmosphere Pressure when the engine is stopped, these items can be used to help determine if the canister pressure sensor characteristics are abnormal, if there is noise, or if the sensor output is stuck at a certain value.		

Vapor Pressure (Calculated)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vapor Pressure (Calculated)	Calculated EVAP system pressure/ Min.: -720.896 kPa (-5407.167 mmHg), Max.: 720.874 kPa (5407.002 mmHg)	Nearly atmospheric pressure: Fuel tank cap removed	No

EVAP System Vent Valve

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
EVAP System Vent Valve	Key-off EVAP system vent valve status/ ON or OFF	OFF: Vent ON: Close	Yes

EVAP Purge VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
EVAP Purge VSV	VSV status for EVAP control/ ON or OFF	-	Yes
	Diagnostic Note: This parameter displays ON when the VSV duty ratio is 30% or more, and displays OFF when the VSV duty ratio is less than 30%.		

Purge Cut VSV Duty

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Purge Cut VSV Duty	Purge cut VSV duty/ Min.: 0%, Max.: 399.9%	-	Yes

9. Air Fuel Ratio Control 1 (All Data)

Target Air-Fuel Ratio

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Target Air-Fuel Ratio	Target air fuel ratio/ Min.: 0, Max.: 1.99	0.8 to 1.2: During idling	Yes
	Diagnostic Note: This is the target air fuel ratio used by the ECM. 1.0 is the stoichiometric air fuel ratio. Values that are more than 1 indicate the system attempting to make the air fuel ratio leaner. Values that are less than 1 indicate the system attempting to make the air fuel ratio richer. Target Air-Fuel Ratio and AF Lambda B1S1 are related.		

10. Air Fuel Ratio Control 2 (Gas AF O2 Sensor)

AF Lambda B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AF Lambda B1S1	Output air fuel ratio associated with Bank 1 Sensor 1/ Min.: 0, Max.: 1.99	• Value less than 1 (0.000 to 0.999) = Rich • 1 = Stoichiometric air fuel ratio • Value more than 1 (1.001 to 1.999) = Lean	Yes
	Diagnostic Note: This is the actual air fuel ratio calculated based on the air fuel ratio sensor output. Performing the "Control the Injection Volume for A/F Sensor" function of the Active Test enables the technician to check the voltage output of the sensor.		

AFS Voltage B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AFS Voltage B1S1	Air fuel ratio sensor output voltage for Bank 1 Sensor 1/ Min.: 0 V, Max.: 7.99 V	2.8 to 3.8 V: Idling, engine warmed up	Yes
	Diagnostic Note: • This is the voltage output of the air fuel ratio sensor (the voltage cannot be measured at the terminals of the sensor). This value is calculated by the ECM based on the current output of the air fuel ratio sensor (refer to AFS Current below for the actual sensor output). • Performing the Control the Injection Volume or Control the Injection Volume for A/F Sensor function of the Active Test enables the technician to check the voltage output of the sensor.		

AFS Current B1S1

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AFS Current B1S1	Air fuel ratio sensor output current for Bank 1 Sensor 1/ Min.: -128 mA, Max.: 127.99 mA	-0.5 to 0.5 mA: Idling, engine warmed up	Yes
	Diagnostic Note: • With a stoichiometric air fuel ratio (for example, during idling after the engine is warmed up), the air fuel ratio sensor current output is approximately -0.5 to 0.5 mA. • When the value is outside the range of 0.7 to 2.2 mA when the fuel-cut is being performed, there is a malfunction in the air fuel ratio sensor or sensor circuit.		

A/F Heater Duty #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Heater Duty #1	Air fuel ratio sensor heater duty ratio/ Min.: 0%, Max.: 399.9%	0 to 100%	Yes

O2S B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2S B1S2	Heated oxygen sensor output voltage for Bank 1 Sensor 2/ Min.: 0 V, Max.: 1.275 V	0.0 to 0.9 V: Driving at 70 km/h (44 mph)	Yes
	Diagnostic Note: This is the output voltage of the heated oxygen sensor. Values close to 0 V indicate an air fuel ratio leaner than the stoichiometric ratio. Values close to 1 V indicate an air fuel ratio richer than the stoichiometric ratio. During air fuel ratio feedback control, the value moves back and forth in the range of 0 to 1 V. Performing the "Control the Injection Volume for A/F Sensor" function of the Active Test enables the technician to check voltage output of the sensor.		

O2S Impedance B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2S Impedance B1S2	Heated oxygen sensor impedance for bank 1 sensor 2/ Min.: 0 ohm, Max.: 21247.67 ohm	5 to 15000 ohm: After driving for 10 minutes or more in urban area	Yes
	Diagnostic Note: After driving approx. 10 min. in an urban area: 5 to 15000 ohm		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	HINT: • When the value is outside the range of 5 to 15000 ohm, there is a problem in the heated oxygen sensor or sensor circuit. • Generally, the value is 50 to 200 ohm.		

O2 Heater B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2 Heater B1S2	Heated oxygen sensor heater for Bank 1 Sensor 2/ Active or Not Act	-	Yes

O2 Heater Curr Val B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2 Heater Curr Val B1S2	Heated oxygen sensor current for Bank 1 Sensor 2/ Min.: 0 A, Max.: 4.999 A	-	Yes
	Diagnostic Note: When the value is any value except 0 A, current is being supplied to the heater.		

Short FT #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Short FT #1	Short-term fuel trim for bank 1/ Min.: -100%, Max.: 99.2%	-15 to 15%	Yes
	Diagnostic Note: This item is the "short-term fuel injection volume compensation ratio" used to maintain the air fuel ratio at the stoichiometric ratio using the air fuel ratio sensor for feedback.		

Long FT #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Long FT #1	Long-term fuel trim for bank 1/ Min.: -100%, Max.: 99.2%	-15 to 15%	Yes
	Diagnostic Note: The ECM will learn the Long FT values based on Short FT. The goal is to keep Short FT at 0% to keep the A/F mixture at the stoichiometric ratio. This value is used to determine whether the air fuel ratio control system is malfunctioning. The condition of the system is determined based on the sum of Short FT and Long FT (excluding times when the system is in transition).		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	• +15% or more: The air fuel ratio may be lean. • -15 to +15%: The air fuel ratio can be determined to be normal. • -15% or less: The air fuel ratio may be rich. The learned value is cleared when the battery cable is disconnected.		

A/F Learn Value Idle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Idle #1	Air fuel ratio learn value of idle area/ Min.: -50%, Max.: 49.6%	-	Yes
	Diagnostic Note: Learning is performed when idling with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher).		

A/F Learn Value Low #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Low #1	Air fuel ratio learn value of low load area/ Min.: -50%, Max.: 49.6%	-	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the low load range (when the range of engine loads is divided into four parts).		

A/F Learn Value Mid1 #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Mid1 #1	Air fuel ratio learn value of middle 1 load area/ Min.: -50%, Max.: 49.6%	-	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the mid-size load range closer to the low load range (when the range of engine loads is divided into four parts).		

A/F Learn Value Mid2 #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn	Air fuel ratio learn value of middle 2 load	-	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Value Mid2 #1	area/ Min.: -50%, Max.: 49.6%		
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the mid-size load range closer to the high load range (when the range of engine loads is divided into four parts).		

A/F Learn Value High #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value High #1	Air fuel ratio learn value of high load area/ Min.: -50%, Max.: 49.6%	-	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the high load range (when the range of engine loads is divided into four parts).		

Total FT #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Total FT #1	Total fuel trim for bank 1/ Min.: -0.5, Max.: 0.496	-0.28 to 0.2: Idling	Yes
	Diagnostic Note: Total FT #1 = Short FT #1 + Long FT #1		

Fuel System Status #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel System Status #1	Fuel system status for bank 1/ OL, CL, OL Drive, OL Fault or CL Fault	CL: Idling after warming up	Yes
	Diagnostic Note: • OL (Open Loop): Has not yet satisfied conditions to go to closed loop. • CL (Closed Loop): Uses feedback to perform fuel control. • OL Drive: Open loop due to driving conditions (fuel enrichment). • OL Fault: Open loop due to a detected system fault. • CL Fault: Closed loop but the air fuel ratio sensor, which is used for fuel control, is malfunctioning. CL (Closed Loop): During air fuel ratio feedback control, AF Lambda B1S1 is approximately 1.0 and AFS Voltage B1S1 is approximately 3.3 V.		

Fuel System Status #2

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel System Status #2	Fuel system status for bank 2/ Unused	Unused	Yes

11. Secondary Air Injection System (Gas 2nd Air)

Air Pump Pressure (Absolute)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Pump Pressure (Absolute)	Air pump pressure (absolute)/ Min.: 0 kPa (0 mmHg), Max.: 65535 kPa (491553.1 mmHg)	Atmospheric pressure +2.5 kPa (18.751 mmHg) or more: Air pump on, air switching valve open Close to atmospheric pressure: Air pump off, air switching valve closed	Yes
	Diagnostic Note: Refer to DTC P2431 INFO .		

Air Pump Pulsation Pressure

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Pump Pulsation Pressure	Air pump pulsation pressure/ Min.: 0 kPa (0 mmHg), Max.: 655.35 kPa (4915.531 mmHg)	-	Yes
	Diagnostic Note: Cumulative pulsation pressure calculated by ECM INFO .		

Secondary Air Control VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Secondary Air Control VSV	Air switching valve status/ ON or OFF	ON: ECM commanding air switching valve to open	Yes

2nd Air System Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
2nd Air System Status	Secondary air injection system status/ ON or OFF	ON: ECM commanding air pump and air switching valve to operate	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This system operates immediately after a cold engine start.		

AI Test

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AI Test	Secondary air injection system operation prohibition/ READY or NOT RDY	Permission status of forced operation of secondary air injection system	Yes

Subfreezing Conditions

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Subfreezing Conditions	Subfreezing conditions status/ ON or OFF	-	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

Air Pump Freeze

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Pump Freeze	Air pump freeze status/ ON or OFF	-	Yes
	Diagnostic Note: This is only available in Freeze Frame Data.		

Air Switching Valve Freeze

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Switching Valve Freeze	Air switching valve status/ ON or OFF	-	Yes
	Diagnostic Note: This is only available in Freeze Frame Data.		

Air Pump Heater

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Pump Heater	Air pump heater status/ ON or OFF	-	Yes
	Diagnostic Note: Active Test support data. This item is displayed only for automatic transmission.		

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12. Ignition System (Ignition)

IGN Advance

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
IGN Advance	Ignition timing advance for No. 1 cylinder/ Min.: -64 deg., Max.: 63.5 deg.	BTDC 4 to 17 deg: Idling	Yes

Knock Feedback Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Knock Feedback Value	Knocking feedback value/ Min.: -1024 deg(CA), Max.: 1023.9 deg(CA)	-19 to 0 deg(CA): Driving at 70 km/h (44 mph)	Yes
	Diagnostic Note: This is the ignition timing retard compensation amount determined by the presence or absence of knocking. Ignition timing = Most retarded timing value*1 + Knock Correct Learn Value*2 + Knock Feedback Value*3 + each compensation amount Example: 21 deg(CA) = 10° + 14° - 3° *1: The most retarded timing value is a constant determined by the engine speed and engine load. *2: The knock correction learned value is calculated as shown below in order to keep Knock Feedback Value as close to -3 deg(CA) as possible. When Knock Feedback Value is less than -4 deg(CA), Knock Correct Learn Value is slowly decreased. When Knock Feedback Value is more than -2 deg(CA), Knock Correct Learn Value is slowly increased. *3: The base value is -3 deg(CA) and is adjusted based on the presence or absence of knocking. When there is no knocking, the value is increased, and when knocking is present, the value is decreased. -1 deg(CA): There is no knocking and ignition timing is advanced. -6 deg(CA): Knocking is present and the ignition timing is being retarded. **HINT:** If Knock Feedback Value does not change around the time when knocking occurs even though knocking continues (for example, stays at -3 deg(CA)), it can be determined that knocking is not being detected. **Possible Causes:** • There is a problem with the knock sensor sensitivity. • The knock sensor is improperly installed. • There is a problem with a wire harness.		

Knock Correct Learn Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Knock Correct Learn Value	Knocking correction learned value/ Min.: -1024 deg(CA), Max.: 1023.9 deg(CA)	-19 to 0 deg(CA): Driving at 70 km/h (44 mph)	Yes
	Diagnostic Note: Refer to "Knock Feedback Value". When there is knocking or a lack of power, compare the following values to another vehicle of the same model. • Engine speed • Calculate Load • IGN Advance • Knock Feedback Value • Knock Correct Learn Value Knock Correct Learn Value is large: There is no knocking and the ignition timing is advanced. Knock Correct Learn Value is small: Knocking is present and the ignition timing is being retarded. **HINT:** When knocking continues even though Knock Correct Learn Value is less than that of the vehicle being used for comparison (in other words, the ignition timing is being retarded but the knocking is not stopping), there may be a buildup of deposits or other such problems due to deterioration over time (oil entering the cylinders, poor quality fuel, etc.).		

Idle Spark Advn Ctrl #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Idle Spark Advn Ctrl #1 Idle Spark Advn Ctrl #2 Idle Spark Advn Ctrl #3 Idle Spark Advn Ctrl #4	Individual cylinder timing advance compensation amount (No. 1 to No. 4)/ Min.: 0 deg(CA), Max.: 15.93 deg(CA)	3 to 13 deg(CA): Idling	Yes
	Diagnostic Note: • This is the ignition timing advance compensation amount used to stabilize idling (each cylinder has a separate value). When the speed for a certain cylinder drops, the system advances the timing for that particular cylinder in an attempt to restore the speed and stabilize idling. • It may be possible to use this item to help determine specific cylinders which are not operating normally.		

13. VVT Control 1 (All Data)

Actual VVT Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Actual VVT Angle #1	VVT displacement angle for bank 1/ Min.: 0 DegFR, Max.: 639.99	-	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	DegFR		
	Diagnostic Note: This is the VVT displacement angle. This is only available in Freeze Frame Data.		

14. VVT Control 2 (Gas Valve Control)

VVT Control Status #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Control Status #1	Variable Valve Timing (VVT) control status for bank 1/ ON or OFF	-	Yes
	Diagnostic Note: ON: The ECM is sending commands to change the timing (even when the timing is advanced, when the timing is being maintained and not being retarded or advanced any further, the value changes to OFF). OFF: The system is commanding the timing to change to the most retarded timing.		

VVT Advance Fail

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Advance Fail	VVT control failure status/ ON or OFF	ON: VVT control failure	Yes
	Diagnostic Note: ON: There is an intake VVT timing advance malfunction.		

VVT Aim Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Aim Angle #1	VVT hold duty learned value for bank 1/ Min.: 0%, Max.: 399.9%	0%: Idling	No
	Diagnostic Note: This value represents the duty ratio necessary to operate the camshaft timing oil control valve in order to block the camshaft timing oil control valve path and maintain the advanced state of the camshaft timing gear. Refer to "VVT OCV Duty #1".		

VVT Change Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Change Angle	VVT displacement angle for bank	0 to 56 DegFR:	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
#1	1/ Min.: 0 DegFR, Max.: 639.9 DegFR	Idling	
	Diagnostic Note: This is the VVT displacement angle during forced operation. Refer to "VVT OCV Duty #1".		

VVT OCV Duty #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT OCV Duty #1	VVT camshaft timing oil control valve operation duty for bank 1/ Min.: 0%, Max.: 399.9%	-	No
	Diagnostic Note: This is the requested duty value for forced operation.		

VVT Ex Hold Lrn Val #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex Hold Lrn Val #1	VVT exhaust hold duty ratio learned value/ Min.: 0%, Max.: 399.9%	-	No
	Diagnostic Note: This value represents the duty ratio necessary to operate the camshaft timing oil control valve in order to block the camshaft timing oil control valve path and maintain the advanced state of the VVT controller. Refer to "VVT Ex OCV Duty #1".		

VVT Ex Chg Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex Chg Angle #1	VVT exhaust displacement angle/ Min.: 0 DegFR, Max.: 639.9 DegFR	-	No
	Diagnostic Note: This is the displacement angle during forced operation. Refer to "VVT Ex OCV Duty #1".		

VVT Ex OCV Duty #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex OCV Duty #1	VVT exhaust camshaft timing oil control valve duty/ Min.: 0%, Max.: 399.9%	-	No
	Diagnostic Note: This is the requested duty value for forced operation.		

VVT Target Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Target Angle #1	VVT intake target angle/ Min.: 0 DegFR, Max.: 639.9 DegFR	-	Yes

VVT Ex Target Angle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex Target Angle #1	VVT exhaust target angle/ Min.: 0 DegFR, Max.: 639.9 DegFR	-	Yes

15. Various Vehicle Conditions 2 (All Data)

VN Turbo Type

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VN Turbo Type	VN turbo type/ Not Avl, Commo, Vacuum or CAN Com	Not Avl (Unused)	No

16. Catalyst (Gas CAT Converter)

Catalyst Temp B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Catalyst Temp B1S1	Catalyst temperature (associated sensor 1): Min.: -40°C (-40°F), Max.: 6513.5°C (11756.3°F)	Close to catalyst inlet temperature	Yes

Catalyst Temp B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Catalyst Temp B1S2	Catalyst temperature (associated sensor 2): Min.: -40°C (-40°F), Max.: 6513.5°C (11756.3°F)	Close to catalyst inlet temperature	Yes

17. Various Vehicle Conditions 3 (All Data)

Starter Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Starter Signal	Starter signal/ ON or OFF	ON: Starter operating OFF: Starter not operating	Yes

Power Steering Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Power Steering Signal	Power steering switch signal/ ON or OFF	ON: Power steering operating	Yes

Neutral Position SW Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Neutral Position SW Signal	Park/neutral position switch status/ ON or OFF	ON: Shift lever in P or N	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

Clutch Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Clutch Switch	Clutch switch status/ ON or OFF	ON: Clutch pedal depressed	Yes
	Diagnostic Note: This item is displayed only for manual transmission.		

Clutch Start SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Clutch Start SW	Clutch start switch status/ ON or OFF	-	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This item is displayed only for manual transmission.		

4WD

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
4WD SW	4WD switch status/ ON or OFF	ON: 4WD control switch in 4L or 4H position	Yes

Transfer L4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Transfer L4	L4 status of the transfer/ ON or OFF	ON: 4WD control switch in 4L position	Yes

Stop Light Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Stop Light Switch	Stop light switch/ ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	Yes

A/C Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/C Signal	A/C switch status/ ON or OFF	ON: A/C ON	Yes

Closed Throttle Position SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Closed Throttle Position SW	Closed throttle position switch/ ON or OFF	• ON: Throttle fully closed • OFF: Throttle open	Yes

Fuel Cut Condition

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Cut Condition	Fuel cut condition/ ON or OFF	ON: Fuel cut operating	Yes

Immobiliser Communication

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Immobiliser Communication	Immobiliser communication/ ON or OFF	ON: Normal	Yes

18. Check Mode (Check Mode)

Check Mode

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
Check Mode	Check mode/ ON or OFF	ON: Check mode ON	Refer to Check Mode Procedure INFO .	No
SPD Test Result	Check mode result for vehicle speed sensor/ Compl or Incmpl	-	-	No
AS Test Result	Check mode result for secondary air injection system/ Compl or Incmpl	-	-	No
Misfire Test Result	Check mode result for misfire monitor/ Compl or Incmpl	-	-	No
OXS1 Test Result	Check mode result for heated oxygen sensor (Bank 1)/ Compl or Incmpl	-	-	No
A/F Test Results #1	Check mode result for air fuel ratio sensor (Bank 1)/ Compl or Incmpl	-	-	No

19. Test Result (Monitor Status)

Monitor Information 1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
Complete Parts Monitor	Comprehensive component monitor/ Not Avl or Avail	-	*1	No
Fuel System Monitor	Fuel system monitor/ Not Avl or Avail	-	*1	No
Misfire Monitor	Misfire monitor/ Not Avl or Avail	-	*1	No
EGR/VVT Monitor	EGR/VVT monitor/ Not Avl or Avail	-	*1	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
EGR/VVT Monitor	EGR/VVT monitor/ Compl or Incmpl	-	*1	No
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor/ Not Avl or Avail	-	*1	No
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor/ Compl or Incmpl	-	*1	No
O2S(A/FS) Monitor	O2S (A/FS) monitor/ Not Avl or Avail	-	*1	No
O2S(A/FS) Monitor	O2S (A/FS) monitor/ Compl or Incmpl	-	*1	No
A/C Monitor	A/C monitor/ Not Avl or Avail	-	*1	No
A/C Monitor	A/C monitor/ Compl or Incmpl	-	*1	No
2nd Air Monitor	2nd air monitor/ Not Avl or Avail	-	*1	No
2nd Air Monitor	2nd air monitor/ Compl or Incmpl	-	*1	No
EVAP Monitor	EVAP monitor/ Not Avl or Avail	-	*1	No
EVAP Monitor	EVAP monitor/ Compl or Incmpl	-	*1	No
Heated Catalyst Monitor	Heated catalyst monitor/ Not Avl or Avail	-	*1	No
Heated Catalyst Monitor	Heated catalyst monitor/ Compl or Incmpl	-	*1	No
Catalyst Monitor	Catalyst monitor/ Not Avl or Avail	-	*1	No
Catalyst Monitor	Catalyst monitor/ Compl or Incmpl	-	*1	No

*1:
Avail: The monitor is available on the vehicle.
Not Avl: The monitor is not available on the vehicle.
Incmpl / Compl: The item changes from Incmpl to Compl if the monitor was completed at least once at some time in the past. This item does not change when the ignition switch is turned off. However, the item changes back to Incmpl when DTCs are cleared or the battery cable is disconnected.
Monitor result (mode 06): The last judgment result is output. This is not cleared when the ignition switch is turned off, but is cleared when DTCs are cleared.

Monitor Information 2

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
Component Monitor ENA	Comprehensive component monitor/ Unable or Enable	-	*2	No
Component Monitor CMPL	Comprehensive component monitor/ Compl or Incmpl	-	*2	No
Fuel System Monitor ENA	Fuel system monitor/ Unable or Enable	-	*2	No
Fuel System Monitor CMPL	Fuel system monitor/ Compl or Incmpl	-	*2	No
Misfire Monitor ENA	Misfire monitor/ Unable or Enable	-	*2	No
Misfire Monitor CMPL	Misfire monitor/ Compl or Incmpl	-	*2	No
EGR/VVT Monitor ENA	EGR monitor/ Unable or Enable	-	*2	No
EGR/VVT Monitor CMPL	EGR monitor/ Compl or Incmpl	-	*2	No
Heater Monitor ENA	O2S (A/FS) heater monitor/ Unable or Enable	-	*2	No
Heater Monitor CMPL	O2S (A/FS) heater monitor/ Compl or Incmpl	-	*2	No
O2S(A/FS) Monitor ENA	O2S (A/FS) monitor/ Unable or Enable	-	*2	No
O2S(A/FS) Monitor CMPL	O2S (A/FS) monitor/ Compl or Incmpl	-	*2	No
A/C Monitor ENA	A/C monitor/ Unable or Enable	-	*2	No
A/C Monitor CMPL	A/C monitor/ Compl or Incmpl	-	*2	No
2nd Air Monitor ENA	2nd air monitor/ Unable or Enable	-	*2	No
2nd Air Monitor CMPL	2nd air monitor/ Compl or Incmpl	-	*2	No
EVAP Monitor ENA	EVAP monitor/ Unable or Enable	-	*2	No
EVAP Monitor CMPL	EVAP monitor/ Compl or Incmpl	-	*2	No
Heated Cat Monitor ENA	Heated catalyst monitor/ Unable or Enable	-	*2	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
Heated Cat Monitor CMPL	Heated catalyst monitor/ Compl or Incmpl	-	*2	No
Catalyst Monitor ENA	Catalyst monitor/ Unable or Enable	-	*2	No
Catalyst Monitor CMPL	Catalyst monitor/ Compl or Incmpl	-	*2	No

*2:
Enable: The monitor is available on the vehicle.
Unable: The monitor is not available on the vehicle.
Incmpl / Compl: The item changes from Incmpl to Compl if the monitor was completed during the current trip. The item changes back to Incmpl when the ignition switch is turned off.
Monitor result (mode 06): The last judgment result is output. This is not cleared when the ignition switch is turned off, but is cleared when DTCs are cleared. Therefore, only when DTCs are cleared at the beginning of a trip do the system monitor (Monitor Information 2) and monitor result (mode 06) match.

20. Various Vehicle Conditions 4 (All Data)

TC Terminal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
TC Terminal	TC terminal status/ ON or OFF	-	Yes

Codes (Include History)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
# Codes (Include History)	Number of codes/ Min.: 0, Max.: 255	0	No
	Diagnostic Note: This is the number of DTCs stored.		

MIL

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MIL	MIL status/ ON or OFF	OFF	No

MIL ON Run Distance

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MIL ON Run Distance	Distance driven with MIL on/ Min.: 0 km (0 mile), Max.: 65535 km (40723 mile)	-	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: This is the distance driven after a DTC is stored.		

Running Time from MIL ON

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Running Time from MIL ON	Running time from MIL ON/ Min.: 0 minutes, Max.: 65535 minutes	Running time after MIL turned ON	No

Time after DTC Cleared

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Time after DTC Cleared	Time after DTCs cleared/ Min.: 0 minutes, Max.: 65535 minutes	Time after DTCs cleared	Yes
	Diagnostic Note: This is the time elapsed after DTCs were cleared (or after the vehicle left the factory). Time elapsed after the ignition switch is turned off is not counted.		

Distance from DTC Cleared

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Distance from DTC Cleared	Distance after DTC cleared/ Min.: 0 km (0 mile), Max.: 65535 km (40723 mile)	Equivalent to drive distance after DTCs erased	Yes

Warm up Cycle Cleared DTC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Warmup Cycle Cleared DTC	Warm-up cycle after DTC cleared/ Min.: 0, Max.: 255	-	Yes
	Diagnostic Note: Number of warm-up cycles after DTC cleared		

Dist Batt Cable Disconnect

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Dist Batt Cable	Distance driven after battery	Total distance vehicle driven after	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Disconnect	cable disconnected/ Min.: 0 km (0 mile), Max.: 65535 km (40723 mile)	battery cable disconnected	

IG OFF Elapsed Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
IG OFF Elapsed Time	Time after ignition switch turned off/ Min.: 0 min, Max.: 655350 min	Cumulative time after the ignition switch is turned off	Yes
	Diagnostic Note: Displays the time elapsed from when the engine is stopped until the engine is started again. **HINT:** When the soak timer does not activate due to the engine being stopped for only a short amount of time, a value for this item may not be stored.		

OBD Requirements

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
OBD Requirements	OBD Requirements	OBD II (California ARB)	No

Number of Emission DTC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Number of Emission DTC	Emission related DTCs	0	No
	Diagnostic Note: Number of emission related DTCs		

TC and TE1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
TC and TE1	TC and CG (TE1) terminals of DLC3: ON or OFF	-	Yes
	Diagnostic Note: Active Test support data		

Total Distance Traveled

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Total Distance Traveled	Total distance traveled/ Min.: 0 km (0 mile),	-	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Max.: 16777215 km (10425361 mile)		

21. Misfire (Gas Misfire)

Ignition Trig. Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Ignition Trig. Count	Ignition counter to calculated misfire rate: Min.: 0, Max.: 65535	0 to 400	Yes

Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cylinder #1 Misfire Count Cylinder #2 Misfire Count Cylinder #3 Misfire Count Cylinder #4 Misfire Count	Misfire count of cylinders 1 to 4/ Min.: 0, Max.: 255	0	Yes

All Cylinders Misfire Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
All Cylinders Misfire Count	All cylinders misfire count/ Min.: 0, Max.: 255	0	Yes

Misfire RPM

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Misfire RPM	Engine speed for first misfire range/ Min.: 0 rpm, Max.: 6375 rpm	0 rpm: 0 misfires	Yes
	Diagnostic Note: • This is the average engine speed recorded when misfiring occurs. • This value is closer to the actual conditions of the vehicle at the time the misfire occurred than the values of engine speed and engine load stored in the freeze frame data. When reproducing malfunction conditions, use this value as a reference.		

Misfire Load

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Misfire Load	Engine load for first misfire range/ Min.: 0 g/rev, Max.: 3.98 g/rev	0 g/rev: 0 misfires	Yes
	Diagnostic Note: • This is the average engine load recorded when misfiring occurs. • This value is closer to the actual conditions of the vehicle at the time the misfire occurred than the values of engine speed and engine load stored in the freeze frame data. When reproducing malfunction conditions, use this value as a reference. **HINT:** To convert g/rev to gm/sec: RPM / 60 x g/rev = gm/sec.		

Misfire Margin

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Misfire Margin	Misfire monitoring/ Min.: -128%, Max.: 127%	0 to 99.2%	Yes
	Diagnostic Note: This is the misfire detection margin. Misfire Margin = (Misfire detection threshold - maximum engine speed variation) / misfire detection threshold x 100% When the variation in the engine speed is large and exceeds the misfire detection threshold, the misfire count starts. Misfire margin is a measure of how much the engine speed variation can increase with respect to the threshold before the engine is determined to be misfiring. A large value means there is a large margin for the engine speed to vary before the engine is determined to be misfiring. Example: When the engine is not determined to be misfiring, Misfire Margin = 52%. When the engine is determined to be misfiring, Misfire Margin = -128 to 0%.		

Catalyst OT MF F/C

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Catalyst OT MF F/C	Fuel cut to prevent catalyst from overheating during misfire/ Not Avl or Avail	• Avail: "Fuel cut to prevent catalyst from overheating during misfire" available • Not Avl: "Fuel cut to prevent catalyst from overheating during misfire" not available	Yes
	Diagnostic Note: For vehicles which support this function, Catalyst OT MF F/C is displayed as "Avail". When a high frequency of misfires is concentrated in a certain cylinder, this function stops		

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	fuel injection for that cylinder. For vehicles which support this function, stop this fuel cut using the Active Test and confirm the misfire counts to determine the malfunctioning cylinder.		

Cat OT MF F/C History

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cat OT MF F/C History	History of fuel cut to prevent catalyst from overheating during misfire/ ON or OFF	ON: Fuel cut operation history exists	Yes
	Diagnostic Note: This can be used to tell whether there was a large amount of misfires concentrated in a certain cylinder.		

Cat OT MF F/C Cylinder #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cat OT MF F/C Cylinder #1 Cat OT MF F/C Cylinder #2 Cat OT MF F/C Cylinder #3 Cat OT MF F/C Cylinder #4	Display of fuel cut operation in No. 1 to No. 4 cylinder (if certain level of misfire malfunction is detected)/ ON or OFF	ON: Fuel cut operating	Yes

22. Various Vehicle Conditions 5 (All Data)

Engine Speed (Starter Off)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed (Starter Off)	Engine speed when starter off/ Min.: 0 rpm, Max.: 51199 rpm	-	Yes
	Diagnostic Note: This is the engine speed immediately after starting the engine.		

Starter Count

TESTER	MEASUREMENT ITEM/RANGE	NORMAL	STORED AS FREEZE

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DISPLAY		CONDITION	FRAME DATA
Starter Count	Number of times starter turned on after ignition switch turned ON/ Min.: 0, Max.: 255	-	Yes
	Diagnostic Note: • Indicates the number of times starter turned ON in the current driving cycle. • Number of times starter turned ON before engine started displayed in the 1 position. • Number of times starter turned ON after engine started displayed in the 10 position. Example: If "21" is displayed on the Techstream, the starter was turned ON 1 time before engine start and turned ON 2 times after engine start. (The maximum value for each counter is 9 times before engine start and 11 times after engine start)		

Run Dist of Previous Trip

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Run Dist of Previous Trip	Distance driven during previous trip/ Min.: 0 km (0 mile), Max.: 655.35 km (407.23 mile)	-	Yes
	Diagnostic Note: Before 5 seconds elapse after starting the engine, which is the DTC P1604 (Startability Malfunction) detection duration, this parameter indicates the distance driven during the previous trip. After 5 seconds elapse after starting the engine, this parameter indicates the distance driven during the current trip calculated from the vehicle speed signal. **HINT:** Run Dist of Previous Trip in the freeze frame data present when the startability malfunction occurred (DTC P1604 detected) indicates the distance driven during the previous trip, but in all other cases, such as for the snapshot data of the Data List (real-time measurements), or for freeze frame data present when DTCs other than P1604 were detected, the value indicates the distance driven during the current trip.		

23. Rough Idle (Gas Rough Idle)

Compression Leakage Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Compression Leakage Count	Compression leakage count/ Min.: 0, Max.: 255	0	Yes
	Diagnostic Note: • When the counter displays 1 or higher during an engine stall, startability malfunction or rough idle, it may be the result of pressure loss caused by deposits jamming the valve, etc. • This item is displayed only for automatic transmission.		

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Rough Idle Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Rough Idle Status	Status of the rough idle status/ Normal, Misfire, Continuous poor combustion, Intermittent poor combustion, Low frequency poor combustion	Normal	Yes
	Diagnostic Note: The following list of statuses indicates the degree and frequency of rough idling from highest to lowest. Use this as a reference when trying to reproduce the rough idling. 1. Misfire 2. Continuous poor combustion 3. Intermittent poor combustion 4. Low frequency poor combustion This item is displayed only for automatic transmission.		

Plural Cylinders Rough Idle

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Plural Cylinders Rough Idle	Status of the plural cylinders rough idle/ ON or OFF	OFF	Yes
	Diagnostic Note: • Indicates multiple cylinders are the cause of rough idling when ON. • This item is displayed only for automatic transmission.		

Rough Idle #1 to Rough Idle #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Rough Idle #1 Rough Idle #2 Rough Idle #3 Rough Idle #4	Status of the rough idle (#1 to #4)/ ON or OFF	OFF	Yes
	Diagnostic Note: • Indicates speed has dropped compared to other cylinders and idling is rough for the indicated cylinder when ON. • This item indicates cylinders which are likely to be the cause of rough idle. • This item is displayed only for automatic transmission.		

24. Various Vehicle Conditions 6 (All Data)

Engine Starting Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Starting Time	Time elapsed before engine starts (after starter turns on until engine speed reaches 400 rpm)/ Min.: 0 ms, Max.: 655350 ms	-	Yes
	Diagnostic Note: • This is the time elapsed after the starter turns on until the engine speed reaches 400 rpm. • This value is cleared 5 seconds after the engine is started and the value is displayed as 0 ms.		

Previous Trip Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Coolant Temp	Engine coolant temperature during previous trip/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes
	Diagnostic Note: Before 120 seconds elapse after starting the engine, this parameter indicates the engine coolant temperature at the end of the previous trip. After 120 seconds elapse after starting the engine, this parameter indicates the engine coolant temperature during the current trip.		

Previous Trip Intake Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Intake Temp	Intake air temperature during previous trip/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes
	Diagnostic Note: Before 120 seconds elapse after starting the engine, this parameter indicates the intake air temperature at the end of the previous trip. After 120 seconds elapse after starting the engine, this parameter indicates the intake air temperature during the current trip.		

Engine Oil Temperature

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Oil Temperature	Engine oil temperature (estimated temperature)/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes

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Previous Trip Eng Oil Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Eng Oil Temp	Engine oil temperature during previous trip/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes

Ambient Temp for A/C

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Ambient Temp for A/C	Ambient temperature for A/C/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes

Previous Trip Ambient Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Ambient Temp	Ambient temperature during previous trip/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	-	Yes

Engine Start Hesitation

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Start Hesitation	History of hesitation during engine start/ ON or OFF	-	Yes
	Diagnostic Note: This value changes to ON when the engine speed does not reach 500 rpm during cranking.		

Low Rev for Eng Start

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Low Rev for Eng Start	History of low engine speed after engine start/ ON or OFF	-	Yes
	Diagnostic Note: This flag changes to ON when the engine speed drops to 200 rpm or less within approximately 2 seconds of starting the engine.		

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Fuel Cut Elps Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Cut Elps Time	Elapsed time since Fuel Cut due to high engine speed/ Min.: 0 sec, Max.: 68746 sec	-	Yes
	Diagnostic Note: The time elapsed after a fuel cut after high engine speed has occurred (More than the rpm at which fuel cut occurs + 500 rpm).		

25. Charging Control (Charging Control)

Alternator Output Duty

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Alternator Output Duty	Generator output duty/ Min.: 0%, Max.: 399.9%	-	Yes

Alt Vol - Non Active Test

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Alt Vol - Non Active Test	Request voltage when regulator not under forced activation/ Min.: 0 V, Max.: 79.998 V	Battery electrolyte temperature varies (12.5 to 14.8 V) while driving: After engine start	Yes

Alt Vol - Active Test

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Alt Vol - Active Test	Request voltage when regulator under forced activation/ Min.: 0 V, Max.: 79.998 V	Request instruction voltage value: After engine start	Yes

Previous Trip Alternator Max Output Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Alternator Max Output Time	Accumulated time of maximum power generation by alternator during previous trip/ Min.: 0 sec, Max.: 65535 sec	-	No

Initial Engine Battery Minimum Voltage

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Initial Engine Battery Minimum Voltage	Minimum battery voltage at engine start/ Min.: 0 V, Max.: 25.5 V	-	No

26. Various Vehicle Conditions 7 (All Data)

ACT VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ACT VSV	A/C cut status for Active Test ON or OFF	-	Yes

Brake Override System

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Brake Override System	Brake override system status/ ON or OFF	ON: Brake override system operating	Yes

Idle Fuel Cut

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Idle Fuel Cut	Fuel cut at idle/ ON or OFF	ON: Fuel cut operating	Yes
	Diagnostic Note: Idle Fuel Cut = "ON" when the throttle valve is fully closed and the engine speed is high.		

FC TAU

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
FC TAU	Fuel cut TAU (fuel cut during very light load)/ ON or OFF	ON: Fuel cut operating	Yes
	Diagnostic Note: This is the fuel cut performed under a very light load to prevent the engine combustion from becoming incomplete.		

Immobiliser Fuel Cut

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Immobiliser Fuel Cut	Status of immobiliser fuel cut/ ON or OFF	-	Yes

Immobiliser Fuel Cut History

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Immobiliser Fuel Cut History	Status of the immobiliser fuel cut history/ ON or OFF	-	Yes

Electrical Load Signal 3

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electrical Load Signal 3	Electrical load signal/ ON or OFF	-	Yes

Cruise Cancel Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cruise Cancel Signal	Status of the cruise cancel signal ON or OFF	-	Yes

27. Various Vehicle Conditions 8 (Vehicle Information)

Model Code

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Model Code	Model code	-	No
	Diagnostic Note: Used for identifying the model code: TRN2###		

Engine Type

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Type	Engine type	-	No
	Diagnostic Note: Used for identifying the engine type: 2TRFE		

Cylinder Number

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cylinder Number	Number of cylinders/ Min.: 0, Max.: 255	-	No
	Diagnostic Note: Used for identifying the number of cylinders: 4		

Transmission Type

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Transmission Type	Transmission type	-	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Diagnostic Note: Used for identifying the transmission type: MT, ECT 6th		

Transmission Type2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Transmission Type2	Transmission type	Unused	No

Destination

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Destination	Destination	-	No
	Diagnostic Note: Used for identifying the destination: A (America)		

Model Year

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Model Year	Model year/ Min.: 1900, Max.: 2155	-	No
	Diagnostic Note: Used for identifying the model year: 20##		

28. Compression (Compression)

Engine Speed of Cyl #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed of Cyl #1 Engine Speed of Cyl #2 Engine Speed of Cyl #3 Engine Speed of Cyl #4	Engine speed for cylinder No. 1 to No. 4/ Min.: 0 rpm, Max.: 51199 rpm	-	No
	Diagnostic Note: This is output only when Check the Cylinder Compression is performed using the Active Test. This is the engine speed for each cylinder measured during the fuel-cut with the engine cranking. When there is compression loss, the engine speed for that cylinder increases. **HINT:** When multiple cylinders have compression loss, the engine speeds for multiple cylinders increase and it is not possible to determine which cylinders have compression loss. At this time, it is necessary to actually perform a compression measurement.		

Av Engine Speed of All Cyl

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Av Engine Speed of All	Average engine speed for all	-	No

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cyl	cylinders/ Min.: 0 rpm, Max.: 51199 rpm		
	Diagnostic Note: This is output only when Check the Cylinder Compression is performed using the Active Test.		

29. A/F Cylinder Imbalance (Gas AF Control)

A/F Sensor Determination (worst value) #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Sensor Determination (worst value) #1	Worst judgment value of A/F sensor output (Bank 1)/ Min.: -1, Max.: 0.99	0.00	Yes
	Diagnostic Note: • The worst value detected during monitoring is displayed. • The value is reset when DTCs are cleared.		

Engine Speed Fluctuation Avg (worst value) #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed Fluctuation Avg (worst value) #1 Engine Speed Fluctuation Avg (worst value) #2 Engine Speed Fluctuation Avg (worst value) #3 Engine Speed Fluctuation Avg (worst value) #4	Worst value of average engine speed fluctuation (Cylinder 1 to 4)/ Min.: 0, Max.: 2.55	0.00	Yes
	Diagnostic Note: • The worst value detected during monitoring is displayed. • The value is reset when DTCs are cleared.		

30. Automatic Transmission System (AT)

Refer to Automatic Transmission System.

*1: 2WD INFO
*2: 4WD INFO

A/T Oil Temperature 1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/T Oil Temperature 1	AT fluid temperature sensor value/ Min.: -40°C (-40°F), Max.: 215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature	Yes

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
		when engine cold	
	Diagnostic Note: • If value is -40°C (-40°F) or 150°C (302°F) or more, AT fluid temperature sensor circuit is open or short. • This item is displayed only for automatic transmission.		

Lock Up

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Lock Up	Lock-up/ ON or OFF	• ON: Lock up operating • OFF: Lock up not operating	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

Shift Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift Status	ECM gearshift command/ 1st, 2nd, 3rd, 4th, 5th and 6th	Same as actual gear position	Yes
	Diagnostic Note: This item is displayed only for automatic transmission.		

31. ACTIVE TEST

HINT:

Using the Techstream to perform Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test.

(g) According to the display on the Techstream, perform the "Active Test".

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TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTES
Control the Injection Volume	Change injection volume	-12.5 to 24.8%	• All injectors tested at the same time • Perform test at less than 3000 rpm • Injection volume can be changed in fine gradations within control range • Control the Injection Volume enables the checking and graphing of the air fuel ratio sensor and heated oxygen sensor voltage outputs. • To conduct the test, enter the following menus: Active Test / Control the Injection Volume / AFS Voltage B1S1 and O2S B1S2. • During the Active Test, air fuel ratio feedback control and feedback learning are stopped.
Control the Injection Volume for A/F ratio Sensor	Change injection volume	-12.5% / 0% / 12.5%	• All injectors tested at the same time • Perform test at less than 3000 rpm • Control the Injection Volume for A/F Sensor enables checking and graphing of air fuel ratio sensor and heated oxygen sensor voltage outputs • To conduct the test, enter the following menus: Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2. • During the Active Test, air fuel ratio feedback control and feedback learning are stopped.
Activate the VSV for Secondary Air Control	Activate the Secondary Air System	ON/OFF	• Do not perform the test for 5 seconds or more. • After the test, do not perform the test again for 30 seconds. • The air switching valve and air pump operate.
Activate the VSV for Evap Control	Activate purge VSV control	ON/OFF	The valve is opened with a 30% duty ratio.
Control the A/C Cut Signal	Control A/C cut signal	ON/OFF	Perform this test when the following conditions are met: • Ignition switch to ON. • Engine is stopped.

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TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTES
			• Shift lever is in P (Neutral).
Control the Fuel Pump / Speed	Activate fuel pump	ON/OFF	Perform this test when the following conditions are met: • Ignition switch to ON. • Engine is stopped. • Shift lever is in P (Neutral).
Connect the TC and TE1	Turn on and off TC and TE1 connection	ON/OFF	• ON: TC and TE1 are connected • OFF: TC and TE1 are disconnected • Perform this test when the following conditions are met: ○ Ignition switch to ON. ○ Engine is stopped. ○ Shift lever is in P (Neutral).
Control the Idle Fuel Cut Prohibit	Prohibit idling fuel cut control	ON/OFF	Perform this test when the following conditions are met: • Ignition switch to ON. • Engine is stopped. • Shift lever is in P (Neutral).
Prohibit the Catalyst OT Misfire prevent F/C	Prohibit catalyst overheat malfunction prevention fuel cut operation during misfire	ON/OFF ON: Fuel cut is prohibited	Confirm that the vehicle is stopped and the engine speed is 3000 rpm or less.
Control the ETCS Open/Close Slow Speed	Throttle actuator	Close/Open Open: Throttle valve opens slowly	Perform this test when the following conditions are met: • Ignition switch to ON • Engine does not start • Fully depressing accelerator pedal (accelerator pedal position: 58 degrees or more) • Shift lever is in P (Neutral).
Control the ETCS Open/Close Fast Speed	Throttle actuator	Close/Open	Same as above.
Control the VVT Linear (Bank 1)	Control VVT (for intake side of bank 1)	-128 to 127% This value added to present camshaft timing oil control valve control duty 100%: Maximum	• Engine stalls or idles roughly when VVT actuator is operated by 100%. • Perform this test when the following conditions are met: ○ Engine is idling.

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TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTES
		advance -100%: Maximum retard	○ Shift lever is in P (Neutral). • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction.
Control the VVT System (Bank 1)	Turn camshaft timing oil control valve ON and OFF	ON/OFF	• Engine stalls or idles roughly when the camshaft timing oil control valve is turned on. • Engine runs and idles normally when the camshaft timing oil control valve is OFF. • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction. • Perform this test when the following conditions are met: ○ Engine is idling. ○ Shift lever is in P (Neutral).
Control the VVT Exhaust Linear (Bank 1)	Control VVT (for exhaust side of bank 1)	-128 to 127% (This value added to present camshaft timing oil control valve control duty) 100%: Maximum advance -100%: Maximum retard	• Engine stalls or idles roughly when camshaft timing oil control valve is turned on. • Engine runs or idles normally when camshaft timing oil control valve is OFF. • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction. • Perform this test when the following conditions are met: ○ Engine is idling. ○ Shift lever is in P (Neutral).
Activate the Vacuum Pump	Leak detection pump	ON/OFF	Refer to EVAP System INFO
Activate the VSV for Vent Value	Vent valve	ON/OFF	Refer to EVAP System INFO
Activate the Air Pump Heater*1	Activate air pump heater	ON/OFF	• This test activates the air pump heater for up to 60 seconds. • To protect the air pump heater, do not perform this test more than 4

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TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTES
			times in a row.
Control the Select Cylinder Fuel Cut	Selected cylinder (cylinder #1 to #4) injector fuel cut	#1/#2/#3/#4 ON/OFF	Perform this test when the following conditions are met: • Vehicle is stopped. • Engine is idling. • Shift lever is in P (Neutral). *2
Control the All Cylinders Fuel Cut	All cylinder fuel cut	ON/OFF	Perform this test when the following conditions are met: • Vehicle is stopped. • Engine is idling. • Shift lever is in P (Neutral). *2
Check the Cylinder Compression	Check the cylinder compression pressure	ON/OFF	Fuel injection and ignition stop in all cylinders *3

*1: for Automatic Transmission

NOTICE:

***2:**

- If the display of the Data List Catalyst OT MF F/C item is Not Avl, perform this Active Test with the vehicle stopped and the engine idling.
- If the display of the Data List Catalyst OT MF F/C item is Avail, perform this Active Test as described below.

a. Stop the engine, turn the ignition switch to ON.
b. Enter the Control the Select Cylinder Fuel Cut.
c. Select the cylinder for fuel cut (cylinder #1 to #4) and turn the Active Test ON (press the RIGHT or LEFT button).
d. Start the engine.

HINT:

*3: In this Active Test, the fuel and ignition of all cylinders is cut. The engine must then be cranked for approximately 10 seconds. At this time, the speed of each cylinder is measured. If the speed of one cylinder is more than the other cylinders, it can be determined that the compression pressure of that cylinder is lower than the other cylinders.

1. Warm up the engine.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

7. Push the snapshot button to turn the snapshot function on.

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HINT:

Using the snapshot function, data can be recorded during the Active Test.

8. While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

9. Crank the engine for about 10 seconds.

HINT:

Continue to crank the engine until the values change from the default value (51199 rpm).

10. Monitor the engine speed (Engine Speed of Cyl #1 to #4) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

11. Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

If the Active Test is changed to OFF while the engine is being cranked, the engine will start.

12. Push the snapshot button to turn the snapshot function off.
13. Select "Stored Data" on the Techstream screen, select the recorded data and display the data as a graph.

HINT:

If the data is not displayed as a graph, the change of the values cannot be observed.

14. Check the change in engine speed values.

HINT:

As the data values of the Active Test return to their default values when cranking is stopped, the engine speed value of each cylinder cannot be observed. Therefore, it is necessary to use the data recorded with the snapshot function to check the engine speed values recorded during cranking.

32. SYSTEM CHECK

HINT:

Performing a System Check enables the system, which consists of multiple actuators, to be operated without removing any parts. In addition, it can show whether or not any DTCs (Pending DTCs) are stored, and can detect potential malfunctions in the system. System Check can be performed with the Techstream.

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine and ECT / Utility.

(d) Perform the System Check by referring to the table below.

(e) Turn the ignition switch OFF.

TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTES
Evaporative System Check (Automatic Mode)	Perform 6 steps in order to operate EVAP key-off monitor automatically	-	• Fuel temperature 35°C (95°F) or less • If no DTCs in Pending DTCs after performing this test, system functioning normally • Refer to EVAP Inspection Procedure INFO
Evaporative System Check (Manual Mode)	Perform 6 steps in order to operate EVAP key-off monitor manually	-	• Fuel temperature 35°C (95°F) or less • Used to detect malfunctioning parts • Refer to EVAP Inspection Procedure INFO
Secondary Air Injection Check (Automatic Mode)	Perform secondary air injection system operation automatically	-	• With warm engine, ignition switch turned off once • If no DTCs in Pending DTCs after performing this test, system functioning normally • Refer to inspection procedure for secondary air injection system DTCs • When performing Air Injection Check operation after battery cable has been reconnected, wait for 7 minutes with ignition switch turned ON or engine running • Turn ignition switch off when System Check finished
Secondary Air Injection Check (Manual Mode)	Perform secondary air injection system operation manually Select monitor item 1, 2 or 3 1. AIR PUMP: ON ASV: OPEN 2. AIR PUMP: OFF ASV: CLOSE 3. AIR PUMP: ON ASV: CLOSE	-	• With warm engine, ignition switch turned OFF once • Used to detect malfunctioning parts • Refer to inspection procedure for secondary air injection system DTCs • When performing Secondary Air Injection Check operation after battery cable has been reconnected, wait for 7 minutes with ignition switch turned ON or engine running • Turn ignition switch off when System Check finishes

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Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: DEFINITION OF TERMS; 2016 MY Tacoma [08/2015 -]		

DEFINITION OF TERMS

TERM	DEFINITION
Monitor Description	Description of what ECM monitors and how it detects malfunctions (monitoring purpose and details).
Related DTCs	Group of diagnostic trouble codes that are output by ECM based on same malfunction detection logic.
Typical Enabling Condition	Preconditions that allow ECM to detect malfunctions. With all preconditions satisfied, ECM stores DTC when monitored value(s) exceeds malfunction threshold(s).
Sequence of Operation	Order of monitor priority, applied if multiple sensors and components are involved in single malfunction detection process. Each sensor and component is monitored in turn, when previous detection operation is completed.
Required Sensor/Components	Sensors and components used by ECM to detect each malfunction.
Frequency of Operation	Number of times ECM checks for each malfunction during each driving cycle. "Once per driving cycle" means ECM only performs checks for that malfunction once during single driving cycle. "Continuous" means ECM performs checks for that malfunction whenever enabling conditions are met.
Duration	Minimum time for which ECM must detect continuous deviation in monitored value(s) in order to store DTC. Timing begins when Typical Enabling Conditions are met.
Malfunction Thresholds	Value beyond which ECM determines malfunctions exist and stores DTCs.
MIL Operation	Timing of MIL illumination after malfunction is detected. "Immediate" means ECM illuminates MIL as soon as malfunction detected. "2 driving cycles" means ECM illuminates MIL if same malfunction is detected second time during next sequential driving cycle.

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Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: DIAGNOSIS SYSTEM; 2016 MY Tacoma [08/2015 -]		

DIAGNOSIS SYSTEM

1. DESCRIPTION

When troubleshooting OBD II (On-Board Diagnostics) vehicles, the Techstream (complying with SAE J1987) must be connected to the DLC3 (Data Link Connector 3) of the vehicle. Various data in the vehicle's ECM (Engine Control Module) can be then read.

OBD II regulations require that the vehicle's on-board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in:

(a) The emission control systems and components.
(b) The powertrain control components (which affect vehicle emissions).
(c) The computer itself.



In addition, the applicable DTCs (Diagnostic Trouble Codes) prescribed by SAE J2012 are recorded in the ECM memory. If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.

To check DTCs, connect the Techstream to the DLC3. The Techstream displays DTCs, freeze frame data, and a variety of engine data. The DTCs and freeze frame data can be erased with the Techstream INFO .

In order to enhance OBD function on vehicles and develop the Off-Board diagnosis system, Controller Area Network (CAN) communication is used in this system. CAN is a network which uses a pair of data transmission lines spanning multiple computers and sensors. It allows for high speed communications between the systems and simplification of the wire harness connections.

Since this system is equipped with CAN communication, connecting the Techstream is necessary to display any information from the ECM. Also, the communication between the Techstream and the ECM uses CAN communication signals. When confirming DTCs and ECM data, connect the Techstream to the DLC3.

2. NORMAL MODE AND CHECK MODE

The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic is used to ensure accurate detection of malfunctions. Check mode is also available as an option for technicians. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (Techstream only)

INFO .

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3. 2 TRIP DETECTION LOGIC

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected during the next subsequent driving cycle, the MIL is illuminated (2nd trip).

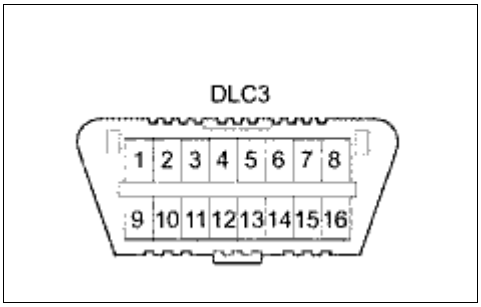
4. FREEZE FRAME DATA

Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

5. DLC3 (Data Link Connector 3)

The vehicle's ECM uses the ISO 15765-4 for communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.

SYMBOL	TERMINAL NO.	NAME	REFERENCE TERMINAL	RESULT	CONDITION
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	11 to 14 V	Always
CANH	6	CAN "High" line	CANL	54 to 69 Ω	Ignition switch off *
CANH	6	CAN "High" line	Battery positive	1 MΩ or higher	Ignition switch off *
CANH	6	CAN "High" line	CG	200 Ω or higher	Ignition switch off *
CANL	14	CAN "Low" line	Battery positive	1 MΩ or higher	Ignition switch off *
CANL	14	CAN "Low" line	CG	200 Ω or higher	Ignition switch off *



HINT:

* : Before measuring the resistance, leave the vehicle as is for at least 1 minute and do not operate the ignition switch, any other switches or the doors.

HINT:

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The DLC3 is the interface prepared for reading various data from the vehicle's ECM. After connecting the cable of the Techstream, turn the ignition switch to ON and turn the Techstream on. If a communication failure message is displayed on the Techstream screen (on the Techstream: Unable to Connect to VIN), a problem exists in either the vehicle or Techstream. In order to identify the location of the problem, connect the Techstream to another vehicle.

If communication is normal: Inspect the DLC3 on the original vehicle.

If communication is impossible: The problem is probably with the Techstream itself. Consult the Service Department listed in the instruction manual.

6. BATTERY VOLTAGE

Standard voltage:

11 to 14 V

If the voltage is below 11 V, recharge the battery before proceeding.

7. MIL (Malfunction Indicator Lamp)

(a) The MIL is illuminated when the ignition switch is first turned to ON (the engine is not running).

(b) The MIL should turn off when the engine is started. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

HINT:

If the MIL is not illuminated when the ignition switch is first turned to ON, check the MIL circuit INFO .

8. ALL READINESS

HINT:

- With "All Readiness", you can check whether or not the DTC judgment has been completed by using the Techstream.
- You should check "All Readiness" after simulating malfunction symptoms or for validation after finishing repairs.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch to off and wait for at least 30 seconds.

(f) Perform the DTC judgment driving pattern to run the DTC judgment.

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(h) Input the DTCs to be confirmed.

(i) Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal

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Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: DIAGNOSTIC TROUBLE CODE CHART; 2016 MY Tacoma [08/2015 -]		

DIAGNOSTIC TROUBLE CODE CHART

HINT:

- Parameters listed in the chart may be different from your readings depending on the type of instruments and other factors.
- If any DTCs are output during a check mode DTC check, check the circuit for the DTCs listed in the table below. For details of each DTC, refer to the "See page" indicated.

SFI system

DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	Comes on	DTC stored	INFO
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	Comes on	DTC stored	INFO
P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)	Comes on	DTC stored	INFO
P0013	Camshaft Position "B" Actuator Circuit / Open (Bank 1)	Comes on	DTC stored	INFO
P0014	Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1)	Comes on	DTC stored	INFO
P0015	Camshaft Position "B" - Timing Over-Retarded (Bank 1)	Comes on	DTC stored	INFO
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	Comes on	DTC stored	INFO
P0017	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)	Comes on	DTC stored	INFO
P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0101	Mass Air Flow Circuit Range / Performance Problem	Comes on	DTC stored	INFO
P0102	Mass or Volume Air Flow Circuit Low Input	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P0103	Mass or Volume Air Flow Circuit High Input	Comes on	DTC stored	INFO
P0111	Intake Air Temperature Sensor Gradient Too High	Comes on	DTC stored	INFO
P0112	Intake Air Temperature Circuit Low Input	Comes on	DTC stored	INFO
P0113	Intake Air Temperature Circuit High Input	Comes on	DTC stored	INFO
P0115	Engine Coolant Temperature Circuit	Comes on	DTC stored	INFO
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	Comes on	DTC stored	INFO
P0117	Engine Coolant Temperature Circuit Low Input	Comes on	DTC stored	INFO
P0118	Engine Coolant Temperature Circuit High Input	Comes on	DTC stored	INFO
P011B	Engine Coolant Temperature / Intake Air Temperature Correlation	Comes on	DTC stored	INFO
P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit	Comes on	DTC stored	INFO
P0121	Throttle Pedal Position Sensor / Switch "A" Circuit Range / Performance	Comes on	DTC stored	INFO
P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input	Comes on	DTC stored	INFO
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input	Comes on	DTC stored	INFO
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Comes on	DTC stored	INFO
P0128	Thermostat	Comes on	DTC stored	INFO
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0137	Heated Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0139	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P013A	Oxygen Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P0141	Oxygen Sensor Heater Circuit (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P014C	A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1	Comes on	DTC stored	INFO
P014D	A/F Sensor Slow Response - Lean to Rich Bank 1 Sensor 1	Comes on	DTC stored	INFO
P015A	A/F Sensor Delayed Response - Rich to Lean Bank 1 Sensor 1	Comes on	DTC stored	INFO
P015B	A/F Sensor Delayed Response - Lean to Rich Bank 1 Sensor 1	Comes on	DTC stored	INFO
P0171	System Too Lean (Bank 1)	Comes on	DTC stored	INFO
P0172	System Too Rich (Bank 1)	Comes on	DTC stored	INFO
P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit	Comes on	DTC stored	INFO
P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input	Comes on	DTC stored	INFO
P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input	Comes on	DTC stored	INFO
P0300	Random / Multiple Cylinder Misfire Detected	Comes on/Blinks*1	DTC stored	INFO
P0301	Cylinder 1 Misfire Detected	Comes on/Blinks*1	DTC stored	INFO
P0302	Cylinder 2 Misfire Detected	Comes on/Blinks*1	DTC stored	INFO
P0303	Cylinder 3 Misfire Detected	Comes on/Blinks*1	DTC stored	INFO
P0304	Cylinder 4 Misfire Detected	Comes on/Blinks*1	DTC stored	INFO
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0335	Crankshaft Position Sensor "A" Circuit	Comes on	DTC stored	INFO
P0339	Crankshaft Position Sensor "A" Circuit Intermittent	Does not come on	DTC stored	INFO
P0340	Camshaft Position Sensor Circuit	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P0342	Camshaft Position Sensor "A" Circuit Low Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0343	Camshaft Position Sensor "A" Circuit High Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0351	Ignition Coil "A" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0352	Ignition Coil "B" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0353	Ignition Coil "C" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0354	Ignition Coil "D" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0365	Camshaft Position Sensor "B" Circuit (Bank 1)	Comes on	DTC stored	INFO
P0367	Camshaft Position Sensor "B" Circuit Low Input (Bank 1)	Comes on	DTC stored	INFO
P0368	Camshaft Position Sensor "B" Circuit High Input (Bank 1)	Comes on	DTC stored	INFO
P0412	Secondary Air Injection System Switching Valve "A" Circuit	Comes on	DTC stored	INFO
P0418	Secondary Air Injection System Control "A" Circuit	Comes on	DTC stored	INFO
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Comes on	DTC stored	INFO
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	Comes on	DTC stored	INFO
P043F	Evaporative Emission System Reference Orifice High Flow	Comes on	DTC stored	INFO
P0441	Evaporative Emission Control System Incorrect Purge Flow	Comes on	DTC stored	INFO
P0451	Evaporative Emission Control System Pressure Sensor Range / Performance	Comes on	DTC stored	INFO
P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input	Comes on	DTC stored	INFO
P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input	Comes on	DTC stored	INFO
P0455	Evaporative Emission Control System Leak Detected (Gross Leak)	Comes on	DTC stored	INFO
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P0500	Vehicle Speed Sensor "A"	Comes on	DTC stored	INFO
P0504	Brake Switch "A" / "B" Correlation	Does not come on	DTC stored	INFO
P0505	Idle Control System	Comes on	DTC stored	INFO
P050A	Cold Start Idle Air Control System Performance	Comes on	DTC stored	INFO
P050B	Cold Start Ignition Timing Performance	Comes on	DTC stored	INFO
P0560	System Voltage	Comes on	DTC stored	INFO
P0604	Random Access Memory (RAM)	Comes on	DTC stored	INFO
P0606	ECM Processor	Comes on	DTC stored	INFO
P0607	Control Module Performance	Comes on	DTC stored	INFO
P060A	Internal Control Module Monitoring Processor Performance	Comes on	DTC stored	INFO
P060B	Internal Control Module A/D Processing Performance	Comes on	DTC stored	INFO
P060D	Internal Control Module Accelerator Pedal Position Performance	Comes on	DTC stored	INFO
P060E	Internal Control Module Throttle Position Performance	Comes on	DTC stored	INFO
P0617	Starter Relay Circuit High	Comes on	DTC stored	INFO
P062F	Internal Control Module EEPROM Error	Comes on	DTC stored	INFO
P0630	VIN not Programmed or Mismatch - ECM / PCM	Comes on	DTC stored	INFO
P0657	Actuator Supply Voltage Circuit / Open	Comes on	DTC stored	INFO
P0724	Brake Switch "B" Circuit High	Comes on	DTC stored	INFO
P101D	A/F Sensor Heater Circuit Performance Bank 1 Sensor 1 Stuck ON	Comes on	DTC stored	INFO
P102D	O2 Sensor Heater Circuit Performance Bank 1 Sensor 2 Stuck ON	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P106B	Evaporative Emission System Pressure Sensor - Secondary Air Injection Pressure Sensor Correlation	Comes on	DTC stored	INFO
P144C*2	Open in Secondary Air Injection System Heater Control Circuit	Comes on	DTC stored	INFO
P144D*2	Short in Secondary Air Injection System Heater Control Circuit	Comes on	DTC stored	INFO
P1603*2	Engine Stall History	Does not come on	DTC stored	INFO
P1604	Startability Malfunction	Does not come on	DTC stored	INFO
P1605	Rough Idling	Does not come on	DTC stored	INFO
P1607	Cruise Control Input Processor	Comes on	DTC stored	INFO
P1613	Secondary Air Injection System Driver	Comes on	DTC stored	INFO
P2102	Throttle Actuator Control Motor Circuit Low	Comes on	DTC stored	INFO
P2103	Throttle Actuator Control Motor Circuit High	Comes on	DTC stored	INFO
P2109	Throttle / Pedal Position Sensor "A" Minimum Stop Performance	Does not come on	DTC stored	INFO
P2111	Throttle Actuator Control System - Stuck Open	Comes on	DTC stored	INFO
P2112	Throttle Actuator Control System - Stuck Closed	Comes on	DTC stored	INFO
P2118	Throttle Actuator Control Motor Current Range / Performance	Comes on	DTC stored	INFO
P2119	Throttle Actuator Control Throttle Body Range / Performance	Comes on	DTC stored	INFO
P2120	Throttle / Pedal Position Sensor / Switch "D" Circuit	Comes on	DTC stored	INFO
P2121	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance	Comes on	DTC stored	INFO
P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input	Comes on	DTC stored	INFO
P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input	Comes on	DTC stored	INFO
P2125	Throttle / Pedal Position Sensor / Switch "E" Circuit	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input	Comes on	DTC stored	INFO
P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input	Comes on	DTC stored	INFO
P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation	Comes on	DTC stored	INFO
P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation	Comes on	DTC stored	INFO
P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P219A	Bank 1 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P219C	Cylinder 1 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P219D	Cylinder 2 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P219E	Cylinder 3 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P219F	Cylinder 4 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P2237	Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2401	Evaporative Emission Leak Detection Pump Stuck OFF	Comes on	DTC stored	INFO
P2402	Evaporative Emission Leak Detection Pump Stuck ON	Comes on	DTC stored	INFO
P2419	Evaporative Emission System Switching Valve Control Circuit Low	Comes on	DTC stored	INFO
P2420	Evaporative Emission System Switching Valve Control Circuit High	Comes on	DTC stored	INFO

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DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P2431	Secondary Air Injection System Air Flow / Pressure Sensor Circuit Range / Performance Bank1	Comes on	DTC stored	INFO
P2432	Secondary Air Injection System Air Flow / Pressure Sensor Circuit Low Bank1	Comes on	DTC stored	INFO
P2433	Secondary Air Injection System Air Flow / Pressure Sensor Circuit High Bank1	Comes on	DTC stored	INFO
P2440	Secondary Air Injection System Switching Valve Stuck Open Bank1	Comes on	DTC stored	INFO
P2441	Secondary Air Injection System Switching Valve Stuck Close Bank1	Comes on	DTC stored	INFO
P2444	Secondary Air Injection System Pump Stuck On Bank1	Comes on	DTC stored	INFO
P2445	Secondary Air Injection System Pump Stuck Off Bank1	Comes on	DTC stored	INFO
P2610	ECM / PCM Internal Engine Off Timer Performance	Comes on	DTC stored	INFO

*1: The MIL flashes when catalyst-damaging misfire is detected.

*2: for Automatic Transmission

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Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: DTC CHECK / CLEAR; 2016 MY Tacoma [08/2015 -]		

DTC CHECK / CLEAR

NOTICE:

When the diagnosis system is changed from normal mode to check mode or vice versa, all DTCs and freeze frame data recorded in normal mode are cleared. Before changing modes, always check and make a note of DTCs and freeze frame data.

HINT:

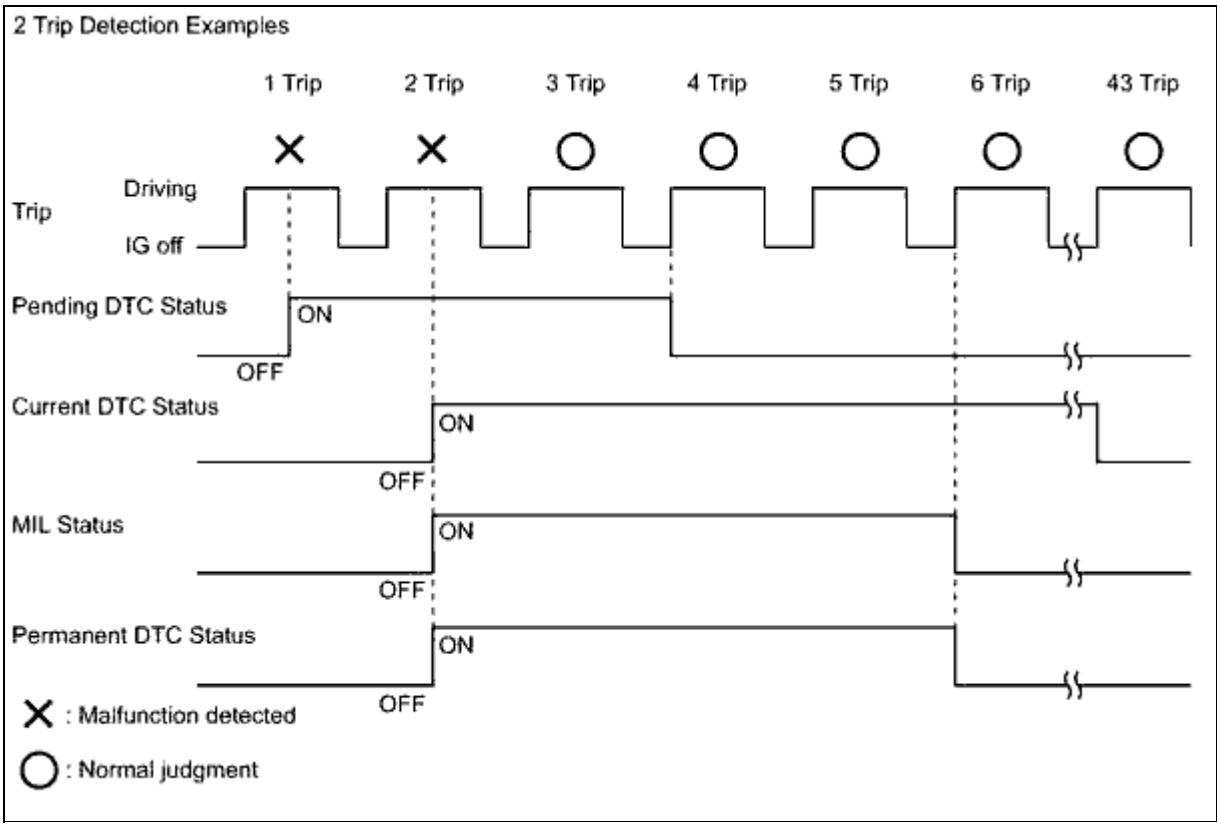
- DTCs that are stored in the ECM can be displayed on the Techstream. The Techstream can display the current, pending and permanent DTCs.
- If a malfunction is detected during the current driving cycle, current and permanent DTCs are stored.
- Some DTCs are not stored if the ECM does not detect the same malfunction again during a second consecutive driving cycle. However, such malfunctions, detected on only one occasion, are stored as pending DTCs.
- Current and pending DTCs can be cleared by using the Techstream or by disconnecting the cable from the negative battery terminal. However, permanent DTCs cannot be cleared using either of these two methods.
- After clearing current DTCs using the Techstream (or by disconnecting the cable from the negative battery terminal), permanent DTCs can be cleared when the system is determined to be normal for the relevant DTCs and then the universal trip is performed. The driving pattern to obtain a normal judgment is described under the "Confirmation Driving Pattern" for the respective DTC.

2 Trip Detection Examples

Pending DTC	Store condition	Malfunction detected
	Clear condition	System determined to be normal or DTCs cleared using Techstream or Cable disconnected from negative battery terminal
Current DTC	Store condition	Malfunction detected (2nd trip)
	Clear condition	No malfunctions in 40 driving cycles or DTCs cleared using Techstream or Cable disconnected from negative battery terminal
Permanent DTC	Store condition	Malfunction detected (2nd trip)
	Clear condition	Ignition switch turned to ON after normal judgment obtained in 3 consecutive driving cycles or After DTCs cleared using Techstream or cable disconnected from negative battery terminal, normal judgment obtained and universal trip performed (not for misfire and fuel system DTCs) or

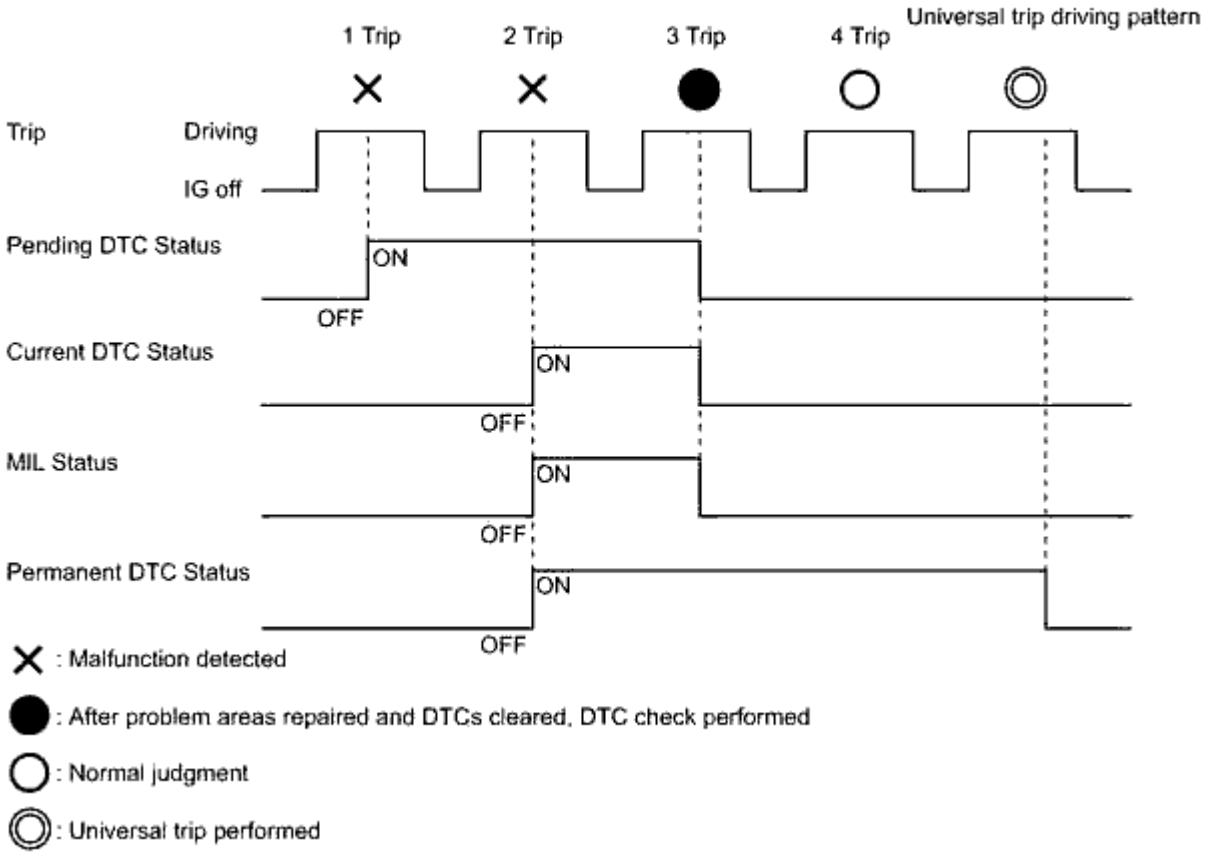
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		After DTCs cleared using Techstream or cable disconnected from negative battery terminal, malfunction not detected when universal trip driving pattern performed (misfire and fuel system DTCs)
MIL	ON	Malfunction detected (2nd trip)
	OFF	Ignition switch turned to ON after normal judgment obtained in 3 consecutive driving cycles or DTCs cleared using Techstream or Cable disconnected from negative battery terminal



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2 Trip Detection Examples (Instance when DTCs were cleared midway through by using the Techstream or by disconnecting the cable from the negative battery terminal)



HINT:

- Obtaining a normal judgment and performing a universal trip driving pattern can be done in the same driving cycle or in different driving cycles.
- It is unnecessary to obtain a normal judgment if the DTCs are misfire or fuel system DTCs.

1. CHECK DTC (Using the Techstream)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Check DTCs and freeze frame data, and then write them down.

(f) Proceed to Diagnostic Trouble Code Chart to check the details of the DTCs INFO .

2. CLEAR DTC (Using the Techstream)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Press the YES button.

3. CLEAR DTC (Without using the Techstream)

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(a) Perform either one of the following operations.

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

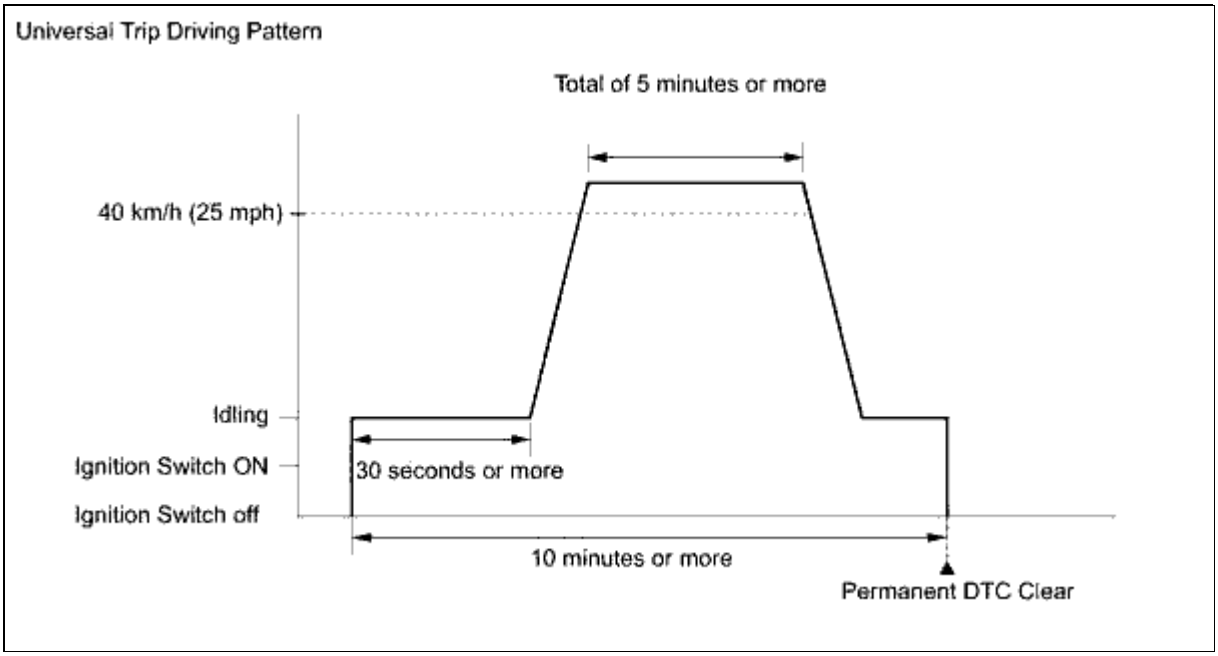
(1) Disconnect the cable from the negative battery terminal for more than 1 minute.

(2) Remove the EFI-MAIN and ETCS fuses from the engine room relay block located inside the engine compartment for more than 1 minute.

4. CLEAR PERMANENT DTC

HINT:

Even if the following procedure is not performed, permanent DTCs are cleared by obtaining a normal judgment during 3 consecutive driving cycles.



(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Check if permanent DTCs are stored.

HINT:

If permanent DTCs are not output, it is not necessary to continue this procedure.

(f) Clear DTCs.

(g) Perform the respective confirmation driving patterns in order to obtain a normal judgment for the output DTCs.

HINT:

- Confirmation driving patterns do not need to be performed for misfire and fuel system DTCs.
- For the confirmation driving pattern, refer to the procedures for the relevant DTC INFO .

(h) Perform the universal trip.

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HINT:

The driving pattern to obtain a normal judgment and the universal trip driving pattern can be performed consecutively in the same driving cycle.

1. Idle the engine for 30 seconds or more.
2. Drive the vehicle at 40 km/h (25 mph) or more for a total of 5 minutes or more.

NOTICE:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

It is possible to complete the drive pattern even if the vehicle decelerates to less than 40 km/h (25 mph) during the driving cycle provided that the vehicle is driven at 40 km/h (25 mph) or more for a total of 5 minutes.

3. Allow 10 minutes or more to elapse from the time the engine is started.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Check that the permanent DTCs have been cleared.

HINT:

The permanent DTCs are cleared when the universal trip is completed.





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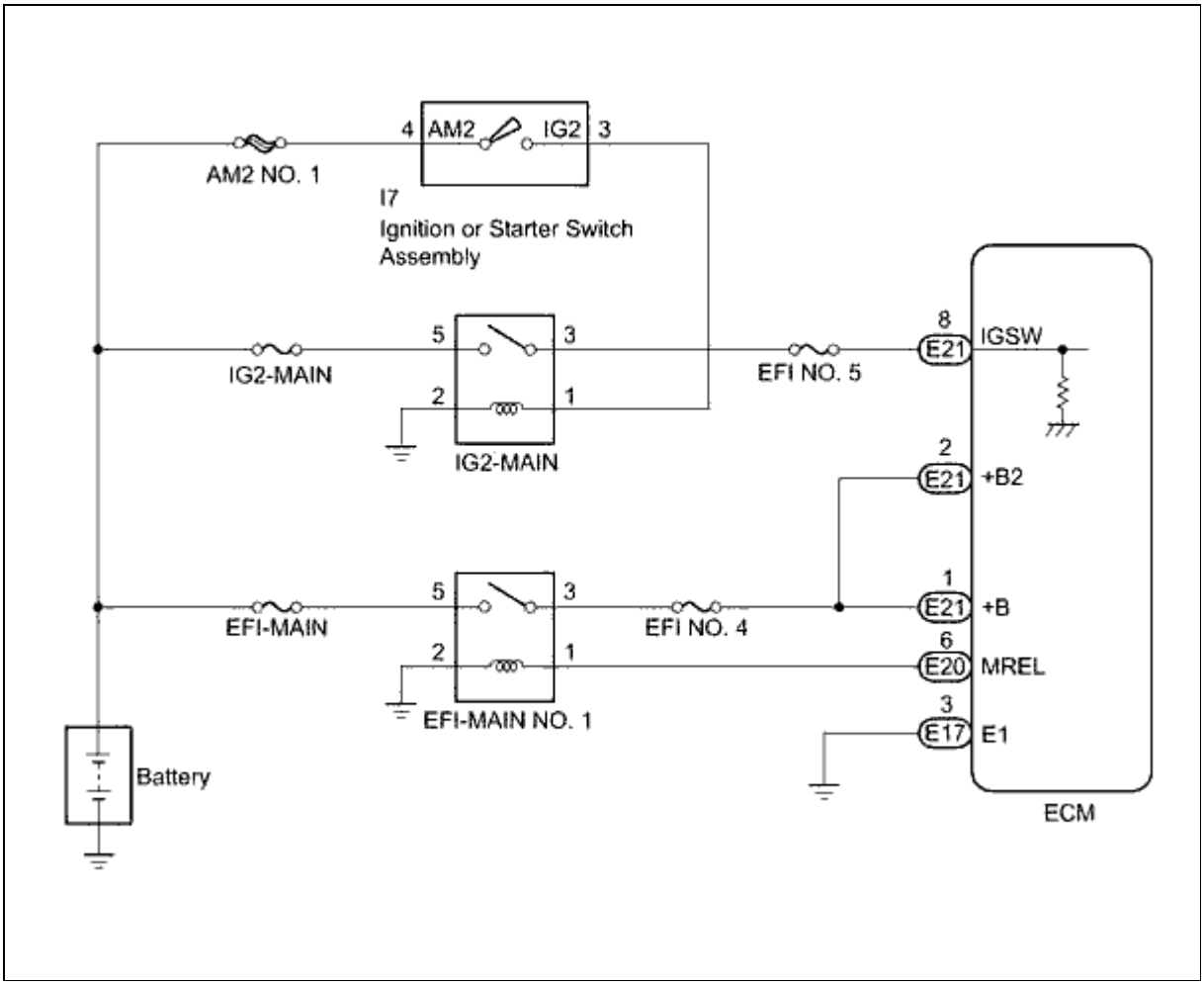
Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000000WZ008LX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: ECM Power Source Circuit; 2016 MY Tacoma [08/2015 -]		

ECM Power Source Circuit

DESCRIPTION

When the ignition switch is turned to ON, the battery voltage is applied to terminal IGSW of the ECM. The ECM MREL output signal causes a current to flow to the coil, closing the contacts of the EFI-MAIN NO. 1 relay and supplying power to terminal +B and +B2 of the ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

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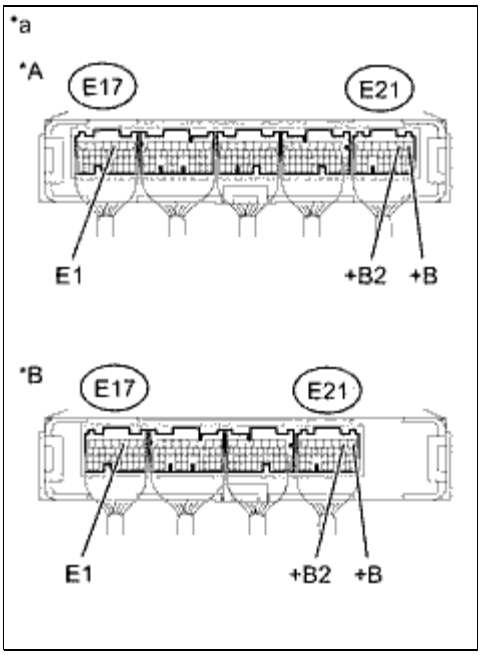
1.	CHECK TERMINAL VOLTAGE (+B, +B2 VOLTAGE)

(a) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E21-1 (+B) - E17-3 (E1)	Ignition switch ON	11 to 14 V
E21-2 (+B2) - E17-3 (E1)	Ignition switch ON	11 to 14 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

NG ▶ **GO TO STEP 2**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

2.	CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)

(a) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E17-3 (E1) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

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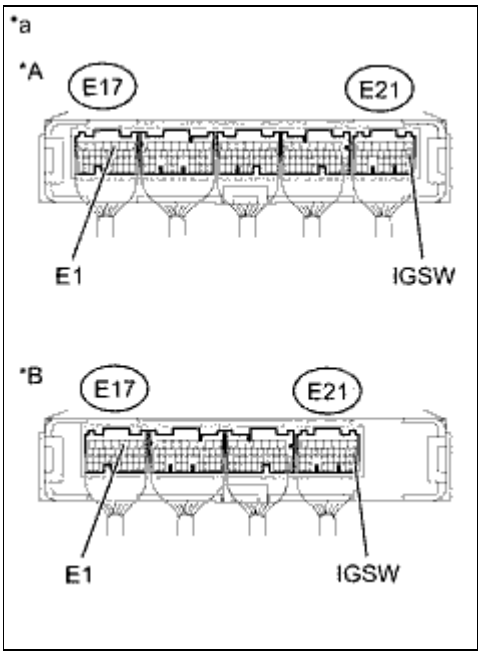
3.	**CHECK TERMINAL VOLTAGE (IGSW VOLTAGE)**

(a) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E21-8 (IGSW) - E17-3 (E1)	Ignition switch ON	11 to 14 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

NG ▶ **GO TO STEP 9**

OK ▼

4.	**CHECK TERMINAL VOLTAGE (MREL VOLTAGE)**

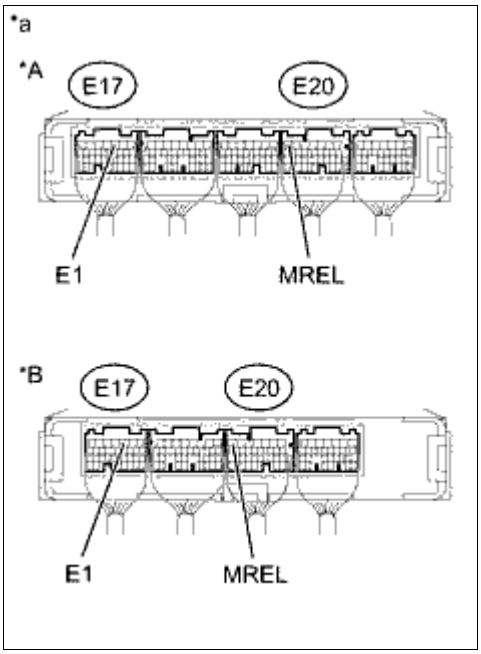
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(a) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E20-6 (MREL) - E17-3 (E1)	Ignition switch ON	11 to 14 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

NG ▶ **REPLACE ECM**

OK ▼

5.	**INSPECT EFI-MAIN NO. 1 RELAY**

(a) Inspect the EFI-MAIN NO. 1 relay INFO .

NG ▶ **REPLACE EFI-MAIN NO. 1 RELAY**

OK ▼

6.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF EFI-MAIN NO. 1 RELAY)**

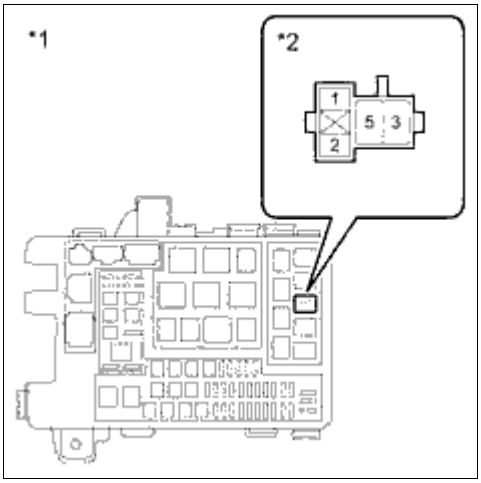
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(a) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (EFI-MAIN NO. 1 relay holder) - Body ground	Always	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	EFI-MAIN NO. 1 Relay Holder

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (EFI-MAIN NO. 1 RELAY - BATTERY)**

OK ▼

7.	**CHECK HARNESS AND CONNECTOR (EFI-MAIN NO. 1 RELAY - BODY GROUND)**

(a) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (EFI-MAIN NO. 1 relay holder) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

8.	**CHECK HARNESS AND CONNECTOR (EFI-MAIN NO. 1 RELAY - ECM)**

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(a) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

(b) Disconnect the E20 and E21 ECM connectors.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (EFI-MAIN NO. 1 relay holder) - E20-6 (MREL)	Always	Below 1 Ω
3 (EFI-MAIN NO. 1 relay holder) - E21-1 (+B)	Always	Below 1 Ω
3 (EFI-MAIN NO. 1 relay holder) - E21-2 (+B2)	Always	Below 1 Ω
1 (EFI-MAIN NO. 1 relay holder) or E20-6 (MREL) - Body ground	Always	10 kΩ or higher
3 (EFI-MAIN NO. 1 relay holder) or E21-1 (+B) - Body ground	Always	10 kΩ or higher
3 (EFI-MAIN NO. 1 relay holder) or E21-2 (+B2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

9.	**INSPECT IG2-MAIN RELAY**

(a) Inspect the IG2-MAIN relay.

NG ▶ **REPLACE IG2-MAIN RELAY**

OK ▼

10.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF IG2-MAIN RELAY)**

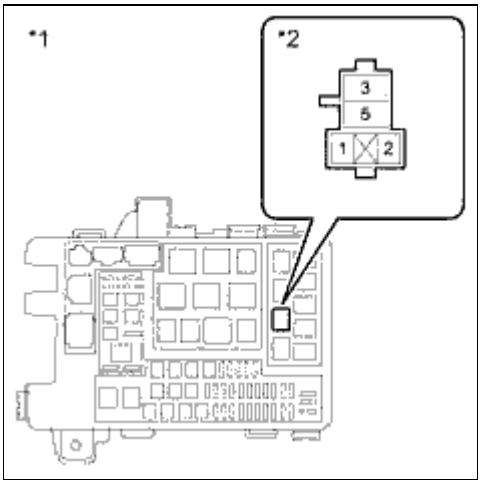
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(a) Remove the IG2-MAIN relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (IG2-MAIN relay holder) - Body ground	Always	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	IG2-MAIN Relay Holder

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IG2-MAIN RELAY - BATTERY)**

OK ▼

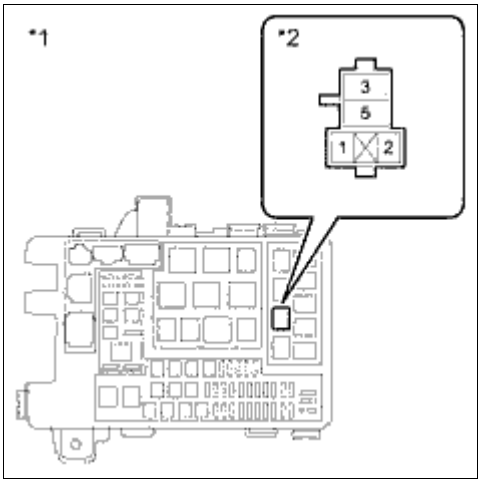
11.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF IG2-MAIN RELAY)

(a) Remove the IG2-MAIN relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
1 (IG2-MAIN relay holder) - Body ground	Ignition switch ON	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	IG2-MAIN Relay Holder

NG ▶ **GO TO STEP 14**

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OK

12.	CHECK HARNESS AND CONNECTOR (IG2-MAIN RELAY - BODY GROUND)

(a) Remove the IG2-MAIN relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (IG2-MAIN relay holder) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

13.	CHECK HARNESS AND CONNECTOR (IG2-MAIN RELAY - ECM)

(a) Remove the IG2-MAIN relay from the engine room relay block.

(b) Disconnect the E21 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (IG2-MAIN relay holder) - E21-8 (IGSW)	Always	Below 1 Ω
3 (IG2-MAIN relay holder) or E21-8 (IGSW) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

14.	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY

(a) Inspect the ignition or starter switch assembly INFO .

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NG ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK ▼

15.	**CHECK HARNESS AND CONNECTOR (IG2-MAIN RELAY - IGNITION OR STARTER SWITCH ASSEMBLY)**

(a) Remove the IG2-MAIN relay from the engine room relay block.

(b) Disconnect the I7 ignition or starter switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (IG2-MAIN relay holder) - I7-3 (IG2)	Always	Below 1 Ω
1 (IG2-MAIN relay holder) or I7-3 (IG2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION OR STARTER SWITCH ASSEMBLY - BATTERY)**

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000000YEQ0BCX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: EVAP System; 2016 MY Tacoma [08/2015 -]		

EVAP System

RELATED DTCS

DTC NO.	MONITORING ITEM	SEE PROCEDURE
P043E	Reference orifice clogged (built into canister pump module)	INFO
P043F	Reference orifice high-flow (built into canister pump module)	
P0441	• Purge VSV (Vacuum Switching Valve) stuck closed • Purge VSV stuck open • Purge flow	INFO
P0451	Canister pressure sensor (built into canister pump module) noise	INFO
P0452	Canister pressure sensor (built into canister pump module) voltage low	
P0453	Canister pressure sensor (built into canister pump module) voltage high	
P0455	EVAP gross leak	INFO
P0456	EVAP small leak	
P2401	Leak detection pump stuck OFF (built into canister pump module)	INFO
P2402	Leak detection pump stuck ON (built into canister pump module)	
P2419	Vent valve stuck closed (built into canister pump module)	
P2420	Vent valve stuck open (vent) (built into canister pump module)	INFO
P2610	Soak timer (built into ECM)	INFO

If any EVAP system DTCs are stored, the malfunctioning area can be determined using the table below.

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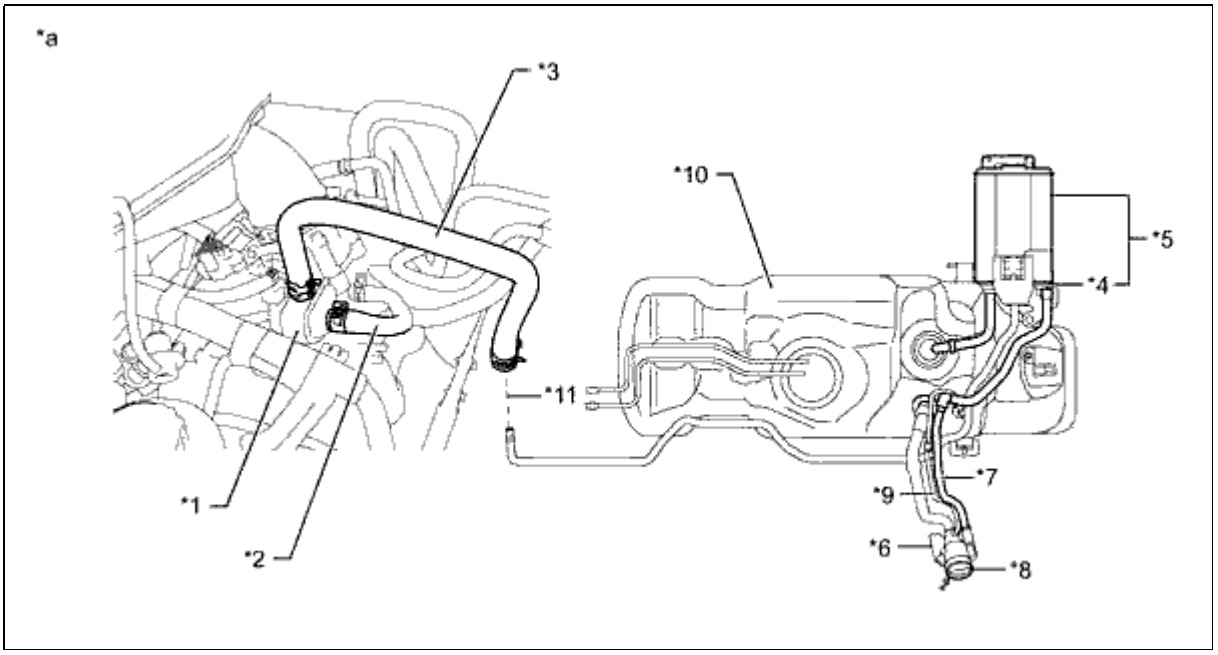
DTCs / Malfunctioning Areas	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●							●	●	
Reference orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Canister pressure sensor signal noise			●							
Canister pressure sensor low output				●						
Canister pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Leak detection pump stuck OFF	●							●	●	
Leak detection pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

NOTICE:

If the reference pressure difference between the first and second checks is greater than the specification, all the DTCs relating to the reference pressure (P043E, P043F, P2401, P2402 and P2419) will all be stored.

DESCRIPTION

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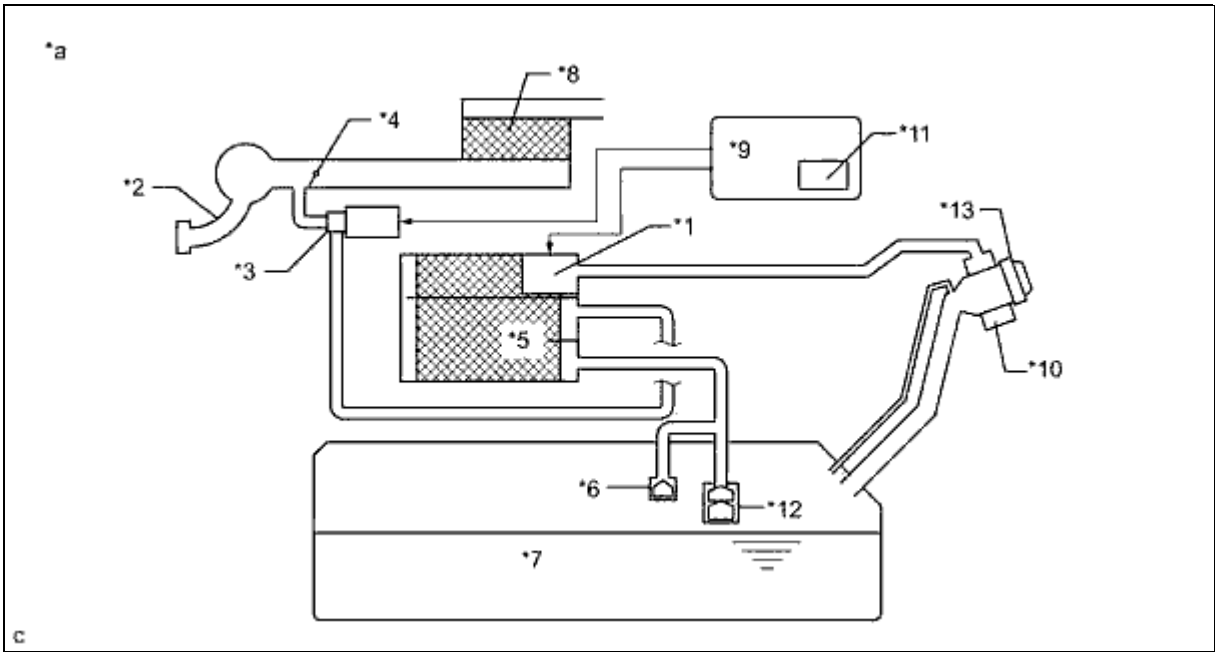
Text in Illustration

*1	Purge VSV	*2	EVAP Hose (to Intake Manifold)
*3	EVAP Hose (from Canister)	*4	Canister Pump Module - Canister Pressure Sensor - Leak Detection Pump - Vent Valve
*5	Canister Assembly	*6	Canister Filter
*7	Air Inlet Port	*8	Fuel Tank Cap Assembly
*9	Bleeding Pipe	*10	Fuel Tank
*11	Purge Line	-	-
*a	Location of EVAP (Evaporative Emission) System	-	-

HINT:

The canister pressure sensor, the leak detection pump and the vent valve are built into the canister pump module.

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Text in Illustration

*1	Canister Pump Module	*2	Intake Manifold
*3	Purge VSV	*4	Throttle Valve
*5	Canister	*6	Cut-off Valve
*7	Fuel Tank	*8	Air Cleaner
*9	ECM	*10	Canister Filter
*11	Soak Timer	*12	Roll-Over Valve
*13	Fuel Tank Cap Assembly	-	-
*a	EVAP System Circuit	-	-

NOTICE:

In the EVAP system of this vehicle, turning ON the vent valve does not seal off the EVAP system. To check for leaks in the EVAP system, disconnect the air inlet vent hose and apply pressure from atmospheric side of the canister.

While the engine is running, if a predetermined condition (closed-loop, etc.) is met, the purge VSV is opened by the ECM and fuel vapors stored in the canister are purged to the intake manifold. The ECM changes the duty cycle ratio of the purge VSV to control purge flow volume.

The purge flow volume is also determined by the intake manifold pressure. Atmospheric pressure is allowed into the canister through the vent valve to ensure that the purge flow is maintained when negative pressure (vacuum) is applied to the canister.

The following two monitors run to confirm appropriate EVAP system operation.

1. Key-off monitor

This monitor checks for EVAP (evaporative emission) system leaks and canister pump module malfunctions. The monitor starts 5 hours* after the ignition switch is turned off. At least 5 hours are required for the fuel to cool down to stabilize the EVAP pressure, thus making the EVAP system monitor more accurate.

The leak detection pump creates negative pressure (vacuum) in the EVAP system and the pressure is measured.

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Finally, the ECM monitors for leaks from the EVAP system, and malfunctions in both the canister pump module and purge VSV based on the EVAP pressure.

HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

2. Purge flow monitor

The purge flow monitor consists of the 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

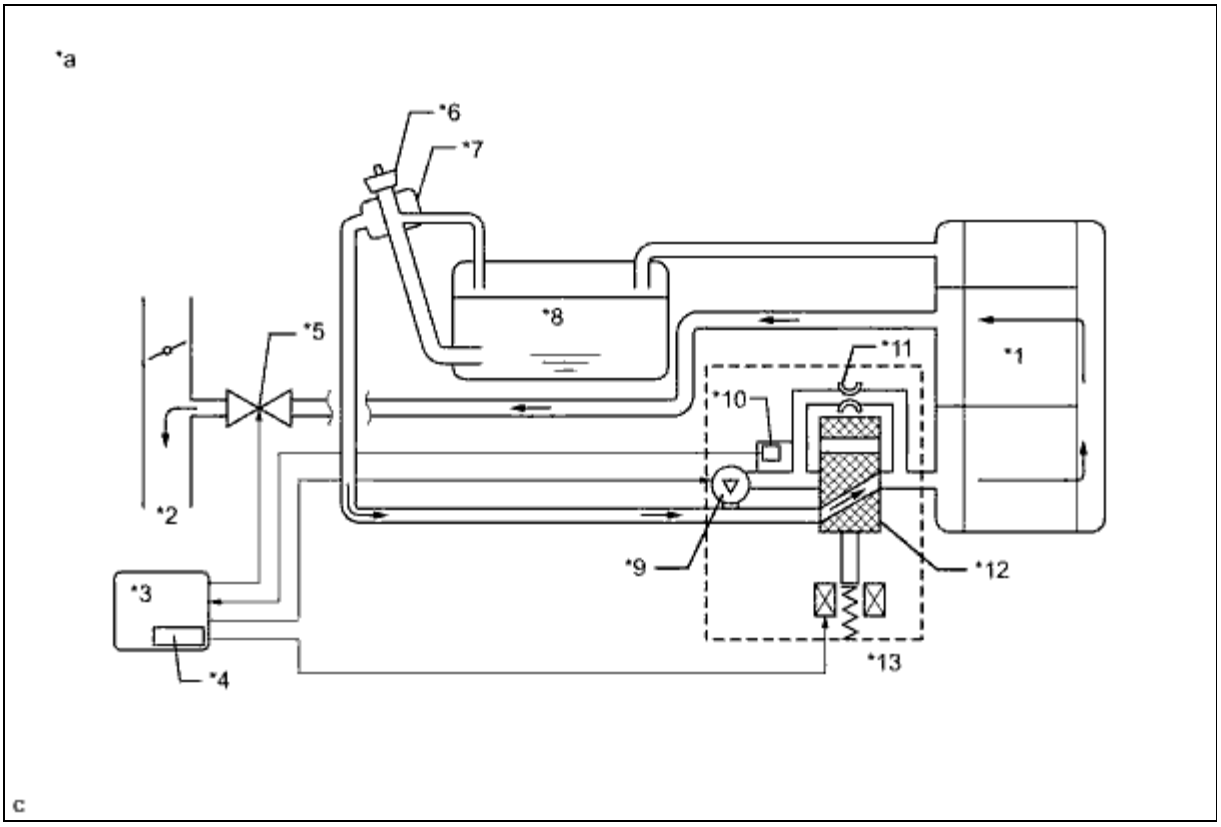
- The 1st monitor

  While the engine is running and the purge VSV (Vacuum Switching Valve) is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
- The 2nd monitor

  The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.15 kPa(gauge) [1.125 mmHg(gauge)], the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and stores DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after of the purge flow monitor, is measured by the ECM.



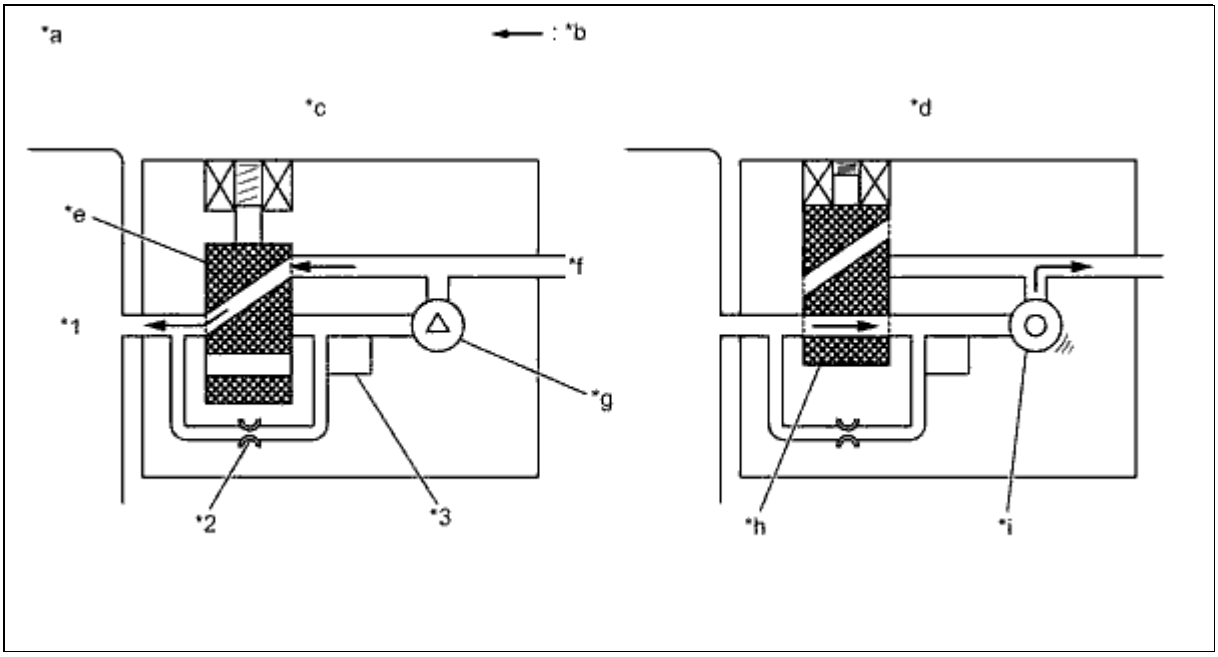
Text in Illustration

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*1	Canister	*2	to Intake Manifold
*3	ECM	*4	Soak Timer
*5	Purge VSV (ON)	*6	Fuel Tank Cap Assembly
*7	Canister Filter	*8	Fuel Tank
*9	Leak Detection Pump (off)	*10	Canister Pressure Sensor
*11	Reference Orifice (0.02 inch)	*12	Vent Valve (OFF)
*13	Canister Pump Module	-	-
*a	EVAP Purge Flow	-	-

COMPONENT	OPERATION
Canister	Contains activated charcoal to absorb EVAP (Evaporative Emissions) generated in fuel tank.
Cut-off valve	Located in fuel tank. Valve floats and closes when fuel tank is 100% full.
Purge VSV (Vacuum Switching Valve)	Opens or closes line between canister and intake manifold. ECM uses purge VSV to control EVAP purge flow. In order to discharge EVAP absorbed by canister to intake manifold, ECM opens purge VSV. EVAP discharge volume to intake manifold controlled by purge VSV duty cycle (current-carrying time). (Open: on, Close: off)
Roll-over valve	Located in fuel tank. Valve closes by its own weight when vehicle overturns to prevent fuel from spilling out.
Soak timer	Built into ECM. To ensure accurate EVAP monitor, measures 5 hours (+/-15 min) after ignition switch is turned off. This allows fuel to cool down, stabilizing EVAP pressure. When approximately 5 hours elapsed, ECM activates (refer to fig. 3)
Canister pump module	Consists of (a) to (d) below. Canister pump module cannot be disassembled.
(a) Vent valve	Vents and closes EVAP system. When ECM turns valve on, EVAP system closed. When, ECM turns valve off, EVAP system is vented. Negative pressure (vacuum) is created in EVAP system to check for EVAP leaks by closing purge VSV, turning on vent valve (closing it) and operating leak detection pump (refer to fig. 1).
(b) Canister pressure sensor	Indicates pressure as voltages. ECM supplies regulated 5 V to pressure sensor, and uses feedback from sensor to monitor EVAP system pressure (refer to fig. 2).
(c) Leak detection pump	Creates negative pressure (vacuum) in EVAP system for leak check.
(d) Reference orifice	Has opening with 0.02 inch diameter. Vacuum is produced through orifice by closing purge VSV, turning off vent valve and operating leak detection pump, to monitor reference pressure. Reference pressure indicates a small leak of EVAP.

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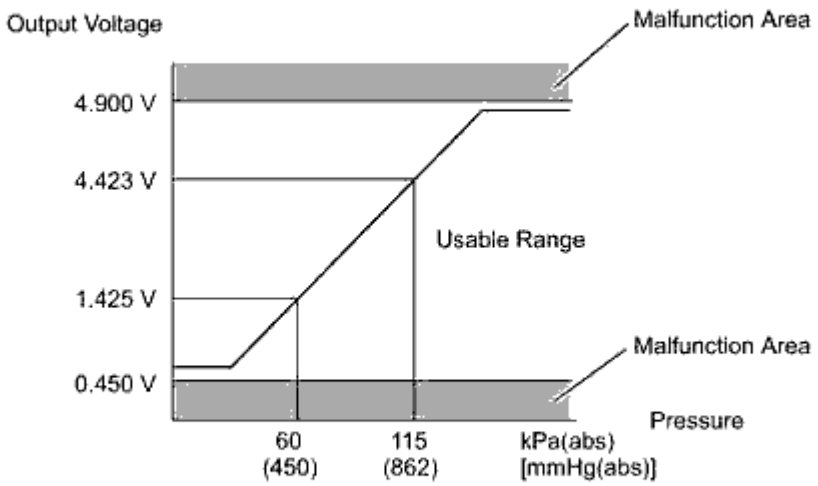


Text in Illustration

*1	Canister	*2	Reference Orifice (0.02 Inch)
*3	Canister Pressure Sensor	-	-
*a	Canister Pump Module (fig. 1)	*b	Airflow
*c	Condition: Purge Flow	*d	Condition: Leak Check
*e	Vent Valve: OFF(vent)	*f	to Canister Filter (Atmosphere)
*g	Leak Detection Pump: OFF	*h	Vent Valve: ON(closed)
*i	Leak Detection Pump: ON	-	-

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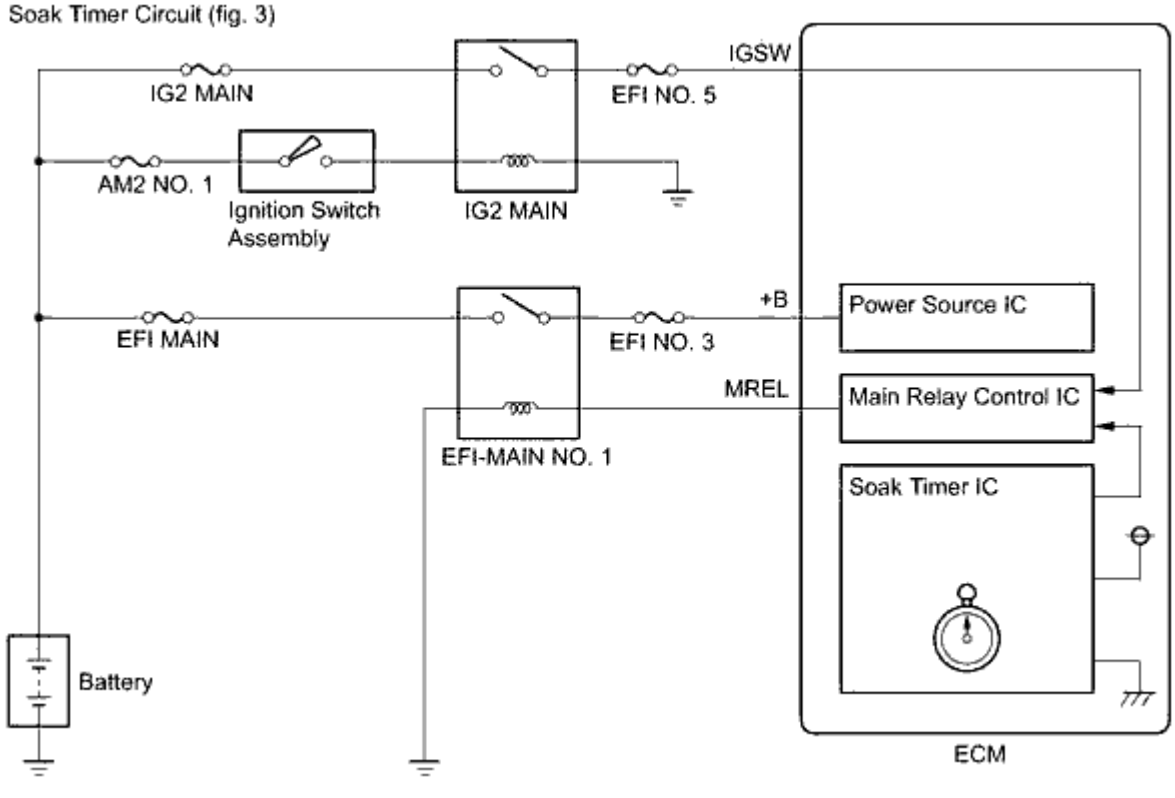
Canister Pressure Sensor Specification (fig. 2)



HINT:

Standard atmospheric pressure is 101.3 kPa(abs) [760 mmHg(abs)]

Soak Timer Circuit (fig. 3)



WIRING DIAGRAM

Refer to DTC P0451 INFO .

INSPECTION PROCEDURE

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NOTICE:

- Inspect the fuses of circuits related to this system before performing the following inspection procedure.
- The Techstream is required to conduct the following diagnostic troubleshooting procedure.

HINT:

- Using Techstream monitor results enables the EVAP (Evaporative Emission) system to be confirmed.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CONFIRM DTC**

(a) Turn the ignition switch off and wait for 10 seconds.

(b) Turn the ignition switch to ON.

(c) Turn the ignition switch off and wait for 10 seconds.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Confirm DTCs and freeze frame data. If any EVAP system DTCs are stored, the malfunctioning area can be determined using the table below.

NOTICE:

If the reference pressure difference between the first and second checks is greater than the specification, all the DTCs relating to the reference pressure (P043E, P043F, P2401, P2402 and P2419) are stored.

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DTCs / Malfunctioning Areas	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●							●	●	
Reference orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Canister pressure sensor signal noise			●							
Canister pressure sensor low output				●						
Canister pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Leak detection pump stuck OFF	●							●	●	
Leak detection pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

NEXT

2.	**PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)**

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

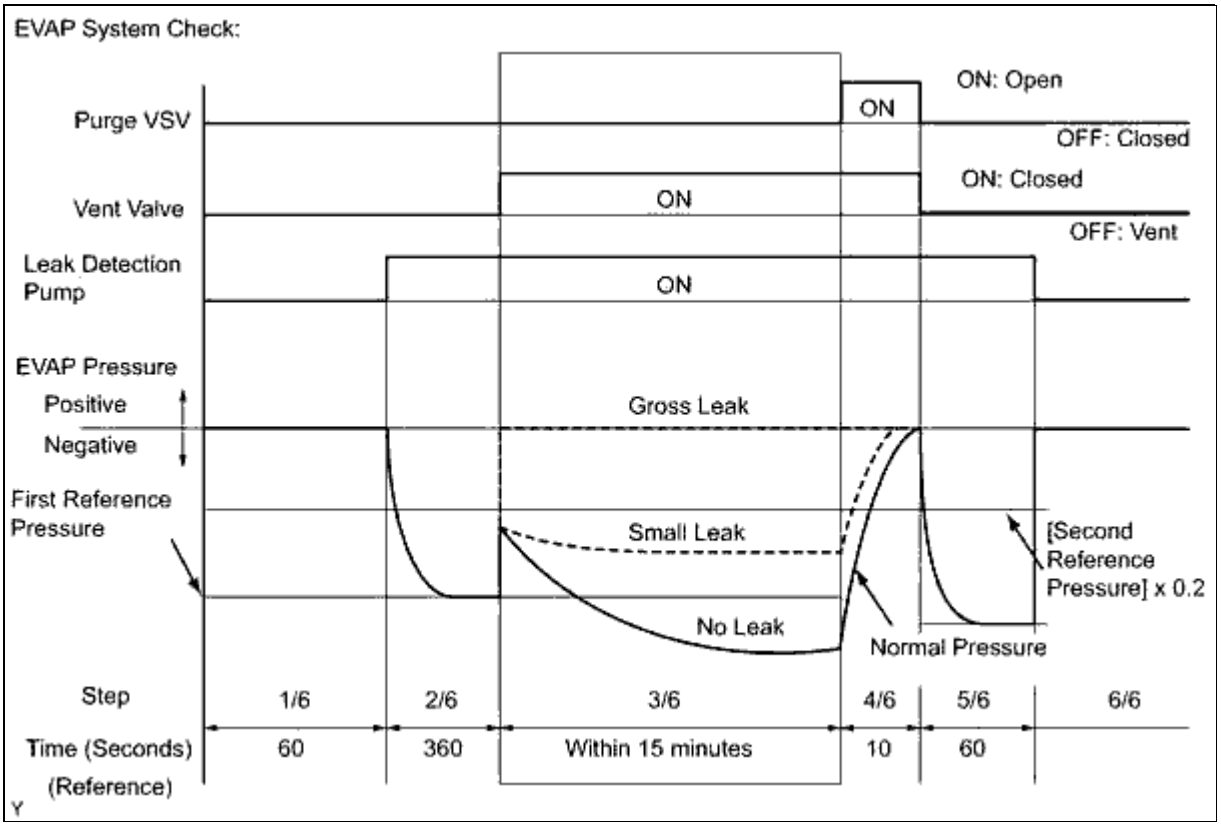
(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes.

HINT:

If no pending DTCs are displayed, perform the Confirmation Driving Pattern. After this confirmation, check for pending DTCs. If no DTCs are displayed, the EVAP system is normal.

NEXT

3.	**PERFORM EVAPORATIVE SYSTEM CHECK (MANUAL MODE)**



NOTICE:

- In the Evaporative System Check (Manual Mode), the series of 6 Evaporative System Check steps are performed manually using the Techstream.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.

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- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

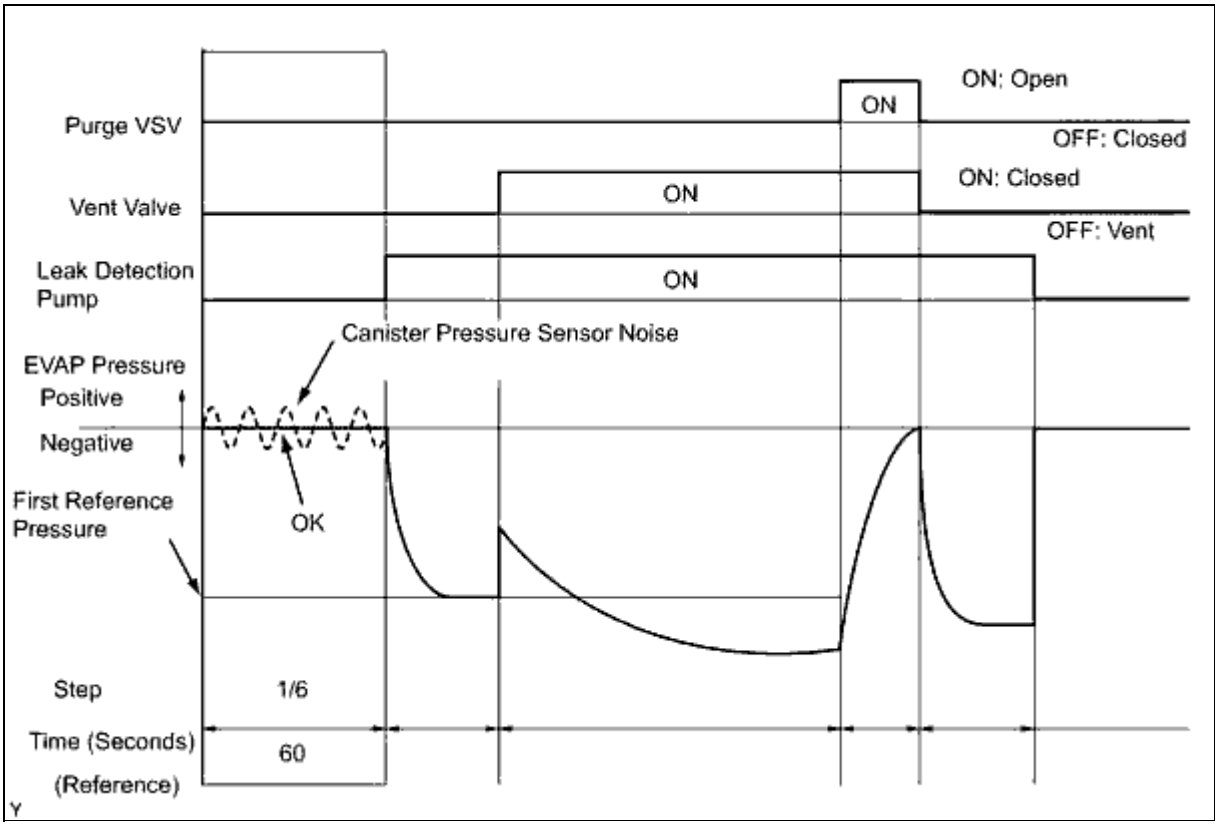
(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Manual Mode.

NEXT

4.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/6)**



(a) Check the EVAP pressure in step 1/6.

Result

DTC*1	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure	Not yet determined	A

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DTC*1	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P0451	EVAP pressure fluctuates by +/-0.3 kPa(gauge) [2.25 mmHg(gauge)] or more	Canister pressure sensor signal noise	B
P0452 or P0453 *2	• EVAP pressure is below 42.11009 kPa(abs) [315.86779 mmHg(abs)] or 123.76147 kPa(abs) [928.33489 mmHg(abs)] or more • EVAP pressure deviates +/-10 kPa [+/-75 mmHg] from actual atmosphere pressure*3	Canister pressure sensor or its circuit has malfunction	C

- *1: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.
- *2: If the canister pressure sensor circuit has an open or short, DTC P0452 or P0453 is stored 0.5 seconds after the ignition switch is turned to ON.

HINT:

*3: Canister pressure sensor standard output range is 70 to 110 kPa(abs) [525 to 825 mmHg(abs)]. This varies by weather.

B ▶ **GO TO STEP 38**

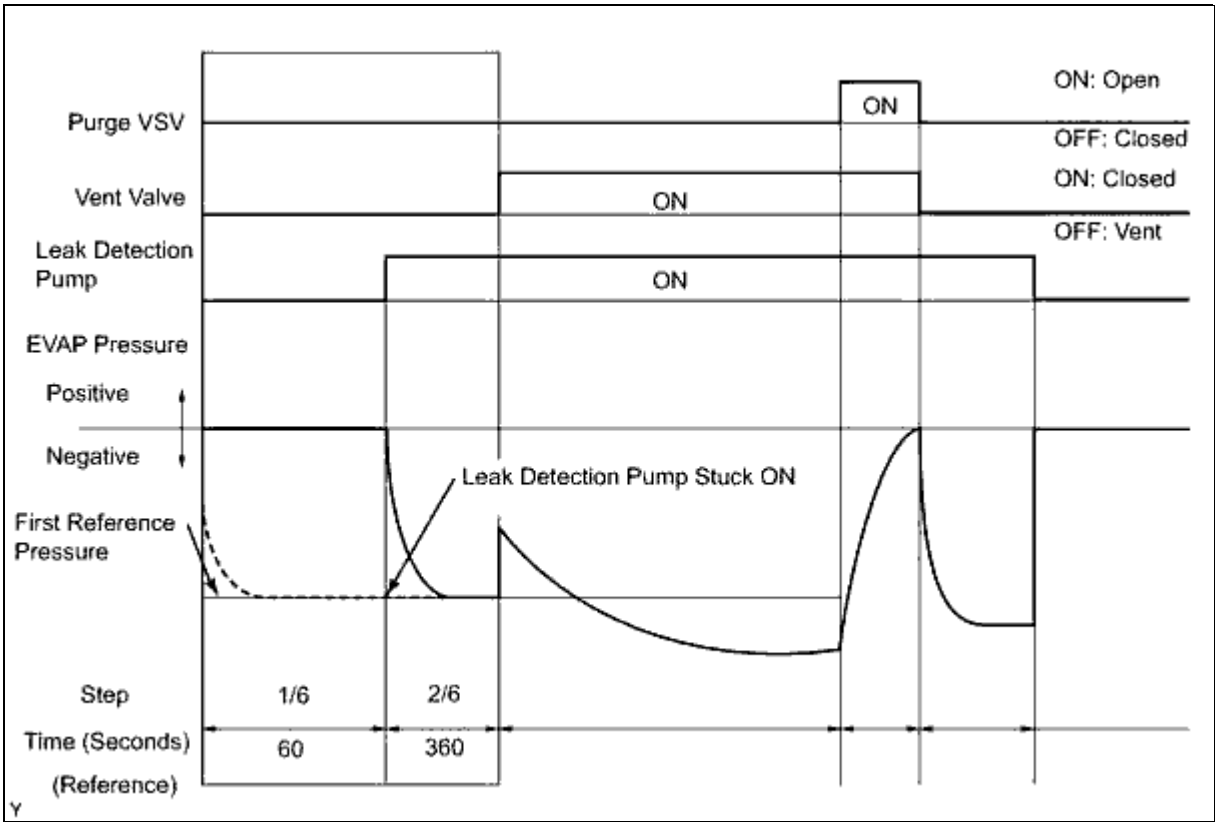
C ▶ **GO TO STEP 12**

A

▼

5.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/6 TO 2/6)**

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(a) Check the EVAP pressure in steps 1/6 and 2/6.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure during step 1/6. Then decreases to reference pressure	Not yet determined	A
P2402	Small difference between EVAP pressures during steps 1/6 and 2/6	Leak detection pump stuck ON	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

HINT:

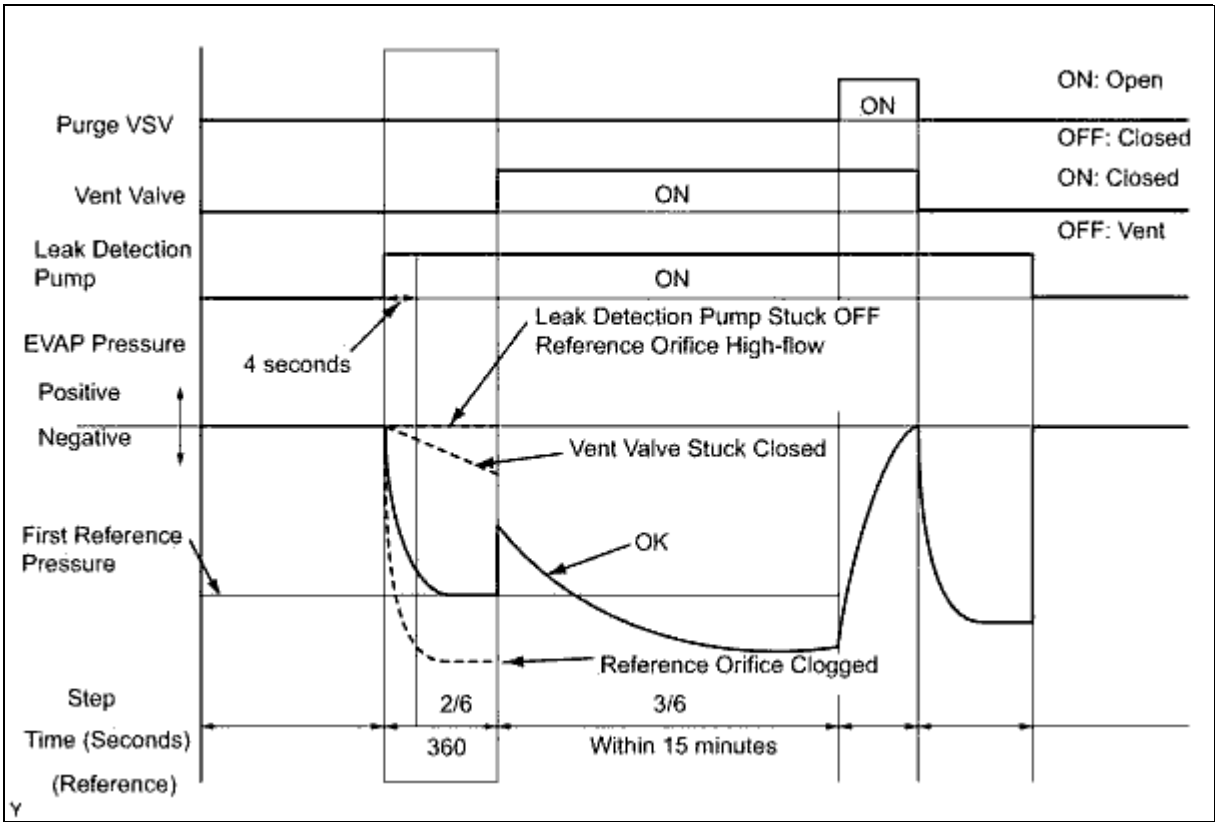
The first reference pressure is the value determined in step 2/6.

B ▶ **GO TO STEP 33**

A ▼

6.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/6)**

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HINT:

Make a note of the pressures checked in inspection items (A) and (B) below.

(a) Check the EVAP pressure 4 seconds after the leak detection pump is activated*1 (A).

*1: The leak detection pump begins to operate as step 1/6 finishes and step 2/6 starts.

(b) Check the EVAP pressure again when it has stabilized. This pressure is the reference pressure (B).

Result

DTC*2	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure in inspection item (B) is between -4.85 kPa(gauge) and -1.057 kPa(gauge) [-36.384 mmHg(gauge) and -7.93 mmHg(gauge)]	Not yet determined	A
P043F and P2401	EVAP pressure in inspection item (B) is -1.057 kPa(gauge) [-7.93 mmHg(gauge)] or more	• Reference orifice high-flow • Leak detection pump stuck OFF	B
P043E	EVAP pressure in inspection item (B) is less than -4.85 kPa(gauge) [-36.384 mmHg(gauge)]	Reference orifice clogged	C
P2419	EVAP pressure in inspection item (A) is more than -1.057 kPa(gauge) [-7.93 mmHg(gauge)]	• Vent valve stuck closed • Leak detection pump performance deteriorates • Leak detection pump circuit malfunctioning (large	D

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DTC*2	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
		resistance exists in the circuit)	

*2: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

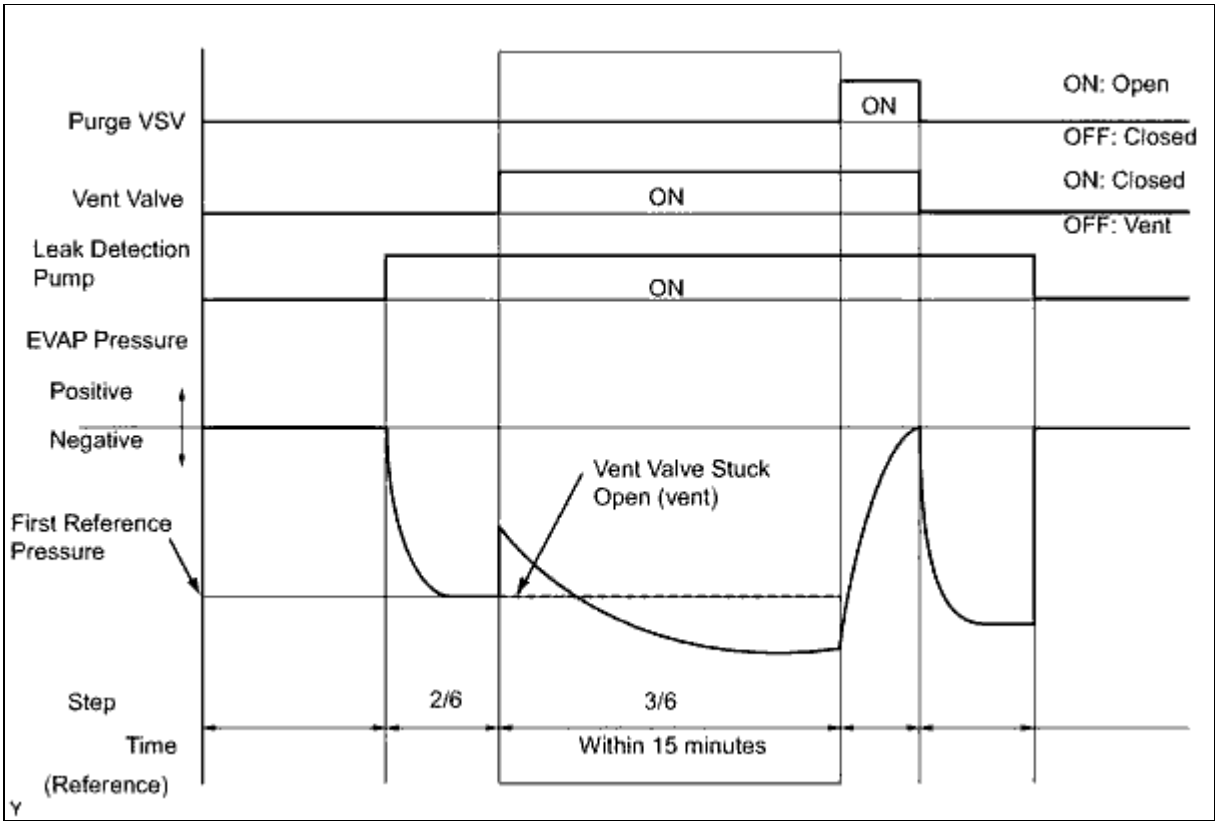
B ▶ **GO TO STEP 11**

C ▶ **GO TO STEP 38**

D ▶ **GO TO STEP 13**

A ▼

7.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/6 TO 3/6)



(a) Check the EVAP pressure in step 3/6.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED

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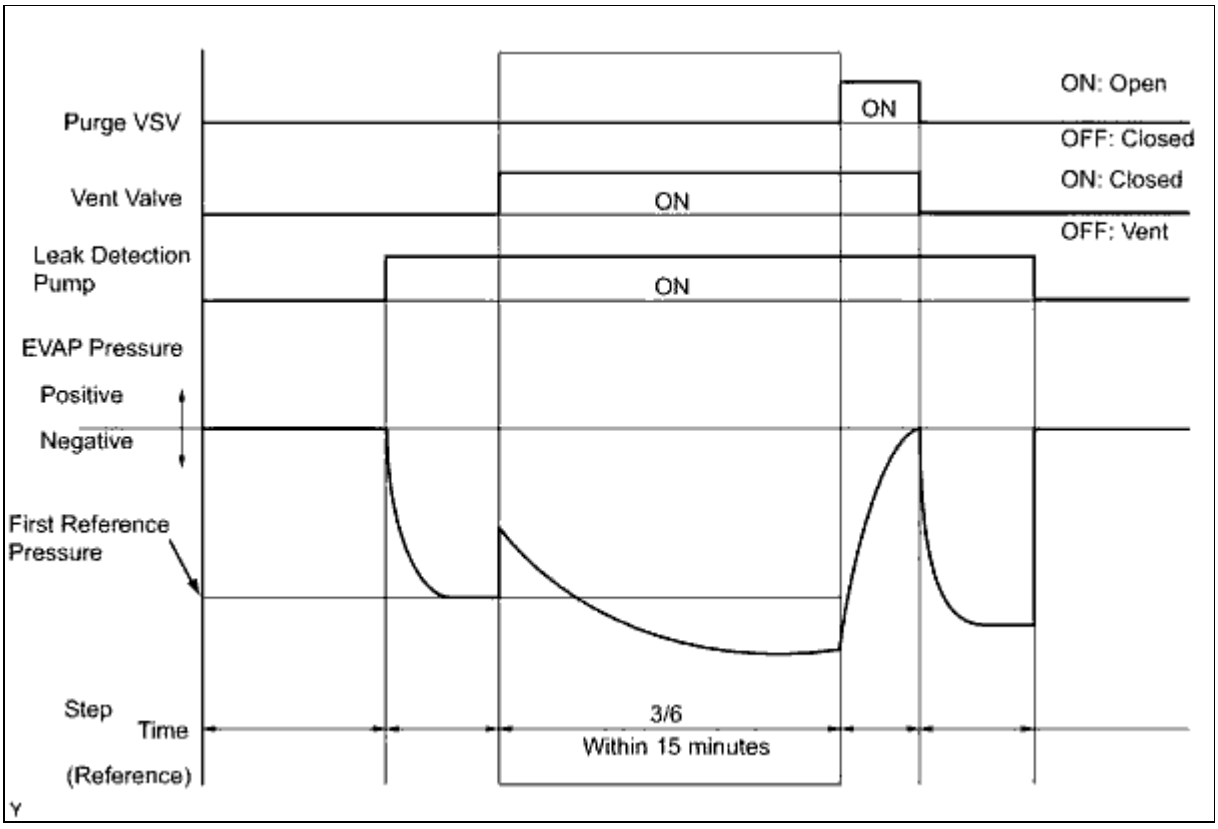
			TO
-	EVAP pressure increases by 0.15 kPa(gauge) [1.125 mmHg(gauge)] or more within 10 seconds of proceeding from step 2/6 to step 3/6	Not yet determined	A
P2420	No variation in EVAP pressure even after proceeding from step 2/6 to step 3/6	• Vent valve stuck open (vent) • Canister (charcoal filter inside canister) clogged	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B ▶ **GO TO STEP 27**

A ▼

8.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/6)**



(a) Wait until the EVAP pressure change is less than 0.12 kPa(gauge) [0.9 mmHg(gauge)] for 40 seconds.

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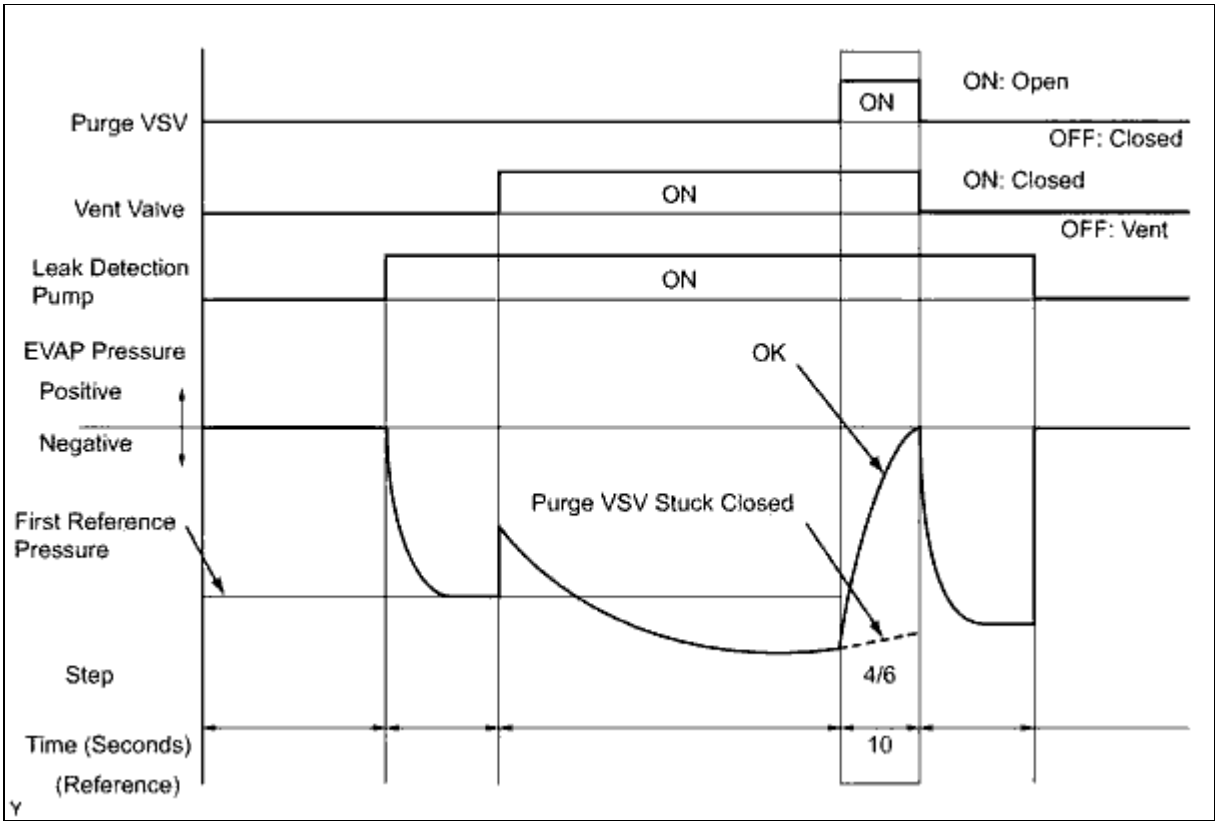
(b) Measure the EVAP pressure and record it.

HINT:

A few minutes are required for the EVAP pressure to become saturated. When there is little fuel in the fuel tank, it takes up to 15 minutes.

NEXT

9.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 4/6)



(a) Check the EVAP pressure in step 4/6.

Result

DTC*1	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure increases by 0.3 kPa(gauge) [2.25 mmHg(gauge)] or more within 10 seconds of proceeding from step 3/6 to step 4/6	Not yet determined	A
P0441 *2	EVAP pressure increases by 0.3 kPa(gauge) [2.25 mmHg(gauge)] or more within 10 seconds of proceeding from step 3/6 to step 4/6	• Purge VSV • Purge VSV circuit • Problems in EVAP hose between purge VSV and intake manifold	B

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DTC*1	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
		• Problems in EVAP hose between canister and purge VSV • ECM	
P0441	Variation in EVAP pressure is less than 0.3 kPa(gauge) [2.25 mmHg(gauge)] for 10 seconds, after proceeding from step 3/6 to step 4/6	• Purge VSV stuck closed • Purge VSV circuit • Canister (charcoal filter inside canister) clogged • Problems in EVAP hose between purge VSV and intake manifold • Problems in EVAP hose between canister and purge VSV • ECM	C

- *1: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.
- *2: This result suggests that due to purge line blockage or purge VSV malfunction, the DTC was stored by the purge flow monitor while the engine was running, or that key-off monitor test result were nearly borderline values.

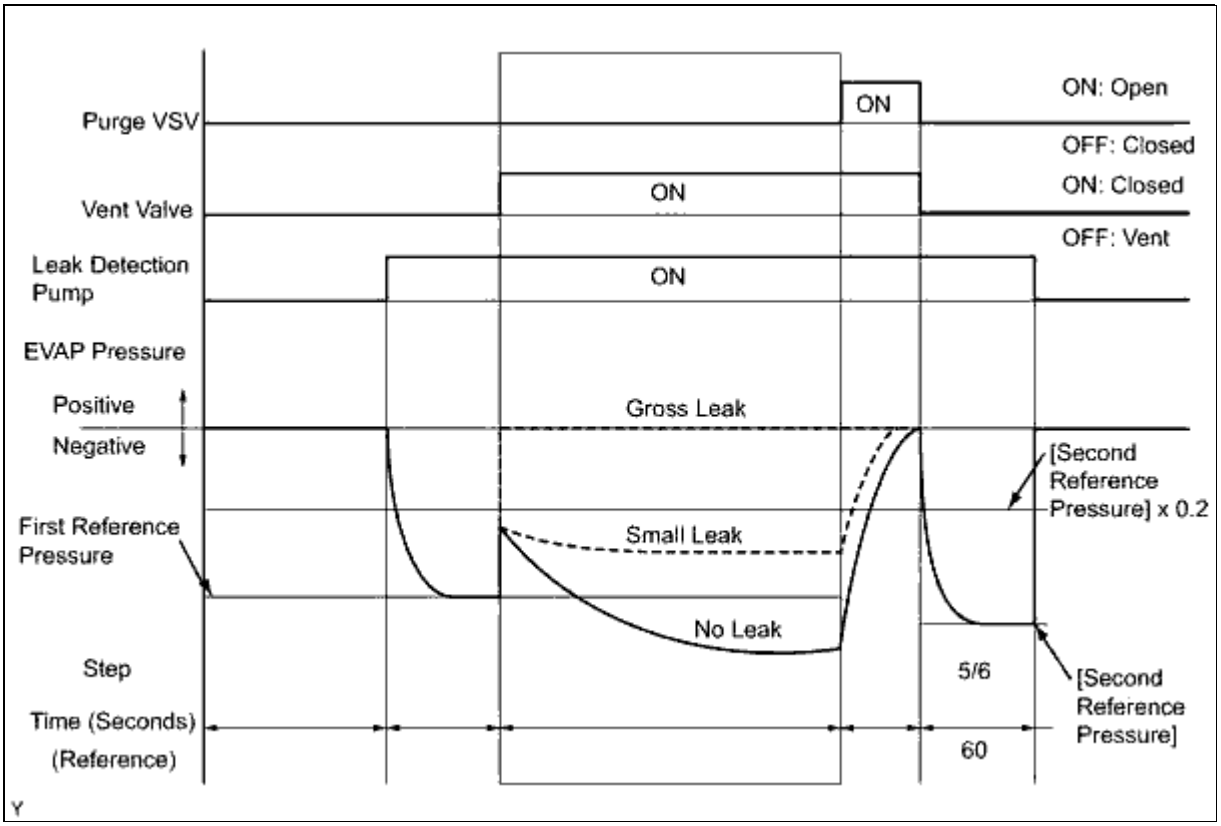
B ▶ **GO TO STEP 22**

C ▶ **GO TO STEP 17**

A ▼

10.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 5/6)**

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(a) Check the EVAP pressure in step 5/6.

(b) Compare the EVAP pressure in step 3/6 and the second reference pressure (step 5/6).

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure from step 3/6 lower than second reference pressure (step 5/6)	Not yet determined (no leakage from EVAP system)	A
P0441 and P0455	EVAP pressure from step 3/6 higher than [second reference pressure (step 5/6) x 0.2]	• Purge VSV stuck open • EVAP gross leak	B
P0456	EVAP pressure from step 3/6 higher than second reference pressure (step 5/6)	EVAP small leak	B

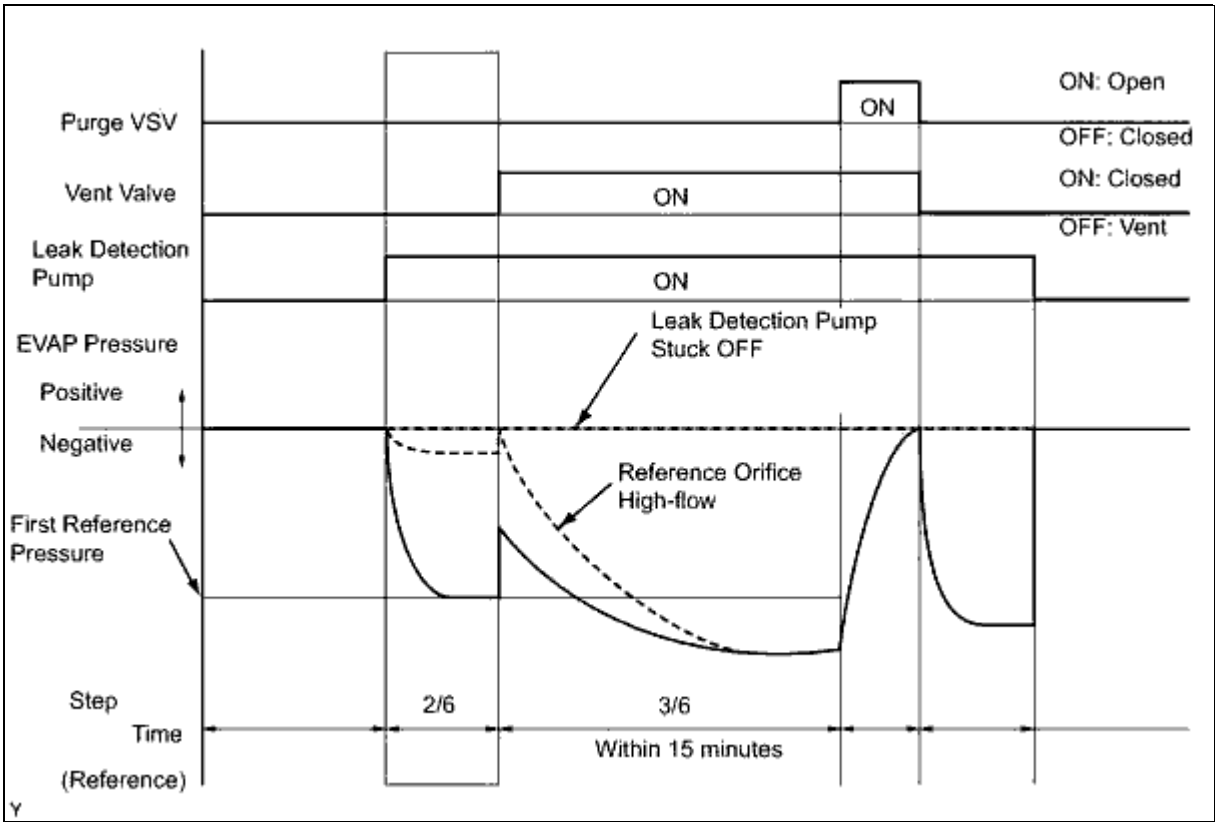
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

A ▶ **GO TO STEP 43**

B ▶ **GO TO STEP 17**

11.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/6)**

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(a) Check the EVAP pressure in step 3/6.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P043F	EVAP pressure less than [reference pressure] measured in step 2/6	Reference orifice high-flow	A
P2401	EVAP pressure almost same as [reference pressure] measured in step 2/6	Leak detection pump stuck off	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

HINT:

The first reference pressure is the value determined in step 2/6.

A ▶ **GO TO STEP 38**

B ▶ **GO TO STEP 31**

12.	INSPECT CANISTER PUMP MODULE (CANISTER PRESSURE SENSOR)

(a) Check the canister pressure sensor circuit, referring to DTC P0451 canister pressure sensor circuit inspection procedure INFO .

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NEXT GO TO STEP 49

13.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

(a) Turn the ignition switch off.

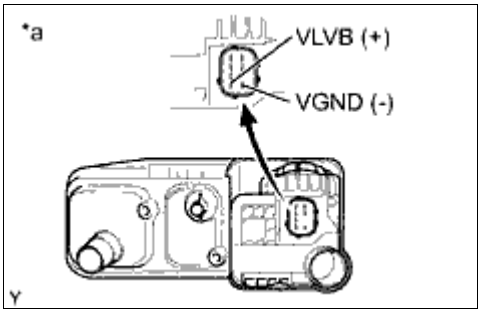
(b) Disconnect the C20 canister pump module connector.

(c) Apply the battery voltage to terminals VLVB and VGND of the canister pump module.

(d) Touch the canister pump module to confirm the vent valve operation.

Text in Illustration

*a	Component without harness connected (Canister Pump Module)



Result

CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Apply battery voltage to terminals VLVB and VGND	Operating	• Wire harness or connector between vent valve and ECM • Leak detection pump performance deteriorates • Leak detection pump circuit malfunctioning (large resistance exists in the circuit) • ECM	A
	Not operating	Vent valve	B

B GO TO STEP 38

A

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14.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E20 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E20-12 (VPMP) - C20-1 (VGND)	Always	Below 1 Ω
E20-12 (VPMP) or C20-1 (VGND) - Body ground	Always	10 kΩ or higher

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
OK	• Leak detection pump performance deteriorates • Leak detection pump circuit malfunctioning (large resistance exists in the circuit) • ECM	A
NG	Wire harness or connector between ECM and canister pump module	B

B ▶ **GO TO STEP 40**

A ▼

15.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E21 ECM connector.

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

Result

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
E21-17 (EMPM) - C20-4 (MGND)	Always	Below 1 Ω	• Canister pump module • Wire harness or connector between canister pump module	A

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
			and ECM • ECM	
		10 kΩ or higher	Wire harness or connector between ECM and canister pump module and ground	B

B ▶ **GO TO STEP 40**

A ▼

16.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E21 ECM connector.

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

Result

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
E21-7 (MPMP) - C20-3 (MTRB)	Always	Below 1 Ω	• Canister pump module • ECM	A
		10 kΩ or higher	Wire harness or connector between canister pump module and body ground	B

A ▶ **GO TO STEP 45**

B ▶ **GO TO STEP 40**

17.	PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)

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(a) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for EVAP Control.

(b) Disconnect the hose (connected to the canister) from the purge VSV.

(c) Start the engine.

(d) Using the Techstream, turn off the purge VSV (Activate the VSV for Evap Control: OFF).

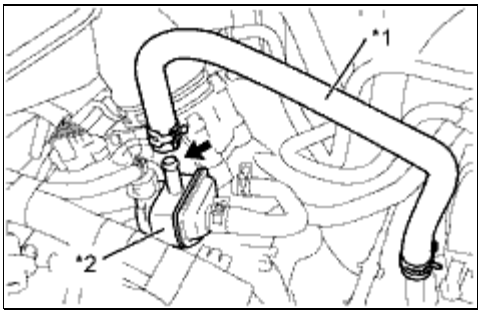
(e) Use your finger to confirm that the purge VSV has no suction.

(f) Using the Techstream, turn on the purge VSV (Activate the VSV for Evap Control: ON).

(g) Use your finger to confirm that the purge VSV has suction.

Text in Illustration

*1	Hose (to canister)
*2	Purge VSV



Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
No suction when purge VSV turned off, and suction applied when turned on	Blockage in the purge line is considered (based on result of step 9): • Problems with EVAP hose between canister and purge VSV • Canister (charcoal filter inside canister) clogged • ECM	A
	Leakage is considered (based on result of step 10): • Fuel tank cap assembly • Leakage from EVAP line, fuel tank, or canister assembly	B
Suction applied when purge VSV turned off	Purge VSV stuck open	C
No suction when purge VSV turned on	• Purge VSV stuck closed • Problems with EVAP	D

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RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
	hose between purge VSV and intake manifold	

B ▶ **GO TO STEP 20**

C ▶ **GO TO STEP 21**

D ▶ **GO TO STEP 23**

A
▼

18.	INSPECT EVAP HOSE (PURGE VSV - CANISTER)

(a) Check for blockages in the EVAP purge line between the purge VSV and canister.

OK:

No blockages in the EVAP purge line between the purge VSV and canister.

NG ▶ **GO TO STEP 44**

OK
▼

19.	INSPECT CHARCOAL CANISTER ASSEMBLY (CHARCOAL FILTER INSIDE CANISTER)

(a) Check for filter blockage in the canister INFO .

OK:

No blockages in the canister.

OK ▶ **GO TO STEP 47**

NG ▶ **GO TO STEP 48**

20.	CHECK FUEL TANK CAP ASSEMBLY

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(a) Check that the fuel tank cap assembly is correctly installed and confirm that the fuel tank cap assembly meets OEM specifications.

(b) Tighten the fuel tank cap assembly firmly (only one click sound could be heard).

HINT:

If an EVAP tester is available, check the fuel tank cap assembly using the tester.

(1) Remove the fuel tank cap assembly and install it onto a fuel tank cap assembly adapter.

(2) Connect an EVAP tester pump hose to the adapter, and pressurize the cap to 3.2 to 3.7 kPa(gauge) [24 to 28 mmHg(gauge)] using an EVAP tester pump.

(3) Seal the adapter and wait for 2 minutes.

(4) Check the pressure. If the pressure is 2 kPa(gauge) [15 mmHg(gauge)] or more, the fuel tank cap assembly is normal.

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Fuel tank cap assembly correctly installed	-	A
Fuel tank cap assembly loose	• Fuel tank cap assembly improperly installed • Defective fuel tank cap assembly • Fuel tank cap assembly does not meet OEM specifications	B
Defective fuel tank cap assembly	-	B
No fuel tank cap assembly	-	C

A ▶ **GO TO STEP 37**

B ▶ **GO TO STEP 35**

C ▶ **GO TO STEP 36**

21.	INSPECT PURGE VSV

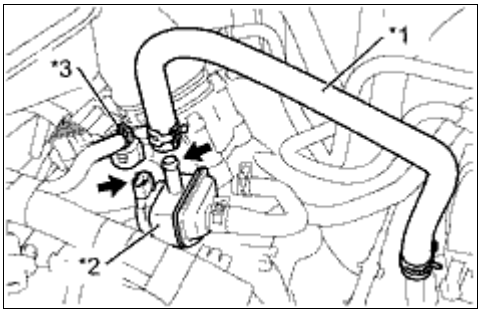
(a) Turn the ignition switch off.

(b) Disconnect the V4 purge VSV connector.

(c) Disconnect the hose (connected to the canister) from the purge VSV.

(d) Start the engine.

(e) Use your finger to confirm that the purge VSV has no suction.



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Text in Illustration

*1	Hose (to canister)
*2	Purge VSV
*3	Connector

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
No suction	• Wire harness or connector between purge VSV and ECM (short to ground) • ECM	A
Suction applied	Purge VSV	B

A ▶ **GO TO STEP 26**

B ▶ **GO TO STEP 39**

22.	**INSPECT EVAP HOSE (PURGE VSV - CANISTER)**

(a) Check for blockages in the EVAP purge line between the purge VSV and canister.

OK:

No blockages in the EVAP purge line between the purge VSV and canister.

NG ▶ **GO TO STEP 44**

OK ▼

23.	**CHECK EVAP HOSE (PURGE VSV - INTAKE MANIFOLD)**

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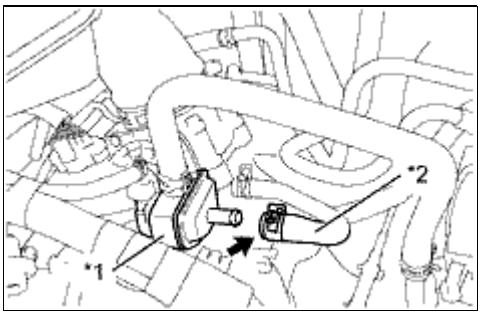
(a) Disconnect the hose (connected to the intake manifold) from the purge VSV.

(b) Start the engine.

(c) Use your finger to confirm that the hose has suction.

Text in Illustration

*1	Purge VSV
*2	Hose (to intake manifold)



Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Suction applied	EVAP hose between purge VSV and intake manifold normal • Purge VSV • Purge VSV power source • Wire harness or connector between purge VSV and ECM	A
No suction	• Intake manifold port • EVAP hose between purge VSV and intake manifold	B

B ▶ **GO TO STEP 34**

A ▼

24.	**INSPECT PURGE VSV**

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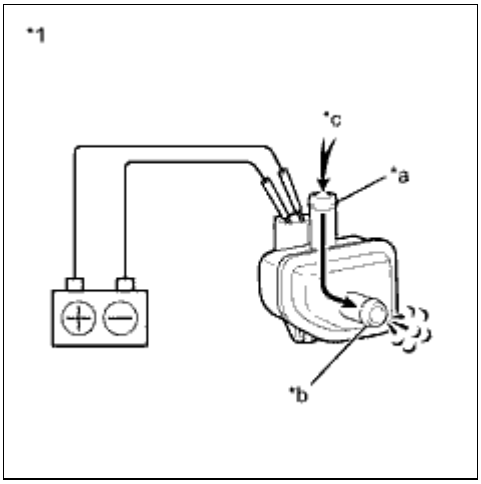
(a) Remove the purge VSV.

(b) Apply the battery voltage to the terminals of the purge VSV.

(c) Confirm that air flows from port E to port F.

Text in Illustration

*1	Purge VSV
*a	Port E
*b	Port F
*c	Air



Result

TEST RESULT	CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
Air flows	Battery voltage is applied to purge VSV terminals	Purge VSV normal • Purge VSV power source • Wire harness or connector between purge VSV and ECM	A
No air flow	Battery voltage is applied to purge VSV terminals	Purge VSV	B

B ▶ **GO TO STEP 39**

A ▼

25.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF PURGE VSV)**

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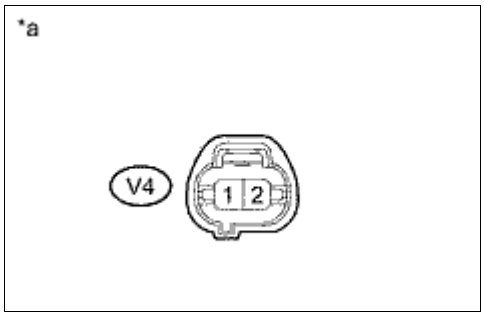
(a) Disconnect the purge VSV connector.

(b) Turn the ignition switch to ON.

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

Text in Illustration

*a	Front view of wire harness connector (to Purge VSV)



Result

TESTER CONNECTION	SWITCH CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
V4-2 - Body ground	Ignition switch ON	11 to 14 V	Purge VSV power source normal • Wire harness or connector between purge VSV and ECM	A
		Other than result above	Wire harness or connectors between purge VSV and battery	B

B ▶ **GO TO STEP 40**

A ▼

26.	**CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)**

(a) Disconnect the E18 ECM connector.

(b) Disconnect the V4 purge VSV connector

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E18-13 (PRG) - V4-1	Always	Below 1 Ω
E18-13 (PRG) or V4-1 - Body ground	Always	10 kΩ or higher

OK ▶ **GO TO STEP 47**

NG ▶ **GO TO STEP 40**

27.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF VENT VALVE)

(a) Turn the ignition switch off.

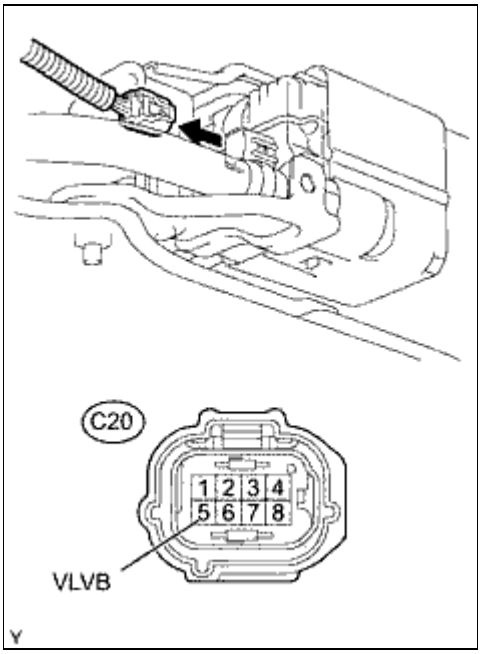
(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

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

Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)



Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
C20-5 (VLVB) - Body ground	Ignition switch ON	11 to 14 V	• Wire harness or connector between vent valve and ECM • Vent valve • Canister (charcoal filter inside canister) clogged • ECM	A
		Below 3 V	• Power source wire harness of	B

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TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
			vent valve	

B GO TO STEP 40

A

28.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

(a) Turn the ignition switch off.

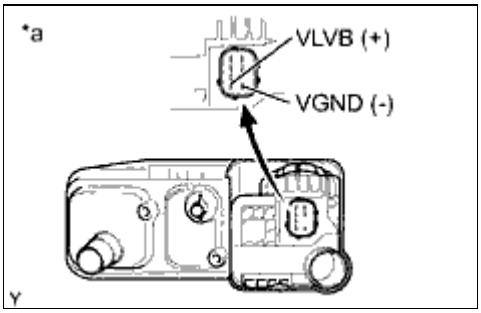
(b) Disconnect the C20 canister pump module connector.

(c) Apply the battery voltage to terminals VLVB and VGND of the pump module.

(d) Touch the canister pump module to confirm the vent valve operation

Text in Illustration

*a	Component without harness connected (Canister Pump Module)



Result

CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Apply battery voltage to terminals VLVB and VGND	Operating	• Wire harness or connector between vent valve and ECM • Canister (charcoal filter inside canister) clogged • ECM	A
	Not operating	• Vent valve	B

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B GO TO STEP 38

A

29.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch off.

(b) Disconnect the E20 ECM connector.

(c) Disconnect the C20 canister pump module connector.

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

Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
E20-12 (VPMP) - C20-1 (VGND)	Always	Below 1 Ω	• Canister (charcoal filter inside canister) clogged • ECM	A
		10 kΩ or higher	Wire harness or connector between ECM and canister pump module	B

B GO TO STEP 40

A

30.	INSPECT CHARCOAL CANISTER ASSEMBLY (CHARCOAL FILTER INSIDE CANISTER)

(a) Check for filter blockage in the canister INFO .

OK:

No blockages in the canister.

OK GO TO STEP 47

NG GO TO STEP 48

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31.	CHECK TERMINAL VOLTAGE (CANISTER PUMP MODULE)

(a) Turn the ignition switch off.

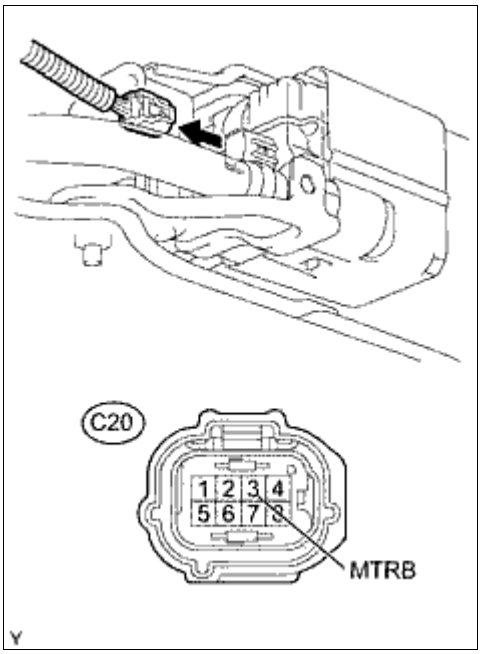
(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

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

Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)



Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
C20-3 (MTRB) - Body ground	Ignition switch ON	9 to 14 V	• Wire harness or connector between leak detection pump and body ground • Leak detection pump	A
		Below 3 V	• Wire harness or connector between leak detection pump and ECM • ECM	B

B ▶ **GO TO STEP 33**

A

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32.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E21 ECM connector.

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

Result

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
E21-17 (EMPM) - C20-4 (MGND)	Always	Below 1 Ω	• Canister pump module • ECM	A
		10 kΩ or higher	Wire harness or connector between leak detection pump and ECM	B

A ▶ **GO TO STEP 45**

B ▶ **GO TO STEP 40**

33.	CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E21 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-7 (MPMP) - C20-3 (MTRB)	Always	Below 1 Ω
E21-7 (MPMP) or C20-3 (MTRB) - Body ground	Always	10 kΩ or higher

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
OK	ECM	A
NG	Wire harness or connector between ECM and canister pump module	B

A ▶ **GO TO STEP 47**

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B GO TO STEP 40

34.	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Stop the engine.

(b) Disconnect the EVAP hose from the intake manifold.

(c) Start the engine.

(d) Use your finger to confirm that the port of the intake manifold has suction.

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Suction applied	EVAP hose between intake manifold and purge VSV	A
No suction	Intake manifold	B

A GO TO STEP 41

B GO TO STEP 42

35.	CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP ASSEMBLY

HINT:

- When reinstalling the fuel tank cap assembly, tighten it firmly (only one click sound could be heard).
- When replacing the fuel tank cap assembly, use a fuel tank cap assembly that meets OEM specifications, and install it firmly.

NEXT GO TO STEP 49

36.	REPLACE FUEL TANK CAP ASSEMBLY

HINT:

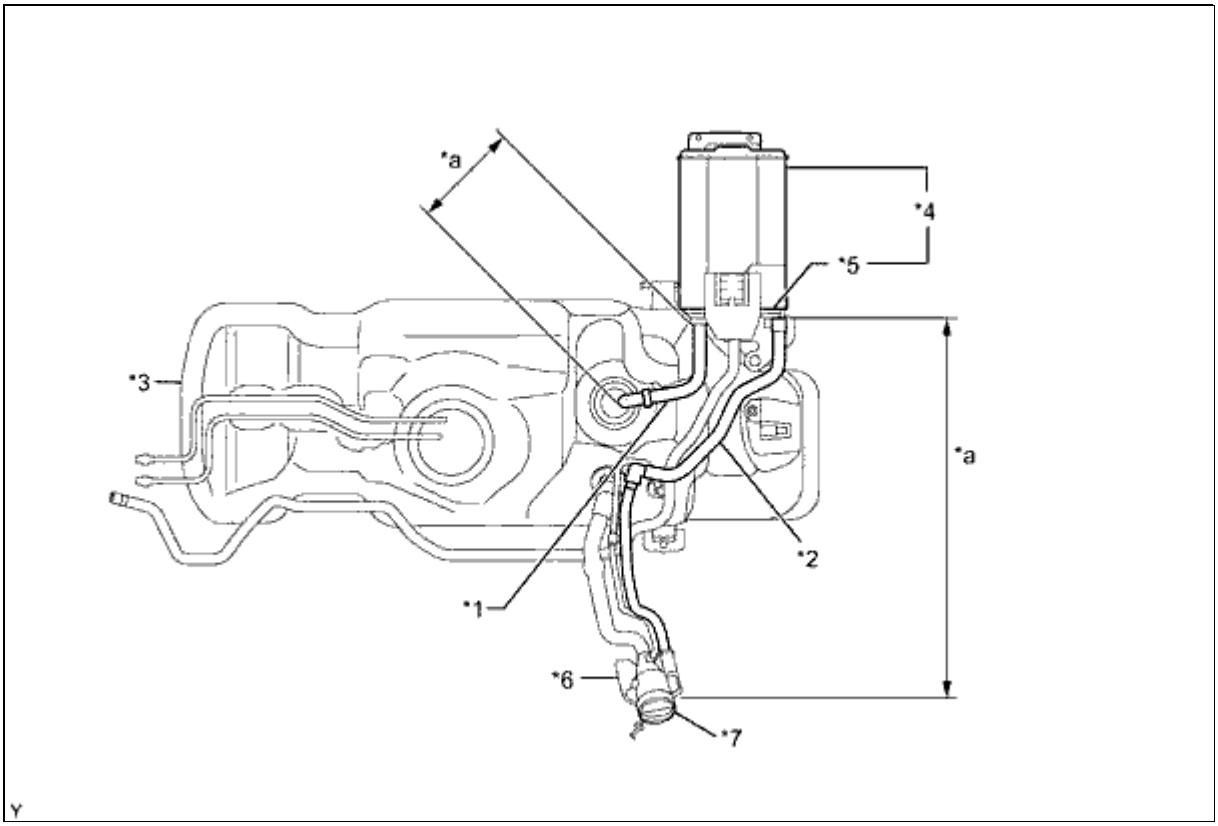
When installing the fuel tank cap assembly, tighten it firmly (only one click sound could be heard).

NEXT GO TO STEP 49

37.	LOCATE EVAP LEAK PART

(a) Disconnect the vent hose.

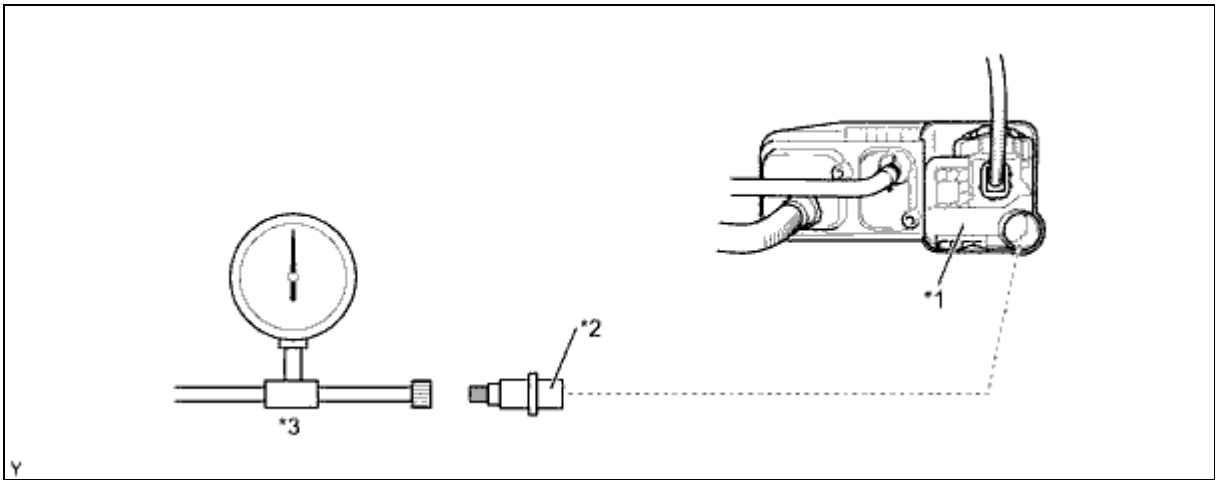
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Text in Illustration

*1	Fuel Tank Vent Hose	*2	Vent Hose
*3	Fuel Tank	*4	Canister Assembly
*5	Canister Pump Module	*6	Canister Filter
*7	Fuel Tank Cap Assembly	-	-
*a	Inspection Area (check for disconnection and/or cracks)	-	-

(b) Connect the EVAP pressure tester tool to the vent hose with the adapter.



Text in Illustration

*1	Canister Pump Module	*2	Adapter

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(c) Pressurize the EVAP system to 3.2 to 3.7 kPa(gauge) [24 to 28 mmHg(gauge)].

(d) Apply soapy water to the piping and connecting parts of the EVAP system.

(e) Look for areas where bubbles appear. This indicates the leak point.

(f) Repair or replace the leak point.

HINT:

Disconnect the hose between the canister and fuel tank from the canister. Block the canister side and conduct an inspection. In this way, the fuel tank can be excluded as an area suspected of causing fuel leaks.

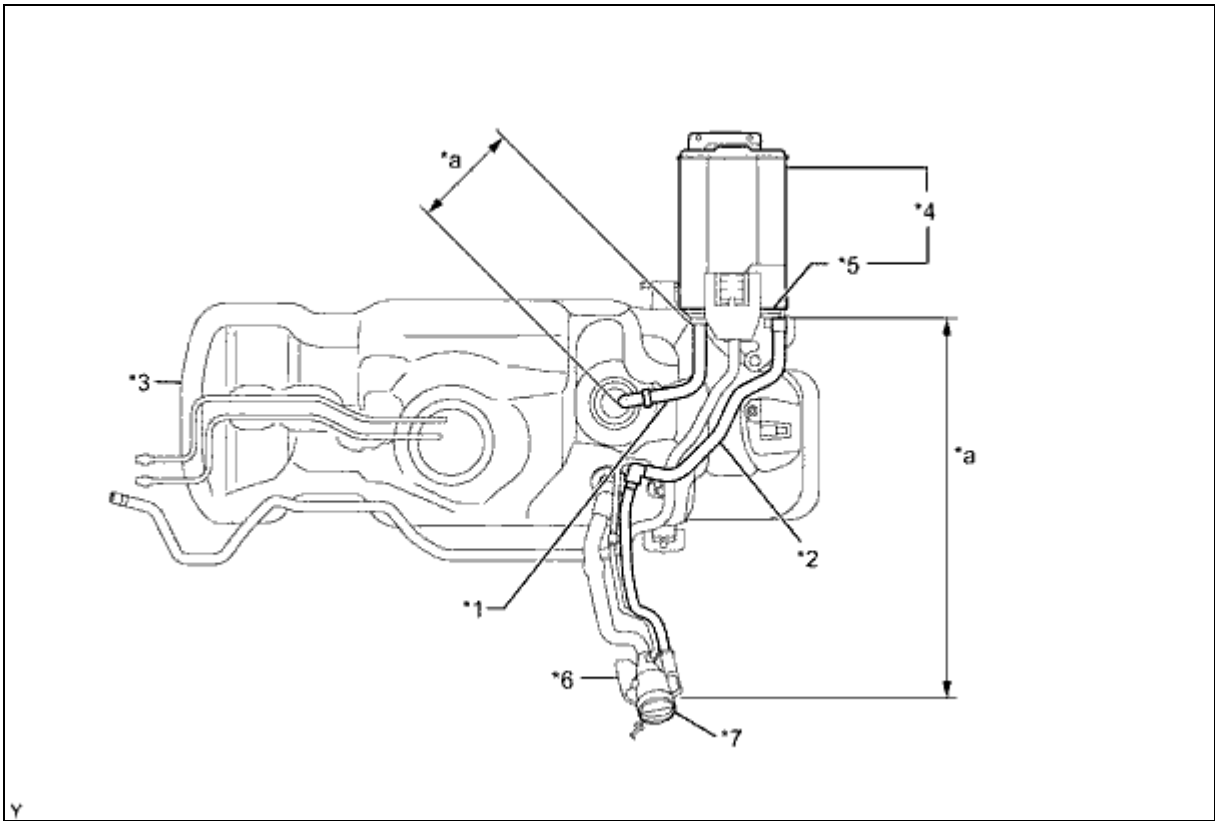
NEXT ▶ **GO TO STEP 49**

38.	REPLACE CANISTER PUMP MODULE

(a) Replace the canister pump module INFO .

NOTICE:

- When replacing the canister pump module, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose. If liquids are present in canister interior, replace canister and canister pump module together (replace canister assembly).
- Check for filter blockage in the canister. If the charcoal filter inside the canister is clogged, replace canister and canister pump module together.
- Check for filter blockage in the canister filter. if the canister filter has blockages, replace the canister filter.



Text in Illustration

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*1	Fuel Tank Vent Hose	*2	Vent Hose
*3	Fuel Tank	*4	Canister Assembly
*5	Canister Pump Module	*6	Canister Filter
*7	Fuel Tank Cap Assembly	-	-
*a	Inspection Area (check for disconnection and/or cracks)	-	-

NEXT **GO TO STEP 49**

39.	**REPLACE PURGE VSV**

(a) Replace the purge VSV.

NEXT **GO TO STEP 49**

40.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT **GO TO STEP 49**

41.	**REPLACE EVAP PURGE LINE (INTAKE MANIFOLD - PURGE VSV)**

NEXT **GO TO STEP 49**

42.	**INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)**

(a) Check that the EVAP purge port of the intake manifold is not clogged. If necessary, replace the intake manifold INFO .

NEXT **GO TO STEP 49**

43.	**REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS**

(a) Repair the malfunctioning areas indicated by the DTCs that had been confirmed when the vehicle was brought in.

NEXT **GO TO STEP 49**

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44.	**REPAIR OR REPLACE EVAP PURGE LINE (PURGE VSV - CANISTER)**

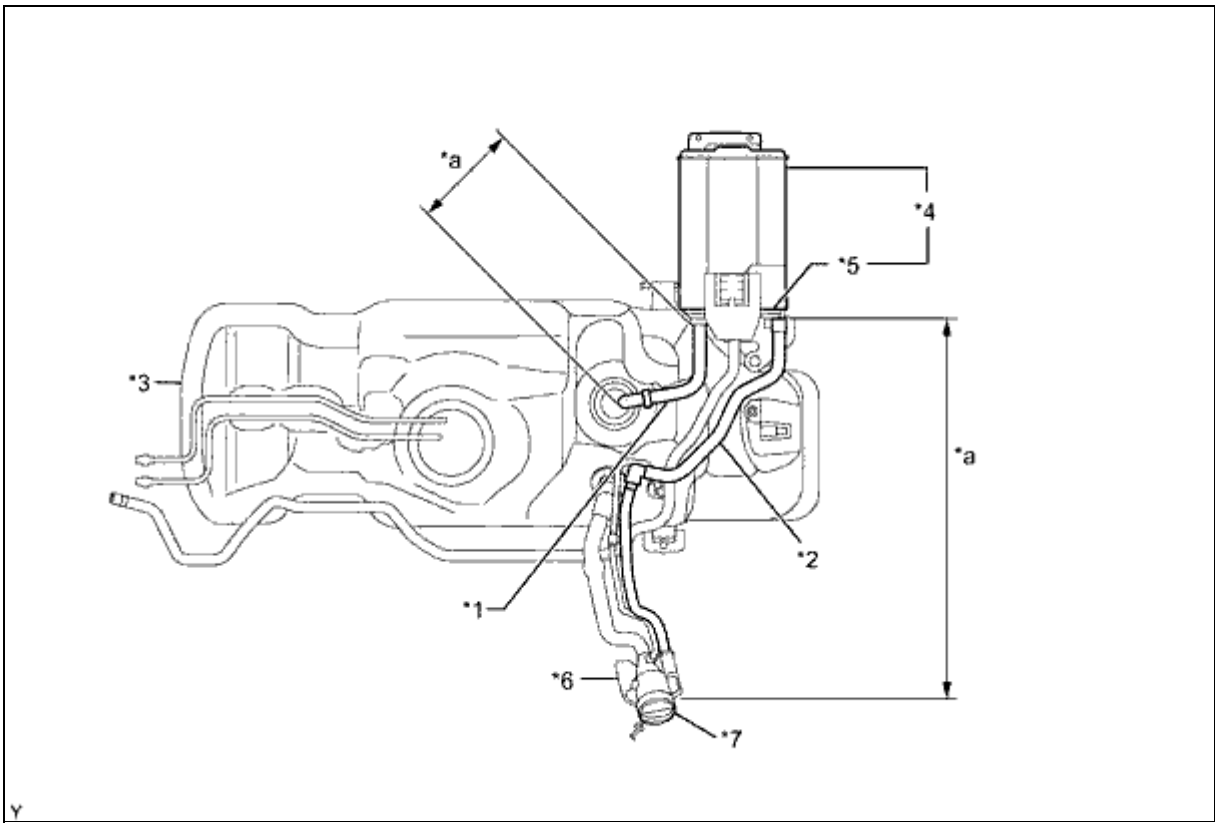
NEXT ▶ **GO TO STEP 49**

45.	**REPLACE CANISTER PUMP MODULE**

(a) Replace the canister pump module INFO .

NOTICE:

- When replacing the canister pump module, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose. If liquids are present in canister interior, replace canister and canister pump module together (replace canister assembly).
- Check for filter blockage in the canister. If the charcoal filter inside the canister is clogged, replace canister and canister pump module together.
- Check for filter blockage in the canister filter. if the canister filter has blockages, replace the canister filter.



Text in Illustration

*1	Fuel Tank Vent Hose	*2	Vent Hose
*3	Fuel Tank	*4	Canister Assembly
*5	Canister Pump Module	*6	Canister Filter
*7	Fuel Tank Cap Assembly	-	-

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*a	Inspection Area (check for disconnection and/or crack)	-	-

NEXT ▶ **GO TO STEP 46**

46.	**PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)**

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes.

Result

RESULT	PROCEED TO
EVAP system DTCs are output	A
No DTCs output (No pending DTCs output)	B

B ▶ **END**

A ▼

47.	**REPLACE ECM**

(a) Replace the ECM INFO .

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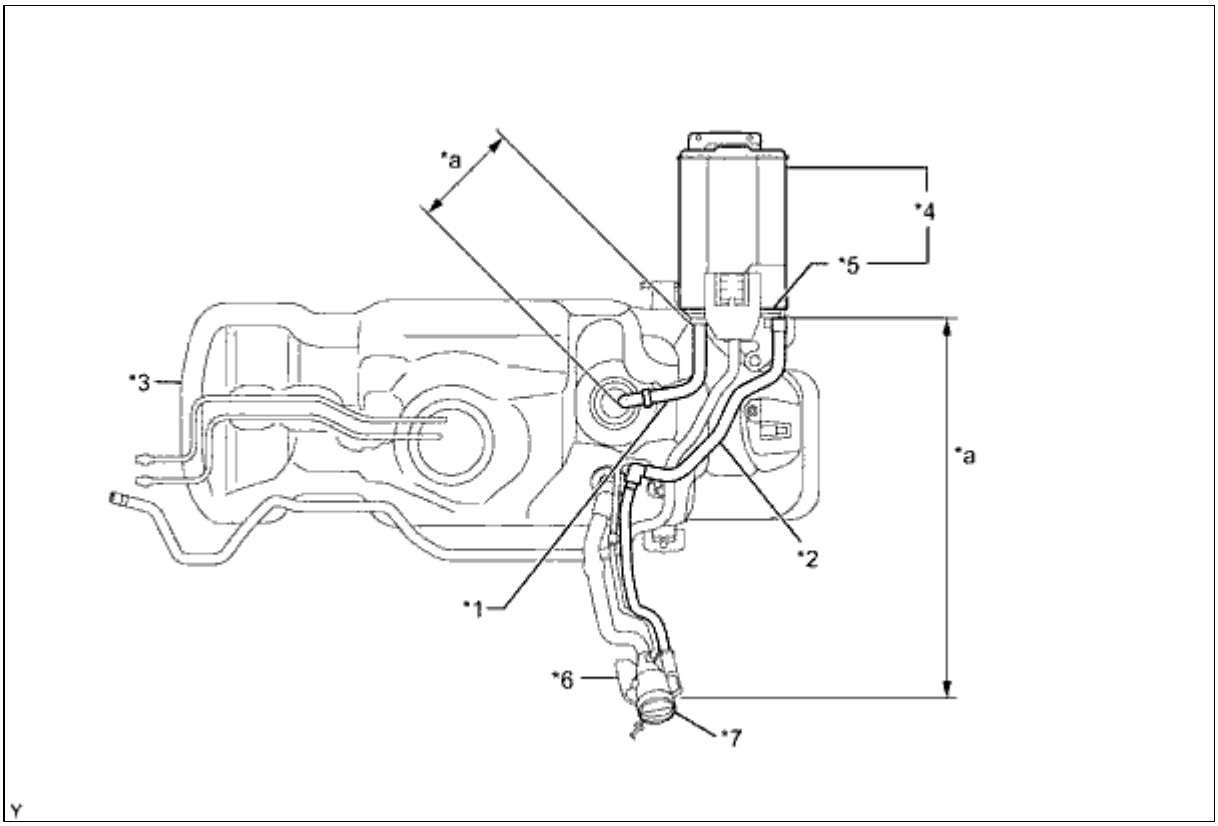
NEXT GO TO STEP 49

48.	REPLACE CANISTER ASSEMBLY

(a) Replace the canister assembly INFO .

NOTICE:

- When replacing the canister assembly, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.
- Check for filter blockage in the canister filter. if the canister filter has blockages, replace the canister filter.



Text in Illustration

*1	Fuel Tank Vent Hose	*2	Vent Hose
*3	Fuel Tank	*4	Canister Assembly
*5	Canister Pump Module	*6	Canister Filter
*7	Fuel Tank Cap Assembly	-	-
*a	Inspection Area (check for disconnection and/or crack)	-	-

NEXT

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49.	PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT ▶ END

CONFIRMATION DRIVING PATTERN

HINT:

After a repair, check Monitor Status by performing the Key-Off Monitor Confirmation and Purge Flow Monitor Confirmation described below.

1. KEY-OFF MONITOR CONFIRMATION

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway).
- The fuel tank is less than 90% full.
- The altitude is less than 7875 ft. (2400 m).
- The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F).
- The intake air temperature is between 4.4°C and 35°C (40°F and 95°F).
- The vehicle remains stationary (the vehicle speed is 0 km/h [0 mph]).

(b) Monitor Conditions

1. Allow the engine to idle for at least 5 minutes.
2. Turn the ignition switch off and wait for 6 hours (8 or 10.5 hours).

HINT:

Do not start the engine until checking Monitor Status. If the engine is started, the steps

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described above must be repeated.

(c) Monitor Status

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor.
5. Check the Monitor Status displayed on the Techstream.

HINT:

If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

2. PURGE FLOW MONITOR CONFIRMATION (P0441)

HINT:

Perform this monitor confirmation after the Key-Off Monitor Confirmation shows Complete.

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway).
- The engine coolant temperature is 4.4°C (40°F) or higher.
- The intake air temperature is 4.4°C (40°F) or higher.

(b) Monitor Conditions

1. Release the pressure from the fuel tank by removing and reinstalling the fuel tank cap assembly.
2. Warm the engine up until the engine coolant temperature reaches more than 75°C (167°F).
3. Increase the engine speed to 3000 rpm once.
4. Allow the engine to idle and turn the A/C switch on for 1 minute.

(c) Monitor Status

1. Turn the ignition switch off (if ON or if the engine is running).
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON.
4. Turn the Techstream on.
5. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor.
6. Check the Monitor Status displayed on the Techstream.

HINT:

If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000005RMD025X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Engine Difficult to Start; 2016 MY Tacoma [08/2015 -]		

Engine Difficult to Start

DESCRIPTION

<table>
<tr><th>PROBLEM SYMPTOM</th><th>SUSPECTED AREA</th><th colspan="2">TROUBLE AREA</th></tr>
<tr><td rowspan="3">• Engine speed fluctuation due to abnormal combustion
• Idle speed too low or high

Strong engine vibration due to above symptoms</td><td rowspan="3">• Ignition malfunction
• Deviation in air fuel ratio (Excessive or insufficient intake air volume or fuel supply)
• Insufficient compression
• Changes in load from another system</td><td>Ignition system</td><td>• Spark plug
• Ignition coil assembly</td></tr>
<tr><td>Fuel system</td><td>• Fuel injector assembly
• Fuel suction tube with pump and gauge assembly
• Fuel pump control circuit
• Fuel pressure regulator assembly
• Fuel line
• Purge VSV system
• Fuel quality (existence of foreign matter, degradation)</td></tr>
<tr><td>Intake and exhaust systems</td><td>• Mass air flow meter
• Intake system (Air leaks or deposit accumulation)
• Throttle body with motor assembly
• Air fuel ratio sensor
• Heated oxygen sensor
• Camshaft timing oil control assembly
• Variable Valve Timing system (VVT system)
• Brake booster assembly</td></tr>
</table>

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PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
		Other control systems	• ECM • Wire harness or connector • Knock sensor • Engine coolant temperature sensor
		Engine	• Thermostat • Engine assembly • Engine mount
		High load from another system	• Air conditioning system • Power steering system • Electrical load signal system

HINT:

- If any other DTCs are output, perform troubleshooting for those DTCs first.
- Make sure to reproduce the conditions present when the malfunction occurred.
- Using the Techstream, read the Data List to confirm the engine operating conditions. This information can be useful when troubleshooting.
- If the problem symptoms do not recur, attempt to reproduce the symptoms and conditions when the malfunction occurred based on the result of the customer problem analysis. Place the priority on confirming the symptoms.

1. SYMPTOM AND CAUSE OF SYSTEM MALFUNCTION

HINT:

The following are descriptions of the characteristics of each system malfunction. After understanding the link between the causes and symptoms, perform the inspection of each component. Even if the problem symptom does not recur, signs of the malfunction may be found in the Data List.

(a) Ignition system

Spark plug

Main cause of malfunction	Performance degradation (wear, existence of foreign matter, etc.)
Symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

HINT:

If the spark plug of the malfunctioning cylinder is abnormally wet with fuel, a leaking fuel injector assembly is suspected.

Ignition coil assembly

Main cause of malfunction	Internal malfunction

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Problem symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

(b) Fuel system

Fuel injector assembly

Main cause of malfunction	Blockage
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Engine is difficult to start due to high concentration of HC
Data List	• Short FT #1 • Long FT #1 • Fuel System Status #1 • Target Air-Fuel Ratio • AF Lambda B1S1 • A/F Learn Value Idle #1 • A/F Learn Value Low #1 • A/F Learn Value Mid1 #1 • A/F Learn Value Mid2 #1 • A/F Learn Value High #1 • Total FT #1

HINT:

- If the engine malfunction disappears when the fuel injection volume is increased or decreased using the "Control the Injection Volume", the respective cylinder may be malfunctioning.
- If the engine is difficult to start only when the vehicle has been left as is for a long time, a leaking fuel injector assembly is suspected.

Fuel system

Main cause of malfunction	Fuel pressure regulator assembly malfunction
Problem symptom	Engine is difficult to start due to insufficient fuel supply

HINT:

- If the pressure regulator cannot maintain residual pressure, fuel vaporization or air intrusion may occur, causing starting difficulty.
- If the air fuel ratio becomes lean only when the engine is running under a high load and at a high engine speed, clogging of the fuel suction tube with pump and gauge assembly or fuel filter is suspected.

Fuel quality

Main cause of malfunction	• Fuel degradation due to age or water contamination • Low fuel quality • Addition of fuel additive
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high

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	• Engine is difficult to start

(c) Intake and exhaust systems

Mass air flow meter

Main cause of malfunction	Performance degradation (existence of foreign matter, etc.)
Problem symptom	Lack of power
Data List	MAF

HINT:

If the value of the Data List item "MAF" is abnormal, a malfunction of the mass air flow meter is suspected.

Throttle system

Main cause of malfunction	Inappropriate trim volume adjustment due to accumulation of deposits
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• ISC Learning Value • ISC Flow • ISC Feedback Value • Electric Load Feedback Val • Air Conditioner FB Val • Eng Stall Control FB Flow

Air fuel ratio sensor, Heated oxygen sensor

Main cause of malfunction	Deviation in sensor characteristics
Problem symptom	Abnormal combustion due to deviation of actual air fuel ratio from calculated ratio
Data List	• AFS Voltage B1S1 • O2S B1S2 • Fuel System Status #1

(d) Engine

Engine assembly

Main cause of malfunction	• Compression loss • Accumulation of deposits (Combustion chamber, intake valve or intake manifold)
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Hesitation during acceleration or stalling

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HINT:

- If deposits have accumulated in the combustion chamber or on an intake valve, the engine may stall when deposits are caught on an intake valve.
- When performing the Active Test "Check the Cylinder Compression", if the speed of one cylinder is higher than the others, the cylinder may have a compression loss.
- If deposits accumulate on the intake valves, the supply of fuel may be delayed due to adherence of the fuel to the deposits, causing a rough idle.

2. Data List Items Related to Engine Difficult to Start

HINT:

Depending on the vehicle model, the applicable Data List items may vary. Data List items other than the ones used in the diagnostic procedure are for reference only.

- ISC Learning Value
- ISC Flow
- ISC Feedback Value
- Electric Load Feedback Val
- Air Conditioner FB Val
- Eng Stall Control FB Flow
- Short FT #1
- Long FT #1
- Fuel System Status #1
- Target Air-Fuel Ratio
- AF Lambda B1S1
- A/F Learn Value Idle #1
- A/F Learn Value Low #1
- A/F Learn Value Mid1 #1
- A/F Learn Value Mid2 #1
- A/F Learn Value High #1
- Total FT #1
- MAF
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count
- AFS Voltage B1S1
- O2S B1S2

INSPECTION PROCEDURE

PROCEDURE

1.	**INTERVIEW THE CUSTOMER**

(a) Interview the customer for details about the conditions when the rough idle occurred.

HINT:

Depending on the conditions when the rough idle occurred, a malfunction in one of the following areas is suspected.

PROBLEM SYMPTOM	SUSPECTED AREA
Engine speed recorded in freeze frame data is 0 rpm (engine does not crank)	Battery depletion, excessive engine friction, starter malfunction or crank position sensor malfunction

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PROBLEM SYMPTOM	SUSPECTED AREA
Engine speed recorded in freeze frame data is between 100 and 500 rpm (engine cranks but combustion does not occur, initial combustion delays or combustion occurs late)	• Wire harness, ignition system or fuel system malfunction • Current Angle (CA) is too small due to VALVEMATIC system malfunction (at extremely low temperature, intake air volume may become insufficient, causing starting difficulty)
Engine speed recorded in freeze frame data is 500 rpm or more (combustion occurs but engine speed drops immediately)	• Improper fuel injection volume (too low or too high) • If Long FT #1 is out of specified range: insufficient fuel supply due to clogging of injectors or fuel suction tube with pump and gauge assembly • If engine cranking speed is high: compression loss due to deposits caught on valves

NEXT

2.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Perform a road test.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(f) Read the DTCs.

Result

RESULT	PROCEED TO
DTCs are not output	A
DTC is output (DTCs other than P1603, P1604 or P1605 are output)	B

B **GO TO DTC CHART**

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A

3.	CHECK INTERVIEW RESULT

(a) Check the interview result.

Result

RESULT	PROCEED TO
Engine is difficult to start only when the vehicle has been left as is for a long time (1 hour or more)	A
Other than above	B

B GO TO STEP 5

A

4.	INSPECT FUEL INJECTOR ASSEMBLY

(a) Clean the inside of the intake manifold with compressed air.

(b) After stopping the engine, measure the HC concentration inside the surge tank for 15 minutes.

Result

RESULT	PROCEED TO
Less than 4000 ppm	A
4000 ppm or higher	B

HINT:

- If the concentration is 4000 ppm or higher, a fuel injector assembly may have a sealing problem.
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

B REPLACE FUEL INJECTOR ASSEMBLY

A

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5.	**CHECK CRANKING**

(a) Check the engine cranking operation.

Result

RESULT	PROCEED TO
The engine does not crank or cranks slowly	A
The engine cranks normally	B

B ▶ **GO TO STEP 7**

A ▼

6.	**INSPECT BATTERY**

(a) Inspect the battery.

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▶ **CHECK STARTER SIGNAL CIRCUIT**

7.	**SYMPTOM CONFIRMATION**

(a) Check if the problem symptoms reported in the customer problem analysis recur.

HINT:

If the problem symptoms do not recur, attempt to reproduce the conditions when the malfunction occurred based on the result of the customer problem analysis.

Result

RESULT	PROCEED TO
The problem symptom recurs	A
The problem symptom does not recur (occurred in the past)	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

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8.	READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ISC Learning Value.

(e) Read the value displayed on the Techstream.

Result

RESULT	PROCEED TO
Less than 6.2 L/s	A
Other than above	B

B **GO TO STEP 15**

A

9.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the value displayed on the Techstream.

Result

DATA LIST	RESULT	PROCEED TO
Short FT #1 + Long FT #1	-15% or higher, or less than 15%	A
	Other than above	B

HINT:

- "Total FT #1" is used to detect an abnormal air fuel ratio. As the value of "Total FT #1" is corrected by the ECM before it is displayed in the Data List, the displayed value may not be equal to the sum of the measured "Short FT #1" and "Long FT #1".

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- An abnormally lean or rich tendency can be checked by reading the following Data List items: A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1 and A/F Learn Value High #1.
- The following may cause a lean air fuel ratio (an operating range in which the air fuel ratio learned value correction is +15% or more):
    a. Decrease in fuel injector assembly injection volume
    b. Decrease in mass air flow meter output (due to existence of foreign matter)
    c. Air leaks in intake system after mass air flow meter
    d. Decrease in fuel pressure (at fuel filter, fuel suction tube with pump and gauge assembly or fuel pressure regulator assembly)
- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value Idle #1" or "A/F Learn Value Low #1" only is corrected to the positive side, an air leak after the mass air flow meter is suspected.
- The following may cause a rich air fuel ratio (an operating range in which the air fuel ratio learned value correction is -15% or less):
    a. Increase in the fuel injector assembly injection volume
    b. Purge VSV system

B ▶ **GO TO STEP 19**

A ▼

10.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE SELECT CYLINDER FUEL CUT)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

HINT:

Reproduce the vehicle conditions when the malfunction occurred. (such as after the engine is warmed up or after a cold start).

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Select Cylinder Fuel Cut / Engine Speed.

(f) According to the display on the Techstream, perform the Active Test and check for a malfunctioning cylinder.

HINT:

- Perform fuel-cut for each cylinder and check the change in the engine speed.
- If the engine speed of a cylinder does not change while performing the Active Test, it can be determined that the cylinder is malfunctioning.
- If the engine speed of all cylinders change while performing the Active Test, it can be determined that multiple cylinders are malfunctioning.
- A cylinder for which the Data List item "Cylinder Misfire Count" increases may be malfunctioning.

Result

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RESULT	PROCEED TO
One cylinder is malfunctioning	A
Multiple or all cylinders are malfunctioning, or the malfunctioning cylinder cannot be determined.	B

B ▶ **GO TO STEP 19**

A ▼

11.	PERFORM ACTIVE TEST USING TECHSTREAM (CHECK THE CYLINDER COMPRESSION)

HINT:

If the vehicle does not support the Active Test "Check the Cylinder Compression", measure the compression pressure. If the compression pressure is normal, go to step 12.

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression / Data List / Compression / Engine Speed of Cyl #1 to #4, Av Engine Speed of All Cyl.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

(g) While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

(h) Crank the engine for about 10 seconds.

(i) Monitor the engine speed (Engine Speed of Cyl and Av Engine Speed of All Cyl) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON

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and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

(j) Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

- If the Active Test is changed to OFF while the engine is being cranked, the engine will start.
- When performing the Active Test, DTC P1604 (Startability Malfunction) may be stored.
- After performing the Active Test, make sure to check and clear DTCs.

(k) Read the value.

HINT:

- If the value of Data List item "Engine Speed of Cyl" of a cylinder is higher than other cylinders, the cylinder may be malfunctioning.
- If the value of Data List item "Engine Speed of Cyl" is high for only one cylinder, compression loss is suspected.

Result

RESULT	PROCEED TO
There is no variation in "Engine Speed of Cyl" (All cylinders display approximately the same value for "Engine Speed of Cyl")	A
There is variation in "Engine Speed of Cyl" (Only one cylinder displays a value for "Engine Speed of Cyl" that differs considerably)	B

B ▶ **GO TO STEP 17**

A ▼

12.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Idle the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

HINT:

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Change the fuel injection volume between the minimum and maximum range of correction (e.g. -12.5% to 12.5%).

Result

RESULT	PROCEED TO
Malfunction is still present even if the fuel injection volume is changed	A
Malfunction disappears when the fuel injection volume is changed	B

B ▶ **GO TO STEP 18**

A ▼

13.	**CHECK IGNITION SYSTEM**

(a) Check the ignition system.

HINT:

- Interchange the ignition coil assembly and spark plug of the malfunctioning cylinder with those of a known good cylinder and check if the malfunctioning cylinder returns to normal.
- If the spark plug of the malfunctioning cylinder is abnormally wet with fuel even after the ignition coil assembly and spark plug are replaced, a leaking fuel injector assembly is suspected.

Result

RESULT	PROCEED TO
The malfunctioning cylinder does not return to normal	A
The malfunctioning cylinder returned to normal	B

B ▶ **GO TO STEP 29**

A ▼

14.	**INSPECT OTHER RELATED COMPONENTS**

(a) Check the ignition coil assembly power source circuit, wire harness and connectors.

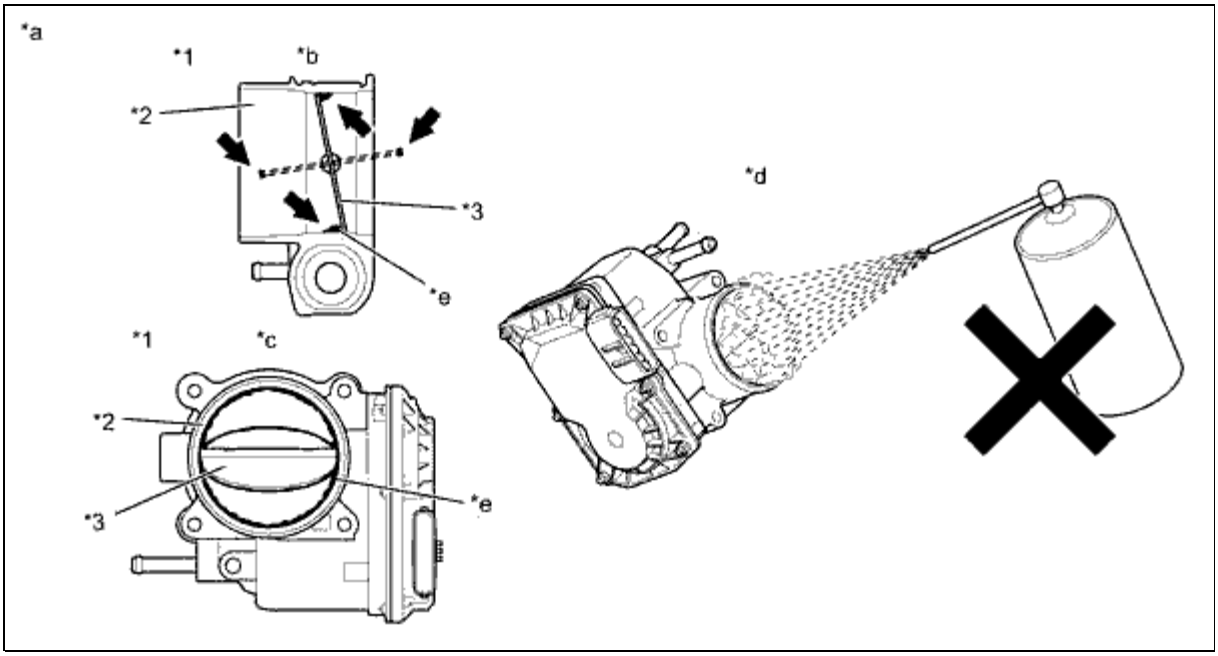
NEXT ▶ **GO TO STEP 29**

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15.	REMOVE FOREIGN OBJECT (CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY)

(a) Clean off any deposits from the inside of the throttle body with motor assembly.

(b) Push open the throttle valve and wipe off any carbon from the valve and bore using a piece of cloth soaked in non-residue solvent.



Text in Illustration

*1	Throttle Body with Motor Assembly	*2	Bore
*3	Valve	-	-
*a	Reference	*b	Throttle Body with Motor Assembly Cross-section Diagram
*c	When valve fully opened	*d	Do not directly apply cleaner
*e	Deposits	-	-

NOTICE:

- Make sure that the cloth or your fingers do not get caught in the valve.
- Make sure that foreign matter does not enter the throttle valve.
- Do not directly apply non-residue solvent to the throttle body with motor assembly or wash the throttle body with motor assembly. Cleaning solvent may leak into the motor from the shaft and cause problems such as rust or valve movement problems.
- If there is coating material on the edge of the valve, be careful not to remove it.

HINT:

The illustrations are for reference only. Actual parts may differ.

NEXT

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16.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

(f) Allow the engine to idle for 3 minutes or more and confirm that the engine speed is within the specified range.

HINT:

If the engine is operated without performing learning value reset and idle learning after cleaning the deposits from the throttle body with motor assembly, the idle speed may increase.

NEXT ▶ **GO TO STEP 30**

17.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure. If the compression pressure of a cylinder is low, inspect the engine assembly and repair or replace parts as necessary INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NEXT ▶ **GO TO STEP 30**

18.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assembly of the malfunctioning cylinder INFO .

HINT:

- If the air fuel ratio learned value is corrected to the positive side for all operating ranges due to low fuel injector assembly injection volume, replace the fuel injector assemblies of all cylinders.
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT ▶ **GO TO STEP 30**

19.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(f) According to the display on the Techstream, read the Data List when the ignition switch is turned to ON and while maintaining an engine speed of 3000 rpm.

Result

RESULT	PROCEED TO
Other than below	A
Ignition switch ON (engine stopped): 1 gm/sec or higher Engine speed 3000 rpm (without load): Less than 7.6 gm/sec	B

B ▶ **GO TO STEP 23**

A ▼

20.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(f) Idle the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2.

(h) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

NOTICE:

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- Read the output voltage immediately after warming up the air fuel ratio sensor and heated oxygen sensor to avoid an inaccurate reading due to a sensor cooling.

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HINT:

The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio sensor)	12.5%	Below 3.1 V
	-12.5%	Higher than 3.4 V
O2S B1S2 (Heated oxygen sensor)	12.5%	Higher than 0.55 V
	-12.5%	Below 0.4 V

Result

RESULT	PROCEED TO
Output voltage values are abnormal	A
Malfunction disappears when fuel injection volume is increased	B
Malfunction is still present when fuel injection volume is increased, even if output voltage values are normal	C

B ▶ **GO TO STEP 22**

C ▶ **GO TO STEP 24**

A ▼

21.	**REPLACE AIR FUEL RATIO SENSOR AND HEATED OXYGEN SENSOR**

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

(b) Replace the heated oxygen sensor INFO .

NEXT ▶ **GO TO STEP 30**

22.	**REPLACE FUEL INJECTOR ASSEMBLY**

(a) Replace the fuel injector assemblies of all cylinders INFO .

HINT:

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Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT ▶ **GO TO STEP 30**

23.	CHECK INTAKE SYSTEM

(a) Check for air leaks or blockage in the intake system components. If a connection problem or foreign matter is found, repair the connection or remove the foreign matter.

HINT:

- If there is foreign matter in the intake system components, remove it before proceeding to the next step.
- If there is no foreign matter in the intake system components, check for foreign matter in the mass air flow meter. If there is foreign matter in the mass air flow meter, remove it.
- Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT ▶ **GO TO STEP 30**

24.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Idle the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(f) When performing the Active Test, check for an operating sound from the fuel pump.

OK:

CONTROL THE FUEL PUMP / SPEED	SPECIFIED CONDITION
ON	Operating sound heard
OFF	Operating sound not heard

Result

RESULT	PROCEED TO
Normal	A
Abnormal	B

B ▶ **GO TO STEP 27**

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A

25.	INSPECT FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY

(a) Attach a fuel pressure gauge and check the fuel pressure when cranking the engine and after stopping the engine INFO .

Standard:

VEHICLE STATE	SPECIFIED CONDITION
Cranking engine	304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2} , 44 to 50 psi)
5 minutes after stopping engine	147 kPa (1.5 kgf/cm ^{2} , 21 psi) or higher

HINT:

- If there is foreign matter such as iron particles on the fuel suction tube with pump and gauge assembly, remove it.
- Make sure that there are no leaks from the fuel lines, signs of fuel leakage or fuel odors.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B GO TO STEP 28

A

26.	INSPECT RELATED PARTS

(a) Inspect the following fuel pump related parts:

- Fuel suction tube with pump and gauge assembly
- Fuel pressure regulator assembly
- Fuel lines and connecting parts
- Fuel filter

NEXT GO TO STEP 29

27.	INSPECT FUEL PUMP CONTROL SYSTEM

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(a) Inspect the fuel pump control system.

NEXT ▶ **GO TO STEP 29**

28.	INSPECT OTHER RELATED COMPONENTS

(a) Inspect other related components.

HINT:

If the malfunctioning part could not be determined by performing the preceding inspections, one of the following malfunctions is suspected.

- Deposits in the intake manifold or on an intake valve
- Delay in fuel supply due to adherence of the fuel to the deposits

NEXT ▼

29.	REPAIR OR REPLACE MALFUNCTIONING PARTS

(a) Repair or replace the malfunctioning part.

(b) Perform "Inspection After Repair" after repairing or replacing the malfunctioning part INFO .

NEXT ▼

30.	CONDUCT CONFIRMATION TEST

(a) Check that the idle has returned to normal.

NEXT ▶ **END**

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000005RMD026X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Engine Stalls; 2016 MY Tacoma [08/2015 -]		

Engine Stalls

DESCRIPTION

PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high Strong engine vibration due to above symptoms	• Ignition malfunction • Deviation in air fuel ratio (Excessive or insufficient intake air volume or fuel supply) • Insufficient compression • Changes in load from another system	Ignition system	• Spark plug • Ignition coil assembly
		Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
		Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly
		Other control systems	• ECM • Wire harness or connector • Knock sensor

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PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
			• Engine coolant temperature sensor
		Engine	• Thermostat • Engine assembly • Engine mount
		High load from another system	• Air conditioning system • Power steering system • Electrical load signal system

HINT:

- If any other DTCs are output, perform troubleshooting for those DTCs first.
- Make sure to reproduce the conditions present when the malfunction occurred.
- Using the Techstream, read the Data List to confirm the engine operating conditions. This information can be useful when troubleshooting.
- If the problem symptoms do not recur, attempt to reproduce the symptoms and conditions when the malfunction occurred based on the result of the customer problem analysis. Place the priority on confirming the symptoms.

1. SYMPTOM AND CAUSE OF SYSTEM MALFUNCTION

HINT:

The following are descriptions of the characteristics of each system malfunction. After understanding the link between the causes and symptoms, perform the inspection of each component. Even if the problem symptom does not recur, signs of the malfunction may be found in the Data List.

(a) Ignition system

Spark plug

Main cause of malfunction	Performance degradation (wear, existence of foreign matter, etc.)
Symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

HINT:

If the spark plug of the malfunctioning cylinder is abnormally wet with fuel, a leaking fuel injector assembly is suspected.

Ignition coil assembly

Main cause of malfunction	Internal malfunction
Problem symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

(b) Fuel system

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Fuel injector assembly

Main cause of malfunction	Blockage
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• Short FT #1 • Long FT #1 • Fuel System Status #1 • Target Air-Fuel Ratio • AF Lambda B1S1 • A/F Learn Value Idle #1 • A/F Learn Value Low #1 • A/F Learn Value Mid1 #1 • A/F Learn Value Mid2 #1 • A/F Learn Value High #1 • Total FT #1

HINT:

If the engine malfunction disappears when the fuel injection volume is increased or decreased using the Control the Injection Volume, the respective cylinder may be malfunctioning.

Purge VSV

Main cause of malfunction	Purge VSV stuck open
Symptom	Engine speed fluctuation due to abnormal combustion
Data List	• EVAP (Purge) VSV • Evap Purge Flow • Purge Density Learn Value • EVAP Purge VSV • Purge Cut VSV Duty

Fuel system

HINT:

If the air fuel ratio becomes lean only when the engine is running under a high load and at a high engine speed, clogging of the fuel suction tube with pump and gauge assembly or fuel filter is suspected.

Fuel quality

Main cause of malfunction	• Fuel degradation due to age or water contamination • Low fuel quality • Addition of fuel additive
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high

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	• Engine is difficult to start

(c) Intake and exhaust systems

Mass air flow meter

Main cause of malfunction	Performance degradation (existence of foreign matter, etc.)
Problem symptom	Lack of power
Data List	MAF

HINT:

If the value of the Data List item "MAF" is abnormal, a malfunction of the mass air flow meter is suspected.

Throttle system

Main cause of malfunction	Inappropriate trim volume adjustment due to accumulation of deposits
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• ISC Learning Value • ISC Flow • ISC Feedback Value • Electric Load Feedback Val • Air Conditioner FB Val • Eng Stall Control FB Flow

Air fuel ratio sensor, Heated oxygen sensor

Main cause of malfunction	Deviation in sensor characteristics
Problem symptom	Abnormal combustion due to deviation of actual air fuel ratio from calculated ratio
Data List	• AFS Voltage B1S1 • O2S B1S2 • Fuel System Status #1

(d) Engine

Engine assembly

Main cause of malfunction	• Compression loss • Accumulation of deposits (Combustion chamber, intake valve or intake manifold)
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Hesitation during acceleration or stalling

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Data List	• Compression Leakage Count • Rough Idle Status • Plural Cylinders Rough Idle • Rough Idle #1 to #4

HINT:

- If deposits have accumulated in the combustion chamber or on an intake valve, the engine may stall when deposits are caught on an intake valve.
- When performing the Active Test "Check the Cylinder Compression", if the speed of one cylinder is higher than the others, the cylinder may have a compression loss.
- If deposits accumulate on the intake valves, the supply of fuel may be delayed due to adherence of the fuel to the deposits, causing a rough idle.

VVT

Main cause of malfunction	Camshaft timing oil control valve assembly stuck open
Symptom	Abnormal combustion due to excessive valve overlap
Data List	• VVT Control Status #1 • VVT Advance Fail • VVT Aim Angle #1 • VVT Change Angle #1 • VVT OCV Duty #1 • VVT Ex Hold Lrn Val #1 • VVT Ex Chg Angle #1 • VVT Ex OCV Duty #1

2. Data List Items Related to Engine Stalls

HINT:

Depending on the vehicle model, the applicable Data List items may vary. Data List items other than the ones used in the diagnostic procedure are for reference only.

- Compression Leakage Count*1
- Rough Idle Status*1
- Plural Cylinders Rough Idle*1
- Rough Idle #1 to #4*1
- ISC Learning Value
- ISC Flow
- ISC Feedback Value
- Electric Load Feedback Val
- Air Conditioner FB Val
- Eng Stall Control FB Flow
- Short FT #1
- Long FT #1
- Fuel System Status #1
- Target Air-Fuel Ratio
- AF Lambda B1S1
- A/F Learn Value Idle #1
- A/F Learn Value Low #1
- A/F Learn Value Mid1 #1

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- A/F Learn Value Mid2 #1
- A/F Learn Value High #1
- Total FT #1
- MAF
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count
- AFS Voltage B1S1
- O2S B1S2
- VVT Control Status #1
- VVT Advance Fail
- VVT Aim Angle #1
- VVT Change Angle #1
- VVT OCV Duty #1
- VVT Ex Hold Lrn Val #1
- VVT Ex Chg Angle #1
- VVT Ex OCV Duty #1
- Engine Speed
- SPD (NT)*1
- Shift SW Status (D Range)*1

*1: for Automatic Transmission

INSPECTION PROCEDURE

PROCEDURE

1.	**INTERVIEW THE CUSTOMER**

(a) Interview the customer for details about the conditions when the engine stalled.

HINT:

- Use any information from the customer problem analysis about the conditions of the vehicle when the malfunction occurred (how the engine stalled, conditions when the engine was restarted, etc.)
- Depending on the conditions when the engine stalled, a malfunction in one of the following areas is suspected.

SYMPTOM	SUSPECTED AREA
Engine vibration occurs and engine stalls	• Abnormal mass air flow meter output due to existence of foreign matter • Abnormal air fuel ratio due to malfunction of air fuel ratio sensor or heated oxygen sensor, air leaks in intake system or insufficient fuel supply
Engine stalls without vibration	Ignition stoppage, fuel injection stoppage or high load from another system
Engine can be started with accelerator pedal depressed	Insufficient air volume
Engine stalls or is difficult to start immediately after engine stalled, regardless of whether engine is cold or warm	Deposits in intake system or combustion chamber caught temporarily on intake or exhaust valve

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NEXT

2.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Perform a road test.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(f) Read the DTCs.

Result

RESULT	PROCEED TO
DTCs are not output	A
DTC is output (DTCs other than P1603, P1604 or P1605 are output)	B

B **GO TO DTC CHART**

A

3.	**SYMPTOM CONFIRMATION**

(a) Check if the problem symptoms reported in the customer problem analysis recur.

HINT:

If the problem symptoms do not recur, attempt to reproduce the conditions when the malfunction occurred based on the result of the customer problem analysis.

Result

RESULT	PROCEED TO
The problem symptom recurs	A
The problem symptom does not recur (occurred in the past)	B

B **CHECK FOR INTERMITTENT PROBLEMS**

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A

4.	READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ISC Learning Value.

(e) Read the value displayed on the Techstream.

Result

RESULT	PROCEED TO
Less than 6.2 L/s	A
Other than above	B

B GO TO STEP 11

A

5.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the value displayed on the Techstream.

Result

DATA LIST	RESULT	PROCEED TO
Short FT #1 + Long FT #1	-15% or higher, or less than 15%	A
	Other than above	B

HINT:

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- "Total FT #1" is used to detect an abnormal air fuel ratio. As the value of "Total FT #1" is corrected by the ECM before it is displayed in the Data List, the displayed value may not be equal to the sum of the measured "Short FT #1" and "Long FT #1".
- An abnormally lean or rich tendency can be checked by reading the following Data List items: A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1 and A/F Learn Value High #1.
- The following may cause a lean air fuel ratio (an operating range in which the air fuel ratio learned value correction is +15% or more):

    a. Decrease in fuel injector assembly injection volume
    b. Decrease in mass air flow meter output (due to existence of foreign matter)
    c. Air leaks in intake system after mass air flow meter
    d. Decrease in fuel pressure (at fuel filter, fuel suction tube with pump and gauge assembly or fuel pressure regulator assembly)

- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value Idle #1" or "A/F Learn Value Low #1" only is corrected to the positive side, an air leak after the mass air flow meter is suspected.
- The following may cause a rich air fuel ratio (an operating range in which the air fuel ratio learned value correction is -15% or less):

    a. Increase in the fuel injector assembly injection volume
    b. Purge VSV system

B ▶ **GO TO STEP 15**

A ▼

6.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE SELECT CYLINDER FUEL CUT)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

HINT:

Reproduce the vehicle conditions when the malfunction occurred. (such as after the engine is warmed up or after a cold start).

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Select Cylinder Fuel Cut / Engine Speed.

(f) According to the display on the Techstream, perform the Active Test and check for a malfunctioning cylinder.

HINT:

- Perform fuel-cut for each cylinder and check the change in the engine speed.
- If the engine speed of a cylinder does not change while performing the Active Test, it can be determined that the cylinder is malfunctioning.
- If the engine speed of all cylinders change while performing the Active Test, it can be determined that multiple cylinders are malfunctioning.
- A cylinder for which the Data List item "Cylinder #1 Misfire Count to Cylinder #4" increases may be

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malfunctioning.

- If "Compression Leakage Count" in the Data List increases, misfiring due to insufficient compression may be occurring.

Result

RESULT	PROCEED TO
One cylinder is malfunctioning	A
Multiple or all cylinders are malfunctioning, or the malfunctioning cylinder cannot be determined.	B

B ▶ **GO TO STEP 15**

A ▼

7.	PERFORM ACTIVE TEST USING TECHSTREAM (CHECK THE CYLINDER COMPRESSION)

HINT:

If the vehicle does not support the Active Test "Check the Cylinder Compression", measure the compression pressure. If the compression pressure is normal, go to step 8.

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

(g) While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

(h) Crank the engine for about 10 seconds.

(i) Monitor the engine speed (Engine Speed of Cyl and Av Engine Speed of All Cyl) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine

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speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

(j) Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

- If the Active Test is changed to OFF while the engine is being cranked, the engine will start.
- When performing the Active Test, DTC P1604 (Startability Malfunction) may be stored.
- After performing the Active Test, make sure to check and clear DTCs.

(k) Read the value.

HINT:

- If the value of Data List item "Engine Speed of Cyl" of a cylinder is higher than other cylinders, the cylinder may be malfunctioning.
- If the value of Data List item "Engine Speed of Cyl" is high for only one cylinder, compression loss is suspected.

Result

RESULT	PROCEED TO
There is no variation in "Engine Speed of Cyl" (All cylinders display approximately the same value for "Engine Speed of Cyl")	A
There is variation in "Engine Speed of Cyl" (Only one cylinder displays a value for "Engine Speed of Cyl" that differs considerably)	B

B ▶ **GO TO STEP 13**

A ▼

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Idle the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

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(g) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

HINT:

Change the fuel injection volume between the minimum and maximum range of correction (e.g. -12.5% to 12.5%).

Result

RESULT	PROCEED TO
Malfunction is still present even if the fuel injection volume is changed	A
Malfunction disappears when the fuel injection volume is changed	B

B ▶ **GO TO STEP 14**

A ▼

9.	**CHECK IGNITION SYSTEM**

(a) Check the ignition system.

HINT:

- Interchange the ignition coil assembly and spark plug of the malfunctioning cylinder with those of a known good cylinder and check if the malfunctioning cylinder returns to normal.
- If the spark plug of the malfunctioning cylinder is abnormally wet with fuel even after the ignition coil assembly and spark plug are replaced, a leaking fuel injector assembly is suspected.

Result

RESULT	PROCEED TO
The malfunctioning cylinder does not return to normal	A
The malfunctioning cylinder returned to normal	B

B ▶ **GO TO STEP 25**

A ▼

10.	**INSPECT OTHER RELATED COMPONENTS**

(a) Check the ignition coil assembly power source circuit, wire harness and connectors.

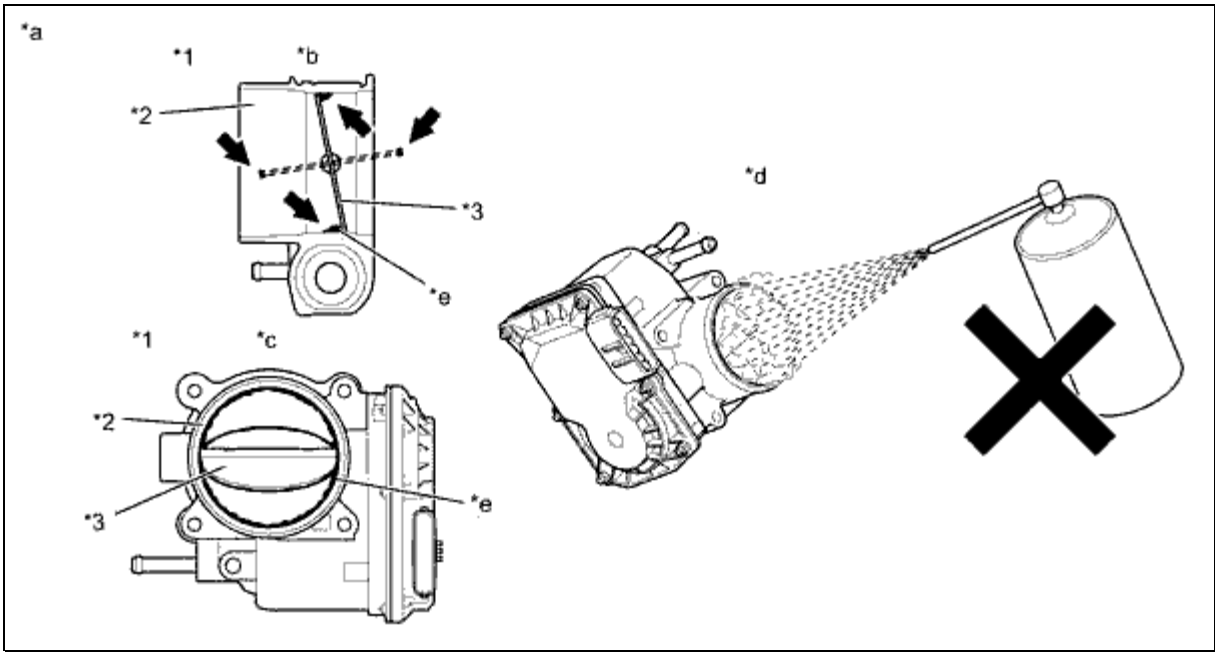
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NEXT GO TO STEP 25

11.	REMOVE FOREIGN OBJECT (CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY)

(a) Clean off any deposits from the inside of the throttle body with motor assembly.

(b) Push open the throttle valve and wipe off any carbon from the valve and bore using a piece of cloth soaked in non-residue solvent.



Text in Illustration

*1	Throttle Body with Motor Assembly	*2	Bore
*3	Valve	-	-
*a	Reference	*b	Throttle Body with Motor Assembly Cross-section Diagram
*c	When valve fully opened	*d	Do not directly apply cleaner
*e	Deposits	-	-

NOTICE:

- Make sure that the cloth or your fingers do not get caught in the valve.
- Make sure that foreign matter does not enter the throttle valve.
- Do not directly apply non-residue solvent to the throttle body with motor assembly or wash the throttle body with motor assembly. Cleaning solvent may leak into the motor from the shaft and cause problems such as rust or valve movement problems.
- If there is coating material on the edge of the valve, be careful not to remove it.

HINT:

The illustrations are for reference only. Actual parts may differ.

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NEXT

12.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

(f) Allow the engine to idle for 3 minutes or more and confirm that the engine speed is within the specified range.

HINT:

If the engine is operated without performing learning value reset and idle learning after cleaning the deposits from the throttle body with motor assembly, the idle speed may increase.

NEXT GO TO STEP 26

13.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure. If the compression pressure of a cylinder is low, inspect the engine assembly and repair or replace parts as necessary INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NEXT GO TO STEP 26

14.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assembly of the malfunctioning cylinder INFO .

HINT:

- If the air fuel ratio learned value is corrected to the positive side for all operating ranges due to low fuel injector assembly injection volume, replace the fuel injector assemblies of all cylinders.
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT GO TO STEP 26

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15.	**READ VALUE USING TECHSTREAM (MAF)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(f) According to the display on the Techstream, read the Data List when the ignition switch is turned to ON and while maintaining an engine speed of 3000 rpm.

Result

RESULT	PROCEED TO
Other than below	A
Ignition switch ON (engine stopped): 1 gm/sec or higher Engine speed 3000 rpm (without load): Less than 7.6 gm/sec	B

B ▶ **GO TO STEP 19**

A ▼

16.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(f) Idle the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / Primary / AFS Voltage B1S1 and O2S B1S2.

(h) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

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NOTICE:

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- Read the output voltage immediately after warming up the air fuel ratio sensor and heated oxygen sensor to avoid an inaccurate reading due to a sensor cooling.

HINT:

The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio sensor)	12.5%	Below 3.1 V
	-12.5%	Higher than 3.4 V
O2S B1S2 (Heated oxygen sensor)	12.5%	Higher than 0.55 V
	-12.5%	Below 0.4 V

Result

RESULT	PROCEED TO
Output voltage values are abnormal	A
Malfunction disappears when fuel injection volume is increased	B
Malfunction is still present when fuel injection volume is increased, even if output voltage values are normal	C

B ▶ **GO TO STEP 18**

C ▶ **GO TO STEP 20**

A ▼

17.	REPLACE AIR FUEL RATIO SENSOR AND HEATED OXYGEN SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

(b) Replace the heated oxygen sensor INFO .

NEXT ▶ **GO TO STEP 26**

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18.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assemblies of all cylinders INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT GO TO STEP 26

19.	CHECK INTAKE SYSTEM

(a) Check for air leaks or blockage in the intake system components. If a connection problem or foreign matter is found, repair the connection or remove the foreign matter.

HINT:

- If there is foreign matter in the intake system components, remove it before proceeding to the next step.
- If there is no foreign matter in the intake system components, check for foreign matter in the mass air flow meter. If there is foreign matter in the mass air flow meter, remove it.
- Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT GO TO STEP 26

20.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) When performing the Active Test, check for an operating sound from the fuel pump.

OK:

CONTROL THE FUEL PUMP / SPEED	SPECIFIED CONDITION
ON	Operating sound heard
OFF	Operating sound not heard

Result

RESULT	PROCEED TO
Normal	A
Abnormal	B

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B GO TO STEP 23

A

21.	INSPECT FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY

(a) Attach a fuel pressure gauge and check the fuel pressure when cranking the engine and after stopping the engine INFO .

Standard:

VEHICLE STATE	SPECIFIED CONDITION
Cranking engine	304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2} , 44 to 50 psi)
5 minutes after stopping engine	147 kPa (1.5 kgf/cm ^{2} , 21 psi) or higher

HINT:

- If there is foreign matter such as iron particles on the fuel suction tube with pump and gauge assembly, remove it.
- Make sure that there are no leaks from the fuel lines, signs of fuel leakage or fuel odors.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B GO TO STEP 24

A

22.	INSPECT RELATED PARTS

(a) Inspect the following fuel pump related parts:

- Fuel suction tube with pump and gauge assembly
- Fuel pressure regulator assembly
- Fuel lines and connecting parts
- Fuel filter

NEXT GO TO STEP 25

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23.	INSPECT FUEL PUMP CONTROL SYSTEM

(a) Inspect the fuel pump control system.

NEXT ▶ **GO TO STEP 25**

24.	INSPECT OTHER RELATED COMPONENTS

(a) Inspect other related components.

HINT:

If the malfunctioning part could not be determined by performing the preceding inspections, one of the following malfunctions is suspected.

- Engine mount deterioration
- Deposits in the intake manifold or on an intake valve
- Delay in fuel supply due to adherence of the fuel to the deposits

NEXT ▼

25.	REPAIR OR REPLACE MALFUNCTIONING PARTS

(a) Repair or replace the malfunctioning part.

(b) Perform "Inspection After Repair" after repairing or replacing the malfunctioning part INFO .

NEXT ▼

26.	CONDUCT CONFIRMATION TEST

(a) Check that the idle has returned to normal.

NEXT ▶ **END**

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000SXT028X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: FAIL-SAFE CHART; 2016 MY Tacoma [08/2015 -]		

FAIL-SAFE CHART

If any of the following DTCs are stored, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily.

DTC	COMPONENT	FAIL-SAFE OPERATION	FAIL-SAFE DEACTIVATION CONDITION
P0011 P0015	VVT system	• Idle up (Control of combustion worsening) • Stopping fuel-cut control	Pass condition detected
P0031 P0032 P101D	Air fuel ratio sensor heater	The ECM turns off air fuel ratio sensor heater.	Ignition switch off
P0037 P0038 P102D	Heated oxygen sensor heater	The ECM turns off heated oxygen sensor heater	Ignition switch off
P0102 P0103	Mass air flow meter	The ECM calculates ignition timing according to engine speed and throttle valve position.	Pass condition detected
P0112 P0113	Intake air temperature sensor	The ECM estimates intake air temperature to be 20°C (68°F).	Pass condition detected
P0115 P0117 P0118	Engine coolant temperature sensor	The ECM estimates engine coolant temperature to be 80°C (176°F).	Pass condition detected
P0120 P0121 P0122 P0123 P0220 P0222 P0223 P0604 P0606 P0607 P060A P060B P060D P060E P0657 P2102 P2103 P2111	Electronic Throttle Control System (ETCS)	The ECM cuts off throttle actuator current and throttle valve returned to 6.5° throttle position by return spring. ECM then adjusts engine output by controlling fuel injection (intermittent fuel-cut) and ignition timing in accordance with accelerator pedal opening angle, to allow vehicle to continue at minimal speed.*1	Pass condition detected and then ignition switch turned off

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DTC	COMPONENT	FAIL-SAFE OPERATION	FAIL-SAFE DEACTIVATION CONDITION
P2112 P2118 P2119 P2135			
P0300 P0301 P0302 P0303 P0304 *2	• Fuel injector assembly • Electronic Throttle Control System (ETCS)	When a catalyst-damaging misfire occurs (MIL blinking), the following fail-safe operation is performed for catalyst overheat malfunction prevention. 1. Under a low load and at a low engine speed: ○ Fuel cut is performed on the malfunctioning cylinder. 2. Under a high load and at a high engine speed: ○ Throttle valve opening angle control is performed. ○ Fuel cut is performed on all cylinders or the malfunctioning cylinder.	Pass condition detected and then ignition switch turned off
P0327 P0328	Knock sensor	The ECM sets the ignition timing to maximum retard.	Ignition switch off
P0351 P0352 P0353 P0354	Ignition coil assembly	The ECM cuts the fuel injection.	Pass condition detected
P2120 P2121 P2122 P2123 P2125 P2127 P2128 P2138	Accelerator pedal rod assembly	The accelerator pedal position sensor has 2 sensor circuits: Main and Sub. If either circuit malfunctions, ECM limits the engine output. If both circuits malfunction, ECM regards accelerator pedal as being released. As a result, throttle valve is closed and engine idles.	Pass condition detected and then ignition switch turned off
P2237 P2238 P2239 P2252 P2253	Air Fuel Ratio Sensor	• Air fuel ratio feedback control is stopped. • Current to the air fuel ratio sensor heater is cut.	Pass condition detected and then ignition switch turned off
P2432 P2433 P2440 P2442 P2445	Secondary Air Injection System	Throttle valve opening angle control is performed.	Pass condition detected

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NOTE:

*1: The vehicle can be driven slowly when the accelerator pedal is depressed firmly and slowly. If the accelerator pedal is depressed quickly, the vehicle may speed up and slow down erratically.
*2: Misfire related fail-safe operations occur when catalyst overheat malfunctions occur.

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000SXU01KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: FREEZE FRAME DATA; 2016 MY Tacoma [08/2015 -]		

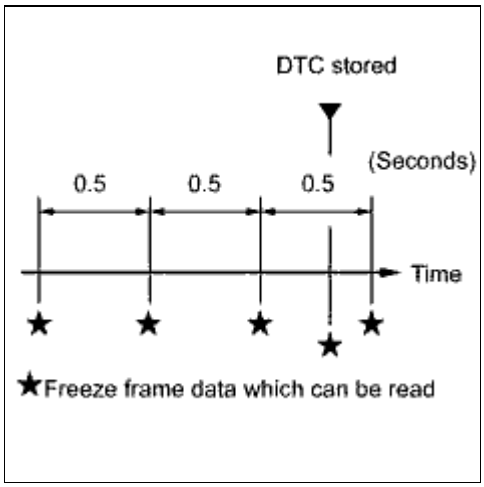
FREEZE FRAME DATA

1. DESCRIPTION

Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, it can help determine if the vehicle was running or stopped, the engine was warmed up or not, the air fuel ratio was LEAN or RICH, and other data from the time the malfunction occurred.

HINT:

If it is impossible to replicate the problem even though a DTC is detected, confirm the freeze frame data.



The ECM records engine conditions in the form of freeze frame data every 0.5 seconds. Using the Techstream, five separate sets of freeze frame data, including the data values at the time when the DTC was stored, can be checked.

- 3 data sets before the DTC was stored.
- 1 data set when the DTC was stored.
- 1 data set after the DTC was stored.

These data sets can be used to simulate the condition of the vehicle around the time of the occurrence of the malfunction. The data may assist in identifying the cause of the malfunction, and in judging whether it was temporary or not.

2. PENDING FREEZE FRAME DATA

HINT:

Pending freeze frame data is stored when a 2 trip DTC is first detected during the first trip.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Select a DTC in order to display its pending freeze frame data.

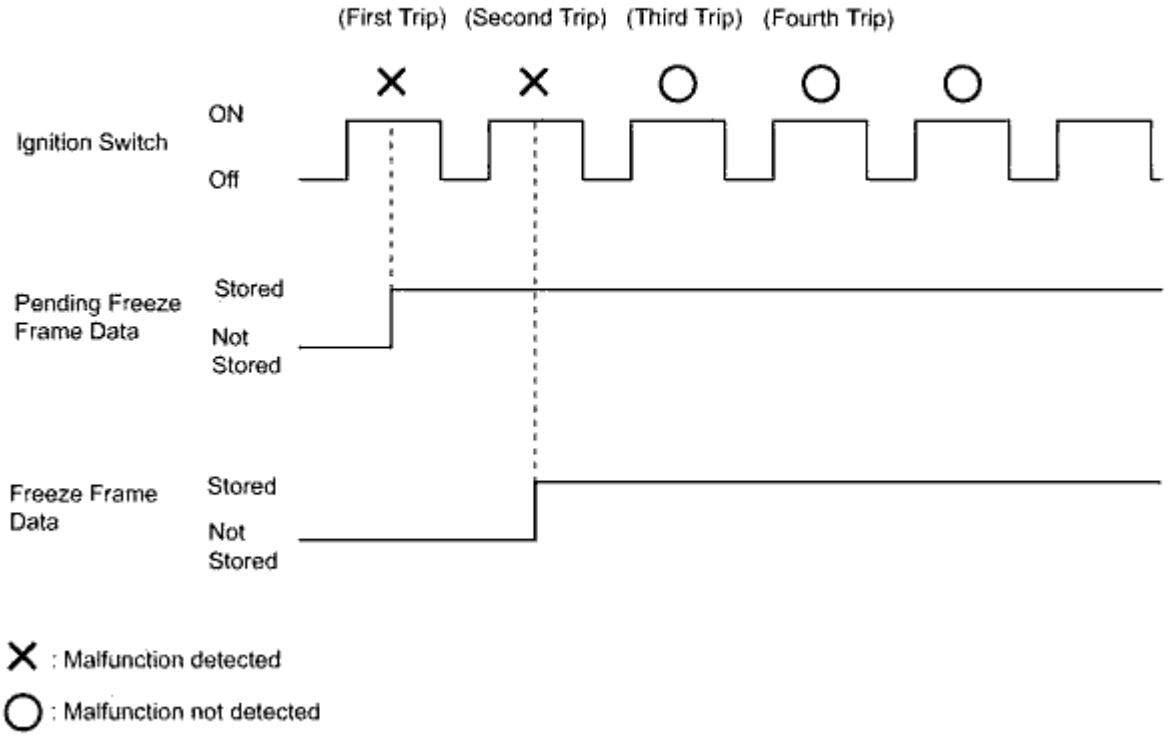
HINT:

- Pending freeze frame data is cleared when any of the following occurs.
  - Using the Techstream, the DTCs are cleared.
  - The cable is disconnected from the negative (-) battery terminal.
  - 40 trips with the engine fully warmed up have been performed after returning to normal. (Pending freeze frame data will not be cleared by only returning the system to normal.)

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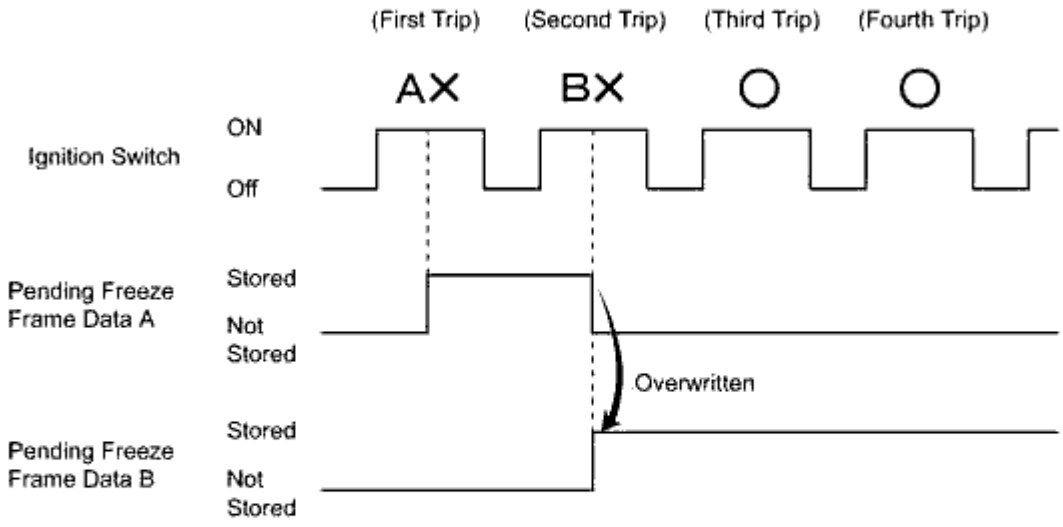
- With previous pending freeze frame data stored, if pending freeze frame data is newly stored when a 2 trip DTC is detected in the first trip, the old freeze frame data will be replaced with the new one of the newly detected DTC in the next trip.

When a DTC is detected in both the first and second trips but the system returns to normal from the third trip (2 trip logic DTC):



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When 2 trip DTC is first detected in the first trip and another 2 trip DTC is first detected in the second trip:



AX : Pending malfunction A detected

BX : Pending malfunction B detected

O : No malfunction detected

3. LIST OF FREEZE FRAME DATA

Refer to "Data List / Active Test" INFO .

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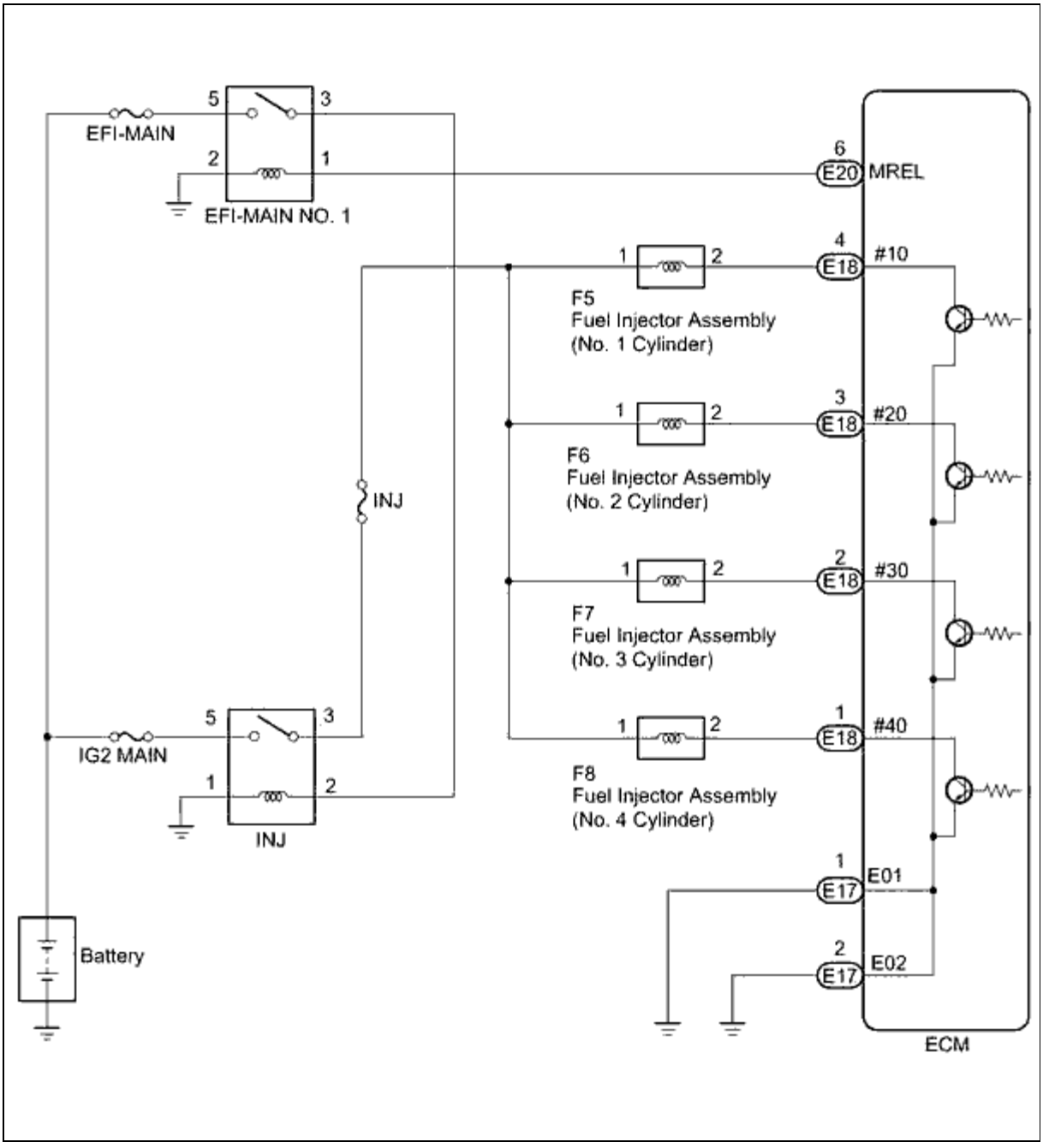
Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000000ZRM0LSX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Fuel Injector Circuit; 2016 MY Tacoma [08/2015 -]		

Fuel Injector Circuit

DESCRIPTION

They inject fuel into the cylinders based on the signals from the ECM.

WIRING DIAGRAM



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INSPECTION PROCEDURE

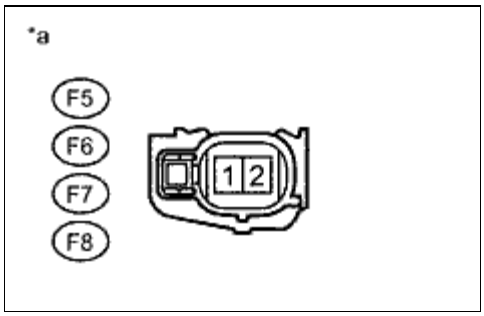
NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CHECK FUEL INJECTOR ASSEMBLY (POWER SOURCE)**

(a) Disconnect the F5, F6, F7 and F8 fuel injector assembly connectors.



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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
F5-1 - Body ground	Ignition switch ON	11 to 14 V
F6-1 - Body ground	Ignition switch ON	11 to 14 V
F7-1 - Body ground	Ignition switch ON	11 to 14 V
F8-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)

NG ▶ **GO TO STEP 4**

OK ▼

2.	**INSPECT FUEL INJECTOR ASSEMBLY**

(a) Inspect the fuel injector assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

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NG ▶ REPLACE FUEL INJECTOR ASSEMBLY

OK ▼

3.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

(a) Disconnect the F5, F6, F7 and F8 fuel injector assembly connectors.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance :

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
F5-2 - E18-4 (#10)	Always	Below 1 Ω
F6-2 - E18-3 (#20)	Always	Below 1 Ω
F7-2 - E18-2 (#30)	Always	Below 1 Ω
F8-2 - E18-1 (#40)	Always	Below 1 Ω
F5-2 or E18-4 (#10) - Body ground	Always	10 kΩ or higher
F6-2 or E18-3 (#20) - Body ground	Always	10 kΩ or higher
F7-2 or E18-2 (#30) - Body ground	Always	10 kΩ or higher
F8-2 or E18-1 (#40) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE ECM

4.	CHECK HARNESS AND CONNECTOR (INJ RELAY - FUEL INJECTOR ASSEMBLY)

(a) Disconnect the F5, F6, F7 and F8 fuel injector assembly connectors.

(b) Remove the INJ relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
F5-1 - 3 (INJ relay holder)	Always	Below 1 Ω
F6-1 - 3 (INJ relay holder)	Always	Below 1 Ω

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
F7-1 - 3 (INJ relay holder)	Always	Below 1 Ω
F8-1 - 3 (INJ relay holder)	Always	Below 1 Ω
F5-1 or 3 (INJ relay holder) - Body ground	Always	10 kΩ or higher
F6-1 or 3 (INJ relay holder) - Body ground	Always	10 kΩ or higher
F7-1 or 3 (INJ relay holder) - Body ground	Always	10 kΩ or higher
F8-1 or 3 (INJ relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

5.	**INSPECT INJ RELAY**

(a) Inspect the INJ relay.

NG ▶ **REPLACE INJ RELAY**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (INJ RELAY - BATTERY)**

(a) Remove the INJ relay from the engine room relay block.

(b) Disconnect the cable from the negative (-) battery terminal.

(c) Disconnect the cable from the positive (+) battery terminal.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (INJ relay holder) - Positive battery terminal	Always	Below 1 Ω
5 (INJ relay holder) or Positive battery terminal - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK

7.	CHECK HARNESS AND CONNECTOR (INJ RELAY - BODY GROUND)

(a) Remove the INJ relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (INJ relay holder) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

8.	CHECK HARNESS AND CONNECTOR (EFI-MAIN NO. 1 RELAY - INJ RELAY)

(a) Remove the INJ relay from the engine room relay block.

(b) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (EFI-MAIN NO. 1 relay holder) - 2 (INJ relay holder)	Always	Below 1 Ω
3 (EFI-MAIN NO. 1 relay holder) or 2 (INJ relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM0000027680COX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Fuel Pump Control Circuit; 2016 MY Tacoma [08/2015 -]		

Fuel Pump Control Circuit

DESCRIPTION

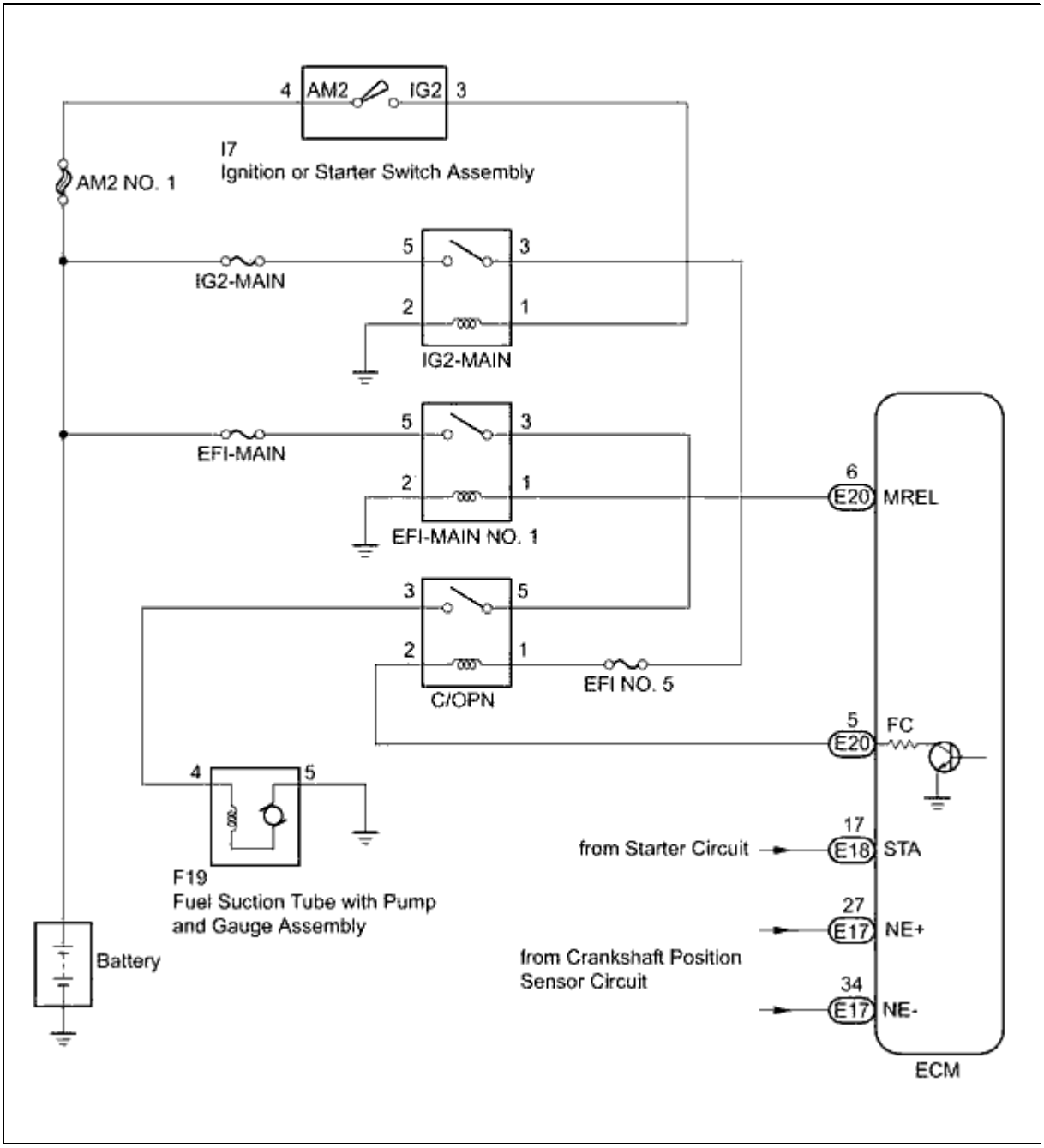
When the engine is cranked, current flows from terminal ST1 of the ignition switch to the ST relay coil and current also flows to terminal STA of the ECM (STA signal).

When the STA signal and NE signal are input to the ECM, Tr is turned on, current flows to the coil of the C/OPN relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates.

While the NE signal is generated (engine running), the ECM keeps Tr on (C/OPN relay on) and the fuel pump continues operating.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) Check whether the fuel pump operation sound occurs when performing the Active Test on the Techstream.

Result

RESULT	PROCEED TO
Fuel pump operating sound does not occur	A
Fuel pump operating sound occurs	B

B ▶ **GO TO STEP 11**

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) Check whether the C/OPN relay operating sound occurs when performing the Active Test on the Techstream.

OK:

Relay operating sounds can be heard from the relay.

NG ▶ **GO TO STEP 7**

OK ▼

3.	**INSPECT FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY**

(a) Inspect the fuel suction tube with pump and gauge assembly INFO .

NG ▶ **REPLACE FUEL SUCTION TUBE WITH PUMP AND**

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OK

4.	**INSPECT C/OPN RELAY**

(a) Inspect the C/OPN relay INFO .

NG ▶ **REPLACE C/OPN RELAY**

OK

5.	**CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY)**

(a) Remove the C/OPN relay from the engine room relay block.

(b) Disconnect the F19 fuel suction tube with pump and gauge assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (C/OPN relay holder) - F19-4	Always	Below 1 Ω
3 (C/OPN relay holder) or F19-4 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6.	**CHECK HARNESS AND CONNECTOR (FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY - BODY GROUND)**

(a) Disconnect the F19 fuel suction tube with pump and gauge assembly connector.

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

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Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
F19-5 - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

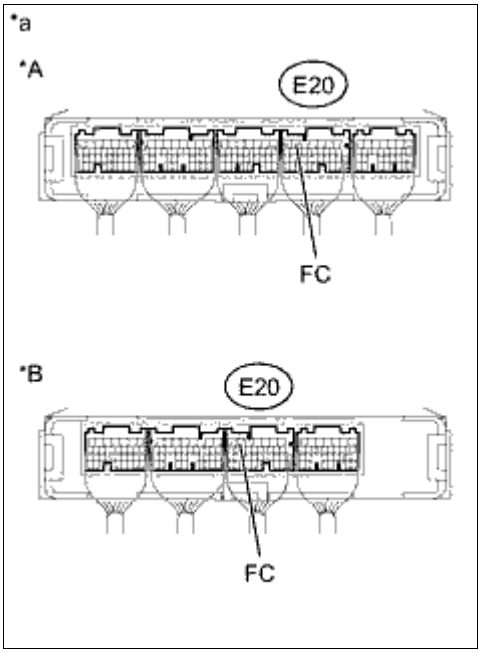
7.	**CHECK TERMINAL VOLTAGE (FC TERMINAL VOLTAGE)**

(a) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E20-5 (FC) - Body ground	Ignition switch ON	11 to 14 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

NG ▶ **GO TO STEP 8**

OK ▶ **REPLACE ECM**

8.	**INSPECT C/OPN RELAY**

(a) Inspect the C/OPN relay INFO .

NG ▶ **REPLACE C/OPN RELAY**

OK

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9.	**CHECK HARNESS AND CONNECTOR (C/OPN RELAY - ECM)**

(a) Remove the C/OPN relay from the engine room relay block.

(b) Disconnect the E20 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (C/OPN relay holder) - E20-5 (FC)	Always	Below 1 Ω
1 (C/OPN relay holder) or E20-5 (FC) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

10.	**CHECK HARNESS AND CONNECTOR (C/OPN RELAY - IG2-MAIN RELAY)**

(a) Remove the C/OPN relay from the engine room relay block.

(b) Remove the IG2-MAIN relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (C/OPN relay holder) - 3 (IG2-MAIN relay holder	Always	Below 1 Ω
2 (C/OPN relay holder) or 3 (IG2-MAIN relay holder - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

11.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT Data List / Starter Signal.

(e) Check the result when the ignition switch is ON and the engine starts.

OK:

CONDITION	STARTER SIGNAL
Ignition switch ON	OFF
Engine Started	ON

NG ▶ **CHECK STARTER SIGNAL CIRCUIT**

OK ▼

12.	READ VALUE USING TECHSTREAM (ENGINE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT Data List / Engine Speed.

(e) Read the values displayed on the Techstream while cranking.

OK:

Values are displayed continuously.

NG ▶ **CHECK CRANKSHAFT POSITION SENSOR CIRCUIT**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000PD916HX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: HOW TO PROCEED WITH TROUBLESHOOTING; 2016 MY Tacoma [08/2015 -]		

HOW TO PROCEED WITH TROUBLESHOOTING

*: Use the Techstream.

1.	**VEHICLE BROUGHT TO WORKSHOP**

NEXT

2.	**CUSTOMER PROBLEM ANALYSIS**

NEXT

3.	**CONNECT TECHSTREAM TO DLC3***

HINT:

If the display indicates a communication fault in the Techstream, inspect the DLC3.

When any CAN communication system DTCs are output, perform troubleshooting on the CAN communication system first.

NEXT

4.	**CHECK DTC AND FREEZE FRAME DATA***

(a) Check DTC INFO .

(b) Check Freeze Frame Data INFO .

HINT:

Record or print DTCs and freeze frame data if necessary.

NEXT

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5.	**CLEAR DTC AND FREEZE FRAME DATA***

(a) Clear DTC INFO .

(b) Clear Freeze Frame Data INFO .

NEXT

6.	**CONDUCT VISUAL INSPECTION**

NEXT

7.	**SELECT CHECK MODE DIAGNOSIS***

(a) Switch the ECM from normal mode to check mode.

HINT:

Refer to Check Mode Procedure INFO .

NEXT

8.	**CONFIRM PROBLEM SYMPTOMS**

(a) Confirm problem symptoms.

HINT:

If the engine does not start, first perform the "Check DTC" procedure and "Conduct Basic Inspection" procedure below.

Result

RESULT	PROCEED TO
Malfunction does not occur	A
Malfunction occurs	B

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B GO TO STEP 10

A

9.	**SIMULATE SYMPTOMS**

HINT:

Refer to Symptom Simulation INFO .

NEXT

10.	**CHECK DTC***

(a) Check for DTCs.

HINT:

Refer to DTC Check / Clear INFO .

Result

RESULT	PROCEED TO
DTCs are output	A
DTCs are not output	B

B GO TO STEP 12

A

11.	**REFER TO DTC CHART**

(a) Refer to Diagnostic Trouble Code Chart INFO .

NEXT

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12.	CONDUCT BASIC INSPECTION

(a) Conduct basic inspection INFO .

Result

RESULT	PROCEED TO
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B ▶ GO TO STEP 17

A

13.	REFER TO PROBLEM SYMPTOMS TABLE

(a) Refer to Problem Symptoms Table INFO .

Result

RESULT	PROCEED TO
Malfunctioning circuit confirmed	A
Malfunctioning parts confirmed	B

B ▶ GO TO STEP 17

A

14.	CHECK ECM POWER SOURCE CIRCUIT

(a) Check the ECM power source circuit.

HINT:

Refer to ECM Power Source Circuit INFO .

NEXT

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15.	**CONDUCT CIRCUIT INSPECTION**

Result

RESULT	PROCEED TO
Malfunction not confirmed	A
Malfunction confirmed	B

B ▶ **GO TO STEP 18**

A

▼

16.	**CHECK FOR INTERMITTENT PROBLEMS**

(a) Check for intermittent problems.

HINT:

Refer to Check for Intermittent Problems INFO .

NEXT

▼

17.	**CONDUCT PARTS INSPECTION**

NEXT

▼

18.	**IDENTIFY PROBLEM**

NEXT

▼

19.	**ADJUST AND/OR REPAIR**

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NEXT

20.	CONDUCT CONFIRMATION TEST

NEXT END

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000004NJD00RX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: INITIALIZATION; 2016 MY Tacoma [08/2015 -]		

INITIALIZATION

1. Inspection After Repair

Perform Learning Value Reset and idle learning after replacing or servicing parts related to engine operation. Details on procedures required are indicated by an asterisk and a number, and are explained in detail following the table.

PART REPLACED	ENGINE OPERATION	LEARNING VALUE RESET*1	IDLE LEARNING*2
• Throttle body assembly*3 • Cleaning the deposits from the throttle body assembly.*3	-	○	○
Engine assembly	-	○	○
• Cylinder head • Camshaft (for intake or exhaust side) • Camshaft timing gear assembly • Camshaft timing exhaust gear assembly • Piston or piston ring • Mass air flow meter • Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Air fuel ratio sensor • Heated oxygen sensor • Engine coolant temperature sensor • Spark plug • Ignition coil	Confirm the following: Perform Learning Value Reset and idle learning when one or more of the following conditions is met. 1. A diagnostic trouble code was output before component replacement. 2. An air fuel ratio learned value (one of A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1, and A/F Learn Value High #1) displayed in the Data List was higher than +/- 15% before component replacement. 3. Starting failure, rough idle, or engine stalls after component replacement.	○	○

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PART REPLACED	ENGINE OPERATION	LEARNING VALUE RESET*1	IDLE LEARNING*2
assembly • Air leaks from intake system • Gas leaks from exhaust system	The items in the list above do not apply.	-	-
Knock sensor*4	-	-	-

○: Necessary.

-: Unnecessary.

NOTICE:

Engine learned values cannot be reset by disconnecting the battery negative (-) terminal or removing the EFI-MAIN and ETCS fuses.

*1: Learning Value Reset

a. Connect the Techstream to the DLC3.
b. Turn the ignition switch to ON.
c. Turn the Techstream on.
d. Enter the following menus: Powertrain / Engine and ECT / Utility / Learning Value Reset.
e. Confirm the following conditions as instructed on the screen.
   - Ignition switch ON
   - Engine stopped
   - Battery voltage is higher than 9 V
f. After confirming, select "Next" and initialize the learned value.

HINT:

If a message indicating Learning Value Reset failure is displayed on the screen, confirm the execution conditions, and perform Learning Value Reset again.

g. After the completion of Learning Value Reset, confirm the air fuel ratio learned values (A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1, and A/F Learn Value High #1) in the Data List.

If 0 is displayed for all the air fuel ratio learned values, initialization has completed correctly.

If a value other than 0 is displayed for one of the air fuel ratio learned values, perform initialization again. After initialization, confirm the air fuel ratio learned values. If a value other than 0 is displayed, replace the ECM.

*2: Idle Learning

a. Turn the ignition switch off and wait for at least 30 seconds.
b. Start the engine and warm it up until the engine coolant temperature is 80°C (176°F) or higher.

HINT:

Learning starts when the engine coolant temperature is 80°C (176°F) or higher.

c. After the engine is warmed up, allow it to idle for 5 minutes with the air conditioning and all accessories off.
d. Confirm that the idle speed is within the standard range.

Standard:

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ENGINE IDLE SPEED
600 to 700 rpm (for Manual Transmission) 700 to 800 rpm (for Automatic Transmission)

HINT:

- Be sure to perform this step with all accessories off.
- Make sure that the shift lever is in N (neutral).

*3: Perform Learning Value Reset and idle learning after replacing the throttle body with motor assembly or cleaning deposits from the throttle body with motor assembly.

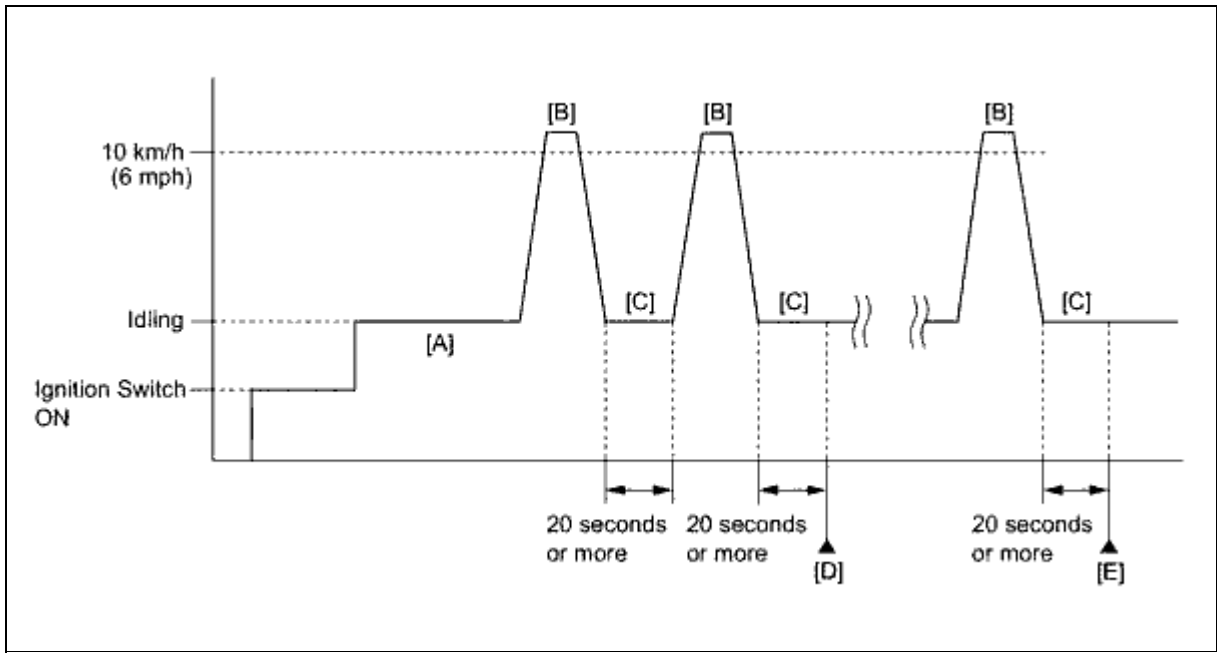
After that, check the idle speed. If the value is out of the specified range, perform the procedure below.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

History information for driving and stopping is necessary to update idle learning.



a. Warm up the engine (engine coolant temperature is 80°C (176°F) or higher, air conditioning and all accessories are off) [A].
b. Drive the vehicle at 10 km/h (6 mph) or more [B].
c. Idle the engine for 20 seconds or more [C].
d. Repeat procedure [B] and [C], and check that the idle speed is within the specified range [D].

Standard:

ENGINE IDLE SPEED
600 to 700 rpm (for Manual Transmission) 700 to 800 rpm (for Automatic Transmission)

HINT:

- Be sure to perform this step with all accessories off.
- Make sure that the shift lever is in N (neutral).

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- If the idle speed is still out of the specified range, repeat procedure [B] and [C] until the idle speed is within the specified range [E].

*4: Drive the vehicle for a short while after replacing the knock sensor, and check if knocking occurs. If knocking occurs, drive the vehicle until knocking stops.





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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000005RMD027X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Lack of Power; 2016 MY Tacoma [08/2015 -]		

Lack of Power

DESCRIPTION

PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high Strong engine vibration due to above symptoms	• Ignition malfunction • Deviation in air fuel ratio (Excessive or insufficient intake air volume or fuel supply) • Insufficient compression • Changes in load from another system	Ignition system	• Spark plug • Ignition coil assembly
		Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
		Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly
		Other control systems	• ECM • Wire harness or connector • Knock sensor

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PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
			• Engine coolant temperature sensor
		Engine	• Thermostat • Engine assembly • Engine mount
		High load from another system	• Air conditioning system • Power steering system • Electrical load signal system

HINT:

- If any other DTCs are output, perform troubleshooting for those DTCs first.
- Make sure to reproduce the conditions present when the malfunction occurred.
- Using the Techstream, read the Data List to confirm the engine operating conditions. This information can be useful when troubleshooting.
- If the problem symptoms do not recur, attempt to reproduce the symptoms and conditions when the malfunction occurred based on the result of the customer problem analysis. Place the priority on confirming the symptoms.

1. SYMPTOM AND CAUSE OF SYSTEM MALFUNCTION

HINT:

The following are descriptions of the characteristics of each system malfunction. After understanding the link between the causes and symptoms, perform the inspection of each component. Even if the problem symptom does not recur, signs of the malfunction may be found in the Data List.

(a) Ignition system

Spark plug

Main cause of malfunction	Performance degradation (wear, existence of foreign matter, etc.)
Symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

HINT:

If the spark plug of the malfunctioning cylinder is abnormally wet with fuel, a leaking fuel injector assembly is suspected.

Ignition coil assembly

Main cause of malfunction	Internal malfunction
Problem symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

(b) Fuel system

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Fuel injector assembly

Main cause of malfunction	Blockage
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• Short FT #1 • Long FT #1 • Fuel System Status #1 • Target Air-Fuel Ratio • AF Lambda B1S1 • A/F Learn Value Idle #1 • A/F Learn Value Low #1 • A/F Learn Value Mid1 #1 • A/F Learn Value Mid2 #1 • A/F Learn Value High #1 • Total FT #1

HINT:

If the engine malfunction disappears when the fuel injection volume is increased or decreased using the Control the Injection Volume, the respective cylinder may be malfunctioning.

Fuel system

HINT:

If the air fuel ratio becomes lean only when the engine is running under a high load and at a high engine speed, clogging of the fuel suction tube with pump and gauge assembly or fuel filter is suspected.

Fuel quality

Main cause of malfunction	• Fuel degradation due to age or water contamination • Low fuel quality • Addition of fuel additive
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Engine is difficult to start

(c) Intake and exhaust systems

Mass air flow meter

Main cause of malfunction	Performance degradation (existence of foreign matter, etc.)
Problem symptom	Lack of power
Data List	MAF

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HINT:

If the value of the Data List item "MAF" is abnormal, a malfunction of the mass air flow meter is suspected.

Throttle system

Main cause of malfunction	Inappropriate trim volume adjustment due to accumulation of deposits
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• ISC Learning Value • ISC Flow • ISC Feedback Value • Electric Load Feedback Val • Air Conditioner FB Val • Eng Stall Control FB Flow

Air fuel ratio sensor, Heated oxygen sensor

Main cause of malfunction	Deviation in sensor characteristics
Problem symptom	Abnormal combustion due to deviation of actual air fuel ratio from calculated ratio
Data List	• AFS Voltage B1S1 • O2S B1S2 • Fuel System Status #1

(d) Engine

Engine assembly

Main cause of malfunction	• Compression loss • Accumulation of deposits (Combustion chamber, intake valve or intake manifold)
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Hesitation during acceleration or stalling

HINT:

- If deposits have accumulated in the combustion chamber or on an intake valve, the engine may stall when deposits are caught on an intake valve.
- When performing the Active Test "Check the Cylinder Compression", if the speed of one cylinder is higher than the others, the cylinder may have a compression loss.
- If deposits accumulate on the intake valves, the supply of fuel may be delayed due to adherence of the fuel to the deposits, causing a rough idle.

2. Data List Items Related to Lack of Power

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HINT:

Depending on the vehicle model, the applicable Data List items may vary. Data List items other than the ones used in the diagnostic procedure are for reference only.

- ISC Learning Value
- ISC Flow
- ISC Feedback Value
- Electric Load Feedback Val
- Air Conditioner FB Val
- Eng Stall Control FB Flow
- Short FT #1
- Long FT #1
- Fuel System Status #1
- Target Air-Fuel Ratio
- AF Lambda B1S1
- A/F Learn Value Idle #1
- A/F Learn Value Low #1
- A/F Learn Value Mid1 #1
- A/F Learn Value Mid2 #1
- A/F Learn Value High #1
- Total FT #1
- MAF
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count
- AFS Voltage B1S1
- O2S B1S2

INSPECTION PROCEDURE

PROCEDURE

1.	**INTERVIEW THE CUSTOMER**

(a) Interview the customer for details about the conditions when experiencing the lack of power.

HINT:

If a lack of power occurs when the engine is running under a high load and at a high engine speed, the fuel filter may be clogged.

NEXT

2.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Perform a road test.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(f) Read the DTCs.

Result

RESULT	PROCEED TO
DTCs are not output	A
DTC is output (DTCs other than P1603, P1604 or P1605 are output)	B

B ▶ **GO TO DTC CHART**

A ▼

3.	**SYMPTOM CONFIRMATION**

(a) Check if the problem symptoms reported in the customer problem analysis recur.

HINT:

If the problem symptoms do not recur, attempt to reproduce the conditions when the malfunction occurred based on the result of the customer problem analysis.

Result

RESULT	PROCEED TO
The problem symptom recurs	A
The problem symptom does not recur (occurred in the past)	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

4.	**READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ISC Learning Value.

(e) Read the value displayed on the Techstream.

Result

RESULT	PROCEED TO
Less than 6.2 L/s	A
Other than above	B

B ▶ **GO TO STEP 12**

A ▼

5.	READ VALUE USING TECHSTREAM (KNOCK CORRECT LEARN VALUE)

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

(c) Turn the Techstream on.

(d) Idle the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Knock Correct Learn Value.

(f) Read the value displayed on the Techstream.

Result

KNOCK CORRECT LEARN VALUE	PROCEED TO
5 deg(CA) or more	A
Less than 5 deg(CA)	B

HINT:

- If the value shown in the Data List is below 5 deg(CA), interview the customer to check if the malfunction is caused by the quality of the fuel being used.
- If the result of the customer problem analysis is that improper fuel was not used or the type of fuel used is unknown, suggest that the customer refuel the vehicle with a different brand of fuel and then check if the malfunction symptoms disappear.

B ▶ **CONFIRM FUEL**

A

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6.	**READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the value displayed on the Techstream.

Result

DATA LIST	RESULT	PROCEED TO
Short FT #1 + Long FT#1	-15% or higher, or less than 15%	A
	Other than above	B

HINT:

- "Total FT #1" is used to detect an abnormal air fuel ratio. As the value of "Total FT #1" is corrected by the ECM before it is displayed in the Data List, the displayed value may not be equal to the sum of the measured "Short FT #1" and "Long FT #1".
- An abnormally lean or rich tendency can be checked by reading the following Data List items: A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1 and A/F Learn Value High #1.
- The following may cause a lean air fuel ratio (an operating range in which the air fuel ratio learned value correction is +15% or more):
    a. Decrease in fuel injector assembly injection volume
    b. Decrease in mass air flow meter output (due to existence of foreign matter)
    c. Air leaks in intake system after mass air flow meter
    d. Decrease in fuel pressure (at fuel filter, fuel suction tube with pump and gauge assembly or fuel pressure regulator assembly)
- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value High #1" only is corrected to the positive side, a malfunction in the fuel system (clogging of the fuel suction tube with pump and gauge assembly or fuel filter) is suspected.
- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value Idle #1" or "A/F Learn Value Low #1" only is corrected to the positive side, an air leak after the mass air flow meter is suspected.
- The following may cause a rich air fuel ratio (an operating range in which the air fuel ratio learned value correction is -15% or less):
    a. Increase in the fuel injector assembly injection volume
    b. Purge VSV system

B **GO TO STEP 16**

A

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7.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE SELECT CYLINDER FUEL CUT)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

HINT:

Reproduce the vehicle conditions when the malfunction occurred. (such as after the engine is warmed up or after a cold start).

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Select Cylinder Fuel Cut / Engine Speed.

(f) According to the display on the Techstream, perform the Active Test and check for a malfunctioning cylinder.

HINT:

- Perform fuel-cut for each cylinder and check the change in the engine speed.
- If the engine speed of a cylinder does not change while performing the Active Test, it can be determined that the cylinder is malfunctioning.
- If the engine speed of all cylinders change while performing the Active Test, it can be determined that multiple cylinders are malfunctioning.
- A cylinder for which the Data List item "Cylinder Misfire Count" increases may be malfunctioning.

Result

RESULT	PROCEED TO
One cylinder is malfunctioning	A
Multiple or all cylinders are malfunctioning, or the malfunctioning cylinder cannot be determined.	B

B ▶ **GO TO STEP 16**

A ▼

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (CHECK THE CYLINDER COMPRESSION)**

HINT:

If the vehicle does not support the Active Test "Check the Cylinder Compression", measure the compression pressure. If the compression pressure is normal, go to step 9.

(a) Warm up the engine.

(b) Turn the ignition switch off.

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(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression / Data List / Compression / Engine Speed of Cyl #1 to #4, Av Engine Speed of All Cyl.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

(g) While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

(h) Crank the engine for about 10 seconds.

(i) Monitor the engine speed (Engine Speed of Cyl and Av Engine Speed of All Cyl) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

(j) Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

- If the Active Test is changed to OFF while the engine is being cranked, the engine will start.
- When performing the Active Test, DTC P1604 (Startability Malfunction) may be stored.
- After performing the Active Test, make sure to check and clear DTCs.

(k) Read the value.

HINT:

- If the value of Data List item "Engine Speed of Cyl" of a cylinder is higher than other cylinders, the cylinder may be malfunctioning.
- If the value of Data List item "Engine Speed of Cyl" is high for only one cylinder, compression loss is suspected.

Result

RESULT	PROCEED TO
There is no variation in "Engine Speed of Cyl" (All cylinders display approximately the same value for "Engine Speed of Cyl")	A

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RESULT	PROCEED TO
There is variation in "Engine Speed of Cyl" (Only one cylinder displays a value for "Engine Speed of Cyl" that differs considerably)	B

B ▶ GO TO STEP 14

A ▼

9.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Idle the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

HINT:

Change the fuel injection volume between the minimum and maximum range of correction (e.g. -12.5% to 12.5%).

Result

RESULT	PROCEED TO
Malfunction is still present even if the fuel injection volume is changed	A
Malfunction disappears when the fuel injection volume is changed	B

B ▶ GO TO STEP 15

A ▼

10.	CHECK IGNITION SYSTEM

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(a) Check the ignition system.

HINT:

- Interchange the ignition coil assembly and spark plug of the malfunctioning cylinder with those of a known good cylinder and check if the malfunctioning cylinder returns to normal.
- If the spark plug of the malfunctioning cylinder is abnormally wet with fuel even after the ignition coil assembly and spark plug are replaced, a leaking fuel injector assembly is suspected.

Result

RESULT	PROCEED TO
The malfunctioning cylinder does not return to normal	A
The malfunctioning cylinder returned to normal	B

B ▶ **GO TO STEP 26**

A ▼

11.	**INSPECT OTHER RELATED COMPONENTS**

(a) Check the ignition coil assembly power source circuit, wire harness and connectors.

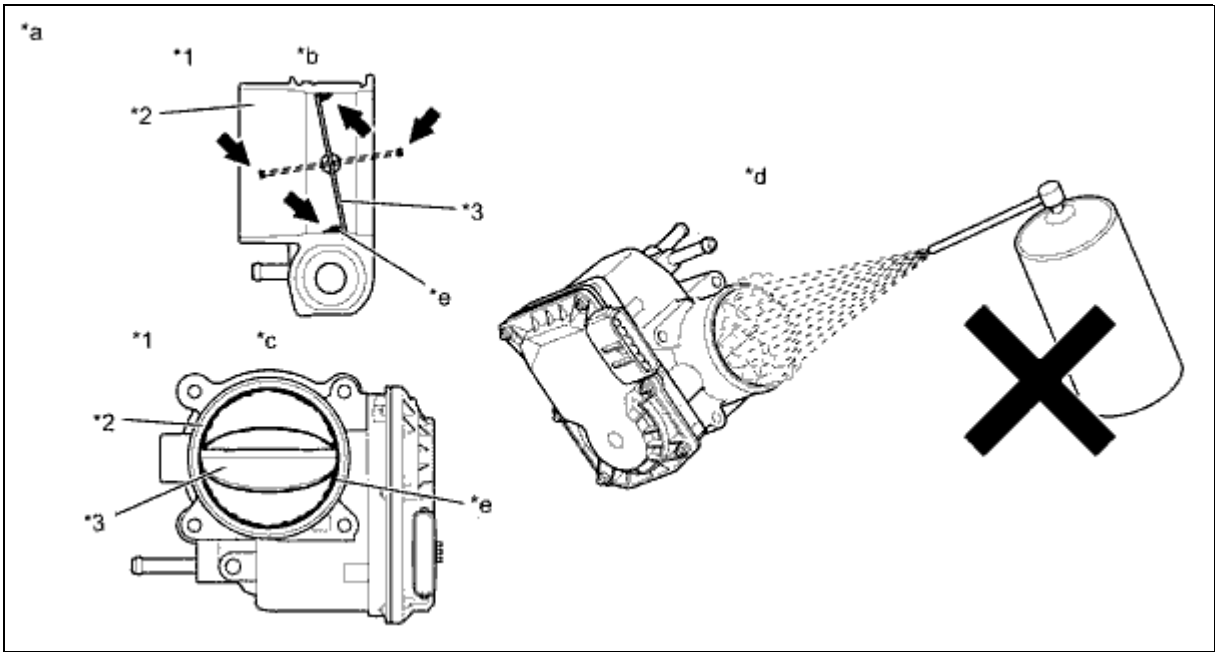
NEXT ▶ **GO TO STEP 26**

12.	**REMOVE FOREIGN OBJECT (CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY)**

(a) Clean off any deposits from the inside of the throttle body with motor assembly.

(b) Push open the throttle valve and wipe off any carbon from the valve and bore using a piece of cloth soaked in non-residue solvent.

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Text in Illustration

*1	Throttle Body with Motor Assembly	*2	Bore
*3	Valve	-	-
*a	Reference	*b	Throttle Body with Motor Assembly Cross-section Diagram
*c	When valve fully opened	*d	Do not directly apply cleaner
*e	Deposits	-	-

NOTICE:

- Make sure that the cloth or your fingers do not get caught in the valve.
- Make sure that foreign matter does not enter the throttle valve.
- Do not directly apply non-residue solvent to the throttle body with motor assembly or wash the throttle body with motor assembly. Cleaning solvent may leak into the motor from the shaft and cause problems such as rust or valve movement problems.
- If there is coating material on the edge of the valve, be careful not to remove it.

HINT:

The illustrations are for reference only. Actual parts may differ.

NEXT

13.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

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(d) Turn the Techstream on.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

(f) Allow the engine to idle for 3 minutes or more and confirm that the engine speed is within the specified range.

HINT:

If the engine is operated without performing learning value reset and idle learning after cleaning the deposits from the throttle body with motor assembly, the idle speed may increase.

NEXT ▶ **GO TO STEP 27**

14.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure. If the compression pressure of a cylinder is low, inspect the engine assembly and repair or replace parts as necessary INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NEXT ▶ **GO TO STEP 27**

15.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assembly of the malfunctioning cylinder INFO .

HINT:

- If the air fuel ratio learned value is corrected to the positive side for all operating ranges due to low fuel injector assembly injection volume, replace the fuel injector assemblies of all cylinders.
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT ▶ **GO TO STEP 27**

16.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

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(f) According to the display on the Techstream, read the Data List when the ignition switch is turned to ON and while maintaining an engine speed of 3000 rpm.

Result

RESULT	PROCEED TO
Other than below	A
Ignition switch ON (engine stopped): 1 gm/sec or higher Engine speed 3000 rpm (without load): Less than 7.6 gm/sec	B

B ▶ **GO TO STEP 20**

A ▼

17.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(f) Idle the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2.

(h) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

NOTICE:

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- Read the output voltage immediately after warming up the air fuel ratio sensor and heated oxygen sensor to avoid an inaccurate reading due to a sensor cooling.

HINT:

The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
AFS Voltage B1S1	12.5%	Below 3.1 V

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TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
(Air fuel ratio sensor)	-12.5%	Higher than 3.4 V
O2S B1S2 (Heated oxygen sensor)	12.5%	Higher than 0.55 V
	-12.5%	Below 0.4 V

Result

RESULT	PROCEED TO
Output voltage values are abnormal	A
Malfunction disappears when fuel injection volume is increased	B
Malfunction is still present when fuel injection volume is increased, even if output voltage values are normal	C

B ▶ **GO TO STEP 19**

C ▶ **GO TO STEP 21**

A ▼

18.	**REPLACE AIR FUEL RATIO SENSOR AND HEATED OXYGEN SENSOR**

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

(b) Replace the heated oxygen sensor INFO .

NEXT ▶ **GO TO STEP 27**

19.	**REPLACE FUEL INJECTOR ASSEMBLY**

(a) Replace the fuel injector assemblies of all cylinders INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT ▶ **GO TO STEP 27**

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20.	CHECK INTAKE SYSTEM

(a) Check for air leaks or blockage in the intake system components. If a connection problem or foreign matter is found, repair the connection or remove the foreign matter.

HINT:

- If there is foreign matter in the intake system components, remove it before proceeding to the next step.
- If there is no foreign matter in the intake system components, check for foreign matter in the mass air flow meter. If there is foreign matter in the mass air flow meter, remove it.
- Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT GO TO STEP 27

21.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) When performing the Active Test, check for an operating sound from the fuel pump.

OK:

CONTROL THE FUEL PUMP / SPEED	SPECIFIED CONDITION
ON	Operating sound heard
OFF	Operating sound not heard

Result

RESULT	PROCEED TO
Normal	A
Abnormal	B

B GO TO STEP 24

A

22.	INSPECT FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY

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(a) Attach a fuel pressure gauge and check the fuel pressure when cranking the engine and after stopping the engine INFO .

Standard:

VEHICLE STATE	SPECIFIED CONDITION
Cranking engine	304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2} , 44 to 50 psi)
5 minutes after stopping engine	147 kPa (1.5 kgf/cm ^{2} , 21 psi) or higher

HINT:

- If there is foreign matter such as iron particles on the fuel suction tube with pump and gauge assembly, remove it.
- Make sure that there are no leaks from the fuel lines, signs of fuel leakage or fuel odors.
- If the air fuel ratio becomes lean only when the engine is running under a high load and at a high engine speed, clogging of the fuel filter is suspected.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **GO TO STEP 25**

A ▼

23.	**INSPECT RELATED PARTS**

(a) Inspect the following fuel pump related parts:

- Fuel suction tube with pump and gauge assembly
- Fuel pressure regulator assembly
- Fuel lines and connecting parts
- Fuel filter

NEXT ▶ **GO TO STEP 26**

24.	**INSPECT FUEL PUMP CONTROL SYSTEM**

(a) Inspect the fuel pump control system.

NEXT ▶ **GO TO STEP 26**

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25.	INSPECT OTHER RELATED COMPONENTS

(a) Inspect other related components.

HINT:

If the malfunctioning part could not be determined by performing the preceding inspections, one of the following malfunctions is suspected.

- Engine mount deterioration
- Deposits in the intake manifold or on an intake valve
- Delay in fuel supply due to adherence of the fuel to the deposits

NEXT

26.	REPAIR OR REPLACE MALFUNCTIONING PARTS

(a) Repair or replace the malfunctioning part.

(b) Perform "Inspection After Repair" after repairing or replacing the malfunctioning part INFO .

NEXT

27.	CONDUCT CONFIRMATION TEST

(a) Check that the idle has returned to normal.

NEXT **END**

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000000WZ11BFX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: MIL Circuit; 2016 MY Tacoma [08/2015 -]		

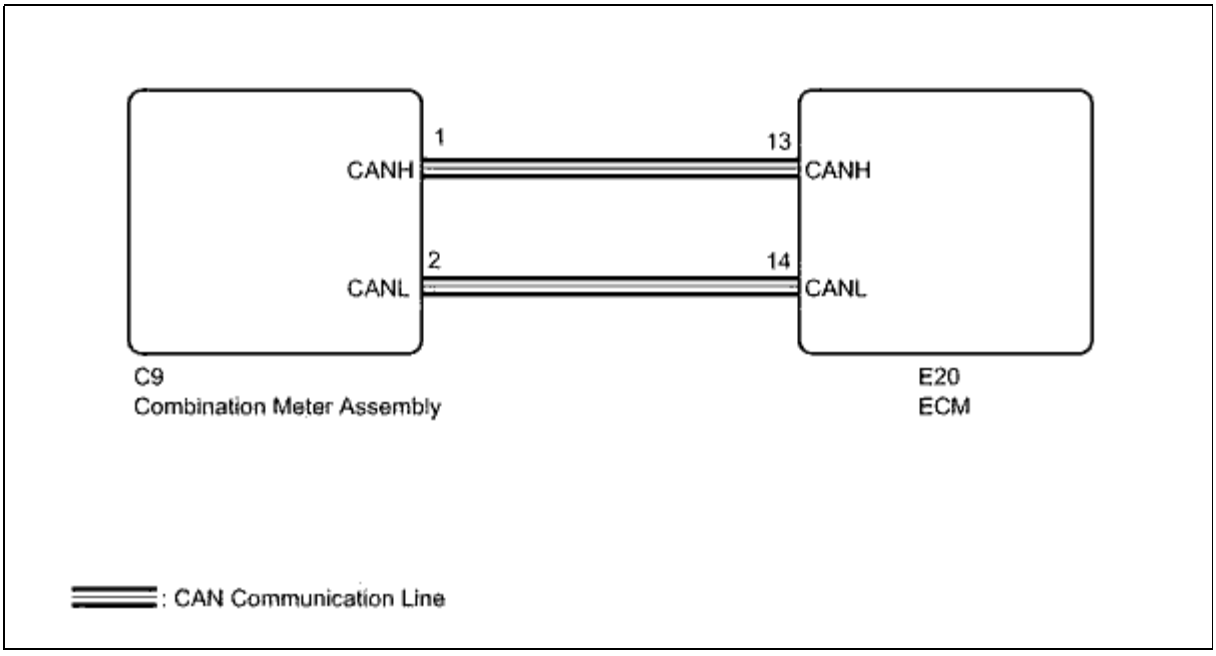
MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate vehicle malfunctions detected by the ECM. When the ignition switch is turned to ON, power is supplied to the MIL circuit, and the ECM provides the circuit ground which illuminates the MIL.

The MIL operation can be checked visually: When the ignition switch is turned to ON, the MIL should be illuminated and should turn off after engine is started. If the MIL remains illuminated or is not illuminated, conduct the following troubleshooting procedure using the Techstream.

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	**CHECK MIL ILLUMINATION**

(a) Check the illumination condition of the MIL.

Result

RESULT	CONDITION	PROCEED TO

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RESULT	CONDITION	PROCEED TO
MIL ON→MIL OFF	Ignition switch ON → engine is started	A
MIL does not illuminate		B
MIL remains ON		C

B ▶ **GO TO VC OUTPUT CIRCUIT**

C ▶ **GO TO STEP 2**

A ▶ **CHECK INTERMITTENT PROBLEMS**

2.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is possible	A
Communication is not possible	B

B ▶ **GO TO VC OUTPUT CIRCUIT**

A ▼

3.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: System Select / Health Check.

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(e) Check if any DTCs have been detected. Note down any DTCs.

Result

RESULT	PROCEED TO
DTCs are not output	A
DTCs are output	B

B ▶ **REPAIR CIRCUIT INDICATED BY OUTPUT DTC**

A ▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (CHECK ENGINE INDICATOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Body Electrical / Combination Meter / Active Test / Check Engine Indicator.

(e) Check the status of the MIL while performing the Active Test.

Result

RESULT	PROCEED TO
Changes	A
Does not change	B

B ▶ **REPLACE COMBINATION METER ASSEMBLY**

A ▶ **REPLACE ECM**

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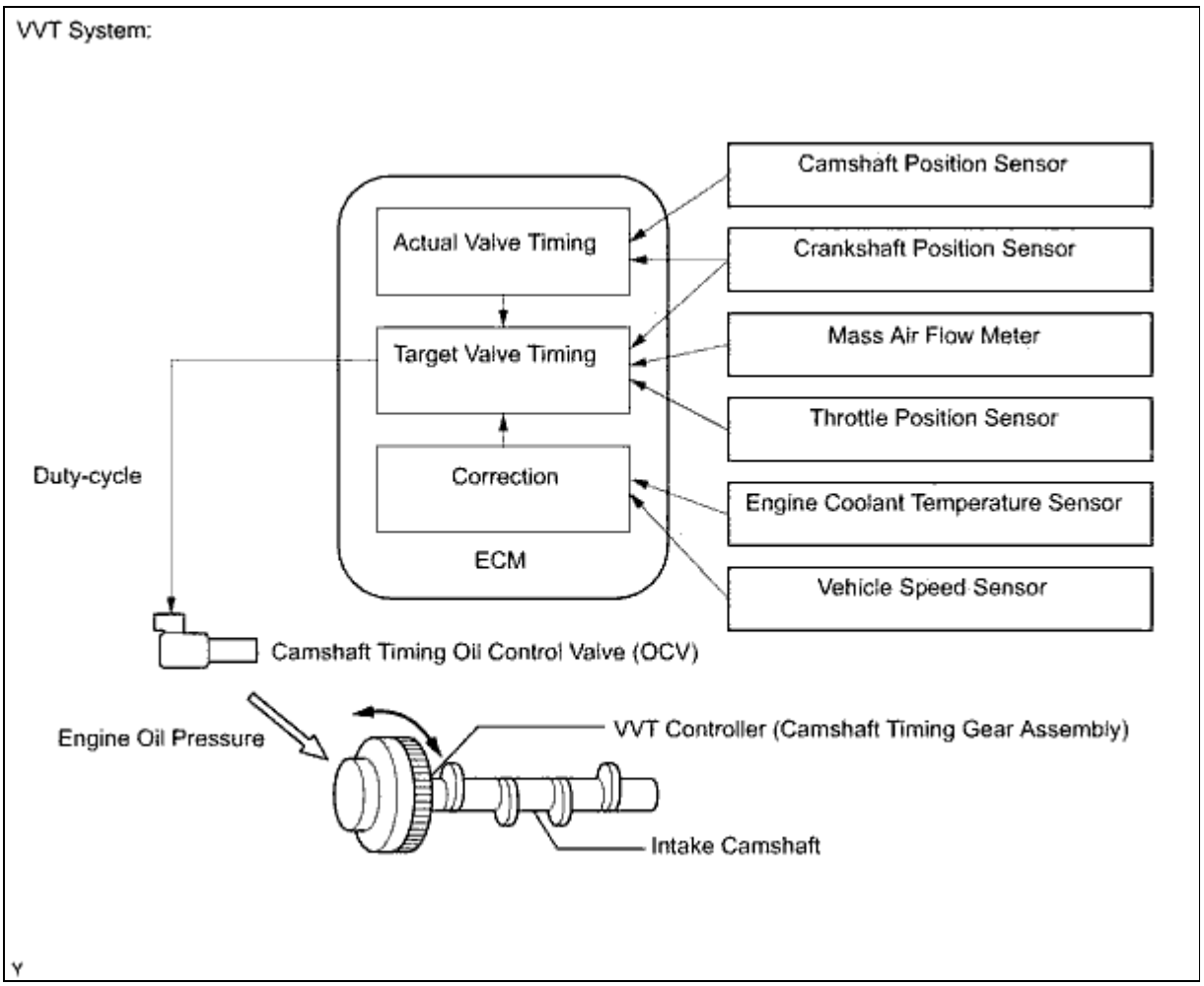
Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000USA01VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0010; Camshaft Position "A" Actuator Circuit (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0010**	**Camshaft Position "A" Actuator Circuit (Bank 1)**

DESCRIPTION

The Variable Valve Timing (VVT) system adjusts the intake valve timing to improve driveability. The engine oil pressure turns the VVT controller to adjust the valve timing.

The Camshaft Timing Oil Control Valve Assembly (OCV) is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies 12 V to the solenoid. The ECM changes the energizing time to the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0010	Open or short in camshaft timing oil control valve assembly circuit (1 trip detection logic)	• Open or short in camshaft timing oil control valve assembly (for intake side) circuit

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Camshaft timing oil control valve assembly (for intake side) • ECM

MONITOR DESCRIPTION

This DTC is designed to detect open or short in the camshaft timing oil control valve assembly circuit. If the camshaft timing oil control valve's duty-cycle is excessively high or low while the engine is running, the ECM will illuminate the MIL and store the DTC.

MONITOR STRATEGY

Related DTCs	P0010: Camshaft Timing Oil Control Valve Range Check
Required Sensors/Components (Main)	Camshaft timing oil control valve assembly (for intake side)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Starter	OFF
Ignition switch	ON
Time after ignition switch OFF to ON	0.5 seconds or more

Case 1

Either of the following conditions is met	Conditions A or B
A. Both of the following conditions are met	-
Battery voltage	11 V or higher, and less than 13 V
Target duty cycle	Less than 70%
B. Both of the following conditions are met	-
Battery voltage	13 V or higher
Target duty cycle	Less than 80%

Case 2

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Current cut status	Not cut

TYPICAL MALFUNCTION THRESHOLDS

Case 1

Output duty cycle	100% or higher

Case 2

Output duty cycle	Output duty cycle 3% or less

COMPONENT OPERATING RANGE

Output duty cycle	Higher than 3%, and less than 100%

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 5 seconds.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0010.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

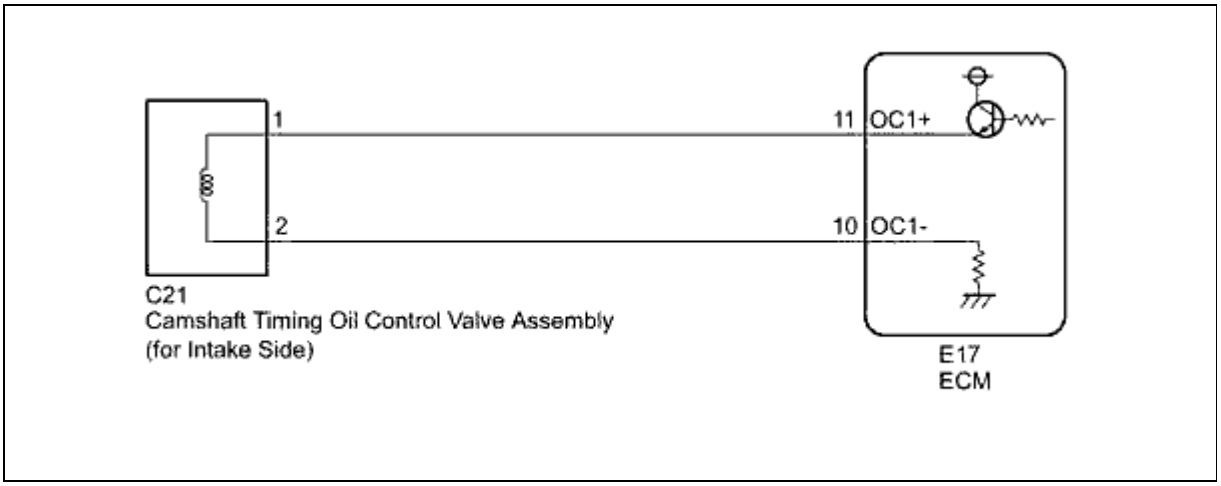
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0010 is output, check the VVT system circuit.
- Read freeze frame data using the Techstream. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC after recording the freeze frame data and DTC.

(e) Turn the ignition switch off.

(f) Start the engine and allow the engine to idle.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0010 is output	A
DTC is not output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE SIDE)**

(a) Inspect the camshaft timing oil control valve assembly (for intake side) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE SIDE)**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE SIDE) - ECM)**

(a) Disconnect the C21 camshaft timing oil control valve assembly (for intake side).

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C21-1 - E17-11 (OC1+)	Always	Below 1 Ω
C21-2 - E17-10 (OC1-)	Always	Below 1 Ω
C21-1 or E17-11 (OC1+) - Body ground	Always	10 kΩ or higher
C21-2 or E17-10 (OC1-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TSG023X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0011,P0012; Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0011**	**Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)**

DTC	**P0012**	**Camshaft Position "A" - Timing Over-Retarded (Bank 1)**

DESCRIPTION

Refer to DTC P0010 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0011	Valve timing is not adjusted in valve timing advance range (1 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly (for intake side) • Oil control valve filter • Camshaft timing gear assembly • ECM
P0012	Valve timing is not adjusted in valve timing retard range (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM optimizes the intake valve timing using the Variable Valve Timing (VVT) system to control the intake camshaft. The VVT system includes the ECM, camshaft timing oil control valve assembly (for intake side) and the VVT controller (camshaft timing gear assembly). The ECM sends a target duty cycle control signal to the camshaft timing oil control valve assembly (for intake side). This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

If the difference between the target and actual intake valve timing is large, and changes in the actual intake valve timing are small, the ECM interprets this as the VVT controller being stuck malfunction and stores a DTC.

Example:

A DTC is stored when the following conditions "A" and "B" are met:

(a) It takes 5 seconds or more to change the valve timing by 5°CA (Condition "A").

(b) After the above condition is met, the camshaft timing oil control valve assembly (for intake camshaft) is forcibly activated for 10 seconds (Condition "B")

DTC P0011 (Advanced Camshaft Timing) is subject to 1 trip detection logic.

DTC P0012 (Retarded Camshaft Timing) is subject to 2 trip detection logic.

These DTCs indicate that the VVT controller cannot operate properly due to camshaft oil control valve assembly (for intake camshaft) malfunctions or the presence of foreign objects in the camshaft oil control valve.

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The monitor will not run unless the following conditions are met:

- The engine is warm (the engine coolant temperature is between 70 to 100°C [158 to 212°F]).
- The vehicle has been driven at more than 64 km/h (40 mph) for 3 minutes.
- The engine has idled for 3 minutes.

MONITOR STRATEGY

Related DTCs	P0011: Advanced Camshaft Timing P0012: Retarded Camshaft Timing
Required Sensors/Components (Main)	Camshaft timing oil control valve assembly (for intake side) Camshaft timing gear assembly
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	Advanced camshaft timing: Immediate Retarded camshaft timing: 2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0016 (VVT System - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)
Battery voltage	11 V or higher
Engine rpm	400 to 4000 rpm
Engine coolant temperature	70 to 100°C (158 to 212°F)

TYPICAL MALFUNCTION THRESHOLDS

P0011: Advanced Camshaft Timing

Both conditions are met:	-
Deviation of actual valve timing and target valve timing	More than 5°CA (Crankshaft Angle) for 5 seconds or more after the VVT hold duty ratio learned value reaches the upper or lower limit.
Valve timing	No change at advanced valve timing

P0012: Retarded Camshaft Timing

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Both conditions are met:	-
Deviation of actual valve timing and target valve timing	More than 5°CA (Crankshaft Angle) for 5 seconds or more after the VVT hold duty ratio learned value reaches the upper or lower limit.
Valve timing	No change at retarded valve timing

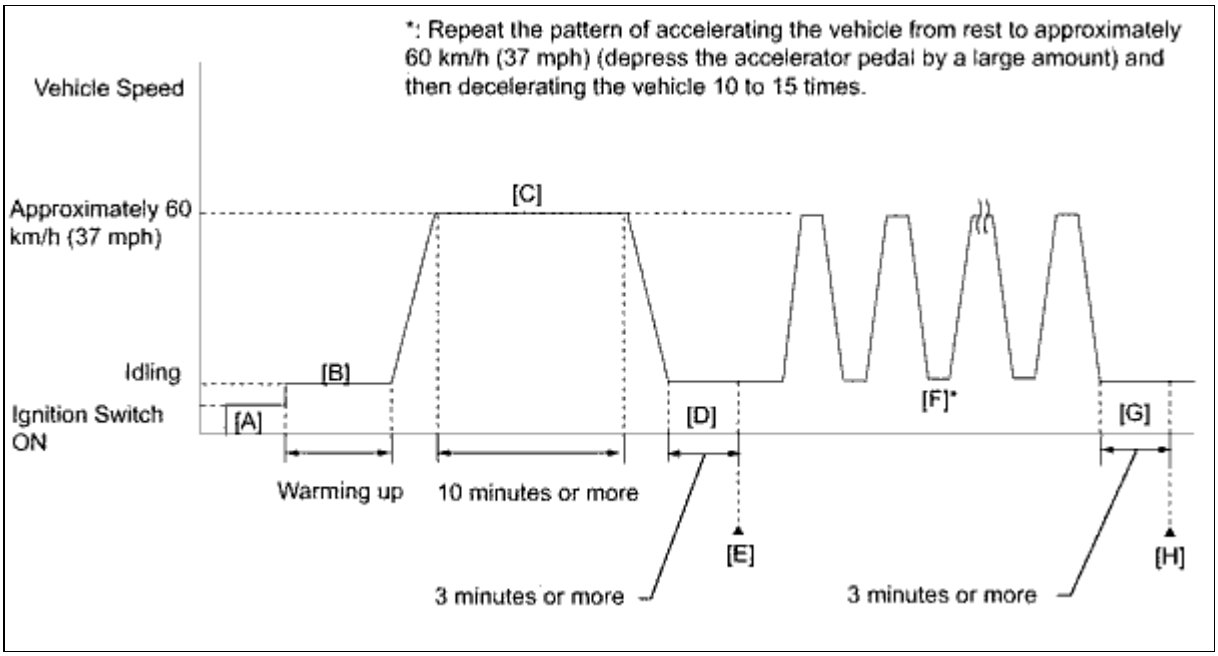
If the difference between the target and actual camshaft timings is greater than the specified value, the ECM operates the VVT (Variable Valve Timing) actuator.

Then, the ECM monitors the camshaft timing change for 5 seconds.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or higher [B].
7. Drive the vehicle at approximately 60 km/h (37 mph) for 10 minutes or more [C].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Idle the engine for 3 minutes or more [D].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.

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- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0011 or P0012.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [F] through [H].

14. Repeat the pattern of accelerating the vehicle from rest to approximately 60 km/h (37 mph) and then decelerating the vehicle 10 to 15 times [F].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Depress the accelerator pedal by a large amount.

15. Idle the engine for 3 minutes or more [G].
16. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [H].
17. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

18. Check the DTC judgment result again.

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the following procedure.

19. Perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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WIRING DIAGRAM

Refer to DTC P0010 INFO .

INSPECTION PROCEDURE

HINT:

- DTC P0011 or P0012 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

TIMING OVER-ADVANCED (VALVE TIMING IS OUT OF SPECIFIED RANGE)	TIMING OVER-RETARDED (VALVE TIMING IS OUT OF SPECIFIED RANGE)
P0011	P0012

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0011 OR P0012)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0011 or P0012 is output	A
DTC P0011 or P0012 and other DTCs are output	B

HINT:

If any DTCs other than P0011 or P0012 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR (BANK 1))**

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(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Warm up the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Linear (Bank 1).

(g) Check the engine speed while operating the camshaft timing oil control valve assembly (for intake camshaft) using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

HINT:

Refer to "Data List / Active Test" [VVT OCV Duty #1, VVT Change Angle #1] INFO .

NG ▶ **GO TO STEP 4**

OK ▼

3.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0011 or P0012 is output	B

HINT:

DTC P0011 or P0012 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **GO TO STEP 4**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE SIDE)**

(a) Inspect the camshaft timing oil control valve assembly (for intake side) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE SIDE)**

OK ▼

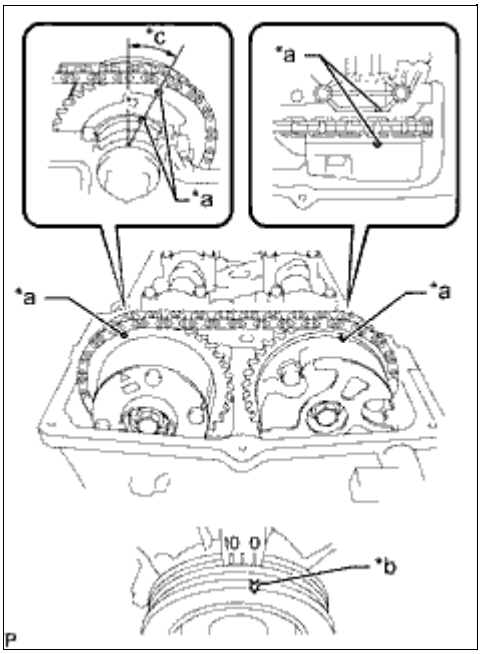
5.	**CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)**

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(a) Remove the cylinder head cover INFO .

Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°



(b) Turn the crankshaft to align the timing marks of the crankshaft.

(c) Align the groove of the crankshaft pulley with the "0" position.

(d) Confirm whether the timing marks of the camshaft pulley and cylinder head cover are facing each other.

HINT:

If the timing marks are not as shown, turn the crankshaft one revolution clockwise.

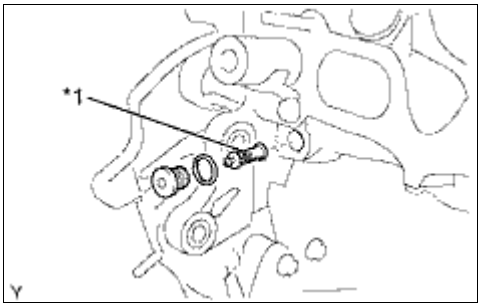
OK:

The timing marks of the camshaft pulley and the cylinder head cover face each other when the groove of the crankshaft pulley is in the "0" position.

NG ▶ **GO TO STEP 9**

OK ▼

6.	**INSPECT OIL CONTROL VALVE FILTER**



(a) Remove the oil control valve filter INFO .

(b) Check that the filter is not clogged.

OK:

Filter is not clogged.

Text in Illustration

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*1	Oil Control Valve Filter

NG ▶ **CLEAN OR REPLACE OIL CONTROL VALVE FILTER**

OK
▼

7.	**REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

(a) Replace the camshaft timing gear assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing gear assembly INFO .

NEXT
▼

8.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0011 or P0012 is output	B

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HINT:

DTC P0011 or P0012 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **REPLACE ECM**

A ▶ **END**

9.	CHECK ENGINE MECHANICAL SYSTEM

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

INFO

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

10.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO

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RESULT	PROCEED TO
DTC is not output	A
DTC P0011 or P0012 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

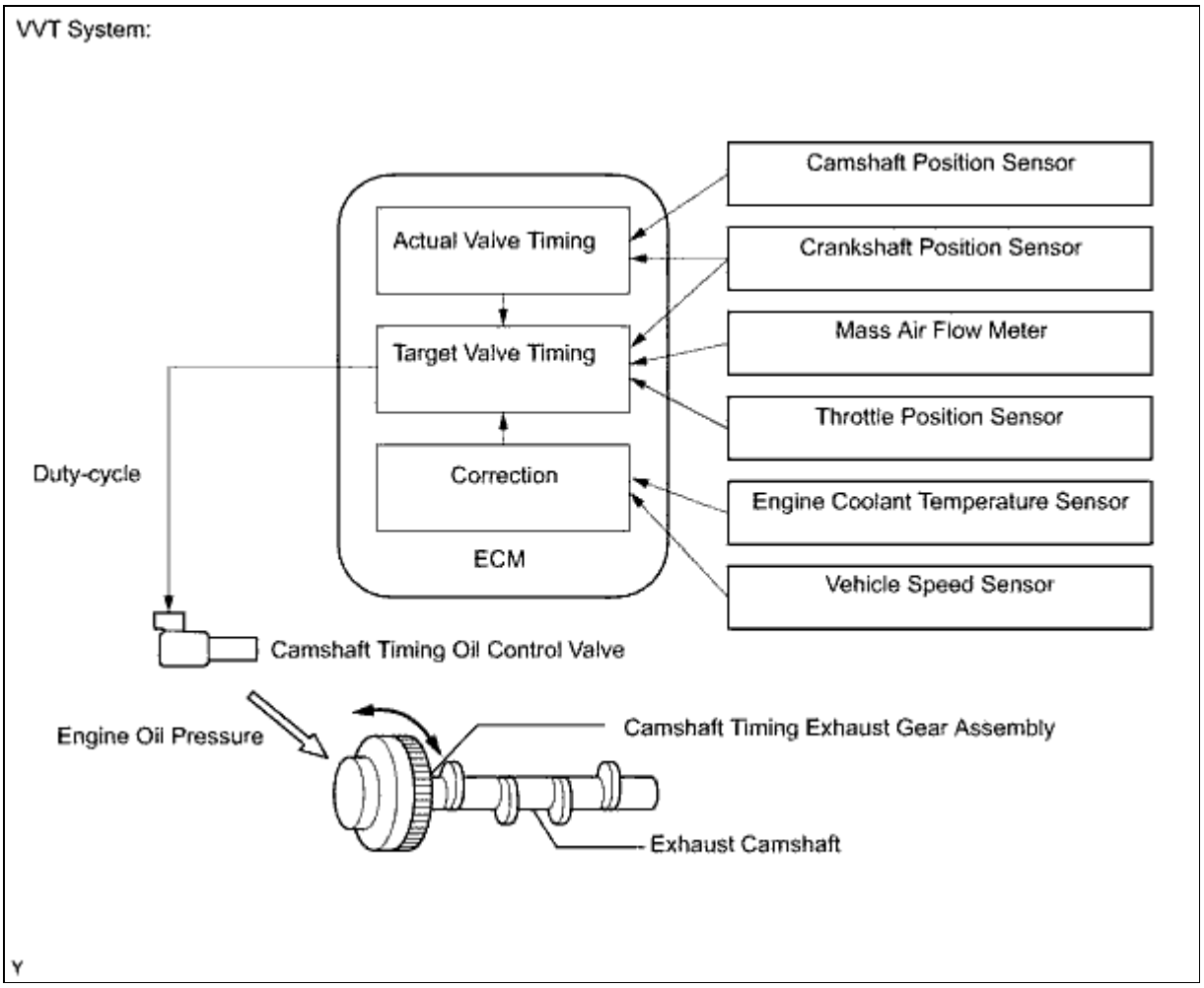
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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000XH70M8X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0013; Camshaft Position "B" Actuator Circuit / Open (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0013**	**Camshaft Position "B" Actuator Circuit / Open (Bank 1)**

DESCRIPTION

The VVT (Variable Valve Timing) system adjusts the exhaust valve timing to improve driveability. The engine oil pressure turns the camshaft actuator to adjust the valve timing. The camshaft timing oil control valve is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies 12 V to the solenoid. The ECM changes the energizing time of the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0013	Open or short in the camshaft timing oil control valve assembly (for exhaust side) circuit (1 trip detection logic).	• Open or short in camshaft timing oil control valve assembly (for exhaust side) circuit

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Camshaft timing oil control valve assembly (for exhaust side) • ECM

MONITOR DESCRIPTION

These DTCs are designed to detect opens or shorts in the camshaft timing oil control valve assembly for (exhaust side) circuit. If the duty-cycle for the camshaft timing oil control valve assembly (for exhaust side) is excessively high or low while the engine is running, the ECM will illuminate the MIL and store the DTC.

MONITOR STRATEGY

Related DTCs	P0013: Camshaft timing oil control valve assembly (for exhaust camshaft of bank 1) range check
Required Sensors/Components (Main)	Camshaft timing oil control valve assembly (for exhaust side)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever the following DTCs are not stored	None
All of the following conditions are met	-
Starter	OFF
Ignition switch	ON
Time after turning ignition switch OFF to ON	0.5 seconds or more

Case 1

Either of the following conditions is met	Conditions A or B
A. Both of the following conditions are met	-
Battery voltage	11 V or higher, and less than 13 V
Target duty cycle	Less than 70%
B. Both of the following conditions are met	-
Battery voltage	13 V or higher

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Target duty cycle	Less than 80%

Case 2

Current cut status	Not cut

TYPICAL MALFUNCTION THRESHOLDS

Case 1

Output duty cycle	100% or higher

Case 2

Output duty cycle	Output duty cycle 3% or less

COMPONENT OPERATING RANGE

Output duty cycle	Higher than 3%, and less than 100%

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0013.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment completed ○ Perform driving pattern after confirming DTC enabling conditions

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TECHSTREAM DISPLAY	DESCRIPTION
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

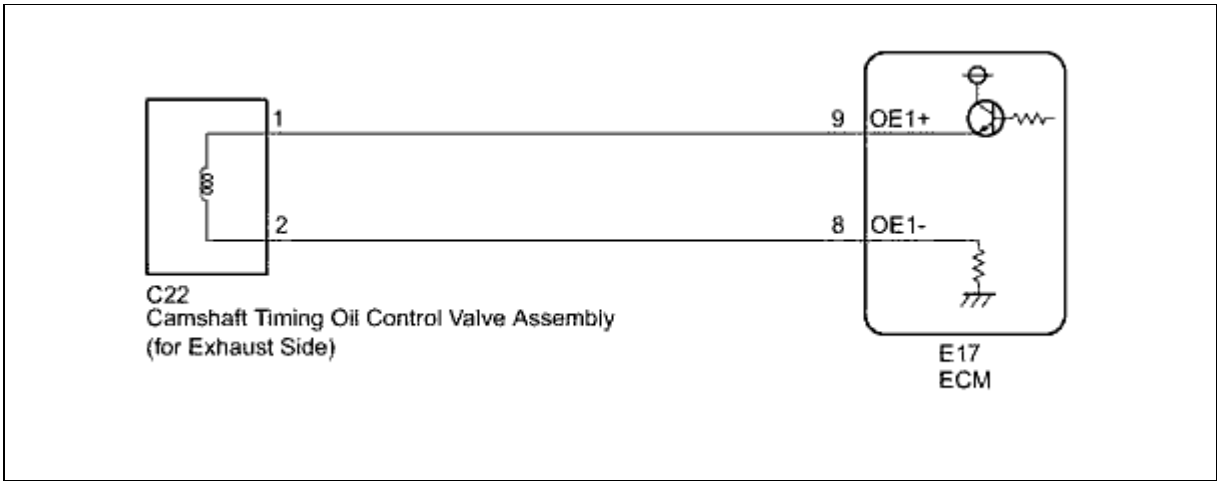
- ○ If the judgment result shows NORMAL, the system is normal.
- ○ If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the test result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- ○ If a permanent DTC is output, the system is malfunctioning.
- ○ If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0010 is output, check the VVT system circuit.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Clear the DTC after recording the freeze frame data and DTC.

(e) Turn the ignition switch off.

(f) Start the engine and allow the engine to idle.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0013 is output	A
DTC is not output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR EXHAUST SIDE)**

(a) Inspect the camshaft timing oil control valve assembly (for exhaust side) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR EXHAUST SIDE)**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR EXHAUST SIDE) - ECM)**

(a) Disconnect the C22 camshaft timing oil control valve assembly (for exhaust side) connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C22-1 - E17-9 (OE1+)	Always	Below 1 Ω

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C22-2 - E17-8 (OE1-)	Always	Below 1 Ω
C22-1 or E17-9 (OE1+) - Body ground	Always	10 kΩ or higher
C22-2 or E17-8 (OE1-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TSG022X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0014,P0015; Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0014**	**Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1)**

DTC	**P0015**	**Camshaft Position "B" - Timing Over-Retarded (Bank 1)**

DESCRIPTION

Refer to DTC P0013 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0014	The valve timing is stuck at a certain value when in the advance range (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly (for exhaust side) • Oil control valve filter • Camshaft timing exhaust gear assembly • ECM
P0015	The valve timing is stuck at a certain value when in the retard range (1 trip detection logic)	

MONITOR DESCRIPTION

The ECM optimizes the exhaust valve timing using the Variable Valve Timing (VVT) system to control the exhaust camshaft. The VVT system includes the ECM, the camshaft timing oil control valve assembly (for exhaust side) and the VVT controller (camshaft timing exhaust gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve assembly (for exhaust side). This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the exhaust camshaft.

If the difference between the target and actual exhaust valve timing is large, and changes in the actual exhaust valve timing are small, the ECM interprets this as a VVT controller stuck malfunction and stores a DTC.

Example:

A DTC is stored when the following conditions "A" and "B" are met:

(a) It takes 5 seconds or more to change the valve timing by 5°CA (Condition "A").

(b) After the above condition is met, the camshaft timing oil control valve assembly (for exhaust camshaft) is forcibly activated for 10 seconds (Condition "B")

DTC P0014 (Advanced Cam Timing) is subject to 2 trip detection logic.

DTC P0015 (Retarded Cam Timing) is subject to 1 trip detection logic.

These DTCs indicate that the VVT controller cannot operate properly due to camshaft timing oil control valve assembly (for exhaust camshaft) malfunctions or the presence of foreign objects in the camshaft timing oil

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control valve assembly (for exhaust camshaft).

MONITOR STRATEGY

Related DTCs	P0014: Advanced Camshaft Timing P0015: Retarded Camshaft Timing
Required Sensors/Components (Main)	Camshaft timing oil control valve assembly (for exhaust side) Camshaft timing exhaust gear assembly
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	Advanced camshaft timing: 2 driving cycles Retarded camshaft timing: Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0013 (Exhaust Camshaft Timing Oil Control Valve) P0017 (Exhaust VVT System - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)
Battery voltage	11 V or higher
Engine rpm	500 to 4000 rpm
Engine coolant temperature	70 to 100°C (158 to 212°F)

TYPICAL MALFUNCTION THRESHOLDS

P0014: Advanced Camshaft Timing

Both conditions are met:	-
Deviation of actual valve timing and target valve timing	More than 5°CA (Crankshaft Angle) for 5 seconds or more after the VVT hold duty ratio learned value reaches the upper or lower limit.
Valve timing	No change at advanced valve timing

P0015: Retarded Camshaft Timing

Both conditions are met:	-
Deviation of actual valve timing and target valve timing	More than 5°CA (Crankshaft Angle) for 5 seconds or more after the VVT hold duty ratio learned value reaches the upper or lower limit.

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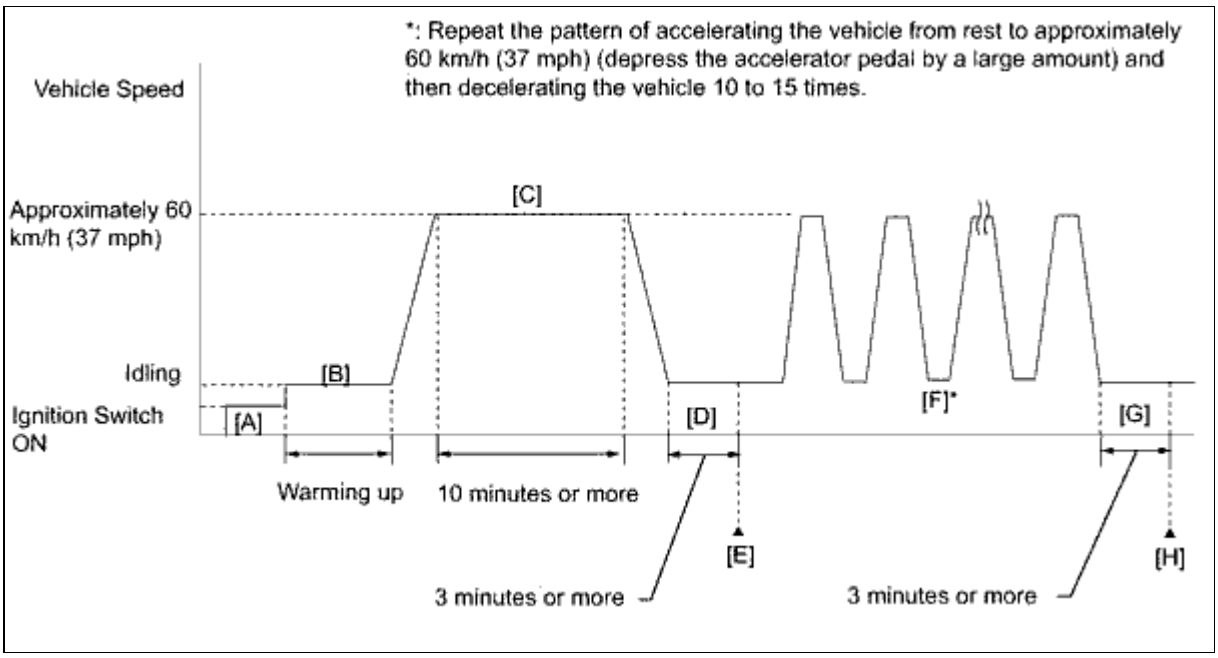
Valve timing	No change at retarded valve timing

If the difference between the target and actual camshaft timing is greater than the specified value, the ECM operates the camshaft timing oil control valve assembly for 10 seconds by applying and releasing oil pressure. Then, the ECM monitors the camshaft timing change for 10 seconds.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or higher [B].
7. Drive the vehicle at approximately 60 km/h (37 mph) for 10 minutes or more [C].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Idle the engine for 3 minutes or more [D].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0014 or P0015.
13. Check the DTC judgment result.

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TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [F] through [H].

14. Repeat the pattern of accelerating the vehicle from rest to approximately 60 km/h (37 mph) and then decelerating the vehicle 10 to 15 times [F].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Depress the accelerator pedal by a large amount.

15. Idle the engine for 3 minutes or more [G].
16. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [H].
17. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

18. Check the DTC judgment result again.

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the following procedure.

19. Perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0013 INFO .

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INSPECTION PROCEDURE

HINT:

- DTC P0014 or P0015 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain set even if the system returns to normal after a short time. Those foreign objects may then be captured by the oil filter.

TIMING OVER-ADVANCED (VALVE TIMING IS OUT OF SPECIFIED RANGE)	TIMING OVER-RETARDED (VALVE TIMING IS OUT OF SPECIFIED RANGE)
P0014	P0015

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0014 OR P0015)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0014 or P0015 is output	A
DTC P0014 or P0015 and other DTCs are output	B

HINT:

If any DTCs other than P0014 or P0015 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT EXHAUST LINEAR (BANK 1))**

(a) Connect the Techstream to the DLC3.

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(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Warm up the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Exhaust Linear (Bank 1).

(g) Check the engine speed while operating the camshaft timing oil control valve assembly (for exhaust camshaft) using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

HINT:

Refer to "Data List / Active Test" [VVT Ex OCV Duty #1, VVT Ex Change Angle #1] INFO .

NG ▶ **GO TO STEP 4**

OK ▼

3.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0014 OR P0015)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

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Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0014 or P0015 is output	B

HINT:

DTC P0014 or P0015 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **GO TO STEP 4**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR EXHAUST SIDE)**

(a) Inspect the camshaft timing oil control valve assembly (for exhaust side) INFO .

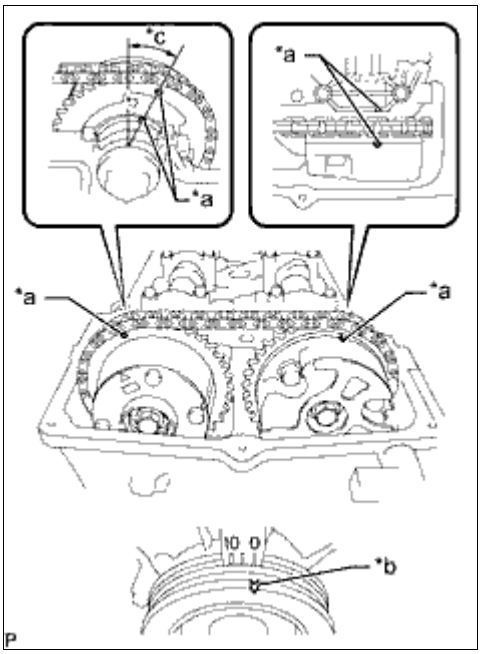
NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR EXHAUST SIDE)**

OK
▼

5.	**CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)**

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(a) Remove the cylinder head cover INFO .



Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°

(b) Turn the crankshaft to align the timing marks of the crankshaft.

(c) Align the groove of the crankshaft pulley with the "0" position.

(d) Confirm whether the timing marks of the camshaft pulley and cylinder head cover are facing each other.

HINT:

If the timing marks are not as shown, turn the crankshaft one revolution clockwise.

OK:

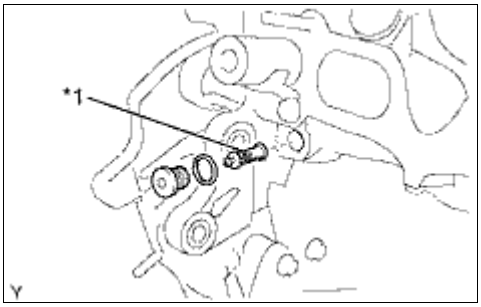
The timing marks of the camshaft pulley and the cylinder head cover face each other when the groove of the crankshaft pulley is in the "0" position.

NG ▶ **GO TO STEP 9**

OK ▼

6.	**INSPECT OIL CONTROL VALVE FILTER**

(a) Remove the oil control valve filter INFO .



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(b) Check that the filter is not clogged.

OK:

Filter is not clogged.

Text in Illustration

*1	Oil Control Valve Filter

NG ▶ **CLEAN OR REPLACE OIL CONTROL VALVE FILTER**

OK ▼

7.	**REPLACE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

(a) Replace the camshaft timing exhaust gear assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing exhaust gear assembly INFO .

NEXT ▼

8.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0014 OR P0015)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

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RESULT	PROCEED TO
DTC is not output	A
DTC P0014 or P0015 is output	B

HINT:

DTC P0014 or P0015 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **REPLACE ECM**

A ▶ **END**

9.	CHECK ENGINE MECHANICAL SYSTEM

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

INFO

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

10.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0014 OR P0015)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0014 or P0015 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000USU024X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0016,P0017; Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A); 2016 MY Tacoma [08/2015 -]		

DTC	**P0016**	**Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)**

DTC	**P0017**	**Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)**

DESCRIPTION

In the VVT (Variable Valve Timing) system, the appropriate intake and exhaust valve open and close timing is controlled by the ECM. The ECM performs intake and exhaust valve control by performing the following: 1) controlling the camshaft and camshaft timing oil control valve assembly, and operating the camshaft timing gear; and 2) changing the relative positions of the camshaft and crankshaft.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0016	Deviation in crankshaft position sensor signal and camshaft position sensor (for intake side) signal (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly (for intake side) • Camshaft timing gear assembly • Oil control valve filter • ECM
P0017	Deviation in crankshaft position sensor signal and camshaft position sensor (for exhaust side) signal (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly (for exhaust side) • Camshaft timing exhaust gear assembly • Oil control valve filter • ECM

MONITOR DESCRIPTION

- To monitor the correlation of the intake camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The intake valve timing is set to the most retarded angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0016.
- To monitor the correlation of the exhaust camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The exhaust valve timing is set to the most advanced angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0017.

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MONITOR STRATEGY

Related DTCs	P0016: Camshaft Timing Misalignment at Idling (for Intake Camshaft) P0017: Camshaft Timing Misalignment at Idling (for Exhaust Camshaft)
Required Sensors/Components (Main)	Camshaft timing gear assembly Camshaft timing exhaust gear assembly
Required Sensors/Components (Related)	Camshaft position sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Less than 1 minute
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Engine rpm	500 to 1000 rpm

TYPICAL MALFUNCTION THRESHOLDS

P0016: Intake Camshaft

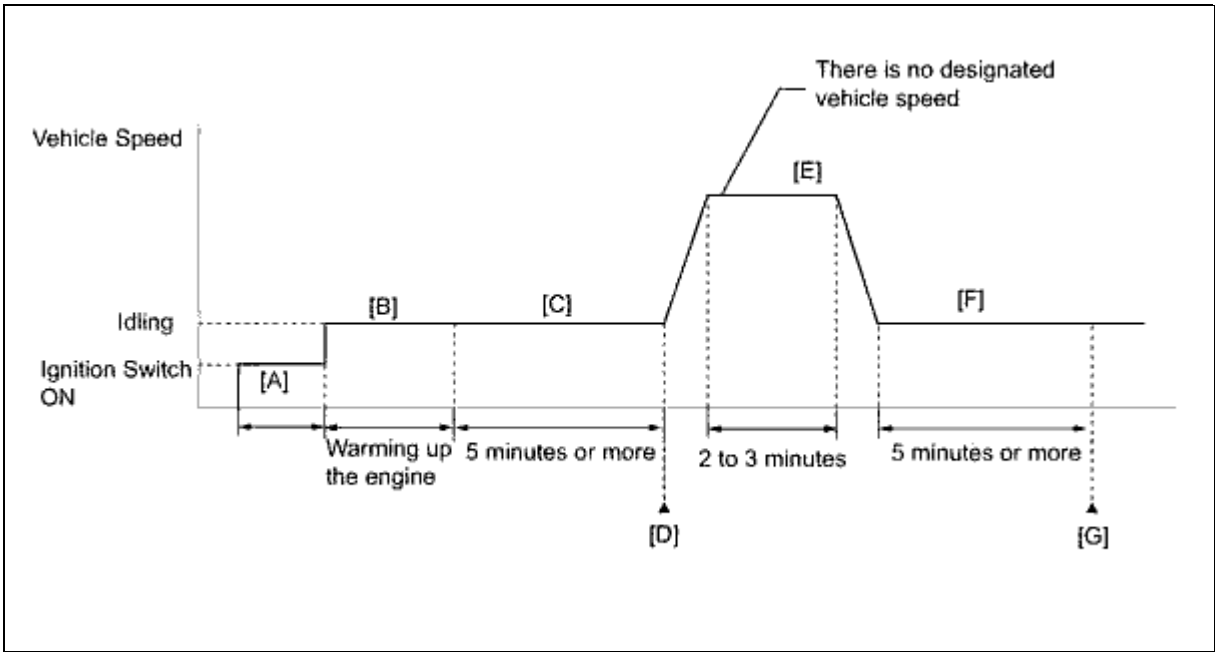
One of following conditions is met	-
VVT learning value at maximum retarded valve timing	Less than 18°CA (crankshaft angle)
VVT learning value at maximum retarded valve timing	More than 36°CA (crankshaft angle)

P0017: Exhaust Camshaft

One of following conditions is met	-
VVT learning value at maximum retarded valve timing	Less than 77.764°CA (crankshaft angle)
VVT learning value at maximum retarded valve timing	More than 100°CA (crankshaft angle)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the ECT reaches 70°C (158°F) or higher [B].
7. Idle the engine for 5 minutes or more [C].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0016 or P0017.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [E] through [G].

13. Drive the vehicle for 2 to 3 minutes [E].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

14. Idle the engine for 5 minutes or more [F].
15. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [G].
16. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

17. Check the DTC judgment result.
18. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 INFO .

INSPECTION PROCEDURE

HINT:

- The monitor for this DTC detects when the timing chain is shifted by one tooth or more.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0016 OR P0017)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO

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RESULT	PROCEED TO
DTC P0016 or P0017 is output	A
DTC P0016 or P0017 and other DTCs are output	B

HINT:

If any DTCs other than P0016 or P0017 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR (BANK 1) OR CONTROL THE VVT EXHAUST LINEAR (BANK 1))**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Check the camshaft timing oil control valve assembly (for intake side).

(1) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Linear (Bank 1).

(2) Check the engine speed while operating the camshaft timing oil control valve assembly (for intake side) using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

HINT:

If the result is not acceptable, cool the engine (engine coolant temperature is 50°C (122°F) or less) and perform the Active Test again.

(f) Check the camshaft timing oil control valve assembly (for exhaust side).

(1) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT Exhaust Linear (Bank 1).

(2) Check the engine speed while operating the camshaft timing oil control valve assembly (for exhaust side) using the Techstream.

OK:

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TECHSTREAM OPERATION	SPECIFIED CONDITION
0%	Normal engine speed
100%	Engine idles roughly or stalls

HINT:

If the result is not acceptable, cool the engine (engine coolant temperature is 50°C (122°F) or less) and perform the Active Test again.

NG ▶ **GO TO STEP 5**

OK ▼

3.	**CHECK ENGINE MECHANICAL SYSTEM** INFO

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0016 OR P0017)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

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RESULT	PROCEED TO
DTC is not output	A
DTC P0016 or P0017 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

5.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE OR EXHAUST SIDE)**

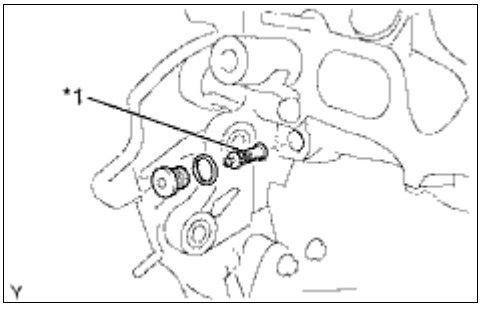
(a) Inspect the camshaft timing oil control valve assembly (for intake or exhaust side) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE OR EXHAUST SIDE)**

OK ▼

6.	**INSPECT OIL CONTROL VALVE FILTER**

(a) Remove the oil control valve filter INFO .



(b) Check that the filter is not clogged.

OK:

Filter is not clogged.

Text in Illustration

*1	Oil Control Valve Filter

NG ▶ **CLEAN OR REPLACE OIL CONTROL VALVE FILTER**

OK

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7.	**REPLACE CAMSHAFT TIMING GEAR ASSEMBLY OR CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

(a) Replace the camshaft timing gear assembly or camshaft timing exhaust gear assembly INFO .

HINT:

Perform "Inspection After Repair" after camshaft timing gear assembly or camshaft timing exhaust gear assembly INFO .

NEXT

8.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0016 OR P0017)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0016 or P0017 is output	B

HINT:

DTC P0016 or P0017 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

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B ▶ REPLACE ECM

A ▶ END

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012AG00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0031,P0032,P101D; Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0031**	**Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)**

DTC	**P0032**	**Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)**

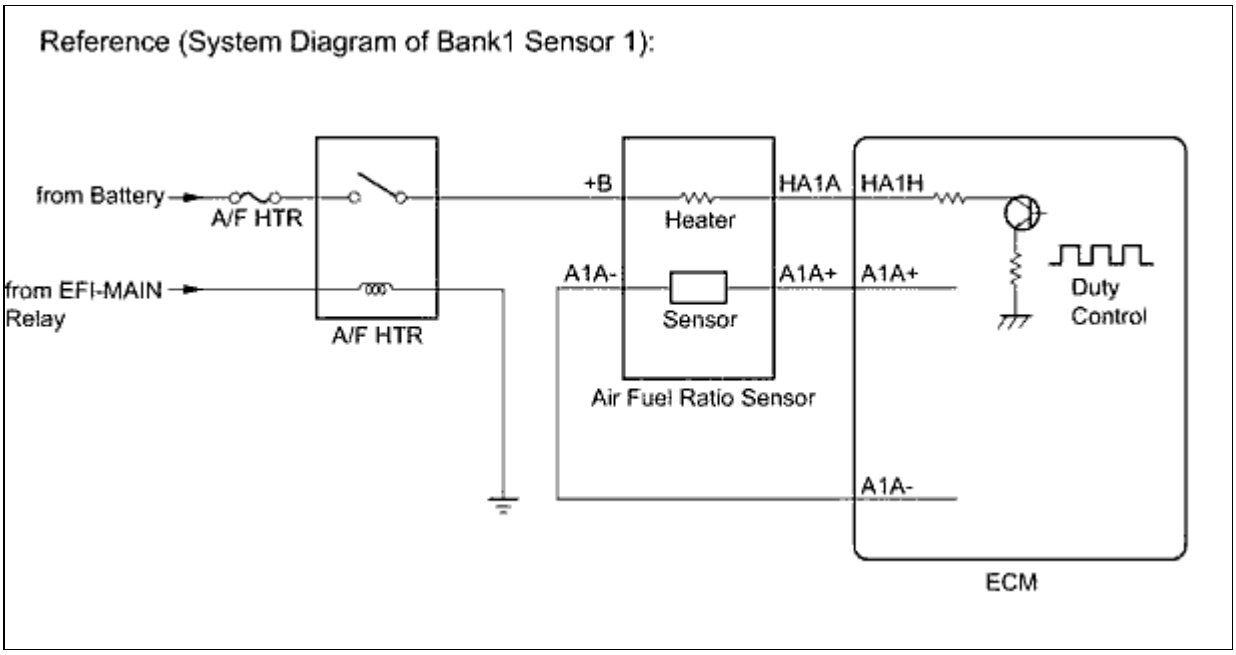
DTC	**P101D**	**A/F Sensor Heater Circuit Performance Bank 1 Sensor 1 Stuck ON**

DESCRIPTION

Refer to DTC P2195 INFO .

HINT:

- When any of these DTCs is stored, the ECM enters fail-safe mode. The ECM turns off the air fuel ratio sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned off.
- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.
- The ECM provides a pulse width modulated control circuit to adjust the current through the heater. The air fuel ratio sensor heater circuit uses a relay on the +B side of the circuit.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0031	Air fuel ratio sensor heater current less than 0.8 A (1 trip detection logic)	• Open in air fuel ratio sensor heater circuit

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Air fuel ratio sensor heater • A/F HTR relay • ECM
P0032	Air fuel ratio sensor heater current failure (1 trip detection logic)	• Short in air fuel ratio sensor heater circuit • Air fuel ratio sensor heater • A/F HTR relay • ECM
P101D	The heater current is higher than the specified value while the heater is not operating (1 trip detection logic)	• Open or short in air fuel ratio sensor heater circuit • ECM

MONITOR DESCRIPTION

The ECM uses information from the air fuel ratio sensor to regulate the air fuel ratio and keep it close to the stoichiometric level. This maximizes the ability of the three-way catalytic converter to purify the exhaust gases.

The air fuel ratio sensor detects oxygen levels in the exhaust gas and transmits the information to the ECM. The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum-coated zirconia and includes an integrated heating element.

The zirconia element generates a small voltage when there is a large difference in the oxygen concentrations between the exhaust gas and outside air. The platinum coating amplifies this voltage generation.

The air fuel ratio sensor is more efficient when heated. When the exhaust gas temperature is low, the sensor cannot generate useful voltage signals without supplementary heating. The ECM regulates the supplementary heating using a duty-cycle approach to adjust the average current in the sensor heater element. If the heater current is outside the normal range, the signal transmitted by the air fuel ratio sensor becomes inaccurate. As a result, the ECM is unable to regulate the air fuel ratio properly.

When the current in the air fuel ratio sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0031: Air Fuel Ratio Sensor Heater Open/Short (Low Electrical Current) P0032: Air Fuel Ratio Sensor Heater Open/Short (High Electrical Current) P101D: Air Fuel Ratio Sensor Heater Performance
Required Sensors/Components (Main)	Air fuel ratio sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous

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Duration	10 seconds: P0031 10.24 seconds: P0032 1 second: P101D
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0031

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Time after heater ON	5 seconds or more
Active heater OFF control	Not operating
Active heater ON control	Not operating
Output duty-cycle	30% or more
A/F sensor heater performance fail (P101D)	Not detected

P0032

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Time after heater ON	5 seconds or more
Active heater OFF control	Not operating
Active heater ON control	Not operating
Output duty-cycle	More than 0%

P101D

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.5 V or higher
Output duty-cycle	10% or higher, and less than 60%
Active heater OFF control	Not operating
Active heater ON control	Not operating
Air fuel ratio sensor check low current fail (P0031)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0031

Heater ON current	Less than 0.8 A

P0032

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All of the following conditions are met	-
1. Command to heater output	ON
2. Heater current detected by heater monitor IC	14 A or higher

P101D

All of the following conditions are met	-
1. Heater OFF current	Higher than 11 A
2. Heater current detected by heater monitor IC	14 A or higher

COMPONENT OPERATING RANGE

P0031

Heater ON current	0.8 A or higher

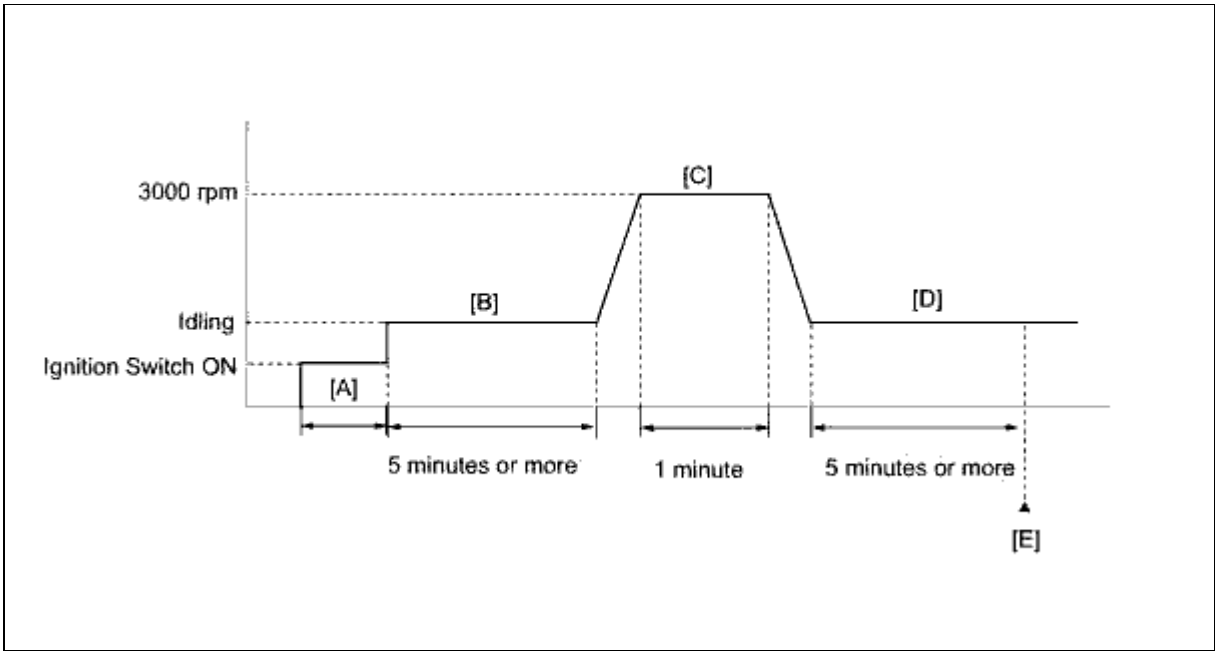
P0032

All of the following conditions are met	-
1. Command to heater output	ON
2. Heater current detected by heater monitor IC	Less than 14 A

P101D

Heater OFF current	11 A or less

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.

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3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and idle it for 5 minutes or more [B].
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 3000 rpm for 1 minute [C].
8. Idle the engine for 5 minutes or more [D].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0031, P0032 or P101D.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [E] again.

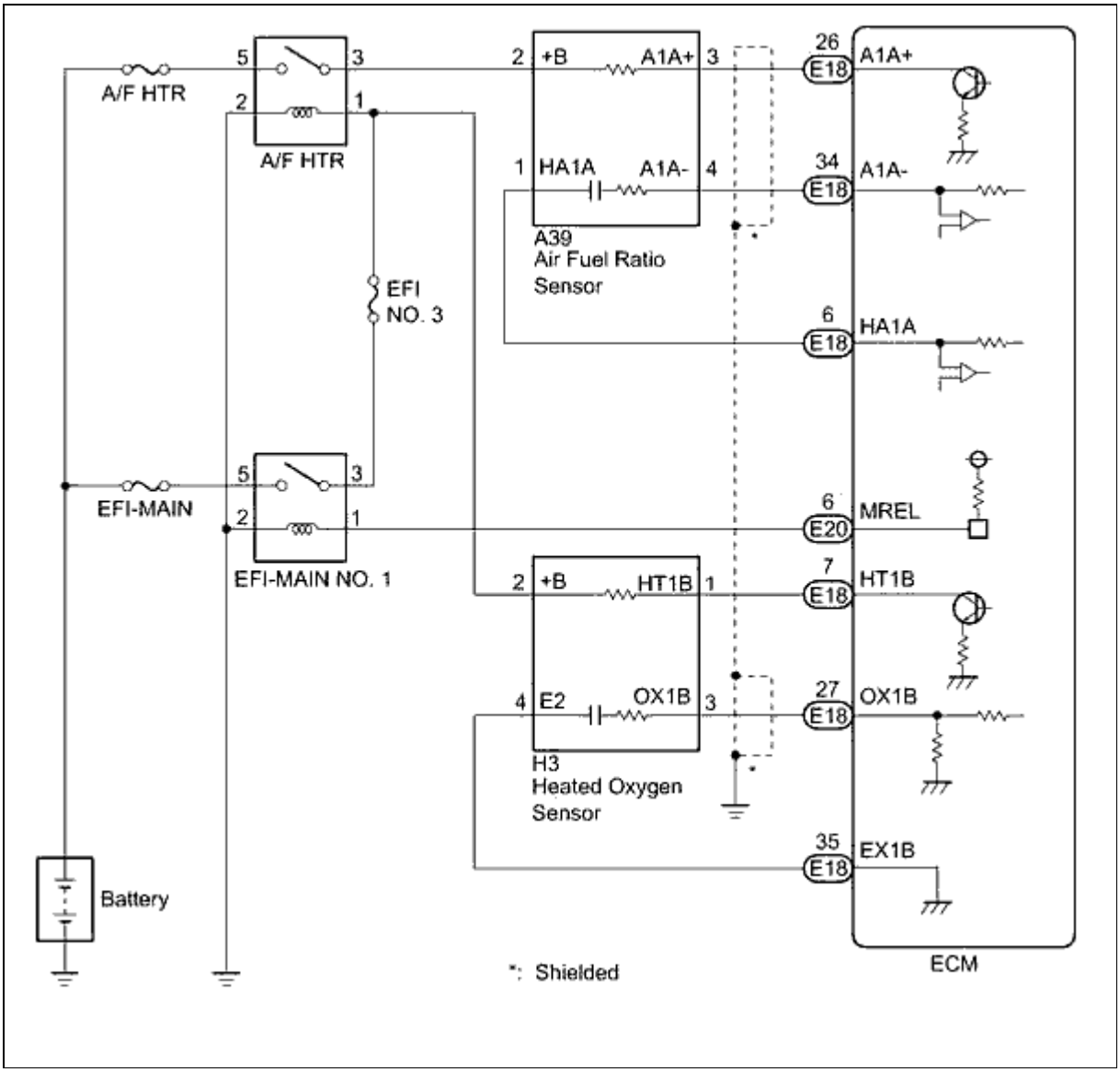
14. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Refer to "Data List / Active Test" [A/F Heater Duty #1] INFO .
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Change the fuel injection volume using the Control the Injection Volume function provided in the Active Test and monitor the air fuel ratio sensor output voltage INFO . If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

PROCEDURE

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1.	**INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

(a) Inspect the air fuel ratio sensor. INFO .

HINT:

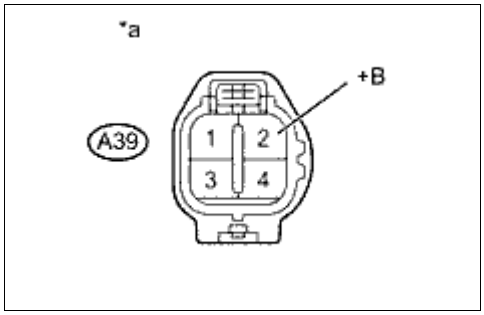
Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK ▼

2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR)**

(a) Disconnect the air fuel ratio sensor connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A39-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Fuel Ratio Sensor)

NG ▶ **GO TO STEP 5**

OK ▼

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3.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

(a) Disconnect the A39 air fuel ratio sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A39-1 (HA1A) or E18-6 (HA1A)	Always	Below 1 Ω
A39-1 (HA1A) or E18-6 (HA1A) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0031, P0032 or P101D)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0031, P0032 or P101D is output	B

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B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

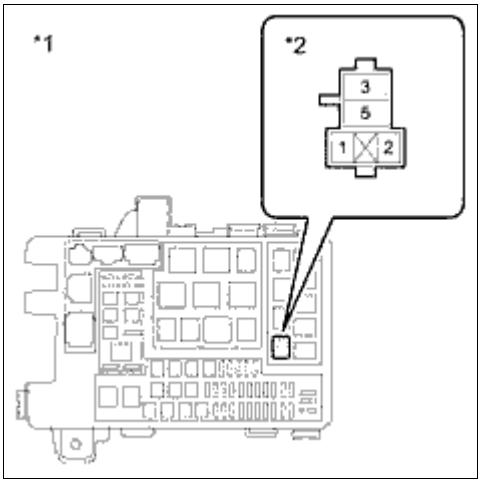
5.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF A/F HTR RELAY)

(a) Remove the A/F HTR relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (A/F HTR relay holder) - Body ground	Always	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	A/F HTR Relay Holder

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (A/F HTR RELAY - BATTERY)

OK ▼

6.	CHECK HARNESS AND CONNECTOR (A/F HTR RELAY - BODY GROUND)

(a) Remove the A/F HTR relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (A/F HTR relay holder) - Body ground	Always	Below 1 Ω

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

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OK

7.	CHECK HARNESS AND CONNECTOR (A/F HTR RELAY - EFI-MAIN NO. 1 RELAY)

(a) Remove the A/F HTR relay from the engine room relay block.

(b) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (A/F HTR relay holder) - 3 (EFI-MAIN NO. 1 relay holder)	Always	Below 1 Ω
1 (A/F HTR relay holder) or 3 (EFI-MAIN NO. 1 relay holder) - Body ground and other terminals	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

8.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - A/F HTR RELAY)

(a) Disconnect the A39 air fuel ratio sensor connector.

(b) Remove the A/F HTR relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A39-2 (+B) - 3 (A/F HTR relay holder)	Always	Below 1 Ω
A39-2 (+B) or 3 (A/F HTR relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE A/F HTR RELAY**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012UW00DX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0037,P0038,P0141,P102D; Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2); 2016 MY Tacoma [08/2015 -]		

DTC	**P0037**	**Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)**

DTC	**P0038**	**Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)**

DTC	**P0141**	**Oxygen Sensor Heater Circuit (Bank 1 Sensor 2)**

DTC	**P102D**	**O2 Sensor Heater Circuit Performance Bank 1 Sensor 2 Stuck ON**

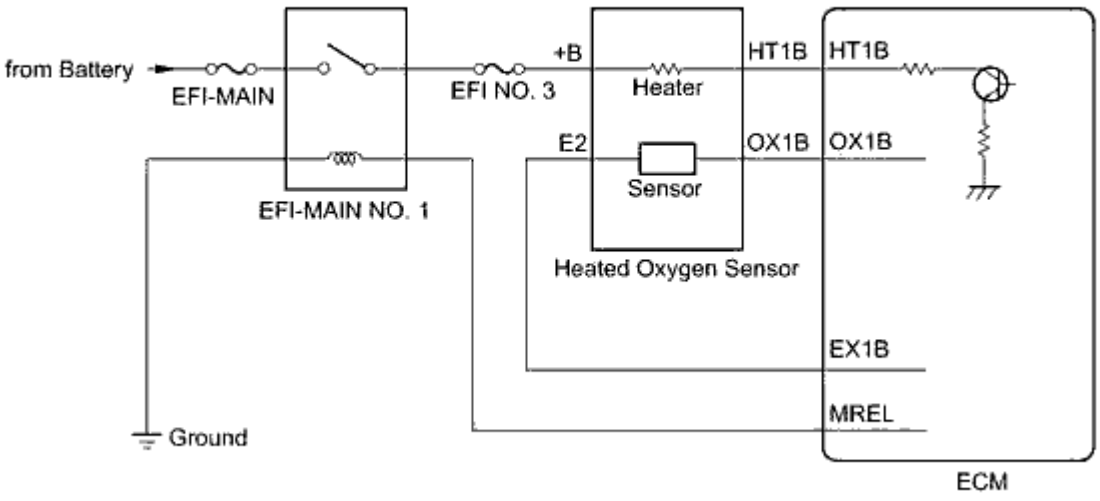
DESCRIPTION

Refer to DTC P0136 INFO .

HINT:

- Sensor 2 refers to the sensor mounted behind the three-way catalytic converter and located far from the engine assembly.
- When any of these DTCs is stored, the ECM enters fail-safe mode. The ECM turns off the heated oxygen sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned off.

Reference (System Diagram of Sensor 2):



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0037	The heater current is less than the specified value while	• Open in heated oxygen sensor

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	the heater is operating (1 trip detection logic)	heater circuit • Heated oxygen sensor heater • ECM
P0038	The heater current is higher than the specified value while the heater is operating (1 trip detection logic)	• Short in heated oxygen sensor heater circuit • Heated oxygen sensor heater • ECM
P0141	The cumulative heater resistance correction value exceeds the threshold (2 trip detection logic)	• Open or short in heated oxygen sensor heater circuit • Heated oxygen sensor heater • ECM
P102D	The heater current is higher than the specified value while the heater is not operating (1 trip detection logic)	ECM

MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentration surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

Heated Oxygen Sensor Heater Range Check (P0037, P0038 and P102D)

The ECM monitors the current applied to the heated oxygen sensor heater to check the heater for malfunctions. If the heater current is outside the normal range, the signal transmitted by the heated oxygen sensor becomes inaccurate. When the current in the heated oxygen sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and stores a DTC.

Heated oxygen sensor heater performance (P0141)

After the accumulated heater ON time exceeds 100 seconds, the ECM calculates the heater resistance using the battery voltage and the current applied to the heater.

If the resistance is above the threshold value, the ECM determines that there is a malfunction in the heated oxygen sensor heater and stores DTC P0141.

MONITOR STRATEGY

Related DTCs	P0037: Heated Oxygen Sensor Heater Range Check (Low Current) P0038: Heated Oxygen Sensor Heater Range Check (High Current) P0141: Heated Oxygen Sensor Heater Performance P102D: Heated Oxygen Sensor Heater ON Stuck
Required Sensors/Components (Main)	Heated oxygen sensor heater

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Required Sensors/Components (Related)	-
Frequency of Operation	Continuous: P0037, P0038, P102D Once per driving cycle: P0141
Duration	0.5 seconds: P0037 Within 3 seconds: P0038 10 seconds: P0141 0.5 seconds: P102D
MIL Operation	Immediate: P0037, P0038, P102D 2 driving cycles: P0141
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0037 (Case 1)

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Completed
Learned heater OFF current operation	Succeeded
Heated oxygen sensor heater high current fail (P0038)	Not detected
Heater ON current - Learned heater OFF current	0.15 A or less
Command to heater output	ON

P0037 (Case 2)

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Completed
Heater OFF current	Higher than 3.5 A
Heater current detected by heater monitor IC	4 A or higher
Heated oxygen sensor heater high current fail (P0038)	Not detected

P0038

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Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Completed

P0141

Monitor runs whenever following DTCs are not stored	None
Heated oxygen sensor heater circuit fail (P0037, P0038 and P102D)	Not detected
Battery voltage	10.5 V or higher
Fuel cut	OFF
Time after fuel cut ON to OFF	30 seconds or more
Accumulated heater ON time	100 seconds or more
Learned heater OFF current operation	Completed
Duration that rear heated oxygen sensor impedance is less than 15 kΩ	2 seconds or more

P102D

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Completed
Heated Oxygen sensor heater low current fail (P0037)	Not detected
Heated Oxygen sensor heater high current fail (P0038)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0037 (Case 1)

Heater ON current - Learned heater OFF current	0.15 A or less

P0037 (Case 2)

Heater ON current	1 A or less

P0038

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Heater current detected by heater monitor IC	4 A or higher
Command to heater output	ON

P0141 (Heater performance monitor check)

Accumulated heater resistance	Varies with sensor element temperature (Example: More than 23 Ω)

P102D

Heater ON current	Higher than 1 A

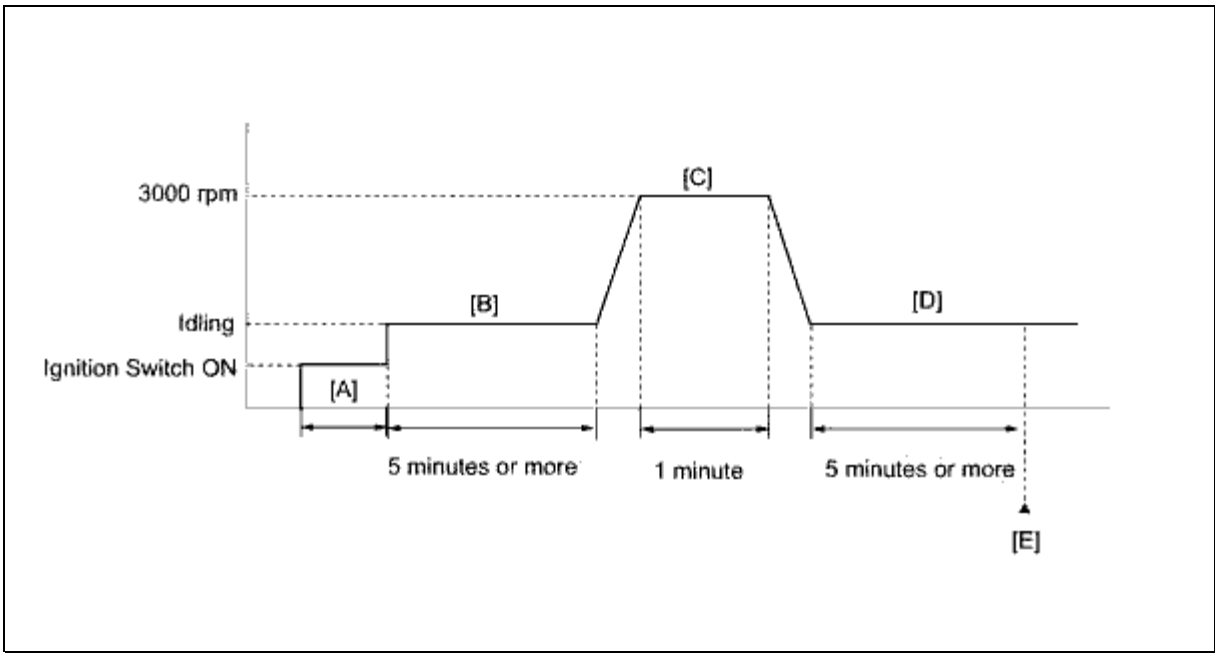
COMPONENT OPERATING RANGE

Heated oxygen sensor heater current	0.4 to 1 A (when engine idles, heated oxygen sensor warmed up and battery voltage 11 to 14 V)

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and idle it for 5 minutes or more [B].
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 3000 rpm for 1 minute [C].
8. Idle the engine for 5 minutes or more [D].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].

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10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0037, P0038, P0141 or P102D.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [E] again.

14. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0031 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- When the values for the Data List items O2 Heater Curr Val B1S2 is not 0 A, the heater is on.
- Refer to "Data List / Active Test" [O2 Heater B1S2 and O2 Heater Curr Val B1S2] INFO .
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

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- Change the fuel injection volume using the Control the Injection Volume function provided in the Active Test and monitor the heated oxygen sensor output voltage INFO . If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

PROCEDURE

1.	**INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)**

(a) Inspect the heated oxygen sensor INFO .

HINT:

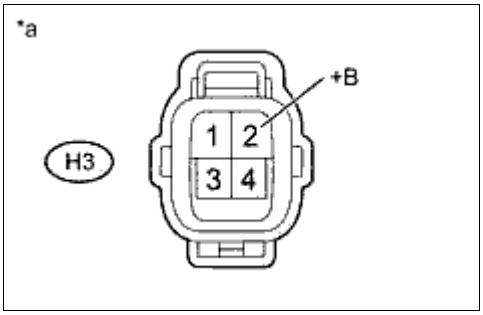
Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

NG ▶ **REPLACE HEATED OXYGEN SENSOR**

OK ▼

2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF HEATED OXYGEN SENSOR)**

(a) Disconnect the heated oxygen sensor connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
H3-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Heated Oxygen Sensor)

NG ▶ **GO TO STEP 5**

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OK

3.	**CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)**

(a) Disconnect the H3 heated oxygen sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
H3-1 (HT1B) - E18-7 (HT1B)	Always	Below 1 Ω
H3-1 (HT1B) or E18-7 (HT1B) - Body ground	Always	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0037, P0038, P0141 or P102D)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read pending DTCs.

Result

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RESULT	PROCEED TO
DTC is not output	A
DTC P0037, P0038, P0141 or P102D is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

5.	**CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - EFI-MAIN NO. 1 RELAY)**

(a) Disconnect the H3 heated oxygen sensor connector.

(b) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
H3-2 (+B) - 3 (EFI-MAIN NO. 1 relay holder)	Always	Below 1 Ω
H3-2 (+B) or 3 (EFI-MAIN NO. 1 relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000UBW019X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0101; Mass Air Flow Circuit Range / Performance Problem; 2016 MY Tacoma [08/2015 -]		

DTC	**P0101**	**Mass Air Flow Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0102 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0101	Conditions (a), (b), (c), (d) and (e) are met (2 trip detection logic): (a) Engine running (b) Engine coolant temperature 70°C (158°F) or higher (c) Throttle position sensor voltage 0.2 V or higher, and less than 2 V (d) Average engine load value ratio*1 less than 0.85, or higher than 1.18 (varies with estimated engine load) (for Automatic Transmission) Average engine load value ratio*1 less than 0.1, or higher than 3.5 (varies with estimated engine load) (for Manual Transmission) (e) Average air fuel ratio less than -20%, or more than 20%	• Mass air flow meter • Intake system • PCV hose connections

*1: Average engine load value ratio = Average engine load based on mass air flow meter output / Average engine load estimated from driving conditions

MONITOR DESCRIPTION

The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide an appropriate air fuel ratio. Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a specific temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the mass air flow meter. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The ECM monitors the average engine load value ratio to check the mass air flow meter for malfunctions. The average engine load value ratio is obtained by comparing the average engine load calculated from the mass air flow meter output to the average engine load estimated from the driving conditions, such as the engine speed and the throttle opening angle. If the average engine load value ratio is below the threshold value, the ECM determines that the intake air volume is low, and if the average engine load value ratio is above the threshold value, the ECM determines that the intake air volume is high.

If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is stored.

MONITOR STRATEGY

Related DTCs	P0101: Mass Air Flow Meter Rationality
Required Sensors/Components (Main)	Mass air flow meter

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Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor Throttle position sensor
Frequency of Operation	Continuous
Duration	10 times
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Throttle position (throttle position sensor)	0.2 V or higher, and less than 2 V
Time after engine start	5 seconds or more
Battery voltage	10.5 V or more
Engine coolant temperature	70°C (158°F) or higher
Estimated load	40% or more, and less than 70% (for Automatic Transmission) 30% or more, and less than 70% (for Manual Transmission)
Mass air flow meter sensor circuit fail (P0102, P0103)	Not detected
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118)	Not detected
Crankshaft position sensor circuit fail (P0335)	Not detected
Throttle position sensor circuit fail (P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135)	Not detected
EVAP system pressure sensor circuit fail (P0452, P0453)	Not detected
Leak detection pump fail (P2401, P2402)	Not detected
EVAP system vent valve fail (P2419, P2420)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

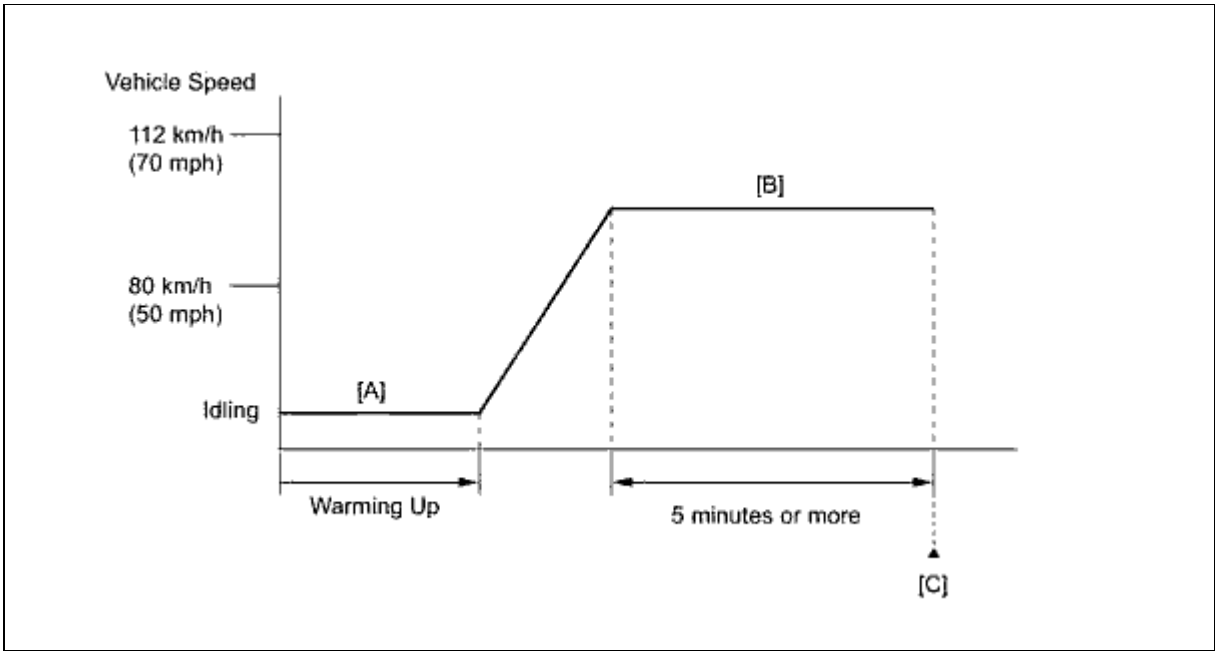
One of the following conditions is met	-
A. Average engine load value ratio	Less than 0.85 or higher than 1.18 (varies with estimated engine load) (for Automatic Transmission) Less than 0.1 or higher than 3.5 (varies with estimated engine load) (for Manual Transmission)
B. Average air fuel ratio	Less than -20% or more than 20%

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WIRING DIAGRAM

Refer to DTC P0102 INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or higher [A].
8. Drive the vehicle at approximately 80 km/h (50 mph) to 112 km/h (70 mph) for 5 minutes or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Drive while keeping the engine load as stable as possible.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0101.
13. Check the DTC judgment result.

TECHSTREAM	DESCRIPTION

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DISPLAY	
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] and [C] again.

14. If no pending DTC is output, perform a universal trip and check for permanent DTC INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0101)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

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RESULT	PROCEED TO
DTC P0101 is output	A
DTC P0101 and other DTCs are output	B

HINT:

If any DTCs other than P0101 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

▼

3.	**CHECK PCV HOSE CONNECTIONS**

(a) Check the PCV hose connections.

OK:

PCV valve and hose are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK

▼

4.	**REPLACE MASS AIR FLOW METER**

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(a) Replace the mass air flow meter.

HINT:

Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NEXT

5.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P0101.

(l) Check the DTC judgment.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM00000122J00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0102,P0103; Mass or Volume Air Flow Circuit Low Input; 2016 MY Tacoma [08/2015 -]		

DTC	**P0102**	**Mass or Volume Air Flow Circuit Low Input**

DTC	**P0103**	**Mass or Volume Air Flow Circuit High Input**

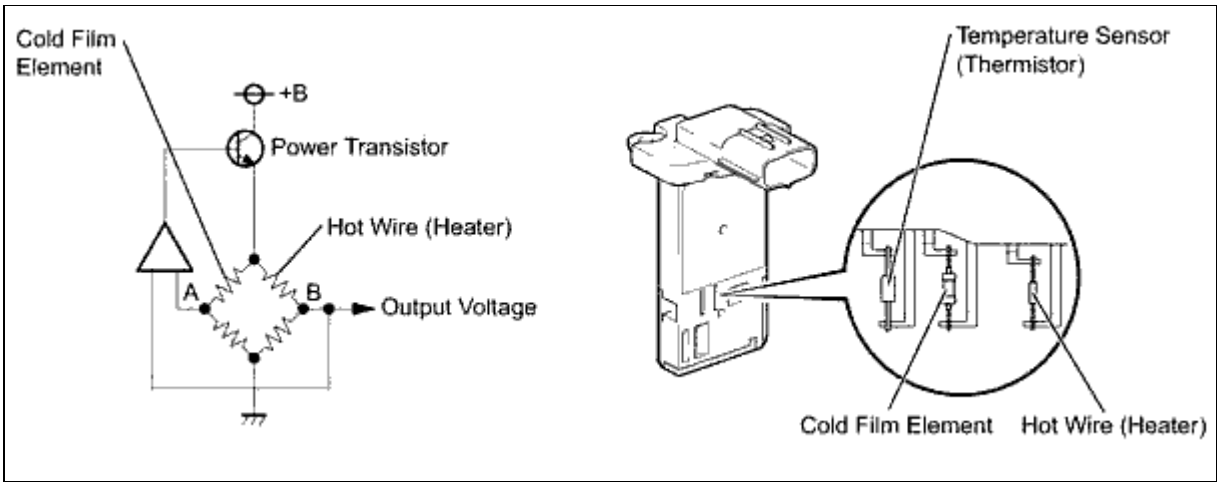
DESCRIPTION

The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide appropriate air fuel ratio. Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a given temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the wire and internal thermistor. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The circuit is constructed so that the platinum hot wire and the temperature sensor created a bridge circuit, and the power transistor is controlled so that the potentials of A and B remain equal to maintain the predetermined temperature.

HINT:

When any of these DTCs is stored, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM, according to the engine speed and throttle valve position. Fail-safe mode continues until a pass condition is detected.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0102	The mass air flow meter voltage is less than 0.2 V for 3 seconds. (1 trip detection logic: Engine speed is less than 4000 rpm)	• Open or short in mass air flow meter circuit • Mass air flow meter

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	(2 trip detection logic: Engine speed is 4000 rpm or more)	• ECM
P0103	The mass air flow meter voltage is higher than 4.9 V for 3 seconds. (1 trip detection logic: Engine speed is less than 4000 rpm) (2 trip detection logic: Engine speed is 4000 rpm or more)	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM

HINT:

When any of these DTCs are stored, check the air-flow rate by selecting the following menu items on the Techstream: Powertrain / Engine and ECT / Data List / MAF.

MASS AIR FLOW RATE (GM/SEC)	MALFUNCTION
Approximately 0.0	• Open in mass air flow meter power source circuit • Open or short in VG circuit
160.0 or more	Open in E2G circuit

MONITOR DESCRIPTION

If there is a defect in the mass air flow meter or an open or short circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the mass air flow meter and stores a DTC.

Example:

When the sensor voltage output remains less than 0.2 V, or higher than 4.9 V, for more than 3 seconds, the ECM stores a DTC.

If the malfunction is not repaired successfully, a DTC is stored 3 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0102: Mass Air Flow Meter Range Check (Low Voltage) P0103: Mass Air Flow Meter Range Check (High Voltage)
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate: Engine speed less than 4000 rpm 2 driving cycles: Engine speed 4000 rpm or more
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0102

Mass air flow meter voltage	Less than 0.2 V

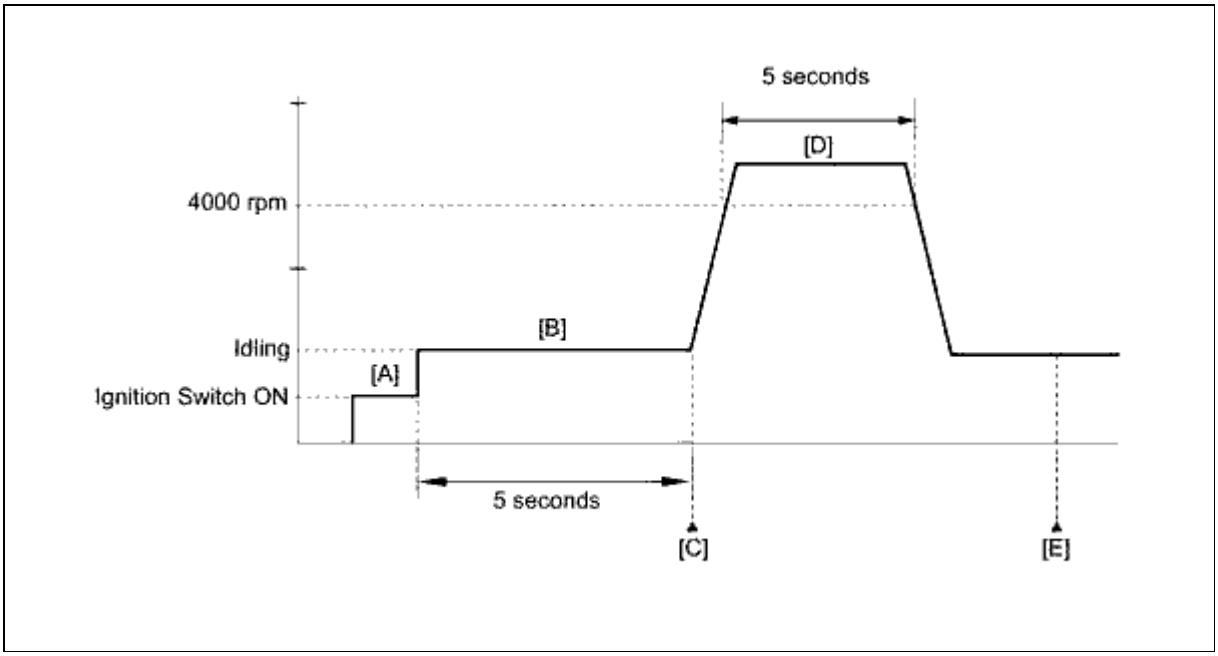
P0103

Mass air flow meter voltage	Higher than 4.9 V

COMPONENT OPERATING RANGE

Mass air flow meter voltage	Between 0.2 V and 4.9 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 5 seconds [B].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
9. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

10. Run the engine at an engine speed of 4000 rpm or more for 5 seconds [D].

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11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].
12. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0102 or P0103.
15. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [E] again.

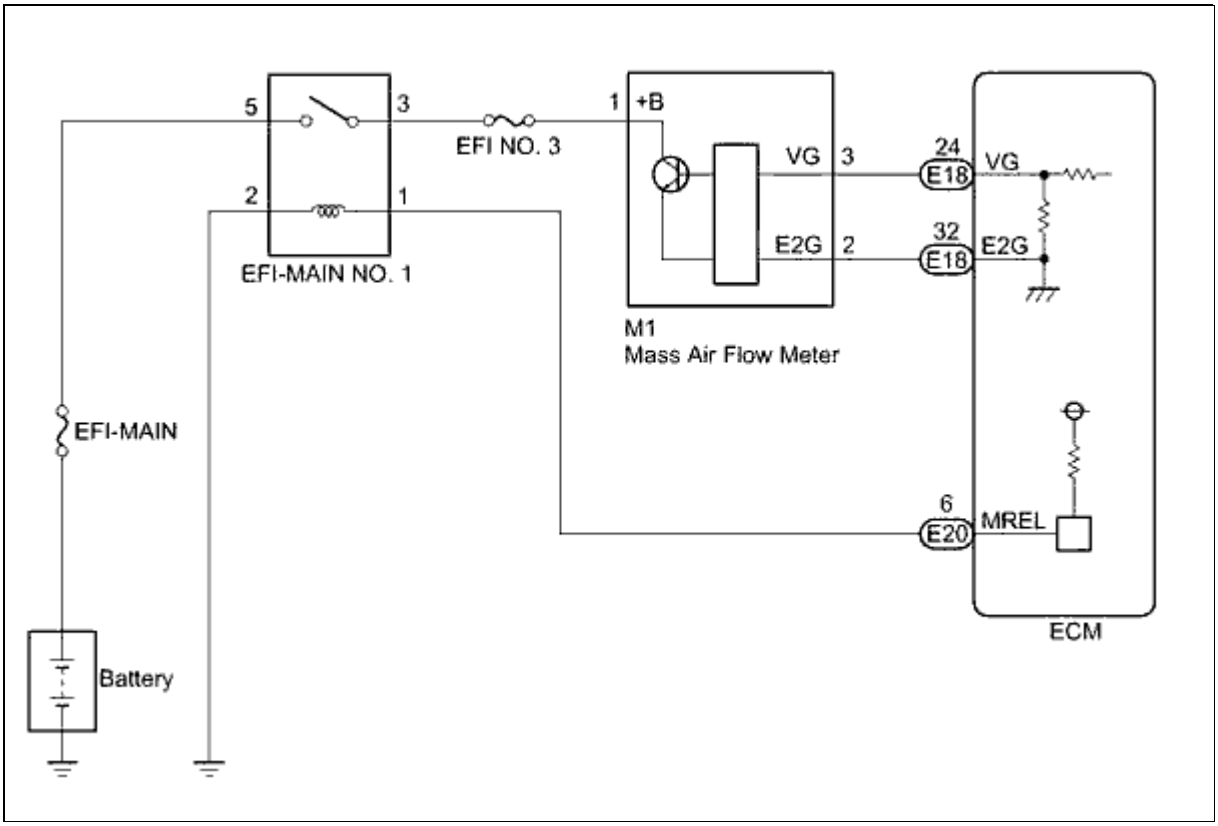
16. If the no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0102 is output	A

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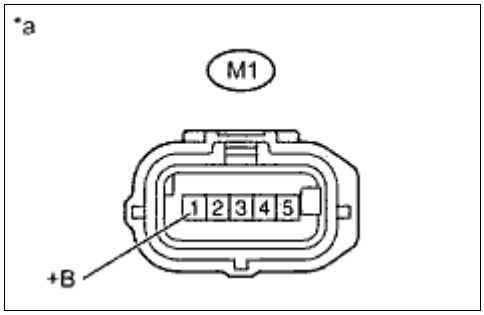
RESULT	PROCEED TO
DTC P0103 is output	B

B ▶ **GO TO STEP 5**

A
▼

2.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF MASS AIR FLOW METER)

(a) Disconnect the mass air flow meter connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
M1-1 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Mass Air Flow Meter)

NG ▶ **GO TO STEP 7**

OK
▼

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the M1 mass air flow meter connector.

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(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-3 (VG) - E18-24 (VG)	Always	Below 1 Ω
M1-2 (E2G) - E18-32 (E2G)	Always	Below 1 Ω
M1-3 (VG) or E18-24 (VG) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	INSPECT MASS AIR FLOW METER

(a) Inspect the mass air flow meter, referring to the On-vehicle Inspection for mass air flow meter INFO .

(b) Inspect the mass air flow meter, referring to the Inspection for mass air flow meter INFO .

(c) Inspect the function of the mass air flow meter.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON.

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(5) Start the engine.

(6) Check that the MAF value changes when the engine is raced.

OK:

The reading changes.

HINT:

Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NG ▶ **REPLACE MASS AIR FLOW METER**

OK ▶ **REPLACE ECM**

5.	CHECK HARNESS AND CONNECTOR (SENSOR GROUND)

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(a) Disconnect the M1 mass air flow meter connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-2 (E2G) - Body ground	Always	Below 1 Ω

HINT:

Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NG ▶ **GO TO STEP 6**

OK ▶ **REPLACE MASS AIR FLOW METER**

6.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

(a) Disconnect the M1 mass air flow meter connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-2 (E2G) - E18-32 (E2G)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

7.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - EFI-MAIN NO. 1 RELAY)**

(a) Disconnect the M1 mass air flow meter connector.

(b) Remove the EFI-MAIN NO. 1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-1 (+B) - 3 (EFI-MAIN NO. 1 relay holder)	Always	Below 1 Ω
M1-1 (+B) or 3 (EFI-MAIN NO. 1 relay holder) - Body ground	Always	10 kΩ or higher

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

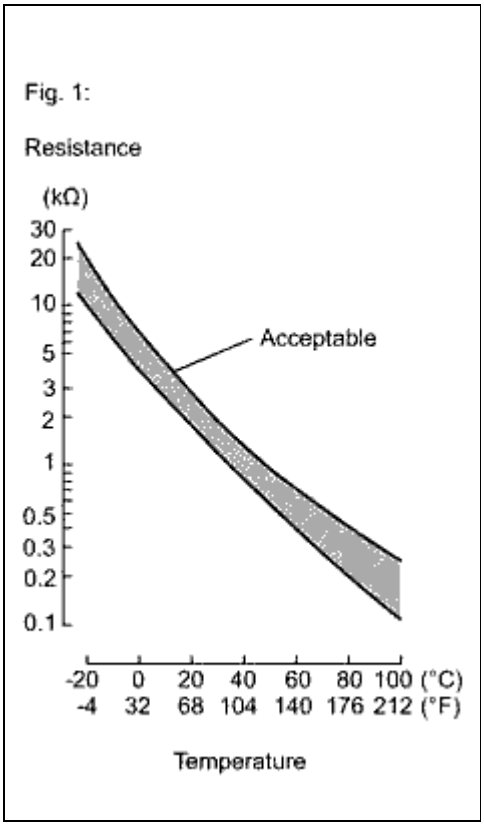
OK ▶ CHECK ECM POWER SOURCE CIRCUIT

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000001WPH09SX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0111; Intake Air Temperature Sensor Gradient Too High; 2016 MY Tacoma [08/2015 -]		

DTC	**P0111**	**Intake Air Temperature Sensor Gradient Too High**

DESCRIPTION



The intake air temperature sensor, mounted on the mass air flow meter, monitors the intake air temperature sensor. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature sensor is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (see Fig. 1).

The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R.

Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, the voltage at terminal THA also varies accordingly. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0111	Either condition below is met (2 trip detection logic): 1. The intake air temperature change, from the previous trip warm-up to the following trip is small.	Mass air flow meter

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	2. The change in the intake air temperature after engine start is less than the threshold value.	

MONITOR DESCRIPTION

After warmed engine stop

The ECM monitors the intake air temperature variation in the period from when the engine was warmed up on the previous trip until the next engine start. If the change in engine coolant temperature sensor output is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected, the MIL is illuminated and the DTC is stored.

After cold engine start

The monitor runs when the engine is started cold after 5 hours or more have elapsed since the engine stopped. If the intake air temperature sensor output variation until the engine has warmed up completely is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is stored.

MONITOR STRATEGY

Related DTCs	P0111: Intake Air Temperature Sensor Rationality (After Engine Stop) P0111: Intake Air Temperature Sensor Rationality (After Cold Engine Start)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	-
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

After Engine Stop

Time after engine start	10 seconds or more
Battery voltage	10.5 V or higher
Engine coolant temperature at ECM started by soak timer	-40°C (-40°F) or higher
Engine coolant temperature before engine stop	70°C (158°F) or higher

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Accumulated mass air flow amount before engine stop	1705 g or more (for Automatic Transmission) 2000050 g or more (for Manual Transmission)
Key-off duration	30 minutes
Mass air flow meter circuit fail (P0102, P0103)	Not detected
Engine coolant temperature sensor circuit (P0115, P0117, P0118)	Not detected
Intake air temperature circuit fail (P0112, P0113)	Not detected
Soak timer circuit fail (P2610)	Not detected

After Cold Engine Start

Key-off duration	5 hours
Time after engine start	10 seconds or more
Engine coolant temperature	70°C (158°F) or higher
Accumulated mass air flow amount	1705 g or more (for Automatic Transmission) 2000050 g or more (for Manual Transmission)
Either of the following conditions 1 or 2 is met:	-
1. Duration while engine load is low	120 seconds or more
2. Duration while engine load is high	10 seconds or more
Mass air flow meter circuit fail (P0102, P0103)	Not detected
Engine coolant temperature sensor circuit (P0115, P0117, P0118)	Not detected
Intake air temperature circuit fail (P0112, P0113)	Not detected
Soak timer circuit fail (P2610)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

After Engine Stop

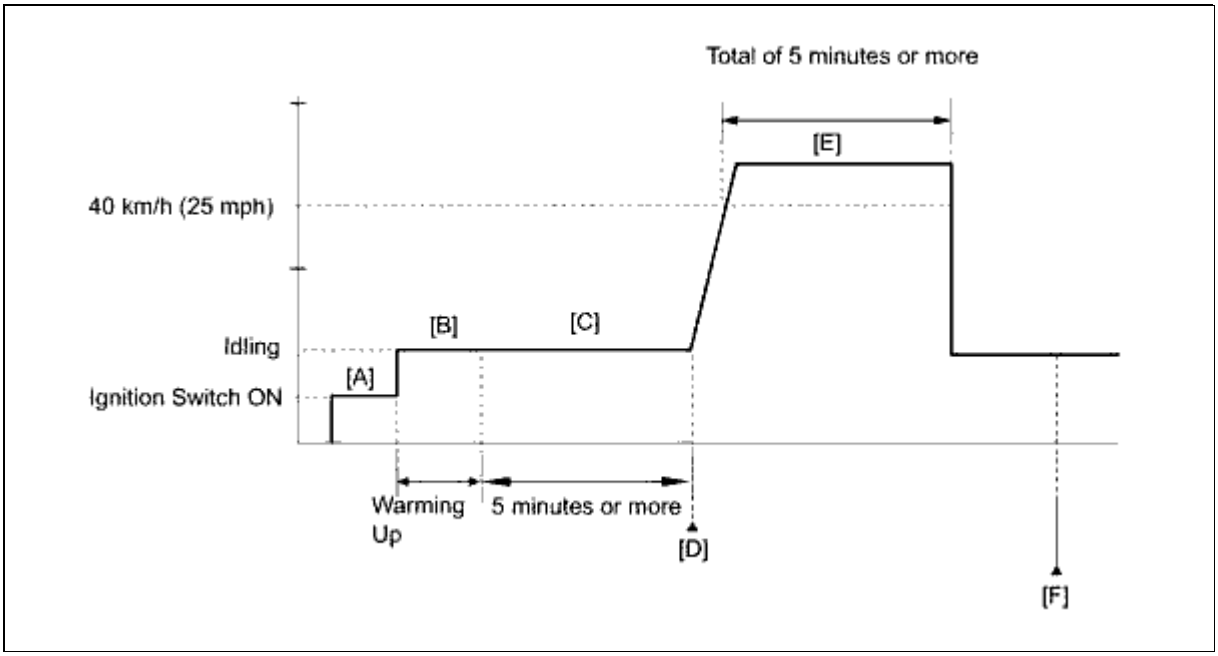
Intake air temperature change	Less than 1°C (2°F)

After Cold Engine Start

Intake air temperature change	Less than 1°C (2°F)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. Idle the engine for 5 minutes or more [C].

HINT:

During steps [A] through [C], if the change in the intake air temperature is below 1°C (1.8°F), the intake air temperature sensor (mass air flow meter) is malfunctioning. It is not necessary to continue this procedure.

8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0111.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [E] and [F].

13. Drive the vehicle at 40 km/h (25 mph) or more for a total of 5 minutes or more [E].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

14. Check the DTC judgment result again [F].

HINT:

If the judgment result shows INCOMPLETE or N/A, perform steps [E] and [F] again.

15. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0112 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0111)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0111 and other DTCs are output	A
DTC P0111 is output	B

HINT:

If any DTCs other than P0111 are output, troubleshoot those DTCs first.

B ▶ **REPLACE MASS AIR FLOW METER**

A ▶ **GO TO DTC CHART**





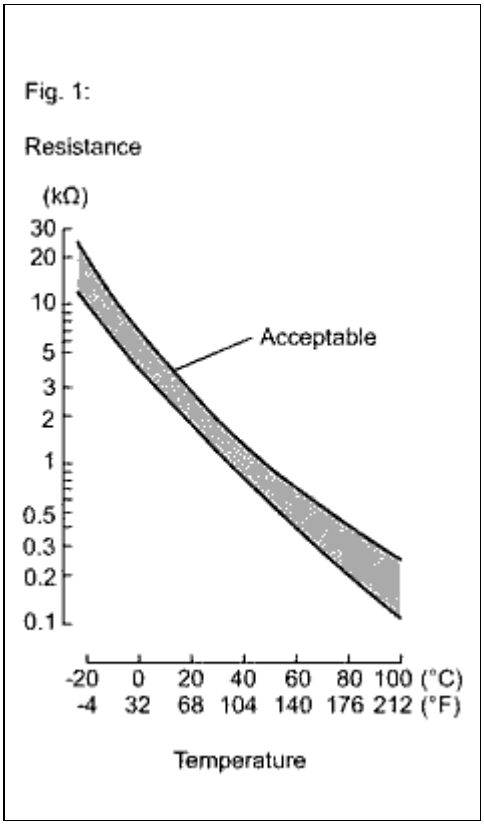
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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000UBX01VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0112,P0113; Intake Air Temperature Circuit Low Input; 2016 MY Tacoma [08/2015 -]		

DTC	**P0112**	**Intake Air Temperature Circuit Low Input**

DTC	**P0113**	**Intake Air Temperature Circuit High Input**

DESCRIPTION



The intake air temperature sensor, built into the mass air flow meter, monitors the intake air temperature. The intake air temperature sensor has a thermistor that varies its resistance depending on the intake air temperature. When the intake air temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected as voltage changes to the ECM terminal (see Fig. 1).

The intake air temperature sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the intake air temperature sensor from terminal THA via resistor R.

Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature sensor, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve drivability.

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HINT:

When any of DTCs P0112 and P0113 are stored, the ECM enters fail-safe mode. During fail-safe mode, the intake air temperature sensor is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0112	A short in the intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM
P0113	An open in the intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM

HINT:

When any of these DTCs are stored, check the intake air temperature using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

TEMPERATURE DISPLAYED	MALFUNCTIONS
-40°C (-40°F)	Open circuit
Higher than 128°C (262°F)	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the intake air temperature sensor and stores the DTC.

Example:

If the sensor voltage output is higher than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the intake air temperature sensor circuit, and stores DTC P0113. Conversely, if the voltage output is less than 0.18 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and stores DTC P0112.

If the malfunction is not repaired successfully, a DTC is stored 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0112: Intake Air Temperature Sensor Range Check (Low Voltage) P0113: Intake Air Temperature Sensor Range Check (High Voltage)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous

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Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever these DTCs are not stored	None
All of the following conditions are met	-
Battery voltage	8 V or higher
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0112

Intake air temperature sensor voltage [Intake air temperature]	Less than 0.18 V [Higher than 128°C (262°F)]

P0113

Intake air temperature sensor voltage [Intake air temperature]	Higher than 4.91 V [Less than -55°C (-67°F)]

COMPONENT OPERATING RANGE

Intake air temperature sensor voltage [intake air temperature]	0.18 V to 4.91 V [-55 to 128°C (-67 to 262°F)]

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 0.5 seconds or more.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0112 or P0113.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed

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TECHSTREAM DISPLAY	DESCRIPTION
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

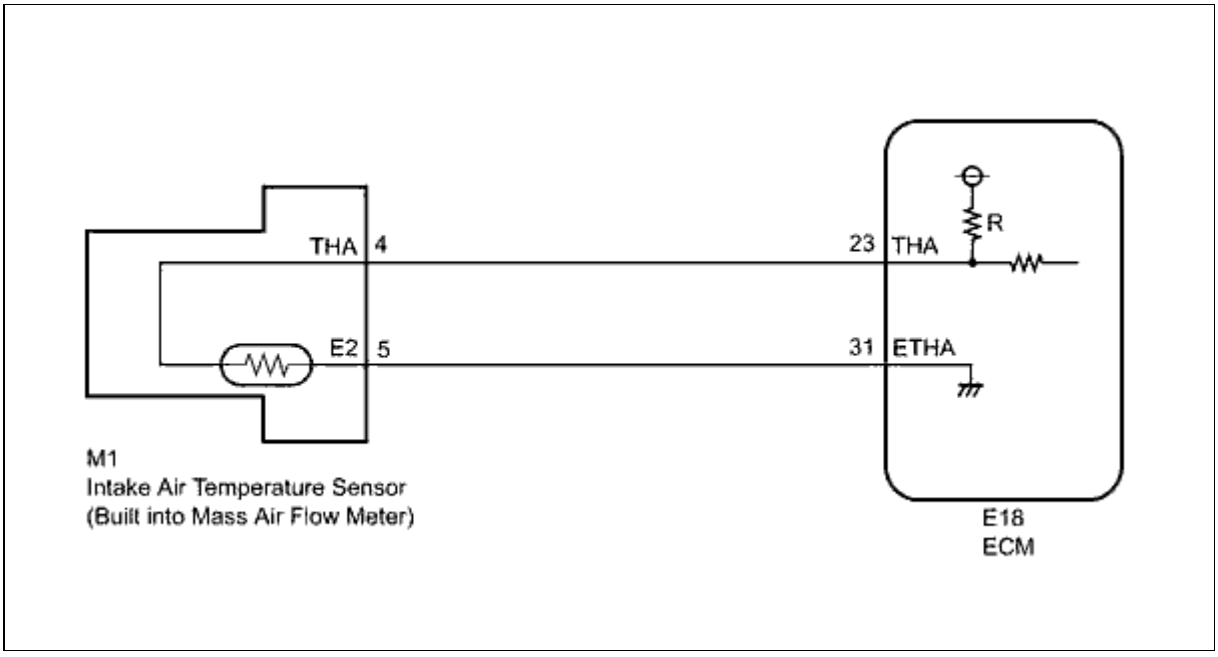
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was

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running or stopped, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

(e) Read the value displayed on the Techstream.

Standard value:

Same value as actual intake air temperature.

Result

RESULT	PROCEED TO
-40°C (-40°F)	A
Higher than 128°C (262°F)	B
Same as actual intake air temperature	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates higher than 128°C (262°F).

B ▶ **GO TO STEP 4**

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)**

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(a) Disconnect the mass air flow meter connector.

(b) Connect terminals M1-4 (THA) and M1-5 (E2) of the mass air flow meter connector on the wire harness side.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

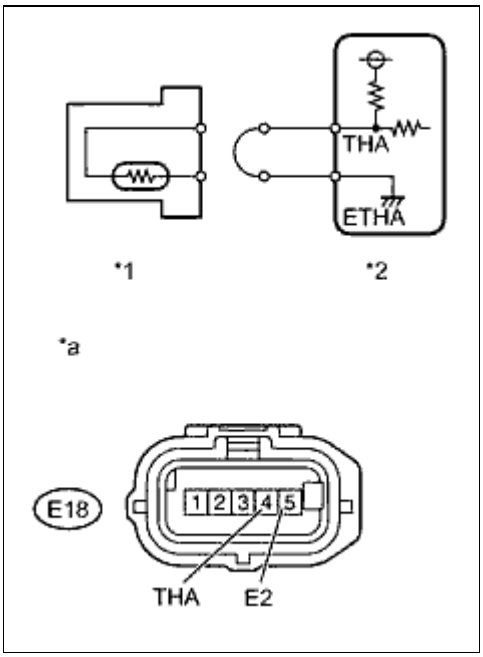
(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

(g) Read the value displayed on the Techstream.

Standard value:

Higher than 128°C (262°F)



Text in Illustration

*1	Mass Air Flow Meter
*2	ECM
*a	Front view of wire harness connector (to Mass Air Flow Meter)

HINT:

Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NG ▶ **GO TO STEP 3**

OK ▶ **REPLACE MASS AIR FLOW METER**

3.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

(a) Disconnect the M1 mass air flow meter connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-4 (THA) - E18-12 (THA)	Always	Below 1 Ω
M1-5 (E2) - E18-11(ETHA)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK ▶ **REPLACE ECM**

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)

(a) Disconnect the M1 mass air flow meter connector.

(b) Connect the Techstream to the DLC3.

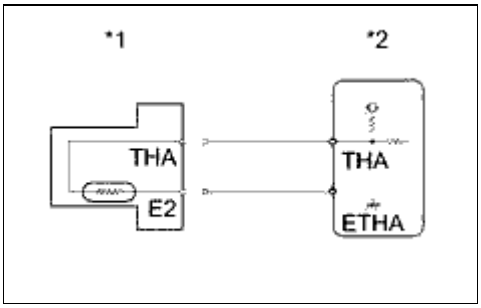
(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

(f) Read the value displayed on the Techstream.

Standard value:
-40°C (-40°F)



Text in Illustration

*1	Mass Air Flow Meter
*2	ECM

HINT:

Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NG ▶ **GO TO STEP 5**

OK ▶ **REPLACE MASS AIR FLOW METER**

5.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the M1 mass air flow meter connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
M1-4 (THA) or E18-12 (THA) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000UCS01UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0115,P0117,P0118; Engine Coolant Temperature Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0115**	**Engine Coolant Temperature Circuit**

DTC	**P0117**	**Engine Coolant Temperature Circuit Low Input**

DTC	**P0118**	**Engine Coolant Temperature Circuit High Input**

DESCRIPTION

A thermistor is built into the engine coolant temperature sensor, of which the resistance value varies according to the engine coolant temperature.

The structure of the sensor and connection to the ECM are the same as the intake air temperature sensor.

HINT:

When any of DTCs P0115, P0117 and P0118 are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECT is estimated to be 80°C (176°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0115	An open or short in the engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0117	A short in the engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0118	An open in the engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM

HINT:

When any of these DTCs are stored, check the ECT by electing the following menus on the Techstream: Powertrain / Engine and ECT / Data List / Coolant Temp.

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TEMPERATURE DISPLAYED	MALFUNCTION
-40°C (-40°F)	Open circuit
Higher than 135°C (275°F)	Short circuit

MONITOR DESCRIPTION

The engine coolant temperature sensor is used to monitor the engine coolant temperature. The engine coolant temperature sensor has a thermistor that varies its resistance depending on the temperature of the engine coolant. When the coolant temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected in the voltage output from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the engine coolant temperature sensor and stores the DTC.

Example:

If the sensor voltage output is higher than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the engine coolant temperature sensor circuit, and stores DTC P0118. Conversely, if the voltage output is less than 0.14 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and stores DTC P0117.

If the malfunction is not repaired successfully, a DTC is stored 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0115: Engine Coolant Temperature Sensor Range Check (Fluctuating) P0117: Engine Coolant Temperature Sensor Range Check (Low Voltage) P0118: Engine Coolant Temperature Sensor Range Check (High Voltage)
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0115

Engine coolant temperature sensor voltage	Less than 0.14 V, or higher than 4.91 V [Higher than 135°C (275°F), or Less than -60°C (-76°F)]

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P0117

Engine coolant temperature sensor voltage [Engine coolant temperature]	Less than 0.14 V [Higher than 135°C (275°F)]

P0118

Engine coolant temperature sensor voltage [Engine coolant temperature]	Higher than 4.91 V [Less than -60°C (-76°F)]

COMPONENT OPERATING RANGE

Engine coolant temperature sensor voltage [Engine coolant temperature]	0.14 V to 4.91 V [-60 to 135°C (-76 to 275°F)]

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 0.5 seconds or more.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0115, P0117 or P0118.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

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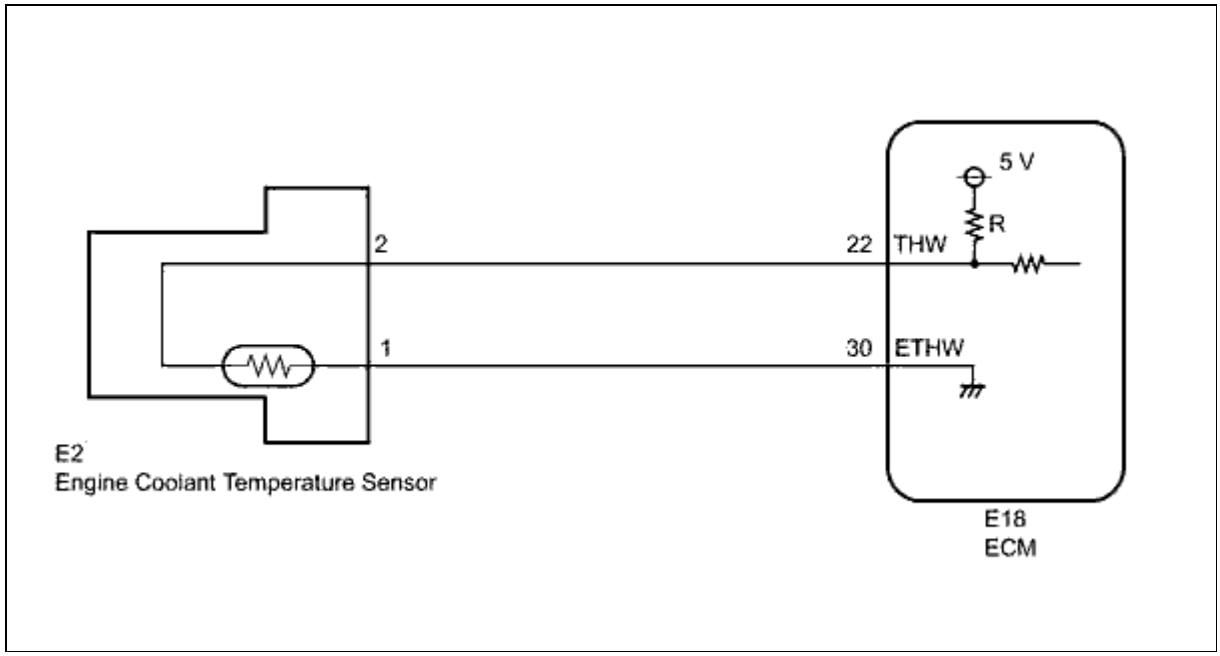
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If DTC P0117 is stored, check that the engine does not overheat (the DTC P0117 may be stored due to engine overheating).

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE COOLANT TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the value displayed on the Techstream.

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Standard value:

Between 75°C and 100°C (167°F and 212°F) with warm engine.

Result

RESULT	PROCEED TO
-40°C (-40°F)	A
Higher than 135°C (275°F)	B
Between 75°C and 100°C (167°F and 212°F)	C

HINT:

If there is an open circuit, the Techstream indicates -40°C (-40°F).

If there is a short circuit, the Techstream indicates higher than 135°C (275°F).

B ▶ **GO TO STEP 4**

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)

(a) Disconnect the engine coolant temperature sensor connector.

(b) Connect terminals E2-1 and E2-2 of the engine coolant temperature sensor connector on the wire harness side.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

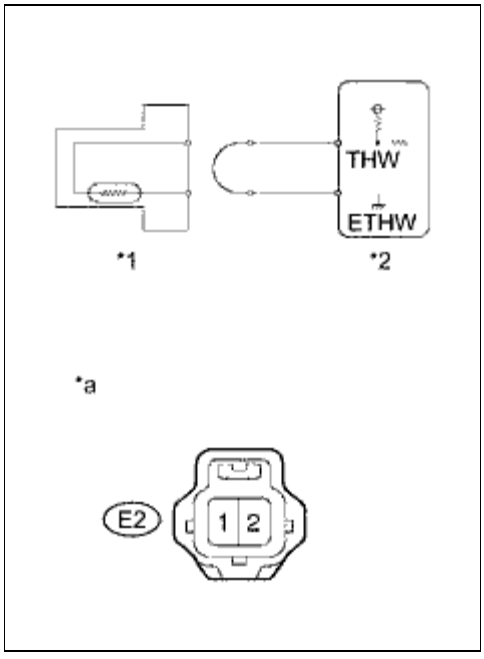
(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(g) Read the value displayed on the Techstream.

Standard value:

Higher than 135°C (275°F)



Text in Illustration

*1	Engine Coolant Temperature Sensor
*2	ECM

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*a	Front view of wire harness or connector (to Engine Coolant Temperature Sensor)

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **GO TO STEP 3**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

3.	**CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

(a) Disconnect the E2 engine coolant temperature sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E2-2 - E18-22 (THW)	Always	Below 1 Ω
E2-1 - E18-30 (ETHW)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

4.	**READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)**

(a) Disconnect the E2 engine coolant temperature sensor connector.

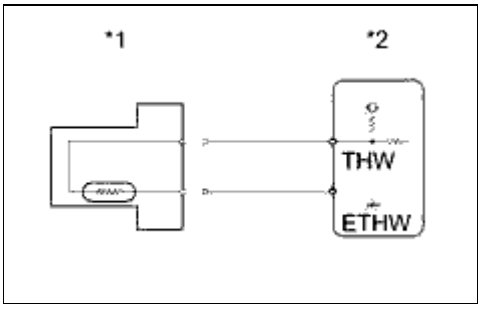
(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(f) Read the value displayed on the Techstream.



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Standard value:

-40°C (-40°F)

Text in Illustration

*1	Engine Coolant Temperature Sensor
*2	ECM

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **GO TO STEP 5**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

5.	**CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

(a) Disconnect the E2 engine coolant temperature sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E2-2 or E18-22 (THW) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000YDB01YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0116; Engine Coolant Temperature Circuit Range / Performance Problem; 2016 MY Tacoma [08/2015 -]		

DTC	**P0116**	**Engine Coolant Temperature Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0115 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0116	When either of following conditions are met (2 trip detection logic): • When cold engine started and engine warmed up, engine coolant temperature sensor value does not change. • After warmed up engine stopped and then next cold engine start performed, engine coolant temperature sensor value does not change.	• Thermostat • Engine coolant temperature sensor

MONITOR DESCRIPTION

Engine Coolant Temperature Sensor Cold Start Monitor

When a cold engine start is performed and then the engine is warmed-up, if the engine coolant temperature sensor value does not change, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is stored.

Engine Coolant Temperature Sensor Soak Monitor

If the engine coolant temperature sensor value does not change after the warmed up engine is stopped and then the next cold engine start is performed, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is stored.

MONITOR STRATEGY

Related DTCs	P0116: Engine Coolant Temperature Sensor Cold Start Monitor P0116: Engine Coolant Temperature Sensor Soak Monitor
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	Crankshaft position sensor Intake air temperature sensor Mass air flow meter
Frequency of Operation	Once per driving cycle
Duration	-: Cold start monitor 10 seconds: Soak monitor
MIL Operation	2 driving cycles

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Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

Engine Coolant Temperature Sensor Cold Start Monitor

Battery voltage	10.5 V or higher
Time after engine start	1 second or more
Engine coolant temperature at engine start	Less than 60°C (140°F)
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118, P0125)	Not detected
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Thermostat fail (P0128)	Not detected
Soak time	0 seconds or more
Accumulated mass air flow	4944 g or more (for Automatic Transmission) 900 g or more (for Manual Transmission)
Fuel cut	OFF
Difference between engine coolant temperature at engine start and intake air temperature	Less than 40°C (72°F)

Engine Coolant Temperature Sensor Soak Monitor

Battery voltage	10.5 V or higher
Engine	Running
Soak time	5 hours or more
Either condition (a) or (b) met	-
(a) Engine coolant temperature	60°C (140°F) or higher
(b) Accumulated mass air flow	9888 g or more (for Automatic Transmission) 5000 g or more (for Manual Transmission)
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118, P0125)	Not detected
Thermostat fail (P0128)	Not detected
Soak timer circuit fail (P2610)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

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Engine Coolant Temperature Sensor Cold Start Monitor

Engine coolant temperature sensor value change	Less than 5°C (9°F)

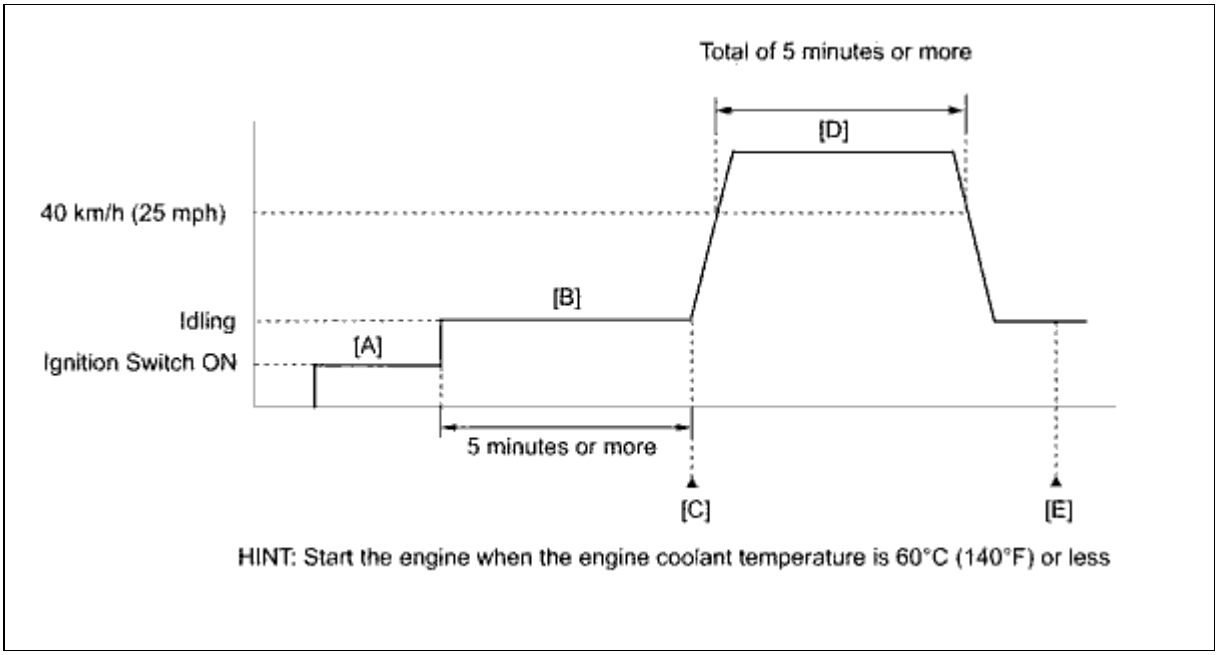
Engine Coolant Temperature Sensor Soak Monitor

Difference between current engine coolant temperature sensor value and previous engine coolant temperature sensor value when engine stopped	Less than 5°C (9°F) [varies with engine coolant temperature of last trip engine stop]

COMPONENT OPERATING RANGE

Engine coolant temperature	Engine coolant temperature sensor value changes in accordance with actual engine coolant temperature

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
4. Check that the engine coolant temperature is 60°C (140°F) or less.
5. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
6. Turn the ignition switch off and wait for at least 30 seconds.
7. Turn the ignition switch to ON and turn the Techstream on [A].
8. Start the engine and idle it for 5 minutes or more [B].

HINT:

If the engine coolant temperature does not change by 5°C (9°F) or higher, the engine coolant temperature sensor is malfunctioning. It is not necessary to continue this procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
10. Read pending DTCs.

HINT:

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- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0116.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [D] and [E].

14. Drive the vehicle at 40 km/h (25 mph) or more for a total of 5 minutes or more [D].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

In the event of the drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed.

15. Check the DTC judgment result again [E].

HINT:

If the judgment result shows INCOMPLETE or N/A, perform steps [D] and [E] again.

16. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0115 INFO .

INSPECTION PROCEDURE

HINT:

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- If any of DTCs P0115, P0117, P0118 or P0125 are stored simultaneously with DTC P0116, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- When the DTC is output, check the engine coolant temperature using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp. If the Coolant Temp value is lower than the actual engine coolant temperature, the engine coolant temperature sensor circuit may be malfunctioning. In this case, check the wire harnesses and connectors (and those connections) between the ECM and the engine coolant temperature sensor first.

PROCEDURE

1.	**CHECK ANY OTHER DTC OUTPUT (IN ADDITION TO DTC P0116)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0116 is output	A
DTC P0116 and other DTCs are output	B

HINT:

If any DTCs other than P0116 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**INSPECT THERMOSTAT**

(a) Check the valve opening temperature of the thermostat INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **REPLACE THERMOSTAT**

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OK ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000010BK0JYX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P011B; Engine Coolant Temperature / Intake Air Temperature Correlation; 2016 MY Tacoma [08/2015 -]		

DTC	**P011B**	**Engine Coolant Temperature / Intake Air Temperature Correlation**

DESCRIPTION

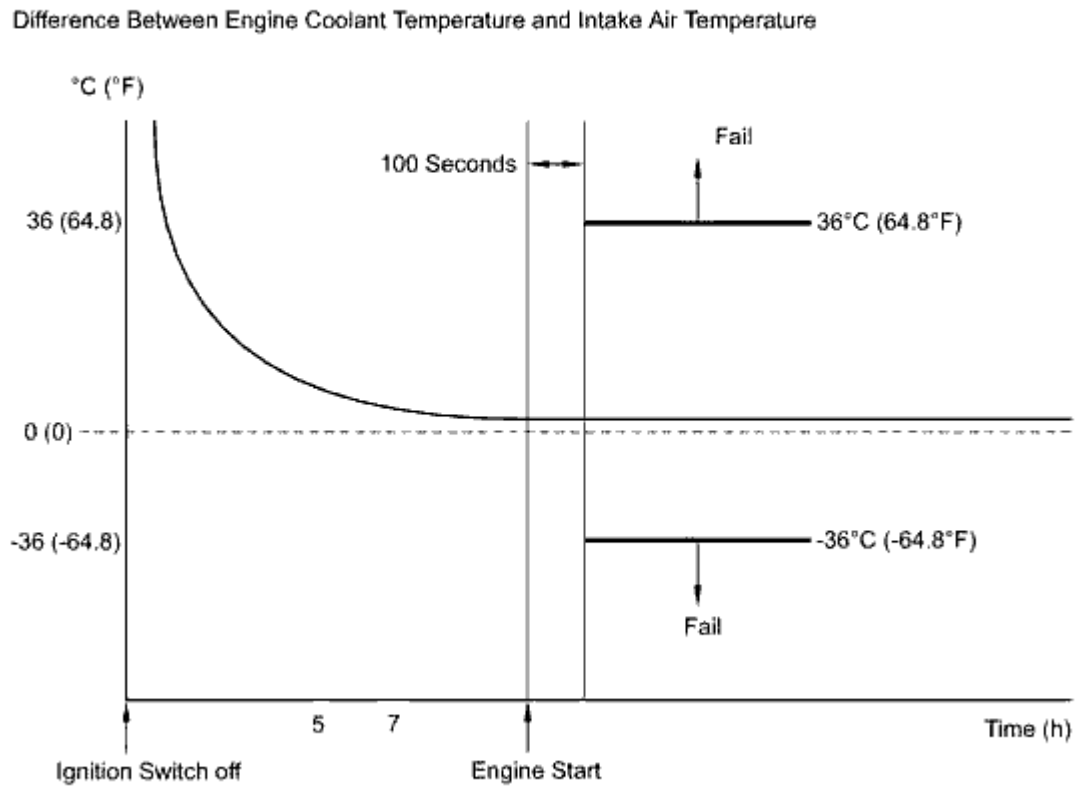
The engine has two temperature sensors, an engine coolant temperature sensor and an intake air temperature sensor, to detect the temperature while the engine is in operation. A thermistor, whose resistance value varies according to the temperature, is built into each sensor. When the temperature is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes. Based on these temperature signals output from the sensors, the ECM determines the fuel injection time and the ignition timing to control the engine.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P011B	**for Automatic Transmission** All of following conditions are met: (2 trip detection logic) a. Battery voltage 10.5 V or higher b. 7 hours or more elapsed from engine stops on previous trip c. 100 seconds after cold engine starts d. Either of the following conditions is met: i. The minimum intake air temperature after engine starts -10°C (14°F) or higher) ii. The engine coolant temperature before engine starts -10°C (14°F) or higher e. The difference between readings of engine coolant temperature and intake air temperature is higher than 36°C (64.8°F). **for Manual Transmission** All of following conditions are met: (2 trip detection logic) a. Battery voltage 10.5 V or higher b. 7 hours or more elapsed from engine stops on previous trip c. 15 seconds after cold engine starts d. Either of the following conditions is met: i. The minimum intake air temperature after engine starts -10°C (14°F) or	• Intake air temperature sensor (built into mass air flow meter) • Engine coolant temperature sensor • ECM

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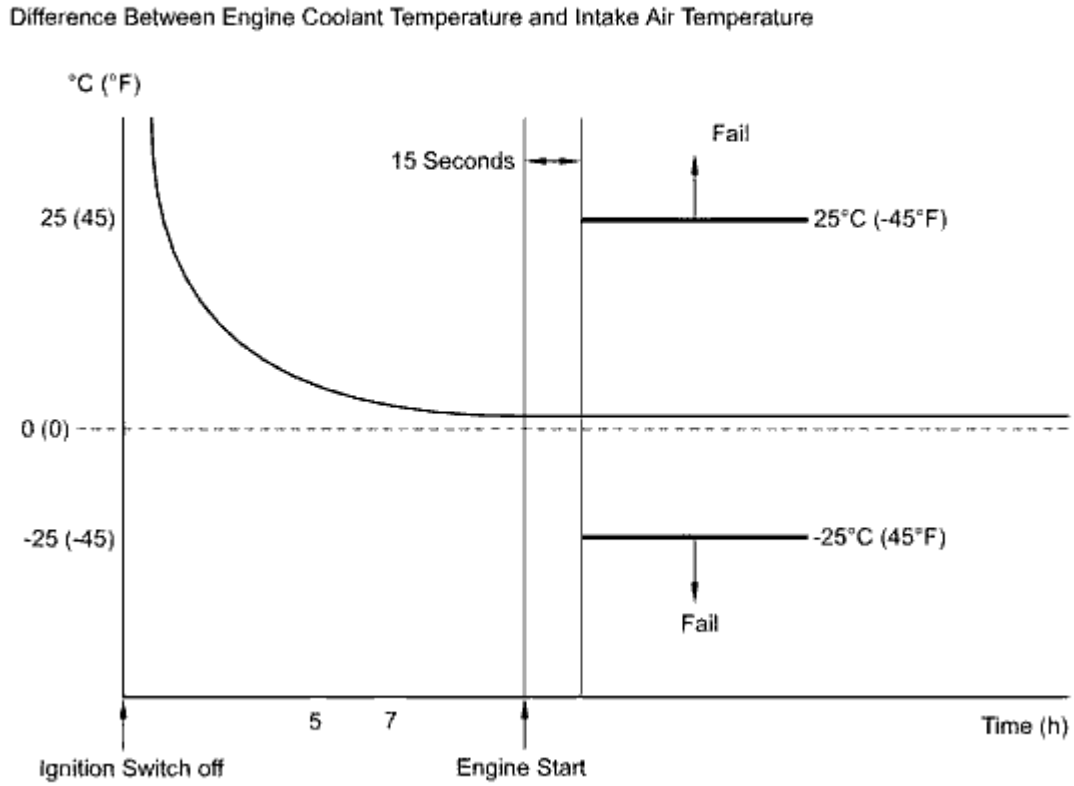
DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	higher) ii. The engine coolant temperature before engine starts -10°C (14°F) or higher e. The difference between readings of engine coolant temperature and intake air temperature is higher than 25°C (45°F).	

for Automatic Transmission:



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for Manual Transmission:



HINT:

- Waiting is required to prevent the temperature of the engine from affecting the readings. If the engine has been operated recently, it will not be possible to accurately compare the readings.
- For diagnosis, in order to duplicate the detection conditions of the DTC, it is necessary to park the vehicle for 7 hours. Parking the vehicle for 7 hours ensures that the actual temperature of the engine coolant temperature and intake air temperature are very similar. When the vehicle has been parked for less than 7 hours, differences in the readings may exist, but this does not necessarily indicate a fault.

MONITOR DESCRIPTION

for Automatic Transmission

The ECM monitors the difference between the engine coolant temperature and the intake air temperature when the engine is started cold to detect the engine temperature conditions. The monitor runs when the engine started cold after 7 hours or more has elapsed since the engine was stopped (ignition switch turned to OFF) on the previous trip. If the difference between the engine coolant temperature and the intake air temperature on a cold start exceeds 36°C (64.8°F), the ECM interprets this as a malfunction in the engine coolant temperature sensor circuit and intake air temperature sensor circuit, and stores the DTC.

for Manual Transmission

The ECM monitors the difference between the engine coolant temperature and the intake air temperature when the engine is started cold to detect the engine temperature conditions. The monitor runs when the engine started cold after 7 hours or more has elapsed since the engine was stopped (ignition switch turned to OFF) on the

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previous trip. If the difference between the engine coolant temperature and the intake air temperature on a cold start exceeds 25°C (45°F), the ECM interprets this as a malfunction in the engine coolant temperature sensor circuit and intake air temperature sensor circuit, and stores the DTC.

MONITOR STRATEGY

Related DTCs	P011B: Engine Coolant Temperature / Intake Air Temperature Sensor Correlation
Required Sensors/Components (Main)	Engine coolant temperature sensor Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	-
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

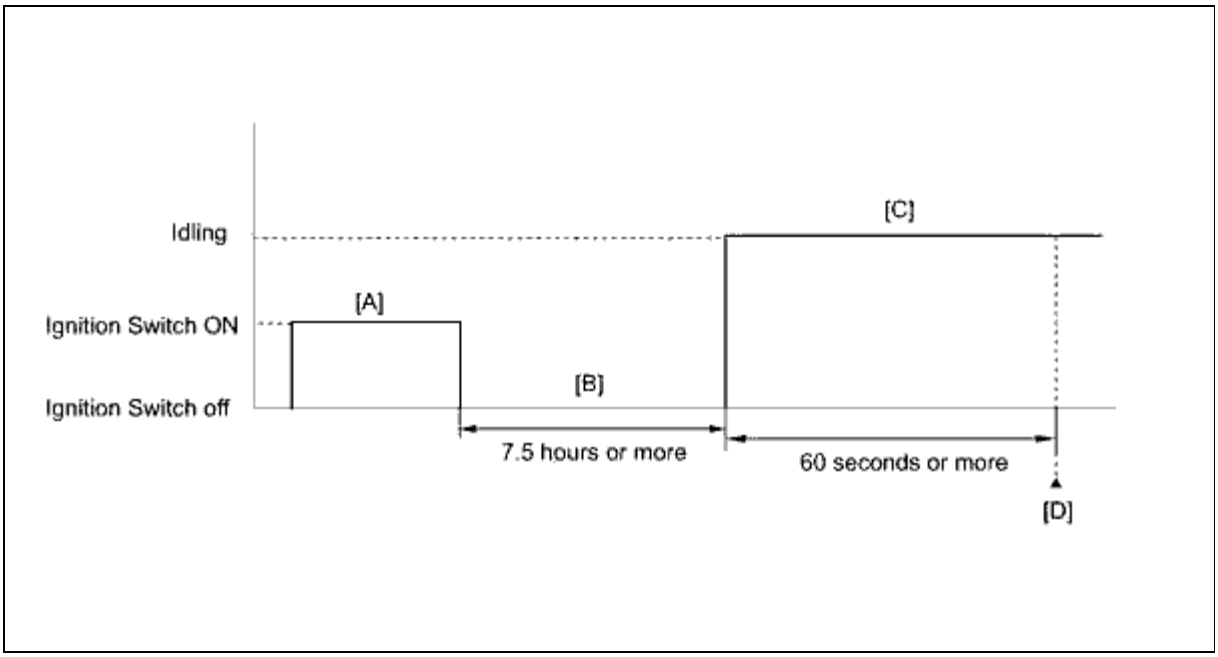
The monitor will run whenever these DTCs are not stored	None
All of following conditions met	Conditions 1 and 2
1. All of following conditions met	Conditions (a), (b), (c) and (d)
(a) After ignition switch ON and engine not running time	Less than 20 seconds
(b) Soak Time	7 hours or more
(c) Battery voltage	10.5 V or higher
(d) Time after engine start	100 seconds or more (for Automatic Transmission) 15 seconds or more (for Manual Transmission)
2. Either of the following conditions are met	Condition (a) and (b)
(a) Minimum intake air temperature after engine start	-10°C (14°F) or higher
(b) Engine coolant temperature before engine start	-10°C (14°F) or higher
3. Engine coolant temperature sensor circuit fail (P0115, P0117, P0118, P0125)	Not detected
4. Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
5. Soak timer circuit fail (P2610)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Deviated temperature (difference between engine coolant temperature and intake air temperature)	Less than -36°C (-64.8°F), or 36°C (64.8°F) or higher (for Automatic Transmission) Less than -25°C (-45°F), or 25°C (45°F) or higher (for Manual Transmission)

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) [A].
4. Turn the ignition switch off.
5. With the engine stopped, leave the vehicle as is for 7.5 hours or more [B].
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and wait 60 seconds or more [C].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P011B.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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TECHSTREAM DISPLAY	DESCRIPTION
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [A] through [D] again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P011B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P011B is output	A
DTC P011B and other DTCs are output	B

HINT:

If any DTCs other than P011B are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

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A

2.	**READ VALUE USING TECHSTREAM (INTAKE AIR)**

(a) Leave the vehicle for 7 hours or more.

HINT:

It is necessary leave the vehicle for 7 hours or more to allow conditions similar to the DTC detection conditions.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

(f) Read the value displayed on the Techstream.

Standard value:

Difference between the intake air temperature and the actual outside air temperature is within 10°C (18°F).

HINT:

- Temperature readings on the vehicle's outside temperature gauge (if equipped) are not suitable for comparing to the intake air temperature reading. The outside temperature gauge has a significant delay built in to prevent swings in the temperature display. Use an accurate thermometer to determine the outside air temperature.
- Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NG ▶ **REPLACE MASS AIR FLOW METER**

OK

3.	**READ VALUE USING TECHSTREAM (COOLANT TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Coolant Temp.

(e) Read the value displayed on the Techstream.

Standard value:

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The difference between the coolant temperature and the actual outside air temperature is within 10°C (18°F).

HINT:

- If the result is not as specified, check if there are heat sources such as a block heater in the engine compartment.
- Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000UII023X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0120-P0123,P0220,P0222,P0223,P2135; Throttle / Pedal Position Sensor / Switch "A" Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0120**	**Throttle / Pedal Position Sensor / Switch "A" Circuit**

DTC	**P0121**	**Throttle Pedal Position Sensor / Switch "A" Circuit Range / Performance**

DTC	**P0122**	**Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input**

DTC	**P0123**	**Throttle / Pedal Position Sensor / Switch "A" Circuit High Input**

DTC	**P0220**	**Throttle / Pedal Position Sensor / Switch "B" Circuit**

DTC	**P0222**	**Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input**

DTC	**P0223**	**Throttle / Pedal Position Sensor / Switch "B" Circuit High Input**

DTC	**P2135**	**Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation**

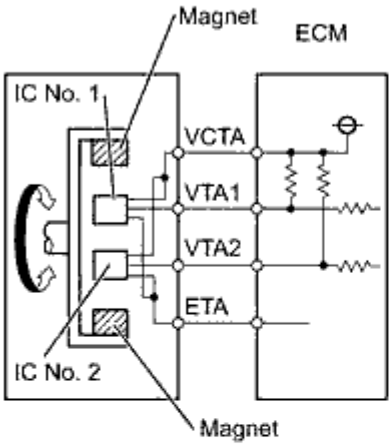
DESCRIPTION

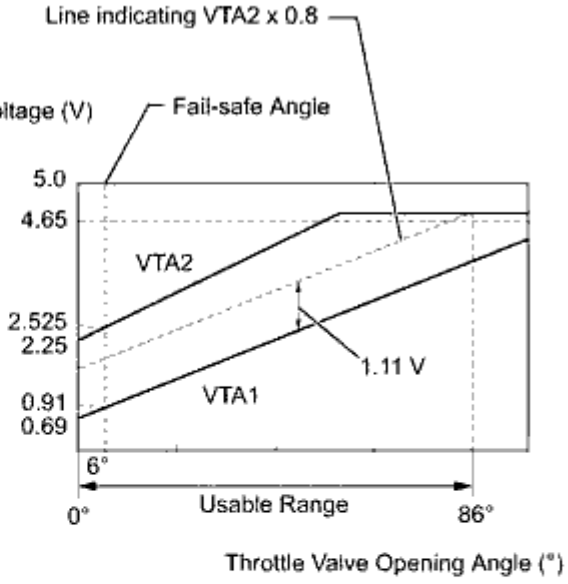
The throttle position sensor is mounted on the throttle body with motor assembly and detects the opening angle of the throttle valve. This sensor is a non-contact type. It uses Hall-effect elements in order to yield accurate signals even in extreme driving conditions, such as at high speeds as well as very low speeds. The throttle position sensor has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.

As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air fuel ratio correction, power increase correction and fuel-cut control.

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Throttle Position Sensor





Note:

The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as a percentage.

Between 10% and 22%: Throttle valve fully closed

Between 64% and 96%: Throttle valve fully open

Approximately 18.6%: Fail-safe angle (6°)

*: During fail-safe control

Characteristics of sensor output:

VTA2 × 0.8 is approximately equal to VTA1 + 1.11 V

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0120	The output voltage of VTA1 quickly fluctuates beyond the lower and upper malfunction thresholds for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • ECM
P0121	The difference between the VTA1 and VTA2 voltages is below 0.8 V or higher than 1.6 V or 2 seconds (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • Throttle position sensor circuit • ECM
P0122	The output voltage of VTA1 0.2 V or less for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • Short in VTA1 circuit

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Open in VC circuit • ECM
P0123	The output voltage of VTA1 4.535 V or higher for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuit • ECM
P0220	The output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • ECM
P0222	The output voltage of VTA2 1.75 V or less for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	The output voltage of VTA2 4.8 V or higher when VTA1 between 0.2 V and 2.02 V for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body with motor assembly) • Open in VTA2 circuit • Open in E2 circuit Short between VC and VTA2 circuit • ECM
P2135	Either condition (a) or (b) met (1 trip detection logic): (a) The difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more (b) The output voltage of VTA1 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	• Short between VTA1 and VTA2 circuit • Throttle position sensor (built into throttle body with motor assembly) • ECM

HINT:

- When any of these DTCs are output, check the throttle valve opening angle using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1 and Throttle Position No. 2.
- Throttle Position No. 1 is the VTA1 signal, and Throttle Position No. 2 is the VTA2 signal.

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Reference (Normal Condition):

TECHSTREAM DISPLAY	ACCELERATOR PEDAL FULLY RELEASED	ACCELERATOR PEDAL FULLY DEPRESSED
Throttle Position No. 1	0.5 to 1.1 V	3.2 to 4.8 V
Throttle Position No. 2	2.1 to 3.1 V	4.6 to 4.98 V

MONITOR DESCRIPTION

The ECM uses the throttle position sensor to monitor the throttle valve opening angle. There are several checks that the ECM performs to confirm the proper operation of the throttle position sensor.

P0120, P0122, P0123, P0220, P0222, P0223, P2135

- A specific voltage difference is expected between the sensor terminals, VTA1 and VTA2, for each throttle valve opening angle. If the difference between VTA1 and VTA2 is incorrect, the ECM interprets this as a malfunction in the sensor, and stores the DTC.
- VTA1 and VTA2 each have a specific voltage range. If VTA1 or VTA2 is outside the normal operating range, the ECM interprets this as a malfunction in the sensor, and stores the DTC.
- VTA1 and VTA2 should never be close to the same voltage level. If VTA1 is within 0.02 V of VTA2, the ECM determines that there is a short circuit in the sensor, and stores the DTC.

If the malfunction is not repaired successfully, a DTC is stored 10 seconds after the engine is next started.

P0121

The ECM uses the throttle position sensor to monitor the throttle valve opening angle.

This sensor transmits two signals: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1. The ECM performs several checks to confirm the proper operation of the throttle position sensor and VTA1.

For each throttle opening angle, a specific voltage difference is expected between the outputs of VTA1 and VTA2. If the voltage output difference between the two signals deviates from the normal operating range, the ECM interprets this as a malfunction of the throttle position sensor. The ECM illuminates the MIL and stores the DTC. If the malfunction is not repaired successfully, the DTC is stored 2 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0120: Throttle Position Sensor 1 Range Check (Fluctuating) P0121: Throttle Position Sensor Rationality P0122: Throttle Position Sensor 1 Range Check (Low Voltage) P0123: Throttle Position Sensor 1 Range Check (High Voltage) P0220: Throttle Position Sensor 2 Range Check (Fluctuating) P0222: Throttle Position Sensor 2 Range Check (Low Voltage) P0223: Throttle Position Sensor 2 Range Check (High Voltage) P2135: Throttle Position Sensor Range Check (Correlation)
Required Sensors/Components (Main)	Throttle position sensor
Required Sensors/Components (Related)	-
Frequency of operation	Continuous

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Duration	2 seconds: P0120, P0122, P0123, P0220, P0222 and P0223 Within 2 seconds: P0121 0.5 seconds: P2135 Case 1 0.4 seconds: P2135 Case 2
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

P0120, P0122, P0123, P0220, P0223, P2135

Monitor runs whenever following DTCs are not stored	None
One of the following conditions is met	-
A. Time after ignition switch OFF to ON	0.012 seconds or more
B. Command to electronic throttle actuator power	ON

P0121

Monitor runs whenever following DTCs are not stored	None
Either of following conditions met	A or B
A. Ignition switch	ON
B. Electronic throttle motor power	ON
Throttle position sensor circuit fail (P0120, P0122, P0123, P0220, P0222, P0223, P2135)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0120

VTA1 voltage	0.2 V or less, or 4.535 V or higher

P0121

Either of following conditions met	-
Difference of learned throttle position sensor opener position voltage between VTA2 and VTA1	Higher than 1.6 V
Difference of learned throttle position sensor opener position voltage between VTA2 and VTA1	Less than 0.8 V

P0122

VTA1 voltage	0.2 V or less

P0123

VTA1 voltage	4.535 V or higher

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P0220

One of the following conditions is met	-
A. VTA2 voltage	1.75 V or less
B. VTA2 voltage when the VTA1 0.2 V or higher, and 2.02 V or less	4.8 V or higher

P0222

VTA2 voltage	1.75 V or less

P0223

VTA2 voltage when the VTA1 0.2 V or higher, and 2.02 V or less	4.8 V or higher

P2135 Case 1

Difference between VTA1 and VTA2 voltage	0.02 V or less

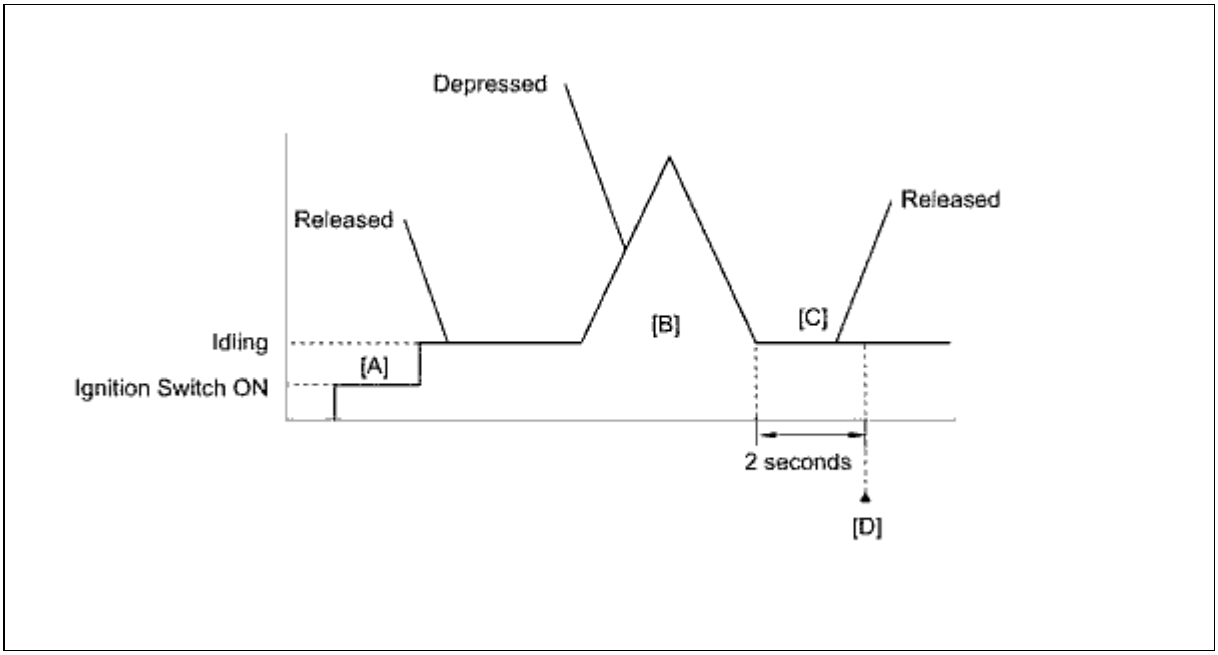
P2135 Case 2

VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

COMPONENT OPERATING RANGE

VTA1 voltage	Higher than 0.2 V, and less than 4.535 V
VTA2 voltage	Higher than 1.75 V, and less than 4.8 V

CONFIRMATION DRIVING PATTERN



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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. With the vehicle stationary, fully depress and release the accelerator pedal [B].
8. Idle the engine for 2 seconds or more [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0120, P0121, P0122, P0123, P0220, P0222, P0223 or P2135.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [D] again.

14. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

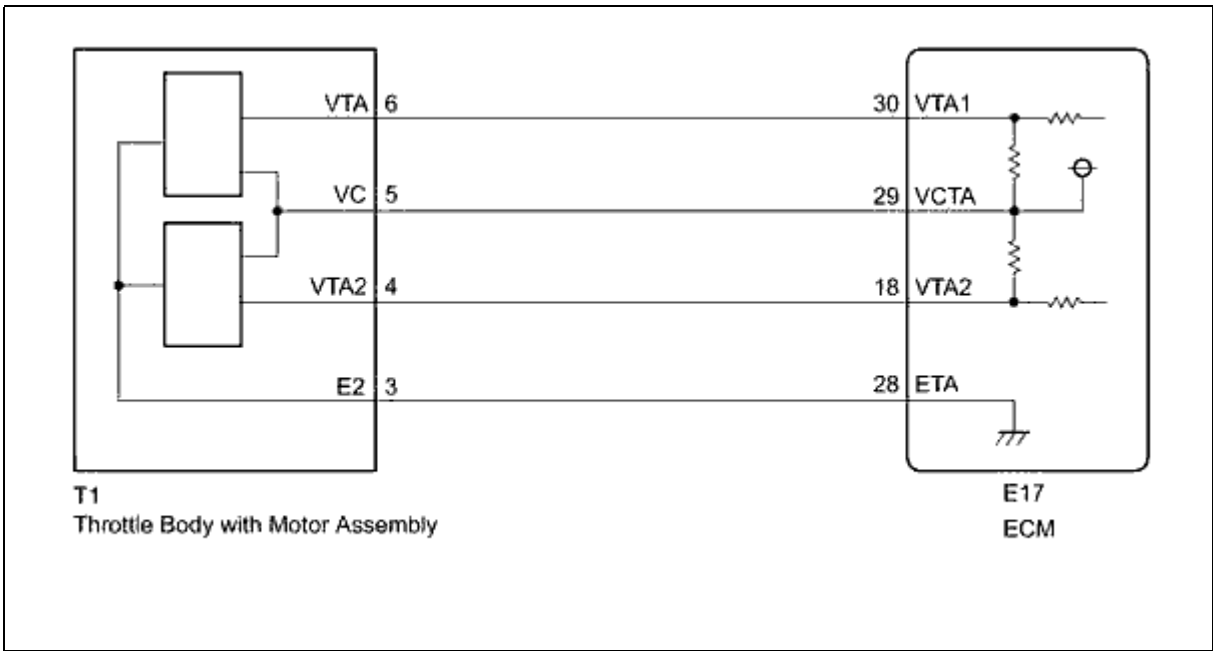
When any of these DTCs or other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is

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depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1 and Throttle Position No. 2.

(e) Check the values displayed on the Techstream.

Result

WHEN ACCELERATOR PEDAL RELEASED	WHEN ACCELERATOR PEDAL DEPRESSED	TROUBLE AREA	PROCEED TO

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THROTTLE POSITION NO. 1	THROTTLE POSITION NO. 2	THROTTLE POSITION NO. 1	THROTTLE POSITION NO. 2		
0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	VC circuit open	A
4.5 to 4.98 V	4.5 to 4.98 V	4.5 to 4.98 V	4.5 to 4.98 V	E2 circuit open	
0 to 0.2 V, or 4.5 to 4.98 V	2.1 to 3.1 V (Fail-safe)	0 to 0.2 V, or 4.5 to 4.98 V	2.1 to 3.1 V (Fail-safe)	VTA1 circuit open or shorted to ground	
0.6 to 1.4 V (Fail-safe)	0 to 0.2 V, or 4.5 to 4.98 V	0.6 to 1.4 V (Fail-safe)	0 to 0.2 V, or 4.5 to 4.98 V	VTA2 circuit open or shorted to ground	
0.5 to 1.1 V	2.1 to 3.1 V	3.2 to 4.8 V (Not fail-safe)	4.6 to 4.98 V (Not fail-safe)	Throttle position sensor circuit normal	B

HINT:

- DTC P0121 is stored when the voltages output from VTA1 and VTA2 are not consistent with the characteristics of the sensors. Therefore, check the Freeze Frame Data when this DTC is output. Use the following formula to confirm relative fluctuations in voltage.

  Calculate the voltage of VTA and VTA2 according to Throttle Sensor Volt % and Throttle Sensor #2 Volt % respectively and confirm their consistency.
  Example:
  Throttle Sensor Volt % / 100 (%) x 5 (V) = Throttle Position No. 1
  Characteristic sensor output:
  VTA2 x 0.8 is approximately equal to VTA1 + 1.11 V
  VTA1: Throttle Position No. 1
  VTA2: Throttle Position No. 2
- If DTC P0121 is output, proceed to the "Check Harness and Connector (Throttle Position Sensor - ECM)"

B ▶ **GO TO STEP 5**

A ▼

2.	CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)

(a) Disconnect the T1 throttle body with motor assembly connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
T1-5 (VC) - E17-29 (VCTA)	Always	Below 1 Ω
T1-6 (VTA) - E17-30 (VTA1)	Always	Below 1 Ω
T1-4 (VTA2) - E17-18 (VTA2)	Always	Below 1 Ω
T1-3 (E2) - E17-28 (ETA)	Always	Below 1 Ω

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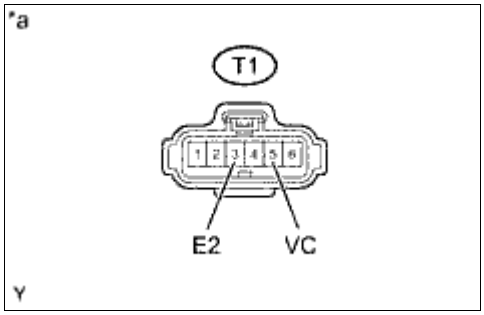
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
T1-5 (VC) or E17-29 (VCTA) - Body ground	Always	10 kΩ or higher
T1-6 (VTA) or E17-30 (VTA1) - Body ground	Always	10 kΩ or higher
T1-4 (VTA2) or E17-18 (VTA2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	**INSPECT ECM (VC VOLTAGE)**

(a) Disconnect the T1 throttle body with motor assembly connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
T1-5 (VC) - T1-3 (E2)	Ignition switch ON	4.5 to 5.5 V

Text in Illustration

*a	Front view of harness connector (to Throttle Body with Motor Assembly)

NG ▶ **REPLACE ECM**

OK ▼

4.	**REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

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(a) Replace the throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NEXT

5.	**CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Start the engine.

(f) Drive the vehicle in accordance with the driving pattern in Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0120, P0121, P0122, P0123, P0220, P0222, P0223 and/or P2135 is output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000T9P0GYX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0125; Insufficient Coolant Temperature for Closed Loop Fuel Control; 2016 MY Tacoma [08/2015 -]		

DTC	**P0125**	**Insufficient Coolant Temperature for Closed Loop Fuel Control**

DESCRIPTION

Refer to DTC P0115 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0125	The engine coolant temperature does not reach the closed loop enabling temperature for 20 minutes (this period varies with the engine coolant temperature at engine start) (2 trip detection logic)	• Engine coolant temperature sensor • Cooling system • Thermostat

MONITOR DESCRIPTION

The resistance of the engine coolant temperature sensor varies in proportion to the actual engine coolant temperature. The ECM supplies a constant voltage to the sensor and monitors the signal output voltage of the sensor. The signal voltage output varies according to the changing resistance of the sensor. After the engine is started, the engine coolant temperature is monitored through this signal. If the engine coolant temperature sensor indicates that the engine is not yet warm enough for closed-loop fuel control, despite a specified period of time having elapsed since the engine was started, the ECM interprets this as a malfunction in the sensor or cooling system and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0125: Insufficient Engine Coolant Temperature for Closed-Loop Fuel Control
Required Sensors/Components (Main)	Thermostat Cooling system
Required Sensors/Components (Related)	Engine coolant temperature sensor and mass air flow meter
Frequency of Operation	Continuous
Duration	**for Automatic Transmission** 70 seconds: Engine coolant temperature at engine start -8.33°C (17°F) or higher 111 seconds: Engine coolant temperature at engine start between -19.44°C (-2.99°F) and -8.33°C (17°F) 1200 seconds: Engine coolant temperature at engine start less than -19.44°C (-2.99°F) **for Manual Transmission**

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	120 seconds: Engine coolant temperature at engine start -8.33°C (17°F) or higher 300 seconds: Engine coolant temperature at engine start between -19.44°C (-2.99°F) and -8.33°C (17°F) 1200 seconds: Engine coolant temperature at engine start less than -19.44°C (-2.99°F)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever these DTCs are not stored	None
Thermostat fail (P0128)	Not detected
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118)	Not detected
Mass air flow meter sensor circuit fail (P0102, P0103)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Time until actual engine coolant temperature reaches closed loop fuel control enabling temperature	**for Automatic Transmission** 70 seconds: Engine coolant temperature at engine start -8.33°C (17°F) or higher 111 seconds: Engine coolant temperature at engine start between -19.44°C (-2.99°F) and -8.33°C (17°F) 1200 seconds: Engine coolant temperature at engine start less than -19.44°C (-2.99°F) **for Manual Transmission** 120 seconds: Engine coolant temperature at engine start -8.33°C (17°F) or higher 300 seconds: Engine coolant temperature at engine start between -19.44°C (-2.99°F) and -8.33°C (17°F) 1200 seconds: Engine coolant temperature at engine start less than -19.44°C (-2.99°F)

CONFIRMATION DRIVING PATTERN

1. Leave the vehicle outside overnight.
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON and turn the Techstream on.
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
5. Check that the engine coolant temperature is less than 0°C (32°F).
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Start the engine.

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10. Wait 20 minutes or more.
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
12. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0125.
15. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

16. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0115 INFO .

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0116, P0117 or P0118 are stored simultaneously with DTC P0125, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0125)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0125 is output	A
DTC P0125 and other DTCs are output	B

HINT:

If any DTCs other than P0125 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**INSPECT THERMOSTAT**

(a) Remove the thermostat INFO .

(b) Check the valve opening temperature of the thermostat INFO .

Standard value:
80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

NG ▶ **REPLACE THERMOSTAT**

OK

▼

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3.	**CHECK COOLING SYSTEM**

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **REPAIR OR REPLACE COOLING SYSTEM**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012FW00FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0128; Thermostat; 2016 MY Tacoma [08/2015 -]		

DTC	**P0128**	**Thermostat**

DESCRIPTION

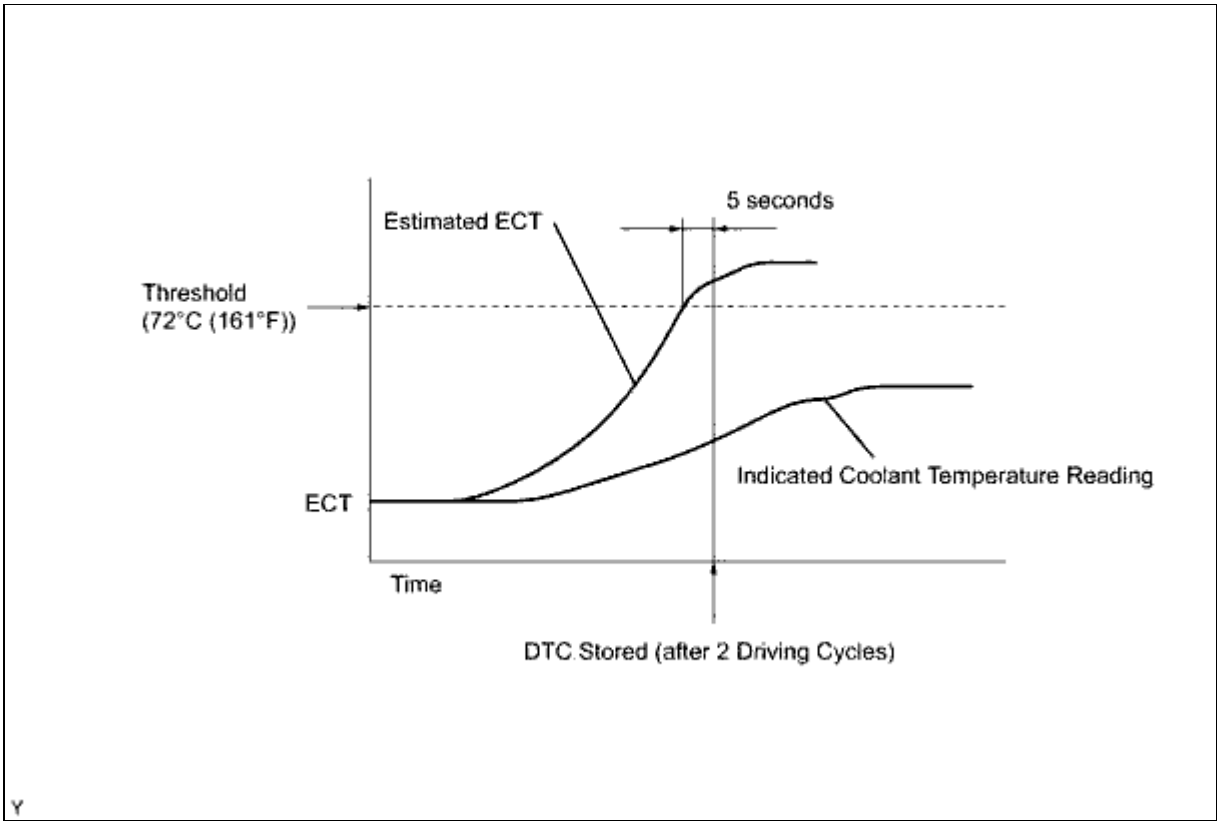
HINT:

This DTC relates to the thermostat.

This DTC is stored when the engine coolant temperature does not reach 70°C (158°F) despite sufficient engine warm-up time.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0128	Conditions (a), (b) and (c) met for 5 seconds (2 trip detection logic): (a) Cold start (b) Engine warmed up (c) Engine coolant temperature less than 72°C (161°F)	• Thermostat • Cooling system • Engine coolant temperature sensor • ECM

MONITOR DESCRIPTION



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The ECM estimates the engine coolant temperature based on the starting temperature, engine loads, and engine speeds. The ECM then compares the estimated temperature with the actual engine coolant temperature. When the estimated engine coolant temperature reaches 72°C (161°F), the ECM checks the actual engine coolant temperature. If the actual engine coolant temperature is less than 72°C (161°F), the ECM interprets this as a malfunction in the thermostat or the engine cooling system and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0128: Coolant Thermostat
Required Sensors/Components (Main)	Thermostat
Required Sensor/Components (Related)	Engine coolant temperature sensor Intake air temperature sensor Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	670 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0351 - P0354 (Igniter) P0500 (Vehicle Speed Sensor) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance)
Battery voltage	11 V or higher
Either of following conditions 1 or 2 met:	-

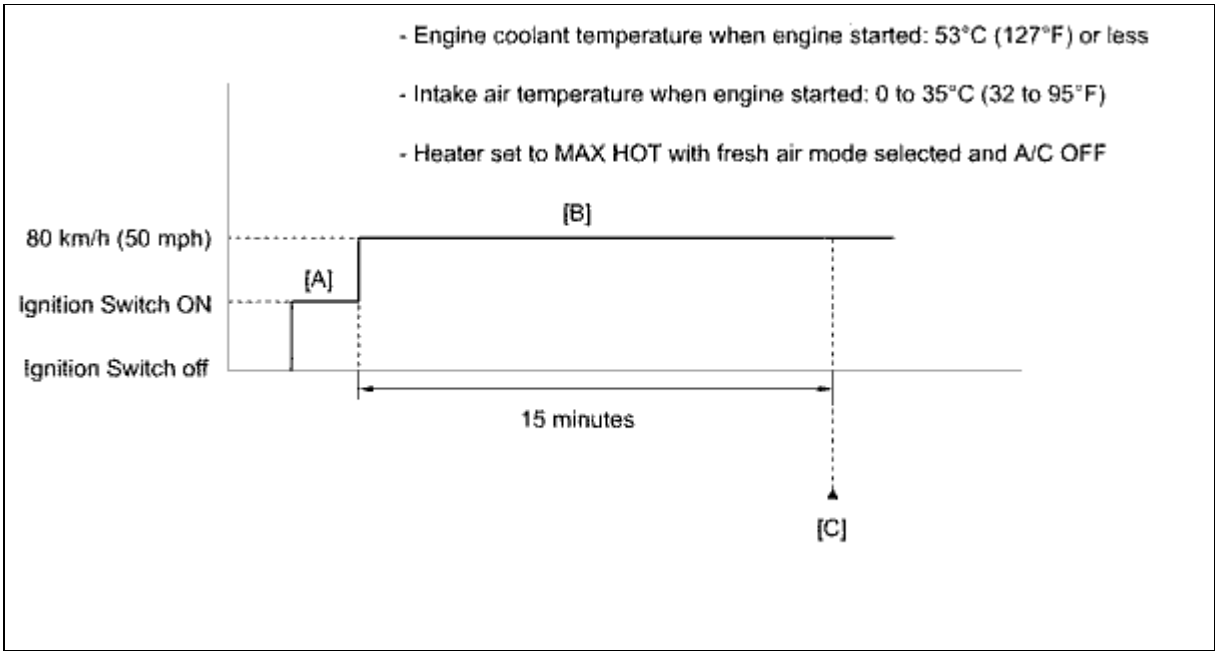
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1. All of following conditions (a), (b) and (c) met:	-
(a) Engine coolant temperature at engine start - Intake air temperature at engine start	-15 to 7°C (-27 to 12.6°F)
(b) Engine coolant temperature at engine start	-10 to 53°C (14 to 127°F)
(c) Intake air temperature at engine start	-10 to 53°C (14 to 127°F)
2. All of following conditions (d), (e) and (f) met:	-
(d) Engine coolant temperature at engine start - Intake Air Temperature at engine start	Higher than 7°C (12.6°F)
(e) Engine coolant temperature at engine start	53°C (127°F) or less
(f) Intake air temperature at engine start	-10°C (14°F) or higher
Accumulated time that vehicle speed is 128 km/h (80 mph) or more	Less than 20 seconds

TYPICAL MALFUNCTION THRESHOLDS

Duration that following conditions met	5 seconds or more
Estimated engine coolant temperature	72°C (161°F) or higher
Engine coolant temperature sensor output	Less than 72°C (161°F)

CONFIRMATION DRIVING PATTERN



1. Stop the engine and allow it to soak.
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON and turn the Techstream on [A].
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp and Intake Air.
5. Check that "Coolant Temp" is 53°C (127°F) or less and "Intake Air" is between 0 and 35°C (32 and 95°F).
6. Set the heater to MAX HOT with fresh air mode selected and turn the A/C off.

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7. Start the engine and drive the vehicle at 80 km/h (50 mph) for 15 minutes [B].

NOTICE:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- Data can be captured relatively easily by using the snapshot function in the Data List.
- Enter the following menus: Data List / Function / Snapshot configuration / Record time / 5 min.
- Data capture can be started by using the target point function. For example, setting the target point to an engine speed of 4000 rpm and then racing the engine, etc. to raise the engine speed to a speed of 4000 rpm or more will cause data capture to start.

8. After "Coolant Temp" stabilizes, check that "Coolant Temp" is 75°C (167°F) or higher [C].

HINT:

If "Coolant Temp" is below 75°C (167°F) while driving the vehicle at 80 km/h (50 mph), inspect the cooling system and thermostat.

INSPECTION PROCEDURE

HINT:

- When the DTC is output, check the engine coolant temperature using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp. If the Coolant Temp value is lower than the actual engine coolant temperature, the engine coolant temperature sensor circuit may be malfunctioning. In this case, check the wire harnesses and connectors (and those connections) between the ECM and the engine coolant temperature sensor first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0128)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
DTC P0128 is output	A
DTC P0128 and other DTCs	B

HINT:

If any DTCs other than P0128 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

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A

2.	CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ REPAIR OR REPLACE COOLING SYSTEM

OK

3.	INSPECT THERMOSTAT

(a) Check the valve opening temperature of the thermostat INFO .

NG ▶ REPLACE THERMOSTAT

OK

4.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TEO0GSX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0136-P0139,P013A; Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2); 2016 MY Tacoma [08/2015 -]		

DTC	**P0136**	**Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)**

DTC	**P0137**	**Heated Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)**

DTC	**P0138**	**Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)**

DTC	**P0139**	**Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)**

DTC	**P013A**	**Oxygen Sensor Slow Response - Rich to Lean Bank 1 Sensor 2**

DESCRIPTION

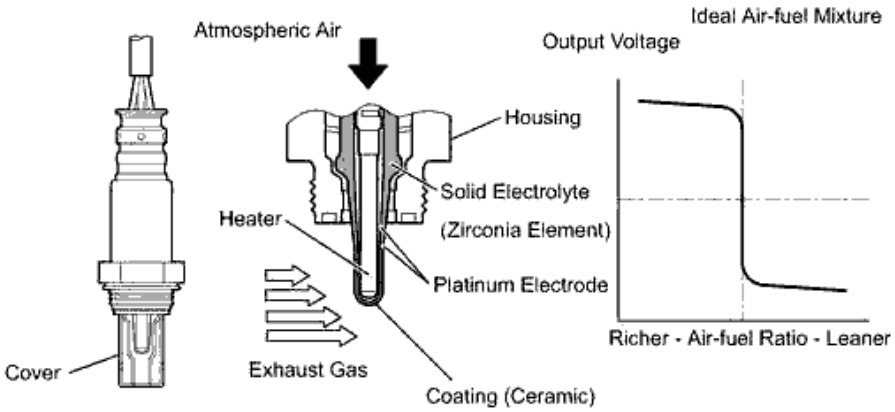
A three way catalytic converter is used in order to convert the carbon monoxide, hydrocarbons, and nitrogen oxides into less harmful substances. To allow the three way catalytic converter to function effectively, it is necessary to keep the air fuel ratio of the engine near the stoichiometric air fuel ratio. For the purpose of helping the ECM to deliver accurate air fuel ratio control, a heated oxygen sensor is used. The heated oxygen sensor is located behind the three way catalytic converter, and detects the oxygen concentration in the exhaust gas. Since the sensor is integrated with the heater that heats the sensing portion, it is possible to detect the oxygen concentration even when the intake air volume is low (the exhaust gas temperature is low).

When the air fuel ratio becomes lean, the oxygen concentration in the exhaust gas is great. The heated oxygen sensor informs the ECM that the post-three way catalytic converter air fuel ratio is lean (low voltage, i.e. less than 0.45 V).

Conversely, when the air fuel ratio is richer than the stoichiometric air fuel level, the oxygen concentration in the exhaust gas becomes small. The heated oxygen sensor informs the ECM that the post-three way catalytic converter air fuel ratio is rich (high voltage, i.e. higher than 0.45 V). The heated oxygen sensor has the property of changing its output voltage drastically when the air fuel ratio is close to the stoichiometric level.

The ECM uses the supplementary information from the heated oxygen sensor to determine whether the air fuel ratio after the three way catalytic converter is rich or lean, and adjusts the fuel injection time accordingly. Thus, if the heated oxygen sensor is working improperly due to internal malfunctions, the ECM is unable to compensate for deviations in the primary air fuel ratio control.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0136	• Abnormal voltage output: During active air-fuel ratio control, heated oxygen sensor voltage does not increase to more than 0.71 V for certain period of time (2 trip detection logic). • Low impedance: Sensor impedance less than 5 Ω for more than 30 seconds when ECM presumes sensor is warmed up and operating normally (2 trip detection logic).	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Air fuel ratio sensor • Gas leak from exhaust system • Fuel pressure • Fuel injector assembly • PCV valve and hose • Intake system
P0137	• Low voltage (open): During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic): (a) Heated oxygen sensor voltage output less than 0.21 V. (b) The target air fuel ratio is rich. • High impedance: Sensor impedance 15 kΩ or more for more than 90 seconds when ECM presumes sensor to be warmed up and operating normally (2 trip detection logic).	• Open in heated oxygen sensor circuit • Heated oxygen sensor • Heated oxygen sensor heater • Air fuel ratio sensor • Gas leak from exhaust system
P0138	Extremely high voltage (short): Heated oxygen sensor voltage output exceeds 1.2 V for more than 10 seconds (2 trip detection logic).	• Short in heated oxygen sensor circuit • Heated oxygen sensor • ECM
P0139	Heated oxygen sensor voltage does not drop to less than 0.2 V immediately after fuel cut starts (2 trip detection logic)	• Short in heated oxygen sensor circuit • Heated oxygen sensor • Gas leak from exhaust system
P013A	Heated oxygen sensor (sensor 2) voltage does not drop from 0.35 V to 0.2 V immediately after fuel cut starts (1 trip detection logic)	• Short in heated oxygen sensor circuit • Heated oxygen sensor

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Gas leak from exhaust system

MONITOR DESCRIPTION

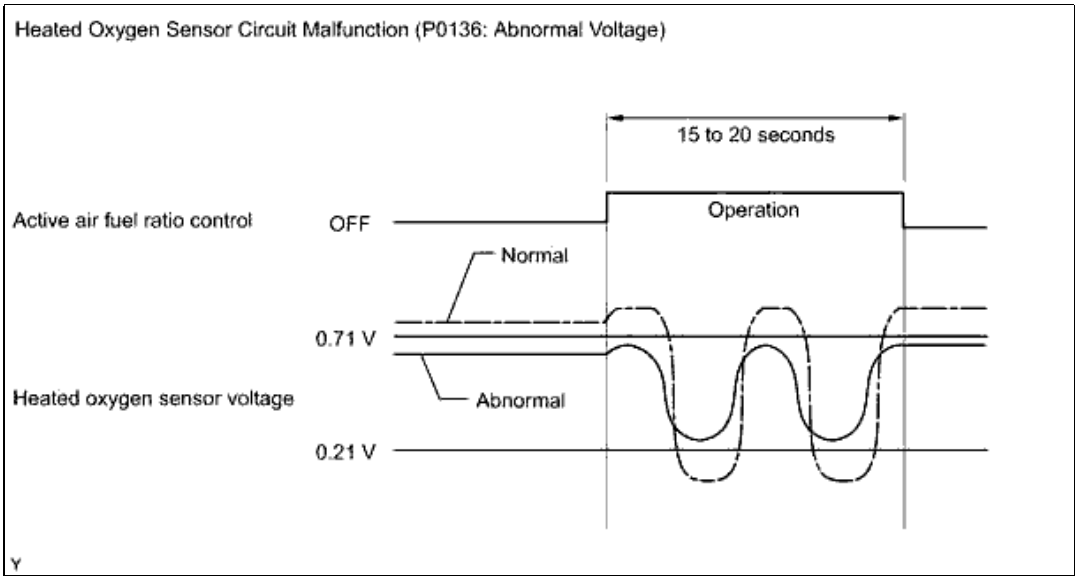
1. Active Air Fuel Ratio Control

   The ECM usually performs air fuel ratio feedback control so that the air fuel ratio sensor output indicates a near stoichiometric air fuel ratio. This vehicle includes active air fuel ratio control in addition to regular air fuel ratio control. The ECM performs active air fuel ratio control to detect any deterioration in the Three Way Catalytic Converter (TWC) and heated oxygen sensor malfunctions (refer to the diagram below).

   Active air fuel ratio control is performed for approximately 15 to 20 seconds while driving with a warm engine. During active air fuel ratio control, the air fuel ratio is forcibly regulated to become lean or rich by the ECM. If the ECM detects a malfunction, a DTC is stored.

2. Abnormal Voltage Output of Heated Oxygen Sensor (DTC P0136)

   While the ECM is performing active air fuel ratio control, the air fuel ratio is forcibly regulated to become rich or lean. If the sensor is not functioning properly, the voltage output variation is small. For example, when the heated oxygen sensor voltage does not increase to 0.71 V or higher during active air fuel ratio control, the ECM determines that the sensor voltage output is abnormal and stores DTC P0136.



3. Open in Heated Oxygen Sensor Circuit (DTC P0137)

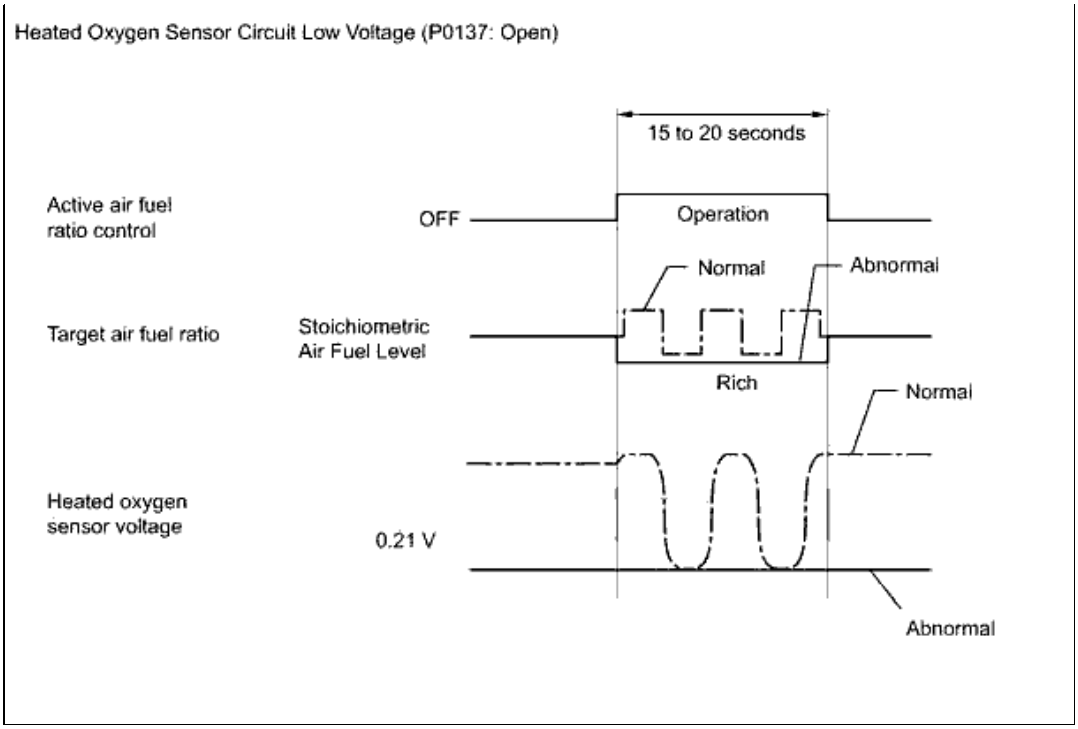
   During active air fuel ratio control, the ECM calculates the Oxygen Storage Capacity (OSC)* of the Three-Way Catalytic Converter (TWC) by forcibly regulating the air fuel ratio to become rich or lean. If the heated oxygen sensor has an open, or the voltage output of the sensor noticeably decreases, the OSC indicates an extraordinarily high value. Even if the ECM attempts to continue regulating the air fuel ratio to become rich or lean, the heated oxygen sensor output does not change.

   While performing active air fuel ratio control, when the target air fuel ratio is rich and the heated oxygen sensor voltage output is 0.21 V or less (lean), the ECM interprets this as an abnormally low sensor output voltage and stores DTC P0137.

HINT:

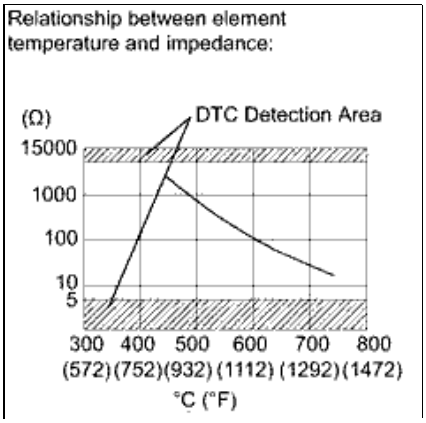
*: The three-way catalytic converter has the capability to store oxygen. The oxygen storage capacity and the emission purification capacity of the three-way catalytic converter are mutually related. The ECM determines whether the catalyst has deteriorated, based on the calculated oxygen storage capacity value INFO .

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4. High or Low Impedance of Heated Oxygen Sensor (DTCs P0136 or P0137)

During normal air fuel ratio feedback control, there are small variations in the exhaust gas oxygen concentration. In order to continuously monitor the slight variations of the heated oxygen sensor signal while the engine is running, the impedance* of the sensor is measured by the ECM. The ECM determines that there is a malfunction in the sensor when the measured impedance deviates from the standard range.



*: The effective resistance in an alternating current electrical circuit.

HINT:

- The impedance cannot be measured using an ohmmeter.
- DTC P0136 indicates the deterioration of the heated oxygen sensor. The ECM stores this DTC by calculating the impedance of the sensor when the typical enabling conditions are satisfied (2 driving cycles).
- DTC P0137 indicate an open or short circuit in the heated oxygen sensor (2 driving cycles). The ECM stores this DTC when the impedance of the sensor exceeds the threshold 15 kΩ.

5. Extremely High Output Voltage of Heated Oxygen Sensor (DTC P0138)

The ECM continuously monitors the heated oxygen sensor output voltage while the engine is running. DTC P0138 is stored if the heated oxygen sensor voltage output is higher than 1.2 V for 10 seconds or more.

6. Abnormal Voltage Output of Heated Oxygen Sensor During Fuel-cut (DTC P0139)

The sensor output voltage drops to less than 0.2 V (extremely lean status) immediately when the vehicle decelerates and fuel cut is operating. If the voltage does not drop to less than 0.2 V for 7 seconds or more, the ECM determines that the sensor response has deteriorated, illuminates the MIL and stores a DTC.

7. Abnormal Voltage Output of Heated Oxygen Sensor during Fuel Cut from Rich Condition (DTC P013A)

If the sensor output voltage does not drop from 0.35 to 0.2 V immediately when the vehicle decelerates and fuel cut is operating, the ECM illuminates the MIL and stores a DTC.

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MONITOR STRATEGY

Related DTCs	P0136: Heated oxygen sensor voltage check (voltage malfunction) P0136: Heated oxygen sensor circuit continuity check (circuit short) P0137: Heated oxygen sensor voltage check (low voltage) P0137: Heated oxygen sensor circuit continuity check (circuit open) P0138: Heated oxygen sensor voltage check (high voltage) P0138: Heated oxygen sensor circuit continuity check (out of range) P0139: Heated oxygen sensor response rate during fuel cut P013A: Heated oxygen sensor response rate during fuel cut from rich condition
Required Sensors/Components (Main)	Heated oxygen sensor
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Mass air flow meter Throttle position sensor Air fuel ratio sensor
Frequency of Operation	Once per driving cycle: Active air fuel ratio control detection, heated oxygen sensor abnormal voltage during fuel cut Continuous: Others
Duration	20 seconds: Heated oxygen sensor voltage check 30 seconds: Heated oxygen sensor circuit continuity check (circuit short) 90 seconds: Heated oxygen sensor circuit continuity check (circuit open) 10 seconds: Heated oxygen sensor circuit continuity check (out of range) 7 seconds: Heated oxygen sensor response rate during fuel cut 7 seconds: Heated oxygen sensor response rate during fuel cut from rich condition
MIL Operation	2 driving cycles: P0136, P0137, P0138 and P0139 1 driving cycle: P013A
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0037, P0038, P102D (Heated Oxygen Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor)

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	P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)

Heated Oxygen Sensor Output Voltage Check (Voltage Malfunction and Low Voltage)

Catalyst monitor precondition	Met
Catalyst monitor precondition defined as when all of following conditions met:	-
Battery voltage	11 V or higher
Intake air temperature	-10°C (14°F) or higher
Engine coolant temperature	70°C (158°F) or higher
Atmospheric pressure	76 kPa(abs) [570 mmHg(abs)] or higher
Idling	OFF
Engine speed	Less than 4000 rpm
A/F sensor status	Activated
Fuel system status	Closed loop
Engine load	10% or more, and less than 90%
Shift position	3rd or more

Heated Oxygen Sensor Circuit Continuity Check (Circuit Short)

Battery voltage	11 V or higher
Estimated sensor temperature	Less than 700°C (1292°F)
ECM monitor	Completed
DTC P0607	Not set

Heated Oxygen Sensor Circuit Continuity Check (Circuit Open)

Battery voltage	11 V or higher
Estimated sensor temperature	450°C (842°F) or higher, and less than 750°C (1382°F)
DTC P0607	Not present

Heated Oxygen Sensor Circuit Continuity Check (Out of Range)

Battery voltage	11 V or higher
Time after engine start	2 seconds or more

Heated Oxygen Sensor Response Rate During Fuel Cut

Engine coolant temperature	70°C (158°F) or higher
Estimated catalyst temperature	400°C (752°F) or higher
Fuel cut	ON

Heated Oxygen Sensor Response Rate during Fuel Cut from Rich Condition

Battery voltage	11 V or higher
Engine coolant temperature	70°C (158°F) or higher
Estimated catalyst temperature	400°C (752°F) or higher

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TYPICAL MALFUNCTION THRESHOLDS

Heated Oxygen Sensor Output Voltage Check (Voltage Malfunction)

All of the following conditions (a), (b) and (c) met	-
(a) Commanded air fuel ratio	14.3 or less
(b) Rear heated oxygen sensor voltage	0.21 V or higher, and less than 0.71 V
(c) OSC (Oxygen Storage Capacity of Catalyst)	2 g or more

Heated Oxygen Sensor Output Voltage Check (Low Voltage)

All of the following conditions (a), (b) and (c) met	-
(b) Commanded air fuel ratio	14.3 or less
(b) Rear heated oxygen sensor voltage	Less than 0.21 V
(c) OSC (Oxygen Storage Capacity of Catalyst)	2 g or more

Heated Oxygen Sensor Circuit Continuity Check (Circuit Short)

Duration of following condition	30 seconds or more
Heated oxygen sensor impedance	Less than 5 Ω

Heated Oxygen Sensor Circuit Continuity Check (Circuit Open)

Duration of following condition	90 seconds or more
Heated oxygen sensor impedance	15 kΩ or more

Heated Oxygen Sensor Circuit Continuity Check (Out of Range)

Duration of following condition	10 seconds or more
Heated oxygen sensor impedance	1.2 V or higher

Heated Oxygen Sensor Response Rate during Fuel Cut

Duration until rear heated oxygen sensor voltage drops to 0.2 V after fuel cut	7 seconds or more

Heated Oxygen Sensor Response Rate during Fuel Cut from Rich Condition

Duration that heated oxygen sensor voltage drops from 0.35 to 0.2 V during fuel cut (Normalized)	1 second or less

COMPONENT OPERATING RANGE

Duration of following condition met	30 seconds or more
Heated oxygen sensor voltage	Varies between 0.1 and 0.9 V

MONITOR RESULT

Refer to Checking Monitor Status INFO .

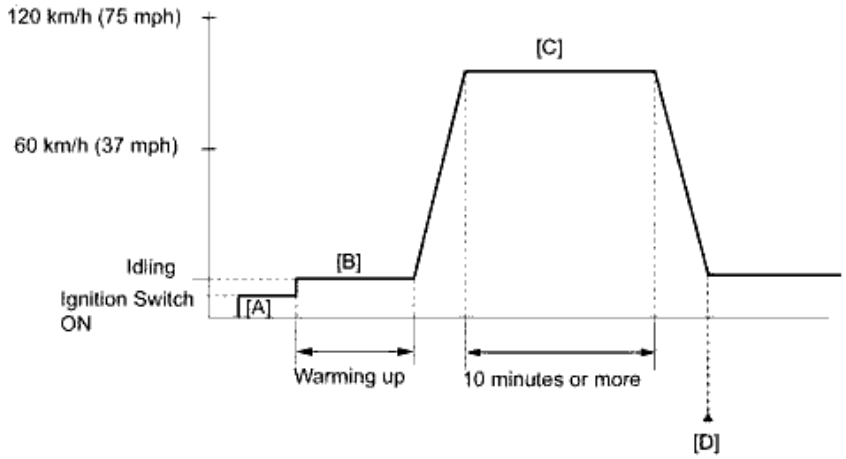
CONFIRMATION DRIVING PATTERN

- This confirmation driving pattern is used in the "Perform Confirmation Driving Pattern" procedure of the following diagnostic troubleshooting procedure.
- Performing this confirmation driving pattern will activate the heated oxygen sensor monitor (The catalyst monitor is

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performed simultaneously). This is very useful for verifying the completion of a repair.

P0136, P0137 and P0138



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. With the transmission in 4th gear or higher, drive the vehicle at 60 to 120 km/h (37 to 75 mph) for 10 minutes or more [C].

NOTICE:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input DTCs: P0136, P0137 or P0138.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory

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TECHSTREAM DISPLAY	DESCRIPTION
	limit

HINT:

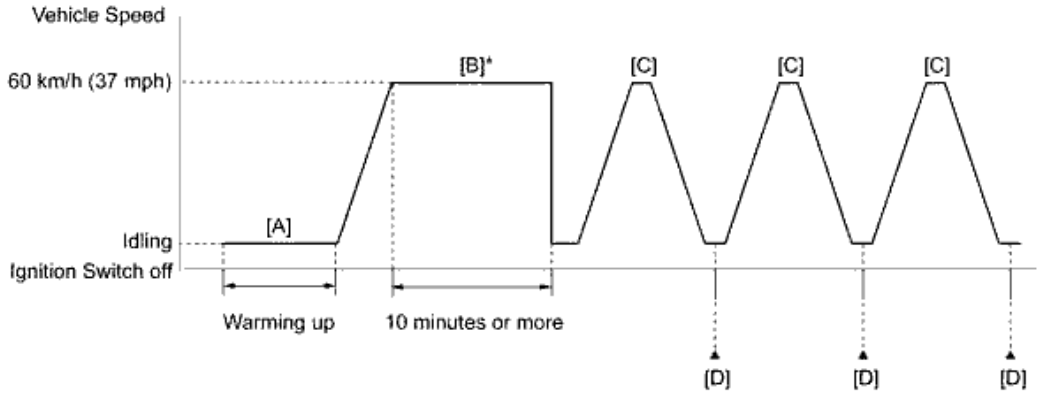
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [C] through [D].

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

P0139 and P013A



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor.
8. Check that Catalyst Efficiency / Current is Incomplete.
9. Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with the shift lever in P or N (for Automatic Transmission), or neutral (for Manual Transmission) [A].

HINT:

In order to keep the idling stable, turn off the A/C and all other electric loads and do not perform any shift operations.

10. Drive the vehicle at approximately 60 km/h (37 mph) for 10 minutes or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Drive the vehicle while keeping the engine load as constant as possible.

11. With the shift lever in 3 position (for Automatic Transmission), or 3rd gear (for Manual Transmission), drive the vehicle at 60 km/h (37 mph), and then decelerate the vehicle by releasing the accelerator pedal for 5 seconds or more to perform the fuel-cut [C].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

12. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / O2 Sensor / RL F/C B1S2 [D].
13. Check the Test Value for RL F/C B1S2.

HINT:

If Test Value displays 0, perform step [C] until it displays a value larger than 0, as the O2 sensor monitor is not finished.

14. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
15. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Input the DTC: P0139 or P013A.
18. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal
- If the judgment result shows INCOMPLETE or N/A, drive the vehicle with the shift lever in 3 position (for Automatic Transmission), or 3rd gear (for Manual Transmission), drive the vehicle at 60 km/h (37 mph), and then perform step [C] again.

19. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0031 INFO .

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

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1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
6. Perform the Active Test operation with the engine idling (press the -12.5 or 12.5 button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

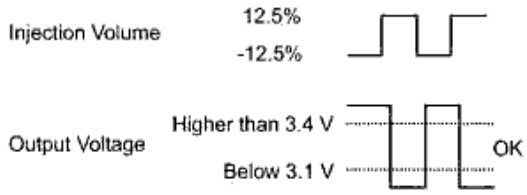
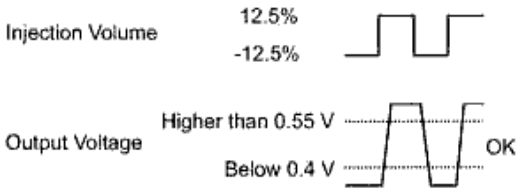
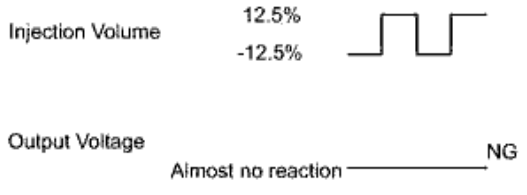
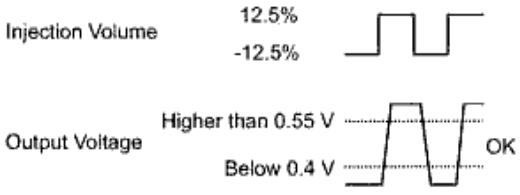
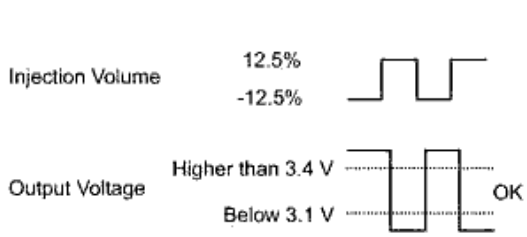
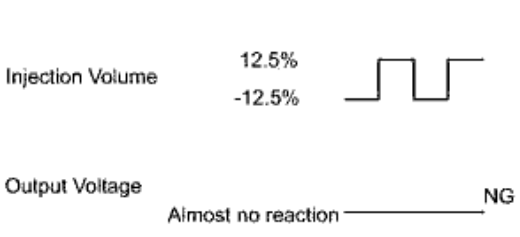
HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

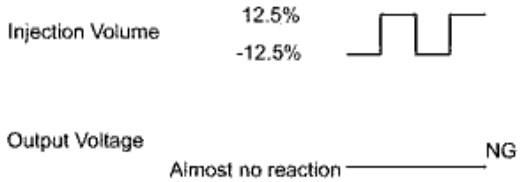
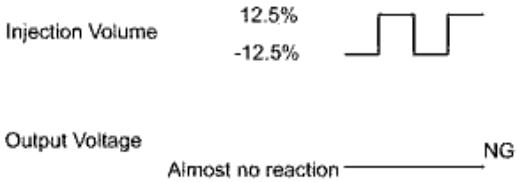
TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	12.5%	Rich	Below 3.1 V
	-12.5%	Lean	Higher than 3.4 V
O2S B1S2 (Heated oxygen)	12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR OUTPUT VOLTAGE	HEATED OXYGEN SENSOR OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen

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CASE	AIR FUEL RATIO SENSOR OUTPUT VOLTAGE	HEATED OXYGEN SENSOR OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
			sensor circuit
4			• Fuel injector assembly • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2; and then press the graph button on the Data List view.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ OUTPUT DTC (DTC P0136, P0137, P0138, P0139 AND P013A)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0138 is output	A
DTC P0137 is output	B
DTC P0136 is output	C
DTC P0139 or P013A is output	D

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RESULT	PROCEED TO
DTC P0136, P0137 or P0138 and other DTCs are output	E

HINT:

If any DTCs other than P0136, P0137, P0138, P0139 and P013A are output, troubleshoot those DTCs first.

B ▶ **GO TO STEP 6**

C ▶ **GO TO STEP 4**

D ▶ **GO TO STEP 15**

E ▶ **GO TO DTC CHART**

A

▼

2.	**INSPECT HEATED OXYGEN SENSOR (CHECK FOR SHORT)**

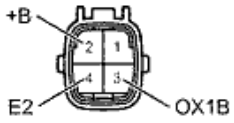
(a) Disconnect the H3 heated oxygen sensor connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (+B) - 4 (E2)	Always	10 kΩ or higher
2 (+B) - 3 (OX1B)		

*a



Text in Illustration

*a	Component without harness connected (Heated Oxygen Sensor)

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

NG ▶ **REPLACE HEATED OXYGEN SENSOR**

OK

▼

3.	**CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT)**

(a) Turn the ignition switch off and wait for 5 minutes or more.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITIONS
E18-7 (HT1B) - E18-27 (OX1B)	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

4.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(f) Change the fuel injection volume using the Techstream, and monitor the voltage output of air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers or increases the fuel injection volume by 12.5%.
- The air fuel ratio sensor is displayed as AFS Voltage B1S1, and the heated oxygen sensor is displayed as O2S B1S2 on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Standard voltage:

Fluctuates between 0.4 V or less and 0.55 V or more.

NG ▶ **GO TO STEP 6**

OK ▼

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(f) Change the fuel injection volume using the Techstream, and monitor the voltage output of the air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

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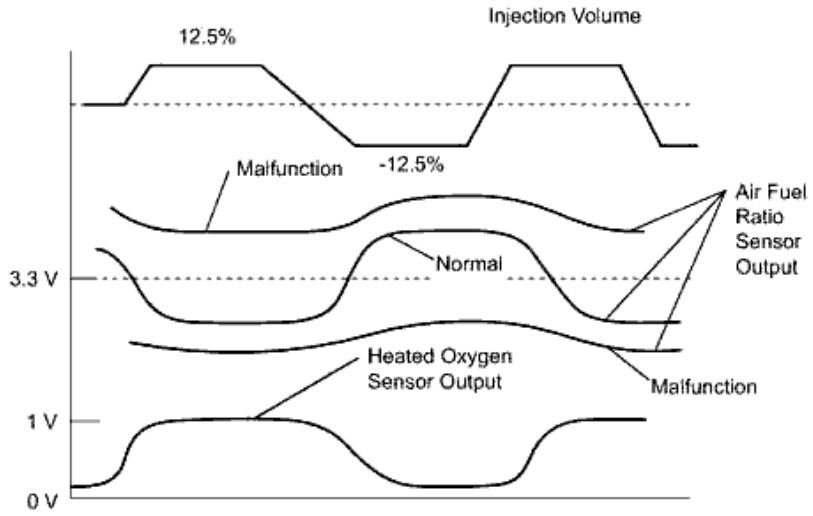
- The Control the Injection Volume for A/F Sensor operation lowers or increases the fuel injection volume by 12.5%.
- The air fuel ratio sensor is displayed as AFS Voltage B1S1, and the heated oxygen sensor is displayed as O2S B1S2 on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

Result

TECHSTREAM DISPLAY (SENSOR)	VOLTAGE VARIATION	PROCEED TO
AFS Voltage B1S1 (Air fuel ratio)	Alternates between higher than and below 3.3 V	OK
	Remains at higher than 3.3 V	OK
	Remains at below 3.3 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either below or higher than 3.3 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ **GO TO STEP 12**

OK ▶ **CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO (FUEL INJECTOR, FUEL SYSTEM, INTAKE SYSTEM, ETC.)**

6.	**CHECK FOR EXHAUST GAS LEAKS**

(a) Check for exhaust gas leaks.

OK:

No exhaust gas leaks.

HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NG ▶ **REPAIR OR REPLACE EXHAUST GAS LEAK POINT**

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OK

7.	**INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)**

(a) Inspect the heated oxygen sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

NG ▶ **REPLACE HEATED OXYGEN SENSOR**

OK

8.	**CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)**

(a) Disconnect the H3 heated oxygen sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
H3-1 (HT1B) - E18-7 (HT1B)	Always	Below 1 Ω
H3-3 (OX1B) - E18-27 (OX1B)	Always	Below 1 Ω
H3-4 (E2) - E18-35 (EX1B)	Always	Below 1 Ω
H3-1 (HT1B) or E18-7 (HT1B) - Body ground	Always	10 kΩ or higher
H3-3 (OX1B) or E18-27 (OX1B) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

9.	**REPLACE HEATED OXYGEN SENSOR**

(a) Replace the heated oxygen sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

NEXT

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10.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Perform the Confirmation Driving Pattern (P0136, P0137 and P0138).

NEXT

11.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0136, P0137 OR P0138)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input DTCs: P0136, P0137 and P0138.

(f) Check that the DTC monitor is NORMAL. If the DTC monitor is INCOMPLETE, perform the drive pattern again but increase the vehicle speed.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P0136, P0137 or P0138 is output)	A
NORMAL (DTC is not output)	B

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

B **END**

A **REPLACE AIR FUEL RATIO SENSOR**

12.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT

13.	**PERFORM CONFIRMATION DRIVING PATTERN**

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(a) Perform the Confirmation Driving Pattern (P0136, P0137 and P0138).

NEXT

14.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0136 OR P0138)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input DTCs: P0136 or P0138.

(f) Check that the DTC monitor is NORMAL. If the DTC monitor is INCOMPLETE, perform the drive pattern again but increase the vehicle speed.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P0136 or P0138 is output)	A
NORMAL (DTC is not output)	B

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

B **END**

A **REPLACE HEATED OXYGEN SENSOR**

15.	**CHECK FOR EXHAUST GAS LEAKS**

(a) Check for exhaust gas leaks.

OK:

No exhaust gas leaks.

HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NG **REPAIR OR REPLACE EXHAUST GAS LEAK POINT**

OK

16.	**CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT)**

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(a) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E18-7 (HT1B) - E18-27 (OX1B)	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

17.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Perform the Confirmation Driving Pattern (P0139 and P013A).

NEXT ▼

18.	**READ DTC OUTPUT (DTC P0139 OR P013A IS OUTPUT AGAIN)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input DTCs: P0139 and P013A.

(f) Check that the DTC monitor is NORMAL. If the DTC monitor is INCOMPLETE, perform the drive pattern again but increase the vehicle speed.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P0139 or P013A is output)	A
NORMAL (DTC is not output)	B

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE HEATED OXYGEN SENSOR**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000WC20OLX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P014C,P014D,P015A,P015B; A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1; 2016 MY Tacoma [08/2015 -]		

DTC	**P014C**	**A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1**

DTC	**P014D**	**A/F Sensor Slow Response - Lean to Rich Bank 1 Sensor 1**

DTC	**P015A**	**A/F Sensor Delayed Response - Rich to Lean Bank 1 Sensor 1**

DTC	**P015B**	**A/F Sensor Delayed Response - Lean to Rich Bank 1 Sensor 1**

DESCRIPTION

Refer to DTC P2195 INFO .

HINT:

Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P014C	The "Rich to Lean response rate deterioration level*" value is standard or less. (2 trip detection logic)	• Air fuel ratio sensor • Air fuel ratio sensor heater • ECM
P014D	The "Lean to Rich response rate deterioration level*" value is standard or more. (2 trip detection logic)	
P015A	The "Rich to Lean delay level*" value is standard or more. (2 trip detection logic)	
P015B	The "Lean to Rich delay level*" value is standard or more. (2 trip detection logic)	

*: Calculated by ECM based on the air fuel ratio sensor output.

MONITOR DESCRIPTION

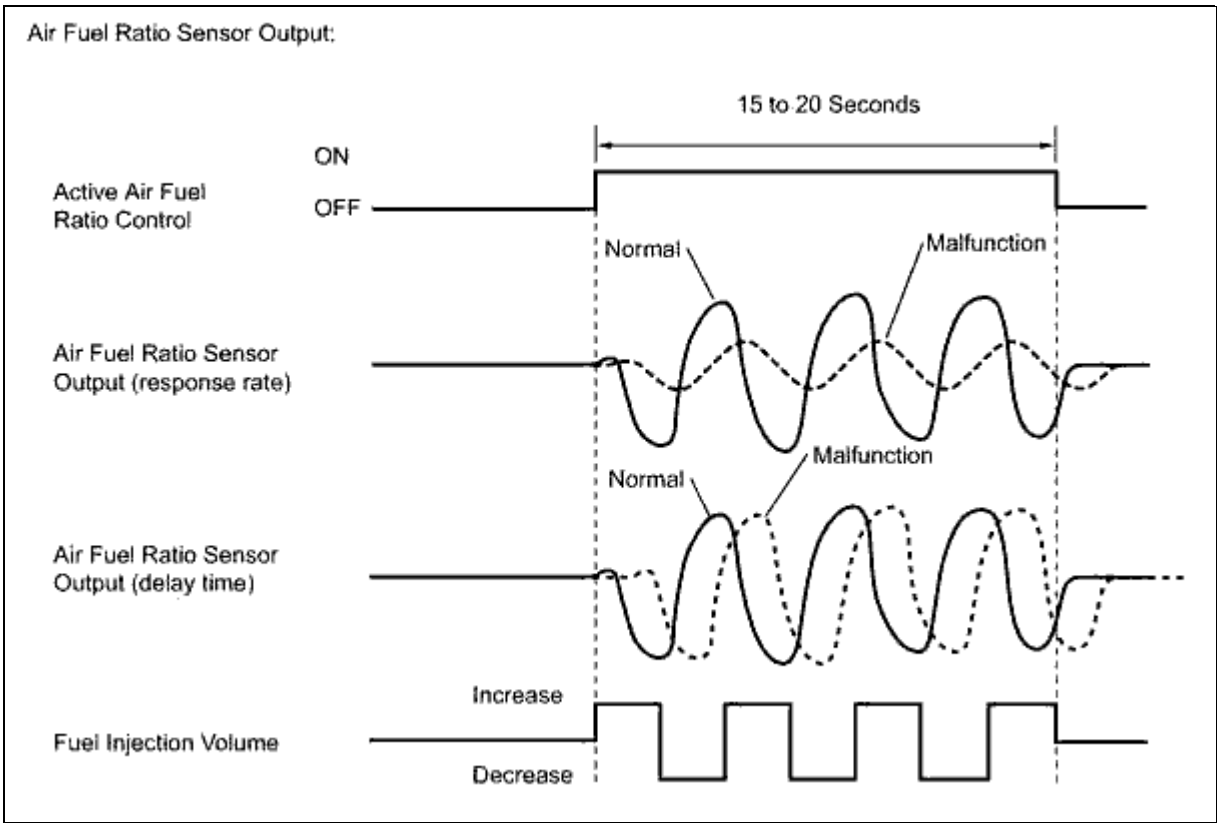
After the engine is warm, the ECM carries out air fuel ratio feedback control, and maintains the air fuel ratio at the theoretical level. In addition, after all the preconditions have been met, active air fuel ratio control is carried out for approximately 15 to 20 seconds, and during active air fuel ratio control, the ECM measures the response of the air fuel ratio sensor by increasing or decreasing a specific injection volume based on the theoretical air fuel ratio learned during normal air fuel control. The ECM determines whether there is an air fuel ratio sensor

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malfunction at the mid-point of active air fuel ratio control.

If the air fuel ratio sensor's response ability is reduced, DTC P014C and P014D are output.

If the time it takes the air fuel ratio sensor output to change is delayed, output to change is delayed, DTC P015A and P015B are output.



MONITOR STRATEGY

Related DTCs	P014C: Air Fuel Ratio Sensor Slow Response (Rich to Lean) P014D: Air Fuel Ratio Sensor Slow Response (Lean to Rich) P015A: Air Fuel Ratio Sensor Delayed Response (Rich to Lean) P015B: Air Fuel Ratio Sensor Delayed Response (Lean to Rich)
Required sensors/Components (Main)	Air fuel ratio sensor
Required sensors/Components (Related)	Vehicle speed sensor Crankshaft position sensor
Frequency of operation	Once per drive cycle
Duration	10 to 15 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment)

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	P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor) P0505 (Idle Speed Control) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)
Active air fuel ratio control	Performing
Active air fuel ratio control is performed when the following conditions met	-
Battery voltage	11 V or higher
Engine Coolant Temperature	70°C (158°F) or higher
Idling	OFF
Engine RPM	1000 rpm or more, and less than 2500 rpm
Air fuel ratio sensor status	Activated
Fuel cut	OFF
Engine load	10% or more, and less than 90%
Shift position	2nd or more
Catalyst monitor	Not yet
Mass air flow	4 gm/sec or more, and less than 18 gm/sec

TYPICAL MALFUNCTION THRESHOLDS

Air Fuel Ratio Sensor (Bank 1) Slow Response (Rich to Lean)

Rich to Lean Response rate deterioration level	0.04 V or less

Air Fuel Ratio Sensor (Bank 1) Slow Response (Lean to Rich)

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Lean to Rich Response rate deterioration level	-0.038 V or higher

Air Fuel Ratio Sensor (Bank 1) Delayed Response (Rich to Lean)

Rich to Lean delay level	311.296 ms or more

Air Fuel Ratio Sensor (Bank 1) Delayed Response (Lean to Rich)

Lean to Rich delay level	311.296 ms or more

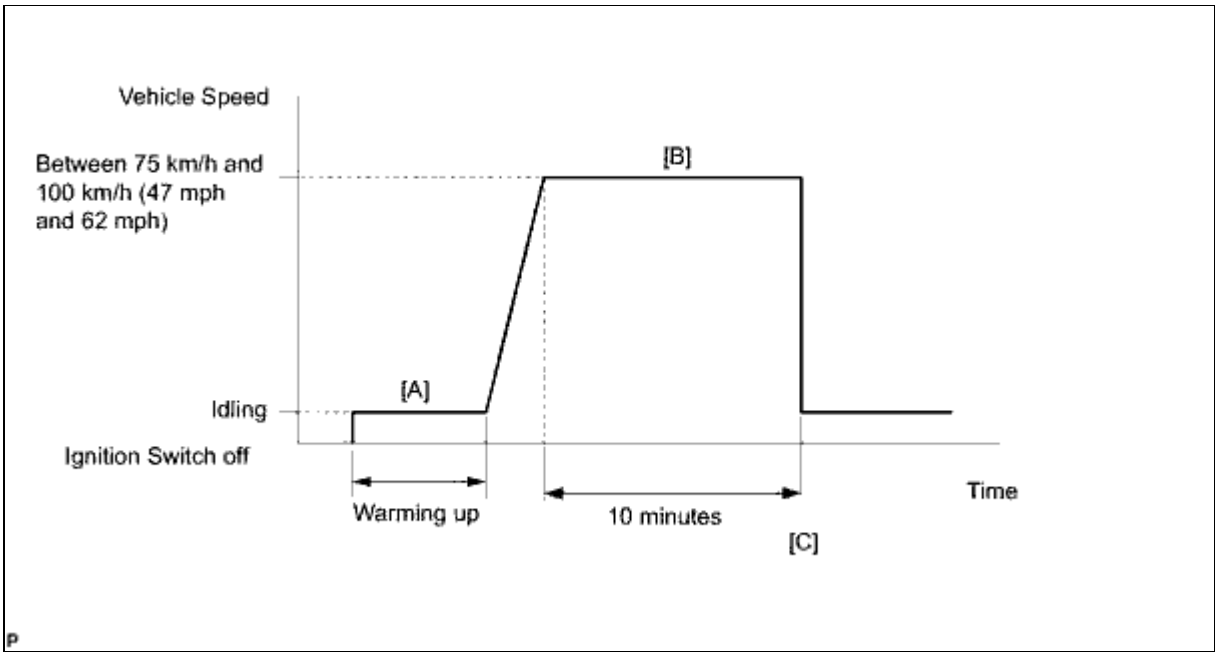
MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

HINT:

Performing this confirmation pattern will activate the air fuel ratio sensor response monitor.



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / O2 Sensor.
8. Check that the monitor item O2 Sensor is Incomplete.

HINT:

The test values for the test items RL RES RATE B1S1, LR RES RATE B1S1, RL DELAY B1S1, and LR DELAY B1S1 do not exist in the Detail of O2 Sensor monitor at this time (the initial value of "0.000" is indicated in each test item).

9. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [A].

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10. Drive the vehicle at a constant speed between 75 and 100 km/h (47 and 62 mph) for 10 minutes [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

11. Check that the monitor item O2 Sensor becomes Complete.

HINT:

Check the test values on the Techstream by entering the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / O2 Sensor / Details / RL RES RATE B1S1, LR RES RATE B1S1, RL DELAY B1S1, and LR DELAY B1S1.

12. If the monitor item O2 Sensor does not become Complete (if the test values indicated on the Techstream do not change), perform Readiness Monitor Drive Pattern for the air fuel ratio sensor and heated oxygen sensor INFO .
13. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
14. Read pending DTC [C].
15. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Input the DTC: P014C, P014D, P015A and P015B.
18. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or N/A, perform step [B] again.

19. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
20. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

21. If the test result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and

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check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0031 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P014C, P014D, P015A OR P015B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P014C, P014D, P015A or P015B is output	A
DTC P014C, P014D, P015A or P015B and other DTCs are output	B

HINT:

If any DTCs other than P014C, P014D, P015A or P015B are output, troubleshooting those DTCs first.

B ▶ GO TO DTC CHART

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A

2.	**INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

(a) Inspect the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK

3.	**CHECK HARNESS AND CONNECTOR (ECM - AIR FUEL RATIO SENSOR)**

(a) Disconnect the A39 air fuel ratio sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A39-1 (HA1A) - E18-6 (HA1A)	Always	Below 1 Ω
A39-3 (A1A+) - E18-26 (A1A+)	Always	Below 1 Ω
A39-4 (A1A-) - E18-34 (A1A-)	Always	Below 1 Ω
A39-1 (HA1A) or E18-6 (HA1A) - Body ground	Always	10 kΩ or higher
A39-3 (A1A+) or E18-26 (A1A+) - Body ground	Always	10 kΩ or higher
A39-4 (A1A-) or E18-34 (A1A-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4.	**CHECK AIR FUEL RATIO SENSOR**

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(a) Check that the proper air fuel ratio sensor is installed to the vehicle.

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK
▼

5.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

NEXT
▼

6.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P014C, P014D, P015A OR P015B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Check the DTC judgment.

Result

RESULT	PROCEED TO
Abnormal (DTC P014C, P014D, P015A or P015B is output)	A
Normal (DTC is not output)	B

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B CHECK FOR INTERMITTENT PROBLEMS

A

7.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT

8.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

NEXT

9.	CHECK WHETHER DTC OUTPUT RECURS (DTC P014C, P014D, P015A OR P015B)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Check the DTC judgment.

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Result

RESULT	PROCEED TO
Normal (DTC is not output)	A
Abnormal (DTC P014C, P014D, P015A or P015B is output)	B

B ▶ **CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TV802EX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0171,P0172; System Too Lean (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0171**	**System Too Lean (Bank 1)**

DTC	**P0172**	**System Too Rich (Bank 1)**

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim consists of both the short-term and long-term fuel trims.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air fuel ratio at stoichiometric levels. The signal from the air fuel ratio sensor indicates whether the air fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air fuel ratio is rich and an increase in the fuel injection volume if it is lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the central value. The long-term fuel trim, which controls overall fuel compensation, compensates for long-term deviations in the fuel trim from the central value caused by the short-term fuel trim compensation.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0171	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	• Intake system • Fuel injector assembly blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leak from exhaust system • Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • Air fuel ratio sensor heater • A/F HTR relay • Air fuel ratio sensor heater circuit • PCV valve and hose • PCV hose connections • ECM • Wire harness or connector

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0172	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	• Intake system • Fuel injector assembly blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leak from exhaust system • Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • Air fuel ratio sensor heater • A/F HTR relay • Air fuel ratio sensor heater circuit • ECM • Wire harness or connector

HINT:

- When DTC P0171 is stored, the actual air fuel ratio is on the lean side. When DTC P0172 is stored, the actual air fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air fuel ratio is lean and DTC P0171 may be stored. The MIL is then illuminated.
- When the total of the short-term and long-term fuel trim values is within the malfunction threshold (and the engine coolant temperature is higher than 75°C [167°F]), the system is functioning normally.

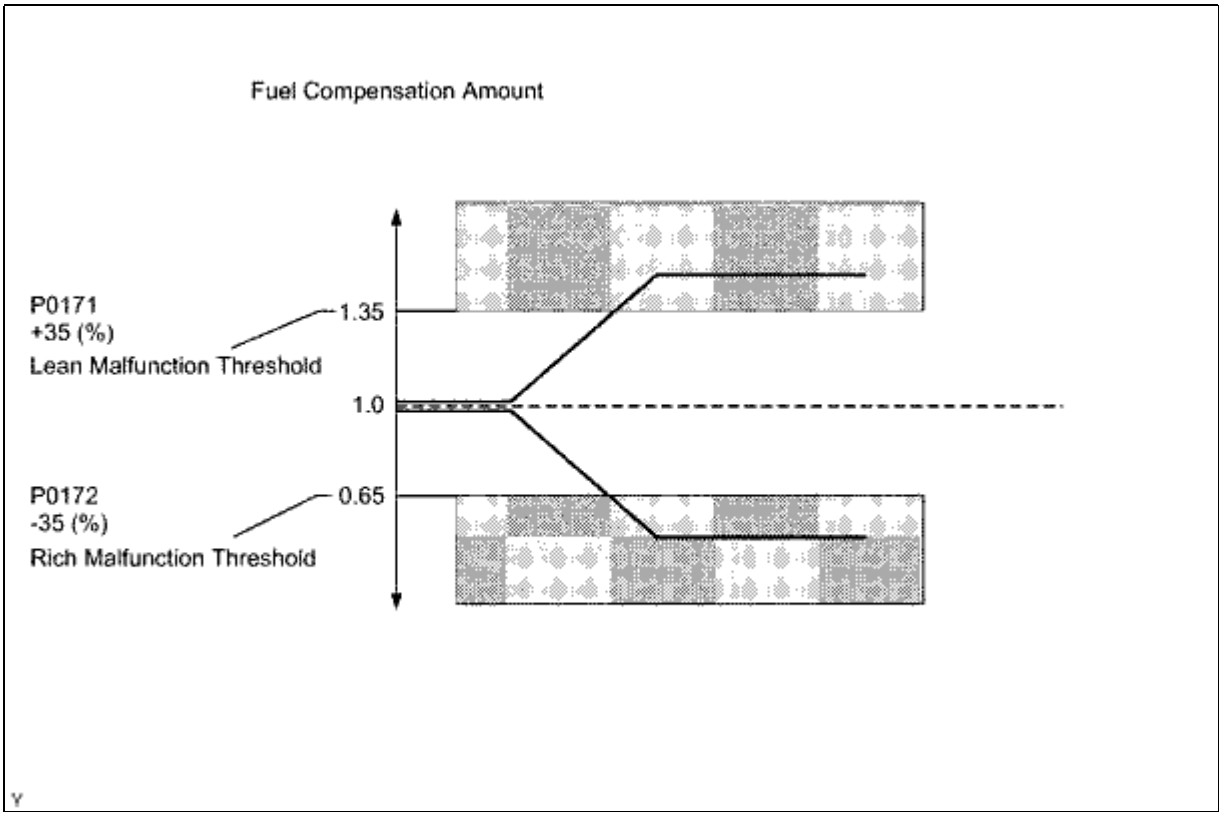
MONITOR DESCRIPTION

Under closed-loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values. Deviations from the ECM's estimated fuel injection volumes also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air fuel ratio). If the average fuel trim learning value exceeds the malfunction thresholds, the ECM interprets this as a fault in the fuel system and stores the DTC.

Example:

The average fuel trim learning value is more than +35% or less than -35%, the ECM interprets this as a fuel system malfunction.

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MONITOR STRATEGY

Related DTCs	P0171: Fuel Trim Lean P0172: Fuel Trim Rich
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Air fuel ratio sensor Mass air flow meter Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater)

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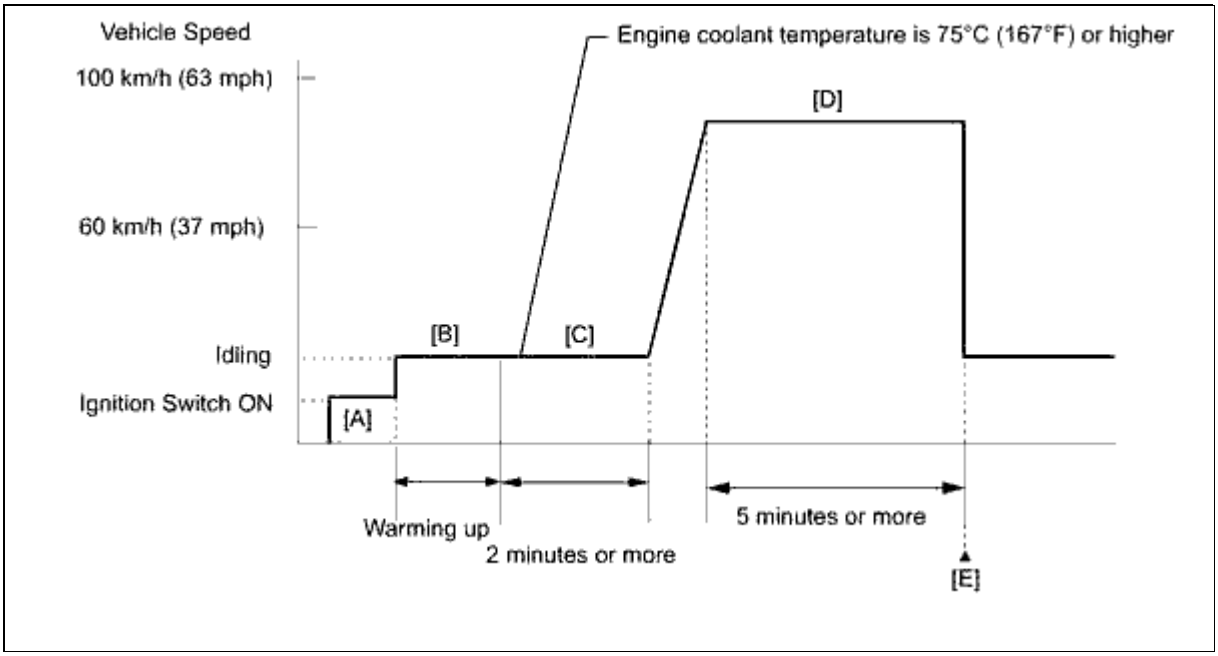
	P0037, P0038, P102D (Heated Oxygen Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0500 (Vehicle Speed Sensor) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)
Fuel system status	Closed-loop
Battery voltage	11 V or higher
Either of following conditions met	1 or 2
1. Engine rpm	Less than 650 rpm
2. Engine load	11.25% or more
Catalyst Monitor	Not executed

TYPICAL MALFUNCTION THRESHOLDS

EVAP purge-cut	Executing
Either of following conditions met	-
Average between short-term fuel trim and long-term fuel trim	35% or more
Average between short-term fuel trim and long-term fuel trim	-35% or less

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off [B].
7. With the engine warmed up, idle the engine for 2 minutes or more [C].
8. Drive the vehicle at a speed between 60 and 100 km/h (37 and 63 mph) for 5 minutes or more [D].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [E].
10. Read pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

11. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

- Refer to DTC P0031 INFO .
- Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

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- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171 OR P0172)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0171 or P0172 is output	A
DTC P0171 or P0172 and other DTCs are output	B

HINT:

If any DTCs other than P0171 or P0172 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**CHECK PCV HOSE CONNECTIONS**

(a) Check the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

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OK

3.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from intake system.

HINT:

- If a malfunction is detected while the brake pedal is being depressed, vacuum leaks in the brake booster assembly are suspected. Inspect the brake booster assembly.
- Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

4.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine and turn the Techstream on.

(c) Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(e) Perform the Control the Injection Volume for A/F Sensor operation with the engine idling (press the -12.5 or 12.5 button to change the fuel injection volume).

(f) Monitor the voltage outputs of air fuel ratio sensor and heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers or increases the fuel injection volume by 12.5%.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE

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TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio sensor)	12.5%	Rich	Below 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen sensor)	12.5%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4

Result

STATUS AFS VOLTAGE B1S1	STATUS O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	SUSPECTED TROUBLE AREAS	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	A
Lean	Lean	Actual air fuel ratio lean	• PCV valve and hose • PCV hose connections • Fuel injector blockage • Gas leakage from exhaust system • Intake system • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor	A
Rich	Rich	Actual air fuel ratio rich	• Fuel injector leakage or blockage • Gas leakage from exhaust system • Ignition system • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor	A
Lean	Lean/Rich	Air fuel ratio sensor malfunction	• Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	• Air fuel ratio sensor	B

Lean: During Control the Injection Volume for A/F Sensor, the air fuel ratio sensor output voltage (AFS Voltage B1S1) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S B1S2) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor, the AFS Voltage B1S1 is consistently less than 3.1 V, and the O2S B1S2 is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor of the Active Test, the output voltage of the

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heated oxygen sensor alternates correctly.

HINT:

Refer to "Data List / Active Test" [AFS Voltage B1S1 and O2S B1S2] INFO .

B ▶ **GO TO STEP 11**

A
▼

5.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the Coolant Temp twice, when the engine is both cold and warmed up.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Coolant Temp	Cold engine	Same as ambient air temperature
	Warm engine	Between 75 and 100°C (167 and 212°F)

HINT:

Perform "Inspection After Repair" after replacing the engine coolant temperature sensor INFO .

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK
▼

6.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF, Coolant Temp and Engine Speed.

(e) Allow the engine to idle until the Coolant Temp reaches 75°C (167°F) or higher.

(f) Read MAF with the engine speed at 2500 rpm.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
MAF	Shift lever position: N A/C: Off Engine Speed: 2500 rpm	Between 8.0 gm/sec. and 14.7 gm/sec.

NG ▶ **GO TO STEP 16**

OK ▼

7.	**CHECK FUEL PRESSURE**

(a) Check the fuel pressure INFO .

NG ▶ **REPAIR OR REPLACE FUEL SYSTEM**

OK ▼

8.	**CHECK FOR EXHAUST GAS LEAKS**

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

HINT:

Perform "Inspection After Repairs" after repairing or replacing the exhaust system INFO .

NG ▶ **REPAIR OR REPLACE EXHAUST SYSTEM**

OK ▼

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9.	CHECK FOR SPARKS (SPARK TEST)

(a) Perform spark test INFO .

HINT:

- If the result of the spark test is normal, proceed to the next step.
- If the spark plugs or ignition system malfunctions, engine misfire may occur. The misfire count can be read using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count (to Cylinder #4 Misfire Count).
- Perform "Inspection After Repair" after repairing or replacing the ignition system INFO .

NEXT

10.	INSPECT FUEL INJECTOR ASSEMBLY (INJECTION AND VOLUME)

(a) Check the injection and volume INFO .

HINT:

- If the injectors malfunction, engine misfire may occur. The misfire count can be read using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count (to Cylinder #4 Misfire Count).
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

OK ▶ **GO TO STEP 15**

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

11.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

(a) Inspect the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK

12.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR) INFO

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NG ▶ GO TO STEP 21

OK ▼

13.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

14.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT ▼

15.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0171 OR P0172)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

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(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0171 or P0172 is output	A
DTC is not output	B

B ▶ **END**

A

▼

16.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR)**

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

▼

17.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0171 OR P0172)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(k) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0171 or P0172 is output	A
DTC is not output	B

B ▶ **END**

A
▼

18.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

19.	**REPLACE MASS AIR FLOW METER**

(a) Replace the mass air flow meter.

HINT:

- If the result of the inspection performed in step 6 indicated no problem, proceed to the next step without replacing the mass air flow meter.
- Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NEXT
▼

20.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0171 or P0172 is output	B

B ▶ **REPLACE ECM**

A ▶ **END**

21.	**CHECK HARNESS AND CONNECTOR (A/F HTR RELAY - AIR FUEL RATIO SENSOR)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

22.	**INSPECT A/F HTR RELAY**

(a) Inspect the A/F HTR relay INFO .

NG ▶ **REPLACE A/F HTR RELAY**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (BATTERY - A/F HTR RELAY)**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TL001FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0300-P0304; Random / Multiple Cylinder Misfire Detected; 2016 MY Tacoma [08/2015 -]		

DTC	**P0300**	**Random / Multiple Cylinder Misfire Detected**

DTC	**P0301**	**Cylinder 1 Misfire Detected**

DTC	**P0302**	**Cylinder 2 Misfire Detected**

DTC	**P0303**	**Cylinder 3 Misfire Detected**

DTC	**P0304**	**Cylinder 4 Misfire Detected**

DESCRIPTION

When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. Extremely high hydrocarbon concentration levels can cause an increase in exhaust emission levels. Extremely high concentrations of hydrocarbons can also cause increases in the three-way catalytic converter temperature, which may cause damage to the three-way catalytic converter. To prevent this increase in emissions and to limit the possibility of thermal damage, the ECM monitors the misfire count. When the temperature of the three-way catalytic converter reaches the point of thermal degradation, the ECM blinks the MIL. To monitor misfires, the ECM uses both the camshaft position sensor and the crankshaft position sensor. The camshaft position sensor is used to identify any misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. Misfires are counted when the crankshaft rotation speed variations exceed predetermined thresholds. If the misfire count exceeds the threshold levels, and could cause emission control system performance deterioration, the ECM illuminates the MIL and stores the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0300	Simultaneous misfiring of several cylinders occurs and one of the following conditions is met (2 trip detection logic): ○ A misfire occurs that may damage the three-way catalytic converter (MIL blinks when detect immediately). ○ An emission deterioration misfire occurs (MIL illuminates).	○ Open or short in engine wire harness ○ Connector connection ○ Vacuum hose connections ○ Ignition system ○ Fuel injector assembly ○ Fuel pressure ○ Mass air flow meter

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0301 P0302 P0303 P0304	Misfiring of a specific cylinder occurs and one of the following conditions is met (2 trip detection logic): ○ A misfire occurs that may damage the three-way catalytic converter (MIL blinks when detect immediately). ○ An emission deterioration misfire occurs (MIL illuminates).	○ Engine coolant temperature sensor ○ Compression pressure ○ Valve clearance ○ Valve timing ○ PCV valve and hose ○ PCV hose connections ○ Intake system ○ ECM ○ Wire harness or connector

When DTCs for misfiring cylinders are randomly stored, but DTC P0300 is not stored, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only stored when several misfiring cylinders are detected at the same time.

MONITOR DESCRIPTION

The ECM illuminates the MIL and stores the DTC when either one of the following conditions, which could cause emission deterioration, is detected (2 trip detection logic).

- Within the first 1000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 10 to 50 misfires per 1000 crankshaft revolutions) occurs once.
- After the first 1000 crankshaft revolutions, an excessive misfiring rate (approximately 10 to 50 misfires per 1000 crankshaft revolutions) occurs 4 times in sequential crankshaft revolutions.

The ECM flashes the MIL (immediate detection logic) and stores a DTC (2 trip detection logic) when either one of the following conditions, which could cause the three-way catalytic converter damage, is detected (2 trip detection logic).

- In every 200 crankshaft revolutions at a high engine rpm, the threshold misfiring percentage is recorded once.
- In every 200 crankshaft revolutions at a normal engine rpm, the threshold misfiring percentage is recorded 3 times.

MONITOR STRATEGY

Related DTCs	P0300: Multiple Cylinder Misfire P0301: Cylinder 1 Misfire P0302: Cylinder 2 Misfire P0303: Cylinder 3 Misfire P0304: Cylinder 4 Misfire
Required Sensors/Components (Main)	Fuel injector assembly Ignition coil assembly Spark plug
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor

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	Intake air temperature sensor Mass air flow meter
Frequency of Operation	Continuous
Duration	1000 crankshaft revolutions (soon after engine is started: 1 time, other 4 times) (Emissions-related misfire) 200 crankshaft revolutions (1 or 3 times) (Catalyst-damaging misfire)
MIL Operation	2 driving cycles: Emission related misfire MIL flashes immediately: Catalyst damaged misfire
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Misfire

Monitor runs whenever following DTCs are not stored	P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0500 (Vehicle Speed Sensor)
Battery voltage	8 V or higher
VVT system	Not operated by scan tool
Engine rpm	400 to 5800 rpm
Fuel-cut	OFF
Either of following conditions 1 or 2 met	-
1. Engine coolant temperature at engine start	Higher than -7°C (19°F)
2. Engine coolant temperature	Higher than 20°C (68°F)

Monitor Period of Emissions-related Misfire

First 1000 revolutions after engine start, or Check Mode	Crankshaft 1000 revolutions
Except above	Crankshaft 1000 revolutions x 4

Monitor Period of Catalyst-damaged-Misfire (MIL Blinks)

All of following conditions 1, 2, 3 and 4 set	Crankshaft 200 revolutions x 3
Except above (MIL blinks immediately)	Crankshaft 200 revolutions

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1. Driving cycle	1st
2. Check mode	OFF
3. Engine RPM	Less than 2700 rpm
4. Intake air amount per revolution	Less than 1.2 g/rev

TYPICAL MALFUNCTION THRESHOLDS

Monitor Period of Emission-related-misfire

Misfire rate	1.4% or more

Monitor Period of Catalyst-damaged-misfire (MIL blinks)

Number of misfire per 200 revolutions	134 or more (varies with intake air amount and engine RPM)

MONITOR RESULT

Refer to Checking Monitor Status INFO .

WIRING DIAGRAM

- Refer to DTC P0102 INFO .
- Refer to Fuel Injector Circuit INFO .

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Record the DTC(s) and freeze frame data.
5. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
6. Using the Techstream, switch the ECM from normal mode to check mode INFO .
7. Read the misfire counts of each cylinder (Cylinder #1 Misfire Count to #4) with the engine idling. If any misfire count is displayed, skip the following confirmation driving pattern.
8. Drive the vehicle so that the vehicle conditions displayed in Misfire RPM and Misfire Load of the Data List are the same as the freeze frame data. Perform this step several times.

HINT:

In order to store misfire DTCs, it is necessary to operate the vehicle for the period of time shown in the table below, confirm the Misfire RPM and Misfire Load in the Data List.

ENGINE RPM	DURATION
Idling	8.0 minutes or more
1000	4.5 minutes or more
2000	2.5 minutes or more
3000	1.5 minutes or more

9. Check whether misfires have occurred by checking DTCs and freeze frame data.

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HINT:

Do not turn the ignition switch off until the stored DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data are cleared.

10. Record the DTC(s), freeze frame data and misfire counts.
11. Turn the ignition switch off and wait for at least 30 seconds.
12. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Check the "Fuel Cut Elps Time" value in the Data List or the freeze frame data which were present when the malfunction occurred. If the value is more than 0 seconds, a high engine speed (8000 rpm or more) has occurred in the past. Since the misfire may be caused by valve rocker arm detaching due to an extremely high engine speed, check that the valve rocker arms are properly attached INFO .
- By clearing the DTC, "Fuel Cut Elps Time" will be cleared.
- If any DTCs other than the misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If the misfire does not recur when the vehicle is brought to the workshop, reproduce the conditions stored in the freeze frame data.
- If the misfire still cannot be reproduced even though the conditions stored in the freeze frame data have been duplicated, one of the following factors is considered to be a possible cause of the problem:
    a. The fuel tank is low.
    b. Improper fuel is used.
    c. The spark plugs have been contaminated.
    d. The problem is complex.
- After finishing repairs, check the misfire counts of the cylinders (Cylinder #1 Misfire Count to #4).
- Be sure to confirm that no misfiring cylinder DTCs are stored again by conducting the confirmation driving pattern, after repairs.
- In the event of DTC P0300 being present, perform the following operations:
    a. Clear DTC INFO .
    b. Start the engine and conduct the confirmation driving pattern.
    c. Read the misfiring rates of each cylinder or DTC(s) using the Techstream or scan tool.
    d. Repair the cylinder(s) that has a high misfiring rate or is indicated by the DTC.
    e. After finishing repairs, conduct the confirmation driving pattern again, in order to verify that DTC P0300 is not stored.
- When one of Short FT #1 or Long FT #1 in the freeze frame data is outside the range of +/-15%, the air fuel ratio may be rich (-15% or less) or lean (+15% or more).
- When the Coolant Temp in the freeze frame data is less than 75°C (167°F), the misfires have occurred only while warming up the engine.
- An extremely imbalanced drive wheel which causes body vibration may cause misfire DTCs detection.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO MISFIRE DTCS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0300, P0301, P0302, P0303 and/or P0304 are output	A
DTC P0300, P0301, P0302, P0303 and/or P0304 and other DTCs are output	B

HINT:

If any DTCs other than P0300, P0301, P0302, P0303 and P0304 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

2.	**CHECK PCV HOSE CONNECTION**

(a) Check the PCV hose connections.

OK:

PCV valve and hose are correctly connected and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK
▼

3.	**READ VALUE USING TECHSTREAM (MISFIRE RPM AND MISFIRE LOAD)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Misfire RPM and Misfire Load.

(e) Read and note the Misfire RPM and Misfire Load (engine load) values.

HINT:

The Misfire RPM and Misfire Load values indicate the vehicle conditions under which the misfire occurred.

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NEXT

4.	**READ VALUE USING TECHSTREAM (CATALYST OT MF F/C)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Catalyst OT MF F/C.

(e) Read the value displayed on the Techstream.

Result

DATA LIST	TECHSTREAM DISPLAY	PROCEED TO
Catalyst OT MF F/C	Avail	A
	Not Avl	B

B **GO TO STEP 6**

A

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (PROHIBIT THE CATALYST OT MISFIRE PREVENT F/C)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Prohibit the Catalyst OT Misfire prevent F/C.

(e) Perform the Active Test.

NOTICE:

When performing the Active Test, make sure the vehicle is stopped and either idling or being revved within 3000 rpm.

NEXT

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6.	READ VALUE USING TECHSTREAM (CYLINDER MISFIRE COUNT)

(a) Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count to Cylinder #4 Misfire Count.

(b) Start the engine allow the engine to idle.

(c) Read each value for Cylinder #1 Misfire Count to Cylinder #4 Misfire Count displayed on the Techstream. If no misfire counts occur in any cylinders, perform steps (d) and (e) and then check the misfire counts again.

(d) Drive the vehicle with the Misfire RPM and Misfire Load noted in the "Read Value Of Techstream (Misfire RPM and Misfire Load)" procedures above.

(e) Read the Cylinder #1 Misfire Count to Cylinder #4 Misfire Count or DTCs displayed on the Techstream.

Result

RESULT	PROCEED TO
Most misfires occur in only 1 or 2 cylinders	A
3 cylinders or more have equal misfire counts	B

HINT:

- If it is difficult to reproduce misfires for each cylinder, check the Data List item called Misfire Margin. Try to find vehicle driving conditions that lower the Misfire Margin value. Values above 30% are considered normal.
- If the freeze frame data's record of the ECT is below 75°C (167°F), the misfire may be detected only when the engine is cold.
- If the freeze frame data's record of the Engine Run Time is below 120 seconds, the misfire may be detected immediately after the engine is started.

B ▶ **GO TO STEP 17**

A

7.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the misfiring cylinder INFO .

HINT:

Perform "Inspection After Repair" after replacing the spark plug INFO .

NG ▶ **REPLACE SPARK PLUG**

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OK

8.	**CHECK FOR SPARKS (SPARK TEST)**

(a) Perform a spark test INFO .

HINT:

If the result of the spark test is normal, proceed to the next step.

NEXT

9.	**CHECK CYLINDER COMPRESSION PRESSURE ON MISFIRING CYLINDER**

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NG ▶ **CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION**

OK

10.	**CHECK TERMINAL VOLTAGE (#10, #20, #30 AND/OR #40)** INFO

NG ▶ **GO TO FUEL INJECTOR CIRCUIT**

OK

11.	**CHECK FUEL INJECTOR ASSEMBLY (FUEL INJECTOR OF MISFIRING CYLINDER)**

(a) Check the fuel injector injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

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HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

OK ▼

12.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

13.	**CHECK FUEL PRESSURE**

(a) Check the fuel pressure INFO .

NG ▶ **GO TO STEP 34**

OK ▼

14.	**READ VALUE USING TECHSTREAM (COOLANT TEMP)** INFO

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

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15.	READ VALUE USING TECHSTREAM (MAF) INFO

NG ▶ GO TO STEP 29

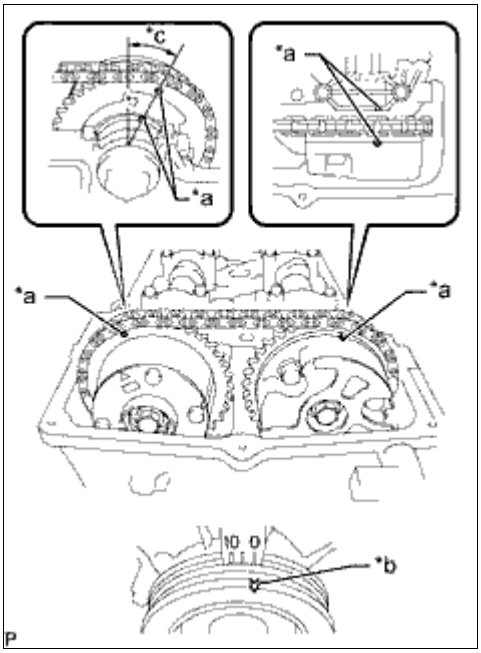
OK

16.	CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)

(a) Remove the cylinder head cover INFO .

Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°



(b) Turn the crankshaft to align the timing marks of the crankshaft.

(c) Align the groove of the crankshaft pulley with the "0" position.

(d) Confirm whether the timing marks of the camshaft pulley and cylinder head cover are facing each other.

HINT:

If the timing marks are not as shown, turn the crankshaft one revolution clockwise.

OK:

The timing marks of the camshaft pulley and the cylinder head cover face each other when the groove of the crankshaft pulley is in the "0" position.

OK ▶ GO TO STEP 29

NG ▶ GO TO STEP 27

17.	CHECK INTAKE SYSTEM INFO

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NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

18.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG ▶ GO TO STEP 34

OK ▼

19.	READ VALUE USING TECHSTREAM (COOLANT TEMP) INFO

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

20.	READ VALUE USING TECHSTREAM (MAF) INFO

NG ▶ GO TO STEP 29

OK ▼

21.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the misfiring cylinder INFO .

HINT:

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Perform "Inspection After Repair" after replacing the spark plug INFO .

NG ▶ REPLACE SPARK PLUG

OK ▼

22.	CHECK FOR SPARKS (SPARK TEST)

(a) Perform a spark test INFO .

HINT:

If the result of the spark test is normal, proceed to the next step.

NEXT ▼

23.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

HINT:

Perform "Inspection After Repair" after repairing or replacing the engine assembly INFO .

NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK ▼

24.	CHECK TERMINAL VOLTAGE (#10, #20, #30 AND/OR #40) INFO

NG ▶ GO TO FUEL INJECTOR CIRCUIT

OK ▼

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25.	CHECK FUEL INJECTOR OF MISFIRING CYLINDER

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

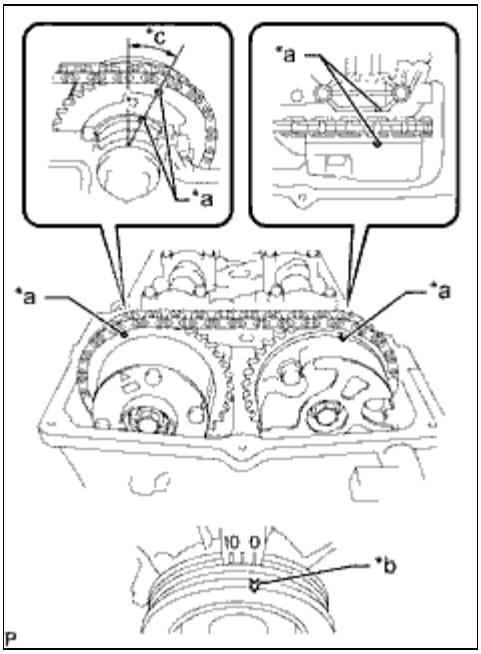
OK ▼

26.	CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)

(a) Remove the cylinder head cover INFO .

Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°



(b) Turn the crankshaft to align the timing marks of the crankshaft.

(c) Align the groove of the crankshaft pulley with the "0" position.

(d) Confirm whether the timing marks of the camshaft pulley and cylinder head cover are facing each other.

HINT:

If the timing marks are not as shown, turn the crankshaft one revolution clockwise.

OK:

The timing marks of the camshaft pulley and the cylinder head cover face each other when the groove of the crankshaft pulley is in the "0" position.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

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B ▶ GO TO STEP 29

A ▼

27.	CHECK ENGINE MECHANICAL SYSTEM

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

INFO

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK ▼

28.	CHECK WHETHER DTC OUTPUT RECURS (MISFIRE DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(l) Input the DTC: P0300, P0301, P0302, P0303 or P0304.

(m) Check the DTC judgment result.

Result

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RESULT	PROCEED TO
ABNORMAL (DTC P0300, P0301, P0302, P0303 or P0304 output)	A
NORMAL (DTC is not output)	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

▼

29.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

▼

30.	**CHECK WHETHER DTC OUTPUT RECURS (MISFIRE DTCS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(l) Input the DTC: P0300, P0301, P0302, P0303 or P0304.

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(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P0300, P0301, P0302, P0303 or P0304 output)	A
NORMAL (DTC is not output)	B

B ▶ **END**

A
▼

31.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

32.	**REPLACE MASS AIR FLOW METER**

(a) Replace the mass air flow meter.

HINT:

- If the results of the inspections performed in steps 15 and 20 indicated no problem, proceed to the next step without replacing the mass air flow meter.
- Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NEXT
▼

33.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(l) Input the DTC: P0300, P0301, P0302, P0303 or P0304.

(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P0300, P0301, P0302, P0303 or P0304 output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

34.	**CHECK FUEL LINE**

(a) Check the fuel lines for leaks or blockage.

HINT:

Perform "Inspection After Repair" after replacing the fuel suction tube with pump and gauge assembly INFO .

NG ▶ **REPAIR OR REPLACE FUEL LINE**

OK ▶ **REPLACE FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000YF401MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0327,P0328; Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor); 2016 MY Tacoma [08/2015 -]		

DTC	**P0327**	**Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)**

DTC	**P0328**	**Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)**

DESCRIPTION

A flat type knock sensor (non-resonant type) has a structure that can detect vibrations between approximately 5 kHz and 15 kHz.

Knock sensors are fitted onto the engine block to detect engine knocking.

The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed.

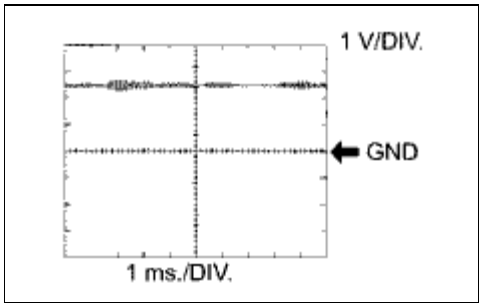
The voltage is generated when the engine block vibrates due to knocking. Any occurrence of engine knocking can be suppressed by delaying the ignition timing.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0327	Output voltage of knock sensor less than 0.5 V (1 trip detection logic)	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of knock sensor higher than 4.5 V (1 trip detection logic)	• Open in knock sensor circuit • Knock sensor • ECM

HINT:

When any of DTCs P0327 and P0328 are stored, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the ignition switch is turned off.

Reference: Inspection using an oscilloscope



The correct waveform is shown.

ECM Terminal Name	Between KNK1 and EKNK

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Tester Range	1 V/DIV., 1 ms./DIV.
Condition	Engine speed maintained 4000 rpm after warming up engine

MONITOR DESCRIPTION

If the output voltage transmitted by the knock sensor remains low or high for more than 1 second, the ECM interprets this as a malfunction in the sensor circuit, and stores the DTC.

The monitor for DTCs P0327 and P0328 begins to run when 5 seconds have elapsed since the engine was started.

If the malfunction is not repaired successfully, any of DTC P0327 or P0328 is stored 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0327: Knock Sensor Range Check (Low Voltage) P0328: Knock Sensor Range Check (High Voltage)
Required Sensors/Components (Main)	Knock sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Time after engine start	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Knock Sensor Range Check (Low voltage) P0327

Knock sensor voltage	Less than 0.5 V

Knock Sensor Range Check (High voltage) P0328

Knock sensor voltage	Higher than 4.5 V

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.

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6. Start the engine and wait 5 minutes.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0327 or P0328.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, idle the engine for 5 minutes and check the DTC judgment result again.

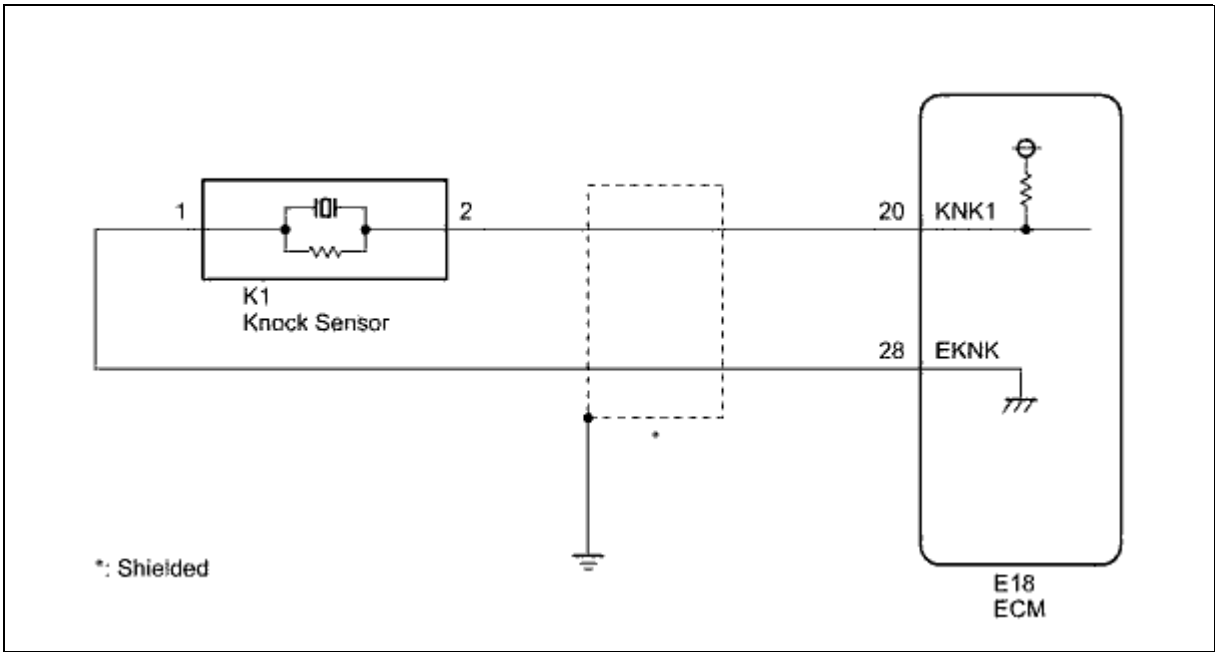
12. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (KNOCK FEEDBACK VALUE)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / Knock Feedback Value.

(f) Read the value while driving the vehicle.

OK:

The value changes.

Malfunction does not occur	Knock Feedback Value changes
Malfunctions occur	Knock Feedback Value does not change

The Knock Feedback Value change can be confirmed by running the engine with a high load, for example, by activating the air conditioning system and racing the engine.

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NG ▶ GO TO STEP 2

OK ▶ CHECK FOR INTERMITTENT PROBLEMS

2.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF KNOCK SENSOR)

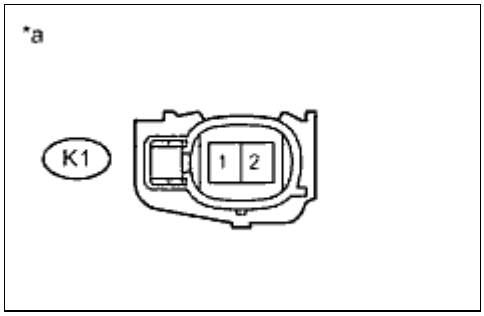
(a) Disconnect the knock sensor connector.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
K1-2 - K1-1	Ignition switch ON	4.5 to 5.5 V



Text in Illustration

*a	Front view of wire harness connector (to Knock Sensor)

NG ▶ GO TO STEP 4

OK ▼

3.	INSPECT KNOCK SENSOR

(a) Inspect the knock sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the knock sensor INFO .

NG ▶ REPLACE KNOCK SENSOR

OK ▶ REPLACE ECM

4.	CHECK HARNESS AND CONNECTOR (KNOCK SENSOR - ECM)

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(a) Disconnect the K1 knock sensor connector.

(b) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
K1-2 - E18-20 (KNK1)	Always	Below 1 Ω
K1-1 - E18-28 (EKNK)	Always	Below 1 Ω
K1-2 or E18-20 (KNK1) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TCW127X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0335,P0339; Crankshaft Position Sensor "A" Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0335**	**Crankshaft Position Sensor "A" Circuit**

DTC	**P0339**	**Crankshaft Position Sensor "A" Circuit Intermittent**

DESCRIPTION

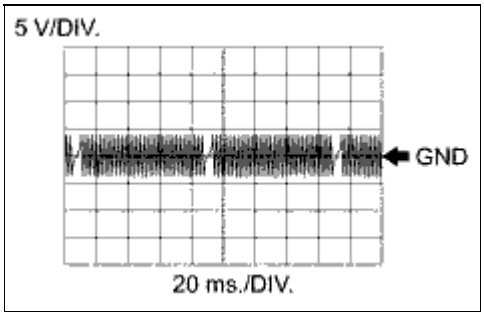
The crankshaft position sensor system consists of a crank angle sensor plate and a pickup coil. The sensor plate has 34 teeth and is installed on the No. 2 crankshaft timing sprocket. The pickup coil is made of wound copper wire, an iron core and a magnet.

The sensor plate rotates and, as each tooth passes by the pickup coil, a pulse signal is created. The pickup coil generates 34 signals per crankshaft revolution. Based on these signals, the ECM calculates the crankshaft position and engine speed. Using these calculations, the fuel injection time and ignition timing are controlled.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0335	When any of following conditions is met when camshaft position sensor circuit fail is not detected: (1 trip detection logic) • Missing crankshaft position sensor signal despite camshaft position sensor signal inputs normal after engine cranked • No crankshaft position sensor signal to ECM while cranking • No crankshaft position sensor signal to ECM while engine running	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • No. 2 crankshaft timing sprocket (crank angle sensor plate) • ECM
P0339	Under conditions (a), (b) and (c), no crankshaft position sensor signal to ECM for 0.05 seconds or more (1 trip detection logic): (a) Engine speed 1000 rpm or more (b) Starter signal off (c) 3 seconds or more have elapsed since starter signal switched from on to off	

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Reference: Inspection using an oscilloscope



ECM Terminal Names	Between NE+ and NE
Tester Ranges	5 V/DIV., 20 ms./DIV.
Conditions	idling

HINT:

- The correct waveforms are as shown.
- NE stands for the crankshaft position sensor signal.
- Grounding failure of the shielded wire may cause noise in the waveforms.

MONITOR DESCRIPTION

If there is no signal from the crankshaft position sensor despite the engine revolving, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, a DTC is stored 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0335: Crankshaft Position Sensor Verify Pulse Input P0335: Crankshaft Position Sensor Range Check/Rationality
Required Sensors/Components (Main)	Crankshaft position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	4.7 seconds: Verify pulse input case 1 -: Verify pulse input case 2 0.016 seconds: Range check/rationality
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Crankshaft Position Sensor Verify Pulse Input

Case 1

Starter	ON
Minimum battery voltage while starter ON	Less than 11 V

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Case 2

Engine speed (Top dead center)	600 rpm or more
Engine speed (30°CA)	600 rpm or more
Starter	OFF
Time after starter ON to OFF	3 seconds or more

Crankshaft Position Sensor Range Check/Rationality

All of the following conditions are met	-
Time after starter OFF to ON	3 seconds or more
Camshaft position sensor circuit fail (P0340, P0342, P0343)	Not detected
Number of camshaft position sensor signal pulse	6 times
Battery voltage	7 V or higher
Minimum battery voltage while starter ON	Less than 11 V

TYPICAL MALFUNCTION THRESHOLDS

Crankshaft Position Sensor Verify Pulse Input

Crankshaft position sensor signal	No signal

Crankshaft Position Sensor Range Check/Rationality

Number of crankshaft position sensor signal pulse	132 times or less, or 174 times or more

COMPONENT OPERATING RANGE

Crankshaft position sensor	• Crankshaft position sensor output voltage fluctuates while crankshaft revolving • 34 crankshaft position sensor signals per crankshaft revolution

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.
7. Idle the engine for 20 seconds or more [A].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0335 or P0339.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

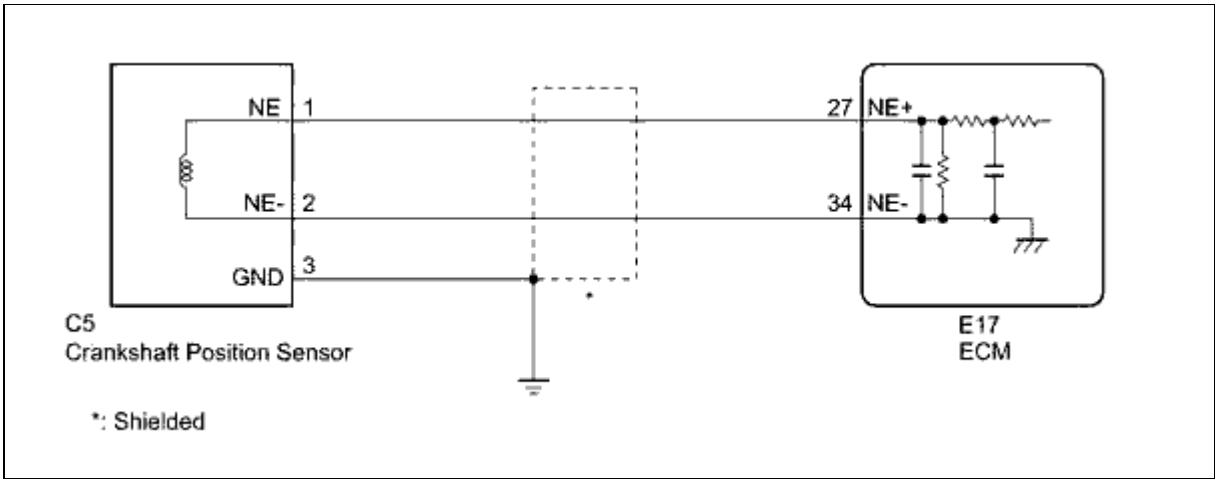
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [A] through [B] again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If no problem is found by this diagnostic troubleshooting procedure, check for problems by referring to the engine mechanical section.

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- After performing the inspection procedure for the crankshaft position sensor, if DTC P0335 is output again, check the following items related to the camshaft position sensor.

    a. Installation condition of the camshaft position sensor
    b. Installation condition of the camshaft
    c. Connection of the camshaft position sensor connector

- Check the engine speed. The engine speed can be checked by using the Techstream. To check, follow the operation below:

    (a) Connect the Techstream to the DLC3.

    (b) Start the engine.

    (c) Turn the Techstream on.

    (d) Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.

    The engine speed may be indicated as zero despite the engine revolving normally. This is caused by a lack of NE signals from the crankshaft position sensor. Alternatively, the engine speed may be indicated as lower than the actual engine speed, if the crankshaft position sensor voltage output is insufficient.

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.

(e) Start the engine.

(f) Read the values displayed on the Techstream while the engine is running.

OK:

Correct values are displayed.

HINT:

- To check the engine speed change, display the graph on the Techstream.
- If the engine does not start, check the engine speed while cranking.
- If the engine speed indicated on the Techstream remains zero (0), there may be an open or short in the Crankshaft Position sensor circuit.

NG ▶ **GO TO STEP 2**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	**INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)**

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(a) Inspect the crankshaft position sensor INFO .

NG ▶ **REPLACE CRANKSHAFT POSITION SENSOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)**

(a) Disconnect the C5 crankshaft position sensor connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C5-1 (NE) - E17-27 (NE+)	Always	Below 1 Ω
C5-2 (NE-) - E17-34 (NE-)	Always	Below 1 Ω
C5-1 (NE) or E17-27 (NE+) - Body ground	Always	10 kΩ or higher
C5-2 (NE-) or E17-34 (NE-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**CHECK CRANKSHAFT POSITION SENSOR (SENSOR INSTALLATION)**

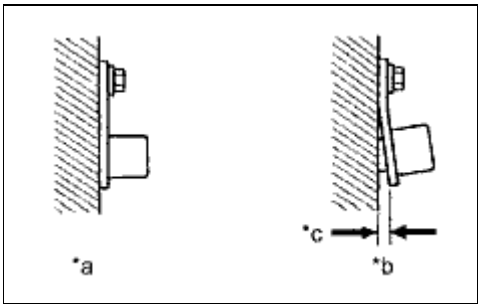
(a) Check the crankshaft position sensor installation.

OK:

Sensor is installed correctly.

Text in Illustration

*a	OK
*b	NG
*c	Clearance



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NG ▶ SECURELY REINSTALL SENSOR

OK ▼

5.	CHECK NO. 2 CRANKSHAFT TIMING SPROCKET (TEETH OF CRANK ANGLE SENSOR PLATE)

(a) Check the teeth of the crank angle sensor plate.

OK:

Sensor plate does not have any cracks or deformation.

NG ▶ REPLACE NO. 2 CRANKSHAFT TIMING SPROCKET

OK ▼

6.	REPLACE CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

NEXT ▼

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0335 AND/OR P0339)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

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(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0335 or P0339 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012JE08CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0340,P0342,P0343; Camshaft Position Sensor Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0340**	**Camshaft Position Sensor Circuit**

DTC	**P0342**	**Camshaft Position Sensor "A" Circuit Low Input (Bank 1 or Single Sensor)**

DTC	**P0343**	**Camshaft Position Sensor "A" Circuit High Input (Bank 1 or Single Sensor)**

DESCRIPTION

The camshaft position sensor (VV1 signal sensor) for the intake camshaft consists of a magnet and MRE (Magneto-Resistive Element).

The camshaft has a timing rotor for the camshaft position sensor. When the camshaft rotates, changes occur in the air gaps between the timing rotor and MRE, which affects the magnet. As a result, the resistance of the MRE material fluctuates. The camshaft position sensor converts the camshaft rotation data to pulse signals, uses the pulse signals to determine the camshaft angle, are sends it to the ECM. Then the ECM uses this data to control fuel injection time and injection timing.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0340	When one of the following conditions is met: • No camshaft position sensor signal to the ECM while cranking (2 trip detection logic). • No camshaft position sensor signal to ECM at engine speed of 600 rpm or higher (1 trip detection logic). • A missing camshaft position sensor signal despite the crankshaft position sensor inputs being normal at an engine speed of 600 rpm or higher (1 trip detection logic).	• Open or short in camshaft position sensor (for intake side) circuit • Camshaft position sensor (for intake side) • Intake camshaft • Timing chain jumped tooth • ECM
P0342	The output voltage of the camshaft position sensor is below 0.3 V for 4 seconds (1 trip detection logic).	• Open or short in camshaft position sensor (for intake side) circuit • Camshaft position sensor (for intake side) • ECM
P0343	The output voltage is higher than 4.7 V for 4 seconds (1 trip detection logic).	• Open or short in camshaft position sensor (for intake side) circuit • Camshaft position sensor

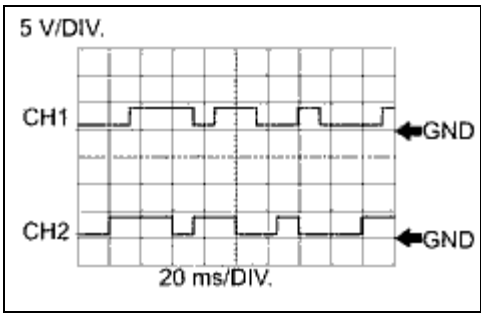
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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		(for intake side) • ECM

HINT:

DTC P0340 indicates a malfunction relating to the camshaft position sensor (+) circuit (the wire harness between the ECM and camshaft position sensor, and the camshaft position sensor itself).

Reference: Inspection using an oscilloscope



ECM Terminal Names	CH1: Between VV1+ and VV1- CH2: Between EV1+ and EV1-
Tester Ranges	5 V/DIV., 20 ms./DIV.
Conditions	Idling

HINT:

- The correct waveform is as shown above.
- VV1 stands for the camshaft position sensor (for intake side) signal and EV1 stands for the camshaft position sensor (for exhaust side) signal.

MONITOR DESCRIPTION

If no signal is transmitted by the camshaft position sensor despite the engine revolving, or the rotation of the camshaft and the crankshaft is not synchronized, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, a DTC is stored 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0340: Camshaft Position Sensor (for Intake side) verify pulse input P0342: Camshaft Position Sensor (for Intake side) range check (low voltage) P0343: Camshaft Position Sensor (for Intake side) range check (high voltage)
Required Sensors/Components (Main)	Camshaft Position Sensor (for Intake side)
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous

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Duration	4 seconds: P0340 (Camshaft Position Sensor (for Intake side) verify pulse input (case 2)) P0342 (Camshaft Position Sensor (for Intake side) range check (low voltage)) P0343 (Camshaft Position Sensor (for Intake side) range check (high voltage)) 5 seconds: P0340 (Camshaft Position Sensor (for Intake side) verify pulse input (case 1))
MIL Operation	2 driving cycles: P0340 (VVT sensor (bank 1) verify pulse input (case 2)) Immediate: Others
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0340: Camshaft Position Sensor Verify Pulse Input (Case 1)

Both of the following conditions are met	-
Starter	ON and not starter ON again
Minimum battery voltage while starter ON	Below 11 V

P0340: Camshaft Position Sensor Verify Pulse Input (Case 2)

All of the following conditions are met	-
Engine speed	600 rpm or higher
Starter	OFF
Camshaft position sensor voltage	0.3 to 4.7 V
VVT system misalignment	Not detected
Camshaft position sensor range check fail	Not detected

P0342, P0343: Camshaft Position Sensor Range Check

All of the following conditions are met	-
Starter	OFF
Ignition switch	ON
Time after ignition switch turned from off to ON	2 seconds or more
Battery voltage	8 V or higher
Camshaft position sensor verify pulse input fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0340: Camshaft Position Sensor Verify Pulse Input (Case 1)

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Camshaft position sensor signal	No signal

P0340: Camshaft Position Sensor Verify Pulse Input (Case 2)

Either of the following conditions is met	1 or 2
1. Camshaft position and crankshaft position phase	Misaligned
2. Camshaft position sensor signal	No signal

P0342: Camshaft Position Sensor Range Check

Camshaft position sensor voltage	Below 0.3 V

P0343: Camshaft Position Sensor Range Check

Camshaft position sensor voltage	Higher than 4.7 V

COMPONENT OPERATING RANGE

Camshaft position sensor voltage	0.3 to 4.7 V

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.
7. Idle the engine for 10 seconds or more [A].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
9. Read the DTCs.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0340.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

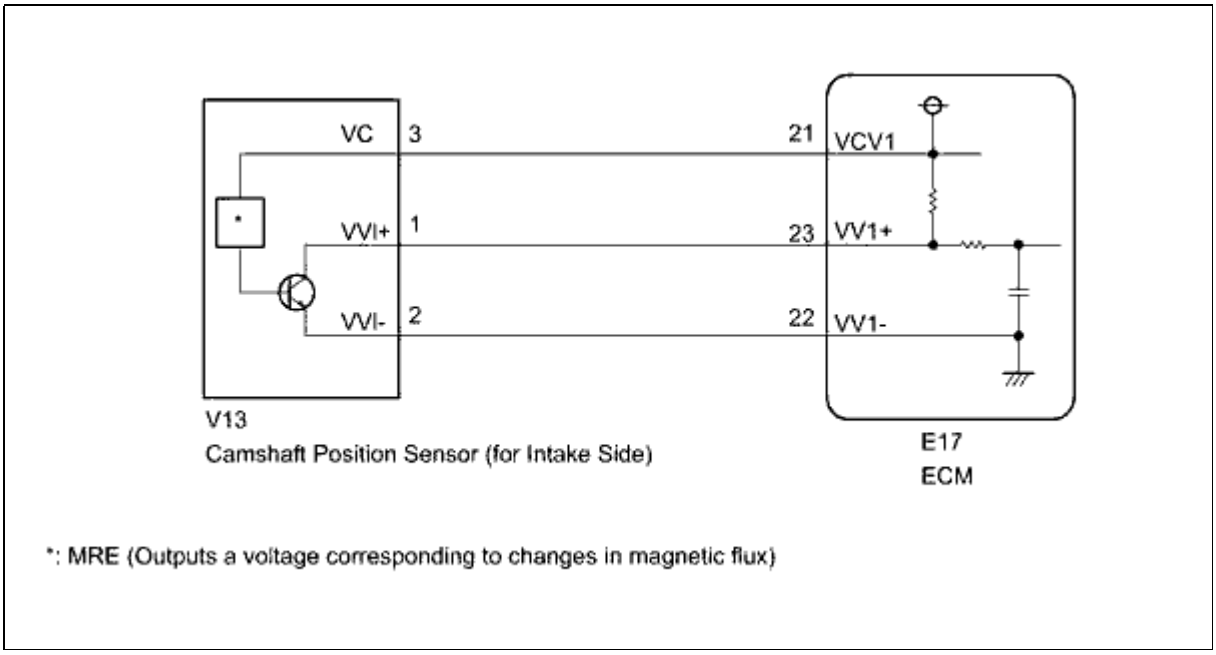
- ○ If the judgment result shows NORMAL, the system is normal.
- ○ If the judgment result shows ABNORMAL, the system has a malfunction.
- ○ If the judgment result shows INCOMPLETE or N/A, perform steps [A] through [B] again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- ○ If a permanent DTC is output, the system is malfunctioning.
- ○ If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If no problem is found through this diagnostic troubleshooting procedure, there may be a mechanical problem with the engine.

PROCEDURE

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1.	**CHECK TERMINAL VOLTAGE (SENSOR POWER SOURCE)**

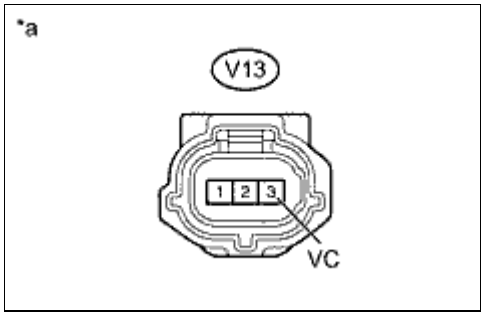
(a) Disconnect the camshaft position sensor (for intake side) connector.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
V13-3 (VC) - Body ground	Ignition switch ON	4.5 to 5.5 V



Text in Illustration

*a	Front view of wire harness connector (to Camshaft Position Sensor (for Intake Side))

NG ▶ **GO TO STEP 10**

OK ▼

2.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR (FOR INTAKE SIDE) - ECM)**

(a) Disconnect the V13 camshaft position sensor (for intake side) connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
V13-1 (VVI+) - E17-23 (VV1+)	Always	Below 1 Ω
V13-2 (VVI-) - E17-22 (VV1-)	Always	Below 1 Ω
V13-1 (VVI+) or E17-23 (VV1+) - Body ground	Always	10 kΩ or higher
V13-2 (VVI-) or E17-22 (VV1-) - Body ground	Always	10 kΩ or higher

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR)

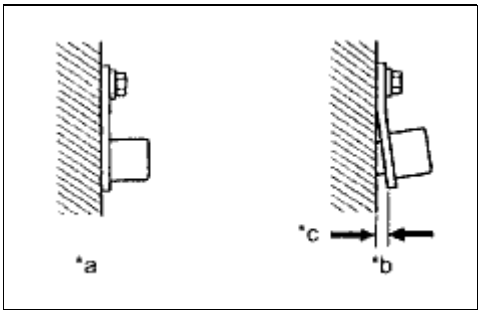
(a) Check the camshaft position sensor (for intake side) installation.

OK:

Camshaft position sensor (for intake side) is installed correctly.

Text in Illustration

*a	OK
*b	NG
*c	Clearance



NG ▶ SECURELY REINSTALL SENSOR

OK ▼

4.	INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (TEETH OF SENSOR PLATE)

(a) Inspect the teeth of the sensor plate.

OK:

Sensor plate teeth do not have any cracks or deformation.

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing gear assembly INFO .

NG ▶ REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

OK ▼

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5.	CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH) INFO

NG ▶ **GO TO STEP 8**

OK
▼

6.	REPLACE CAMSHAFT POSITION SENSOR (FOR INTAKE SIDE)

(a) Replace the camshaft position sensor (for intake side) INFO .

NEXT
▼

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0340, P0342 OR P0343)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P0340, P0342 or P0343 is output	A
DTC is not output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **END**

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A

8.	**CHECK ENGINE MECHANICAL SYSTEM**

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

INFO

NG → **CHECK MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

9.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0340, P0342 OR P0343)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P0340, P0342 or P0343 is output	A
DTC is not output	B

HINT:

If the engine does not start, replace the ECM.

B → **CHECK FOR INTERMITTENT PROBLEMS**

A → **REPLACE ECM**

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10.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR (FOR INTAKE SIDE) - ECM)**

(a) Disconnect the V13 camshaft position sensor (for intake side) connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
V13-3 (VC) - E17-21 (VCV1)	Always	Below 1 Ω
V13-3 (VC) or E17-21 (VCV1) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TCY019X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0351-P0354; Ignition Coil "A" Primary / Secondary Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0351**	**Ignition Coil "A" Primary / Secondary Circuit**

DTC	**P0352**	**Ignition Coil "B" Primary / Secondary Circuit**

DTC	**P0353**	**Ignition Coil "C" Primary / Secondary Circuit**

DTC	**P0354**	**Ignition Coil "D" Primary / Secondary Circuit**

CAUTION / NOTICE / HINT

DESCRIPTION

HINT:

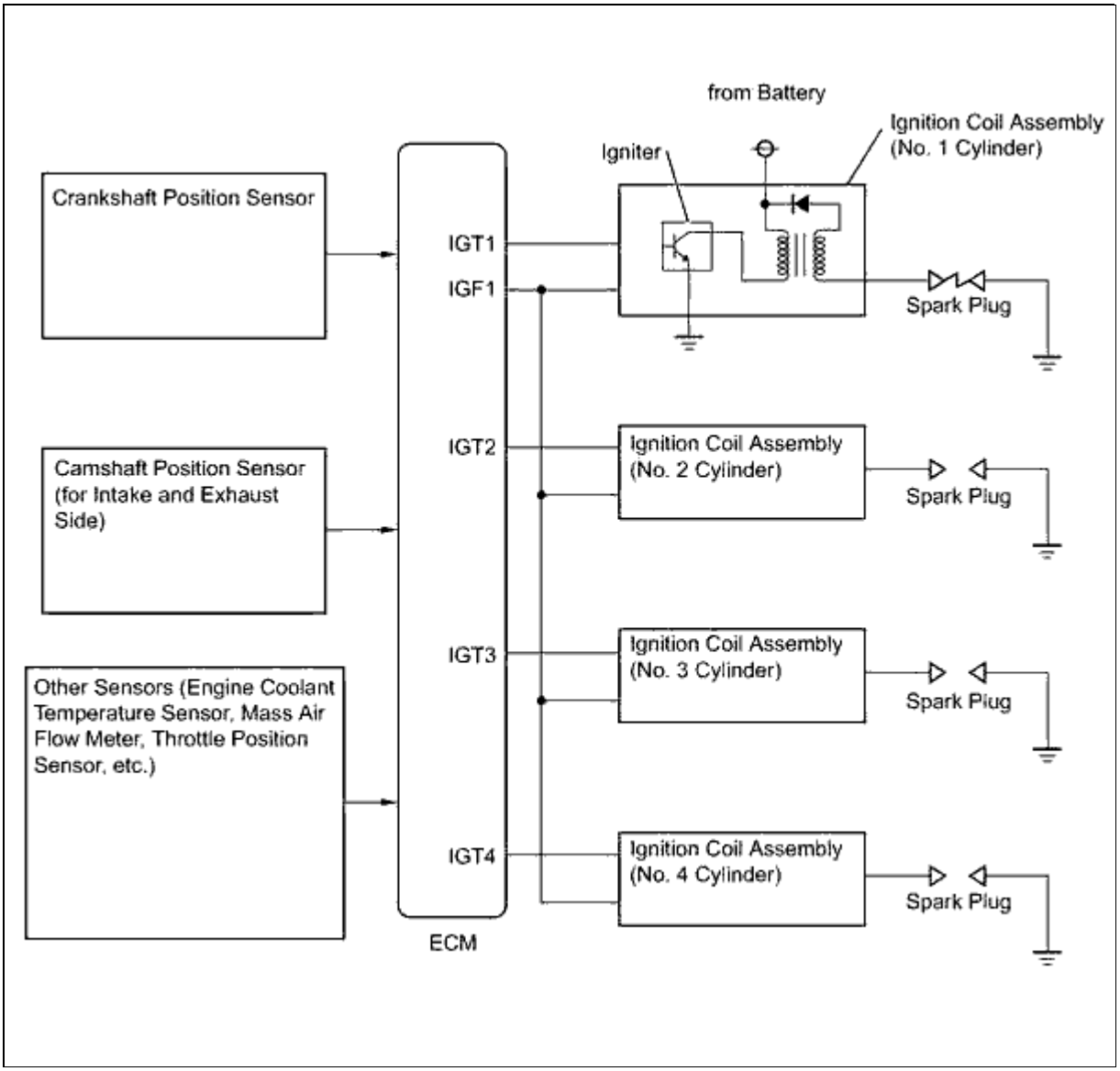
- These DTCs indicate malfunctions relating to the primary circuit.
- If DTC P0351 is stored, check ignition coil assembly (No. 1 cylinder) circuit.
- If DTC P0352 is stored, check ignition coil assembly (No. 2 cylinder) circuit.
- If DTC P0353 is stored, check ignition coil assembly (No. 3 cylinder) circuit.
- If DTC P0354 is stored, check ignition coil assembly (No. 4 cylinder) circuit.

A direct ignition system is used on this vehicle.

The direct ignition system is a 1-cylinder ignition system in which each cylinder is ignited by one ignition coil and one spark plug is connected to the end of each secondary wiring. A powerful voltage, generated in the secondary wiring, is applied directly to each spark plug. The sparks of the spark plugs pass from the center electrodes to the ground electrodes.

The ECM determines the ignition timing and transmits the ignition (IGT) signals to each cylinder. Using the IGT signal, the ECM turns the power transistor inside the igniter on and off. The power transistor, in turn, switches on and off the current to the primary coil. When the current to the primary coil is cut off, a powerful voltage is generated in the secondary coil. This voltage is applied to the spark plugs, causing them to spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back an ignition confirmation (IGF) signal to the ECM, for each cylinder ignition.

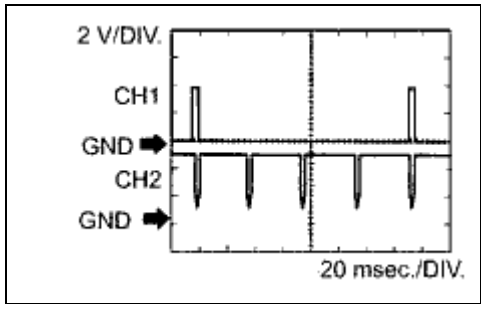
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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine running (1 trip detection logic)	• Ignition system • Open or short in IGF1 or IGT circuit (1 to 4) between ignition coil assembly and ECM • Ignition coil assembly • ECM

Reference: Inspection using an oscilloscope.

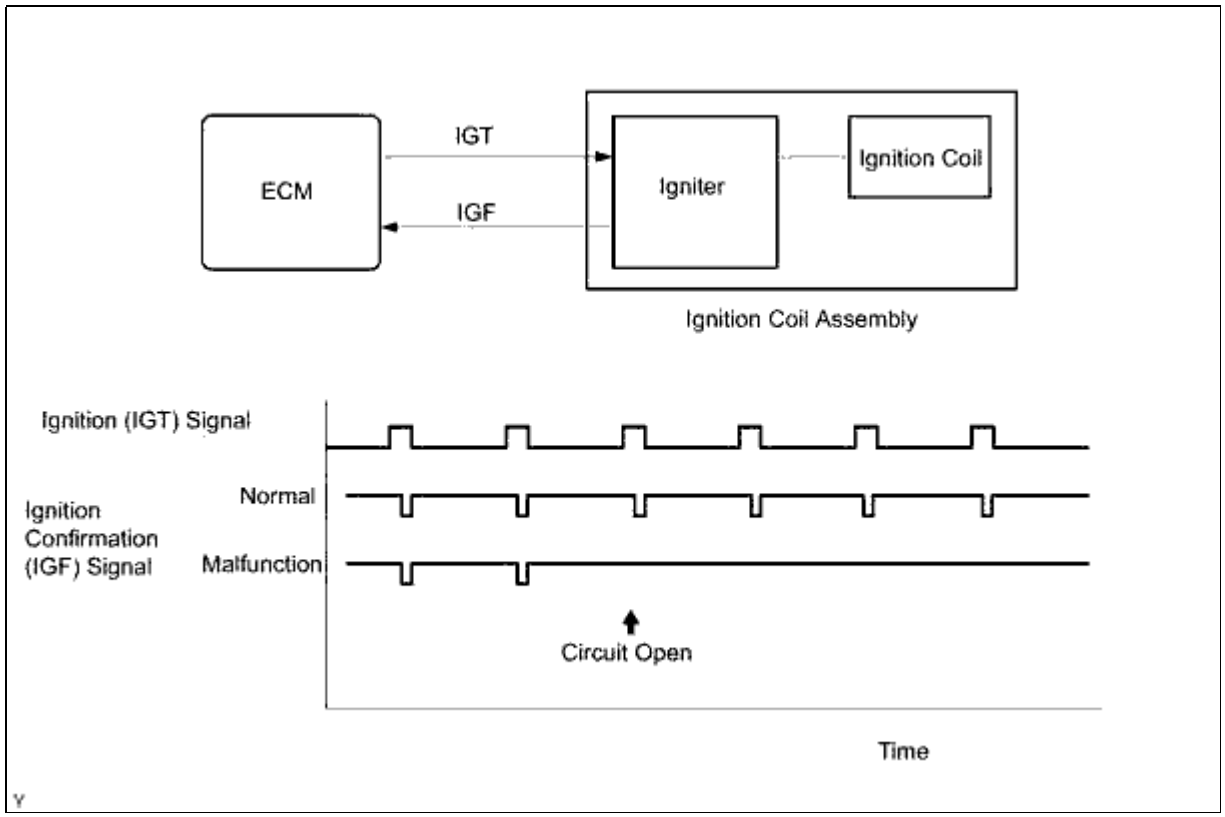
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While cranking or idling, check the waveform between terminals IGT (1 to 4) and E1, and IGF1 and E1 of the ECM connector.

ECM Terminal Name	CH1: IGT1, IGT2, IGT3, IGT4 and E1 CH2: IGF1 and E1
Tester Range	2 V/DIV., 20 msec./DIV.
Condition	Idling

MONITOR DESCRIPTION



If the ECM does not receive any IGF signals despite transmitting the IGT signal, it interprets this as a fault in the igniter and stores a DTC.

If the malfunction is not repaired successfully, a DTC is stored 1 second after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0351: Igniter (Cylinder 1) Malfunction P0352: Igniter (Cylinder 2) Malfunction

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	P0353: Igniter (Cylinder 3) Malfunction P0354: Igniter (Cylinder 4) Malfunction
Required Sensors/Components (Main)	Igniter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	-
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Either of following conditions A or B met	-
A. Engine speed	1500 rpm or less
B. Starter	OFF
Either of following conditions C or D met	-
C. Both of following conditions (a) and (b) met	-
(a) Engine speed	500 rpm or less
(b) Battery voltage	6 V or higher
D. All of following conditions (a), (b) and (c) met	-
(a) Engine speed	More than 500 rpm
(b) Battery voltage	10 V or higher
(c) Number of sparks after CPU reset	5 sparks or more

TYPICAL MALFUNCTION THRESHOLDS

IGF signal	ECM does not receive any IGF signal despite ECM sending IGT signal to igniter

COMPONENT OPERATING RANGE

Following condition is met	2 times or more
Confirmed ignition signal	Signal input

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.
7. Idle the engine for 10 seconds or more [A].

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8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
9. Read the DTCs.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0351, P0352, P0353 or P0354.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [A] through [B] again.

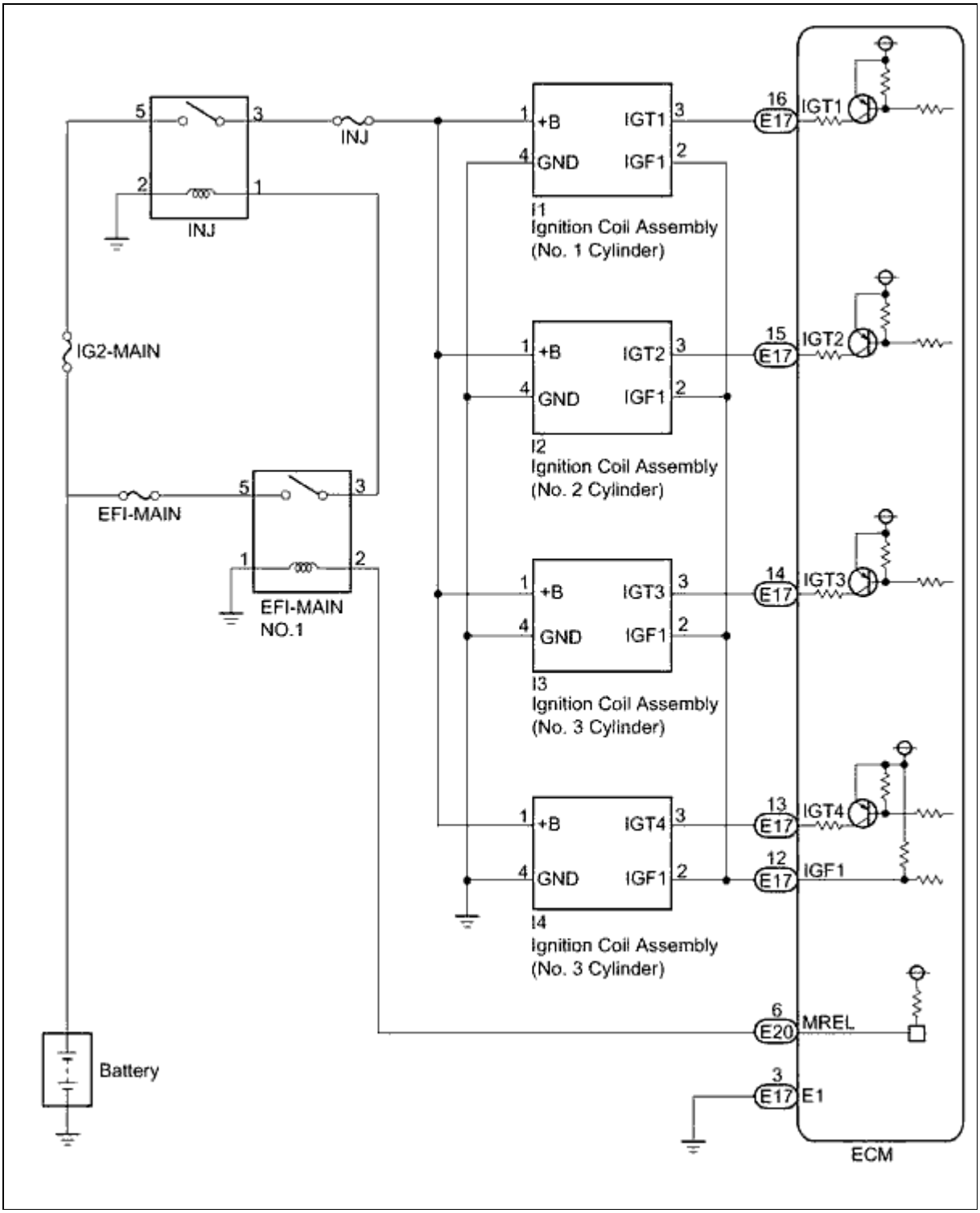
13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

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PROCEDURE

1.	**CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - BODY GROUND)**

(a) Disconnect the I1, I2, I3 and I4 ignition coil assembly connectors.

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

Standard Resistance:

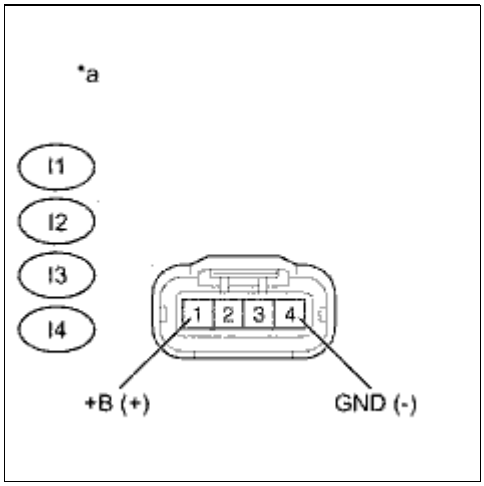
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I1-4 (GND) - Body ground	Always	Below 1 Ω
I2-4 (GND) - Body ground	Always	Below 1 Ω
I3-4 (GND) - Body ground	Always	Below 1 Ω
I4-4 (GND) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

2.	**INSPECT TERMINAL VOLTAGE (POWER SOURCE OF IGNITION COIL ASSEMBLY)**

(a) Disconnect the ignition coil assembly connectors.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION

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TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
I1-1 (+B) - I1-4 (GND)	Ignition switch ON	11 to 14 V
I2-1 (+B) - I2-4 (GND)	Ignition switch ON	11 to 14 V
I3-1 (+B) - I3-4 (GND)	Ignition switch ON	11 to 14 V
I4-1 (+B) - I4-4 (GND)	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Ignition Coil Assembly)

NG ▶ **GO TO STEP 5**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - ECM)**

(a) Disconnect the I1, I2, I3 and I4 ignition coil assembly connectors.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I1-2 (IGF) - E17-12 (IGF1)	Always	Below 1 Ω
I2-2 (IGF) - E17-12 (IGF1)	Always	Below 1 Ω
I3-2 (IGF) - E17-12 (IGF1)	Always	Below 1 Ω
I4-2 (IGF) - E17-12 (IGF1)	Always	Below 1 Ω
I1-3 (IGT1) - E17-16 (IGT1)	Always	Below 1 Ω
I2-3 (IGT2) - E17-15 (IGT2)	Always	Below 1 Ω
I3-3 (IGT3) - E17-14 (IGT3)	Always	Below 1 Ω
I4-3 (IGT4) - E17-13 (IGT4)	Always	Below 1 Ω
I1-2 (IGF) or E17-12 (IGF1) - Body ground	Always	10 kΩ or higher
I2-2 (IGF) or E17-12 (IGF1) - Body ground	Always	10 kΩ or higher
I3-2 (IGF) or E17-12 (IGF1) - Body ground	Always	10 kΩ or higher
I4-2 (IGF) or E17-12 (IGF1) - Body ground	Always	10 kΩ or higher
I1-3 (IGT1) or E17-16 (IGT1) - Body ground	Always	10 kΩ or higher

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I2-3 (IGT2) or E17-15 (IGT2) - Body ground	Always	10 kΩ or higher
I3-3 (IGT3) or E17-14 (IGT3) - Body ground	Always	10 kΩ or higher
I4-3 (IGT4) or E17-13 (IGT4) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0351, P0352, P0353 OR P0354)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Shuffle the arrangement of the ignition coil assemblies (among No. 1 to No. 4 cylinders).

NOTICE:

Do not change the location of the connectors.

(f) Perform a simulation test.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
Same DTC output	A
Different ignition coil DTC output	B

HINT:

Perform "Inspection After Repair" after replacing the ignition coil assembly INFO .

B ▶ **REPLACE IGNITION COIL ASSEMBLY**

A ▶ **REPLACE ECM**

5.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - INJ RELAY)

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(a) Disconnect the I1, I2, I3 and I4 ignition coil assembly connectors.

(b) Remove the INJ relay from the engine room relay block.

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

Standard Resistance:

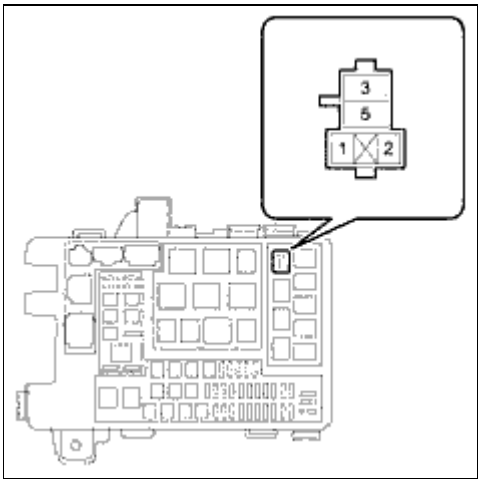
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I1-1 (+B) - 3 (INJ relay holder)	Always	Below 1 Ω
I2-1 (+B) - 3 (INJ relay holder)	Always	Below 1 Ω
I3-1 (+B) - 3 (INJ relay holder)	Always	Below 1 Ω
I4-1 (+B) - 3 (INJ relay holder)	Always	Below 1 Ω
I1-1 (+B), I2-1 (+B), I3-1 (+B), I4-1 (+B) or 3 (INJ relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

6.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF INJ RELAY)**

(a) Remove the INJ relay from the engine room relay block.



Text in Illustration

*1	Engine Room Relay Block
*2	INJ Relay holder

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (INJ relay holder) - Body ground	Always	11 to 14 V

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NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INJ RELAY - BATTERY)**

OK ▼

7.	**CHECK HARNESS AND CONNECTOR (INJ RELAY - BODY GROUND)**

(a) Remove the INJ relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (INJ relay holder) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

8.	**CHECK HARNESS AND CONNECTOR (EFI-MAIN NO.1 - INJ RELAY)**

(a) Remove the INJ relay from the engine room relay block.

(b) Remove the EFI-MAIN NO.1 relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (INJ relay holder) - 3 (EFI-MAIN NO.1 relay holder)	Always	Below 1 Ω
1 (INJ relay holder) or 3 (EFI-MAIN NO.1 relay holder) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE INJ RELAY**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000YTB0MNX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0365,P0367,P0368; Camshaft Position Sensor "B" Circuit (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0365**	**Camshaft Position Sensor "B" Circuit (Bank 1)**

DTC	**P0367**	**Camshaft Position Sensor "B" Circuit Low Input (Bank 1)**

DTC	**P0368**	**Camshaft Position Sensor "B" Circuit High Input (Bank 1)**

DESCRIPTION

The exhaust camshaft's Variable Valve Timing (VVT) sensor (EV1 signal) consists of a magnet and MRE (Magneto-Resistive Element).

The exhaust camshaft has 3 teeth on its outer circumference.

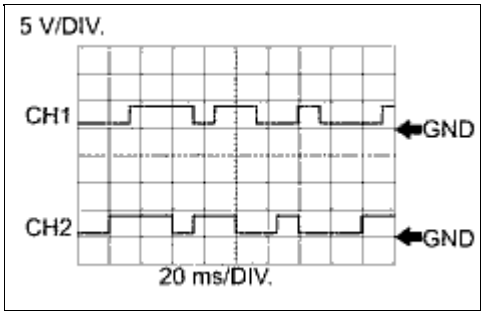
When the exhaust camshaft rotates, changes occur in the air gaps between the 3 teeth and MRE, which affects the magnetic field. As a result, the resistance of the MRE material fluctuates. The camshaft position sensor converts the exhaust camshaft rotation data to pulse signals, uses the pulse signals to determine the camshaft angle, and sends the camshaft angle data to the ECM.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0365	There is no camshaft position sensor signal despite the crankshaft position sensor input being normal at an engine speed of 600 rpm or more (1 trip detection logic).	• Open or short in camshaft position sensor (for exhaust side) circuit • Camshaft position sensor (for exhaust side) • Exhaust camshaft • Timing chain has jumped tooth • ECM
P0367	Output voltage of the camshaft position sensor is below 0.3 V for 4 seconds (1 trip detection logic).	• Open or short in camshaft position sensor (for exhaust side) circuit • Camshaft position sensor (for exhaust side) • Exhaust camshaft • Timing chain has jumped tooth • ECM

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0368	Output voltage of the camshaft position sensor is higher than 4.7 V for 4 seconds (1 trip detection logic).	• Open or short in camshaft position sensor (for exhaust side) circuit • Camshaft position sensor (for exhaust side) • Exhaust camshaft • Timing chain has jumped tooth • ECM

Reference: Inspection using an oscilloscope



ECM Terminal Names	CH1: Between VV1+ and VV1- CH2: Between EV1+ and EV1-
Tester Ranges	5 V/DIV., 20 ms./DIV.
Conditions	Idling

HINT:

- The correct waveforms are as shown.
- VV1 stands for the camshaft position sensor (for intake side) signal and EV1 stands for the camshaft position sensor (for exhaust side) signal.

MONITOR DESCRIPTION

If no signal is transmitted by the camshaft position sensor despite the camshaft revolving, or the rotations of the camshaft and crankshaft are not synchronized, the ECM interprets this as a malfunction of the sensor.

MONITOR STRATEGY

Related DTCs	P0365: Camshaft Position Sensor (for Exhaust Side) verify pulse input P0367: Camshaft Position Sensor (for Exhaust Side) range check (low voltage) P0368: Camshaft Position Sensor (for Exhaust Side) range check (high voltage)
Required Sensors/Components (Main)	Camshaft Position Sensor (for Exhaust Side)
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous

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Duration	5 seconds: P0365 4 seconds: P0367, P0368
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever the following DTCs are not stored	None

P0365: Camshaft Position Sensor (for Exhaust Side) Verify Pulse Input

All of the following conditions are met	-
Engine speed	600 rpm or higher
Camshaft position sensor (for exhaust side) range check fail (P0367, P0368)	Not detected
Ignition switch	ON
Starter	OFF
Battery voltage	8 V or higher
Camshaft position sensor (for exhaust side) range check fail	Not detected

P0367 and P0368: Camshaft Position Sensor (for Exhaust Side) Range Check

All of the following conditions are met	-
Starter	OFF
Ignition switch	ON
Time after ignition switch turned from OFF to ON	2 seconds or more
Battery voltage	8 V or higher
Camshaft position sensor (for exhaust side) range check fail (P0365)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0365: Camshaft Position Sensor (for Exhaust Side) Verify Pulse Input

Camshaft position sensor (for exhaust side) signal	No signal

P0367: Camshaft Position Sensor (for Exhaust Side) Range Check (Low Voltage)

Camshaft position sensor (for exhaust side) voltage	Less than 0.3 V

P0368: Camshaft Position Sensor (for Exhaust Side) Range Check (High Voltage)

Camshaft position sensor (for exhaust side) voltage	Higher than 4.7 V

COMPONENT OPERATING RANGE

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Camshaft position sensor (for exhaust side) voltage	0.3 to 4.7 V

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.
7. Idle the engine for 10 seconds or more.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0365, P0367 or P0368.
12. Check the DTC judgment result.

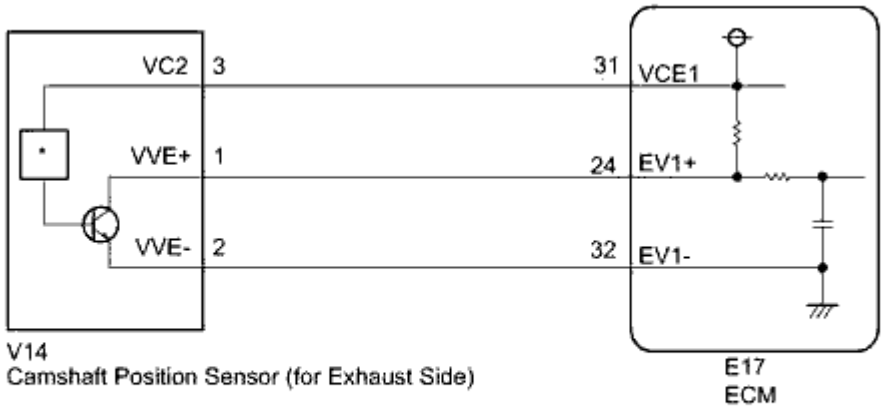
TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the Confirmation Driving Pattern and check the DTC judgment result again.

WIRING DIAGRAM

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*: MRE (Outputs a voltage corresponding to changes in magnetic flux)

INSPECTION PROCEDURE

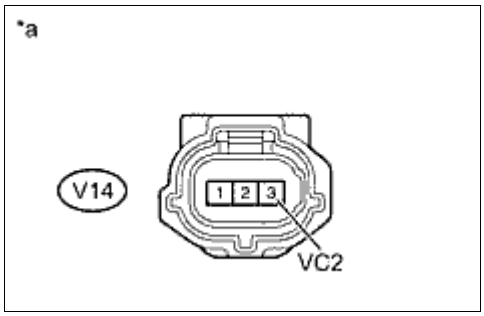
HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK TERMINAL VOLTAGE (SENSOR POWER SOURCE)**

(a) Disconnect the camshaft position sensor (for exhaust side) connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
V14-3 (VC2) - Body ground	Ignition switch ON	4.5 to 5.0 V

Text in Illustration

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*a	Front view of wire harness connector (to Camshaft Position Sensor (for Exhaust Side))

NG ▶ GO TO STEP 10

OK ▼

2.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR(FOR EXHAUST SIDE) - ECM)**

(a) Disconnect the V14 camshaft position sensor (for exhaust side) connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
V14-1 (VVE+) - E17-24 (EV1+)	Always	Below 1 Ω
V14-2 (VVE-) - E17-32 (EV1-)	Always	Below 1 Ω
V14-1 (VVE+) or E17-24 (EV1+) - Body ground	Always	10 kΩ or higher
V14-2 (VVE-) or E17-32 (EV1-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

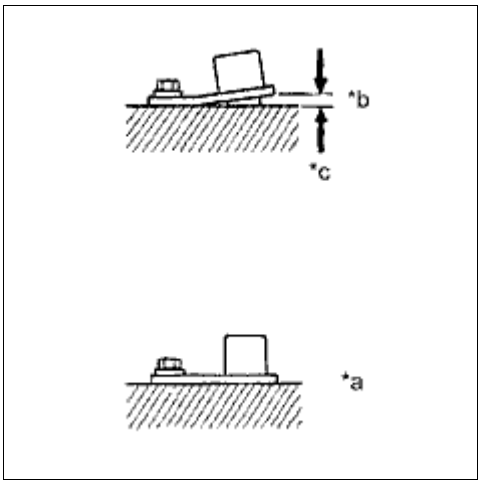
3.	**CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR (FOR EXHAUST SIDE))**

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(a) Check the camshaft position sensor (for exhaust side) installation.

OK:

Camshaft position sensor (for exhaust side) is installed correctly.



Text in Illustration

*a	OK
*b	NG
*c	Clearance

NG ▶ **SECURELY REINSTALL SENSOR**

OK ▼

4.	**INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (TEETH OF SENSOR PLATE)**

(a) Inspect the teeth of the sensor plate.

OK:

Sensor plate teeth do not have any cracks or deformation.

HINT:

Perform "Inspection After Repair" after replacing the exhaust camshaft INFO .

NG ▶ **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

OK ▼

5.	**CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)** INFO

NG ▶ **GO TO STEP 8**

OK ▼

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6.	REPLACE CAMSHAFT POSITION SENSOR (FOR EXHAUST SIDE)

(a) Replace the camshaft position sensor (for exhaust side) INFO .

NEXT

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0365, P0367 OR P0368)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P0365, P0367 or P0368 is output	A
DTC is not output	B

HINT:

If the engine does not start, replace the ECM.

B **END**

A

8.	CHECK ENGINE MECHANICAL SYSTEM

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

INFO

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NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

9.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0365, P0367 OR P0368)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P0365, P0367 or P0368 is output	A
DTC is not output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE ECM**

10.	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR (FOR EXHAUST SIDE) - ECM)

(a) Disconnect the V14 camshaft position sensor (for exhaust side) connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
V14-3 (VC2) - E17-31 (VCE1)	Always	Below 1 Ω
V14-3 (VC2) or E17-31 (VCE1) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012FY065X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0412; Secondary Air Injection System Switching Valve "A" Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0412**	**Secondary Air Injection System Switching Valve "A" Circuit**

DESCRIPTION

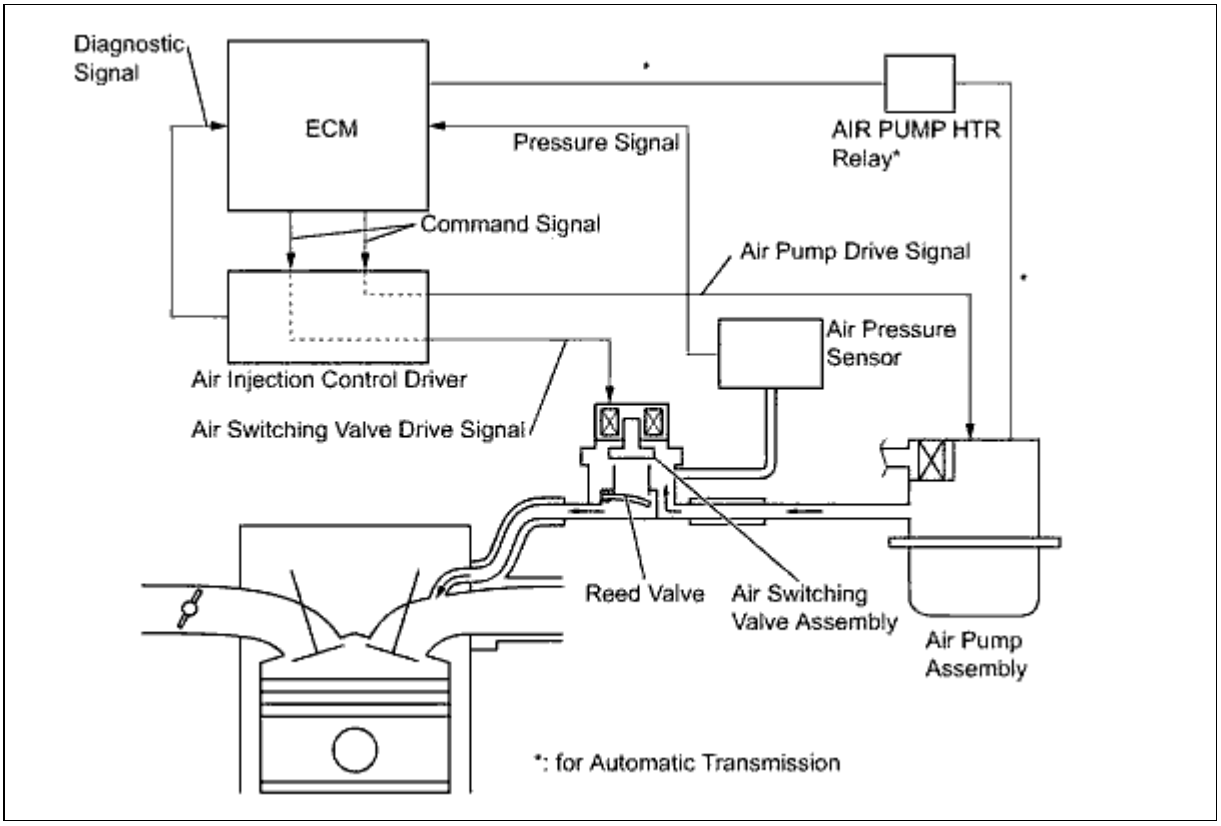
The secondary air injection system consists of an air pump assembly, the air switching valve assembly, an air pressure sensor, the air injection control driver and the ECM. For a short time after cold engine starts, the secondary air injection system pumps secondary air to the exhaust port of the cylinder head to purify the exhaust emissions. The secondary air is supplied by the air pump assembly and is pumped to the exhaust port through the air switching valve assembly.

The air injection control driver drives the air switching valve assembly and the air pump assembly according to command signals transmitted by the ECM. The air pressure sensor detects the pressure in the secondary air passage when the secondary air injection system is ON and OFF, and transmits pressure signal to the ECM.

The air injection control driver is not only equipped to drive the pump and valve, but also with a diagnosis function to detect malfunctions in the secondary air injection system circuit.

HINT:

As a large current is required to drive the air pump assembly and air switching valve assembly, an air injection control driver is included in this system.



DTC	DTC DETECTION CONDITION	TROUBLE AREA

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NO.		
P0412	After cold engine starts, all of following conditions met (1 trip detection logic): a. Secondary air injection system not operating (air pump and air switching valve are off) b. Diagnostic signal from air injection control driver 31% or more, and 48% or less c. Battery voltage 8 V or higher	• Open in air switching valve drive circuit • Short between air switching valve drive circuit and +B circuit • Air injection control driver • Air switching valve assembly • ECM
	After cold engine starts, all of following conditions met (1 trip detection logic): a. Secondary air injection system operating (air pump and air switching valve are on) b. Diagnostic signal from air injection control driver 31% or more, and 48% or less c. Battery voltage 8 V or higher	• Short between air switching valve drive circuit and body ground • Air injection control driver • Air switching valve assembly • ECM

MONITOR DESCRIPTION

The air injection control driver detects open and short circuits according to the voltages of the air pump assembly terminal and the air switching valve assembly terminal, and transmits diagnostic information as a signal to the ECM.

For a short time after cold engine starts, the ECM transmits command signals to the air injection control driver to drive the air pump assembly and air switching valve assembly.

The air injection control driver transmits an air switching valve malfunction signal to the ECM if either of the following conditions is met:

- The voltage at the air injection control driver terminal relating to the air switching valve assembly is low despite the air injection control driver receiving command signals from the ECM to drive the air switching valve assembly.
- The voltage at the air injection control driver terminal relating to the air switching valve is high despite the air injection control driver receiving no command signals from the ECM to drive the air switching valve assembly.

The ECM stores the DTC based on diagnostic signals from the air injection control driver.

MONITOR STRATEGY

Related DTCs	P0412: Secondary Air Injection System Air Switching Valve Circuit Range Check
Required Sensors/Components (Main)	Air injection control driver
Required Sensors/Components (Related)	Air switching valve assembly
Frequency of Operation	Once per drive cycle
Duration	3 seconds

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MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Case 1

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Command to air pump	ON
Command to air switching valve	ON
Battery voltage	8 V or higher
Ignition switch	ON
Time after ignition switch OFF to ON	More than 0.5 seconds
Starter	OFF
Time after starter ON to OFF	More than 0.5 seconds

Case 2

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Command to air pump	OFF
Command to air switching valve	OFF
Battery voltage	8 V or higher
Ignition switch	ON
Time after ignition switch OFF to ON	More than 0.5 seconds
Starter	OFF
Time after starter ON to OFF	More than 0.5 seconds

TYPICAL MALFUNCTION THRESHOLDS

Diagnostic signal duty ratio from air injection control driver	31% or more, and 48% or less

COMPONENT OPERATING RANGE

Diagnostic signal duty ratio from air injection control driver	70% or more, and 90% or less when secondary air injection system operating. 0% when secondary air injection system not operating.

CONFIRMATION DRIVING PATTERN

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system

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for a maximum of 5 seconds.

Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.

- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. After the "Secondary Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P0412.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

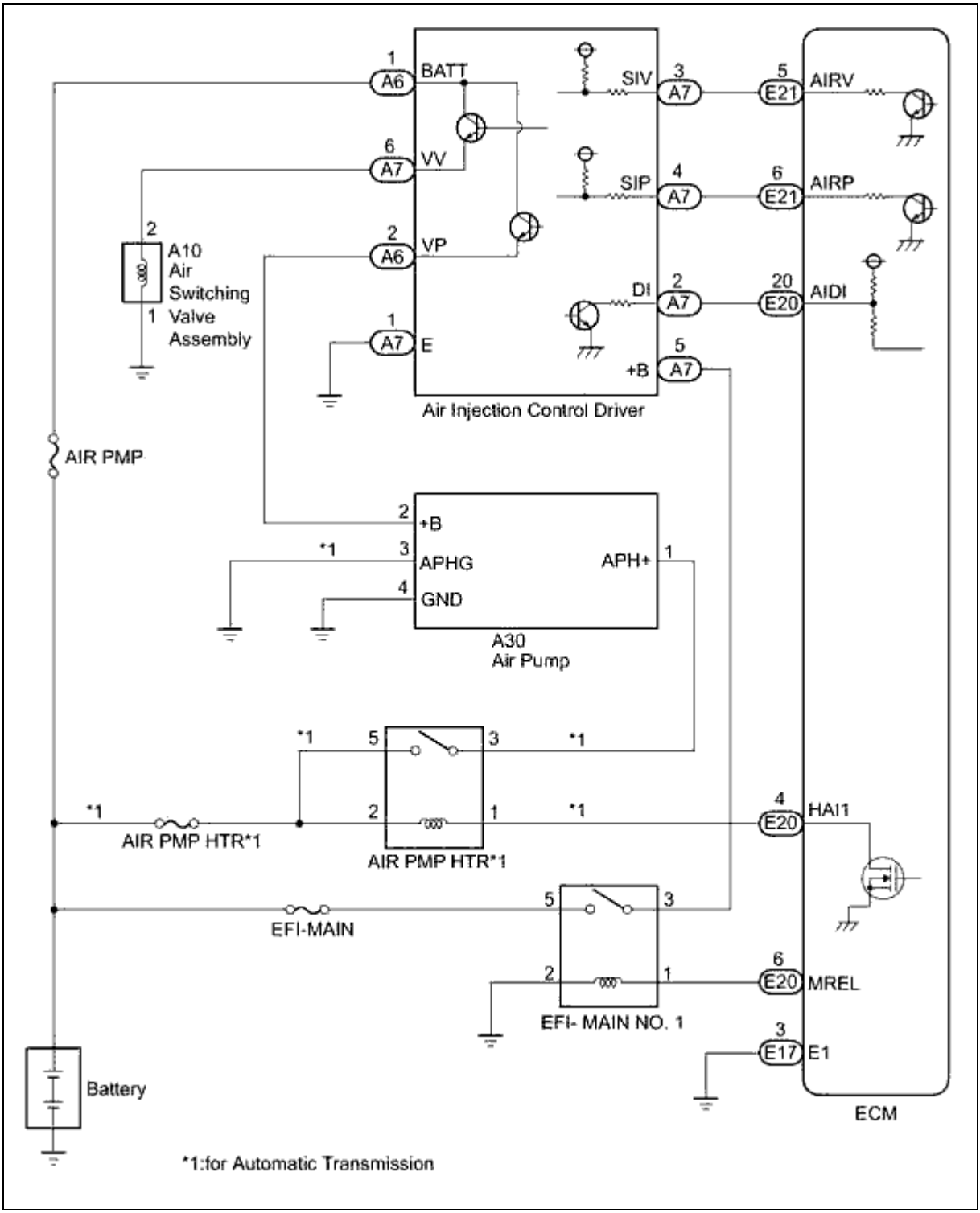
HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

18. Turn the ignition switch off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- By using the Techstream to perform the Secondary Air Injection Check operation in the System Check, the air fuel ratio and the pressure in the secondary air injection system passage can be checked while the secondary air injection system is operating. This helps technicians to troubleshoot the system when it malfunctions

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- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**INSPECT AIR SWITCHING VALVE ASSEMBLY**

(a) Inspect the air switching valve assembly INFO .

NG ▶ **REPLACE AIR SWITCHING VALVE ASSEMBLY**

OK ▼

2.	**CHECK HARNESS AND CONNECTOR (AIR SWITCHING VALVE ASSEMBLY - BODY GROUND)**

(a) Disconnect the A10 air switching valve assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A10-1 - Body ground	Always	Below 1 Ω
A10-2 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (AIR SWITCHING VALVE ASSEMBLY - AIR INJECTION CONTROL DRIVER)**

(a) Disconnect the A10 air switching valve assembly connector.

(b) Disconnect the A7 air injection control driver connector.

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

Standard Resistance:

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A10-2 - A7-6 (VV)	Always	Below 1 Ω
A10-2 or A7-6 (VV) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE AIR INJECTION CONTROL DRIVER**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012FZ06MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0418; Secondary Air Injection System Control "A" Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P0418**	**Secondary Air Injection System Control "A" Circuit**

DESCRIPTION

Refer to DTC P0412 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0418	After cold engine starts, all of following conditions met (2 trip detection logic): a. Secondary air injection system not operating (air pump and air switching valve are off) b. Diagnostic signal from air injection control driver 11% or more, and 29% or less c. Battery voltage 8 V or higher	• Open in air pump drive circuit • Short between air pump drive circuit and +B circuit • Air pump assembly • Air injection control driver • ECM
	After cold engine starts, all of following conditions met (2 trip detection logic): a. Secondary air injection system operating (air pump and air switching valve are on) b. Diagnostic signal from air injection control driver 11% or more, and 29% or less c. Battery voltage 8 V or higher	• Short between air pump drive circuit and body ground • Air pump assembly • Air injection control driver • ECM

MONITOR DESCRIPTION

The air injection control driver detects open and short circuits according to the voltages of the air pump terminal and the air switching valve terminal, and transmits diagnostic information as a signal to the ECM.

For a short time after cold engine starts, the ECM transmits command signals to the air injection control driver to drive the air pump assembly and air switching valve assembly.

The air injection control driver transmits an air pump assembly malfunction signal to the ECM if either of the following conditions is met:

- The voltage at the air injection control driver terminal relating to the air pump assembly is low despite the air injection control driver receiving command signals from the ECM to drive the air pump assembly.
- The voltage at the air injection control driver terminal relating to the air pump assembly is high despite the air injection control driver receiving no command signals from the ECM to drive the air pump assembly.

The ECM stores the DTC based on diagnostic signals from the air injection control driver.

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MONITOR STRATEGY

Related DTCs	P0418: Secondary Air Injection System Air Pump Circuit Range Check
Required Sensors/Components (Main)	Air injection control driver
Required Sensors/Components (Related)	Air pump assembly
Frequency of Operation	Once per drive cycle
Duration	3 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Case 1

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Command to air pump	ON
Command to air switching valve	ON
Battery voltage	8 V or higher
Ignition switch	ON
Time after ignition switch OFF to ON	More than 0.5 seconds
Starter	OFF
Time after starter ON to OFF	More than 0.5 seconds

Case 2

Monitor runs whenever following DTCs are not stored	None
All of following conditions are met	-
Command to air pump	OFF
Command to air switching valve	OFF
Battery voltage	8 V or higher
Ignition switch	ON
Time after ignition switch OFF to ON	More than 0.5 seconds
Starter	OFF
Time after starter ON to OFF	More than 0.5 seconds

TYPICAL MALFUNCTION THRESHOLDS

Diagnostic signal duty ratio from air injection control driver	11% or more, and 29% or less

COMPONENT OPERATING RANGE

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Diagnostic signal duty ratio from air injection control driver	70% or more, and 90% or less when secondary air injection system operating. 0% when secondary air injection system not operating.

CONFIRMATION DRIVING PATTERN

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

    HINT:

    - If a DTC is output, the system is malfunctioning.
    - If a DTC is not output, perform the following procedure.
14. After the "Secondary Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P0418.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

18. Turn the ignition switch off.

WIRING DIAGRAM

Refer to DTC P0412 INFO .

INSPECTION PROCEDURE

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.
- After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

- By using the Techstream to perform the Secondary Air Injection Check operation in the System Check, the air fuel ratio and the pressure in the secondary air injection system passage can be checked while the secondary air injection system is operating. This helps technicians to troubleshoot the system when it malfunctions.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK HARNESS AND CONNECTOR (AIR PUMP ASSEMBLY - AIR INJECTION CONTROL DRIVER - BODY GROUND)**

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(a) Disconnect the A30 air pump assembly connector.

(b) Disconnect the A6 and A7 air injection control driver.

(c) Disconnect the cable from the negative (-) battery terminal.

(d) Disconnect the cable from the positive (+) battery terminal.

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

Standard Resistance :

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A30-4 (GND) - A7-1 (E)	Always	Below 1 Ω
A30-2 (B) - A6-2 (VP)	Always	Below 1 Ω
A6-1 (BATT) - Positive (+) battery terminal	Always	Below 1 Ω
A30-2 or A6-2 (VP) - Body ground	Always	10 kΩ or higher
A6-1 (BATT) or Positive (+) battery terminal - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

2.	**INSPECT AIR PUMP ASSEMBLY**

(a) Inspect the air pump assembly INFO .

NG ▶ **GO TO STEP 3**

OK ▶ **REPLACE AIR INJECTION CONTROL DRIVER**

3.	**REPLACE AIR PUMP ASSEMBLY**

(a) Replace the air pump assembly INFO .

NEXT ▼

4.	**CHECK WHETHER DTC OUTPUT RECURS**

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(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

(g) Turn the ignition switch off and wait for at least 30 seconds.

(h) Turn the ignition switch to ON.

(i) Turn the Techstream on.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.

(k) Start the engine after the Techstream initialization is finished.

(l) Perform the System Check operation by pressing Next.

(m) After operating the secondary air injection system, perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.

(n) Read pending DTCs.

OK:

No pending DTC is output.

(o) Turn the ignition switch off.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

NG ▶ **REPLACE AIR INJECTION CONTROL DRIVER**

OK ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TMD0F5X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0420; Catalyst System Efficiency Below Threshold (Bank 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P0420**	**Catalyst System Efficiency Below Threshold (Bank 1)**

MONITOR DESCRIPTION

The ECM uses sensors mounted in front of and behind the Three-Way Catalytic Converter (TWC) to monitor its efficiency.

The first sensor, the air fuel ratio sensor, sends pre-catalyst information to the ECM. The second sensor, the heated oxygen sensor, sends post-catalyst information to the ECM.

In order to detect any deterioration in the three-way catalytic converter, the ECM calculates the oxygen storage capacity of the three-way catalytic converter. This calculation is based on the voltage output of the heated oxygen sensor while performing active air fuel ratio control, rather than the conventional detecting method, which uses the locus ratio.

The oxygen storage capacity value is an indication of the oxygen storage capacity of the three-way catalytic converter. When the vehicle is being driven with a warm engine, active air fuel ratio control is performed for approximately 15 to 20 seconds. When it is performed, the ECM deliberately sets the air fuel ratio to lean or rich levels. If a rich-lean cycle of the heated oxygen sensor is long, the oxygen storage capacity becomes greater. There is a direct correlation between the oxygen storage capacity of the heated oxygen sensor and the three-way catalytic converter.

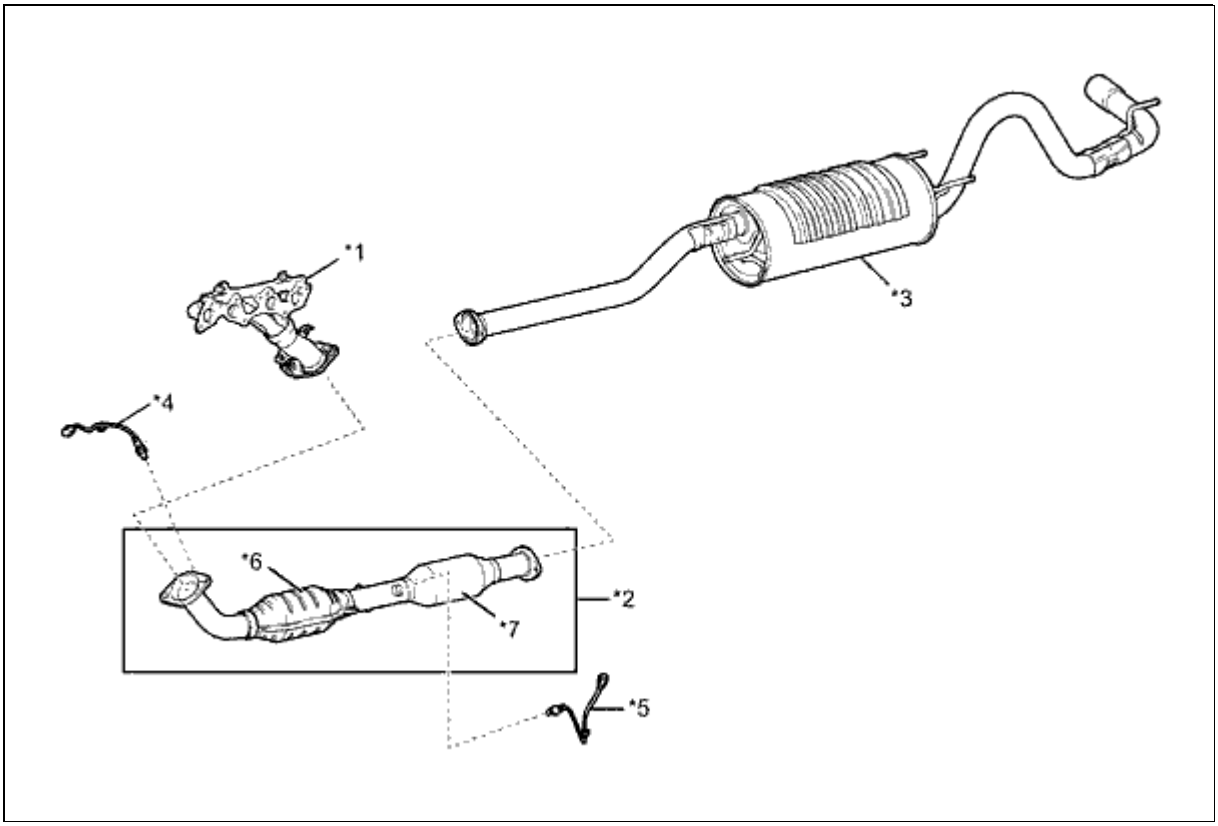
The ECM uses the oxygen storage capacity value to determine the state of the three-way catalytic converter. If any deterioration has occurred, it illuminates the MIL and stores the DTC.

This system determines the deterioration of the entire catalyst system (including the front and rear catalysts), by using the oxygen storage capacity value of the front catalyst, that is more sensitive than the rear catalyst, as the representative value. Therefore, be sure to replace the front and rear catalysts together when catalyst replacement is necessary.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0420	The oxygen storage capacity value smaller than standard value under active air fuel ratio control (1 trip detection logic)	• Front exhaust pipe assembly (TWC: Front and rear catalyst) • Gas leakage from exhaust system • Air fuel ratio sensor • Heated oxygen sensor

CATALYST LOCATION

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Text in Illustration

*1	Exhaust Manifold	*2	Front Exhaust Pipe Assembly
*3	Tail Exhaust Pipe Assembly	*4	Air Fuel Ratio Sensor
*5	Heated Oxygen Sensor	*6	TWC: Front Catalyst
*7	TWC: Rear Catalyst	-	-

MONITOR STRATEGY

Related DTCs	P0420: Catalyst Deterioration
Required Sensors/Components (Main)	Three-way catalytic converter
Required Sensors/Components (Related)	Air fuel ratio sensor Heated oxygen sensor Intake air temperature sensor Mass air flow meter Crankshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	About 30 seconds
MIL Operation	1 driving cycle
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0037, P0038, P102D (Heated Oxygen Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0136, P0137, P0138, P0139, P013A, P0607 (Rear Oxygen Sensor) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0500 (Vehicle Speed Sensor) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)
Response rate during fuel cut from rich condition	Completed
Battery voltage	11 V or higher
Intake air temperature	-10°C (14°F) or higher
Engine coolant temperature	70°C (158°F) or higher
Atmospheric pressure	76 kPa(abs) [570 mmHg(abs)] or higher
Idling	OFF
Engine rpm	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel system status	Closed loop
Engine load	10% or more, and less than 90%
All of the following conditions are met	Condition 1, 2 and 3
1. Mass air flow rate	3 gm/sec or more, and less than 60 gm/sec
2. Front catalyst temperature	525°C (977°F) or higher, and less than 840°C (1544°F) (for Automatic Transmission) 520°C (968°F) or higher, and less than 840°C (1544°F) (for Manual

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	Transmission)
3. Rear catalyst temperature	455°C (851°F) or higher, and less than 760°C (1400°F) (for Automatic Transmission) 480°C (893°F) or higher, and less than 760°C (1400°F) (for Manual Transmission)
Shift position	3rd or higher (for Automatic Transmission) 4th or higher (for Manual Transmission)

TYPICAL MALFUNCTION THRESHOLDS

Oxygen Storage Capacity (OSC) of catalyst (Normalized)	Less than 1

MONITOR RESULT

Refer to Checking Monitor Status INFO .

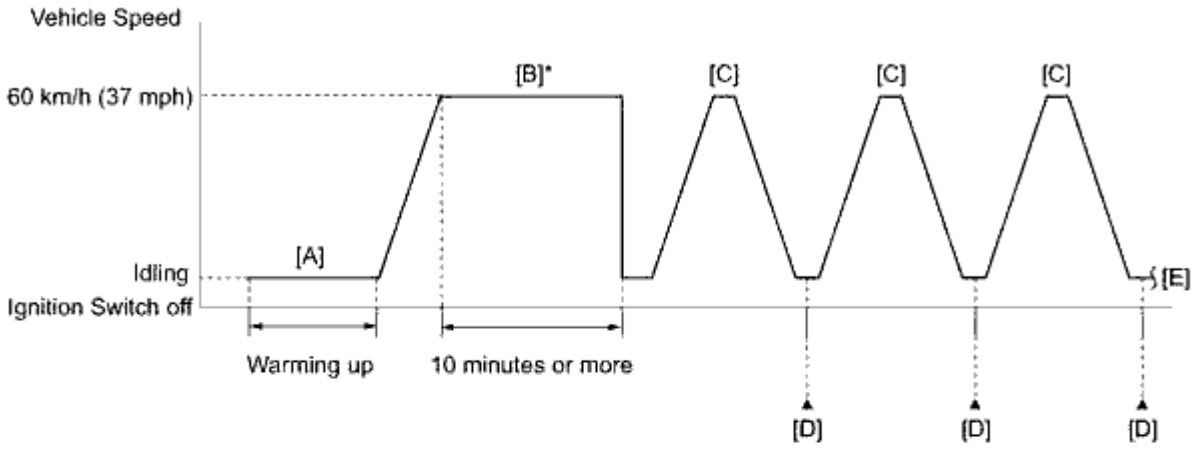
CONFIRMATION DRIVING PATTERN

HINT:

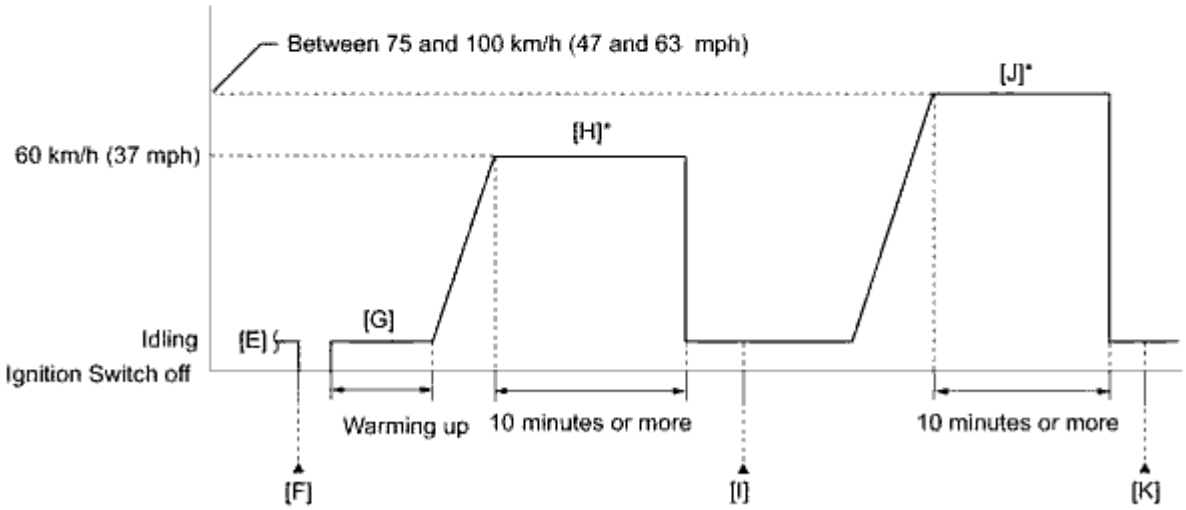
- It is necessary that the response of the heated oxygen sensor is normal in order to confirm DTCs P0420. Therefore, perform the driving pattern for the heated oxygen sensor monitor before performing the drive pattern for the catalyst efficiency monitor.
- Performing this confirmation driving pattern will activate the catalyst efficiency monitor. This is very useful for verifying the completion of a repair.

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Heated Oxygen Sensor Monitor Driving Pattern



Catalyst Efficiency Monitor Driving Pattern



*: Drive the vehicle while keeping the engine load as constant as possible.

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor.
8. Check that Catalyst Efficiency / Current is Incomplete.
9. Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher [A].
10. Drive the vehicle at approximately 60 km/h (37 mph) for 10 minutes or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

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Drive the vehicle while keeping the engine load as constant as possible.

11. With the shift lever in 3 position (for Automatic Transmission) or 3rd gear (for Manual Transmission), drive the vehicle at 60 km/h (37 mph), and then decelerate the vehicle by releasing the accelerator pedal for 5 seconds or more to perform the fuel-cut [C].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

12. Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / O2 Sensor / RL F/C B1S2 [D].
13. Check the Test Value for RL F/C B1S2.

    a. If Test Value displays a value larger than 0, perform the following procedure, as the O2 sensor monitor is finished.

HINT:

If Test Value displays 0, perform step [C] until it displays a value larger than 0, as the O2 sensor monitor is not finished.

14. Turn the ignition switch off and wait for at least 30 seconds [F].
15. Turn the ignition switch to ON and turn the Techstream on.
16. Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher [G].
17. Drive the vehicle at approximately 60 km/h (37 mph) for 10 minutes or more [H].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- Drive the vehicle while keeping the engine load as constant as possible.
- The monitor item will change to Complete as the Catalyst Efficiency monitor operates [I].

18. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
19. Check if any DTCs are stored.

HINT:

If the monitor item does not change to Complete, and no DTCs are stored, perform the following procedure.

20. Drive the vehicle at a speed between 75 and 100 km/h (47 and 63 mph) for 10 minutes or more [J].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- Drive the vehicle while keeping the engine load as constant as possible.
- The monitor item will change to Complete as the Catalyst Efficiency monitor operates.

21. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [K].
22. Check if any DTCs are stored.

HINT:

If the monitor item does not change to Complete, and no DTCs are stored, extend the driving time.

23. If no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

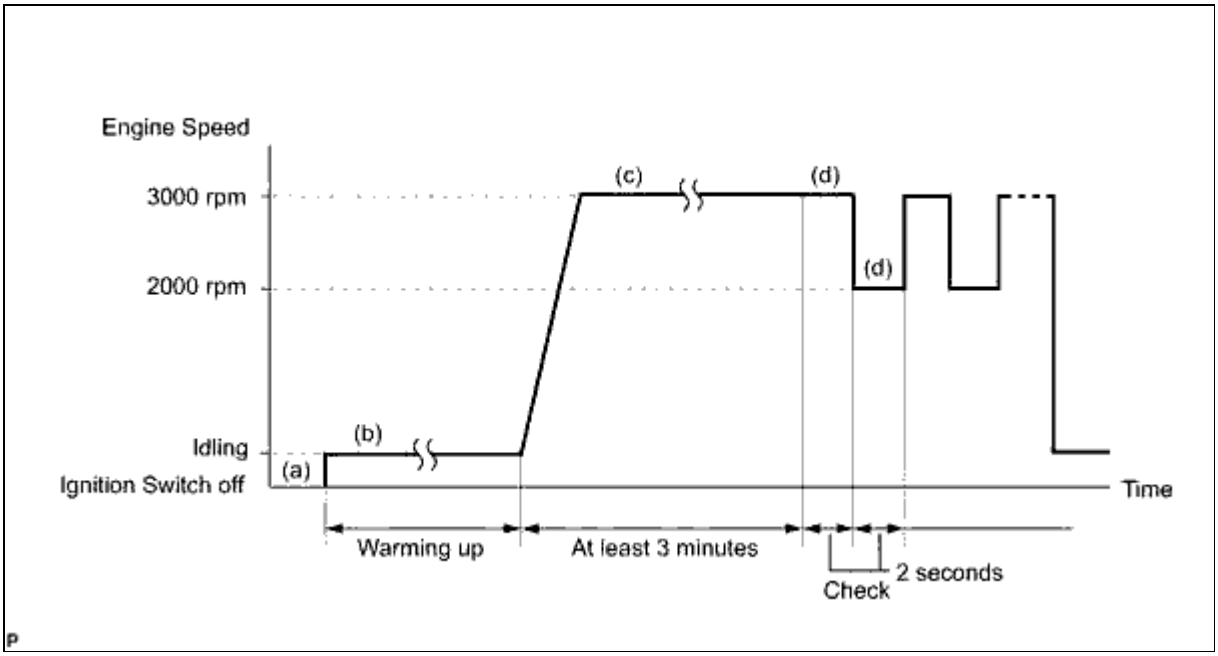
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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CONDITIONING FOR SENSOR TESTING

HINT:

Perform the operation with the engine speeds and time durations described below prior to checking the waveforms of the air fuel ratio and heated oxygen sensors. This is to activate the sensors sufficiently to obtain appropriate inspection results.



(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up with all the accessories switched off until the engine coolant temperature stabilizes.

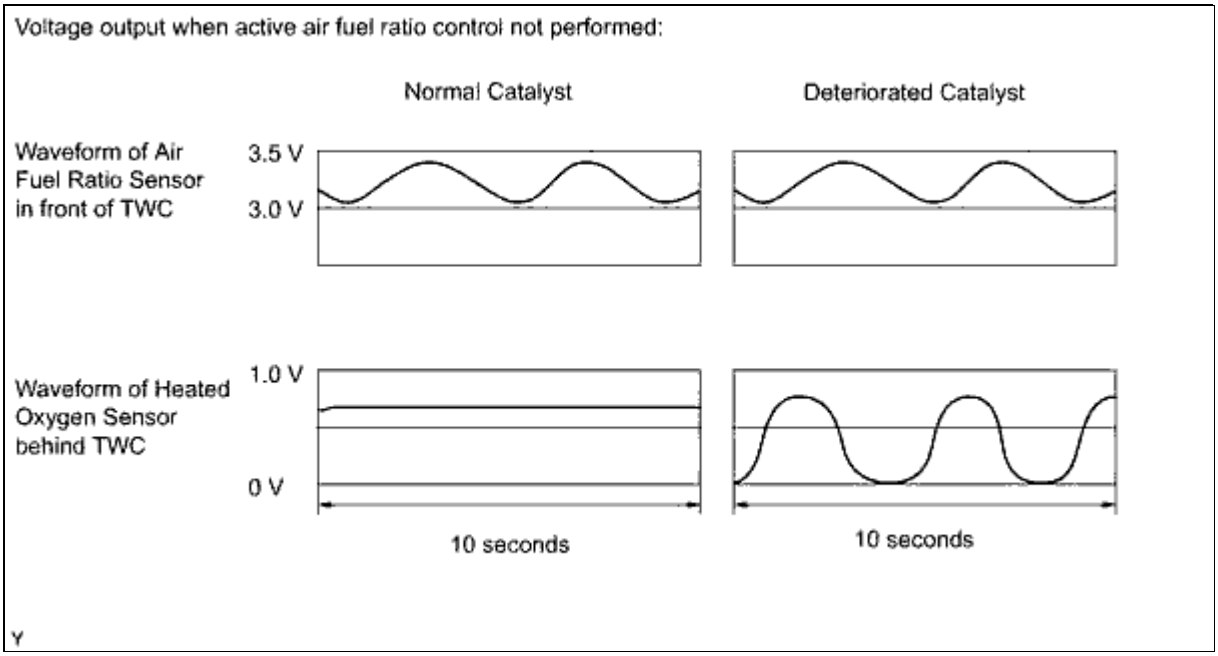
(c) Run the engine at an engine speed of between 2500 rpm and 3000 rpm for at least 3 minutes.

(d) While running the engine at 3000 rpm for 2 seconds, and then 2000 rpm for 2 seconds, check the waveforms of the air fuel ratio and heated oxygen sensors using the Techstream.

HINT:

- If the voltage output of either the air fuel ratio or heated oxygen sensor does not fluctuate, or there is a noise in the waveform of either sensor, the sensor may be malfunctioning.
- If the voltage outputs of both the sensors remain lean or rich, the air fuel ratio may be extremely lean or rich. In such cases, perform the Control the Injection Volume Active Test using the Techstream.
- If the Three-way Catalytic Converter (TWC) has deteriorated, the heated oxygen sensor (located behind the three-way catalytic converter voltage output fluctuates up and down frequently, even under normal driving conditions (active air fuel ratio control is not performed).

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INSPECTION PROCEDURE

HINT:

- If malfunction cannot be found when troubleshooting DTC P0420, a lean or rich abnormality may be the cause. Perform troubleshooting by following the inspection procedure for P0171 (System Too Lean) and P0172 (System Too Rich).
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0420 is output	A
DTC P0420 and other DTCs	B

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HINT:

If any DTCs other than P0420 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up.

(c) Turn the Techstream on.

(d) Run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(f) Perform the Active Test operation with the engine idling (press the -12.5 or 12.5 button to change the fuel injection volume).

(g) Monitor the voltage outputs of the air fuel ratio sensor and heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers or increases the fuel injection volume by 12.5%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio sensor)	12.5%	Rich	Less than 3.1
	-12.5%	Lean	More than 3.4
O2S B1S2 (Heated oxygen sensor)	12.5%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4

Result

STATUS AFS VOLTAGE	STATUS O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO AND HEATED OXYGEN SENSOR CONDITION	MISFIRE	MAIN SUSPECTED TROUBLE AREA	PROCEED TO

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B1S1					
Lean/Rich	Lean/Rich	Normal	-	• Three-way catalytic converter • Gas leakage from exhaust system	A
Lean	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	
Lean/Rich	Lean	Heated oxygen sensor malfunction	-	• Heated oxygen sensor • Gas leakage from exhaust system	C
Lean/Rich	Rich	Heated oxygen sensor malfunction	-	• Heated oxygen sensor • Gas leakage from exhaust system	
Lean	Lean	Actual air fuel ratio lean	May occur	• Extremely rich or lean actual air fuel ratio • Gas leakage from exhaust system	D
Rich	Rich	Actual air fuel ratio rich	-	• Extremely rich or lean actual air fuel ratio • Gas leakage from exhaust system	

Lean: During Control the Injection Volume for A/F Sensor, the air fuel ratio sensor output voltage (AFS Voltage B1S1) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S B1S2) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor, the AFS Voltage B1S1 is consistently less than 3.1 V, and the O2S B1S2 is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor of the Active Test, the output voltage of the heated oxygen sensor alternates correctly.

B ▶ **GO TO STEP 5**

C ▶ **GO TO STEP 6**

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D ▶ GO TO STEP 8

A ▼

3.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

NG ▶ GO TO STEP 10

OK ▼

4.	REPLACE FRONT EXHAUST PIPE ASSEMBLY (TWC: FRONT AND REAR CATALYST)

HINT:

Confirm the replacement parts, referring to the illustration in the Catalyst Location.

(a) Replace the front exhaust pipe assembly (TWC: front and rear catalyst) INFO .

NEXT ▶ END

5.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT ▶ GO TO STEP 11

6.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

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NG ▶ GO TO STEP 10

OK ▼

7.	REPLACE HEATED OXYGEN SENSOR

(a) Replace the heated oxygen sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the heated oxygen sensor INFO .

NEXT ▶ GO TO STEP 11

8.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NG ▶ GO TO STEP 10

OK ▼

9.	CHECK CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO

(a) Check the cause of extremely rich or lean actual air fuel ratio, referring to the DTC P0171 Inspection Procedure INFO .

NEXT ▶ GO TO STEP 11

10.	REPAIR OR REPLACE EXHAUST GAS LEAK POINT

(a) Repair or replace exhaust gas leak point.

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HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NEXT

11.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0420)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(k) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0420 is output	A
DTC is not output	B

B ▶ **END**

A

12.	**REPLACE FRONT EXHAUST PIPE ASSEMBLY (TWC: FRONT AND REAR CATALYST)**

HINT:

Confirm the replacement parts, referring to the illustration in the Catalyst Location.

(a) Replace the front exhaust pipe assembly (TWC: front and rear catalyst) INFO .

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000YE401HX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P043E,P043F,P2401,P2402,P2419; Evaporative Emission System Leak Detection Reference Orifice Low Flow; 2016 MY Tacoma [08/2015 -]		

DTC	**P043E**	**Evaporative Emission System Leak Detection Reference Orifice Low Flow**

DTC	**P043F**	**Evaporative Emission System Reference Orifice High Flow**

DTC	**P2401**	**Evaporative Emission Leak Detection Pump Stuck OFF**

DTC	**P2402**	**Evaporative Emission Leak Detection Pump Stuck ON**

DTC	**P2419**	**Evaporative Emission System Switching Valve Control Circuit Low**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P043E	Reference orifice clogged	P043E, P043F, P2401, P2402 and P2419 stored when one of following conditions met during key-off EVAP monitor: • Reference orifice clogged • Reference orifice high-flow • Leak detection pump OFF malfunction • Leak detection pump ON malfunction • Vent valve ON (closed) malfunction	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • ECM	While ignition switch off	2 trip
P043F	Reference orifice high-flow				
P2401	Leak detection pump stuck OFF				
P2402	Leak detection pump stuck ON				
P2419	Vent valve stuck closed				

HINT:

The reference orifice is located inside the canister pump module.

DESCRIPTION

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The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

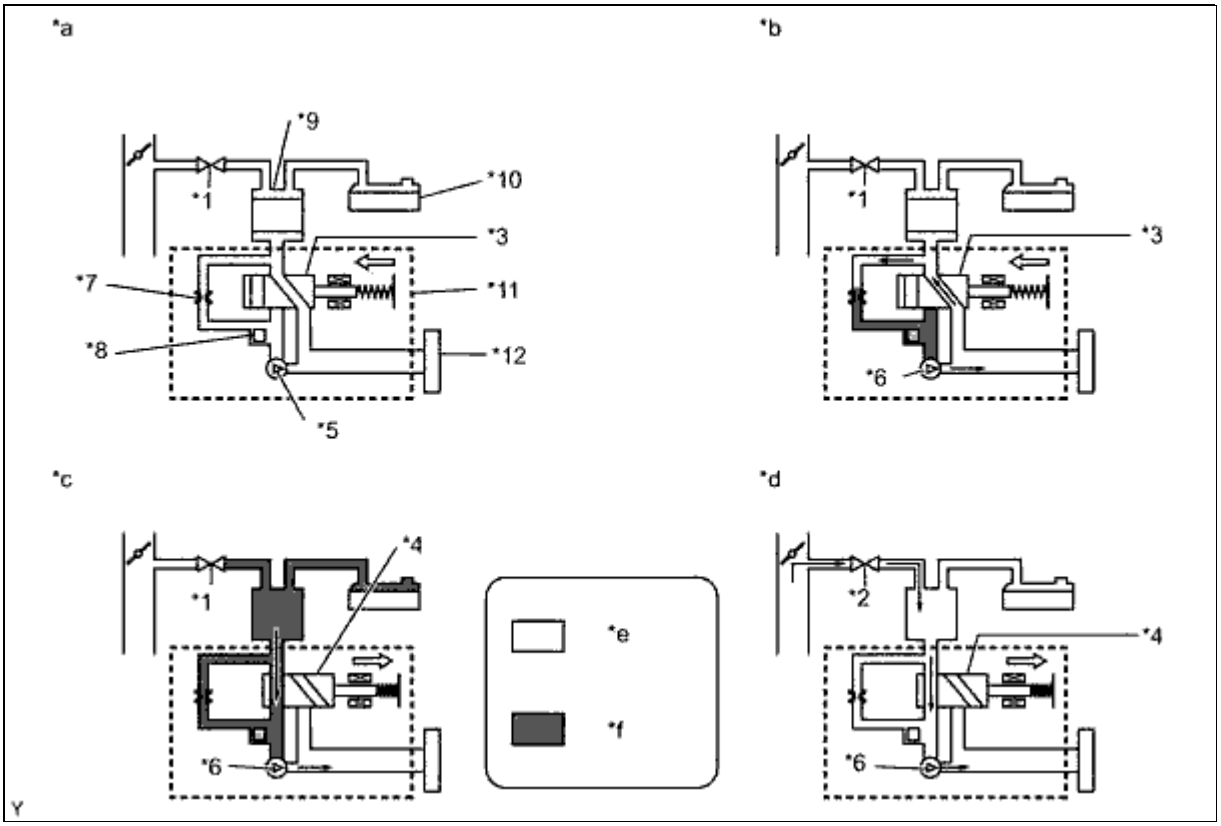
HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	Activated by soak timer, 5, 7 or 9.5 hours after ignition switch turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa(abs) and 110 kPa(abs) [525 mmHg(abs) and 825 mmHg(abs)], ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine reference pressure, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second reference pressure measurement	After second reference pressure measurement, leak check is performed by comparing first and second reference pressure. If stabilized system pressure is higher than second reference pressure, ECM determines that EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

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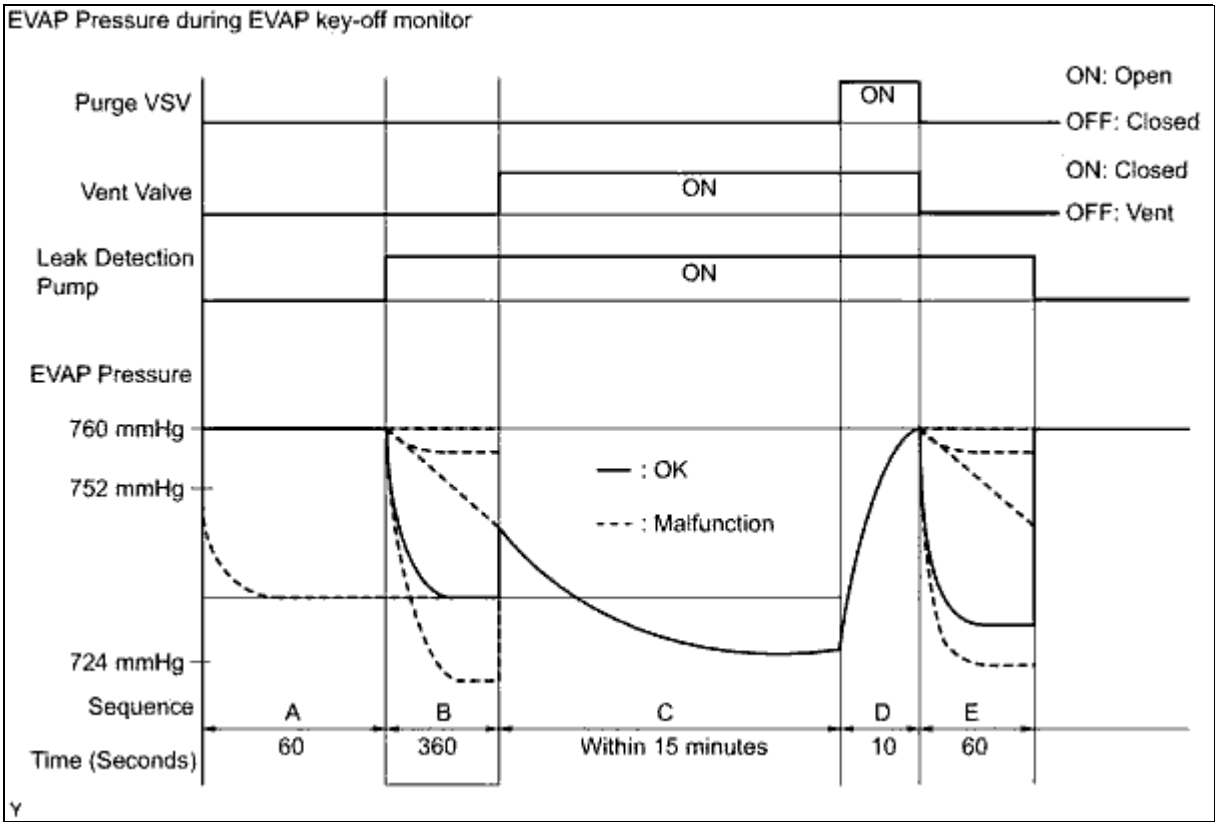
Text in Illustration

*1	Purge VSV: OFF (closed)	*2	Purge VSV: ON (open)
*3	Vent Valve: OFF (vent)	*4	Vent Valve: ON (closed)
*5	Leak Detection Pump: OFF	*6	Leak Detection Pump: ON
*7	Reference Orifice (0.02 inch)	*8	Canister Pressure Sensor
*9	Canister	*10	Fuel Tank
*11	Canister Pump Module	*12	Canister Filter
*a	Operation A: Atmospheric Pressure Measurement	*b	Operation B, E: Reference Pressure Measurement
*c	Operation C: EVAP System Pressure Measurement	*d	Operation D: Purge VSV Monitor
*e	Atmospheric Pressure	*f	Negative Pressure

The leak detection pump creates negative pressure through the reference orifice (in operation B and E). When the system is normal, the EVAP pressure is between 97 to 100 kPa(abs) [724 to 752 mmHg(abs)]* and saturated within a minute. If not, the ECM interprets this as a malfunction. The ECM illuminates the MIL and stores a DTC if this malfunction is detected in consecutive drive cycles.

*: Typical value.

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MONITOR STRATEGY

Required Sensors/Components	Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 7 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Atmospheric pressure	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]
Battery voltage	10.5 V or higher
Vehicle speed	Less than 4 km/h (2.5 mph)
Ignition switch	OFF
Time after key-off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool

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Leak detection pump	Not operated by scan tool
Both of following conditions met before key-off	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)
Intake air temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is below 0.286 kPa(gauge) [2.14 mmHg(gauge)] in 60 seconds.

One of following conditions met	-
EVAP pressure just after reference pressure measurement started	Higher than -0.25 kPa(gauge) [-1.875 mmHg(gauge)]
Reference pressure	Below -4.85 kPa(gauge) [-36.384 mmHg(gauge)]
Reference pressure	-1.057 kPa(gauge) [-7.93 mmHg(gauge)] or higher
Reference pressure	Not saturated within 55 seconds
Difference between first reference pressure and second reference pressure	0.9 kPa(gauge) [6.76 mmHg(gauge)] or higher

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
8. After the "Evaporative System Check" is completed, check for All Readiness by entering the following

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menus: Powertrain / Engine and ECT / Utility / All readiness.

9. Input the DTC: P043E, P043F, P2401, P2402 or P2419.
10. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

11. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

Refer to the EVAP Inspection Procedure INFO .

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000SWF0DZX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0441; Evaporative Emission Control System Incorrect Purge Flow; 2016 MY Tacoma [08/2015 -]		

DTC	**P0441**	**Evaporative Emission Control System Incorrect Purge Flow**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0441	Purge VSV (Vacuum Switching Valve) stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. Reference pressure measured at start and at end of leak check. If stabilized pressure higher than [second reference pressure x 0.2], ECM determines that purge VSV stuck open.	• Purge VSV • Connector/wire harness (Purge VSV - ECM) • ECM • Canister pump module • Leak from EVAP system	While ignition switch off	2 trip
	Purge VSV stuck closed	After EVAP leak check performed, purge VSV turned ON (open), and atmospheric air introduced into EVAP system. Reference pressure measured at start and at end of check. If pressure does not return to near atmospheric pressure, ECM determines that purge VSV stuck closed.	• Purge VSV • Purge line • Connector/wire harness (Purge VSV - ECM) • ECM • Canister pump module • Canister assembly (filter inside canister clogged) • Leak from EVAP system		
	Purge flow	While engine running, following conditions successively met: • Negative pressure not created in EVAP system when purge VSV turned ON (open) • EVAP system pressure change less than 0.15 kPa(gauge) [1.125 mmHg(gauge)] when vent valve turned ON (closed) • Atmospheric pressure change before and after purge flow monitor less	• Purge VSV • Purge line • Connector/wire harness (Purge VSV - ECM) • ECM • Canister pump module • Canister assembly (filter inside canister clogged) • Leak from EVAP system	While engine running	

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DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
		than 0.1 kPa(gauge) [0.75 mmHg(gauge)]			

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

The 2 monitors, Key-off and purge flow, are used to detect malfunctions relating to DTC P0441. The Key-Off monitor is initiated by the ECM internal timer, known as the soak timer, 5 hours after the ignition switch is turned off. The purge flow monitor runs while the engine is running.

1. KEY-OFF MONITOR

5 hours* after the ignition switch is turned off, the electric leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

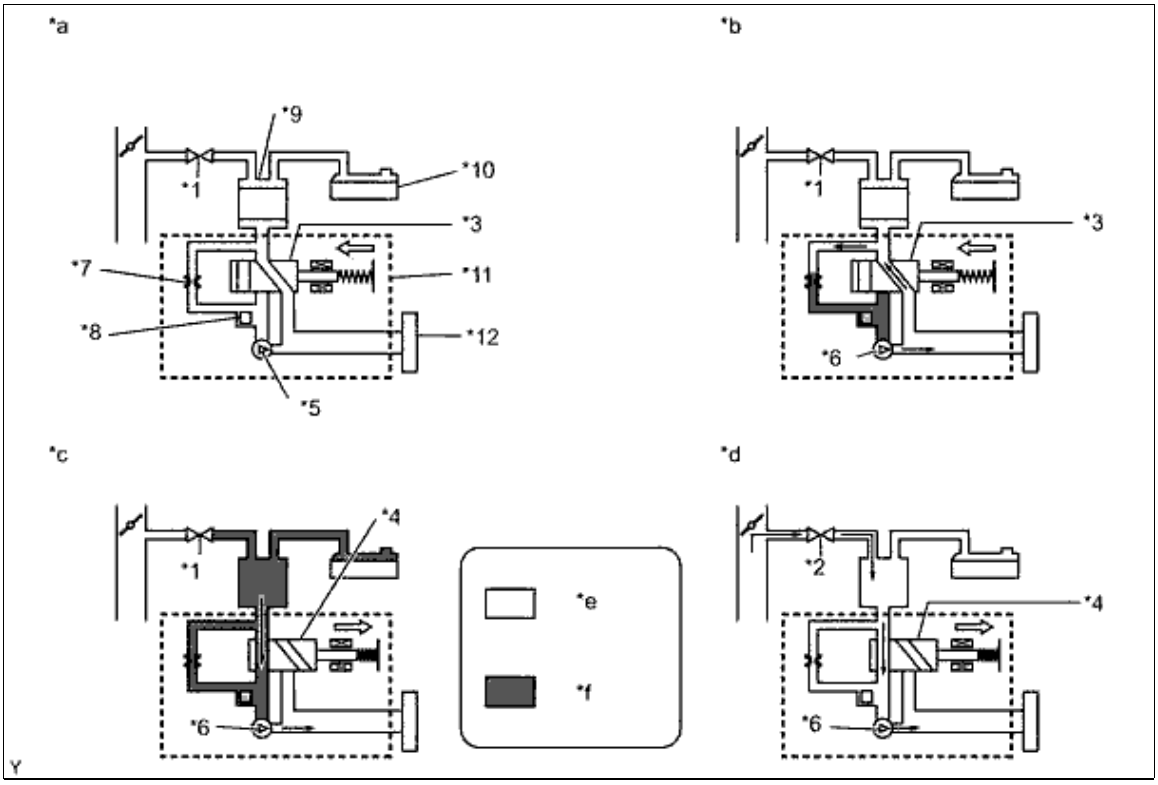
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa(abs) and 110 kPa(abs) [525 mmHg(abs) and 825 mmHg(abs)], ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine reference pressure, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure is measured by ECM. A large increase indicates normality.	10 seconds
E	Second reference pressure measurement	After second reference pressure measurement, leak check is performed by comparing first and second reference pressure. If stabilized system pressure is higher than second reference pressure, ECM determines that EVAP system leaking.	60 seconds

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SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



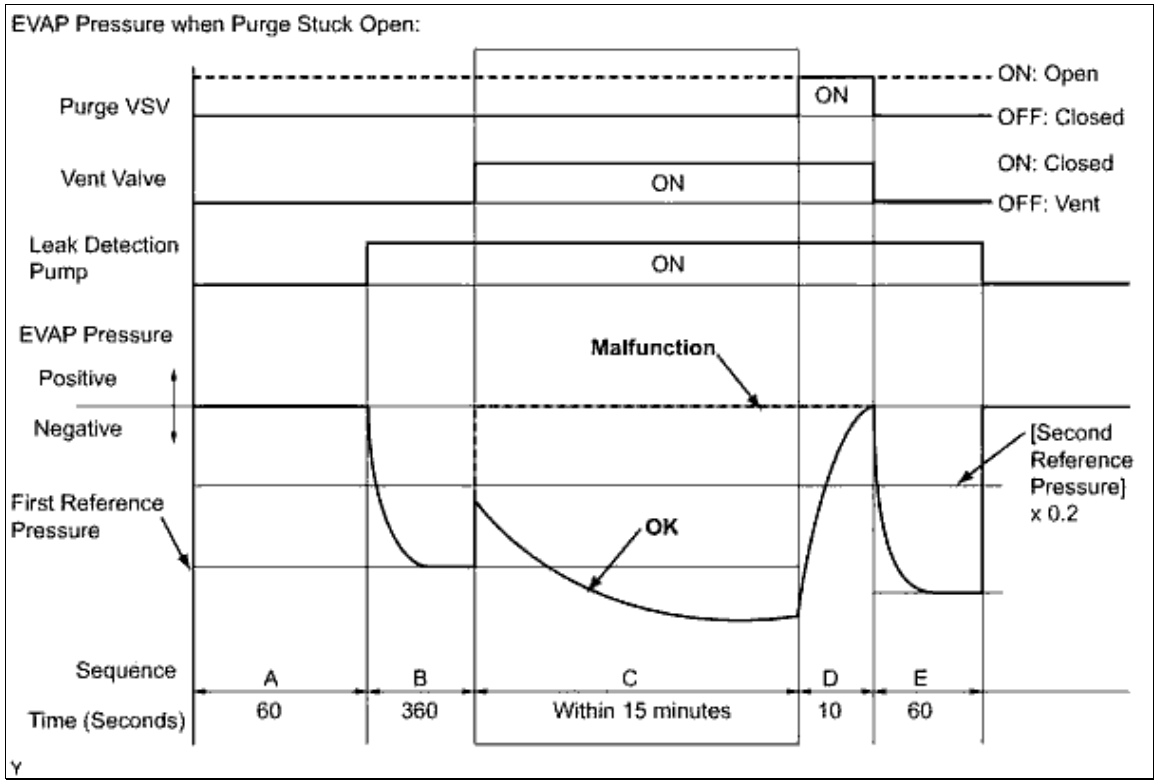
Text in Illustration

*1	Purge VSV: OFF (closed)	*2	Purge VSV: ON (open)
*3	Vent Valve: OFF (vent)	*4	Vent Valve: ON (closed)
*5	Leak Detection Pump: OFF	*6	Leak Detection Pump: ON
*7	Reference Orifice (0.02 inch)	*8	Canister Pressure Sensor
*9	Canister	*10	Fuel Tank
*11	Canister Pump Module	*12	Canister Filter
*a	Operation A: Atmospheric Pressure Measurement	*b	Operation B, E: Reference Pressure Measurement
*c	Operation C: EVAP System Pressure Measurement	*d	Operation D: Purge VSV Monitor
*e	Atmospheric Pressure	*f	Negative Pressure

a. Purge VSV stuck open

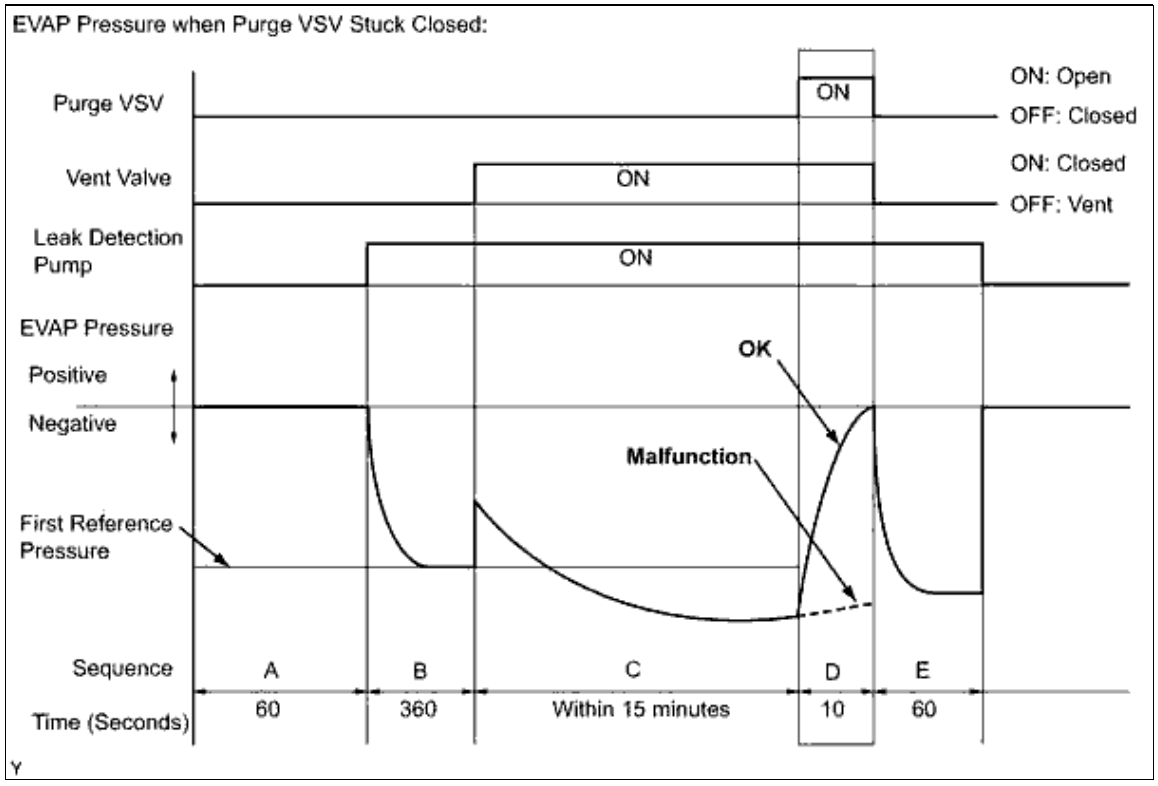
In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second reference pressure x 0.2], the ECM interprets this as the purge VSV being stuck open. The ECM illuminates the MIL and stores the DTC (2 trip detection logic).

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b. Purge VSV stuck closed

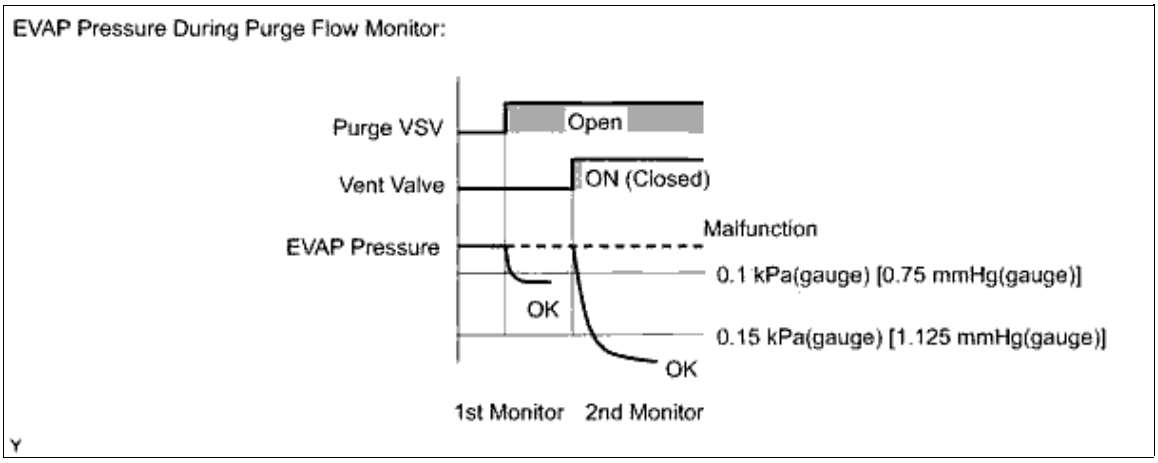
In operation D, the canister pressure sensor measures the EVAP (Evaporative Emission) system pressure. The pressure measurement for the purge VSV monitor begins when the purge VSV is turned on (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa(gauge) [2.25 mmHg(gauge)] or more, the purge VSV is functioning normally. If the pressure does not increase, the ECM interprets this as the purge VSV being stuck closed. The ECM illuminates the MIL and stores the DTC (2 trip detection logic).



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2. PURGE FLOW MONITOR

The purge flow monitor consists of 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.



- The 1st monitor

  While the engine is running and the purge VSV is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.

- The 2nd monitor

  The vent valve is turned on (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.15 kPa(gauge) [1.125 mmHg(gauge)], the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and stores DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after conduction of the purge flow monitor, is measured by the ECM.

MONITOR STRATEGY

Required Sensors/Components	Purge VSV Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 20 minutes: Purge VSV stuck open/close Within 30 seconds: Purge flow
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

Key-off Monitor

Atmospheric pressure	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]

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Purge Flow Monitor

Engine	Running
Engine coolant temperature	4.4°C (40°F) or higher
Intake air temperature	4.4°C (40°F) or higher
Canister pressure sensor malfunction	Not detected
Purge VSV	Not operated by scan tool
EVAP system check	Not operated by scan tool
Atmospheric pressure	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]
Battery voltage	10 V or higher
Purge duty-cycle	8% or more

TYPICAL MALFUNCTION THRESHOLDS

Purge VSV Stuck Open

EVAP pressure when vacuum introduction is complete	Higher than reference pressure x 0.2

Purge VSV Stuck Closed

EVAP pressure change after purge VSV is open	Less than 0.3 kPa(gauge) [2.25 mmHg(gauge)]

Purge Flow

Both of the following conditions are met:	Conditions 1 and 2
1. EVAP pressure change when purge flow is started	Less than 0.1 kPa(gauge) [0.75 mmHg(gauge)]
2. EVAP pressure change during purge flow when EVAP pressure switching valve is ON (closed)	Less than 0.15 kPa(gauge) [1.125 mmHg(gauge)]

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and wait 20 minutes or more.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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10. Enter the following menus: Powertrain / Engine and ECT / Utility / All readiness.
11. Input the DTC: P0441.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ You should perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the following procedure.

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

13. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
14. Turn the ignition switch off and wait for at least 30 seconds.
15. Turn the ignition switch to ON and turn the Techstream on.
16. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
17. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
18. Input the DTC: P0441.
19. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

20. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

Refer to EVAP System INFO .

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000012MC0CUX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0451-P0453; Evaporative Emission Control System Pressure Sensor Range / Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P0451**	**Evaporative Emission Control System Pressure Sensor Range / Performance**

DTC	**P0452**	**Evaporative Emission Control System Pressure Sensor / Switch Low Input**

DTC	**P0453**	**Evaporative Emission Control System Pressure Sensor / Switch High Input**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0451	Canister pressure sensor noise	Sensor output voltage fluctuates frequently within certain time period.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition OFF) • Engine running	2 trip
P0452	Canister pressure sensor voltage low	Sensor output less than 42.11009 kPa(abs) [315.86779 mmHg(abs)] for 0.5 seconds.		• Ignition ON • EVAP monitoring (ignition OFF)	1 trip
P0453	Canister pressure sensor voltage stuck	Sensor output more than 123.76147 kPa(abs) [928.33489 mmHg(abs)] for 0.5 seconds.			

HINT:

The canister pressure sensor is built into the canister pump module.

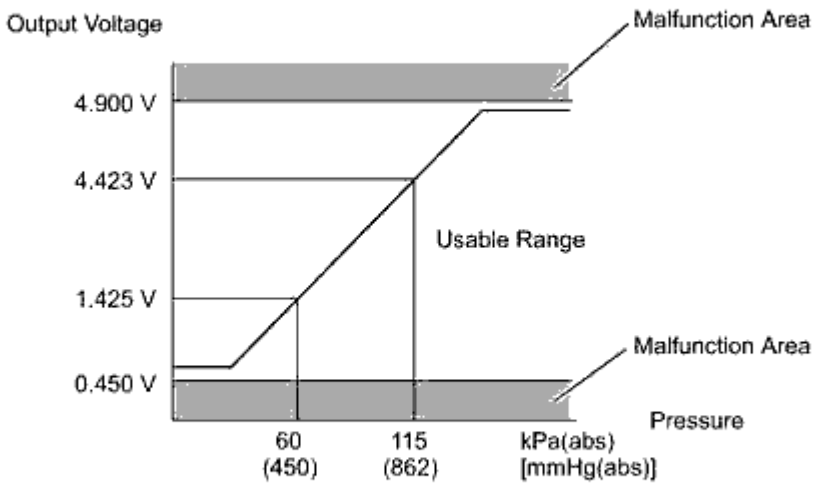
DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

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Canister Pressure Sensor Specification (fig. 2)



HINT:

Standard atmospheric pressure is 101.3 kPa(abs) [760 mmHg(abs)]

1. DTC P0451: Canister pressure sensor noise

   If the canister pressure sensor voltage output fluctuates rapidly for 10 seconds, the ECM stops the EVAP system monitor. The ECM interprets this as noise from the canister pressure sensor, and stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC.

   (2 trip detection logic).
2. DTC P0452: Canister pressure sensor voltage low

   If the canister pressure sensor voltage output [pressure] is below 0.45 V: 42.11009 kPa(abs) [315.86779 mmHg(abs)], the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC (1 trip detection logic).
3. DTC P0453: Canister pressure sensor voltage high

   If the canister pressure sensor voltage output [pressure] is 4.9 V: 123.76147 kPa(abs) [928.33489 mmHg(abs)] or more, the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC (1 trip detection logic).

MONITOR STRATEGY

Required Sensors/Components (Main)	Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds: P0452 and P0453 Less than 15 seconds: P0451 (noise monitor)

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MIL Operation	Immediate: P0452 and P0453 2 driving cycles: P0451
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

P0451 (Noise monitor)

Atmospheric pressure (absolute pressure)	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]
Battery voltage	10.5 V or more
Intake air temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)
Canister pressure sensor malfunction (P0452, 0453)	Not detected
Either of following conditions met	A or B
A. Engine condition	Running
B. Time after key-off	5 or 7 or 9.5 hours

P0452 and P0453

All of the following conditions are met	-
Either of following conditions met	(a) or (b)
(a) Ignition switch	ON
(b) Soak timer	ON
Battery voltage	8 V or higher
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0451: Canister pressure sensor noise monitor

Frequency that EVAP pressure change 0.3 kPa(gauge) [2.25 mmHg(gauge)] or more	10 times or more in 10 seconds

P0452: Canister pressure sensor low voltage

EVAP pressure	Less than 42.11009 kPa(abs) [315.86779 mmHg(abs)]

P0453: Canister pressure sensor high voltage

EVAP pressure	Higher than 123.76147 kPa(abs) [928.33489 mmHg(abs)]

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CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.
5. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
6. Turn the ignition switch off and wait for at least 30 seconds.
7. Turn the ignition switch to ON and turn the Techstream on.
8. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
9. After the "Evaporative System Check" is completed, check All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0451, P0452 or P0453.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

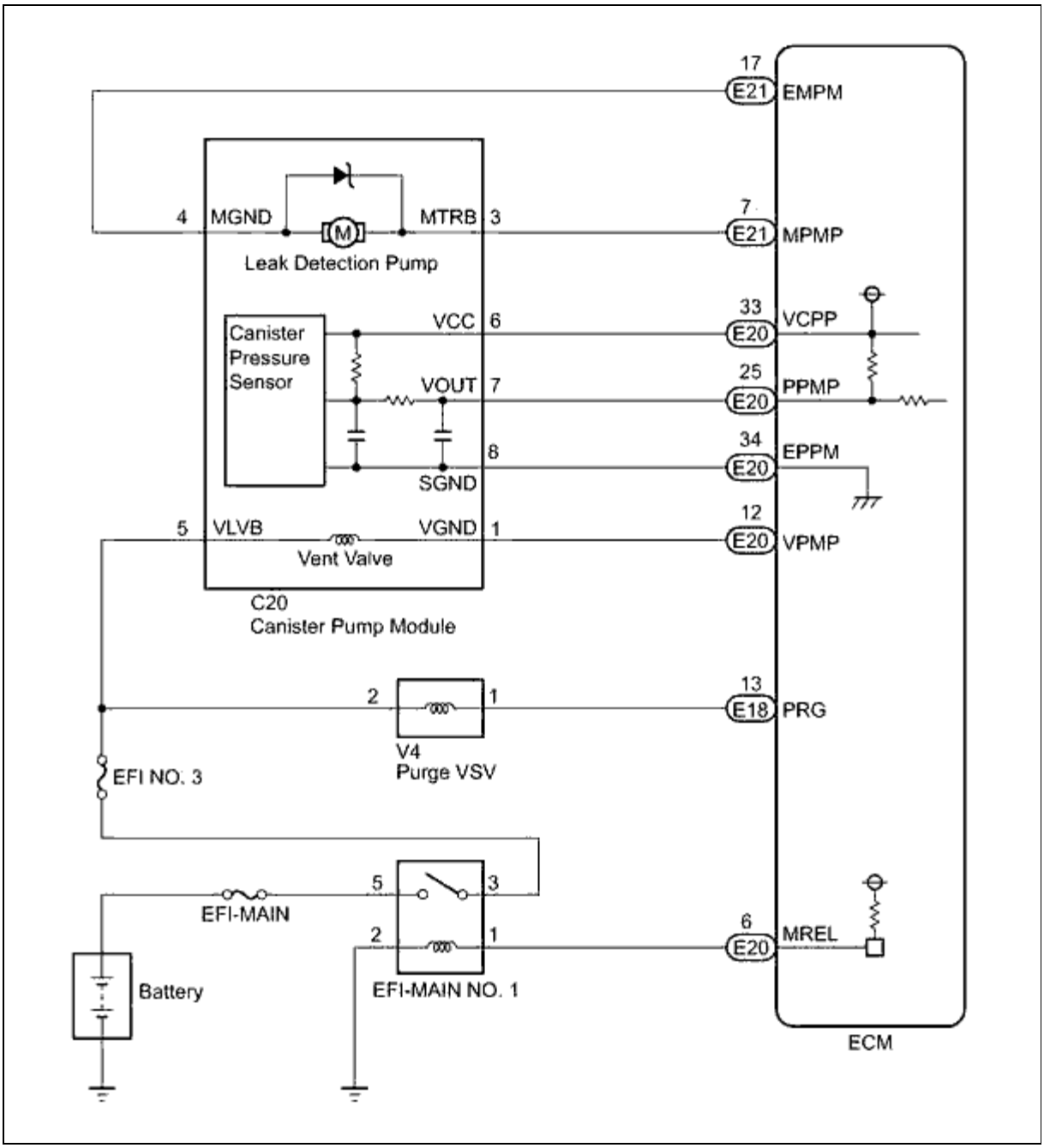
12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

- When a vehicle is brought into the workshop, leave it as it is. Do not change the vehicle condition. For example, do not tighten the fuel tank cap assembly.
- Do not disassemble the canister pump module.
- The Techstream is required to conduct the following diagnostic troubleshooting procedure.
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CONFIRM DTC AND EVAP PRESSURE**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON (do not start the engine).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / Vapor Pressure Pump.

(g) Read the EVAP (Evaporative Emission) pressure displayed on the Techstream.

Result

DISPLAY (DTC OUTPUT)	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P0451	-	Canister pressure sensor	C
P0452	Less than 42.11009 kPa(abs) [315.86779 mmHg(abs)]	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor • Short in ECM circuit	A
P0453	Higher than 123.76147 kPa(abs) [928.33479 mmHg(abs)]	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor • Open in ECM circuit	B

B ▶ **GO TO STEP 4**

C ▶ **GO TO EVAP SYSTEM (EVAP SYSTEM INSPECTION PROCEDURE)**

A ▼

2.	**CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

(a) Turn the ignition switch off.

(b) Disconnect the E20 ECM connector.

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

Result

TESTER CONNECTION	CONDITION	TEST	SUSPECTED TROUBLE AREA	PROCEED

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		RESULT		TO
E20-25 (PPMP) - Body ground	Always	Below 10 Ω	• Wire harness/connector (ECM - Canister pressure sensor) • Short in canister pressure sensor circuit	A
		10 kΩ or higher	• Wire harness/connector (ECM - Canister pressure sensor) • Short in ECM circuit	B

B ▶ **GO TO STEP 7**

A ▼

3.	**CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

(a) Disconnect the C20 canister pump module connector.

(b) Disconnect the E20 ECM connector.

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

Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
E20-25 (PPMP) - Body ground	Always	10 kΩ or higher	Short in canister pressure sensor circuit	A
		Below 10 Ω	Short in wire harness/connector (ECM - canister pressure sensor)	B

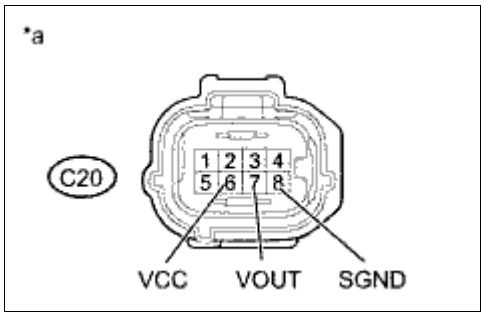
A ▶ **GO TO STEP 5**

B ▶ **GO TO STEP 6**

4.	**CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

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(a) Disconnect the canister pump module connector.



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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C20-8 (SGND) - Body ground	Always	100 Ω or less

(c) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C20-6 (VCC) - Body ground	Ignition switch ON	4.5 to 5.5 V
C20-7 (VOUT) - Body ground	Ignition switch ON	4.5 to 5.5 V

Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)

Result

TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Voltage and resistance within standard ranges	Open in canister pressure sensor circuit	A
Voltage and resistance outside standard ranges	Open in wire harness/connector (ECM - Canister pressure sensor)	B

B ▶ **GO TO STEP 6**

A ▼

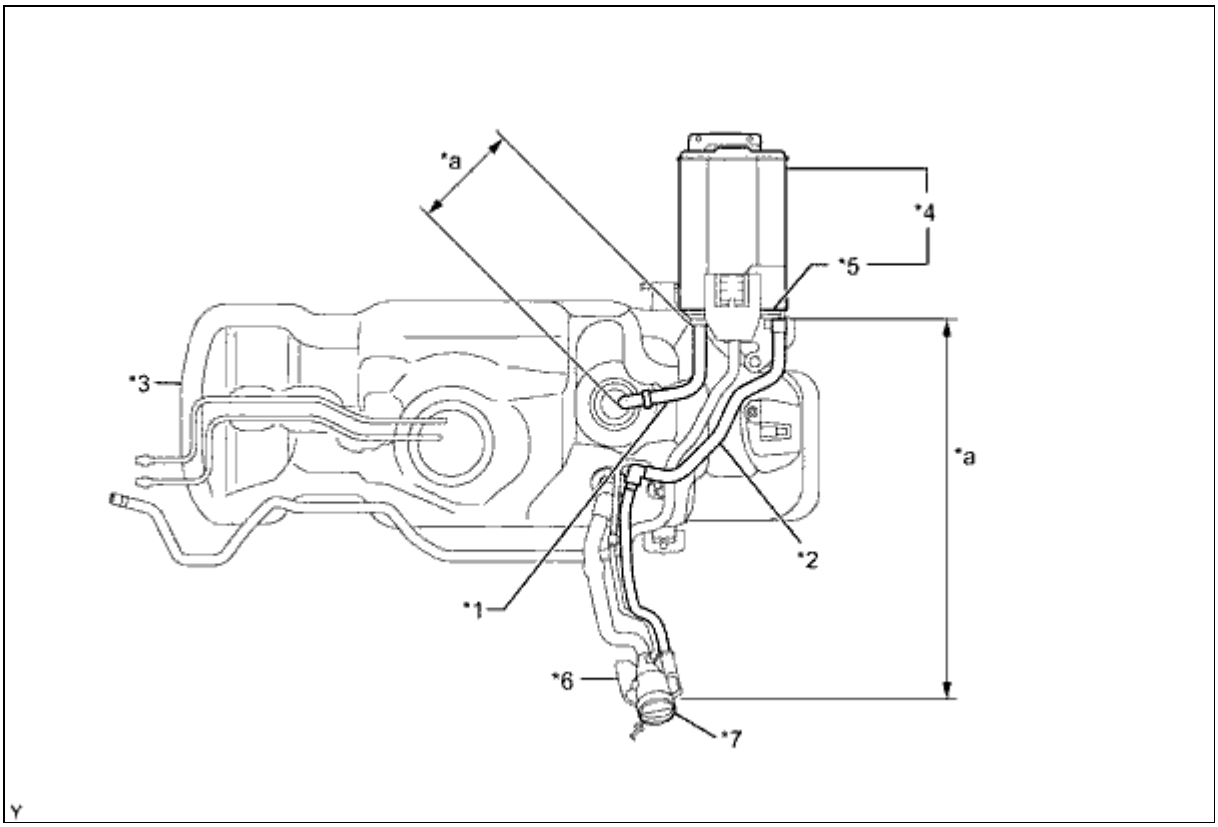
5.	**REPLACE CANISTER PUMP MODULE**

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(a) Replace the canister pump module INFO .

NOTICE:

- When replacing the canister pump module, check the canister pump module interior, canister interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose. If liquids are present in the canister interior, replace canister and canister pump module together (replace canister assembly).
- Check for filter blockage in the canister. If the charcoal filter inside the canister is clogged, replace canister and the canister pump module together (replace canister assembly).
- Check for filter blockage in the canister filter. If the canister filter has blockages, replace the canister filter.



Text in Illustration

*1	Fuel Tank Vent Hose	*2	Vent Hose
*3	Fuel Tank	*4	Canister Assembly
*5	Canister Pump Module	*6	Canister Filter
*7	Fuel Tank Cap Assembly	-	-
*a	Inspection Area (Check for Disconnection and/or Crack)	-	-

NEXT ▶ **GO TO STEP 8**

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)**

HINT:

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If the exhaust tail pipe has been removed, go to the next step before reinstalling it.

NEXT ▶ **GO TO STEP 8**

7.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT ▶ **GO TO STEP 8**

8.	**CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P0451, P0452 or P0453.

(l) Check the DTC judgment result.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions

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TECHSTREAM DISPLAY	DESCRIPTION
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

NEXT END

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000SWH0D6X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0455,P0456; Evaporative Emission Control System Leak Detected (Gross Leak); 2016 MY Tacoma [08/2015 -]		

DTC	**P0455**	**Evaporative Emission Control System Leak Detected (Gross Leak)**

DTC	**P0456**	**Evaporative Emission Control System Leak Detected (Very Small Leak)**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0455	EVAP gross leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. Reference pressure is measured at start and end of leak check. If stabilized pressure is higher than [second reference pressure x 0.2], ECM determines that EVAP system has a large leak.	• Fuel tank cap assembly (loose) • Leakage from EVAP line (canister assembly - fuel tank) • Leakage from EVAP line (purge VSV - canister assembly) • Leakage from canister pump module • Leakage from fuel tank • Leakage from canister assembly	While ignition switch off	2 trip
P0456	EVAP small leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. Reference pressure measured at start and end of leak check. If stabilized pressure is higher than second reference pressure, ECM determines that EVAP system has a small leak.			

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

5 hours*1 after the ignition switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned

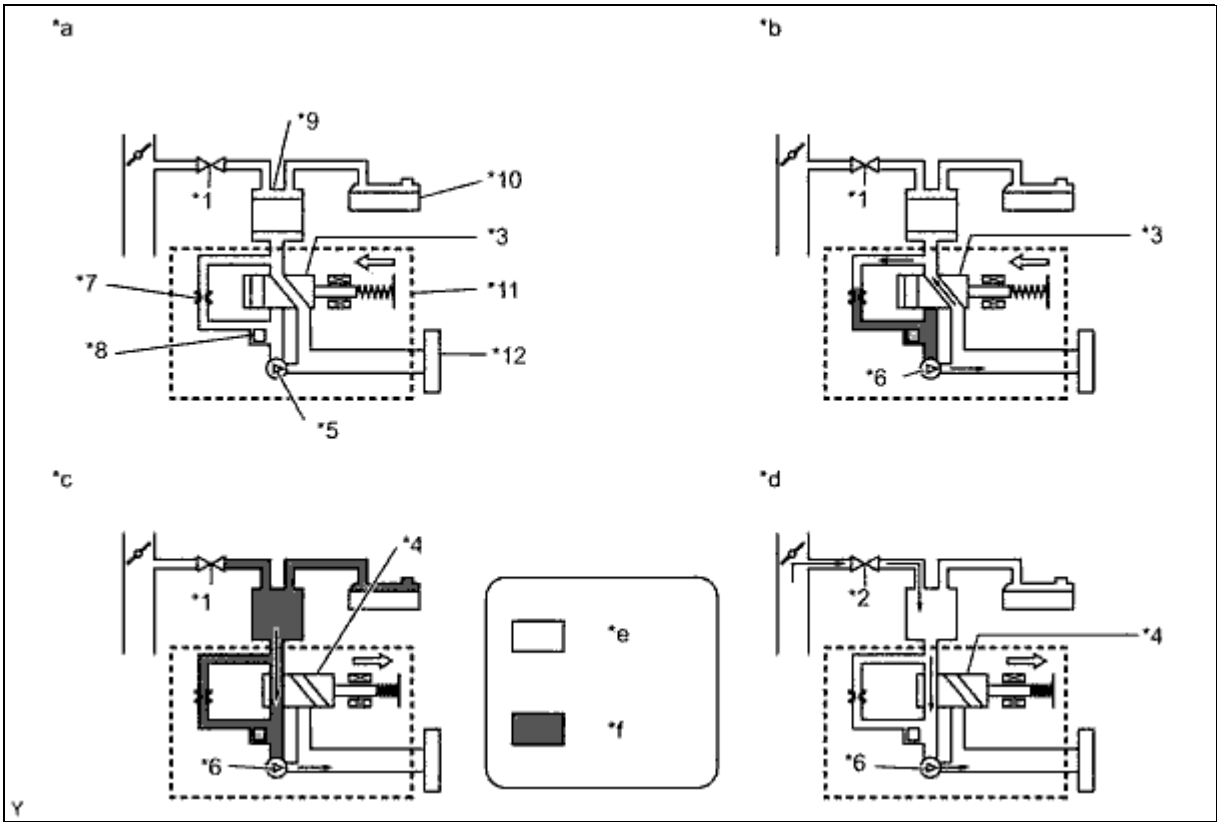
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off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa(abs) and 110 kPa(abs) [525 mmHg(abs) and 825 mmHg(abs)], ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine reference pressure, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second reference pressure measurement	After second reference pressure measurement, leak check is performed by comparing first and second reference pressure. If stabilized system pressure is higher than second reference pressure, ECM determines that EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

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Text in Illustration

*1	Purge VSV: OFF (closed)	*2	Purge VSV: ON (open)
*3	Vent Valve: OFF (vent)	*4	Vent Valve: ON (closed)
*5	Leak Detection Pump: OFF	*6	Leak Detection Pump: ON
*7	Reference Orifice (0.02 inch)	*8	Canister Pressure Sensor
*9	Canister	*10	Fuel Tank
*11	Canister Pump Module	*12	Canister Filter
*a	Operation A: Atmospheric Pressure Measurement	*b	Operation B, E: Reference Pressure Measurement
*c	Operation C: EVAP System Pressure Measurement	*d	Operation D: Purge VSV Monitor
*e	Atmospheric Pressure	*f	Negative Pressure

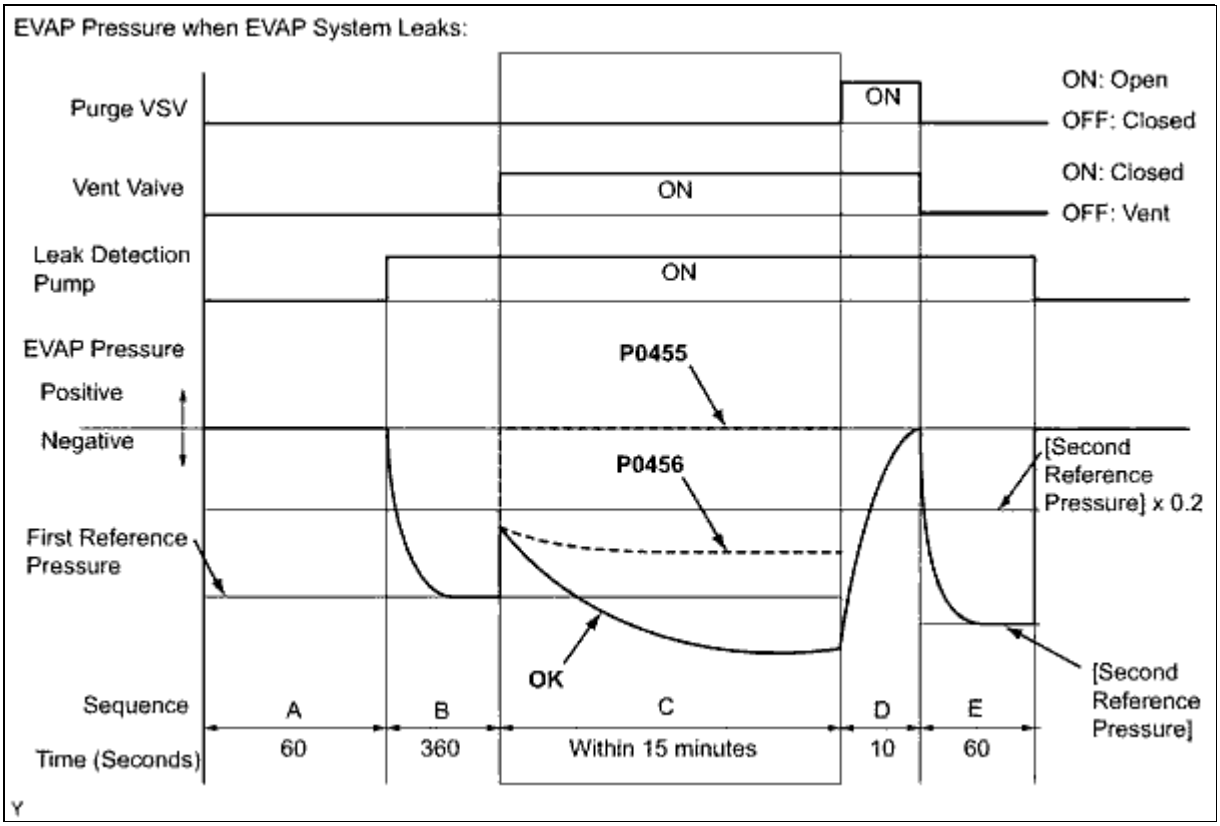
(a) P0455: EVAP (Evaporative Emission) gross leak

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second reference pressure x 0.2] (near atmospheric pressure), the ECM determines that the EVAP system has a large leak, illuminates the MIL and stores the DTC (2 trip detection logic).

(b) P0456: EVAP very small leak

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than second reference pressure, the ECM determines that the EVAP system has a small leak, illuminates the MIL and stores the DTC (2 trip detection logic).

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MONITOR STRATEGY

Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 20 minutes (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Atmospheric pressure	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]
Battery voltage	10.5 V or higher
Vehicle speed	Less than 4 km/h (2.5 mph)
Ignition switch	OFF
Time after key-off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool

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Leak detection pump	Not operated by scan tool
Both of following conditions met before-key off	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)
Intake air temperature	4.4°C (40°F) or higher, and less than 35°C (95°F))

TYPICAL MALFUNCTION THRESHOLDS

P0455: EVAP Gross Leak

EVAP pressure when vacuum introduction complete	Higher than [reference pressure x 0.2]

P0456: EVAP Small Leak

EVAP pressure when vacuum introduction complete	Between reference pressure and [reference pressure x 0.2]

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
8. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
9. Input the DTC: P0455 or P0456.
10. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed

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TECHSTREAM DISPLAY	DESCRIPTION
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

11. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

Refer to EVAP System INFO .

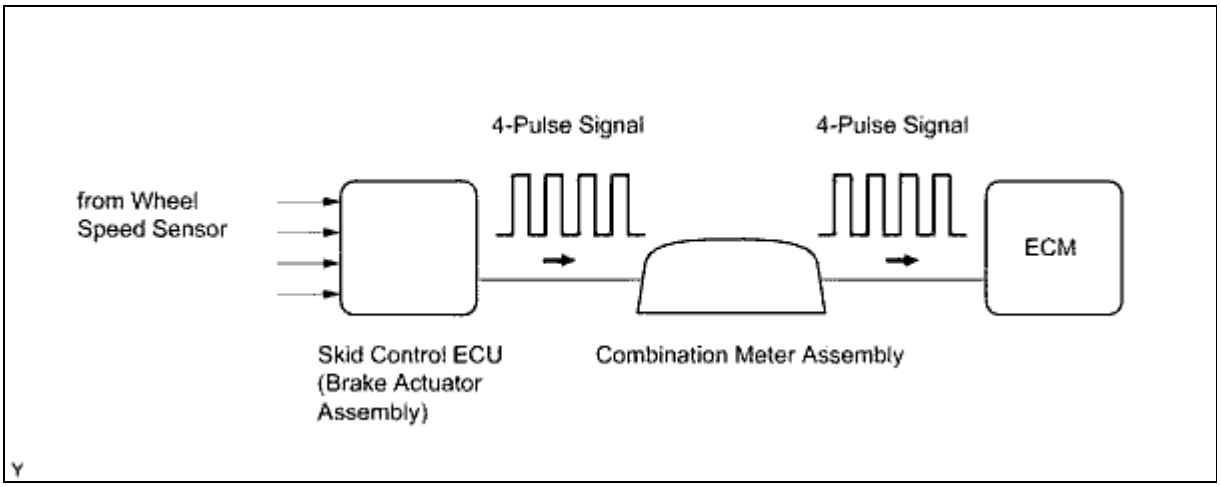
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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000014CU00XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0500; Vehicle Speed Sensor "A"; 2016 MY Tacoma [08/2015 -]		

DTC	**P0500**	**Vehicle Speed Sensor "A"**

DESCRIPTION

Vehicles which are equipped with ABS (Anti-lock Brake System) detect the vehicle speed using the skid control ECU (brake actuator assembly) and wheel speed sensor. The wheel speed sensor monitors the wheel rotation speed and sends a signal to the skid control ECU (brake actuator assembly). The skid control ECU (brake actuator assembly) converts the wheel speed signal into a 4-pulse signal and transmits it to the ECM via the combination meter assembly. The ECM determines the vehicle speed based on the frequency of the pulse signal.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0500	While vehicle being driven, no vehicle speed sensor signal transmitted to ECM (2 trip detection logic)	• Open or short in speed signal circuit • Speed meter circuit (skid control ECU) • Combination meter assembly • ECM

MONITOR DESCRIPTION

Automatic Transmission Models:

The ECM assumes that the vehicle is being driven when the indicated vehicle speed is 9 km/h (5.59 mph) or more. If there is no speed signal from the combination meter assembly despite these conditions being met, the ECM interprets this as a malfunction in the speed signal circuit. The ECM then illuminates the MIL and stores the DTC.

Manual Transmission Models:

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The ECM assumes that the vehicle is being driven when the idle fuel-cut operation* is being executed. If there is no signal from the vehicle speed sensor, despite these conditions being met, the ECM interprets this as a malfunction in the speed signal circuit. The ECM then illuminates the MIL and stores the DTC.

*: Idle fuel-cut is executed when the throttle valve is fully closed and engine speed is over 2800 rpm.

MONITOR STRATEGY

Related DTCs	P0500: Vehicle Speed Sensor "A" Pulse Input Error
Required Sensors/Components (Main)	Combination meter assembly Skid control ECU assembly
Required Sensors/Components (Related)	Park/neutral position switch Engine coolant temperature sensor Camshaft position sensor Mass air flow meter
Frequency of Operation	Continuous
Duration	3.9 seconds: for Manual Transmission 5 seconds: for Automatic Transmission
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

for Automatic Transmission

Battery voltage	8 V or higher
Starter	OFF
Ignition switch	ON
Vehicle speed	9 km/h (5.59 mph) or more
Time after ignition switch OFF to ON	3 seconds or more

for Manual Transmission

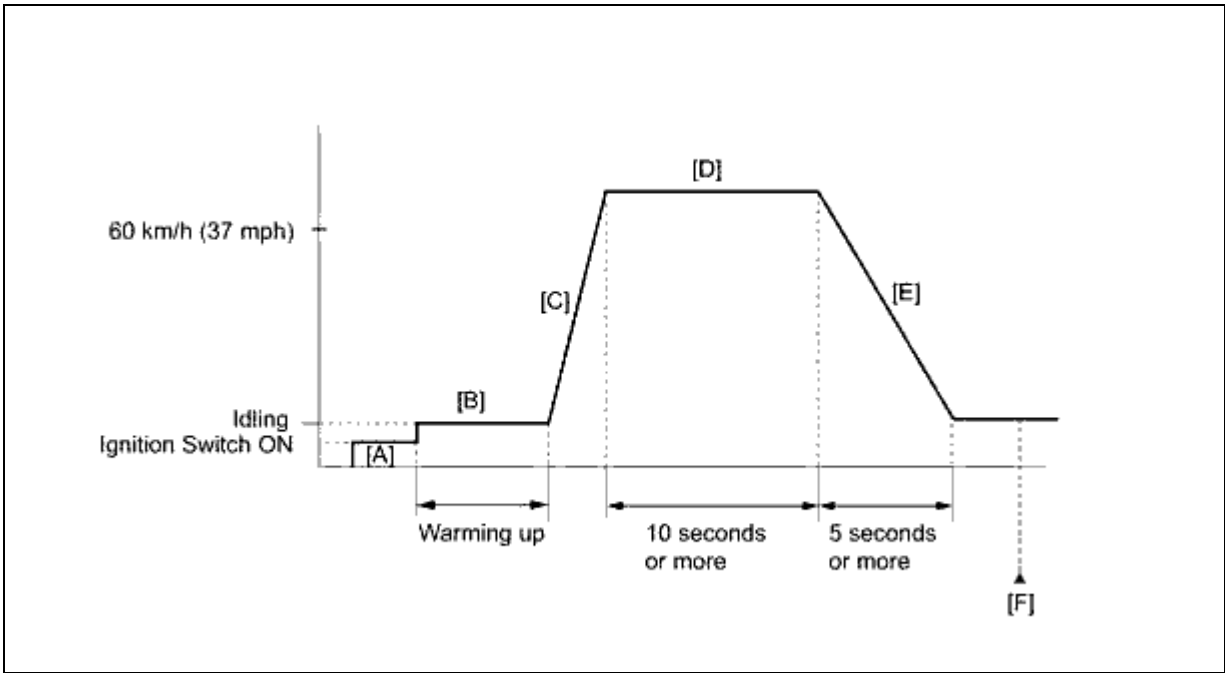
Battery voltage	8 V or higher
Starter	OFF
Ignition switch	ON
Fuel-cut	ON
Time after ignition switch OFF to ON	3 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

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Vehicle speed sensor signal	No pulse input

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the ECT reaches 75°C (167°F) or higher [B].
7. Accelerate the vehicle to 60 km/h (37 mph) or higher [C].
8. Maintain the vehicle speed at 60 km/h (37 mph) or higher for 10 seconds or more [D].
9. Decelerate the vehicle by releasing the accelerator pedal for 5 seconds or more to perform fuel cut [E].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws

10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [F].
11. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0500.
14. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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HINT:

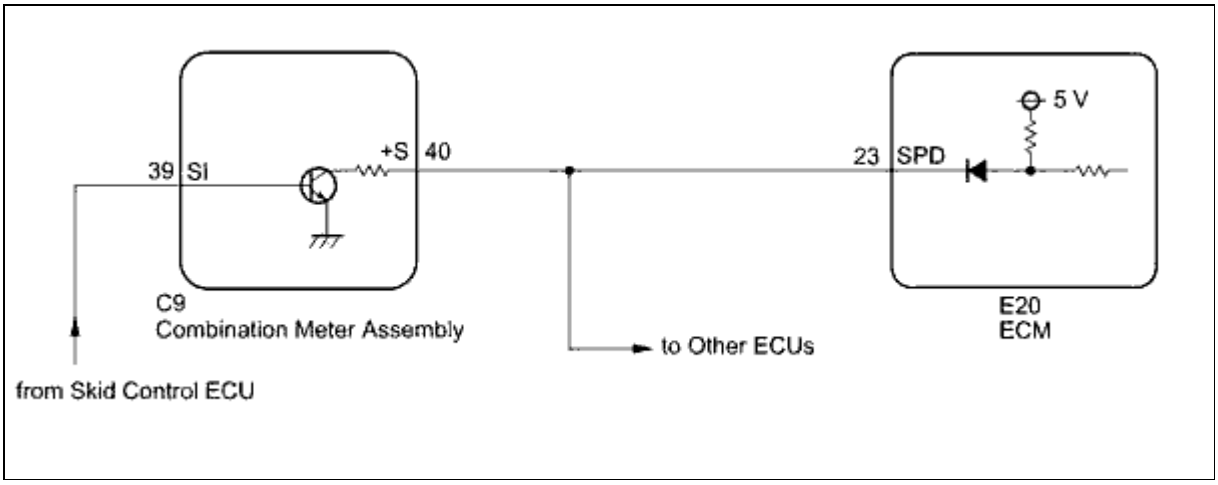
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

15. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Various systems use the vehicle speed signal distributed from the combination meter assembly. Check all the components possibly related to speed signal.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (VEHICLE SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Vehicle Speed.

(e) Drive the vehicle.

(f) Read the value displayed on the Techstream.

Result

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RESULT	PROCEED TO
Values displayed on Techstream and speedometer display not equal	A
Values displayed on Techstream and speedometer display equal	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

▼

2.	**CHECK HARNESS AND CONNECTOR (COMBINATION METER ASSEMBLY - ECM)**

(a) Disconnect the C9 combination meter assembly connector.

(b) Disconnect the E20 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C9-40 (+S) - E20-23 (SPD)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

▼

3.	**CHECK COMBINATION METER ASSEMBLY**

(a) Check the circuits that send vehicle speed signals to this system in the combination meter system INFO .

NEXT

▼

4.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Start the engine.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read the DTCs.

HINT:

If no DTCs (no pending DTCs) are output to the Techstream, the repair has been successfully completed.

NEXT **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000T8O020X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0504; Brake Switch "A" / "B" Correlation; 2016 MY Tacoma [08/2015 -]		

DTC	**P0504**	**Brake Switch "A" / "B" Correlation**

DESCRIPTION

The stop light switch is a duplex system that transmits two signals: STP and ST1-. These two signals are used by the ECM to monitor whether or not the brake system is working properly. If the signals, which indicate the brake pedal is being depressed and released, are detected simultaneously, the ECM interprets this as a malfunction in the stop light switch and stores the DTC.

HINT:

The normal conditions are as shown in the table below.

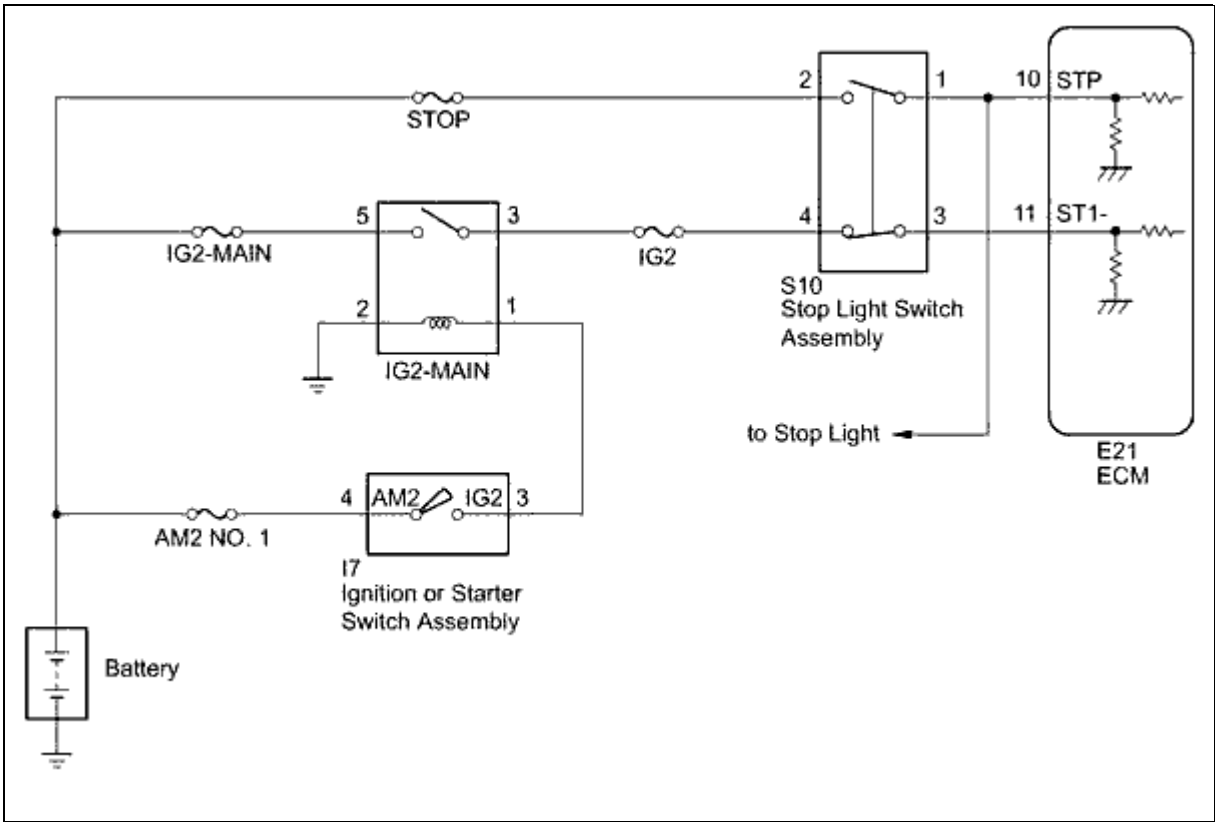
SIGNAL (ECM TERMINAL)	BRAKE PEDAL RELEASED	IN TRANSITION	BRAKE PEDAL DEPRESSED
STP	OFF	ON	ON
ST1-	ON	ON	OFF

- [OFF] denotes ground potential.
- [ON] denotes battery potential (+B).
- On the Techstream, both the Data List items Stop Light Switch and ST1 are ON when the brake pedal is depressed because the ST1 indication characteristic is opposite to the Stop Light Switch indication.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0504	Conditions (a), (b) and (c) continue for 0.5 seconds or more (1 trip detection logic): (a) Ignition switch ON (b) Brake pedal released (c) STP signal OFF when ST1- signal OFF	• Short in stop light switch signal circuit • Stop light switch assembly • ECM

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Stop light switch conditions can be checked using the Techstream.

a. Connect the Techstream to the DLC3.
b. Turn the ignition switch to ON.
c. Turn the Techstream on.
d. Enter the following menus: Powertrain / Engine and ECT / Data List / Stop Light Switch and ST1.
e. Check the Data List indication when the brake pedal is depressed and released.

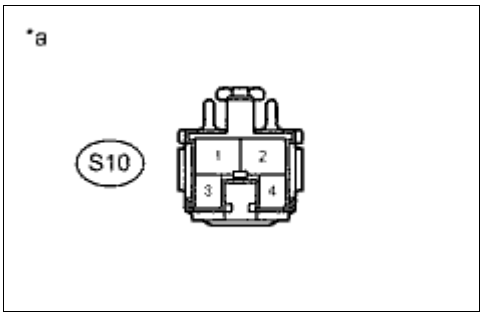
BRAKE PEDAL OPERATION	STOP LIGHT SWITCH	ST1
Depressed	ON	ON
Released	OFF	OFF

PROCEDURE

1.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF STOP LIGHT SWITCH ASSEMBLY)**

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(a) Disconnect the stop light switch assembly connector.



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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
S10-2 - Body ground	Always	11 to 14 V

Text in Illustration

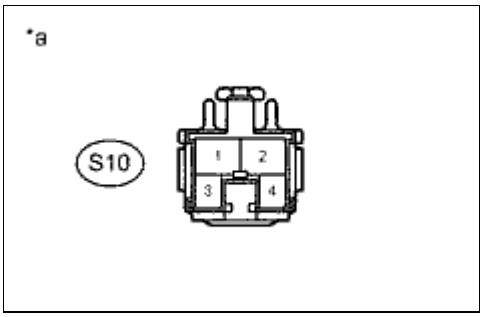
*a	Front view of wire harness connector (to Stop Light Switch Assembly)

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (STOP LIGHT SWITCH ASSEMBLY - BATTERY)**

OK ▼

2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF STOP LIGHT SWITCH ASSEMBLY)**

(a) Disconnect the stop light switch assembly connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION

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TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
S10-4 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Stop Light Switch Assembly)

NG ▶ **GO TO STEP 5**

OK ▼

3.	**INSPECT STOP LIGHT SWITCH ASSEMBLY**

(a) Inspect the stop light switch assembly INFO .

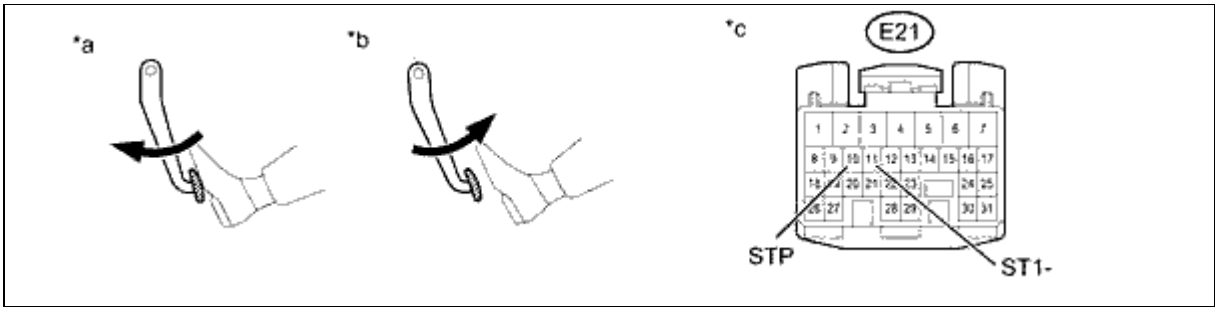
NG ▶ **REPLACE STOP LIGHT SWITCH ASSEMBLY**

OK ▼

4.	**CHECK TERMINAL VOLTAGE (STP AND ST1 - VOLTAGE)**

(a) Disconnect the ECM connector.

(b) Turn the ignition switch to ON.



Text in Illustration

*a	Brake Pedal Depressed	*b	Brake Pedal Released
*c	Front view of wire harness connector (to ECM)	-	-

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-11 (ST1-) - Body ground	Released	7.5 to 14 V
	Depressed	Below 1.5 V
E21-10 (STP) - Body ground	Released	Below 1.5 V
	Depressed	7.5 to 14 V

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (STOP LIGHT SWITCH ASSEMBLY - ECM)**

OK ▶ **REPLACE ECM**

5.	**CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH ASSEMBLY - IG2-MAIN RELAY)**

(a) Disconnect the S10 stop light switch assembly connector.

(b) Remove the IG2-MAIN relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
S10-4 - 3 (IG2-MAIN relay holder)	Always	Below 1 Ω
S10-4 or 3 (IG2-MAIN relay holder) - Body ground and other terminals	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000T8M0UOX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0505; Idle Control System; 2016 MY Tacoma [08/2015 -]		

DTC	**P0505**	**Idle Control System**

DESCRIPTION

The idling speed is controlled by the Electronic throttle control system. The electronic throttle control system is comprised of: 1) the one valve type throttle body; 2) the throttle actuator, which operates the throttle valve; 3) the throttle position sensor, which detects the opening angle of the throttle valve; 4) the accelerator pedal position sensor, which detects the accelerator pedal position; and 5) the ECM, which controls the electronic throttle control system. Based on the target idling speed, the ECM controls the throttle actuator to provide the proper throttle valve opening angle.

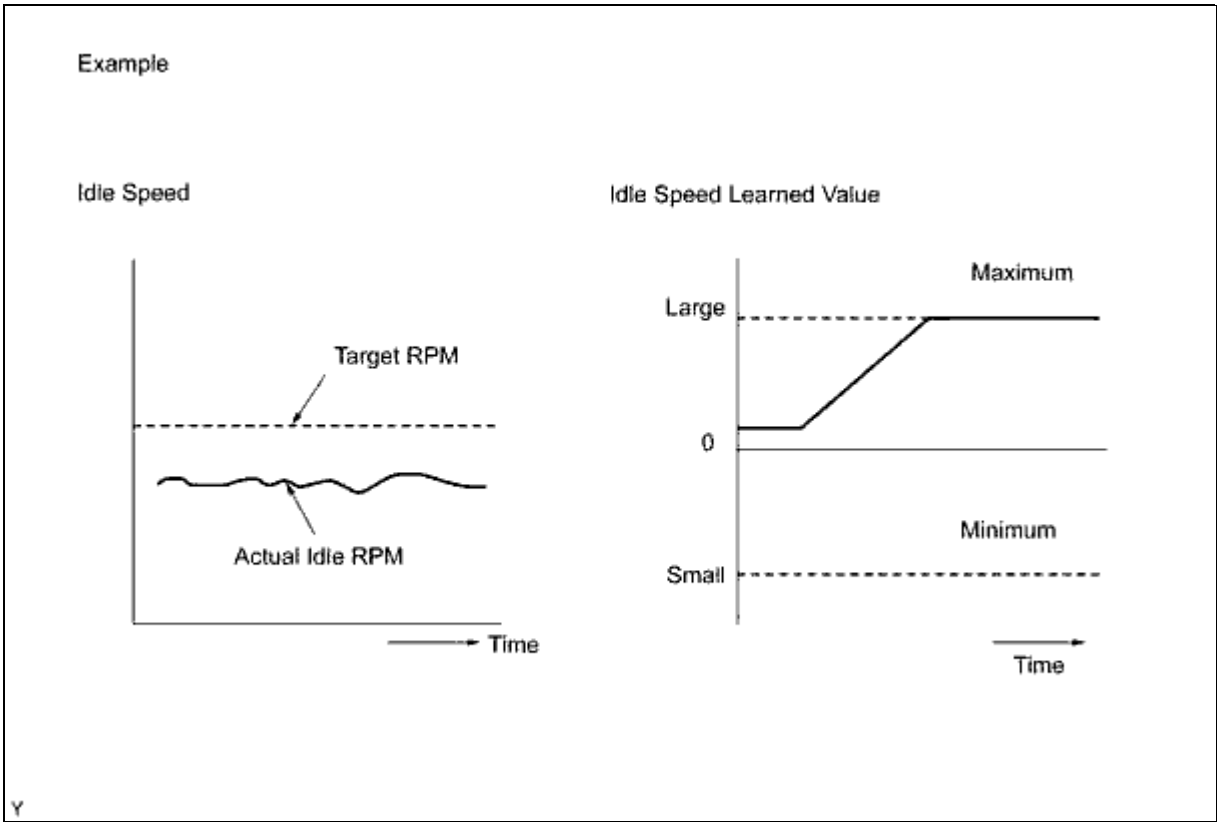
DTC NO.	DTC DETECTION CONDITION	TROUBLE AREAS
P0505	Idling speed continues to vary greatly from target idling speed (2 trip detection logic)	• Electronic Throttle Control System (ETCS) • Intake system • PCV hose connection • ECM

MONITOR DESCRIPTION

The ECM monitors the idling speed and idling air flow volume to conduct idle speed control. The ECM determines that the idle speed control system is malfunctioning if the following conditions are met:

- The difference between the target engine idling speed and actual engine idling speed exceeds the threshold and the IAC flow rate learned value is stuck at the upper or lower limit for 5 seconds or more.
- After driving at a vehicle speed of 10 km/h (6.25 mph) or more, the difference between the target and actual engine idling speed exceeds the threshold 5 times or more during a driving cycle, and then the system determines that the IAC flow rate learned value is stuck at the upper or lower limit, or that the IAC flow rate learned value has been changed by an amount that exceeds the threshold.

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MONITOR STRATEGY

Related DTCs	P0505: ISC Function
Required Sensors/Components (Main)	Electronic throttle control system
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Vehicle speed sensor
Frequency of Operation	Continuous
Duration	5 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter)

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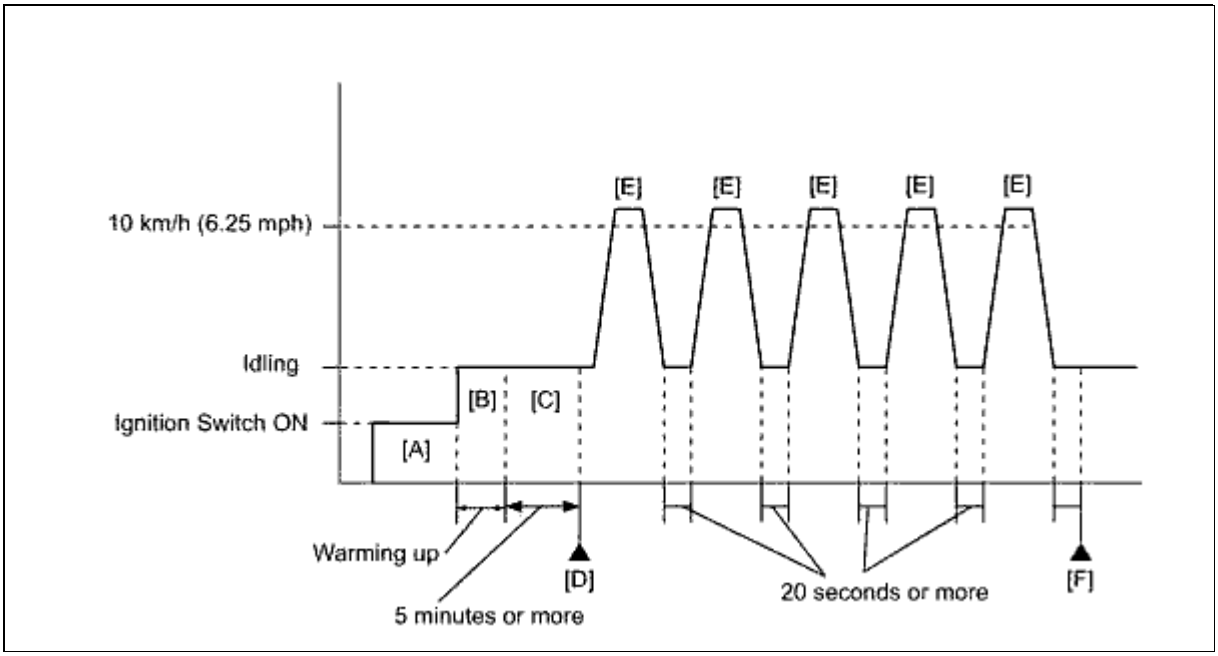
	P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500 (Vehicle Speed Sensor) P0748, P0778, P0798 (Pressure Control Solenoid) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance)
Engine	Running

TYPICAL MALFUNCTION THRESHOLDS

Either condition is met	1 or 2
1. Both of following conditions A and B met	-
A. Engine rpm - Target engine rpm	Less than -100 rpm, or more than 150 rpm (A/C off and NSW off) Less than -100 rpm, or more than 200 rpm (A/C on or NSW on)
B. AC flow rate learned value	0.5 L/sec. or less, or 6.4 L/sec. or more for 5 seconds or more
2. Both of following conditions C and D met	-
C. Both of following conditions (a) and (b) met	5 times or more
(a) Engine rpm- Target engine rpm	Less than -100 rpm, or more than 150 rpm (A/C off and NSW off) Less than -100 rpm, or more than 200 rpm (A/C on or NSW on)
(b) Vehicle condition	Stopped after being driven at 10 km/h (6.25 mph) or more
D. Either of following condition is met	(c) or (d)
(c) Amount of change of IAC learned value	+1.96 L/sec. or more, or -2.96 L/sec. or more for 5 seconds or less
(d) IAC flow rate learned value	0.5 L/sec. or less, or 6.4 L/sec. or more for 5 seconds or more

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on [A].
7. Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off [B].
8. Idle the engine for 5 minutes or more [C].

HINT:

In order to keep the idling stable, turn off the A/C and all other electric loads and do not perform any shift operations.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0505.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [E] and [F].

14. Accelerate the vehicle to 10 km/h (6.25 mph) or more, and then idle the engine for 20 seconds or more [E].
15. Repeat step [E] 5 times.
16. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [F].
17. Read pending DTCs.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

18. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
19. Input the DTC: P0505.
20. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

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21. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- The following conditions may also cause DTC P0505 to be stored:
  a. The floor carpet overlapping slightly onto the accelerator pedal, causing the accelerator pedal to be slightly depressed and therefore the throttle valve position to be slightly open.
  b. The accelerator pedal being not fully released.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Refer to "Data List / Active Test" [Engine Speed, ISC Feedback Value and ISC Learning Value] INFO .

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0505)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0505 is output	A
DTC P0505 and other DTCs are output	B

HINT:

If any DTCs other than P0505 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**CHECK PCV HOSE CONNECTIONS**

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(a) Check the PCV hose connections.

OK:

PCV valve and hose are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK ▼

3.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

4.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (THROTTLE VALVE)**

(a) Check the throttle valve condition.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NG ▶ **REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

OK ▼

5.	**CONFIRM WHETHER DTC OUTPUT RECURS**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0505 is output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002U13049X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P050A; Cold Start Idle Air Control System Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P050A**	**Cold Start Idle Air Control System Performance**

DESCRIPTION

This monitor will run when the engine is started with the engine coolant temperature at -10 to 50°C (14 to 122°F). The DTC will be stored after the engine idles for 13 seconds (2 trip detection logic).

The DTC is designed to monitor the idle air control at cold start. When the engine is started with the engine coolant temperature at lower than 50°C (122°F), the ECM measures the accumulated mass air flow at engine idling. If it does not reach the criteria within 10 seconds, the ECM interprets this as a malfunction. The MIL is illuminated and a DTC is stored when the malfunction is detected in consecutive driving cycles (2 trip detection logic).

The electronic throttle control system controls the idle speed. The electronic throttle control system operates the throttle actuator to open and close the throttle valve, and adjusts the intake air amount to achieve the target idle speed.

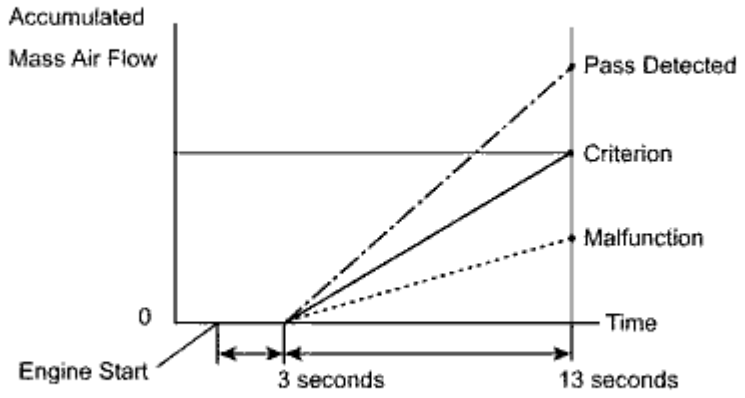
NOTICE:

When the cable is disconnected from the negative battery terminal during inspections or repairs, the idle speed control learning values are cleared. This DTC cannot be stored with the idle speed control learning values cleared.

HINT:

The idle speed control learning is performed when the engine is warmed up and has been idling for 5 minutes.

P050A Detection Logic:



Engine Coolant Temperature: -10 to 50°C (14 to 122°F)

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P050A	Insufficient mass air flow at cold start (2 trip detection logic)	• Throttle body with motor assembly • Mass air flow meter • PCV hose • Air cleaner filter element sub-assembly • Intake system • VVT system • Wire harness or connector • ECM

MONITOR STRATEGY

Related DTCs	P050A: Cold Start Idle Air Speed Control System
Required sensors/Components (Main)	Throttle body with motor assembly
Required sensors/Components (Related)	Mass air flow meter Engine coolant temperature sensor
Frequency of operation	Once per driving cycle
Duration	10 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0500 (Vehicle Speed Sensor)

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	P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance)
Battery voltage	8 V or higher
Time after engine start	3 seconds or more
Starter	OFF
Engine coolant temperature at engine start	-10°C (14°F) or higher
Engine coolant temperature	-10°C (14°F) or higher, and less than 50°C (122°F)
Engine idling time	3 seconds or more
Fuel-cut	OFF
Vehicle speed	Less than 3 km/h (1.875 mph)
Time after shift position changed	1 second or more
Atmospheric pressure	76 kPa(abs) [570 mmHg(abs)] or higher

TYPICAL MALFUNCTION THRESHOLDS

Accumulated mass air flow	Less than 35.79 g (varies with engine coolant temperature) (for Automatic Transmission) Less than 34.38 g (varies with engine coolant temperature) (for Manual Transmission)

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on [A].
7. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
8. Check that "Coolant Temp" in the Data List is within the range of -10 to 50°C (14 to 122°F).
9. Start the engine and warm it up until the coolant temperature is the same as the coolant temperature in the freeze frame data.
10. Idle the engine for 1 minute or more [B].
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
12. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P050A.
15. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed

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TECHSTREAM DISPLAY	DESCRIPTION
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, idle the engine for 3 minutes, let the engine cool down, and then perform steps [A] through [C] again.

16. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050A)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following the menus: Powertrain / Engine and ECT / Trouble Codes.

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(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P050A is output	A
DTC P050A and other DTCs are output	B

HINT:

If any DTCs other than P050A are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**READ VALUE USING TECHSTREAM (FUEL TRIM)**

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter.

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the values displayed on the Techstream at engine idle.

(f) Add together the Short FT #1 and Long FT #1 values to obtain the total fuel trim.

Standard:

Total of Short FT #1 and Long FT #1 values is between -20% and 20%.

NG ▶ **GO TO STEP 5**

OK

▼

3.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (THROTTLE VALVE)**

(a) Check that there are no deposits around the throttle valve and throttle valve condition.

OK:

No deposits around throttle valve and throttle valve moves smoothly.

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OK ▶ **GO TO STEP 14**

NG ▶ **GO TO STEP 4**

4.	**REPAIR OR REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

(a) Repair or replace throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after repairing or replacing the throttle body with motor assembly INFO .

NEXT ▶ **GO TO STEP 14**

5.	**CHECK PCV HOSE CONNECTIONS**

(a) Check the PCV hose connections.

OK:

PCV valve and hose are connected correctly and are not damaged.

NG ▶ **GO TO STEP 10**

OK ▼

6.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from the intake system.

NG ▶ **GO TO STEP 11**

OK ▼

7.	**CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

(a) Visually check that the air cleaner filter element is not excessively contaminated with dirt or oil.

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OK:

The air cleaner filter element is not excessively contaminated with dirt or oil.

NG ▶ **GO TO STEP 12**

OK ▼

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (FOR INTAKE OR EXHAUST SIDE))** INFO

NG ▶ **GO TO STEP 13**

OK ▼

9.	**READ VALUE USING TECHSTREAM (MAF)** INFO

OK ▶ **GO TO STEP 14**

NG ▶ **GO TO STEP 15**

10.	**REPAIR OR REPLACE PCV HOSE**

(a) Repair or replace the PCV hose.

NEXT ▶ **GO TO STEP 14**

11.	**REPAIR OR REPLACE INTAKE SYSTEM**

(a) Repair or replace the intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT ▶ **GO TO STEP 14**

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12.	REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Replace the air cleaner filter element sub-assembly.

NEXT ▶ **GO TO STEP 14**

13.	CHECK AND REPAIR VVT SYSTEM

(a) Check and repair the VVT system.

HINT:

Refer to DTC P0011 Inspection Procedure INFO .

NEXT ▼

14.	CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050A.

(n) Check the DTC judgment result.

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Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050A is output)	B

B ▶ **GO TO STEP 15**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

15.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

▼

16.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)**

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

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(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050A.

(n) Check the DTC judgment result.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P050A is output)	A
NORMAL (DTC is not output)	B

B ▶ **END**

A

▼

17.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

▼

18.	**REPLACE MASS AIR FLOW METER**

(a) Replace the mass air flow meter.

HINT:

- If the results of the inspections performed in step 9 indicated no problem, proceed to the next step without replacing the mass air flow meter.
- Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NEXT

▼

19.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

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NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050A.

(n) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050A is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000045EL00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P050B; Cold Start Ignition Timing Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P050B**	**Cold Start Ignition Timing Performance**

DESCRIPTION

This monitor will run when the engine is started at an engine coolant temperature of -10 to 50°C (14 to 122°F). The DTC will be stored after the engine idles for 13 seconds (2 trip detection logic).

The DTC is designed to monitor the ignition timing at cold start. When the engine is started at an engine coolant temperature of less than 50°C (122°F), the ECM checks the ignition timing at engine idling. If the ignition timing advances beyond the specified level within 10 seconds, the ECM interprets this as a malfunction. The MIL is illuminated and a DTC is stored when the malfunction is detected in consecutive driving cycles (2 trip detection logic).

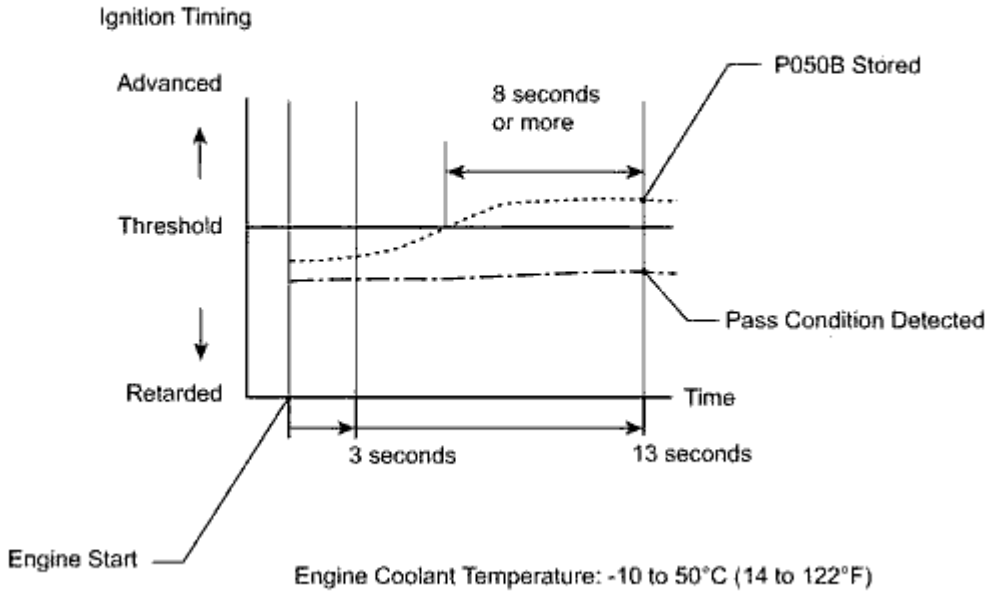
NOTICE:

When the cable is disconnected from the negative battery terminal during inspections or repairs, the ISC (Idle Speed Control) learning values are cleared. This DTC cannot be stored with the ISC learning values cleared.

HINT:

The ISC learning is performed when the engine is warmed up and has been idling for 5 minutes.

P050B Detection Logic:



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P050B	Insufficient ignition timing retard at cold start (2 trip detection logic)	• Throttle body with motor assembly • Mass air flow meter • PCV system • Air cleaner filter element sub-assembly • Intake system • VVT system • Wire harness or connector • ECM

MONITOR STRATEGY

Related DTCs	P050B: Cold Start Ignition Timing Performance
Required sensors/Components (Main)	Throttle body with motor assembly
Required sensors/Components (Related)	Mass air flow meter Engine coolant temperature sensor
Frequency of operation	Once per drive cycle
Duration	10 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0500 (Vehicle Speed Sensor) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance)

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Battery voltage	8 V or higher
Time after engine start	3 seconds or more
Starter	OFF
Engine coolant temperature at engine start	-10°C (14°F) or higher
Engine coolant temperature	-10°C (14°F) or higher, and less than 50°C (122°F)
Fuel-cut	OFF
Engine idling time	3 seconds or more
Vehicle speed	Less than 3 km/h (1.875 mph)
Atmospheric pressure	76 kPa(abs) [570 mmHg(abs)] or higher

TYPICAL MALFUNCTION THRESHOLDS

Accumulated time when ignition timing retard is cut off	8 seconds or more

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on [A].
7. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
8. Check that "Coolant Temp" in the Data List is within the range of -10 to 50°C (14 to 122°F).
9. Start the engine and warm it up until the coolant temperature is the same as the coolant temperature in the freeze frame data.
10. Idle the engine for 1 minute or more [B].
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
12. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P050B.
15. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- ○ If the judgment result shows NORMAL, the system is normal.
- ○ If the judgment result shows ABNORMAL, the system has a malfunction.
- ○ If the judgment result shows INCOMPLETE or N/A, idle the engine for 3 minutes, let the engine cool down, and then perform steps [A] through [C] again.

16. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- ○ If a permanent DTC is output, the system is malfunctioning.
- ○ If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before pending the following inspection procedure.

HINT:

- DTC P050B may be stored when the engine has the symptoms listed below. If necessary, check the trouble areas listed below.

SYMPTOM	FACTOR	TROUBLE AREA
Low idle speed when engine is cold (immediately after engine start)	Excessive engine friction	○ Engine oil deterioration ○ Drive belt tension ○ A/C compressor ○ Generator ○ Vane pump
Rough idle when engine is cold (immediately after engine start)	Abnormal combustion	Fuel quality

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be help determining if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time malfunction occurred.

PROCEDURE

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1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P050B is output	A
DTC P050B and other DTCs are output	B

HINT:

If any DTCs other than P050B are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**READ VALUE USING TECHSTREAM (FUEL TRIM)**

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter.

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the values displayed on the Techstream at engine idle.

(f) Add together the Short FT #1 and Long FT #1 values to obtain the total fuel trim.

Standard:

Total of Short FT #1 and Long FT #1 values is between -20% and 20%.

NG ▶ **GO TO STEP 5**

OK

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3.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (THROTTLE VALVE)**

(a) Check for deposits around the throttle valve and throttle valve condition.

OK:

No deposits around throttle valve and throttle valve moves smoothly.

OK ▶ **GO TO STEP 14**

NG ▶ **GO TO STEP 4**

4.	**REPAIR OR REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

(a) Repair or replace the throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after repairing or replacing the throttle body with motor assembly INFO .

NEXT ▶ **GO TO STEP 14**

5.	**CHECK PCV HOSE CONNECTIONS**

(a) Check the PCV hose connections.

OK:

PCV valve and hose are connected correctly and are not damaged.

NG ▶ **GO TO STEP 10**

OK

▼

6.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

OK:

No leaks from the intake system.

NG ▶ **GO TO STEP 11**

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OK

7.	**CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

(a) Visually check that the air cleaner filter element is not excessively contaminated with dirt or oil.

OK:

The air cleaner filter element is not excessively contaminated with dirt or oil.

NG ▶ **GO TO STEP 12**

OK

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE OR EXHAUST SIDE))** INFO

NG ▶ **GO TO STEP 13**

OK

9.	**READ VALUE USING TECHSTREAM (MAF)** INFO

OK ▶ **GO TO STEP 14**

NG ▶ **GO TO STEP 15**

10.	**REPAIR OR REPLACE PCV HOSE**

(a) Repair or replace the PCV hose.

NEXT ▶ **GO TO STEP 14**

11.	**REPAIR OR REPLACE INTAKE SYSTEM**

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(a) Repair or replace the intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT ▶ **GO TO STEP 14**

12.	REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Replace the air cleaner filter element sub-assembly.

NEXT ▶ **GO TO STEP 14**

13.	CHECK AND REPAIR VVT SYSTEM

(a) Check and repair the VVT system.

HINT:

Refer to DTC P0011 Inspection Procedure INFO .

NEXT ▼

14.	CHECK WHETHER DTC OUTPUT RECURS (DTC P050B)

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

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(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050B.

(n) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050B is output)	B

B ▶ **GO TO STEP 15**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

15.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT ▼

16.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P050B)**

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

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(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050B.

(n) Check the DTC judgment result.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P050B is output)	A
NORMAL (DTC is not output)	B

B ▶ **END**

A

▼

17.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

▼

18.	**REPLACE MASS AIR FLOW METER**

(a) Replace the mass air flow meter.

HINT:

- If the results of the inspections performed in step 9 indicated no problem, proceed to the next step without replacing the mass air flow meter.
- Perform "Inspection After Repair" after replacing the mass air flow meter INFO .

NEXT

▼

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19.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(i) Check that the engine coolant temperature is between - 10°C and 50°C (14 and 122°F).

(j) Start the engine and warm it up.

(k) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(l) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(m) Input the DTC: P050B.

(n) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050B is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000T8P1JSX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0560; System Voltage; 2016 MY Tacoma [08/2015 -]		

DTC	**P0560**	**System Voltage**

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is in the OFF position. This power allows the ECM to store data such as DTC history, freeze frame data and fuel trim values. If the battery voltage falls below a minimum level, the stored ECM data is cleared and the ECM determines that there is a malfunction in the power supply circuit. When the engine is next started, the ECM illuminates the MIL and stores the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0560	Open in ECM back up power source circuit (1 trip detection logic)	• Open in back up power source circuit • Battery • Battery terminals • ECM

HINT:

If DTC P0560 is stored, the ECM does not store other DTCs and the data stored in the ECM is partly cleared.

MONITOR STRATEGY

Related DTCs	P0560: ECM System Voltage
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate (MIL illuminated after next engine start)
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

Stand-by RAM	Initialized
Battery voltage	Less than 3.5 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTCs.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0560.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

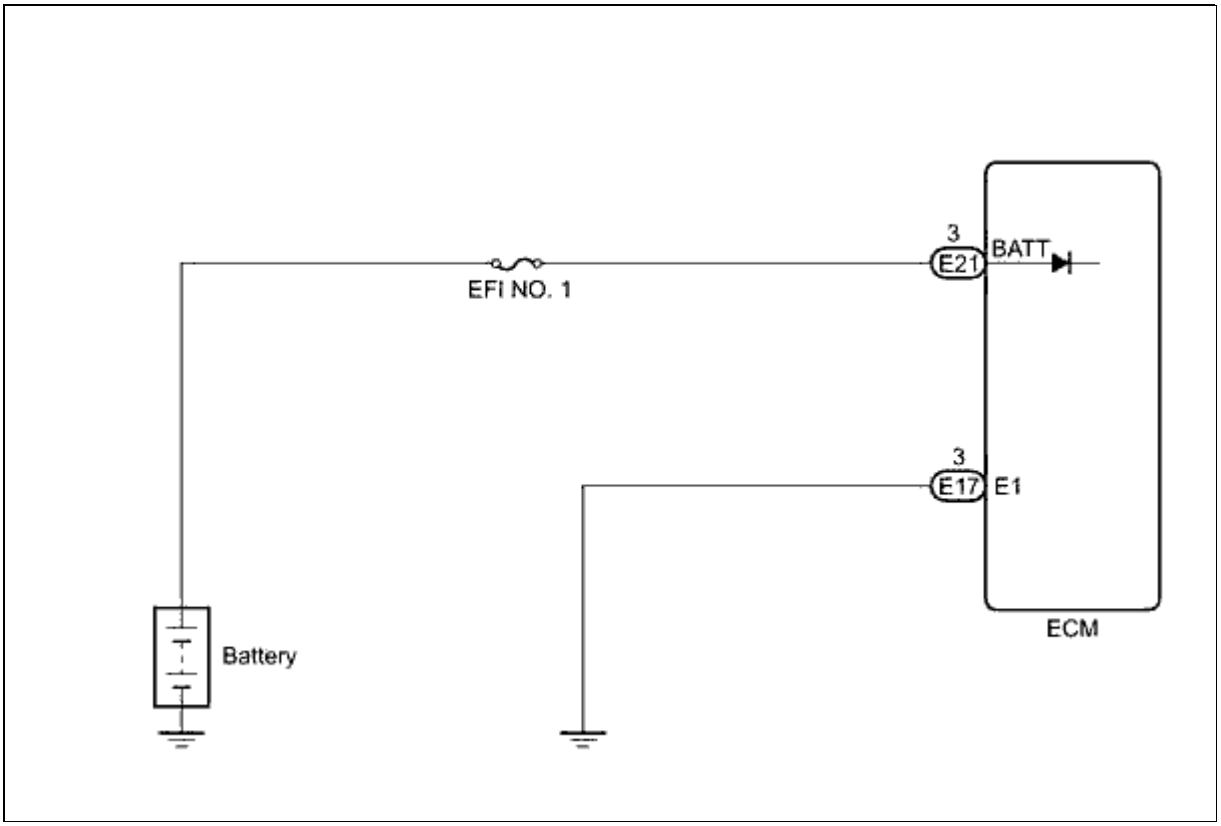
12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.
- After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**INSPECT BATTERY**

(a) Check that the battery is not depleted INFO .

OK:

Battery is not depleted.

NG ▶ **REPLACE BATTERY**

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OK

2.	**CHECK BATTERY TERMINAL**

(a) Check that the battery terminals are not loose or corroded.

OK:

Battery terminals are not loose or corroded.

NG → **REPAIR OR REPLACE BATTERY TERMINAL**

OK

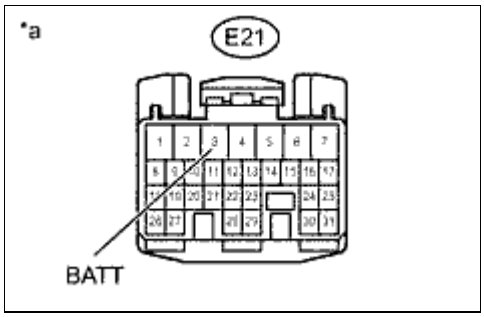
3.	**CHECK HARNESS AND CONNECTOR (ECM - BATTERY)**

(a) Disconnect the ECM connector.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-3 (BATT) - Body ground	Always	11 to 14 V



Text in Illustration

*a	Front view of harness connector (to ECM)

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0560)**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Turn the ignition switch off and turn the Techstream off.

(i) Turn the ignition switch to ON and turn the Techstream on.

(j) Wait 5 seconds or more.

(k) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(l) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0560 is output	A
DTC is not output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002KQO0F6X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0604; Random Access Memory (RAM); 2016 MY Tacoma [08/2015 -]		

DTC	**P0604**	**Random Access Memory (RAM)**

DESCRIPTION

The ECM continuously monitors its internal memory status. This self-check ensures that the ECM is functioning properly. This is diagnosed by internal "mirroring" of the main CPU and sub CPU to detect the Random Access Memory (RAM) errors. If outputs from these CPUs are different and deviate from the standard, the ECM will illuminate the MIL and stores the DTC immediately.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0604	ECM RAM errors (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P0604: ECM RAM Error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	None
Frequency of operation	Continuous
Duration	6 times
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

RAM mirror check	Fail

CONFIRMATION DRIVING PATTERN

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.

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3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P0604.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

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HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(n) Read DTCs.

OK:

P0604 is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002I3T035X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0606; ECM Processor; 2016 MY Tacoma [08/2015 -]		

DTC	**P0606**	**ECM Processor**

DESCRIPTION

The ECM continuously monitors its main and sub CPUs. This self-check ensures that the ECM is functioning properly. If outputs from the CPUs are different and deviate from the standard, the ECM illuminates the MIL and stores the DTC immediately.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0606	There is an ECM main CPU error (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P0606: ECM range check
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	Within 1 second
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

Case 1 and Case 2

Both of the following conditions are met	-
Write Inhibit	Permit
Time after Write status forbiddance to permit	0.5 seconds or more

Case 3 and Case 4

All of the following conditions are met	-
Battery voltage	8 V or higher

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Ignition switch	ON
Starter	OFF
Write Inhibit	Permit
Time after Write status forbiddance to permit	0.5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Case 1

One of the following conditions is met	5 seconds or more
ROM check sum	Error
RAM Read/Write check	Fail
Specific software routine operation period check	Fail
Software functional check	Fail

Case 2

Following condition is met	40 times or more
Specific software routine operation period check	Fail

Case 3

Following condition is met	25 times or more
DMA communication	No response

Case 4

Following condition is met	8 times or more
Watchdog from monitoring processor	Not toggle
CPU reset	Occurred

CONFIRMATION DRIVING PATTERN

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.

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10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 1 second or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P0606.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

CAUTION:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 1 second or more.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read DTCs.

OK:
P0606 is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002I3S0E9X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0607; Control Module Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P0607**	**Control Module Performance**

DESCRIPTION

The ECM continuously monitors its internal processors (CPUs), and heated oxygen sensor transistors. This self-check ensures that the ECM is functioning properly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0607	• ECM CPUs malfunction • Heated oxygen sensor transistor (built into the ECM) malfunctions	• Exhaust gas leak • Heated oxygen sensor • ECM

MONITOR STRATEGY

Related DTCs	P0607: Control Module Performance
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Heated oxygen sensor
Frequency of operation	Continuous
Duration	60 seconds
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

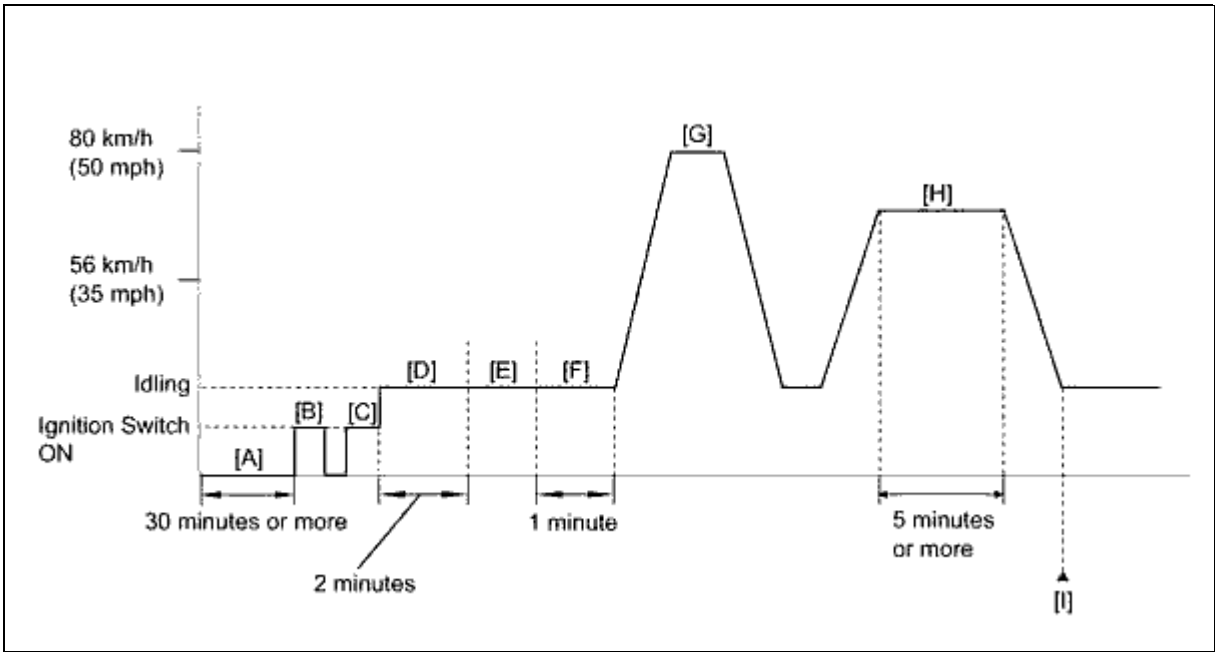
Monitor runs whenever the following DTCs are not store	None
Engine	Running
Estimated heated oxygen sensor temperature	450 to 800°C (842 to 1472°F)

TYPICAL MALFUNCTION THRESHOLDS

Heated oxygen sensor transistor	Fail

CONFIRMATION DRIVING PATTERN

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1. Stop the engine for 30 minutes or more [A].
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON and turn the Techstream on [B].
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on [C].
7. Start the engine and wait 2 minutes [D].
8. Warm up the engine until the engine coolant temperature is 75°C (167°F) or higher [E].
9. Idle the engine for 1 minute [F].
10. Accelerate the vehicle to 80 km/h (50 mph) and stop the vehicle [G].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

11. Drive the vehicle at 56 to 80 km/h (35 to 50 mph) for 5 minutes or more [H].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [I].
13. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P0607, P0136, P0137 or P0138.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [E] through [I] again.

17. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0607 and P0136, P0137 or P0138 are output	A
Only DTC P0607 is output	B

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B GO TO STEP 3

A

2.	INSPECT DTC (DTC P0136, P0137 OR P0138)

(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If P0137 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If P0138 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT GO TO STEP 6

3.	CHECK EXHAUST GAS LEAK

(a) Allow the engine to idle and rev the engine.

(b) Check for exhaust gas leaks around the heated oxygen sensor.

If any exhaust gas leaks are present, repair them and proceed to "Perform Confirmation Driving Pattern". If no exhaust gas leaks are present, proceed to "Perform Confirmation Driving Pattern".

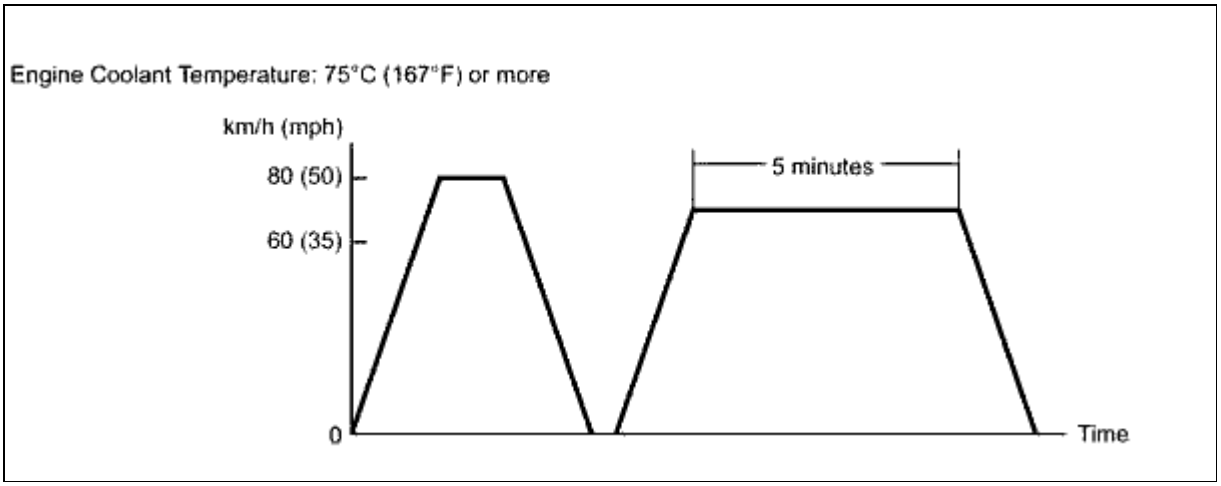
HINT:

- If no exhaust gas leaks are present, there may be a malfunction in the heated oxygen sensor circuit.
- If any exhaust gas leaks are present around the heated oxygen sensor, noise appears in the output voltage of the heated oxygen sensor.
- Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NEXT

4.	PERFORM CONFIRMATION DRIVING PATTERN

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(a) Clear DTC INFO .

(b) Connect the Techstream to the DLC3.

(c) Start the engine.

(d) Turn the Techstream on.

(e) Warm up the engine until the engine coolant temperature becomes 75°C (167°F) or more.

(f) Perform the drive pattern.

(1) Accelerate the vehicle to 80 km/h (50 mph) and stop the vehicle.

(2) Drive the vehicle between 60 and 80 km/h (35 and 50 mph) for 5 minutes.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0607 and P0136, P0137 or P0138 are output	A
Only DTC P0607 is output	B
No DTC is output	C

B ▶ **REPLACE ECM**

C ▶ **GO TO STEP 6**

A ▼

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5.	INSPECT DTC (DTC P0136, P0137 OR P0138)

(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If P0137 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If P0138 is output, troubleshoot for that DTC first INFO . Then proceed to "Inspect ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT

6.	INSPECT ECM

(a) Clear DTC INFO .

(b) Stop the engine and wait for 30 minutes.

(c) Connect the Techstream to the DLC3.

(d) Start the engine and allow it to idle for 2 minutes.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Check the DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0607 is output	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002Z1R0I0X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P060A; Internal Control Module Monitoring Processor Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P060A**	**Internal Control Module Monitoring Processor Performance**

DESCRIPTION

The main CPU and sub CPU of the ECM perform data communication between each other. The main CPU monitors the communications and WDC pulses from the sub CPU. When the signal malfunctions below are detected, this DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060A	There is an ECM sub CPU error (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P060A: ECM CPU Error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	-
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	Condition 1 or 2
1. All conditions are met:	-
- CPU reset	1 time or more
- Learned throttle position - Learned accelerator pedal position	0.4 V or higher
- Command to electronic throttle actuator	OFF
2. CPU reset	2 times or more

CONFIRMATION DRIVING PATTERN

NOTICE:

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After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P060A.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(n) Read DTCs.

OK:

P060A is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002Z1S0T5X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P060B; Internal Control Module A/D Processing Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P060B**	**Internal Control Module A/D Processing Performance**

MONITOR DESCRIPTION

This DTC is stored when a communication error occurs in the ECM.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060B	An ECM main CPU communication error (1 trip detection logic)	• ECM • Knock sensor

MONITOR STRATEGY

Related DTCs	P060B: ECM main CPU communication error
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2 times: AD converter is fail 30 times: Knock sensor circuit is fail, Knock sensor serial communication
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

When one of the following conditions is met	-
AD converter	Fail
Knock sensor circuit	Fail
Knock sensor signal communication	Fail

CONFIRMATION DRIVING PATTERN

NOTICE:

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After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P060B.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT (DTC P060B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P060B is output	B
DTC P060B and P0327, P0328 are output	C

B ▶ **REPLACE ECM**

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C ▶ GO TO DTC P0327, P0328

A ▶ CHECK FOR INTERMITTENT PROBLEMS

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002Z1S0T4X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P060D; Internal Control Module Accelerator Pedal Position Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P060D**	**Internal Control Module Accelerator Pedal Position Performance**

DESCRIPTION

The ECM monitors the input signals of the accelerator pedal position sensor No. 1. When the input signals and control signals deviate, this DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060D	There is an ECM main CPU error (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P060D: Internal Control Module, Accelerator Pedal Position
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

TYPICAL MALFUNCTION THRESHOLDS

Difference of main accelerator pedal position and sub accelerator pedal position	0.3 V or higher

CONFIRMATION DRIVING PATTERN

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.

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5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P060D.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as

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freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(n) Read DTCs.

OK:

P060D is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002Z1T0HDX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P060E; Internal Control Module Throttle Position Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P060E**	**Internal Control Module Throttle Position Performance**

DESCRIPTION

The ECM monitors the input signals of the throttle position sensor No. 1 and stop light switch. As the ECM monitors the input signals of the throttle position sensor No. 1 and the STP signals of the stop light switch, if the input signals and control signals deviate, this DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060E	When either condition below is met (1 trip detection logic): • ECM main CPU error • ECM sub CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060E: Internal Control Module, Throttle Position
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	1 second: Throttle sensor fail 13 times: Brake switch signal fail
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
DMA communication error	Not detected

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	Condition 1 or 2
1. Difference of main throttle position and sub throttle position	0.3 V or higher
2. Main stop light switch signal and sub stop light switch signal	Different

CONFIRMATION DRIVING PATTERN

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NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P060E.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(n) Read DTCs.

OK:

P060E is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TA01LFX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0617; Starter Relay Circuit High; 2016 MY Tacoma [08/2015 -]		

DTC	**P0617**	**Starter Relay Circuit High**

DESCRIPTION

While the engine is being cranked, the positive battery voltage is applied to terminal STA of the ECM.

If the ECM detects the Starter Control (STA) signal while the vehicle is being driven, it determines that there is a malfunction in the STA circuit. The ECM then illuminates the MIL and stores the DTC.

This monitor runs when the vehicle is driven at 20 km/h (12.43 mph) for over 20 seconds.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0617	When conditions (a), (b) and (c) met, positive (+B) battery voltage 10.5 V or higher applied to ECM for 20 seconds (1 trip detection logic): (a) Vehicle speed 20 km/h (12.43 mph) or more (b) Engine speed 1000 rpm or more (c) STA signal ON	• Park/neutral position switch*1 • Clutch start switch*2 • Starter relay circuit • Ignition switch assembly • ECM

*1: for Automatic Transmission
*2: for Manual Transmission

MONITOR STRATEGY

Related DTCs	P0617: Starter Signal
Required Sensors/Components (Main)	Starter relay Park/neutral position switch (for Automatic Transmission) Clutch start switch (for Manual Transmission) Ignition switch
Required Sensors/Components (Related)	Vehicle speed sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	20 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

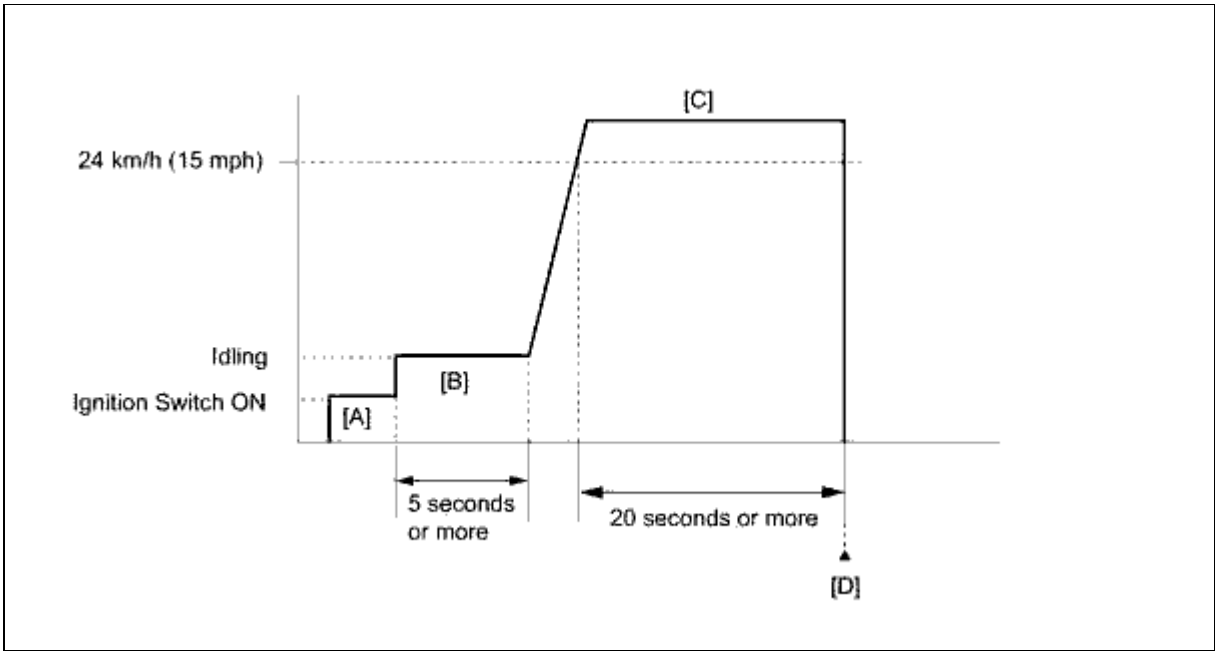
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Monitor runs whenever following DTCs are not stored	None
Battery voltage	10.5 V or higher
Vehicle speed	20 km/h (12.43 mph) or more
Engine speed	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Starter signal	ON

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Idle the engine for 5 seconds or more [B].
7. Drive the vehicle at 24 km/h (15 mph) or more for 20 seconds or more [C].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0617.
12. Check the DTC judgment result.

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TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

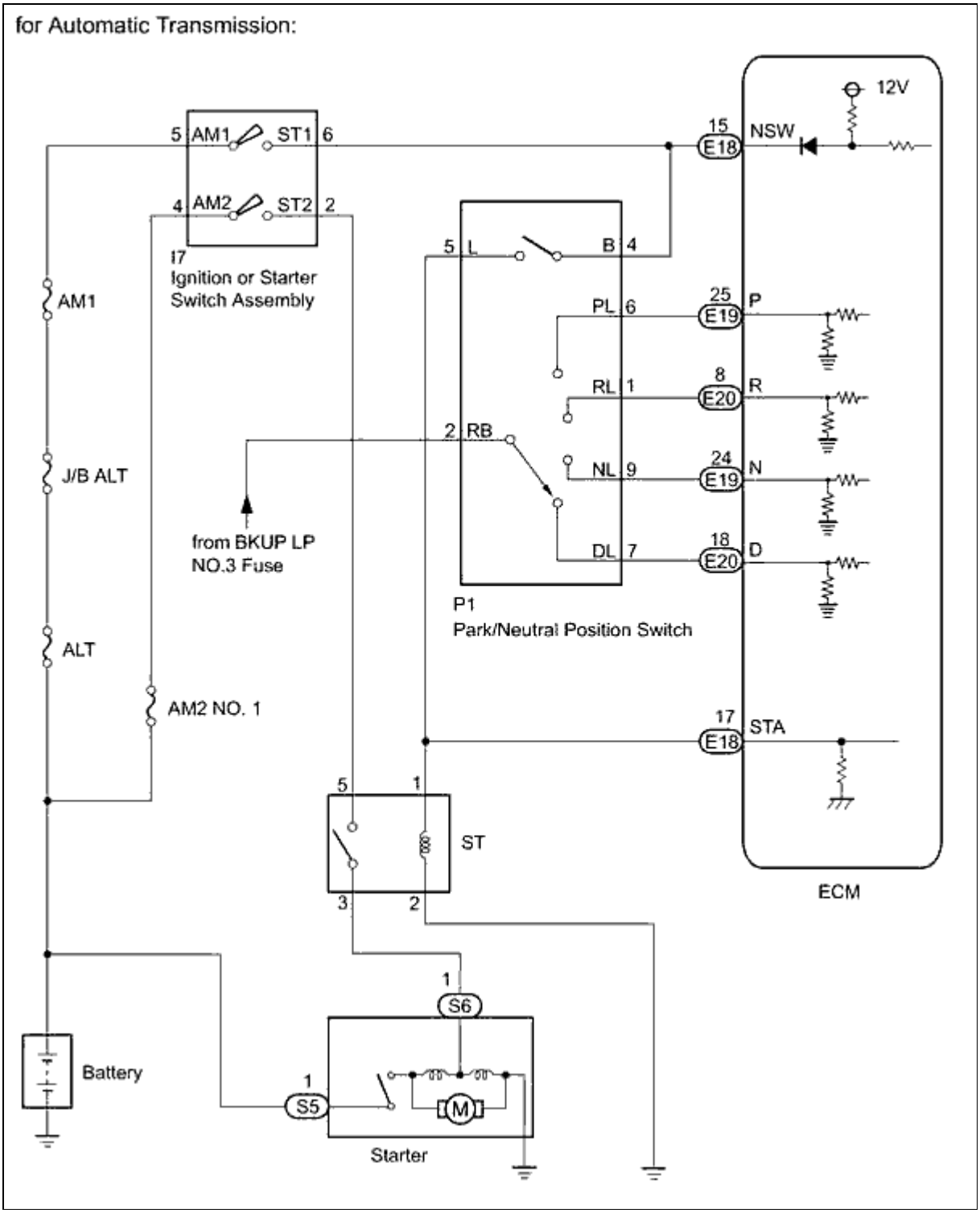
HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

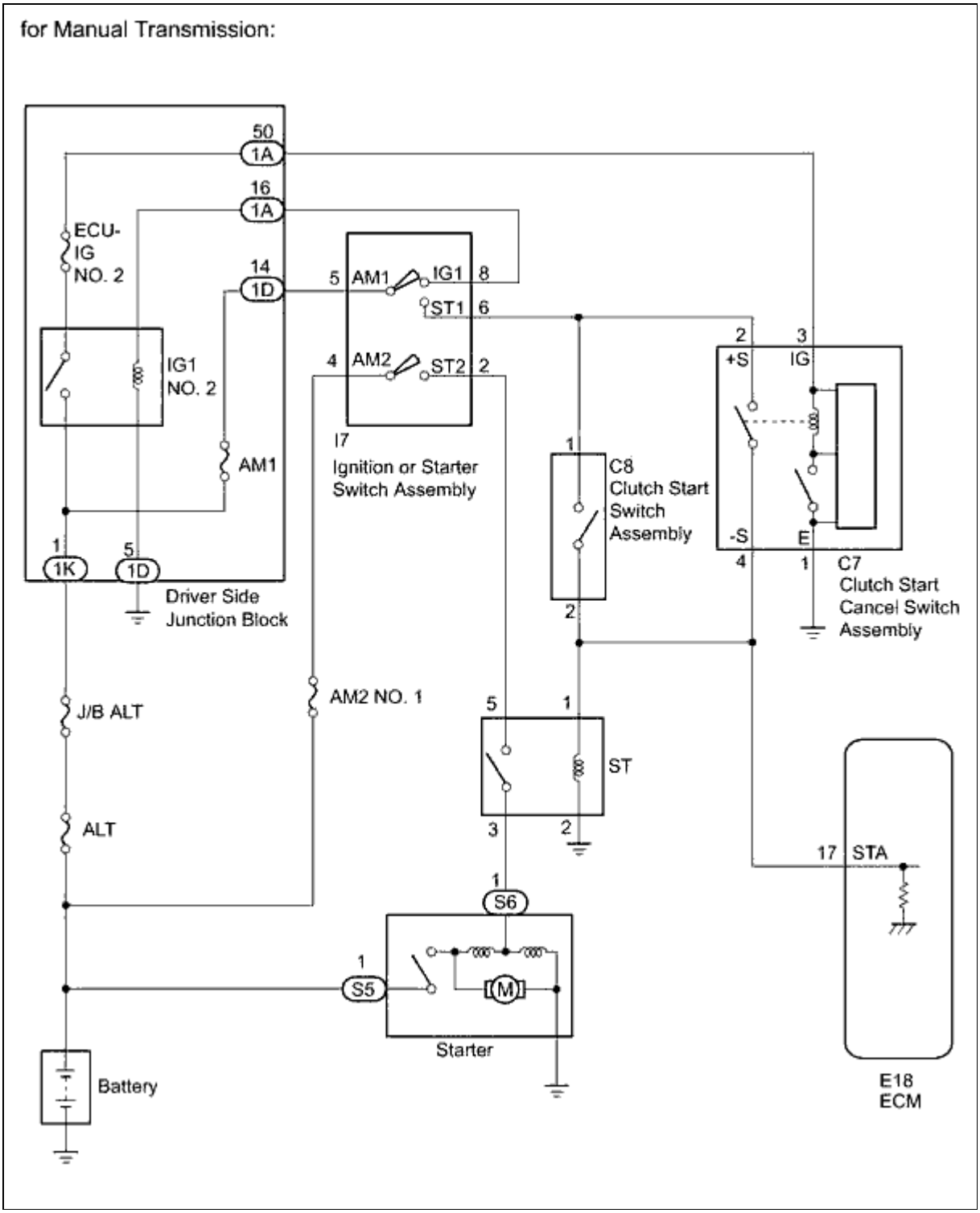
WIRING DIAGRAM

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for Automatic Transmission:



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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- The following troubleshooting flowchart is based on the premise that the engine is cranked normally.

  If the engine will not crank, proceed to the problem symptoms table INFO .
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when

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malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the vehicle is driven at 20 km/h (12.43 mph) or more.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

Result

CONDITION	STARTER SW	PROCEED TO
Driving at 20 km/h (12.43 mph) or more	OFF	A
	ON	B*1
		C*2

*1: for Automatic Transmission
*2: for Manual Transmission

B ▶ **GO TO STEP 2**

C ▶ **GO TO STEP 9**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Disconnect the P1 park/neutral position switch connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

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(f) Read the value displayed on the Techstream when the ignition switch is ON.

Result

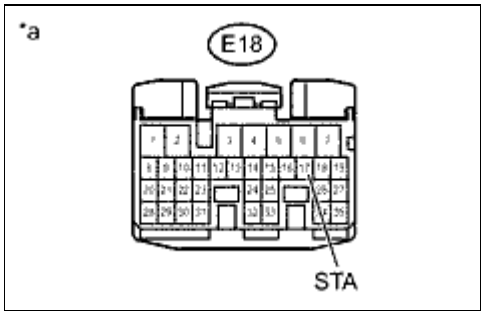
RESULT	PROCEED TO
ON	A
OFF	B

B ▶ **GO TO STEP 4**

A ▼

3.	**INSPECT ECM (STA TERMINAL VOLTAGE)**

(a) Disconnect the ECM connector.



(b) Disconnect the P1 park/neutral position switch connector.

(c) Turn the ignition switch to ON.

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

Result

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	PROCEED TO
E18-17 (STA) - Body ground	Ignition switch ON	11 to 14 V	A
		Below 1.5 V	B

Text in Illustration

*a	Front view of wire harness connector (to ECM)

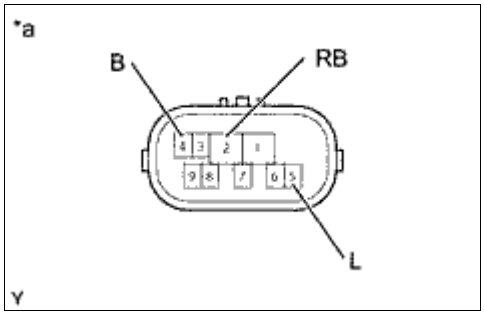
B ▶ **REPLACE ECM**

A ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (STARTER RELAY ASSEMBLY - PARK/NEUTRAL**

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4.	INSPECT PARK/NEUTRAL POSITION SWITCH (STARTER SIGNAL)

(a) Disconnect the P1 park/neutral position switch connector.



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

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
4 (B) - 5 (L)	Always	10 kΩ or higher
2 (RB) - 5 (L)	Always	10 kΩ or higher

Text in Illustration

*a	Component without harness connected (to Park/Neutral Position Switch)

Result

RESULT	PROCEED TO
Outside standard range (Tester Connection 4 (B) - 5 (L))	A
Outside standard range (Tester Connection 2 (RB) - 5 (L)) (for AC60E Automatic Transmission)	B
Outside standard range (Tester Connection 2 (RB) - 5 (L)) (for AC60F Automatic Transmission)	C
Within standard range	D

B*1 ▶ **REPLACE PARK/NEUTRAL POSITION SWITCH**

C*2 ▶ **REPLACE PARK/NEUTRAL POSITION SWITCH**

D ▶ **GO TO STEP 7**

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A

5.	**REPLACE PARK/NEUTRAL POSITION SWITCH**

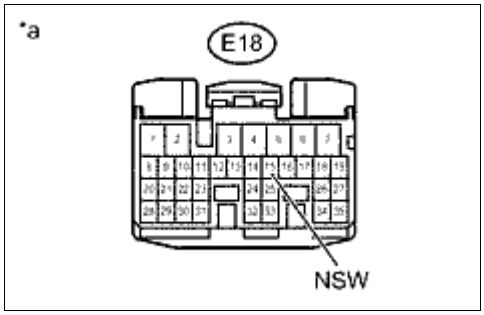
(a) Replace the park/neutral position switch.

- for 2WD: INFO
- for 4WD: INFO

NEXT

6.	**INSPECT ECM (NSW TERMINAL VOLTAGE)**

(a) Disconnect the ECM connector.



(b) Disconnect the P1 park/neutral position switch connector.

(c) Turn the ignition switch to ON.

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

Result

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E18-15 (NSW) - Body ground	Ignition switch ON	Below 1.5 V

Text in Illustration

*a	Front view of wire harness connector (to ECM)

NG ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK ▶ **REPLACE ECM**

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7.	**INSPECT IGNITION OR STARTER SWITCH ASSEMBLY**

(a) Inspect the ignition or starter switch assembly INFO .

NG ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK ▼

8.	**CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM - IGNITION OR STARTER SWITCH ASSEMBLY)**

(a) Disconnect the P1 park/neutral position switch connector.

(b) Disconnect the E18 ECM connector.

(c) Disconnect the I7 ignition or starter switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
P1-4 (B), E18-15 (NSW) or I7-6 (ST1) - Body ground and other terminals	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

9.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Disconnect the C8 clutch start switch assembly connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(f) Read the value displayed on the Techstream when the ignition switch is ON.

Result

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RESULT	PROCEED TO
ON	A
OFF	B

B ▶ GO TO STEP 12

A ▼

10.	READ VALUE USING TECHSTREAM (STARTER SIGNAL)

(a) Disconnect the C7 clutch start cancel switch assembly connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(f) Read the value displayed on the Techstream when the ignition switch is ON.

Result

RESULT	PROCEED TO
OFF	A
ON	B

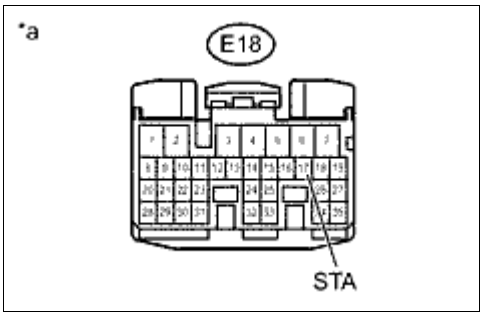
B ▶ REPLACE CLUTCH START SWITCH ASSEMBLY

A ▼

11.	INSPECT ECM (STA TERMINAL VOLTAGE)

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(a) Disconnect the ECM connector.



(b) Disconnect the C8 clutch start switch assembly connector.

(c) Disconnect the C7 clutch start cancel switch assembly connector.

(d) Turn the ignition switch to ON.

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

Result

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	PROCEED TO
E18-17 (STA) - Body ground	Ignition switch ON	11 to 14 V	A
		Below 1.5 V	B

Text in Illustration

*a	Front view of wire harness connector (to ECM)

B ▶ **REPLACE ECM**

A ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ST RELAY - CLUTCH START SWITCH ASSEMBLY - CLUTCH START CANCEL SWITCH ASSEMBLY - ECM)**

12.	**INSPECT CLUTCH START SWITCH ASSEMBLY**

(a) Inspect the clutch start switch assembly INFO .

B ▶ **GO TO STEP 14**

A ▼

13.	**REPLACE CLUTCH START SWITCH ASSEMBLY**

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(a) Replace the clutch start switch assembly INFO .

NEXT

14.	**INSPECT IGNITION OR STARTER SWITCH ASSEMBLY**

(a) Inspect the ignition or starter switch assembly INFO .

NG ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK

15.	**CHECK HARNESS AND CONNECTOR (CLUTCH START SWITCH - IGNITION OR STARTER SWITCH - CLUTCH START CANCEL SWITCH)**

(a) Disconnect the C8 clutch start switch assembly connector.

(b) Disconnect the I7 ignition or starter switch assembly connector.

(c) Disconnect the C7 clutch start cancel switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1, I7-6 (ST1) or C7-2 (+S) - Body ground and other terminals	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000003Q3G071X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P062F; Internal Control Module EEPROM Error; 2016 MY Tacoma [08/2015 -]		

DTC	**P062F**	**Internal Control Module EEPROM Error**

DESCRIPTION

The ECM monitors its internal operation and stores this DTC when it detects an internal malfunction.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P062F	There is an ECM internal error (EEPROM) (1 trip detection logic).	ECM

MONITOR DESCRIPTION

The ECM monitors its internal operation. If there is an internal operation malfunction, the ECM illuminates the MIL and stores a DTC.

MONITOR STRATEGY

Related DTCs	P062F: Internal Control Module EEPROM Error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Once per driving cycle
Duration	3 times
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Time after starter ON to OFF	More than 0.5 seconds
Battery voltage	8 V or higher
Ignition switch	ON

TYPICAL MALFUNCTION THRESHOLDS

Either condition is met	1 or 2
1. Permanent fault code data	Mismatch (3 times or more)
2. EEPROM communication	Timeout

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CONFIRMATION DRIVING PATTERN

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Start the engine and wait for 30 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P062F.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

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- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Start the engine and wait for 30 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read DTCs.

OK:

P062F is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000TA1020X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0630; VIN not Programmed or Mismatch - ECM / PCM; 2016 MY Tacoma [08/2015 -]		

DTC	**P0630**	**VIN not Programmed or Mismatch - ECM / PCM**

DESCRIPTION

DTC P0630 is stored when the Vehicle Identification Number (VIN) is not stored in the Engine Control Module (ECM) or the input VIN is not accurate. Input the VIN with the Techstream.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0630	Either condition is met (1 trip detection logic): • VIN not stored in ECM • Input VIN in ECM not accurate	ECM

MONITOR STRATEGY

Related DTCs	P0630: VIN not Programmed
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.325 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or higher
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

VIN code	Not programmed

COMPONENT OPERATING RANGE

VIN code	Programmed

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0630.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	**READ DTC OUTPUT (CURRENT DTC)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(d) Read DTCs.

If any DTCs other than P0630 are output, troubleshoot those DTCs first.

Result

RESULT	PROCEED TO
DTC P0630 output	A
DTC P0630 and other DTCs output	B

NOTICE:

If P0630 is stored, the VIN must be input to the ECM using the Techstream. However, all DTCs are cleared automatically by the Techstream when inputting the VIN. If DTCs other than P0630 are stored, check them first.

B ▶ **GO TO DTC CHART**

A

2.	**INPUT VIN WITH TECHSTREAM**

(a) Input the VIN INFO .

NEXT ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000002I3U0JFX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0657; Actuator Supply Voltage Circuit / Open; 2016 MY Tacoma [08/2015 -]		

DTC	**P0657**	**Actuator Supply Voltage Circuit / Open**

DESCRIPTION

The ECM monitors the output voltage to the throttle actuator. This self-check ensures that the ECM is functioning properly. The output voltage usually is 0 V when the ignition switch is turned off. If the output voltage is 7 V or higher when the ignition switch is turned off, the ECM will illuminate the MIL and stores the DTC when the ignition switch is turned ON.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0657	Throttle actuator power supply error (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P0657: ETCS Power Supply
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Throttle actuator
Frequency of operation	Once per driving cycle
Duration	-
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Throttle actuator power supply	7 V or higher

TYPICAL MALFUNCTION THRESHOLDS

Both of the following conditions are met	-
Last trip condition	Met
Electronic throttle actuator power supply	ON

CONFIRMATION DRIVING PATTERN

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative

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(-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Turn the ignition switch to ON.
10. Wait 10 seconds or more.
11. Turn the ignition switch off.
12. Wait 15 seconds or more.
13. Connect the Techstream to the DLC3.
14. Turn the ignition switch to ON and turn the Techstream on.
15. Wait 5 seconds or more.
16. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
17. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

18. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
19. Input the DTC: P0657.
20. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

21. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.

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- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the Techstream off.

(f) Turn the ignition switch off.

(g) Disconnect the Techstream.

(h) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(i) Connect the cable to the negative (-) battery terminal.

(j) Turn the ignition switch to ON.

(k) Wait 10 seconds or more.

(l) Turn the ignition switch off.

(m) Wait 15 seconds or more.

(n) Connect the Techstream to the DLC3.

(o) Turn the ignition switch to ON and turn the Techstream on.

(p) Wait 5 seconds or more.

(q) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(r) Read DTCs.

OK:

P0657 is not present.

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NG ▶ REPLACE ECM

OK ▶ CHECK FOR INTERMITTENT PROBLEMS

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000W880Z7X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P0724; Brake Switch "B" Circuit High; 2016 MY Tacoma [08/2015 -]		

DTC	**P0724**	**Brake Switch "B" Circuit High**

DESCRIPTION

The stop light switch is part of a duplex system that transmits 2 signals: STP and ST1-. These 2 signals are used by the ECM to monitor whether or not the brake system is working properly. This DTC indicates that the stop light switch remains on. When the stop light switch remains on during GO and STOP driving, the ECM interprets this as a fault in the stop light switch. Then the MIL illuminates and the ECM stores the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0724	The stop light switch remains ON even when the vehicle is driven in a GO (30 km/h (18.65 mph) or more) and STOP (less than 3 km/h (1.86 mph)) pattern 5 times (2 trip detection logic)	• Short in stop light switch signal circuit • Stop light switch assembly • ECM

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains ON. When the stop light switch remains ON during GO and STOP driving, the ECM interprets this as a fault in the stop light switch. Then the MIL illuminates and the ECM stores the DTC. The vehicle must GO (30 km/h (18.65 mph) or more) and STOP (less than 3 km/h (1.86 mph)) 5 times for 2 driving cycles in order for the DTC to be output.

MONITOR STRATEGY

Related DTCs	P0724: Stop light Switch/Range Check/Rationality
Required sensors/Components	Stop light switch assembly Vehicle speed sensor
Frequency of operation	Continuous
Duration	GO and STOP 5 times
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Battery voltage	8 V or higher
Starter	OFF

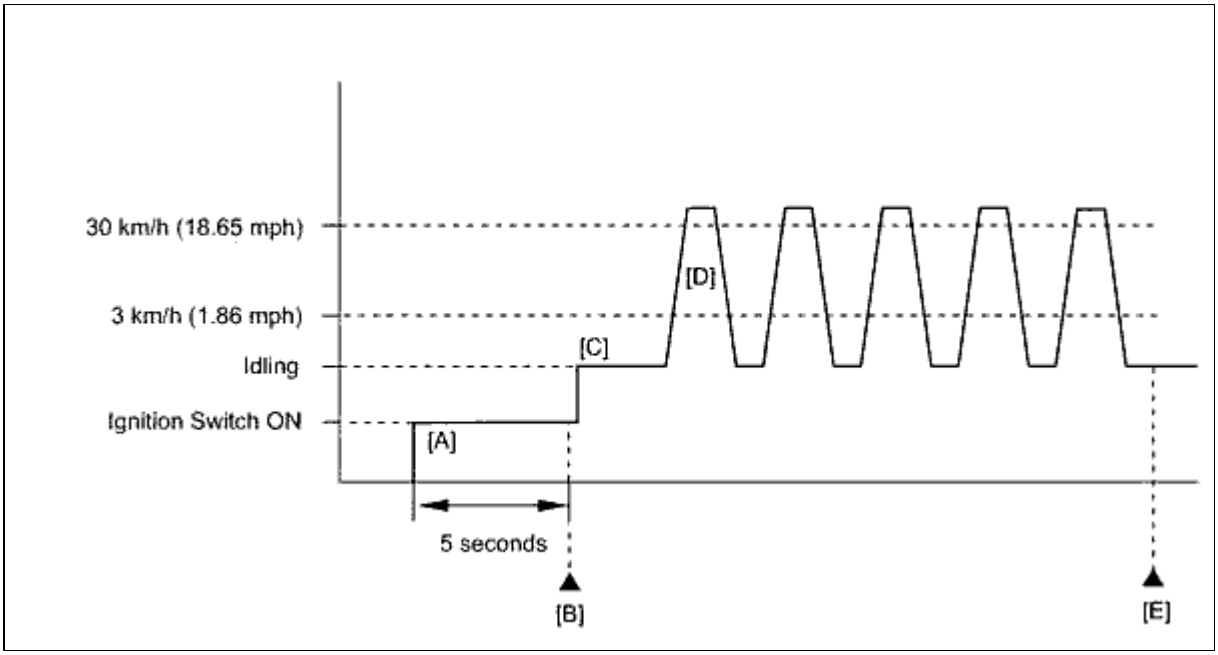
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Ignition switch	ON
GO: Vehicle speed	30 km/h (18.65 mph) or more
STOP: Vehicle speed	Less than 3 km/h (1.86 mph)

TYPICAL MALFUNCTION THRESHOLDS

Stop light switch status	ON

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 5 seconds after clearing DTCs.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
8. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P0724.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [C] through [E].

12. Start the engine [C].
13. Accelerate the vehicle to 30 km/h (18.65 mph) or more, depress the brake pedal and decelerate the vehicle to 3 km/h (1.86 mph) or less [D]. Repeat step [D] 5 times.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

14. Check the DTC judgment result [E].
15. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0504 INFO .

INSPECTION PROCEDURE

NOTICE:

- In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Using the Techstream to read the Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List in troubleshooting is one of the way to save time.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1. Warm up the engine.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.

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4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Data List.
7. Follow the instructions on the Techstream and read the Data List.

ITEM	MEASUREMENT ITEM/RANGE (DISPLAY)	NORMAL CONDITION	DIAGNOSTIC NOTE
Stop Light Switch	Stop light switch status/ ON or OFF	○ Brake pedal is depressed ON ○ Brake pedal is released OFF	-

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (STOP LIGHT SWITCH)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine and ECT / Data List / Stop Light Switch.

(d) Read the values displayed on the Techstream.

OK:

TECHSTREAM DISPLAY	MEASUREMENT ITEM: RANGE (DISPLAY)	NORMAL CONDITION
Stop Light Switch	Stop light switch status: ON or OFF	• ON: Brake pedal is depressed • OFF: Brake pedal is released

NG ▶ **GO TO STEP 2**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	**CHECK STOP LIGHT SWITCH ASSEMBLY INSTALLATION**

(a) Check the stop light switch assembly installation INFO .

OK:

Stop light switch assembly is installed correctly.

NG ▶ **SECURELY REINSTALL STOP LIGHT SWITCH ASSEMBLY**

OK

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3.	**INSPECT STOP LIGHT SWITCH ASSEMBLY**

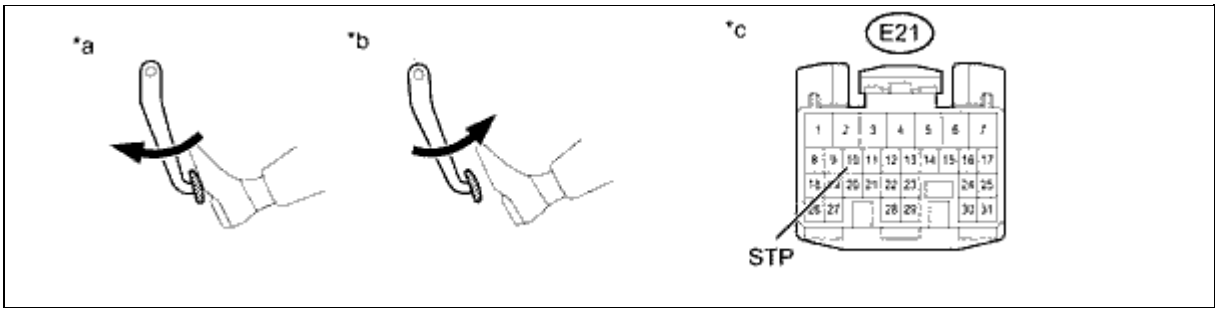
(a) Inspect the stop light switch assembly INFO .

NG ▶ **REPLACE STOP LIGHT SWITCH ASSEMBLY**

OK

4.	**CHECK TERMINAL VOLTAGE (STP VOLTAGE)**

(a) Disconnect the ECM connector.



Text in Illustration

*a	Brake pedal depressed	*b	Brake pedal released
*c	Front view of wire harness connector (to ECM)	-	-

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-10 (STP) - Body ground	Brake pedal released	Below 1.5 V
	Brake pedal depressed	7.5 to 14 V

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000045EM00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P106B; Evaporative Emission System Pressure Sensor - Secondary Air Injection Pressure Sensor Correlation; 2016 MY Tacoma [08/2015 -]		

DTC	**P106B**	**Evaporative Emission System Pressure Sensor - Secondary Air Injection Pressure Sensor Correlation**

DESCRIPTION

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P106B	The pressure detected by the canister pressure sensor (Vapor Pressure Pump*) and the pressure detected by the air pressure sensor of air switching valve (Bank 1) (Air Pump Pressure (Absolute)*) differ by higher than 6.98 kPa (52 mmHg) (2 trip detection logic)	• Canister pressure sensor (canister pump module) • Air pressure sensor

HINT:

*: Name of Data List item

MONITOR DESCRIPTION

This DTC is stored when a deviation from air pressure sensor characteristics is detected.

The air pressure sensors* are checked 55 minutes after the ignition switch is turned off. If the pressures detected by the air pressure sensors* differ by a certain amount, the MIL is illuminated and a DTC is stored (2 trip detection logic).

HINT:

- *: DTC P106B checks the canister pressure sensor and the air pressure sensor of the air switching valve.
- Correct judgment may not be possible when the altitude is 4000 m (13120 ft.) or more.

MONITOR STRATEGY

Related DTCs	P106B: Evaporative Emission System Pressure Sensor - Secondary Air Injection System Pressure Sensor Correlation
Required sensors/Components	Canister pressure sensor (canister pump module) Air pressure sensor
Frequency of operation	Once per driving cycle
Duration	Less than 65 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not	P0452, P0453 (Evaporative Emission System Pressure Sensor)

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stored	P2431, P2432, P2433 (Secondary Air Injection System Pressure Sensor) P2440, P2441, P2444, P2445 (Secondary Air Injection System)
Time elapsed after engine stop	50 minutes
Time after ECM started by soak-timer	60 seconds or more
Battery voltage	10.5 V or higher
Intake air temperature	-10°C (14°F) or higher
Engine coolant temperature	-10°C (14°F) or higher

TYPICAL MALFUNCTION THRESHOLDS

Difference between EVAP pressure and secondary air injection absolute pressure	Higher than 6.98 kPa (52 mmHg)

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) [A].
5. Start the engine.
6. Idle the engine for 10 seconds [B].
7. Turn the ignition switch off.
8. Soak the vehicle for 55 minutes [C].
9. Turn the ignition switch to ON.
10. Turn the Techstream on.
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
12. Read pending DTCs [D].

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P106B.
15. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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TECHSTREAM DISPLAY	DESCRIPTION
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- ○ If the judgment result shows NORMAL, the system is normal.
- ○ If the judgment result shows ABNORMAL, the system has a malfunction.
- ○ If the judgment result shows INCOMPLETE or N/A, perform steps [A] through [D] again.

16. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- ○ If a permanent DTC is output, the system is malfunctioning.
- ○ If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- Refer to "Data List / Active Test" [Air Pump Pressure (Absolute), Vapor Pressure Pump] INFO .
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P106B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P106B is output	A
DTC P106B and other DTCs are output	B

HINT:

If any other DTCs other than P106B are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

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A

2.	**READ VALUE USING TECHSTREAM (AIR PUMP PRESSURE (ABSOLUTE) AND VAPOR PRESSURE PUMP)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Vapor Pressure Pump and Air Pump Pressure (Absolute).

(e) Compare the Vapor Pressure Pump and Air Pump Pressure (Absolute) data from the Data List with day's atmospheric pressure*.

*: Standard atmospheric pressure is 101 kPa (760 mmHg) at sea level. The atmospheric pressure decreases by approximately 1 kPa (7.5 mmHg) for every 100 m of elevation increase. Atmospheric pressure is also affected by weather conditions. The Atmosphere pressure listed in the Data List cannot be used as a reference for this check.

HINT:

If you do not know the atmospheric pressure refer to the Vapor Pressure Pump value of other vehicles in the workshop and check the difference in pressure.

Result

RESULT	PROCEED TO
If the Air Pump Pressure (Absolute) value differs from the atmospheric pressure by +/-3.5 kPa (26.25 mmHg) or more	A
If the Vapor Pressure Pump value differs from the atmospheric pressure by +/-3.5 kPa (26.25 mmHg) or more	B

B **GO TO STEP 4**

A

3.	**REPLACE AIR SWITCHING VALVE ASSEMBLY**

(a) Replace the air switching valve assembly INFO .

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NEXT GO TO STEP 5

4.	REPLACE CANISTER PUMP MODULE

(a) Replace the canister pump module INFO .

NEXT

5.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Perform the confirmation drive pattern.

HINT:

Refer to the Confirmation Driving Pattern.

NEXT END

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000046N101XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P144C,P144D; Open in Secondary Air Injection System Heater Control Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P144C**	**Open in Secondary Air Injection System Heater Control Circuit**

DTC	**P144D**	**Short in Secondary Air Injection System Heater Control Circuit**

DESCRIPTION

The ECM operates the air pump heater relay which causes the air pump heater to operate.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P144C	Open or short in the air pump heater relay circuit for 5 seconds (1 trip detection logic)	• Open or short in air pump heater relay circuit • c • ECM
P144D	Open or short in the air pump heater relay circuit for 5 seconds (1 trip detection logic)	• Open or short in air pump heater relay circuit • air pump heater (AIR PMP HTR) relay • ECM

MONITOR DESCRIPTION

These DTCs are designed to detect a malfunction in the air pump heater relay circuit. When the system is normal, the battery voltage is applied to terminal HAI1 of the ECM while the c is turned off, and the battery voltage is not applied to terminal HAI1 of the ECM while the air pump heater relay is turned on. The ECM illuminates the MIL and stores a DTC when either one of the following conditions is detected.

- The battery voltage is not applied to terminal HAI1 while the air pump heater relay is off.
- The battery voltage is applied to terminal HAI1 while the air pump heater relay is on.

MONITOR STRATEGY

Related DTCs	P144C: Air pump heater relay circuit range check (Low voltage) P144D: Air pump heater relay circuit range check (High voltage)
Required Sensors/Components (Main)	air pump heater (AIR PMP HTR) relay
Required Sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	5 seconds
MIL operation	Immediate

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Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

Case1

All of following conditions met	-
Current command to air pump heater relay	ON
Last command to air pump heater relay	ON
Battery	8 V or higher
Ignition switch	ON
Starter	OFF

Case2

All of following conditions met	-
Current command to air pump heater relay	OFF
Last command to air pump heater relay	OFF
Battery	8 V or higher
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

P144C:Range check (Low voltage)

Air pump heater relay output terminal voltage level	Low

P144D:Range check (High voltage)

Air pump heater relay output terminal voltage level	High

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait for 10 seconds.
7. Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the Air Pump Heater.
8. Activate the air pump heater for 10 seconds or more.

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HINT:

- The active test activates the air pump heater for up to 60 seconds.
- To protect the air pump heater, do not perform this test more than 4 times in a row.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Code.
10. Read Pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P144C or P144D.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If no permanent DTC is output, the system is normal.
- If a permanent DTC is output, the system is malfunctioning.

WIRING DIAGRAM

Refer to DTC P0412 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses of circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was

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moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

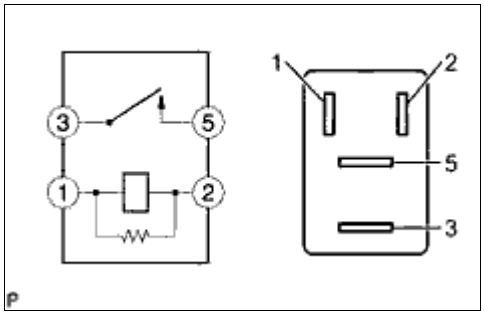
PROCEDURE

1.	**INSPECT AIR PMP HTR RELAY**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied	10 kΩ or higher
	Battery voltage applied to terminals 1 and 2	Below 1 Ω

NG ▶ **REPLACE AIR PMP HTR RELAY**

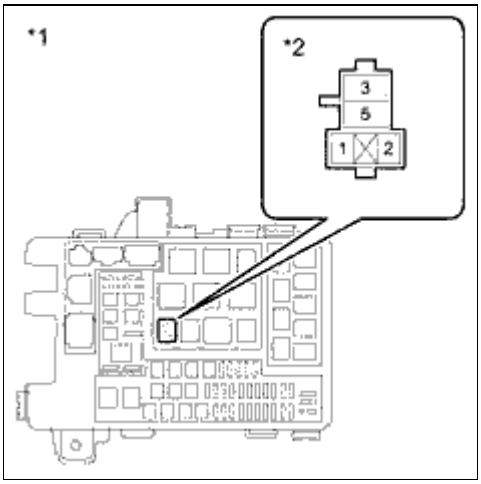
OK ▼

2.	**CHECK AIR PMP HTR RELAY (POWER SOURCE)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Standard Voltage:



TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
2 (AIR PMP HTR relay holder) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*1	Engine Room Relay Block

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*2	AIR PMP HTR Relay Holder

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

3.	**CHECK HARNESS AND CONNECTOR (ECM - AIR PMP HTR RELAY)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

(b) Disconnect the E20 ECM connector.

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

Standard resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (AIR PMP HTR relay holder) - E20-4 (HAI1)	Always	Below 1 Ω
1 (AIR PMP HTR relay holder) or E20-4 (HAI1) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000005RNK00FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P1603; Engine Stall History; 2016 MY Tacoma [08/2015 -]		

DTC	**P1603**	**Engine Stall History**

DESCRIPTION

HINT:

DTC P1603 is stored only for automatic transmission.

After starting the engine, this DTC is stored when the engine stops without the ignition switch being operated.

Using the Techstream, the conditions present when the DTC was stored can be confirmed by referring to the freeze frame data. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.

It is necessary to check if the vehicle has run out of fuel before performing troubleshooting, as this DTC is also stored when the engine stalls due to running out of fuel.

DTC NO.	DTC DETECTION CONDITION
P1603	After monitoring for startability problems (P1604) finishes and 2 seconds or more have elapsed after starting the engine, with the engine running, the engine stops (the engine speed drops to 200 rpm or less) without the ignition switch being operated for 0.5 seconds or more (1 trip detection logic).

Trouble Area

Ignition system	• Spark plug • Ignition coil assembly
Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly

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Other control systems	• ECM • Wire harness or connector • Knock sensor • Engine coolant temperature sensor
Engine	• Thermostat • Engine assembly • Engine mount
High load from another system	• Air conditioning system • Power steering system • Electrical load signal system • Automatic transmission system

INSPECTION PROCEDURE

HINT:

- DTC P1603
  - In contrast to normal malfunction diagnosis for components, circuits and systems, DTCs P1603 is used to determine the malfunctioning area from the problem symptoms and freeze frame data when the user mentions problems such as engine stall.

    As this DTC can be stored as a result of certain user actions, even if the DTC is output, if the customer makes no mention of problems, clear the DTC without performing any troubleshooting and return the vehicle to the customer.
  - As DTCs may be stored when an Active Test or learning is performed, make sure to clear the DTCs before returning the vehicle to the customer.
  - DTCs related to engine stall problems may be detected due to operations performed by the user. The following are a few examples. Ask questions to the user about how the vehicle is operated and give advice as necessary.
    - Ran out of fuel
    - Rolled down on a slope and engine stalls (backed up in D, moved forward in R)
  - If any other DTCs are output, perform troubleshooting for those DTCs first.
- CUSTOMER PROBLEM ANALYSIS

  Use any information from the customer problem analysis about the condition of the vehicle at the time when the problem occurred (how the engine stopped, conditions when the engine was restarted, etc.) as a reference.

SYMPTOM	SUSPECTED AREA
Engine vibration occurs and engine stops	○ Abnormal mass air flow meter sub-assembly output due to existence of foreign matter ○ Abnormal air fuel ratio due to malfunction of heated oxygen sensor, air leaks in intake system or insufficient fuel supply
Engine stops with no engine vibration	Ignition system, injection stoppage, high load from external parts

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SYMPTOM	SUSPECTED AREA
Engine can be started with accelerator pedal depressed	Insufficient air volume
Engine stalls or is difficult to start immediately after engine stalled, regardless of whether engine is cold or warm	Deposits in intake system or combustion chamber caught temporarily on intake or exhaust valve

- FREEZE FRAME DATA
  - Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
  - When confirming the freeze frame data, be sure to check all multi freeze frame data INFO .
  - When confirming the freeze frame data, if there are multiple items related to the cause of the malfunction, perform troubleshooting for all related items.
  - Try to operate the vehicle under the conditions recorded in the freeze frame data which were present when the malfunction occurred. Confirm the data at this time and the data when the engine is idling (engine warmed up, no load, and shift lever in D or N) and compare this data with the freeze frame data.
- PRECAUTIONS
  - Inspections take into account the fact that the malfunction may not have recurred and place emphasis on checking the vehicle conditions present at the time when the malfunction occurred.
  - When performing inspections, jiggle the relevant wire harnesses and connectors in an attempt to reproduce malfunctions that do not always occur.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

RESULT	PROCEED TO
Only DTC P1603 is output	A
DTCs other than P1603 are output	B

HINT:

- When DTC P1603 and P1605 are output simultaneously, perform the troubleshooting for P1605 first.
- Using freeze frame data, confirm the conditions the moment the DTC was stored and after the DTC was stored. This information can be useful when troubleshooting.

B ▶ **GO TO DTC CHART**

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A

2.	READ FREEZE FRAME DATA (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM FOR DTC P1603	RESULT	SUSPECTED AREA	ACTION	PROCEED TO
ISC Learning Value	Less than 6.2 L/s	-	Go to the next step	A
	6.2 L/s or more	Throttle valve assembly	Go to Engine Stalls (from step 11)	B

B GO TO ENGINE STALLS

A

3.	READ FREEZE FRAME DATA (AFS VOLTAGE B1S1, SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM FOR DTC P1603			SUSPECTED AREA	ACTION	PROCEED TO
AFS VOLTAGE B1S1	SHORT FT #1	LONG FT #1			
3.8 V or higher	15% or more	-	Fuel suction tube with pump	Go to Engine	NEXT

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FREEZE FRAME DATA ITEM FOR DTC P1603			SUSPECTED AREA	ACTION	PROCEED TO
AFS VOLTAGE B1S1	SHORT FT #1	LONG FT #1			
			and gauge assembly	Stalls (from step 20)	
Less than 2.8 V, or 3.8 V or higher	Less than -15%, or 15% or more	Less than -15%, or 15% or more	• Mass air flow meter • Air fuel ratio sensor • Fuel suction tube with pump and gauge assembly	Go to Engine Stalls (from step 15)*	
2.8 V to 3.8 V	-15% to 15%	-15% to 15%	-	Go to Engine Stalls	

HINT:

*: If the value of AFS Voltage B1S1, Short FT #1 or Long FT #1 is as specified, malfunction of a component listed in the "Suspected Area" column of the table is suspected.

NEXT ▶ **GO TO ENGINE STALLS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000005RMB00LX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P1604; Startability Malfunction; 2016 MY Tacoma [08/2015 -]		

DTC	**P1604**	**Startability Malfunction**

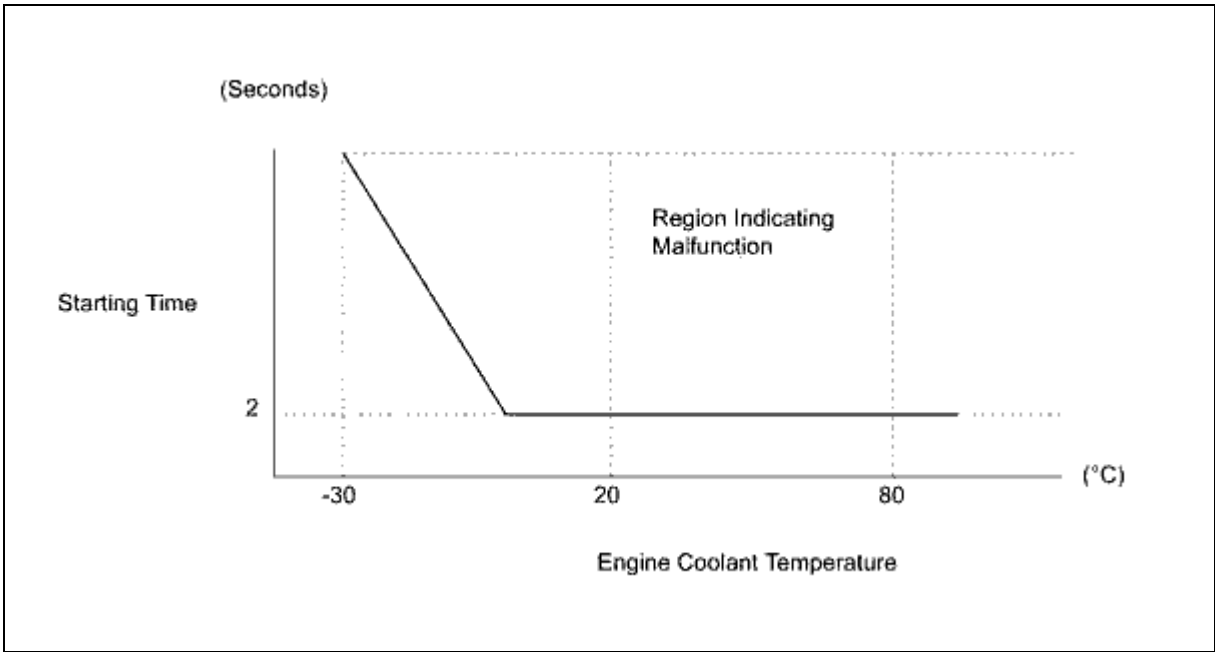
DESCRIPTION

This DTC is stored when the engine does not start even though the STA signal is input or when the engine takes a long time to start, and when the engine speed is low or the engine stalls just after the engine starts.

Using the Techstream, the conditions present when the DTC was stored can be confirmed by referring to the freeze frame data. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.

It is necessary to check if the vehicle ran out of fuel before performing troubleshooting, as this DTC is also stored when there is engine starting trouble due to running out of fuel.

DTC NO.	DTC DETECTION CONDITION
P1604	Either condition is met (1 trip detection logic): • The engine speed is below 500 rpm with the STA signal on for a certain amount of time (refer to the illustration below). • After the engine starts (engine speed is 500 rpm or more), the engine speed drops to 200 rpm or less within approximately 2 seconds.



Trouble Area

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Ignition system	• Spark plug • Ignition coil assembly
Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel pressure regulator assembly • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly
Other control systems	• ECM • Wire harness or connector • Knock sensor • Engine coolant temperature sensor
Engine	• Thermostat • Engine assembly • Engine mount
High load from another system	• Air conditioning system • Power steering system • Electrical load signal system • Automatic transmission system*1

*1: for Automatic transmission

INSPECTION PROCEDURE

HINT:

- DTC P1604
  - In contrast to normal malfunction diagnosis for components, circuits and systems, DTC P1604 is used to determine the malfunctioning area from the problem symptoms and freeze frame data when the user mentions problems such as starting difficulty.

    As this DTC can be stored as a result of certain user actions, even if the DTC is output, if the customer makes no mention of problems, clear the DTC without performing any troubleshooting and return the vehicle to the customer.
  - As DTCs may be stored when an Active Test or learning is performed, make sure to clear the

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DTCs before returning the vehicle to the customer.

- If any other DTCs are output, perform troubleshooting for those DTCs first.

- DATA LIST / FREEZE FRAME DATA
  - When this Data List item "Immobiliser Communication" is OFF or "Immobiliser Fuel Cut" is ON, the engine cannot be started.
  - Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
  - When confirming the freeze frame data, be sure to check all 5 sets of freeze frame data INFO .
  - When confirming the freeze frame data, if there are multiple items related to the cause of the malfunction, perform troubleshooting for all related items.
  - Try to start the vehicle under the conditions recorded in the freeze frame data which were present when the malfunction occurred. Confirm the data at this time and compare it with the freeze frame data.
  - If the malfunction does not recur, carefully check the vehicle conditions from when the malfunction occurred using freeze frame data.
- PRECAUTIONS
  - When performing inspections, jiggle the relevant wire harnesses and connectors in an attempt to reproduce malfunctions that do not always occur.
  - If the same inspection or replacement procedure appears 2 times when performing an inspection procedure, it is not necessary to repeat the procedure the second time.

PROCEDURE

1.	**CHECK FOR ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P1604 is output	A
DTC P1604 and other DTCs are output	B

HINT:

- If any DTCs other than P1604 are output, troubleshoot those DTCs first.
- Using freeze frame data, confirm the conditions the moment the DTC was stored and after the DTC was stored. This information can be useful when troubleshooting.

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B GO TO DTC CHART

A

2.	**READ FREEZE FRAME DATA (IMMOBILISER COMMUNICATION AND IMMOBILISER FUEL CUT)**

HINT:

If the vehicle is not equipped with an engine immobiliser system, proceed to next step.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

OK:

DATA LIST ITEM	TECHSTREAM DISPLAY
Immobiliser Communication	ON
Immobiliser Fuel Cut	OFF

HINT:

If the engine is started immediately after reconnecting the battery terminal, the engine may stall immediately after it starts due to the intercommunication process between each ECU. For this reason, when starting the engine after reconnecting the battery terminal, first turn the ignition switch to ON and then wait several seconds for the communication process to complete before starting the engine.

NG CHECK ENGINE IMMOBILISER SYSTEM

OK

3.	**READ FREEZE FRAME DATA (ISC LEARNING VALUE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	ACTION	PROCEED TO
ISC Learning Value	Less than 6.2 L/s	-	Go to the next step	A
	6.2 L/s or more	Throttle valve assembly	Go to Engine Difficult to Start (from step 15)	B

B ▶ **GO TO ENGINE DIFFICULT TO START**

A ▼

4.	**READ FREEZE FRAME DATA (ENGINE SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	ACTION	PROCEED TO
Engine Speed	All 5 sets of freeze frame data are 0 rpm (engine did not crank or engine speed was not detected properly)	• Starter signal circuit • Crankshaft position sensor system • Battery fully depleted	Go to Engine Difficult to Start (from step 5)	A
	100 to 500 rpm (engine cranked but initial combustion did not occur or was delayed)	• Fuel suction tube with pump and gauge assembly • Leaking fuel injector assembly • Spark plug • Ignition coil assembly	Go to the next step	B

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FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	ACTION	PROCEED TO
	500 rpm or higher (engine speed dropped immediately after initial combustion) (Low Rev for Eng Start is ON)	• Spark plug • Ignition coil assembly		

B ▶ GO TO STEP 5

A ▶ GO TO ENGINE DIFFICULT TO START

5.	INTERVIEW THE CUSTOMER

(a) Interview the customer for details about the conditions when the malfunction occurred.

HINT:

If the engine is difficult to start only when the vehicle has been left as is for a long time, a leaking fuel injector assembly is suspected.

Result

RESULT	SUSPECTED AREA	ACTION	PROCEED TO
Engine is difficult to start only when the vehicle has been left as is for a long time (1 hour or more)	Leaking fuel injector assembly	Go to Engine Difficult to Start (from step 4)	A
Other than above	• Fuel suction tube with pump and gauge assembly • Spark plug • Ignition coil assembly	Go to the next step	B

B ▶ GO TO STEP 6

A ▶ GO TO ENGINE DIFFICULT TO START

6.	INTERVIEW THE CUSTOMER

(a) Interview the customer for details about the conditions when the malfunction occurred.

HINT:

If the vehicle is mostly driven for short distances, deposits may have accumulated on the spark plugs, causing starting difficulty.

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Result

RESULT	SUSPECTED AREA	ACTION	PROCEED TO
Mostly driven short distances	• Spark plug • Ignition coil assembly	Go to Engine Difficult to Start (from step 13)	NEXT
Not mostly driven short distances	• Fuel suction tube with pump and gauge assembly • Spark plug • Ignition coil assembly	Go to Engine Difficult to Start (from step 9)	

NEXT **GO TO ENGINE DIFFICULT TO START**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000005RMC00KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P1605; Rough Idling; 2016 MY Tacoma [08/2015 -]		

DTC	**P1605**	**Rough Idling**

DESCRIPTION

This DTC is stored if the combustion state of any cylinder is unstable.

Using the Techstream, the conditions present when the DTC was stored can be confirmed by referring to the freeze frame data. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.

It is necessary to check if the vehicle ran out of fuel before performing troubleshooting, as this DTC is also stored when idling is unstable due to running out of fuel.

DTC NO.	DTC DETECTION CONDITION
P1605	When idling with the accelerator pedal released and the vehicle stopped, this item detects when the combustion is unstable from the sudden changes in engine speed between the cylinders. Detection for 2 to 10 seconds according to the combustion state. (1 trip detection logic)

Trouble Area

Ignition system	• Spark plug • Ignition coil assembly
Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly
Other control systems	• ECM • Wire harness or connector

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	• Knock sensor • Engine coolant temperature sensor
Engine	• Thermostat • Engine assembly • Engine mount
High load from another system	• Air conditioning system • Power steering system • Electrical load signal system • Automatic transmission system*1

*1: Automatic transmission

INSPECTION PROCEDURE

HINT:

- DTC P1605
  - In contrast to conventional DTCs for components, circuits and systems, DTC P1605 is used to estimate the malfunctioning area from problem symptoms and freeze frame data in response to symptoms such as "rough idling", "strong engine vibrations", etc. Such problem symptoms can occur even in the following conditions:
    - Driving with long-stored fuel (fuel that has remained in the tank for long periods of time)
    - Using fuel not acclimated to the climate during a change of seasons
    - Temporarily using low-quality fuel (fuel that contains water or has poor fuel properties)
  - As DTCs may be stored when an Active Test or learning is performed, make sure to clear the DTCs before returning the vehicle to the customer.
  - If any other DTCs are output, perform troubleshooting for those DTCs first.
- FREEZE FRAME DATA
  - Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
  - When confirming the freeze frame data, be sure to check all 5 sets of freeze frame data INFO .
  - When confirming freeze frame data, if there are multiple items related to the cause of the malfunction, perform troubleshooting for all related items.
  - Try to operate the vehicle under the conditions recorded in the freeze frame data which were present when the malfunction occurred. Confirm the data at this time and the data when the engine is idling (engine warmed up, no load, and shift lever in D or N) and compare this data with the freeze frame data.
- PRECAUTIONS
  - Inspections take into account the fact that the malfunction may not have recurred and place emphasis on checking the vehicle conditions present at the time when the malfunction occurred.
  - When performing inspections, jiggle the relevant wire harnesses and connectors in an attempt

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to reproduce malfunctions that do not always occur.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

RESULT	PROCEED TO
Only DTC P1605 is output	A*1
	B*2
DTCs other than P1605 are output	C

*1: for Automatic Transmission

*2: for Manual Transmission

HINT:

- If any DTCs other than P1605 are output, troubleshoot those DTCs first.
- Using freeze frame data, confirm the conditions the moment the DTC was stored and after the DTC was stored. This information can be useful when troubleshooting.

B ▶ **GO TO DTC P1603**

C ▶ **GO TO DTC CHART**

A ▼

2.	**READ FREEZE FRAME DATA (ROUGH IDLE, PLURAL CYLINDERS ROUGH IDLE, ROUGH IDLE STATUS, COMPRESSION LEAKAGE COUNT)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were

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present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM FOR DTC P1605			SUSPECTED AREA	ACTION	PROCEED TO
• ROUGH IDLE #1 TO #4 • PLURAL CYLINDERS ROUGH IDLE	ROUGH IDLE STATUS	COMPRESSION LEAKAGE COUNT			
"One of Rough Idle #1 to #4 is ON" and "Plural Cylinders Rough Idle is OFF"	"Misfire"	0	• Spark plug • Ignition coil assembly • Fuel injector assembly	Go to Rough Idling (from step 8)	A
	One of the following is displayed: • Continuous poor combustion • Intermittent poor combustion • Low frequency poor combustion	0	• Fuel injector assembly • Spark plug • Ignition coil assembly		
Plural Cylinders Rough Idle is ON	One of the following is displayed: • Misfire • Continuous poor combustion • Intermittent poor combustion • Low frequency poor combustion	0	• Mass air flow meter • Fuel injector assembly • Fuel system • Air fuel ratio sensor	Go to Rough Idling (from step 15)	B

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FREEZE FRAME DATA ITEM FOR DTC P1605			SUSPECTED AREA	ACTION	PROCEED TO
• ROUGH IDLE #1 TO #4 • PLURAL CYLINDERS ROUGH IDLE	ROUGH IDLE STATUS	COMPRESSION LEAKAGE COUNT			
"One of Rough Idle #1 to #4 is ON" or "Plural Cylinders Rough Idle is ON"	One of the following is displayed: • Misfire • Continuous poor combustion • Intermittent poor combustion • Low frequency poor combustion	1 or more	Pressure loss from valve damage, deposits jamming the valve etc.	Check compression and clean deposits in combustion chamber and intake system.	C

B ▶ **GO TO STEP 4**

C ▶ **GO TO STEP 5**

A ▼

3.	**DETERMINE CAUSE OF MALFUNCTION FOR INDIVIDUAL CYLINDER**

(a) Perform troubleshooting from Rough Idling step 8 (PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)) and onward.

NEXT ▶ **GO TO ROUGH IDLING**

4.	**DETERMINE CAUSE OF MALFUNCTION FOR MULTIPLE OR ALL CYLINDERS**

(a) Perform troubleshooting from Rough Idling step 15 (READ VALUE USING TECHSTREAM (MAF)) and onward.

NEXT ▶ **GO TO ROUGH IDLING**

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5.	PERFORM ACTIVE TEST USING TECHSTREAM (CHECK THE CYLINDER COMPRESSION)

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

(g) While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

(h) Crank the engine for about 10 seconds.

(i) Monitor the engine speed (Engine Speed of Cyl and Av Engine Speed of All Cyl) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

(j) Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

- If the Active Test is changed to OFF while the engine is being cranked, the engine will start.
- When performing the Active Test, DTC P1604 (Startability Malfunction) may be stored.
- After performing the Active Test, make sure to check and clear DTCs.

(k) Read the value.

HINT:

- If the value of Data List item "Engine Speed of Cyl" of a cylinder is higher than other cylinders, the cylinder may be malfunctioning.
- If the value of Data List item "Engine Speed of Cyl" is high for only one cylinder, compression loss is suspected.

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Result

RESULT	PROCEED TO
There is no variation in "Engine Speed of Cyl" (All cylinders display approximately the same value for "Engine Speed of Cyl")	A
There is variation in "Engine Speed of Cyl" (Only one cylinder displays a value for "Engine Speed of Cyl" that differs considerably)	B

B ▶ **GO TO STEP 6**

A ▶ **CLEAN OFF ANY DEPOSITS**

6.	**CHECK CYLINDER COMPRESSION PRESSURE**

(a) Measure the cylinder compression pressure. If the compression pressure of a cylinder is low, inspect the engine assembly and repair or replace parts as necessary INFO .

NEXT ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000032440D1X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P1607; Cruise Control Input Processor; 2016 MY Tacoma [08/2015 -]		

DTC	**P1607**	**Cruise Control Input Processor**

DESCRIPTION

The ECM continuously monitors its main and sub CPUs. This self-check ensures that the ECM is functioning properly. If outputs from the CPUs are different and deviate from the standard, the ECM will illuminate the MIL and store this DTC immediately.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1607	ECM CPUs malfunction (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTC	P1607: Internal Control Module Range Check
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Cruise control
Frequency of Operation	Continuous
Duration	0.3 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Cruise control	Forbiddance
DMA communication error	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Cruise control	Prohibited
Either condition is met:	1 or 2
1. Cruise control	Operating
2. Low speed control	Operating

CONFIRMATION DRIVING PATTERN

NOTICE:

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After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
13. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P1607.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Wait 16 seconds or more.

(m) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(n) Read DTCs.

OK:

P1607 is not present.

NG ▶ **REPLACE ECM**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013HE06PX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P1613; Secondary Air Injection System Driver; 2016 MY Tacoma [08/2015 -]		

DTC	**P1613**	**Secondary Air Injection System Driver**

DESCRIPTION

Refer to DTC P0412 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1613	Either of following conditions (1) or (2) met (1) All of following conditions met (1 trip detection logic): • Either of air pump assembly or air switching valve assembly not operating • Diagnostic signal from air injection control driver 80% • Battery voltage 8 V or higher (2) Both of following conditions met (1 trip detection logic): • Battery voltage 8 V or higher • Diagnostic signal from air injection control driver abnormal (duty signal other than 0, 20, 40, 80 and 100%)	• Air injection control driver • Open in air injection control driver ground circuit
	All of following conditions met (1 trip detection logic): a. Secondary air injection system operating (air switching valve and air pump are on) b. Diagnostic signal from air injection control driver 0% c. Battery voltage 8 V or higher	• Short in diagnostic information signal circuit (air injection control driver - ECM) • Open or short in air pump and air switching valve command signal circuit (air injection control driver - ECM) • Open in air injection control driver ground circuit • Air injection control driver • ECM
	Both of following conditions met (1 trip detection logic): a. Battery voltage 8 V or higher b. Diagnostic signal from air injection control driver 100%	• Open or short in air injection control driver power source circuit • Open in diagnostic information signal circuit (air injection control driver - ECM) • Air injection control driver • ECM

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MONITOR DESCRIPTION

For a short time after cold engine starts, the ECM transmits command signals to the air injection control driver to drive the air pump assembly and the air switching valve assembly. The air injection control driver detects open and short circuits according to the voltages at the air injection control driver terminals to the air pump assembly and air switching valve assembly, and the circuit voltage of the air injection control driver power source, and transmits diagnostic information as a signal to the ECM.

If the secondary air injection system circuit or the air injection control driver itself malfunctions, the air injection control driver sends a malfunction signal (duty signal) as diagnostic information to the ECM (when the system is normal, a system normal signal is sent). The ECM stores the DTC based on the diagnostic information from the air injection control driver.

EXAMPLE:

1. The duty ratio of the diagnostic signal from the air injection control driver is 0 or 100% (remains at 0 V or the same as battery voltage).
2. The duty ratio of the diagnostic signal from the air injection control driver shows an impossible ratio (other than 0, 20, 40, 80 and 100%).
3. The air injection control driver outputs the normal signal (normal duty signal: 80%) while the system is not operating.

MONITOR STRATEGY

Related DTCs	P1613: Secondary Air Injection System Air Injection Control Driver Circuit Range Check
Required Sensors/Components (Main)	Air injection control driver
Required Sensors/Components (Related)	Air switching valve
Frequency of Operation	Once per driving cycle
Duration	3 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Case 1 and 4

Monitor runs whenever following DTCs are not stored	None
Battery voltage	8 V or higher
Ignition switch	ON
Starter	OFF

Case 2

Monitor runs whenever following DTCs are not stored	None
Either a or b met:	-

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a. Command to air pump	OFF
b. Command to air switching valve	OFF
Battery voltage	8 V or higher
Ignition switch	ON
Starter	OFF

Case 3

Monitor runs whenever following DTCs are not stored	None
Following conditions (a) and (b) met	-
a. Command to air pump	ON
b. Command to air switching valve	ON
Battery voltage	8 V or higher
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Case 1

One of following conditions met:	A, B, C or D
A. Diagnostic signal duty ratio from air injection control driver	1% or more, and 10% or less
B. Diagnostic signal duty ratio from air injection control driver	30%
C. Diagnostic signal duty ratio from air injection control driver	49%
D. Diagnostic signal duty ratio from air injection control driver	91% or more, and 99% or less

Case 2

Diagnostic signal duty ratio from air injection control driver	70% or more, and 90% or less

Case 3

Diagnostic signal duty ratio from air injection control driver	0%

Case 4

Diagnostic signal duty ratio from air injection control driver	100%

COMPONENT OPERATING RANGE

Diagnostic signal duty ratio from air injection control driver	70% or more, and 90% or less when secondary air injection system operating. 0% when secondary air injection system not operating.

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CONFIRMATION DRIVING PATTERN

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

    HINT:

    - If a DTC is output, the system is malfunctioning.
    - If a DTC is not output, perform the following procedure.
14. After the "Secondary Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P1613.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

18. Turn the ignition switch off.

WIRING DIAGRAM

Refer to DTC P0412 INFO .

INSPECTION PROCEDURE

CAUTION:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- By using the Techstream to perform the Secondary Air Injection Check operation in the System Check, the air fuel ratio and the pressure in the secondary air injection system passage can be checked while the secondary air injection system is operating. This helps technicians to troubleshoot the system when it malfunctions.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P1613)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(d) Read DTCs.

Result

RESULT	PROCEED TO
DTC P1613 are output	A
DTC P1613 and other DTCs are output	B

HINT:

If any DTCs other than P1613 are output, troubleshoot those DTCs first.

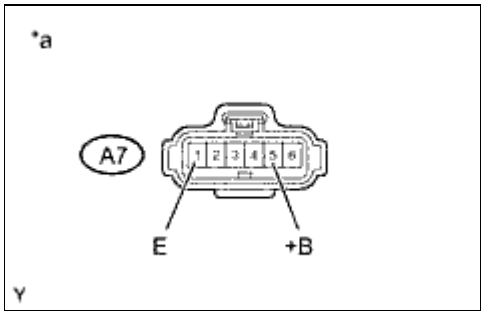
B ▶ **GO TO DTC CHART**

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A

2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR INJECTOR CONTROL DRIVER)**

(a) Disconnect the air injection control driver connector.



(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A7-5 (+B) - A7-1 (E)	Ignition Switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Injection Control Driver)

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3.	**CHECK HARNESS AND CONNECTOR (AIR INJECTION CONTROL DRIVER - ECM, BODY GROUND)**

(a) Disconnect the E20 and E21 ECM connector.

(b) Disconnect the A7 air injection control driver connector.

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

Standard Resistance:

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-6 (AIRP) - A7-4 (SIP)	Always	Below 1 Ω
E21-5 (AIRV) - A7-3 (SIV)	Always	Below 1 Ω
E20-20 (AIDI) - A7-2 (DI)	Always	Below 1 Ω
A7-1 (E) - Body ground	Always	Below 1 Ω
E21-6 (AIRP) or A7-4 (SIP) - Body ground	Always	10 kΩ or higher
E21-5 (AIRV) or A16-3 (SIV) - Body ground	Always	10 kΩ or higher
E20-20 (AIDI) or A7-2 (DI) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**INSPECT AIR INJECTION CONTROL DRIVER (DI TERMINAL VOLTAGE)**

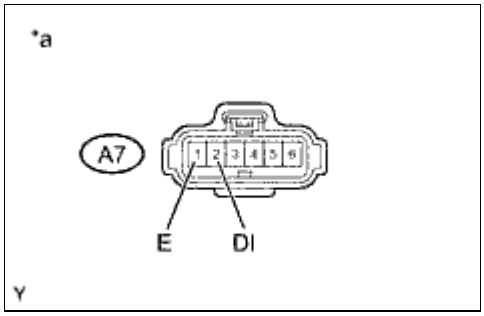
(a) Disconnect the air injection control driver connector.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A7-2 (DI) - A7-1 (E)	Ignition Switch ON	11 to 14 V



Text in Illustration

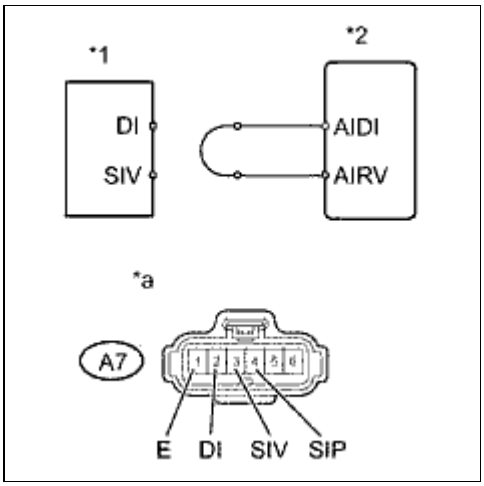
*a	Front view of wire harness connector (to Air Injection Control Driver)

NG ▶ **REPLACE ECM**

OK ▼

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5.	**PERFORM ACTIVE TEST USING TECHSTREAM**



(a) Disconnect the air injection control driver connector.

(b) Connect terminals DI and SIV of the wire harness connector for the air injection control driver.

Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Start the engine.

(h) Perform the secondary air injection system intrusive operation while the engine is idling.

(i) Measure the voltage between the SIV and E terminals of the ECM connector when the secondary air injection system is on and off.

(j) Turn the ignition switch off.

HINT:

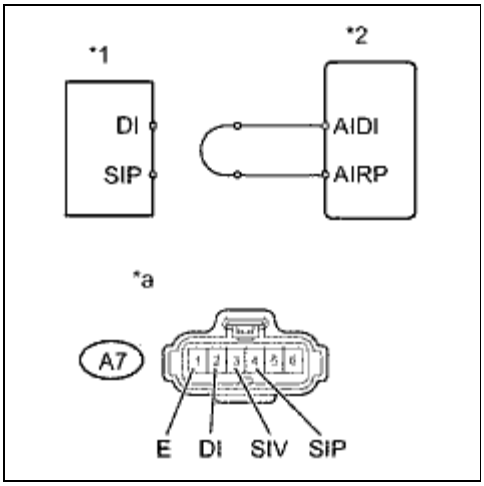
- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.

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- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-3 (SIV) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V



(k) Connect terminals DI and SIP of the wire harness connector for the air injection control driver.

Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(l) Connect the Techstream to the DLC3.

(m) Turn the ignition switch to ON.

(n) Turn the Techstream on.

(o) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(p) Start the engine.

(q) Perform the secondary air injection system intrusive operation while the engine is idling.

(r) Measure the voltage between the SIP and E terminals of the ECM connector when the secondary air injection system is on and off.

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(s) Turn the ignition switch off.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-4 (SIP) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

NG ▶ **REPLACE ECM**

OK
▼

6.	**REPLACE AIR INJECTION CONTROL DRIVER**

(a) Replace the air injection control driver.

NEXT
▼

7.	**CHECK WHETHER DTC OUTPUT RECURS (SYSTEM CHECK AUTOMATIC MODE)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear the DTCs (See page ES-32).

(g) Turn the ignition switch off and wait for at least 30 seconds.

(h) Turn the ignition switch to ON.

(i) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.

(j) Start the engine after the Techstream initialization is finished.

(k) Perform the System Check operation by pressing ENTER (Next).

(l) After operating the secondary air injection system, press the Exit button to confirm the secondary air injection system pending codes.

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(m) Check Pending DTCs.

OK:

No pending DTC output.

(n) Turn the ignition switch off.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

NG ▶ **REPLACE ECM**

OK ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFU0ZOX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2102,P2103; Throttle Actuator Control Motor Circuit Low; 2016 MY Tacoma [08/2015 -]		

DTC	**P2102**	**Throttle Actuator Control Motor Circuit Low**

DTC	**P2103**	**Throttle Actuator Control Motor Circuit High**

DESCRIPTION

The throttle actuator is operated by the ECM and opens and closes the throttle valve using gears.

The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle body with motor assembly. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This Electronic Throttle Control System (ETCS) does not use a throttle cable.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2102	Conditions (a) and (b) continue for 2.0 seconds (1 trip detection logic): (a) Throttle actuator duty ratio 80% or more (b) Throttle actuator current less than 0.5 A	• Open in throttle actuator circuit • Throttle actuator • ECM
P2103	Either of following conditions is met (1 trip detection logic): • Motor driver IC high current limiter monitor input fails • Motor driver IC high current inhibit signal on	• Short in throttle actuator circuit • Throttle actuator • Throttle valve • Throttle body with motor assembly • ECM

MONITOR DESCRIPTION

The ECM monitors the electrical current through the electronic actuator, and detects malfunctions and open circuits in the throttle actuator based on this value. If the current is outside the standard range, the ECM determines that there is a malfunction in the throttle actuator. In addition, if the throttle valve does not function properly (for example, stuck on), the ECM determines that there is a malfunction. The ECM then illuminates the MIL and stores the DTC.

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Example:

When the electrical current is less than 0.5 A and the throttle actuator duty ratio exceeds 80%, the ECM interprets this as the current being outside the standard range, and illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, a DTC is stored when the engine is quickly revved to a high rpm several times after the engine has idled for 5 seconds after engine start.

MONITOR STRATEGY

Related DTCs	P2102: Throttle Actuator Current (Low Current) P2103: Throttle Actuator Current (High Current)
Required Sensors/Components (Main)	Throttle actuator (throttle body with motor assembly)
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	2 seconds: P2102 25 times: P2103 (Case 1) 0.6 seconds: P2103 (Case 2)
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None

P2102

Command to electric throttle actuator	ON
Output duty cycle	80% or more
Electric throttle actuator power supply voltage	8 V or higher
|Motor current - Last motor current|	less than 0.2 A

P2103

Command to electric throttle actuator	ON
Either of the following conditions 1 or 2 is met:	-
1. Electric throttle actuator power supply voltage	8 V or higher
2. Command to electric throttle actuator power	ON
Battery voltage	8 V or higher
Starter	OFF
Full-close control	OFF

TYPICAL MALFUNCTION THRESHOLDS

P2102

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Throttle actuator current	Less than 0.5 A

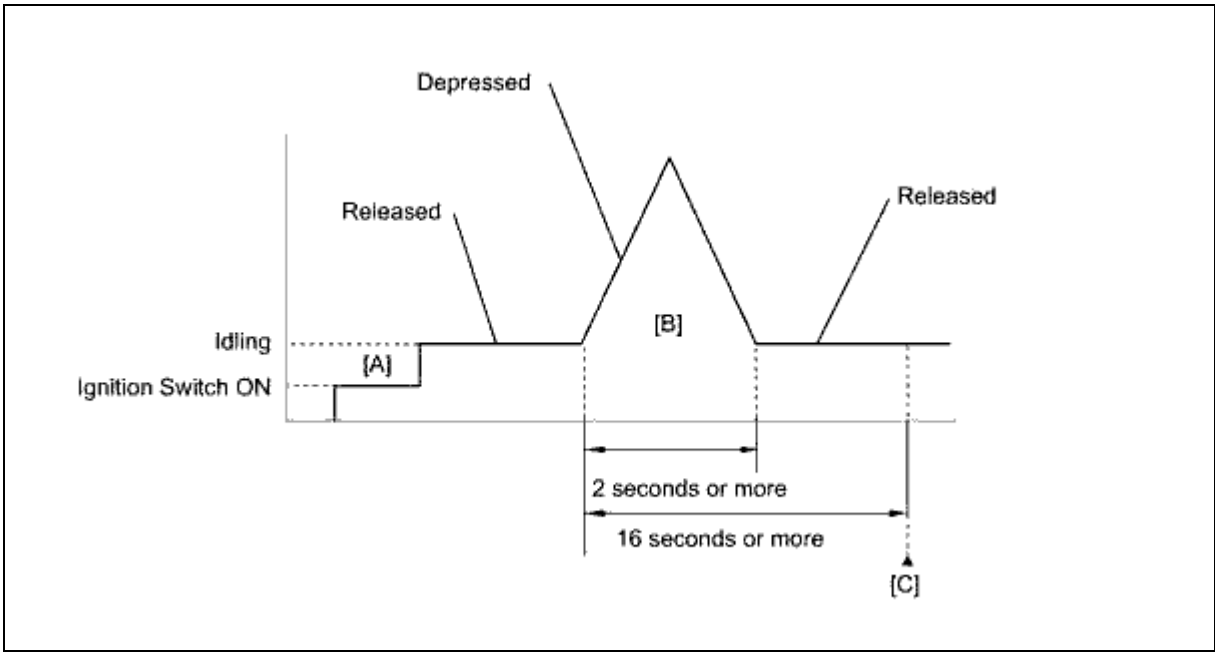
P2103 (Case 1)

Motor driver IC high current limiter monitor input	Fail

P2103 (Case 2)

Motor driver IC high current inhibit signal	ON

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. With the vehicle stationary, fully depress the accelerator pedal and quickly release it [B].
8. Check that 16 seconds or more have elapsed from the instant when the accelerator pedal is first depressed.
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P2102 or P2103.
13. Check the DTC judgment result.

TECHSTREAM	DESCRIPTION

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DISPLAY	
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [C] again.

14. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

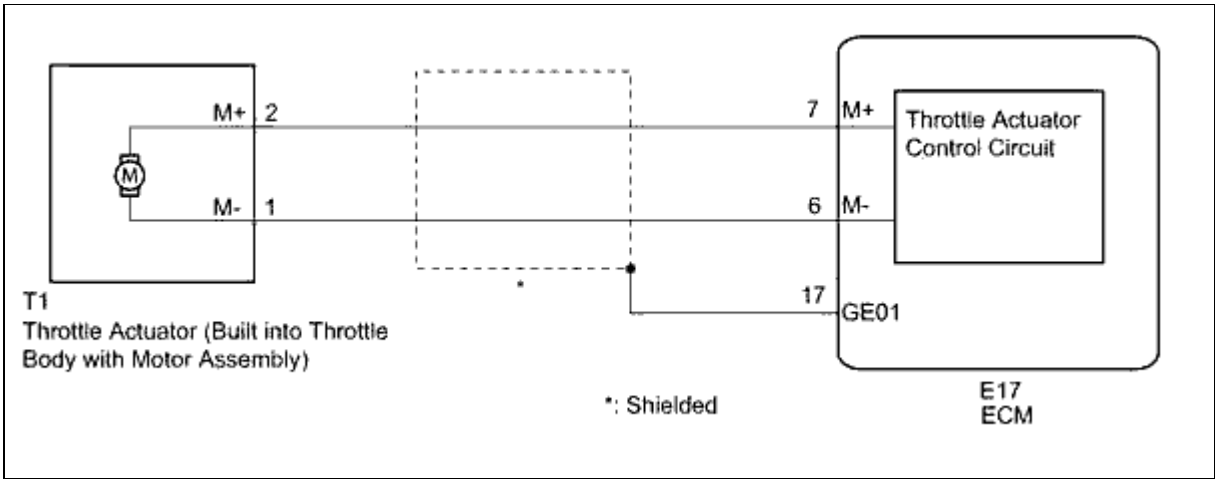
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When either of these DTCs or other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM



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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- The throttle actuator current (Throttle Motor Current) and the throttle actuator duty ratio (Throttle Motor Open Duty / Throttle Motor Close Duty) can be read using the Techstream. However the ECM shuts off the throttle actuator current when the electronic throttle control system malfunctions.

PROCEDURE

1.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)**

(a) Inspect the throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NG ▶ **REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

OK ▼

2.	**CHECK HARNESS AND CONNECTOR (THROTTLE BODY WITH MOTOR ASSEMBLY - ECM)**

(a) Disconnect the T1 throttle body with motor assembly connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
T1-2 (M+) - E17-7 (M+)	Always	Below 1 Ω
T1-1 (M-) - E17-6 (M-)	Always	Below 1 Ω
T1-2 (M+) or E17-7 (M+) - Body ground	Always	10 kΩ or higher
T1-1 (M-) or E17-6 (M-) - Body ground	Always	10 kΩ or higher

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for foreign objects between the throttle valve and the housing.

OK:

No foreign objects between the throttle valve and housing.

HINT:

Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

NG ▶ REMOVE FOREIGN OBJECT AND CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY

OK ▼

4.	INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (THROTTLE VALVE)

(a) Check if the throttle valve opens and closes smoothly.

OK:

Throttle valve opens and closes smoothly.

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NG ▶ REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY

OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** X39400000RM0MEC
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2109; Throttle / Pedal Position Sensor "A" Minimum Stop Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P2109**	**Throttle / Pedal Position Sensor "A" Minimum Stop Performance**

DESCRIPTION

The idling speed is controlled by the Electronic Throttle Control System (ETCS).

The electronic throttle control system is comprised of a throttle actuator, which operates the throttle valve, and a throttle position sensor, which detects the opening amount of the throttle valve.

The ECM controls the throttle actuator to adjust the throttle valve opening amount so that the idling speed is maintained at the target idling speed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2109	The ISC learned value is approximately 3 times larger than normal even though the actual intake air amount during idling is within the normal range (up to 1.5 times the normal amount) (5 trip detection logic)	Throttle body with motor assembly

HINT:

- The ISC learned value is the calculated intake air amount corresponding to the throttle opening amount necessary to maintain the idling speed.
- This malfunction is only detected once per trip. After it has been detected once, the system will not monitor for the malfunction for the rest of the trip.
- The system uses the throttle body with motor assembly and mass air flow meter to detect this malfunction.

MONITOR DESCRIPTION

If there are deposits in the throttle valve, a decrease in the ISC flow rate may cause engine stall or unstable idling. Therefore, the necessary ISC flow rate for idling is maintained using the ISC learned value and feedback. The ECM stores this DTC if the ISC learned value approaches its limit. The ECM begins monitoring for the DTC detection conditions when the following preconditions are met:

1) The mass air flow meter is normal.
2) Atmospheric pressure is 85 kPa(abs) [637.5 mmHg(abs)] or higher.
3) The vehicle has been driven at a speed of 30 km/h (18.6 mph) or more at least once.
4) The engine coolant temperature is 45°C (113°F) or less at engine start, the engine is warmed up and conditions for ISC learning are met, or the ignition switch has been turned to ON (include engine running) for 1 hour or more, the engine is warmed up and conditions for ISC learning are met.

INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
- Since a pending DTC is not stored for this DTC, it takes time to confirm whether the malfunction has been

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successfully repaired by checking for this DTC. When confirming whether the malfunction has been successfully repaired, compare "ISC Learning Value" recorded in the freeze frame data with "ISC Learning Value" in the Data List after repairs have been made to save time.

PROCEDURE

1.	**CHECK FOR ANY OTHER DTCS OUTPUT (IN ADDITION TO P2109)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

RESULT	PROCEED TO
Only DTC P2109 is output	A
DTC P2109 and other DTCs are output	B

HINT:

If any DTCs other than P2109 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**CHECK FREEZE FRAME DATA**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, check "ISC Learning Value" in the freeze frame data INFO .

HINT:

Be sure to confirm "ISC Learning Value" in the freeze frame data as it is used when confirming whether the malfunction has been successfully repaired.

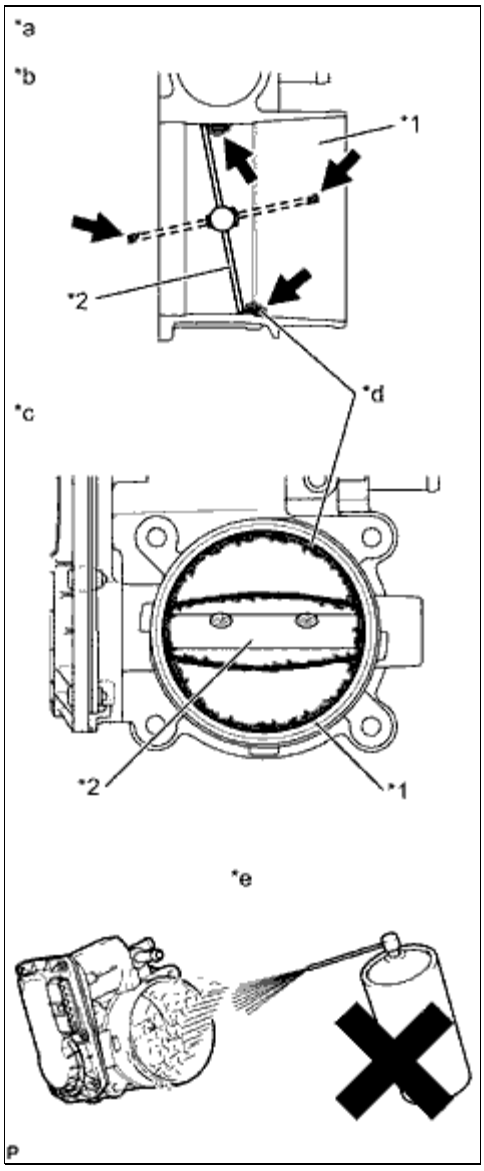
NEXT

▼

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3.	**REMOVE FOREIGN OBJECT (CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY)**

(a) Clean off any deposits from the inside of the throttle body with motor assembly.



Text in Illustration

*1	Bore
*2	Valve
*a	Reference
*b	Throttle Body With Motor Assembly Cross-section Diagram
*c	When valve fully opened
*d	Deposits
*e	Do not directly apply cleaner

(1) Push open the throttle valve and wipe off any carbon from the valve and bore using a cloth soaked in non-residue solvent.

NOTICE:

- Make sure that the cloth or your fingers do not get caught in the valve.
- Make sure that foreign matter does not enter the throttle valve.
- Do not directly apply non-residue solvent to the throttle body with motor assembly or wash the throttle body with motor assembly. Cleaning solvent may leak into the motor from the shaft and cause problems such as rust or valve movement problems.
- If there is coating material on the edge of the valve, be careful not to remove it.
- Push the throttle valve open gently with your finger and check that the throttle valve moves smoothly.

HINT:

If the throttle valve does not open smoothly, replace the throttle body with motor assembly.

NEXT

4.	**READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)**

(a) Perform "Inspection After Repair" after cleaning or replacing the throttle body with motor assembly INFO .

(b) Enter the following menus: Powertrain / Engine and ECT / Data List / ISC Learning Value.

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(c) Read the value.

OK:

The value is half of "ISC Learning Value" recorded in the freeze frame data or less.

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NG ▶ **REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

OK ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFV145X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2111,P2112; Throttle Actuator Control System - Stuck Open; 2016 MY Tacoma [08/2015 -]		

DTC	**P2111**	**Throttle Actuator Control System - Stuck Open**

DTC	**P2112**	**Throttle Actuator Control System - Stuck Closed**

DESCRIPTION

The throttle actuator is operated by the ECM, and opens and closes the throttle valve using gears. The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle body with motor assembly. The throttle position sensor provides feedback to the ECM so that the ECM can control the throttle actuator (throttle valve) appropriately in response to driver inputs.

HINT:

This ETCS (Electronic Throttle Control System) does not use a throttle cable.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2111	Throttle actuator does not close even when the ECM commands it to close (1 trip detection logic)	• Throttle actuator • Throttle body with motor assembly • Throttle valve • Wire harness or connector • ECM
P2112	Throttle actuator does not open even when the ECM commands it to open (1 trip detection logic)	• Throttle actuator • Throttle body with motor assembly • Throttle valve • Wire harness or connector • ECM

MONITOR DESCRIPTION

The ECM determines that there is a malfunction in the ETCS when the throttle valve remains at a fixed angle despite a high drive current from the ECM. The ECM illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, a DTC is stored when the accelerator pedal is fully depressed and released quickly (to fully open and close the throttle valve) after the engine is next started.

MONITOR STRATEGY

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Related DTCs	P2111: Throttle Actuator Stuck Open P2112: Throttle Actuator Stuck Closed
Required Sensors/Components (Main)	Throttle actuator (throttle body with motor assembly)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	None

P2111 Throttle actuator stuck open

All of following conditions met	-
System guard* judge condition	ON
Throttle actuator current	2 A or higher
Duty cycle to close throttle	80% or more

P2112 Throttle actuator stuck closed

All of following conditions met	-
System guard* judge condition	ON
Throttle actuator current	2 A or higher
Duty cycle to open throttle	80% or more

* System guard set when the following conditions are met	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor fail	Not detected
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or higher
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P211 Throttle actuator stuck open

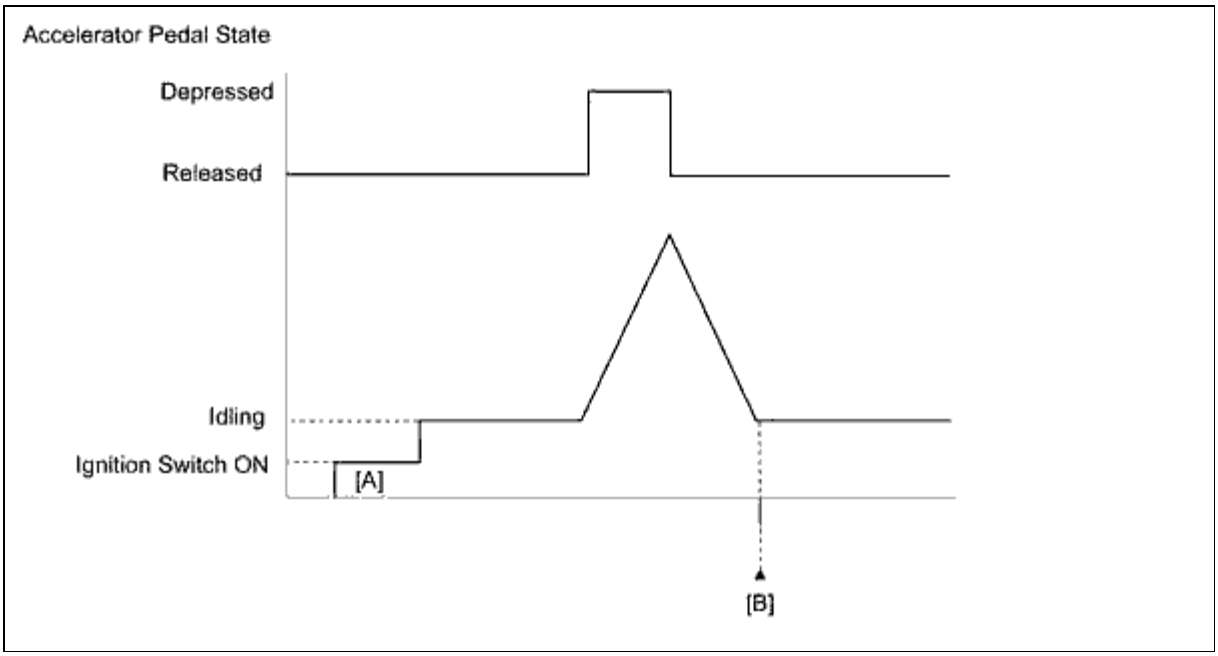
Throttle position sensor voltage change	No change

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P2112 Throttle actuator stuck closed

Throttle position sensor voltage change	No change

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and fully depress and release the accelerator pedal quickly (to fully open and close the throttle valve).
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
8. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
10. Input the DTC: P2111 or P2112.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When either of these DTCs or other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM

Refer to DTC P2102 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Refer to "Data List / Active Test" [Throttle Position Command, Throttle Position No. 1, Throttle Motor Current, Throttle Motor Duty (Open), Throttle Motor Duty (Close)] INFO .

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2111 OR P2112)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2111 or P2112 is output	A
DTC P2111 or P2112 and other DTCs are output	B

HINT:

If any DTCs other than P2111 or P2112 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)**

(a) Check for contamination between the throttle valve and housing. If necessary, clean the throttle body with motor assembly. Also check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

HINT:

Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

NG ▶ **GO TO STEP 5**

OK ▼

3.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION)**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1, Throttle Position No. 2 and Throttle Position Command.

(h) Read the values displayed on the Techstream while wiggling the ECM wire harness.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
Value in Data List changes when wire harness is wiggled, or DTC is output*	A
Other than above	B

*: As the DTC was stored due to a change in the contact resistance of the connector, repair or replace the wire harness or connector INFO .

B ▶ **GO TO STEP 6**

A ▼

4.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - THROTTLE BODY WITH MOTOR ASSEMBLY)**

(a) As the DTC was stored due to a change in the contact resistance of the connector, repair or replace the wire harness or connector INFO .

NEXT ▶ **END**

5.	**REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

(a) Replace the throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

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NEXT

6.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2111 OR P2112)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P2111 or P2112 is output	B

B REPLACE ECM

A END

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFW0ZQX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2118; Throttle Actuator Control Motor Current Range / Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P2118**	**Throttle Actuator Control Motor Current Range / Performance**

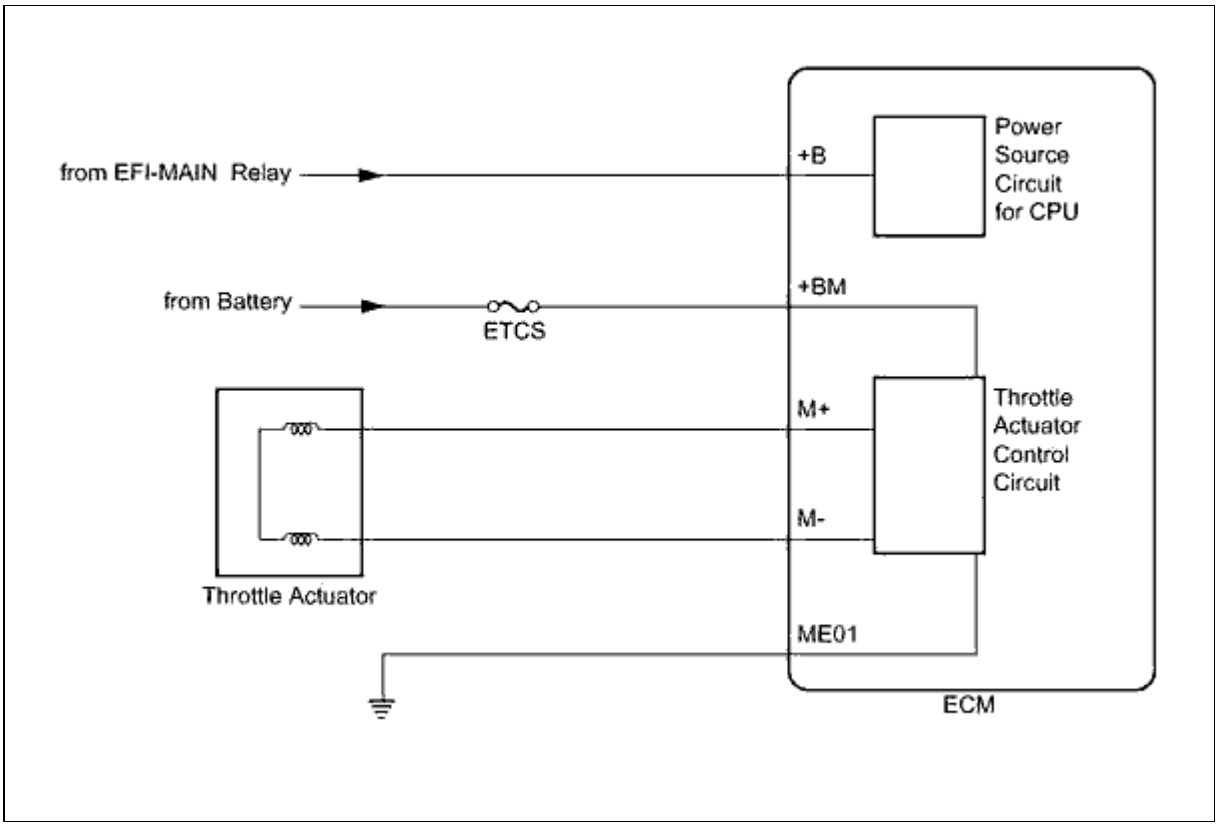
DESCRIPTION

The Electronic Throttle Control System (ETCS) has a dedicated power supply circuit. The voltage (+BM) is monitored and when it is low (less than 4 V), the ECM determines that there is a malfunction in the electronic throttle control system and cuts off the current to the throttle actuator.

When the voltage becomes unstable, the electronic throttle control system itself becomes unstable. For this reason, when the voltage is low, the current to the throttle actuator is cut. If repairs are made and the system returns to normal, turn the ignition switch off. The ECM then allows the current to flow to the throttle actuator so that it can be restarted.

HINT:

The ETCS does not use a throttle cable.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2118	An open in Electronic Throttle Control System (ETCS) power source (+BM) circuit (1 trip detection logic)	• Open in Electronic Throttle Control System (ETCS) power source circuit

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Battery • Battery terminals • ECM

MONITOR DESCRIPTION

The ECM monitors the battery supply voltage applied to the throttle actuator.

When the power supply voltage (+BM) drops less than 4 V for 0.8 seconds or more, the ECM interprets this as an open in the power supply circuit (+BM). The ECM illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2118: Throttle Actuator Power Supply
Required Sensors/Components (Main)	Throttle actuator Throttle valve (throttle body with motor assembly) ETCS fuse
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	0.8 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Battery voltage	8 V or higher
Command to electronic throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

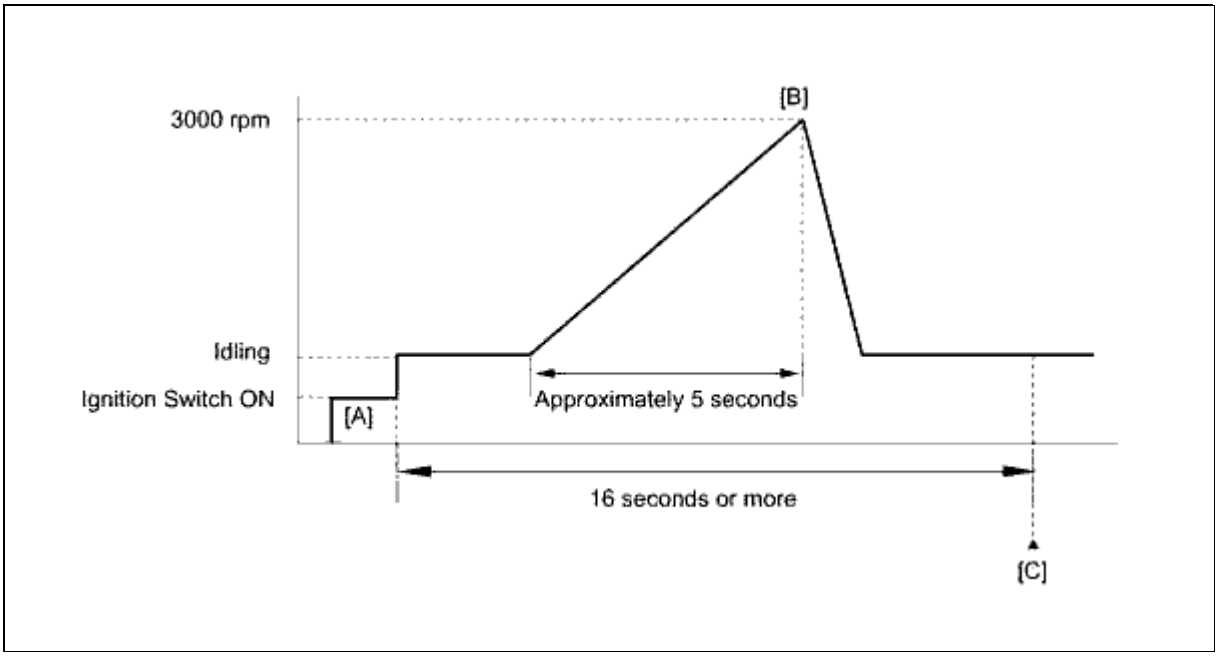
Electronic throttle actuator power supply voltage	Less than 4 V

COMPONENT OPERATING RANGE

Electric throttle control	Normal

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Slowly depress the accelerator pedal, raise the engine speed to approximately 3000 rpm over approximately 5 seconds, and then idle the engine [B].
8. Check that 16 seconds or more have elapsed since the engine was started.
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
10. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P2118.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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TECHSTREAM DISPLAY	DESCRIPTION
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [C] again.

14. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

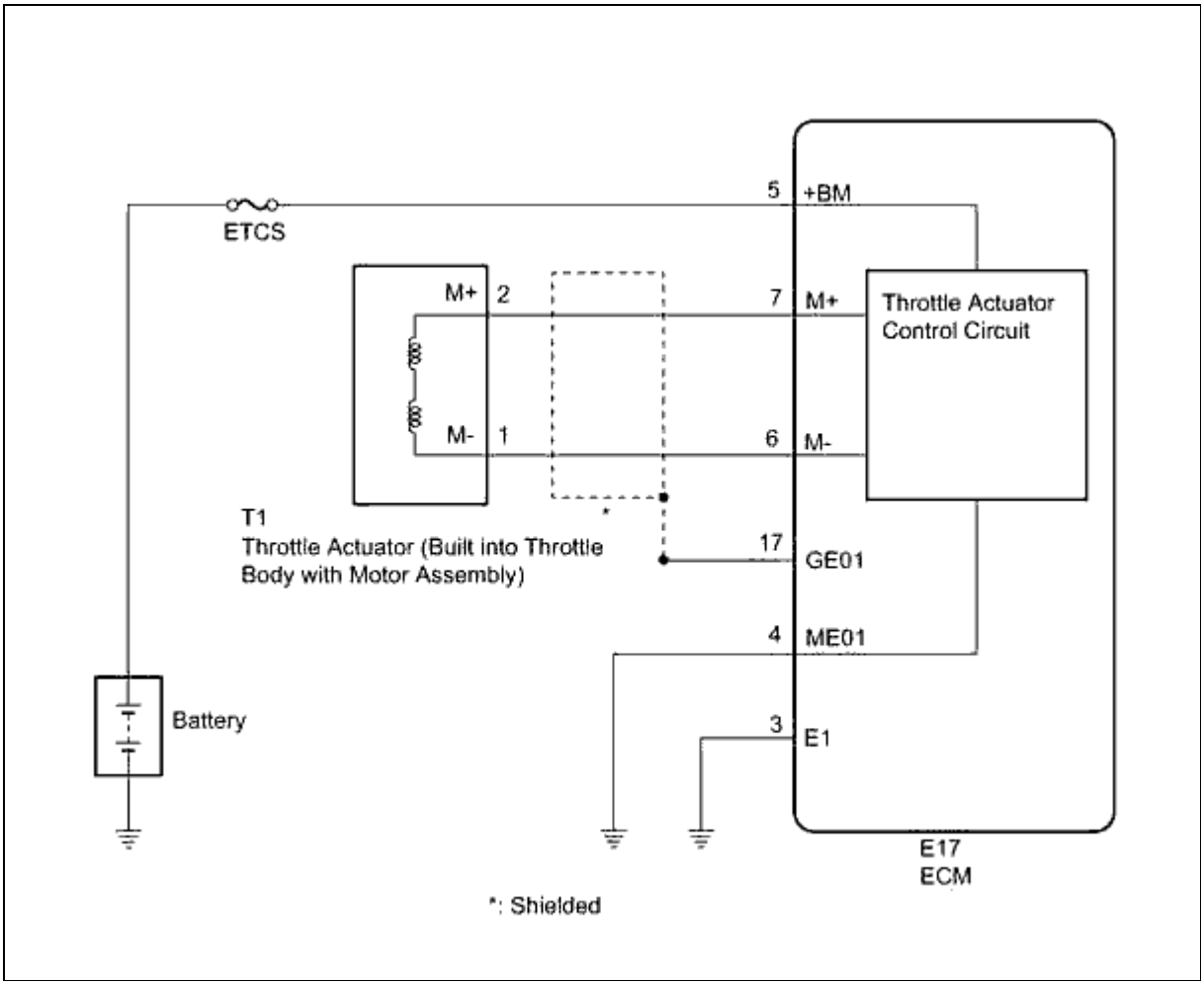
FAIL-SAFE

When this DTC, as well as other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions, is stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses of circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (+BM VOLTAGE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / +BM Voltage.

(e) Read the value displayed on the Techstream.

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Result

RESULT	PROCEED TO
Below 11 V or higher than 14 V	A
11 to 14 V	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

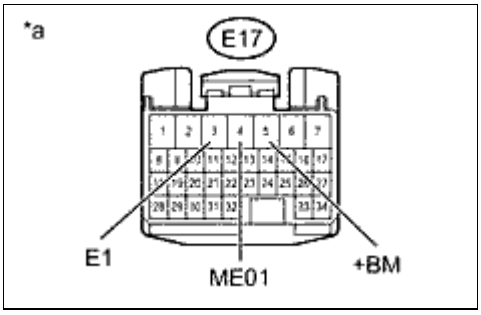
2.	**CHECK HARNESS AND CONNECTOR (ECM - BATTERY, BODY GROUND)**

(a) Disconnect the ECM connectors.

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

Standard Voltage:

TESTER CONNECTION	CONNECTION	SPECIFIED CONDITION
E17-5 (+BM) - Body ground	Always	11 to 14 V



Text in Illustration

*a	Front view of wire harness connector (to ECM)

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

Standard Resistance:

TESTER CONNECTION	CONNECTION	SPECIFIED CONDITION
E17-4 (ME01) - Body ground	Always	Below 1 Ω
E17-3 (E1) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFX14RX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2119; Throttle Actuator Control Throttle Body Range / Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P2119**	**Throttle Actuator Control Throttle Body Range / Performance**

DESCRIPTION

The Electronic Throttle Control System (ETCS) is composed of the throttle actuator, throttle position sensor, accelerator pedal rod assembly and ECM. The ECM operates the throttle actuator to regulate the throttle valve in response to driver inputs. The throttle position sensor detects the opening angle of the throttle valve, and provides the ECM with feedback so that the throttle valve can be appropriately controlled by the ECM.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2119	Throttle valve opening angle continues to vary greatly from target opening angle (1 trip detection logic)	• Electronic Throttle Control System (ETCS) • ECM • Wire harness or connector

MONITOR DESCRIPTION

The ECM determines the actual opening angle of the throttle valve from the throttle position sensor signal. The actual opening angle is compared to the target opening angle commanded by the ECM. If the difference between these two values is outside the standard range, the ECM interprets this as a malfunction in the ETCS. The ECM then illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored when the accelerator pedal is quickly released (to close the throttle valve) after the engine speed reaches 5000 rpm by the accelerator pedal being fully depressed (fully open the throttle valve).

MONITOR STRATEGY

Related DTCs	P2119: ETCS Malfunction
Required Sensors/Components (Main)	Throttle actuator (throttle body with motor assembly)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Closed: 1 second Open: 0.6 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

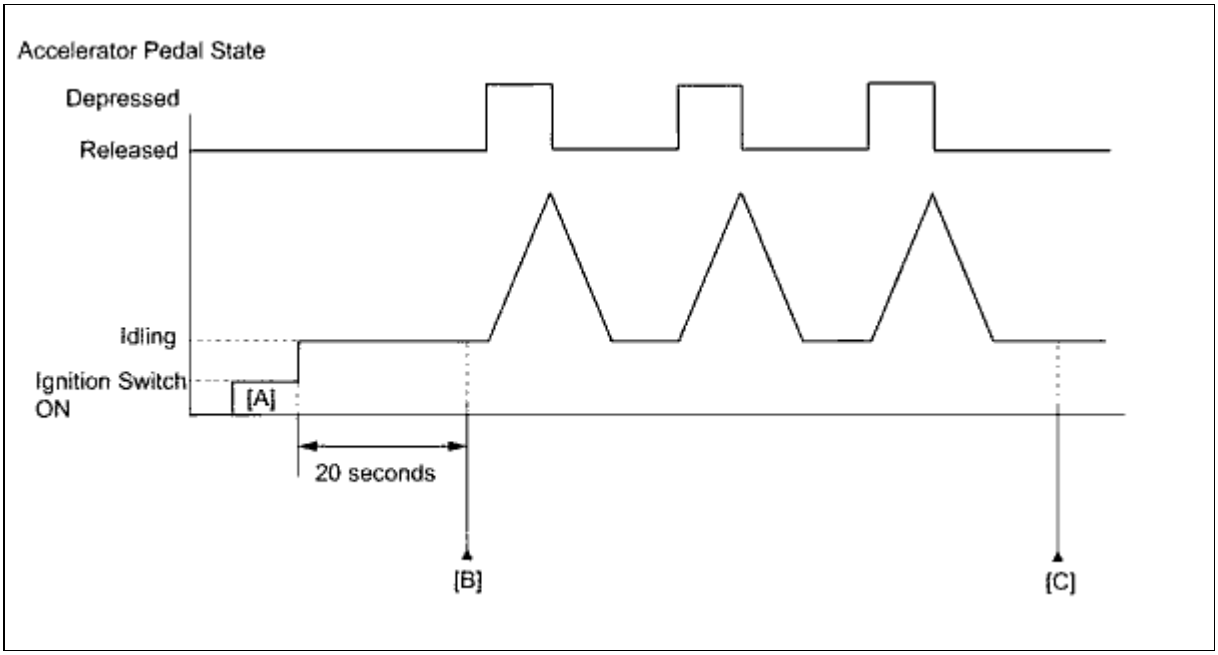
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Monitor runs whenever following DTCs are not stored	None
System guard* judge condition	ON
* System guard is ON when the following conditions set	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor fail	Not detected
Throttle actuator current-cut	Not executing
Throttle actuator power supply	4 V or higher
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Either of following conditions is met	1 or 2
1. Difference between commanded closed throttle position and current closed throttle position	0.3 V or higher
2. Difference between commanded open throttle position and current open throttle position	0.3 V or higher

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 20 seconds.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [B].
9. Read pending DTCs.

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HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P2119.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, fully depress and release the accelerator pedal 3 times, and then check the DTC judgment result [C].

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC, as well as other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions, is stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM

Refer to DTC P2102 INFO .

INSPECTION PROCEDURE

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NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Refer to "Data List / Active Test" [Throttle Position command, Throttle Position No. 1, Throttle Motor Current, Throttle Motor Duty (Open) and Throttle Motor Duty (Close)] INFO .
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2119)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2119 is output	A
DTC P2119 and other DTCs are output	B

HINT:

If any DTCs other than P2119 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

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(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1 and Throttle Position Command.

(h) Read the values displayed on the Techstream while fully depressing and releasing the accelerator pedal quickly.

Result

RESULT	PROCEED TO
Throttle Position No. 1 does not change	A
Throttle Position No. 1 changes even a little	B

HINT:

When a DTC is output, the system changes to fail-safe mode. Therefore, only use the data up until the time the DTC is stored for confirmation.

B ▶ **GO TO STEP 4**

A

▼

3.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)**

(a) Inspect the throttle body with motor assembly INFO .

NG ▶ **GO TO STEP 7**

OK

▼

4.	**INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)**

(a) Check for contamination between the throttle valve and housing. If necessary, clean the throttle body with motor assembly. Also, check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

HINT:

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Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

NG ▶ **GO TO STEP 7**

OK ▼

5.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1 and Throttle Position Command.

(h) Read the values displayed on the Techstream while wiggling the ECM wire harness.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
Value in Data List changes when wire harness is wiggled, or DTC is output*	A
Other than above	B

*: As the DTC was stored due to a change in the contact resistance of the connector, repair or replace the wire harness or connector INFO .

B ▶ **GO TO STEP 8**

A ▼

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - THROTTLE BODY WITH MOTOR ASSEMBLY)**

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(a) As the DTC was stored due to a change in the contact resistance of the connector, repair or replace the wire harness or connector INFO .

NEXT ▶ **END**

7.	REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY

(a) Replace the throttle body with motor assembly INFO .

HINT:

Perform "Inspection After Repair" after replacing the throttle body with motor assembly INFO .

NEXT ▼

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2119)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P2119 is output	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFY0XDX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2120,P2122,P2123,P2125,P2127,P2128,P2138; Throttle / Pedal Position Sensor / Switch "D" Circuit; 2016 MY Tacoma [08/2015 -]		

DTC	**P2120**	**Throttle / Pedal Position Sensor / Switch "D" Circuit**

DTC	**P2122**	**Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input**

DTC	**P2123**	**Throttle / Pedal Position Sensor / Switch "D" Circuit High Input**

DTC	**P2125**	**Throttle / Pedal Position Sensor / Switch "E" Circuit**

DTC	**P2127**	**Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input**

DTC	**P2128**	**Throttle / Pedal Position Sensor / Switch "E" Circuit High Input**

DTC	**P2138**	**Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation**

DESCRIPTION

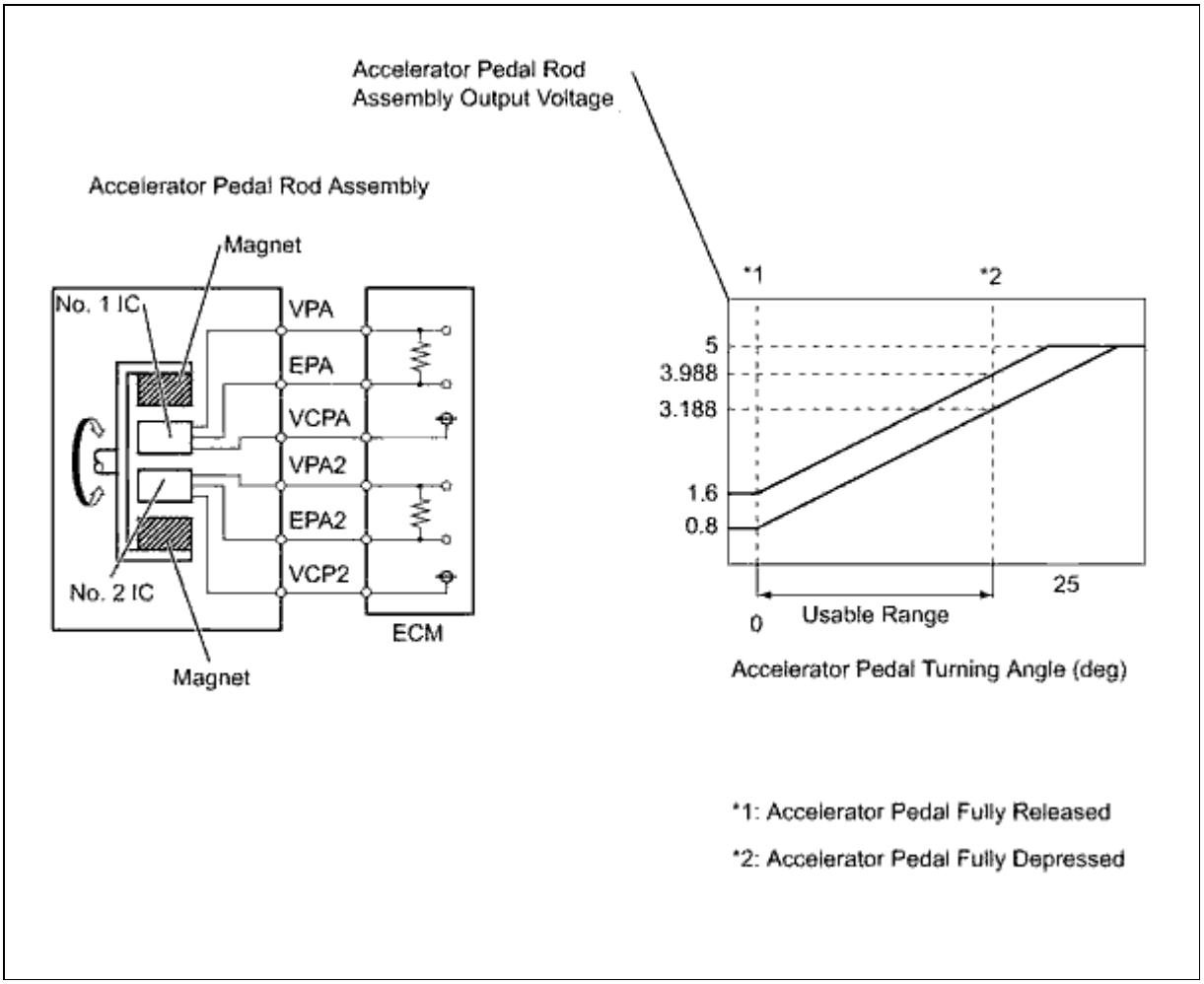
HINT:

- These DTCs relate to the accelerator pedal rod assembly.
- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- The ECM monitors the actual accelerator pedal opening angle (throttle valve opening angle) through the signals from VPA and VPA2, and controls the throttle actuator according to these signals.

The accelerator pedal rod assembly is built into the accelerator pedal rod assembly and has 2 sensor circuits: VPA (main) and VPA2 (sub). This sensor is a non-contact type sensor and uses Hall-effect elements in order to yield accurate signals even in extreme driving conditions, such as at high speeds as well as very low speeds. The voltage, which is applied to terminals VPA and VPA2 of the ECM, varies between 0.5 V and 4.75 V in proportion to the operating angle of the accelerator pedal (throttle valve). A signal from VPA indicates the actual accelerator pedal opening angle (throttle valve opening angle) and is used for engine control. A signal from VPA2 conveys the status of the VPA circuit and is used to check the accelerator pedal rod assembly itself.

The ECM monitors the actual accelerator pedal opening angle (throttle valve opening angle) through the signals from VPA and VPA2, and controls the throttle actuator according to these signals.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2120	VPA fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• Accelerator pedal rod assembly • ECM
P2122	VPA 0.4 V or less for 0.5 seconds or more when accelerator pedal fully released (1 trip detection logic)	• Accelerator pedal rod assembly • Open in VCP1 circuit • Open or ground short in VPA circuit • ECM
P2123	VPA 4.8 V or more for 2.0 seconds or more (1 trip detection logic)	• Accelerator pedal rod assembly • Open in EPA circuit • ECM
P2125	VPA2 fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• Accelerator pedal rod assembly • ECM

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HINT:

When any of these DTCs are stored, check the accelerator pedal rod assembly voltage by entering the following menus: Powertrain / Engine and ECT / Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

TROUBLE AREA	ACCELERATOR PEDAL RELEASED		ACCELERATOR PEDAL DEPRESSED	
	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
Open or ground short in VPA circuit	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 4.75 V
Open or ground short in VPA2 circuit	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 4.98 V	4.5 to 4.98 V	4.5 to 4.98 V	4.5 to 4.98 V
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 4.75 V

HINT:

Accelerator pedal positions are expressed as voltages.

MONITOR DESCRIPTION

When either of the voltage outputs of VPA or VPA2 deviates from the standard range, or the difference between the voltage outputs of the 2 sensor circuits is less than the threshold, the ECM determines that there is a malfunction in the accelerator pedal rod assembly. The ECM then illuminates the MIL and stores the DTC.

Example:

When the voltage output of VPA drops below 0.4 V for more than 0.5 seconds when the accelerator pedal is fully depressed, DTC P2122 is stored.

If the malfunction is not repaired successfully, a DTC is stored 2 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2120: Accelerator Pedal Position Sensor 1 (VPA) Range Check (Chattering) P2122: Accelerator Pedal Position Sensor 1 (VPA) Range Check (Low Voltage) P2123: Accelerator Pedal Position Sensor 1 (VPA) Range Check (High Voltage) P2125: Accelerator Pedal Position Sensor 2 (VPA2) Range Check (Chattering) P2127: Accelerator Pedal Position Sensor 2 (VPA2) Range Check (Low Voltage) P2128: Accelerator Pedal Position Sensor 2 (VPA2) Range Check (High Voltage) P2138: Accelerator Pedal Position Sensor Range Check (Correlation)
Required Sensors/Components (Main)	Accelerator pedal rod assembly

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Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds: P2120, P2122, P2125 and P2127 2 seconds: P2123, P2128 and P2138
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Either of following conditions met:	-
Ignition switch	ON (0.012 seconds or more)
Command to electronic throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

P2120

One of the following conditions is met:	1 or 2
1. All of following conditions met:	(a) and (b)
(a) VPA voltage	0.4 V or less
(b) VPA2 voltage - Learned VPA2 accelerator off position voltage	0.04 V or higher
2. VPA voltage	4.8 V or higher

P2122

All of following conditions met:	(a) and (b)
(a) VPA voltage	0.4 V or less
(b) VPA2 voltage - Learned VPA2 accelerator off position voltage	0.04 V or higher

P2123

(a) VPA voltage	4.8 V or higher

P2125

One of the following conditions is met:	1 or 2
1. All of following conditions met:	(a) and (b)
(a) VPA2 voltage	1.2 V or less
(b) VPA voltage - Learned VPA accelerator off position voltage	0.04 V or higher
2. All of following conditions met:	(a) and (b)
(a) VPA2 voltage	4.8 V or higher

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(b) VPA voltage	0.4 V or higher, and 3.45 V or less

P2127

All of following conditions met:	(a) and (b)
(a) VPA2 voltage	1.2 V or less
(b) VPA voltage - Learned VPA accelerator off position voltage	0.04 V or higher

P2128

All of following conditions met:	(a) and (b)
(a) VPA2 voltage	4.8 V or higher
(b) VPA voltage	0.4 V or higher, and 3.45 V or less

P2138

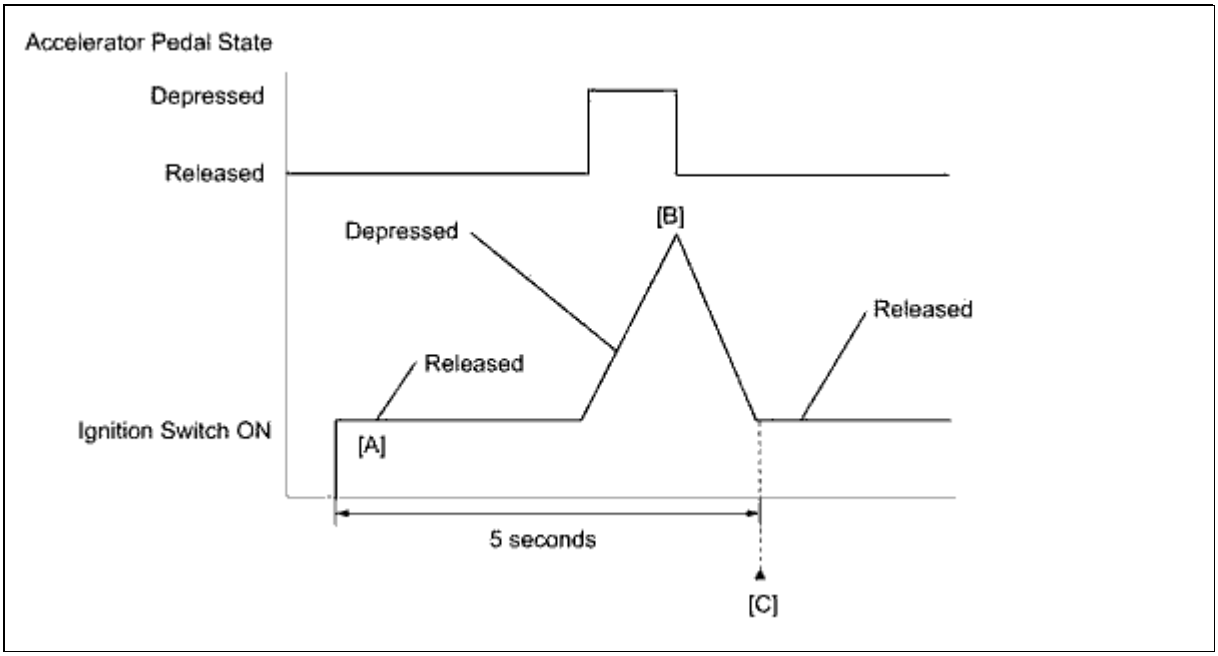
One of the following conditions is met:	Condition A or B
Condition A	-
Difference between VPA and VPA2 voltages	0.02 V or less
Condition B	-
VPA voltage	0.4 V or less
VPA2 voltage	1.2 V or less

COMPONENT OPERATING RANGE

VPA voltage	0.4 V to 4.8 V
VPA2 voltage	1.2 V to 4.8 V
Difference between VPA and VPA2 voltages	Higher than 0.02 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Fully depress and release the accelerator pedal [B].
7. Check that 5 seconds or more have elapsed since the ignition switch is turned ON.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P2120, P2122, P2123, P2125, P2127, P2128 or P2138.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [C] again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

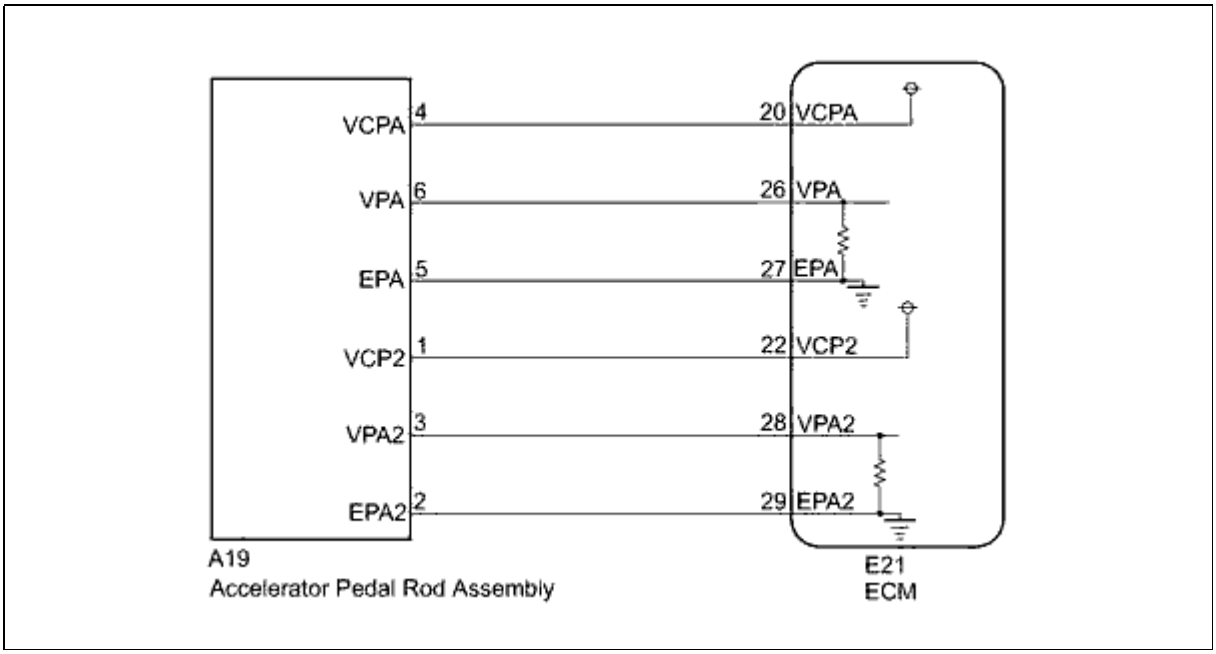
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When any of DTCs P2120, P2121, P2122, P2123, P2125, P2127, P2128 and P2138 is stored, the ECM enters fail-safe mode. If either of the 2 sensor circuit malfunctions, the ECM limits the engine output. If both of the circuits malfunction, the ECM regards the accelerator pedal as being released. As a result, the throttle valve is closed and the engine idles.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is turned off.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- These DTCs relate to the accelerator pedal rod assembly.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ACCEL SENSOR OUT NO. 1 AND NO. 2)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

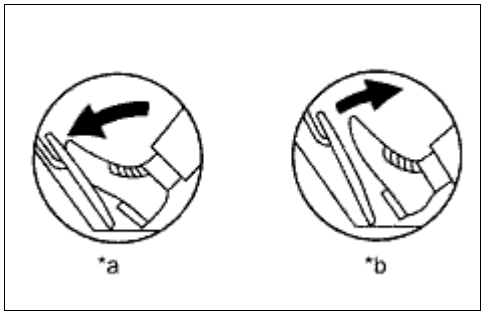
(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) Read the value displayed on the Techstream.

Standard Voltage:

ACCELERATOR PEDAL OPERATION	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2	DIFFERENCE BETWEEN ACCEL SENSOR OUT NO. 1 AND ACCEL SENSOR OUT NO. 2
Released	0.5 to 1.1 V	1.2 to 2.0 V	More than 0.02 V
Depressed	2.6 to 4.5 V	3.4 to 4.75 V	



Text in Illustration

*a	Depressed
*b	Released

OK ▶ **GO TO STEP 5**

NG ▶ **GO TO STEP 2**

2.	**CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL ROD ASSEMBLY - ECM)**

(a) Disconnect the A19 accelerator pedal rod assembly connector.

(b) Disconnect the E21 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A19-6 (VPA) - E21-26 (VPA)	Always	Below 1 Ω
A19-5 (EPA) - E21-27 (EPA)	Always	Below 1 Ω
A19-4 (VCPA) - E21-20 (VCPA)	Always	Below 1 Ω
A19-3 (VPA2) - E21-28 (VPA2)	Always	Below 1 Ω

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A19-2 (EPA2) - E21-29 (EPA2)	Always	Below 1 Ω
A19-1 (VCP2) - E21-22 (VCP2)	Always	Below 1 Ω
A19-6 (VPA) or E21-26 (VPA) - Body ground	Always	10 kΩ or higher
A19-5 (EPA) or E21-27 (EPA) - Body ground	Always	10 kΩ or higher
A19-4 (VCPA) or E21-20 (VCPA) - Body ground	Always	10 kΩ or higher
A19-3 (VPA2) or E21-29 (VPA2) - Body ground	Always	10 kΩ or higher
A19-2 (EPA2) or E21-29 (EPA2) - Body ground	Always	10 kΩ or higher
A19-1 (VCP2) or E21-22 (VCP2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF ACCELERATOR PEDAL ROD ASSEMBLY)**

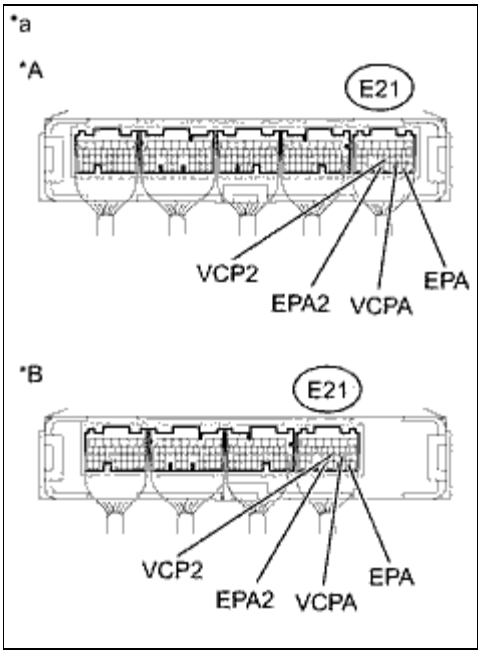
(a) Disconnect the A19 accelerator pedal rod assembly connector.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E21-20 (VCPA) - E21-27 (EPA)	Ignition switch ON	4.5 to 5.5 V
E21-22 (VCP2) - E21-29 (EPA2)	Ignition switch ON	4.5 to 5.5 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

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NG ▶ REPLACE ECM

OK
▼

4.	REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

(a) Replace the accelerator pedal rod assembly INFO .

NEXT
▼

5.	CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL SENSOR DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output	A
DTC is not output	B

B ▶ END

A ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000PFZ0Z4X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2121; Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance; 2016 MY Tacoma [08/2015 -]		

DTC	**P2121**	**Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance**

DESCRIPTION

HINT:

- Refer to DTC P2120 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2121	Either of following conditions 1 or 2 met for 0.5 seconds (1 trip detection logic) 1. Difference between VPA and VPA2 is less than 0.4 V, or more than 1.2 V. (learned value of accelerator off position) 2. Difference between VPA and VPA2 is greater than or equal to the specified value.	• Accelerator pedal sensor circuit • Accelerator pedal rod assembly • ECM

MONITOR DESCRIPTION

The accelerator pedal rod assembly is mounted on the accelerator pedal sensor bracket. The accelerator pedal rod assembly has 2 sensor elements and 2 signal outputs: VPA and VPA2. VPA is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA. When the difference between the voltage outputs of VPA and VPA2 deviates from the standard, the ECM determines that the accelerator pedal sensor is malfunctioning. The ECM turns on the MIL and the DTC is stored.

MONITOR STRATEGY

Related DTCs	P2121: Accelerator Pedal Position Sensor Rationality
Required Sensors/Components (Main)	Accelerator pedal rod assembly
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	-: Case 1 0.5 seconds: Case 2
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All Case 1 and Case 2

Monitor runs whenever following DTCs are not stored	None

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One of the following conditions is met:	1 or 2
1. Ignition switch	ON
2. Command to electronic throttle actuator power	ON
Accelerator pedal position sensor(P2120, P2122, P2123, P2125, P2127, P2128, P2138)	Not detected

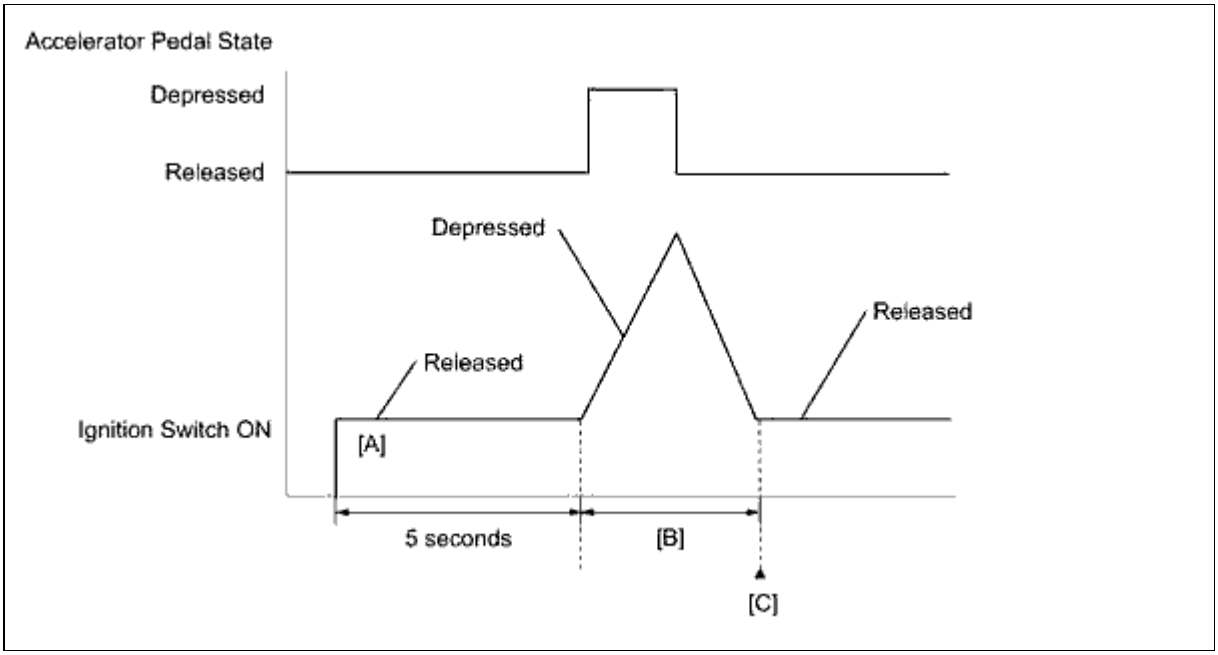
Case 2

One of the following conditions is met:	a or b
a) VPA voltage - Learned VPA accelerator off position voltage	0.04 V or higher
b) VPA2 voltage - Learned VPA2 accelerator off position voltage	0.04 V or higher

TYPICAL MALFUNCTION THRESHOLDS

Difference between VPA voltage and VPA2 voltage (learned value of accelerator off position)	Less than 0.4 V, or higher than 1.2 V
|(VPA voltage - Learned VPA accelerator off position voltage) - (VPA2 voltage - Learned VPA2 accelerator off position voltage)|	0.165 V or higher (varies with accelerator position)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait for 5 seconds after turning the ignition switch to ON.
7. Operate the accelerator pedal in accordance with the following procedure [B].

    a. Enter the following menus: Powertrain / Engine and ECT / Data List / Gas Throttle / Accel Sens. No. 1 Volt %, and Accel Sens. No.2 Volt %.

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b. Slowly depress the accelerator pedal until Accel Sens. No.1 Volt % is approximately 30% and Accel Sens. No.2 Volt % is approximately 46%, then slowly release the accelerator pedal.

8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [C].
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P2121.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [C] again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

The accelerator pedal position sensor has two (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the two sensor circuits and switches to fail-safe mode. In fail-safe mode, the ECM limits the engine output. If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal as being fully closed. In this case, the throttle valve remains closed as if the engine is idling.

If a pass condition is detected and then the ignition switch is turned off, the fail-safe operation stops and the system returns to a normal condition.

WIRING DIAGRAM

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Refer to DTC P2120 INFO .

INSPECTION PROCEDURE

HINT:

- This DTC relates to the accelerator pedal rod assembly.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2121)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2121 is output	A
DTC P2121 and other DTCs are output	B

HINT:

If any DTCs other than P2121 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**READ VALUE USING TECHSTREAM (ACCEL SENSOR OUT NO. 1 AND NO. 2)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

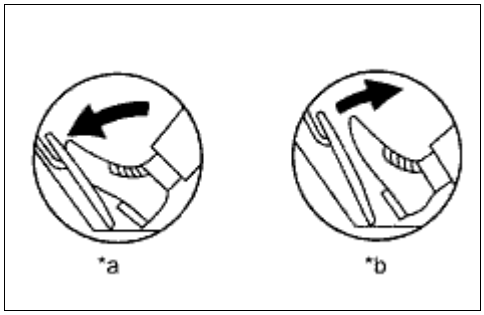
(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) Read the values displayed on the Techstream.

Standard Voltage:

ACCELERATOR PEDAL OPERATION	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 4.75 V



Text in Illustration

*a	Depressed
*b	Released

NG ▶ **GO TO STEP 3**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

3.	REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

(a) Replace the accelerator pedal rod assembly INFO .

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL ROD ASSEMBLY DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off.

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(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2121 is output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013HA00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2195,P2196; Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P2195**	**Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)**

DTC	**P2196**	**Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)**

DESCRIPTION

- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

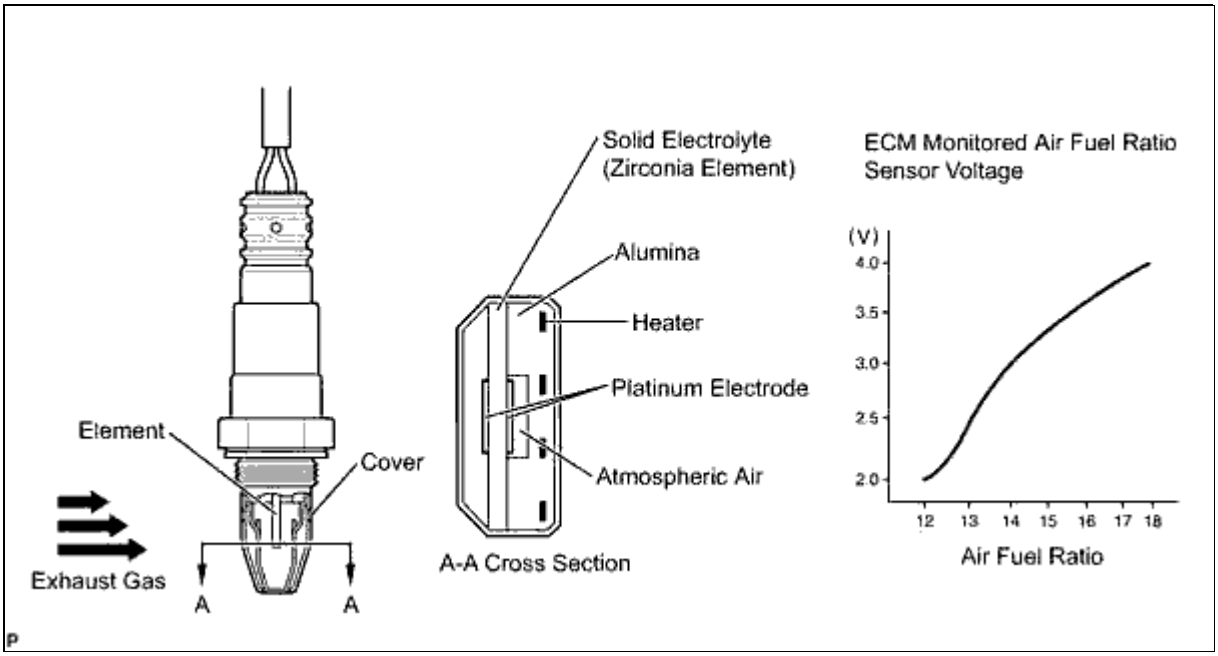
The air fuel ratio sensor generates a voltage* that corresponds to the actual air fuel ratio. This sensor voltage is used to provide the ECM with feedback so that it can control the air fuel ratio. The ECM determines the deviation from the stoichiometric air fuel ratio level, and regulates the fuel injection time. If the air fuel ratio sensor malfunctions, the ECM is unable to control the air fuel ratio accurately.

The air fuel ratio sensor is the planar type and is integrated with the heater, which heats the solid electrolyte (zirconia element). This heater is controlled by the ECM. When the intake air volume is low (the exhaust gas temperature is low), current flows into the heater to heat the sensor, in order to facilitate accurate air fuel ratio detection. The heat generated by the heater is conducted to the solid electrolyte through the alumina, and therefore the sensor activation is accelerated.

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx) components in the exhaust gas, a three-way catalytic converter is used. For the most efficient use of the three-way catalytic converter, the air fuel ratio must be precisely controlled so that it is always close to the stoichiometric level.

*: Value changes inside the ECM. Since the air fuel ratio sensor is the current output element, a current is converted to a voltage inside the ECM. Any measurements taken at the air fuel ratio sensor or ECM connectors will show a constant voltage.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2195	Conditions (a) and (b) continue for 5 seconds or more (2 trip detection logic): (a) Air fuel ratio sensor voltage higher than 3.8 V (b) Heated oxygen sensor voltage rises from less than 0.21 V.	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • Air fuel ratio sensor heater • A/F HTR relay • Intake system • Exhaust system • Fuel line • Fuel pressure • Fuel injector assembly • ECM
P2195	While fuel-cut operation performed (during vehicle deceleration), air fuel ratio sensor current 2.2 mA or higher for 3 seconds. (2 trip detection logic)	• Air fuel ratio sensor • ECM
P2196	Conditions (a) and (b) continue for 5 seconds or more (2 trip detection logic): (a) Air fuel ratio sensor voltage less than 2.8 V for 10 seconds (b) Heated oxygen sensor voltage falls from 0.71 V.	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • Air fuel ratio sensor heater • A/F HTR relay • Intake system • Exhaust system • Fuel line • Fuel pressure • Fuel injector assembly • ECM

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2196	While fuel-cut operation performed (during vehicle deceleration), air fuel ratio sensor current less than 0.7 mA for 3 seconds. (2 trip detection logic)	• Air fuel ratio sensor • ECM

HINT:

- When any of these DTCs are stored, check the air fuel ratio sensor voltage output by entering the following menus: Powertrain / Engine and ECT / Data List / AFS Voltage B1S1.
- Short-term fuel trim values can also be read using the Techstream.
- The ECM regulates the voltages at the A1A+ and A1A- terminals of the ECM to a constant level. Therefore, the air fuel ratio sensor voltage output cannot be confirmed without using the Techstream.
- If the air fuel ratio sensor is malfunctioning, the ECM stores the DTC P2195 or P2196.

MONITOR DESCRIPTION

1. Sensor voltage detection monitor

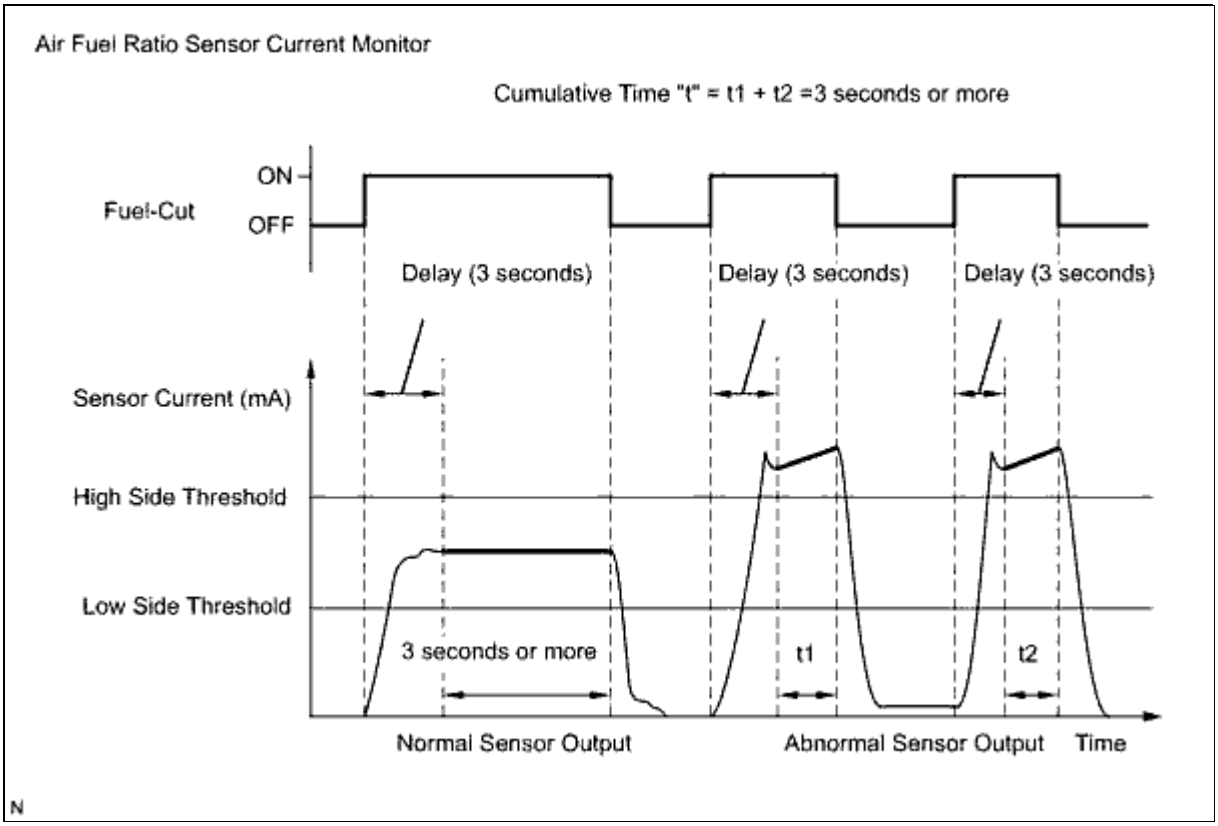
Under air fuel ratio feedback control, If the air fuel ratio sensor output voltage is less than 2.8 V (very rich condition) for 5 seconds despite the rear heated oxygen sensor output voltage being less than 0.71 V, the ECM stores DTC P2196. Alternatively, if the air fuel ratio sensor output voltage is higher than 3.8 V (very lean condition) for 5 seconds despite the rear heated oxygen sensor output voltage being 0.21 V or higher, DTC P2195 is stored.

2. Sensor current detection monitor

A rich air fuel mixture causes a low air fuel ratio sensor current, and a lean air fuel mixture causes a high air fuel ratio sensor current. Therefore, the sensor output becomes low during acceleration, and it becomes high during deceleration with the throttle valve fully closed. The ECM monitors the air fuel ratio sensor current during fuel-cut and detects any abnormal current values.

If the air fuel ratio sensor output is 2.2 mA or higher for more than 3 seconds of cumulative time, the ECM interprets this as a malfunction in the air fuel ratio sensor and stores DTC P2195 (stuck on high side). If the air fuel ratio sensor output is less than 0.7 mA for more than 3 seconds of cumulative time, the ECM stores DTC P2196 (stuck on low side).

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MONITOR STRATEGY

Related DTCs	P2195: Air Fuel Ratio Sensor Signal Stuck Lean P2196: Air Fuel Ratio Sensor Signal Stuck Rich
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Heated oxygen sensor
Frequency of Operation	Continuous
Duration	5 seconds: Sensor voltage detection monitor 3 seconds: Sensor current detection monitor
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

The monitor will run whenever these DTCs are not stored	P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor)

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	P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor) P0505 (Idle Speed Control) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)

Sensor voltage detection monitor

Time after engine start	30 seconds or more
Air fuel ratio sensor status	Activated
Fuel system status	Closed-loop

Sensor current detection monitor

Battery voltage	11 V or higher
Atmospheric pressure	76 kPa(abs) [570 mmHg(abs)] or higher
Air fuel ratio sensor status	Activated
Engine coolant temperature	70°C (158°F) or higher
Continuous time of fuel cut	3 seconds or more, and less than 10 seconds

TYPICAL MALFUNCTION THRESHOLDS

Sensor voltage detection monitor (Lean side malfunction P2195)

Heated oxygen sensor voltage	0.21 or more
Air fuel ratio sensor voltage	Higher than 3.8 V

Sensor voltage detection monitor (Rich side malfunction P2196)

Heated oxygen sensor voltage	Less than 0.71 V
Air fuel ratio sensor voltage	Less than 2.8 V

Sensor current detection monitor (High side malfunction P2195)

Air fuel ratio sensor current	2.2 mA or higher

Sensor current detection monitor (Rich side malfunction P2196)

Air fuel ratio sensor current	Less than 0.7 mA

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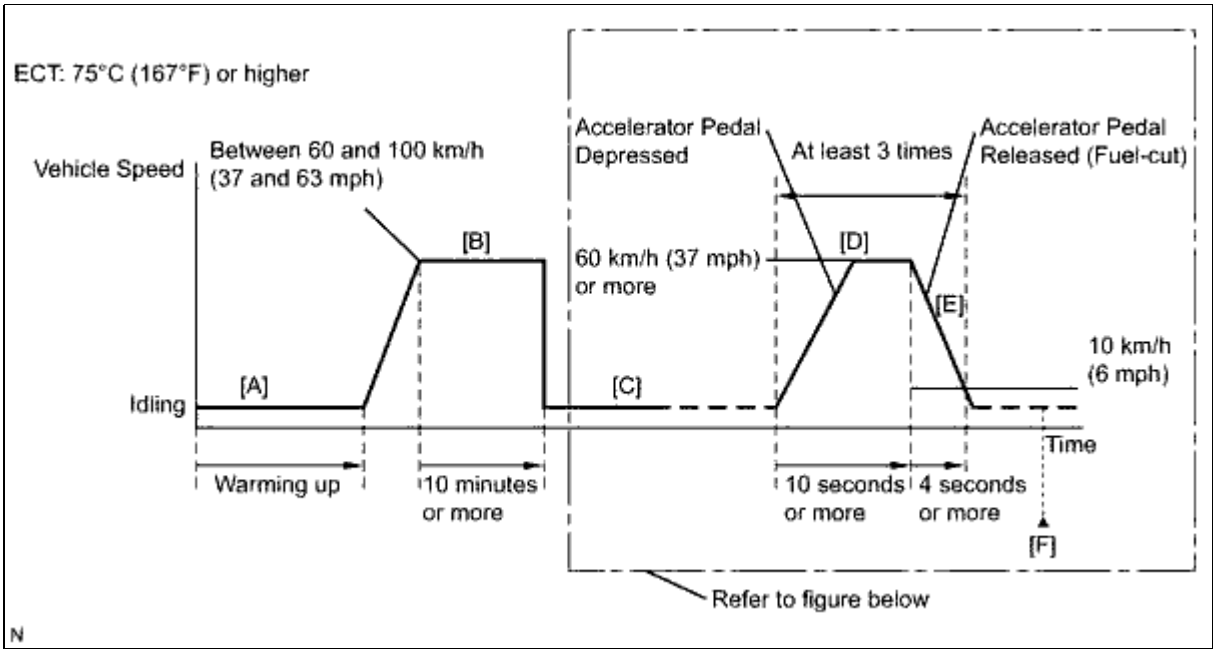
MONITOR RESULT

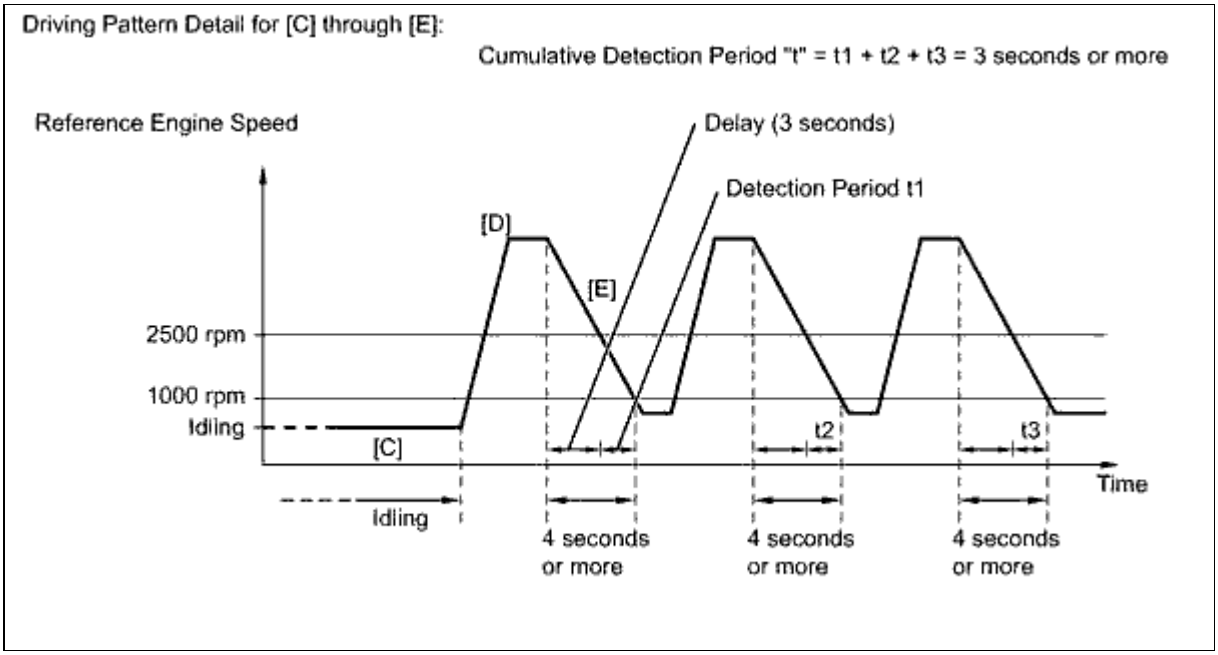
Refer to Checking Monitor Status INFO .

WIRING DIAGRAM

Refer to DTC P0031 INFO .

CONFIRMATION DRIVING PATTERN





1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.

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6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and warm it up until the ECT reaches 75°C (167°F) or higher [A].
8. On the Techstream, enter the following menus to check the fuel-cut status: Powertrain / Engine and ECT / Data List / Idle Fuel Cut.
9. Drive the vehicle at a speed between 60 and 100 km/h (37 and 63 mph) for at least 10 minutes [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

10. With the shift lever in 2nd range (for Automatic Transmission) or 2nd gear (for Manual Transmission) [C].
11. Accelerate the vehicle to 60 km/h (37 mph) or more by depressing the accelerator pedal for at least 10 seconds [D].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

12. Soon after performing step [D] above, release the accelerator pedal for at least 4 seconds without depressing the brake pedal in order to execute fuel-cut control [E].

HINT:

Fuel-cut is performed when the following conditions are met:

- Accelerator pedal is fully released.
- Engine speed is 2500 rpm or more (fuel injection returns at 1000 rpm).

13. Allow the vehicle to decelerate until the vehicle speed decreases to less than 10 km/h (6 mph).
14. Repeat steps [C] through [E] above at least 3 times in one driving cycle.
15. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [F].
16. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

17. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
18. Input the DTC: P2195 or P2196.
19. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform steps [B] through [F] again.

20. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2195 or P2196 is output	A
DTC P2195 or P2196 and P0136, P0137 or P0138 are output	
DTC P2195 or P2196 and other DTCs are output	B

HINT:

If any DTCs relating to the air fuel ratio sensor (DTCs for the air fuel ratio sensor heater or air fuel ratio sensor admittance) are output, troubleshoot those DTCs first.

B GO TO DTC CHART

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A

2.	**CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

(a) Has the vehicle run out of fuel in the past?

NO ▶ **GO TO STEP 4**

YES

3.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P2195 or P2196 is output)	B

B ▶ **GO TO STEP 4**

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A ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

4.	**READ VALUE USING TECHSTREAM (TEST VALUE OF AIR FUEL RATIO SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(f) Enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / O2 Sensor / current.

(g) Check that the status of O2 Sensor is Complete. If the status is still Incomplete, drive the vehicle according to the driving pattern again.

(h) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details / RANGE B1S1.

(i) Check the test value of the air fuel ratio sensor output current during fuel-cut.

Result

RESULT	PROCEED TO
Within normal range (0.7 mA or higher, and less than 2.2 mA)	A
Outside normal range (less than 0.7 mA, or 2.2 mA or higher)	B

B ▶ **GO TO STEP 14**

A

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine and run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

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(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(f) Perform the Control the Injection Volume for A/F Sensor operation with the engine idling (press the -12.5 or 12.5 button to change the fuel injection volume).

(g) Monitor the voltage outputs of the air fuel ratio sensor and the heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers or increases the fuel injection volume by 12.5%.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	12.5%	Rich	Below 3.1 V
	-12.5%	Lean	Higher than 3.4 V
O2S B1S2 (Heated oxygen)	12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

Result

STATUS OF AFS VOLTAGE B1S1	STATUS OF O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	PROCEED TO
Lean	Lean	Actual air fuel ratio lean	A
Rich	Rich	Actual air fuel ratio rich	
Lean	Lean/Rich	Air fuel ratio sensor malfunction	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	
Lean/Rich	Lean/Rich	Normal	

Lean: During Control the Injection Volume for A/F Sensor Active Test, the air fuel ratio sensor output voltage (AFS Voltage B1S1) is consistently higher than 3.4 V, and the heated oxygen sensor output voltage (O2S B1S2) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor Active Test, the AFS Voltage B1S1 is consistently less than 3.1 V, and the O2S B1S2 is consistently higher than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor Active Test, the output voltage of the heated oxygen sensor alternates correctly.

HINT:

Refer to "Data List / Active Test" [AFS Voltage B1S1 and O2S B1S2] INFO .

B GO TO STEP 14

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A

6.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks.

OK:

No leaks in the intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK

7.	CHECK FOR EXHAUST GAS LEAK

(a) Check the exhaust gas leaks.

OK:

No gas leaks.

HINT:

Perform "Inspection After Repairs" after repairing or replacing the exhaust system INFO .

NG ▶ REPAIR OR REPLACE EXHAUST SYSTEM

OK

8.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG ▶ GO TO STEP 16

OK

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9.	**INSPECT FUEL INJECTOR ASSEMBLY**

(a) Check the fuel injector assembly injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

OK

10.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT

11.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

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(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P2195 or P2196 is output)	A
NORMAL (DTC is not output)	B

B ▶ **END**

A

▼

12.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT

▼

13.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

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(l) Check the DTC judgment.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

NEXT **END**

14.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT

15.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

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(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P2195 or P2196 is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

16.	**CHECK FUEL LINE**

(a) Check the fuel lines for leaks or blockage.

HINT:

Perform "Inspection After Repair" after replacing the fuel suction tube with pump and gauge assembly INFO .

NG ▶ **REPAIR OR REPLACE FUEL LINE**

OK ▶ **REPLACE FUEL SUCTION TUBE WITH PUMP AND GAUGE ASSEMBLY**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000004GKG03KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P219A,P219C-P219F; Bank 1 Air-Fuel Ratio Imbalance; 2016 MY Tacoma [08/2015 -]		

DTC	**P219A**	**Bank 1 Air-Fuel Ratio Imbalance**

DTC	**P219C**	**Cylinder 1 Air-Fuel Ratio Imbalance**

DTC	**P219D**	**Cylinder 2 Air-Fuel Ratio Imbalance**

DTC	**P219E**	**Cylinder 3 Air-Fuel Ratio Imbalance**

DTC	**P219F**	**Cylinder 4 Air-Fuel Ratio Imbalance**

DESCRIPTION

Refer to P0300 INFO .

Refer to P2195 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P219A	The difference in air fuel ratios between the cylinders exceeds the threshold. (2 trip detection logic)	• Fuel injector assembly • Intake system • Gas leak from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM
P219C	The difference in air fuel ratios between the cylinders exceeds the threshold. (2 trip detection logic)	• Fuel injector assembly • Intake system • Gas leak from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P219D	The difference in air fuel ratios between the cylinders exceeds the threshold. (2 trip detection logic)	• Fuel injector assembly • Intake system • Gas leak from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM
P219E	The difference in air fuel ratios between the cylinders exceeds the threshold. (2 trip detection logic)	• Fuel injector assembly • Intake system • Gas leak from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM
P219F	The difference in air fuel ratios between the cylinders exceeds the threshold. (2 trip detection logic)	• Fuel injector assembly • Intake system • Gas leak from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM

MONITOR DESCRIPTION

Fuel System Air Fuel Ratio Cylinder Imbalance Monitor

The ECM uses the air fuel ratio sensor and crankshaft position sensor to monitor the difference in air fuel ratios between the cylinders caused by differences in injection volumes between the cylinders, leakage in the intake or exhaust system, etc.

When the air fuel ratios of the cylinders are lean or rich with respect to each other, the ECM determines that a problem is present and stores the DTC.

Air Fuel Ratio Sensor Monitoring Method: P219A is stored primarily when a rich side imbalance is detected.

When the system detects a difference in air fuel ratios between the cylinders due to fluctuation in the air fuel ratio sensor output over 1 engine cycle (2 crankshaft revolutions), the system determines that there is a problem.

Crankshaft Position Sensor Monitoring Method: P219C, P219D, P219E and/or P219F are stored primarily when a lean side imbalance is detected.

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The system monitors the engine speed variation and when the variation becomes large, the system determines that there is a difference in air fuel ratios between the cylinders, which it determines to be a problem.

MONITOR STRATEGY

Related DTCs	P219A: Air Fuel Ratio Cylinder Imbalance Monitor P219C: Air fuel ratio cylinder imbalance monitor (cylinder 1) P219D: Air fuel ratio cylinder imbalance monitor (cylinder 2) P219E: Air fuel ratio cylinder imbalance monitor (cylinder 3) P219F: Air fuel ratio cylinder imbalance monitor (cylinder 4)
Required Sensors/Components (Main)	Air fuel ratio sensor Crankshaft position sensor
Required Sensors/Components (Related)	Mass air flow meter Engine coolant temperature sensor Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds: Air fuel ratio sensor monitoring method 30 seconds: Crankshaft position sensor monitoring method
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0500 (Vehicle Speed Sensor) P2440, P2441, P2444, P2445 (Secondary Air Injection System)

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P219A Air Fuel Ratio Sensor Monitoring Method

Air fuel ratio sensor status	Activated
Engine speed	1400 rpm or more, and less than 2200 rpm (for Automatic Transmission) 1400 rpm or more, and less than 2400 rpm (for Manual Transmission)
Engine coolant temperature	70°C (158°F) or higher
Mass air flow	34 g/sec. or more, and less than 45 g/sec. (for Automatic Transmission) 31 g/sec. or more, and less than 45 g/sec. (for Manual Transmission)
Fuel system status	Closed loop
Atmospheric pressure	76 kPa (570 mmHg) or higher

P219C, P219D, P219E, P219F Crankshaft Position Sensor Monitoring Method

Vehicle speed	Less than 3 km/h (1.875 mph)
Engine speed	425 rpm or more, and less than 1150 rpm (for Automatic Transmission) 500 rpm or more, and less than 1150 rpm (for Manual Transmission)
Engine coolant temperature	70°C (158°F) or higher
Air fuel ratio sensor status	Activated
Battery voltage	11 V or higher
Fuel system status	Closed loop

TYPICAL MALFUNCTION THRESHOLDS

P219A Air Fuel Ratio Sensor Monitoring Method

Air fuel ratio sensor monitoring method criteria (rich side imbalance)	0.361 or more

P219C, P219D, P219E and P219F Crankshaft Position Sensor Monitoring Method

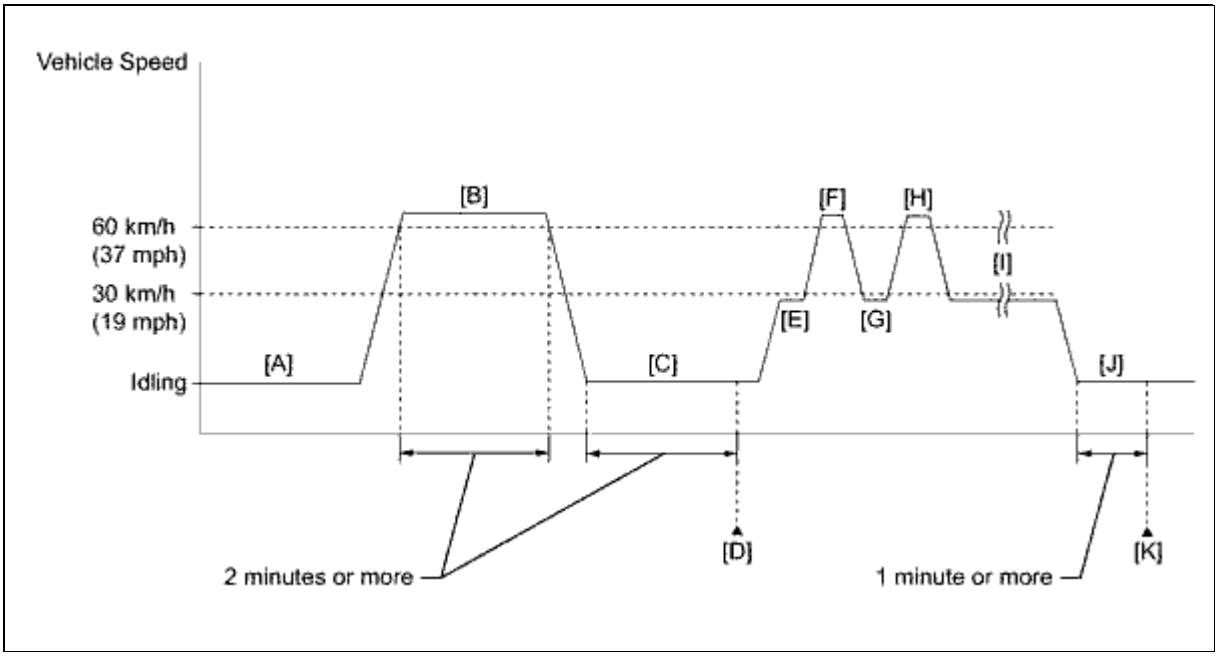
Crankshaft position sensor monitoring method criteria (lean side imbalance)	1 or more

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [A].

HINT:

The A/C switch and all accessory switches should be off and the shift lever should be in P or N (for Automatic Transmission), or neutral (for Manual Transmission).

8. Drive the vehicle at 60 km/h (37 mph) or higher for 2 minutes or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

It is acceptable to turn electrical loads on while driving.

9. Idle the engine for 2 minutes or more [C].

HINT:

The A/C switch and all accessory switches should be off and the shift lever should be in P or N (neutral).

10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [D].
11. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

12. Drive the vehicle at less than 30 km/h (19 mph) for 5 seconds or more [E].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

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13. Accelerate the vehicle from 30 to 60 km/h (19 to 37 mph) over a period of approximately 10 to 20 seconds.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Refer to the values of mass air flow and engine speed in Typical Enabling Conditions before accelerating the vehicle from 30 to 60 km/h (19 to 37 mph).

14. Drive the vehicle at 60 km/h (37 mph) or more for 5 seconds or more [F].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

15. Drive the vehicle at less than 30 km/h (19 mph) for 5 seconds or more [G].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

16. Accelerate the vehicle from 30 to 60 km/h (19 to 37 mph) over a period of approximately 10 to 20 seconds.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Refer to the values of mass air flow and engine speed in Typical Enabling Conditions before accelerating the vehicle from 30 to 60 km/h (19 to 37 mph).

17. Drive the vehicle at 60 km/h (37 mph) or more for 5 seconds or more [H].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

18. Repeat steps [G] through [H] above at least 2 times [I].
19. Idle the engine for 1 minute or more [J].

HINT:

The A/C switch and all accessory switches should be off and the shift lever should be in P or N (for Automatic Transmission), or neutral (for Manual Transmission).

20. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes [K].
21. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

22. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
23. Input the DTC: P219A, P219C, P219D, P219E or P219F.
24. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the following procedure.

25. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to Fuel Injector Circuit INFO .

INSPECTION PROCEDURE

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- When any air fuel ratio imbalance is detected, the ECM will perform air fuel ratio feedback control to make the air fuel ratio close to the stoichiometric level. This may result in an air fuel ratio imbalance of normal cylinders and DTCs may be stored.
- Refer to A/F Sensor Determination (worst value) #1, Engine Speed Fluctuation Avg (worst value) #1 to #4, Cylinder #1 to #4 Misfire Count, Short FT #1 and Long FT #1 in the Data List / Active Test INFO .

PROCEDURE

1.	**CHECK FOR ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P219A, P219C, P219D, P219E and/or P219F is output	A
DTC P219A, P219C, P219D, P219E and/or P219F and other DTCs are output	B

HINT:

If any DTCs other than P219A, P219C, P219D, P219E and/or P219F are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**READ VALUE USING TECHSTREAM (FREEZE FRAME DATA)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Freeze Frame Data Item for DTC P219A, P219C, P219D, P219E and/or P219F

- Vehicle Speed
- Engine Speed
- Calculate Load
- Accelerator Idle Position
- Short FT #1
- Long FT #1
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count
- A/F Sensor Determination (worst value) #1
- Engine Speed Fluctuation Avg (worst value) #1 to #4

HINT:

When the sum of Short FT #1 and Long FT #1 is positive, the engine is running lean, and when the sum is negative, the engine is running rich.

AIR FUEL RATIO SENSOR MONITORING METHOD (P219A)	CRANKSHAFT POSITION SENSOR MONITORING METHOD (P219C, P219D, P219E AND P219F)	NOTE
DTCs are output	DTC is output (Only one DTC relating to a single cylinder is	Malfunctioning of cylinders detected by Crankshaft Position Sensor Monitoring Method

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AIR FUEL RATIO SENSOR MONITORING METHOD (P219A)	CRANKSHAFT POSITION SENSOR MONITORING METHOD (P219C, P219D, P219E AND P219F)	NOTE
	output)	is primarily suspected
DTCs are output	DTCs are output (Multiple DTCs relating to multiple cylinders are output)	Malfunctioning of cylinders except ones detected by Crankshaft Position Sensor Monitoring Method is primarily suspected.*
DTCs are not output	DTCs are output	Malfunctioning of cylinders detected by Crankshaft Position Sensor Monitoring Method is primarily suspected.
DTCs are output	DTCs are not output	Malfunctioning of the bank detected by Air Fuel Ratio Sensor Monitoring Method is primarily suspected

*: When any air-fuel ratio imbalance is detected, the ECM will perform air-fuel ratio feedback control to make the air-fuel ratio close to the stoichiometric level. This may result in an air-fuel ratio imbalance of normal cylinders and DTCs may be stored.

NEXT

3.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

HINT:

- If any misfire count ("Cylinder #1 Misfire Count" to "Cylinder #4 Misfire Count) increases while idling or driving the vehicle, proceed to step 6.
- Perform inspections while focusing on the cylinder whose misfire count has increased.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

Result

RESULT	PROCEED TO
DTC P219A is output	A
DTC P219A, and P219C, P219D, P219E or P219F is output	B
DTC P219C, P219D, P219E and/or P219F is output	

NEXT

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4.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

HINT:

The A/C switch and all accessory switches should be off and the shift lever should be in P or N (for Automatic Transmission), or neutral (for Manual Transmission).

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume / Data List / Cylinder #1 to #4 Misfire Count.

HINT:

When the "Control the Injection Volume" Active Test is selected (injection volume is 0%), if a misfire count increases, proceed to step 6 (Check Intake System).

(f) Perform the Control the Injection Volume operation with the engine idling.

(g) Check the misfire counts ("Cylinder #1 Misfire Count" to "Cylinder #4 Misfire Count") while decreasing the injection volume in 5% increments.

NOTICE:

Do not decrease the injection volume by more than 20%.

The cylinder whose misfire count has not increased can be assumed to be running rich. Therefore, perform inspections while focusing on that cylinder.

NEXT

5.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system INFO .

NG **REPAIR OR REPLACE EXHAUST SYSTEM**

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OK

6.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leakage.

OK:

No leakage in intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

7.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the cylinder causing the imbalance INFO .

HINT:

Perform "Inspection After Repair" after replacing the spark plug INFO .

NG ▶ **REPLACE SPARK PLUG**

OK

8.	CHECK FOR SPARK (SPARK TEST)

(a) Perform a spark test INFO .

HINT:

- If the result of the spark test is normal, proceed to the next step.
- Perform "Inspection After Repair" after replacing the spark plug INFO .

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NEXT

9.	**CHECK CYLINDER COMPRESSION PRESSURE**

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NG ▶ **CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION**

OK

10.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF FUEL INJECTOR ASSEMBLY)** INFO

NG ▶ **GO TO FUEL INJECTOR CIRCUIT**

OK

11.	**CHECK FUEL INJECTOR ASSEMBLY OF CYLINDER CAUSING IMBALANCE**

(a) Check the fuel injector injection [whether fuel volume is high or low, and whether injection pattern is poor] INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

OK

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12.	CHECK FOR CAUSE OF FAILURE

(a) If the cause of the problem has not been found even after performing the troubleshooting procedure, perform the inspection below.

(b) Check the intake valve for deposits.

HINT:

As the DTC may have been stored due to deposits on the intake valve, remove the cylinder head and check the intake valve.

NEXT

13.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Check for DTCs.

DTCs are not output.

NEXT **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013H900DX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2237-P2239,P2252,P2253; Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1); 2016 MY Tacoma [08/2015 -]		

DTC	**P2237**	**Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)**

DTC	**P2238**	**Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)**

DTC	**P2239**	**Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)**

DTC	**P2252**	**Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)**

DTC	**P2253**	**Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)**

DESCRIPTION

HINT:

- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.
- Refer to DTC P2195 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2237	An open in the circuit between terminals A1A+ and A1A- of the air fuel ratio sensor while the engine is running (2 trip detection logic)	• Open in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM
P2238	• Case 1 Condition (a) or (b) continues for 5.0 seconds or more (2 trip detection logic) (a) Voltage at terminal A1A+ is 0.5 V or less. (b) Voltage difference between terminals A1A+ and A1A- is 0.1 V or less. • Case 2: Air fuel ratio sensor admittance: Less than 0.0054 1/Ω (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2239	The A1A+ voltage is higher than 4.5 V (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM
P2252	The A1A- voltage is 0.5 V or less (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM
P2253	The A1A- voltage is higher than 4.5 V (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM

MONITOR DESCRIPTION

These DTCs are output when there is an open or short in the air fuel ratio sensor circuit, or if air fuel ratio sensor output drops.

To detect these problems, the voltage of the air fuel ratio sensor is monitored when turning the ignition switch to the ON position, and the admittance (admittance is an electrical term that indicates the ease of flow of current) is checked while driving. If the voltage of the air fuel ratio sensor is between 0.6 V and 4.5 V, it is considered normal. If the voltage is outside of the specified range, or the admittance is less than the standard value, the ECM will determine that there is a malfunction in the air fuel ratio sensor. If the same malfunction is detected in the next driving cycle, the MIL is illuminated and a DTC is stored.

MONITOR STRATEGY

Related DTCs	P2237: Air Fuel Ratio Sensor Open Circuit between A1A+ and A1A- P2238: Low Impedance P2238: Air Fuel Ratio Sensor Short Circuit between A1A+ and A1A- P2238: Air Fuel Ratio Sensor Short Circuit between A1A+ and GND P2239: Air Fuel Ratio Sensor Short Circuit between A1A+ and +B P2252: Air fuel Ratio Sensor Short Circuit between A1A- and GND P2253: Air Fuel Ratio Sensor Short Circuit between A1A- and +B
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Engine coolant temperature sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	P2237: 10 seconds P2238 (air fuel ratio sensor low admittance): 10 seconds Others: 5 seconds
MIL Operation	2 driving cycles

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Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not stored	P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0412, P0418, P1613 (Secondary Air Injection System Control) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor) P0505 (Idle Speed Control) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2440, P2441, P2444, P2445 (Secondary Air Injection System)

Air fuel ratio sensor open circuit between A1A+ and A1A-

Estimated sensor temperature	450 to 550°C (842 to 1022°F)
Engine	Running
Battery voltage	11 V or higher
Ignition switch	ON
Time after Ignition switch is OFF to ON	5 seconds or more

Air fuel ratio sensor low impedance

Estimated sensor temperature	700 to 800°C (1292 to 1472°F)
Engine coolant temperature	0°C (32°F) or higher
Fuel cut	Not executed

Air fuel ratio sensor short circuit between A1A+ and A1A-, GND

Battery voltage	11 V or higher
Ignition switch	ON
Time after ignition switch off to ON	5 seconds or more

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Others:

Battery voltage	11 V or higher
Ignition switch	ON
Time after ignition switch off to ON	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P2237 (Air Fuel Ratio Sensor Open Circuit Between A1A+ and A1A-)

Air fuel ratio sensor admittance	Below 0.0018 1/Ω

P2238 (Air Fuel Ratio Sensor Low Impedance)

Air fuel ratio sensor admittance	Below 0.0054 1/Ω

P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and GND)

A1A+ terminal voltage	0.5 V or less

P2239 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and +B)

A1A+ terminal voltage	Higher than 4.5 V

P2252 (Air Fuel Ratio Sensor Short Circuit Between A1A- and GND)

A1A- terminal voltage	0.5 V or less

P2253 (Air Fuel Ratio Sensor Short Circuit Between A1A- and +B)

A1A- terminal voltage	Higher than 4.5 V

P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and A1A-)

Difference between A1A+ terminal and A1A- terminal voltage	0.1 V or less

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and wait 5 minutes.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.

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- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P2237, P2238, P2239, P2252 or P2253.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, idle the engine for 5 minutes and check the DTC judgment result again.

13. If no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0031 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Refer to "Data List / Active Test" [AFS Voltage B1S1] INFO .

PROCEDURE

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1.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

2.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

NEXT
▼

3.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2237, P2238, P2239, P2252 OR P2253)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to the ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(j) Input the DTC: P2237, P2238, P2239, P2252 or P2253.

(k) Check the DTC judgment.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A

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RESULT	PROCEED TO
ABNORMAL (DTC P2237, P2238, P2239, P2252 or P2253 is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000YER01AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2420; Evaporative Emission System Switching Valve Control Circuit High; 2016 MY Tacoma [08/2015 -]		

DTC	**P2420**	**Evaporative Emission System Switching Valve Control Circuit High**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P2420	Vent valve stuck open (vent)	Following condition met during key-off EVAP monitor: • EVAP pressure change when vent valve closed (ON) below 0.3 kPa(gauge) [2.25 mmHg(gauge)]	• Canister pump module (reference orifice, vacuum pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • Canister assembly (filter inside canister clogged) • ECM	While ignition switch off	2 trip

HINT:

The vent valve is built into the canister pump module.

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

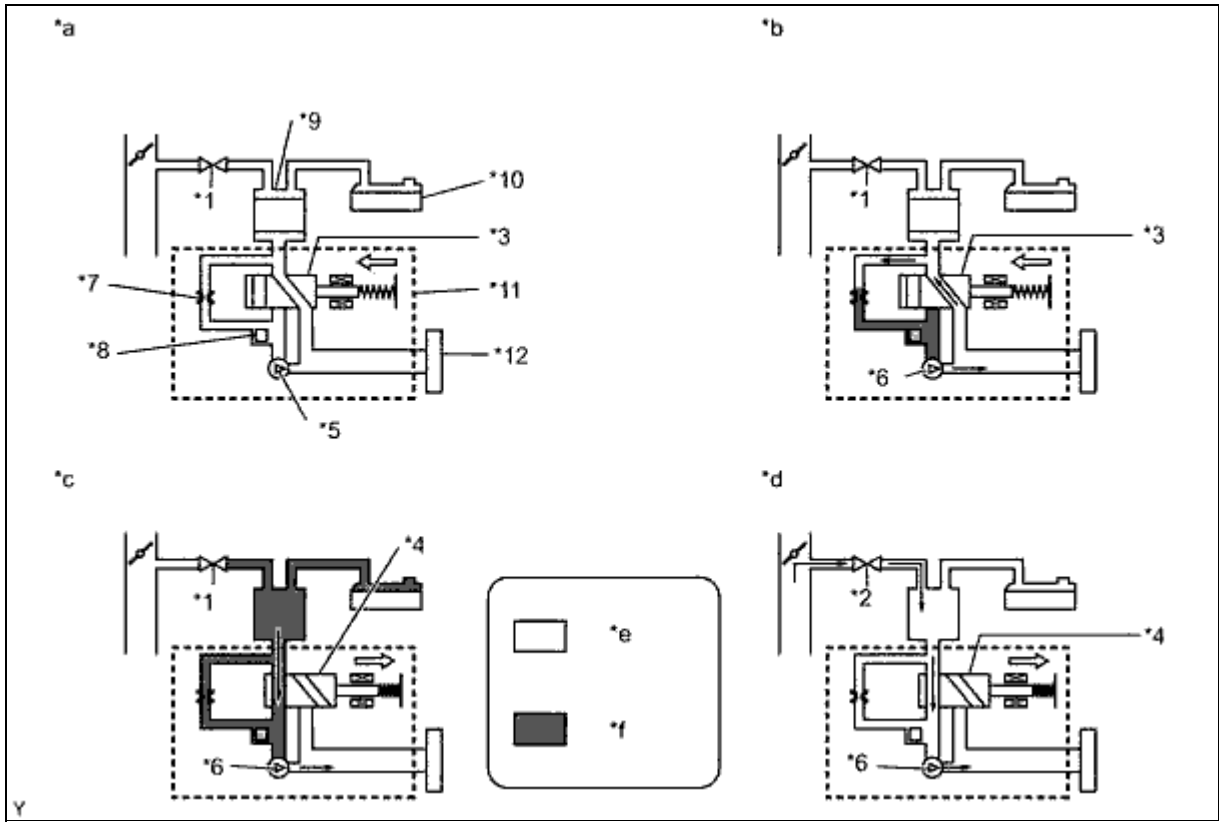
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	Activated by soak timer, 5 hours (7 or 9.5 hours) after ignition switch is turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa(abs) and 110	60 seconds

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SEQUENCE	OPERATION	DESCRIPTION	DURATION
		kPa(abs) [525 mmHg(abs) and 825 mmHg(abs)], ECM cancels EVAP system monitor.	
B	First reference pressure measurement	In order to determine reference pressure, vacuum pump creates negative pressure (vacuum) through reference orifice and then ECM checks if vacuum pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and then EVAP system pressure is measured. Write down measured value as they will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second reference pressure measurement	After second reference pressure measurement, leak check is performed by comparing first and second reference pressure. If stabilized system pressure is higher than second reference pressure, ECM determines that there is a leak in EVAP system.	60 seconds
-	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



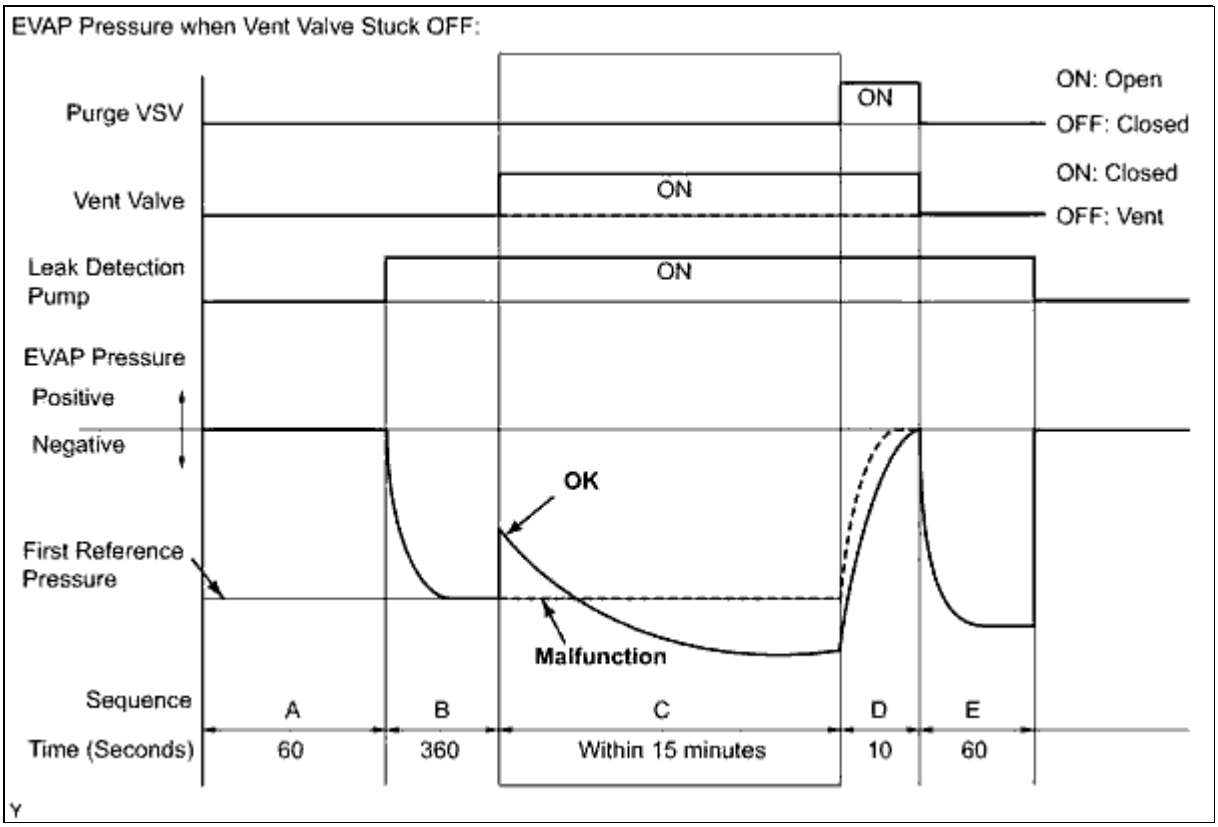
Text in Illustration

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*1	Purge VSV: OFF (closed)	*2	Purge VSV: ON (open)
*3	Vent Valve: OFF (vent)	*4	Vent Valve: ON (closed)
*5	Leak Detection Pump: OFF	*6	Leak Detection Pump: ON
*7	Reference Orifice (0.02 inch)	*8	Canister Pressure Sensor
*9	Canister	*10	Fuel Tank
*11	Canister Pump Module	*12	Canister Filter
*a	Operation A: Atmospheric Pressure Measurement	*b	Operation B, E: Reference Pressure Measurement
*c	Operation C: EVAP System Pressure Measurement	*d	Operation D: Purge VSV Monitor
*e	Atmospheric Pressure	*f	Negative Pressure

P2420: Vent valve stuck open (vent)

In operation C, the vent valve turns ON (closed) and the EVAP system pressure is then measured by the ECM using the canister pressure sensor to conduct an EVAP leak check. If the pressure does not increase when the vent valve is open, the ECM interprets this as the vent valve being stuck open. The ECM illuminates the MIL and stores the DTC.



MONITOR STRATEGY

Required Sensors/Components	Purge VSV Canister pump module
Frequency of Operation	Once per driving cycle

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Duration	Within 7 minutes (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not stored	None
Atmospheric pressure	70 kPa(abs) [525 mmHg(abs)] or higher, and less than 110 kPa(abs) [825 mmHg(abs)]
Battery voltage	10.5 V or higher
Vehicle speed	Less than 4 km/h (2.5 mph)
Ignition switch	OFF
Time after key-off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions met before key-off	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)
Intake air temperature	4.4°C (40°F) or higher, and less than 35°C (95°F)

TYPICAL MALFUNCTION THRESHOLDS

EVAP pressure change after EVAP canister vent valve ON	Less than 0.3 kPa(gauge) [2.25 mmHg(gauge)]

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 6 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
7. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
8. Input the DTC: P2420.
9. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

Refer to the EVAP system INFO .

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013HB05IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2431-P2433; Secondary Air Injection System Air Flow / Pressure Sensor Circuit Range / Performance Bank1; 2016 MY Tacoma [08/2015 -]		

DTC	**P2431**	**Secondary Air Injection System Air Flow / Pressure Sensor Circuit Range / Performance Bank1**

DTC	**P2432**	**Secondary Air Injection System Air Flow / Pressure Sensor Circuit Low Bank1**

DTC	**P2433**	**Secondary Air Injection System Air Flow / Pressure Sensor Circuit High Bank1**

DESCRIPTION

The secondary air injection system consists of an air pump assembly, the air switching valve assembly, an air pressure sensor, the air injection control driver and the ECM. For a short time after cold engine starts, the secondary air injection system pumps secondary air to the exhaust port of the cylinder head to purify the exhaust emissions. The secondary air is supplied by the air pump assembly and is pumped to the exhaust port through the air switching valve assembly.

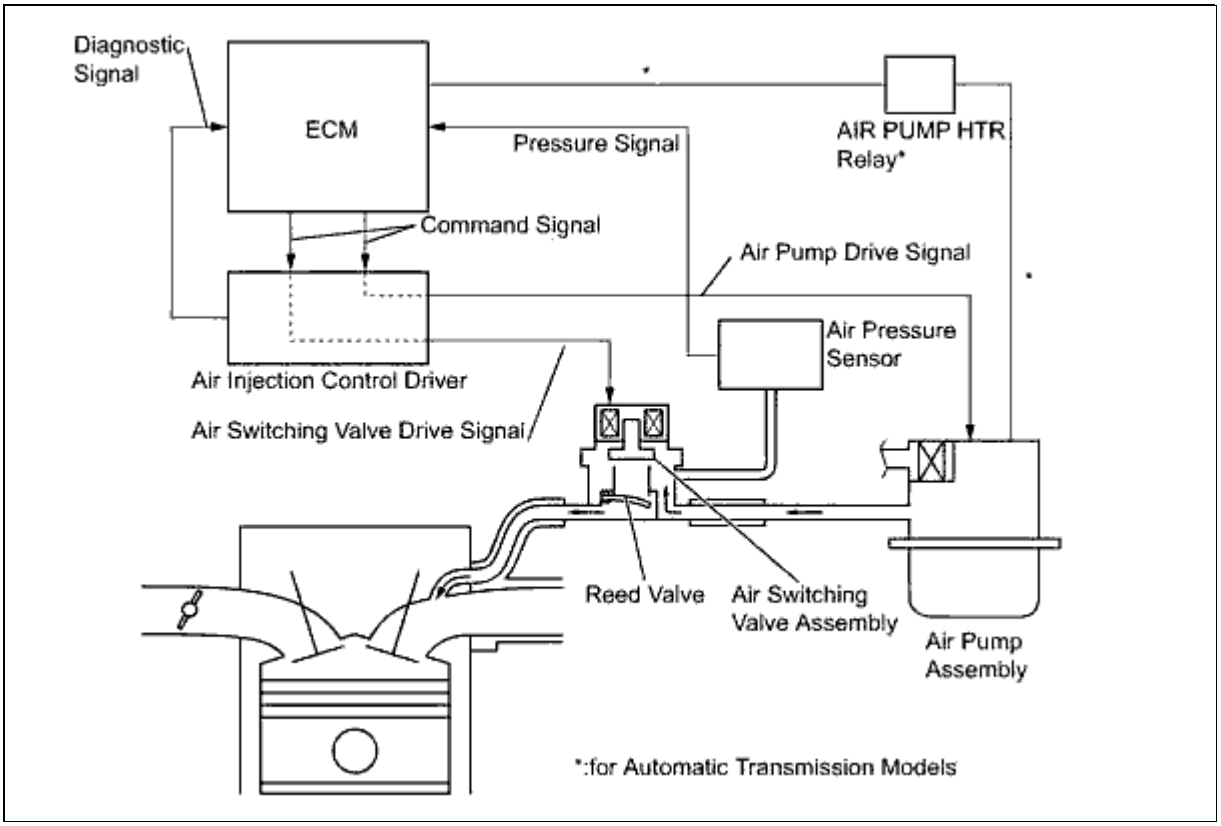
The air injection control driver drives the air switching valve assembly and the air pump assembly according to command signals transmitted by the ECM. The air pressure sensor detects the pressure in the secondary air passage when the secondary air injection system is ON and OFF, and transmits pressure signal to the ECM.

The air injection control driver is not only equipped to drive the pump and valve, but also with a diagnosis function to detect malfunctions in the secondary air injection system circuit.

HINT:

As a large current is required to drive the air pump assembly and air switching valve assembly, an air injection control driver is included in this system.

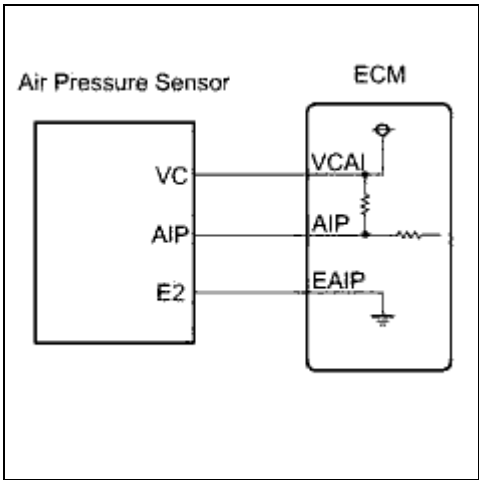
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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2431	Air pressure sensor indicates less than 45.63 kPa (342 mmHg), or higher than 135 kPa (1013 mmHg) (2 trip detection logic)	• Air pressure sensor • Open or short in air pressure sensor circuit • ECM
P2432	While engine running, voltage output of air pressure sensor remains less than 0.5 V (1 trip detection logic)	• Air pressure sensor • Open or short in air pressure sensor circuit • ECM
P2433	While engine running, voltage output of air pressure sensor remains above 4.5 V (1 trip detection logic)	• Air pressure sensor • Open or short in air pressure sensor circuit • ECM

MONITOR DESCRIPTION

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The ECM monitors the pressure in the secondary air passage using the air pressure sensor located on the air switching valve assembly in the secondary air injection system.

If there is a defect in the sensor or the sensor circuit, the voltage level deviates from the normal operating range, the ECM interprets this deviation as a malfunction in the air pressure sensor or circuit and stores a DTC.

MONITOR STRATEGY

Related DTCs	P2431: Air Flow/Pressure Sensor Circuit Rationality P2432: Air Flow/Pressure Sensor Circuit Range Check (Low Voltage) P2433: Air Flow/Pressure Sensor Circuit Range Check (High Voltage)
Required Sensors/Components (Main)	Air pressure sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	P2432 and P2433: 0.5 seconds P2431: 5 seconds
MIL Operation	P2432 and P2433: Immediate P2431: 2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P2431

Monitor runs whenever following DTCs are not stored	None
Secondary air injection system pressure sensor circuit fail (P2342, P2433)	Not detected
Starter	OFF
Battery voltage	8 V or higher
Ignition switch	ON
Time after starter ON to OFF	2 seconds or more

P2432 and P2433

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Monitor runs whenever following DTCs are not stored	None
Starter	OFF
Battery voltage	8 V or higher
Ignition switch	ON

TYPICAL MALFUNCTION THRESHOLDS

P2431

Secondary air injection system pressure	Less than 45.63 kPa (342 mmHg), or higher than 135 kPa (1013 mmHg)

P2432

Air pressure sensor voltage	Less than 0.5 V

P2433

Secondary air injection system pressure sensor voltage	Higher than 4.5 V

COMPONENT OPERATING RANGE

Secondary air injection system pressure sensor voltage	Between 0.5 V and 4.5 V

CONFIRMATION DRIVING PATTERN

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.

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9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. After the "Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P2431, P2432 or P2433.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

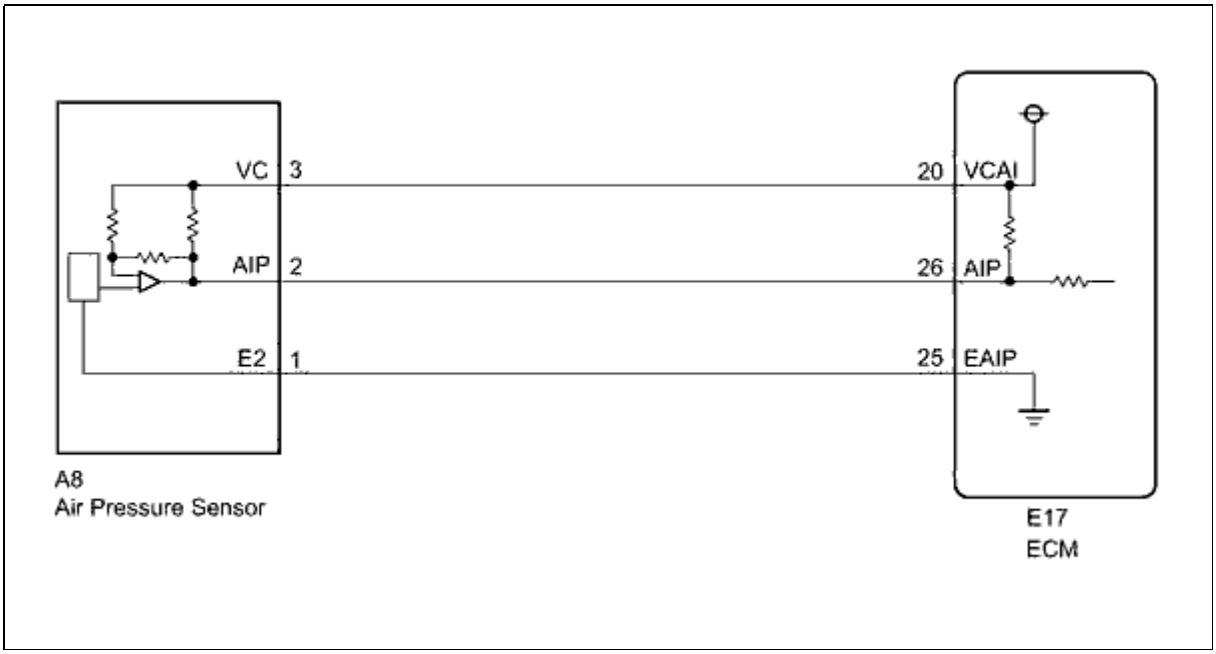
HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

18. Turn the ignition switch off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- Refer to "Data List / Active Test" [Air Pump Pressure (Absolute)] INFO .
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK HARNESS AND CONNECTOR (AIR PRESSURE SENSOR - ECM)**

(a) Disconnect the A8 air pressure sensor connector.

(b) Disconnect the E17 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A8-1 (E2) - E17-25 (EAIP)	Always	Below 1 Ω
A8-2 (AIP) - E17-26 (AIP)	Always	Below 1 Ω
A8-3 (VC) - E17-20 (VCAI)	Always	Below 1 Ω
A8-2 (AIP) or E17-26 (AIP) - Body ground	Always	10 kΩ or higher
A8-3 (VC) or E17-20 (VCAI) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK

2.	**INSPECT ECM (SENSOR POWER SOURCE CIRCUIT)**

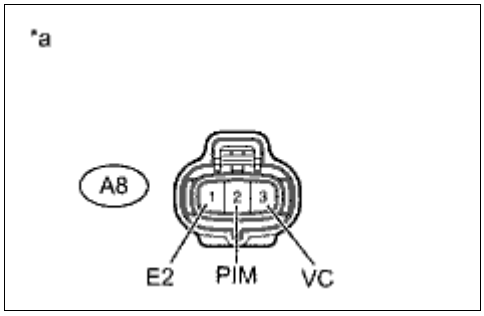
(a) Disconnect the A8 air pressure sensor connector.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A8-3 (VC) - A8-1 (E2)	Ignition switch ON	4.5 to 5.5 V



Text in Illustration

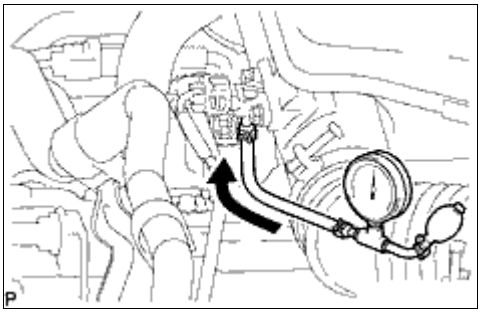
*a	Front view of wire harness connector (to Air Pressure Sensor)

NG ▶ **REPLACE ECM**

OK

3.	**READ DATA LIST (AIR PUMP PRESSURE (ABSOLUTE))**

(a) Connect a pressure gauge to the air pressure sensor as shown in the illustration.



(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Air Pump Pressure (Absolute).

(f) Check that the pressure displayed on the Techstream fluctuates when applying the pressure to the air pressure

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sensor with the pressure gauge.

OK:

Pressure fluctuates in response to pressure applied with pressure gauge.

HINT:

The Techstream displays the air pump pressure (Air Pump Pressure (Absolute)) as absolute pressure.

NG ▶ **REPLACE AIR PRESSURE SENSOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013HC05WX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2440,P2441; Secondary Air Injection System Switching Valve Stuck Open Bank1; 2016 MY Tacoma [08/2015 -]		

DTC	**P2440**	**Secondary Air Injection System Switching Valve Stuck Open Bank1**

DTC	**P2441**	**Secondary Air Injection System Switching Valve Stuck Close Bank1**

DESCRIPTION

Refer to DTC P0412 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2440	Air pressure sensor detects pulsation of exhaust gas despite ECM commanding air switching valve to close, while engine running (1 trip detection logic)	• Air switching valve assembly • Open or short in air switching valve circuit • Air pressure sensor • Air pressure sensor circuit • Air injection control driver • ECM • AIR PMP HTR relay*1
P2441	Air pressure sensor detects no pulsation of exhaust gas despite ECM commanding air switching valve to open, while engine running (2 trip detection logic)	• Air switching valve assembly • Open or short in air switching valve circuit • Vacuum hose (air switching valve - air pressure sensor) • Air injection hose • Air pressure sensor • Air pressure sensor circuit • Air injection control driver • ECM • AIR PMP HTR relay*1

*1: for Automatic Transmission

HINT:

Air switching valve normal operation:

When the air switching valve assembly is open, exhaust gas pulsation occurs in the secondary air passage.

When the air switching valve assembly is closed, exhaust gas pulsation does not occur in the secondary air passage.

MONITOR DESCRIPTION

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Air switching valve assembly of the secondary air injection system.

If either of the following conditions occurs, the ECM interprets it as a malfunction of the secondary air injection system, and illuminates the MIL and stores a DTC:

- Exhaust gas pulsation is detected by the air pressure sensor despite the ECM commanding the air switching valve assembly to close.
- Exhaust gas pulsation is not detected by the air pressure sensor despite the ECM commanding the air switching valve assembly to open.

MONITOR STRATEGY

Related DTCs	P2440: Air Control Valve Stuck Open P2441: Air Control Valve Stuck Close
Required Sensors/Components (Main)	Air pressure sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	7 seconds: P2440 AIR valve is stuck open (Case1), P2441 AIR valve is stuck close 2 seconds: P2440 AIR valve is stuck open (Case2)
MIL Operation	1 driving cycle: P2440 AIR valve is stuck open 2 driving cycles: P2441 AIR valve is stuck close
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire)

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	P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor) P106B (EVAP Emission Control System Pressure Sensor - Air Injection System Pressure Sensor Correlation) P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2431, P2432, P2433 (Secondary Air Injection System Pressure Sensor)

P2440 AIR Valve Stuck Open (Case1), P2441 AIR Valve Stuck Close

Battery voltage	11 V or higher
Atmospheric pressure	45 kPa (337.5 mmHg) or more
Engine	Running
AIR monitor during AIR: ON*1	Completed
AIR monitor during AIR: OFF*2	Completed
Malfunction judgment	Not detected
Pass judgment	Not detected
AIR injector driver (open/short or out of range)	Not detected
AIR pressure sensor (open/short or out of range)	Not detected

P2440 AIR Valve Stuck Open (Case2)

One of the following conditions is met	(a), (b) or (c)
(a) Cumulative intake air amount	182 g/sec or more (for Automatic Transmission) 181 g/sec or more (for Manual Transmission)
(b) Difference between starting temperature and current temperature	30°C (86°F) or higher
(c) Starting coolant temperature	65°C (149°F) or higher
AIR pump	OFF
AIR valve	Close
Engine speed	Less than 3750 rpm
AIR pressure sensor (open/short or out of range)	Not detected
Time after engine started	5 seconds or more
Time after AIR in operation	10 seconds or more
AIR valve open stuck (DTC P2440)	Not detected
AIR pressure sensor stuck	Not in operation
Engine load	20% or more

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*1: AIR monitor during AIR: ON	-
Time after secondary air injection starts operation	5 seconds or more
Air pump	ON
Air switching valve	Open
Engine speed	Less than 3750 rpm
Engine speed	775 rpm or more
Intake air amount per liter	More than 100 g/sec
Time after engine start	5 seconds or more

*2: AIR monitor during AIR: OFF	-
Time after secondary air injection starts operation	10 seconds or more
Air pump	OFF
Air switching valve	Close
Engine speed	Less than 3000 rpm
AIR monitor during AIR: ON	Completed
Engine load	6% or more, and less than 60%
Time after engine started	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P2440 AIR Valve Stuck Open

P2440 AIR valve is stuck open	-
One of the following conditions is met	A or B
A: One of the following conditions is met (Case1)	(a) or (b)
(a) Condition 1 (AIR OFF)	-
(b) Condition 2 (AIR OFF)	-
B: Cumulative pressure pulsation (Case2)	80 kPa or higher

P2441 AIR Valve Stuck Close

P2441 AIR valve stuck closed	-
One of the following conditions is met	(a) or (b)
(a) Condition 3 (AIR ON)	-
(b) Condition 4 (AIR ON)	-

Secondary Air Injection ON (Condition 1)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	12.5 kPa (93.75 mmHg) or higher

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AIR pressure	1.5 kPa (11.25 mmHg) or higher

Secondary Air Injection ON (Condition 2)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	12.5 kPa (93.75 mmHg) or higher
AIR pressure	Below 1.5 kPa (11.25 mmHg)

Secondary Air Injection ON (Condition 3)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	Below 12.5 kPa (93.75 mmHg)
AIR pressure	1.5 kPa (11.25 mmHg) or higher

Secondary Air Injection ON (Condition 4)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	Below 12.5 kPa (93.75 mmHg)
AIR pressure	Below 1.5 kPa (11.25 mmHg)

Secondary Air Injection OFF (Condition 1)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	50 kPa (375.03 mmHg) or higher
AIR pressure	4.12 kPa (30.902 mmHg) or higher

Secondary Air Injection OFF (Condition 2)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	50 kPa (375.03 mmHg) or higher
AIR pressure	Below 4.12 kPa (30.902 mmHg)

Secondary Air Injection OFF (Condition 3)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	Below 50 kPa (375.03 mmHg)
AIR pressure	4.12 kPa (30.902 mmHg) or higher

Secondary Air Injection OFF (Condition 4)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	Below 50 kPa (375.03 mmHg)
AIR pressure	Below 4.12 kPa (30.902 mmHg)

HINT:

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Refer to "Data List / Active Test" [Air Pump Pressure (Absolute) and Air Pump Pulsation Pressure] INFO .

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

    HINT:

    - If a pending DTC is output, the system is malfunctioning.
    - If a pending DTC is not output, perform the following procedure.
14. After the "Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P2440 or P2441.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal

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TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If no permanent DTC is output, the system is normal.
- If a permanent DTC is output, the system is malfunctioning.

18. Turn the ignition switch off.

WIRING DIAGRAM

Refer to P0412 INFO .
Refer to P2431 INFO .

INSPECTION PROCEDURE

NOTICE:

Refer to "Data List / Active Test" [Air Pump Pressure (Absolute), and Air Pump Pulsation Pressure] INFO .

HINT:

Determination by ECM monitoring:

The ECM locates malfunctions in the secondary air injection system by detecting the pressure in the secondary air injection passage between the air pump and air switching valve and stores a DTC. Soon after a cold engine start, the monitor runs for a short time while the secondary air injection system is both ON and OFF. The ECM detects both the pressure and the exhaust pulsation and compares them.

The following 4 patterns are secondary air injection system pressure conditions in the secondary air injection system passage.

Pressure condition in Secondary Air Injection System Case 1:

Air Pump	ON
Air Switching Valve	Open
Pressure	1.5 kPa (11.25 mmHg) or higher
Pulsation Detection	Exhaust gas pulsation detected

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Pressure condition in Secondary Air Injection System Case 2:

Air Pump	OFF
Air Switching Valve	Open
Pressure	Less than 4.12 kPa (30.902 mmHg)
Pulsation Detection	Exhaust gas pulsation detected

Pressure condition in Secondary Air Injection System Case 3:

Air Pump	ON
Air Switching Valve	Closed
Pressure	1.5 kPa (11.25 mmHg) or higher
Pulsation Detection	Slight pulsation detected

Pressure condition in Secondary Air Injection System Case 4:

Air Pump	OFF
Air Switching Valve	Close
Pressure	Less than 4.12 kPa (30.902 mmHg)
Pulsation Detection	Exhaust pulsation not detected

If the detected pressure is high, the air pump is assumed to be ON and if it alternates sharply, the air switching valve is assumed to be open. The ECM locates malfunctions from the combination of pressures detected when the secondary air injection system is ON and OFF.

HINT:

The exhaust pulsation value is calculated in the ECM. If the calculated value exceeds a certain level, the ECM determines that the exhaust pulsation is in the secondary air injection system.

HINT:

- In case 3, as the air pressure sensor detects a slight pump operation pulsation, the detected value is not constant. Since the pump outlet is blocked by closing the air switching valve assembly, the average pressure is higher than in case 1 [approximately 20 to 30 kPa (150.120 to 225.018 mmHg)].
- In case 1, the average pressure is approximately 9 to 11 kPa (67.505 to 82.506 mmHg). The value of 1.5 kPa (11.25 mmHg) indicated in the table above is a threshold for detecting pump malfunctions.

DETECTED CONDITION WHILE SECONDARY AIR INJECTION OPERATING: AIR PUMP ON, AIR SWITCHING VALVE OPEN	DETECTED CONDITION WHILE SECONDARY AIR INJECTION NOT OPERATING: AIR PUMP OFF, AIR SWITCHING VALVE CLOSED	ECM DETERMINATION	DTC OUTPUT
Case 1	Case 4	Normal	-
Case 1	Case 2	Air Switching Valve stuck open	P2440
Case 1	Case 3	Air pump stuck ON	P2444
Case 2	Case 4	Air pump stuck OFF	P2445

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DETECTED CONDITION WHILE SECONDARY AIR INJECTION OPERATING: AIR PUMP ON, AIR SWITCHING VALVE OPEN	DETECTED CONDITION WHILE SECONDARY AIR INJECTION NOT OPERATING: AIR PUMP OFF, AIR SWITCHING VALVE CLOSED	ECM DETERMINATION	DTC OUTPUT
Case 3	Case 4	Air Switching Valve stuck closed	P2441
Case 1	Case 1	Air Switching Valve stuck open and Air pump stuck ON	P2440 and P2444
Case 2	Case 2	Air Switching Valve stuck open and Air pump stuck OFF	P2440 and P2445
Case 3	Case 3	Air Switching Valve stuck closed and Air pump stuck ON	P2441 and P2444
Case 4	Case 4	Air Switching Valve stuck closed and Air pump stuck OFF	P2441 and P2445

HINT:

- If the vacuum hose between the air switching valve assembly and the air pressure sensor is not connected correctly, case 4 may occur.
- By using the Techstream to perform the Secondary Air Injection Check operation in the System Check, the air fuel ratio and the pressure in the secondary air injection system passage can be checked while the secondary air injection system is operating. This helps technicians to troubleshoot the system when it malfunctions. Furthermore, pending DTCs also can be checked by performing Utility / Secondary Air Injection Check / Automatic Mode after the repair.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

System Check:

The pressure in the secondary air passage can be checked using the Techstream.

a. Start the engine and warm it up.
b. Turn the ignition switch off.
c. Connect the Techstream to the DLC3.
d. Turn the ignition switch to ON and turn the Techstream on.
e. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN and AIR PUMP: OFF, ASV: CLOSE.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

f. Start the engine.
g. Perform the secondary air injection system forced operation while the engine is idling.
h. Check that the air pump assembly (AIR PUMP), air switching valve assembly (ASV) and pressure in the secondary air injection system passage (PRESSURE) displayed on the Techstream, indicate the conditions shown in the table below.

Standard:

TECHSTREAM	AIR	AIR SWITCHING	PRESSURE*1	PULSATION*2

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OPERATION	PUMP	VALVE		
AIR PUMP: ON, ASV: OPEN	ON	OPEN	1.5 kPa (11.25 mmHg) or more	12.5 kPa (93.75 mmHg) or higher
AIR PUMP: OFF, ASV: CLOSE	OFF	CLOSE	Less than 4.12 kPa (30.902 mmHg)	Less than 50 kPa (375.03 mmHg)

*1: Average pumping pressure (gauge pressure). The pressure should be 1 kPa (7.5 mmHg) or higher when the secondary air injection system operates.

*2: The cumulative exhaust pulsation calculated by the ECM. If the calculated value exceeds a certain level, the ECM determines that the exhaust pulsation is in the secondary air injection system.

i. Turn the ignition switch off.

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If an ERROR as shown in the illustration is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO SECONDARY AIR INJECTION SYSTEM DTCS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2440 and/or P2441 is output	A*1 B*2

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RESULT	PROCEED TO
DTC P2440 and/or P2441, and P0412 are output	C
P2440 and/or P2441, and other DTCs (except P0412)	D

*1: for Automatic Transmission
*2: for Manual Transmission

If any DTCs other than P2440 and/or P2441 are output, troubleshoot those DTCs first.

B ▶ **GO TO STEP 8**

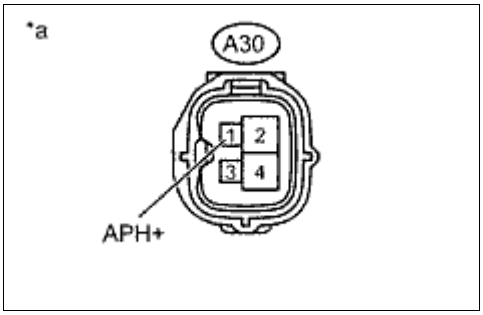
C ▶ **GO TO AIR SWITCHING VALVE INSPECTION PROCEDURE**

D ▶ **GO TO DTC CHART**

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE AIR PUMP HEATER)

(a) Disconnect the air pump connector.



(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT/ Active Test / Activate the Air Pump Heater.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A30-1 (APH+) - Body ground	Activate the Air Pump Heater is ON	11 to 14 V

Text in Illustration

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*a	Front view of wire harness connector (to Air Pump Assembly)

NG ▶ **GO TO STEP 4**

OK ▼

3.	**INSPECT AIR PUMP ASSEMBLY (HEATER RESISTANCE)**

(a) Inspect the air pump assembly INFO .

NG ▶ **REPLACE AIR PUMP ASSEMBLY**

OK ▼

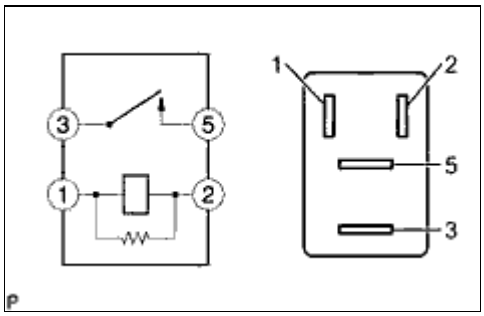
4.	**INSPECT AIR PMP HTR RELAY**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied	10 kΩ or higher
	Battery voltage applied to terminals 1 and 2	Below 1 Ω



NG ▶ **REPLACE AIR PMP HTR RELAY**

OK ▼

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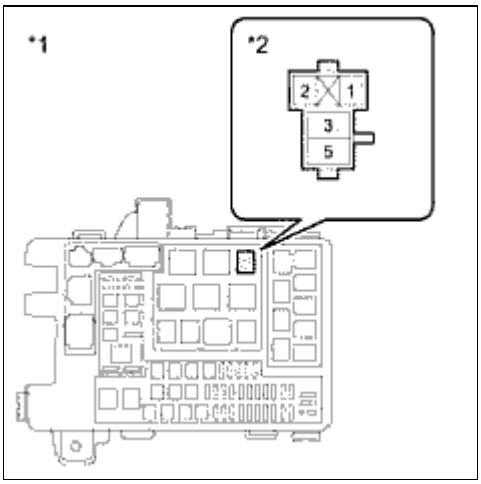
5.	**CHECK AIR PMP HTR RELAY (POWER SOURCE)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Text in Illustration

*1	Engine Room Relay Block
*2	AIR PMP HTR Relay Holder



Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (AIR PMP HTR relay holder) - Body ground	Always	11 to 14 V

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR PMP HTR RELAY - BATTERY)**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (AIR PUMP - AIR PMP HTR RELAY, BODY GROUND)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

(b) Disconnect the A30 air pump connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (AIR PMP HTR relay holder) - A30-1 (APH+)	Always	Below 1 Ω
A30-3 (APHG) - Body ground	Always	Below 1 Ω
3 (AIR PMP HTR relay holder) or A30-1 (APH+) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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7.	**INSPECT AIR PUMP ASSEMBLY**

(a) Inspect the air pump assembly INFO .

NG ▶ **REPLACE AIR PUMP ASSEMBLY**

OK

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (SECONDARY AIR INJECTION SYSTEM OPERATION)**

(a) Perform a visual check

(1) Start the engine and warm it up.

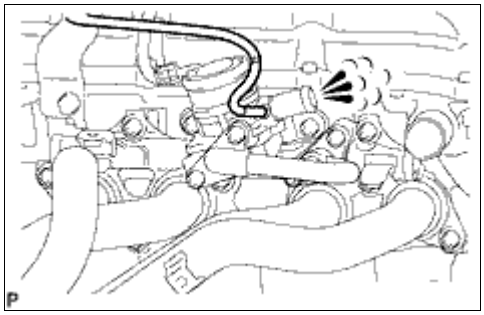
(2) Turn the ignition switch off.

(3) Disconnect the No. 1 air injection system hose.

(4) Connect the Techstream to the DLC3.

(5) Turn the ignition switch to ON and turn the Techstream on.

(6) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.



HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(7) Start the engine.

(8) Perform the secondary air injection system forced operation while the engine is idling.

(9) Place your hand near the air switching valve assembly port and check that the exhaust gas pressure pulsates when the ASV is turned on.

CAUTION:

To avoid the danger of being burned by the exhaust gas, bring your hand close to the valve port slowly.

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(10) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: CLOSE.

(11) Check that the exhaust gas does not pulsate when the air switching valve assembly is turned off.

(12) Turn the ignition switch off.

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds. Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks. While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR). If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If it is necessary to repeat the check, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

OK

AIR PUMP OPERATION	AIR SWITCHING VALVE OPERATION	EXHAUST GAS PULSATION
ON	OFF	Not detected
ON	ON	Detected

B ▶ **GO TO STEP 16**

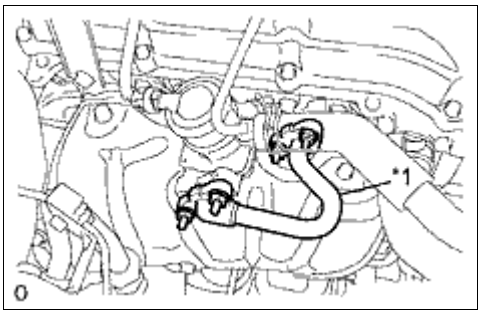
A ▼

9.	**INSPECT NO. 4 INTAKE PIPE (BLOCKAGES AND LEAKAGES)**

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(a) Check that the No. 4 intake pipe is securely connected to both the exhaust manifold and the air switching valve

(b) Inspect the No. 4 intake pipe for blockages and damage.



Text in Illustration

*1	No. 4 Intake Pipe

OK:

No blockages or damage on No. 4 intake pipe.

NG ▶ **REPLACE NO. 4 INTAKE PIPE**

OK ▼

10.	**INSPECT AIR SWITCHING VALVE ASSEMBLY (AIR SWITCHING VALVE OPERATION)**

(a) Inspect the air switching valve assembly INFO .

NG ▶ **REPLACE AIR SWITCHING VALVE ASSEMBLY**

OK ▼

11.	**INSPECT AIR INJECTION CONTROL DRIVER (POWER SOURCE OF AIR INJECTION CONTROL DRIVER)**

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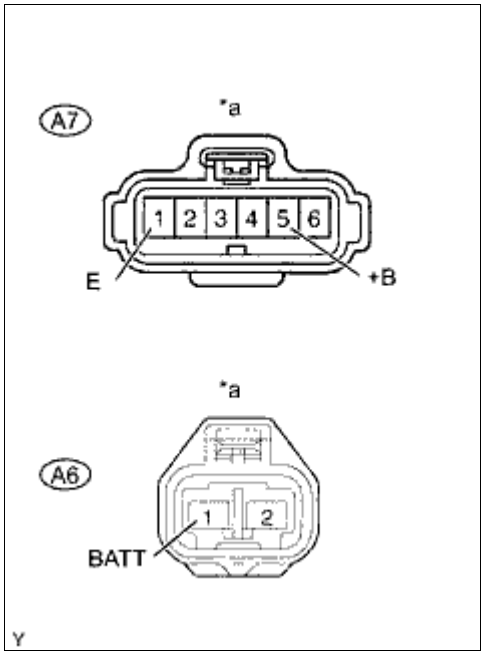
(a) Disconnect the air injection control driver connectors.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A7-5 (+B) - Body ground	Ignition Switch ON	11 to 14 V (near battery voltage)
A6-1 (BATT) - Body ground	Always	11 to 14 V (near battery voltage)



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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-1 (E) - Body ground	Always	Below 1 Ω

Text in Illustration

*a	Front view of wire harness connector (to Air Injection Control Driver)

NG ▶ **REPAIR OR REPLACE AIR INJECTION CONTROL DRIVER POWER SOURCE CIRCUIT**

OK ▼

12.	**CHECK HARNESS AND CONNECTOR (ECM - AIR INJECTION CONTROL DRIVER)**

(a) Disconnect the E21 ECM connector.

(b) Disconnect the A7 air injection control driver connector.

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

Standard Resistance:

Tester Connection	Condition	Specified Condition

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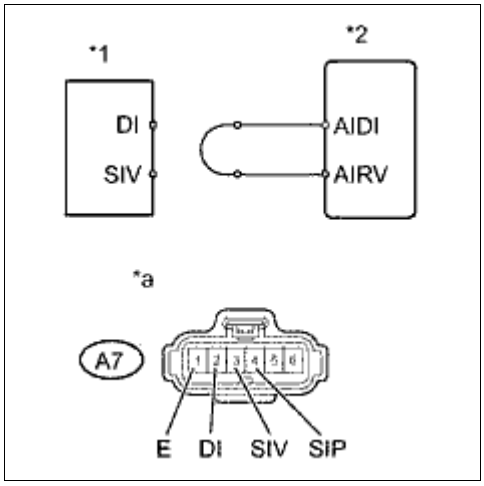
E21-5 (AIRV) - A7-3 (SIV)	Always	Below 1 Ω
E21-5 (AIRV) or A7-3 (SIV) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

13.	**PERFORM ACTIVE TEST USING TECHSTREAM**

(a) Disconnect the air injection control driver connector.



(b) Connect terminals DI and SIV of the wire harness connector for the air injection control driver.

Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Start the engine.

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(h) Perform the secondary air injection system forced operation while the engine is idling.

(i) Measure the voltage between the SIV and E terminals of the ECM connector when the secondary air injection system is ON and OFF.

NOTICE:

- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Resistance:

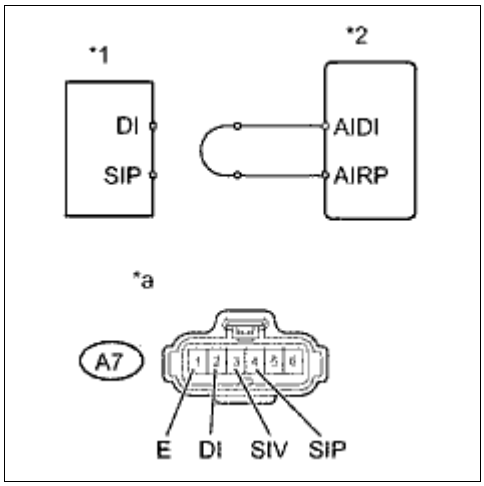
Tester Connection	Condition	Specified Condition
A7-3 (SIV) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
A7-3 (SIV) - A7-1 (E)	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(j) Turn the ignition switch off.

(k) Connect terminals DI and SIP of the wire harness connector for the air injection control driver.

Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)



(l) Connect the Techstream to the DLC3.

(m) Turn the ignition switch to ON.

(n) Turn the Techstream on.

(o) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(p) Start the engine.

(q) Perform the secondary air injection system forced operation while the engine is idling.

(r) Measure the voltage between the SIP and E terminals of the ECM connector when the secondary air injection system is ON and OFF.

NOTICE:

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- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A7-4 (SIP) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
A7-4 (SIP) - A7-1 (E)	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(s) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK
▼

14.	**REPLACE AIR INJECTION CONTROL DRIVER**

(a) Replace the air injection control driver.

NEXT
▼

15.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2440 AND/OR P2441)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.

(h) Start the engine after the Techstream initialization is finished.

(i) Perform the System Check operation by pressing Next.

(j) After operating the secondary air injection system, perform the following to confirm the secondary air

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injection system pending DTCs: Press the Exit.

(k) Check pending DTCs.

OK:

No pending DTC output.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

(l) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK ▶ **END**

16.	**INSPECT VACUUM HOSES (AIR SWITCHING VALVE - AIR PRESSURE SENSOR)**

OK:

No blockage and no deformation in vacuum hose.

NG ▶ **REPAIR OR REPLACE VACUUM HOSE**

OK ▼

17.	**INSPECT AIR PRESSURE SENSOR**

(a) Connect a pressure gauge to the air pressure sensor as shown in the illustration.

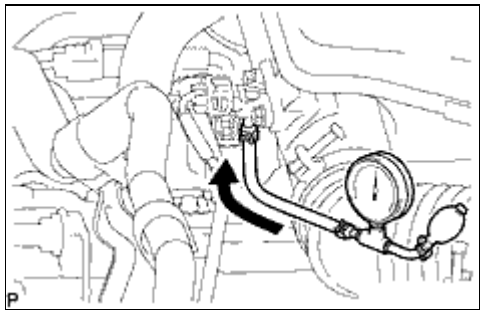
(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Air Pump Pressure (Absolute).

(f) Check that the pressure displayed on the Techstream fluctuates when applying pressure to the air pressure sensor with the pressure gauge.



OK:

Pressure fluctuates in response to pressure applied with pressure gauge.

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HINT:

The Techstream displays the air pump pressure (Air Pump Pressure (Absolute) as absolute pressure.

NG ▶ **REPLACE AIR PRESSURE SENSOR**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM0000013HD05DX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2444,P2445; Secondary Air Injection System Pump Stuck On Bank1; 2016 MY Tacoma [08/2015 -]		

DTC	**P2444**	**Secondary Air Injection System Pump Stuck On Bank1**

DTC	**P2445**	**Secondary Air Injection System Pump Stuck Off Bank1**

DESCRIPTION

Refer to P0412 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2444	Secondary air pressure 4.12 kPa (30.902 mmHg) or higher despite ECM commanding air pump to turn off (2 trip detection logic)	• Short in air pump circuit • Open or short in air pressure sensor circuit • Air pressure sensor • Air injection control driver • ECM • AIR PMP HTR relay*1
P2445	Secondary air pressure below 1.5 kPa (11.25 mmHg) despite ECM commanding air pump to turn on (2 trip detection logic)	• Air pump assembly • Open in air pump circuit • Air injection system piping • Vacuum hose (air pressure sensor - air switching valve) • Air pressure sensor • Open or short in air pressure sensor circuit • Air injection control driver • ECM • AIR PMP HTR relay*1

*1: for Automatic Transmission

MONITOR DESCRIPTION

The ECM monitors the pressure in the secondary air passage using the air pressure sensor located on the air switching valve assembly of the secondary air injection system. The sensor measures the pressure in the secondary air passage and transmits a signal to the ECM.

If either of the following conditions occurs, the ECM interprets it as a malfunction of the secondary air injection system, and illuminates the MIL and stores a DTC:

- The pressure indicated by the air pressure sensor does not reach threshold levels despite the ECM

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turning on the air pump assembly.

- The pressure indicated by the air pressure sensor exceeds threshold levels despite the ECM turning off the air pump assembly.

MONITOR STRATEGY

Related DTCs	P2444: Air Pump Stuck ON P2445: Air Pump Stuck OFF
Required Sensors/Components (Main)	Air pressure sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	7 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not stored	P0010 (Camshaft Timing Oil Control Valve) P0011 (VVT System - Advance) P0012 (VVT System - Retard) P0013 (Exhaust Camshaft Timing Oil Control Valve) P0014 (Exhaust VVT System - Advance) P0015 (Exhaust VVT System - Retard) P0016 (VVT System - Misalignment) P0017 (Exhaust VVT System - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Coolant Temperature for Closed Loop Fuel Control) P014C, P014D, P015A, P015B, P2195, P2196, P2237, P2238, P2239, P2252, P2253 (Air Fuel Ratio Sensor) P0171, P0172 (Fuel System) P0301 - P0304 (Misfire) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351 - P0354 (Igniter) P0365, P0367, P0368 (Exhaust Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500, P0722 (Vehicle Speed Sensor) P106B (EVAP Emission Control System Pressure Sensor - Air Injection System Pressure Sensor Correlation)

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	P219A, P219C, P219D, P219E, P219F (Air Fuel Ratio Imbalance) P2431, P2432, P2433 (Secondary Air Injection System Pressure Sensor)

P2444 AIR Pump Stuck ON, P2445 AIR Pump Stuck OFF

Battery voltage	11 V or higher
Atmospheric pressure	45 kPa(abs) [337.5 mmHg(abs)] or higher
Engine	Running
AIR monitor during AIR: ON*1	Completed
AIR monitor during AIR: OFF*2	Completed
Malfunction judgment	Not detected
Pass judgment	Not detected
AIR injector driver (open/short or out of range)	Not detected
AIR pressure sensor (open/short or out of range)	Not detected

P2445 Air Flow Insufficient

Battery voltage	11 V or higher
Atmospheric pressure	45 kPa(abs) [337.5 mmHg(abs)] or higher
Engine	Running
AIR monitor during AIR: ON*1	Completed
AIR monitor during AIR: ON*3	Completed
Following conditions are met during AIR ON	
Cumulative pressure pulsation	12.5 kPa (93.75 mmHg) or higher
AIR pressure	1.5 kPa (11.25 mmHg) or higher
Malfunction judgment	Not detected
Pass judgment	Not detected
AIR injector driver (open/short or out of range)	Not detected
AIR pressure sensor (open/short or out of range)	Not detected

*1: AIR monitor during AIR: ON	-
Time after secondary air injection starts operation	5 seconds or more
Air pump	ON
Air switching valve	Open
Engine speed	Less than 3750 rpm
Engine speed	775 rpm or more
Time after engine start	5 seconds or more

*2: AIR monitor during AIR: OFF	-

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Time after secondary air injection starts operation	10 seconds or more
Air pump	OFF
Air switching valve	Close
Engine speed	Less than 3000 rpm
Secondary air injection monitor during secondary air injection ON	Completed
Engine load	6% or more, and less than 60%
Time after engine started	5 seconds or more

*3: Air flow AIR monitor during AIR: ON	-
Air switching valve	Open
Time after secondary air injection starts operation	1 second or more

TYPICAL MALFUNCTION THRESHOLDS

P2444 Air Pump Stuck ON

One of the following conditions is met	(a) or (b)
(a) Condition 1 (AIR OFF)	-
(b) Condition 3 (AIR OFF)	-

P2445 Air Pump Stuck OFF

One of the following conditions is met	(a) or (b)
(a) Condition 2 (AIR ON)	-
(b) Condition 4 (AIR ON)	-

P2445 Air Flow Insufficient

Air flow value	80 l/min or less

Secondary Air Injection ON (Condition 1)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	12.5 kPa (93.75 mmHg) or higher
AIR pressure	1.5 kPa (11.25 mmHg) or higher

Secondary Air Injection ON (Condition 2)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	12.5 kPa (93.75 mmHg) or higher
AIR pressure	Below 1.5 kPa (11.25 mmHg)

Secondary Air Injection ON (Condition 3)

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Following conditions are met during AIR ON	-
Cumulative pressure pulsation	Below 12.5 kPa (93.75 mmHg)
AIR pressure	1.5 kPa (11.25 mmHg) or higher

Secondary Air Injection ON (Condition 4)

Following conditions are met during AIR ON	-
Cumulative pressure pulsation	Below 12.5 kPa (93.75 mmHg)
AIR pressure	Below 1.5 kPa (11.25 mmHg)

Secondary Air Injection OFF (Condition 1)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	50 kPa (375.03 mmHg) or higher
AIR pressure	4.12 kPa (30.902 mmHg) or higher

Secondary Air Injection OFF (Condition 2)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	50 kPa (375.03 mmHg) or higher
AIR pressure	Below 4.12 kPa (30.902 mmHg)

Secondary Air Injection OFF (Condition 3)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	Below 50 kPa (375.03 mmHg)
AIR pressure	4.12 kPa (30.902 mmHg) or higher

Secondary Air Injection OFF (Condition 4)

Following conditions are met during AIR OFF	-
Cumulative pressure pulsation	Below 50 kPa (375.03 mmHg)
AIR pressure	Below 4.12 kPa (30.902 mmHg)

CONFIRMATION DRIVING PATTERN

NOTICE:

- Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.

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- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

1. Start the engine and warm it up.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
7. Turn the ignition switch off and wait for at least 30 seconds.
8. Turn the ignition switch to ON and turn the Techstream on.
9. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.
10. Start the engine after the Techstream initialization is finished.
11. Perform the System Check operation by pressing Next.
12. Perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.
13. Check for pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. After the "Secondary Air injection check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P2444 or P2445.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

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HINT:

- If no permanent DTC is output, the system is normal.
- If a permanent DTC is output, the system is malfunctioning.

18. Turn the ignition switch off.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

WIRING DIAGRAM

Refer to DTC P0412 INFO .

INSPECTION PROCEDURE

HINT:

Determination by ECM monitoring:

The ECM locates malfunctions in the secondary air injection system by detecting the pressure in the secondary air injection passage between the air pump assembly and air switching valve assembly and stores a DTC. Soon after cold engine starts, the monitor runs for a short time while the secondary air injection system is both ON and OFF. The ECM detects both the pressure and the exhaust pulsation and compares them.

The following 4 patterns are secondary air injection system pressure conditions in the secondary air injection system passage.

Pressure condition in Secondary Air Injection System Case 1

Air Pump	ON
Air Switching Valve	Open
Pressure	1.5 kPa (11.25 mmHg) or higher
Pulsation Detection	Exhaust gas pulsation detected

Pressure condition in Secondary Air Injection System Case 2

Air Pump	OFF
Air Switching Valve	Open
Pressure	Less than 4.12 kPa (30.902 mmHg)
Pulsation Detection	Exhaust gas pulsation detected

Pressure condition in Secondary Air Injection System Case 3

Air Pump	ON
Air Switching Valve	Closed
Pressure	1.5 kPa (11.25 mmHg) or higher
Pulsation Detection	Slight pulsation detected

Pressure condition in Secondary Air Injection System Case 4

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Air Pump	OFF
Air Switching Valve	Closed
Pressure	Less than 4.12 kPa (30.902 mmHg)
Pulsation Detection	Exhaust pulsation not detected

If the detected pressure is high, the air pump assembly is assumed to be ON and if it alternates sharply*, the air switching valve assembly is assumed to be open. The ECM locates malfunctions from the combination of pressures detected when the secondary air injection system is ON and OFF.

*: The exhaust pulsation value is calculated in the ECM. If the calculated value exceeds a certain level, the ECM determines that the exhaust pulsation is in the secondary air injection system.

HINT:

- In case 3, as the air pressure sensor detects a slight pump operation pulsation, the detected value is not constant. Since the pump outlet is blocked by closing the air switching valve assembly, the average pressure is higher than in case 1 [approximately 20 to 30 kPa (150.120 to 225.018 mmHg)].
- In case 1, the average pressure is approximately 9 to 11 kPa (67.505 to 82.506 mmHg). The value of 1.5 kPa (11.25 mmHg) indicated in the table above is a threshold for detecting pump malfunctions.

DETECTED CONDITION WHILE SECONDARY AIR INJECTION OPERATING: AIR PUMP ON, AIR SWITCHING VALVE OPEN	DETECTED CONDITION WHILE SECONDARY AIR INJECTION NOT OPERATING: AIR PUMP OFF, AIR SWITCHING VALVE CLOSED	ECM DETERMINATION	DTCS OUTPUT
Case 1	Case 4	Normal	-
Case 1	Case 2	Air switching valve stuck open	P2440
Case 1	Case 3	Air pump stuck ON	P2444
Case 2	Case 4	Air pump stuck OFF	P2445
Case 3	Case 4	Air switching valve stuck closed	P2441
Case 1	Case 1	Air switching valve stuck open and Air pump stuck ON	P2440 and P2444
Case 2	Case 2	Air switching valve stuck open and Air pump stuck OFF	P2440 and P2445
Case 3	Case 3	Air switching valve stuck closed and Air pump stuck ON	P2441 and P2444
Case 4	Case 4	Air switching valve stuck closed and Air pump stuck OFF	P2441 and P2445

HINT:

- If the vacuum hose between the air switching valve assembly and the air pressure sensor is not connected correctly, case 4 may occur.
- By using the Techstream to perform the Secondary Air Injection Check operation in the System Check, the air fuel ratio and the pressure in the secondary air injection system passage can be checked while the secondary air injection system is operating. This helps technicians to troubleshoot the system when it malfunctions. Furthermore, Pending DTCs also can be checked by performing System Check / Automatic

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Mode after the repair.

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

System Check:

The pressure in the secondary air passage can be checked using the Techstream.

a. Start the engine and warm it up.
b. Turn the ignition switch off.
c. Connect the Techstream to the DLC3.
d. Turn the ignition switch to ON.
e. Turn the Techstream on.
f. Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN and AIR PUMP: OFF, ASV: CLOSE.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

g. Start the engine.
h. Perform the secondary air injection system forced operation while the engine is idling.
i. Check that the air pump assembly (AIR PUMP), air switching valve assembly (ASV) and pressure in the secondary air injection system passage (PRESSURE) displayed on the Techstream, indicate the conditions shown in the table below.

Standard:

TECHSTREAM OPERATION	AIR PUMP	ASV	PRESSURE*1	PULSATION*2
AIR PUMP: ON, ASV: OPEN	ON	OPEN	1.5 kPa (11.25 mmHg) or higher	12.5 kPa (93.75 mmHg) or higher
AIR PUMP: OFF, ASV: CLOSE	OFF	CLOSE	Less than 4.12 kPa (30.902 mmHg)	Less than 50 kPa (375.03 mmHg)

*1: Average pumping pressure (gauge pressure). The pressure should be 2.5 kPa (18.751 mmHg) or higher when the secondary air injection system operates.

*2: The cumulative exhaust pulsation calculated by the ECM. If the calculated value exceeds a certain level, the ECM determines that the exhaust pulsation is in the secondary air injection system.

j. Turn the ignition switch off.

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If an ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the

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secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2444 AND/OR P2445)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2444 and/or P2445 is output	A*1 B*2
DTC P2444 and/or P2445, and P0418 are output	C
DTC P2444 and/or P2445, and other DTCs (except P0418) are output	D

*1: for Automatic Transmission
*2: for Manual Transmission

If any DTCs other than P2444, P2445 and/or P0418 are output, troubleshoot those DTCs first.

B ▶ **GO TO STEP 7**

C ▶ **GO TO AIR PUMP INSPECTION PROCEDURE**

D ▶ **GO TO DTC CHART**

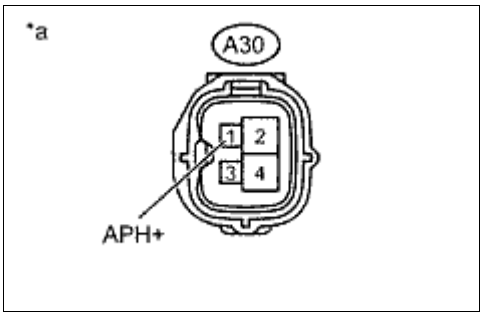
A

▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE AIR PUMP HEATER)**

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(a) Disconnect the air pump connector.



(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON and turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT/ Active Test / Activate the Air Pump Heater.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A30-1 (APH+) - Body ground	Activate the Air Pump Heater is ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Pump Assembly)

NG ▶ **GO TO STEP 4**

OK ▼

3.	**INSPECT AIR PUMP ASSEMBLY (HEATER RESISTANCE)**

(a) Inspect the air pump assembly INFO .

NG ▶ **REPLACE AIR PUMP ASSEMBLY**

OK ▼

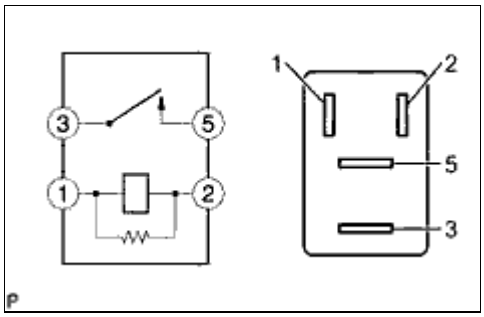
4.	**INSPECT AIR PMP HTR RELAY**

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(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied	10 kΩ or higher
	Battery voltage applied to terminals 1 and 2	Below 1 Ω

NG ▶ **REPLACE AIR PMP HTR RELAY**

OK ▼

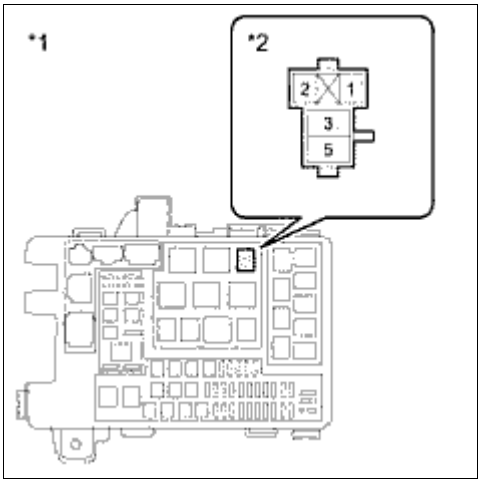
5.	**CHECK AIR PMP HTR RELAY (POWER SOURCE)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (AIR PMP HTR relay holder) - Body ground	Always	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	AIR PMP HTR Relay Holder

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR PMP HTR RELAY - BATTERY)**

OK

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6.	**CHECK HARNESS AND CONNECTOR (AIR PUMP ASSEMBLY - AIR PMP HTR RELAY, BODY GROUND)**

(a) Remove the AIR PMP HTR relay from the engine room relay block.

(b) Disconnect the A30 air pump assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (AIR PMP HTR relay holder) - A30-1 (APH+)	Always	Below 1 Ω
A30-3 (APHG) - Body ground	Always	Below 1 Ω
3 (AIR PMP HTR relay holder) or A30-1 (APH+) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

7.	**PERFORM ACTIVE TEST USING TECHSTREAM (SECONDARY AIR INJECTION SYSTEM OPERATION)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN and AIR PUMP: OFF, ASV: CLOSE.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Start the engine.

(h) Perform the secondary air injection system forced operation while the engine is idling.

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(i) Check that the air pump assembly (AIR PUMP), air switching valve assembly (ASV) and pressure in the secondary air injection system passage (PRESSURE) status displayed on the Techstream, indicate the conditions shown in the table below.

Standard:

TECHSTREAM OPERATION	AIR PUMP	AIR SWITCHING VALVE	PRESSURE*
AIR PUMP: ON, ASV: OPEN	ON	ON	1.5 kPa (11.25 mmHg) or more
AIR PUMP: OFF, ASV: CLOSE	OFF	OFF	Less than 4.12 kPa (30.902 mmHg)

*: Average pumping pressure. The pressure should be 2.5 kPa (18.751 mmHg) or more when the secondary air injection system operates.

(j) Turn the ignition switch off.

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibited, the Techstream display indicates the prohibition (WAIT or ERROR).

  If an ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

NG ▶ **GO TO STEP 9**

OK ▼

8.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2444 AND/OR P2445)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

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(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Automatic Mode.

(h) Start the engine after the Techstream initialization is finished.

(i) Perform the System Check operation by pressing Next.

(j) After operating the secondary air injection system, perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.

(k) Check pending DTCs.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Result

RESULT	PROCEED TO
DTC P2444 and/or P2445 is output	A
No pending DTC	B

(l) Turn the ignition switch off.

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

9.	**CHECK VACUUM HOSES (AIR PRESSURE SENSOR - AIR SWITCHING VALVE ASSEMBLY)**

(a) Check the vacuum hose connections with the air pressure sensor and air switching valve.

(b) Inspect the vacuum hose for blockages and damage.

OK:

Vacuum hose has no blockages or damage.

NG ▶ **REPAIR OR REPLACE VACUUM HOSE**

OK ▼

10.	**INSPECT AIR PRESSURE SENSOR**

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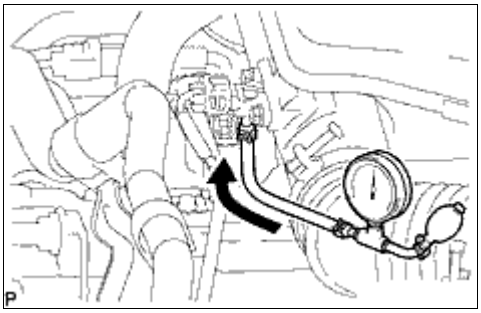
(a) Connect a pressure gauge to the air pressure sensor as shown in the illustration.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Air Pump Pressure (Absolute).



(f) Check that the pressure displayed on the Techstream fluctuates when applying the pressure to the air pressure sensor with the pressure gauge.

OK:

Pressure fluctuates in response to pressure applied with pressure gauge.

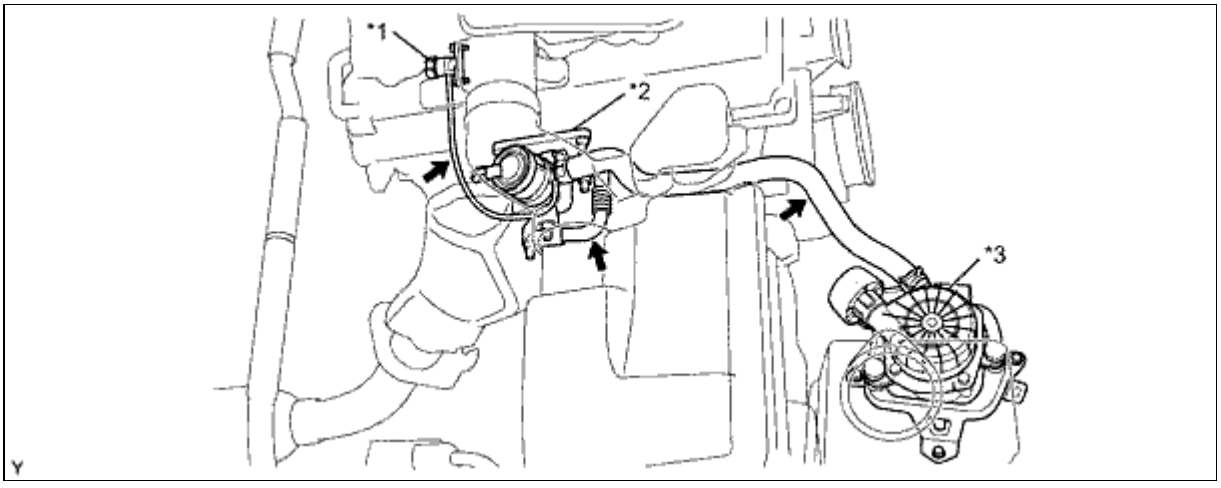
HINT:

The Techstream displays the air pump pressure (Air Pump Pressure (Absolute) as absolute pressure.

NG ▶ **REPLACE AIR PRESSURE SENSOR**

OK ▼

11.	**CHECK AIR INJECTION SYSTEM PIPE CONNECTIONS**



Text in Illustration

*1	Air Pressure Sensor	*2	Air Switching Valve Assembly

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*3	Air Pump Assembly	-	-

(a) Check that all the pipes and hoses between the air pump assembly and air switching valve assembly are securely connected.

(b) Inspect the pipes and hoses for blockages and damage.

OK:

Secondary air injection system piping has no blockages or damage.

NG ▶ **REPAIR OR REPLACE SECONDARY AIR INJECTION SYSTEM PIPING**

OK ▼

12.	**INSPECT AIR INJECTION CONTROL DRIVER (AIR INJECTION CONTROL DRIVER POWER SOURCE CIRCUIT)**

(a) Disconnect the air injection control driver connectors.

(b) Turn the ignition switch to ON.

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

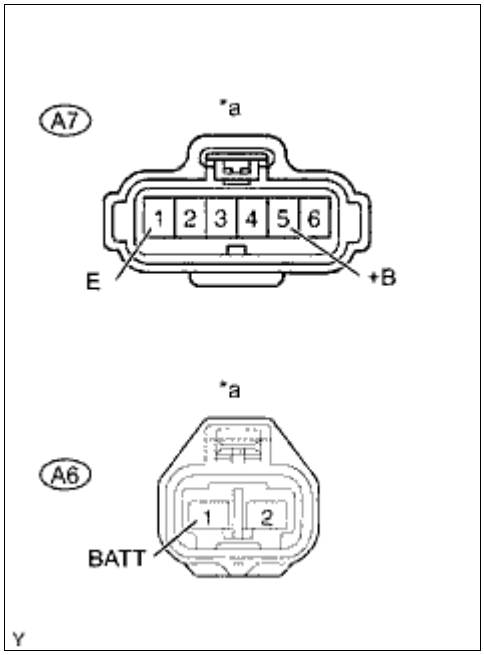
Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A7-5 (+B) - Body ground	Ignition Switch ON	11 to 14 V
A6-1 (BATT) - Body ground	Always	11 to 14 V

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-1 (E) - Body ground	Always	Below 1 Ω



Text in Illustration

*a	Front view of wire harness connector (to Air Injection Control Driver)

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NG ▶ **REPAIR OR REPLACE AIR INJECTION CONTROL DRIVER POWER SOURCE CIRCUIT**

OK ▼

13.	**CHECK HARNESS AND CONNECTOR (ECM - AIR INJECTION CONTROL DRIVER)**

(a) Disconnect the E21 ECM connector.

(b) Disconnect the A7 air injection control driver connector.

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

Standard Resistance :

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E21-6 (AIRP) - A7-4 (SIP)	Always	Below 1 Ω
E21-6 or A7-4 (SIP) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

14.	**INSPECT AIR PUMP ASSEMBLY**

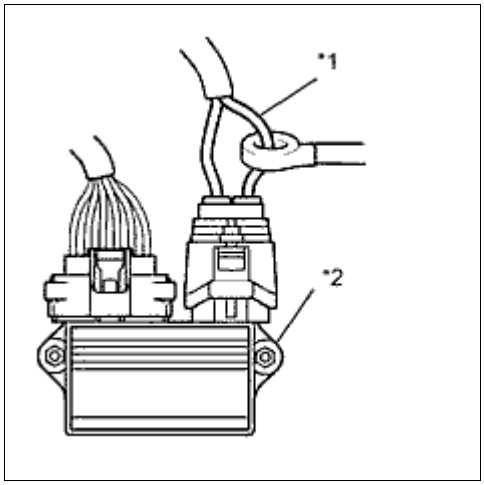
(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the 400 A probe of an ammeter to the (+) wire of the air pump assembly.

Text in Illustration

*1	Air Pump Wire
*2	Air Injection Control Driver



(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON.

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(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN and AIR PUMP: OFF, ASV: CLOSE.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(h) Measure the current while the air pump is on and off.

Standard Current:

TECHSTREAM OPERATION	AIR PUMP	AIR SWITCHING VALVE	SPECIFIED CONDITION
AIR PUMP: ON, ASV: OPEN	ON	OPEN	10 to 40 A
AIR PUMP: OFF, ASV: CLOSE	OFF	CLOSE	Below 1 A

NOTICE:

- This Secondary Air Injection Check only allows technicians to operate the secondary air injection system for a maximum of 5 seconds.

  Furthermore, the check can only be performed up to 4 times per trip. If the test is repeated, intervals of at least 30 seconds are required between checks.

  While secondary air injection system operation using the Techstream is prohibition (WAIT or ERROR).

  If ERROR is displayed on the Techstream during the test, stop the engine for 10 minutes, and then try again.
- Performing the Secondary Air Injection Check repeatedly may cause damage to the secondary air injection system. If necessary, leave an interval of several minutes between System Check operations to prevent the system from overheating.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected. Wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

NG ▶ **GO TO STEP 18**

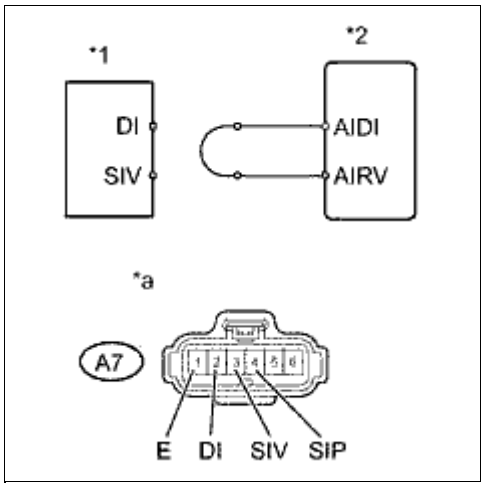
OK ▼

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15.	**PERFORM ACTIVE TEST USING TECHSTREAM**

(a) Disconnect the air injection control driver connector.

(b) Connect terminals DI and SIV of the wire harness connector for the air injection control driver.



Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Start the engine.

(h) Perform the secondary air injection system intrusive operation while the engine is idling.

(i) Measure the voltage between the SIV and E terminals of the ECM connector when the secondary air injection system is on and off.

(j) Turn the ignition switch off.

NOTICE:

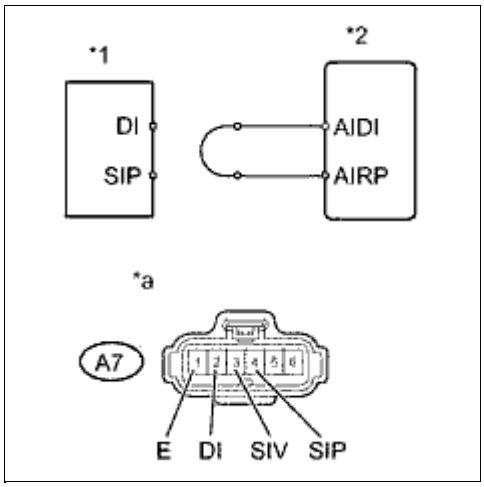
- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

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Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-3 (SIV) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(k) Connect terminals DI and SIP of the wire harness connector for the air injection control driver.



Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(l) Connect the Techstream to the DLC3.

(m) Turn the ignition switch to ON.

(n) Turn the Techstream on.

(o) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(p) Start the engine.

(q) Perform the secondary air injection system intrusive operation while the engine is idling.

(r) Measure the voltage between the SIP and E terminals of the ECM connector when the secondary air injection system is on and off.

NOTICE:

- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.

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- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-4 (SIP) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(s) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK
▼

16.	**REPLACE AIR INJECTION CONTROL DRIVER**

(a) Replace the air injection control driver.

NEXT
▼

17.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2444 AND/OR P2445)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air injection check / Automatic Mode.

(h) Start the engine after the Techstream initialization is finished.

(i) Perform the System Check operation by pressing Next.

(j) After operating the air injection system, perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.

(k) Check pending DTCs.

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OK:

No pending DTC output.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

(l) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK ▶ **END**

18.	**REPLACE AIR PUMP ASSEMBLY**

(a) Replace the air pump assembly INFO .

NEXT

19.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2444 AND/OR P2445)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air injection check / Automatic Mode.

(h) Start the engine after the Techstream initialization is finished.

(i) Perform the System Check operation by pressing Next.

(j) After operating the secondary air injection system, perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.

(k) Check pending DTCs.

OK:

No pending DTC output.

NOTICE:

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- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

(l) Turn the ignition switch off.

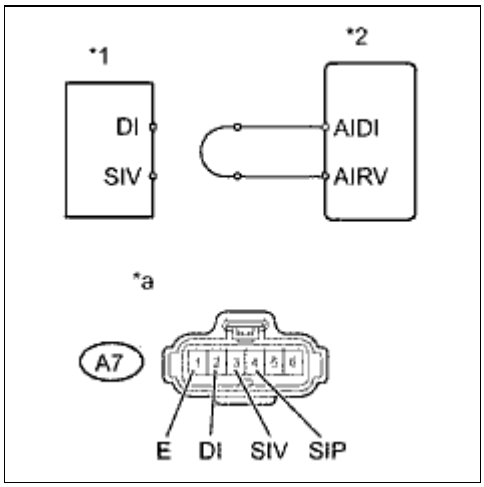
NG ▶ **GO TO STEP 20**

OK ▶ **END**

20.	**PERFORM ACTIVE TEST USING TECHSTREAM**

(a) Disconnect the air injection control driver connector.

(b) Connect terminals DI and SIV of the wire harness connector for the air injection control driver.



Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(g) Start the engine.

(h) Perform the secondary air injection system intrusive operation while the engine is idling.

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(i) Measure the voltage between the SIV and E terminals of the ECM connector when the secondary air injection system is on and off.

NOTICE:

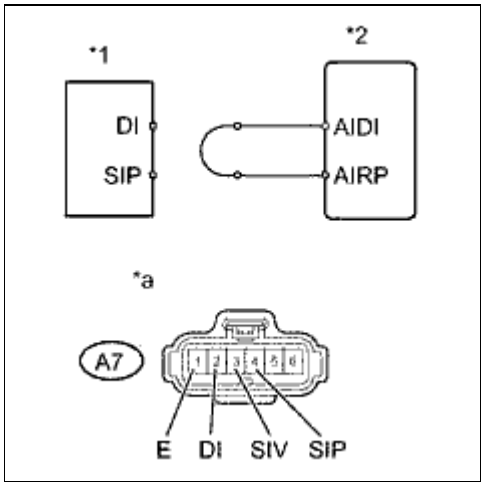
- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-3 (SIV) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(j) Turn the ignition switch off.

(k) Connect terminals DI and SIP of the wire harness connector for the air injection control driver.



Text in Illustration

*1	Air Injection Control Driver
*2	ECM
*a	Front view of wire harness connector (to Air Injection Control Driver)

(l) Connect the Techstream to the DLC3.

(m) Turn the ignition switch to ON.

(n) Turn the Techstream on.

(o) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air Injection Check / Manual Mode / AIR PUMP: ON, ASV: OPEN.

HINT:

When Manual Mode is selected, the Techstream initialization (atmospheric pressure measurement) is performed automatically. The initialization takes 10 seconds. After the initialization, AIR PUMP and ASV operation can be selected.

(p) Start the engine.

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(q) Perform the secondary air injection system intrusive operation while the engine is idling.

(r) Measure the voltage between the SIP and E terminals of the ECM connector when the secondary air injection system is on and off.

NOTICE:

- Do not perform the System Check operation repetitively. It may cause the damage in the system. If necessary, leave an interval of several minutes between System Check operations.
- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A7-4 (SIP) - A7-1 (E)	AIR PUMP: ON, ASV: OPEN	0.5 to 2 V
	AIR PUMP: OFF, ASV: CLOSE	11 to 14 V

(s) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK ▼

21.	**REPLACE AIR INJECTION CONTROL DRIVER**

(a) Replace the air injection control driver.

NEXT ▼

22.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2444 AND/OR P2445)**

(a) Start the engine and warm it up.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).

(g) Enter the following menus: Powertrain / Engine and ECT / Utility / Secondary Air injection check /

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Automatic Mode.

(h) Start the engine after the Techstream initialization is finished.

(i) Perform the System Check operation by pressing Next.

(j) After operating the air injection system, perform the following to confirm the secondary air injection system pending DTCs: Press the Exit.

(k) Check pending DTCs.

OK:

No pending DTC output.

NOTICE:

- When performing the Secondary Air Injection Check operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch off when the Secondary Air Injection Check operation finishes.

(l) Turn the ignition switch off.

NG ▶ **REPLACE ECM**

OK ▶ **END**

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Last Modified: 11-13-2015	6.6 C	**Doc ID:** RM000000T6X0GXX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: P2610; ECM / PCM Internal Engine Off Timer Performance; 2016 MY Tacoma [08/2015 -]		

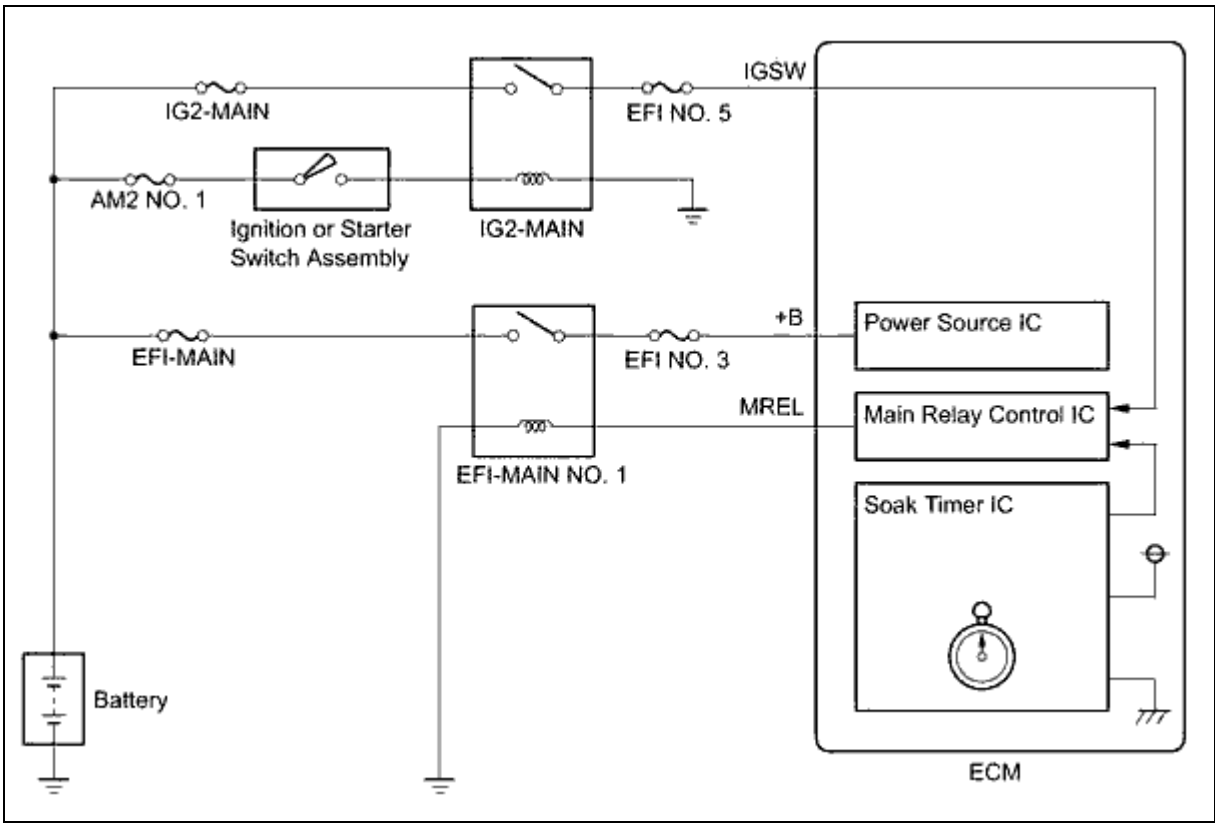
DTC	**P2610**	**ECM / PCM Internal Engine Off Timer Performance**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P2610	Soak timer (built into ECM)	ECM internal malfunction (2 trip detection logic).	ECM	Ignition switch off	2 trip

DESCRIPTION

The soak timer operates after the ignition switch is turned off. When a certain amount of time has elapsed after turning the ignition switch off the soak timer activates the ECM to perform malfunction checks which can only be performed after the engine is stopped. The soak timer is built into the ECM.



MONITOR DESCRIPTION

1. While the engine is running, the ECM monitors the synchronization of the soak timer and the CPU clock. If these two are not synchronized, the ECM interprets this as a malfunction, illuminates the MIL and stores the DTC.

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2. If the soak timer activates the ECM even though only a short amount of time has elapsed since the ignition switch was turned off, or if the soak timer does not activate the ECM even though a considerable amount of time has elapsed since the ignition switch was turned off, the ECM determines that the soak timer is malfunctioning, illuminates the MIL and stores a DTC the next time the ignition switch is turned ON.

MONITOR STRATEGY

Related DTC	P2610: ECM internal engine off timer performance
Required Sensors/Components	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	2 times: Case 1 -: Case 2 and 3
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever the following DTCs are not stored	None

Case 1

All of the following conditions are met	-
Battery voltage	8 V or higher
Ignition switch	OFF
CPU clock elapsed time	1.96608 seconds or more

Case 2

All of the following conditions are met	-
Internal engine OFF timer (elapsed time from engine stop)	10 minutes or more, and less than 30 minutes
Ignition switch	ON
Battery voltage	8 V or higher
Starter	OFF

Case 3

All of the following conditions are met	-
Internal engine OFF timer (elapsed time from engine stop)	40 minutes or more
Battery voltage	8 V or higher
Ignition switch	ON

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Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Case 1

One of the following conditions is met	Condition A, B or C
A. Both of the following conditions are met	Condition (a) and (b)
(a) CPU clock elapsed time	1.96608 seconds or more, and less than 8.323072 seconds
(b) Internal engine off timer	9.375 seconds or more
B. Both of the following conditions are met	Condition (c) and (d)
(c) CPU clock elapsed time	8.323072 to 10.420224 seconds
(d) Internal engine off timer	18.75 seconds or more
C. Both of the following conditions are met	Condition (e) and (f)
(e) CPU clock elapsed time	More than 10.420224 seconds
(f) Internal engine off timer	Less than 9.375 seconds

Case 2

ECM started by internal engine OFF timer last trip	Yes

Case 3

ECM started by internal engine OFF timer last trip	No

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Start the engine and warm it up.
6. Turn the ignition switch off and wait for at least 15 seconds.
7. Start the engine.
8. Stop the engine and leave the vehicle for 60 minutes or more.
9. Turn the ignition switch to ON and turn the Techstream on.
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
11. Read the pending DTCs.

    HINT:

    - If a pending DTC is output, the system is malfunctioning.
    - If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P2610.
14. Check the DTC judgment result.

TECHSTREAM	DESCRIPTION

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DISPLAY	
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

15. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- DTC P2610 is stored if an internal ECM problem is detected. Diagnostic procedures are not required. ECM replacement is necessary.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT

2.	**CHECK WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) On the Techstream, enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) If no pending DTC is displayed, the repair has been successfully completed.

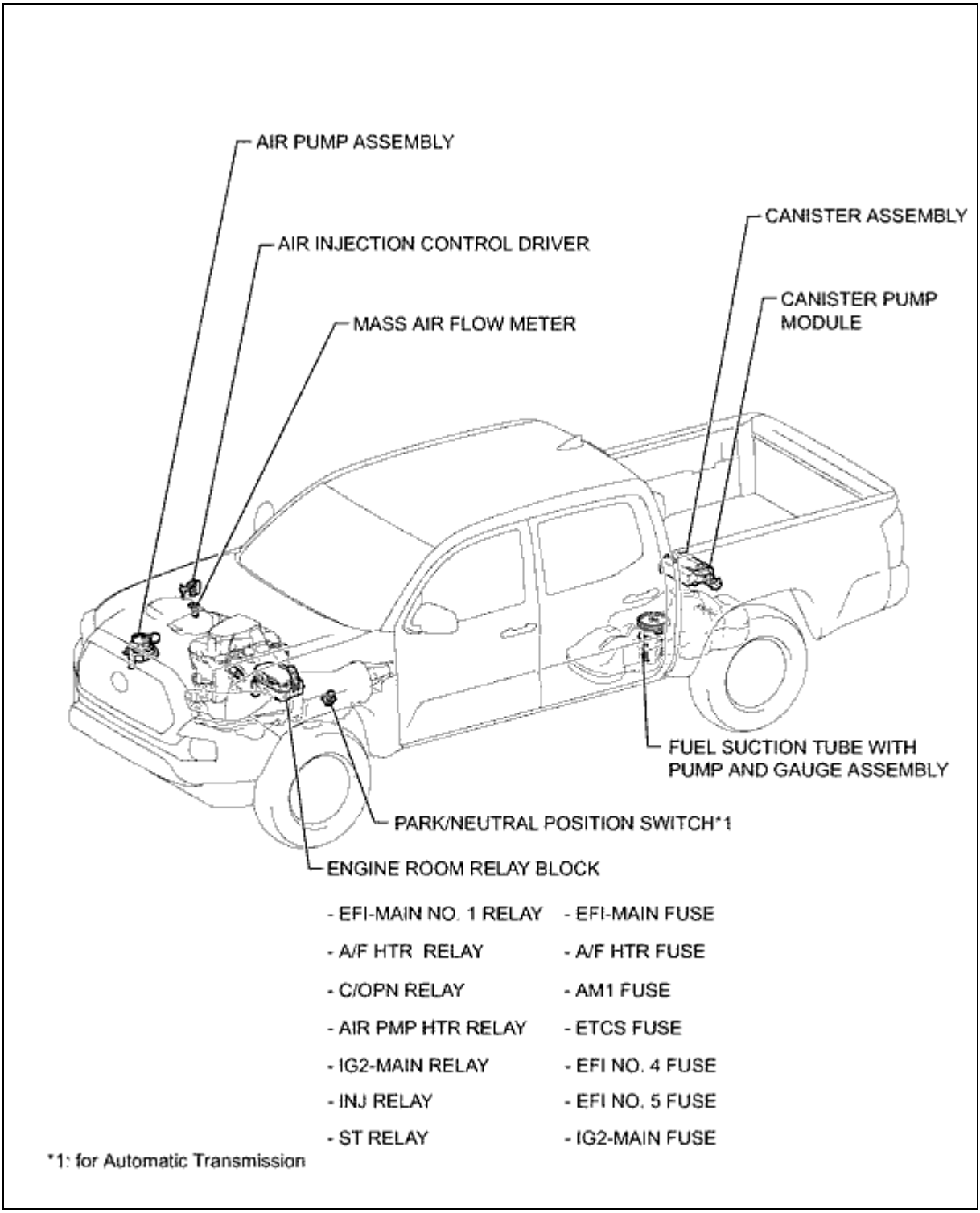
NEXT END

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM000000SXN01TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

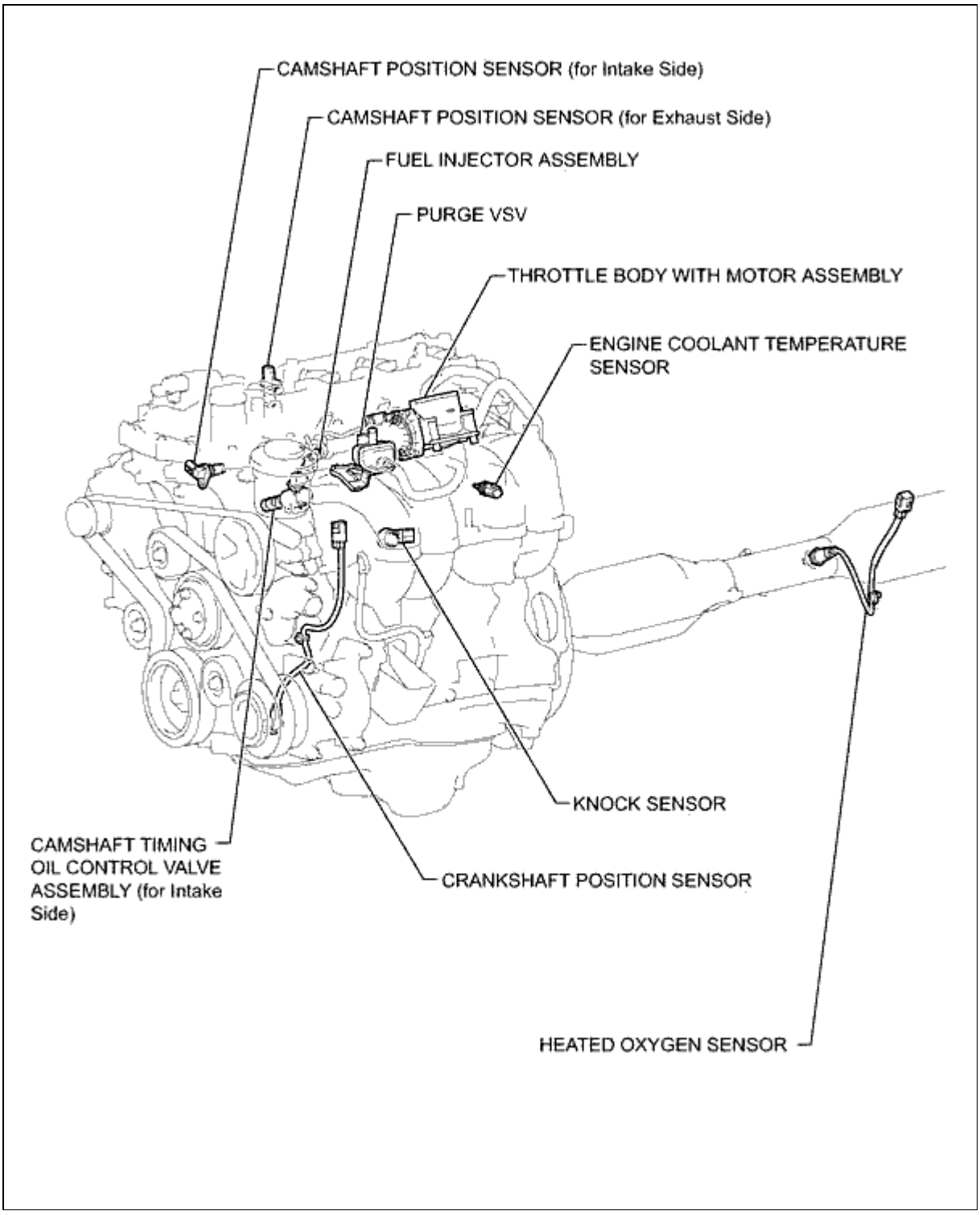
PARTS LOCATION

ILLUSTRATION



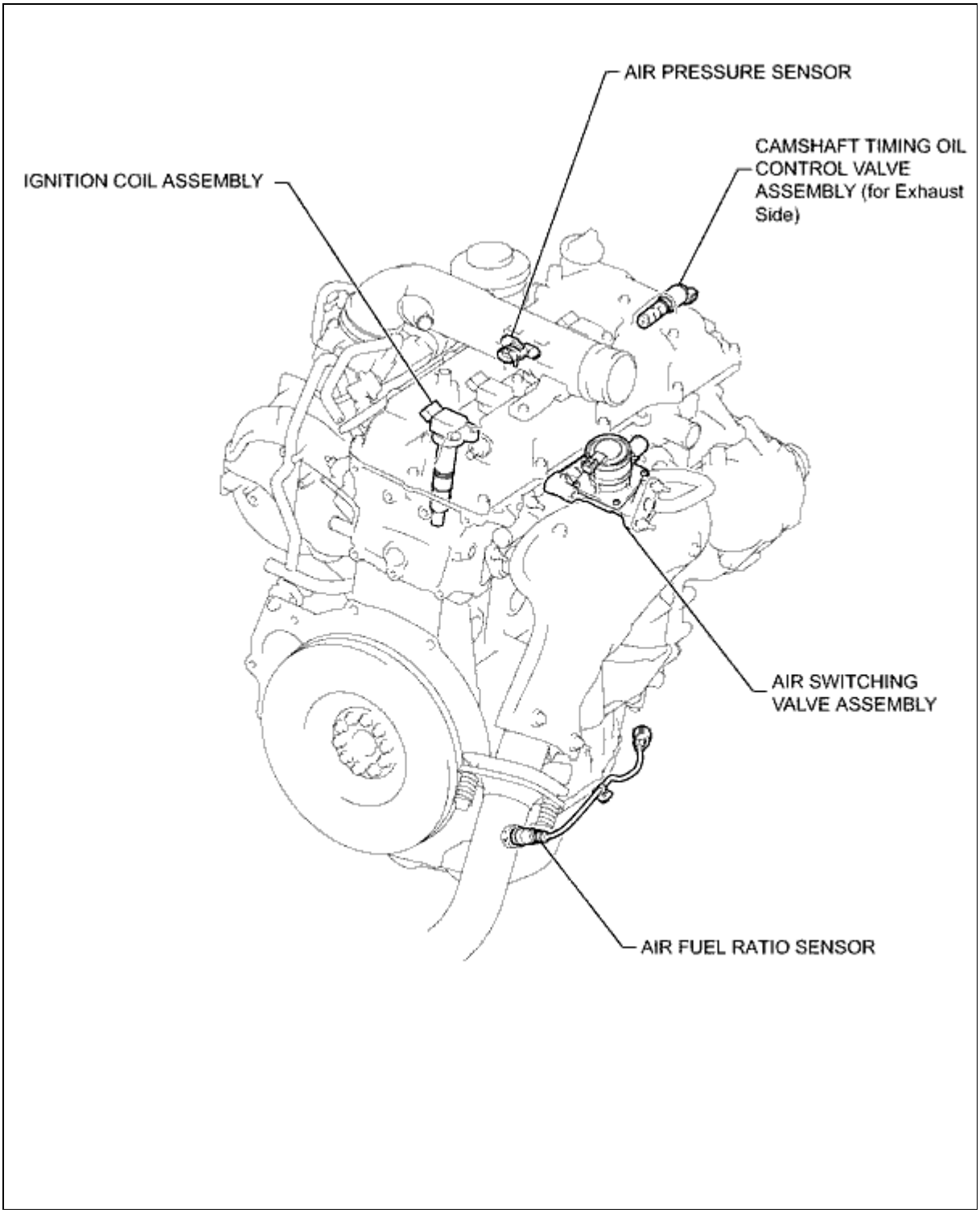
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ILLUSTRATION



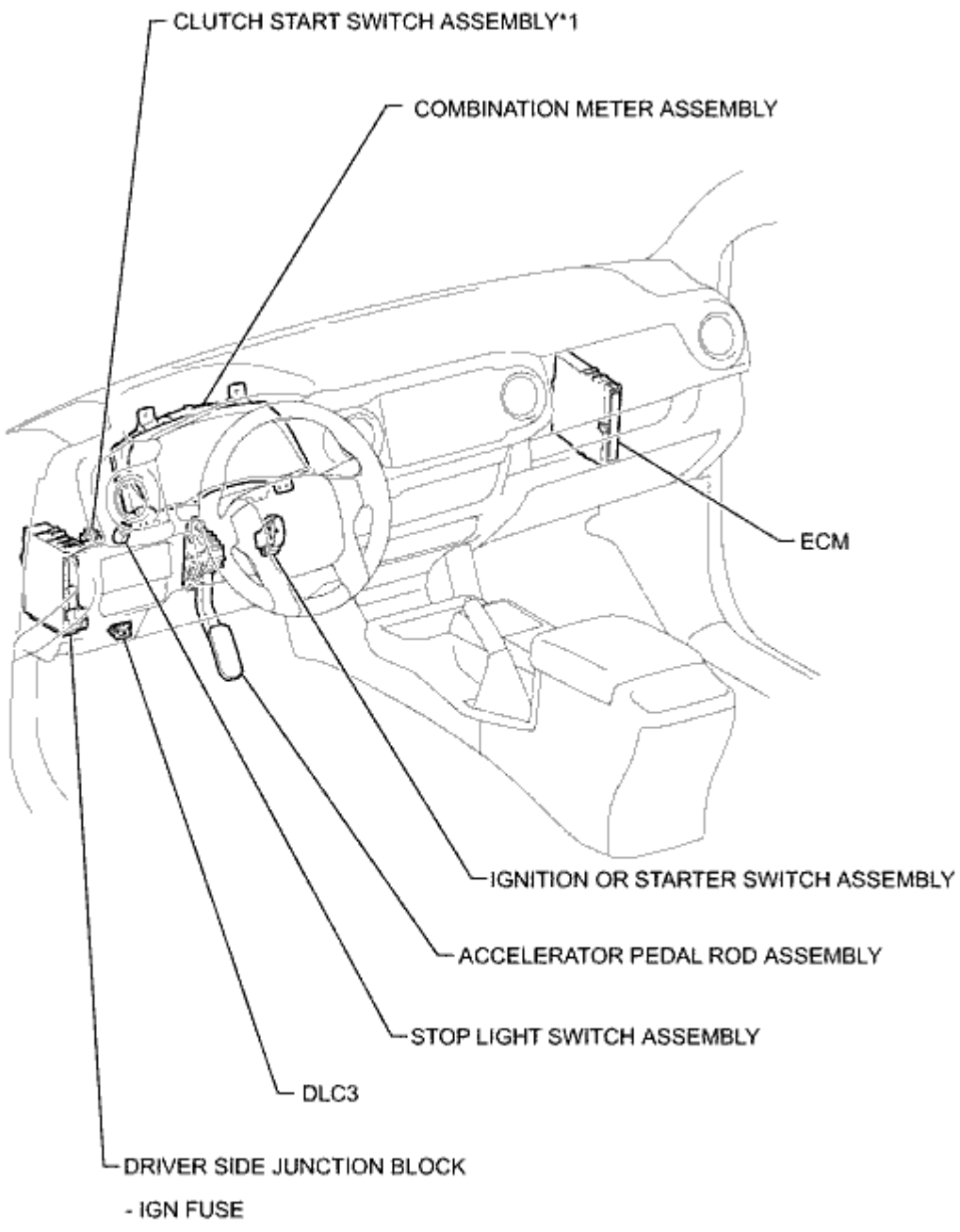
ILLUSTRATION

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ILLUSTRATION

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*1: for Manual Transmission

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Last Modified: 11-13-2015	6.6 L	**Doc ID:** RM000000X8V01FX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: PRECAUTION; 2016 MY Tacoma [08/2015 -]		

PRECAUTION

1. INITIALIZATION

NOTICE:

- If the ECM is replaced, register the ECU communication ID for Engine Immobiliser System INFO .
- Make sure to perform Reset Memory (AT initialization) when replacing the automatic transmission assembly, engine assembly or ECM.
  - For AC60E automatic transmission INFO .
  - For AC60F automatic transmission INFO .
- Perform Registration (VIN registration) when replacing the ECM INFO .

HINT:

- The engine learned value cannot be reset by disconnecting the battery negative (-) terminal or removing the EFI-MAIN and ETCS fuse.
- Refer to Initialization to perform Learning Value Reset and idle learning INFO .

2. WHEN USING TECHSTREAM

NOTICE:

Observe the following items for safety reasons:

- Before using the Techstream, read the instruction manual.
- Prevent the Techstream cable from being caught on the pedals, shift lever or steering wheel when driving with the Techstream connected to the vehicle.
- When driving the vehicle for testing purposes using the Techstream, 2 persons are required. One is for driving the vehicle, and the other operates the Techstream.

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Last Modified: 11-13-2015	6.6 T	**Doc ID:** RM000000SXO021X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: PROBLEM SYMPTOMS TABLE; 2016 MY Tacoma [08/2015 -]		

PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

SFI system

SYMPTOM	SUSPECTED AREA	SEE PAGE
Engine does not crank (Does not start)	Battery	INFO
	Starter relay	INFO
	Starter assembly	INFO
	Starter signal circuit	INFO
	Park/neutral position switch*2	INFO
	Park/neutral position switch*3	INFO
	Clutch start switch*1	INFO
No initial combustion (Does not start)	ECM power source circuit	INFO
	Engine immobiliser system	INFO
	VC output circuit	INFO
	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	Ignition system	INFO
	Crankshaft position sensor	INFO
	Camshaft position sensor (for intake side)	INFO
	VVT system	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Engine cranks normally but difficult to start	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO

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SYMPTOM	SUSPECTED AREA	SEE PAGE
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	Ignition system	INFO
	Spark plug	INFO
	Engine coolant temperature sensor	INFO
	Compression	INFO
	Crankshaft position sensor	INFO
	ECM power source circuit	INFO
	Starter signal circuit	INFO
	Intake system	INFO
	Electronic throttle control system	INFO
	Flow chart [Engine difficult to start]	INFO
	PCV valve	INFO
	PCV hose	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Incomplete intermittent combustion occurs (Does not start)	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	Fuel lines	-
	Ignition system	INFO
	Spark plug	INFO
	Crankshaft position sensor	INFO
	Camshaft position sensor (for intake side)	INFO
	Starter signal circuit	INFO
	Electronic throttle control system	INFO
	Intake system	INFO
	VVT system	INFO
High engine speed	Air conditioning signal circuit*4	INFO
	Air conditioning signal circuit*5	INFO
	ECM power source circuit	INFO
	Electronic throttle control system	INFO
	Engine coolant temperature sensor	INFO

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SYMPTOM	SUSPECTED AREA	SEE PAGE
	Intake system	INFO
	PCV valve	INFO
	PCV hose	INFO
Low engine speed (Poor idle)	Air conditioning signal circuit*4	INFO
	Air conditioning signal circuit*5	INFO
	Fuel pump control circuit	INFO
	Electronic throttle control system	INFO
	Intake system	INFO
	PCV valve	INFO
	PCV hose	INFO
Rough idle	Flow chart [Lack of power]	INFO
	Flow chart [Rough idling]	INFO
	Fuel pump control circuit	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	Fuel line	-
	VVT system	INFO
	Compression	INFO
	Air fuel ratio sensor	INFO
	Heated oxygen sensor	INFO
	Purge VSV	INFO
	Mass air flow meter	INFO
	Ignition system	INFO
	Spark plug	INFO
	Knock sensor	INFO
	Intake system	INFO
	Electronic throttle control system	INFO
	PCV valve	INFO
	PCV hose	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Hunting (Poor idle)	Intake system	INFO
	Electronic throttle control system	INFO
	Mass air flow meter	INFO

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SYMPTOM	SUSPECTED AREA	SEE PAGE
	Air fuel ratio sensor	INFO
	PCV valve	INFO
	PCV hose	INFO
	ECM power source circuit	INFO
	Fuel pump control circuit	INFO
	Spark plug	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
Hesitation and/or poor acceleration (Poor driveability)	Flow chart [Lack of power]	INFO
	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	Fuel lines	-
	Intake system	INFO
	Electronic throttle control system	INFO
	Mass air flow meter	INFO
	Ignition system	INFO
	Compression	INFO
	VVT system	INFO
	Knock sensor	INFO
	ECM power source circuit	INFO
	Brake override system	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Lack of power	Flow chart [Lack of power]	INFO
Surging (Poor driveability)	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	ECM power source circuit	INFO
	Ignition system	INFO

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SYMPTOM	SUSPECTED AREA	SEE PAGE
	Spark plug	INFO
	Mass air flow meter	INFO
	VVT system	INFO
	Compression	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Engine stalls soon after starting	Flow chart [Engine stalls]	INFO
	Fuel pump control circuit	INFO
	Fuel suction tube with pump and gauge assembly	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly	INFO
	ECM power source circuit	INFO
	Ignition system	INFO
	Spark plug	INFO
	Intake system	INFO
	Mass air flow meter	INFO
	Compression	INFO
	VVT system	INFO
	Electronic throttle control system	INFO
	PCV valve	INFO
	PCV hose	INFO
	No. 1 valve rocker arm sub-assembly*3	INFO
Engine stalls only during A/C operation	Air conditioning signal circuit*4	INFO
	Air conditioning signal circuit*5	INFO
	ECM	INFO

*1: for Manual Transmission
*2: for AC60E Automatic Transmission
*3: for AC60F Automatic Transmission
*4: for Automatic Air conditioning System
*5: for Manual Air conditioning System

HINT:

*3: Check the "Fuel Cut Elps Time" value in the Data List or the freeze frame data which were present when the malfunction occurred. If the value is more than 0 seconds, a high engine speed (fuel cut speed +500 rpm or more) has occurred in the past. Since the misfire may be caused by No. 1 valve rocker arm sub-assembly detaching due to an extremely high engine speed, check that the No. 1 valve rocker arm sub-assembly are properly attached INFO . By clearing the DTC, "Fuel Cut Elps Time" will be cleared.

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Last Modified: 11-13-2015	6.6 D	**Doc ID:** RM000000SXQ0B7X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: READINESS MONITOR DRIVE PATTERN; 2016 MY Tacoma [08/2015 -]		

READINESS MONITOR DRIVE PATTERN

1. PURPOSE OF READINESS TESTS

- The On-Board Diagnostic (OBD II) system is designed to monitor the performance of emission related components, and indicate any detected abnormalities using DTCs (Diagnostic Trouble Codes). Since various components need to be monitored during different driving conditions, the OBD II system is designed to run separate monitoring programs called Readiness Monitors.
- To view the status, enter the following menus: Powertrain / Engine and ECT / Monitor / Current Monitor / Current.
- When the status of a Readiness Monitor reads Complete, the necessary conditions have been met for running the performance tests for that Readiness Monitor.
- A generic OBD II scan tool can also be used to view the Readiness Monitor status.

HINT:

Many state Inspection and Maintenance (I/M) programs require the status of vehicle Readiness Monitor to show Complete before beginning emission tests.

The Readiness Monitor is reset to Incomplete if:

- The ECM has lost battery power or blown a fuse.
- DTCs have been cleared.
- The conditions for running the Readiness Monitor have not been met.

If the Readiness Monitor status shows Incomplete, follow the appropriate Readiness Monitor Drive Pattern to change the status to Complete.

CAUTION:

Strictly observe posted speed limits, traffic laws, and road conditions when performing these drive patterns.

NOTICE:

These drive patterns represent the fastest method of satisfying all conditions necessary to achieve complete status for each specific Readiness Monitor.

In the event of a drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed. In most cases, the Readiness Monitor will still achieve complete status upon completion of the drive pattern.

To ensure completion of the Readiness Monitors, avoid sudden changes in vehicle load and speed (driving up and down hills and/or sudden acceleration).

2. CATALYST MONITOR (ACTIVE AIR FUEL RATIO CONTROL TYPE)

(a) Refer to Confirmation Driving Pattern [P0420] INFO .

3. VVT SYSTEM MONITOR

(a) Refer to Confirmation Driving Pattern [P0011] INFO .

(b) Refer to Confirmation Driving Pattern [P0014] INFO .

4. EVAP SYSTEM MONITOR (KEY OFF TYPE)

(a) Refer to Confirmation Driving Pattern [EVAP System] INFO .

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5. AIR FUEL RATIO AND HEATED OXYGEN SENSOR MONITORS (ACTIVE AIR FUEL RATIO CONTROL TYPE)

(a) Refer to Confirmation Driving Pattern [P0136] INFO .

(b) Refer to Confirmation Driving Pattern [P2195] INFO .

6. AIR FUEL RATIO AND HEATED OXYGEN SENSOR HEATER MONITORS (FRONT AIR FUEL RATIO AND REAR HEATED OXYGEN SENSOR TYPE)

(a) Refer to Confirmation Driving Pattern [P0031] INFO .

(b) Refer to Confirmation Driving Pattern [P0037] INFO .

7. SECONDARY AIR INJECTION MONITOR

(a) Refer to Confirmation Driving Pattern [P0412] INFO .

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Last Modified: 11-13-2015	6.6 M	**Doc ID:** RM000000PDT0FWX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: REGISTRATION; 2016 MY Tacoma [08/2015 -]		

REGISTRATION

NOTICE:

The Vehicle Identification Number (VIN) must be input into the replacement ECM.

HINT:

The VIN is a 17-digit alphanumeric vehicle identification number. The Techstream is required to register the VIN.

1. DESCRIPTION (Using the Techstream)

HINT:

This registration section consists of 2 parts: Read VIN and Write VIN.

(a) Read VIN: This process allows the VIN stored in the ECM to be read in order to confirm that the 2 VINs, provided with the vehicle and stored in the vehicle ECM, are the same.

(b) Write VIN: This process allows the VIN to be input into the ECM. If the ECM is replaced, or the ECM VIN and vehicle VIN do not match, the VIN can be registered, or overwritten in the ECM by following this procedure.

2. READ VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / VIN / VIN Read.

3. WRITE VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / VIN / VIN Write.

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000005RMD024X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Rough Idling; 2016 MY Tacoma [08/2015 -]		

Rough Idling

DESCRIPTION

PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high Strong engine vibration due to above symptoms	• Ignition malfunction • Deviation in air fuel ratio (Excessive or insufficient intake air volume or fuel supply) • Insufficient compression • Changes in load from another system	Ignition system	• Spark plug • Ignition coil assembly
		Fuel system	• Fuel injector assembly • Fuel suction tube with pump and gauge assembly • Fuel pump control circuit • Fuel line • Purge VSV system • Fuel quality (existence of foreign matter, degradation)
		Intake and exhaust systems	• Mass air flow meter • Intake system (Air leaks or deposit accumulation) • Throttle body with motor assembly • Air fuel ratio sensor • Heated oxygen sensor • Camshaft timing oil control assembly • Variable Valve Timing system (VVT system) • Brake booster assembly
		Other control systems	• ECM • Wire harness or connector • Knock sensor

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PROBLEM SYMPTOM	SUSPECTED AREA	TROUBLE AREA	
			• Engine coolant temperature sensor
		Engine	• Thermostat • Engine assembly • Engine mount
		High load from another system	• Air conditioning system • Power steering system • Electrical load signal system

HINT:

- If any other DTCs are output, perform troubleshooting for those DTCs first.
- Make sure to reproduce the conditions present when the malfunction occurred.
- Using the Techstream, read the Data List to confirm the engine operating conditions. This information can be useful when troubleshooting.
- If the problem symptoms do not recur, attempt to reproduce the symptoms and conditions when the malfunction occurred based on the result of the customer problem analysis. Place the priority on confirming the symptoms.

1. SYMPTOM AND CAUSE OF SYSTEM MALFUNCTION

HINT:

The following are descriptions of the characteristics of each system malfunction. After understanding the link between the causes and symptoms, perform the inspection of each component. Even if the problem symptom does not recur, signs of the malfunction may be found in the Data List.

(a) Ignition system

Spark plug

Main cause of malfunction	Performance degradation (wear, existence of foreign matter, etc.)
Symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

HINT:

If the spark plug of the malfunctioning cylinder is abnormally wet with fuel, a leaking fuel injector assembly is suspected.

Ignition coil assembly

Main cause of malfunction	Internal malfunction
Problem symptom	Engine speed fluctuation due to abnormal combustion
Data List	Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

(b) Fuel system

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Fuel injector assembly

Main cause of malfunction	Blockage
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• Short FT #1 • Long FT #1 • Fuel System Status #1 • Target Air-Fuel Ratio • AF Lambda B1S1 • A/F Learn Value Idle #1 • A/F Learn Value Low #1 • A/F Learn Value Mid1 #1 • A/F Learn Value Mid2 #1 • A/F Learn Value High #1 • Total FT #1

HINT:

If the engine malfunction disappears when the fuel injection volume is increased or decreased using the Control the Injection Volume, the respective cylinder may be malfunctioning.

Fuel system

HINT:

If the air fuel ratio becomes lean only when the engine is running under a high load and at a high engine speed, clogging of the fuel suction tube with pump and gauge assembly or fuel filter is suspected.

Fuel quality

Main cause of malfunction	• Fuel degradation due to age or water contamination • Low fuel quality • Addition of fuel additive
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Engine is difficult to start

(c) Intake and exhaust systems

Mass air flow meter

Main cause of malfunction	Performance degradation (existence of foreign matter, etc.)
Problem symptom	Lack of power
Data List	MAF

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HINT:

If the value of the Data List item "MAF" is abnormal, a malfunction of the mass air flow meter is suspected.

Throttle system

Main cause of malfunction	Inappropriate trim volume adjustment due to accumulation of deposits
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high
Data List	• ISC Learning Value • ISC Flow • ISC Feedback Value • Electric Load Feedback Val • Air Conditioner FB Val • Eng Stall Control FB Flow

Air fuel ratio sensor, Heated oxygen sensor

Main cause of malfunction	Deviation in sensor characteristics
Problem symptom	Abnormal combustion due to deviation of actual air fuel ratio from calculated ratio
Data List	• AFS Voltage B1S1 • O2S B1S2 • Fuel System Status #1

(d) Engine

Engine assembly

Main cause of malfunction	• Compression loss • Accumulation of deposits (Combustion chamber, intake valve or intake manifold)
Problem symptom	• Engine speed fluctuation due to abnormal combustion • Idle speed too low or high • Hesitation during acceleration or stalling
Data List	• Compression Leakage Count • Rough Idle Status • Plural Cylinders Rough Idle • Rough Idle #1 to #4

HINT:

- If deposits have accumulated in the combustion chamber or on an intake valve, the engine may stall when deposits are caught on an intake valve.
- When performing the Active Test "Check the Cylinder Compression", if the speed of one cylinder is higher

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than the others, the cylinder may have a compression loss.
- If deposits accumulate on the intake valves, the supply of fuel may be delayed due to adherence of the fuel to the deposits, causing a rough idle.

2. Data List Items Related to Rough Idling

HINT:

Depending on the vehicle model, the applicable Data List items may vary. Data List items other than the ones used in the diagnostic procedure are for reference only.

- Compression Leakage Count*1
- Rough Idle Status*1
- Plural Cylinders Rough Idle*1
- Rough Idle #1 to #4*1
- ISC Learning Value
- ISC Flow
- ISC Feedback Value
- Electric Load Feedback Val
- Air Conditioner FB Val
- Eng Stall Control FB Flow
- Short FT #1
- Long FT #1
- Fuel System Status #1
- Target Air-Fuel Ratio
- AF Lambda B1S1
- A/F Learn Value Idle #1
- A/F Learn Value Low #1
- A/F Learn Value Mid1 #1
- A/F Learn Value Mid2 #1
- A/F Learn Value High #1
- Total FT #1
- MAF
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count
- AFS Voltage B1S1
- O2S B1S2

*1: for Automatic Transmission

INSPECTION PROCEDURE

PROCEDURE

1.	**INTERVIEW THE CUSTOMER**

(a) Interview the customer for details about the conditions when the rough idle occurred.

HINT:

Depending on the conditions when the rough idle occurred, a malfunction in one of the following areas is suspected.

PROBLEM SYMPTOM	SUSPECTED AREA

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PROBLEM SYMPTOM	SUSPECTED AREA
Hesitation or lack of power occurs during acceleration, regardless of whether engine is cold or warm	• For low mileage vehicles (ODO reading of less than approximately 20000 km (7722 mile) or yearly mileage of less than 2000 km (772 mile)): Fuel quality (degradation, water contamination, etc.) • For high mileage vehicles (ODO reading of more than approximately 150000 km (57915 mile)): Excessively lean air fuel ratio during acceleration due to deposits in intake system or combustion chamber caught temporarily on intake or exhaust valve or adherence of fuel to the deposits • Abnormal mass air flow meter output due to existence of foreign matter • Decrease in fuel injector assembly injection volume due to low quality fuel
Engine stalls or is difficult to start immediately after engine stalled, regardless of whether engine is cold or warm	Deposits in intake system or combustion chamber caught temporarily on intake or exhaust valve
• When decelerating vehicle to a stop, engine speed drops momentarily and vehicle shudders • When moving shift lever from N to D or R, or operating air conditioning system or any electrical components, engine speed fluctuates and vehicle shudders	Temporary deviation in the electrical throttle system idle speed control due to external factors (fuel quality, air conditioning system (environmental causes or low refrigerant pressure), charging system (battery deterioration or low power generation by the alternator) or brake booster system)

NEXT

2.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Perform a road test.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(f) Read the DTCs.

Result

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RESULT	PROCEED TO
DTCs are not output	A
DTC is output (DTCs other than P1603, P1604 or P1605 are output)	B

B ▶ **GO TO DTC CHART**

A ▼

3.	SYMPTOM CONFIRMATION

(a) Check if the problem symptoms reported in the customer problem analysis recur.

HINT:

If the problem symptoms do not recur, attempt to reproduce the conditions when the malfunction occurred based on the result of the customer problem analysis.

Result

RESULT	PROCEED TO
The problem symptom recurs	A
The problem symptom does not recur (occurred in the past)	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

4.	READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ISC Learning Value.

(e) Read the value displayed on the Techstream.

Result

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RESULT	PROCEED TO
Less than 6.2 L/s	A
Other than above	B

B ▶ **GO TO STEP 11**

A ▼

5.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the value displayed on the Techstream.

Result

DATA LIST	RESULT	PROCEED TO
Short FT #1 + Long FT #1	-15% or higher, or less than 15%	A
	Other than above	B

HINT:

- "Total FT #1" is used to detect an abnormal air fuel ratio. As the value of "Total FT #1" is corrected by the ECM before it is displayed in the Data List, the displayed value may not be equal to the sum of the measured "Short FT #1" and "Long FT #1".
- An abnormally lean or rich tendency can be checked by reading the following Data List items: A/F Learn Value Idle #1, A/F Learn Value Low #1, A/F Learn Value Mid1 #1, A/F Learn Value Mid2 #1 and A/F Learn Value High #1.
- The following may cause a lean air fuel ratio (an operating range in which the air fuel ratio learned value correction is +15% or more):
    a. Decrease in fuel injector assembly injection volume
    b. Decrease in Mass air flow meter output (due to existence of foreign matter)
    c. Air leaks in intake system after Mass air flow meter
    d. Decrease in fuel pressure (at fuel filter, fuel suction tube with pump and gauge assembly or fuel pressure regulator assembly)
- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value High #1" only is corrected to the positive side, a malfunction in the fuel system (clogging of the fuel suction tube with pump and gauge assembly or fuel filter) is suspected.
- On vehicles which the learning value for each operating range can be checked, if the value of "A/F Learn Value Idle #1" or "A/F Learn Value Low #1" only is corrected to the positive side, an air leak after the mass air flow meter is suspected.
- The following may cause a rich air fuel ratio (an operating range in which the air fuel ratio learned value correction is -15% or less):

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a. Increase in the fuel injector assembly injection volume
b. Purge VSV system

B GO TO STEP 15

A

6.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE SELECT CYLINDER FUEL CUT)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

HINT:

Reproduce the vehicle conditions when the malfunction occurred. (such as after the engine is warmed up or after a cold start).

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Select Cylinder Fuel Cut / Engine Speed.

(f) According to the display on the Techstream, perform the Active Test and check for a malfunctioning cylinder.

HINT:

- Perform fuel-cut for each cylinder and check the change in the engine speed.
- If the engine speed of a cylinder does not change while performing the Active Test, it can be determined that the cylinder is malfunctioning.
- If the engine speed of all cylinders change while performing the Active Test, it can be determined that multiple cylinders are malfunctioning.
- A cylinder for which the Data List item "Cylinder Misfire Count" increases may be malfunctioning.
- If "Compression Leakage Count" in the Data List increases, misfiring due to insufficient compression may be occurring.

Result

RESULT	PROCEED TO
One cylinder is malfunctioning	A
Multiple or all cylinders are malfunctioning, or the malfunctioning cylinder cannot be determined.	B

B GO TO STEP 15

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A

7.	PERFORM ACTIVE TEST USING TECHSTREAM (CHECK THE CYLINDER COMPRESSION)

HINT:

If the vehicle does not support the Active Test "Check the Cylinder Compression", measure the compression pressure. If the compression pressure is normal, go to step 8.

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression / Data List / Compression / Engine Speed of Cyl #1 to #4, Av Engine Speed of All Cyl.

HINT:

To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

(g) While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

HINT:

After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

(h) Crank the engine for about 10 seconds.

(i) Monitor the engine speed (Engine Speed of Cyl and Av Engine Speed of All Cyl) displayed on the Techstream.

HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

(j) Stop cranking the engine, and then change "Check the Cylinder Compression" to OFF after the engine stops.

NOTICE:

- If the Active Test is changed to OFF while the engine is being cranked, the engine will start.
- When performing the Active Test, DTC P1604 (Startability Malfunction) may be stored.

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- After performing the Active Test, make sure to check and clear DTCs.

(k) Read the value.

HINT:

- If the value of Data List item "Engine Speed of Cyl" of a cylinder is higher than other cylinders, the cylinder may be malfunctioning.
- If the value of Data List item "Engine Speed of Cyl" is high for only one cylinder, compression loss is suspected.

Result

RESULT	PROCEED TO
There is no variation in "Engine Speed of Cyl" (All cylinders display approximately the same value for "Engine Speed of Cyl")	A
There is variation in "Engine Speed of Cyl" (Only one cylinder displays a value for "Engine Speed of Cyl" that differs considerably)	B

B ▶ **GO TO STEP 13**

A ▼

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Idle the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

HINT:

Change the fuel injection volume between the minimum and maximum range of correction (e.g. -12.5% to 12.5%).

Result

RESULT	PROCEED TO
Malfunction is still present even if the fuel injection volume is changed	A
Malfunction disappears when the fuel injection volume is changed	B

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B GO TO STEP 14

A

9.	**CHECK IGNITION SYSTEM**

(a) Check the ignition system.

HINT:

- Interchange the ignition coil assembly and spark plug of the malfunctioning cylinder with those of a known good cylinder and check if the malfunctioning cylinder returns to normal.
- If the spark plug of the malfunctioning cylinder is abnormally wet with fuel even after the ignition coil assembly and spark plug are replaced, a leaking fuel injector assembly is suspected.

Result

RESULT	PROCEED TO
The malfunctioning cylinder does not return to normal	A
The malfunctioning cylinder returned to normal	B

B GO TO STEP 21

A

10.	**INSPECT OTHER RELATED COMPONENTS**

(a) Check the ignition coil assembly power source circuit, wire harness and connectors.

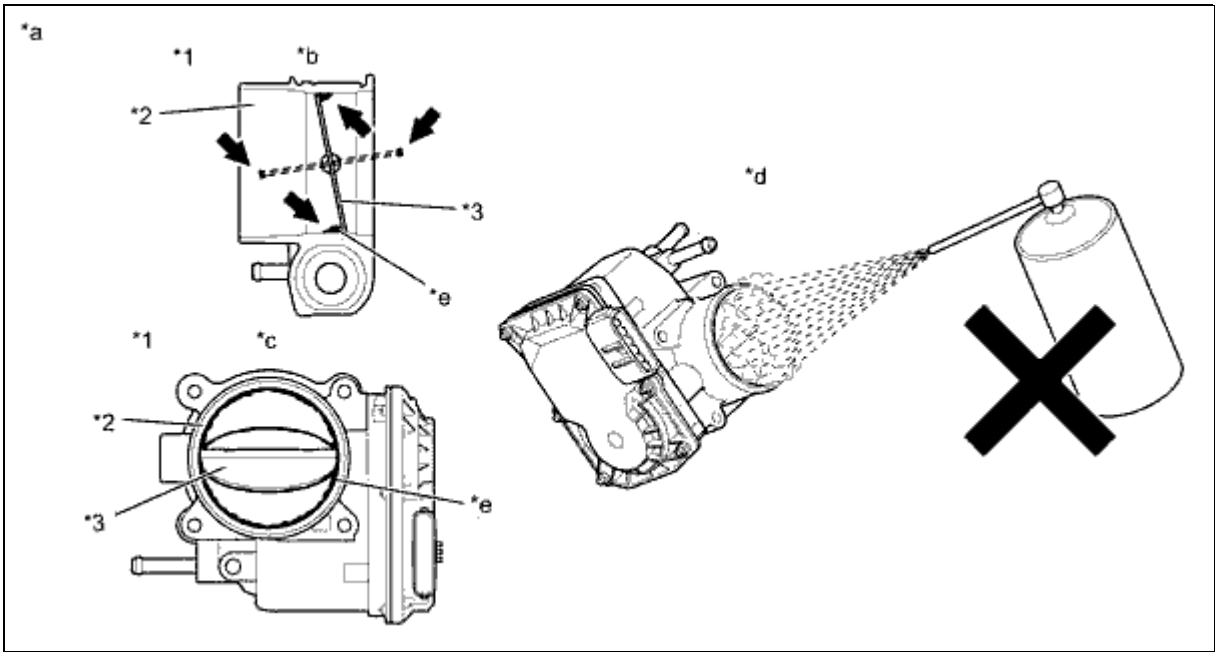
NEXT GO TO STEP 21

11.	**REMOVE FOREIGN OBJECT (CLEAN THROTTLE BODY WITH MOTOR ASSEMBLY)**

(a) Clean off any deposits from the inside of the throttle body with motor assembly.

(b) Push open the throttle valve and wipe off any carbon from the valve and bore using a piece of cloth soaked in non-residue solvent.

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Text in Illustration

*1	Throttle Body with Motor Assembly	*2	Bore
*3	Valve	-	-
*a	Reference	*b	Throttle Body with Motor Assembly Cross-section Diagram
*c	When valve fully opened	*d	Do not directly apply cleaner
*e	Deposits	-	-

NOTICE:

- Make sure that the cloth or your fingers do not get caught in the valve.
- Make sure that foreign matter does not enter the throttle valve.
- Do not directly apply non-residue solvent to the throttle body with motor assembly or wash the throttle body with motor assembly. Cleaning solvent may leak into the motor from the shaft and cause problems such as rust or valve movement problems.
- If there is coating material on the edge of the valve, be careful not to remove it.

HINT:

The illustrations are for reference only. Actual parts may differ.

NEXT

12.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

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(d) Turn the Techstream on.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

(f) Allow the engine to idle for 3 minutes or more and confirm that the engine speed is within the specified range.

HINT:

If the engine is operated without performing learning value reset and idle learning after cleaning the deposits from the throttle body with motor assembly, the idle speed may increase.

NEXT **GO TO STEP 22**

13.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure. If the compression pressure of a cylinder is low, inspect the engine assembly and repair or replace parts as necessary INFO .

HINT:

Perform "Inspection After Repair" after replacing the engine assembly INFO .

NEXT **GO TO STEP 22**

14.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assembly of the malfunctioning cylinder INFO .

HINT:

- If the air fuel ratio learned value is corrected to the positive side for all operating ranges due to low fuel injector assembly injection volume, replace the fuel injector assemblies of all cylinders.
- Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT **GO TO STEP 22**

15.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

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(f) According to the display on the Techstream, read the Data List when the ignition switch is turned to ON and while maintaining an engine speed of 3000 rpm.

Result

RESULT	PROCEED TO
Other than below	A
Ignition switch ON (engine stopped): 1 gm/sec or higher Engine speed 3000 rpm (without load): Less than 7.6 gm/sec	B

B ▶ **GO TO STEP 19**

A ▼

16.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up until the engine coolant temperature 75°C (167°F) or higher with all the accessories switched off.

(e) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(f) Idle the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / Primary / AFS Voltage B1S1 and O2S B1S2.

(h) According to the display on the Techstream, perform the Active Test and check the vehicle conditions when increasing and decreasing the fuel injection volume.

NOTICE:

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- Read the output voltage immediately after warming up the air fuel ratio sensor and heated oxygen sensor to avoid an inaccurate reading due to a sensor cooling.

HINT:

The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
AFS Voltage B1S1	12.5%	Below 3.1 V

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TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	VOLTAGE
(Air fuel ratio sensor)	-12.5%	Higher than 3.4 V
O2S B1S2 (Heated oxygen sensor)	12.5%	Higher than 0.55 V
	-12.5%	Below 0.4 V

Result

RESULT	PROCEED TO
Output voltage values are abnormal	A
Malfunction disappears when fuel injection volume is increased	B
Malfunction is still present when fuel injection volume is increased, even if output voltage values are normal	C

B ▶ **GO TO STEP 18**

C ▶ **GO TO STEP 20**

A ▼

17.	REPLACE AIR FUEL RATIO SENSOR AND HEATED OXYGEN SENSOR

(a) Replace the air fuel ratio sensor INFO .

HINT:

Perform "Inspection After Repair" after replacing the air fuel ratio sensor INFO .

(b) Replace the heated oxygen sensor INFO .

NEXT ▶ **GO TO STEP 22**

18.	REPLACE FUEL INJECTOR ASSEMBLY

(a) Replace the fuel injector assemblies of all cylinders INFO .

HINT:

Perform "Inspection After Repair" after replacing the fuel injector assembly INFO .

NEXT ▶ **GO TO STEP 22**

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19.	CHECK INTAKE SYSTEM

(a) Check for air leaks or blockage in the intake system components. If a connection problem or foreign matter is found, repair the connection or remove the foreign matter.

HINT:

- If there is foreign matter in the intake system components, remove it before proceeding to the next step.
- If there is no foreign matter in the intake system components, check for foreign matter in the mass air flow meter. If there is foreign matter in the mass air flow meter, remove it.
- Perform "Inspection After Repair" after repairing or replacing the intake system INFO .

NEXT **GO TO STEP 22**

20.	INSPECT OTHER RELATED COMPONENTS

(a) Inspect other related components.

HINT:

If the malfunctioning part could not be determined by performing the preceding inspections, one of the following malfunctions is suspected.

- Engine mount deterioration
- Deposits in the intake manifold or on an intake valve
- Delay in fuel supply due to adherence of the fuel to the deposits

NEXT

21.	REPAIR OR REPLACE MALFUNCTIONING PARTS

(a) Repair or replace the malfunctioning part.

(b) Perform "Inspection After Repair" after repairing or replacing the malfunctioning part INFO .

NEXT

22.	CONDUCT CONFIRMATION TEST

(a) Check that the idle has returned to normal.

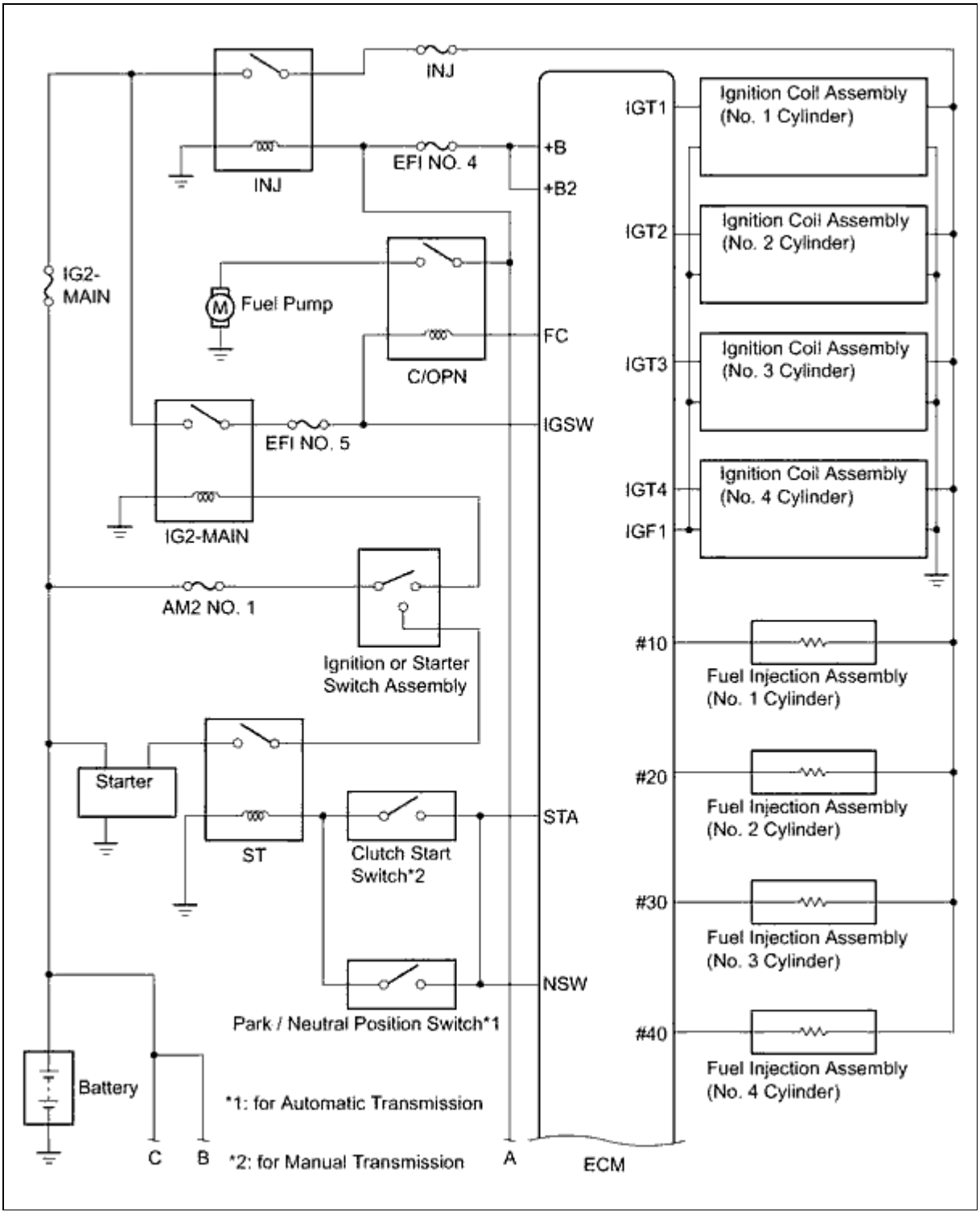
NEXT **END**

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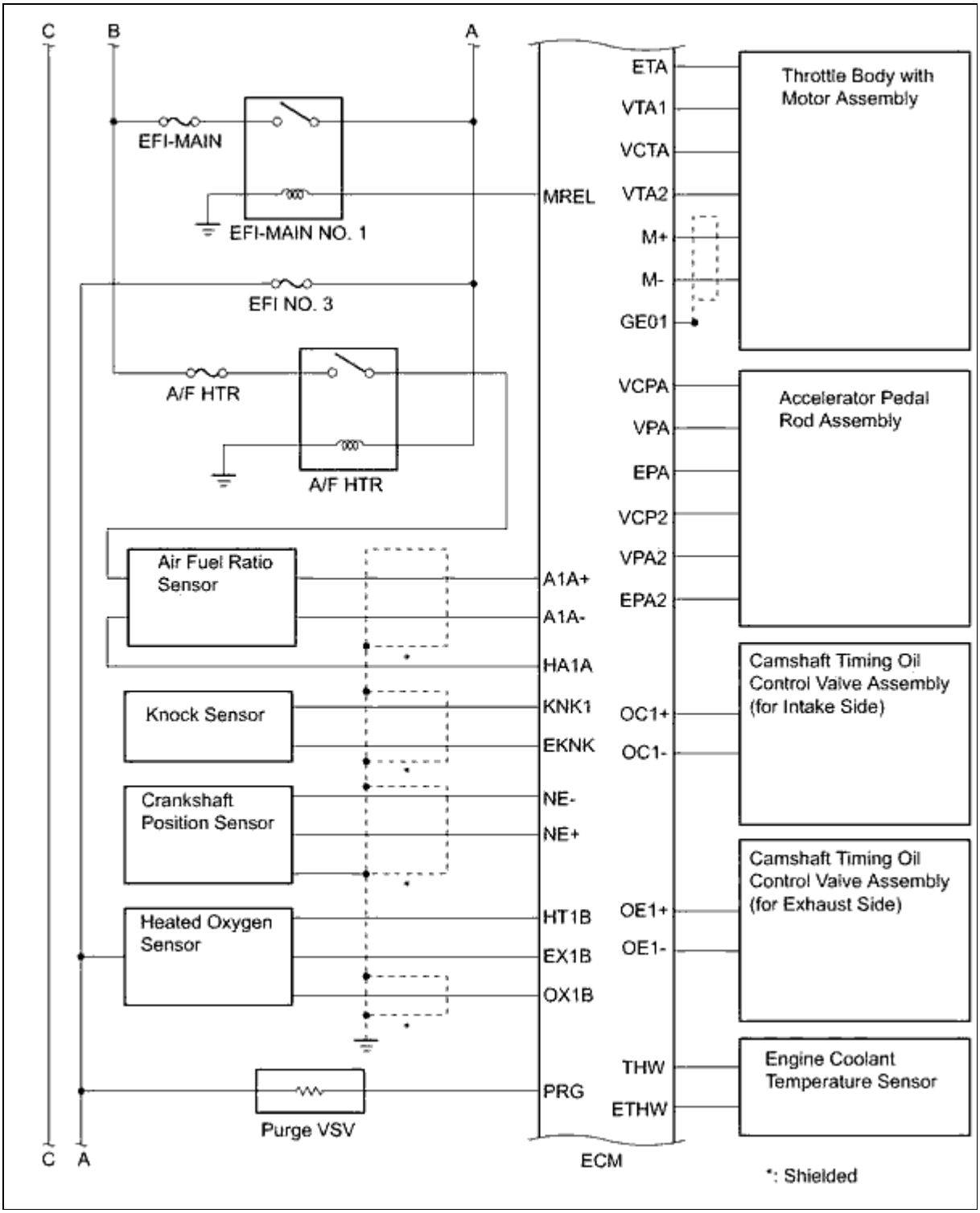
Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000SXR01YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM

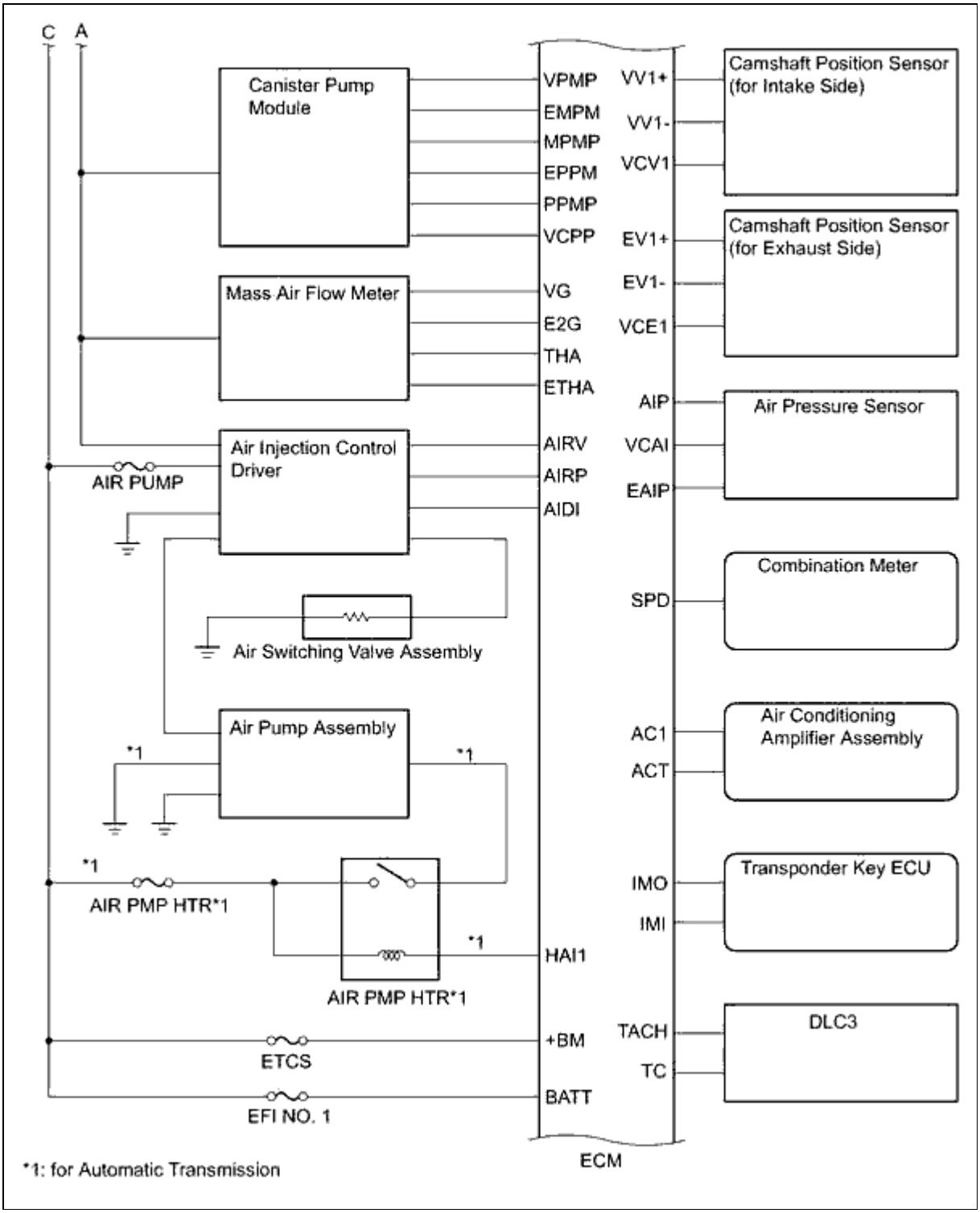
1. SYSTEM DIAGRAM



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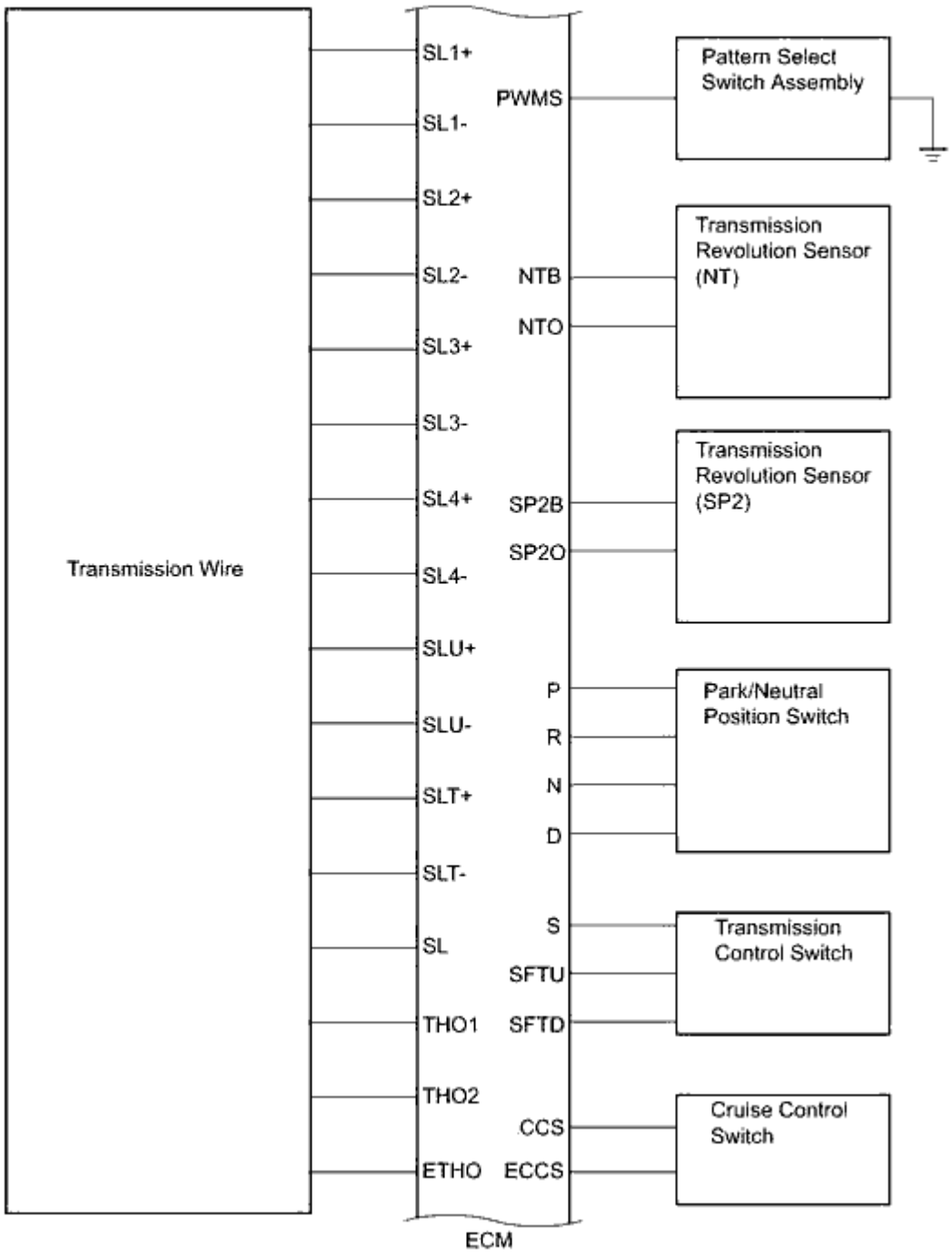


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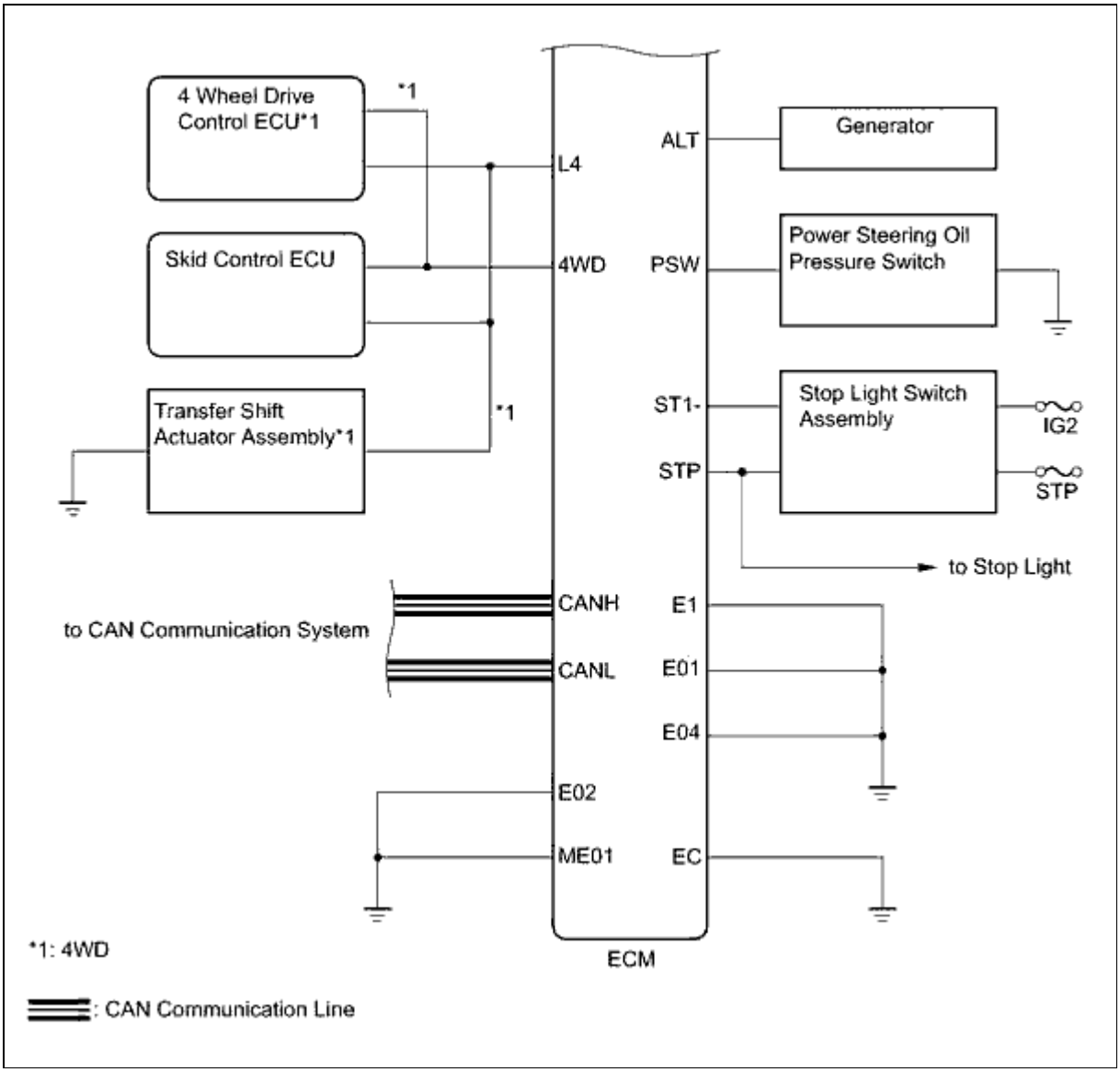


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for Automatic Transmission:



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2. COMMUNICATION WITH OTHER COMPUTERS

HINT:

For CAN communication line connection information, refer to CAN Communication System INFO .

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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000000TI40ATX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: Starter Signal Circuit; 2016 MY Tacoma [08/2015 -]		

Starter Signal Circuit

DESCRIPTION

While the engine is being cranked, current flows from terminal ST1 of the ignition switch to the ST relay and also flows to terminal STA of the ECM (STA signal). The ECM uses the STA signal to control the fuel injection and ignition timing when the engine starts.

WIRING DIAGRAM

Refer to DTC P0617 INFO .

INSPECTION PROCEDURE

NOTICE:

- After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CHECK WHETHER ENGINE CAN BE CRANKED**

(a) Check if the engine can be cranked.

Result

RESULT	PROCEED TO
Engine cannot be cranked	A
Engine can be cranked	B

B ▶ **GO TO STEP 19**

A ▼

2.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the ignition switch is turned to the ON and START position.

OK:

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	OFF
START	ON

NG ▶ **GO TO STEP 11**

OK ▼

3.	**INSPECT ST RELAY**

(a) Inspect the ST relay INFO .

NG ▶ **REPLACE ST RELAY**

OK ▼

4.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF ST RELAY)**

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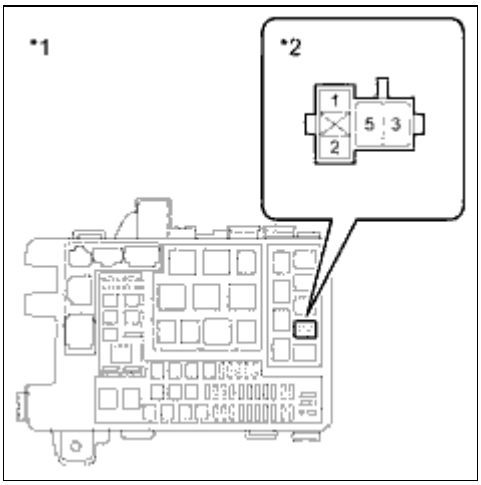
(a) Remove the ST relay from the engine room relay block.

(b) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
5 (ST relay holder) - Body ground	Ignition switch ON	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block
*2	ST Relay Holder

NG ▶ **GO TO STEP 9**

OK ▼

5.	**CHECK HARNESS AND CONNECTOR (ST RELAY - STARTER ASSEMBLY)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the S6 starter assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (ST relay holder) - S6-1	Always	Below 1 Ω
3 (ST relay holder) or S6-1 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

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6.	**CHECK HARNESS AND CONNECTOR (BATTERY - STARTER ASSEMBLY)**

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Disconnect the cable from the positive (+) battery terminal.

(c) Disconnect the S6 starter assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Positive (+) battery terminal - S5-1	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

7.	**CHECK HARNESS AND CONNECTOR (ST RELAY - BODY GROUND)**

(a) Remove the ST relay from the engine room relay block.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (ST relay holder) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

8.	**CHECK HARNESS AND CONNECTOR (ST RELAY - ECM)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the E18 ECM connector.

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

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Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (ST relay holder) - E18-17 (STA)	Always	Below 1 Ω
1 (ST relay holder) or E18-17 (STA) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

9.	**INSPECT IGNITION OR STARTER SWITCH ASSEMBLY**

(a) Inspect the ignition or starter switch assembly INFO .

NG ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK ▼

10.	**CHECK HARNESS AND CONNECTOR (ST RELAY - ECM)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the I7 ignition or starter switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (ST relay holder) - I7-7 (ST2)	Always	Below 1 Ω
5 (ST relay holder) or I7-7 (ST2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION OR STARTER SWITCH ASSEMBLY - BATTERY)**

11.	**INSPECT IGNITION OR STARTER SWITCH ASSEMBLY**

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(a) Inspect the ignition or starter switch assembly INFO .

Result

RESULT	PROCEED TO
OK (for Automatic Transmission)	A
OK (for Manual Transmission)	B
NG	C

B ▶ **GO TO STEP 15**

C ▶ **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

A ▼

12.	INSPECT PARK/NEUTRAL POSITION SWITCH

(a) Inspect the park/neutral position switch.

- for AC60E Automatic Transmission INFO
- for AC60F Automatic Transmission INFO

Result

RESULT	PROCEED TO
OK	A
NG (for AC60F Automatic Transmission)	B
NG (for AC60E Automatic Transmission)	C

B ▶ **REPLACE PARK/NEUTRAL POSITION SWITCH**

C ▶ **REPLACE PARK/NEUTRAL POSITION SWITCH**

A ▼

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13.	**CHECK HARNESS AND CONNECTOR (IGNITION SWITCH - PARK/NEUTRAL POSITION SWITCH - ECM)**

(a) Disconnect the I7 ignition or starter switch assembly connector.

(b) Disconnect the P1 park/neutral position switch connector.

(c) Disconnect the E18 ECM connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I7-6 (ST1) - P1-4 (B)	Always	Below 1 Ω
I7-6 (ST1) - E18-15 (NSW)	Always	Below 1 Ω
I7-6 (ST1), P1-4 (B) or E18-15 (NSW) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

14.	**CHECK HARNESS AND CONNECTOR (ST RELAY - ECM - PARK/NEUTRAL POSITION SWITCH)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the E18 ECM connector.

(c) Disconnect the P1 park/neutral position switch connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
P1-5 (L) - E18-17 (STA)	Always	Below 1 Ω
E18-17 (STA) - 1 (ST relay holder)	Always	Below 1 Ω
1 (ST relay holder), P1-5 (L) or E18-17 (STA) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

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15.	**INSPECT CLUTCH START SWITCH ASSEMBLY**

(a) Inspect the clutch start switch assembly INFO .

NG ▶ **REPLACE CLUTCH START SWITCH ASSEMBLY**

OK ▼

16.	**CHECK HARNESS AND CONNECTOR (IGNITION SWITCH - CLUTCH START SWITCH ASSEMBLY - CLUTCH START CANCEL SWITCH ASSEMBLY)**

(a) Disconnect the I7 ignition or starter switch assembly connector.

(b) Disconnect the C8 clutch start cancel switch assembly connector.

(c) Disconnect the C7 clutch start switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
I7-3 (ST1) - C8-1	Always	Below 1 Ω
I7-3 (ST1) - C7-2 (+S)	Always	Below 1 Ω
I7-3 (ST1), C8-1 or C7-2 (+S) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

17.	**CHECK HARNESS AND CONNECTOR (ST RELAY - ECM - CLUTCH START SWITCH ASSEMBLY - CLUTCH START CANCEL SWITCH ASSEMBLY)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the E18 ECM connector.

(c) Disconnect the C8 clutch start switch assembly connector.

(d) Disconnect the C7 clutch start switch assembly connector.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-2 - E18-17 (STA)	Always	Below 1 Ω
C7-4 (-S) - E18-17 (STA)	Always	Below 1 Ω
E18-17 (STA) - 1 (ST relay holder)	Always	Below 1 Ω
1 (ST relay holder), C8-2, E18-17 (STA) or C7-4 (-S) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

18.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the ignition switch is turned to the ON and START positions.

OK:

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	OFF
START	ON

NG ▶ **GO TO STEP 19**

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

19.	**CHECK HARNESS AND CONNECTOR (ECM - ST RELAY)**

(a) Remove the ST relay from the engine room relay block.

(b) Disconnect the E18 ECM connector.

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

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Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E18-17 (STA) - 1 (ST relay holder)	Always	Below 1 Ω

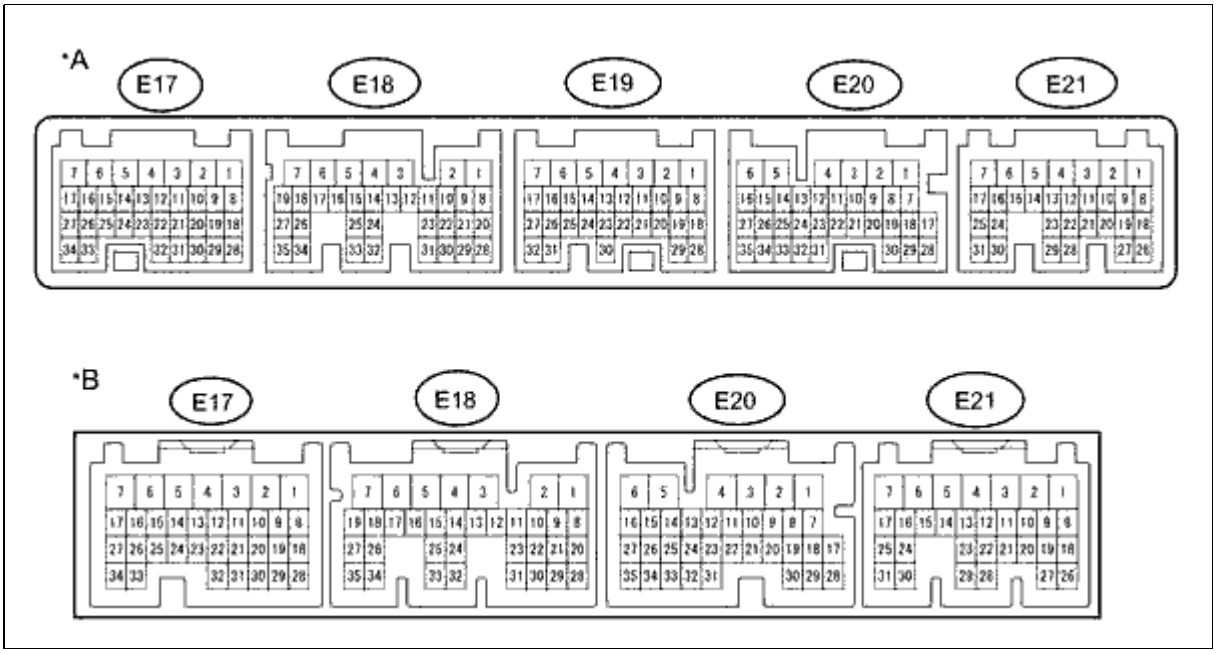
NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000SXP01YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: TERMINALS OF ECM; 2016 MY Tacoma [08/2015 -]		

TERMINALS OF ECM



*A	for Automatic Transmission	*B	for Manual Transmission

HINT:

The standard normal voltage between each pair of ECM terminals is shown in the table below. The appropriate conditions for checking each pair of terminals are also indicated. The result of checks should be compared with the standard normal voltage for that pair of terminals, displayed in the Specified Condition column. The illustration above can be used as a reference to identify the ECM terminal locations.

TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E17-5 (+BM) - E17-3 (E1)	GR - W-B	Power source of ECM	Always	11 to 14 V
E17-6 (M-) - E17-4 (ME01)	G - W-B	Throttle actuator operation signal (negative terminal)	Idling with warm engine	Pulse generation (See waveform 1)
E17-7 (M+) - E17-4 (ME01)	R - W-B	Throttle actuator operation signal (positive terminal)	Idling with warm engine	Pulse generation (See waveform 2)
E17-8 (OE1-) - E17-9 (OE1+)	L - P	Camshaft timing oil control valve assembly operation signal (for exhaust side)	Idling	Pulse generation (See waveform

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TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
				3)
E17-10 (OC1-) - E17-11 (OC1+)	SB - BE	Camshaft timing oil control valve assembly operation signal (for intake side)	Idling	Pulse generation (See waveform 4)
E17-12 (IGF1) - E17-3 (E1)	W - W-B	Ignition coil assembly (ignition confirmation signal)	Ignition switch ON	4.5 to 5.5 V
			Idling	Pulse generation (See waveform 5)
E17-13 (IGT4) - E17-3 (E1)	BE - W-B	Ignition coil assembly (ignition signal)	Idling	Pulse generation (See waveform 5)
E17-14 (IGT3) - E17-3 (E1)	LG - W-B			
E17-15 (IGT2) - E17-3 (E1)	Y - W-B			
E17-16 (IGT1) - E17-3 (E1)	SB - W-B			
E17-18 (VTA2) - E17-28 (ETA)	V - W	Throttle position sensor signal (for sensor malfunction detection)	Ignition switch ON, accelerator pedal fully released	2.1 to 3.1 V
			Ignition switch ON, accelerator pedal fully depressed	4.6 to 5.0 V
E17-20 (VCAI) - E17-25 (EAIP)	L - V	Power source of air pressure sensor (specific voltage)	Ignition switch ON	4.5 to 5.0 V
E17-21 (VCV1) - E17-3 (E1)	G - W-B	Power source of camshaft position sensor (for intake side) (specific voltage)	Ignition switch ON	4.5 to 5.5 V
E17-22 (VV1-) - E17-23 (VV1+)	R - Y	Camshaft position sensor signal (for intake side)	Idling with warm engine	Pulse generation (See waveform 6)
E17-24 (EV1+) - E17-32 (EV1-)	G - LG	Camshaft position sensor signal (for exhaust side)	Idling with warm engine	Pulse generation (See waveform 6)
E17-26 (AIP) - E17-25 (EAIP)	B - V	Air pressure sensor	Ignition switch ON	0.5 to 4.5 V
E17-27 (NE+) - E17-34 (NE-)	R - G	Crankshaft position sensor signal	Idling with warm engine	Pulse generation (See waveform 7)

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TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E17-29 (VCTA) - E17-28 (ETA)	BE - W	Power source of throttle position sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V
E17-30 (VTA1) - E17-28 (ETA)	B - W	Throttle position sensor signal (for engine control)	Ignition switch ON, accelerator pedal fully released	0.5 to 1.1 V
			Ignition switch ON, accelerator pedal fully depressed	3.2 to 4.8 V
E17-31 (VCE1) - E17-3 (E1)	P - W-B	Power source of camshaft position sensor (for exhaust side) (specific voltage)	Ignition switch ON	4.5 to 5.5 V
E18-1 (#40) - E17-1 (E01) E18-2 (#30) - E17-1 (E01) E18-3 (#20) - E17-1 (E01) E18-4 (#10) - E17-1 (E01)	G - W-B GR - W-B R - W-B W - W-B	Fuel injector assembly signal	Ignition switch ON	11 to 14 V
			Idling	Pulse generation (See waveform 8)
E18-6 (HA1A) - E18-5 (E04)	P - W-B	Air fuel ratio sensor heater operation signal	Idling	Pulse generation (See waveform 9)
			Ignition switch ON	11 to 14 V
E18-7 (HT1B) - E18-5 (E04)	SB - W-B	Heated oxygen sensor heater operation signal	Idling	Below 3.0 V
			Ignition switch ON	11 to 14 V
E18-8 (PSW) - E17-3 (E1)	SB - W-B	Power steering oil pressure switch	While turning steering wheel	Below 1.5 V
E18-13 (PRG) - E17-1 (E01)	Y - W-B	Purge VSV operation signal	Ignition switch ON	11 to 14 V
			Idling, under purge control	Pulse generation (See waveform 10)
E18-15 (NSW) - E17-3 (E1)	V - W-B	Park/neutral position switch signal	Ignition switch ON, shift lever not in P or N	11 to 14 V
			Ignition switch ON, shift lever in P or N	Below 3.0 V
E18-16 (ALT) - E17-3 (E1)	L - W-B	Generator	Ignition switch ON	11 to 14 V
E18-17 (STA) - E17-3 (E1)	BE - W-B	Starter signal	Shift position N, ignition switch START	5.5 V or higher

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TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E18-20 (KNK1) - E18-28 (EKNK)	B - W	Knock sensor signal	Engine speed maintained at 4000 rpm after warming up engine	Pulse generation (See waveform 11)
E18-22 (THW) - E18-30 (ETHW)	Y - BR	Engine coolant temperature sensor signal	Idling, engine coolant temperature 80°C (176°F)	0.2 to 1.0 V
E18-23 (THA) - E18-31 (ETHA)	BE - G	Intake air temperature sensor signal	Idling, Intake air temperature 20°C (68°F)	0.5 to 3.4 V
E18-24 (VG) - E18-32 (E2G)	P - GR	Mass air flow meter signal	Idling, shift lever in P or Nor neutral, A/C switch off	0.5 to 3.0 V
E18-26 (A1A+) - E17-3 (E1)	G - W-B	Air fuel ratio sensor signal	Always (Ignition switch ON)	3.3 V*1
E18-27 (OX1B) - E18-35 (EX1B)	W - B	Heated oxygen sensor signal	Engine speed maintained 2500 rpm for 2 minutes after warming up sensor	Pulse generation (See waveform 12)
E18-34 (A1A-) - E17-3 (E1)	R - W-B	Air fuel ratio sensor signal	Always (Ignition switch ON)	2.9 V*1
E20-4 (HAI1) - E17-3 (E1)	W - W-B	Air pump heater for secondary air injection system	Air pump heater operating	11 to 14 V
E20-5 (FC) - E17-1 (E01)	L - W-B	Fuel pump control	Ignition switch ON	11 to 14 V
E20-6 (MREL) - E17-3 (E1)	GR - W-B	EFI -MAIN relay operation signal	Ignition switch ON	11 to 14 V
E20-7 (4WD) - E17-3 (E1)	LG - W-B	4WD detection switch signal input	Ignition switch ON Transfer position 2WD	10 to 14 V
			Ignition switch ON Transfer position 4WD	Below 1.5 V
E20-8 (R) - E17-3 (E1)	V - W-B	R shift position switch signal	Ignition switch ON and shift lever in R	11 to 14 V
			Ignition switch ON and shift lever not in R	Below 1 V
E20-11 (TACH) - E17-3 (E1)	BE - W-B	Engine speed signal	Idling	Pulse generation (See waveform 13)
E20-12 (VPMP) - E17-3 (E1)	V - W-B	Vent valve (built into canister pump module)	Ignition switch ON	11 to 14 V
E20-13 (CANH) - E17-3 (E1)	B - W-B	CAN communication line	Ignition switch ON	Pulse generation (See waveform 14)

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TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E20-14 (CANL) - E17-3 (E1)	W - W-B	CAN communication line	Ignition switch ON	Pulse generation (See waveform 15)
E20-18 (D) - E17-3 (E1)	SB - W-B	D shift position switch signal	Ignition switch ON and shift lever in D	11 to 14 V
			Ignition switch ON and shift lever not in D	Below 1 V
E20-20 (AIDI) - E17-3 (E1)	G - W-B	Diagnostic information signal for secondary air injection system	Secondary air injection system operates	Pulse generation (See waveform 16)
E20-23 (SPD) - E17-3 (E1)	R - W-B	Vehicle speed signal from combination meter assembly	Driving at 20 km/h (12 mph)	Pulse generation (See waveform 17)
E20-25 (PPMP) - E20-34 (EPPM)	G -LG	Canister pressure sensor (built into canister pump module)	Ignition switch ON	3 to 3.6 V
E20-33 (VCPP) - E20-34 (EPPM)	P - LG	Power of source of canister pressure sensor	Ignition switch ON	4.5 to 5.5 V
E21-1 (+B) - E17-3 (E1)	B - W-B	Power source of ECM	Ignition switch ON	11 to 14 V
E21-2 (+B2) - E17-3 (E1)	B - W-B	Power source of ECM	Ignition switch ON	11 to 14 V
E21-3 (BATT) - E17-3 (E1)	L - W-B	Battery (for measuring battery voltage and for ECM memory)	Always	11 to 14 V
E21-5 (AIRV) - E17-3 (E1)	R - W-B	Air switching valve for secondary air injection system	Ignition switch ON	11 to 14 V
E21-6 (AIRP) - E17-3 (E1)	SB - W-B	Air pump control	Ignition switch ON	11 to 14 V
E21-7 (MPMP) - E21-17 (EMPM)	Y - W-B	Leak detection pump (built into canister pump module)	Leak detection pump OFF	Below 3.0 V
			Leak detection pump ON	11 to 14 V
E21-8 (IGSW) - E17-3 (E1)	LG - W-B	Ignition or starter switch assembly	Ignition switch ON	11 to 14 V
E21-10 (STP) - E17-3 (E1)	P - W-B	Stop light switch assembly	Brake pedal depressed	7.5 to 14 V
			Brake pedal released	Below 1.5 V
E21-11 (ST1-) - E17-3 (E1)	V - W-B	Stop light switch assembly	Ignition switch ON, Brake pedal depressed	Below 1.5 V
			Ignition switch ON, Brake pedal released	7.5 to 14 V

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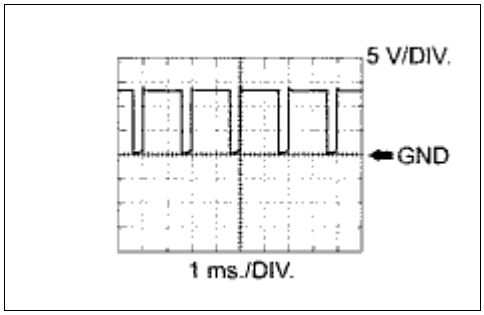
TERMINAL NO.	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
E21-18 (EC) - Body ground	W-B - -	Ground	Always	Below 1 Ω
E21-19 (TC) - E17-3 (E1)	G - W-B	Terminal TC of DLC3	Ignition switch ON	11 to 14 V
E21-20 (VCPA) - E21-27 (EPA)	R - LG	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.5 V
E21-22 (VCP2) - E21-29 (EPA2)	W - V	Power source of accelerator pedal rod assembly (for VPA2)	Ignition switch ON	4.5 to 5.5 V
E21-26 (VPA) - E21-27 (EPA)	P - LG	Accelerator pedal rod assembly signal (for engine control)	Ignition switch ON, accelerator pedal fully released	0.5 to 1.1 V
			Ignition switch ON, accelerator pedal fully depressed	2.6 to 4.5 V
E21-28 (VPA2) - E21-29 (EPA2)	GR - V	Accelerator pedal rod assembly signal (for sensor malfunction detection)	Ignition switch ON, accelerator pedal fully released	1.2 to 2.0 V
			Ignition switch ON, accelerator pedal fully depressed	3.4 to 4.75 V
E17-1 (E01) - Body ground	W-B - -	Ground	Always	Below 1 Ω
E17-2 (E02) - Body ground	W-B - -	Ground	Always	Below 1 Ω

*1: The ECM terminal voltage is constant regardless of the output voltage from the sensor.

1. WAVEFORM 1

Throttle actuator signal operation signal (negative terminal)

ECM Terminal Name	Between M- and ME01
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling with warm engine



HINT:

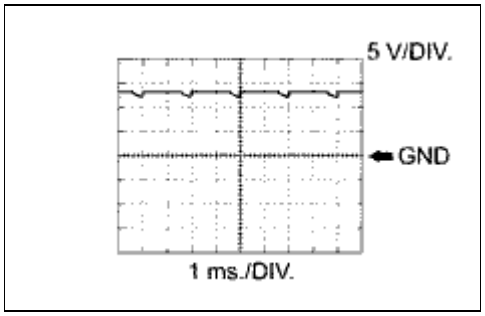
The duty ratio varies depending on the throttle actuator operation.

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2. WAVEFORM 2

Throttle actuator operation signal (positive terminal)

ECM Terminal Name	Between M+ and ME01
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling with warm engine



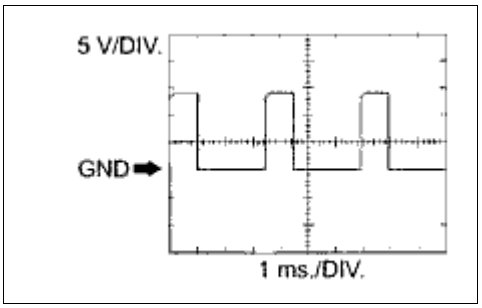
HINT:

The duty ratio varies depending on the throttle actuator operation.

3. WAVEFORM 3

(a) Camshaft timing oil control valve assembly (for exhaust side) operation signal

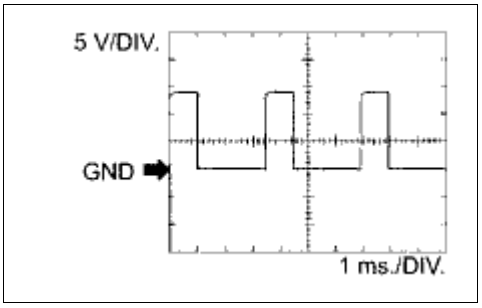
ECM Terminal Names	Between OE1+ and OE1-
Tester Ranges	5 V/DIV., 1 ms./DIV.
Conditions	Idling



4. WAVEFORM 4

Camshaft timing oil control valve assembly (for intake side) operation signal

ECM Terminal Name	Between OC1+ and OC1-
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling



HINT:

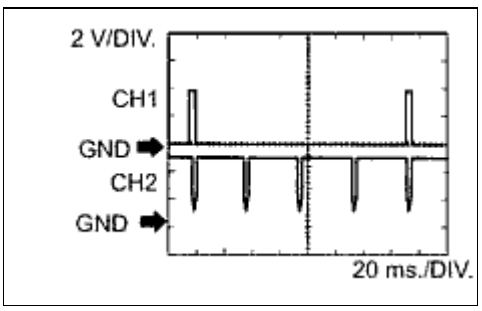
The wavelength becomes shorter as the engine speed increases.

5. WAVEFORM 5

(a) Igniter IGT signal (from ECM to igniter)

(b) Igniter IGF signal (from igniter to ECM)

ECM Terminal Name	CH1: Between IGT (1 to 4) and E1 CH2: Between IGF1 and E1
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling



HINT:

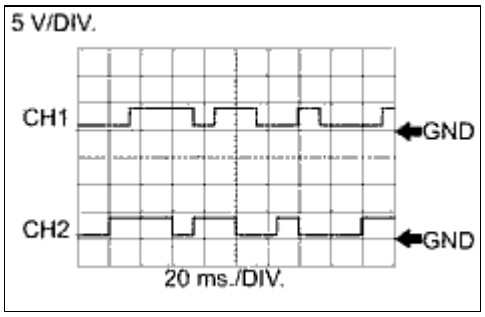
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The wavelength becomes shorter as the engine speed increases.

6. WAVEFORM 6

(a) Camshaft position sensor signal (for intake and exhaust side)

ECM Terminal Names	CH1: Between VV1+ and VV1- CH2: Between EV1+ and EV1-
Tester Ranges	5 V/DIV., 20 ms./DIV.
Conditions	Idling



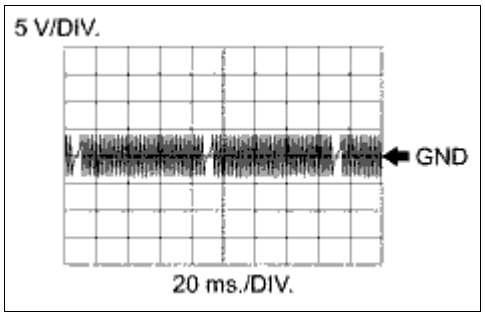
HINT:

- The wavelength becomes shorter as the engine speed increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle.
- The wavelength becomes shorter as the engine speed increases.

7. WAVEFORM 7

(a) Crankshaft position sensor signal

ECM Terminal Names	Between NE+ and NE
Tester Ranges	5 V/DIV., 20 ms./DIV.
Conditions	idling



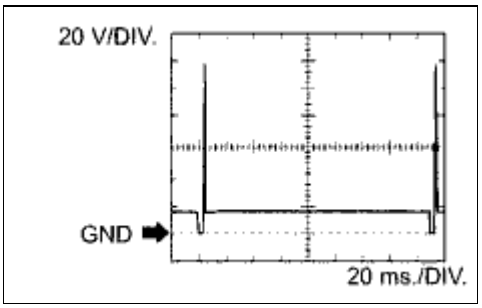
HINT:

The wavelength becomes shorter as the engine speed increases.

8. WAVEFORM 8

Fuel injector assembly signal

ECM Terminal Name	Between #10 (to #40) and E01
Tester Range	20 V/DIV., 20 ms./DIV.
Condition	Idling



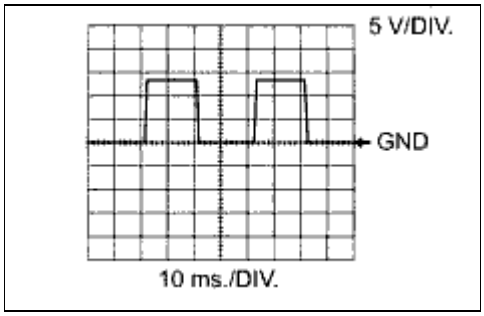
HINT:

The wavelength becomes shorter as the engine speed increases.

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9. WAVEFORM 9

Air fuel ratio sensor heater signal



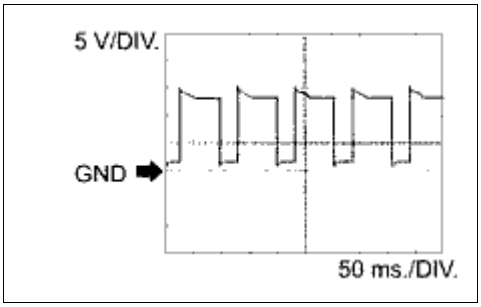
ECM Terminal Name	Between HA1A and E04
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Idling with warm engine

HINT:

The wavelength varies in accordance with the engine operating condition.

10. WAVEFORM 10

Purge VSV operation signal



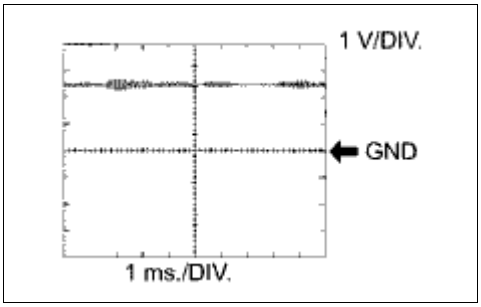
ECM Terminal Name	Between PRG and E01
Tester Range	5 V/DIV., 50 ms./DIV.
Condition	Idling

HINT:

If the waveform is not similar to the illustration, check the waveform again after idling for 10 minutes or more.

11. WAVEFORM 11

Knock sensor signal



ECM Terminal Name	Between KNK1 and EKNK
Tester Range	1 V/DIV., 0.01 to 1 ms./DIV.
Condition	Engine speed maintained 4000 rpm after warming up engine

HINT:

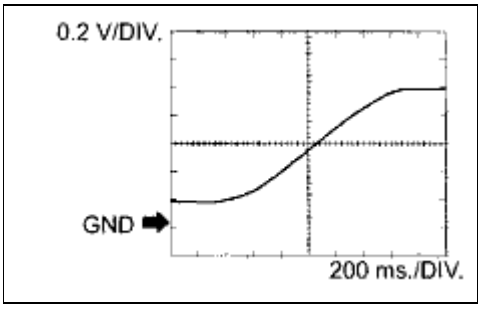
- The wavelength becomes shorter as the engine speed increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle.

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12. WAVEFORM 12

Heated oxygen sensor signal

ECM Terminal Name	Between OX1B and EX1B
Tester Range	0.2 V/DIV., 200 ms./DIV.
Condition	Engine speed maintained 2500 rpm for 2 minutes after warming up sensor



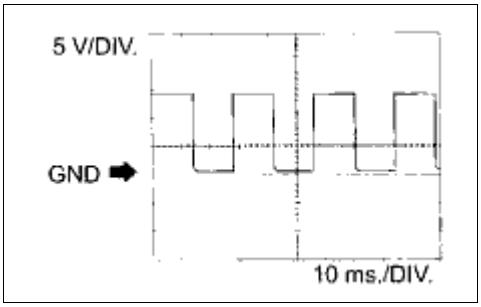
HINT:

In the DATA LIST, item O2S B1S2 shows the ECM input values from the heated oxygen sensor.

13. WAVEFORM 13

Engine speed signal

ECM Terminal Name	Between TACH and E1
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Idling



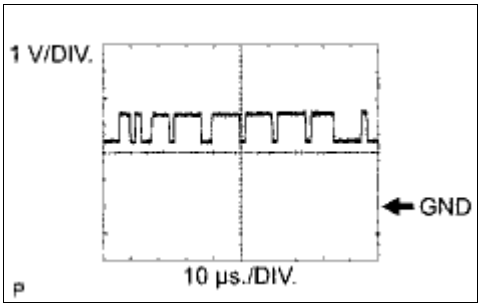
HINT:

The wavelength becomes shorter as the engine speed increases.

14. WAVEFORM 14

CAN communication signal (reference)

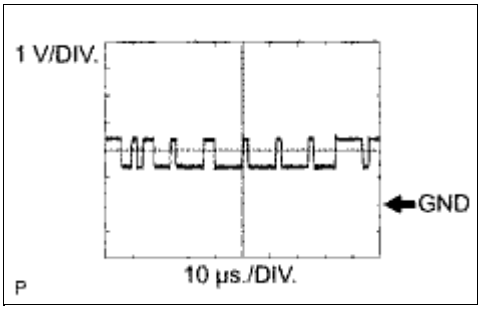
ECM Terminal Name	Between CANH and E1
Tester Range	1 V/DIV., 10 µs./DIV.
Condition	Ignition switch ON



15. WAVEFORM 15

CAN communication signal (reference)

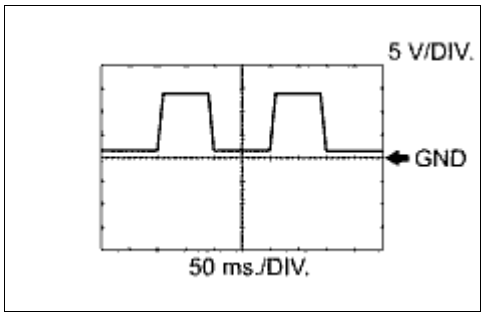
ECM Terminal Name	Between CANL and E1
Tester Range	1 V/DIV., 10 µs./DIV.
Condition	Ignition switch ON



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16. WAVEFORM 16

Terminal DI of air injection control driver



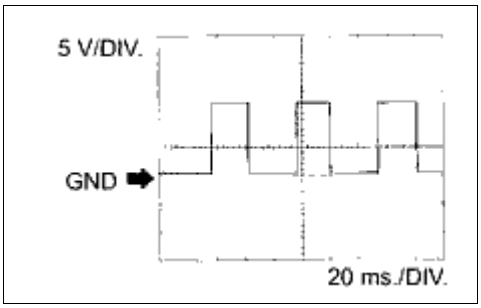
ECM Terminal Name	Between AIDI and E1
Tester Range	5 V/DIV., 50 ms./DIV.
Condition	Secondary air injection system operates

HINT:

The wavelength changes when the air injection control driver detects malfunctions in the air injection system INFO .

17. WAVEFORM 17

Vehicle speed signal



ECM Terminal Name	Between SPD and E1
Tester Range	5 V/DIV., 20 ms./DIV.
Condition	Driving at 20 km/h (12 mph)

HINT:

The wavelength becomes shorter as the vehicle speed increases.

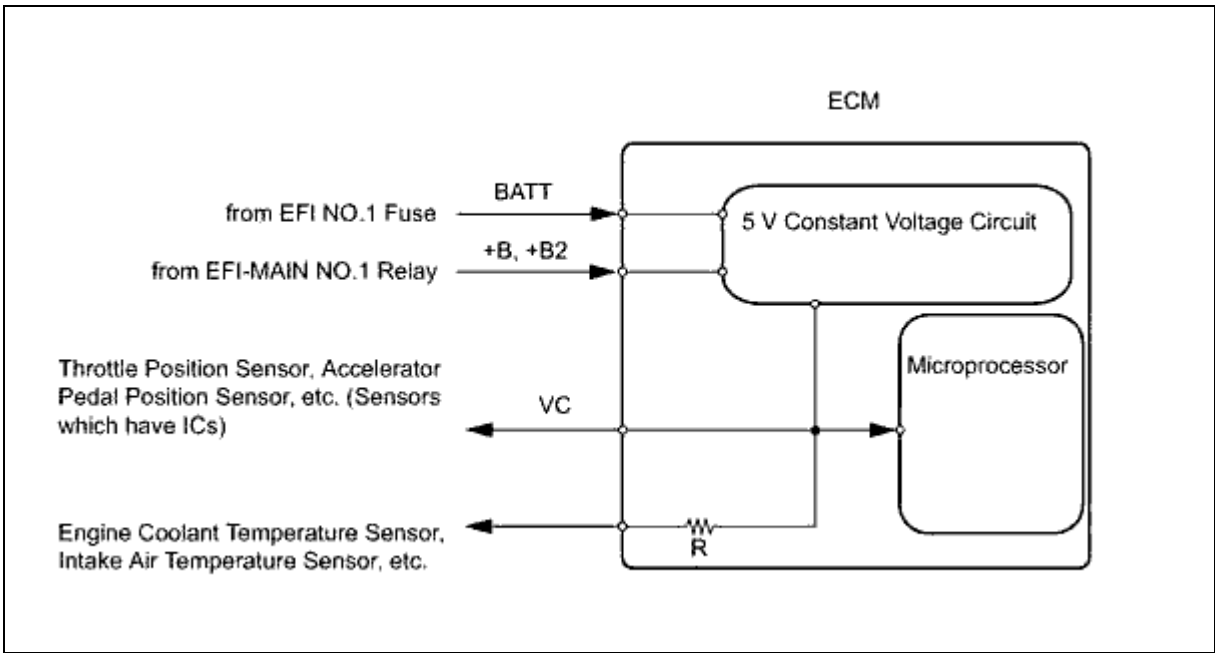
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Last Modified: 11-13-2015	6.6 J	**Doc ID:** RM000001D6V0X8X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: SFI SYSTEM: VC Output Circuit; 2016 MY Tacoma [08/2015 -]		

VC Output Circuit

DESCRIPTION

The ECM constantly generates a 5 V power source voltage from the battery voltage supplied to the +B (BATT) terminal to operate the microprocessor. The ECM also provides this power source voltage to the sensors through the VC output circuit.



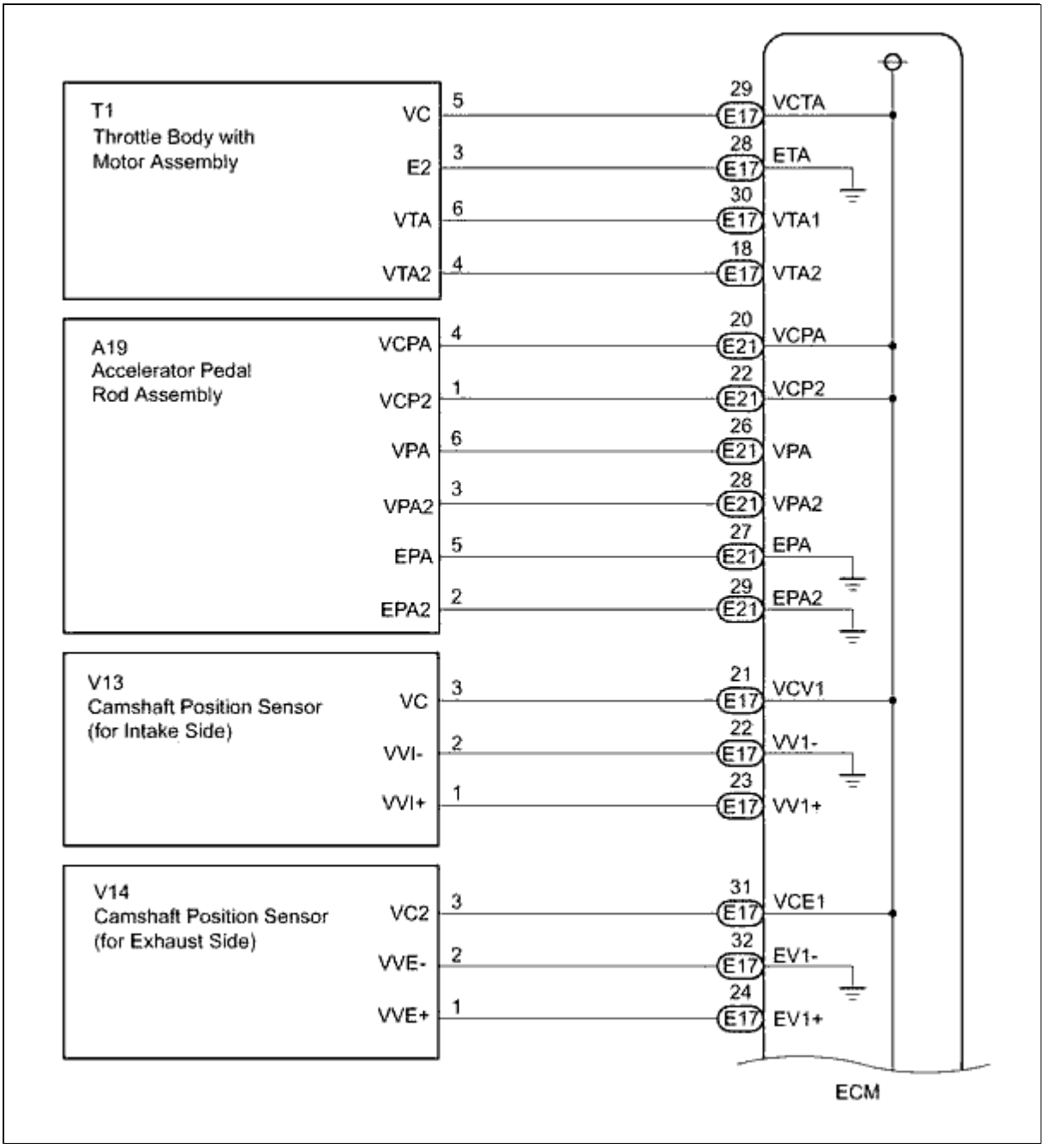
When the VC circuit is short-circuited, the microprocessor in the ECM and the sensors that are supplied with power through the VC circuit are inactivated because power is not supplied from the VC circuit. Under this condition, the system does not start up and the MIL does not illuminate even if the system malfunctions.

HINT:

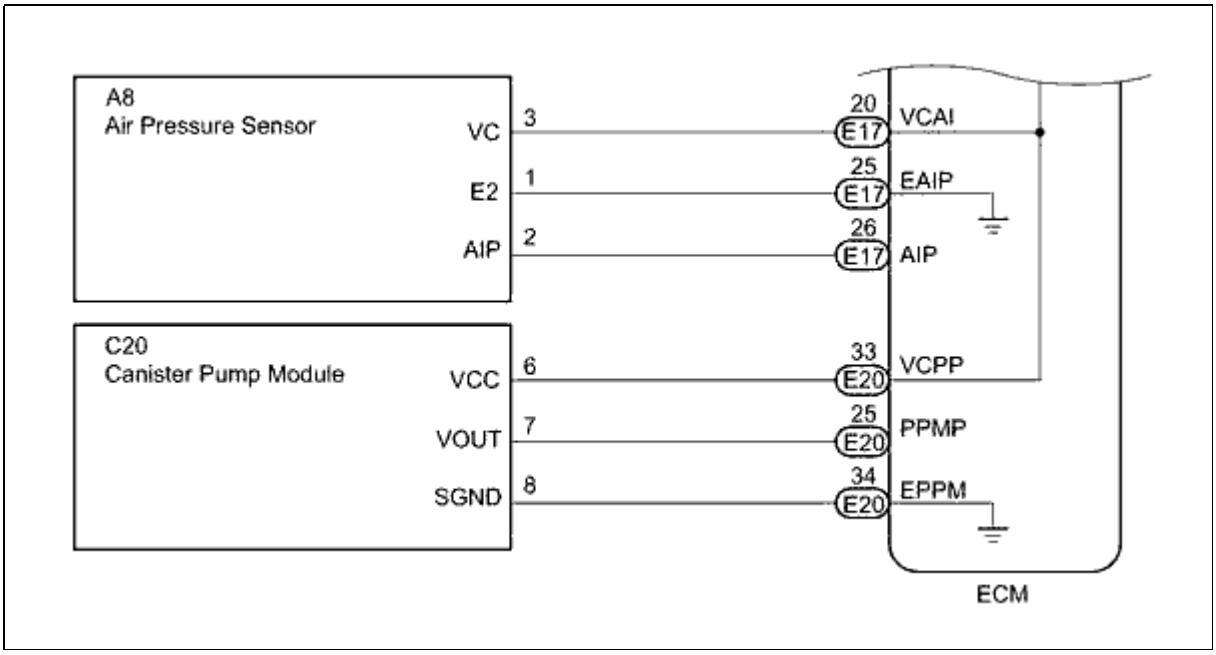
Under normal conditions, the MIL is illuminated for several seconds when the ignition switch is first turned to ON. The MIL goes off when the engine is started.

WIRING DIAGRAM

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INSPECTION PROCEDURE

PROCEDURE

1.	**READ VALUE USING TECHSTREAM**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

A ▼

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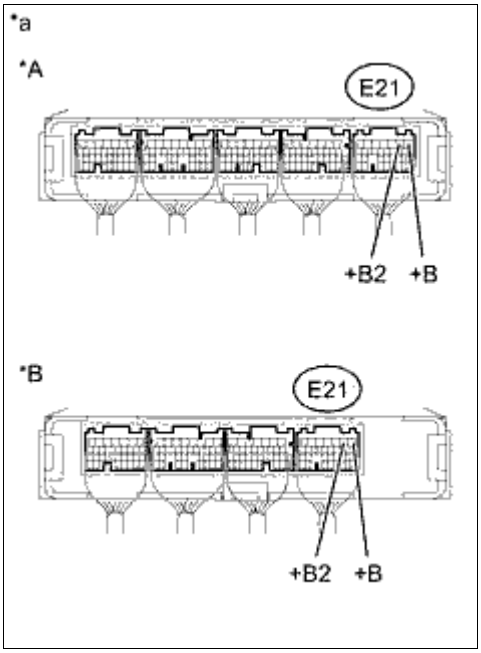
2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF ECM)**

(a) Turn the ignition switch to ON.

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

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
E21-1 (+B) - Body ground	Ignition switch ON	11 to 14 V
E21-2 (+B2) - Body ground	Ignition switch ON	11 to 14 V



Text in Illustration

*A	for Automatic Transmission
*B	for Manual Transmission
*a	Component with harness connected (ECM)

HINT:

If the result is not as specified, since current is not flowing to the +B and +B2 terminals of the ECM, the system may not be started.

NG ▶ **GO TO MIL CIRCUIT**

OK ▼

3.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (THROTTLE BODY WITH MOTOR ASSEMBLY)**

(a) Disconnect the T1 throttle body with motor assembly connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

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It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

HINT:

Perform "Inspection After Repair" after cleaning the throttle body with motor assembly INFO .

B ▶ **REPLACE THROTTLE BODY WITH MOTOR ASSEMBLY**

A ▼

4.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (ACCELERATOR PEDAL ROD ASSEMBLY)**

(a) Disconnect the A19 accelerator pedal rod assembly connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ **REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

A ▼

5.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (AIR PRESSURE SENSOR)**

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(a) Disconnect A8 the air pressure sensor connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ **REPLACE AIR PRESSURE SENSOR**

A ▼

6.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (CAMSHAFT POSITION SENSOR (FOR INTAKE SIDE))**

(a) Disconnect the V13 camshaft position sensor (for intake side) connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ **REPLACE CAMSHAFT POSITION SENSOR (FOR INTAKE SIDE)**

A

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7.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (CAMSHAFT POSITION SENSOR (FOR EXHAUST SIDE))**

(a) Disconnect the V14 camshaft position sensor (for exhaust side) connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ **REPLACE CAMSHAFT POSITION SENSOR (FOR EXHAUST SIDE)**

A

8.	**CHECK CONNECTION BETWEEN TECHSTREAM AND ECM (CANISTER PUMP MODULE)**

(a) Disconnect the C20 canister pump module connector.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

HINT:

It can be checked using the "Engine and ECT" item of the Data List.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

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B ▶ REPLACE CANISTER PUMP MODULE

A ▼

9.	CHECK HARNESS AND CONNECTOR

(a) Disconnect the T1 throttle body with motor assembly connector.

(b) Disconnect the A19 accelerator pedal rod assembly connector.

(c) Disconnect the A8 air pressure sensor connector.

(d) Disconnect the V13 camshaft position sensor (for intake side) connector.

(e) Disconnect the V14 camshaft position sensor (for exhaust side) connector.

(f) Disconnect the C20 canister pump module connector.

(g) Disconnect the E17, E20 and E21 ECM connectors.

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E17-29 (VCTA) - Body ground	Always	10 kΩ or higher
E21-20 (VCPA) - Body ground	Always	10 kΩ or higher
E21-22 (VCP2) - Body ground	Always	10 kΩ or higher
E17-20 (VCAI) - Body ground	Always	10 kΩ or higher
E17-31 (VCE1) - Body ground	Always	10 kΩ or higher
E17-21 (VCV1) - Body ground	Always	10 kΩ or higher
E20-33 (VCPP) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

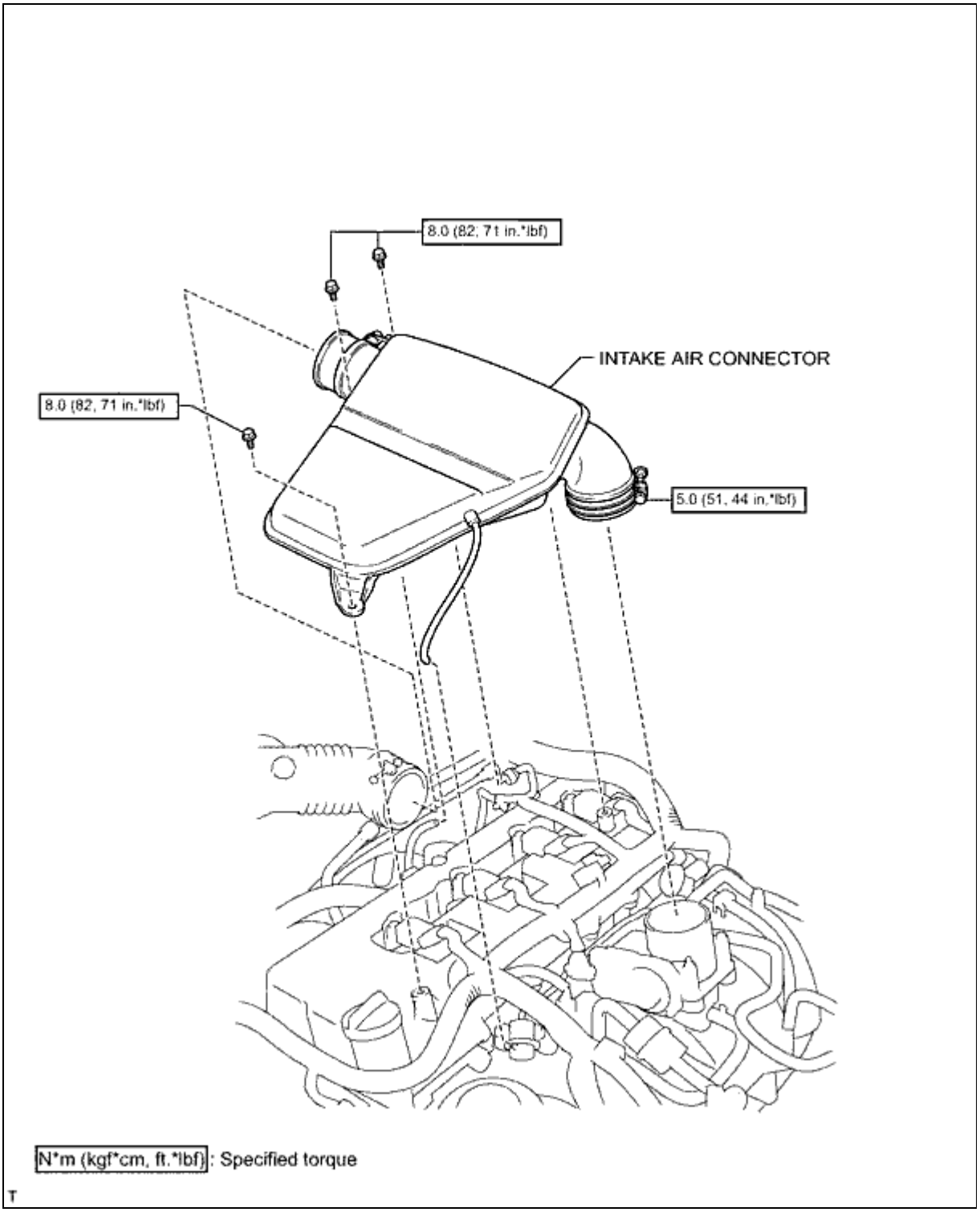
OK ▶ REPLACE ECM

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000VWN02CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: THROTTLE BODY: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

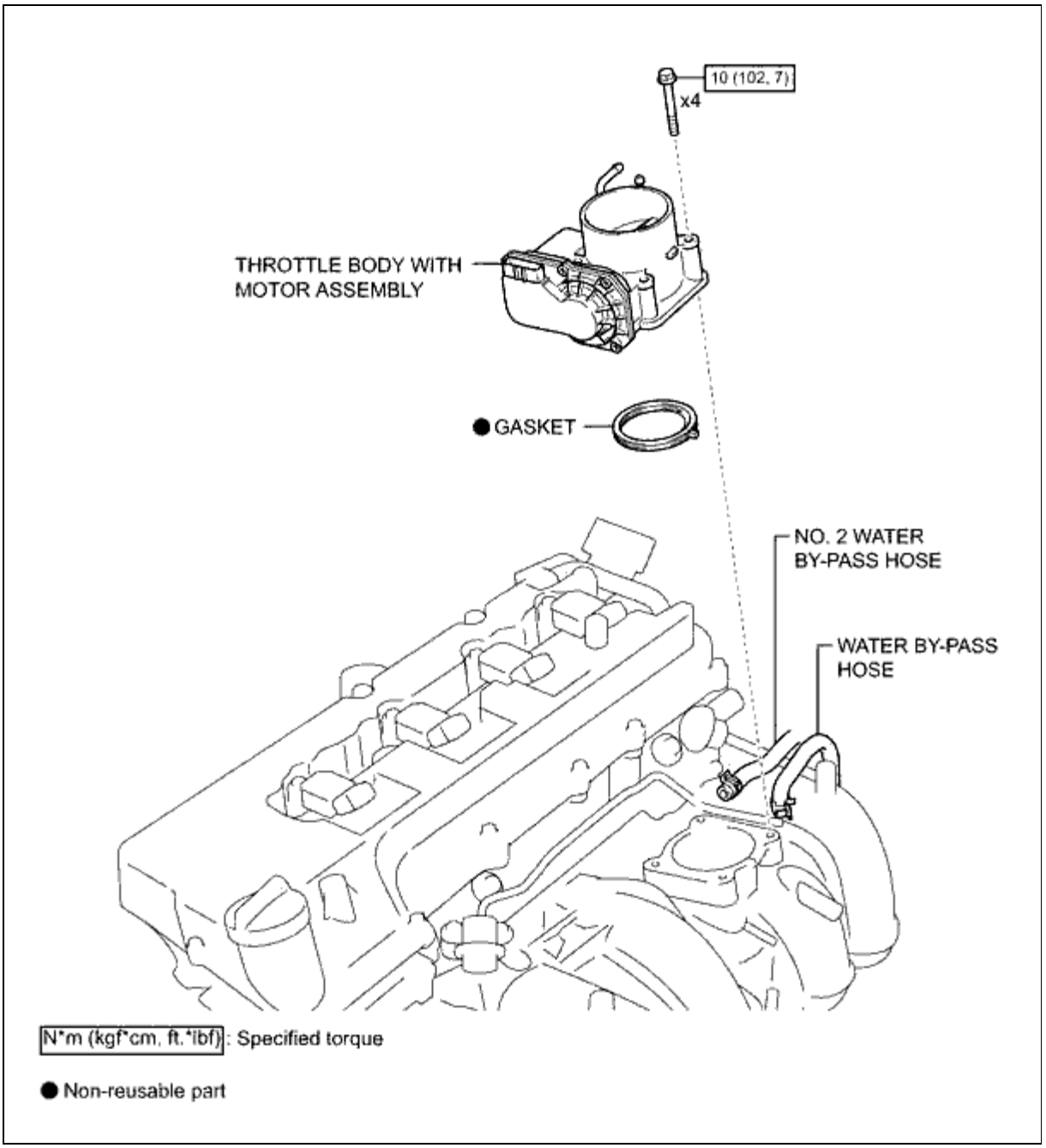
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000VWM02NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: THROTTLE BODY: INSPECTION; 2016 MY Tacoma [08/2015 -]		

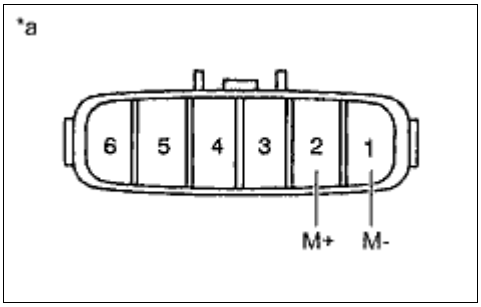
INSPECTION

1. INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY

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

Text in Illustration

*a	Component without harness connected (Throttle Body with Motor Assembly)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (M+) - 1 (M-)	20°C (68°F)	0.3 to 100 Ω

If the result is not as specified, replace the throttle body with motor assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VWL03YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: THROTTLE BODY: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY

HINT:

Perform "Inspection After Repair" after cleaning or replacing the throttle body with motor assembly INFO .

(a) Install a new gasket to the intake manifold.

(b) Install the throttle body with motor assembly to the intake manifold with the 4 bolts.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}

(c) Connect the water by-pass hose to the throttle body with motor assembly.

(d) Connect the No. 2 water by-pass hose to the throttle body with motor assembly.

(e) Connect the throttle body with motor assembly connector.

2. INSTALL INTAKE AIR CONNECTOR

(a) Install the intake air connector with the 3 bolts.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(b) Tighten the 2 hose clamp bolts.

Torque:

5.0 N·m {51 kgf·cm, 44in·lbf}

(c) Connect the vacuum hose.

(d) Connect the No. 2 ventilation hose.

(e) Connect the vacuum hose.

(f) Engage the wire harness clamp.

(g) Connect the pressure sensor connector.

3. ADD ENGINE COOLANT INFO

4. INSPECT FOR ENGINE COOLANT LEAK INFO

5. PERFORM INITIALIZATION

NOTICE:

Perform the following procedure after replacing or removing and installing the ECM, throttle body with motor assembly or any throttle body with motor assembly components. The following procedure should also be performed if the throttle body with motor assembly is cleaned.

(a) Disconnect the EFI No. 1 and ETCS fuses at the same time. Wait at least 60 seconds, and then reconnect the fuses.

(b) Turn the ignition switch to ON without operating the accelerator pedal.

NOTICE:

If the accelerator pedal is operated, perform the above steps again.

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(c) Connect the Techstream to the DLC3 and clear the DTCs INFO .

(d) Start the engine and check that the MIL is not illuminated and that the idle speed is within the specified range when the A/C is switched off after the engine is warmed up.

Standard Idling Speed:

TRANSMISSION	IDLING SPEED
Manual Transmission	600 to 700 rpm (With the shift lever in neutral)
Automatic Transmission	700 to 800 rpm (With the shift lever in N)

NOTICE:

Be sure to perform this step with all accessories off.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Sensor Position.

(f) Fully depress the accelerator pedal and check that the value is 60% or more.

(g) Perform a road test and confirm that there are no abnormalities.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000VWP02IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: THROTTLE BODY: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY WITH MOTOR ASSEMBLY

(a) Listen to the throttle control motor operating sounds.

(1) Turn the ignition switch to ON.

(2) When pressing the accelerator pedal, listen to the running sounds of the motor. Make sure no friction noises come from the motor.

If friction noises exist, check the throttle body, wire harness and ECM.

(b) Inspect the throttle position sensor.

(1) Warm up the engine.

(2) Turn the ignition switch off.

(3) Connect the Techstream to the DLC3.

(4) Turn the ignition switch to ON.

(5) Turn the Techstream on.

(6) Enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Sensor Position.

(7) Depress the accelerator pedal. When the throttle valve is fully opened, check that the Throttle Position value is within the specified range.

Standard:

60 % or more

NOTICE:

When checking the standard throttle valve opening percentage, the transmission should be in the neutral position.

If the result is not as specified, check the throttle body, wire harness and ECM.

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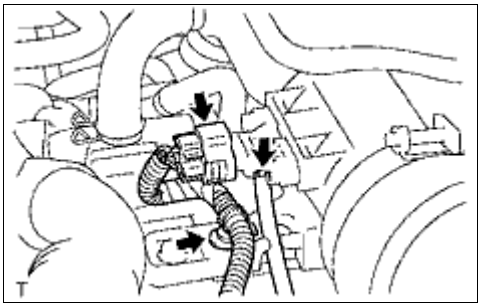
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000VWO039X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE CONTROL SYSTEM: THROTTLE BODY: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DRAIN ENGINE COOLANT INFO

2. REMOVE INTAKE AIR CONNECTOR

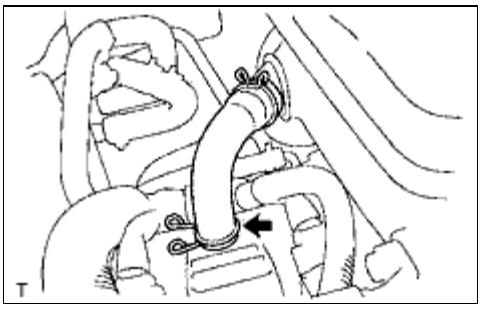
(a) Disconnect the pressure sensor connector.



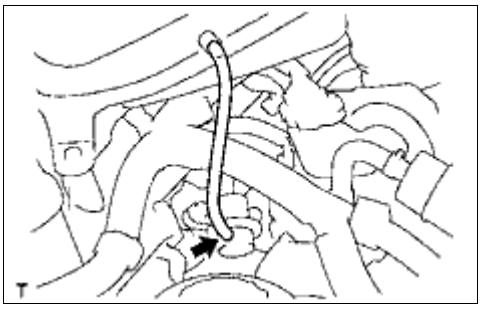
(b) Disengage the wire harness clamp.

(c) Disconnect the vacuum hose.

(d) Disconnect the No. 2 ventilation hose.

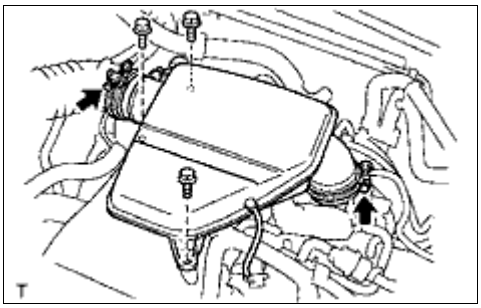


(e) Disconnect the vacuum hose.



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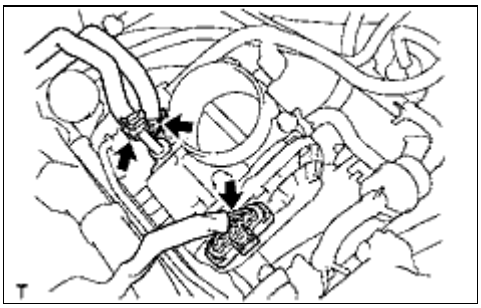
(f) Loosen the 2 hose clamp bolts.



(g) Remove the 3 bolts and intake air connector.

3. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY

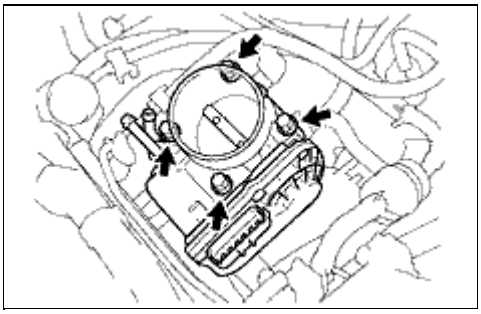
(a) Disconnect the throttle body with motor assembly connector.



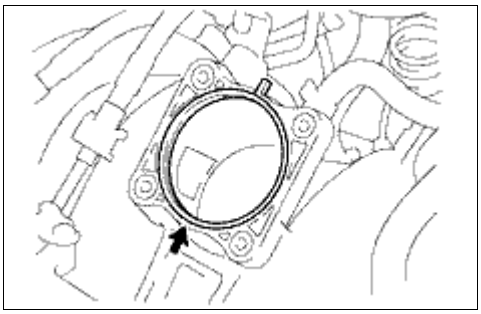
(b) Disconnect the No. 2 water by-pass hose from the throttle body with motor assembly.

(c) Disconnect the water by-pass hose from the throttle body with motor assembly.

(d) Remove the 4 bolts and throttle body with motor assembly from the intake manifold.



(e) Remove the gasket from the intake manifold.

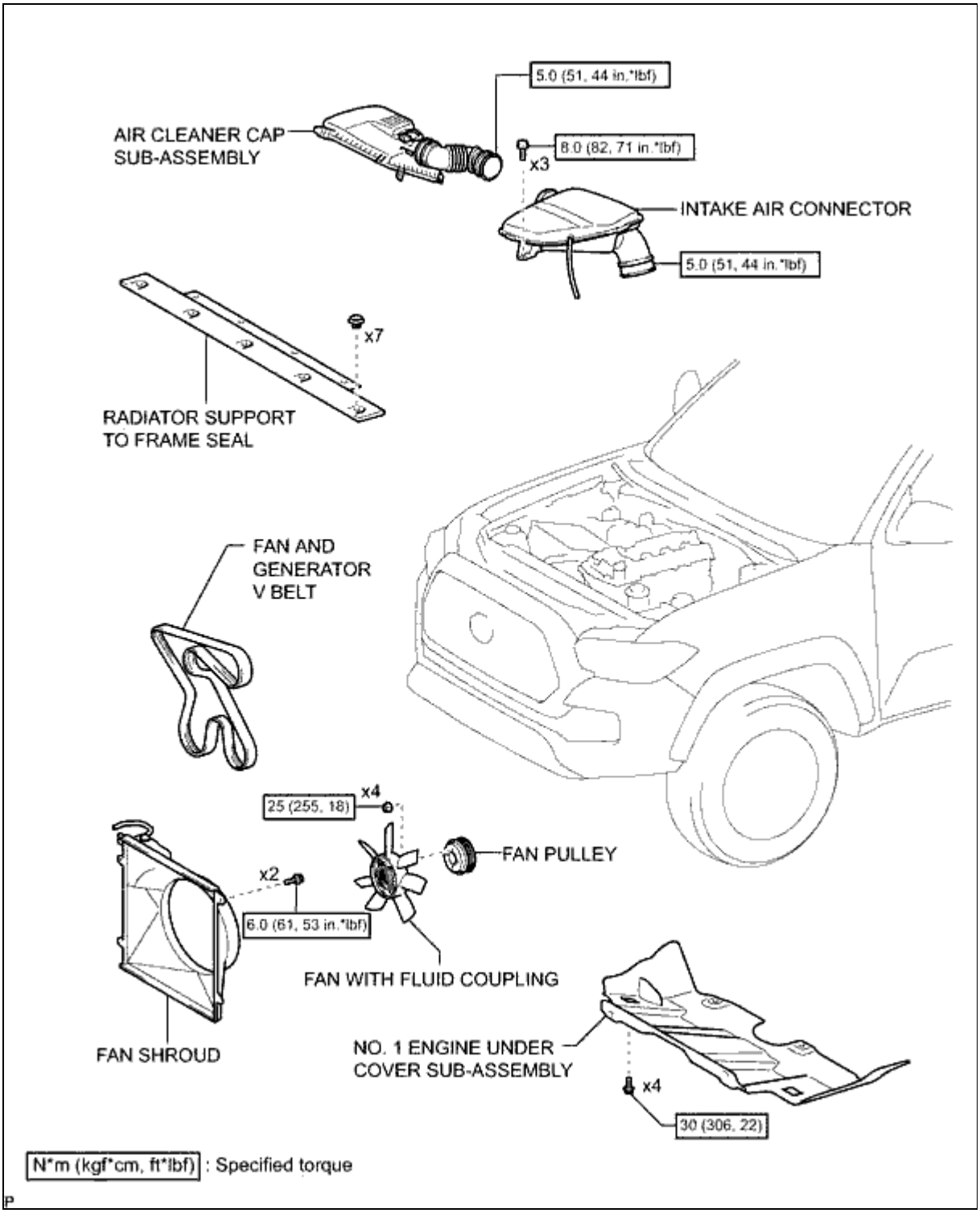


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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000YMZ01SX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CAMSHAFT: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

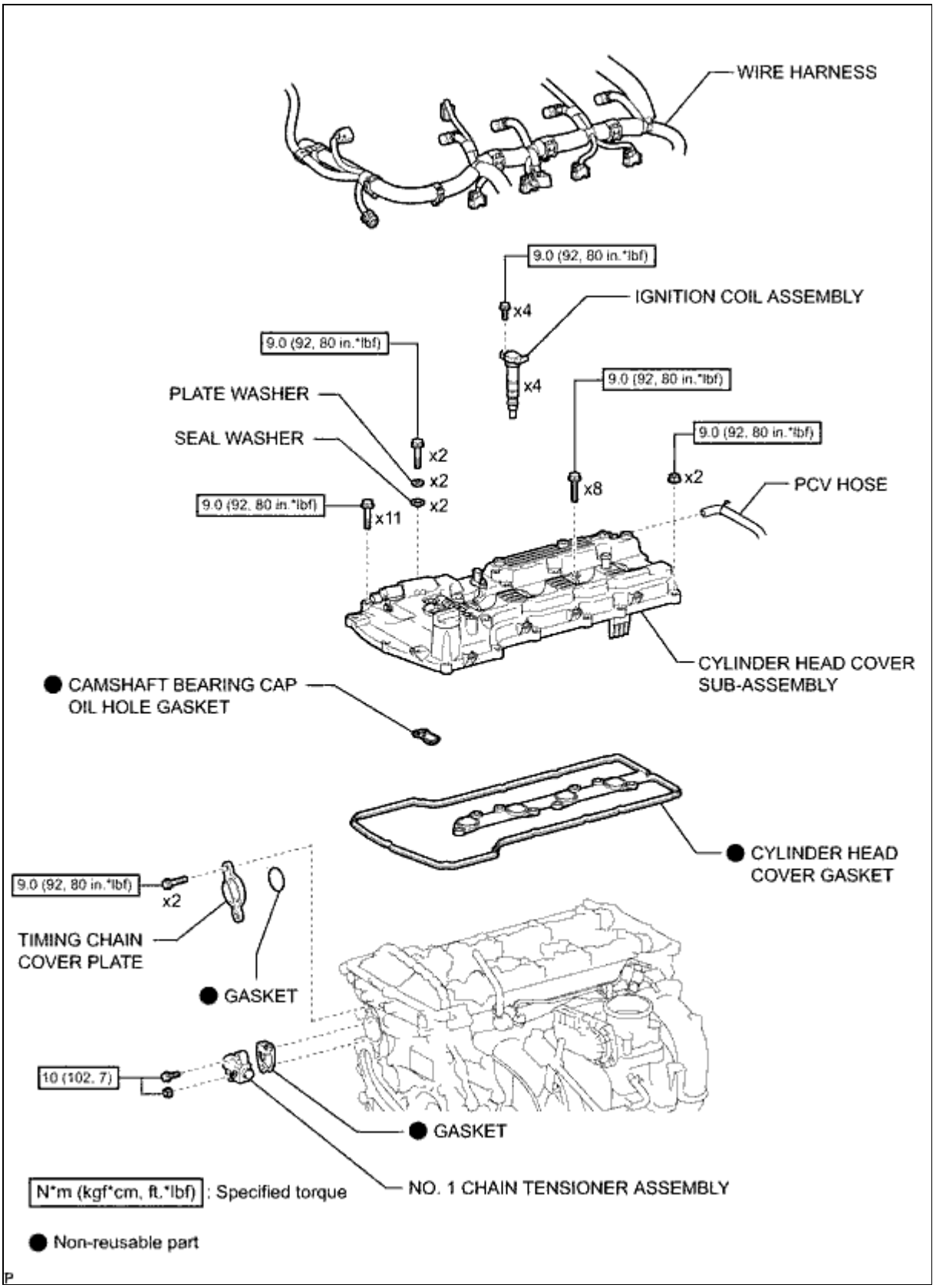
COMPONENTS

ILLUSTRATION



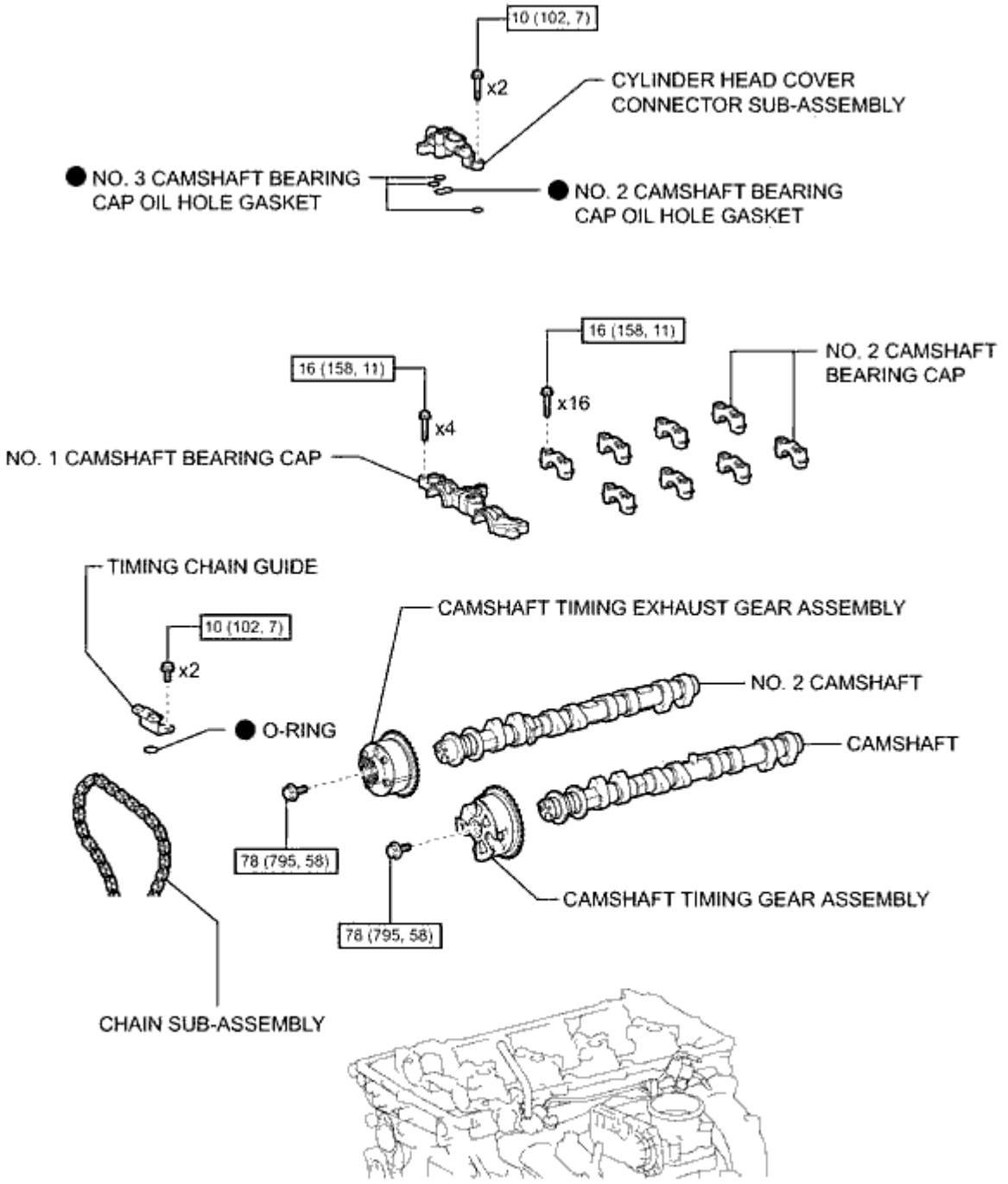
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ILLUSTRATION



ILLUSTRATION

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

● Non-reusable part

P

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000YMY02VX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CAMSHAFT: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

HINT:

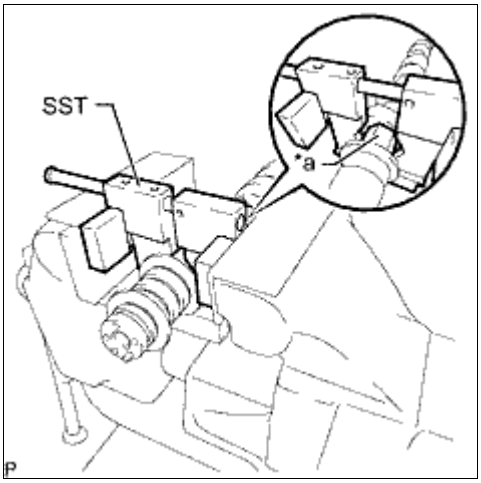
Perform "Inspection After Repairs" after replacing the camshaft, No. 2 camshaft, camshaft timing gear assembly or camshaft timing exhaust gear assembly INFO .

1. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

HINT:

Perform "Inspection After Repairs" after replacing the camshaft timing exhaust gear assembly INFO .

(a) Using SST, grip the hexagonal portion, and then secure SST and No. 2 camshaft in a vise as shown in the illustration.



Text in Illustration

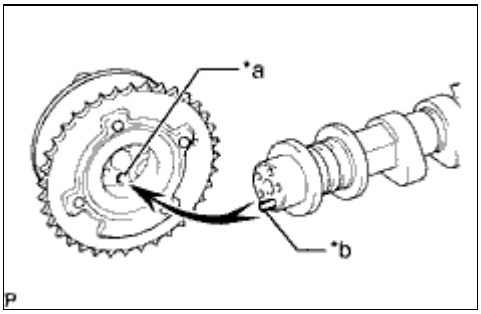
*a	Hexagonal Portion

SST: 09212-31010

NOTICE:

- Do not damage the No. 2 camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

(b) Align and attach the straight pin of the No. 2 camshaft with the straight pin hole of the camshaft timing exhaust gear assembly.

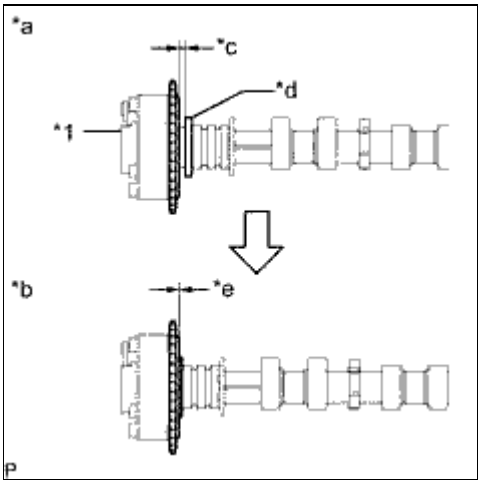


Text in Illustration

*a	Straight Pin Hole
*b	Straight Pin

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(c) Check that there is no clearance between the camshaft timing exhaust gear assembly and camshaft flange.



Text in Illustration

*1	Camshaft Timing Exhaust Gear Assembly
*a	Incorrect
*b	Correct
*c	Clearance
*d	Camshaft Flange
*e	No Clearance

NOTICE:

Be sure not to remove the other 4 bolts. If removing the bolts, exchange the camshaft timing exhaust gear assembly.

(d) Fix the camshaft timing exhaust gear assembly with the flange bolt.

Torque:

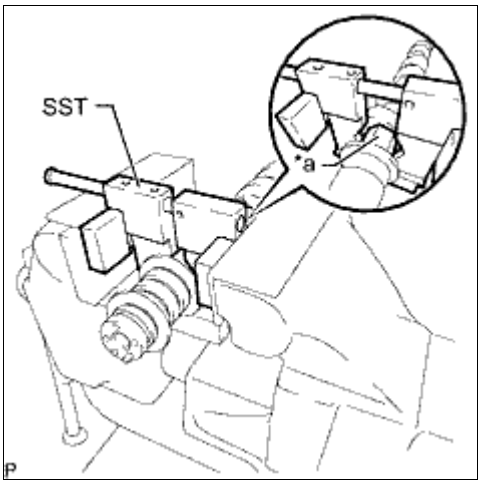
78 N·m {795 kgf·cm, 58ft·lbf}

2. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

HINT:

Perform "Inspection After Repairs" after replacing the camshaft timing gear assembly INFO .

(a) Using SST, grip the hexagonal portion, and then secure SST and camshaft in a vise as shown in the illustration.



Text in Illustration

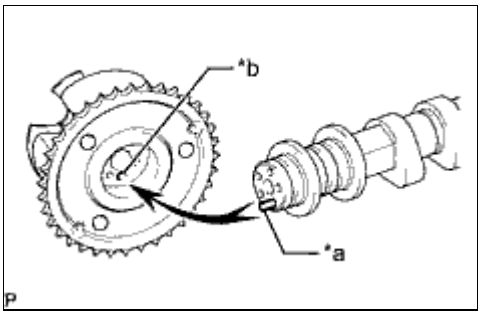
*a	Hexagonal Portion

SST: 09212-31010

NOTICE:

- Do not damage the camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

(b) Align the straight pin hole and straight pin and install the camshaft timing gear assembly to the camshaft.



Text in Illustration

*a	Straight Pin
*b	Straight Pin Hole

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(c) Lightly press the gear against the camshaft and turn the gear. Push further at the position where the straight pin enters the straight pin hole.

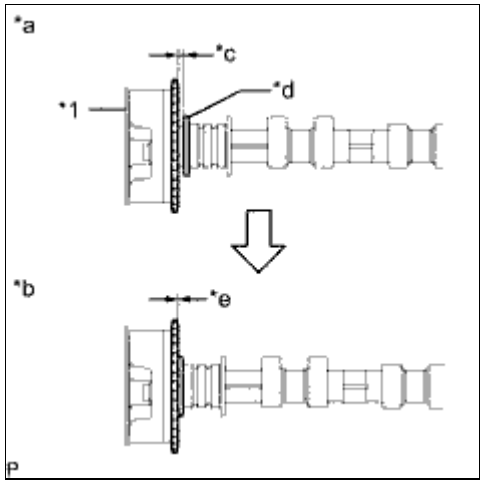
NOTICE:

Be sure not to turn the camshaft timing gear assembly in the retard direction (the right angle).

(d) Check that there is no clearance between the camshaft timing gear assembly and the flange of the camshaft.

Text in Illustration

*1	Camshaft Timing Gear Assembly
*a	Incorrect
*b	Correct
*c	Clearance
*d	Camshaft Flange
*e	No Clearance



NOTICE:

- Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break.
- Be sure not to remove the other 3 bolts. If removing the bolts, exchange the camshaft timing gear assembly.

(e) With the camshaft timing gear assembly fixed in place, install the flange bolt.

Torque:

78 N·m {795 kgf·cm, 58ft·lbf}

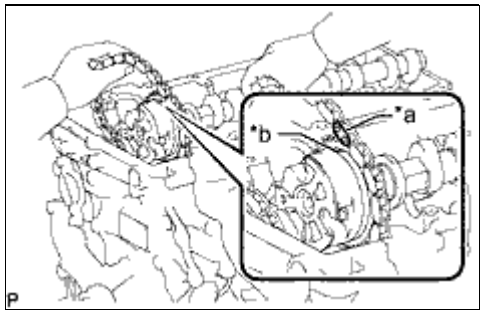
(f) Check that the camshaft timing gear assembly can move in the retard direction (the right angle), and is locked at the most retarded position.

3. INSTALL CAMSHAFT AND NO. 2 CAMSHAFT

(a) Apply clean engine oil to the camshaft cams and cylinder head journals.

Text in Illustration

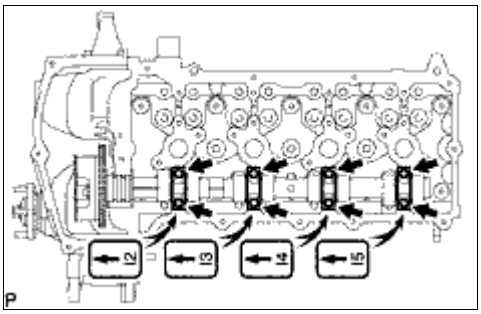
*a	Paint Mark
*b	Timing Mark



(b) Install the chain sub-assembly to the camshaft timing gear assembly with the paint mark of the link aligned with the timing mark of the camshaft timing gear assembly.

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(c) Temporarily install the 4 No. 2 camshaft bearing caps using the 8 bolts as shown in the illustration.

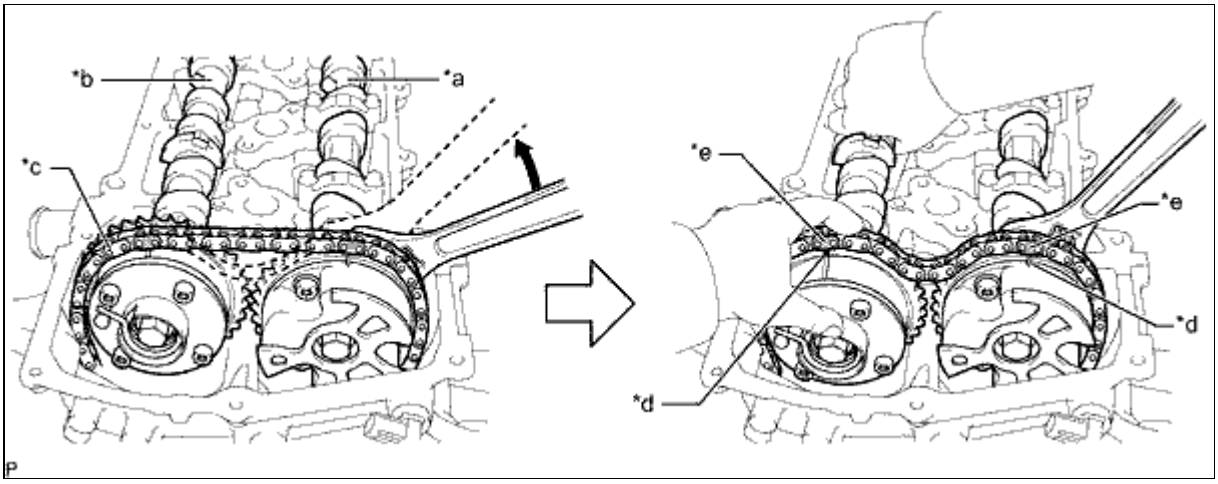


(d) Install the chain sub-assembly to the No. 2 camshaft, and then install the No. 2 camshaft to the cylinder head sub-assembly.

HINT:

Place the chain sub-assembly on the camshaft timing gear assembly but do not engage the teeth of the sprocket and the chain sub-assembly.

(e) Move the camshaft in the direction shown in the illustration to loosen the chain sub-assembly, and align the paint mark on the camshaft timing gear assembly and chain sub-assembly and connect the chain sub-assembly to the camshaft timing gear assembly.

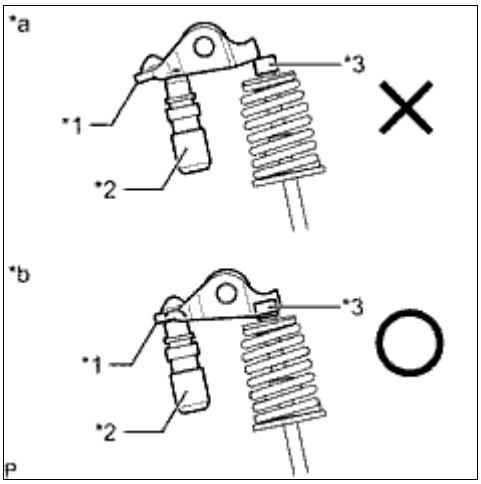


Text in Illustration

*a	Camshaft	*b	No. 2 Camshaft
*c	Chain Sub-assembly	*d	Timing Mark
*e	Paint Mark	-	-

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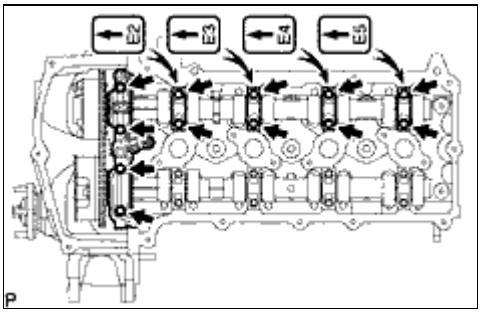
(f) Make sure that the No. 1 valve rocker arm sub-assemblies are installed as shown in the illustration.



Text in Illustration

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Lash Adjuster Assembly
*3	Valve Stem Cap
*a	Incorrect
*b	Correct

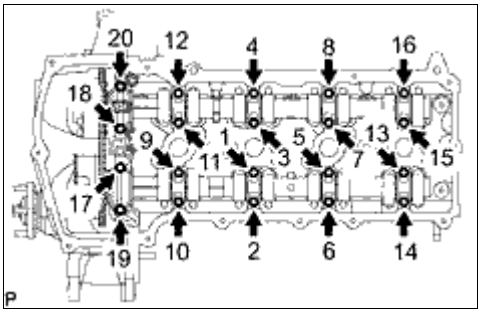
(g) Temporarily install the No. 1 camshaft bearing cap and 4 No. 2 camshaft bearing caps using the 12 bolts.



(h) Install the 20 bolts in the order shown in the illustration.

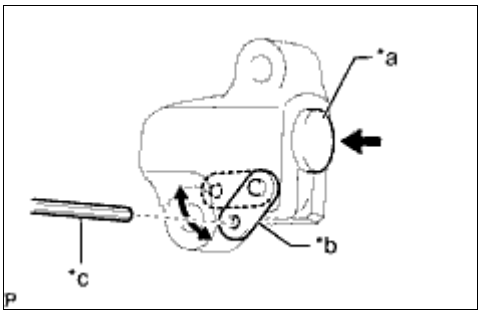
Torque:

16 N·m {158 kgf·cm, 11ft·lbf}



4. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate upward to release the lock and push the plunger deep into the tensioner.



Text in Illustration

*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench

(b) Move the stopper plate downward to set the lock and insert a hexagon wrench into the hole of the stopper plate.

(c) Install a new gasket and the No. 1 chain tensioner assembly with the bolt and nut.

Torque:

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10 N·m {102 kgf·cm, 7ft·lbf}

NOTICE:

Remove the hexagon wrench after installing the timing chain guide.

(d) Install a new gasket to the timing chain cover plate.

(e) Install the timing chain cover plate to the timing chain cover sub-assembly with the 2 bolts.

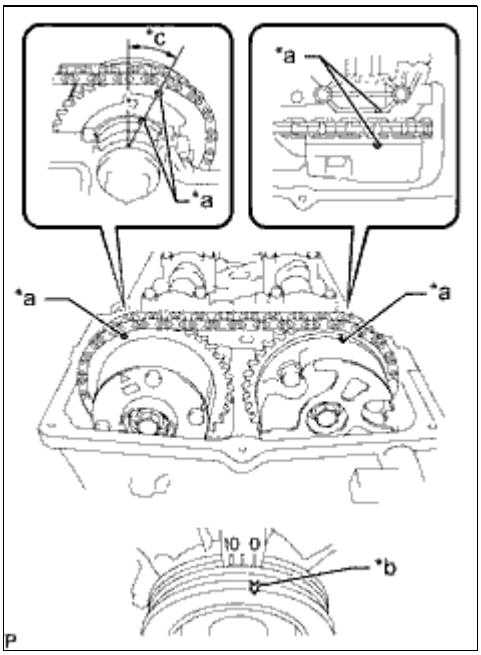
Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

5. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Check that the No. 1 cylinder is set to TDC/compression.

(1) Rotate the crankshaft two full rotations, and then check that all timing marks are in the position shown in the illustration.



Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°

If the timing marks do not match, set the chain sub-assembly again.

6. INSTALL TIMING CHAIN GUIDE INFO

7. INSTALL CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY INFO

8. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

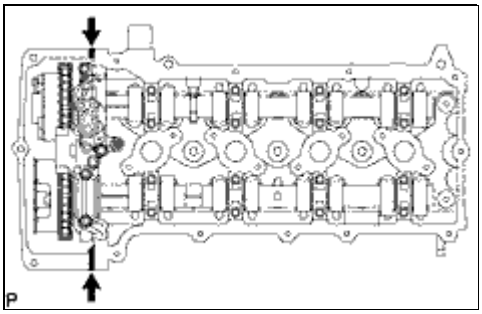
HINT:

Perform "Inspection After Repairs" after replacing the ignition coil assembly INFO .

(a) Clean and degrease the contact surfaces of the cylinder head cover sub-assembly, timing chain cover sub-assembly and cylinder head sub-assembly.

(b) Apply seal packing as shown in the illustration.

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Text in Illustration

➡	Seal Packing

Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent
Seal packing diameter:
4.0 mm (0.157 in.)

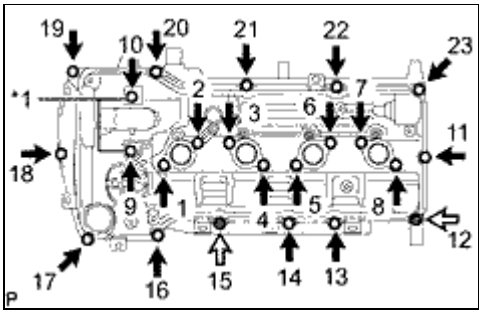
NOTICE:

- Install the cylinder head cover sub-assembly within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not add the engine oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.

(c) Install a new camshaft bearing cap oil hole gasket to the cylinder head cover spacer.

(d) Install a new cylinder head cover gasket to the cylinder head cover sub-assembly.

(e) Install the cylinder head cover sub-assembly, 2 plate washers and 2 seal washers with the 21 bolts and 2 nuts, and tighten the 21 bolts and 2 nuts in the sequence shown in the illustration.



Text in Illustration

*1	Plate Washer and Seal Washer
➡	Bort
⇨	Nut

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

NOTICE:

Make sure that the metal face of the seal washer is facing upward.

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(f) Connect the PCV hose to the PCV valve sub-assembly and slide the clip to secure the hose.

(g) Install the 4 ignition coil assemblies to the cylinder head cover sub-assembly with the 4 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(h) Install the engine wire harness clamps.

(i) Connect the throttle body with motor assembly connector.

(j) Connect the purge VSV connector.

(k) Connect the 4 ignition coil connectors.

9. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

10. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

11. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

12. INSTALL FAN SHROUD INFO

13. INSTALL INTAKE AIR CONNECTOR INFO

14. INSTALL AIR CLEANER CAP SUB-ASSEMBLY INFO

15. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

16. ADD ENGINE OIL INFO

17. INSPECT FOR OIL LEAK INFO

18. INSPECT ENGINE OIL LEVEL INFO

19. INSPECT IGNITION TIMING INFO

20. INSPECT ENGINE IDLE SPEED INFO

21. INSTALL RADIATOR SUPPORT TO FRAME SEAL INFO

22. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000YN002IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CAMSHAFT: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO

2. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

3. REMOVE RADIATOR SUPPORT TO FRAME SEAL INFO

4. DRAIN ENGINE OIL INFO

5. REMOVE AIR CLEANER CAP SUB-ASSEMBLY INFO

6. REMOVE INTAKE AIR CONNECTOR INFO

7. REMOVE FAN SHROUD INFO

8. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

9. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

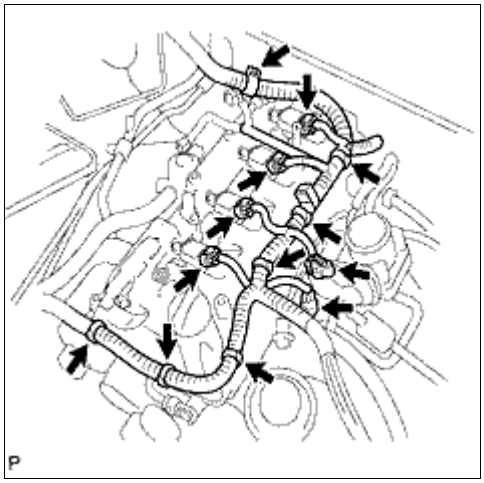
10. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

11. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

HINT:

Perform "Inspection After Repairs" after replacing the ignition coil assembly INFO .

(a) Disconnect the 4 ignition coil connectors.



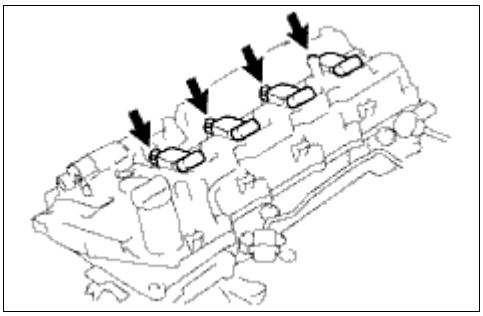
(b) Disconnect the throttle body with motor assembly connector.

(c) Disconnect the purge VSV connector.

(d) Disconnect the engine wire harness clamps.

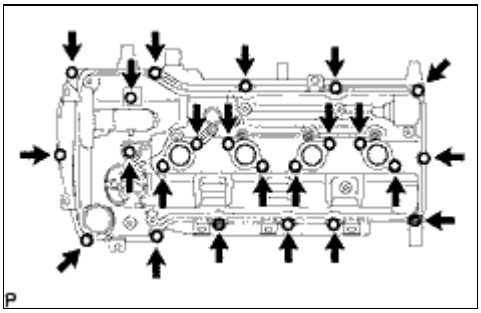
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(e) Remove the 4 bolts and 4 ignition coil assemblies.



(f) Slide the clip and disconnect the PCV hose from the PCV valve sub-assembly.

(g) Remove the 21 bolts, 2 nuts, 2 plate washers, 2 seal washers and cylinder head cover sub-assembly.



(h) Remove the cylinder head cover gasket from the cylinder head cover sub-assembly.

(i) Remove the camshaft bearing cap oil hole gasket from the cylinder head cover spacer.

12. REMOVE CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY INFO

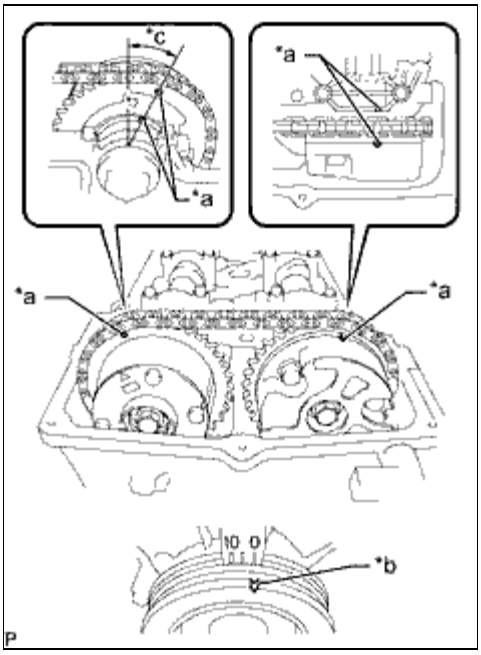
13. REMOVE TIMING CHAIN GUIDE INFO

14. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley, and align its groove with the "0" timing mark of the timing chain cover sub-assembly.

Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°



(b) Check that the timing marks of the camshaft timing gear and sprocket are aligned with the timing marks of the No. 1 bearing cap as shown in the illustration.

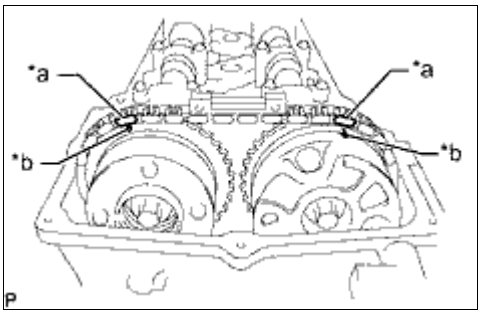
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HINT:

If the timing marks do not align, rotate the crankshaft clockwise again and align the timing marks.

15. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

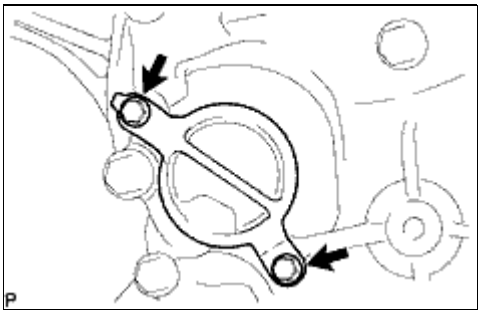
(a) Place paint marks on the chain sub-assembly, camshaft timing gear assembly and camshaft timing exhaust gear assembly.



Text in Illustration

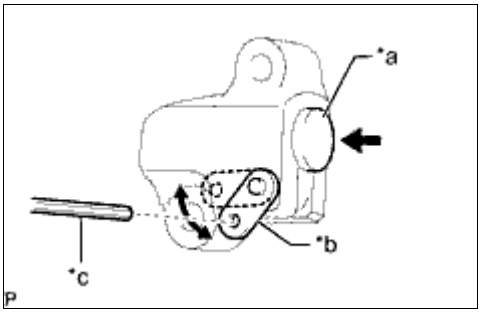
*a	Paint Mark
*b	Timing Mark

(b) Remove the 2 bolts and timing chain cover plate from the timing chain or belt cover sub-assembly.



(c) Remove the gasket from the timing chain cover plate.

(d) Move the stopper plate upward to release the lock and push the plunger deep into the tensioner.

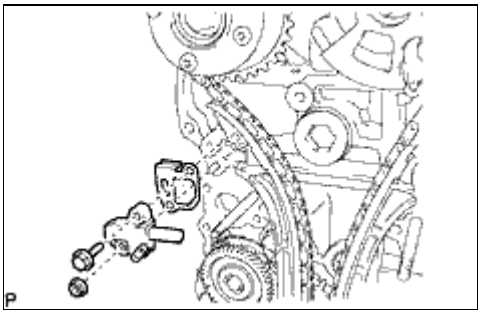


Text in Illustration

*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench

(e) Move the stopper plate downward to set the lock and insert a hexagon wrench into the stopper plate hole.

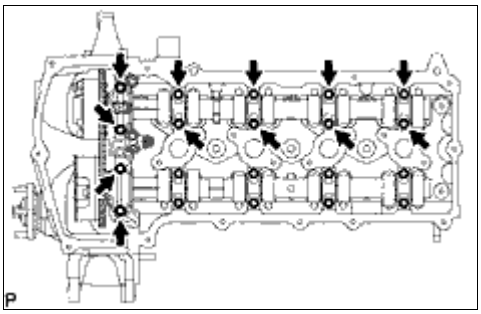
(f) Remove the bolt, nut, No. 1 chain tensioner assembly and gasket.



16. REMOVE NO. 2 CAMSHAFT

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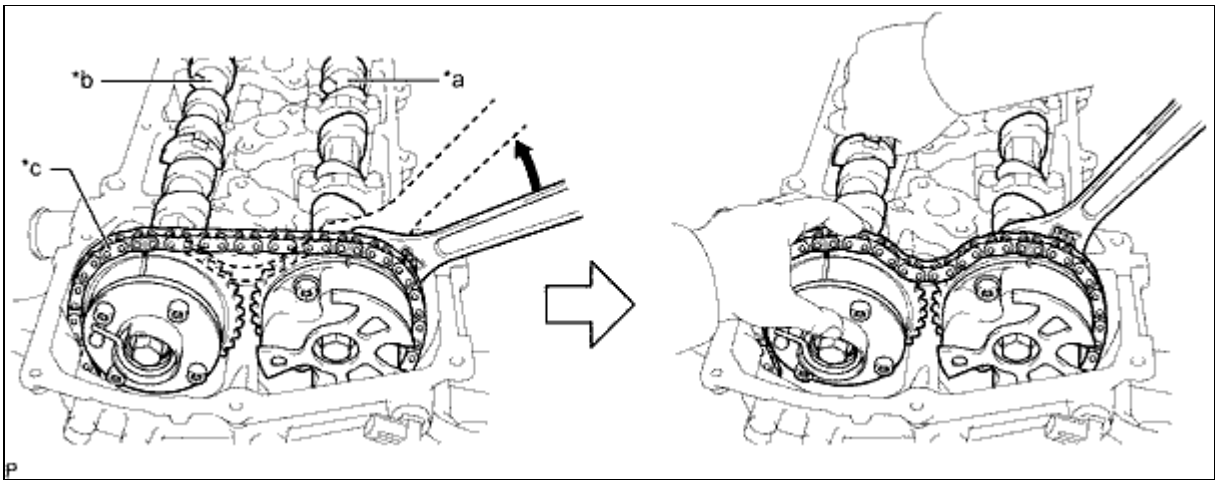
(a) Uniformly loosen the 12 bolts and then remove the No. 1 camshaft bearing cap and 4 No. 2 camshaft bearing caps.



NOTICE:

Uniformly loosen the bolts while keeping the No. 2 camshaft level.

(b) Move the camshaft in the direction shown in the illustration to loosen the chain sub-assembly, and then remove the No. 2 camshaft.



Text in Illustration

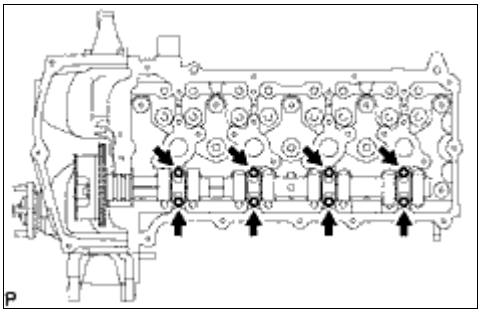
*a	Camshaft	*b	No. 2 Camshaft
*c	Chain Sub-assembly	-	-

NOTICE:

Do not pry the No. 2 camshaft with a tool as an excessive amount of force may be applied to it.

17. REMOVE CAMSHAFT

(a) Uniformly loosen the 8 bolts and then remove the 4 No. 2 camshaft bearing caps.

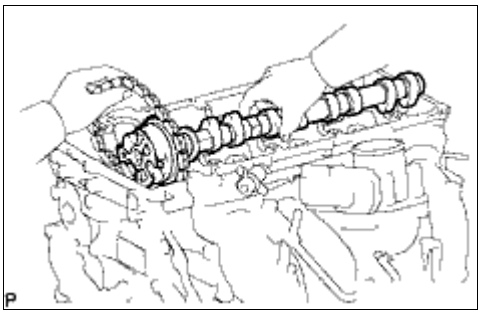


NOTICE:

Uniformly loosen the bolts while keeping the camshaft level.

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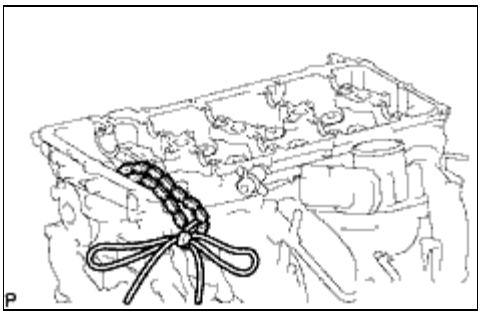
(b) Remove the camshaft while holding the chain sub-assembly.



NOTICE:

Do not pry the camshaft with a tool as an excessive amount of force may be applied to it.

(c) Secure the chain sub-assembly with a string as shown in the illustration.



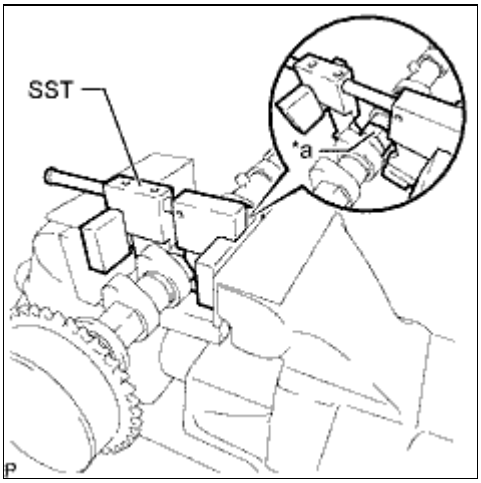
NOTICE:

Be careful not to drop anything inside the timing chain cover sub-assembly.

18. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

(a) Check the lock of the camshaft timing gear assembly.

(1) Using SST, grip the hexagonal portion, and then secure SST and camshaft in a vise as shown in the illustration and check that the camshaft timing gear assembly does not rotate.



Text in Illustration

*a	Hexagonal Portion

SST: 09212-31010

NOTICE:

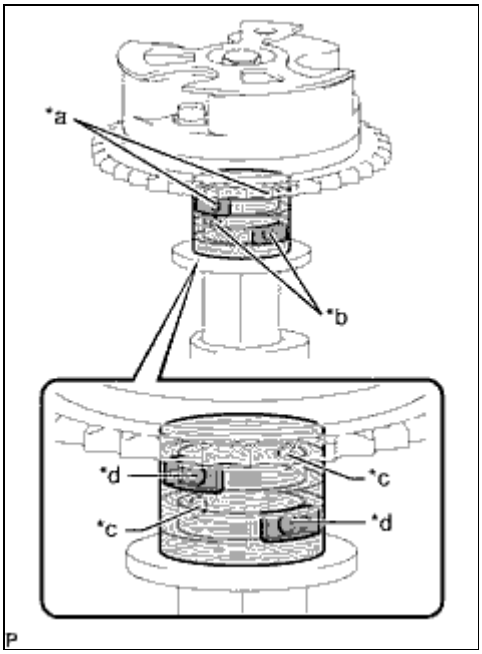
- Do not damage the camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

(b) Release the lock pin.

(1) Clean the camshaft journal with non-residue solvent.

(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

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Text in Illustration

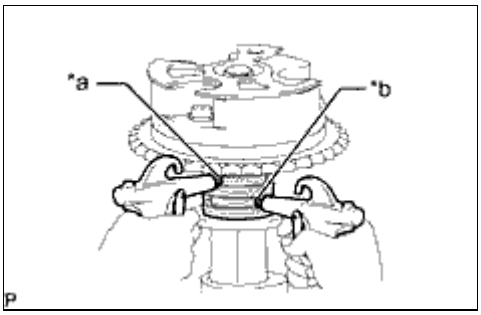
*a	Retard Side Path
*b	Advance Side Path
*c	Open
*d	Close
	Rubber Piece
	Vinyl Tape

HINT:

1 retard side path and 1 advance side path are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.

(3) Break through the tape over the advance side path, and then break through the tape over the retard side path on the opposite side from the hole over the advance side path as shown in the illustration.

(4) Apply compressed air at approximately 200 kPa (2.0 kgf/cm 2 , 28 psi) to the 2 open paths accessible through the holes in the tape.



Text in Illustration

*a	Retard Side Path
*b	Advance Side Path

NOTICE:

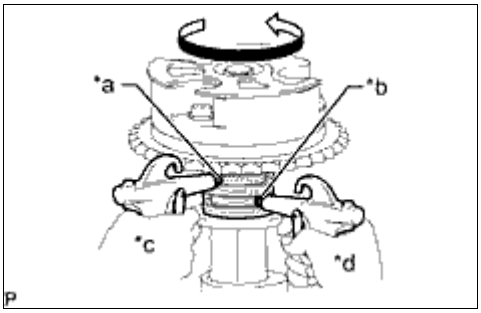
Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

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(5) Check that the camshaft timing gear assembly revolves in the advance direction when reducing the air pressure applied to the retard side path.

Text in Illustration

*a	Retard Side Path
*b	Advance Side Path
*c	Decompress
*d	Hold Pressure



OK:

Gear rotates in the advance direction.

HINT:

This operation releases the lock pin which holds the timing gear in the most retarded position.

(6) When the camshaft timing gear assembly reaches the most advanced position, release the air pressure from the retard side path and advance side path in that order.

NOTICE:

- Do not release the air pressure from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.
- When releasing the air pressure from the advance side path, release it slowly.

(c) Check for smooth rotation.

(1) Rotate the camshaft timing gear assembly within its movable range several times, but do not turn it to the most retarded position. Check that the gear rotates smoothly.

CAUTION:

Do not use air pressure to perform the smooth operation check.

(d) Check the lock in the most retarded position.

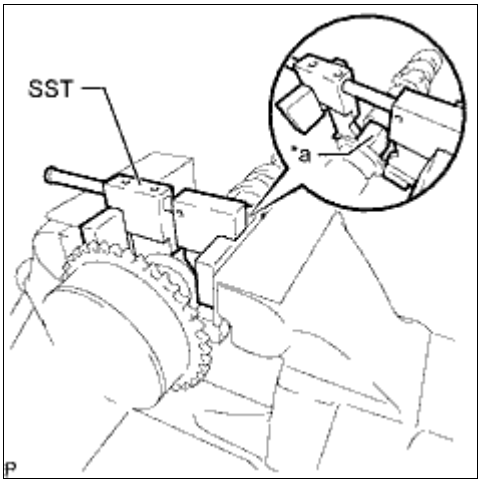
(1) Confirm that the camshaft timing gear assembly becomes locked at the most retarded position.

19. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

(a) Using SST, grip the hexagonal portion, and then secure SST and camshaft in a vise as shown in the illustration.

Text in Illustration

*a	Hexagonal Portion



SST: 09212-31010

NOTICE:

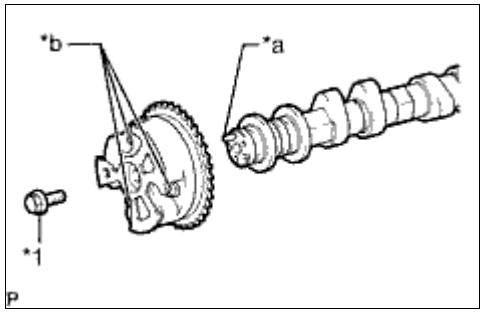
- Do not damage the camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

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(b) Remove the flange bolt and camshaft timing gear assembly.

Text in Illustration

*1	Flange Bolt
*a	Straight Pin
*b	Do Not Remove



NOTICE:

- Be sure not to remove the other 3 bolts.
- If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.

20. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

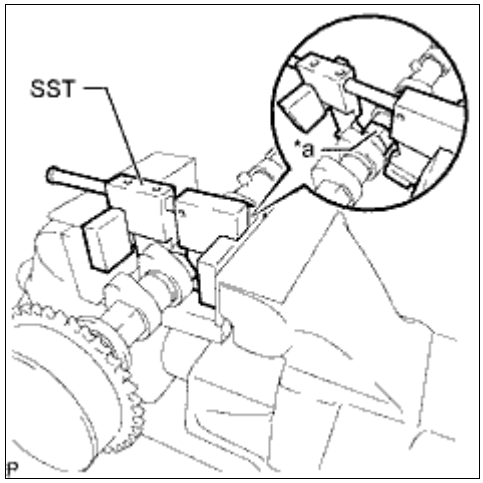
(a) Check the lock of the camshaft timing exhaust gear assembly.

(1) Using SST, grip the hexagonal portion, and then secure SST and No. 2 camshaft in a vise as shown in the illustration and check that the camshaft timing exhaust gear assembly does not rotate.

Text in Illustration

*a	Hexagonal Portion

SST: 09212-31010



NOTICE:

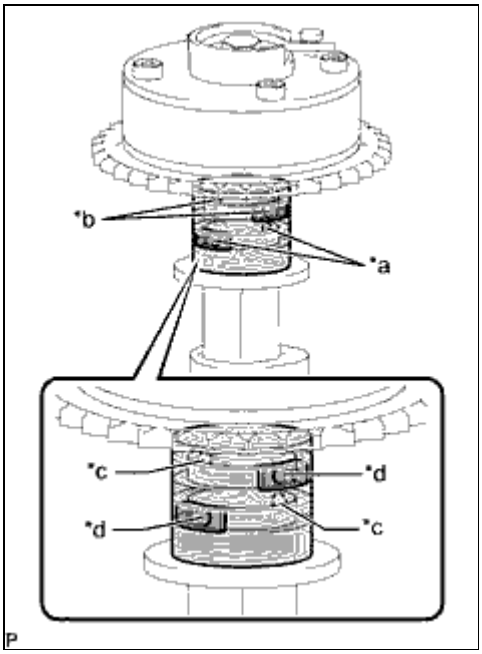
- Do not damage the No. 2 camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

(b) Release the lock pin.

(1) Clean the No. 2 camshaft journal with non-residue solvent.

(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

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Text in Illustration

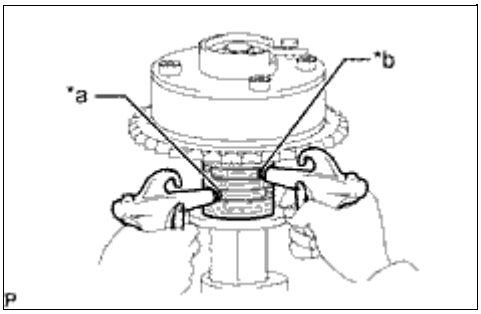
*a	Retard Side Path
*b	Advance Side Path
*c	Open
*d	Close
	Rubber Piece
	Vinyl Tape

HINT:

There are 4 oil paths in the grooves of the No. 2 camshaft. Plug 2 paths with pieces of rubber.

(3) Break through the tape over the advance side path, and then break through the tape over the retard side path on the opposite side from the hole over the advance side path as shown in the illustration.

(4) Apply compressed air at approximately 200 kPa (2.0 kgf/cm 2 , 28 psi) to the 2 open paths (the advance side path and retard side path).



Text in Illustration

*a	Retard Side Path
*b	Advance Side Path

NOTICE:

Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

HINT:

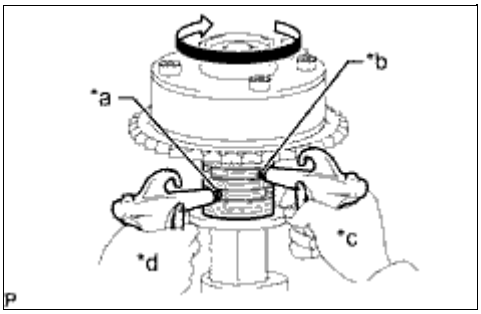
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The lock pin is released in this condition.

(5) Check that the camshaft timing exhaust gear assembly turns in the retard direction when reducing the air pressure applied to the advance side path.

Text in Illustration

*a	Retard Side Path
*b	Advance Side Path
*c	Decompress
*d	Hold Pressure



HINT:

The lock pin is released and the camshaft timing exhaust gear assembly turns in the retard direction.

(6) When the camshaft timing exhaust gear assembly moves to the most retarded position, release the air pressure from the advance side path, and then release the air pressure from the retard side path.

NOTICE:

Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear assembly may abruptly shift in the advance direction and break the lock pin or other parts.

(c) Check for smooth rotation.

(1) Turn the camshaft timing exhaust gear assembly within its movable range (21.5 to 23.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.

NOTICE:

When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist spring operation, and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

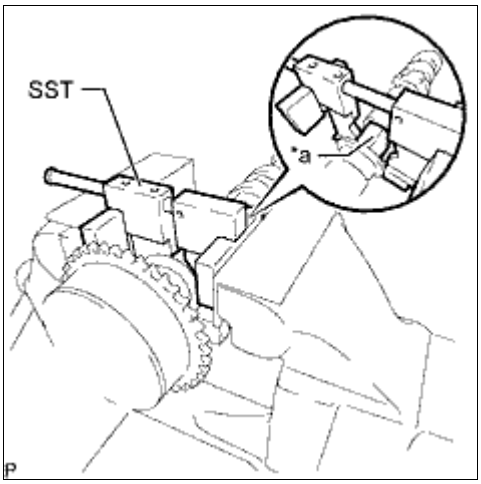
(d) Check the lock at the most advanced position.

(1) Make sure that the camshaft timing exhaust gear assembly locks at the most advanced position.

21. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

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(a) Using SST, grip the hexagonal portion, and then secure SST and No. 2 camshaft in a vise as shown in the illustration.



Text in Illustration

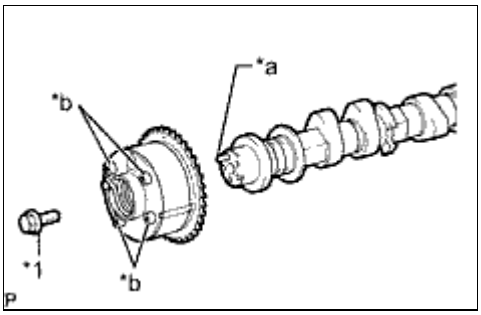
*a	Hexagonal Portion

SST: 09212-31010

NOTICE:

- Do not damage the No. 2 camshaft.
- Never grip areas other than the hexagonal portion, as this may cause damage.

(b) Remove the flange bolt and camshaft timing exhaust gear assembly.



Text in Illustration

*1	Flange Bolt
*a	Straight Pin
*b	Do Not Remove

NOTICE:

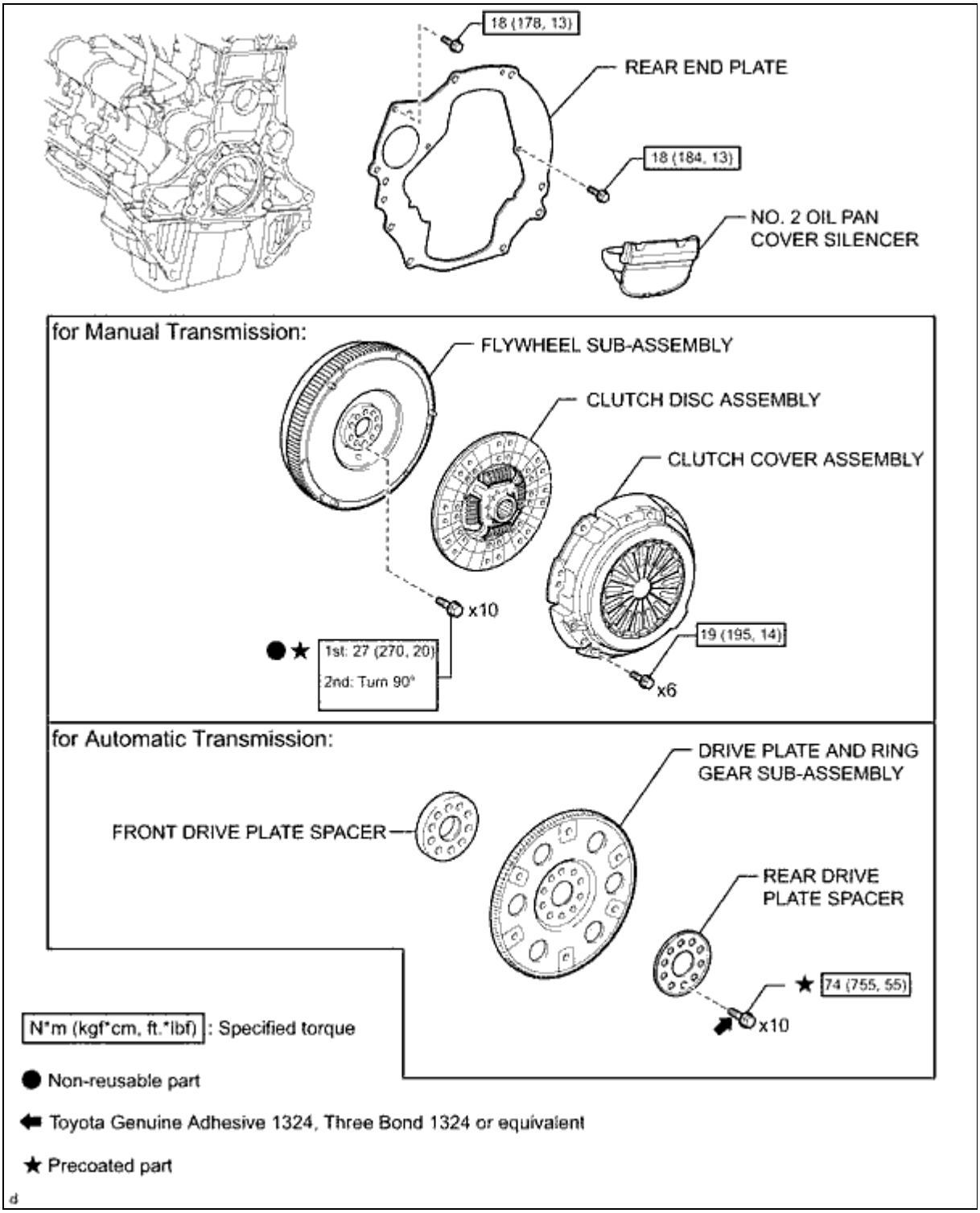
Be sure not to remove the other 4 bolts.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000017OK014X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CYLINDER HEAD: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

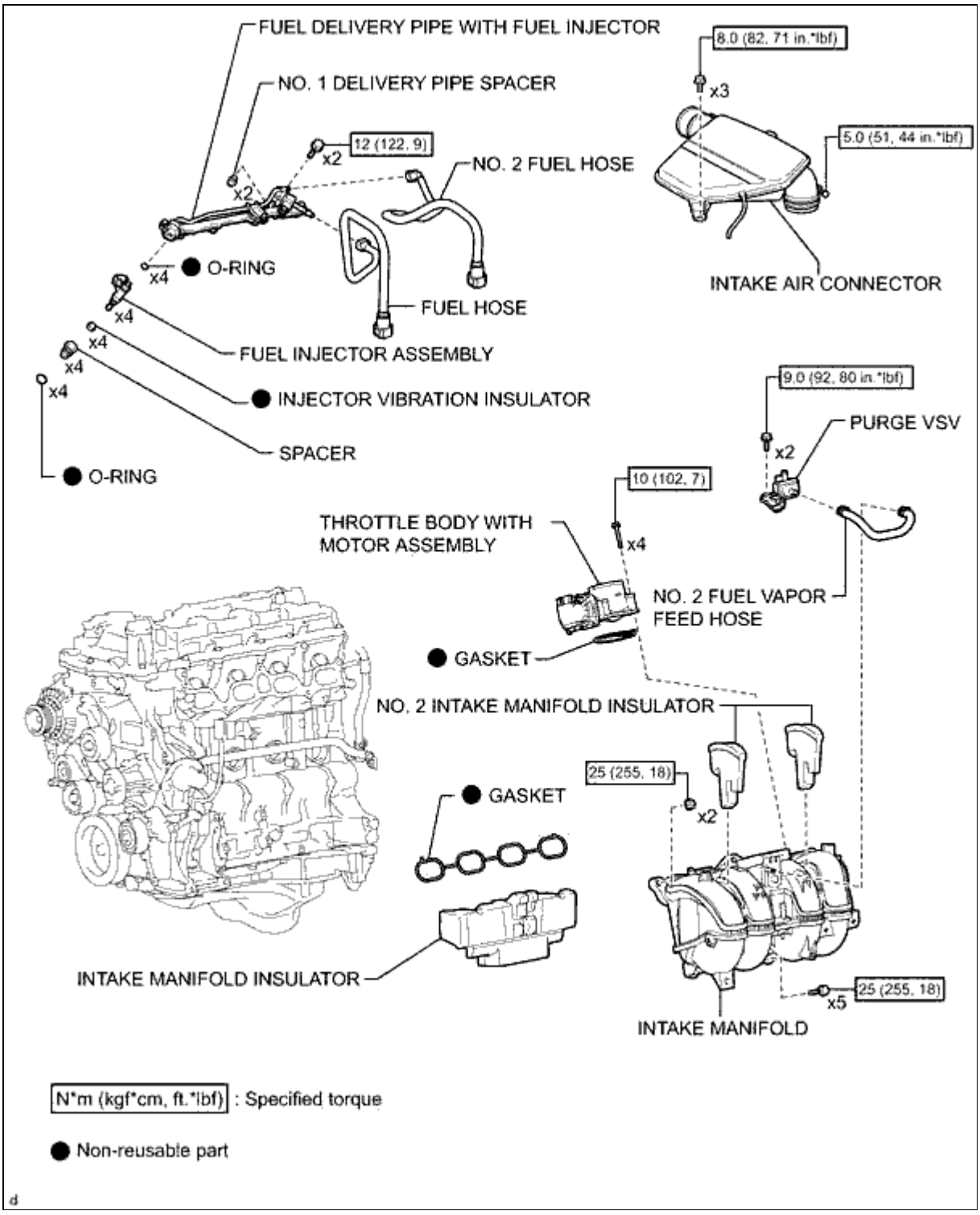
COMPONENTS

ILLUSTRATION



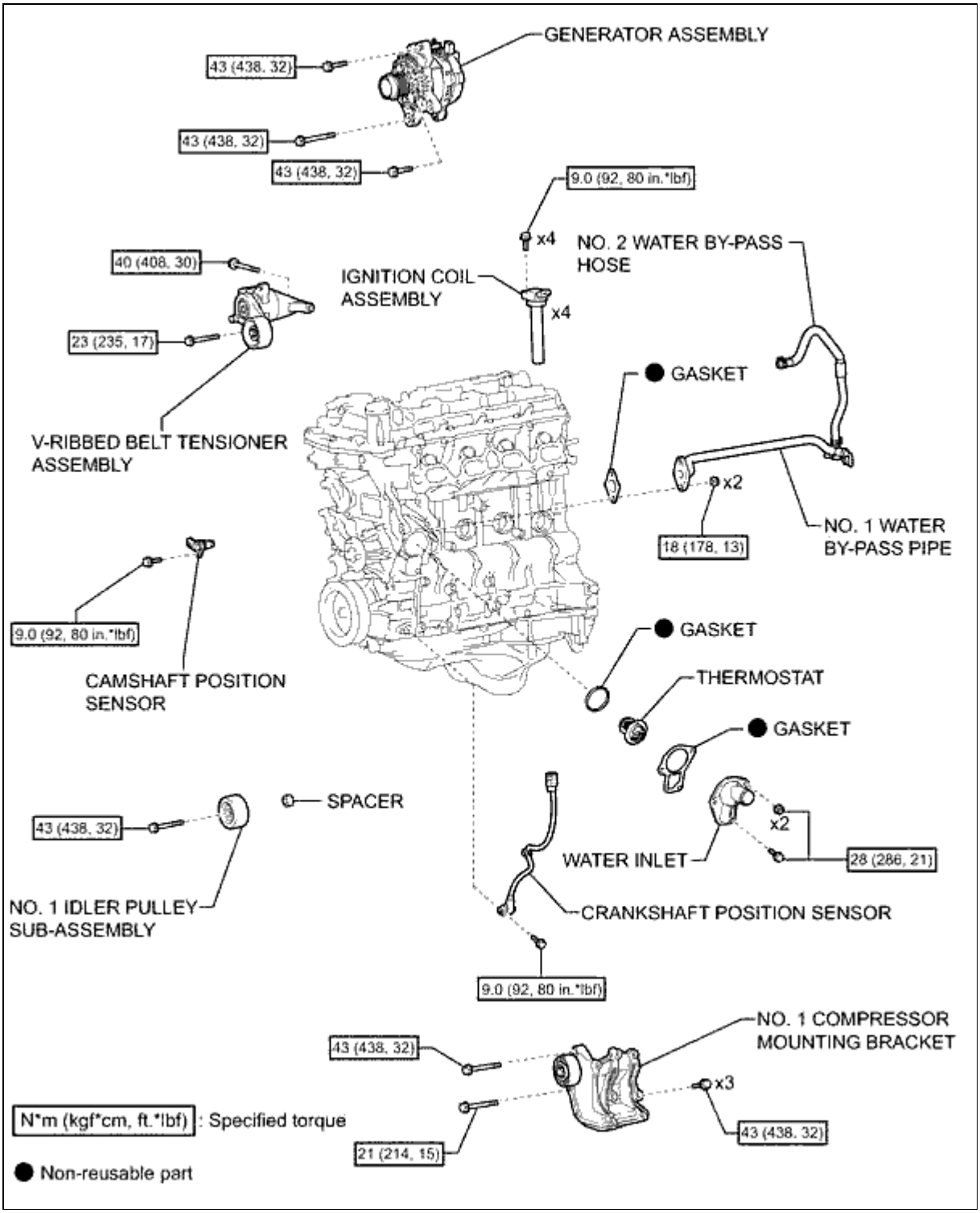
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ILLUSTRATION



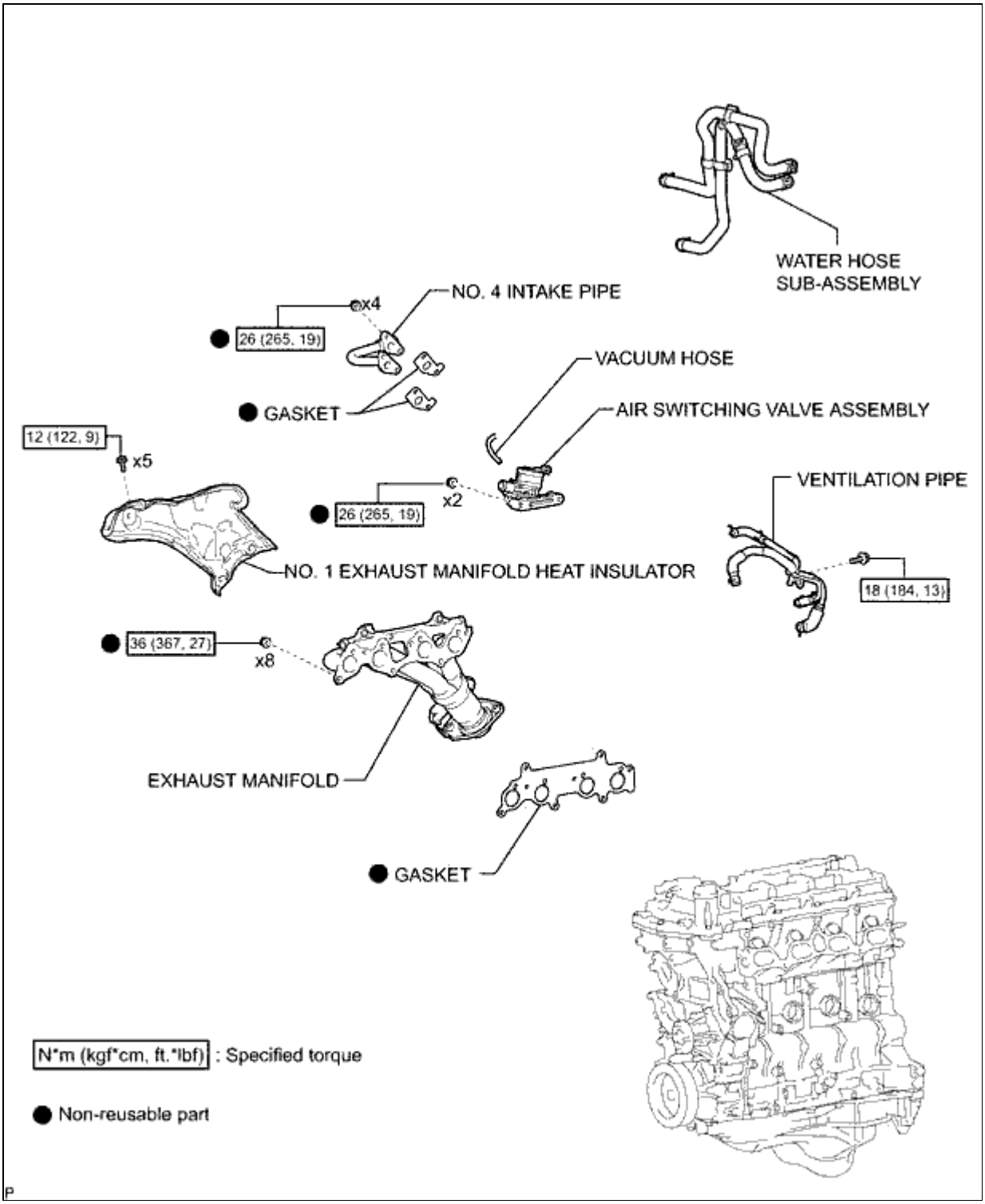
ILLUSTRATION

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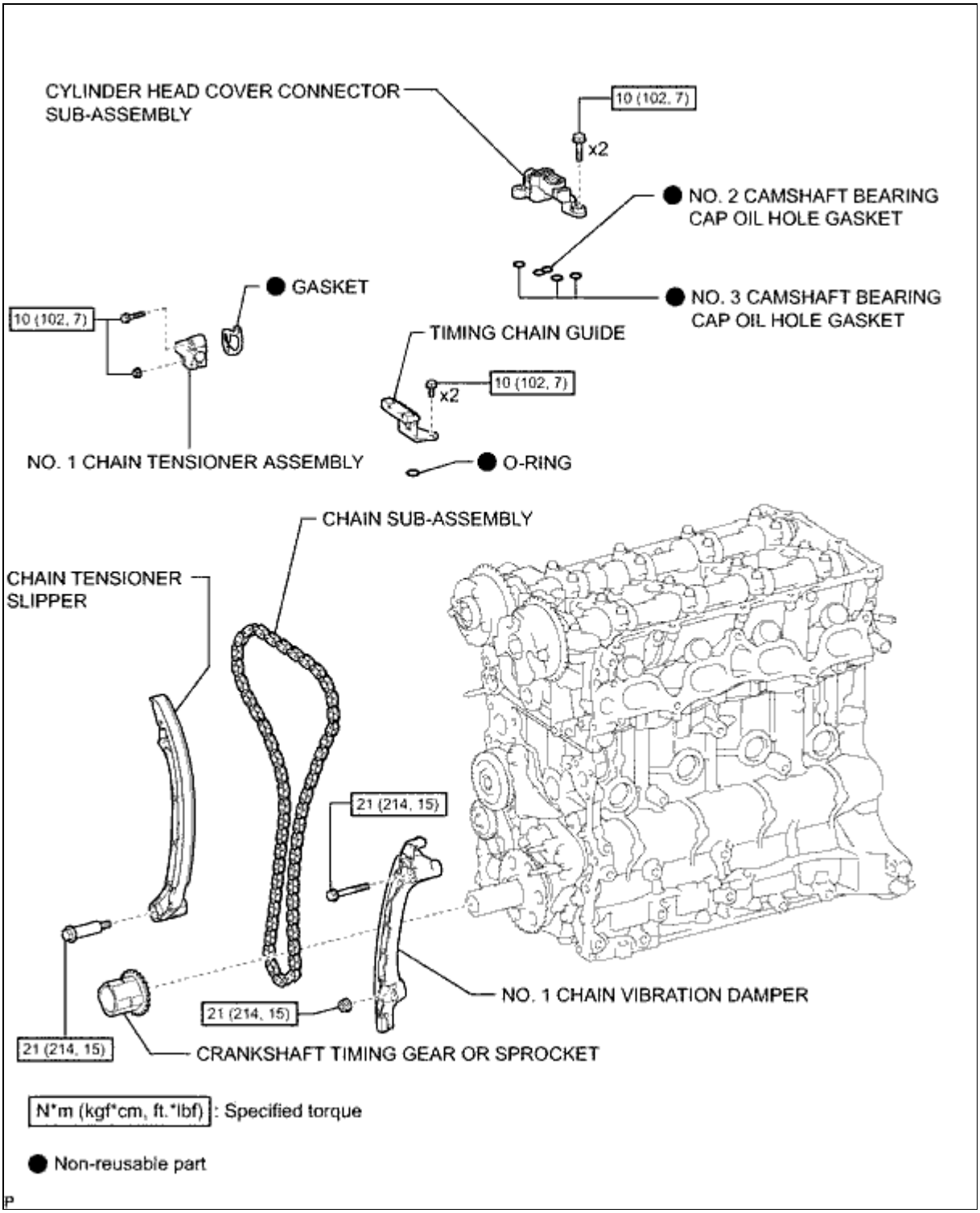
ILLUSTRATION

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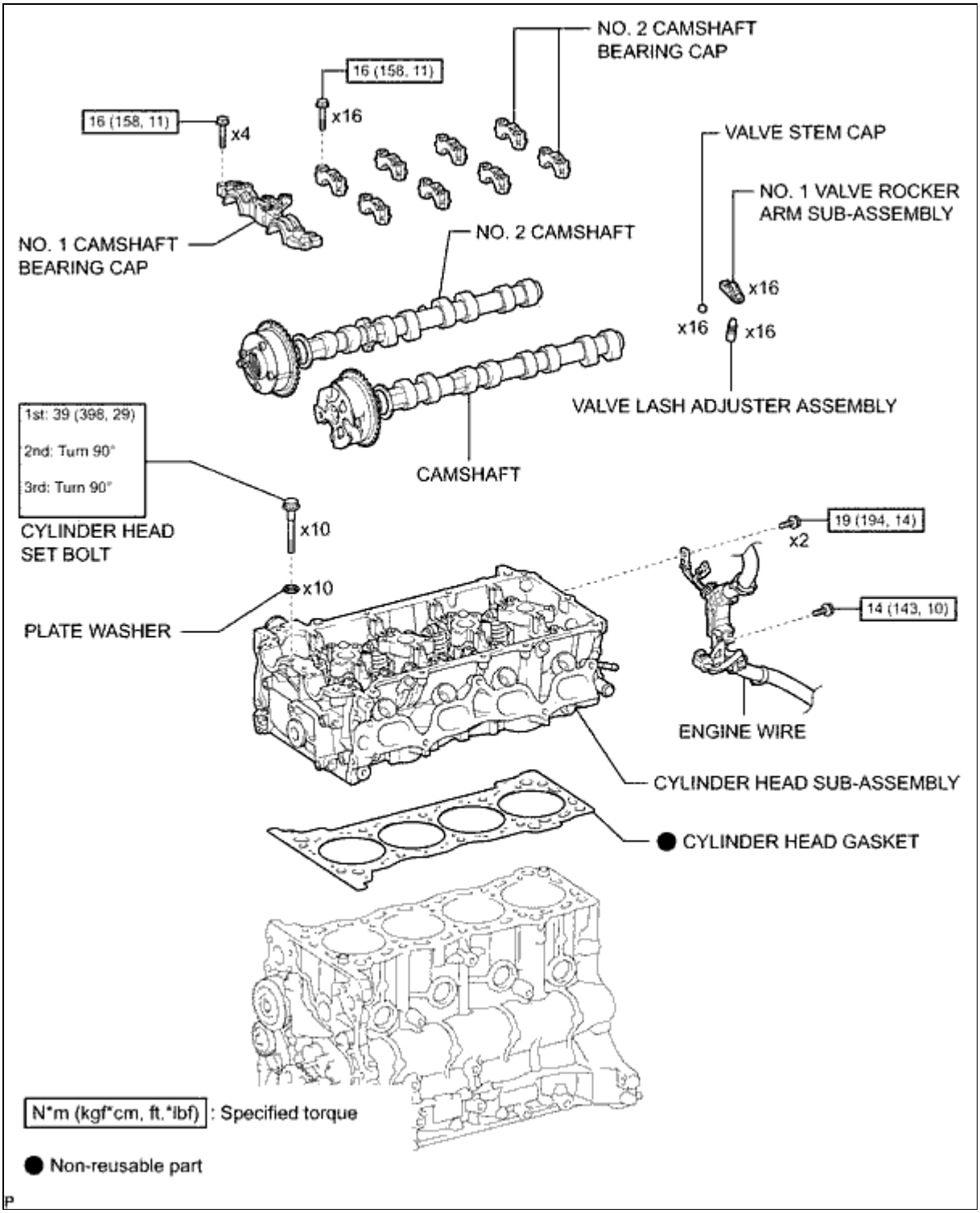
ILLUSTRATION

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ILLUSTRATION

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017OI01GX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CYLINDER HEAD: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

HINT:

Perform "Inspection After Repairs" after replacing the camshaft, No. 2 camshaft or cylinder head sub-assembly INFO .

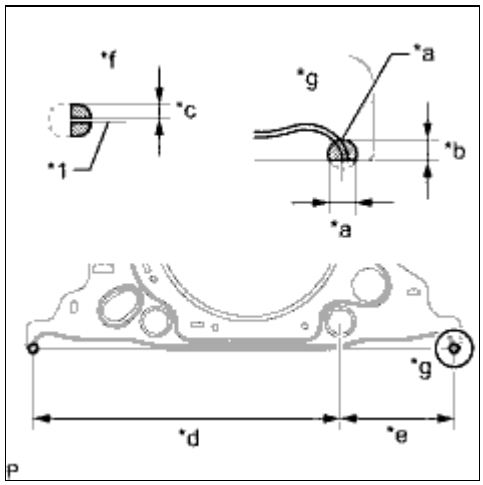
1. INSTALL CYLINDER HEAD GASKET

(a) Clean and degrease the contact surfaces of the cylinder head sub-assembly and cylinder block sub-assembly.

(b) Apply seal packing to a new cylinder head gasket as shown in the illustration.

Text in Illustration

*1	Cylinder Head Gasket
*a	7.0 to 9.0 mm (0.276 to 0.354 in.)
*b	5.0 to 7.0 mm (0.197 to 0.276 in.)
*c	3.0 to 5.0 mm (0.118 to 0.197 in.)
*d	166.25 mm (6.55 in.)
*e	62.25 mm (2.46 in.)
*f	Side View
*g	View A



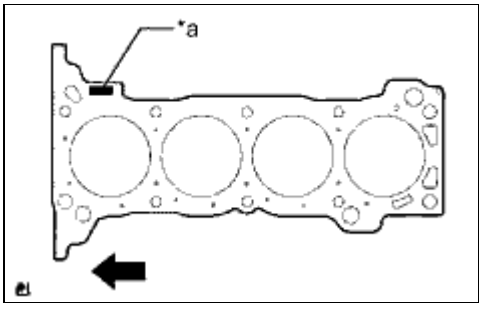
Seal Packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent.

NOTICE:

- Be sure to clean and degrease the contact surfaces.
- Apply seal packing to the bead on the cylinder head gasket.
- Install the cylinder head gasket within 3 minutes and tighten the cylinder head set bolts within 15 minutes after applying seal packing.

(c) Place the cylinder head gasket on the cylinder block surface with the lot No. stamp facing upward.



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Text in Illustration

*a	Lot No.
➡	Engine Front

NOTICE:

- Remove any oil from the contact surface.
- Make sure that the cylinder head gasket is installed in the correct direction.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

HINT:

- Perform "Inspection After Repairs" after replacing the cylinder head sub-assembly INFO .
- The cylinder head bolts are tightened in 3 successive steps.

(a) Place the cylinder head sub-assembly on the cylinder block.

NOTICE:

- Make sure that no oil is on the mounting surface of the cylinder head sub-assembly.
- Place the cylinder head sub-assembly on the cylinder block gently so as not to damage the gasket with the bottom part of the cylinder head sub-assembly.

(b) Install the plate washers to the cylinder head set bolts.

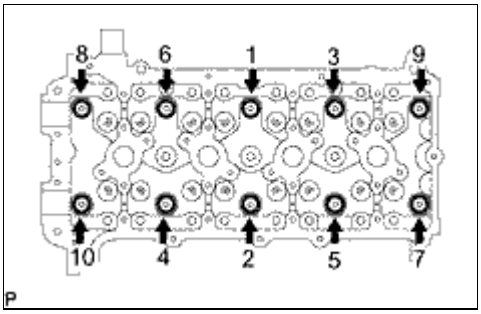
(c) Apply a light coat of engine oil to the threads and under the heads of the cylinder head set bolts.

(d) Step 1:

Using several steps, install and uniformly tighten the 10 cylinder head set bolts with plate washers in the sequence shown in the illustration.

Torque:

39 N·m {398 kgf·cm, 29ft·lbf}



(e) Mark the front of each cylinder head set bolt head with paint.

(f) Step 2:

Tighten the cylinder head set bolts 90° in the sequence shown in step 1.

(g) Step 3:

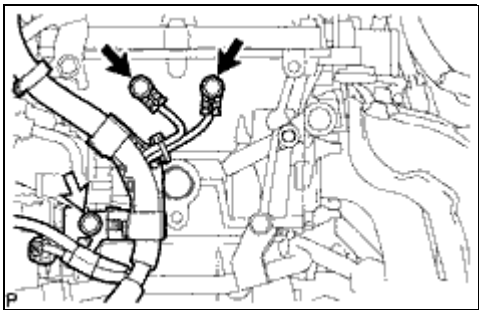
Tighten the cylinder head set bolts another 90° in the sequence shown in step 1.

(h) Check that the paint marks are now at a 180° angle to the front.

3. CONNECT ENGINE WIRE

(a) Connect the engine wire to the cylinder head sub-assembly with the 3 bolts.

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Text in Illustration

➡	Bolt A
⇨	Bolt B

Torque:

for bolt A -

19 N·m {194 kgf·cm, 14ft·lbf}

for bolt B -

14 N·m {143 kgf·cm, 10ft·lbf}

4. INSTALL VALVE STEM CAP

(a) Apply a light coat of engine oil to the valve stem ends.

(b) Install the 16 valve stem caps to the cylinder head sub-assembly.

NOTICE:

Do not drop the valve stem caps into the cylinder head sub-assembly.

5. INSTALL VALVE LASH ADJUSTER ASSEMBLY

(a) Inspect each valve lash adjuster assembly before installing it INFO .

(b) Install the 16 valve lash adjuster assemblies to the cylinder head sub-assembly.

NOTICE:

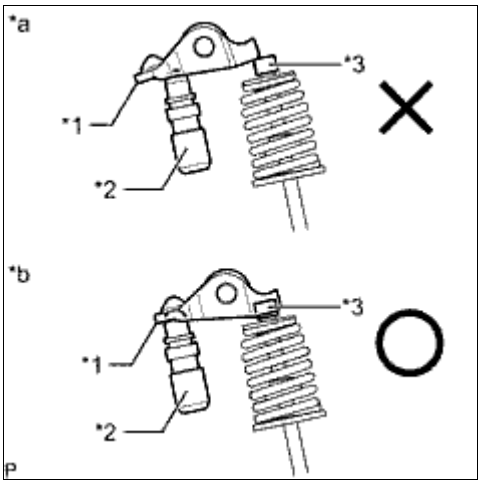
Install each valve lash adjuster assembly to the same place it was removed from.

6. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

(a) Apply clean engine oil to the valve lash adjuster assembly tips and valve stem cap surfaces.

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(b) Install the 16 No. 1 valve rocker arm sub-assemblies as shown in the illustration.



Text in Illustration

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Lash Adjuster Assembly
*3	Valve Stem Cap
*a	Incorrect
*b	Correct

NOTICE:

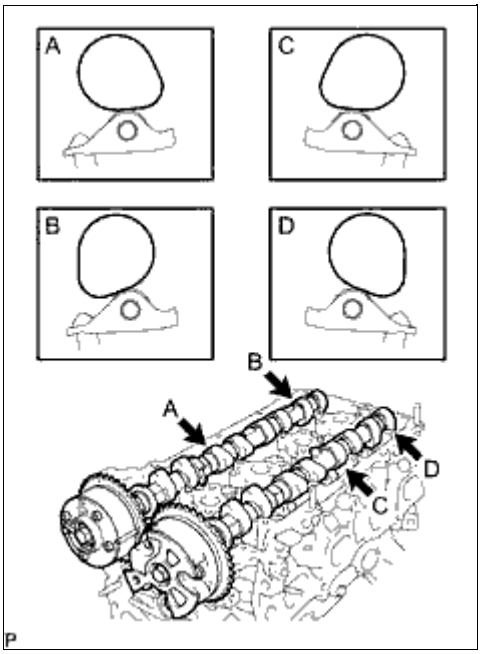
Install the valve stem cap, valve lash adjuster assembly and No. 1 valve rocker arm sub-assembly to the same places they were removed from.

7. INSTALL CAMSHAFTS

HINT:

Perform "Inspection After Repairs" after replacing the camshaft or No. 2 camshaft INFO .

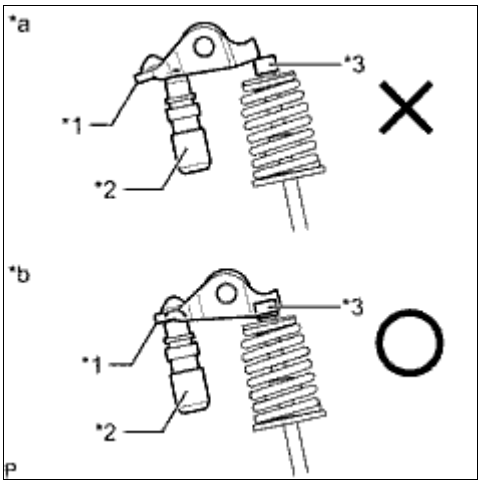
(a) Apply clean engine oil to the camshaft cams and cylinder head journals.



(b) Position the camshaft and No. 2 camshaft as shown in the illustration.

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(c) Make sure that the No. 1 valve rocker arm sub-assemblies are installed as shown in the illustration.

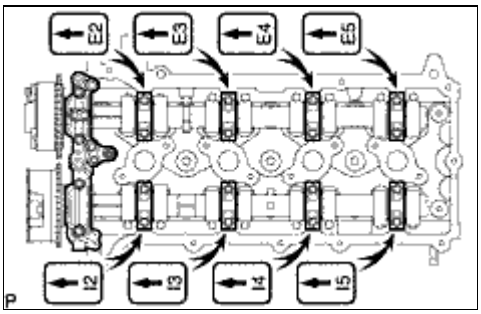


Text in Illustration

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Lash Adjuster Assembly
*3	Valve Stem Cap
*a	Incorrect
*b	Correct

8. INSTALL CAMSHAFT BEARING CAP

(a) Temporarily install the No. 1 camshaft bearing cap.



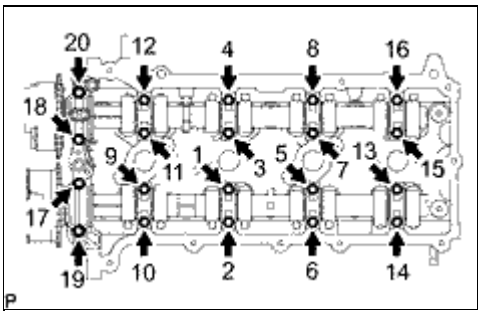
(b) Confirm the location for each No. 2 camshaft bearing cap and install each one to the proper location.

(c) Uniformly temporarily install the 20 bolts while keeping the camshaft level.

(d) Tighten the 20 bolts in the order shown in the illustration.

Torque:

16 N·m {158 kgf·cm, 11ft·lbf}



9. INSTALL NO. 1 CHAIN VIBRATION DAMPER INFO

10. INSTALL CHAIN SUB-ASSEMBLY INFO

11. INSTALL CHAIN TENSIONER SLIPPER INFO

12. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY INFO

13. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION INFO

14. INSTALL TIMING CHAIN GUIDE INFO

15. INSTALL CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY INFO

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16. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY INFO

17. INSTALL OIL PAN SUB-ASSEMBLY INFO

18. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY INFO

19. INSTALL OIL PAN COVER SILENCER INFO

20. INSTALL OIL LEVEL DIPSTICK SUB-ASSEMBLY

21. INSTALL CRANKSHAFT PULLEY INFO

22. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY INFO

23. INSTALL IGNITION COIL ASSEMBLY INFO

24. INSTALL NO. 1 WATER BY-PASS PIPE INFO

25. INSTALL CRANKSHAFT POSITION SENSOR INFO

26. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

27. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

28. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

29. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY INFO

30. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY INFO

31. INSTALL THERMOSTAT INFO

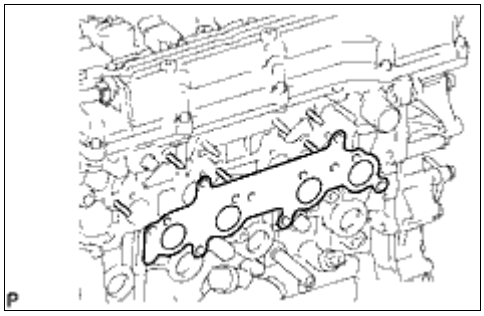
32. INSTALL WATER INLET INFO

33. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET INFO

34. INSTALL GENERATOR ASSEMBLY INFO

35. INSTALL EXHAUST MANIFOLD

(a) Install a new gasket.

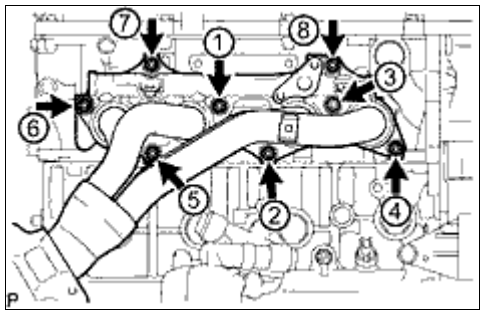


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(b) Install the exhaust manifold with 8 new nuts in the order shown in the illustration.

Torque:

36 N·m {367 kgf·cm, 27ft·lbf}



36. INSTALL AIR SWITCHING VALVE ASSEMBLY INFO

37. INSTALL NO. 4 INTAKE PIPE INFO

38. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

39. INSTALL VENTILATION PIPE INFO

40. INSTALL FUEL DELIVERY PIPE WITH FUEL INJECTOR INFO

41. INSTALL WATER HOSE SUB-ASSEMBLY INFO

42. INSTALL INTAKE MANIFOLD INFO

43. INSTALL PURGE VSV INFO

44. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY INFO

45. INSTALL NO. 2 FUEL HOSE INFO

46. INSTALL FUEL HOSE INFO

47. INSTALL INTAKE AIR CONNECTOR INFO

48. INSTALL REAR END PLATE INFO

49. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

50. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

51. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

52. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

53. INSTALL ENGINE ASSEMBLY

INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017KN01GX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: CYLINDER HEAD: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE ENGINE ASSEMBLY

INFO

2. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

3. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

4. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

5. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

6. REMOVE REAR END PLATE INFO

7. REMOVE INTAKE AIR CONNECTOR INFO

8. REMOVE FUEL HOSE INFO

9. REMOVE NO. 2 FUEL HOSE INFO

10. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY INFO

11. REMOVE PURGE VSV INFO

12. REMOVE INTAKE MANIFOLD INFO

13. REMOVE WATER HOSE SUB-ASSEMBLY INFO

14. REMOVE FUEL DELIVERY PIPE WITH FUEL INJECTOR INFO

15. REMOVE VENTILATION PIPE INFO

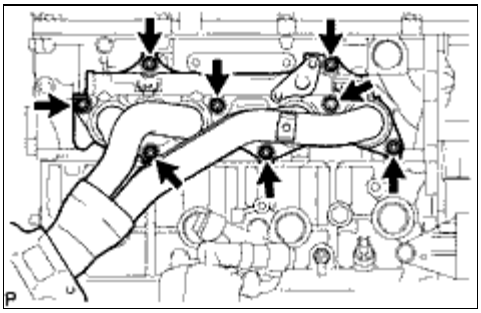
16. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

17. REMOVE NO. 4 INTAKE PIPE INFO

18. REMOVE AIR SWITCHING VALVE ASSEMBLY INFO

19. REMOVE EXHAUST MANIFOLD

(a) Remove the 8 nuts and exhaust manifold.



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(b) Remove the gasket.

20. REMOVE GENERATOR ASSEMBLY INFO

21. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY INFO

22. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET INFO

23. REMOVE WATER INLET INFO

24. REMOVE THERMOSTAT INFO

25. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY INFO

26. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

27. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

28. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

29. REMOVE CRANKSHAFT POSITION SENSOR INFO

30. REMOVE NO. 1 WATER BY-PASS PIPE INFO

31. REMOVE IGNITION COIL ASSEMBLY INFO

32. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

33. REMOVE CRANKSHAFT PULLEY INFO

34. REMOVE OIL LEVEL DIPSTICK SUB-ASSEMBLY

35. REMOVE OIL PAN COVER SILENCER INFO

36. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY INFO

37. REMOVE OIL PAN SUB-ASSEMBLY INFO

38. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY INFO

39. REMOVE CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY INFO

40. REMOVE TIMING CHAIN GUIDE INFO

41. SET NO. 1 CYLINDER TO TDC/COMPRESSION INFO

42. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY INFO

43. REMOVE CHAIN TENSIONER SLIPPER INFO

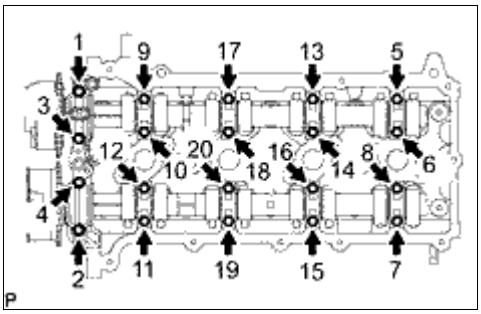
44. REMOVE NO. 1 CHAIN VIBRATION DAMPER INFO

45. REMOVE CHAIN SUB-ASSEMBLY

46. REMOVE CAMSHAFT BEARING CAP

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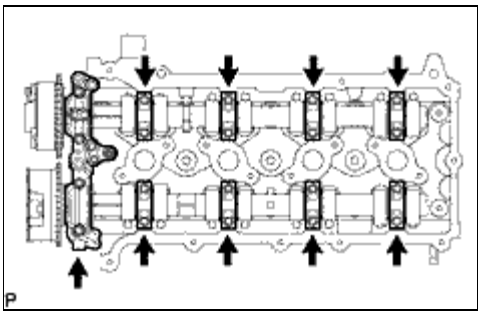
(a) Uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.



NOTICE:

Uniformly loosen the bolts while keeping the camshaft level.

(b) Remove the 9 bearing caps.

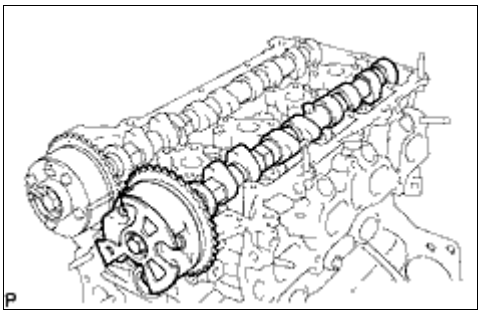


HINT:

Arrange the removed parts in the correct order.

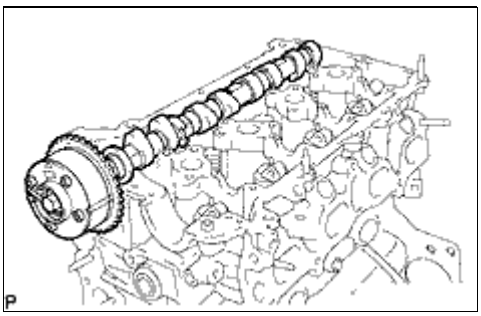
47. REMOVE CAMSHAFT

(a) Remove the camshaft.



48. REMOVE NO. 2 CAMSHAFT

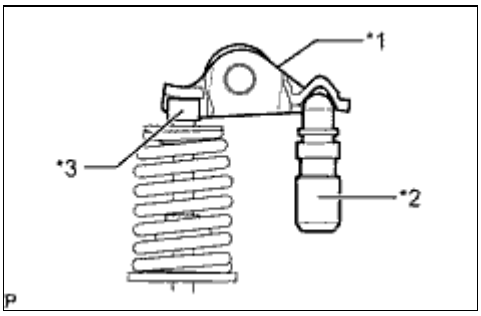
(a) Remove the No. 2 camshaft.



49. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

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(a) Remove the 16 No. 1 valve rocker arm sub-assemblies from the cylinder head sub-assembly.



Text in Illustration

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Lash Adjuster Assembly
*3	Valve Stem Cap

HINT:

Arrange the removed parts in the correct order.

50. REMOVE VALVE LASH ADJUSTER ASSEMBLY

(a) Remove the 16 valve lash adjuster assemblies from the cylinder head sub-assembly.

HINT:

Arrange the removed parts in the correct order.

51. REMOVE VALVE STEM CAP

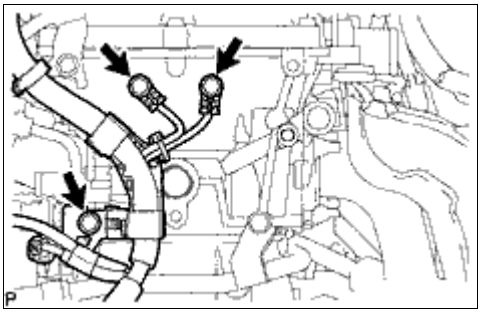
(a) Remove the 16 valve stem caps from the cylinder head sub-assembly.

HINT:

Arrange the removed parts in the correct order.

52. DISCONNECT ENGINE WIRE

(a) Remove the 3 bolts and disconnect the engine wire from the cylinder head sub-assembly.

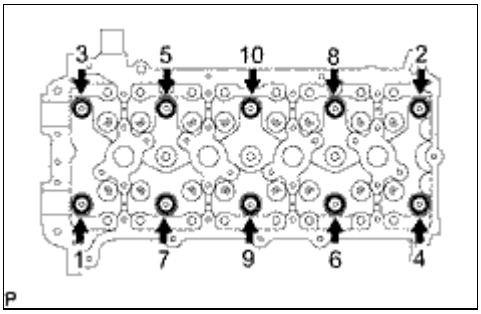


53. REMOVE CYLINDER HEAD SUB-ASSEMBLY

(a) Uniformly loosen the 10 cylinder head set bolts in the sequence shown in the illustration. Remove the 10 cylinder head set bolts and plate washers.

NOTICE:

- Be careful not to drop plate washers into the cylinder head sub-assembly.
- Head warpage or cracking could result from removing cylinder head set bolts in the incorrect order.



(b) Remove the cylinder head sub-assembly.

54. REMOVE CYLINDER HEAD GASKET

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(a) Remove the cylinder head gasket from the cylinder block.

55. INSPECT CYLINDER HEAD SET BOLT INFO

56. INSPECT CYLINDER HEAD SUB-ASSEMBLY INFO

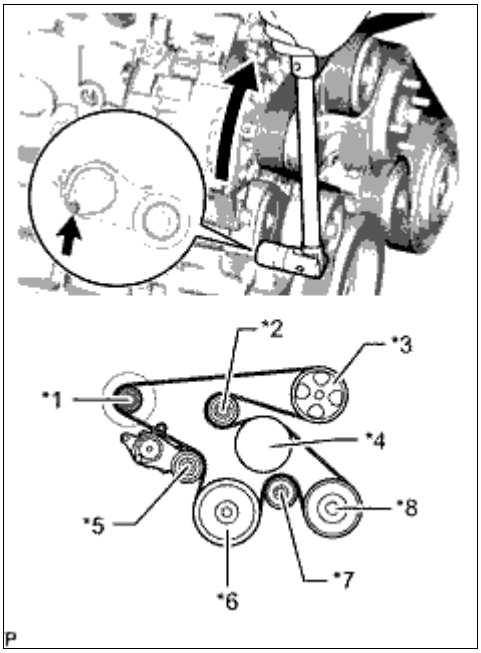
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017GN00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: DRIVE BELT: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL FAN AND GENERATOR V BELT

(a) Install the fan and generator V belt to all the pulleys except the tensioner pulley.



Text in Illustration

*1	Generator Assembly
*2	Idler Pulley Sub-assembly
*3	Vane Pump Assembly
*4	Fan Pulley
*5	Tensioner Pulley
*6	Crankshaft Pulley
*7	No. 1 Idler Pulley Sub-assembly
*8	Cooler Compressor Assembly

(b) Use the hexagon-shaped part indicated by the arrow in the illustration to move the tensioner pulley downward, and then install the fan and generator V belt to the tensioner pulley.

NOTICE:

- The backside of the fan and generator V belt should face the tensioner pulley.
- Check that the fan and generator V belt is properly installed to each pulley.

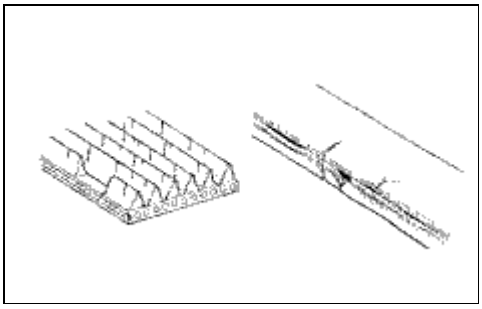
2. INSPECT FAN AND GENERATOR V BELT INFO

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017GP00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: DRIVE BELT: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

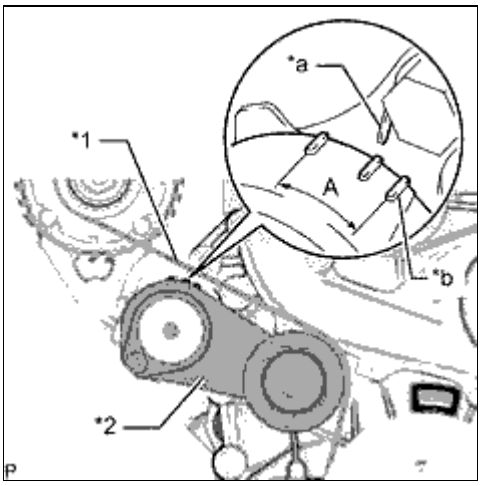
1. INSPECT FAN AND GENERATOR V BELT



(a) Visually check the belt for excessive wear, frayed cords, etc.

If any defects are found, replace the V-ribbed belt.

(b) Check that the tensioner indicator mark is within range A shown in the illustration.



Text in Illustration

*1	Fan and Generator V Belt
*2	V-ribbed Belt Tensioner Assembly
*a	Bracket Side Indicator
*b	Arm Side Indicator

If the mark is not within range A, replace the fan and generator V belt.

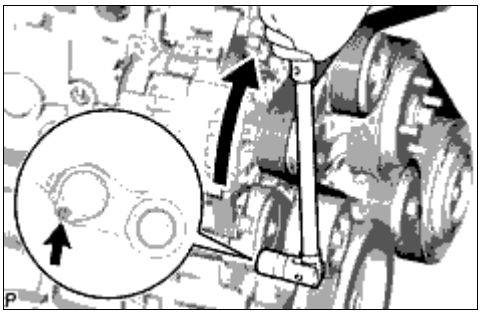
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017GO00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: DRIVE BELT: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE FAN AND GENERATOR V BELT

(a) Use the hexagon-shaped part indicated by the arrow in the illustration to move the tensioner pulley downward and decrease the tension in the fan and generator V belt. Then remove the fan and generator V belt.



NOTICE:

When removing the fan and generator V belt, do not use the bolt of the idle pulley.

HINT:

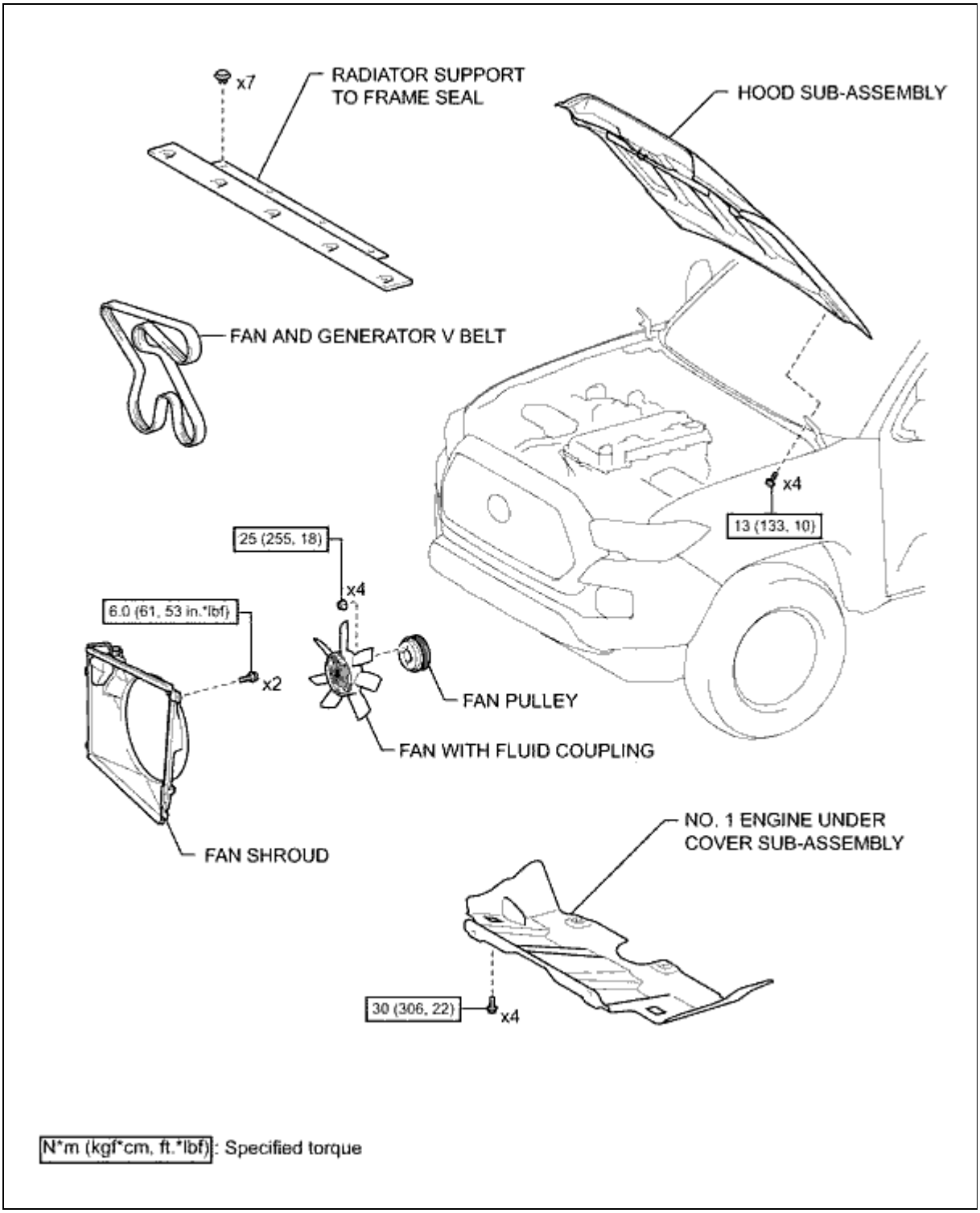
After removing the fan and generator V belt, move the tensioner upward as far as possible.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000017O900BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

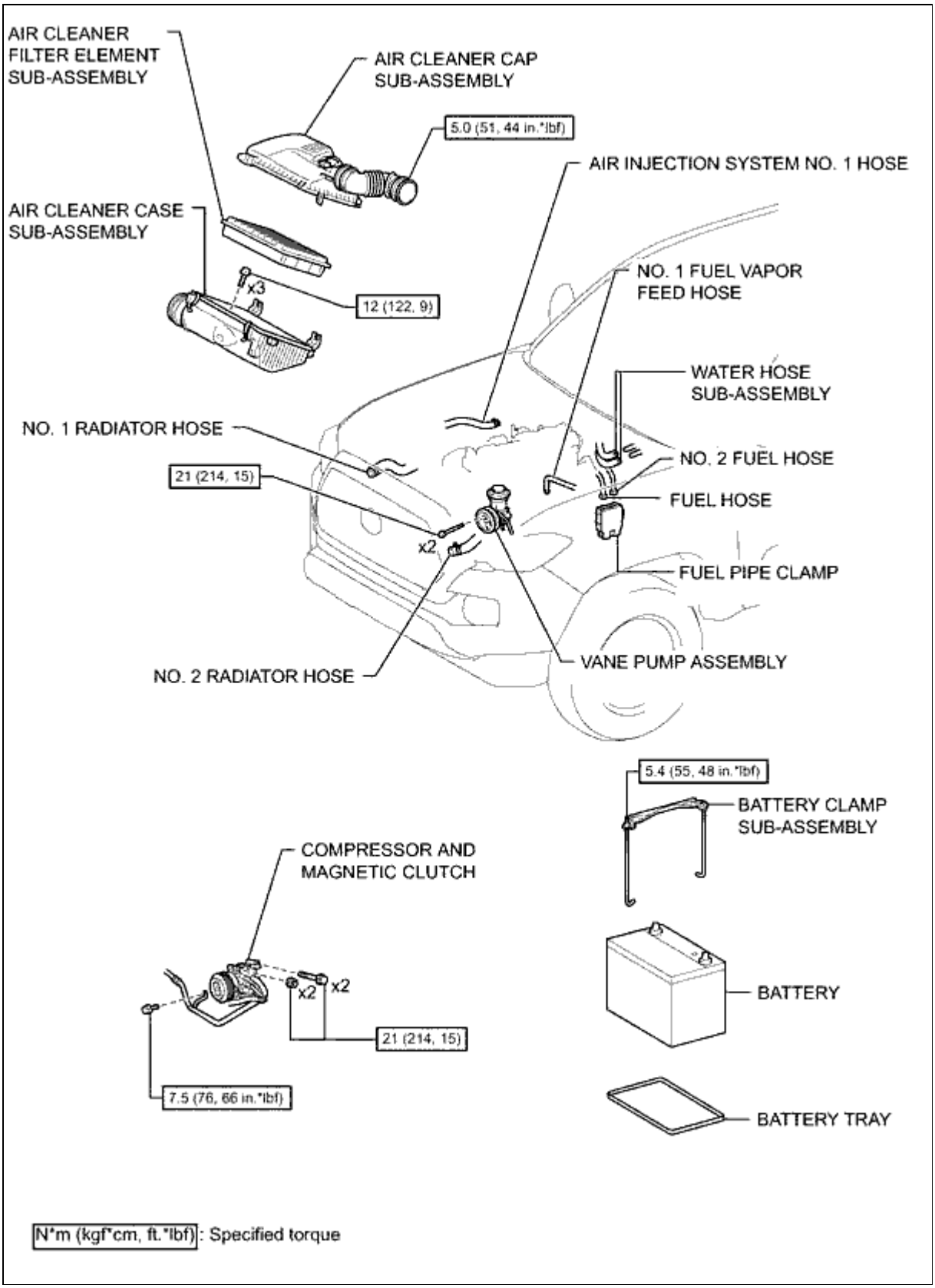
COMPONENTS

ILLUSTRATION



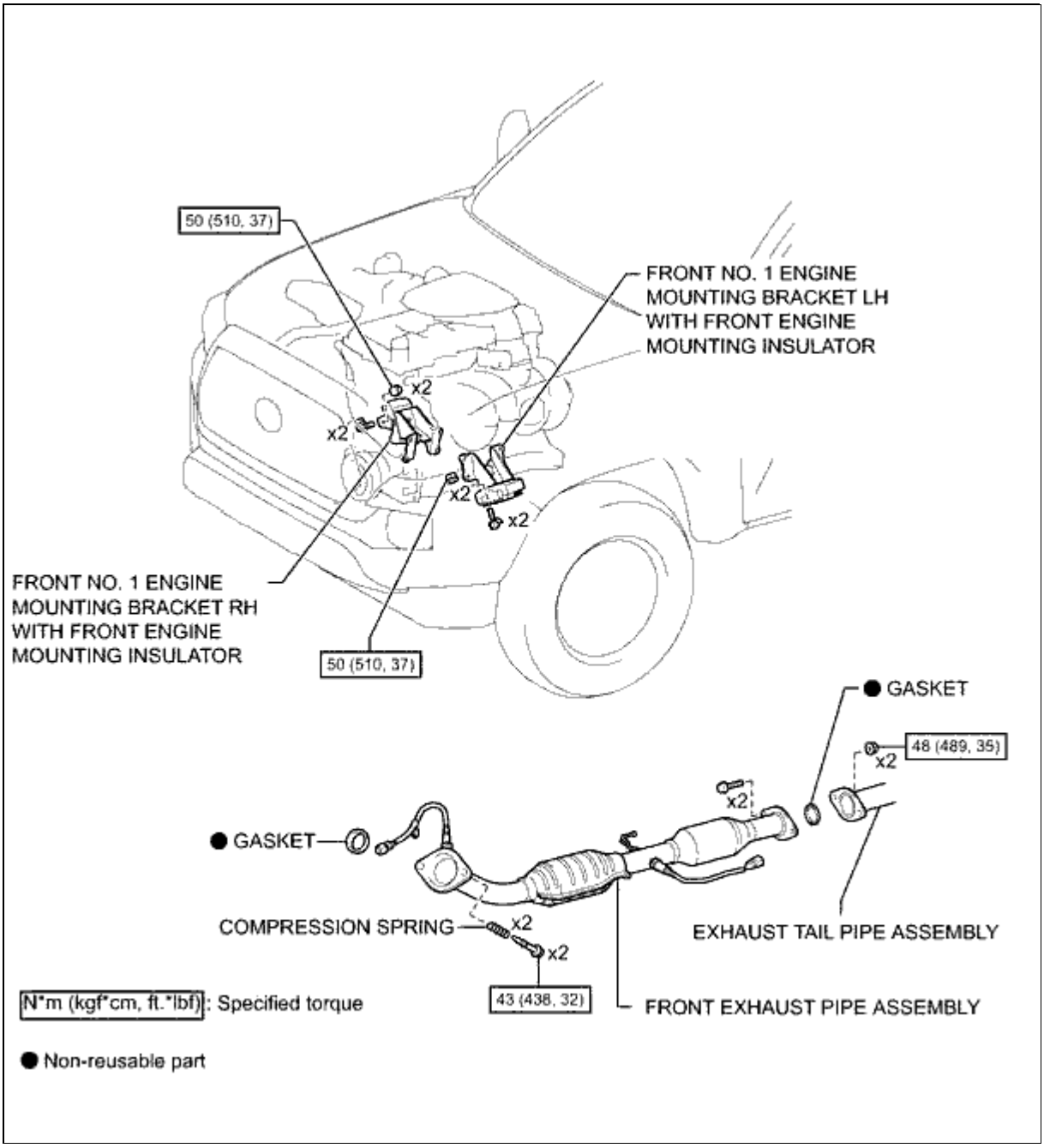
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ILLUSTRATION



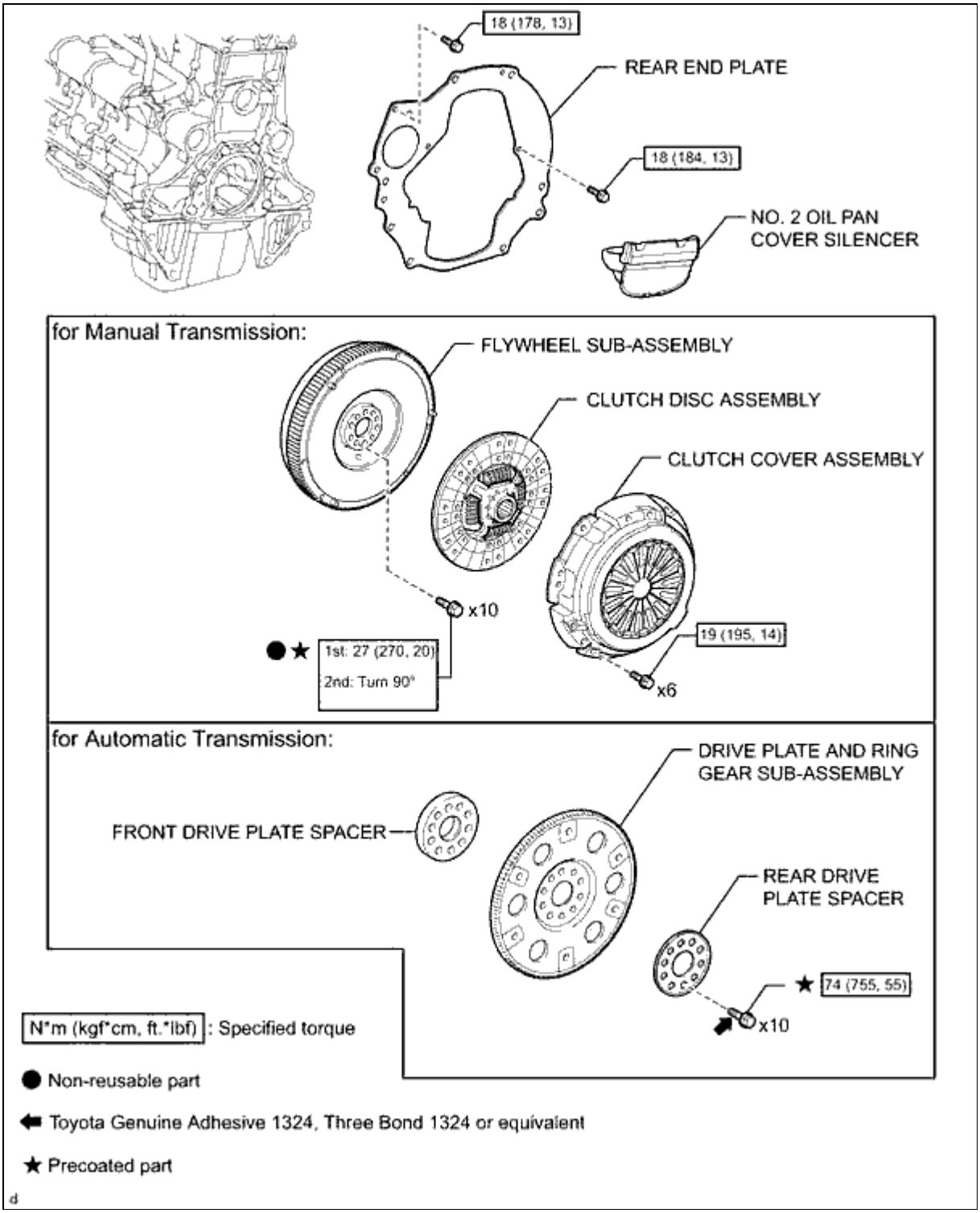
ILLUSTRATION

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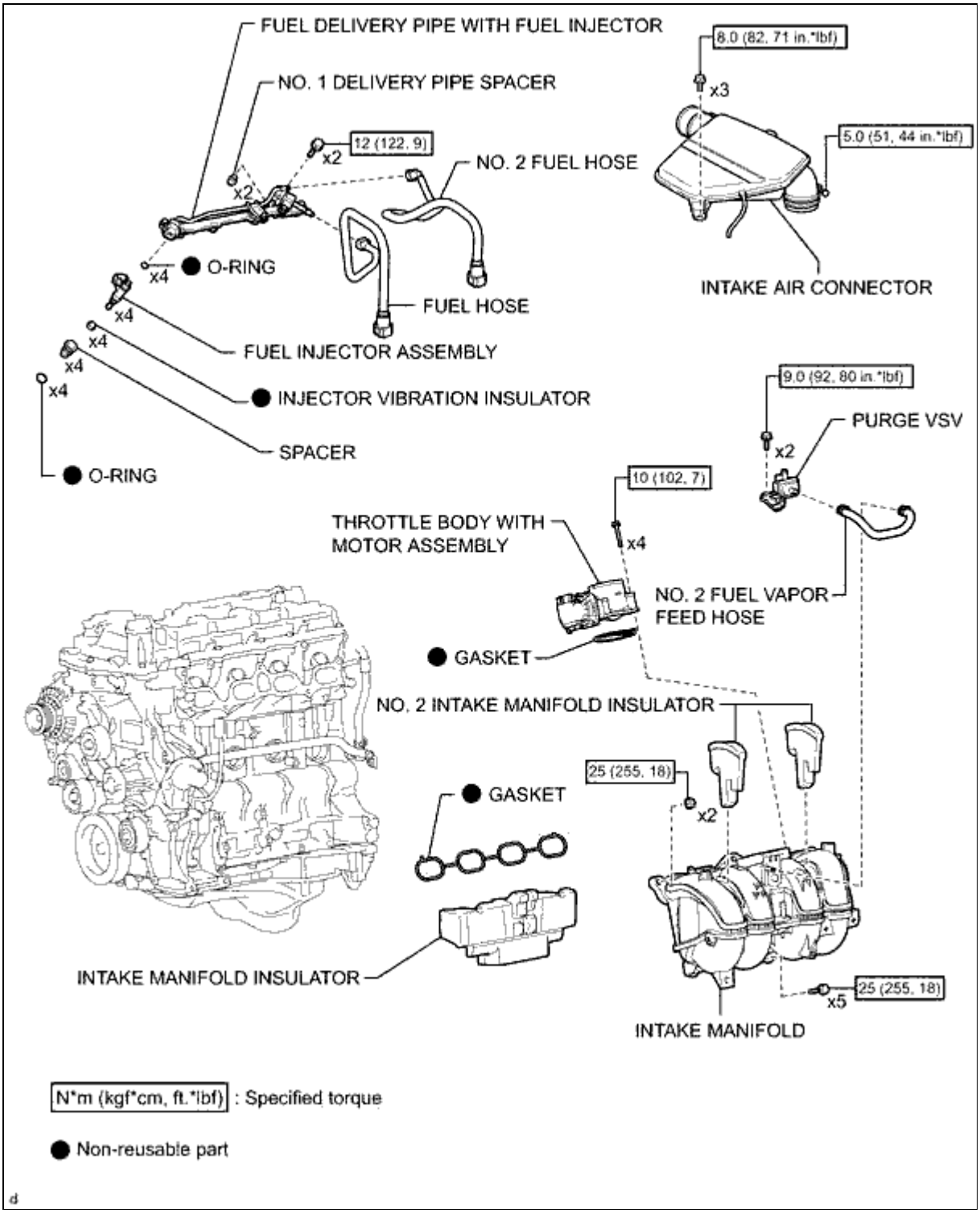
ILLUSTRATION

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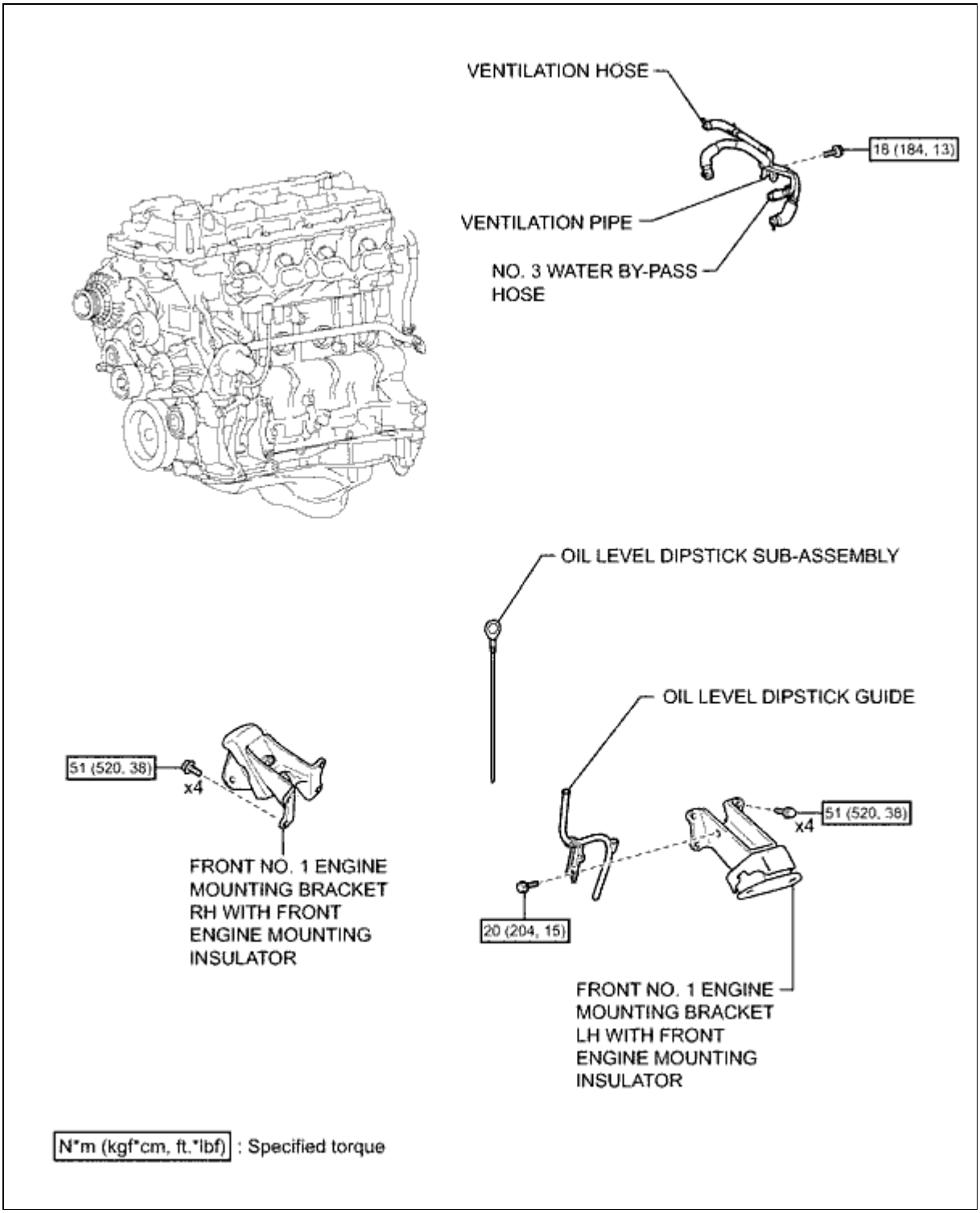
ILLUSTRATION

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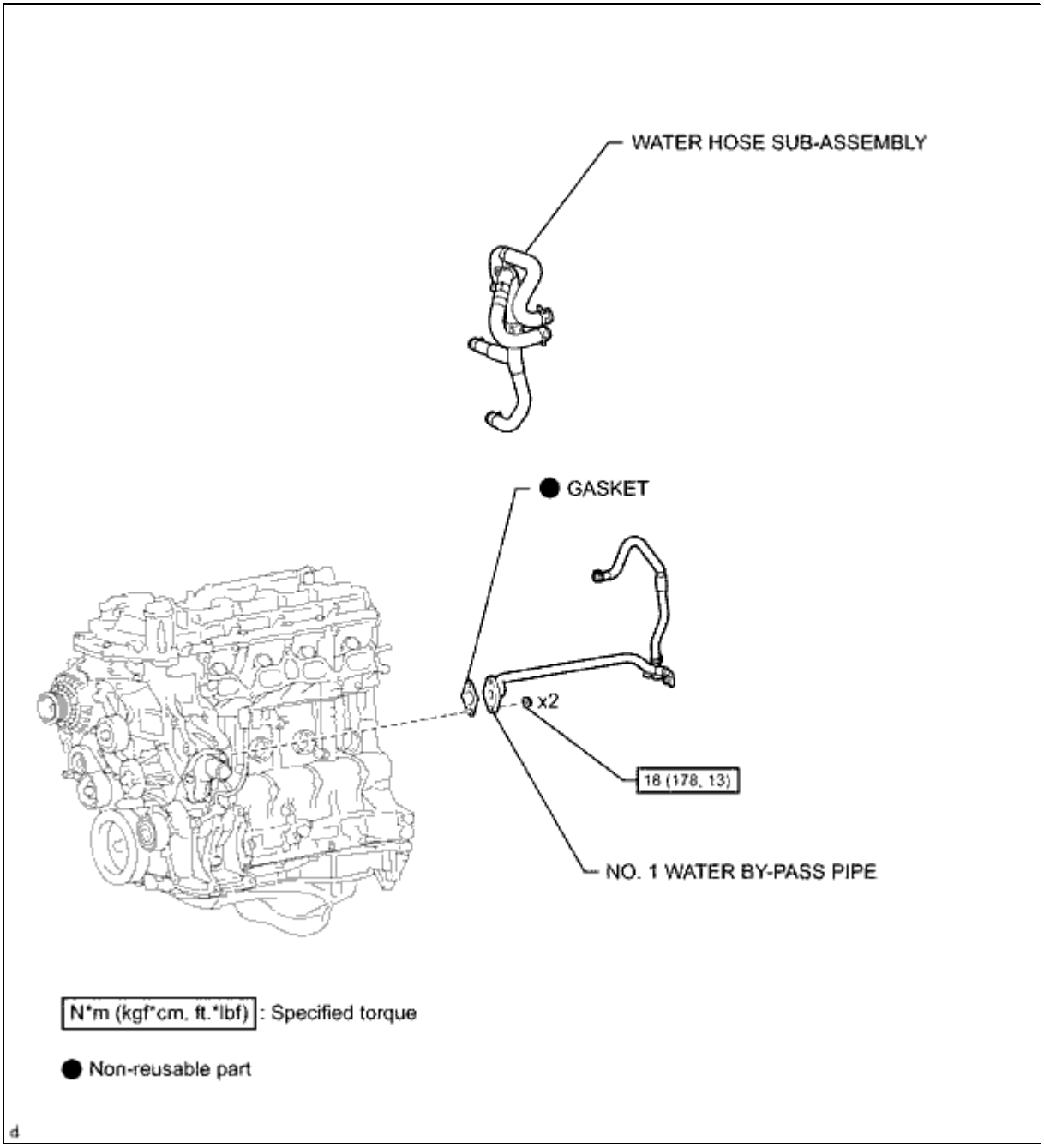
ILLUSTRATION

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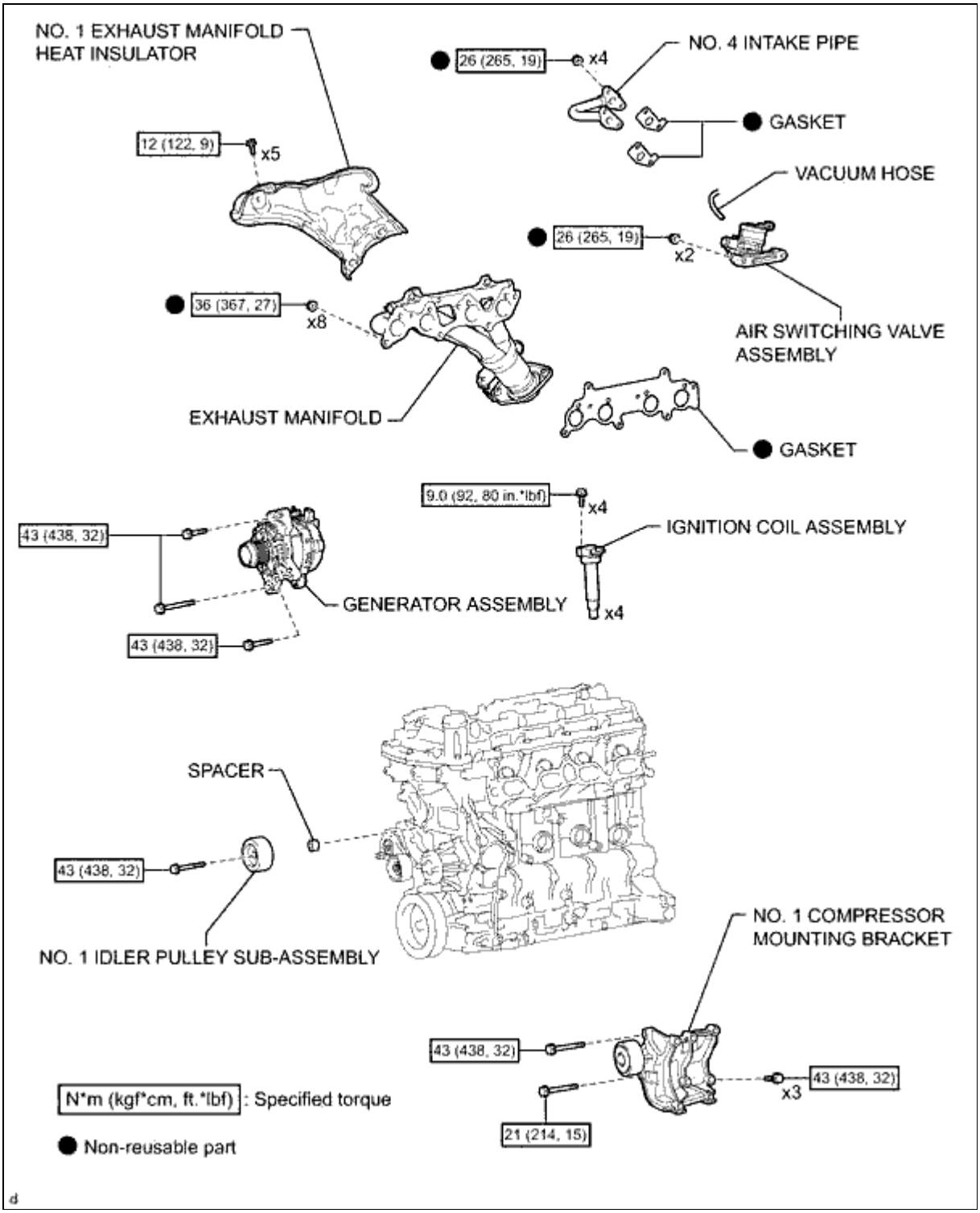
ILLUSTRATION

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ILLUSTRATION

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017O800CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

HINT:

Perform "Inspection After Repairs" after replacing the engine assembly INFO .

1. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET RH

(a) Install the front No. 1 engine mounting bracket RH with front engine mounting insulator with the 4 bolts.

Torque:

51 N·m {520 kgf·cm, 38ft·lbf}

2. INSTALL EXHAUST MANIFOLD INFO

3. INSTALL AIR SWITCHING VALVE ASSEMBLY INFO

4. INSTALL NO. 4 INTAKE PIPE INFO

5. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

6. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY

(a) Install the spacer and No. 1 idler pulley sub-assembly with the bolt.

Torque:

43 N·m {438 kgf·cm, 32ft·lbf}

7. INSTALL GENERATOR ASSEMBLY INFO

8. INSTALL IGNITION COIL ASSEMBLY

HINT:

Perform "Inspection After Repairs" after replacing the ignition coil assembly INFO .

(a) Install the 4 ignition coil assemblies to the cylinder head cover sub-assembly with the 4 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

9. INSTALL VENTILATION PIPE

(a) Install the ventilation pipe with the bolt.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

(b) Connect the No. 3 water by-pass hose and slide the hose clip to secure it.

(c) Connect the ventilation hose and slide the hose clip to secure it.

10. INSTALL NO. 1 WATER BY-PASS PIPE

(a) Install a new gasket and No. 1 water by-pass pipe with the 2 nuts.

Torque:

18 N·m {178 kgf·cm, 13ft·lbf}

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11. INSTALL FUEL INJECTOR ASSEMBLY INFO

12. INSTALL FUEL DELIVERY PIPE WITH FUEL INJECTOR INFO

13. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET LH

(a) Install the front No. 1 engine mounting bracket LH with the front engine mounting insulator with the 4 bolts.

Torque:

51 N·m {520 kgf·cm, 38ft·lbf}

14. INSTALL OIL LEVEL DIPSTICK GUIDE

(a) Install the oil level dipstick guide with the bolt.

Torque:

20 N·m {204 kgf·cm, 15ft·lbf}

15. INSTALL OIL LEVEL DIPSTICK SUB-ASSEMBLY

16. INSTALL ENGINE WIRE

17. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET INFO

18. INSTALL WATER HOSE SUB-ASSEMBLY

(a) Install the water hose sub-assembly and slide the 2 hose clips to secure it.

19. INSTALL INTAKE MANIFOLD INFO

20. INSTALL PURGE VSV

(a) Install the purge VSV with the 2 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(b) Connect the No. 2 fuel vapor feed hose and slide the hose clip to secure it.

21. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY INFO

22. INSTALL NO. 2 FUEL HOSE INFO

23. INSTALL FUEL HOSE INFO

24. INSTALL INTAKE AIR CONNECTOR INFO

25. INSTALL REAR END PLATE

(a) Install the rear end plate with the 2 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

(b) Install the No. 2 oil pan cover silencer.

26. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

27. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

28. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

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29. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

30. INSTALL ENGINE ASSEMBLY

(a) Attach the engine sling device and chain block to the engine hangers.

(b) Keep the engine level, and align the front No. 1 engine mounting bracket RH with front engine mounting insulator and No. 1 engine mounting bracket LH with front engine mounting insulator with the body mountings.

(c) Attach the front No. 1 engine mounting bracket RH with front engine mounting insulator and No. 1 engine mounting bracket LH with front engine mounting insulator, and install the 4 bolts and 4 nuts.

Torque:

50 N·m {510 kgf·cm, 37ft·lbf}

(d) Remove the 2 bolts and 2 engine hangers.

31. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for Automatic Transmission)

TRANSMISSION	SEE PAGE
AC60E	INFO
AC60F	INFO

32. INSTALL MANUAL TRANSMISSION ASSEMBLY (for Manual Transmission)

INFO

33. INSTALL FRONT EXHAUST PIPE ASSEMBLY INFO

34. INSTALL EXHAUST TAIL PIPE ASSEMBLY INFO

35. INSTALL ENGINE WIRE

(a) Connect all wire harnesses and connectors in the engine room.

(b) Connect the connector to the ECM.

36. CONNECT AIR INJECTION SYSTEM NO. 1 HOSE

(a) Connect the air injection system No. 1 hose.

37. CONNECT NO. 1 FUEL VAPOR FEED HOSE

(a) Connect the No. 1 fuel vapor feed hose and slide the hose clip to secure it.

38. CONNECT NO. 2 FUEL HOSE

(a) Connect the No. 2 fuel hose INFO .

39. CONNECT FUEL HOSE

(a) Connect the fuel hose INFO .

(b) Install the fuel pipe clamp.

40. CONNECT WATER HOSE SUB-ASSEMBLY

(a) Connect the water hose sub-assembly and slide the 2 hose clips to secure it.

41. INSTALL NO. 1RADIATOR HOSE

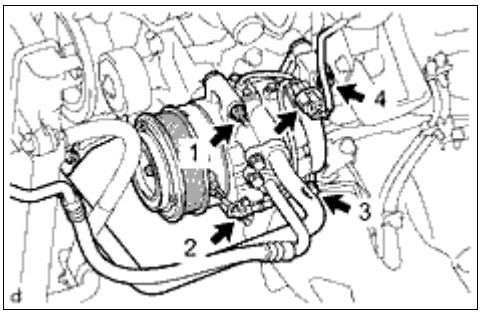
42. INSTALL COMPRESSOR AND MAGNETIC CLUTCH

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(a) Install the compressor and magnetic clutch with the 4 bolts in the order shown in the illustration.

Torque:

21 N·m {214 kgf·cm, 15ft·lbf}



(b) Connect the compressor and magnetic clutch connector.

(c) Install the bolt.

Torque:

7.5 N·m {76 kgf·cm, 66in·lbf}

43. INSTALL NO. 2 RADIATOR HOSE

44. INSTALL VANE PUMP ASSEMBLY

(a) Install the vane pump with the 2 bolts.

Torque:

21 N·m {214 kgf·cm, 15ft·lbf}

(b) Connect the vane pump connector.

45. INSTALL AIR CLEANER CASE SUB-ASSEMBLY

(a) Install the air cleaner case sub-assembly with the 3 bolts.

Torque:

12 N·m {122 kgf·cm, 9ft·lbf}

46. INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

47. INSTALL AIR CLEANER CAP SUB-ASSEMBLY INFO

48. INSTALL FAN SHROUD INFO

49. INSTALL RADIATOR SUPPORT TO FRAME SEAL INFO

50. INSTALL BATTERY TRAY

51. INSTALL BATTERY

52. ADD ENGINE COOLANT INFO

53. ADD ENGINE OIL INFO

54. INSPECT FOR ENGINE OIL LEVEL INFO

55. INSPECT FOR FUEL LEAK INFO

56. INSPECT FOR ENGINE COOLANT LEAK INFO

57. INSPECT FOR OIL LEAK INFO

58. INSPECT FOR EXHAUST GAS LEAK

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HINT:

Perform "Inspection After Repairs" after repairing gas leaks in the exhaust system INFO .

59. INSPECT IGNITION TIMING INFO

60. INSPECT ENGINE IDLE SPEED INFO

61. INSPECT CO/HC INFO

62. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

63. INSTALL HOOD SUB-ASSEMBLY

(a) Install the hood sub-assembly with the 4 bolts.

Torque:

13 N·m {133 kgf·cm, 10ft·lbf}

(b) Connect the washer nozzle hose.

64. ADJUST HOOD SUB-ASSEMBLY

INFO

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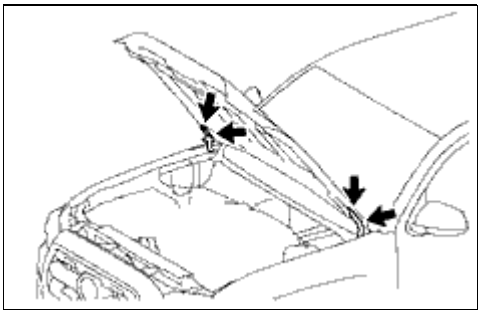
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017OA00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE HOOD SUB-ASSEMBLY

(a) Disconnect the washer nozzle hose.

(b) Remove the 4 bolts and hood sub-assembly.



2. DISCHARGE FUEL SYSTEM PRESSURE

INFO

3. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

4. DRAIN ENGINE OIL INFO

5. DRAIN ENGINE COOLANT INFO

6. REMOVE BATTERY

7. REMOVE BATTERY TRAY

8. REMOVE RADIATOR SUPPORT TO FRAME SEAL INFO

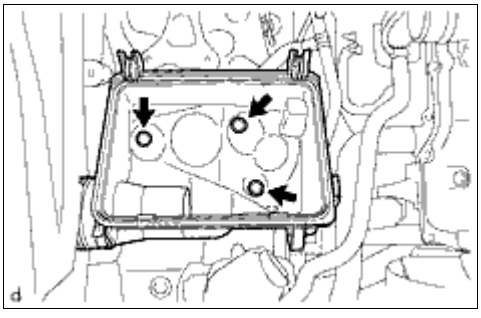
9. REMOVE FAN SHROUD INFO

10. REMOVE AIR CLEANER CAP SUB-ASSEMBLY INFO

11. REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

12. REMOVE AIR CLEANER CASE SUB-ASSEMBLY

(a) Remove the 3 bolts and air cleaner case sub-assembly.

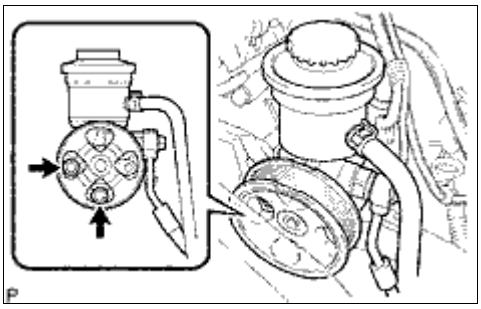


13. SEPARATE VANE PUMP ASSEMBLY

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(a) Disconnect the vane pump connector.

(b) Remove the 2 bolts and separate the vane pump.



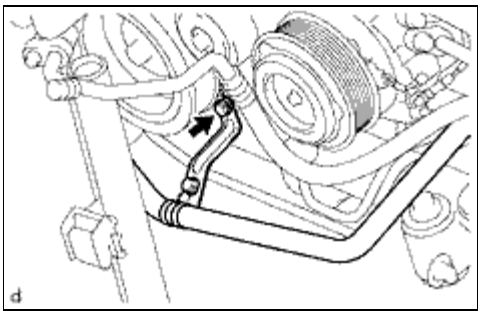
HINT:

Do not disconnect the hose. Hang the vane pump with a rope.

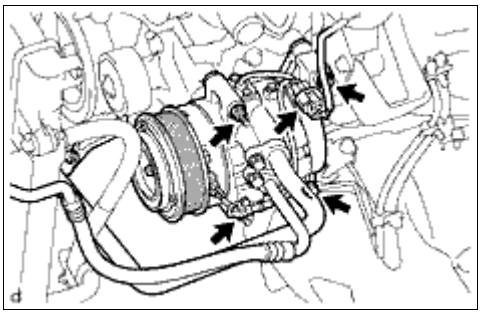
14. REMOVE NO. 2 RADIATOR HOSE

15. SEPARATE COMPRESSOR AND MAGNETIC CLUTCH

(a) Remove the bolt.



(b) Disconnect the compressor and magnetic clutch connector.



(c) Remove the 4 bolts and separate the compressor and magnetic clutch.

HINT:

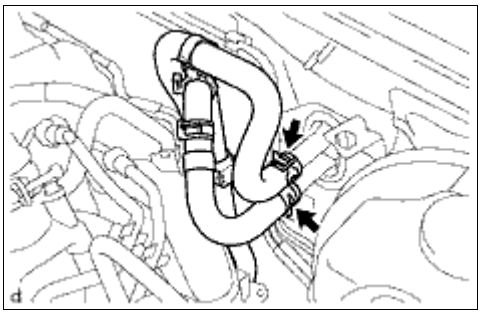
Do not disconnect the hose. Hang the compressor and magnetic clutch with a rope.

16. REMOVE NO. 1 RADIATOR HOSE

17. DISCONNECT WATER HOSE SUB-ASSEMBLY

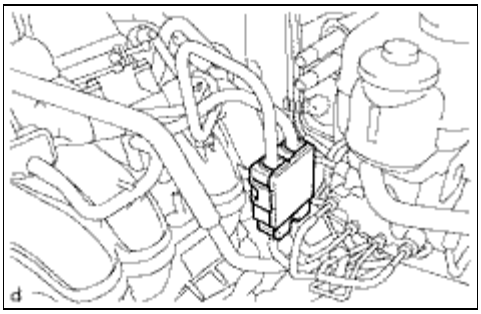
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(a) Slide the 2 hose clips and disconnect the water hose sub-assembly.

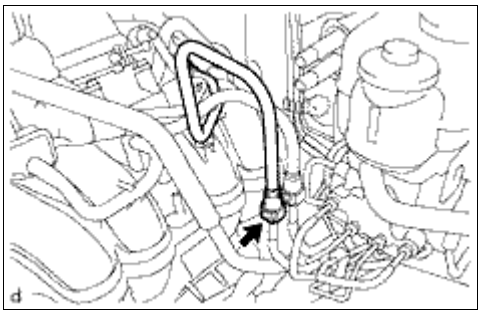


18. DISCONNECT FUEL HOSE

(a) Remove the fuel pipe clamp INFO .

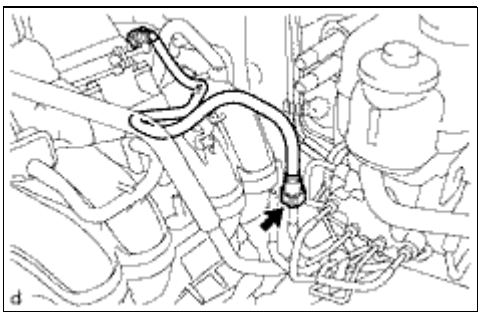


(b) Disconnect the fuel hose INFO .



19. DISCONNECT NO. 2 FUEL HOSE

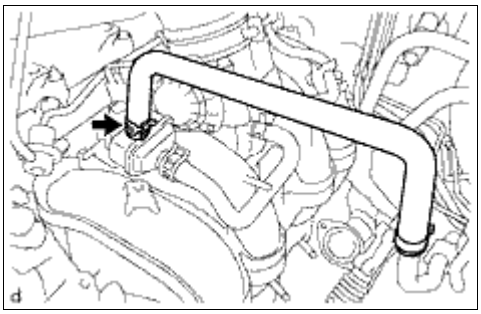
(a) Disconnect the No. 2 fuel pipe hose INFO .



20. SEPARATE NO. 1 FUEL VAPOR FEED HOSE

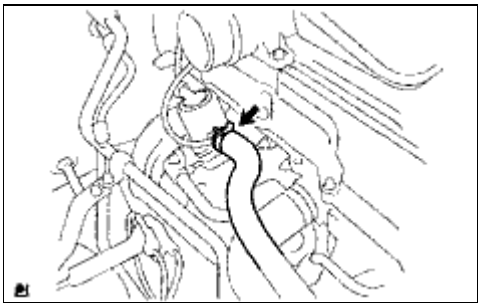
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(a) Slide the hose clip and disconnect the No. 1 fuel vapor feed hose.



21. DISCONNECT AIR INJECTION SYSTEM NO. 1 HOSE

(a) Slide the hose clip and disconnect the air injection system No. 1 hose.



22. DISCONNECT ENGINE WIRE

(a) Disconnect the connector from the ECM, then pull the engine wire harness to the compartment side.

NOTICE:

Do not forcibly pull the wire harness to the engine compartment side.

(b) Disconnect all wire harnesses and connectors in the engine room.

23. REMOVE EXHAUST TAIL PIPE ASSEMBLY INFO

24. REMOVE FRONT EXHAUST PIPE ASSEMBLY INFO

25. REMOVE MANUAL TRANSMISSION ASSEMBLY (for Manual Transmission)

INFO

26. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for Automatic Transmission)

TRANSMISSION	SEE PAGE
AC60E	INFO
AC60F	INFO

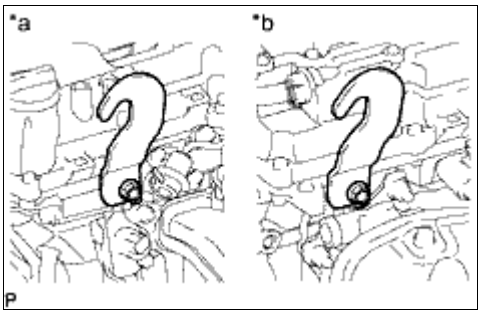
27. REMOVE ENGINE ASSEMBLY

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(a) Install the 2 engine hangers with the 2 bolts.

Text in Illustration

*a	Front
*b	Rear



Torque:

42 N·m {420 kgf·cm, 30ft·lbf}

Part No:

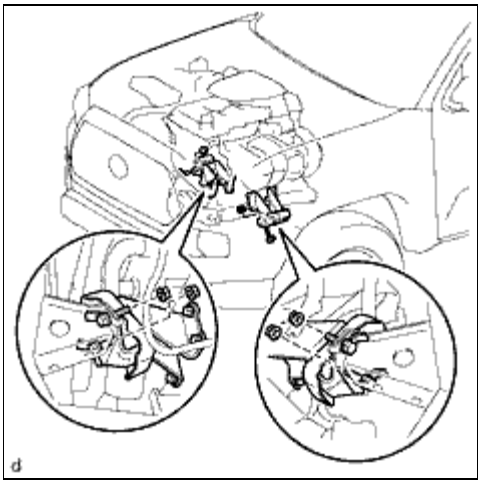
PART NAME	PART NO.
Engine hanger	12281-75050
Bolt	91672-81025

NOTICE:

Be sure to use the bolts when installing the engine hanger.

(b) Attach the engine sling device and chain block to the engine hangers.

(c) Remove the 4 bolts, 4 nuts, front No. 1 engine mounting bracket RH with front engine mounting insulator and No. 1 engine mounting bracket LH with front engine mounting insulator.



(d) Lift the engine out of the vehicle slowly and carefully by operating the engine sling device and chain block.

NOTICE:

Make sure that no wires, hoses or cables are connected to the engine.

28. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

29. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

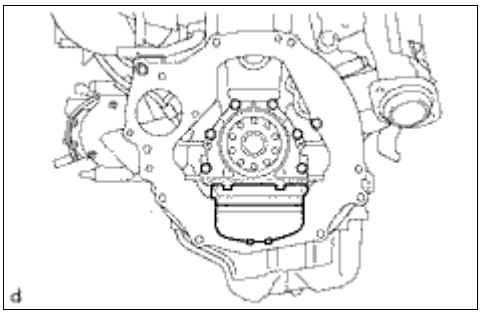
30. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

31. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

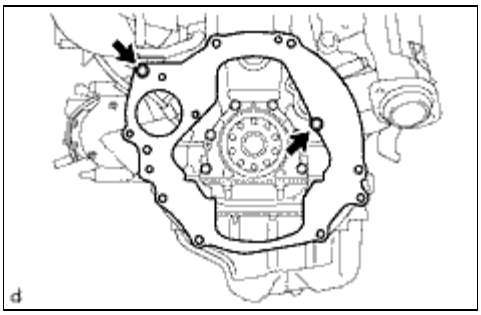
32. REMOVE REAR END PLATE

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(a) Remove the No. 2 oil pan cover silencer.



(b) Remove the 2 bolts and rear end plate.



33. REMOVE INTAKE AIR CONNECTOR INFO

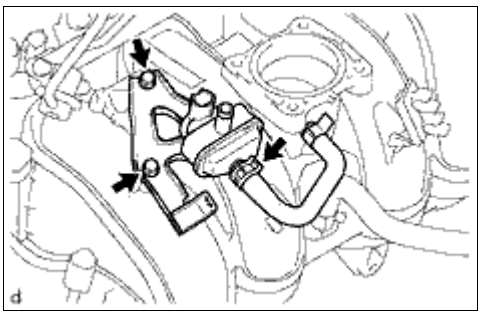
34. REMOVE FUEL HOSE INFO

35. REMOVE NO. 2 FUEL HOSE INFO

36. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY INFO

37. REMOVE PURGE VSV

(a) Slide the hose clip and disconnect the No. 2 fuel vapor feed hose.



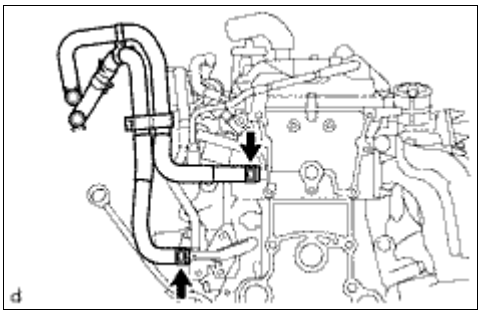
(b) Remove the 2 bolts and purge VSV.

38. REMOVE INTAKE MANIFOLD INFO

39. REMOVE WATER HOSE SUB-ASSEMBLY

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(a) Slide the 2 hose clips and remove the water hose sub-assembly.



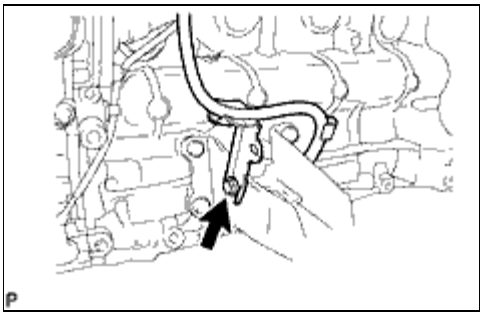
40. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET INFO

41. REMOVE ENGINE WIRE

42. REMOVE OIL LEVEL DIPSTICK SUB-ASSEMBLY

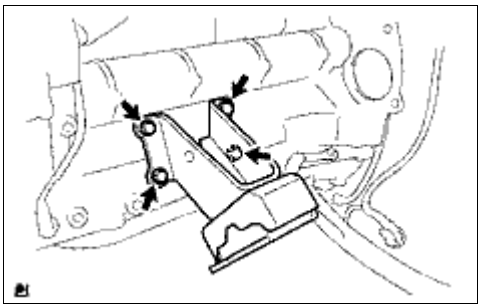
43. REMOVE OIL LEVEL DIPSTICK GUIDE

(a) Remove the bolt and oil level dipstick guide.



44. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET LH

(a) Remove the 4 bolts and front No. 1 engine mounting bracket LH with the front engine mounting insulator.

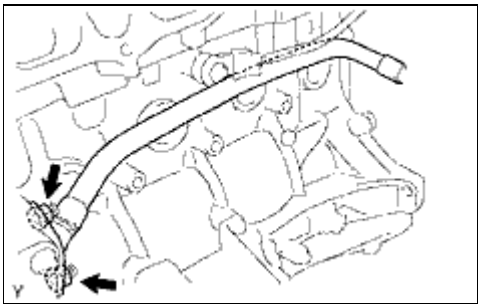


45. REMOVE FUEL DELIVERY PIPE WITH FUEL INJECTOR INFO

46. REMOVE FUEL INJECTOR ASSEMBLY INFO

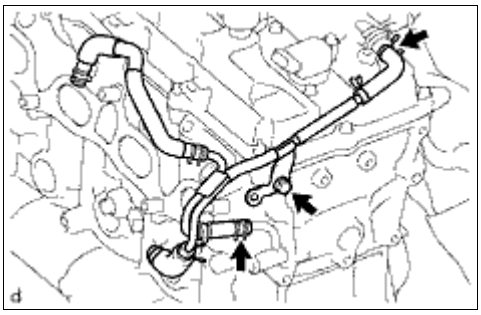
47. REMOVE NO. 1 WATER BY-PASS PIPE

(a) Remove the 2 nuts, No. 1 water by-pass pipe and gasket.



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48. REMOVE VENTILATION PIPE

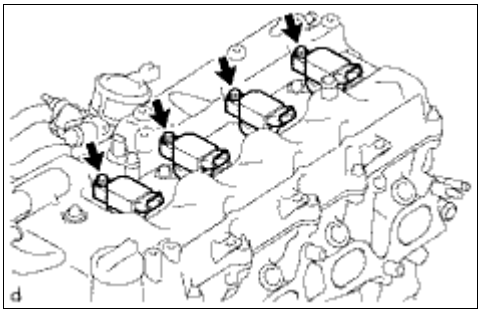


(a) Slide the hose clip and disconnect the ventilation hose.

(b) Slide the hose clip and disconnect the No. 3 water by-pass hose.

(c) Remove the bolt and ventilation pipe.

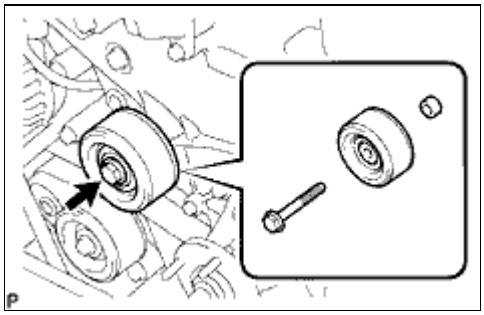
49. REMOVE IGNITION COIL ASSEMBLY



(a) Remove the 4 bolts and 4 ignition coil assemblies from the cylinder head cover sub-assembly.

50. REMOVE GENERATOR ASSEMBLY INFO

51. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY



(a) Remove the bolt, spacer and No. 1 idler pulley sub-assembly.

52. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

53. REMOVE NO. 4 INTAKE PIPE INFO

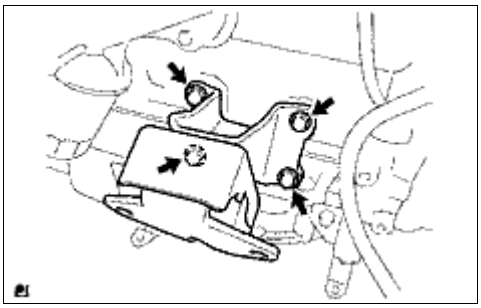
54. REMOVE AIR SWITCHING VALVE ASSEMBLY INFO

55. REMOVE EXHAUST MANIFOLD INFO

56. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET RH

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(a) Remove the 4 bolts and front No. 1 engine mounting bracket RH with the front engine mounting insulator.

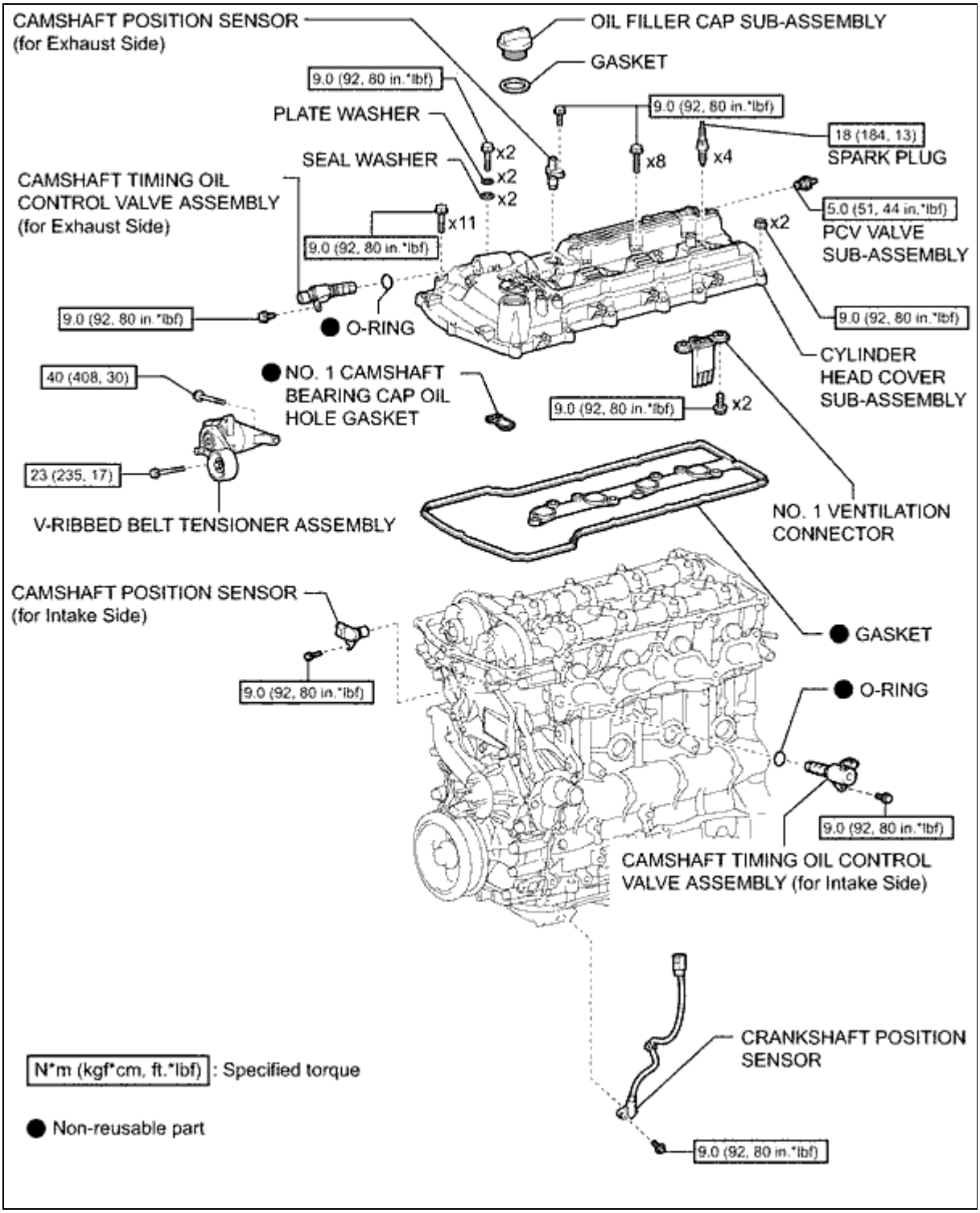


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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000004Z65008X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

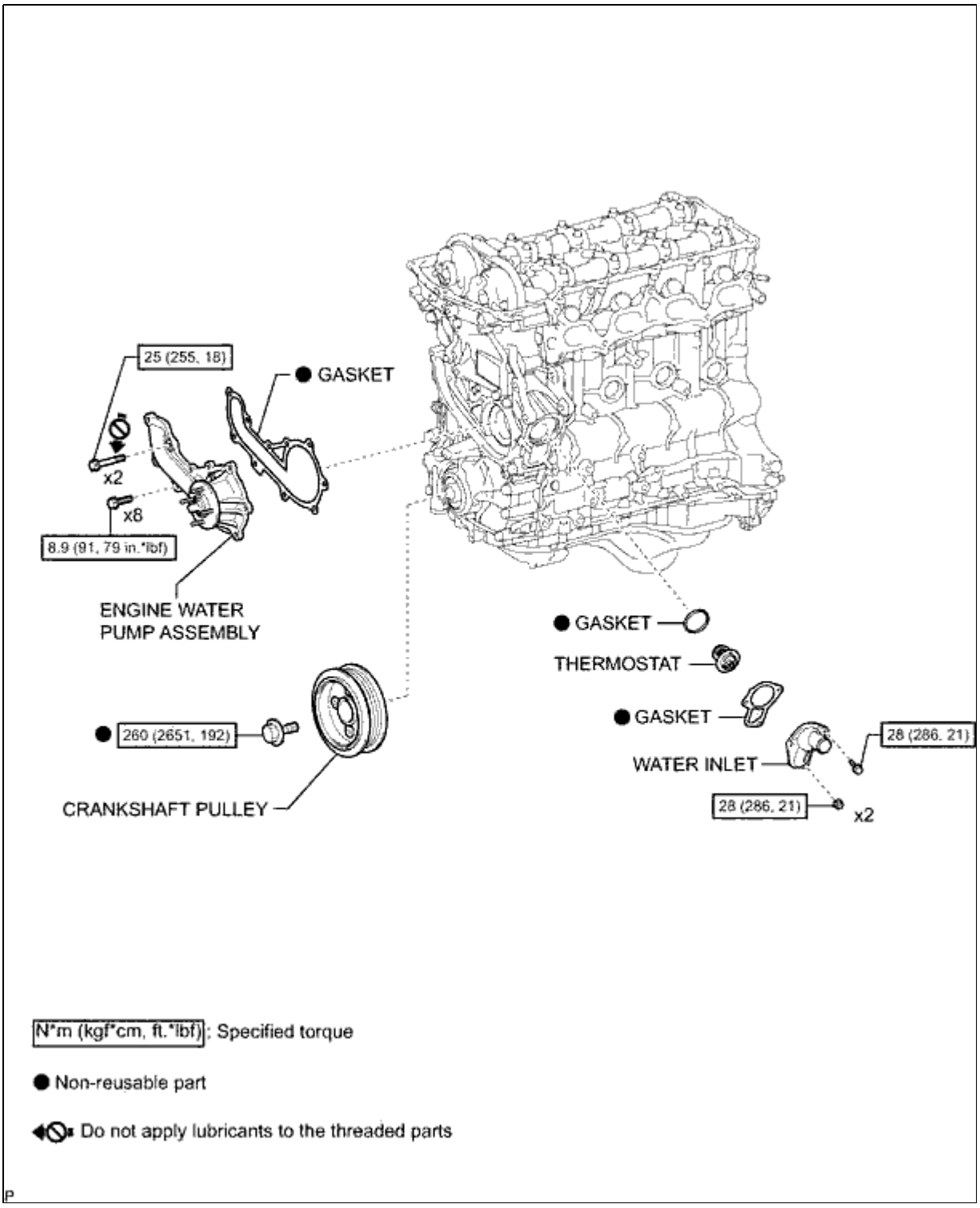
COMPONENTS

ILLUSTRATION



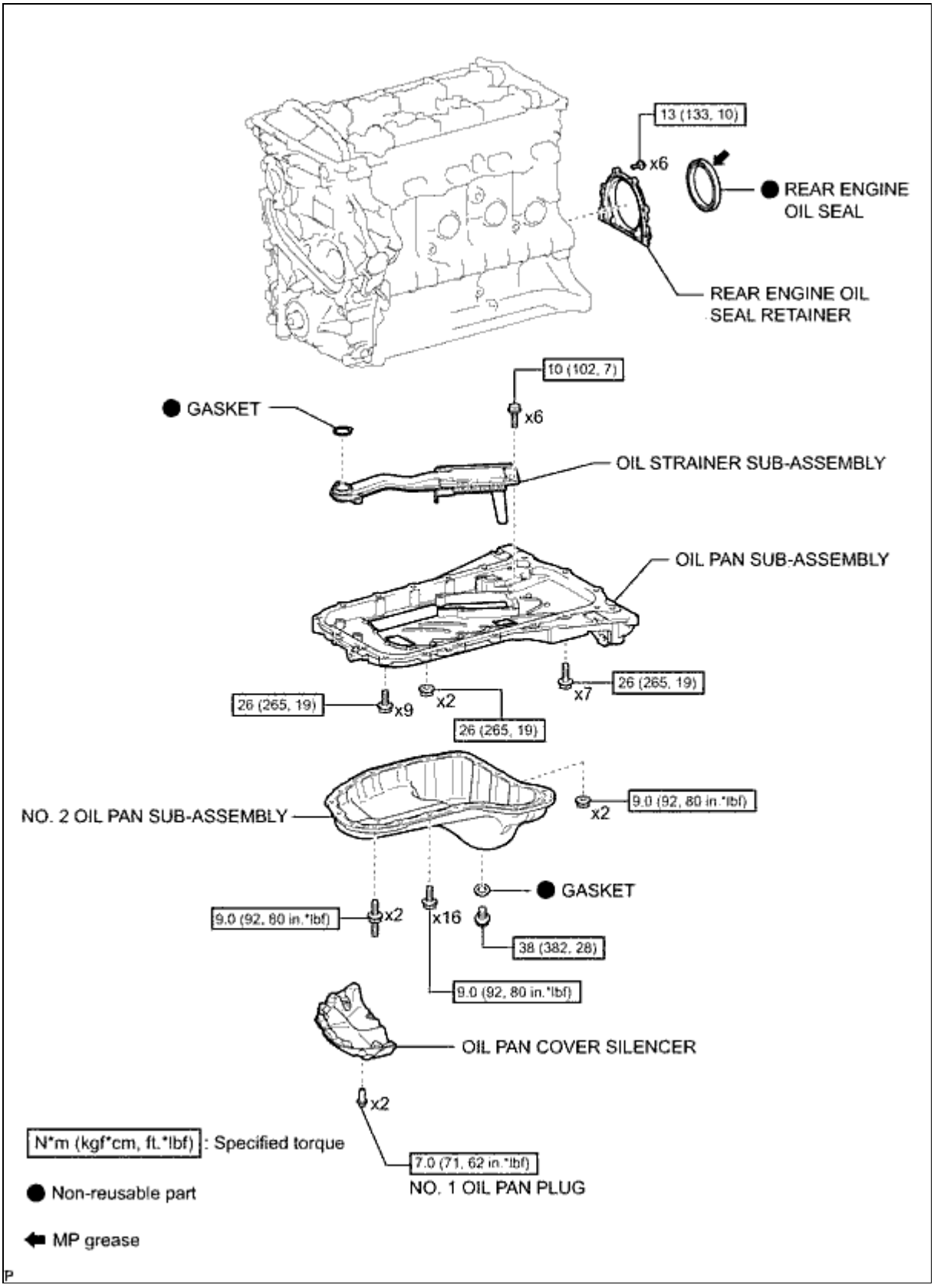
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ILLUSTRATION



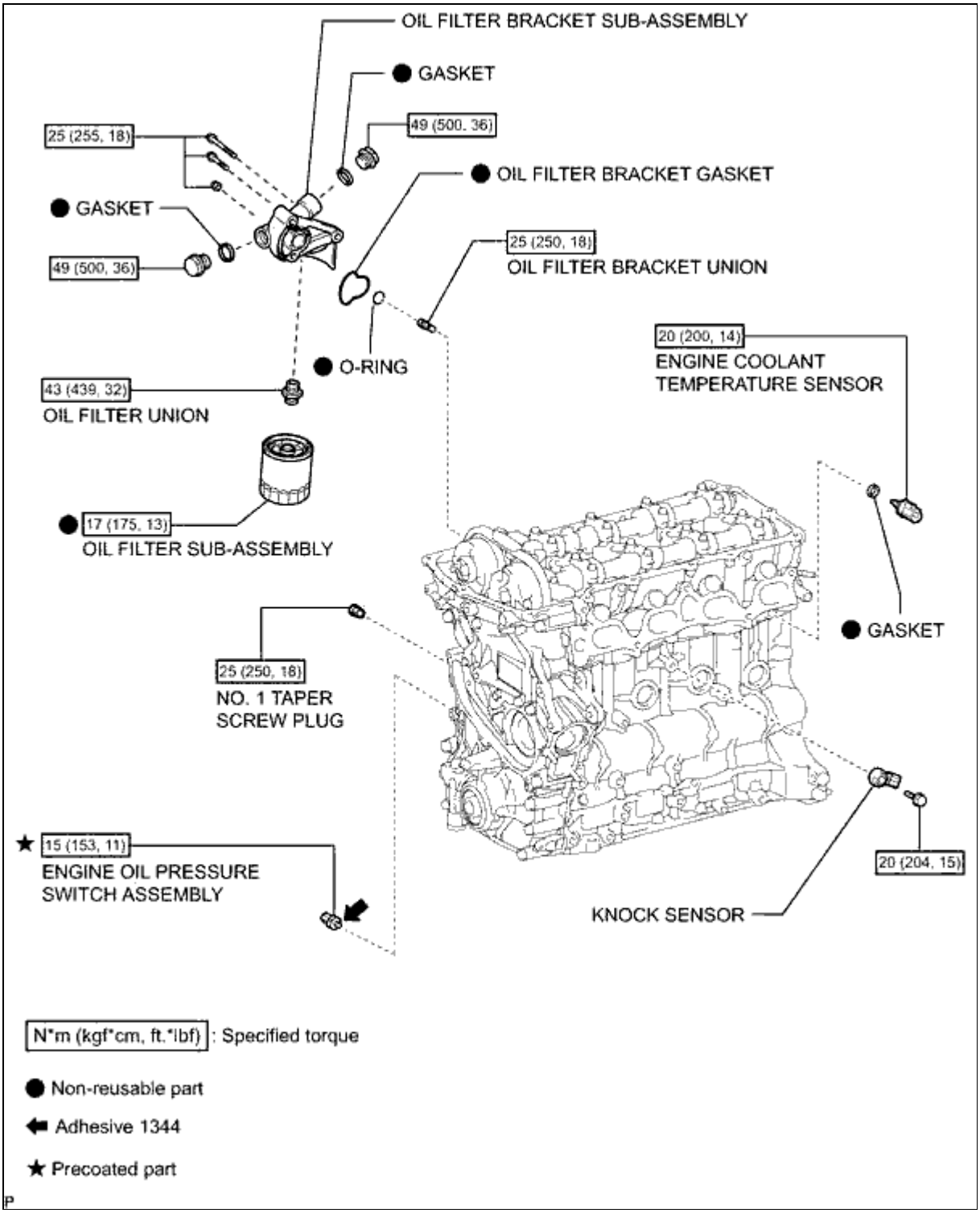
ILLUSTRATION

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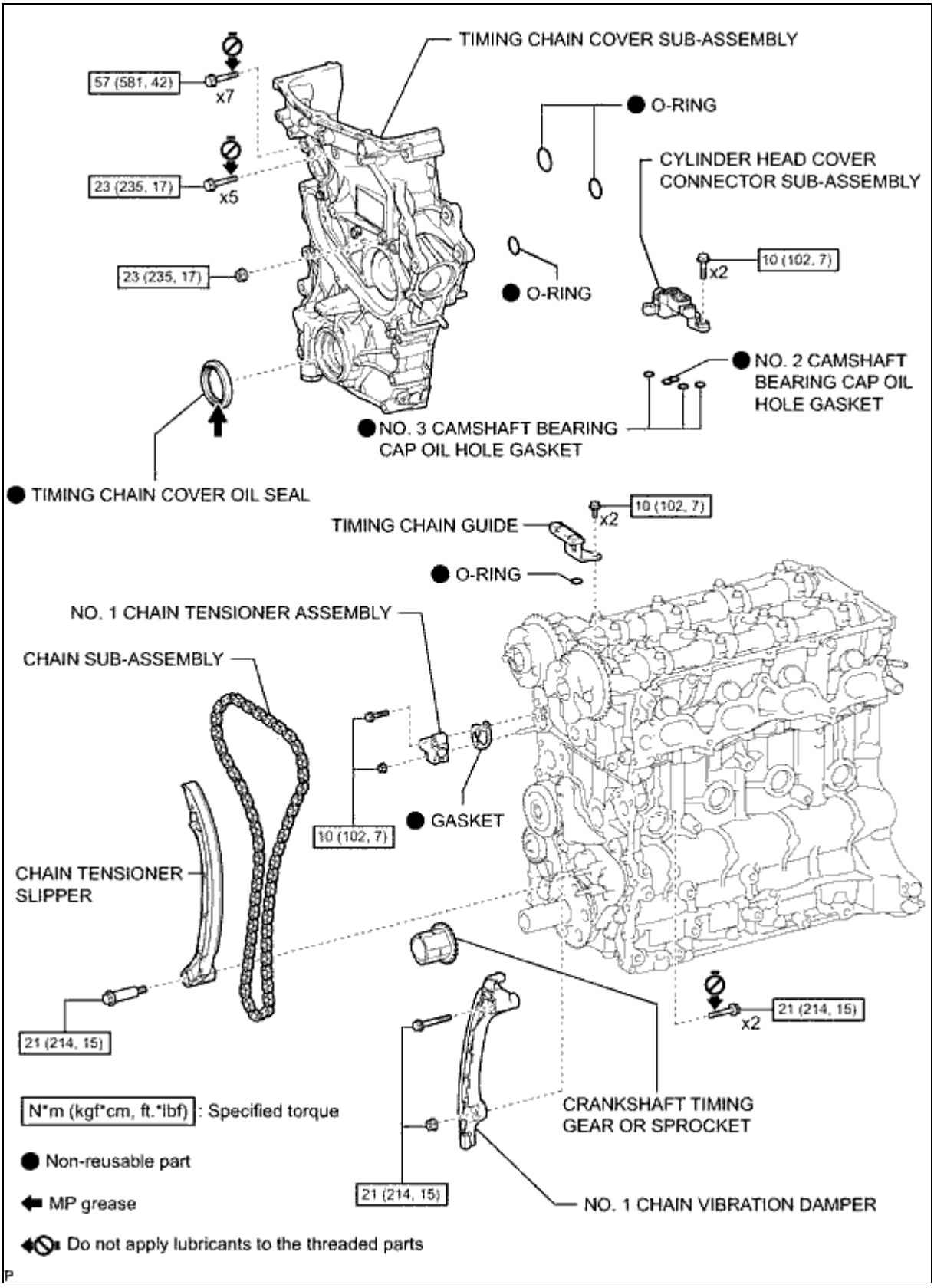
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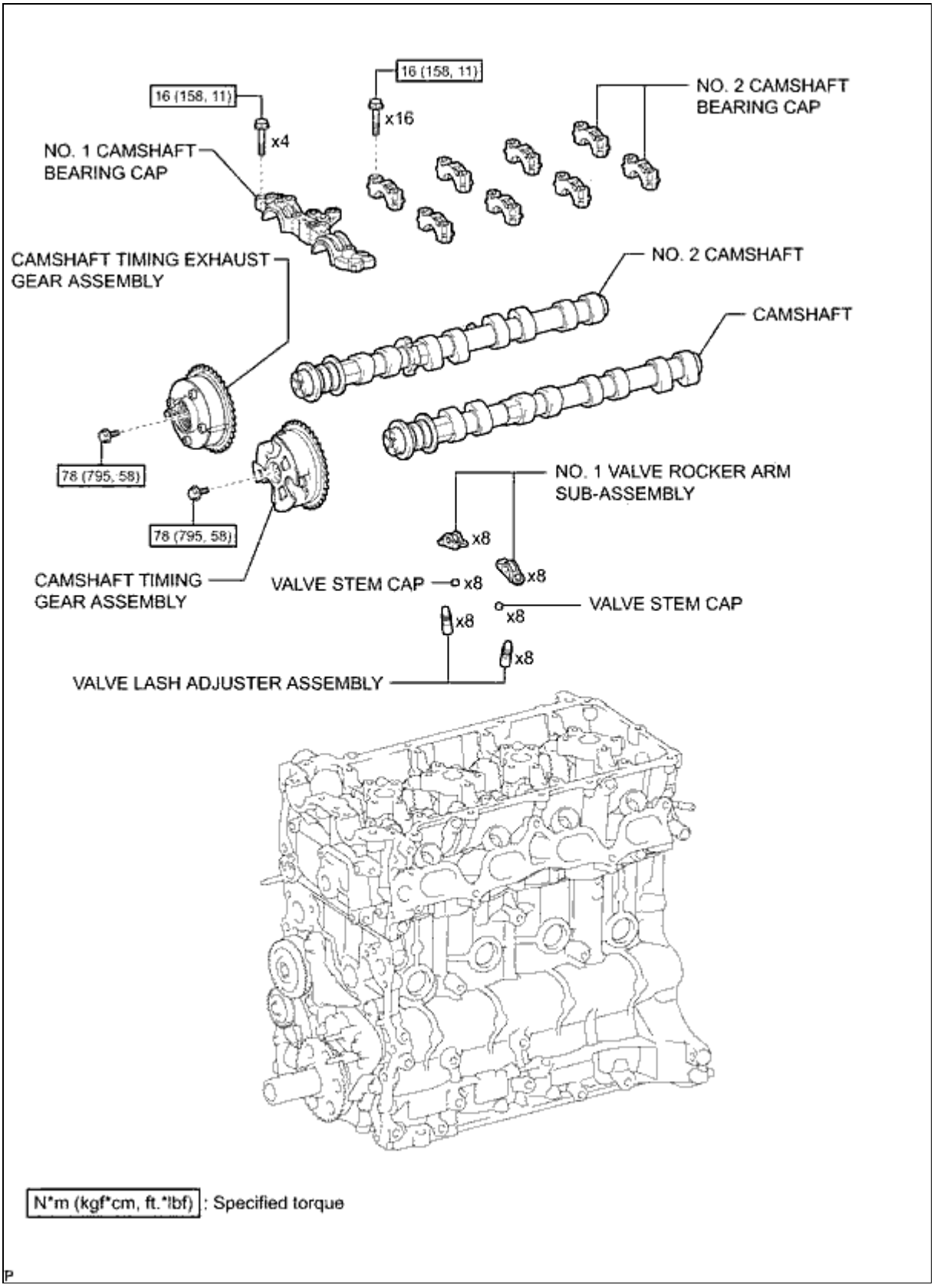
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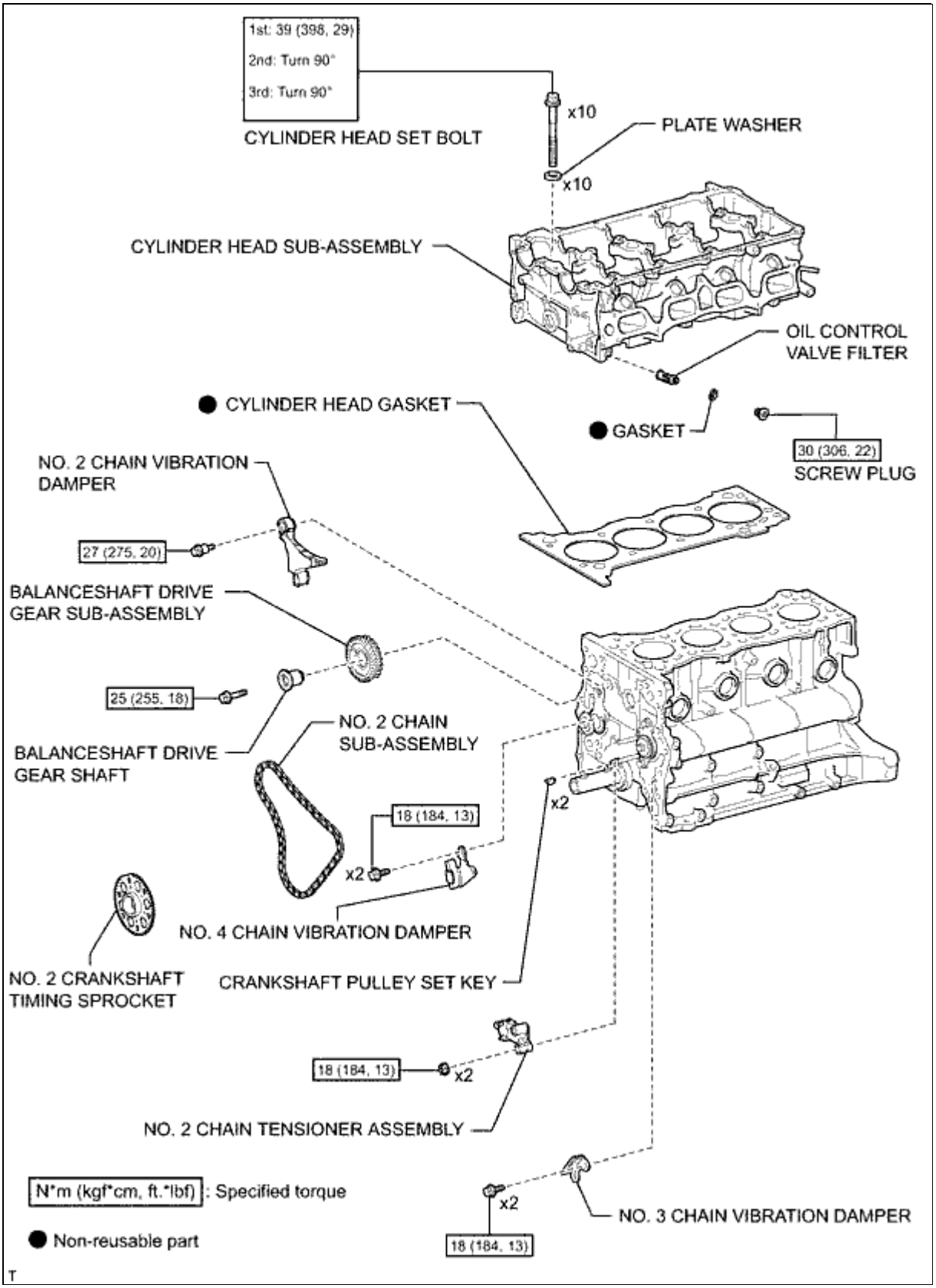
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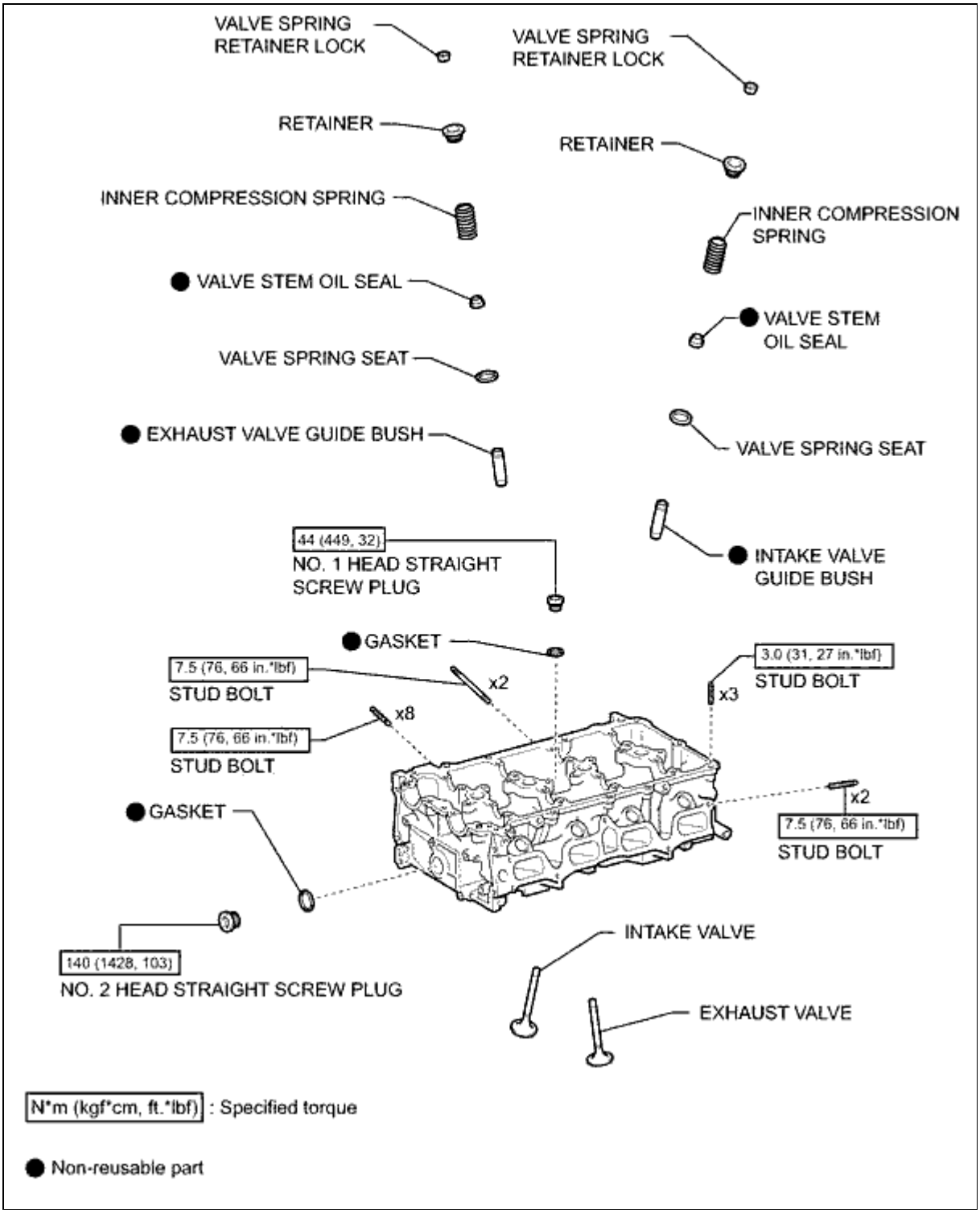
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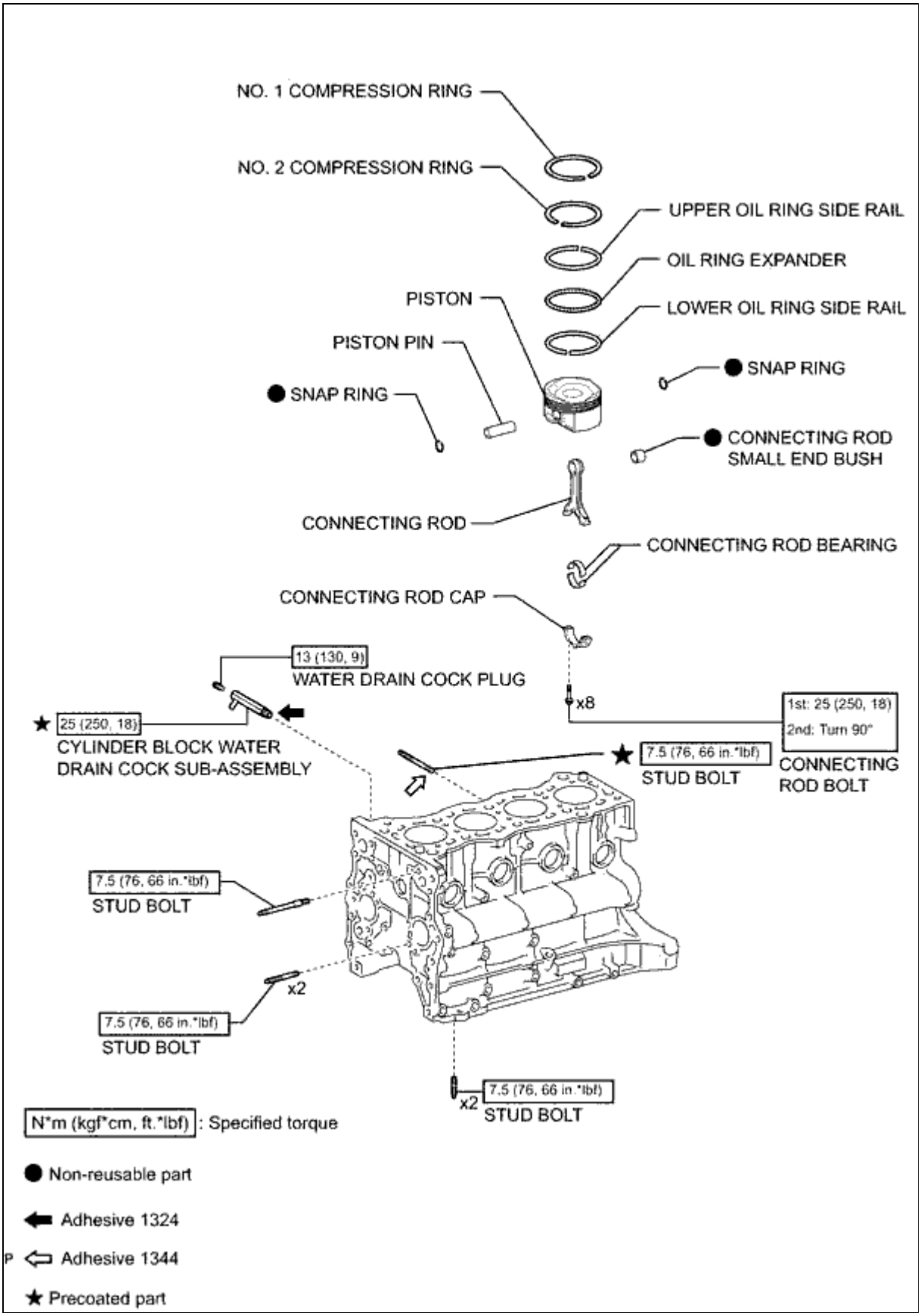
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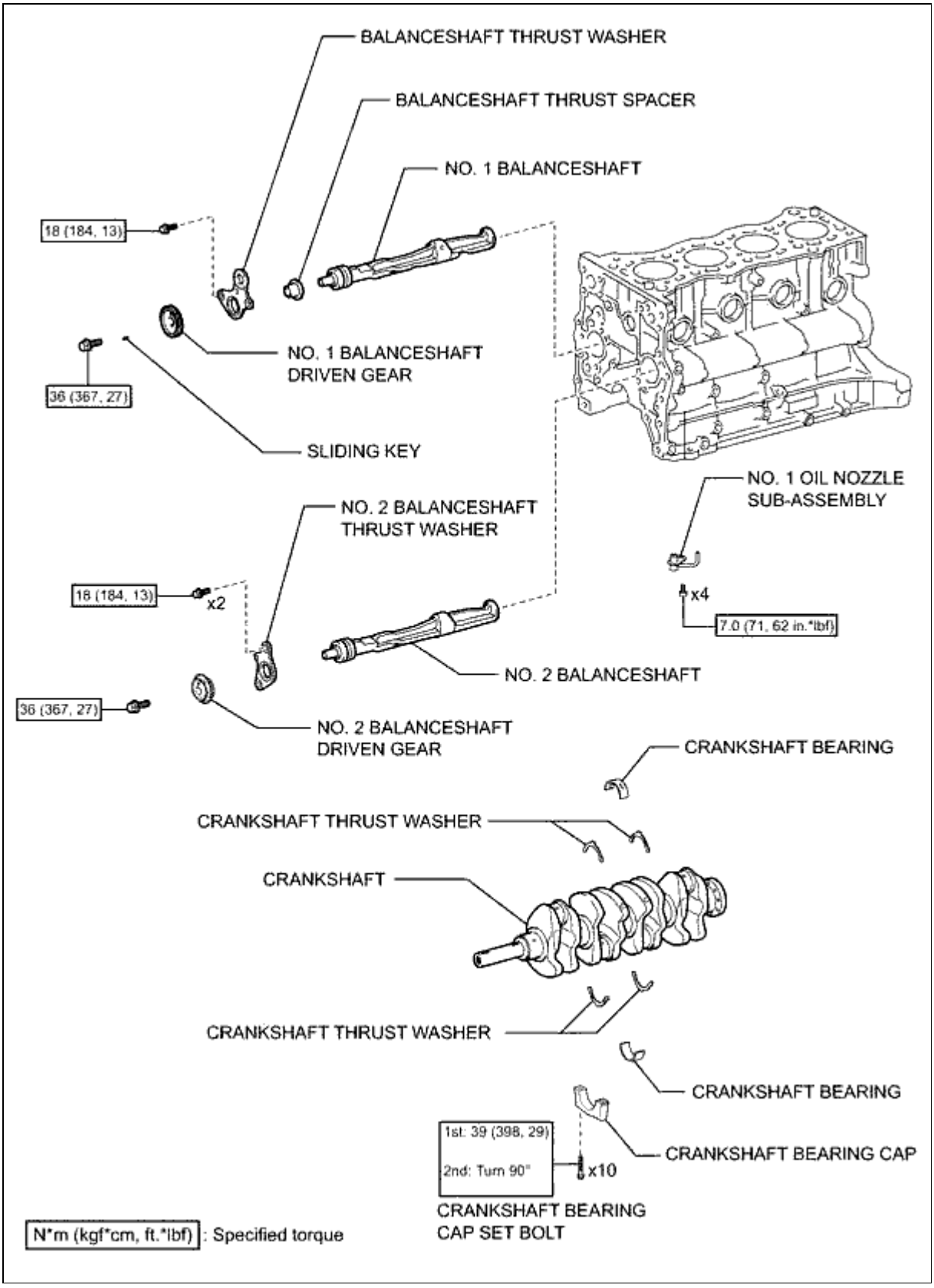
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000125A06GX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: DISASSEMBLY; 2016 MY Tacoma [08/2015 -]		

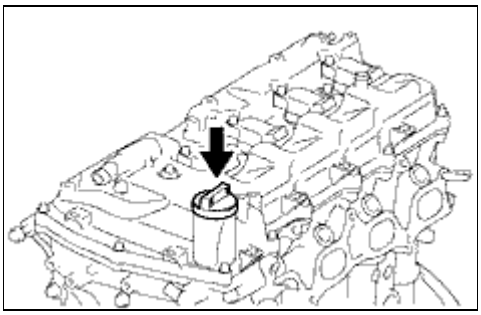
DISASSEMBLY

1. REMOVE SPARK PLUG

(a) Using a 16 mm spark plug wrench, remove the 4 spark plugs from the cylinder head sub-assembly.

2. REMOVE OIL FILLER CAP SUB-ASSEMBLY

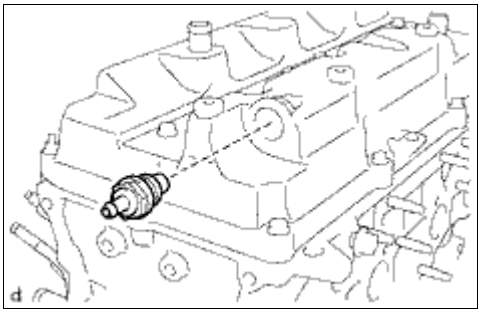
(a) Remove the oil filler cap sub-assembly.



(b) Remove the gasket from the oil filler cap sub-assembly.

3. REMOVE PCV VALVE SUB-ASSEMBLY

(a) Remove the PCV valve sub-assembly.



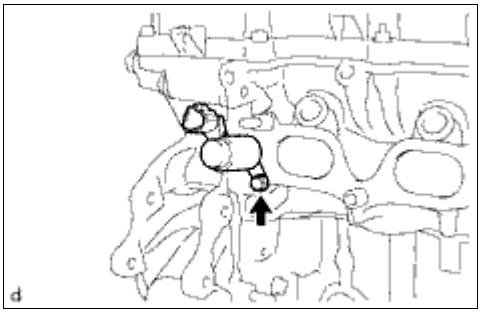
4. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

5. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

6. REMOVE CRANKSHAFT POSITION SENSOR INFO

7. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)

(a) Remove the bolt and camshaft timing oil control valve assembly.

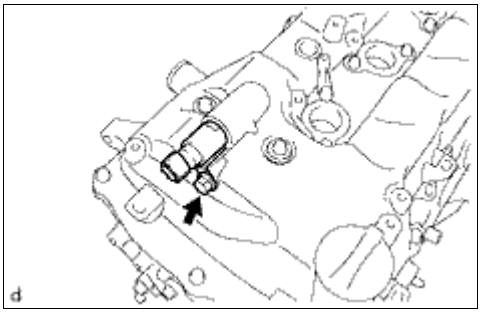


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(b) Remove the O-ring from the camshaft timing oil control valve assembly.

8. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)

(a) Remove the bolt and camshaft timing oil control valve assembly.

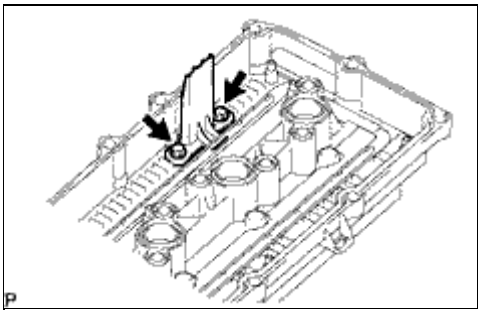


(b) Remove the O-ring from the camshaft timing oil control valve assembly.

9. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

10. REMOVE NO. 1 VENTILATION CONNECTOR

(a) Remove the 2 bolts and No. 1 ventilation connector from the cylinder head cover sub-assembly.



11. REMOVE WATER INLET INFO

12. REMOVE THERMOSTAT INFO

13. REMOVE CRANKSHAFT PULLEY INFO

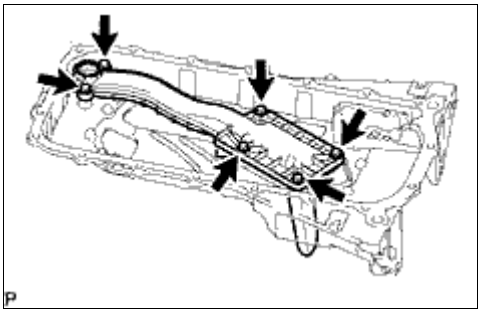
14. REMOVE OIL PAN COVER SILENCER INFO

15. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY INFO

16. REMOVE OIL PAN SUB-ASSEMBLY INFO

17. REMOVE OIL STRAINER SUB-ASSEMBLY

(a) Remove the 6 bolts, oil strainer sub-assembly and gasket.



18. REMOVE OIL PAN STUD BOLT

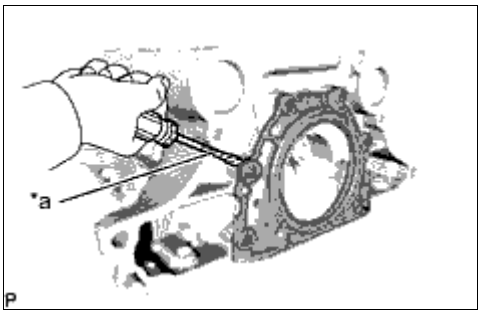
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NOTICE:

If a stud bolt is deformed or its threads are damaged, replace it.

19. REMOVE REAR ENGINE OIL SEAL RETAINER

(a) Remove the 6 bolts.



(b) Using a screwdriver, pry out the rear engine oil seal retainer.

Text in Illustration

*a	Protective Tape

HINT:

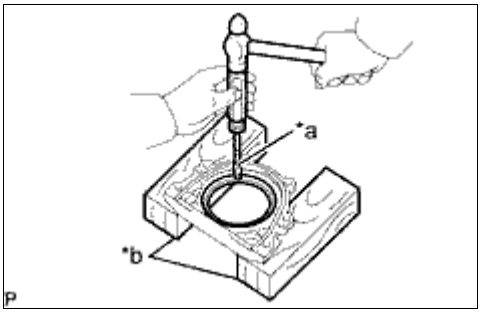
Protective tape the screwdriver tip before use.

20. REMOVE REAR ENGINE OIL SEAL

(a) Place the rear engine oil seal retainer on wooden blocks.

Text in Illustration

*a	Protective Tape
*b	Wooden Blocks



(b) Using a screwdriver and hammer, tap out the rear engine oil seal.

HINT:

Protective tape the screwdriver tip before use.

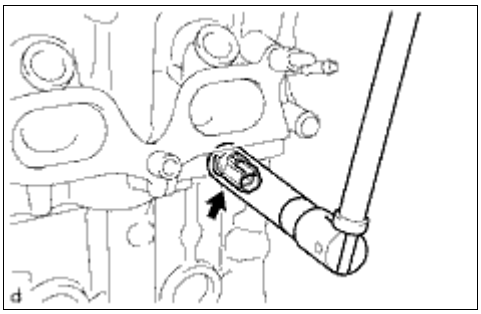
21. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY INFO

22. REMOVE KNOCK SENSOR INFO

23. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

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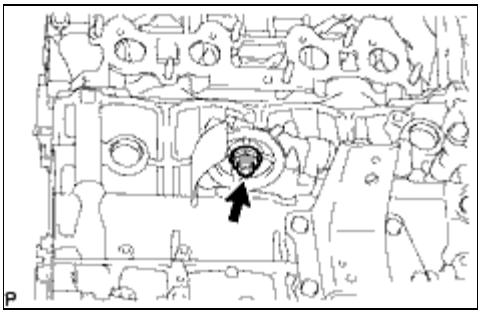
(a) Using a 19 mm deep socket wrench, remove the engine coolant temperature sensor and gasket.



24. REMOVE OIL FILTER SUB-ASSEMBLY INFO

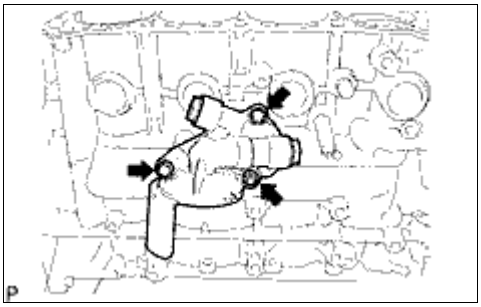
25. REMOVE OIL FILTER UNION

(a) Using a 27 mm socket wrench, remove the oil filter union.



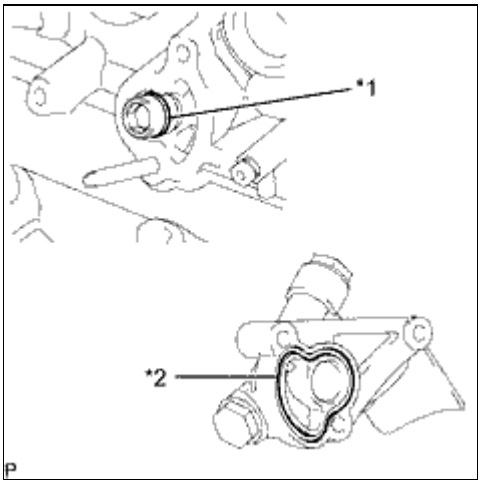
26. REMOVE OIL FILTER BRACKET SUB-ASSEMBLY

(a) Remove the 2 bolts and nut from the oil filter bracket sub-assembly.



(b) Remove the 2 screw plugs and 2 gaskets from the oil filter bracket sub-assembly.

(c) Remove the oil filter bracket gasket and O-ring.

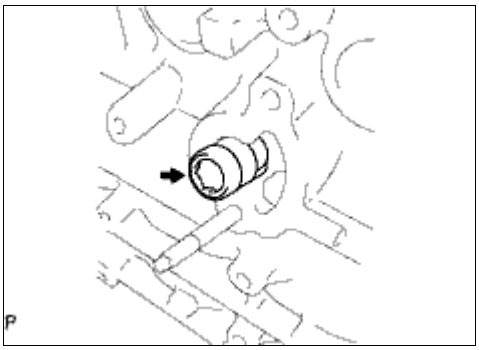


Text in Illustration

*1	O-ring
*2	Oil Filter Bracket Gasket

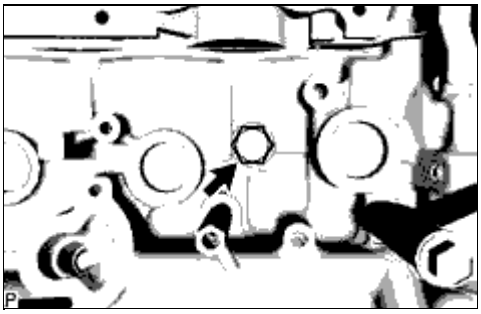
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(d) Using a hexagon wrench, remove the oil filter bracket union.



27. REMOVE NO. 1 TAPER SCREW PLUG

(a) Remove the No. 1 taper screw plug from the cylinder block.



28. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY INFO

29. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY INFO

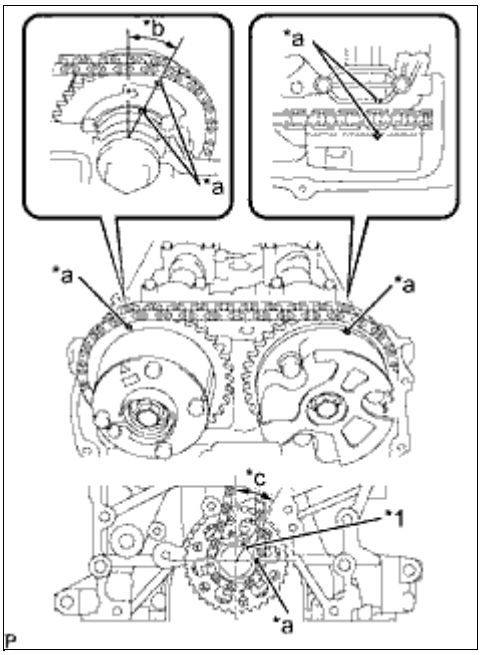
30. REMOVE ENGINE WATER PUMP ASSEMBLY INFO

31. REMOVE TIMING CHAIN COVER OIL SEAL INFO

32. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Temporarily install the crankshaft pulley bolt.

(b) Rotate the crankshaft clockwise so that the timing marks on the crankshaft timing gear and camshaft timing gears are as shown in the illustration.



Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Approximately 13°
*c	Approximately 30°

HINT:

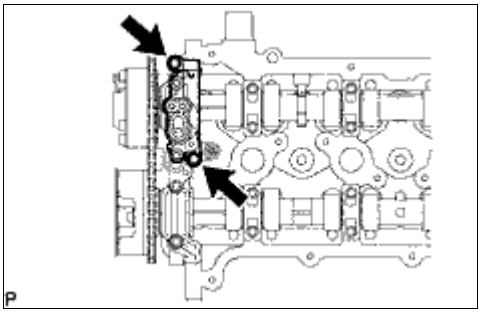
If the timing marks do not align, rotate the crankshaft clockwise again and align the timing marks.

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(c) Remove the crankshaft pulley bolt.

33. REMOVE CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY

(a) Remove the 2 bolts and cylinder head cover connector sub-assembly.



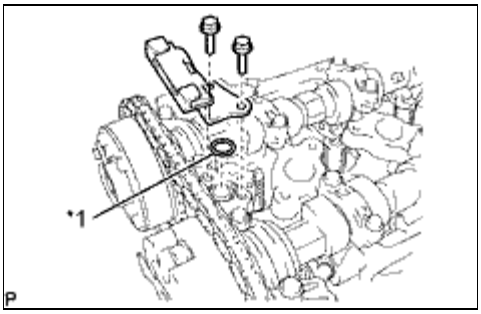
(b) Remove the No. 2 camshaft bearing cap oil hole gasket and 3 No. 3 camshaft bearing cap oil hole gaskets from the No. 1 camshaft bearing cap.

34. REMOVE TIMING CHAIN GUIDE

(a) Remove the 2 bolts, timing chain guide and O-ring.

Text in Illustration

*1	O-ring



35. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

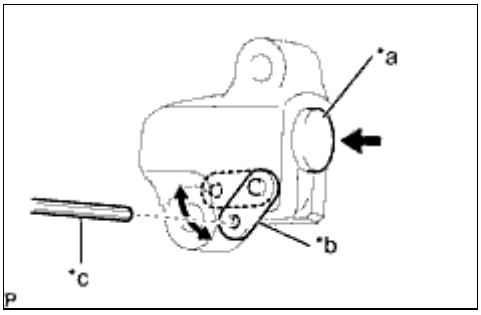
NOTICE:

- When the No. 1 chain tensioner assembly is removed, do not rotate the crankshaft.
- When the chain is removed and the camshaft needs to be rotated, rotate the crankshaft 90° to the right.

(a) Move the stopper plate upward to release the lock and push the plunger deep into the tensioner.

Text in Illustration

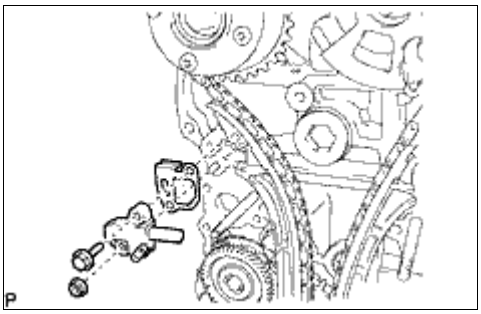
*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench



(b) Move the stopper plate downward to set the lock and insert a hexagon wrench into the stopper plate hole.

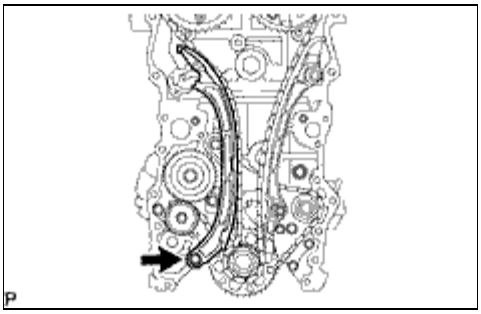
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(c) Remove the bolt, nut, No. 1 chain tensioner assembly and gasket.



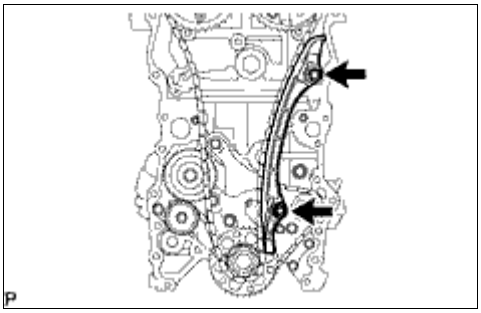
36. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.



37. REMOVE NO. 1 CHAIN VIBRATION DAMPER

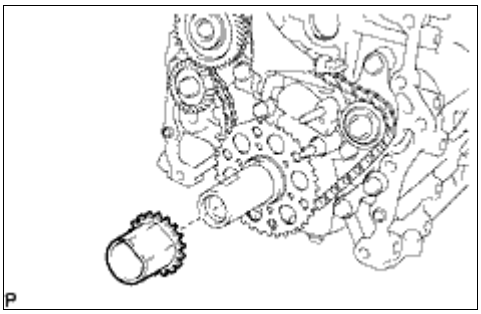
(a) Remove the bolt, nut and No. 1 chain vibration damper.



38. REMOVE CHAIN SUB-ASSEMBLY

39. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Remove the crankshaft timing gear or sprocket from the crankshaft.



40. REMOVE CAMSHAFT BEARING CAP INFO

41. REMOVE CAMSHAFT INFO

42. REMOVE NO. 2 CAMSHAFT INFO

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43. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY INFO

44. REMOVE VALVE LASH ADJUSTER ASSEMBLY INFO

45. REMOVE VALVE STEM CAP INFO

46. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY INFO

47. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY INFO

48. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY INFO

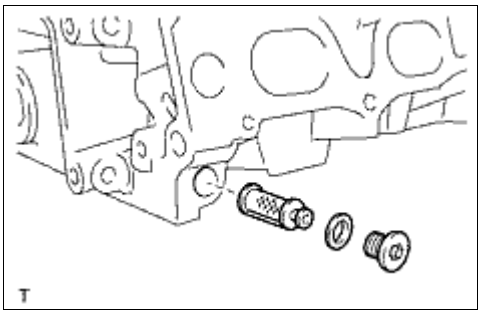
49. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY INFO

50. REMOVE CYLINDER HEAD SUB-ASSEMBLY INFO

51. REMOVE CYLINDER HEAD GASKET INFO

52. REMOVE OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, remove the screw plug.



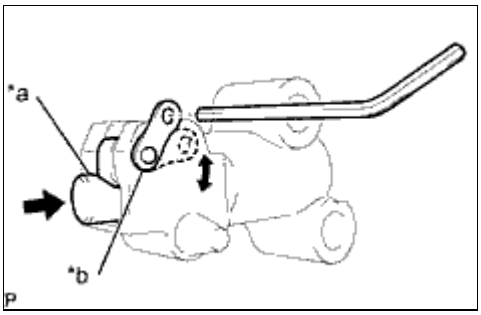
(b) Remove the oil control valve filter and gasket.

53. REMOVE NO. 2 CHAIN VIBRATION DAMPER

(a) Move the stopper plate downward to release the lock and push the plunger deep into the tensioner.

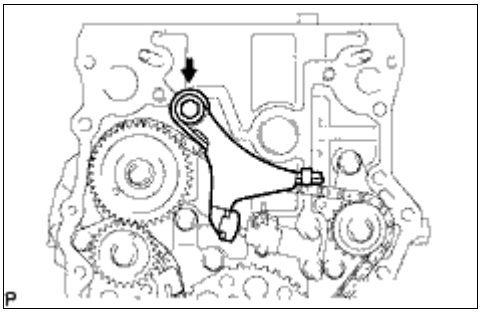
Text in Illustration

*a	Plunger
*b	Stopper Plate



(b) Move the stopper plate upward to set the lock and insert a hexagon wrench into the stopper plate hole.

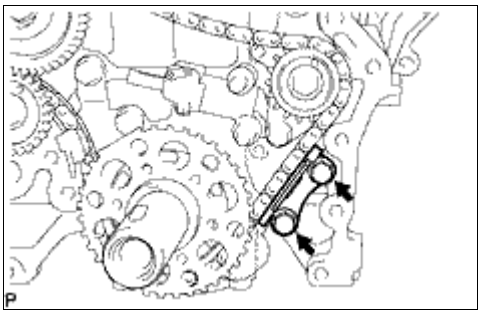
(c) Remove the bolt and No. 2 chain vibration damper.



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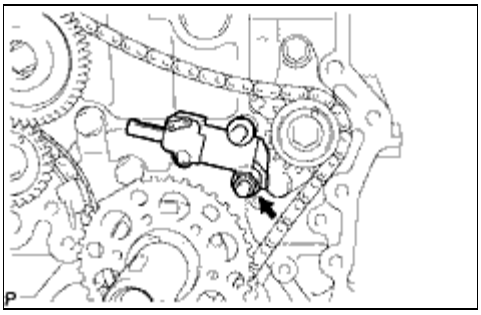
54. REMOVE NO. 3 CHAIN VIBRATION DAMPER

(a) Remove the 2 bolts and No. 3 chain vibration damper.



55. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

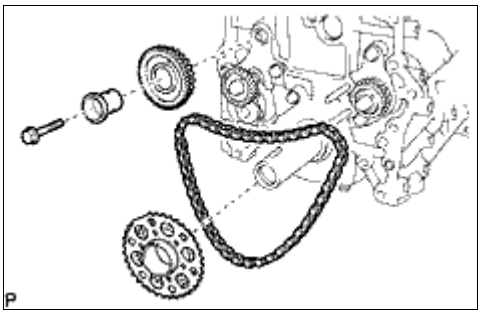
(a) Remove the hexagon wrench from the No. 2 chain tensioner assembly.



(b) Remove the nut and No. 2 chain tensioner assembly.

56. REMOVE NO. 2 CHAIN SUB-ASSEMBLY

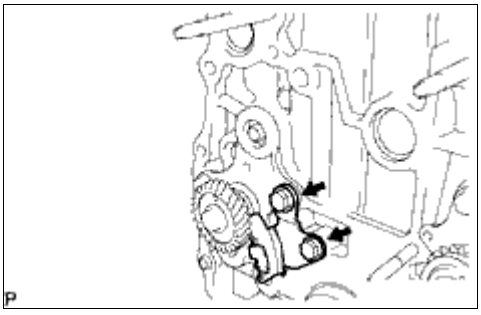
(a) Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear sub-assembly.



(b) Remove the crankshaft timing sprocket and No. 2 chain sub-assembly.

57. REMOVE NO. 4 CHAIN VIBRATION DAMPER

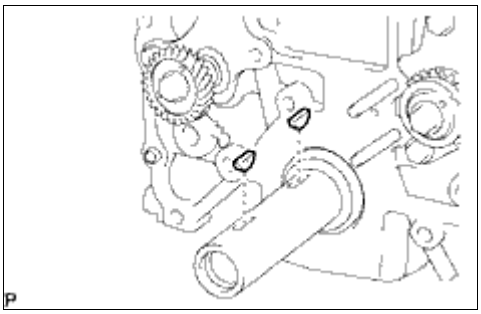
(a) Remove the 2 bolts and No. 4 chain vibration damper.



58. REMOVE CRANKSHAFT PULLEY SET KEY

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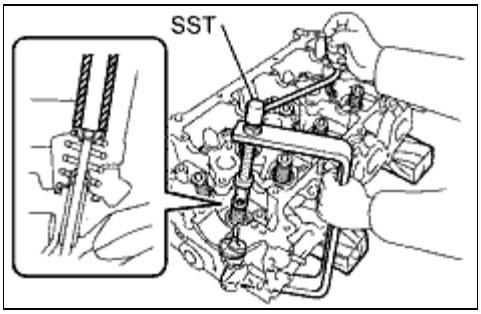
(a) Remove the 2 crankshaft pulley set keys from the crankshaft.



59. REMOVE INTAKE VALVE

(a) Using SST and wooden blocks, compress the inner compression spring and remove the valve spring retainer locks.

SST: 09202-70020
SST: 09202-00021



(b) Remove the retainer, inner compression spring and valve.

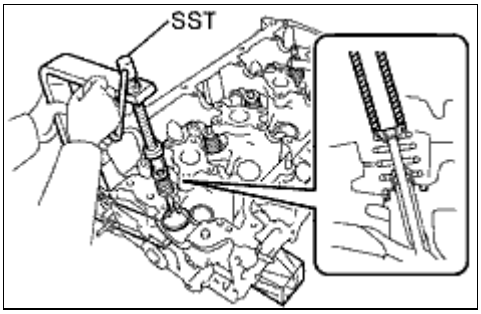
HINT:

Arrange the removed parts in the correct order.

60. REMOVE EXHAUST VALVE

(a) Using SST and wooden blocks, compress the inner compression spring and remove the valve spring retainer locks.

SST: 09202-70020
SST: 09202-00021



(b) Remove the retainer, inner compression spring and valve.

HINT:

Arrange the removed parts in the correct order.

61. REMOVE VALVE STEM OIL SEAL

(a) Using needle-nose pliers, remove the 16 oil seals.

62. REMOVE VALVE SPRING SEAT

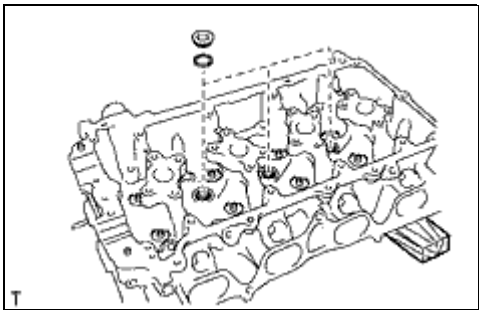
(a) Remove the 16 valve spring seats from the cylinder head.

63. REMOVE NO. 1 HEAD STRAIGHT SCREW PLUG

NOTICE:

If coolant leaks from the No. 1 head straight screw plug or the plug is corroded, replace it.

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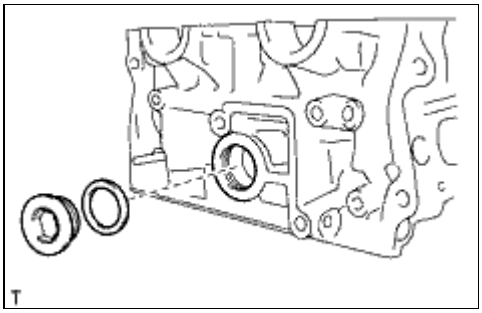


(a) Using a 10 mm hexagon wrench, remove the 3 screw plugs and 3 gaskets.

64. REMOVE NO. 2 HEAD STRAIGHT SCREW PLUG

NOTICE:

If coolant leaks from the No. 2 head straight screw plug or the plug is corroded, replace it.



(a) Using a 19 mm hexagon wrench, remove the screw plug and gasket.

65. REMOVE STUD BOLT

NOTICE:

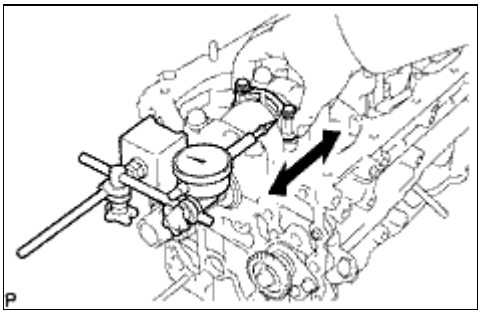
If a stud bolt is deformed or its threads are damaged, replace it.

66. INSPECT CONNECTING ROD THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:
0.15 to 0.35 mm (0.00591 to 0.0138 in.)
Maximum thrust clearance:
0.40 mm (0.0157 in.)

If the thrust clearance is more than the maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



67. INSPECT CONNECTING ROD OIL CLEARANCE

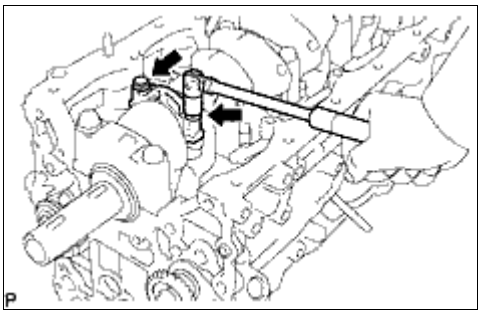
(a) Check that the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.

HINT:

The matchmarks on the connecting rods and caps are for ensuring correct reassembly.

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(b) Remove the 2 connecting rod bolts.



(c) Using the 2 removed connecting rod bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

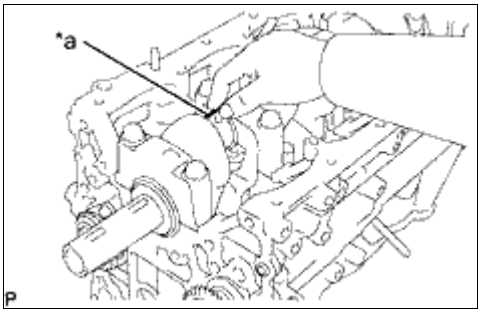
HINT:

Keep the lower bearing installed to the connecting rod cap.

(d) Clean the crank pin and bearing.

(e) Check the crank pin and bearing for pitting and scratches.

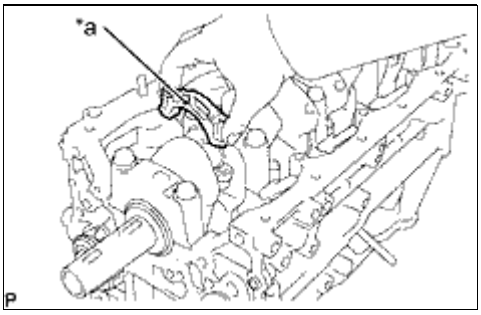
(f) Lay a strip of Plastigage on the crank pin.



Text in Illustration

*a	Plastigage

(g) Check that the front mark of the connecting rod cap is facing forward.



Text in Illustration

*a	Front Mark

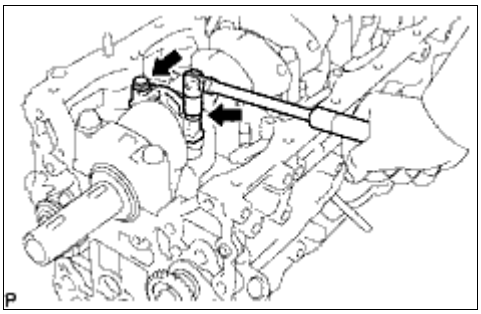
(h) Install the connecting rod cap INFO .

NOTICE:

Do not turn the crankshaft.

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(i) Remove the 2 bolts and connecting rod cap (refer to the steps above).

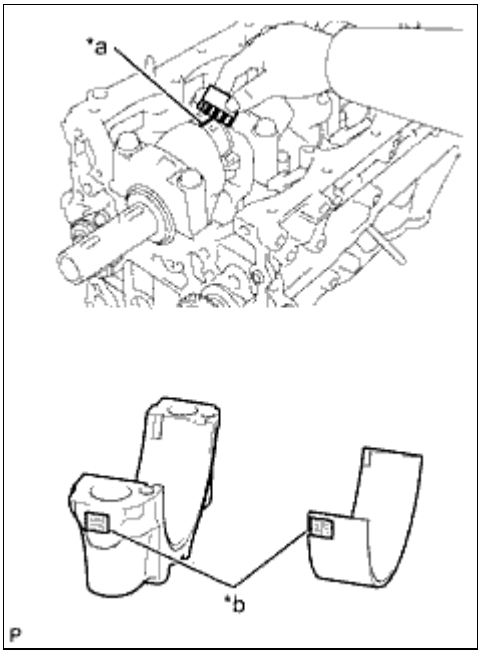


(j) Measure the Plastigage at its widest point.

Standard oil clearance:
0.039 to 0.066 mm (0.00154 to 0.00260 in.)
Maximum oil clearance:
0.066 mm (0.00260 in.)

Text in Illustration

*a	Plastigage
*b	4, 5 or 6 Mark



If the oil clearance is more than the maximum, replace the connecting rod bearings. If necessary, inspect the crankshaft.

If replacing a bearing, replace it with one that has the same number as its respective connecting rod cap. The standard thickness of each bearing is indicated by a 4, 5 or 6 mark on its surface.

Standard crankshaft pin diameter:
52.989 to 53.002 mm (2.086 to 2.087 in.)
Standard Bearing Center Wall Thickness:

ITEM	SPECIFIED CONDITION
Mark 4	1.487 to 1.490 mm (0.05854 to 0.05866 in.)
Mark 5	1.491 to 1.493 mm (0.05870 to 0.05878 in.)
Mark 6	1.494 to 1.496 mm (0.05882 to 0.05890 in.)

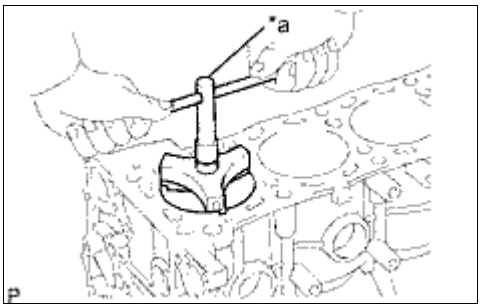
(k) Completely remove the Plastigage.

(l) Perform the inspection above for each crank pin.

68. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

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(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.



Text in Illustration

*a	Ridge Reamer

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

69. REMOVE CONNECTING ROD BEARING

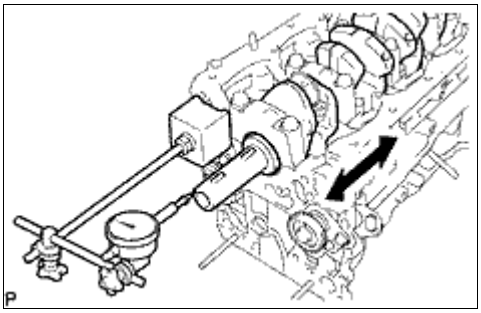
(a) Remove the connecting rod bearings from the connecting rods and connecting rod caps.

HINT:

Arrange the removed parts in the correct order.

70. INSPECT CRANKSHAFT THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.



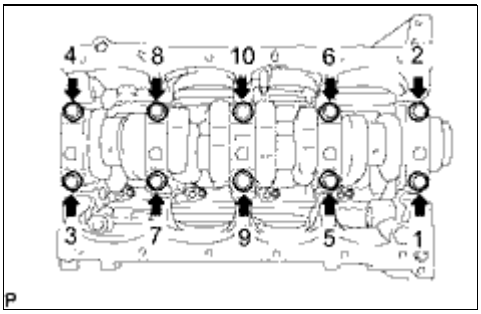
Standard thrust clearance:
0.02 to 0.22 mm (0.000787 to 0.00866 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

If the thrust clearance is more than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

Thrust washer thickness:
2.440 to 2.490 mm (0.0961 to 0.0980 in.)

71. REMOVE CRANKSHAFT

(a) Uniformly loosen the 10 crankshaft bearing cap set bolts in several steps in the sequence shown in the illustration.



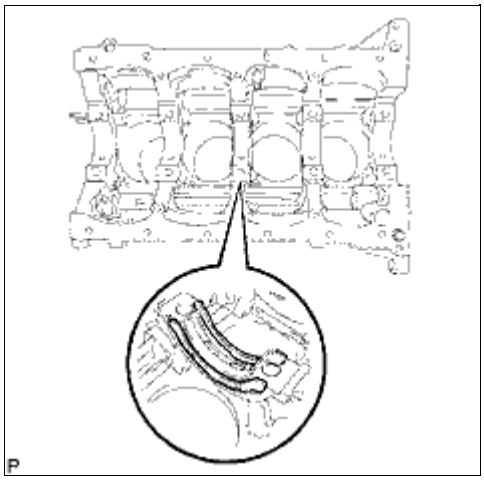
HINT:

- Keep the lower bearings and crankshaft bearing caps together.
- Arrange the thrust washers in the correct order.

(b) Lift out the crankshaft to remove it.

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(c) Remove the upper thrust washers from the cylinder block.



HINT:

Arrange the main bearing caps, bearings and thrust washers in the correct order.

72. REMOVE CRANKSHAFT BEARING

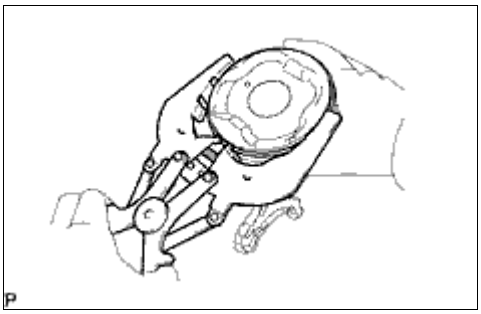
(a) Remove the crankshaft bearings from the cylinder block and bearing caps.

HINT:

Arrange the removed parts in the correct order.

73. REMOVE PISTON RING SET

(a) Using a piston ring expander, remove the 2 compression rings.



(b) Remove the oil ring expander and 2 oil ring side rails by hand.

HINT:

Arrange the piston rings in the correct order.

74. REMOVE PISTON WITH PIN SUB-ASSEMBLY

(a) Check the fitting condition between the piston and piston pin.

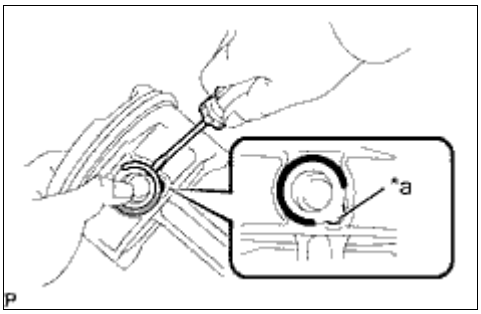
(1) Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

(b) Disconnect the connecting rod from the piston.

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(1) Using a screwdriver, pry off the snap rings from the piston.

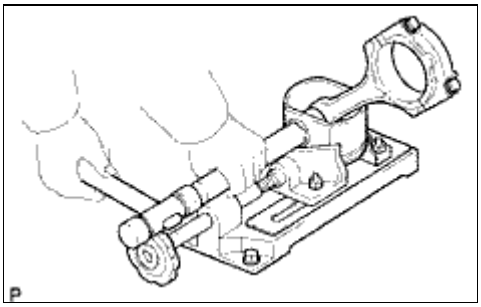


Text in Illustration

*a	Service Hole

(2) Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

(3) Using a brass bar and plastic-faced hammer, lightly tap out the piston pin and remove the connecting rod.



HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

75. CLEAN PISTON WITH PIN SUB-ASSEMBLY

(a) Using a gasket scraper, remove the carbon from the piston top.

(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.

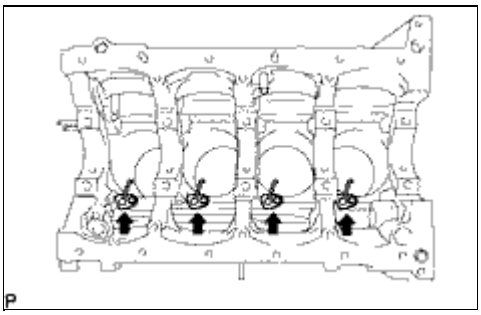
(c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.

76. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

(a) Using a 5 mm hexagon wrench, remove the No. 1 oil nozzle sub-assembly.



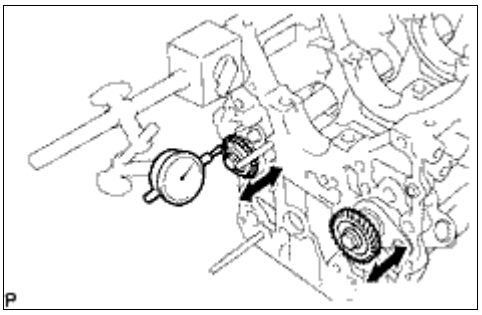
77. INSPECT BALANCESHAFT THRUST CLEARANCE

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(a) Using a dial indicator, measure the thrust clearance while moving the balanceshaft back and forth.

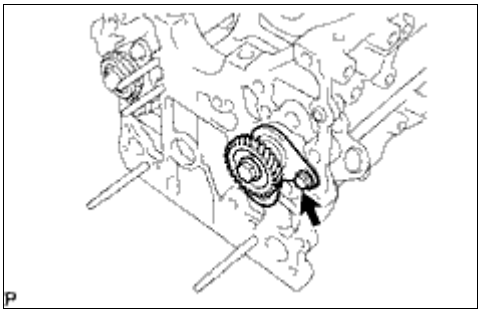
Standard thrust clearance:
0.07 to 0.13 mm (0.00276 to 0.00512 in.)
Maximum thrust clearance:
0.20 mm (0.00787 in.)

If the thrust clearance is more than the maximum, replace the balanceshaft thrust washer. If necessary, replace the balanceshaft.



78. REMOVE NO. 1 BALANCESHAFT

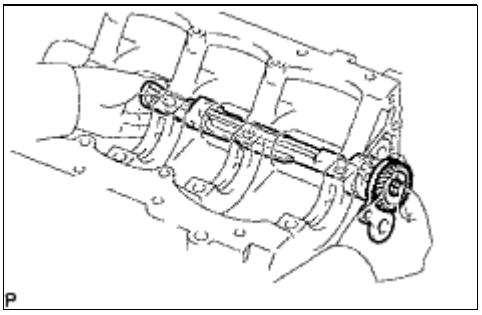
(a) Remove the bolt.



(b) Remove the balanceshaft from the cylinder block.

NOTICE:

When removing the balanceshaft, be sure to support the balanceshaft with both hands and avoid scratching the balanceshaft bearing on the cylinder block.

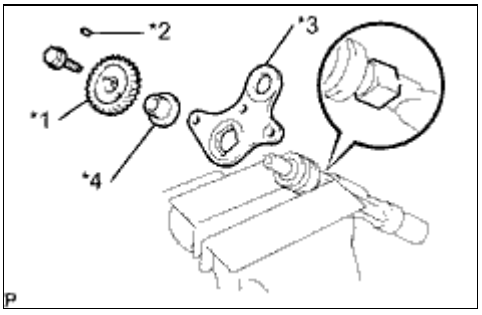


79. REMOVE NO. 1 BALANCESHAFT DRIVEN GEAR

(a) Mount the head portion of the balanceshaft in a vise.

NOTICE:

Do not damage the balanceshaft.



(b) Remove the bolt.

(c) Remove the No. 1 balanceshaft driven gear, sliding key, balanceshaft thrust washer and balanceshaft thrust spacer.

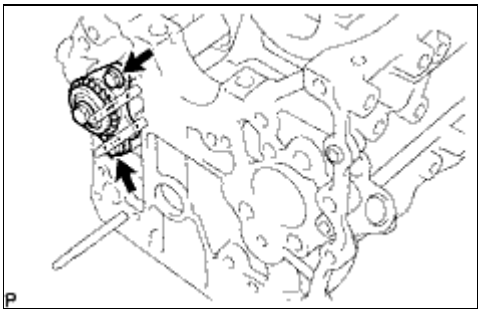
Text in Illustration

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*1	No. 1 Balanceshaft Driven Gear
*2	Sliding Key
*3	Balanceshaft Thrust Washer
*4	Balanceshaft Thrust Spacer

80. REMOVE NO. 2 BALANCESHAFT

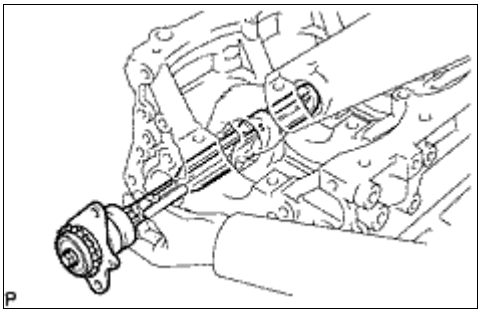
(a) Remove the 2 bolts.



(b) Remove the balanceshaft from the cylinder block.

NOTICE:

When removing the balanceshaft, be sure to support the balanceshaft with both hands and avoid scratching the balanceshaft bearing on the cylinder block.

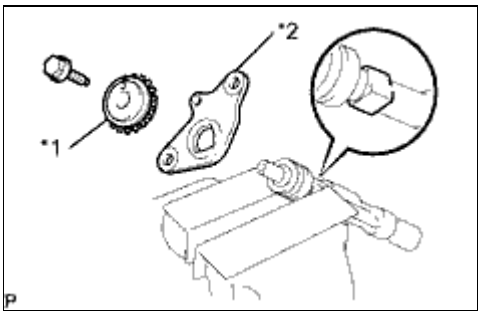


81. REMOVE NO. 2 BALANCESHAFT DRIVEN GEAR

(a) Mount the head portion of the balanceshaft in a vise.

NOTICE:

Do not damage the balanceshaft.



(b) Remove the bolt.

(c) Remove the No. 2 balanceshaft driven gear and No. 2 balanceshaft thrust washer.

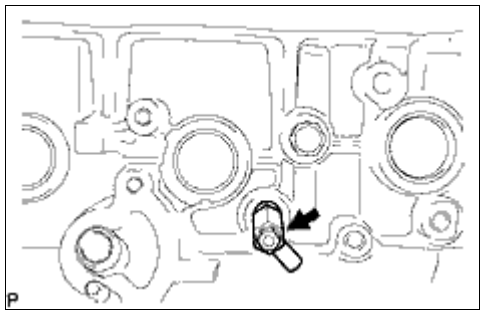
Text in Illustration

*1	No. 2 Balanceshaft Driven Gear
*2	No. 2 Balanceshaft Thrust Washer

82. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

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(a) Remove the cylinder block water drain cock sub-assembly from the cylinder block.



(b) Remove the water drain cock plug from the cylinder block water drain cock sub-assembly.

83. REMOVE STUD BOLT

NOTICE:

If a stud bolt is deformed or its threads are damaged, replace it.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000447K00UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: INSPECTION; 2016 MY Tacoma [08/2015 -]		

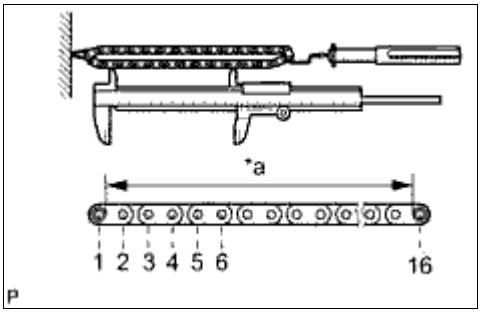
INSPECTION

HINT:

- Any digits beyond the 0.01 mm (1/1000 in.) place for standard, minimum and maximum values should be used as a reference only.
- When both standard and maximum or minimum values are listed for an inspection, use the standard value as a reference only and base any judgments on the maximum and minimum values.

1. INSPECT CHAIN SUB-ASSEMBLY

(a) Pull the chain sub-assembly with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.



(b) Using a vernier caliper, measure the length of 16 links.

Maximum chain elongation:
147.5 mm (5.81 in.)

Text in Illustration

*a	Measuring Area

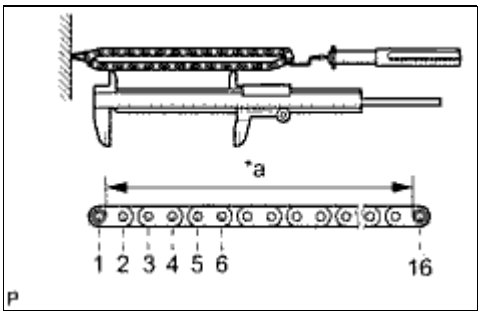
If the elongation is more than the maximum, replace the chain sub-assembly.

NOTICE:

Perform the measurement at 3 random places.

2. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

(a) Pull the No. 2 chain sub-assembly with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.



(b) Using a vernier caliper, measure the length of 16 links.

Maximum chain elongation:
123.6 mm (4.87 in.)

Text in Illustration

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*a	Measuring Area

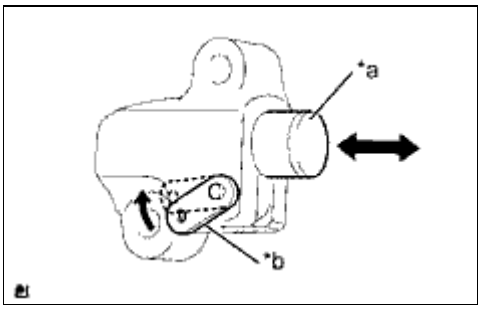
If the elongation is more than the maximum, replace the No. 2 chain sub-assembly.

NOTICE:

Perform the measurement at 3 random places.

3. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate upward to release the lock. Push the plunger and check that it moves smoothly.

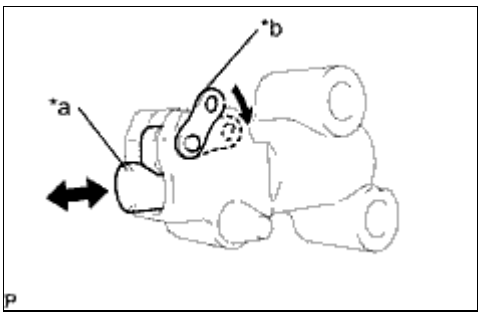


Text in Illustration

*a	Plunger
*b	Stopper Plate

4. INSPECT NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate downward to release the lock. Push the plunger and check that it moves smoothly.

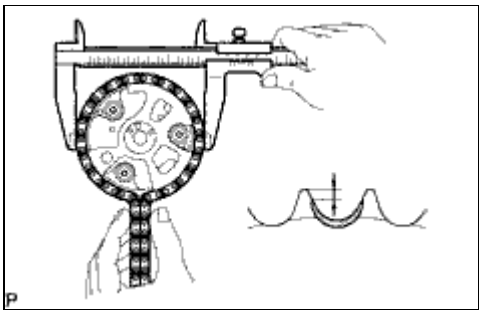


Text in Illustration

*a	Plunger
*b	Stopper Plate

5. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

(a) Measure the distance between the most worn out camshaft timing gear tip and the beginning of the worn area below the tip.



Minimum distance:

1.0 mm (0.0394 in.)

Text in Illustration

	Worn Area

If the distance is less than the minimum, replace the camshaft timing gear assembly.

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If the worn area is too small or difficult to distinguish from a normal area, perform the following 2 steps.

(b) Wrap the chain sub-assembly around the camshaft timing gear assembly.

(c) Using a vernier caliper, measure the sprocket diameter with the chain sub-assembly.

Minimum sprocket diameter (with chain):
113.8 mm (4.48 in.)

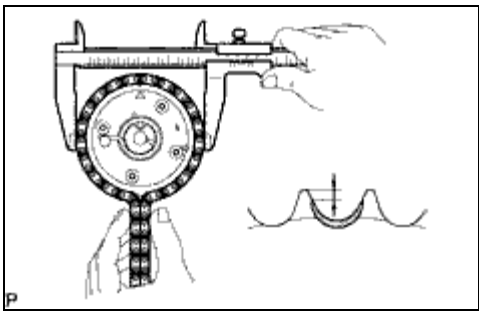
HINT:

The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain sub-assembly and camshaft timing gear assembly.

6. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

(a) Measure the distance between the most worn out camshaft timing gear tip and the beginning of the worn area below the tip.



Minimum distance:
1.0 mm (0.0394 in.)

Text in Illustration

	Worn Area

If the distance is less than the minimum, replace the camshaft timing exhaust gear assembly.

If the worn area is too small or difficult to distinguish from a normal area, perform the following 2 steps.

(b) Wrap the chain sub-assembly around the camshaft timing exhaust gear assembly.

(c) Using a vernier caliper, measure the sprocket diameter with the chain sub-assembly.

Minimum sprocket diameter (with chain):
113.8 mm (4.48 in.)

HINT:

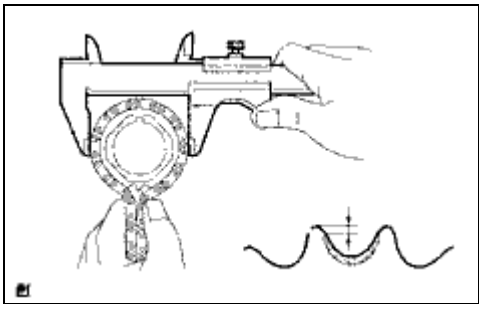
The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain sub-assembly and camshaft timing exhaust gear assembly.

7. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Measure the distance between the most worn out crankshaft timing gear or sprocket tip and the beginning of the worn area below the tip.

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Minimum distance:
1.0 mm (0.0394 in.)

Text in Illustration

	Worn Area

If the distance is less than the minimum, replace the crankshaft timing gear or sprocket.

If the worn area is too small or difficult to distinguish from a normal area, perform the following 2 steps.

(b) Wrap the chain sub-assembly around the crankshaft timing gear or sprocket.

(c) Using a vernier caliper, measure the sprocket diameter with the chain sub-assembly.

Minimum sprocket diameter (with chain):
59.4 mm (2.34 in.)

HINT:

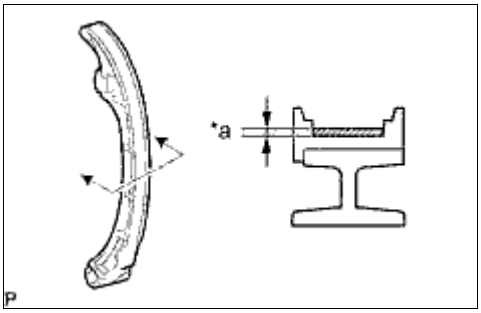
The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing gear or sprocket.

8. INSPECT CHAIN TENSIONER SLIPPER

(a) Using a vernier caliper, measure the chain tensioner slipper wear.

Maximum wear:
2.0 mm (0.0787 in.)



Text in Illustration

*a	Wear

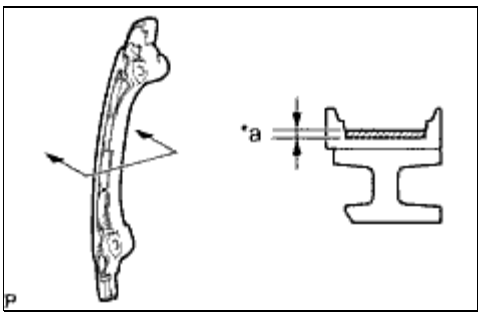
If the wear is more than the maximum, replace the chain tensioner slipper.

9. INSPECT NO. 1 CHAIN VIBRATION DAMPER

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(a) Using a vernier caliper, measure the No. 1 chain vibration damper wear.

Maximum wear:
2.0 mm (0.0787 in.)



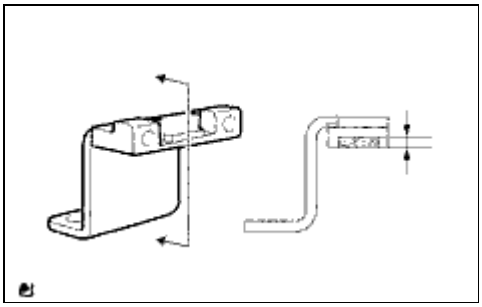
Text in Illustration

*a	Wear

If the wear is more than the maximum, replace the No. 1 chain vibration damper.

10. INSPECT TIMING CHAIN GUIDE

(a) Using a vernier caliper, measure the timing chain guide wear.



Maximum wear:
0.5 mm (0.0197 in.)

Text in Illustration

	Wear

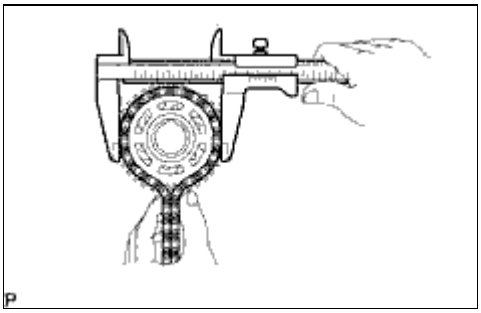
If the wear is more than the maximum, replace the timing chain guide.

11. INSPECT NO. 2 CRANKSHAFT TIMING SPROCKET

(a) Wrap the chain around the No. 2 crankshaft timing sprocket.

(b) Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain):
96.7 mm (3.81 in.)



HINT:

The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the No. 2 chain sub-assembly and No. 2 crankshaft timing sprocket.

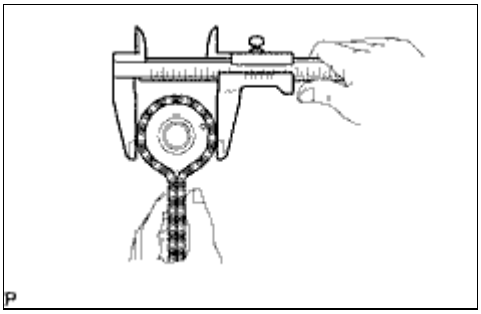
12. INSPECT BALANCESHAFT DRIVE GEAR SUB-ASSEMBLY

(a) Wrap the No. 2 chain sub-assembly around the balanceshaft drive gear sub-assembly.

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(b) Using a vernier caliper, measure the sprocket diameter with the No. 2 chain sub-assembly.

Minimum sprocket diameter (with chain):
75.9 mm (2.99 in.)



HINT:

The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the No. 2 chain sub-assembly and balanceshaft drive gear sub-assembly.

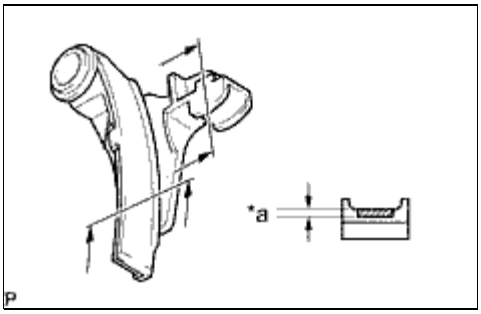
13. INSPECT NO. 2 CHAIN VIBRATION DAMPER

(a) Using a vernier caliper, measure the No. 2 chain vibration damper wear.

Maximum wear:
1.0 mm (0.0394 in.)

Text in Illustration

*a	Wear



If the wear is more than the maximum, replace the No. 2 chain vibration damper.

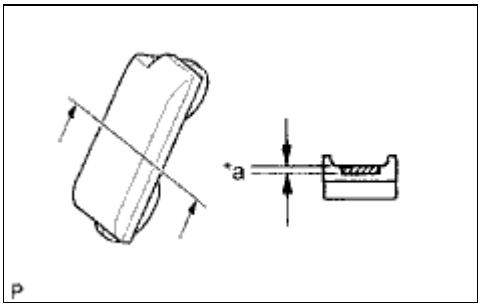
14. INSPECT NO. 3 CHAIN VIBRATION DAMPER

(a) Using a vernier caliper, measure the No. 3 chain vibration damper wear.

Maximum wear:
1.0 mm (0.0394 in.)

Text in Illustration

*a	Wear



If the wear is more than the maximum, replace the No. 3 chain vibration damper.

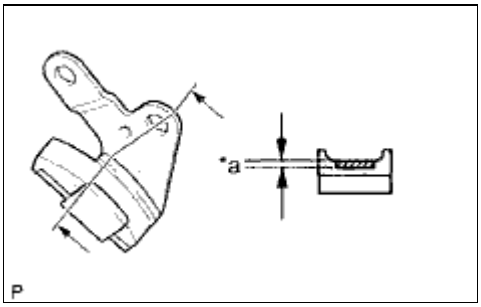
15. INSPECT NO. 4 CHAIN VIBRATION DAMPER

(a) Using a vernier caliper, measure the No. 4 chain vibration damper wear.

Maximum wear:
1.0 mm (0.0394 in.)

Text in Illustration

*a	Wear



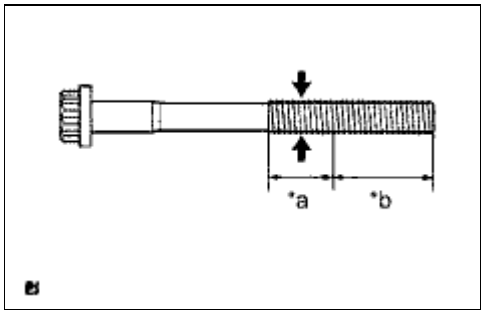
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If the wear is more than the maximum, replace the No. 4 chain vibration damper.

16. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the diameter of the most elongated threads in the measuring area.

Standard outside diameter:
10.76 to 10.97 mm (0.424 to 0.432 in.)
Minimum outside diameter:
10.40 mm (0.409 in.)
Distance:
30 mm (1.18 in.)



Text in Illustration

*a	Measuring area
*b	Distance

If a visual check reveals no excessively thin areas, check the center of the measuring area (see illustration) and find the area that has the smallest diameter.

If the diameter is less than the minimum, replace the cylinder head set bolt.

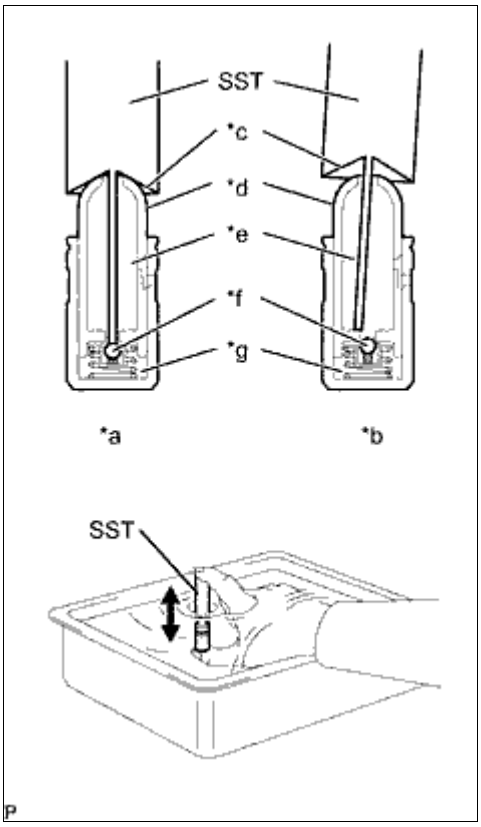
17. INSPECT VALVE LASH ADJUSTER ASSEMBLY

NOTICE:

- Keep the lash adjuster free from dirt and foreign objects.
- Only use clean engine oil.

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(a) Place the lash adjuster into a container full of new engine oil.



Text in Illustration

*a	Correct
*b	Incorrect
*c	Taper Part
*d	Plunger
*e	Low Pressure Chamber
*f	Check Ball
*g	High Pressure Chamber

(b) Insert the tip of SST into the lash adjuster plunger and use the tip to press down on the check ball inside the plunger.

SST: 09276-75010

(c) Squeeze SST and the lash adjuster together to move the plunger up and down 5 to 6 times.

(d) Check the movement of the plunger and bleed air.

OK:

Plunger moves up and down.

NOTICE:

When bleeding high-pressure air from the compression chamber, make sure that the tip of SST is actually pressing the check ball as shown in the illustration. If the check ball is not pressed, air will not bleed.

(e) After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

OK:

Plunger can be pressed 3 times.

If the plunger can still be compressed after pressing it 3 times, replace the valve lash adjuster with a new one.

18. INSPECT CAMSHAFT

(a) Check the camshaft runout.

(1) Place the camshaft on V-blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:
0.03 mm (0.00118 in.)

If the circle runout is more than the maximum, replace the camshaft.

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(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
42.855 to 42.955 mm (1.687 to 1.691 in.)
Minimum cam lobe height:
42.855 mm (1.687 in.)

If the cam lobe height is less than the minimum, replace the camshaft.

(c) Using a micrometer, measure the journal diameter.

Standard Journal Diameter:

ITEM	SPECIFIED CONDITION
No. 1 journal	35.949 to 35.965 mm (1.415 to 1.416 in.)
Other journal	26.959 to 26.975 mm (1.061 to 1.062 in.)

If the journal diameter is not as specified, check the oil clearance.

19. INSPECT NO. 2 CAMSHAFT

(a) Check the No. 2 camshaft runout.

(1) Place the No. 2 camshaft on V-blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:
0.03 mm (0.00118 in.)

If the circle runout is more than the maximum, replace the No. 2 camshaft.

(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
42.854 to 42.954 mm (1.687 to 1.691 in.)
Minimum cam lobe height:
42.854 mm (1.687 in.)

If the cam lobe height is less than the minimum, replace the No. 2 camshaft.

(c) Using a micrometer, measure the journal diameter.

Standard Journal Diameter:

ITEM	SPECIFIED CONDITION
No. 1 journal	35.949 to 35.965 mm (1.415 to 1.416 in.)
Other journal	26.959 to 26.975 mm (1.061 to 1.062 in.)

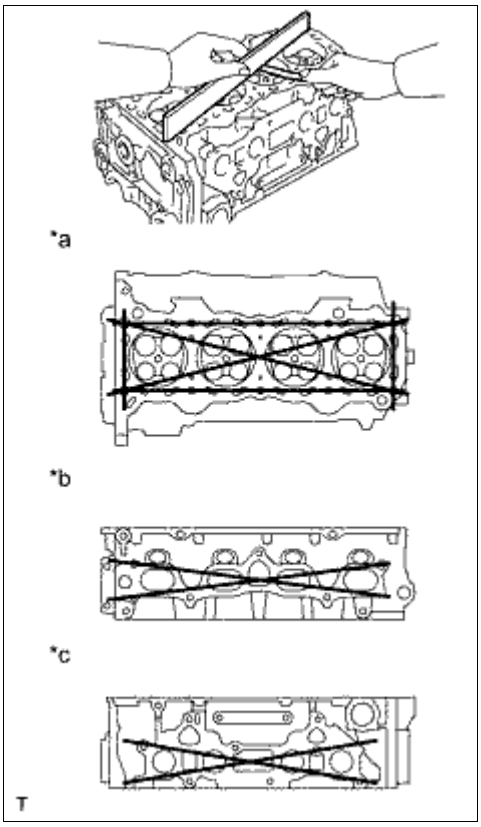
If the journal diameter is not as specified, check the oil clearance.

20. INSPECT CYLINDER HEAD SUB-ASSEMBLY

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(a) Using a precision straightedge and feeler gauge, measure the warpage of the surfaces that contact the cylinder block and manifolds.

Maximum warpage:
0.05 mm (0.00197 in.)



Text in Illustration

*a	Cylinder Head Lower Side
*b	Intake Manifold Side
*c	Exhaust Manifold Side

If the warpage is more than the maximum, replace the cylinder head sub-assembly.

(b) Using a dye penetrant, check the intake ports, exhaust ports and cylinder head surface for cracks.

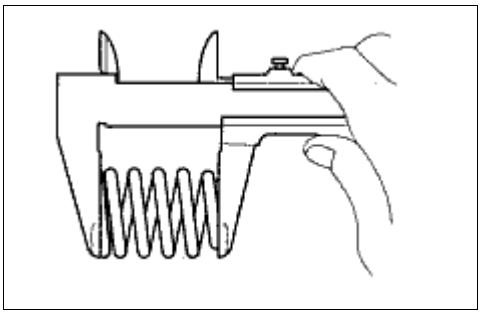
If cracked, replace the cylinder head sub-assembly.

21. INSPECT INNER COMPRESSION SPRING

(a) Using a vernier caliper, measure the free length of the inner compression spring.

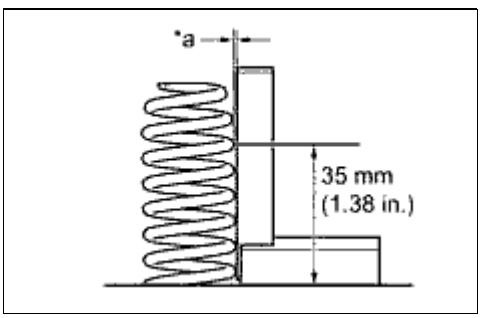
Standard free length:
52.13 mm (2.05 in.)

If the free length is not as specified, replace the inner compression spring.



(b) Using a steel square, measure the deviation of the inner compression spring at the position shown in the illustration.

Maximum deviation:
1.3 mm (0.0512 in.)
Maximum angle:
2°



Text in Illustration

*a	Deviation

If the deviation is more than the maximum, replace the inner

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compression spring.

22. INSPECT INTAKE VALVE

(a) Using a vernier caliper, measure the overall length of the valve.

Standard overall length:
106.26 mm (4.18 in.)
Minimum overall length:
105.96 mm (4.17 in.)

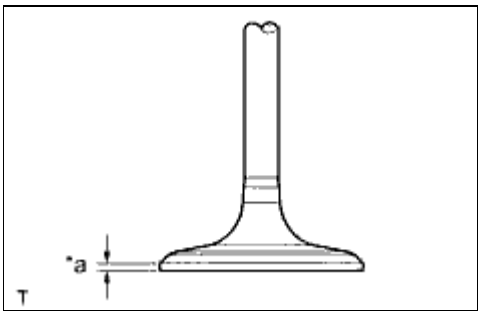
If the overall length is less than the minimum, replace the intake valve.

(b) Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:
5.470 to 5.485 mm (0.215 to 0.216 in.)

(c) Using a vernier caliper, measure the valve head margin thickness.

Standard margin thickness:
1.05 to 1.45 mm (0.0413 to 0.0571 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)



Text in Illustration

*a	Margin Thickness

If the margin thickness is less than the minimum, replace the intake valve.

23. INSPECT EXHAUST VALVE

(a) Using a vernier caliper, measure the overall length of the valve.

Standard overall length:
106.74 mm (4.20 in.)
Minimum overall length:
106.44 mm (4.19 in.)

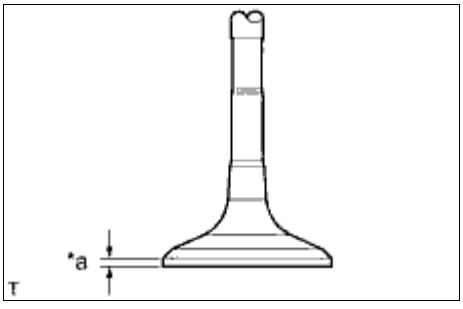
If the overall length is less than the minimum, replace the exhaust valve.

(b) Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:
5.465 to 5.480 mm (0.215 to 0.216 in.)

(c) Using a vernier caliper, measure the valve head margin thickness.

Standard margin thickness:
1.2 to 1.6 mm (0.0472 to 0.0630 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)



Text in Illustration

*a	Margin Thickness

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If the margin thickness is less than the minimum, replace the exhaust valve.

24. INSPECT VALVE SEAT

(a) Apply a light coat of Prussian blue to the valve face.

(b) Lightly press the valve face against the valve seat.

HINT:

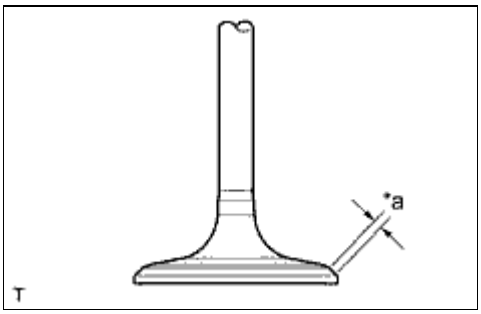
Do not rotate the valve while pressing the valve against the valve seat.

(c) Check the valve face and valve seat by using the following procedure.

(1) Check that Prussian blue appears around the entire valve face. If not, replace the valve.

(2) If Prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.

(3) Check that the valve seat contacts the middle of the valve face with the width between 1.1 and 1.5 mm (0.0433 and 0.0591 in.).

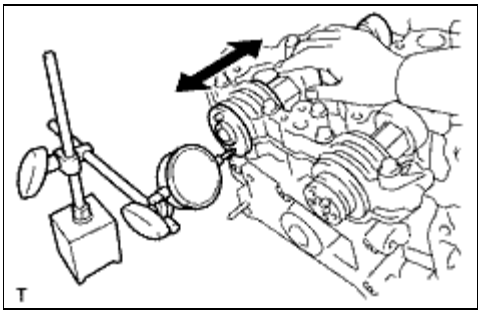


Text in Illustration

*a	Width

25. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts INFO .



(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.10 to 0.24 mm (0.00394 to 0.00945 in.)
Maximum thrust clearance:
0.26 mm (0.0102 in.)

If the thrust clearance is more than the maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.

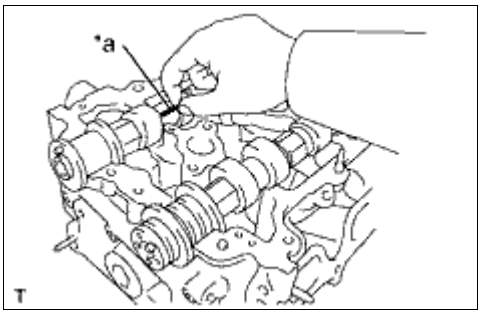
26. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

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(c) Lay a strip of Plastigage across each of the camshaft journals.



Text in Illustration

*a	Plastigage

(d) Install the bearing caps INFO .

NOTICE:

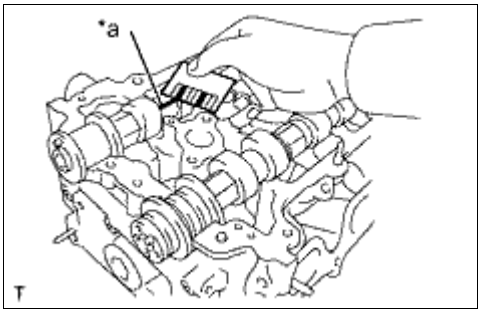
Do not turn the camshafts.

(e) Remove the bearing caps INFO .

(f) Measure the Plastigage at its widest point.

Standard Oil Clearance:

ITEM	SPECIFIED CONDITION
No. 1 journal	0.035 to 0.072 mm (0.00138 to 0.00283 in.)
Other journals	0.025 to 0.062 mm (0.000984 to 0.00244 in.)



Maximum oil clearance:
0.08 mm (0.00315 in.)

Text in Illustration

*a	Plastigage

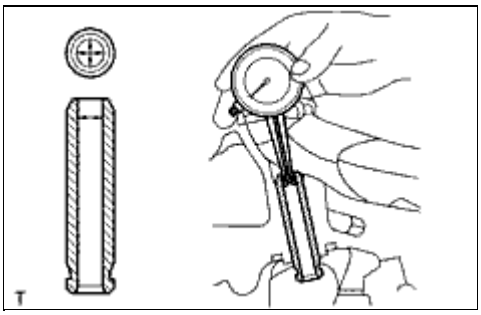
If the oil clearance is more than the maximum, replace the camshaft. If necessary, replace the cylinder head sub-assembly.

(g) Completely remove the Plastigage.

27. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:
5.51 to 5.53 mm (0.217 to 0.218 in.)



(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard Oil Clearance:

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ITEM	SPECIFIED CONDITION
Intake	0.025 to 0.060 mm (0.000984 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

Maximum Oil Clearance:

ITEM	SPECIFIED CONDITION
Intake	0.08 mm (0.00315 in.)
Exhaust	0.10 mm (0.00397 in.)

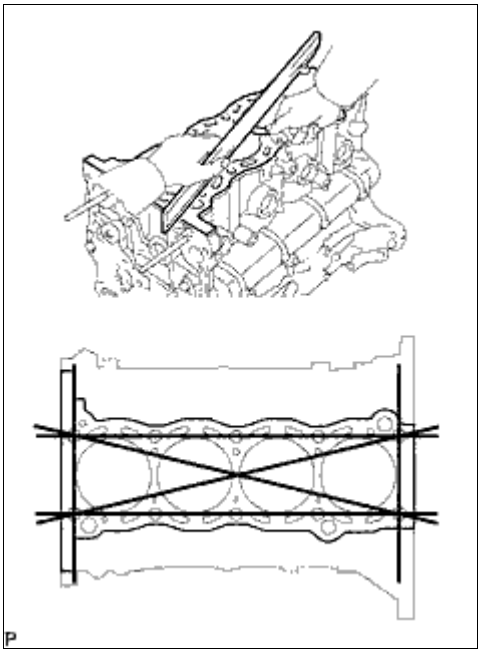
If the clearance is more than the maximum, replace the valve and valve guide bush.

28. INSPECT CYLINDER BLOCK FOR WARPAGE

(a) Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head gasket.

Maximum warpage:
0.05 mm (0.00197 in.)

If the warpage is more than the maximum, replace the cylinder block.



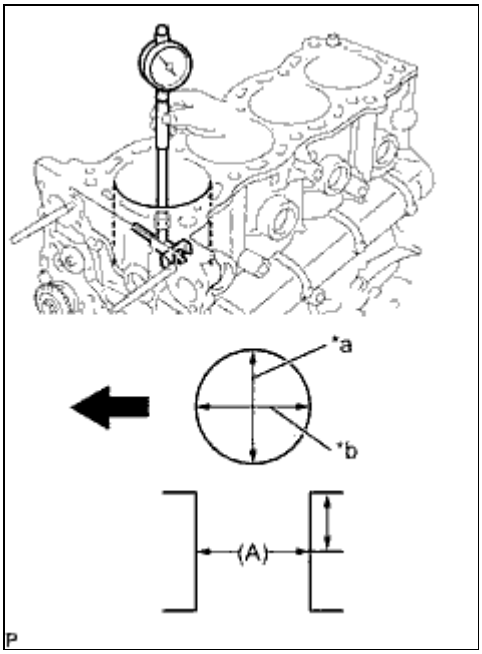
(b) Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all 4 cylinders. If necessary, replace the cylinder block.

29. INSPECT CYLINDER BORE

(a) Using a cylinder gauge, measure the cylinder bore diameter at position A in the thrust and axial directions.

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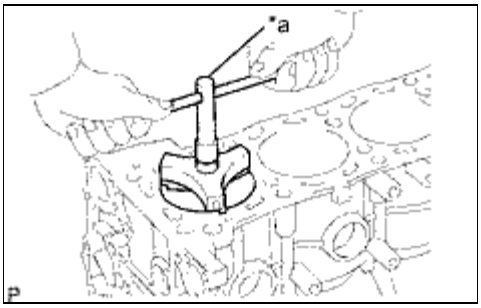
Reference value (new parts):
94.990 to 95.003 mm (3.7398 to 3.7403 in.)
Maximum difference in diameter:
0.2 mm (0.00787 in.)
Measurement position:
70 mm (2.76 in.)

Text in Illustration

*a	Thrust Direction
*b	Axial Direction
➡	Front

If the diameter is more than the maximum, rebore all 4 cylinders. If necessary, replace the cylinder block.

(b) Inspect the cylinder ridge.



Text in Illustration

*a	Ridge Reamer

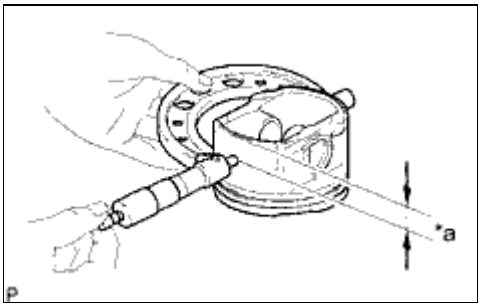
If the wear is less than 0.2 mm (0.00787 in.), using a ridge reamer, grind the top of the cylinder.

30. INSPECT PISTON DIAMETER

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(a) Using a micrometer, measure the piston diameter at right angles to the piston center line where the distance from the piston end is as specified.

Distance:
13.8 mm (0.543 in.)
Reference value (new parts):
94.955 to 94.965 mm (3.7384 to 3.7388 in.)



Text in Illustration

*a	Distance

31. INSPECT PISTON OIL CLEARANCE

(a) Measure the cylinder bore diameter in the thrust direction.

(b) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Reference value (new parts):
0.025 to 0.048 mm (0.000984 to 0.00189 in.)

If the oil clearance is more than the standard, replace all the pistons and rebore all the cylinders. If necessary, replace the cylinder block.

32. INSPECT RING GROOVE CLEARANCE

(a) Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

Standard Ring Groove Clearance:

ITEM	SPECIFIED CONDITION
No. 1 compression ring	0.02 to 0.07 mm (0.000787 to 0.00276 in.)
No. 2 compression ring	0.02 to 0.06 mm (0.000787 to 0.00236 in.)
Oil ring	0.06 to 0.12 mm (0.00236 to 0.00472 in.)

If the groove clearance is not as specified, replace the piston with pin.

33. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.

(c) Using a feeler gauge, measure the end gap.

Standard End Gap:

ITEM	SPECIFIED CONDITION
No. 1 compression ring	0.30 to 0.35 mm (0.0118 to 0.0138 in.)
No. 2 compression ring	0.59 to 0.71 mm (0.0232 to 0.0280 in.)
Oil ring	0.10 to 0.35 mm (0.00394 to 0.0138 in.)

Maximum End Gap:

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ITEM	SPECIFIED CONDITION
No. 1 compression ring	0.90 mm (0.0354 in.)
No. 2 compression ring	1.36 mm (0.0535 in.)
Oil ring	0.75 mm (0.0295 in.)

If the end gap is more than the maximum, replace the piston ring. If the end gap is less than the standard, even with a new piston ring, rebore all 4 cylinders or replace the cylinder block.

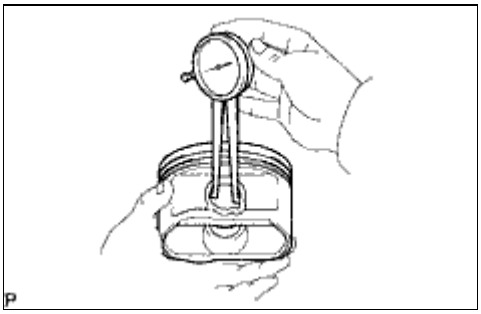
34. INSPECT PISTON PIN OIL CLEARANCE

HINT:

There is only 1 type supply part for piston with pin.

(a) Using a caliper gauge, measure the inside diameter of the piston pin hole.

Standard piston pin hole inside diameter:
22.001 to 22.010 mm (0.866 to 0.867 in.)

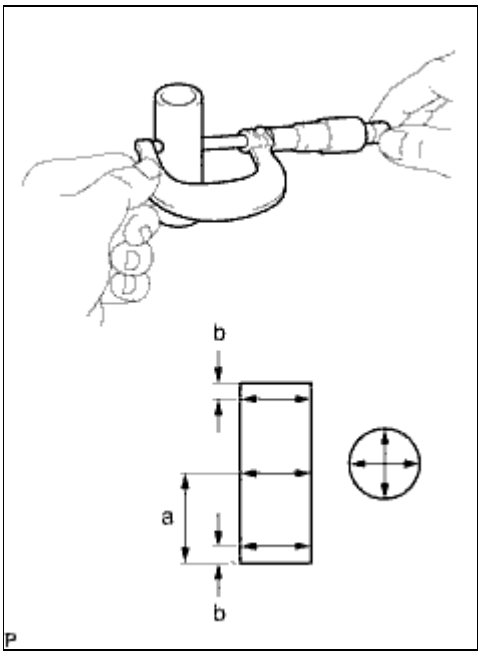


(b) Using a micrometer, measure the piston pin diameter.

Measurement Position:

MEASUREMENT POSITION	PISTON PIN POSITION
a	31 mm (1.22 in.)
b	6 mm (0.24 in.)

Standard piston pin diameter:
21.997 to 22.009 mm (0.8660 to 0.8665 in.)



(c) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:
0.001 to 0.007 mm (0.0000394 to 0.000276 in.)
Maximum oil clearance:
0.010 mm (0.000394 in.)

If the oil clearance is more than the maximum, replace the piston and piston pin as a set.

(d) Using a caliper gauge, measure the inside diameter of the connecting rod bush.

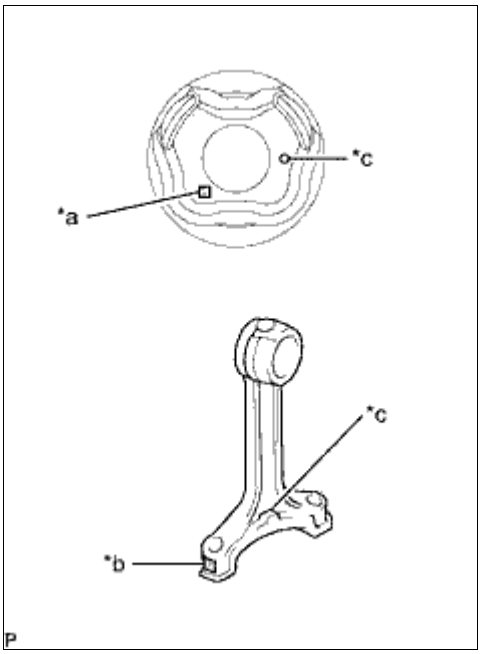
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Standard bush inside diameter:
22.005 to 22.014 mm (0.866 to 0.867 in.)

If the diameter is not as specified, replace the connecting rod small end bush.

(e) Subtract the piston pin diameter measurement from the bush inside diameter measurement.

Standard oil clearance:
0.005 to 0.011 mm (0.000197 to 0.000433 in.)
Maximum oil clearance:
0.025 mm (0.000984 in.)



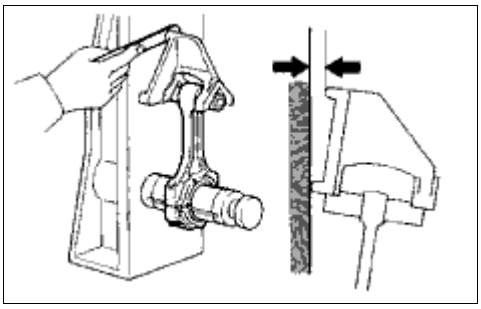
Text in Illustration

*a	Piston Pin Hole Inside Diameter Mark
*b	Connecting Rod Bushing Inside Diameter Mark
*c	Front Mark

If the oil clearance is more than the maximum, replace the connecting rod small end bush. If necessary, replace the connecting rod and piston pin as a set.

35. INSPECT CONNECTING ROD SUB-ASSEMBLY

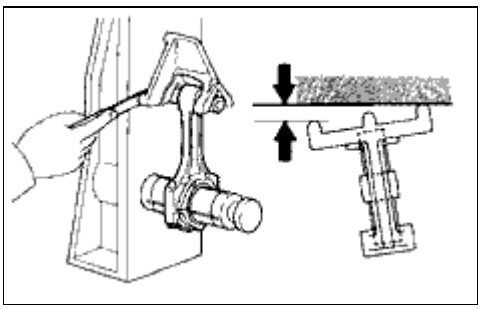
(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.



(1) Check for bend.

Maximum bend:
0.05 mm (0.00197 in.) per 100 mm (3.94 in.)

If the bend is more than the maximum, replace the connecting rod sub-assembly.



(2) Check for twist.

Maximum twist:
0.15 mm (0.00591 in.) per 100 mm (3.94 in.)

If the twist is more than the maximum, replace the connecting rod sub-assembly.

36. INSPECT CRANKSHAFT

(a) Inspect the circle runout.

(1) Place the crankshaft on V-blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

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Maximum circle runout:
0.03 mm (0.00118 in.)

If the circle runout is more than the maximum, replace the crankshaft.

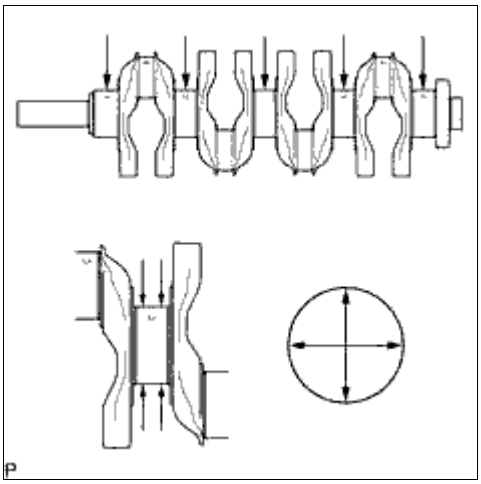
(b) Inspect the main journals.

(1) Using a micrometer, measure the diameter of each main journal.

Standard Journal Diameter:

ITEM	SPECIFIED CONDITION
No. 3 journal	59.981 to 59.994 mm (2.361 to 2.362 in.)
Except No. 3 journal	59.987 to 60.000 mm (2.3617 to 2.3622 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.



(2) Check each main journal for taper and out-of- round as shown in the illustration.

Maximum taper and out-of-round:
0.005 mm (0.000197 in.)

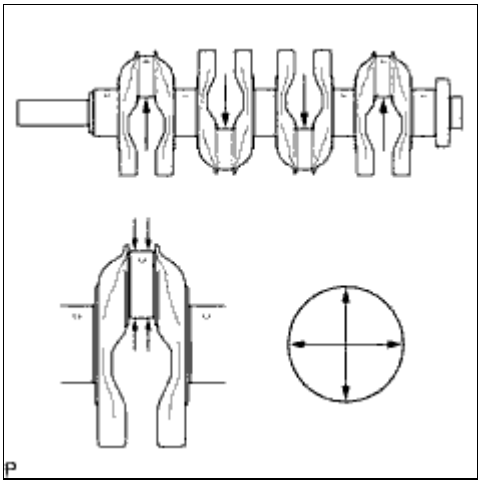
If the taper and out-of-round is more than the maximum, replace the crankshaft.

(c) Inspect the crank pin.

(1) Using a micrometer, measure the diameter of each crank pin.

Standard diameter:
52.989 to 53.002 mm (2.086 to 2.087 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.



(2) Check each crank pin for taper and out-of-round as shown in the illustration.

Maximum taper and out-of-round:
0.003 mm (0.000118 in.)

If the taper and out-of-round is more than the maximum, replace the crankshaft.

37. INSPECT CRANKSHAFT OIL CLEARANCE

HINT:

- Keep the lower bearings and crankshaft bearing caps together.
- Arrange the thrust washers in the correct order.

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- Keep the upper crankshaft bearings and upper thrust washers together with the cylinder block.

(a) Clean each main journal and bearing.

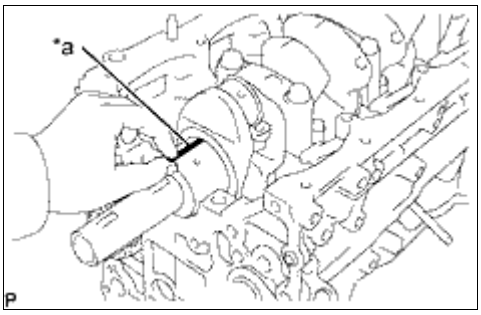
(b) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearing.

(c) Install the crankshaft bearings and upper crankshaft thrust washers.

(d) Place the crankshaft on the cylinder block.

(e) Lay a strip of Plastigage across each journal.



Text in Illustration

*a	Plastigage

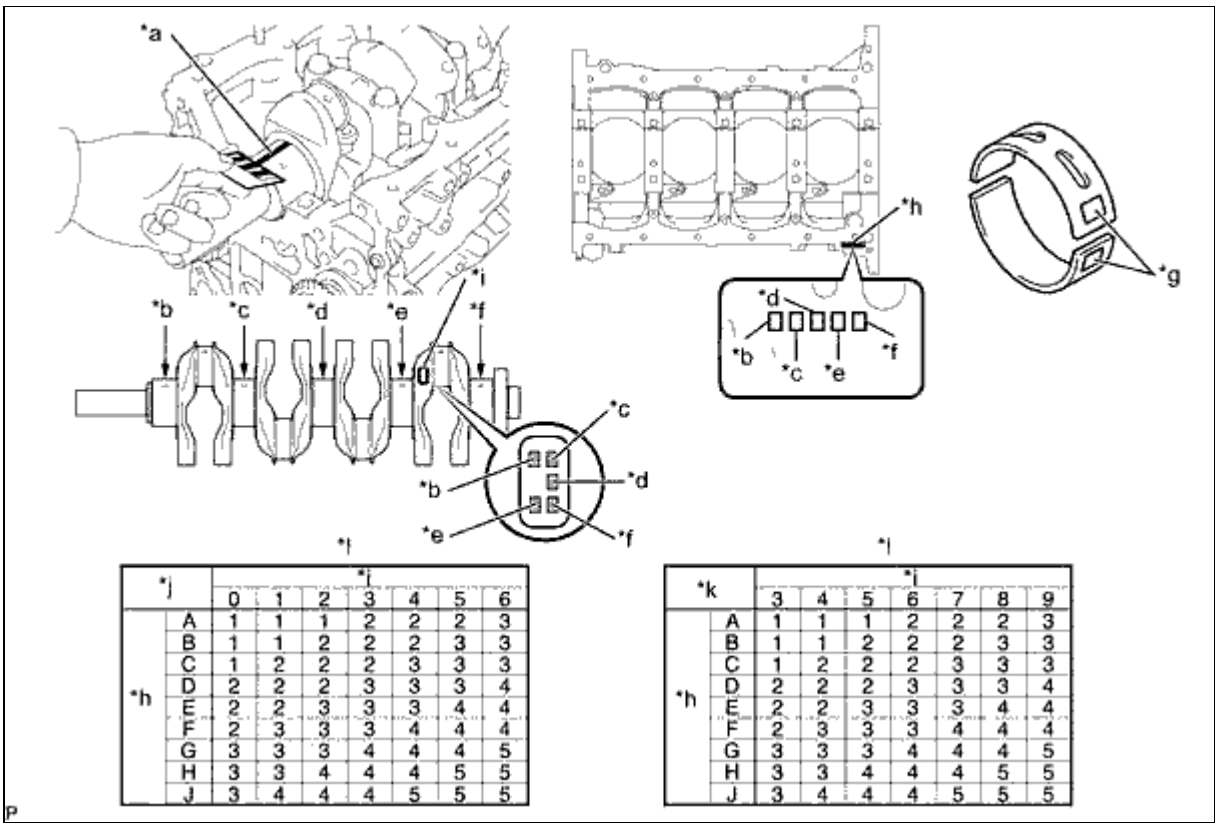
(f) Install the 5 crankshaft bearing caps with the 10 bolts INFO .

NOTICE:

Do not turn the crankshaft.

(g) Remove the 10 bolts and 5 crankshaft bearing caps INFO .

(h) Measure the Plastigage at its widest point.



*j	*i						
*h	0	1	2	3	4	5	6
A	1	1	1	2	2	2	3
B	1	1	2	2	2	3	3
C	1	2	2	2	3	3	3
D	2	2	2	3	3	3	4
E	2	2	3	3	3	4	4
F	2	3	3	3	4	4	4
G	3	3	3	4	4	4	5
H	3	3	4	4	4	5	5
J	3	4	4	4	5	5	5

*k	*i						
*h	3	4	5	6	7	8	9
A	1	1	1	2	2	2	3
B	1	1	2	2	2	3	3
C	1	2	2	2	3	3	3
D	2	2	2	3	3	3	4
E	2	2	3	3	3	4	4
F	2	3	3	3	4	4	4
G	3	3	3	4	4	4	5
H	3	3	4	4	4	5	5
J	3	4	4	4	5	5	5

Text in Illustration

*a	Plastigage	*b	No. 1 Journal

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*c	No. 2 Journal	*d	No. 3 Journal
*e	No. 4 Journal	*f	No. 5 Journal
*g	Crankshaft Bearing Code	*h	Cylinder Block Journal Code
*i	Crankshaft Journal Code	*j	#1J, #2J, #4J, #5J
*k	#3J	*l	Bearing Code Chart

Standard Oil Clearance:

ITEM	SPECIFIED CONDITION
No. 3 journal	0.030 to 0.044 mm (0.00118 to 0.00173 in.)
Other journal	0.024 to 0.038 mm (0.000945 to 0.00150 in.)

Maximum oil clearance:
0.10 mm (0.0039 in.)

If the oil clearance is more than the maximum, replace the crankshaft bearing.

If replacing the cylinder block, measure the bearing standard clearance.

Check the cylinder block journal code and crankshaft journal code and refer to the crankshaft bearing selection chart to select a bearing size.

(Example) (Excluding No. 3 journal): When the cylinder block journal code is "D" and the crankshaft journal code is "4", select crankshaft bearing selection code "3" from the crankshaft bearing selection chart.

Cylinder Block Main Journal Bore Diameter:

ITEM	SPECIFIED CONDITION
Mark A	64.004 to 64.006 mm (2.51984 to 2.51992 in.)
Mark B	64.007 to 64.008 mm (2.51996 to 2.51999 in.)
Mark C	64.009 to 64.010 mm (2.52003 to 2.52007 in.)
Mark D	64.011 to 64.012 mm (2.52011 to 2.52015 in.)
Mark E	64.013 to 64.014 mm (2.52019 to 2.52023 in.)
Mark F	64.015 to 64.016 mm (2.52027 to 2.52031 in.)
Mark G	64.017 to 64.018 mm (2.52035 to 2.52039 in.)
Mark H	64.019 to 64.020 mm (2.52043 to 2.52047 in.)
Mark J	64.021 to 64.022 mm (2.52051 to 2.52055 in.)

Crankshaft Journal Bore Diameter:

ITEM	SPECIFIED CONDITION (OTHER JOURNAL)	SPECIFIED CONDITION (NO. 3 JOURNAL)
Mark 0	59.999 to 60.000 mm (2.36216 to 2.36220 in.)	-
Mark 1	59.997 to 59.998 mm (2.36208 to 2.36212 in.)	-
Mark 2	59.995 to 59.996 mm (2.36200 to 2.36204 in.)	-
Mark 3	59.993 to 59.994 mm (2.36192 to 2.36196 in.)	59.993 to 59.994 mm (2.36192 to 2.36196 in.)

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ITEM	SPECIFIED CONDITION (OTHER JOURNAL)	SPECIFIED CONDITION (NO. 3 JOURNAL)
Mark 4	59.991 to 59.992 mm (2.36185 to 2.36189 in.)	59.991 to 59.992 mm (2.36185 to 2.36189 in.)
Mark 5	59.989 to 59.990 mm (2.36177 to 2.36181 in.)	59.989 to 59.990 mm (2.36177 to 2.36181 in.)
Mark 6	59.987 to 59.988 mm (2.36169 to 2.36173 in.)	59.987 to 59.988 mm (2.36169 to 2.36173 in.)
Mark 7	-	59.985 to 59.986 mm (2.36161 to 2.36165 in.)
Mark 8	-	59.983 to 59.984 mm (2.36153 to 2.36157 in.)
Mark 9	-	59.981 to 59.982 mm (2.36145 to 2.36149 in.)

Standard Bearing Center Wall Thickness:

ITEM	SPECIFIED CONDITION
Mark 1	1.987 to 1.990 mm (0.07823 to 0.07835 in.)
Mark 2	1.991 to 1.993 mm (0.07839 to 0.07846 in.)
Mark 3	1.994 to 1.996 mm (0.07850 to 0.07858 in.)
Mark 4	1.997 to 1.999 mm (0.07862 to 0.07870 in.)
Mark 5	2.000 to 2.002 mm (0.07874 to 0.07882 in.)

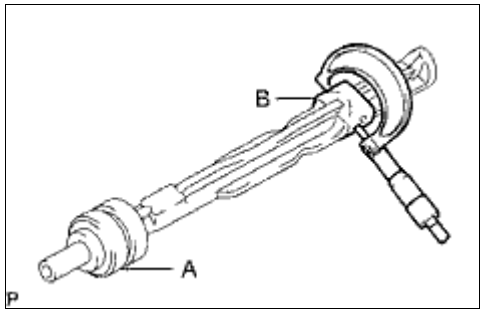
(i) Completely remove the Plastigage.

(j) Perform the inspection above for each journal.

38. INSPECT NO. 1 BALANCESHAFT

(a) Inspect the diameter of the journal.

(1) Using a micrometer, measure the diameter of the balanceshaft main journals.

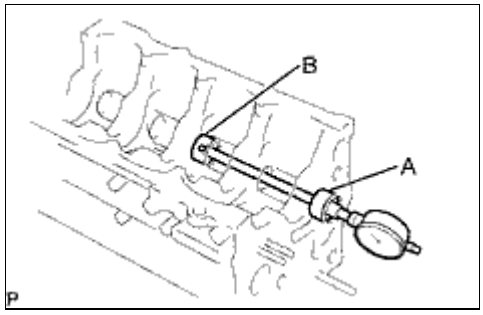


Standard Main Journal Diameter:

ITEM	SPECIFIED CONDITION
A	37.969 to 37.985 mm (1.49 to 1.50 in.)
B	37.449 to 37.465 mm (1.474 to 1.475 in.)

(b) Inspect the diameter of the bearing.

(1) Using a cylinder gauge, measure the inside diameter of the balanceshaft bearing.



Standard Bearing Inside Diameter:

ITEM	SPECIFIED CONDITION
A	38.025 to 38.045 mm (1.497 to 1.498 in.)
B	37.525 to 37.545 mm (1.477 to 1.478 in.)

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(c) Inspect the oil clearance.

(1) Subtract the balanceshaft main journal diameter measurement from the balanceshaft bearing inside diameter measurement.

Standard Oil Clearance:

ITEM	SPECIFIED CONDITION
A	0.040 to 0.076 mm (0.00157 to 0.00299 in.)
B	0.060 to 0.096 mm (0.00236 to 0.00378 in.)

Maximum oil clearance:
0.15 mm (0.00591 in.)

If the oil clearance is more than the maximum, replace the cylinder block and balanceshaft.

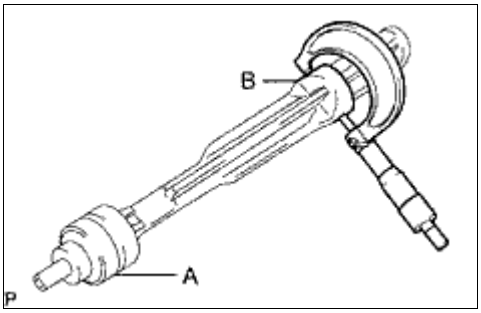
39. INSPECT NO. 2 BALANCESHAFT

(a) Inspect the diameter of the journal.

(1) Using a micrometer, measure the diameter of the balanceshaft main journals.

Standard Main Journal Diameter:

ITEM	SPECIFIED CONDITION
A	37.969 to 37.985 mm (1.49 to 1.50 in.)
B	37.449 to 37.465 mm (1.474 to 1.475 in.)

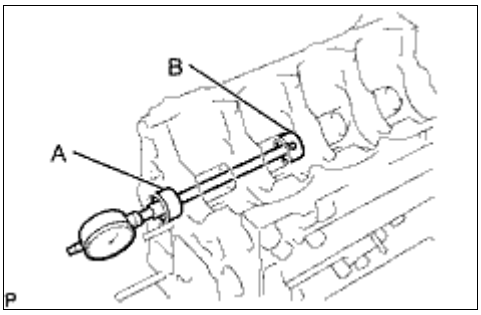


(b) Inspect the diameter of the bearing.

(1) Using a cylinder gauge, measure the inside diameter of the balanceshaft bearing.

Standard Bearing Inside Diameter:

ITEM	SPECIFIED CONDITION
A	38.025 to 38.045 mm (1.497 to 1.498 in.)
B	37.525 to 37.545 mm (1.477 to 1.478 in.)



(c) Inspect the oil clearance.

(1) Subtract the balanceshaft main journal diameter measurement from the balanceshaft bearing inside diameter measurement.

Standard Oil Clearance:

ITEM	SPECIFIED CONDITION
A	0.040 to 0.076 mm (0.00157 to 0.00299 in.)
B	0.060 to 0.096 mm (0.00236 to 0.00378 in.)

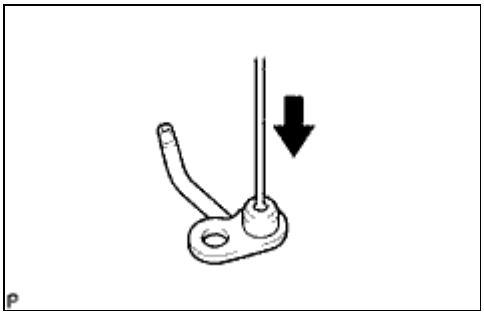
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Maximum oil clearance:
0.15 mm (0.00591 in.)

If the oil clearance is more than the maximum, replace the cylinder block and balanceshaft.

40. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY

(a) Push the check valve with a pin to check if it is stuck.



Text in Illustration

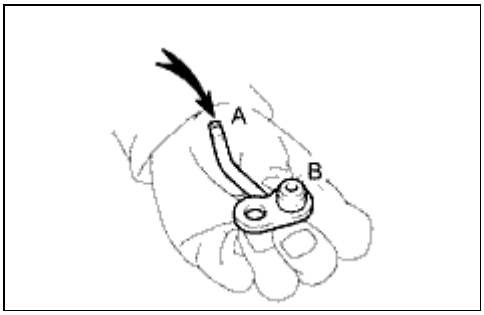
➡	Push

If the check valve is stuck, replace the No. 1 oil nozzle sub-assembly.

(b) Push the check valve with a pin to check if it moves smoothly.

If the check valve does not move smoothly, clean or replace the No. 1 oil nozzle sub-assembly.

(c) Apply air into A. Check that air does not leak through B.

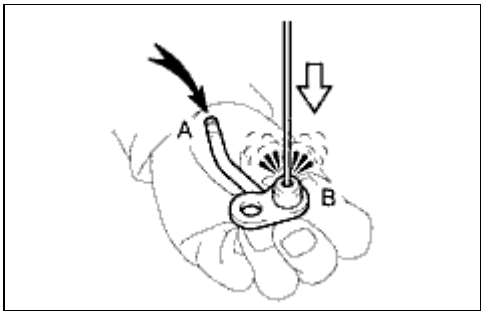


Text in Illustration

➡	Air

If air leaks, clean or replace the No. 1 oil nozzle sub-assembly.

(d) Push the check valve while applying air into A. Check that air passes through B.



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Text in Illustration

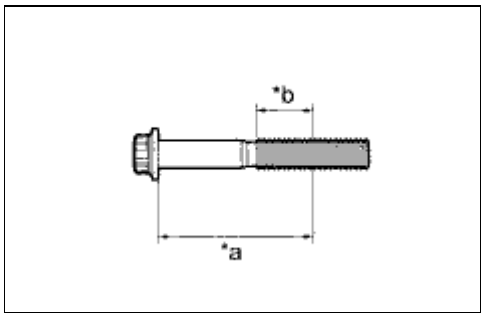
➡	Air
⇨	Push

If air does not pass through B, clean or replace the No. 1 oil nozzle sub-assembly.

41. INSPECT CRANKSHAFT BEARING CAP SET BOLT

(a) Using a vernier caliper, measure the diameter of the most elongated threads in the measuring area.

Distance:
64 mm (2.52 in.)
Standard diameter:
10.76 to 10.97 mm (0.424 to 0.432 in.)
Minimum diameter:
10.66 mm (0.420 in.)



Text in Illustration

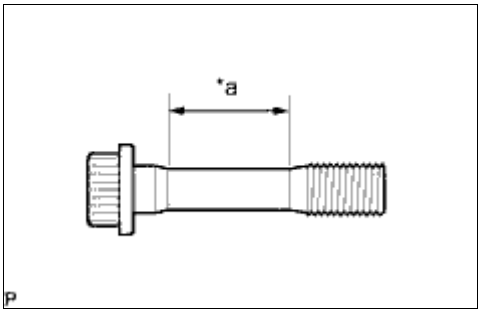
*a	Distance
*b	Measuring Area

If the diameter is less than the minimum, replace the crankshaft bearing cap set bolt.

42. INSPECT CONNECTING ROD BOLT

(a) Using a vernier caliper, measure the tension portion diameter of the bolt.

Standard diameter:
7.2 to 7.3 mm (0.283 to 0.287 in.)
Minimum diameter:
7.0 mm (0.276 in.)



Text in Illustration

*a	Tension Portion

If the diameter is less than the minimum, replace the connecting rod bolt.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000125B05ZX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: REASSEMBLY; 2016 MY Tacoma [08/2015 -]		

REASSEMBLY

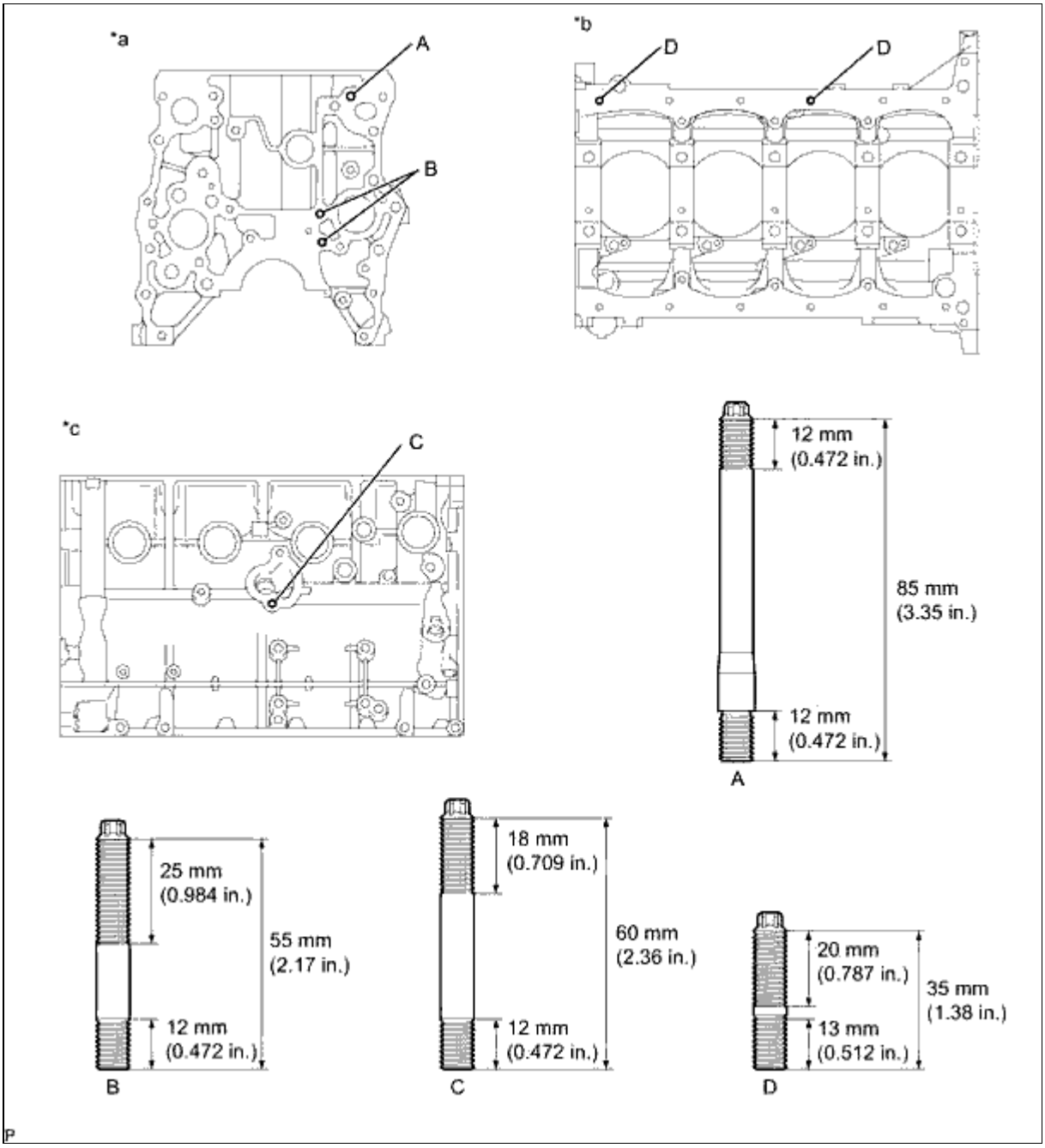
HINT:

Perform "Inspection After Repairs" after replacing the piston sub-assembly or piston ring INFO .

1. INSTALL STUD BOLT

NOTICE:

If a stud bolt is deformed or its threads are damaged, replace it.



Text in Illustration

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*a	Front Side	*b	Lower Side
*c	Exhaust Side	-	-

(a) Using an E8 "TORX" socket wrench, install the stud bolt labeled A.

Torque:

7.5 N·m {76 kgf·cm, 66in·lbf}

(b) Using an E7 "TORX" socket wrench, install the stud bolts labeled B and D.

Torque:

7.5 N·m {76 kgf·cm, 66in·lbf}

(c) Apply adhesive to the hole for the stud bolt labeled C in the cylinder block. Using an E7 "TORX" socket wrench, install the stud bolt labeled C.

Torque:

7.5 N·m {76 kgf·cm, 66in·lbf}

HINT:

When reusing a stud bolt, apply adhesive to the bolt before installing it.

Adhesive:
Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

2. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

(a) Apply adhesive to the drain cock.

Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

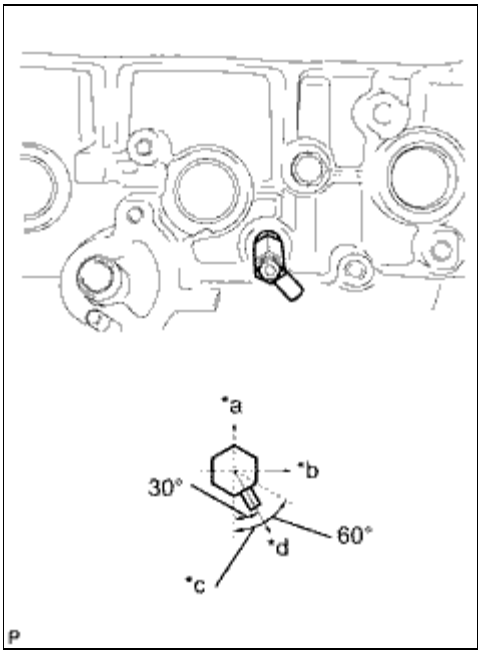
(b) Install the cylinder block water drain cock as shown in the illustration.

Torque:

25 N·m {250 kgf·cm, 18ft·lbf}

Text in Illustration

*a	Upper Side
*b	Front
*c	Allowable Range
*d	Target Direction



NOTICE:

- Do not rotate the drain cock more than 1 revolution (360°) after tightening the drain cock to the specified torque.
- Do not loosen the drain cock to adjust it. If an adjustment is necessary, remove the drain cock and reinstall it.

(c) Install the water drain cock plug to the water drain cock sub-assembly.

Torque:

13 N·m {130 kgf·cm, 9ft·lbf}

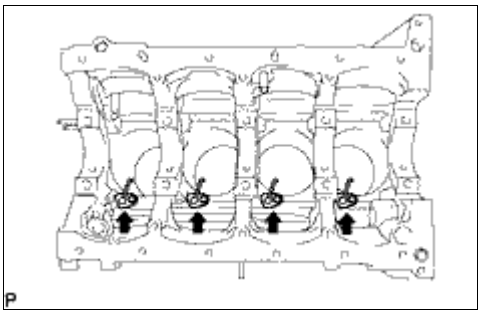
3. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

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(a) Using a 5 mm hexagon wrench, install the No. 1 oil nozzle sub-assembly.

Torque:

7.0 N·m {71 kgf·cm, 62in·lbf}



4. INSTALL NO. 2 BALANCESHAFT DRIVEN GEAR

(a) Mount the head portion of the balanceshaft in a vise.

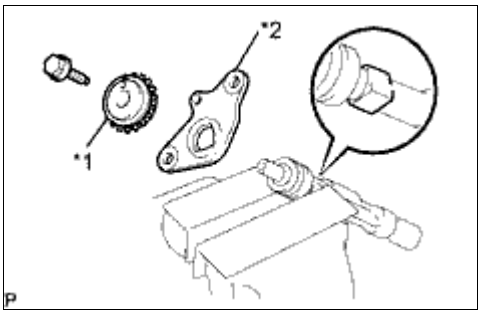
NOTICE:

Do not damage the balanceshaft.

(b) Install the No. 2 balanceshaft thrust washer and No. 2 balanceshaft driven gear.

Text in Illustration

*1	No. 2 Balanceshaft Driven Gear
*2	No. 2 Balanceshaft Thrust Washer



(c) Install the bolt.

Torque:

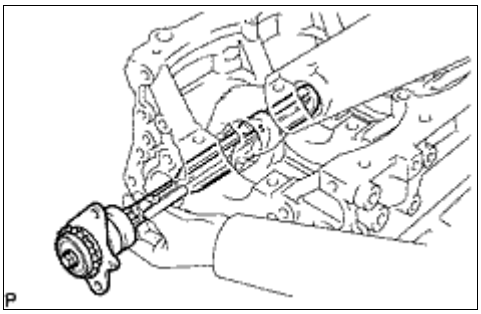
36 N·m {367 kgf·cm, 27ft·lbf}

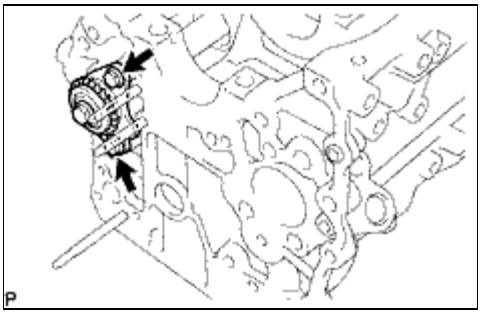
5. INSTALL NO. 2 BALANCESHAFT

(a) Install the balanceshaft to the cylinder block.

NOTICE:

When installing the balanceshaft, be sure to support the balanceshaft with both hands and avoid scratching the balanceshaft bearing on the cylinder block.





(b) Install the 2 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

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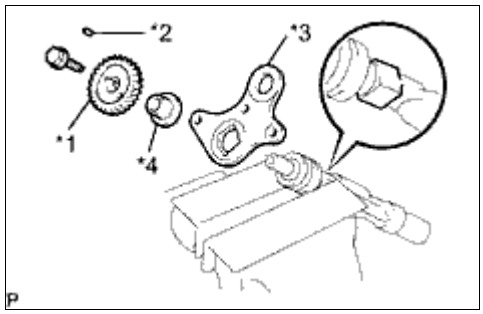
6. INSTALL NO. 1 BALANCESHAFT DRIVEN GEAR

(a) Mount the head portion of the balanceshaft in a vise.

NOTICE:

Do not damage the balanceshaft.

(b) Install the No. 1 balanceshaft thrust washer, balanceshaft thrust spacer, sliding key and No. 1 balanceshaft driven gear.



Text in Illustration

*1	No. 1 Balanceshaft Driven Gear
*2	Sliding Key
*3	Balanceshaft Thrust Washer
*4	Balanceshaft Thrust Spacer

(c) Install the bolt.

Torque:

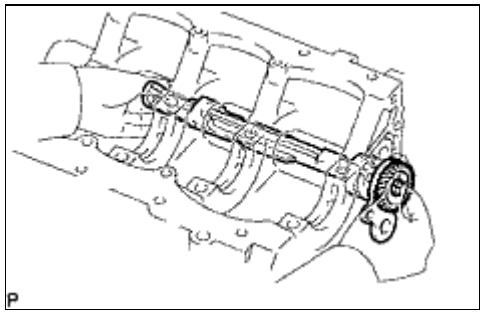
36 N·m {367 kgf·cm, 27ft·lbf}

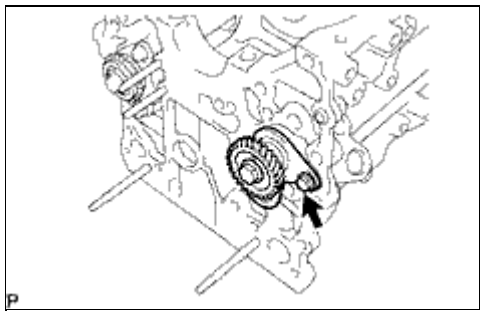
7. INSTALL NO. 1 BALANCESHAFT

(a) Install the No. 1 balanceshaft to the cylinder block.

NOTICE:

When installing the balanceshaft, be sure to support the balanceshaft with both hands and avoid scratching the balanceshaft bearing on the cylinder block.





(b) Install the bolt.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

8. INSTALL PISTON WITH PIN SUB-ASSEMBLY

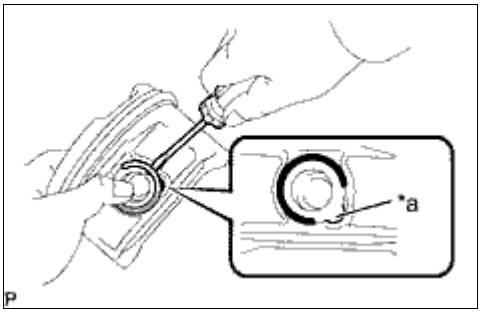
HINT:

Perform "Inspection After Repairs" after replacing the piston sub-assembly INFO .

(a) Assemble the piston and connecting rod.

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(1) Using a screwdriver, install a new snap ring at one end of the piston pin hole.



Text in Illustration

*a	Service Hole

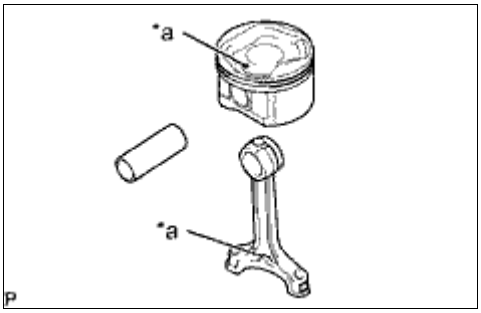
HINT:

Make sure that the end gap of the snap ring is not aligned with the service hole cutout portion of the piston.

(2) Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

(3) Coat the piston pin with engine oil.

(4) Align the front marks of the piston and connecting rod and push in the piston pin with your thumb.



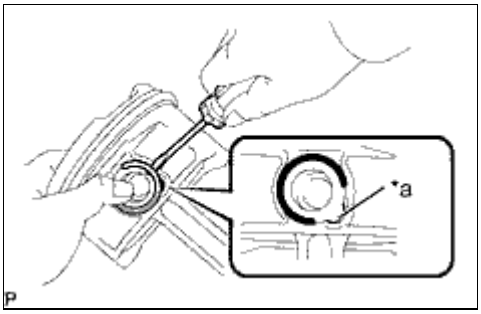
Text in Illustration

*a	Front Mark

HINT:

The piston and pin are a matched set.

(5) Using a screwdriver, install a new snap ring at the other end of the piston pin hole.



Text in Illustration

*a	Service Hole

HINT:

Make sure that the end gap of the snap ring is not aligned with the service hole cutout portion of the piston.

(6) Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.

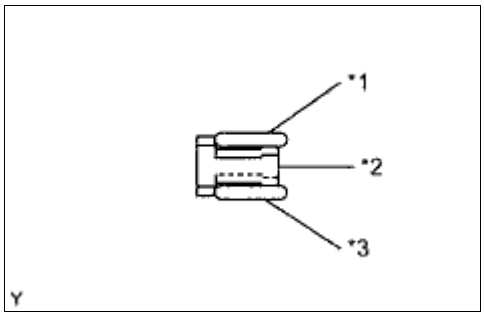
9. INSTALL PISTON RING SET

HINT:

Perform "Inspection After Repairs" after replacing the piston ring INFO .

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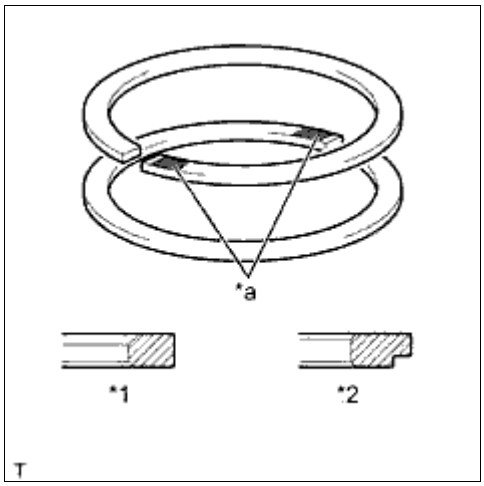
(a) Install the oil ring expander and 2 oil ring side rails by hand.



Text in Illustration

*1	Upper Oil Ring Side Rail
*2	Oil Ring Expander
*3	Lower Oil Ring Side Rail

(b) Using a piston ring expander, install the 2 compression rings so that the painted marks are positioned as shown in the illustration.



HINT:

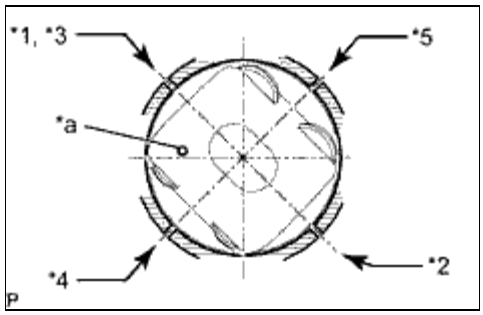
- Install the No. 1 compression ring with the code mark (1N) facing upward.
- Install the No. 2 compression ring with the code mark (2N) facing upward.

Text in Illustration

*1	No. 1 Compression Ring
*2	No. 2 Compression Ring
*a	Code Mark

(c) Position the piston rings so that the ring ends are as shown in the illustration.

Text in Illustration



*1	No. 1 Compression Ring
*2	No. 2 Compression Ring
*3	Oil Ring Expander
*4	Upper Oil Ring Side Rail
*5	Lower Oil Ring Side Rail
*a	Front Mark

NOTICE:

Do not align the compression ring ends.

10. INSTALL CRANKSHAFT BEARING

NOTICE:

Do not apply engine oil to the contact area or backside of the bearing.

HINT:

The crankshaft bearing cap set bolts are tightened in 2 progressive steps.

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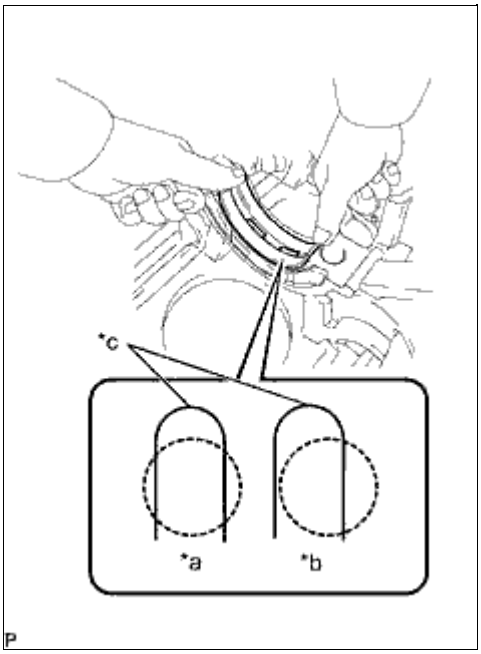
(a) Clean the main journal and both surfaces of the bearing.

(b) Install the upper bearing.

(1) Install the upper bearing to the cylinder block as shown in the illustration.

Reference (Difference in Dimension of Cylinder Block and Bearing):

ITEM	SPECIFIED CONDITION
# 1, 5 journal	3.75 mm (0.148 in.)
# 3 journal	1.75 mm (0.0689 in.)
# 2, 4 journal	2.75 mm (0.108 in.)



NOTICE:

- Do not apply engine oil to the bearings or their contact surfaces.
- Both sides of the oil groove in the cylinder block should be visible through the oil feed holes in the bearing. The amount visible on each side of the holes should be equal.

Text in Illustration

*a	Correct
*b	Incorrect
*c	Oil Groove

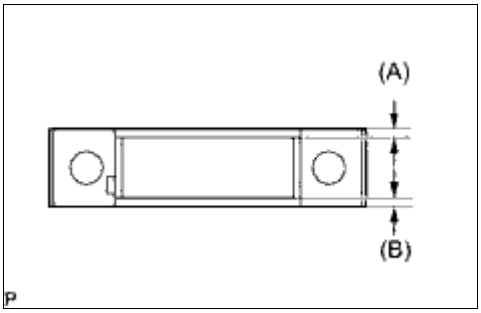
(c) Install the lower bearing.

(1) Install the lower bearing to the bearing cap.

(2) Using a vernier caliper, measure the distance between the bearing cap edge and lower bearing edge.

Dimension A - B or B - A:
0.3 mm (0.0118 in.) or less
Reference (Dimension of A or B):

ITEM	SPECIFIED CONDITION
# 1, 5 journal	3.75 mm (0.148 in.)
# 3 journal	1.75 mm (0.0689 in.)
# 2, 4 journal	2.75 mm (0.108 in.)



NOTICE:

Do not apply engine oil to the bearings or their contact surfaces.

(d) With the upper bearing and lower bearing installed, use a plastic-faced hammer to install the bearing caps to the cylinder block.

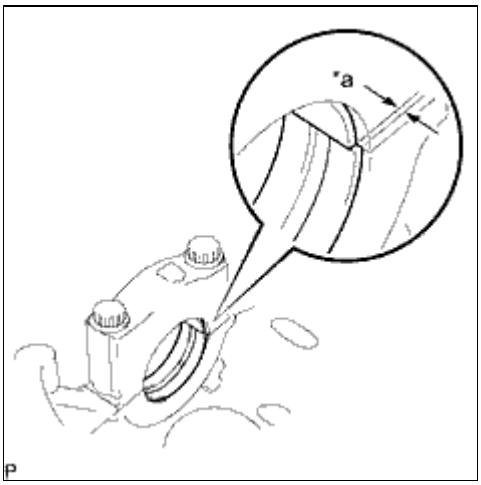
NOTICE:

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Make sure that the bearing caps are installed in the correct positions and facing in the correct direction.

(e) Using a vernier caliper, measure the amount of misalignment between the upper bearing and lower bearing as shown in the illustration.

Standard misalignment:
0.9 mm (0.0354 in.) or less



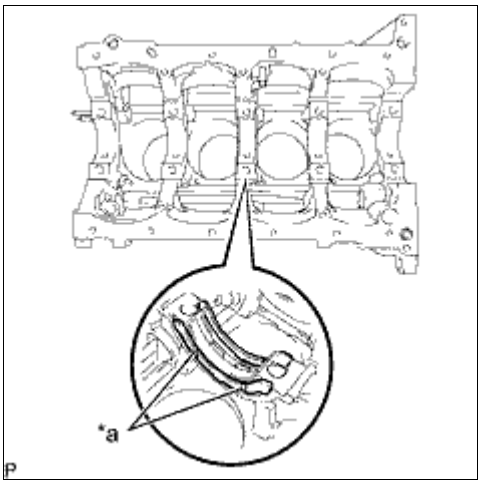
Text in Illustration

*a	Misalignment

(f) Remove the bearing cap.

(g) Apply engine oil to the thrust washers.

(h) Install the 2 thrust washers to the No. 3 journal position of the cylinder block with the oil grooves facing outward.



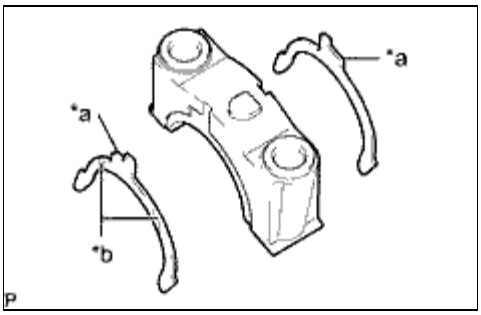
Text in Illustration

*a	Oil Groove

NOTICE:

Be careful when installing the upper and lower thrust washers as they are similar but cannot be interchanged.

(i) Install the 2 thrust washers to the No. 3 bearing cap with the grooves facing outward.



Text in Illustration

*a	Claw
*b	Oil Groove

NOTICE:

Be careful when installing the thrust bearing upper and lower as they are similar but cannot be interchanged. The bearing lower has a claw as shown in the illustration.

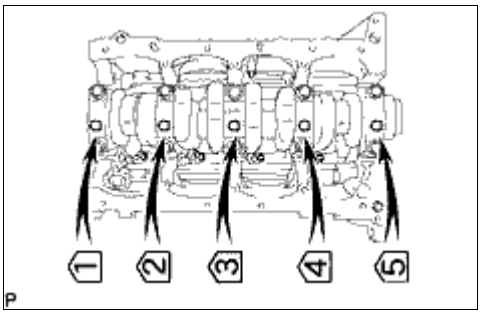
(j) Apply engine oil to the lower bearing.

11. INSTALL CRANKSHAFT

(a) Apply engine oil to the upper bearing, and then place the crankshaft on the cylinder block.

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(b) Install the 5 crankshaft bearing caps in their proper locations.



(c) Install the crankshaft bearing cap set bolt.

(1) Apply a light coat of engine oil to the threads and under the heads of the crankshaft bearing cap set bolts.

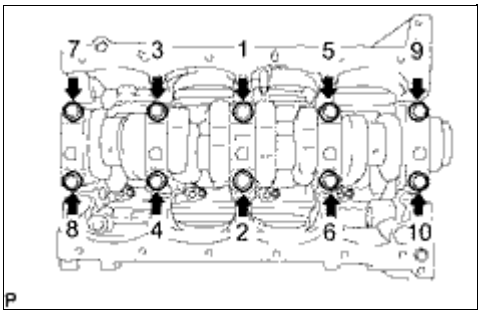
(2) Temporarily install the crankshaft bearing cap set bolts.

HINT:

The main crankshaft bearing cap set bolts are tightened in 2 progressive steps.

(3) Step 1:

Uniformly tighten the 10 main crankshaft bearing cap set bolts in the sequence shown in the illustration.



Torque:

39 N·m {398 kgf·cm, 29ft·lbf}

If any of the main crankshaft bearing cap set bolts does not meet the torque specification, replace the main crankshaft bearing cap set bolt.

(4) Mark the front of the crankshaft bearing cap set bolts with paint.

(5) Step 2:

Tighten the crankshaft bearing cap set bolts 90° in the sequence shown in step 1.

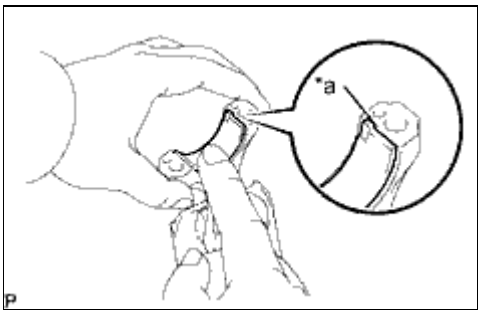
(6) Check that the paint marks are now at a 90° angle to the front.

(d) Check that the crankshaft turns smoothly.

(e) Check the crankshaft thrust clearance INFO .

12. INSTALL CONNECTING ROD BEARING

(a) Align the bearing claw with the groove of the connecting rod or connecting rod cap.



Text in Illustration

*a	Claw

(b) Install the bearings to the connecting rod and connecting rod cap.

NOTICE:

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Clean the backside of the bearing and the surface of the connecting rod or connecting rod cap that contacts the bearing.

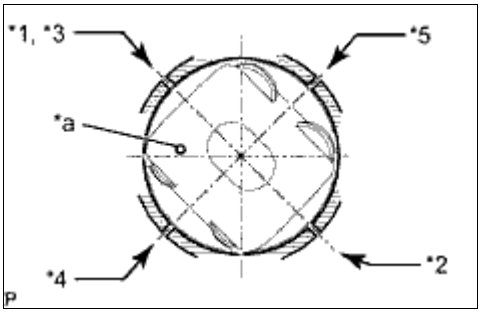
13. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

(a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.

(b) Position the piston rings so that the ring ends are as shown in the illustration.

Text in Illustration

*1	No. 1 Compression Ring
*2	No. 2 Compression Ring
*3	Oil Ring Expander
*4	Upper Oil Ring Side Rail
*5	Lower Oil Ring Side Rail
*a	Front Mark



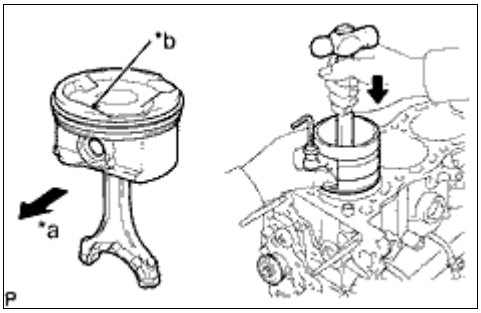
NOTICE:

Do not align the compression ring ends.

(c) Using a piston ring compressor, push the numbered piston and connecting rod assembly into the correct cylinder with the front mark of the piston facing forward.

Text in Illustration

*a	Front
*b	Front Mark

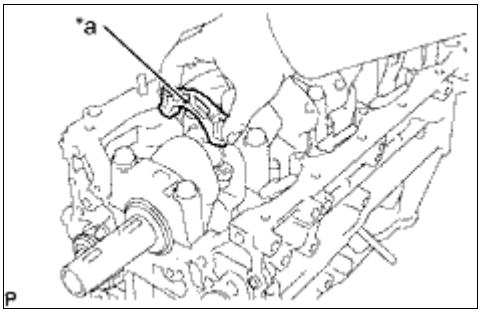


(d) Match the numbered connecting rod cap with the correct connecting rod.

(e) Check that the front mark of the connecting rod cap is facing forward.

Text in Illustration

*a	Front Mark



(f) Install the connecting rod bolts.

HINT:

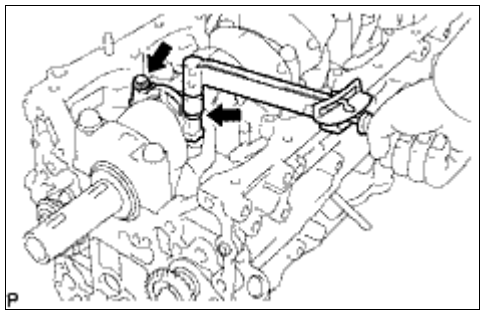
The connecting rod bolts are tightened in 2 progressive steps.

(1) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.

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(2) Step 1:

Install and alternately tighten the bolts of the connecting rod cap in several steps.



Torque:

25 N·m {250 kgf·cm, 18ft·lbf}

(3) Mark the front of each connecting rod cap bolt with paint.

(4) Step 2:

Tighten the cap bolts 90° as shown.

(5) Check that the painted marks are now at a 90° angle to the front.

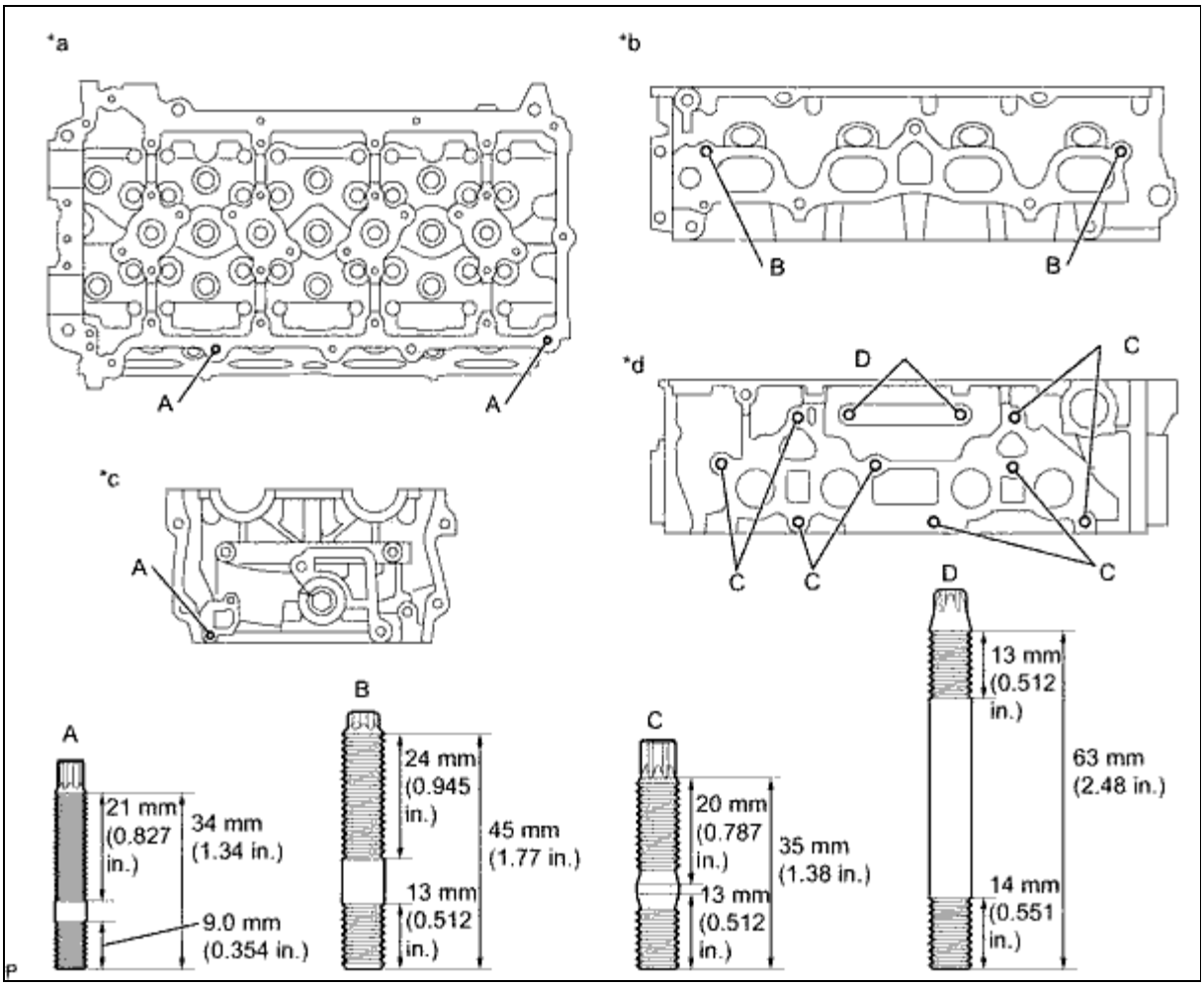
(g) Check that the crankshaft turns smoothly.

(h) Check the connecting rod thrust clearance INFO .

14. INSTALL STUD BOLT

NOTICE:

If a stud bolt is deformed or its threads are damaged, replace it.



Text in Illustration

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*a	Cylinder Head Upper Side	*b	Intake Side
*c	Front Side	*d	Exhaust Side

(a) Using E6, E7 and E8 "TORX" socket wrenches, install the stud bolts.

Torque:

for stud bolt A -

3.0 N·m {31 kgf·cm, 27in·lbf}

for stud bolt B -

7.5 N·m {76 kgf·cm, 66in·lbf}

for stud bolt C -

7.5 N·m {76 kgf·cm, 66in·lbf}

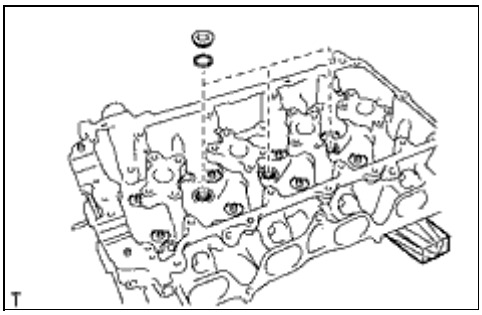
for stud bolt D -

7.5 N·m {76 kgf·cm, 66in·lbf}

15. INSTALL NO. 1 HEAD STRAIGHT SCREW PLUG

NOTICE:

If coolant leaks from the No. 1 head straight screw plug or the plug is corroded, replace it.



(a) Using a 10 mm hexagon wrench, install 3 new gaskets and the straight screw plugs.

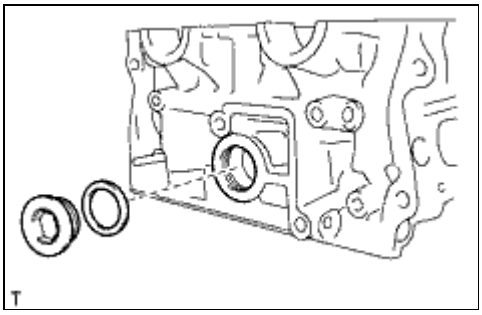
Torque:

44 N·m {449 kgf·cm, 32ft·lbf}

16. INSTALL NO. 2 HEAD STRAIGHT SCREW PLUG

NOTICE:

If coolant leaks from the No. 2 head straight screw plug or the plug is corroded, replace it.



(a) Using a 19 mm hexagon wrench, install a new gasket and the straight screw plug.

Torque:

140 N·m {1428 kgf·cm, 103ft·lbf}

17. INSTALL VALVE SPRING SEAT

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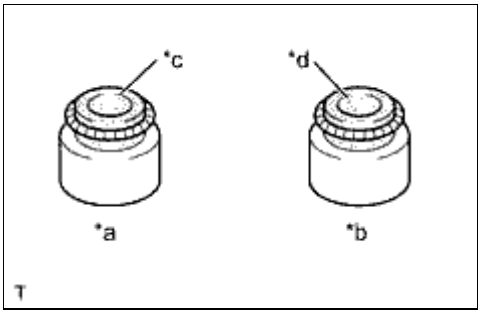
(a) Install the 16 valve spring seats to the cylinder head.

18. INSTALL VALVE STEM OIL SEAL

(a) Apply a light coat of engine oil to new oil seals.

Text in Illustration

*a	Intake Side
*b	Exhaust Side
*c	Gray
*d	Black



NOTICE:

Pay attention when installing the intake and exhaust oil seals. For example, installing an intake oil seal to the exhaust side or installing an exhaust oil seal to the intake side can cause installation problems later.

HINT:

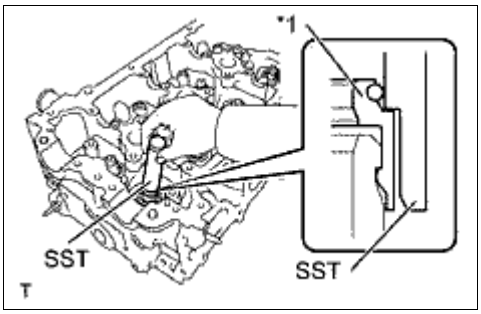
The intake valve oil seals are gray and the exhaust valve oil seals are black.

(b) Using SST, push in the 16 oil seals to install them.

SST: 09201-41020

Text in Illustration

*1	Valve Stem Oil Seal

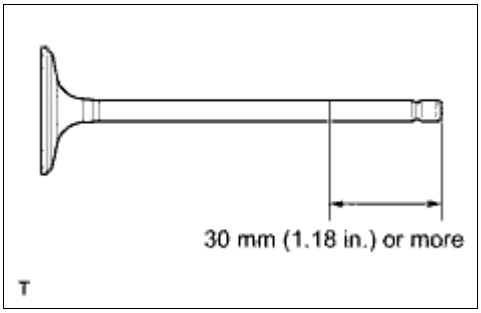


NOTICE:

Failure to use SST will cause the seal to be damaged or improperly seated.

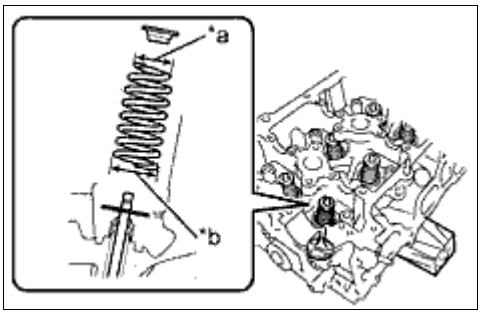
19. INSTALL INTAKE VALVE

(a) Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.



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(b) Install the valve, inner compression spring and retainer to the cylinder head.



Text in Illustration

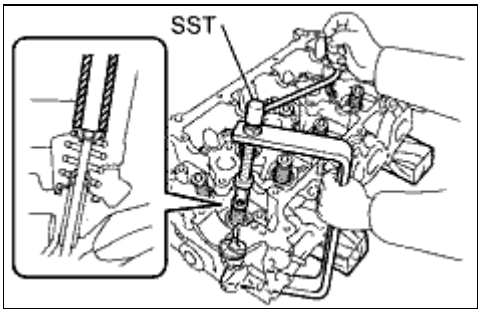
*a	Narrow
*b	Wide

NOTICE:

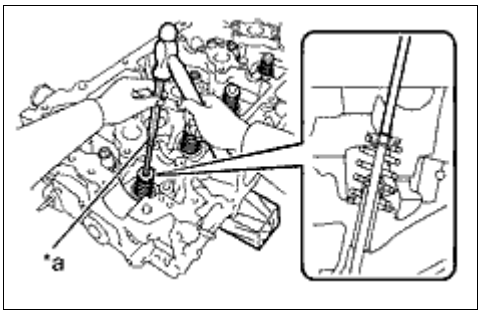
Install the same parts in the same combination to the original locations.

(c) Using SST and wooden blocks, compress the inner compression spring and install the 2 valve spring retainer locks.

SST: 09202-70020
SST: 09202-00021



(d) Using a 5 mm pin punch and plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.



Text in Illustration

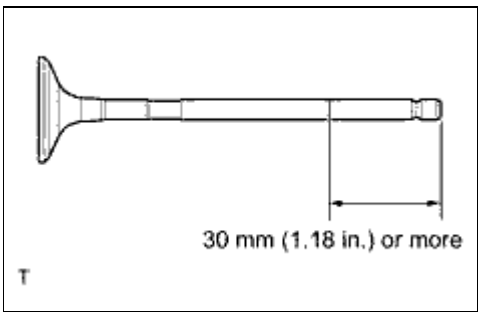
*a	5 mm Pin Punch

NOTICE:

Do not damage the valve stem tip.

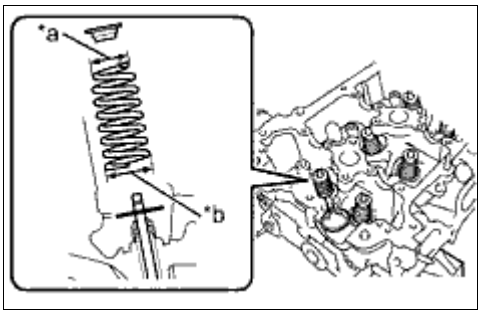
20. INSTALL EXHAUST VALVE

(a) Apply plenty of engine oil to the tip area of the exhaust valve shown in the illustration.



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(b) Install the valve, inner compression spring and retainer to the cylinder head.

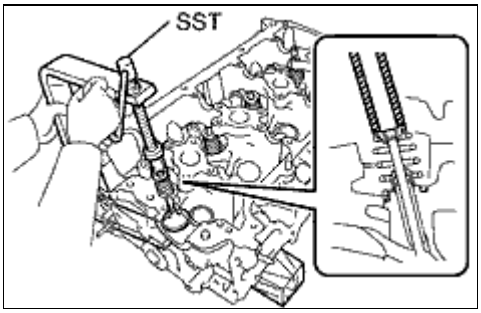


Text in Illustration

*a	Narrow
*b	Wide

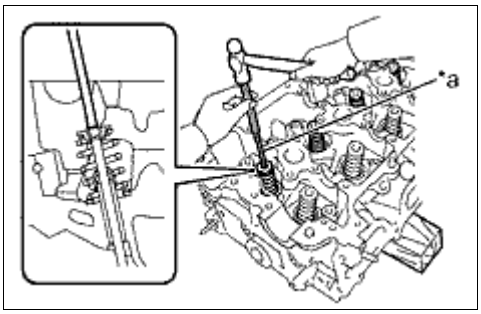
NOTICE:

Install the same parts in the same combination to the original locations.



(c) Using SST and wooden blocks, compress the inner compression spring and install the 2 valve spring retainer locks.

SST: 09202-70020
SST: 09202-00021



(d) Using a 5 mm pin punch and plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

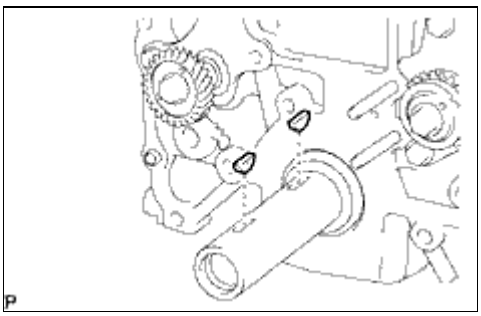
Text in Illustration

*a	5 mm Pin Punch

NOTICE:

Do not damage the valve stem tip.

21. INSTALL CRANKSHAFT PULLEY SET KEY



(a) Install the 2 pulley keys to the crankshaft.

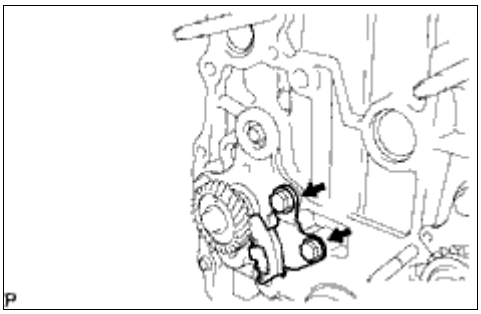
22. INSTALL NO. 4 CHAIN VIBRATION DAMPER

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(a) Install the vibration damper with the 2 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}



23. INSTALL NO. 2 CHAIN SUB-ASSEMBLY

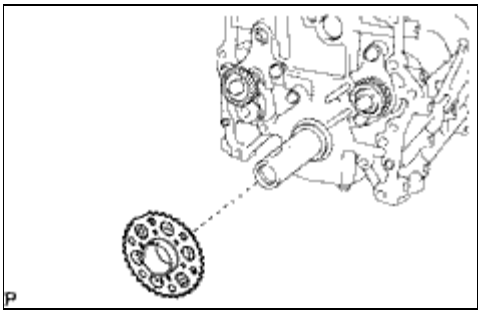
(a) Install the timing sprocket as shown in the illustration.

NOTICE:

Check that the No. 1 cylinder is at TDC and that the weights of the No. 1 and No. 2 balanceshafts are at the bottom.

HINT:

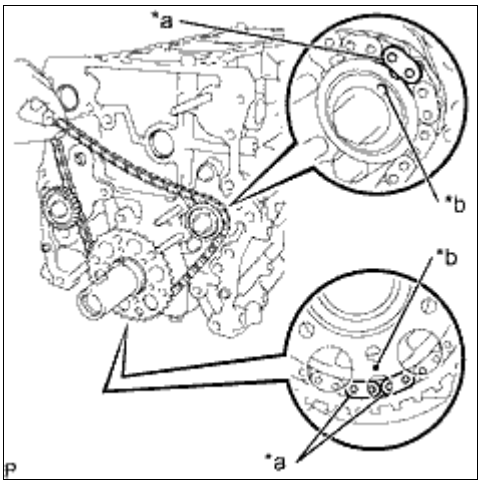
Install the timing sprocket with the front mark facing forward.



(b) As shown in the illustration, install the chain to the sprocket and gear with the mark plates aligned with the timing marks on the sprocket and gear.

Text in Illustration

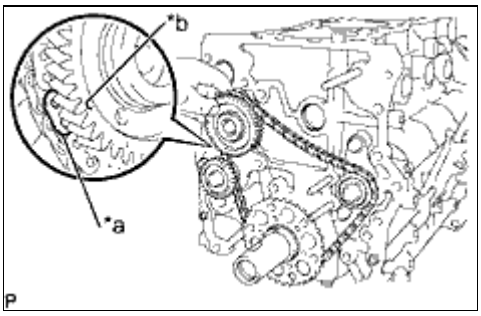
*a	Mark Plate (Yellow)
*b	Timing Mark



(c) Fit the other mark link of the chain behind the large timing mark of the balanceshaft drive gear.

Text in Illustration

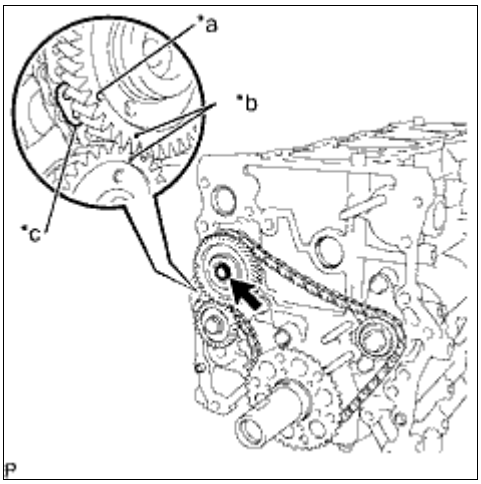
*a	Mark Plate (Yellow)
*b	Large Timing Mark



(d) Insert the balanceshaft drive gear shaft through the balanceshaft drive gear so that it fits into the thrust plate hole.

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(e) Align the small timing mark of the balanceshaft drive gear with the large timing mark of the balanceshaft timing gear.



Text in Illustration

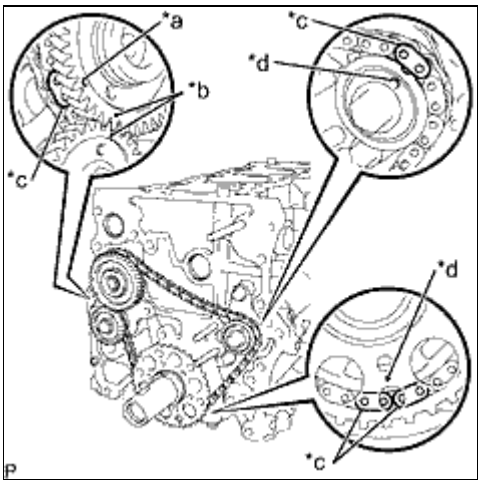
*a	Large Timing Mark
*b	Small Timing Mark
*c	Mark Plate (Yellow)

(f) Install the bolt to the balanceshaft drive gear.

Torque:

25 N·m {255 kgf·cm, 18ft·lbf}

(g) Check that each timing mark is aligned with the corresponding mark link.



Text in Illustration

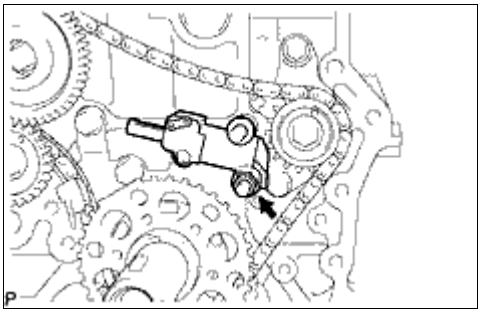
*a	Large Timing Mark
*b	Small Timing Mark
*c	Mark Plate (Yellow)
*d	Timing Mark

NOTICE:

Check that the No. 1 cylinder is at TDC and that the weights of the No. 1 and No. 2 balanceshafts are at the bottom.

24. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Install the chain tensioner assembly with the nut.



Torque:

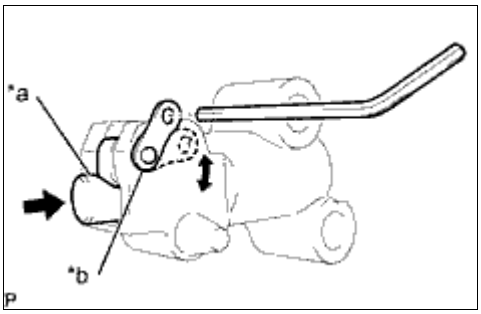
18 N·m {184 kgf·cm, 13ft·lbf}

NOTICE:

Install the chain tensioner with the pin installed, and then remove the pin after installation. When performing this step, do not push the vibration damper against the chain.

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(b) Move the stopper plate downward to release the lock and push the plunger deep into the tensioner.

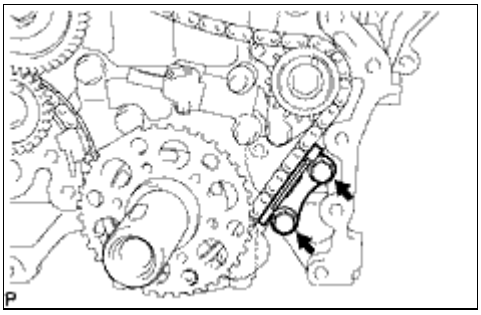


Text in Illustration

*a	Plunger
*b	Stopper Plate

(c) Move the stopper plate upward to set the lock and insert a hexagon wrench into the stopper plate hole.

25. INSTALL NO. 3 CHAIN VIBRATION DAMPER

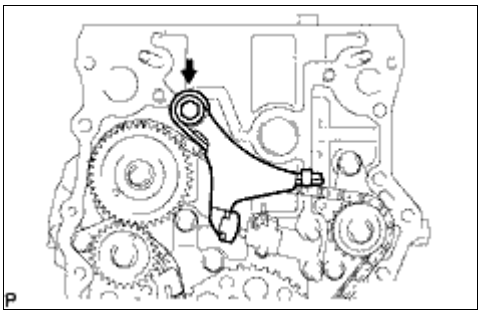


(a) Install the chain vibration damper with the 2 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

26. INSTALL NO. 2 CHAIN VIBRATION DAMPER



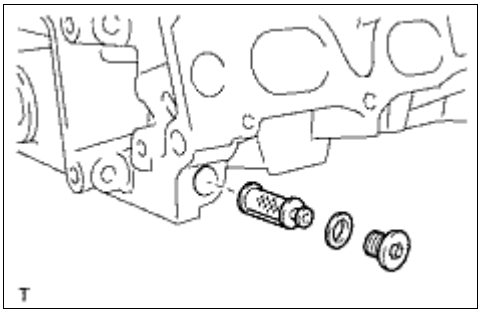
(a) Install the chain vibration damper with the bolt.

Torque:

27 N·m {275 kgf·cm, 20ft·lbf}

(b) Remove the hexagon wrench from the chain tensioner assembly and release the plunger.

27. INSTALL OIL CONTROL VALVE FILTER



(a) Check that no foreign matter is on the mesh part of the filter.

If foreign matter is present, clean the part thoroughly.

(b) Using an 8 mm hexagon wrench, install a new gasket and the oil control valve filter with the screw plug.

Torque:

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30 N·m {306 kgf·cm, 22ft·lbf}

28. INSTALL CYLINDER HEAD GASKET INFO

29. INSTALL CYLINDER HEAD SUB-ASSEMBLY INFO

30. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY INFO

31. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY INFO

32. INSTALL VALVE STEM CAP INFO

33. INSTALL VALVE LASH ADJUSTER ASSEMBLY INFO

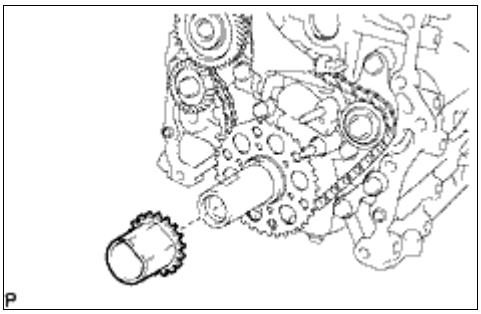
34. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY INFO

35. INSTALL CAMSHAFTS INFO

36. INSTALL CAMSHAFT BEARING CAP INFO

37. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Install the crankshaft timing gear or sprocket as shown in the illustration.

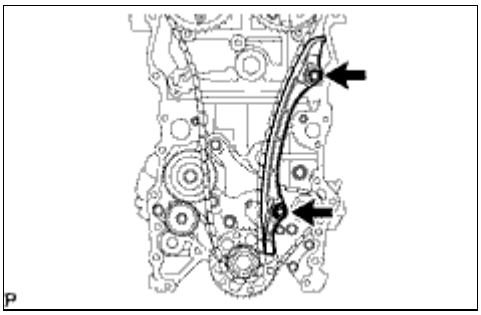


38. INSTALL NO. 1 CHAIN VIBRATION DAMPER

(a) Install the No. 1 chain vibration damper with the bolt and nut.

Torque:

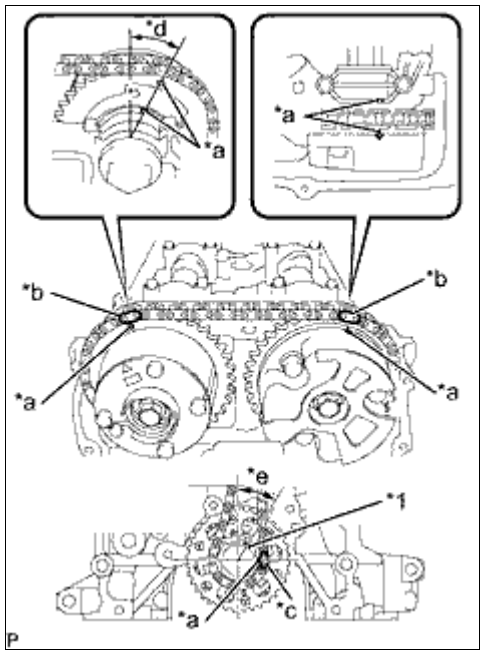
21 N·m {214 kgf·cm, 15ft·lbf}



39. INSTALL CHAIN SUB-ASSEMBLY

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(a) As shown in the illustration, install the chain sub-assembly to the camshaft timing exhaust gear assembly and camshaft timing gear assembly with the mark plates aligned with the timing marks on the camshaft timing exhaust gear assembly and camshaft timing gear assembly.



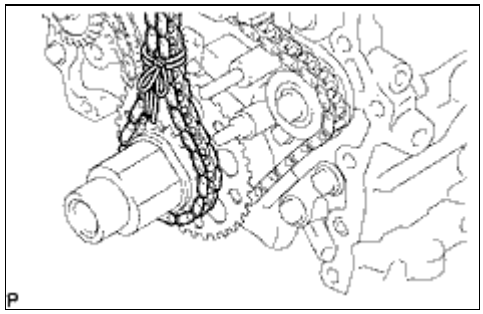
Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Mark Plate (Pink)
*c	Mark Plate (Yellow)
*d	Approximately 13°
*e	Approximately 30°

HINT:

- The camshaft mark plate is pink.
- The crankshaft mark plate is yellow.

(b) Use a rope to tie the chain sub-assembly of the crankshaft timing gear or sprocket. Tie the rope near the crankshaft timing gear or sprocket.



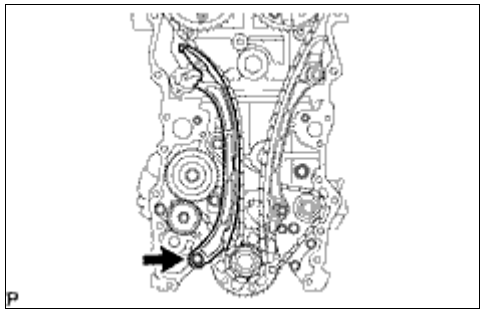
NOTICE:

After the chain tensioner has been installed, the rope must be removed.

HINT:

The rope is tied so that the chain sub-assembly will not jump a tooth.

40. INSTALL CHAIN TENSIONER SLIPPER



(a) Install the chain tensioner slipper with the bolt.

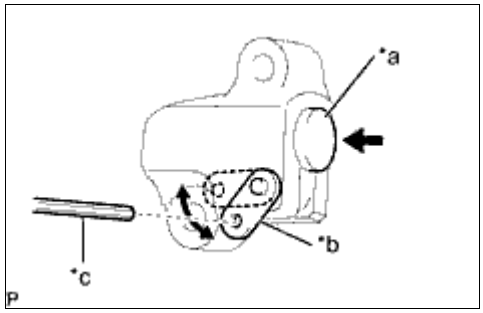
Torque:

21 N·m {214 kgf·cm, 15ft·lbf}

41. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

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(a) Move the stopper plate upward to release the lock and push the plunger deep into the tensioner.



Text in Illustration

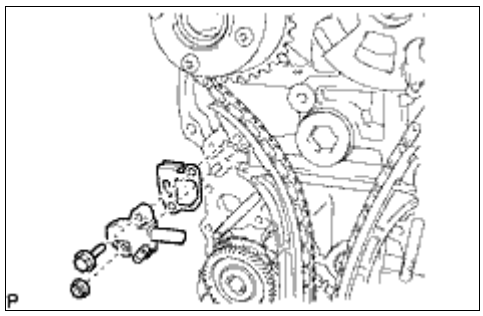
*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench

(b) Move the stopper plate downward to set the lock and insert a hexagon wrench into the hole of the stopper plate.

(c) Install a new gasket and the No. 1 chain tensioner assembly with the bolt and nut.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}



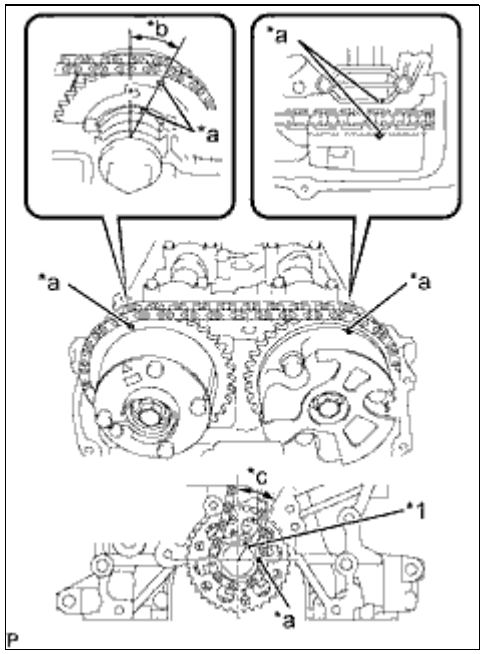
(d) Remove the hexagon wrench from the No. 1 chain tensioner assembly and release the plunger.

42. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Check that the No. 1 cylinder is set to TDC/compression.

(1) Rotate the crankshaft two full rotations, and then check that all timing marks are in the position shown in the illustration.

If the timing marks do not match, set the chain sub-assembly again.



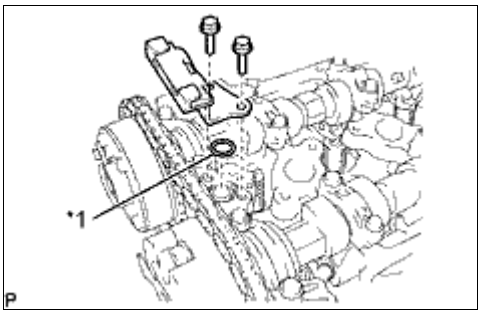
Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Approximately 13°
*c	Approximately 30°

43. INSTALL TIMING CHAIN GUIDE

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(a) Install a new O-ring to the No. 1 camshaft bearing cap.



Text in Illustration

*1	O-ring

(b) Install the timing chain guide with the 2 bolts.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}

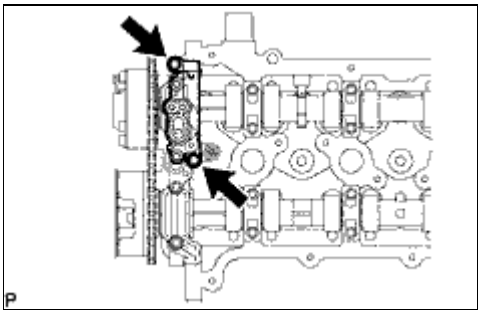
44. INSTALL CYLINDER HEAD COVER CONNECTOR SUB-ASSEMBLY

(a) Install a new No. 2 camshaft bearing cap oil hole gasket and 3 new No. 3 camshaft bearing cap oil hole gaskets to the No. 1 camshaft bearing cap.

(b) Install the cylinder head cover connector sub-assembly with the 2 bolts.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}



45. INSTALL ENGINE WATER PUMP ASSEMBLY INFO

46. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY INFO

47. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY INFO

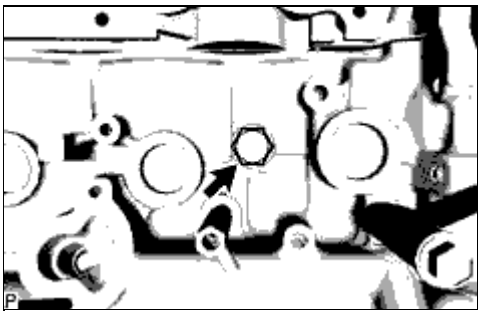
48. INSTALL TIMING CHAIN COVER OIL SEAL INFO

49. INSTALL NO. 1 TAPER SCREW PLUG

(a) Install the No. 1 taper screw plug to the cylinder block.

Torque:

25 N·m {250 kgf·cm, 18ft·lbf}



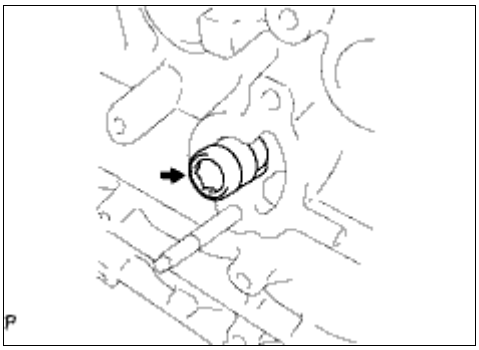
50. INSTALL OIL FILTER BRACKET SUB-ASSEMBLY

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(a) Using a hexagon wrench, install the oil filter bracket union.

Torque:

25 N·m {250 kgf·cm, 18ft·lbf}

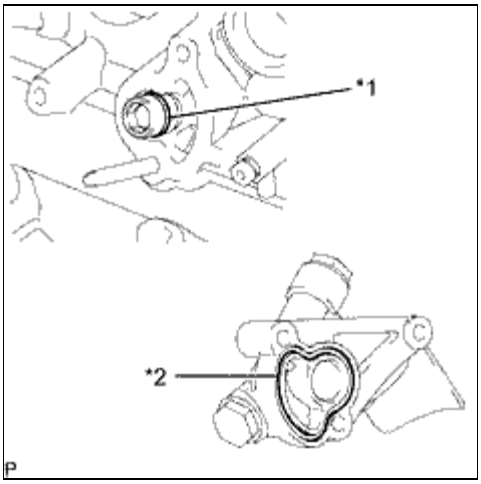


(b) Install a new oil filter bracket gasket to the oil filter bracket.

(c) Install a new O-ring to the oil filter bracket union.

Text in Illustration

*1	O-ring
*2	Oil Filter Bracket Gasket



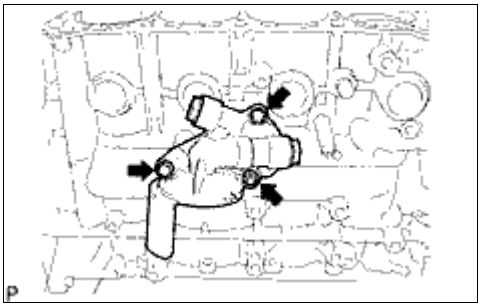
NOTICE:

Apply a light coat of engine oil to the O-ring and oil filter bracket.

(d) Install the oil filter bracket sub-assembly with the 2 bolts and nut.

Torque:

25 N·m {255 kgf·cm, 18ft·lbf}



(e) Install 2 new gaskets and the 2 screw plugs to the oil filter bracket sub-assembly.

Torque:

49 N·m {500 kgf·cm, 36ft·lbf}

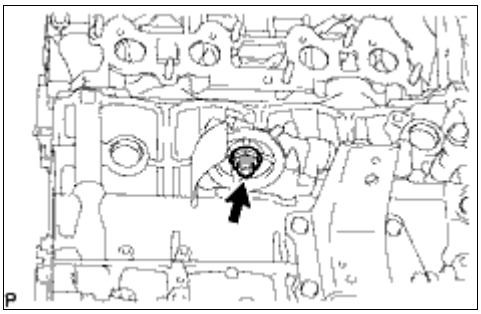
51. INSTALL OIL FILTER UNION

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(a) Using a 27 mm socket wrench, install the oil filter union.

Torque:

43 N·m {439 kgf·cm, 32ft·lbf}



52. INSTALL OIL FILTER SUB-ASSEMBLY INFO

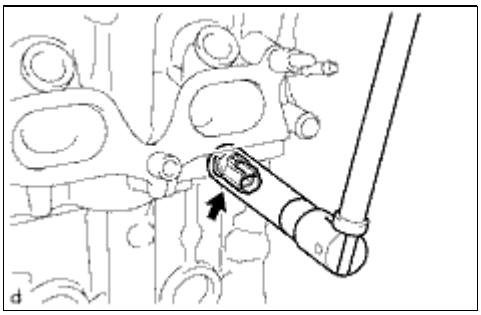
53. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

(a) Install a new gasket to the engine coolant temperature sensor.

(b) Using a 19 mm deep socket wrench, install the engine coolant temperature sensor.

Torque:

20 N·m {200 kgf·cm, 14ft·lbf}



54. INSTALL KNOCK SENSOR INFO

55. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY INFO

56. INSTALL REAR ENGINE OIL SEAL RETAINER

(a) Clean and degrease the contact surfaces of the rear engine oil seal retainer and cylinder block sub-assembly.

(b) Apply seal packing in a continuous bead as shown in the illustration.

Seal packing:

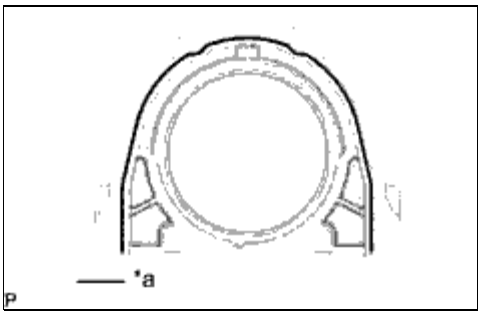
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard seal diameter:

2.0 to 3.0 mm (0.0787 to 0.118 in.)

Text in Illustration

*a	Seal Packing



NOTICE:

- Remove any oil from the contact surface.
- Install the rear engine oil seal retainer within 3 minutes after applying seal packing.
- Do not start the engine for at least 4 hours after installation.

(c) Install the rear engine oil seal retainer with the 6 bolts.

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Torque:

13 N·m {133 kgf·cm, 10ft·lbf}

57. INSTALL REAR ENGINE OIL SEAL INFO

58. INSTALL OIL PAN STUD BOLT

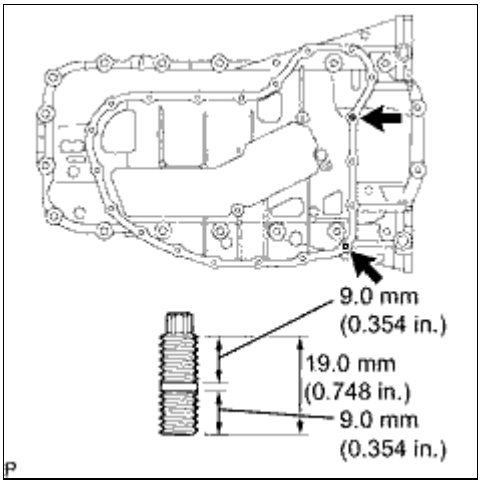
NOTICE:

If a stud bolt is deformed or threads are damaged, replace it.

(a) Using E6 "TORX" socket wrench, install the stud bolts.

Torque:

3.0 N·m {31 kgf·cm, 27in·lbf}

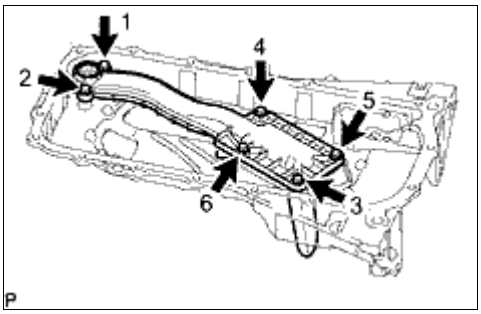


59. INSTALL OIL STRAINER SUB-ASSEMBLY

(a) Install the oil strainer sub-assembly with the 6 bolts, and tighten the 6 bolts in the sequence shown in the illustration.

Torque:

10 N·m {102 kgf·cm, 7ft·lbf}



(b) Install a new gasket to the oil strainer sub-assembly.

60. INSTALL OIL PAN SUB-ASSEMBLY INFO

61. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY INFO

62. INSTALL OIL PAN COVER SILENCER INFO

63. INSTALL CRANKSHAFT PULLEY INFO

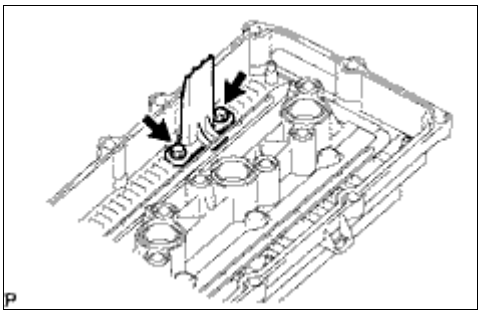
64. INSTALL THERMOSTAT INFO

65. INSTALL WATER INLET INFO

66. INSTALL NO. 1 VENTILATION CONNECTOR

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(a) Install the No. 1 ventilation connector to the cylinder head cover sub-assembly with the 2 bolts.



67. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY INFO

68. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)

(a) Apply a light coat of engine oil to a new O-ring and install the O-ring to the camshaft timing oil control valve assembly.

NOTICE:

Do not damage the O-ring when installing.

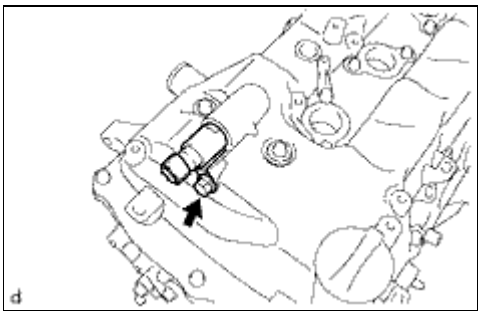
HINT:

An O-ring is already installed in a new camshaft timing oil control valve assembly. So, the O-ring only needs to be coated with engine oil when the assembly is replaced with a new one.

(b) Install the camshaft timing oil control valve assembly to the cylinder head cover sub-assembly with the bolt.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}



NOTICE:

- Replace with a new part if it is dropped or if it receives a strong impact.
- Make sure that the O-ring is not cracked or jammed when installing.

69. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)

(a) Apply a light coat of engine oil to a new O-ring and install the O-ring to the camshaft timing oil control valve assembly.

NOTICE:

Do not damage the O-ring when installing.

HINT:

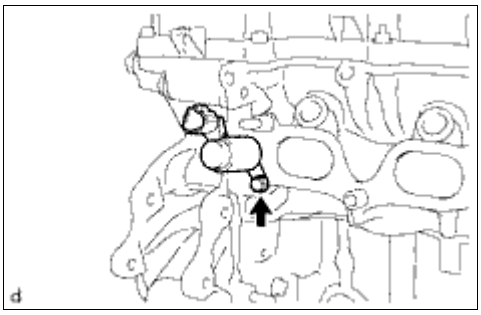
An O-ring is already installed in a new camshaft timing oil control valve assembly. So, the O-ring only needs to be coated with engine oil when the assembly is replaced with a new one.

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(b) Install the camshaft timing oil control valve assembly to the cylinder head sub-assembly with the bolt.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}



NOTICE:

- Replace with a new part if it is dropped or if it receives a strong impact.
- Make sure that the O-ring is not cracked or jammed when installing.

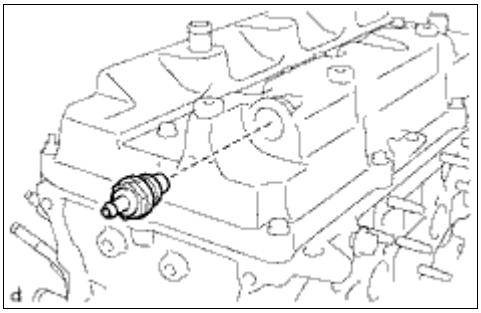
70. INSTALL CRANKSHAFT POSITION SENSOR INFO

71. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

72. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

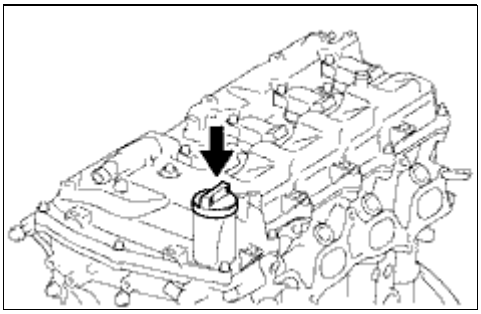
73. INSTALL PCV VALVE SUB-ASSEMBLY

(a) Install the ventilation valve sub-assembly.



74. INSTALL OIL FILLER CAP SUB-ASSEMBLY

(a) Install the gasket to the oil filler cap.



(b) Install the oil filler cap.

75. INSTALL SPARK PLUG

(a) Using a 16 mm spark plug wrench, install the 4 spark plugs to the cylinder head sub-assembly.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000003E2B00UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: REPAIR; 2016 MY Tacoma [08/2015 -]		

REPAIR

HINT:

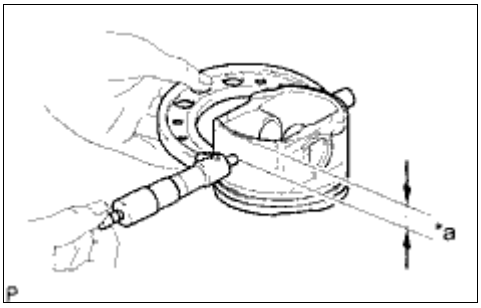
- Bore all 4 cylinders to fit the O/S piston outside diameter.
- Replace all the piston rings with ones to match the O/S pistons.

1. BORE CYLINDER

(a) Prepare 4 new O/S pistons.

(b) Using a micrometer, measure the piston diameter at right angles to the piston center line where the distance from the piston end is as specified.

Standard piston diameter (O/S 0.50):
95.471 to 95.481 mm (3.7587 to 3.7591 in.)
Distance:
13.8 mm (0.543 in.)



Text in Illustration

*a	Distance

(c) Calculate the amount each cylinder is to be rebored as follows.

HINT:

Size to be rebored = P + C - H

P = Piston diameter

C = Piston oil clearance: 0.009 to 0.048 mm (0.000354 to 0.00189 in.)

H = Allowance for honing: 0.02 mm (0.000787 in.) or less

(d) Bore and hone the cylinders to the calculated dimensions.

NOTICE:

Excess honing will destroy the finished roundness.

(e) Using a cylinder gauge, measure the cylinder bore diameter and calculate the honing allowance.

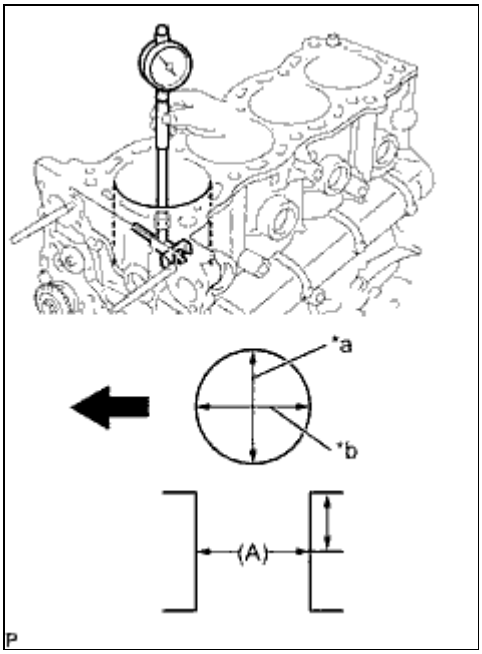
HINT:

Honing allowance = cylinder bore diameter - (piston diameter + oil clearance)

(f) Finish the cylinder bore using the calculated value.

(g) Using a cylinder gauge, measure the cylinder bore diameter.

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Standard oil clearance:

0.009 to 0.048 mm (0.000354 to 0.00189 in.)

Text in Illustration

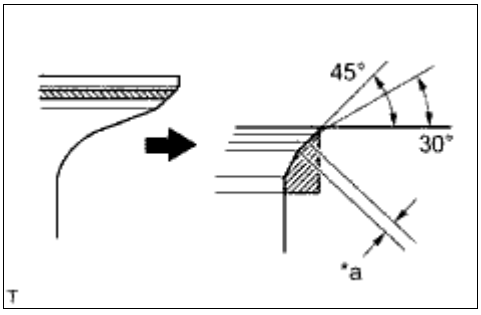
*a	Thrust Direction
*b	Axial Direction
➡	Front

2. REPAIR INTAKE VALVE SEAT

NOTICE:

- Repair the seat while checking the seating position.
- Keep the lip free of foreign matter.
- Take off the cutter gradually to make the intake valve seat smooth.

(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

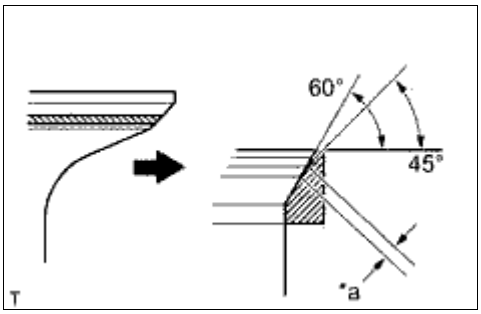


Text in Illustration

*a	Width

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(b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



Text in Illustration

*a	Width

(c) Hand-lap the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.

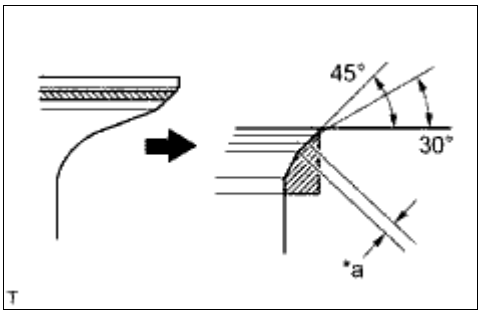
Standard width:
1.1 to 1.5 mm (0.0433 to 0.0591 in.)

3. REPAIR EXHAUST VALVE SEAT

NOTICE:

- Repair the seat while checking the seating position.
- Keep the lip free of foreign matter.
- Take off the cutter gradually to make the exhaust valve seat smooth.

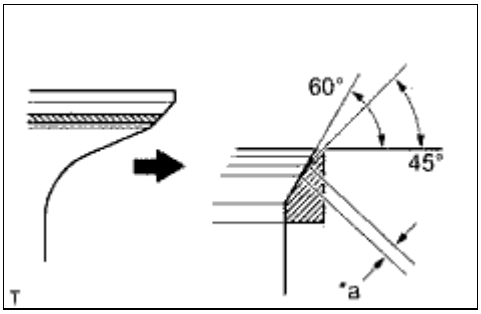
(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



Text in Illustration

*a	Width

(b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



Text in Illustration

*a	Width

(c) Hand-lap the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.

Standard width:
1.1 to 1.5 mm (0.0433 to 0.0591 in.)

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000125A06HX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE UNIT: REPLACEMENT; 2016 MY Tacoma [08/2015 -]		

REPLACEMENT

1. REPLACE INTAKE VALVE GUIDE BUSH

(a) Heat the cylinder head sub-assembly to 80 to 100°C (176 to 212°F).

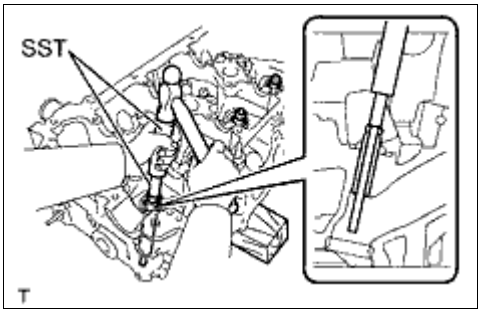
(b) Place the cylinder head sub-assembly on wooden blocks.

(c) Using SST and a hammer, tap out the intake valve guide bush.

SST: 09201-01055

SST: 09950-70010

09951-07100



(d) Using a caliper gauge, measure the bush bore diameter of the cylinder head sub-assembly.

Standard Bush Bore Diameter:

ITEM	SPECIFIED CONDITION
STD	10.285 to 10.306 mm (0.405 to 0.406 in.)
O/S 0.05	10.335 to 10.356 mm (0.407 to 0.408 in.)

If the bush bore diameter of the cylinder head sub-assembly is more than 10.306 mm (0.406 in.), machine the bush bore so that the diameter is between 10.335 and 10.356 mm (0.407 and 0.408 in.).

If the bush bore diameter of the cylinder head sub-assembly is more than 10.356 mm (0.408 in.), replace the cylinder head sub-assembly.

(e) Select a new intake valve guide bush.

New Valve Guide Bush:

ITEM	SPECIFIED CONDITION	
Bush Bore Diameter	10.333 to 10.344 mm (0.4068 to 0.4072 in.)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)
Use Bush	STD	O/S 0.05

HINT:

Standard bush length: 43.0 to 44.0 mm (1.69 to 1.73 in.)

(f) Heat the cylinder head sub-assembly to 80 to 100°C (176 to 212°F).

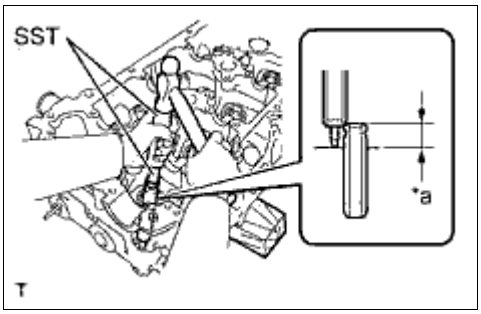
(g) Place the cylinder head sub-assembly on wooden blocks.

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(h) Using SST and a hammer, tap in a new intake valve guide bush to the specified protrusion height.

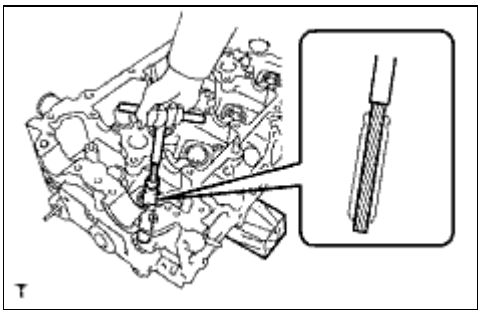
SST: 09201-01055
SST: 09950-70010
09951-07100

Standard protrusion height:
9.8 to 10.2 mm (0.386 to 0.402 in.)



Text in Illustration

*a	Height



(i) Using a sharp 5.5 mm reamer, ream the intake valve guide bush to obtain the standard clearance between the intake valve guide bush and valve stem.

Standard oil clearance:
0.025 to 0.060 mm (0.000984 to 0.00236 in.)

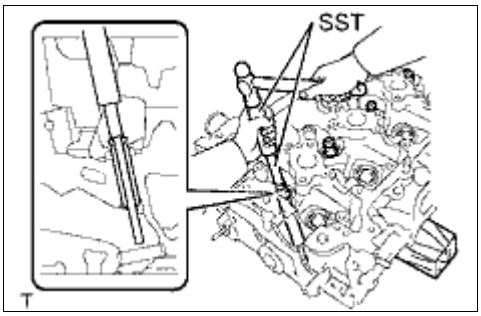
2. REPLACE EXHAUST VALVE GUIDE BUSH

(a) Heat the cylinder head sub-assembly to 80 to 100°C (176 to 212°F).

(b) Place the cylinder head sub-assembly on wooden blocks.

(c) Using SST and a hammer, tap out the exhaust valve guide bush.

SST: 09201-01055
SST: 09950-70010
09951-07100



(d) Using a caliper gauge, measure the bush bore diameter of the cylinder head sub-assembly.

Standard Bush Bore Diameter:

ITEM	SPECIFIED CONDITION
STD	10.285 to 10.306 mm (0.405 to 0.406 in.)
O/S 0.05	10.335 to 10.356 mm (0.407 to 0.408 in.)

If the bush bore diameter of the cylinder head sub-assembly is more than 10.306 mm (0.406 in.), machine the bush bore so that the diameter is between 10.335 and 10.356 mm (0.407 and 0.408 in.).

If the bush bore diameter of the cylinder head sub-assembly is more than 10.356 mm (0.408 in.), replace the cylinder head sub-assembly.

(e) Select a new exhaust valve guide bush.

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New Valve Guide Bush:

ITEM	SPECIFIED CONDITION	
Bush Bore Diameter	10.333 to 10.344 mm (0.4068 to 0.4072 in.)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)
Use Bush	STD	O/S 0.05

HINT:

Standard bush length: 43.0 to 44.0 mm (1.69 to 1.73 in.)

(f) Heat the cylinder head sub-assembly to 80 to 100°C (176 to 212°F).

(g) Place the cylinder head sub-assembly on wooden blocks.

(h) Using SST and a hammer, tap in a new exhaust valve guide bush to the specified protrusion height.

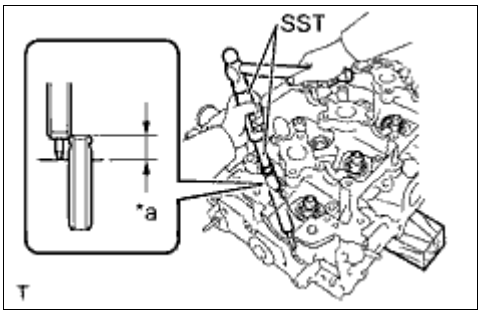
SST: 09201-01055

SST: 09950-70010

09951-07100

Standard protrusion height:

7.6 to 8.0 mm (0.299 to 0.315 in.)



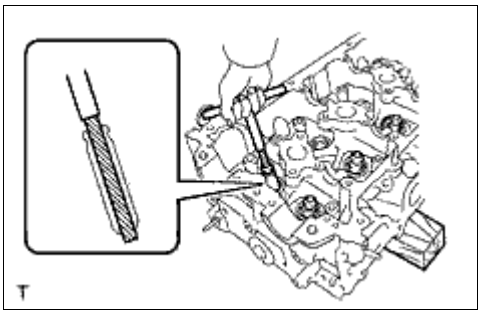
Text in Illustration

*a	Height

(i) Using a sharp 5.5 mm reamer, ream the exhaust valve guide bush to obtain the standard clearance between the exhaust valve guide bush and valve stem.

Standard oil clearance:

0.030 to 0.065 mm (0.00118 to 0.00256 in.)

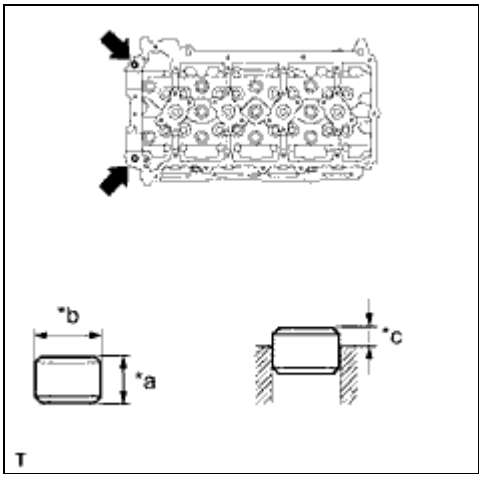


3. REPLACE CAMSHAFT BEARING CAP SETTING RING PIN

NOTICE:

It is not necessary to remove a ring pin unless it is being replaced.

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(a) Remove the ring pins.

(b) Using a plastic-faced hammer, tap in a new ring pin until the pin stops.

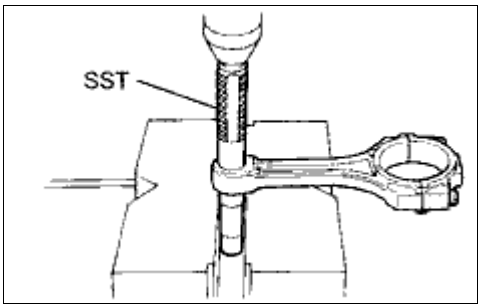
Standard Ring Pin:

ITEM	HEIGHT	WIDTH	PROTRUSION HEIGHT
Ring pin	7 mm (0.276 in.)	10 mm (0.394 in.)	2.5 to 3.8 mm (0.0984 to 0.150 in.)

Text in Illustration

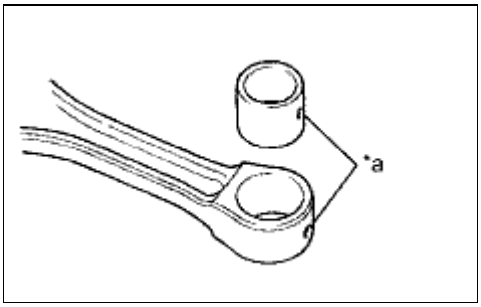
*a	Height
*b	Width
*c	Protrusion Height

4. REPLACE CONNECTING ROD SMALL END BUSH



(a) Using SST and a press, press out the bush.

SST: 09222-30010



(b) Align the oil holes of a new bush and the connecting rod.

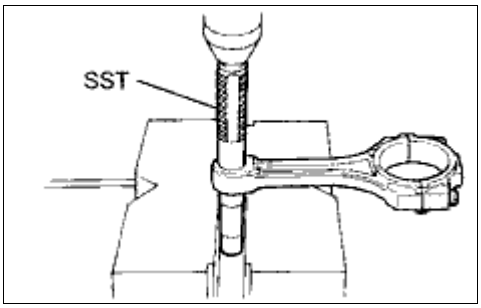
Text in Illustration

*a	Oil Hole

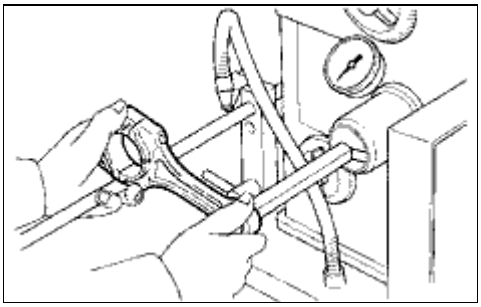
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(c) Using SST and a press, press in the bush.

SST: 09222-30010



(d) Using a pin hole grinder, hone the bush to obtain the standard specified clearance between the bush and piston pin.



(e) Check that the piston pin fits at normal room temperature.

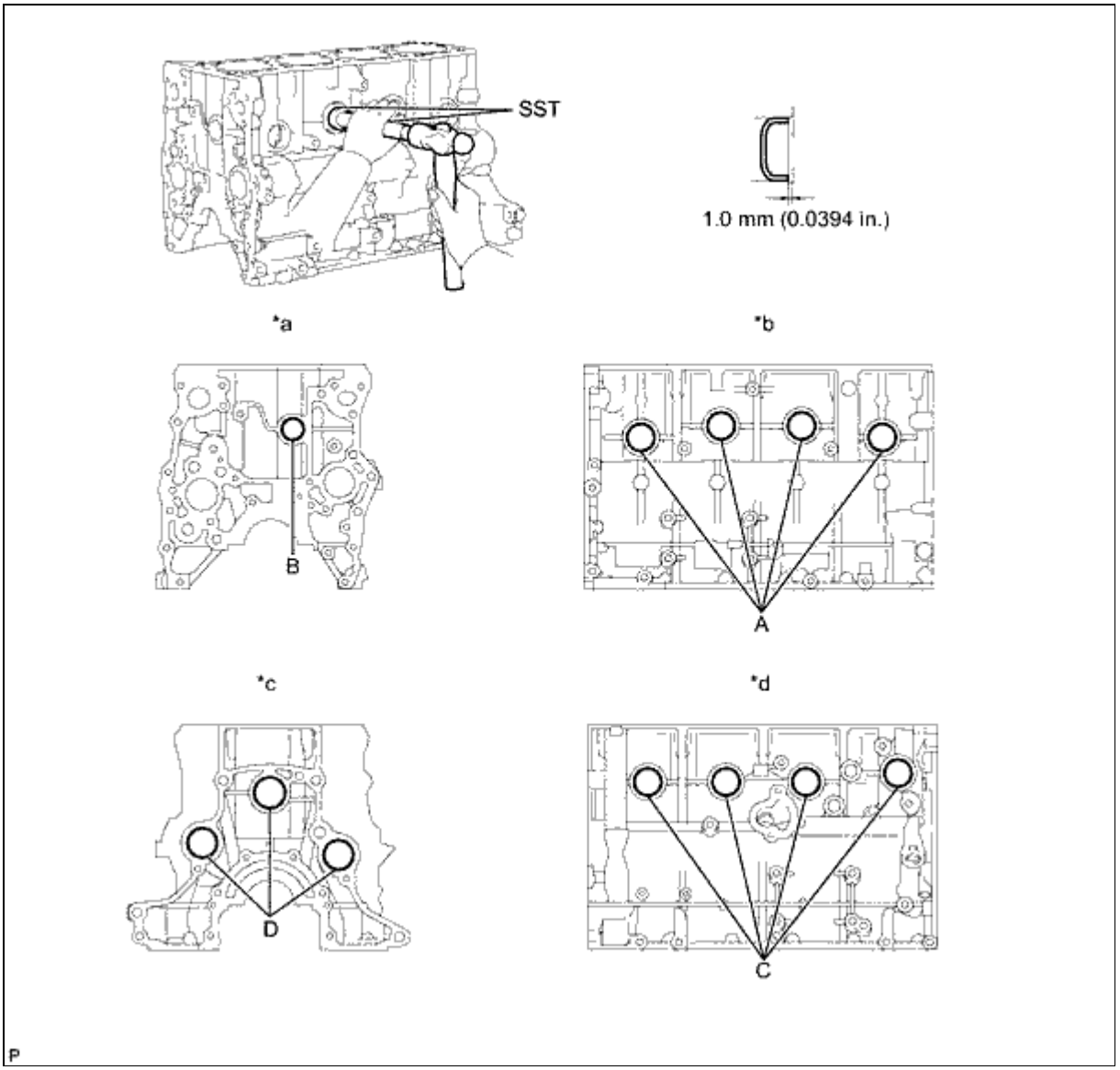
(1) Coat the piston pin with engine oil and push it into the connecting rod with your thumb.

5. REPLACE TIGHT PLUG

NOTICE:

If coolant leaks from the tight plug or the plug is corroded, replace it.

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Text in Illustration

*a	Front Side	*b	Intake Side
*c	Rear Side	*d	Exhaust Side

(a) Apply adhesive to new tight plugs.

Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent.

(b) Using SST, tap in the 8 tight plugs labeled A and C.

SST: 09950-60010
09951-00350
SST: 09950-70010
09951-07100

(c) Using SST, tap in the tight plug labeled B.

SST: 09950-60010
09951-00300
SST: 09950-70010

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09951-07100

(d) Using SST, tap in the 3 tight plugs labeled D.

SST: 09950-60010

09951-00400

SST: 09950-70010

09951-07100

6. REPLACE STRAIGHT PIN

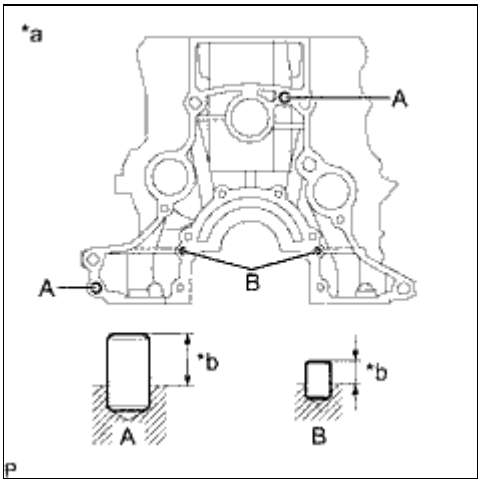
NOTICE:

It is not necessary to remove a straight pin unless it is being replaced.

(a) Using a plastic-faced hammer, tap in new straight pins to the cylinder block.

Standard Straight Pin:

ITEM	WIDE	PROTRUSION
Pin A	10 mm (0.394 in.)	13 mm (0.512 in.)
Pin B	6.0 mm (0.236 in.)	5.5 mm (0.217 in.)



Text in Illustration

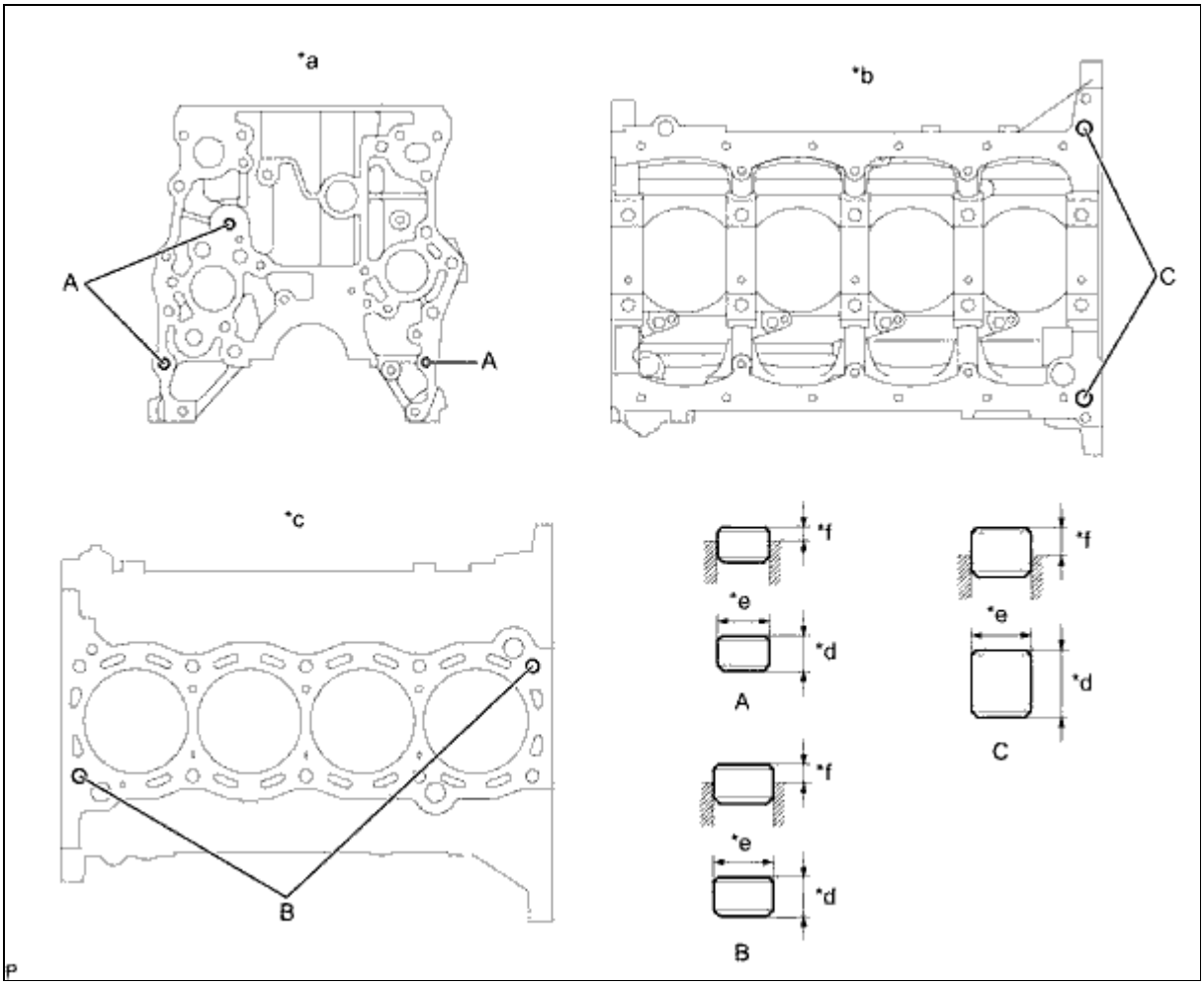
*a	Rear Side
*b	Protrusion

7. REPLACE RING PIN

NOTICE:

It is not necessary to remove a ring pin unless it is being replaced.

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Text in Illustration

*a	Front Side	*b	Lower Side
*c	Upper Side	*d	Height
*e	Width	*f	Protrusion

(a) Using a plastic-faced hammer, tap in new ring pins to the cylinder block.

Standard Ring Pin:

ITEM	HEIGHT	WIDTH	PROTRUSION
Pin A	9.0 mm (0.354 in.)	11 mm (0.433 in.)	3.5 to 4.5 mm (0.138 to 0.177 in.)
Pin B	14 mm (0.511 in.)	15 mm (0.591 in.)	7.5 to 9.5 mm (0.295 to 0.374 in.)
Pin C	20 mm (0.787 in.)	14 mm (0.511 in.)	7.0 to 9.0 mm (0.276 to 0.354 in.)

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017OE00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: ENGINE: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT ENGINE COOLANT

INFO

2. INSPECT ENGINE OIL

INFO

3. INSPECT BATTERY

INFO

4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Remove the air cleaner filter element sub-assembly from the air cleaner case sub-assembly.

(b) Visually check that the air cleaner filter element sub-assembly is not excessively damaged or oily. If necessary, replace the air cleaner filter element sub-assembly.

HINT:

- If there is any dirt or a blockage in the air cleaner filter element sub-assembly, clean it with compressed air.
- If any dirt or a blockage remains even after cleaning the air cleaner filter element sub-assembly with compressed air, replace it.

(c) Install the air cleaner filter element sub-assembly to the air cleaner case sub-assembly.

5. INSPECT SPARK PLUG

INFO

6. INSPECT FAN AND GENERATOR V BELT

INFO

7. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY

(a) Idle the engine and then stop the engine. Check that the fan and generator V belt is between the edges of the tensioner pulley.

(b) Remove the fan and generator V belt from the tensioner pulley.

(c) Turn the pulley, and check that the tensioner bearing moves smoothly and quietly.

If necessary, replace the V-ribbed belt tensioner assembly.

8. INSPECT VALVE LASH ADJUSTER NOISE

(a) Rev up the engine several times. Check that the engine does not emit unusual noises.

If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then perform the inspection above again.

If any defects or problems are found during the inspection above, perform a valve lash adjuster assembly inspection INFO .

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9. INSPECT IGNITION TIMING

NOTICE:

- Turn all electrical systems and the air conditioning switch off.
- Perform the inspection when the cooling fan motor is turned off.

(a) Warm up and stop the engine.

(b) When using a Techstream:

(1) Connect the Techstream to the DLC3.

(2) Start the engine.

(3) Turn the Techstream on.

(4) Enter the following menus:

Select: Powertrain / Engine and ECT / Data List / IGN Advance.

Standard ignition timing:

TRANSMISSION	IGNITION TIMING
Manual Transmission	5 to 15°BTDC (With the shift lever in neutral)
Automatic Transmission	5 to 15°BTDC (With the shift lever in N)

(5) Check that the ignition timing advances immediately when engine speed is increased.

(6) Enter the following menus: Powertrain / Engine and ECT / Active Test / Connect the TC and TE1.

(7) Monitor IGN Advance.

(8) Perform the Active Test.

Standard ignition timing:

TRANSMISSION	IGNITION TIMING
Manual Transmission	3 to 7° BTDC (With the shift lever in neutral)
Automatic Transmission	3 to 7° BTDC (With the shift lever in N)

(c) When not using the Techstream:

(1) Loosen the hose clamp from the throttle body side.

(2) Remove the 3 bolts and disconnect the intake air connector.

HINT:

Move the intake air connector so that the tester probe of a timing light can be connected to the wire of the ignition coil for the No. 1 cylinder.

(3) Connect the tester probe of a timing light to the wire of the ignition coil connector for the No. 1 cylinder.

NOTICE:

Use a timing light that detects primary signals.

(4) Connect the intake air connector.

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HINT:

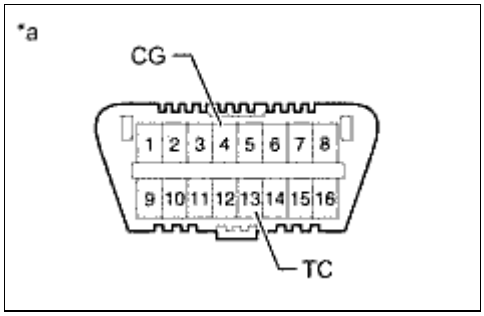
Return the parts to their original positions so that the engine can be started.

(5) Start the engine and idle it.

(6) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

Text in Illustration

*a	Front view of DLC3



SST: 09843-18040

NOTICE:

- Confirm the terminal numbers before connecting them. Connecting the wrong terminals can damage the engine.
- When checking the ignition timing, the shift lever should be in N or P.

(7) Using the timing light, check the ignition timing.

Standard ignition timing:

TRANSMISSION	IGNITION TIMING
Manual Transmission	3 to 7° BTDC (With the shift lever in neutral)
Automatic Transmission	3 to 7° BTDC (With the shift lever in N)

(8) Remove SST from the DLC3.

(9) Check the ignition timing.

Standard ignition timing:

TRANSMISSION	IGNITION TIMING
Manual Transmission	5 to 15°BTDC (With the shift lever in neutral)
Automatic Transmission	5 to 15°BTDC (With the shift lever in N)

(10) Check that the ignition timing advances immediately when the engine speed is increased.

(11) Turn the ignition switch off.

(12) Disconnect the timing light from the engine.

(13) Connect the intake air connector with the 3 bolts.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(14) Tighten the hose clamp.

Torque:

5.0 N·m {51 kgf·cm, 44in·lbf}

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10. INSPECT ENGINE IDLING SPEED

NOTICE:

- Turn all electrical systems and the air conditioning switch off.
- Perform the inspection when the cooling fan motor is turned off.

(a) Warm up and stop the engine.

(b) When using a Techstream:

(1) Connect the Techstream to the DLC3.

(2) Start the engine.

(3) Turn the Techstream on.

(4) Enter the following menus:

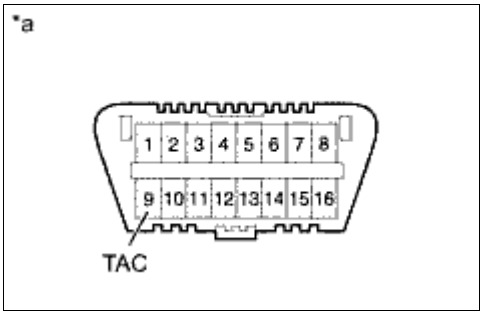
Select: Powertrain / Engine and ECT / Data List / Engine Speed.

Standard idling speed:

TRANSMISSION	IDLING SPEED
Manual Transmission	600 to 700 rpm (With the shift lever in neutral)
Automatic Transmission	700 to 800 rpm (With the shift lever in N)

(c) When not using a Techstream:

(1) Using SST, connect the terminal 9 (TAC) of the DLC3.



Text in Illustration

*a	Front view of DLC3

SST: 09843-18040

(2) Start the engine.

(3) Inspect the engine idle speed.

Standard idling speed:

TRANSMISSION	IDLING SPEED
Manual Transmission	600 to 700 rpm (With the shift lever in neutral)
Automatic Transmission	700 to 800 rpm (With the shift lever in N)

11. INSPECT COMPRESSION

(a) Warm up and stop the engine.

(b) Remove the intake air connector from the No. 1 air cleaner hose and throttle body with motor assembly INFO .

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(c) Remove the 4 ignition coil assemblies from the cylinder head cover sub-assembly INFO .

(d) Remove the 4 spark plugs from the cylinder head sub-assembly.

(e) Disconnect the 4 fuel injector assembly connectors from the 4 injector assemblies.

(f) Inspect the cylinder compression pressure.

(1) Insert a compression gauge into the spark plug hole. (Procedure A)

(2) While cranking the engine, measure the compression pressure. (Procedure B)

Standard compression pressure:
1230 kPa (12.5 kgf/cm ^{2} , 178 psi)
Minimum pressure:
880 kPa (9.0 kgf/cm ^{2} , 128 psi) or more
Difference between each cylinder:
98 kPa (1.0 kgf/cm ^{2} , 14 psi) or less

NOTICE:

- Use a fully-charged battery so the engine speed can be increased to 250 rpm or more.
- Inspect the other cylinders in the same way.
- Measure the compression in as short a time as possible.

(3) Repeat procedures A and B for each cylinder.

(4) If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat procedures A and B for cylinders with low compression.

HINT:

- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
- If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage from the gasket.

(g) Connect the 4 fuel injector assembly connectors to the 4 injector assemblies.

(h) Install the 4 spark plugs to the cylinder head sub-assembly.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

(i) Install the 4 ignition coil assemblies to the cylinder head cover sub-assembly INFO .

(j) Install the intake air connector to the No. 1 air cleaner hose and throttle body with motor assembly INFO .

(k) Clear the DTCs INFO .

12. INSPECT CO/HC

(a) Start the engine.

(b) Run the engine at 2500 rpm for approximately 180 seconds.

(c) Insert the CO/HC meter testing probe at least 40 cm (1.3 ft) into the tailpipe during idling.

(d) Immediately check the CO/HC concentration during idling and/or at 2500 rpm.

HINT:

- Complete the measurement within 3 minutes.
- When carrying out the 2 modes (idling and 2500 rpm) test, the measurement orders are prescribed by the applicable local regulations.

(e) If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

(1) Check the air fuel ratio sensor operation INFO and heated oxygen sensor operation INFO .

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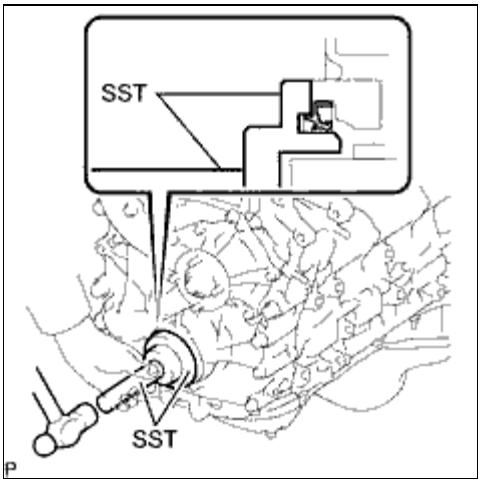
CO	HC	PROBLEMS	CAUSES
Normal	High	Rough idling	1. Faulty ignition: ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leakage from intake and exhaust valves 4. Leakage from cylinders
Low	High	Rough idling (Fluctuation HC reading)	1. Vacuum leaks: ○ Ventilation hoses ○ Intake manifold ○ Throttle body with motor assembly ○ Brake booster line 2. Lean mixture causing misfire
High	High	Rough idling (Black smoke from exhaust)	1. Restricted air cleaner filter element sub-assembly 2. Plugged Ventilation valve sub-assembly 3. Faulty SFI systems: ○ Faulty pressure regulator assembly ○ Faulty engine coolant temperature sensor ○ Faulty mass air flow meter ○ Faulty ECM ○ Faulty injector assembly ○ Faulty throttle body with motor assembly

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000463800TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: FRONT CRANKSHAFT OIL SEAL: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL TIMING CHAIN COVER OIL SEAL



(a) Apply MP grease to the lip of a new timing chain cover oil seal.

NOTICE:

- Do not allow foreign matter to contact the lip of the timing chain cover oil seal.
- Do not allow MP grease to contact the dust seal.

(b) Temporarily install the timing chain cover oil seal to the timing chain cover sub-assembly.

(c) Using SST and a hammer, tap in the timing chain cover oil seal until its surface is flush with the chain cover edge.

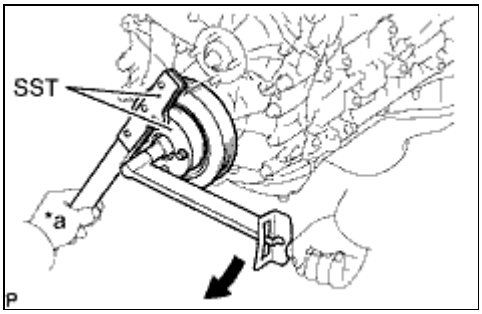
SST: 09223-75010
SST: 09950-70010
09951-07100

NOTICE:

- Keep the lip free from foreign matter.
- Do not tap the timing chain cover oil seal at an angle.

2. INSTALL CRANKSHAFT PULLEY

(a) Align the key groove of the crankshaft pulley with the pulley set key and slide on the crankshaft pulley.



Text in Illustration

*a	Hold

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➡	Turn

(b) Using SST, install a new crankshaft pulley bolt.

SST: 09213-54015

91651-60855

SST: 09330-00021

Torque:

260 N·m {2651 kgf·cm, 192ft·lbf}

NOTICE:

Do not reuse the pulley bolt.

3. INSTALL FAN SHROUD INFO

4. INSTALL RADIATOR SUPPORT TO FRAME SEAL LH INFO

5. INSPECT FOR OIL LEAK INFO

6. INSPECT ENGINE OIL LEVEL INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000463A00TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: FRONT CRANKSHAFT OIL SEAL: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE RADIATOR SUPPORT TO FRAME SEAL LH

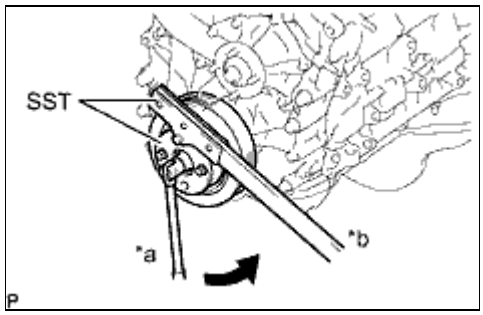
INFO

2. REMOVE FAN SHROUD

INFO

3. REMOVE CRANKSHAFT PULLEY

(a) Using SST, hold the crankshaft pulley and loosen the pulley bolt until 2 or 3 threads are screwed into the crankshaft.



Text in Illustration

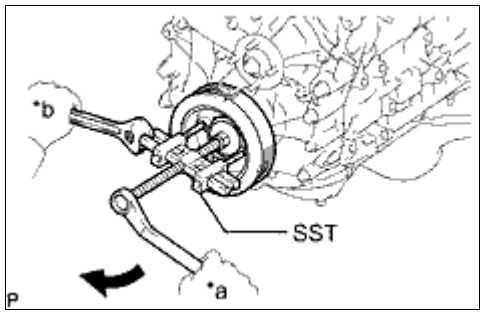
*a	Loosen
*b	Hold

SST: 09213-54015

91651-60855

SST: 09330-00021

(b) Using SST and the pulley bolt, remove the crankshaft pulley.



Text in Illustration

*a	Loosen
*b	Hold

SST: 09950-50013

09951-05010

09952-05010

09953-05010

09954-05021

HINT:

Apply lubricant to the threads and end of SST.

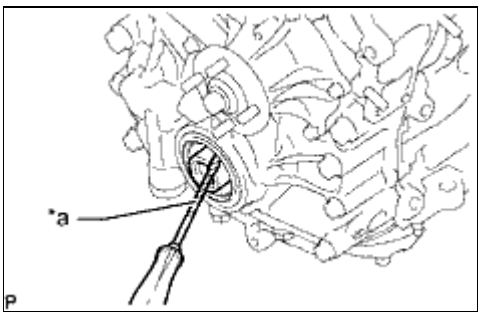
4. REMOVE TIMING CHAIN COVER OIL SEAL

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(a) Using a screwdriver, pry out the timing chain cover oil seal.

Text in Illustration

*a	Protective Tape



NOTICE:

- Do not damage the surface of the timing chain cover oil seal press fit hole or the crankshaft.
- Check the crankshaft for damage after removing the timing chain cover oil seal. If the crankshaft is damaged, smooth the surface with 400-grit sandpaper.

HINT:

Tape the screwdriver tip before use.

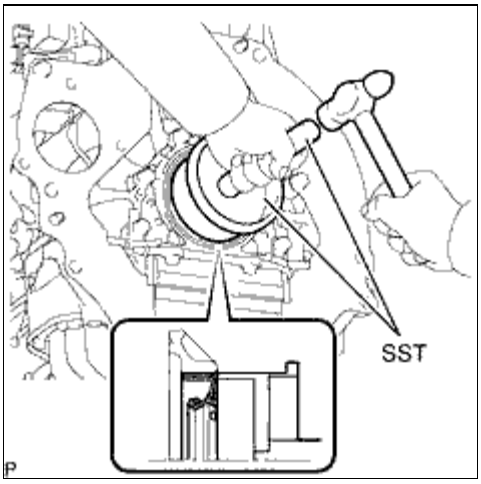
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000027IF07XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: REAR CRANKSHAFT OIL SEAL: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL REAR ENGINE OIL SEAL

(a) Apply a light coat of MP grease to the lip of a new rear engine oil seal.



NOTICE:

- Do not allow foreign matter to contact the lip of the rear engine oil seal.
- Do not allow MP grease to contact the dust seal.

(b) Using SST and a hammer, tap in the rear engine oil seal until its surface is flush with the rear engine oil seal retainer edge.

SST: 09223-15030

SST: 09950-70010

09951-07150

NOTICE:

- Wipe off any extra grease from the crankshaft.
- Do not tap in the rear engine oil seal at an angle.

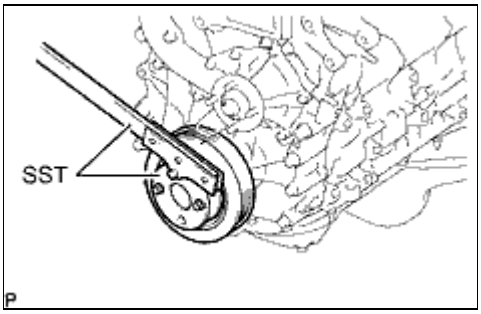
2. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission)

(a) Using SST, hold the crankshaft.

SST: 09213-54015

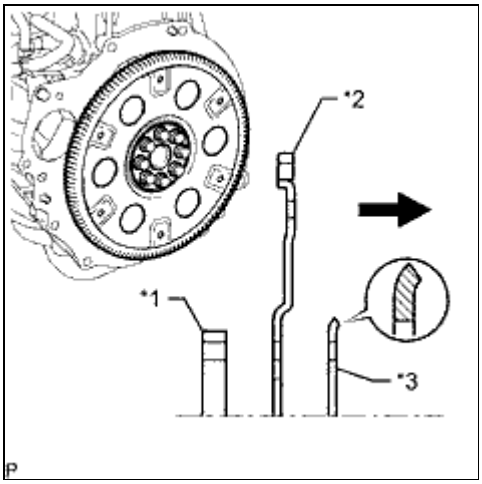
91651-60855

SST: 09330-00021



(b) Install the front drive plate spacer, drive plate and ring gear sub-assembly and rear drive plate spacer to the crankshaft.

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Text in Illustration

*1	Front Drive Plate Spacer
*2	Drive Plate and Ring Gear Sub-assembly
*3	Rear Drive Plate Spacer
➡	Transmission Side

HINT:

- The front drive plate spacer is reversible.
- As the rear drive plate spacer and drive plate and ring gear sub-assembly are not reversible, be sure to install it so that it is facing in the direction shown in the illustration.

(c) Clean the bolts and bolt holes.

(d) Apply adhesive to 2 or 3 threads at the end of each of the 10 bolts.

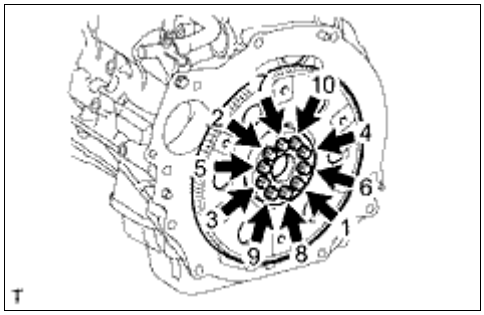
Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

(e) Install and uniformly tighten the 10 bolts in several steps in the sequence shown in the illustration.

Torque:

74 N·m {755 kgf·cm, 55ft·lbf}



NOTICE:

Do not start the engine for at least an hour after installing the drive plate and ring gear sub-assembly.

3. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)

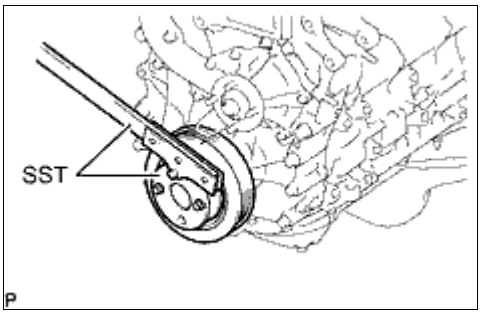
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(a) Using SST, hold the crankshaft.

SST: 09213-54015

91651-60855

SST: 09330-00021

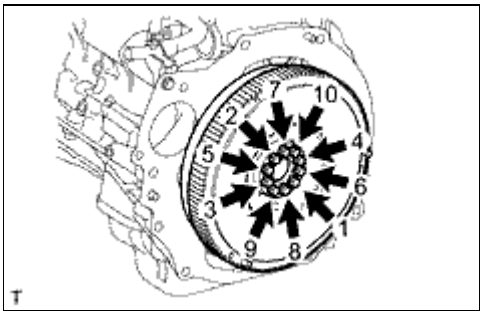


(b) Clean the bolt holes.

(c) Install the flywheel sub-assembly with 10 new bolts and uniformly tighten the bolts in several steps in the sequence shown in the illustration.

Torque:

27 N·m {270 kgf·cm, 20ft·lbf}



(d) Mark the top of the bolts with paint.

(e) Tighten the 10 bolts 90° in the same sequence.

(f) Check that the paint marks are now at a 90° angle to the top.

4. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

5. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

6. INSPECT AND ADJUST CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

7. INSTALL MANUAL TRANSMISSION UNIT ASSEMBLY (for Manual Transmission)

INFO

8. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for Automatic Transmission)

INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000027IH07XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: REAR CRANKSHAFT OIL SEAL: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE MANUAL TRANSMISSION UNIT ASSEMBLY (for Manual Transmission)

INFO

2. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for Automatic Transmission)

INFO

3. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

4. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

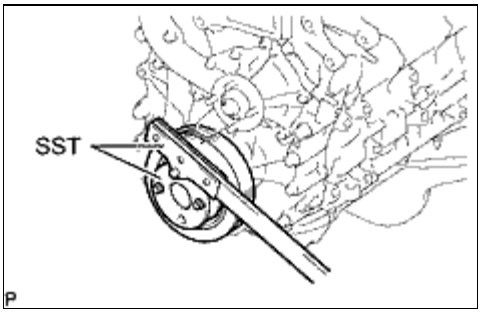
5. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)

(a) Using SST, hold the crankshaft.

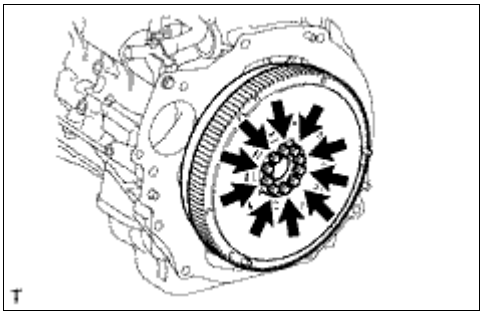
SST: 09213-54015

91651-60855

SST: 09330-00021



(b) Remove the 10 bolts and flywheel sub-assembly.



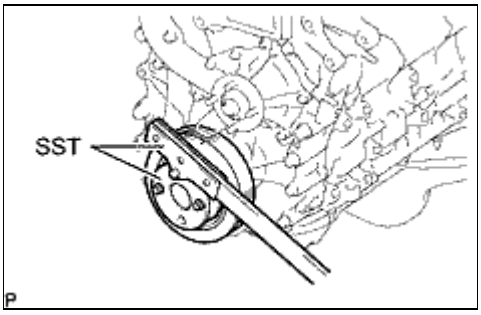
6. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission)

(a) Using SST, hold the crankshaft.

SST: 09213-54015

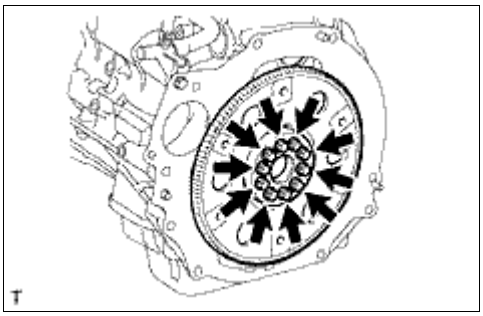
91651-60855

SST: 09330-00021



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(b) Remove the 10 bolts, rear drive plate spacer, drive plate and ring gear sub-assembly and front drive plate spacer.

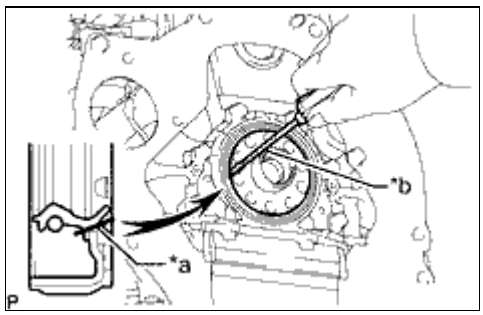


7. REMOVE REAR ENGINE OIL SEAL

(a) Using a knife, cut off the lip of the rear engine oil seal.

Text in Illustration

*a	Cut Position
*b	Protective Tape



(b) Using a screwdriver pry out the rear engine oil seal.

NOTICE:

- Do not damage the surface of the rear engine oil seal press fit hole or the crankshaft.
- After removing the rear engine oil seal, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

HINT:

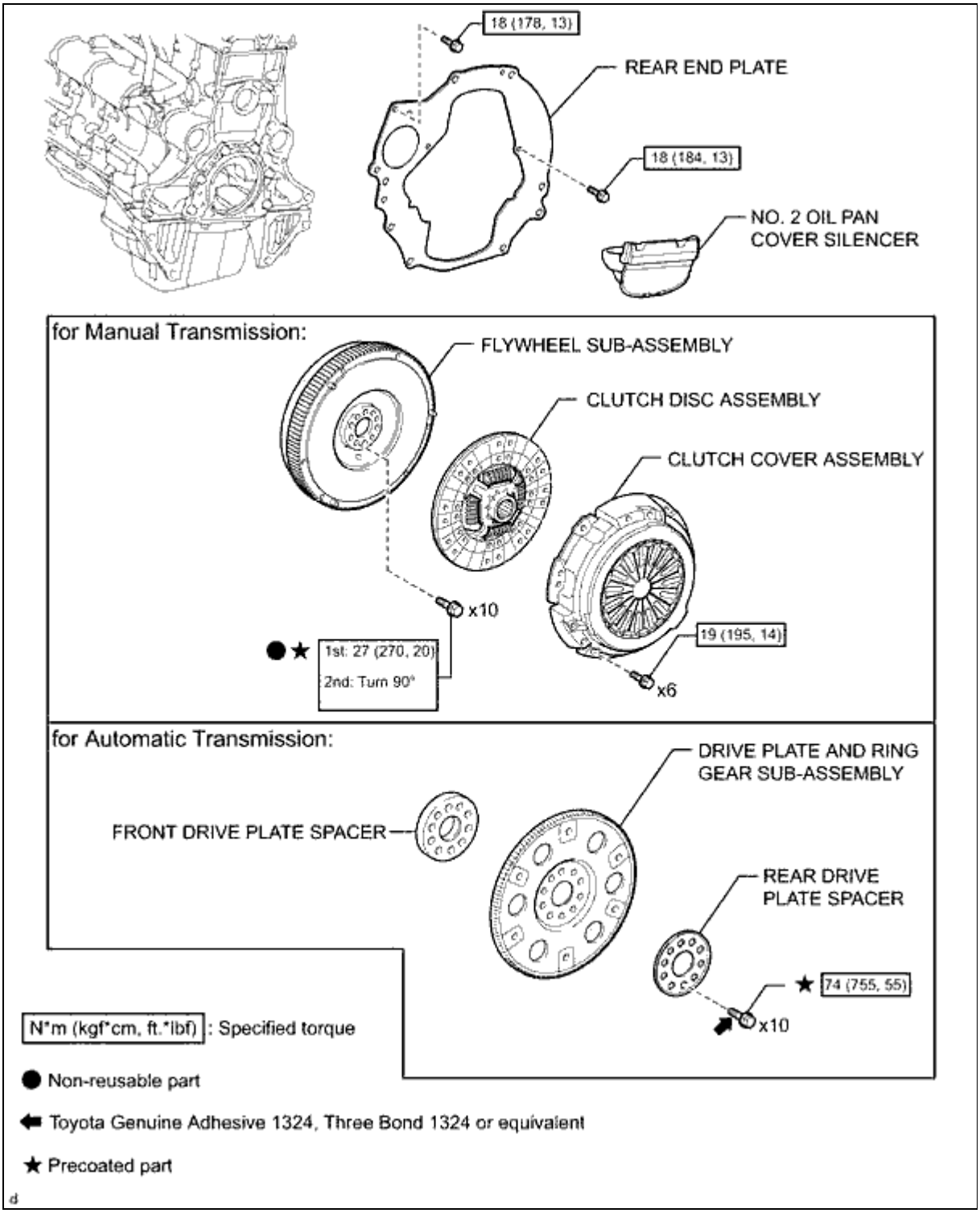
Tape the screwdriver tip before use.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM0000017OC00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: TIMING CHAIN: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

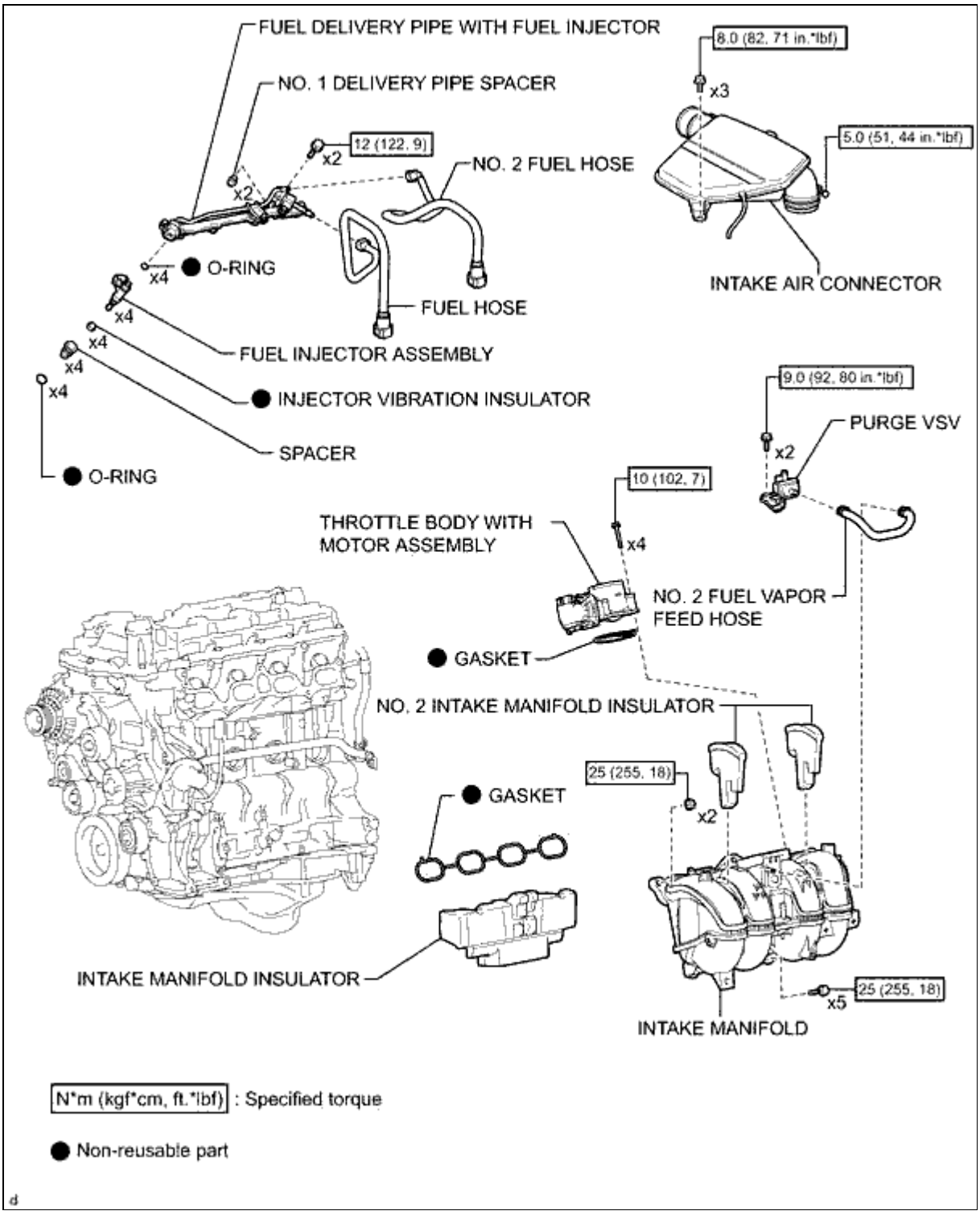
COMPONENTS

ILLUSTRATION



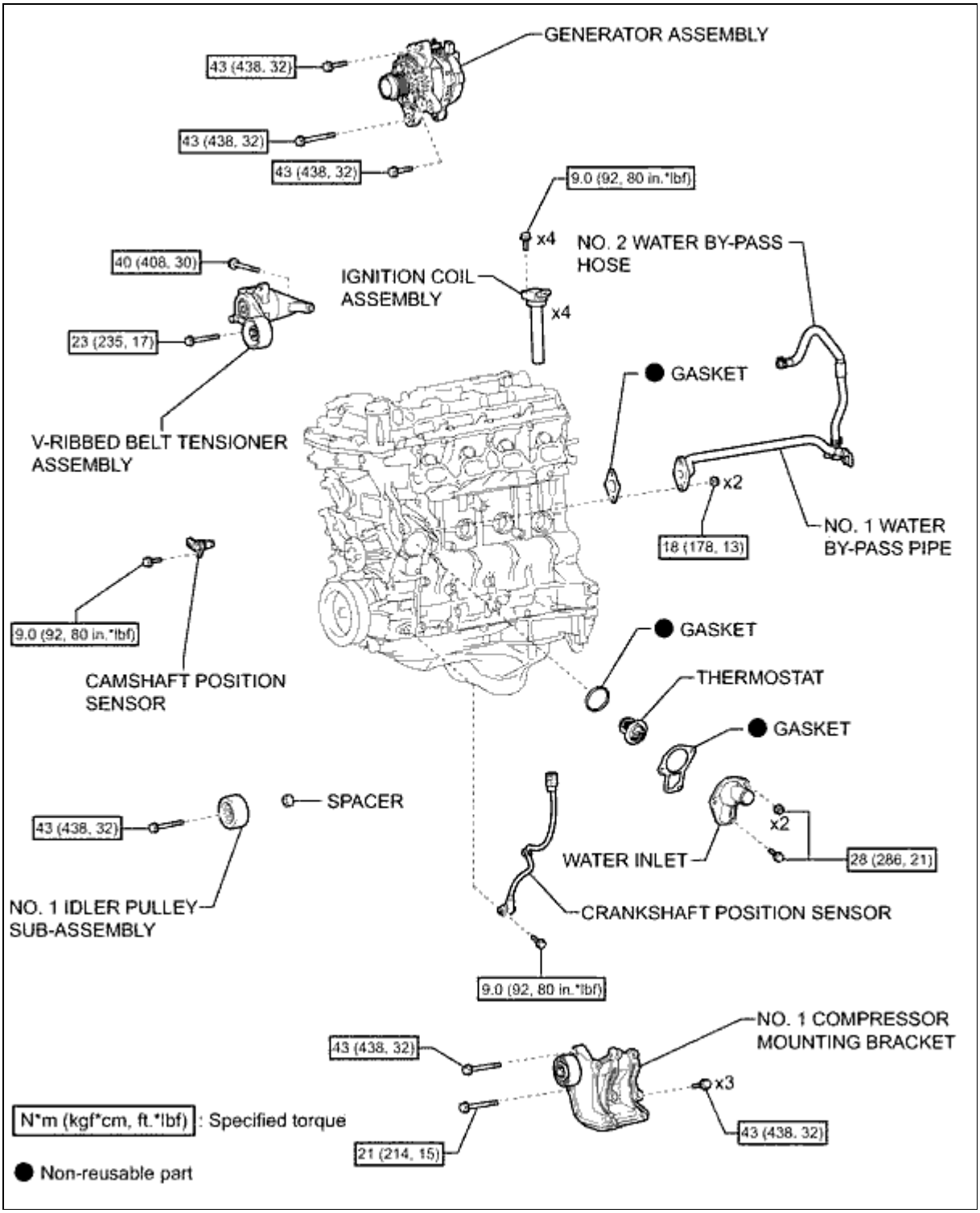
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ILLUSTRATION



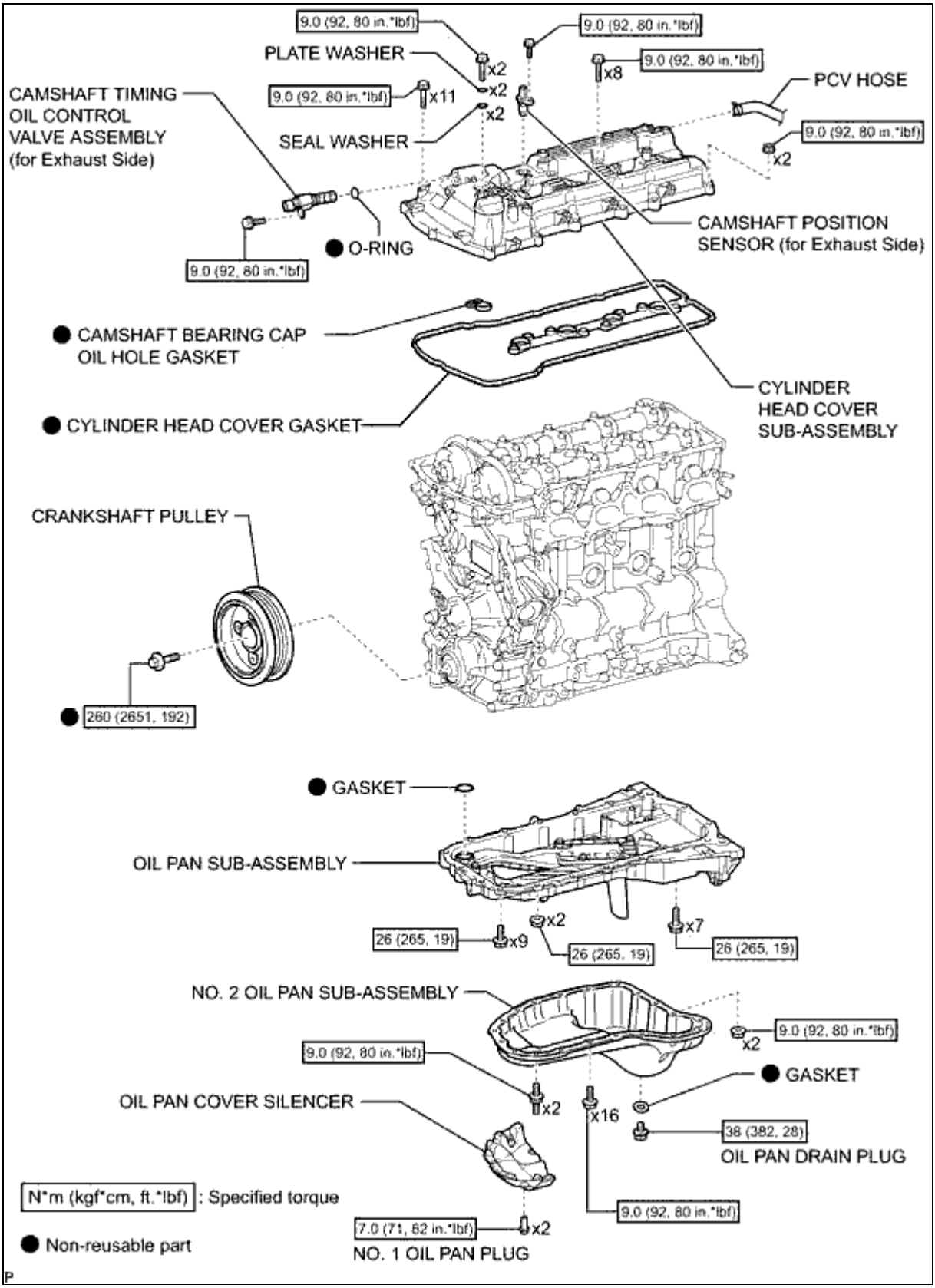
ILLUSTRATION

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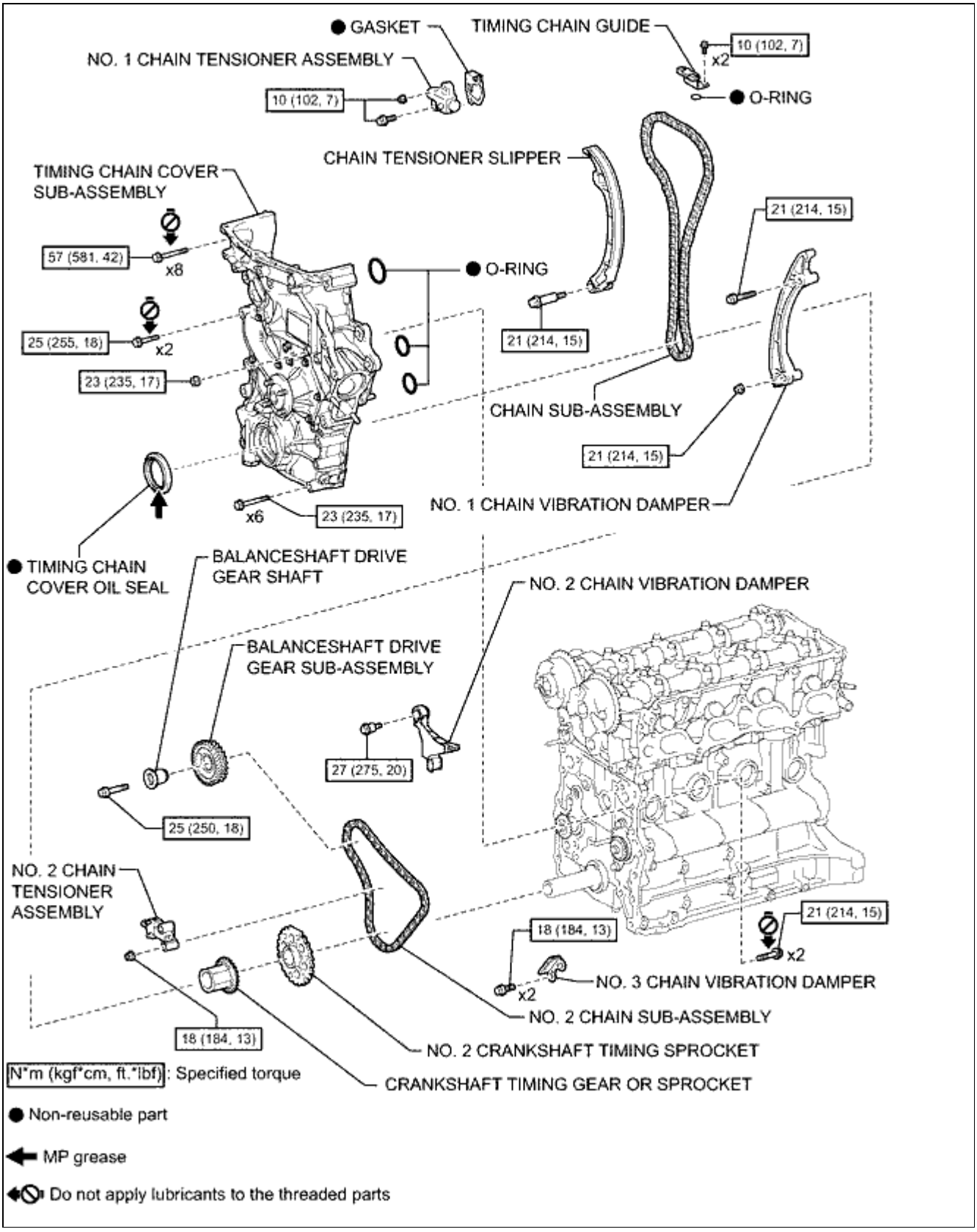
ILLUSTRATION

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ILLUSTRATION

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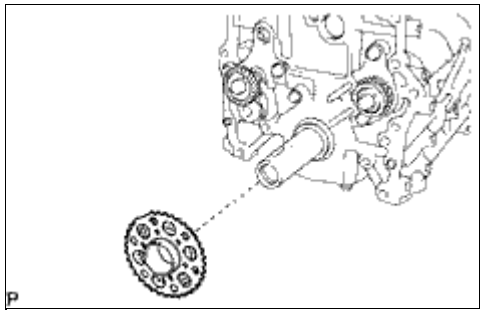
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017OB00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: TIMING CHAIN: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL NO. 2 CHAIN SUB-ASSEMBLY

(a) Install the timing sprocket as shown in the illustration.



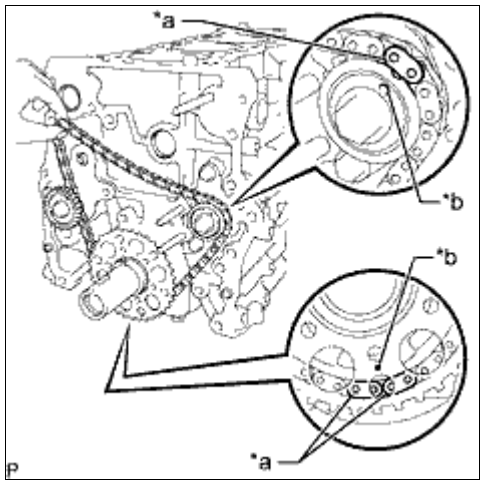
NOTICE:

Check that the No. 1 cylinder is at TDC and that the weights of the No. 1 and No. 2 balanceshafts are at the bottom.

HINT:

Install the timing sprocket with the front mark facing forward.

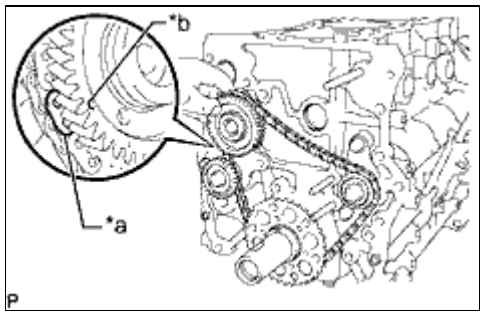
(b) As shown in the illustration, install the chain to the sprocket and gear with the mark plates aligned with the timing marks on the sprocket and gear.



Text in Illustration

*a	Mark Plate (Yellow)
*b	Timing Mark

(c) Fit the other mark link of the chain behind the large timing mark of the balanceshaft drive gear.



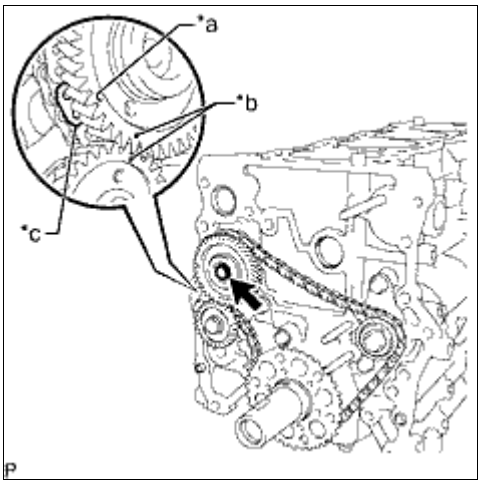
Text in Illustration

*a	Mark Plate (Yellow)
*b	Large Timing Mark

(d) Insert the balanceshaft drive gear shaft through the balanceshaft drive gear so that it fits into the thrust plate hole.

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(e) Align the small timing mark of the balanceshaft drive gear with the timing mark of the balanceshaft timing gear.



Text in Illustration

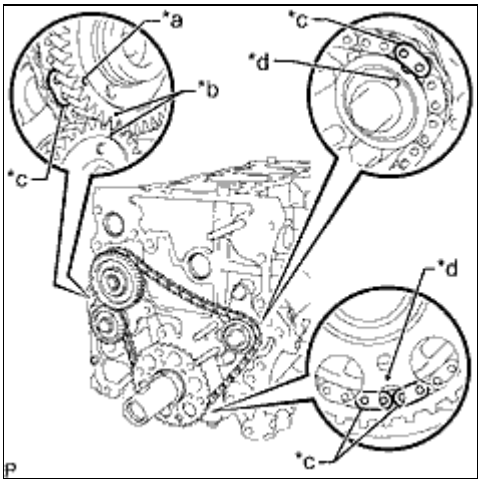
*a	Large Timing Mark
*b	Small Timing Mark
*c	Mark Plate (Yellow)

(f) Install the bolt onto the balanceshaft drive gear and tighten it.

Torque:

25 N·m {250 kgf·cm, 18ft·lbf}

(g) Check that each timing mark is aligned with the corresponding mark link.



Text in Illustration

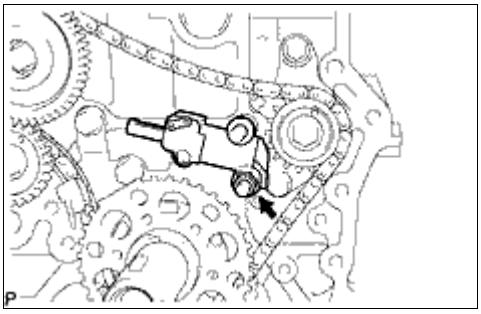
*a	Large Timing Mark
*b	Small Timing Mark
*c	Mark Plate (Yellow)
*d	Timing Mark

NOTICE:

Check that the No. 1 cylinder is at TDC and that the weights of the No. 1 and No. 2 balanceshafts are at the bottom.

2. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Install the No. 2 chain tensioner assembly with the nut.



Torque:

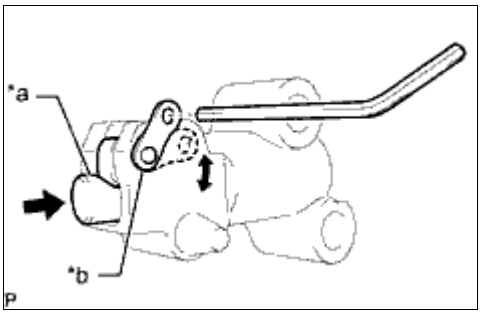
18 N·m {184 kgf·cm, 13ft·lbf}

NOTICE:

Install the No. 2 chain tensioner assembly with the pin installed, and then remove the pin after installation. When performing this step, do not push the vibration damper against the chain.

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(b) Move the stopper plate downward to release the lock and push the plunger deep into the tensioner.



Text in Illustration

*a	Plunger
*b	Stopper Plate

(c) Move the stopper plate upward to set the lock and insert a hexagon wrench into the stopper plate hole.

3. INSTALL NO. 3 CHAIN VIBRATION DAMPER

(a) Install the No. 3 chain vibration damper with the 2 bolts.

Torque:

18 N·m {184 kgf·cm, 13ft·lbf}

4. INSTALL NO. 2 CHAIN VIBRATION DAMPER

(a) Install the chain vibration damper with the bolt.

Torque:

27 N·m {275 kgf·cm, 20ft·lbf}

(b) Remove the pin from the No. 2 chain tensioner assembly and release the plunger.

5. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Install the crankshaft timing gear or sprocket.

6. INSTALL NO. 1 CHAIN VIBRATION DAMPER

(a) Install the vibration damper with the bolt and nut.

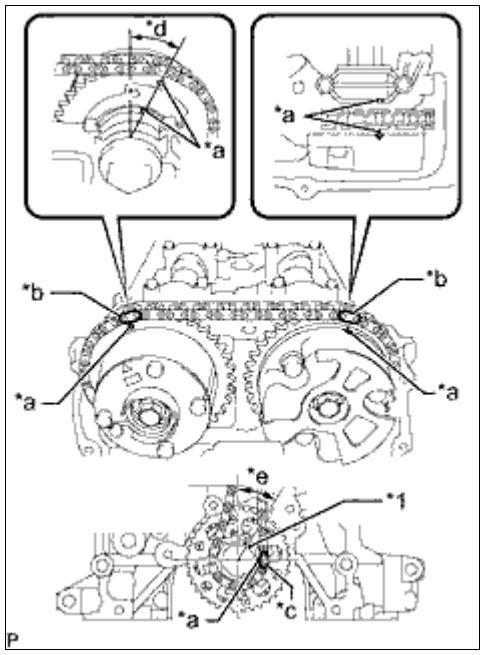
Torque:

21 N·m {214 kgf·cm, 15ft·lbf}

7. INSTALL CHAIN SUB-ASSEMBLY

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(a) As shown in the illustration, install the chain subassembly to the camshaft timing exhaust gear assembly and camshaft timing gear assembly with the mark plates aligned with the timing marks on the camshaft timing exhaust gear assembly and camshaft timing gear assembly.



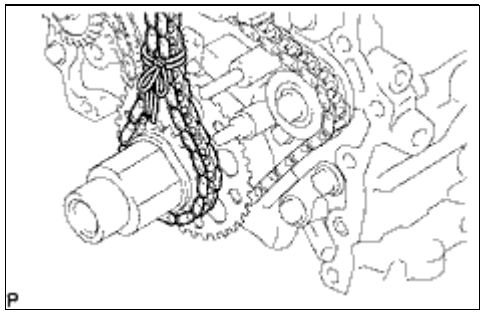
Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Mark Plate (Pink)
*c	Mark Plate (Yellow)
*d	Approximately 13°
*e	Approximately 30°

HINT:

- The camshaft mark plate is pink.
- The crankshaft mark plate is yellow.

(b) Use a rope to tie the chain of the crankshaft timing sprocket. Tie the rope near the sprocket.



NOTICE:

After the No. 2 chain tensioner assembly has been installed, the rope must be removed.

HINT:

The rope is tied to prevent gear jumping.

8. INSTALL CHAIN TENSIONER SLIPPER

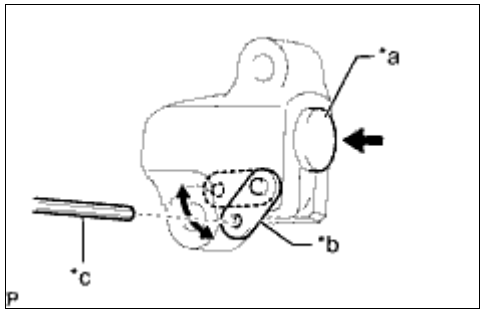
(a) Install the tensioner slipper with the bolt.

Torque:

21 N·m {214 kgf·cm, 15ft·lbf}

9. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate upward to release the lock and push the plunger deep into the tensioner.



Text in Illustration

*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench

(b) Move the stopper plate downward to set the lock and insert a hexagon wrench into the hole of the stopper plate.

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(c) Install a new gasket and the No. 1 chain tensioner assembly with the bolt and nut.

Torque:

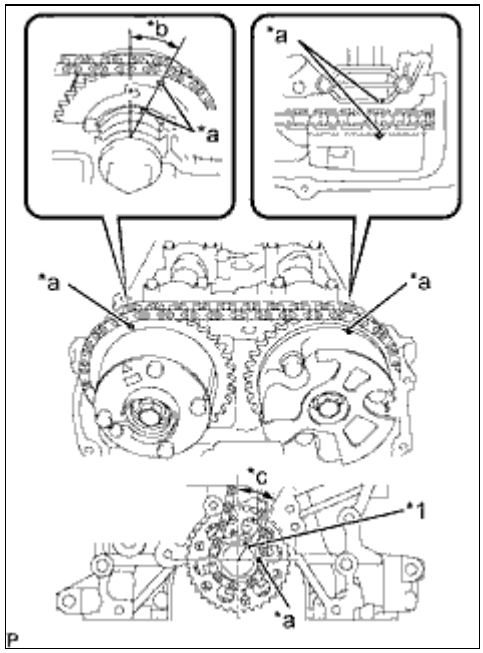
10 N·m {102 kgf·cm, 7ft·lbf}

(d) Remove the hexagon wrench from the No. 1 chain tensioner assembly and release the plunger.

10. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Check that the No. 1 cylinder is set to TDC/compression.

(1) Rotate the crankshaft two full rotations, and then check that all timing marks are in the position shown in the illustration.



Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Approximately 13°
*c	Approximately 30°

11. INSTALL TIMING CHAIN GUIDE

(a) Install a new O-ring and the chain guide with the 2 bolts.

Torque:

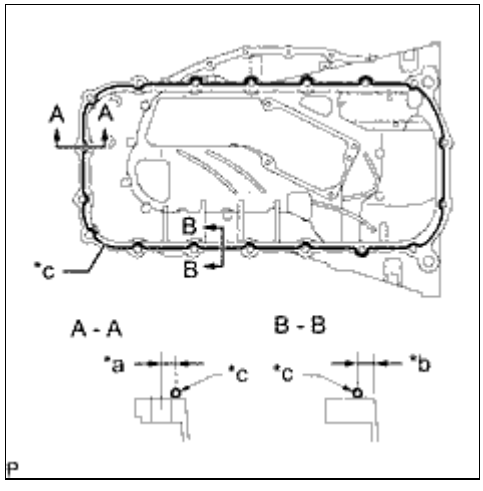
10 N·m {102 kgf·cm, 7ft·lbf}

12. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY INFO

13. INSTALL OIL PAN SUB-ASSEMBLY

(a) Clean and degrease the contact surfaces of the oil pan sub-assembly and cylinder block sub-assembly.

(b) Apply continuous beads of seal packing to the places shown in the illustration.



Text in Illustration

*a	8.0 mm (0.315 in.)
*b	6.5 mm (0.256 in.)
*c	Seal Packing

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

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Seal width:

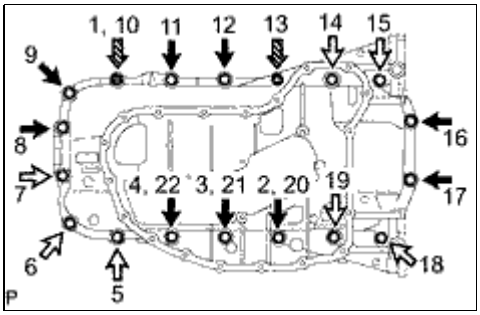
2.0 to 3.0 mm (0.079 to 0.118 in.)

NOTICE:

- Remove any oil from the contact surface.
- Install the crankcase within 3 minutes of applying the seal packing.
- Do not start the engine for at least 2 hours after installation.

(c) Install a new gasket to the oil strainer sub-assembly.

(d) Temporarily install the oil pan sub-assembly with the 16 bolts and 2 nuts.



Text in Illustration

➡	Bolt A
⇨	Bolt B
⇛	Nut

Bolt Length

ITEM	LENGTH
Bolt A	20 mm (0.79 in.)
Bolt B	40 mm (1.57 in.)

(e) Uniformly tighten the 16 bolts and 2 nuts in the sequence shown in the illustration.

Torque:

26 N·m {265 kgf·cm, 19ft·lbf}

14. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

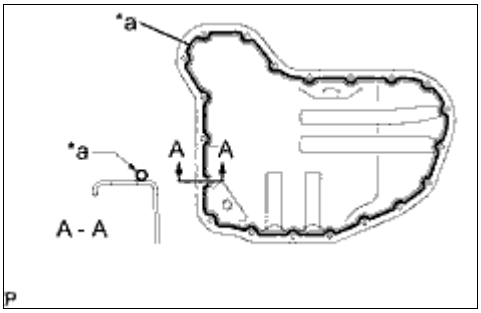
(a) Clean and degrease the contact surfaces of the oil pan sub-assembly and No. 2 oil pan sub-assembly.

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(b) Apply continuous beads of seal packing to the places shown in the illustration.

Text in Illustration

*a	Seal Packing



Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

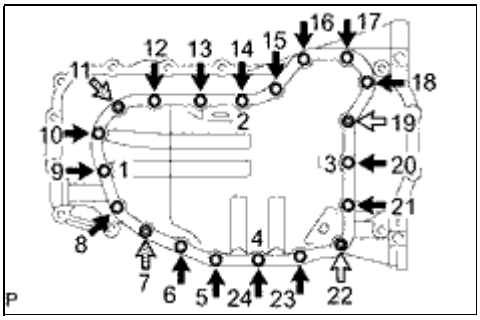
Seal packing diameter:

3.0 to 4.0 mm (0.118 to 0.157 in.)

NOTICE:

- Remove any oil from the contact surface.
- Install the No. 2 oil pan sub-assembly within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.
- Do not start the engine for at least 4 hours after the installation.

(c) Temporarily install the No. 2 oil pan sub-assembly with the 16 bolts and 2 adjusting screws, 2 nuts.



Text in Illustration

➡	Bolt
⇨	Nut
⇛	Adjusting Screw

(d) Uniformly tighten the 16 bolts and 2 adjusting screws, 2 nuts in the order shown in the illustration.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(e) Install a new gasket and the drain plug.

Torque:

38 N·m {382 kgf·cm, 28ft·lbf}

15. INSTALL OIL PAN COVER SILENCER

(a) Install the oil pan cover silencer with the 2 No. 1 oil pan plugs.

Torque:

7.0 N·m {71 kgf·cm, 62in·lbf}

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16. INSTALL OIL LEVEL DIPSTICK SUB-ASSEMBLY

17. INSTALL CRANKSHAFT PULLEY INFO

18. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY INFO

19. INSTALL IGNITION COIL ASSEMBLY INFO

20. INSTALL NO. 1 WATER BY-PASS PIPE INFO

21. INSTALL CRANKSHAFT POSITION SENSOR INFO

22. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

23. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

24. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

25. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY

(a) Install the No. 1 idler pulley sub-assembly with the bolt.

Torque:

43 N·m {438 kgf·cm, 32ft·lbf}

26. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY INFO

27. INSTALL THERMOSTAT INFO

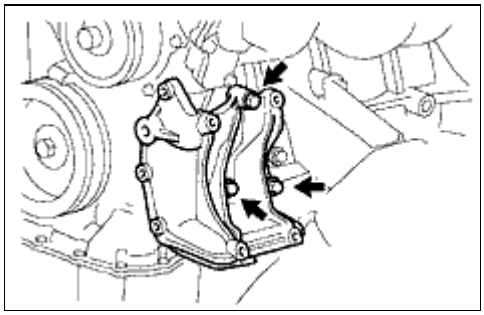
28. INSTALL WATER INLET INFO

29. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET

NOTICE:

Install the No. 1 compressor mounting bracket exactly as described in the procedures below to properly secure and prevent damage to the fan and generator V belt.

(a) Temporarily install the No. 1 compressor mounting bracket with the 3 bolts.

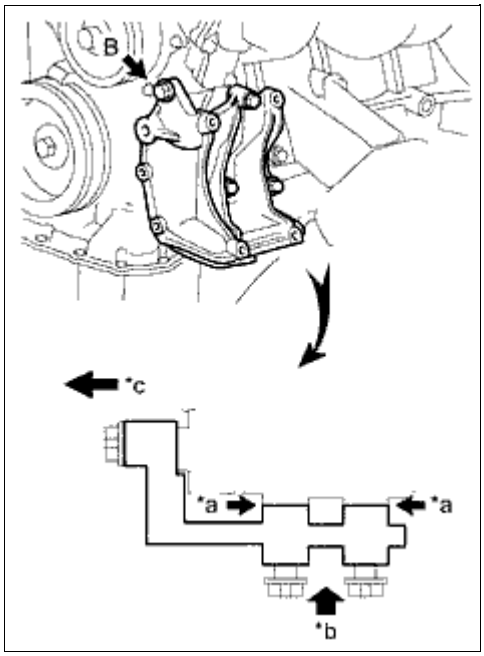


HINT:

Temporarily install the No. 1 compressor mounting bracket with the 3 bolts so that the bracket can be moved by hand.

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(b) Push the No. 1 compressor mounting bracket toward the cylinder block as shown in the illustration and tighten bolt B.



Text in Illustration

*a	No Clearance
*b	Push
*c	Front

Torque:

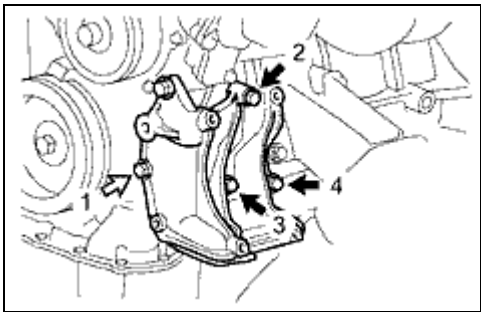
for bolt B -

43 N·m {438 kgf·cm, 32ft·lbf}

HINT:

Make sure there is no clearance between the cylinder block and No. 1 compressor mounting bracket as shown in the illustration.

(c) Uniformly tighten the 4 bolts in the order shown in the illustration.



Text in Illustration

➡	Bolt A
⇨	Bolt C

Torque:

for bolt A -

43 N·m {438 kgf·cm, 32ft·lbf}

for bolt C -

21 N·m {214 kgf·cm, 15ft·lbf}

30. INSTALL GENERATOR ASSEMBLY INFO

31. INSTALL INTAKE MANIFOLD INFO

32. REMOVE PURGE VSV INFO

33. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY INFO

34. INSTALL NO. 2 FUEL HOSE INFO

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35. INSTALL FUEL HOSE INFO

36. INSTALL INTAKE AIR CONNECTOR INFO

37. INSTALL REAR END PLATE INFO

38. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

39. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

40. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

41. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

42. INSTALL ENGINE ASSEMBLY

INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017OD00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE ENGINE MECHANICAL: TIMING CHAIN: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE ENGINE ASSEMBLY

INFO

2. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission) INFO

3. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission) INFO

4. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) INFO

5. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) INFO

6. REMOVE REAR END PLATE INFO

7. REMOVE INTAKE AIR CONNECTOR INFO

8. REMOVE FUEL HOSE INFO

9. REMOVE NO. 2 FUEL HOSE INFO

10. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY INFO

11. REMOVE PURGE VSV INFO

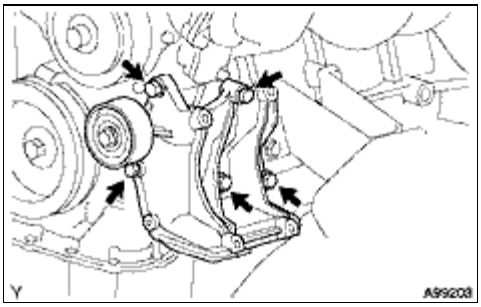
12. REMOVE INTAKE MANIFOLD INFO

13. REMOVE GENERATOR ASSEMBLY INFO

14. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY INFO

15. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET

(a) Remove the 5 bolts and No. 1 compressor mounting bracket.



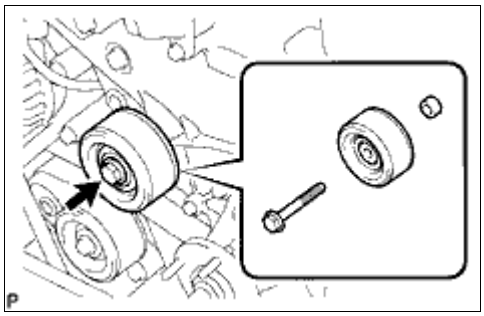
16. REMOVE WATER INLET INFO

17. REMOVE THERMOSTAT INFO

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18. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY

(a) Remove the bolt, No. 1 idler pulley sub-assembly and spacer.



19. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

20. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

21. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

22. REMOVE CRANKSHAFT POSITION SENSOR INFO

23. REMOVE NO. 1 WATER BY-PASS PIPE INFO

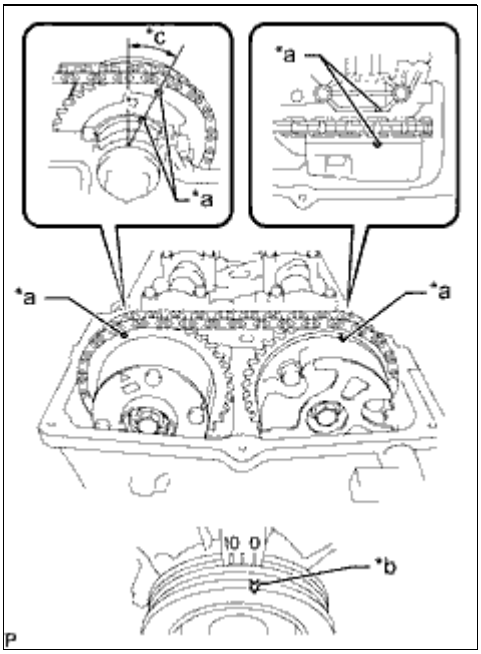
24. REMOVE IGNITION COIL ASSEMBLY INFO

25. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

26. REMOVE CRANKSHAFT PULLEY

(a) Set the No. 1 cylinder to the TDC/ compression.

(1) Turn the crankshaft pulley clockwise and align its timing mark notch with the timing mark "0".



Text in Illustration

*a	Timing Mark
*b	Groove
*c	Approximately 13°

(2) Check that the timing marks of the camshaft timing gear are located as illustrated.

HINT:

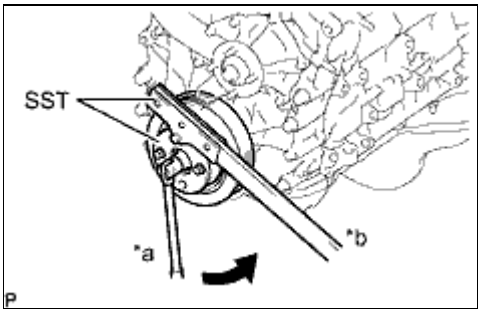
If not, turn the crankshaft to align the marks.

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(b) Using SST, loosen the crankshaft pulley bolt.

Text in Illustration

*a	Turn
*b	Hold



SST: 09213-54015

91651-60855

SST: 09330-00021

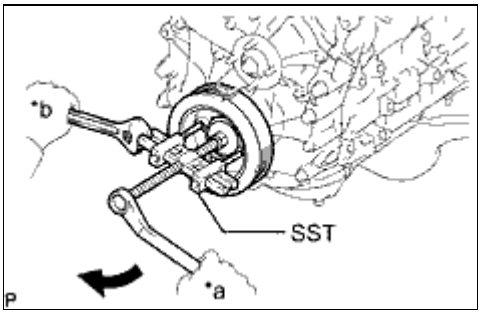
HINT:

Loosen the crankshaft pulley bolt until only 2 or 3 threads are still installed in the crankshaft.

(c) Using SST, remove the crankshaft pulley and crankshaft pulley bolt.

Text in Illustration

*a	Turn
*b	Hold



SST: 09950-50013

09951-05010

09952-05010

09953-05010

09954-05021

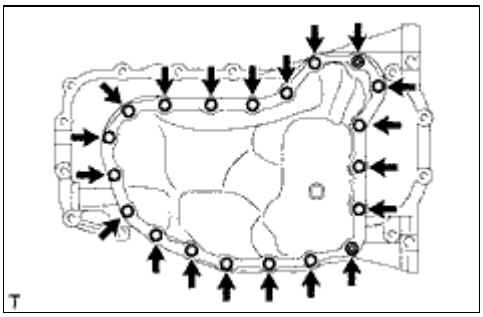
27. REMOVE OIL LEVEL DIPSTICK SUB-ASSEMBLY

28. REMOVE OIL PAN COVER SILENCER

(a) Remove the 2 No. 1 oil pan plugs and oil pan cover silencer.

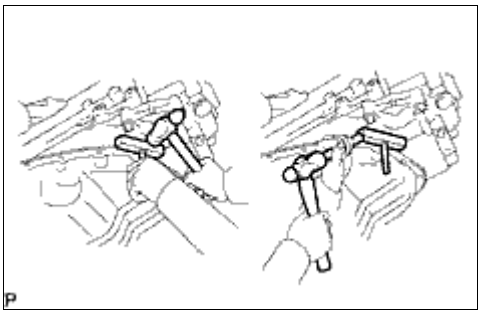
29. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

(a) Remove the 16 bolts, 2 adjusting screws, and 2 nuts.



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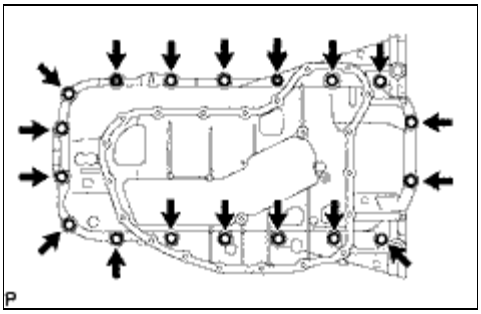
(b) Insert the blade of an oil pan seal cutter between the oil pans. Cut through the applied sealer and remove the No. 2 oil pan sub-assembly.



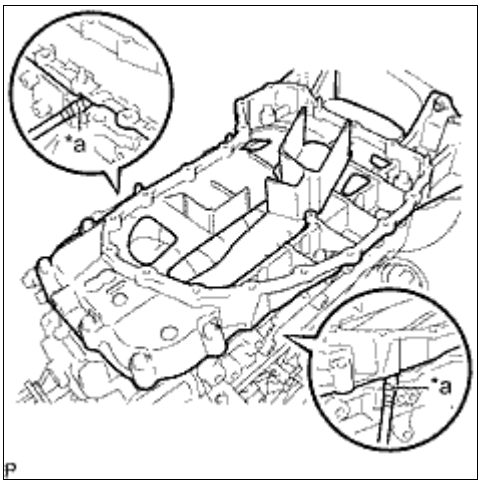
NOTICE:

Be careful not to damage the contact surface of the oil pans.

30. REMOVE OIL PAN SUB-ASSEMBLY



(a) Remove the 16 bolts and 2 nuts.



(b) Remove the oil pan sub-assembly by prying between the oil pan sub-assembly and cylinder block with a screwdriver.

Text in Illustration

*a	Protective Tape

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and oil pan.

HINT:

Tape the screwdriver tip before use.

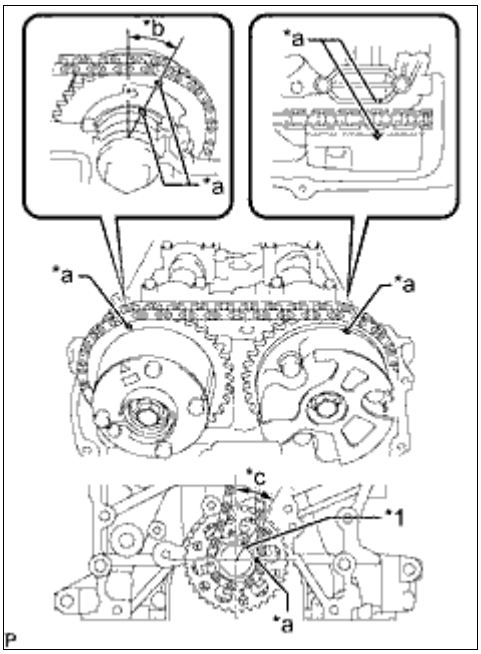
(c) Remove the gasket from the oil strainer sub-assembly.

31. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY INFO

32. REMOVE TIMING CHAIN GUIDE

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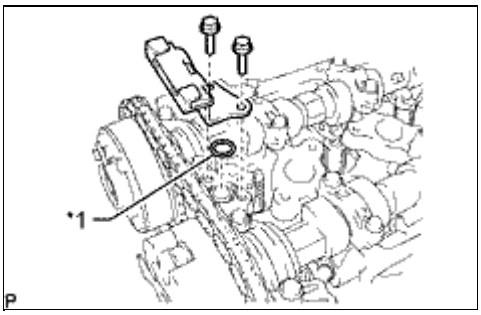
(a) Make sure that each matchmark is in the position shown in the illustration.



Text in Illustration

*1	Crankshaft Pulley Set Key
*a	Timing Mark
*b	Approximately 13°
*c	Approximately 30°

(b) Remove the 2 bolts, timing chain guide and O-ring.



Text in Illustration

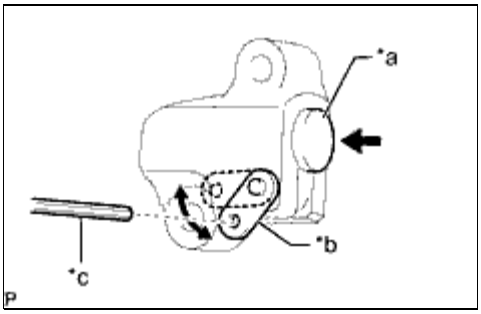
*1	O-ring

33. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

NOTICE:

- When the chain tensioner is removed, do not rotate the crankshaft.
- When the chain is removed and the camshaft needs to be rotated, rotate the crankshaft 90° to the right.

(a) Move the stopper plate upward to release the lock, and push the plunger deep into the No. 1 chain tensioner assembly.



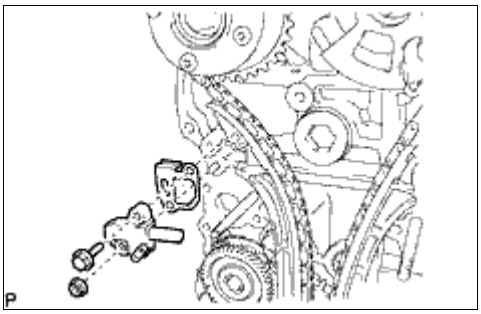
Text in Illustration

*a	Plunger
*b	Stopper Plate
*c	Hexagon Wrench

(b) Move the stopper plate downward to set the lock, and insert a 3.0 mm (0.118 in.) diameter bar into the stopper plate hole.

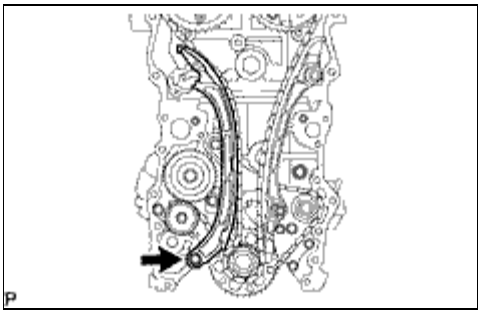
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(c) Remove the bolt, nut, No. 1 chain tensioner assembly and gasket.



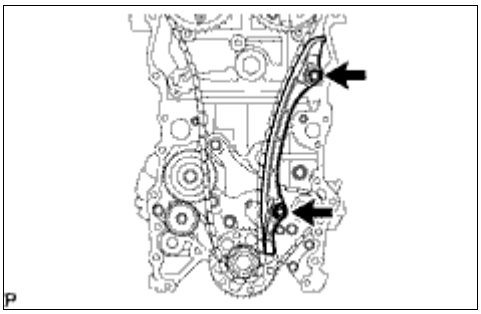
34. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.



35. REMOVE NO. 1 CHAIN VIBRATION DAMPER

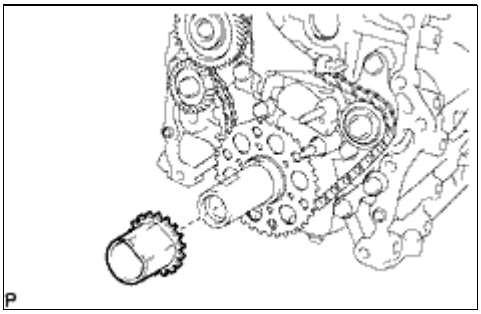
(a) Remove the bolt, nut and No. 1 chain vibration damper.



36. REMOVE CHAIN SUB-ASSEMBLY

37. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

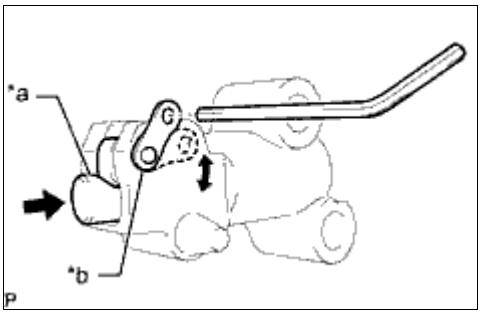
(a) Remove the crankshaft timing gear or sprocket from the crankshaft.



38. REMOVE NO. 2 CHAIN VIBRATION DAMPER

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(a) Move the stopper plate downward to release the lock and push the plunger deep into the tensioner.

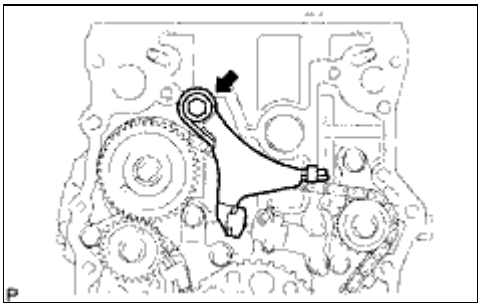


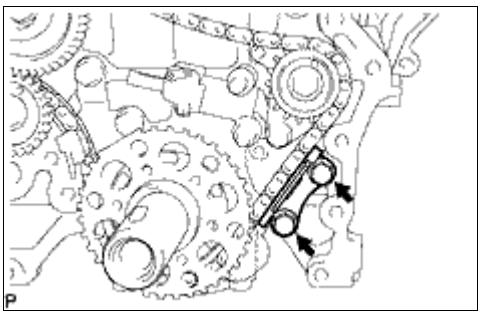
Text in Illustration

*a	Plunger
*b	Stopper Plate

(b) Move the stopper plate upward to set the lock and insert a hexagon wrench into the stopper plate hole.

(c) Remove the bolt and No. 2 chain vibration damper.





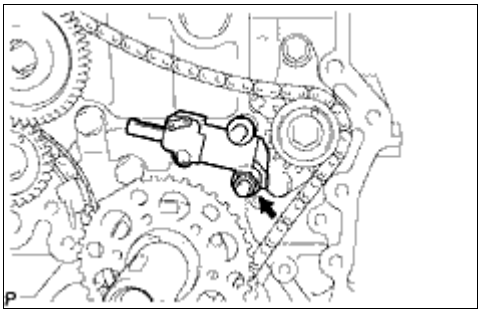
39. REMOVE NO. 3 CHAIN VIBRATION DAMPER

(a) Remove the 2 bolts and No. 3 chain vibration damper.

40. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Remove the hexagon wrench from the No. 2 chain tensioner assembly.

(b) Remove the nut and No. 2 chain tensioner assembly.

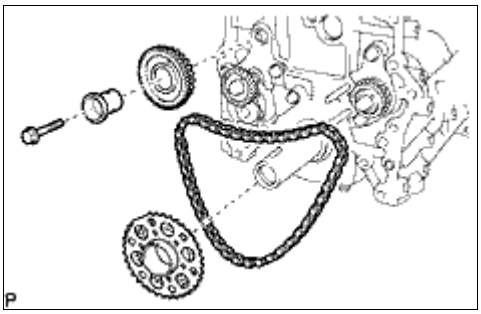


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41. REMOVE NO. 2 CHAIN SUB-ASSEMBLY

(a) Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear sub-assembly.

(b) Remove the crankshaft timing sprocket and No. 2 chain sub-assembly.

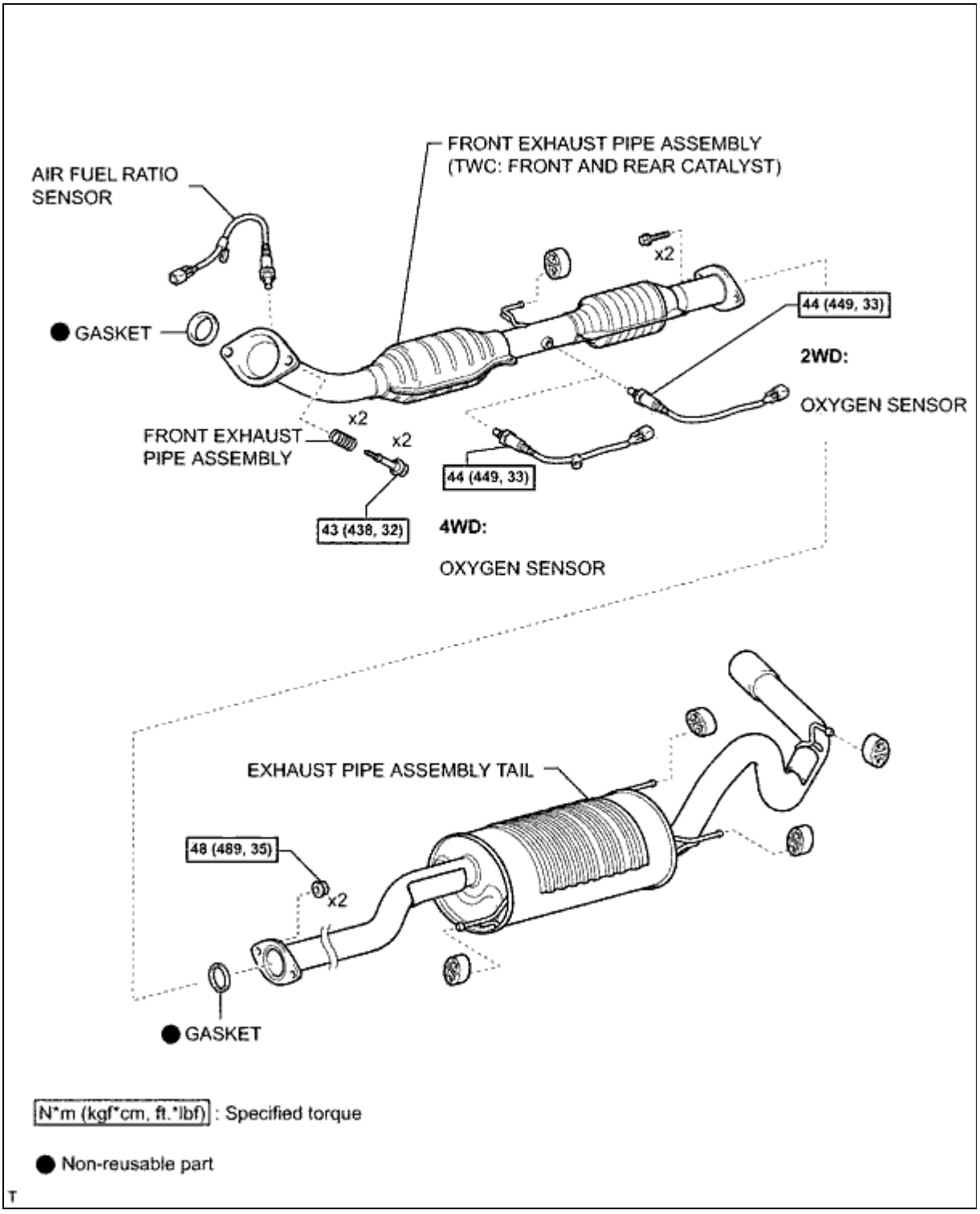


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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000QCY00IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EXHAUST: EXHAUST PIPE: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION

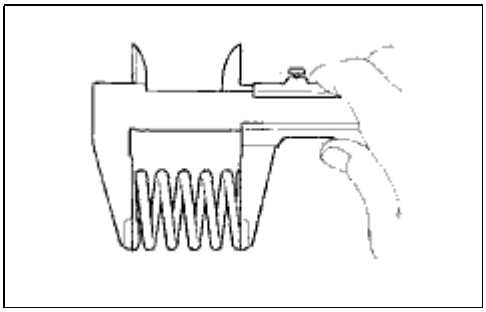


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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QCX00JX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EXHAUST: EXHAUST PIPE: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL EXHAUST PIPE ASSEMBLY FRONT



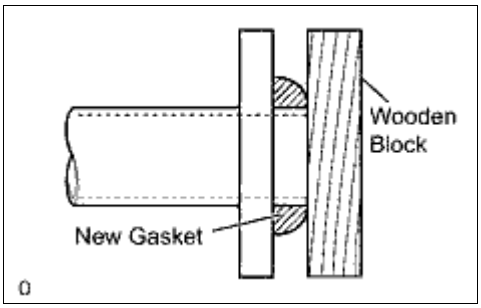
(a) Check the free length.

(1) Using vernier calipers, measure the free length of the compression spring.

Minimum:
40.5 mm (1.594 in.)

If the free length is less than the minimum, replace the compression spring.

(b) Using a wooden block and plastic-faced hammer, tap in a new gasket until it is flush with the exhaust manifold.



NOTICE:

- Make sure that the gasket is in the correct angle when installing.
- Do not reuse the removed gasket.
- Never push a new gasket into the exhaust manifold by installing the exhaust pipe front into the exhaust manifold.

(c) Install the exhaust pipe front into the exhaust pipe support.

(d) Tighten the 2 bolts and 2 compression springs.

Torque:

43 N·m {438 kgf·cm, 32ft·lbf}

2. INSTALL EXHAUST PIPE ASSEMBLY TAIL

(a) Install a new gasket onto the exhaust pipe front.

(b) Install the exhaust pipe tail onto the 4 exhaust pipe supports.

(c) Tighten the 2 bolts and 2 nuts.

Torque:

48 N·m {489 kgf·cm, 35ft·lbf}

3. INSTALL OXYGEN SENSOR INFO

4. INSTALL AIR FUEL RATIO SENSOR INFO

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5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

6. INSPECT FOR EXHAUST GAS LEAK

Perform "Inspection After Repairs" after repairing or replacing the exhaust system INFO .

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QCZ00IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE EXHAUST: EXHAUST PIPE: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. CABLE FROM NEGATIVE BATTERY TERMINAL

2. REMOVE AIR FUEL RATIO SENSOR INFO

3. REMOVE OXYGEN SENSOR INFO

4. REMOVE EXHAUST PIPE ASSEMBLY TAIL

(a) Remove the 2 bolts and 2 nuts.

(b) Remove the exhaust pipe tail from the 4 exhaust pipe supports.

(c) Remove the gasket from the exhaust pipe front.

5. REMOVE EXHAUST PIPE ASSEMBLY FRONT

(a) Remove the 2 bolts and 2 compression springs.

(b) Remove the exhaust pipe front from the exhaust pipe support.

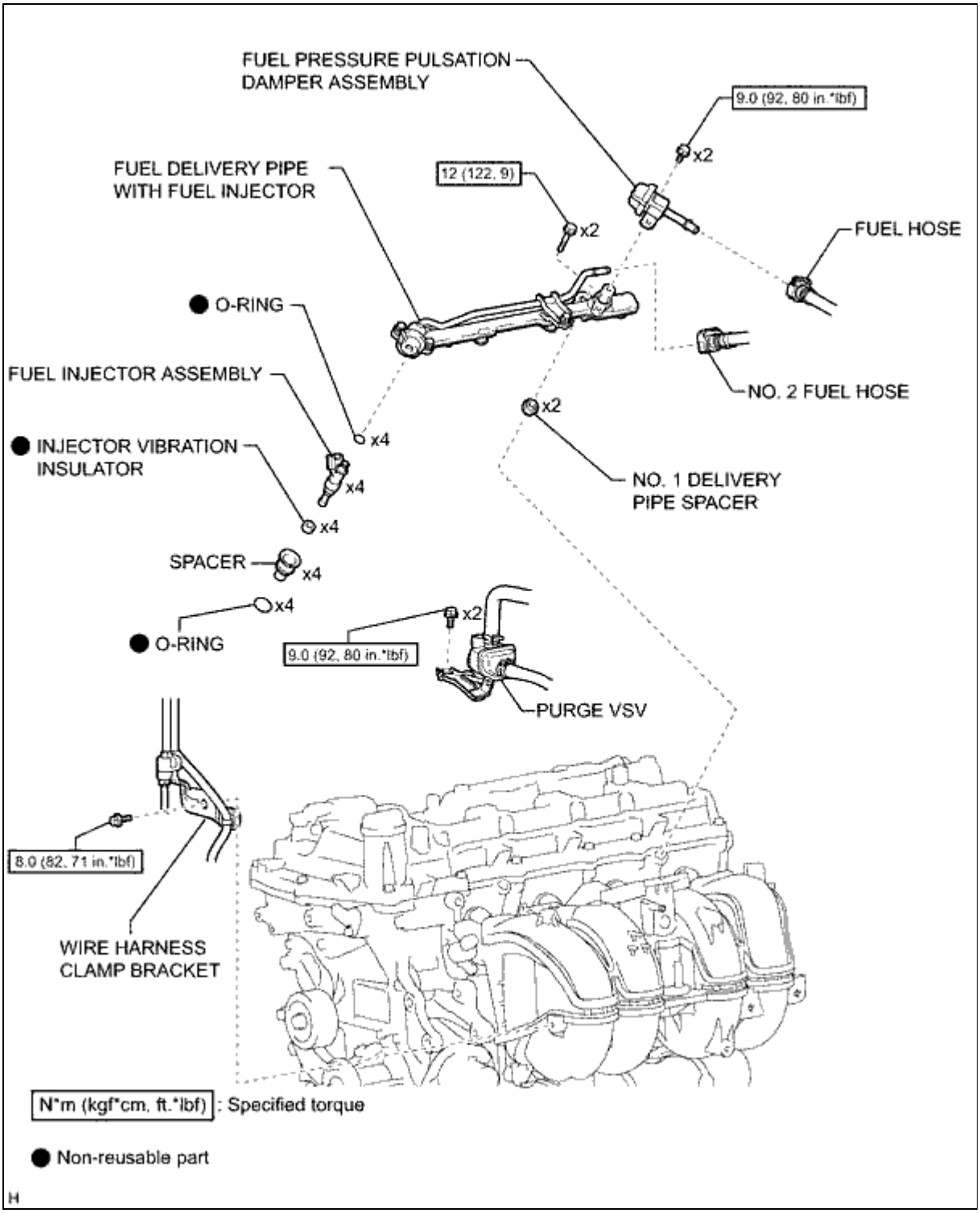
(c) Remove the gasket from the exhaust manifold.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000PE209YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL INJECTOR: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000WQQ0CFX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL INJECTOR: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT FUEL INJECTOR ASSEMBLY

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	11.6 to 12.4 Ω

If the result is not as specified, replace the fuel injector assembly.

2. INSPECT INJECTION VOLUME AND LEAKAGE

(a) Check the injection volume.

CAUTION:

This test involves high-pressure fuel and electricity, therefore, safety precautions should be taken. Perform this test in a safe area and avoid any sparks and flames. Do not smoke.

(1) Discharge the fuel system pressure INFO .

(2) Remove the fuel hose from the fuel pressure pulsation damper assembly INFO .

(3) Remove the fuel hose INFO .

(4) Disconnect the fuel pressure regulator INFO .

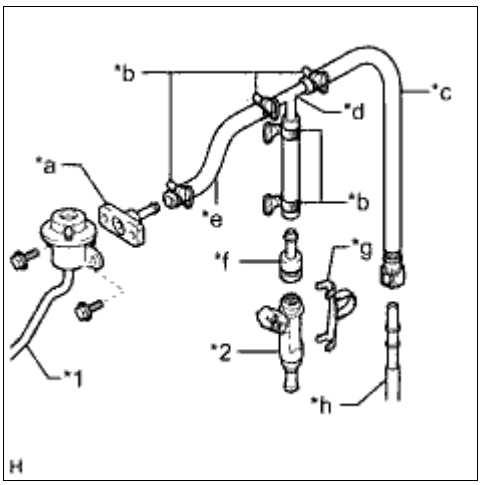
NOTICE:

Do not disconnect the No. 2 fuel hose.

(5) Assemble SST as shown in the illustration.

Text in Illustration

*1	Fuel Pressure Regulator
*2	Fuel Injector Assembly
*a	SST (Union)
*b	SST (Hose Band)
*c	SST (Fuel Tube Connector)
*d	SST (3 Way)
*e	SST (Hose)
*f	SST (Adapter)
*g	SST (Clamp)
*h	Fuel Pipe

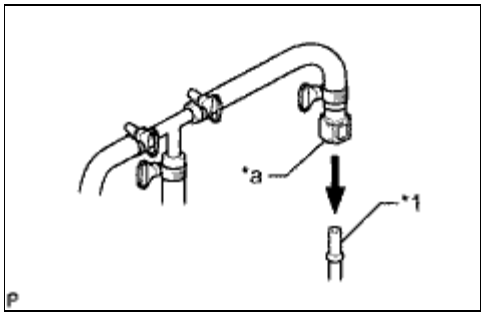


SST: 09268-31014

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09268-41091
09268-41110
09268-41120
09268-41310
09268-41500
09268-41700
95336-08070

(6) Connect SST to the fuel filter assembly.

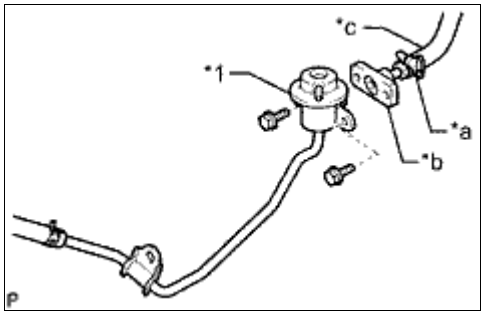


Text in Illustration

*1	Fuel Filter Assembly
*a	SST (Fuel Tube Connector)

SST: 09268-31014
09268-41500

(7) Install the fuel pressure regulator to SST (union) with the 2 bolts.



Text in Illustration

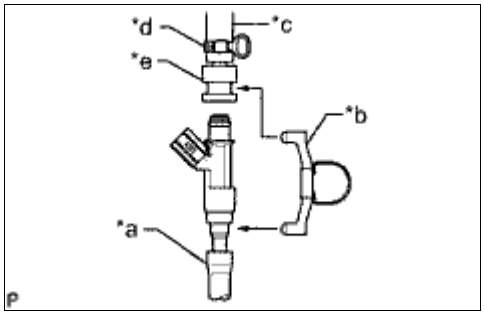
*1	Fuel Pressure Regulator
*a	SST (Hose Band)
*b	SST (Union)
*c	SST (Hose)

SST: 09268-31014
09268-41091
09268-41700
95336-08070
Torque:
9.0 N·m {92 kgf·cm, 80in·lbf}

NOTICE:
Make sure that the O-ring is installed to the pressure regulator.

(8) Install the O-ring to the fuel injector assembly.

(9) Assemble SST as shown in the illustration.



Text in Illustration

*a	Vinyl Tube
*b	SST (Clamp)
*c	SST (Hose)
*d	SST (Hose Band)

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*e	SST (Adaptor)

SST: 09268-31014

09268-41110

09268-41310

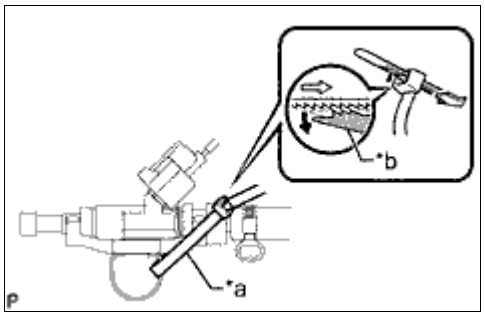
09268-41700

95336-08070

(10) Pass SST (tie band) through the loop on the handle of SST (clamp) to secure SST (clamp) to SST (adapter).

Text in Illustration

*a	SST (Tie Band)
*b	Lock



SST: 09268-31014

09268-41800

NOTICE:

- As SST (tie band) does not completely prevent SST (clamp) from becoming loose, do not subject the parts to any impacts while using them.
- Before using SST (tie band), make sure that there is no deterioration, damage or cracks. If there are any abnormalities, replace SST.

HINT:

When removing SST (tie band), disengage the lock.

(11) Check that SST (clamp) and SST (adapter) cannot be easily separated.

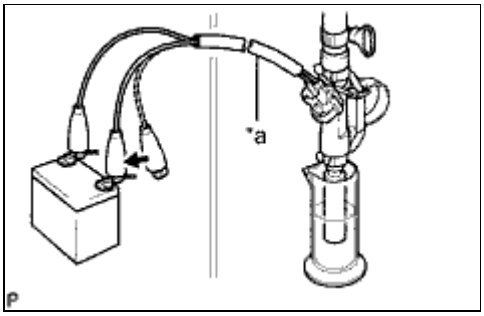
(12) Put the fuel injector assembly into a graduated cylinder.

CAUTION:

Install a suitable vinyl tube to the fuel injector assembly to contain any gasoline spray.

(13) Operate the fuel pump INFO .

(14) Connect SST (EFI inspection wire H) to the fuel injector assembly and the battery for 15 seconds and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.



Text in Illustration

*a	SST (EFI inspection wire H)

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➡	Connect

SST: 09842-30080

Standard injection volume:

87 to 105 cm^3 (5.3 to 6.4 cu in.) per 15 seconds

Difference between each injector:

18 cm^3 (1.1 cu in.) or less

NOTICE:

- Make sure that SST (EFI inspection wire H) is securely connected.
- Always do the switching at the battery side.

If the injection volume is not as specified, replace the fuel injector assembly.

(b) Check the leakage.

(1) In the condition above, disconnect the tester probes of SST (EFI inspection wire H) from the battery and check the fuel leakage from the fuel injector assembly.

Fuel leakage:

1 drop or less in 25 minutes

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000Q460D6X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL INJECTOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

HINT:

Perform "Inspection After Repairs" after replacing the fuel injector INFO .

1. INSTALL FUEL INJECTOR ASSEMBLY

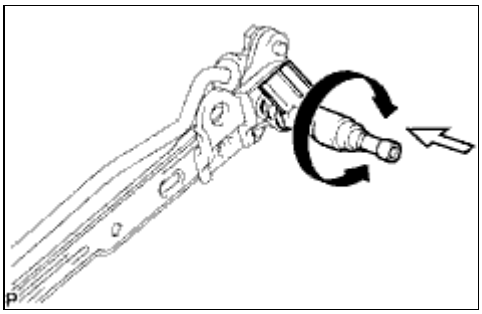
HINT:

Perform "Inspection After Repairs" after replacing the fuel injector INFO .

(a) Apply a light coat of gasoline or spindle oil to new O-rings, then install one onto each fuel injector assembly.

(b) Apply a light coat of gasoline or spindle oil to the contact surfaces of the fuel delivery pipe and the O-ring of the fuel injector assembly.

(c) Apply a light coat of gasoline or spindle oil to the O-ring again, then install the fuel injector assembly into the fuel delivery pipe by turning it right and left.



Text in Illustration

➡	Turn
⇨	Push

NOTICE:

Make sure that the O-ring is not cracked or jammed when installing.

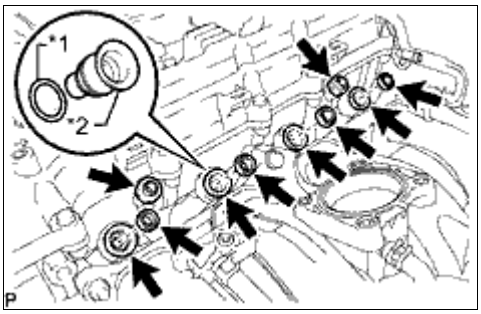
(d) Check that the fuel injector assembly rotates smoothly.

If the fuel injector assembly does not rotate, replace the O-ring.

2. INSTALL FUEL DELIVERY PIPE WITH FUEL INJECTOR

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(a) Apply a light coat of gasoline or spindle oil to new O-rings, and then install one to each spacer.



Text in Illustration

*1	O-ring
*2	Spacer

(b) Install the 4 spacers to the cylinder head sub-assembly.

(c) Install 4 new injector vibration insulators to the cylinder head sub-assembly.

(d) Install the 2 No. 1 delivery pipe spacers to the cylinder head sub-assembly.

(e) Install the fuel delivery pipe together with the 4 fuel injector assemblies, and then temporarily install the fuel delivery pipe with the 2 bolts.

NOTICE:

Do not drop the fuel injector assemblies when installing the fuel delivery pipe.

(f) Check that the fuel injector assemblies rotate smoothly.

If any fuel injector assembly does not rotate, replace its O-ring.

(g) Tighten the 2 bolts.

Torque:

12 N·m {122 kgf·cm, 9ft·lbf}

(h) Connect the purge VSV with the 2 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(i) Connect the harness clamp bracket with the bolt.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(j) Engage the clamp and connect the wire harness clamp.

(k) Connect the purge VSV connector.

(l) Connect the 4 fuel injector assembly connectors.

3. INSTALL FUEL PRESSURE PULSATION DAMPER ASSEMBLY INFO

4. CONNECT FUEL HOSE

(a) Connect the fuel hose INFO .

5. CONNECT NO. 2 FUEL HOSE

(a) Connect the No. 2 fuel hose INFO .

6. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

7. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

cardiagn.com

5.4 N·m {55 kgf·cm, 48in·lbf}

8. INSPECT FOR FUEL LEAK

(a) Make sure that there are no fuel leaks after performing maintenance on the fuel system.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON and turn the Techstream on.

NOTICE:

Do not start the engine.

(3) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(4) Check that there are no leaks from the fuel system.

If there are fuel leaks, repair or replace parts as necessary.

(5) Turn the ignition switch off.

(6) Disconnect the Techstream from the DLC3.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000Q480DDX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL INJECTOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. PRECAUTION

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

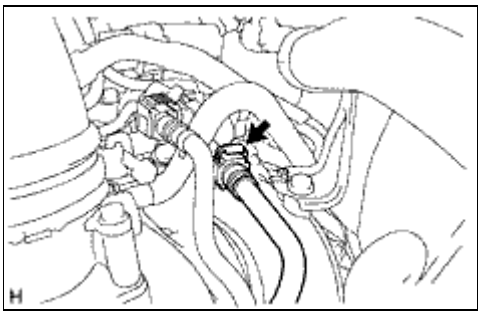
3. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

4. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

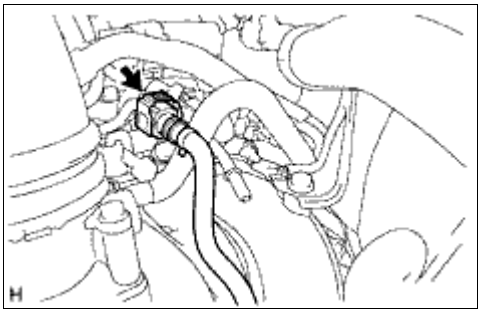
5. DISCONNECT FUEL HOSE

(a) Disconnect the fuel hose INFO .



6. DISCONNECT NO. 2 FUEL HOSE

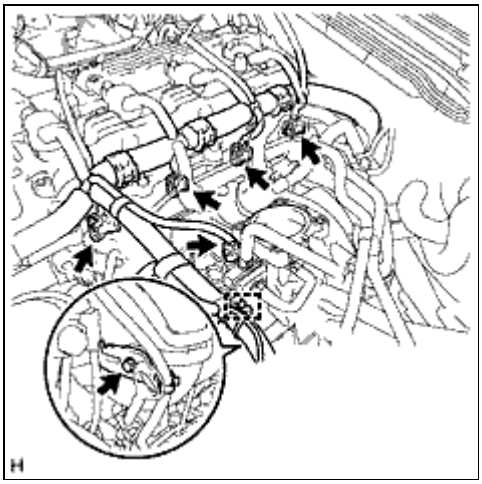
(a) Disconnect the No. 2 fuel hose INFO .



7. REMOVE FUEL PRESSURE PULSATION DAMPER ASSEMBLY INFO

8. REMOVE FUEL DELIVERY PIPE WITH FUEL INJECTOR

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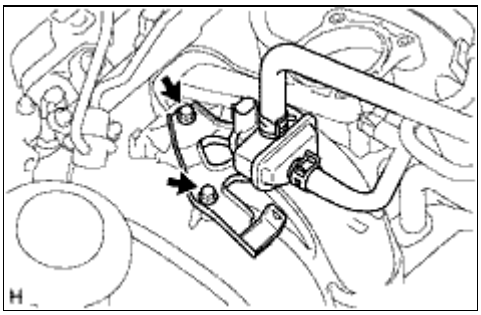
(a) Disconnect the 4 fuel injector assembly connectors.

(b) Disconnect the purge VSV connector.

(c) Disengage the clamp and disconnect the wire harness clamp.

(d) Remove the bolt and disconnect the wire harness clamp bracket.

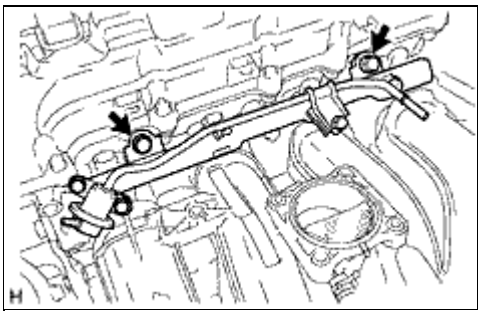
(e) Remove the 2 bolts and disconnect the purge VSV.



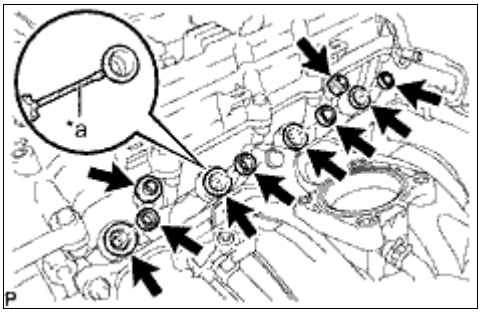
(f) Remove the 2 bolts and fuel delivery pipe together with the fuel injectors.

NOTICE:

Be careful not to drop the fuel injectors when removing the fuel delivery pipe.



(g) Remove the 2 No. 1 delivery pipe spacers.



Text in Illustration

*a	Protective Tape

(h) Remove the 4 injector vibration insulators.

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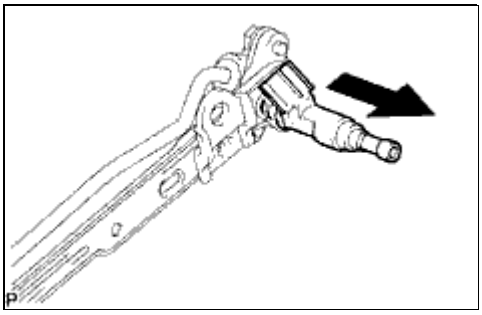
(i) Using a screwdriver, remove the 4 spacers.

HINT:

Tape the screwdriver tip before use.

9. REMOVE FUEL INJECTOR ASSEMBLY

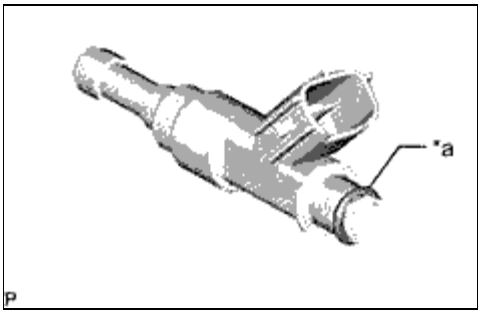
(a) Remove the 4 fuel injector assemblies from the fuel delivery pipe.



Text in Illustration

➡	Pull Out

(b) Remove the 4 O-rings from the 4 fuel injector assemblies.



Text in Illustration

*a	O-ring

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000UJZ07YX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PRESSURE PULSATION DAMPER: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL FUEL PRESSURE PULSATION DAMPER ASSEMBLY

(a) Apply a light coat of spindle oil or gasoline to a new O-ring and install the O-ring to the fuel pressure pulsation damper assembly.

(b) Install the fuel pressure pulsation damper assembly with the 2 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

2. CONNECT FUEL HOSE INFO

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

4. INSPECT FOR FUEL LEAK INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000UK1081X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PRESSURE PULSATION DAMPER: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. PRECAUTION

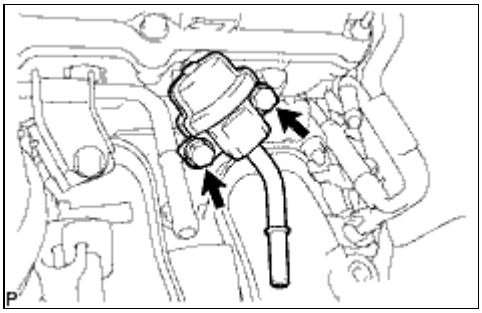
NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

3. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

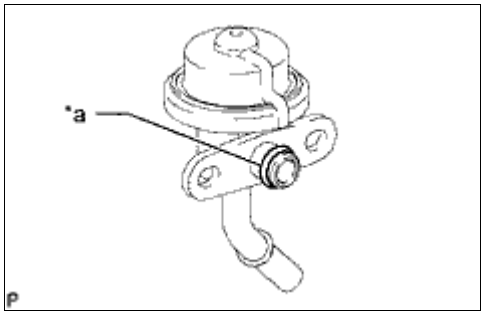
4. DISCONNECT FUEL HOSE INFO

5. REMOVE FUEL PRESSURE PULSATION DAMPER ASSEMBLY



(a) Remove the 2 bolts and fuel pressure pulsation damper assembly.

(b) Remove the O-ring from the fuel pressure pulsation damper assembly



Text in Illustration

*a	O-ring

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000015ZK00UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PRESSURE REGULATOR: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL FUEL PRESSURE REGULATOR ASSEMBLY

(a) Apply a light coat of spindle oil or gasoline to a new O-ring and install the O-ring to the fuel pressure regulator assembly.

(b) Install the fuel pressure regulator assembly with the 3 bolts.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(c) Connect the wire harness clamp bracket with the bolt.

Torque:

8.0 N·m {82 kgf·cm, 71in·lbf}

(d) Attach the wire harness clamp.

(e) Connect the purge VSV connector.

2. CONNECT NO. 2 FUEL HOSE INFO

3. INSTALL THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

5. INSPECT FOR FUEL LEAK INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000015ZM00UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PRESSURE REGULATOR: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. PRECAUTION

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

3. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

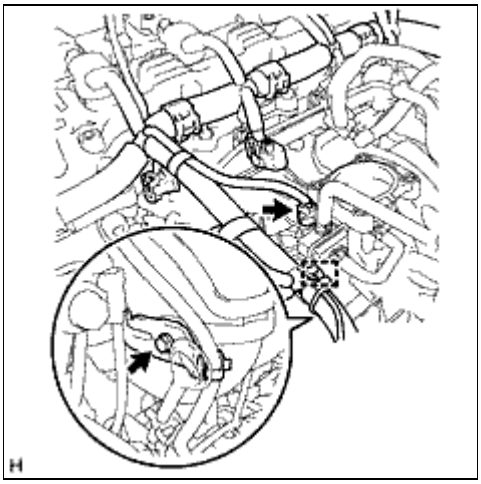
4. REMOVE THROTTLE BODY WITH MOTOR ASSEMBLY

INFO

5. DISCONNECT NO. 2 FUEL HOSE INFO

6. REMOVE FUEL PRESSURE REGULATOR ASSEMBLY

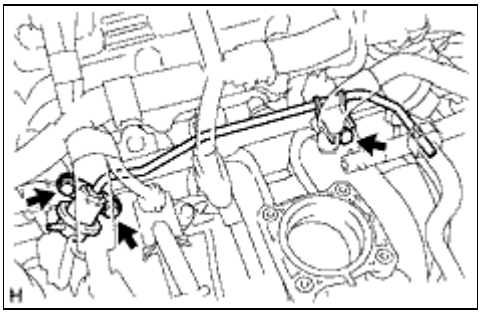
(a) Disconnect the purge VSV connector.



(b) Disengage the clamp and disconnect the wire harness.

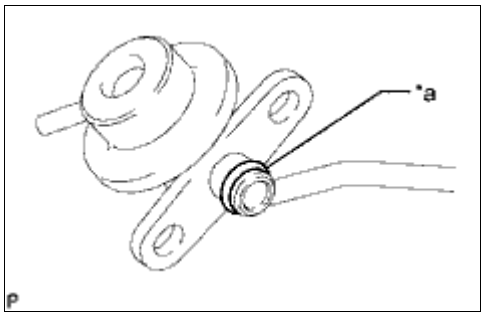
(c) Remove the bolt and disconnect the wire harness clamp bracket.

(d) Remove the 3 bolts and fuel pressure regulator assembly.



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(e) Remove the O-ring from the fuel pressure regulator assembly.



Text in Illustration

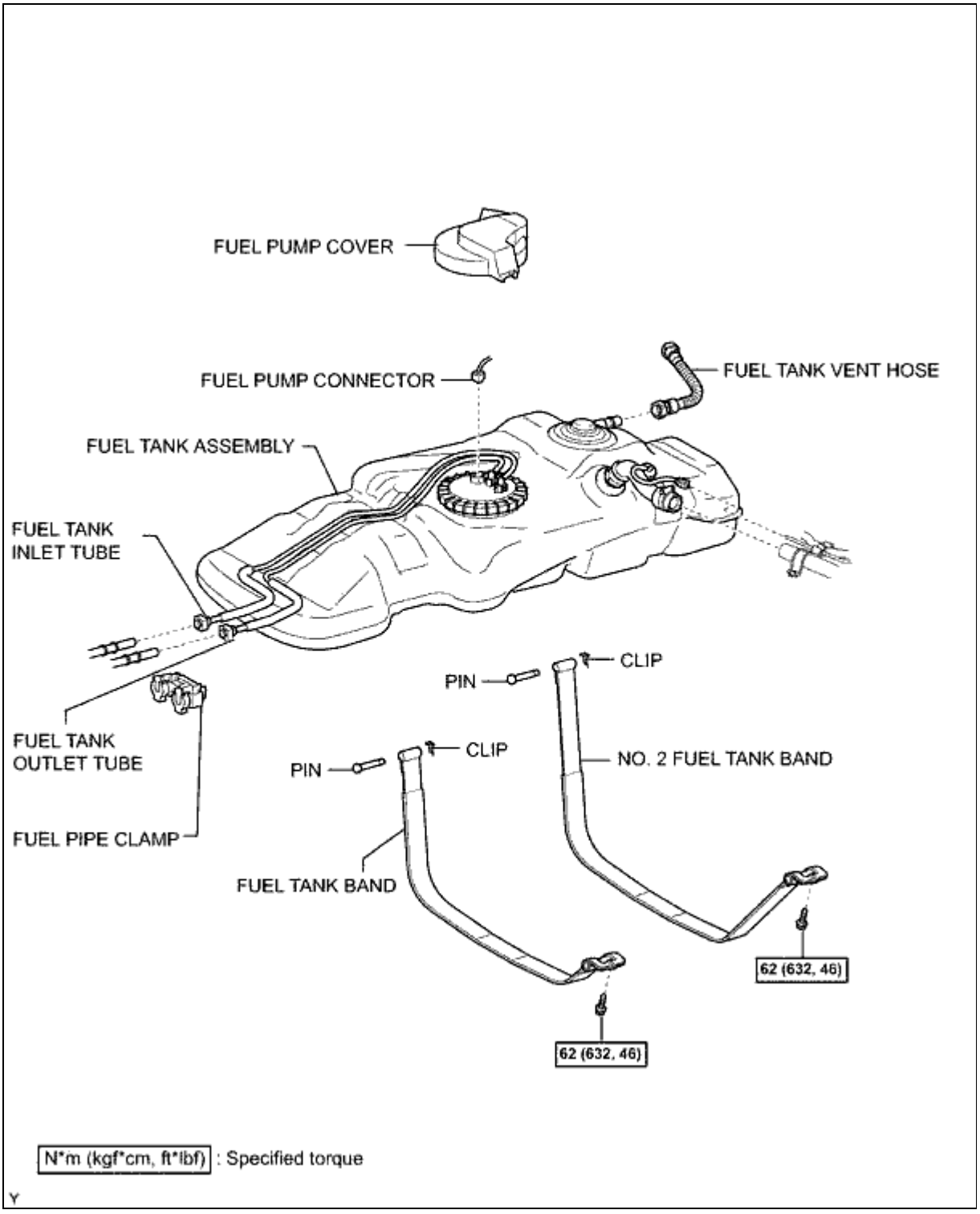
*a	O-ring

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000QDV087X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

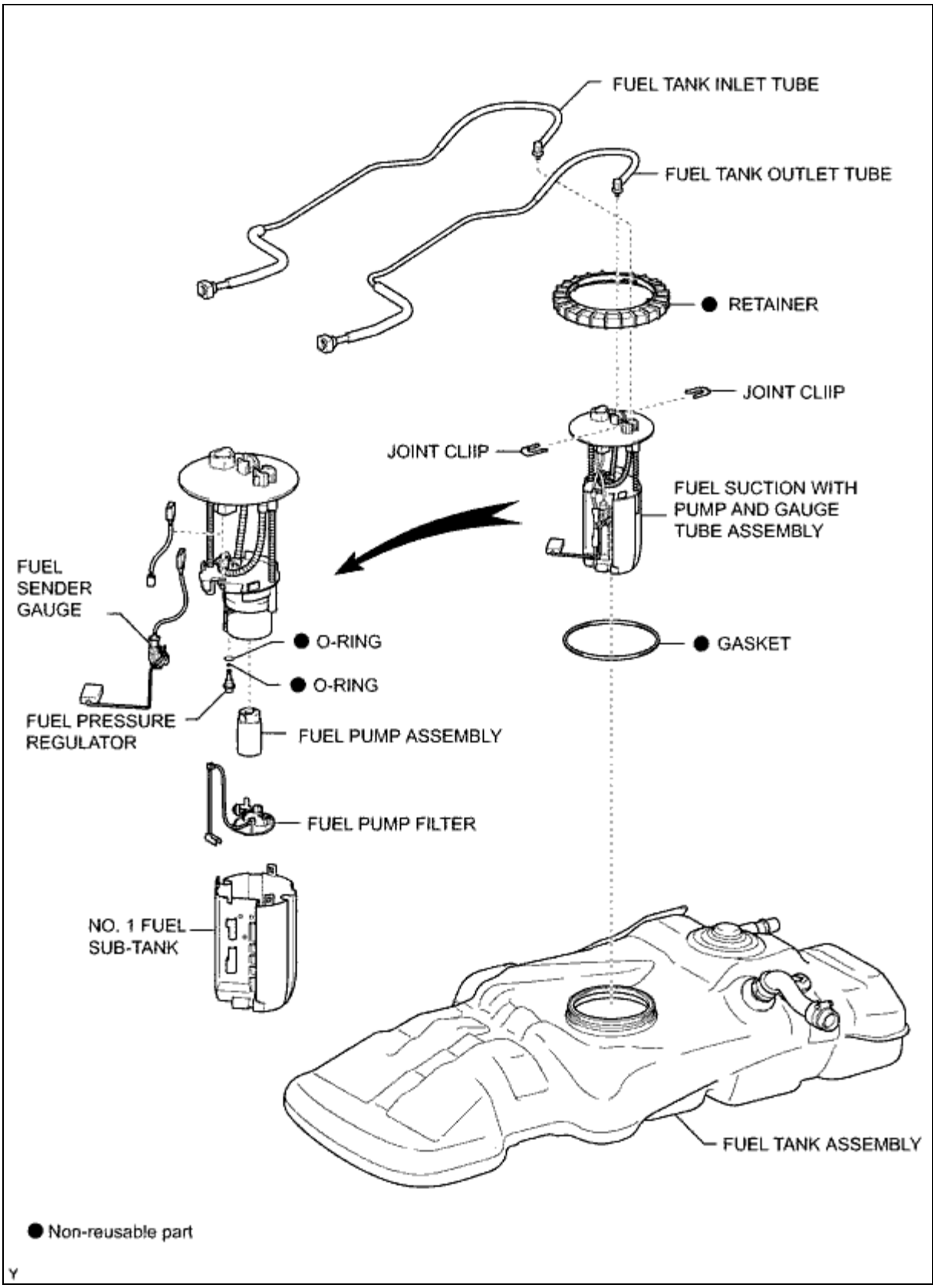
COMPONENTS

ILLUSTRATION



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ILLUSTRATION

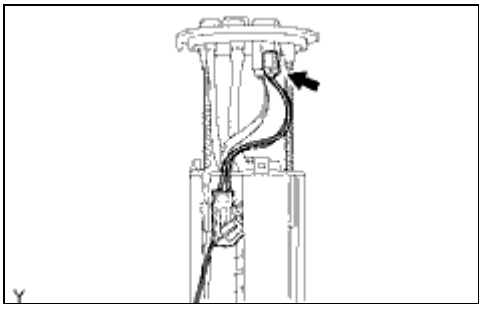


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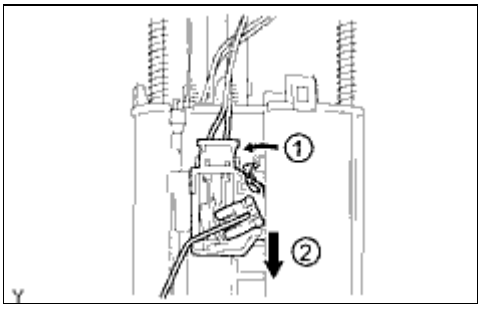
Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000TK507NX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: DISASSEMBLY; 2016 MY Tacoma [08/2015 -]		

DISASSEMBLY

1. REMOVE FUEL SENDER GAGE ASSEMBLY

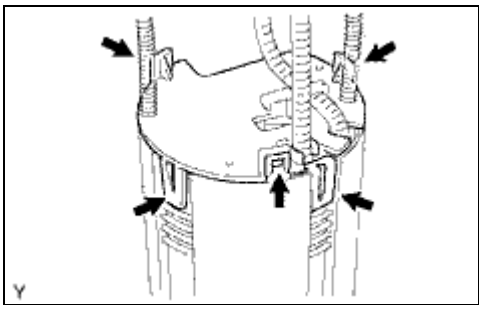


(a) Disconnect the connector.

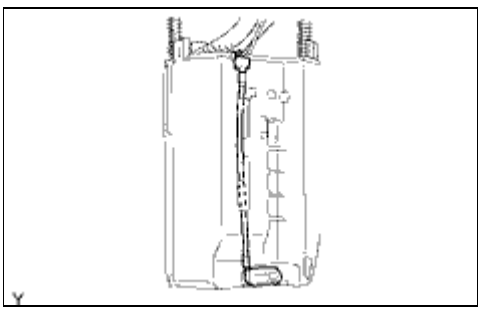


(b) Disengage the claw fitting and remove the sender gauge by sliding it in the direction as shown in the illustration.

2. REMOVE NO. 1 FUEL SUB-TANK



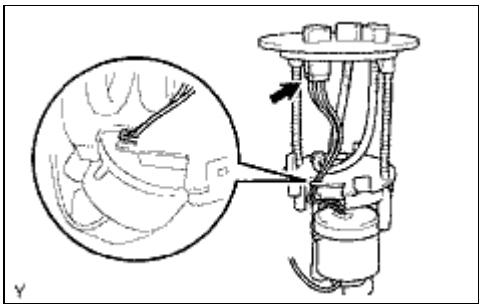
(a) Disengage the 5 claw fittings and remove the fuel pump tank.



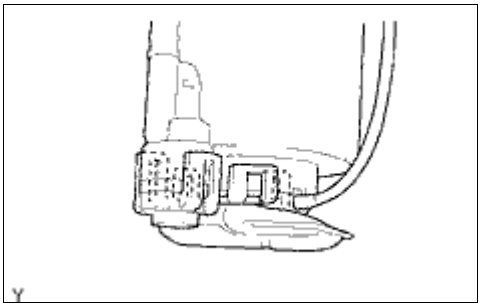
(b) Separate the connector and disengage the clamp.

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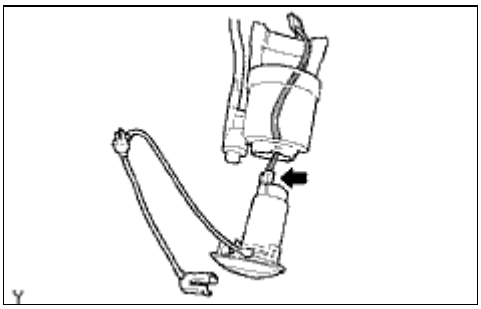
3. REMOVE FUEL PUMP ASSEMBLY



(a) Disengage the clamp, then disconnect the connector.

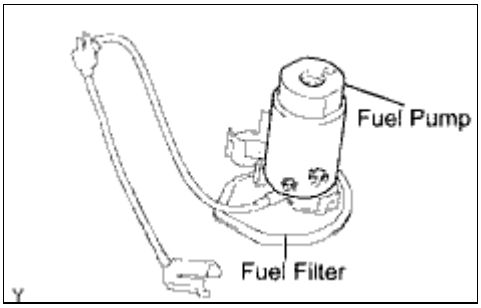


(b) Disengage the 5 claw fittings and separate the fuel pump from the fuel pump case.



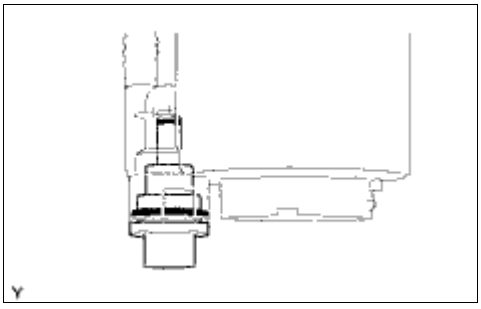
(c) Disconnect the connector from the fuel pump.

4. REMOVE FUEL PUMP FILTER



(a) Remove the fuel filter from the fuel pump.

5. REMOVE FUEL PRESSURE REGULATOR ASSEMBLY



(a) Remove the fuel pressure regulator and the 2 O-rings.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000W1H06SX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

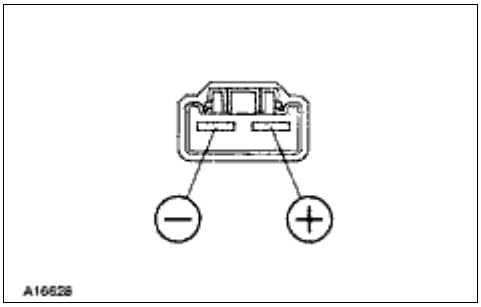
1. INSPECT FUEL PUMP

(a) Check the resistance.

(1) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

0.2 to 3.0 Ω at 20°C (68°F)



(b) Check the operation.

(1) Apply battery voltage to both terminals. Check that the pump operates.

NOTICE:

- These tests must be performed quickly (within 10 seconds) to prevent damage to the pump.
- Keep the fuel pump as far away from the battery as possible.
- Always do the switching at the battery side.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QDU0BQX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL FUEL SUCTION WITH PUMP & GAGE TUBE ASSEMBLY INFO

2. INSTALL FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE INFO

3. INSTALL FUEL TANK ASSEMBLY INFO

4. CONNECT FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE INFO

5. ADD FUEL

6. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

7. CHECK FOR FUEL LEAK INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000TK6079X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: REASSEMBLY; 2016 MY Tacoma [08/2015 -]		

REASSEMBLY

1. INSTALL FUEL PRESSURE REGULATOR ASSEMBLY

(a) Install the new O-ring into the fuel pump case.

(b) Install the new O-ring onto the fuel pressure regulator.

2. INSTALL FUEL PUMP FILTER

3. INSTALL FUEL PUMP ASSEMBLY

(a) Install the fuel pump assembly.

HINT:

Perform "Inspection After Repairs" after replacing the fuel pump INFO .

4. INSTALL NO. 1 FUEL SUB-TANK

5. INSTALL FUEL SENDER GAGE ASSEMBLY

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QDW0BAX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL PUMP: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

3. DISCONNECT FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE INFO

4. REMOVE FUEL TANK ASSEMBLY INFO

5. REMOVE FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE INFO

6. REMOVE FUEL SUCTION WITH PUMP & GAUGE TUBE ASSEMBLY INFO

7. DRAIN FUEL

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000Q3M06TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION AND FOR FUEL LEAK

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

NOTICE:

Do not start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) Check the fuel pump operation.

(1) Check for pressure in the fuel inlet tube from the fuel line. Check that the sound of fuel flowing in the fuel tank can be heard.

If there is no sound, check the integration relay, fuel pump, ECM and wiring connector.

(f) Inspect for fuel leaks INFO .

2. CHECK FUEL PRESSURE

(a) Check the battery voltage INFO .

(b) Discharge the fuel system pressure INFO .

(c) Disconnect the cable from the negative battery terminal.

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

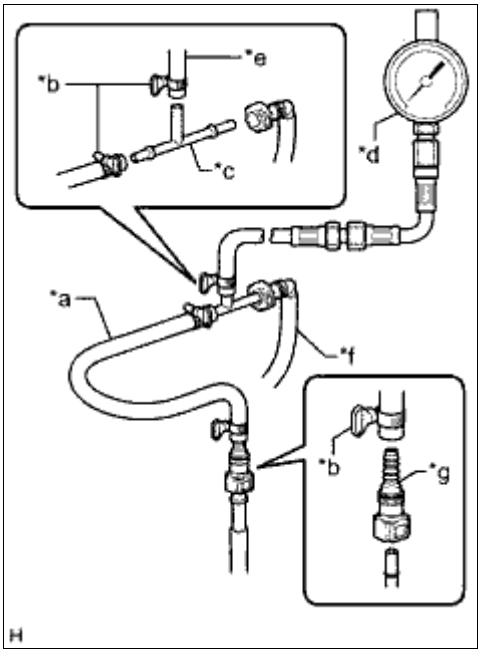
(d) Disconnect the fuel hose INFO .

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(e) Install SST (pressure gauge) as shown in the illustration.

SST: 09268-45101

09268-41250
09268-41260
09268-41280
09268-41500
09268-41700
95336-08070



Text in Illustration

*a	SST (Hose)
*b	SST (Hose Band)
*c	SST (T-Joint)
*d	SST (Pressure Gauge)
*e	SST (Hose Joint)
*f	Fuel Hose
*g	SST (Fuel Tube Connector)

(f) Wipe off any gasoline.

(g) Reconnect the cable to the negative battery terminal.

(h) Operate the fuel pump.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON.

NOTICE:

Do not start the engine.

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed / ON.

(i) Measure the fuel pressure.

Standard fuel pressure:
304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2} , 44 to 50 psi)

If the pressure is higher than the specification, replace the fuel pressure regulator assembly.

If the pressure is below the specification, check the fuel hoses and connectors, fuel pump, fuel filter assembly and fuel pressure regulator assembly.

(j) Start the engine.

(k) Measure the fuel pressure.

Standard fuel pressure:
304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2} , 44 to 50 psi)

If the pressure is not as specified, check the fuel pump, fuel pressure regulator assembly and/or fuel injector assemblies.

(l) Stop the engine.

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(m) Check that the fuel pressure remains as specified for 5 minutes after the engine has stops.

Standard fuel pressure:
147 kPa (1.5 kgf/cm ^{2} , 21 psi) or higher

If the pressure is not as specified, check the fuel pump, fuel pressure regulator assembly and/or fuel injector assemblies.

(n) Disconnect the cable from the negative (-) battery terminal and carefully remove SST and the fuel tube connector to prevent gasoline from spraying.

(o) Connect the fuel hose INFO .

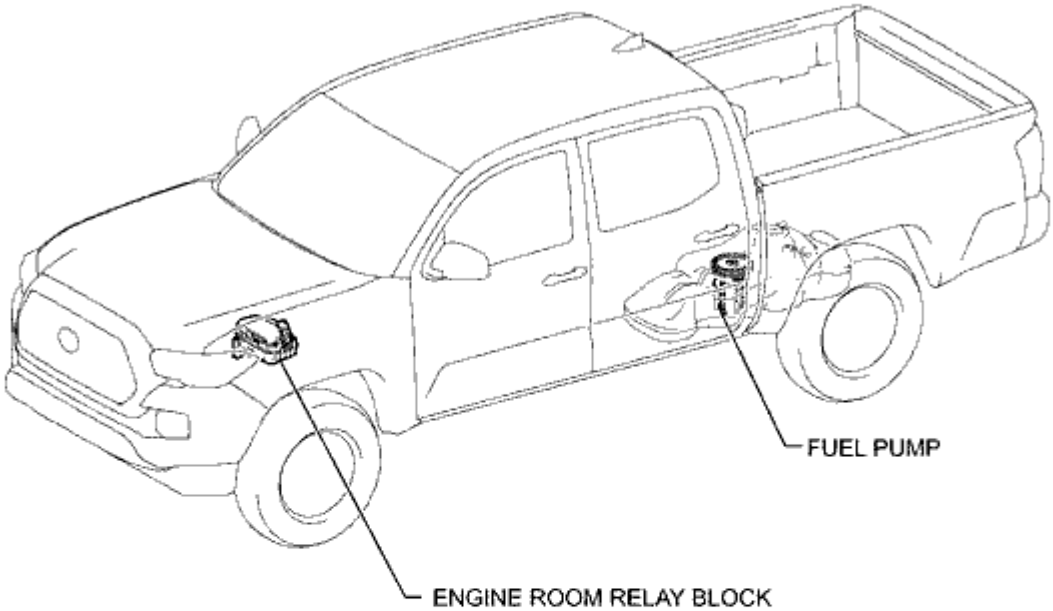
(p) Inspect for fuel leaks INFO .

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM000000VHO05HX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

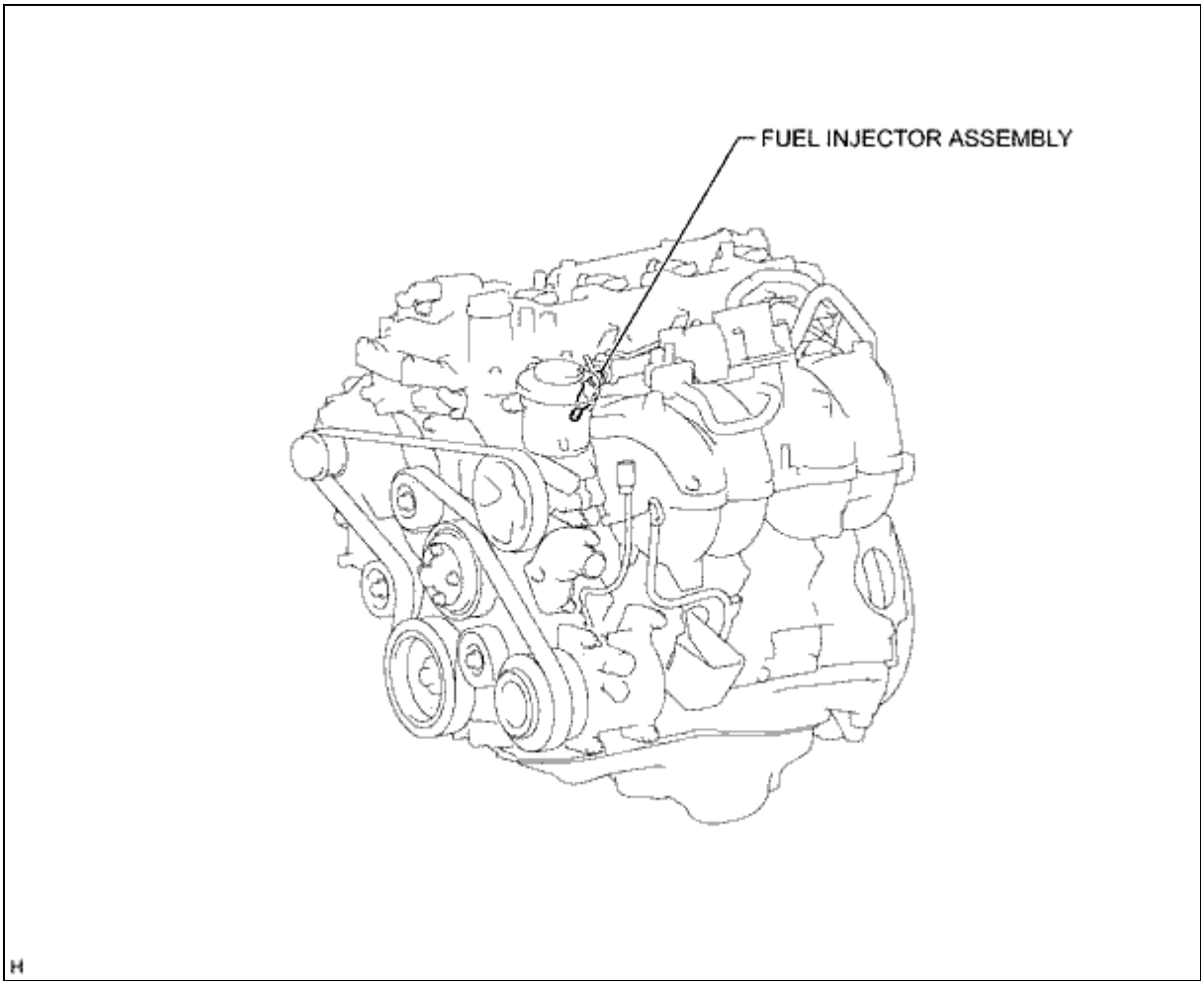
PARTS LOCATION

ILLUSTRATION



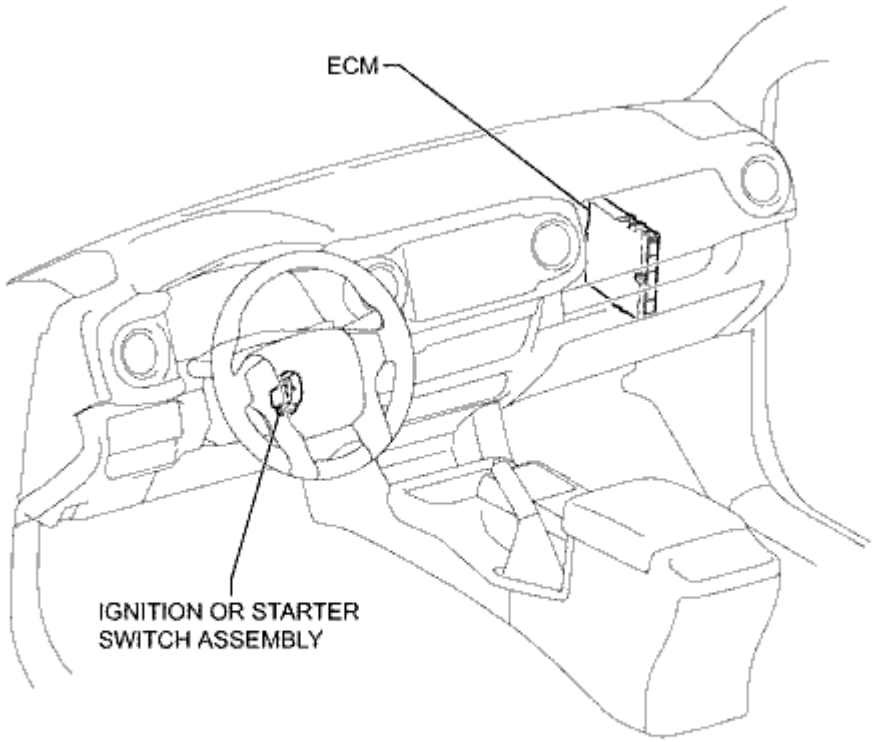
ILLUSTRATION

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ILLUSTRATION

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H

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Last Modified: 11-13-2015	6.6 L	**Doc ID:** RM0000028RU061X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL SYSTEM: PRECAUTION; 2016 MY Tacoma [08/2015 -]		

PRECAUTION

1. PRECAUTION

(a) Before starting work on the fuel system, including inspections and repairs, disconnect the cable from the negative (-) battery terminal.

(b) Do not smoke or work near fire when performing work on the fuel system.

(c) Keep gasoline away from rubber or leather parts.

2. DISCHARGE FUEL SYSTEM PRESSURE

CAUTION:

- Take precautions to prevent gasoline from spilling out before removing fuel system parts.
- Pressure still remains in the fuel lines even after performing the following procedures. When disconnecting a fuel line, cover it with a piece of cloth to prevent fuel from spraying or coming out.

(a) Remove the circuit opening relay from the engine room relay block.

(b) Start the engine. After the engine stops, turn the ignition switch off.

HINT:

DTC P0171 (system too lean) may be stored.

(c) Check that the engine does not start.

(d) Remove the fuel tank cap and let the air out of the fuel tank.

(e) Disconnect the cable from the negative battery (-) terminal.

NOTICE:

After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work INFO .

(f) Reinstall the circuit opening relay.

3. FUEL SYSTEM

(a) When disconnecting a high pressure fuel line, a large amount of gasoline will spill out. Follow these procedures.

(1) Disconnect the fuel pump tube.

(2) Drain any fuel remaining inside the fuel pump tube.

(3) To protect the disconnected fuel pump tube from damage and contamination, cover it with a plastic bag.

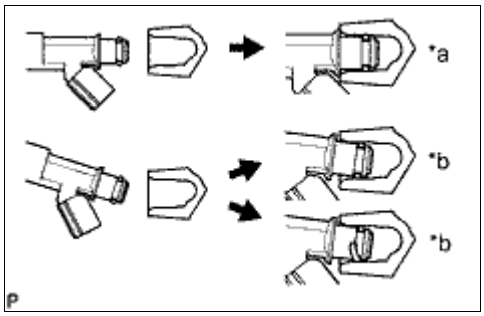
(4) Put a container under the connection.

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(b) Observe these precautions when removing and installing the fuel injector assemblies.

Text in Illustration

*a	Correct
*b	Incorrect



(1) Never reuse the O-ring.

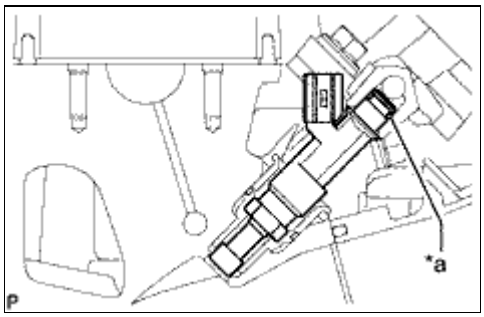
(2) When installing a new O-ring to the fuel injector assembly, do not damage it.

(3) Coat new O-rings with spindle oil or gasoline before installation. Do not use engine oil, gear oil or brake oil.

(c) Install the fuel injector assembly to the fuel delivery pipe and lower intake manifold as shown in the illustration.

Text in Illustration

*a	O-ring



NOTICE:

Before installing the fuel injector assembly, be sure to apply spindle oil or gasoline to the place where the fuel delivery pipe or cylinder head contacts the O-ring of the fuel injector assembly.

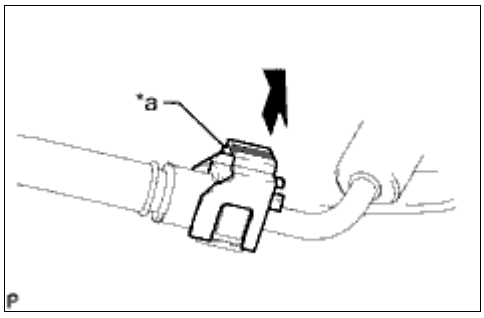
(d) Perform the following procedure when disconnecting the fuel tube connector (Quick Type A).

(1) Fuel Hose Connector Cover Type:

1. Disengage the lock claw by lifting up the cover as shown in the illustration.

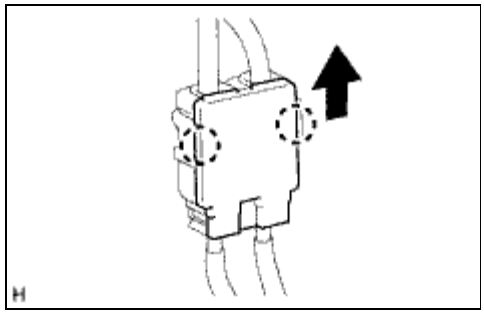
Text in Illustration

*a	Fuel Hose Connector Cover



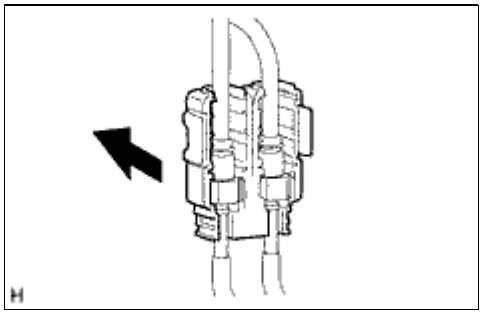
(2) Fuel Pipe Clamp Type:

1. Disengage the 2 claws and remove the No. 2 fuel pipe clamp.



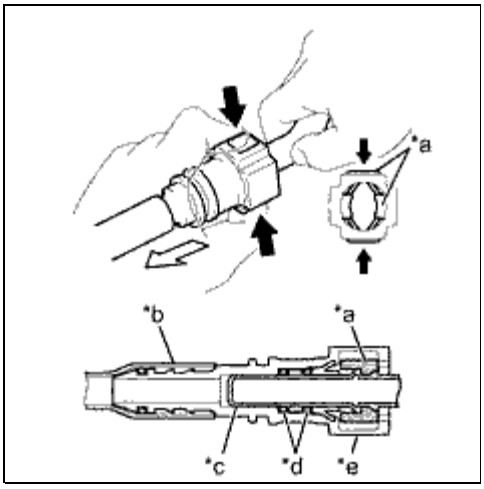
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2. Remove the No. 1 fuel pipe clamp



(3) Check whether there is any foreign matter on the fuel pipe around the fuel tube connector before disconnecting it and remove the foreign matter as necessary.

(4) Pinch the retainer of the fuel tube connector, and then pull out the fuel tube connector to disconnect the fuel tube from the fuel pipe.



Text in Illustration

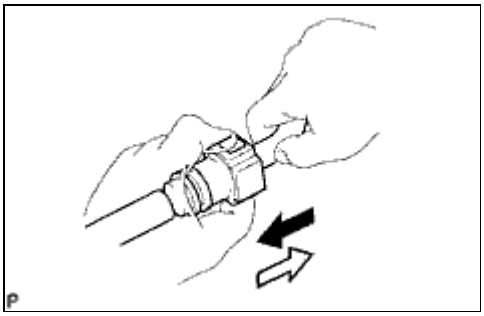
*a	Retainer
*b	Nylon Tube
*c	Fuel Pipe
*d	O-ring
*e	Fuel Tube Connector
➡	Pinch
⇨	Pull

NOTICE:

Be sure to disconnect the fuel tube connector by hand.

(5) If the fuel tube connector and fuel pipe are stuck, push in and pull on the fuel tube connector to release it. Pull the fuel tube connector out of the fuel pipe carefully.

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Text in Illustration

➡	Pull
⇨	Push

NOTICE:

Be sure to disconnect the fuel tube connector by hand.

(6) Check that there is no dirt or other foreign matter on the sealing surfaces of the disconnected fuel pipes. Clean the surfaces if necessary.

(7) Cover the disconnected fuel pipe and fuel tube connector with plastic bags to prevent damage and contamination.

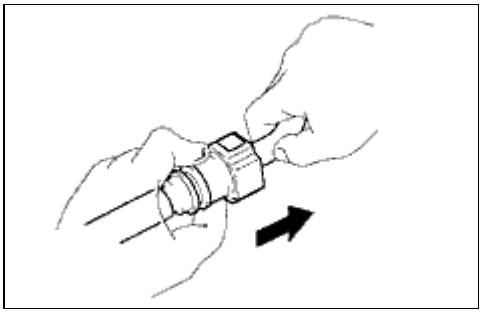
NOTICE:

Do not damage the fuel pipe or fuel tube connector, and prevent entry of foreign matter.

(e) Perform the following procedure when connecting a fuel tube connector (Quick Type A).

(1) Check if there is any damage or foreign matter on the connecting parts of the fuel pipes.

(2) Line up the 2 parts of the fuel pipes to be connected, and push them together until the fuel tube connector makes a "click" sound.



Text in Illustration

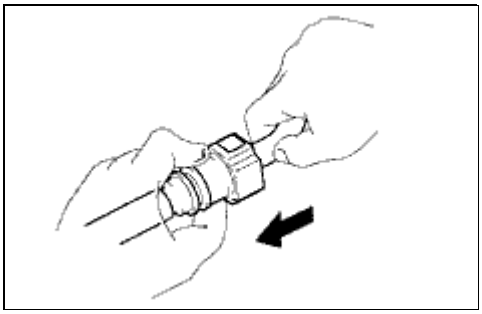
➡	Push

HINT:

If the fuel pipe is difficult to push into the fuel tube connector, apply a small amount of clean engine oil to the tip of the fuel pipe and reinsert it.

(3) After connecting the fuel pipes, check that the fuel pipe and fuel tube connector are securely connected by pulling on them.

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Text in Illustration

➡	Pull

(4) Fuel Pipe Clamp Type:

1. Install the No. 1 fuel pipe clamp.
2. Engage the 2 claws and install the No. 2 fuel pipe clamp.

(5) Fuel Hose Connector Cover Type:

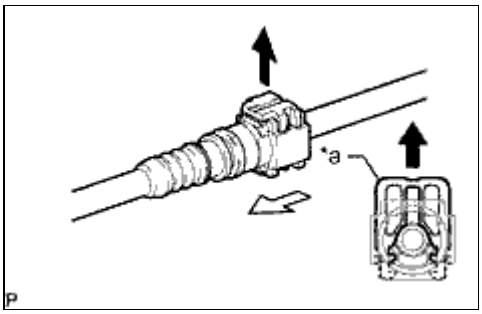
1. Engage the lock claws to the connector by pushing down on the cover.

(6) Check for any fuel leaks.

(f) Perform the following procedure when disconnecting the fuel tube connector (Quick Type B).

(1) Check whether there is any foreign matter on the fuel pipe around the fuel tube connector before disconnecting it and remove the foreign matter as necessary.

(2) Pull the tabs of the retainer to disengage the lock claws and pull out the fuel tube connector from the fuel pipe.



Text in Illustration

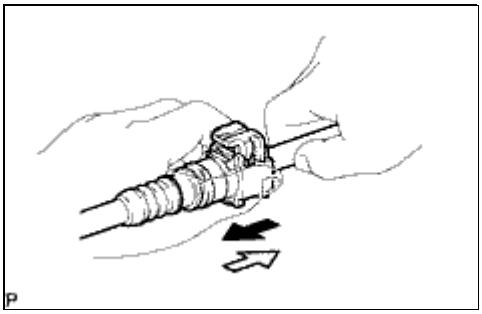
*a	Retainer
➡	Pull
⇨	Pull Out

NOTICE:

Be sure to disconnect the fuel tube connector by hand.

(3) If the fuel tube connector and fuel pipe are stuck, push in and pull on the fuel tube connector to release it. Pull the fuel tube connector out of the fuel pipe carefully.

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Text in Illustration

➡	Pull
⇨	Push

NOTICE:

Be sure to disconnect the fuel tube connector by hand.

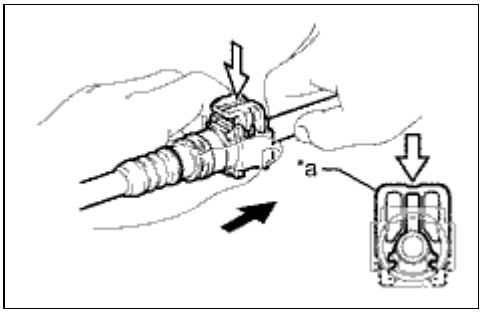
(4) Check that there is no dirt or other foreign matter on the sealing surfaces of the disconnected fuel pipes. Clean the surfaces if necessary.

(5) Cover the disconnected fuel pipe and fuel tube connector with plastic bags to prevent damage and contamination.

(g) Perform the following procedure when connecting the fuel tube connector (Quick Type B).

(1) Check if there is any damage or foreign matter on the connecting parts of the fuel pipes.

(2) Line up the fuel pipe and fuel tube connector and push them together until a "click" sound is heard. If the pipe is difficult to push into the connector, apply a small amount of clean engine oil to the tip of the fuel pipe and reinsert it.



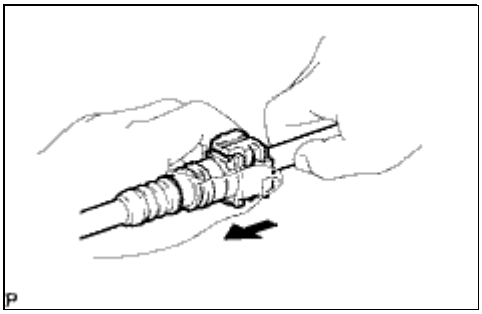
Text in Illustration

*a	Retainer
➡	Push
⇨	Push Down

(3) Push down the retainer.

(4) After connecting the fuel pipes, check that the fuel pipe and fuel tube connector are securely connected by pulling on them.

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Text in Illustration

➡	Pull

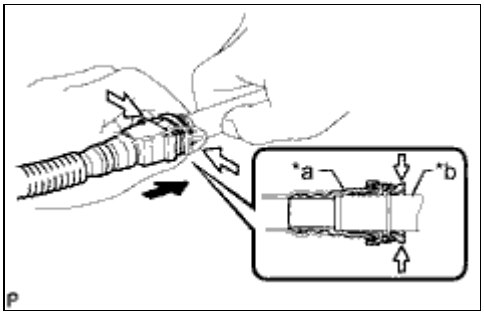
(h) Observe these precautions when handling the nylon tube.

NOTICE:

- Be careful not to turn the connection part of the nylon tube and the quick connector when connecting them.
- Do not kink the nylon tube.
- Do not remove the EPDM protector on the outside of the nylon tube.
- Do not bend the nylon tube as this may cause blockage.

(i) Perform the following procedure when disconnecting the fuel tube connector (Quick Type C).

(1) Pinch the retainer and pull out the fuel tube connector with the fuel tube connector pushed toward the fuel pipe to disconnect the fuel tube from the fuel pipe.



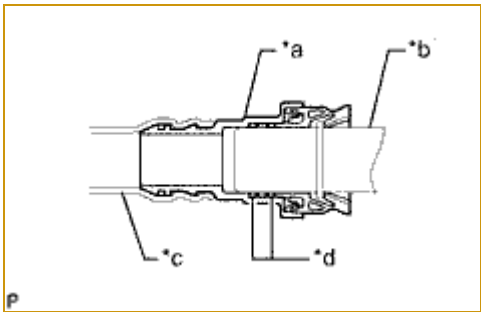
Text in Illustration

*a	Fuel Tube Connector
*b	Fuel Pipe
➡	Push
⇨	Pinch

NOTICE:

- Remove dirt or foreign objects on the fuel tube connector before performing this procedure.

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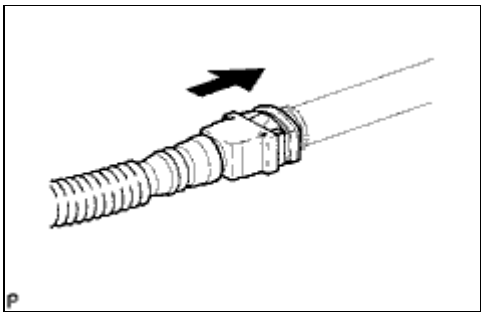
- Do not allow any scratches or foreign objects on the parts when disconnecting them as the fuel tube connector has the O-ring that seals the fuel pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, kink or twist the nylon tube.
- Protect the connecting part by covering it with a plastic bag after disconnecting the fuel tube.
- If the fuel tube connector and fuel pipe are stuck, push and pull them to release them.

Text in Illustration

*a	Fuel Tube Connector
*b	Fuel Pipe
*c	Nylon Tube
*d	O-ring

(j) Perform the following procedure when connecting the fuel tube connector (Quick Type C).

(1) Align the fuel tube connector with the fuel pipe, and then push in the fuel tube connector until the retainer makes a "click" sound to connect the fuel tube to the fuel pipe.



Text in Illustration

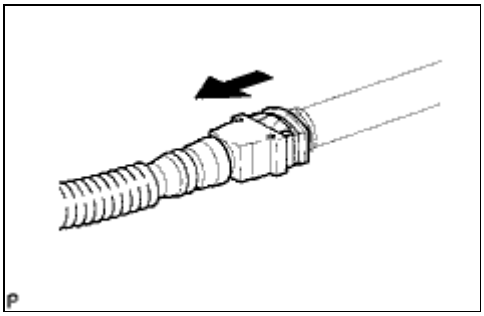
➡	Push

NOTICE:

- Check that there are no scratches or foreign objects on the connected part of the fuel tube connector and fuel pipe before performing this procedure.
- After connecting the fuel tube, check that the fuel tube is securely connected by pulling the fuel tube connector.

(2) After connecting the fuel pipe and the connector, check that the fuel pipe and connector are securely connected by trying to pull them apart.

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Text in Illustration

➡	Pull

(3) Inspect for fuel leaks.

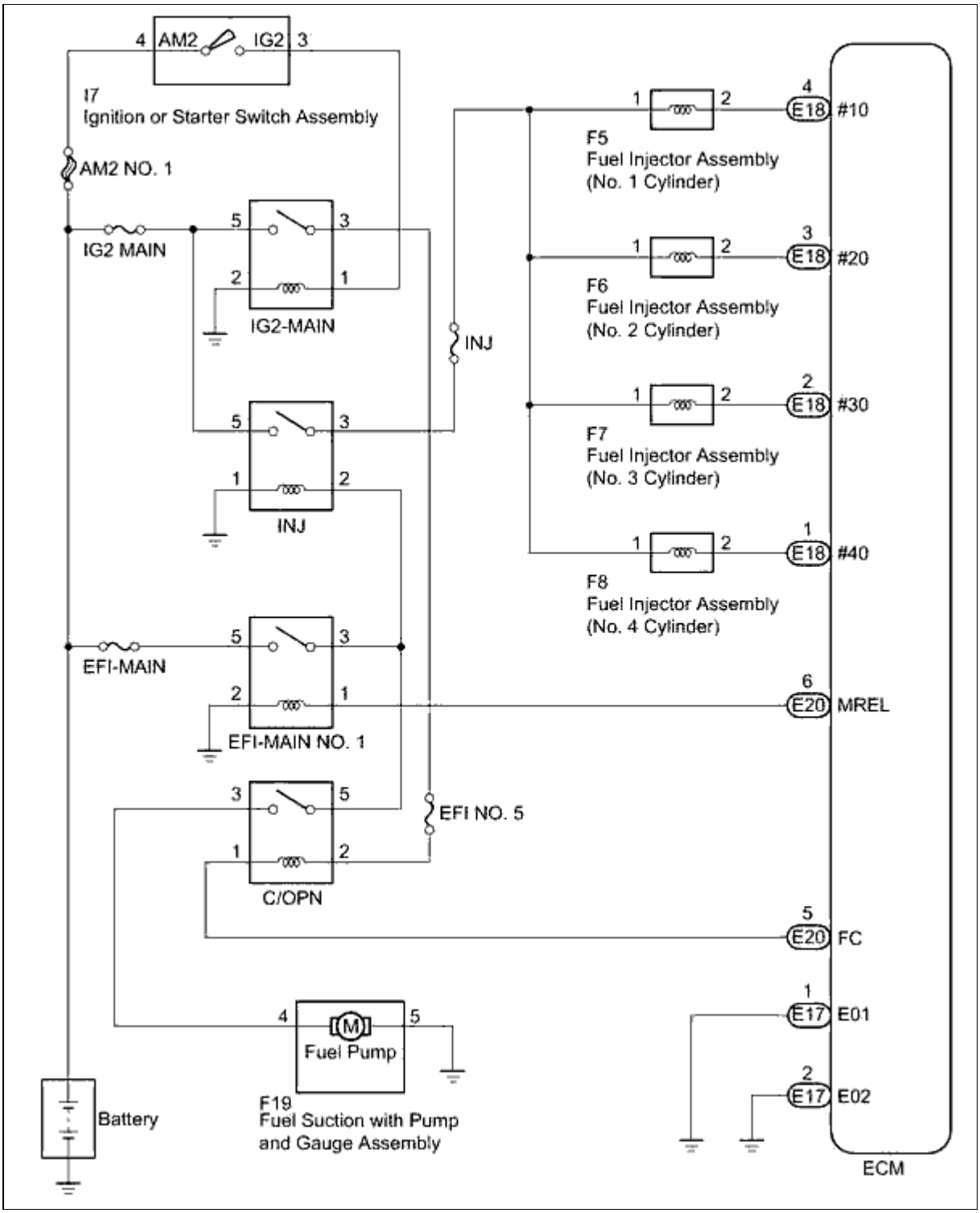
4. INSPECT FOR FUEL LEAK

INFO

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000PDZ05KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM

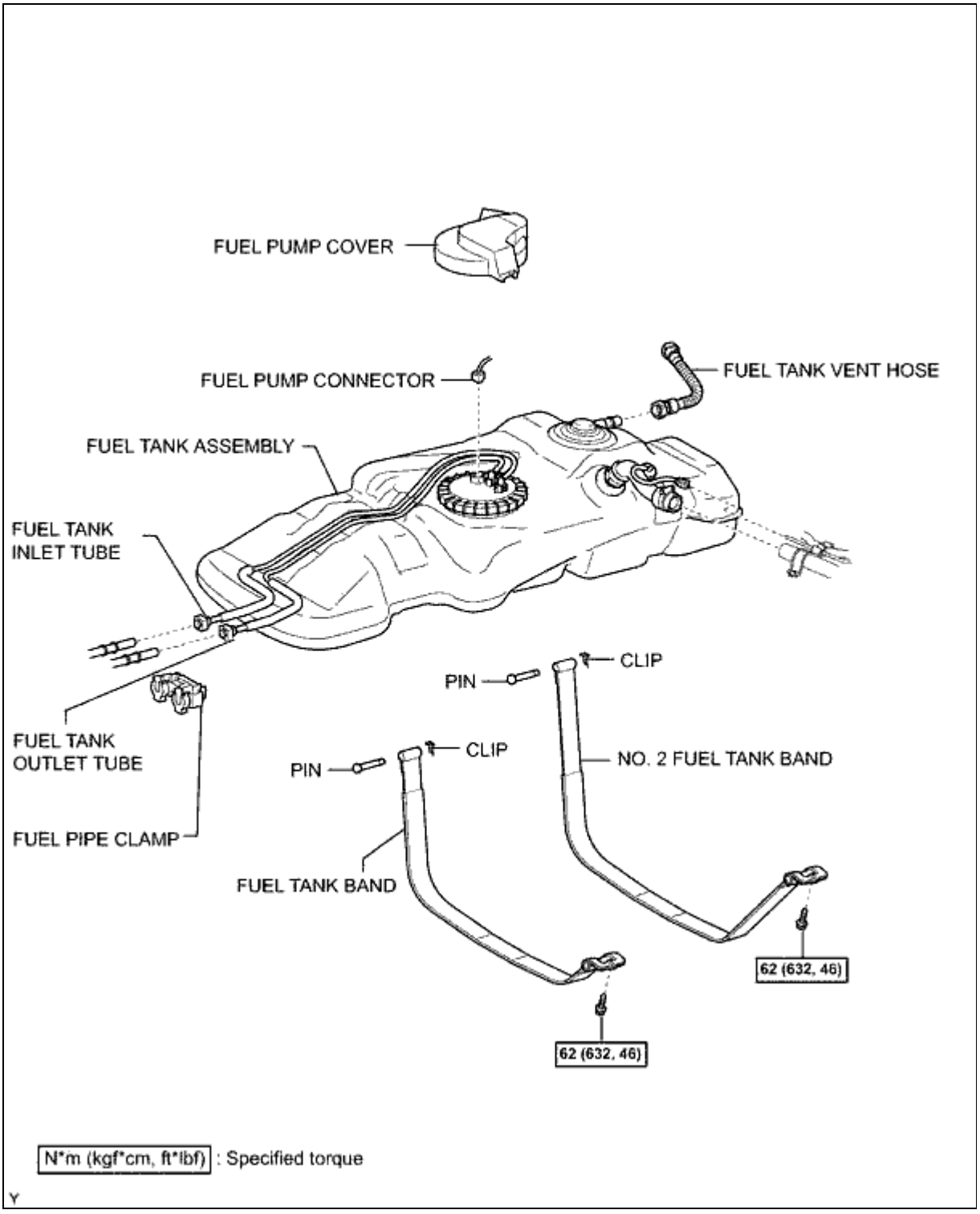


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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000000QDY059X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL TANK: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

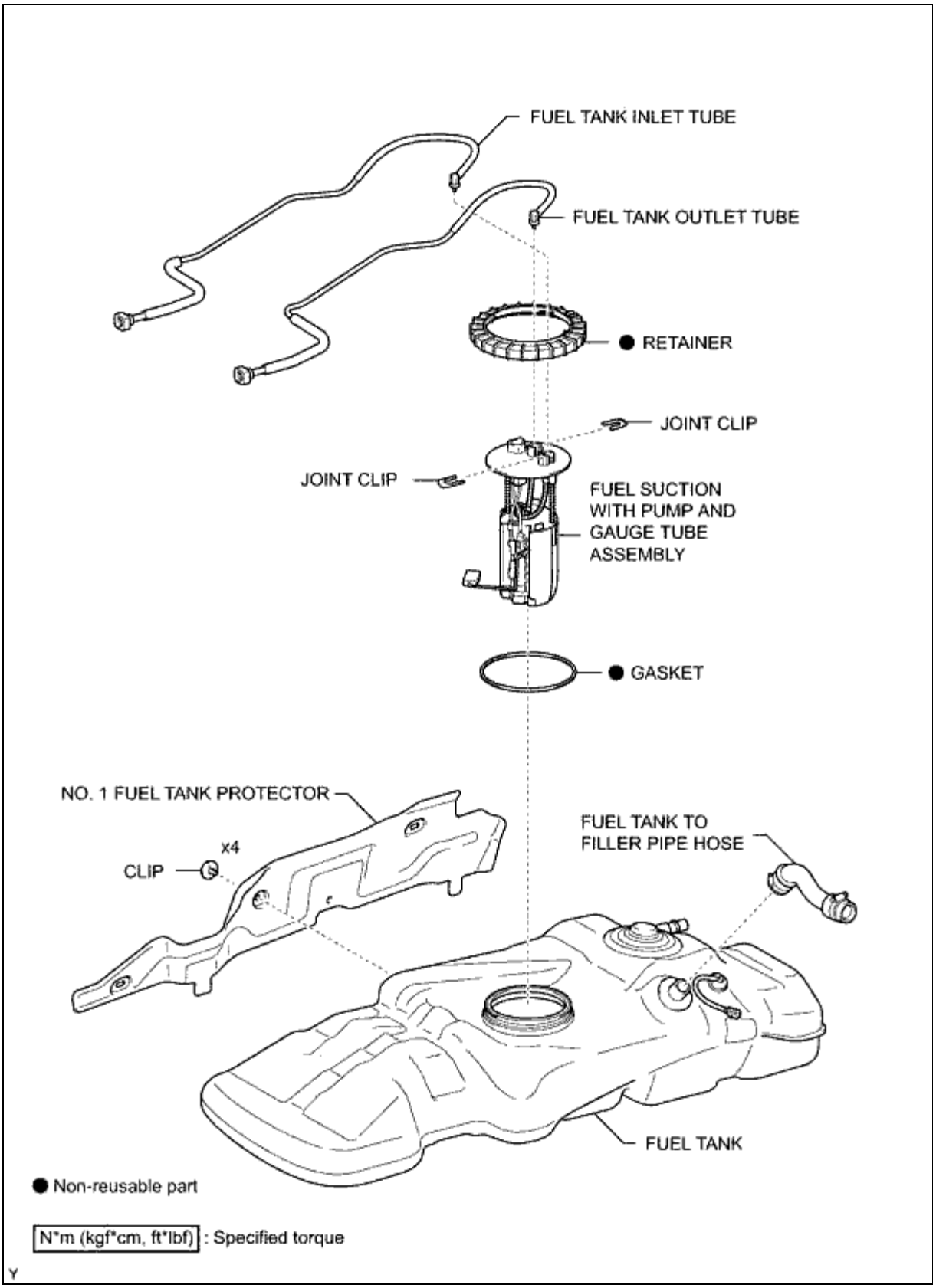
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QDX07BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL TANK: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL NO. 1 FUEL TANK PROTECTOR

(a) Install the fuel tank protector with the 4 clips.

2. INSTALL FUEL TANK TO FILLER PIPE HOSE

(a) Install the fuel tank onto the filler pipe hose, then tighten the pipe clamp bolt.

3. INSTALL FUEL SUCTION WITH PUMP & GAGE TUBE ASSEMBLY

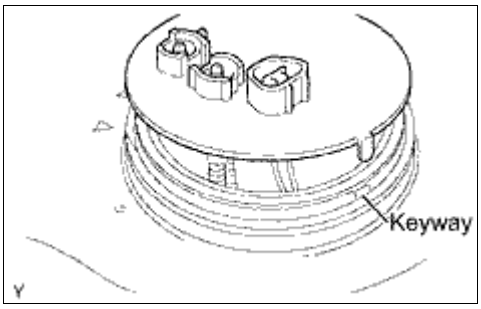
(a) Install a new gasket onto the fuel tank.

(b) Set the fuel pump assembly in the fuel tank.

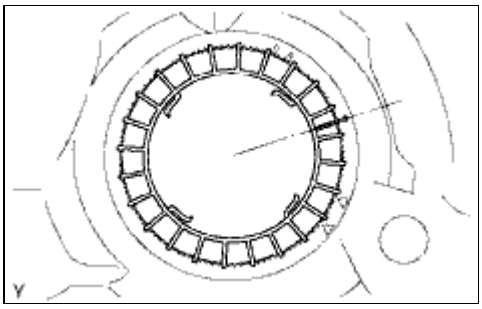
NOTICE:

Be careful not to bend the arm of the sender gauge.

(c) Fit a spline of the fuel suction tube assembly into a keyway of the fuel tank.

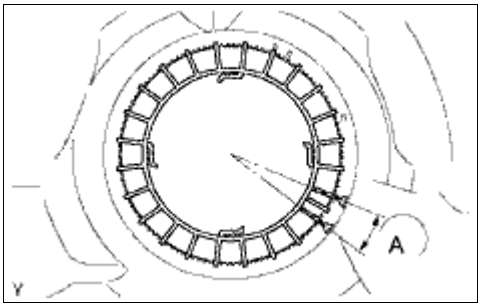


(d) Install a new retainer.



(1) Align the mark on a new retainer with the rib on the fuel tank as shown in the illustration.

(2) Using SST, turn the retainer 740°to 780°clockwise (more than 2 turns), and position the mark on the retainer within range A to install it.



SST: 09808-14020

09808-01410

09808-01420

09808-01430

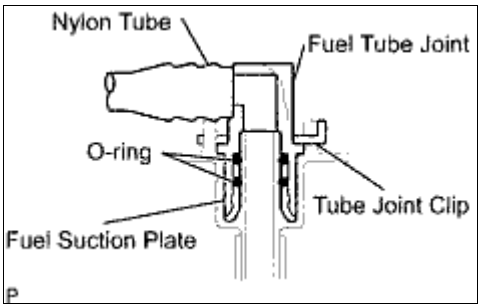
HINT:

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The ribs on the retainer can be fitted into the tip of the SST.

4. INSTALL FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE

(a) Install the fuel tank main tube and return tube with the 2 joint clips.



NOTICE:

- Check that there are no scratches or foreign objects around the connected part of the fuel tube joint and plug before performing this work.
- Check that the fuel tube joint is securely inserted to the end.
- Check that the tube joint clips are on the collar of the fuel tube joint.
- After installing the tube joint clip, check that the fuel tank main tube and return tube can be pulled out.

5. INSTALL FUEL TANK ASSEMBLY

(a) Set the fuel tank assembly onto the mission jack.

(b) Connect the fuel tank vent hose.

(1) Align the fuel tank vent connector with the pipe, then push in the fuel tank vent connector until the retainer makes a "click" sound to connect the fuel tank vent hose to the fuel suction plate.

NOTICE:

- Check that there are no scratches or foreign objects around the connected part of the fuel tank vent connector and plug before performing this work.
- After connecting the fuel tank vent hose, check that the fuel tank vent hose is securely connected by pulling the quick connector.

(c) Connect the fuel pump connector.

(d) Connect the fuel tank to filler pipe hose.

(e) Install the fuel pump cover.

(f) Install the 2 fuel tank bands.

(1) Install the 2 fuel tank bands with the 2 pins and 2 clips.

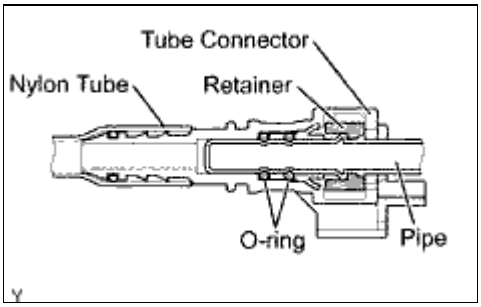
(2) Install the 2 fuel tank bands with the 2 bolts.

Torque:

62 N·m {632 kgf·cm, 46ft·lbf}

(g) Connect the fuel tank breather tube.

(1) Align the fuel tube connector with the pipe, then push the fuel tube connector in until the retainer makes a "click" sound to connect the fuel tank vent breather tube.



NOTICE:

- Check that there are no scratches or foreign objects around the connected part of the fuel tube connector and pipe before performing this work.
- After connecting the fuel tank breather tube, check that the fuel pump tube is securely connected by pulling the fuel tube connector and pipe.

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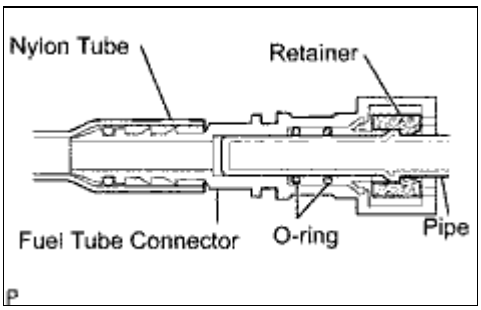
(2) Install the checker onto the pipe.

(h) Tighten the clamp bolt.

6. CONNECT FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE

(a) Connect the fuel tank main tube and return tube.

(1) Align the fuel tube connector with the pipe, then push the fuel tube connector in until the retainer makes a "click" sound to connect the fuel tank main tube and return tube.



NOTICE:

- Check that there are no scratches or foreign objects around the connected part of the fuel tube connector and pipe before performing this work.
- After connecting the fuel tube connector, check that the fuel tube connector and pipe are securely connected by pulling them.

(b) Install the fuel pipe clamp.

7. ADD FUEL

8. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

9. CHECK FOR FUEL LEAK INFO

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000QDZ074X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE FUEL: FUEL TANK: REMOVAL; 2016 MY Tacoma [08/2015 -]		

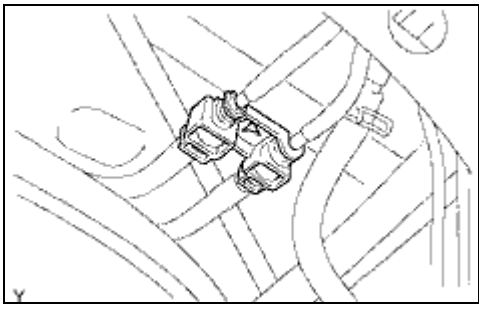
REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

INFO

2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

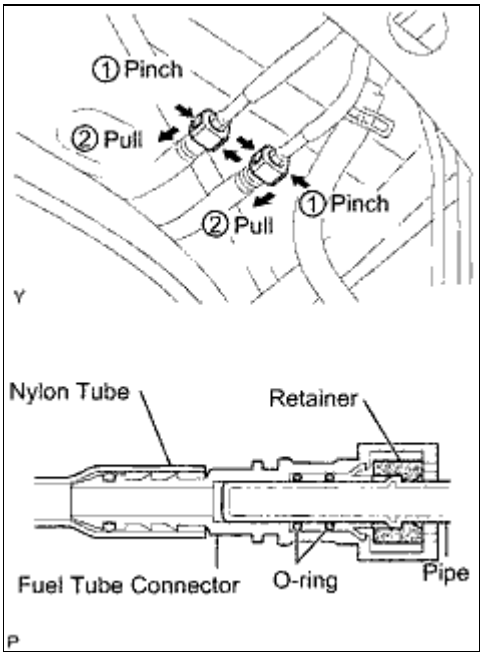
3. DISCONNECT FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE



(a) Remove the fuel pipe clamp.

(b) Disconnect the fuel tank main tube and fuel tank return tube.

(1) Pinch the retainer as illustrated, then pull the fuel tube connectors out of the pipes.

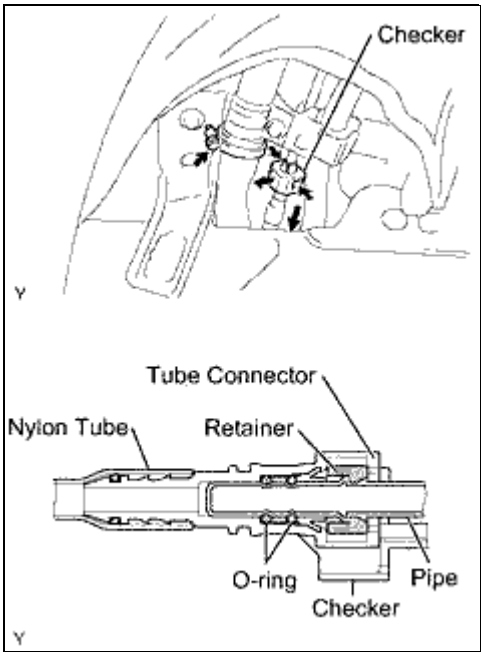


NOTICE:

- Remove any dirt and foreign objects from the fuel tube connector before performing this work.
- Do not allow any scratches or foreign objects on the parts when disconnecting, as the fuel tube connector has the O-ring that seals the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tube.
- If the fuel tube connector and pipe are stuck, push and pull to release them.

4. REMOVE FUEL TANK ASSEMBLY

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(a) Loosen the clamp bolt.

(b) Disconnect the fuel breather tube.

(1) Remove the checker of the fuel tube connector from the pipe.

(2) Pinch the retainer of the fuel tube connector, then pull the tube connector out of the pipe.

NOTICE:

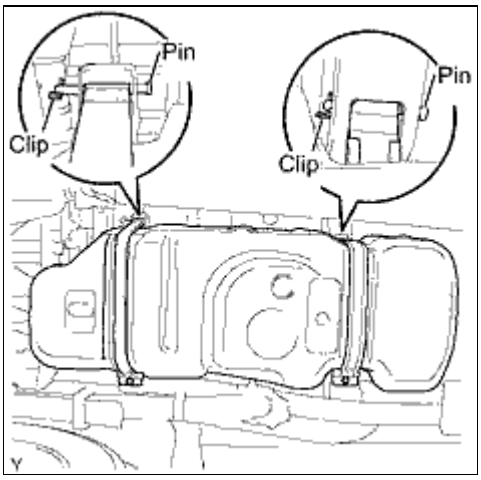
- Remove any dirt and foreign objects from the fuel tube connector before performing this work.
- Do not allow any scratches or foreign objects on the parts when disconnecting, as the fuel tube connector has the O-ring that seals the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tube.
- If the fuel tube connector and pipe are stuck, push and pull to release them.

(c) Hold the fuel tank using the mission jack.

(d) Remove the 2 fuel tank bands.

(1) Remove the 2 bolts.

(2) Remove the 2 clips and 2 pins, then remove the 2 fuel tank bands.



(e) Remove the fuel pump cover.

(f) Slightly jack the fuel tank down and separate the fuel tank to filler pipe hose from the inlet pipe.

NOTICE:

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Slowly jack down the fuel tank so as not to tear the wire harness and hose.

(g) Disconnect the fuel pump connector.

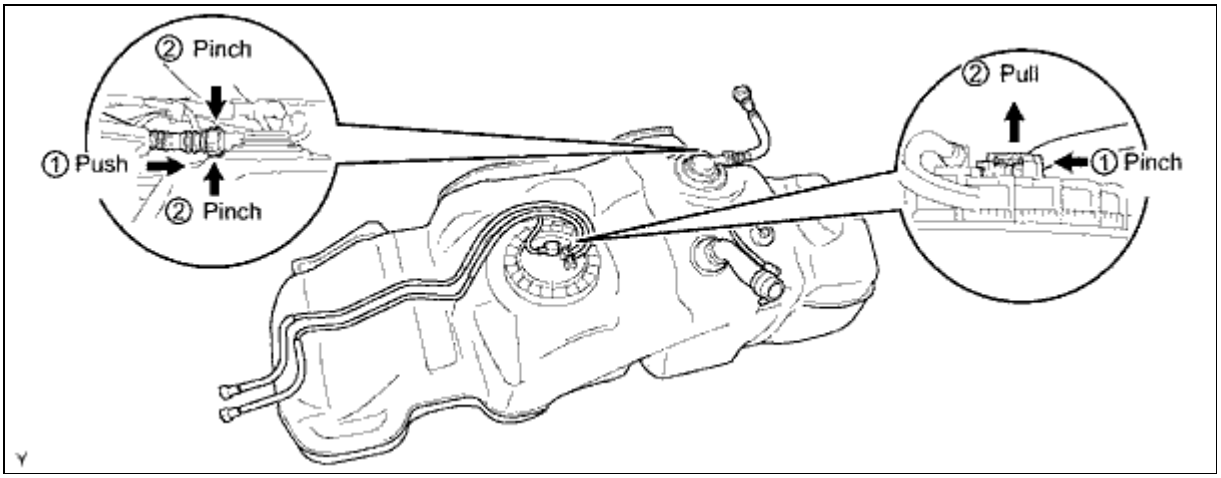
(h) Disconnect the fuel tank vent hose.

(1) Pinch the retainer and pull the fuel tank vent hose connector out of the charcoal canister to disconnect the fuel tank vent hose from the charcoal canister.

NOTICE:

- Remove any dirt and foreign objects from the fuel tank vent hose connector before performing this work.
- Do not allow any scratches of foreign objects on the parts when disconnecting, as the fuel tank vent hose connector has the O-ring that seals the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tank vent hose.
- If the fuel tank vent connector and pipe are stuck, push and pull to release them.

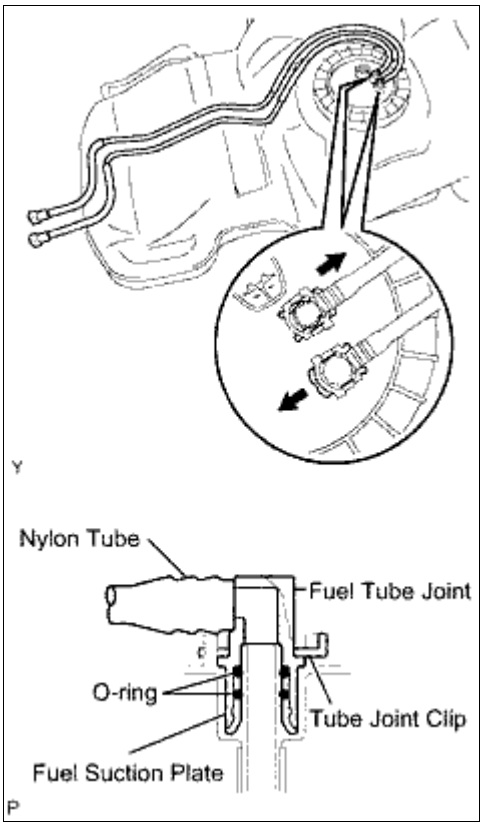
(i) Remove the fuel tank assembly.



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5. REMOVE FUEL TANK MAIN TUBE AND FUEL TANK RETURN TUBE

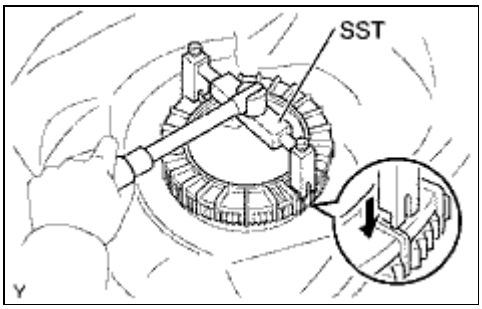
(a) Remove the 2 joint clips, then remove the fuel tank main tube and fuel tank return tube.



NOTICE:

- Remove any dirt and foreign objects from the fuel tube connector before performing this work.
- Do not allow any scratches or foreign objects on the parts when disconnecting, as the fuel tube connector has the O-ring that seals the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the disconnected part by covering it with a vinyl bag after disconnecting the fuel tube.
- If the fuel tube connector and pipe are stuck, push and pull to release them.

6. REMOVE FUEL SUCTION WITH PUMP & GAGE TUBE ASSEMBLY



NOTICE:

Protect the connector and tube joint with masking tape or equivalent to prevent any foreign objects from sticking to them. Clean any dirt and foreign objects from the fuel suction tube assembly before removing.

(a) Using a SST, loosen the retainer.

SST: 09808-14020

09808-01410

09808-01420

09808-01430

HINT:

The ribs on the retainer can be fitted into a tip of the SST.

(b) Remove the retainer.

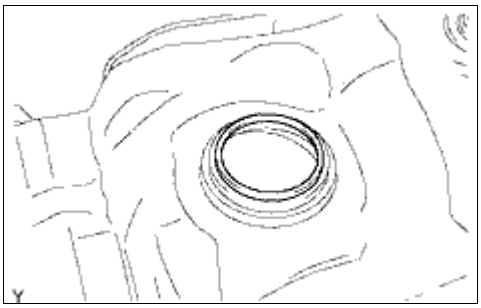
(c) Pull the fuel pump assembly out of the fuel tank.

NOTICE:

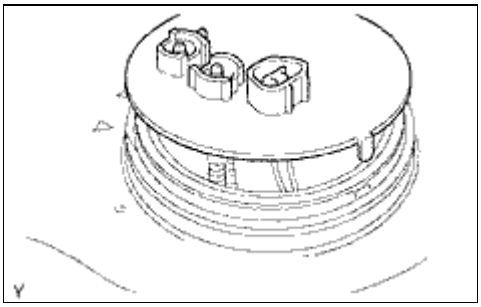
Be careful not to bend the arm of the sender gauge.

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(d) Remove the gasket from the fuel tank.



7. DRAIN FUEL

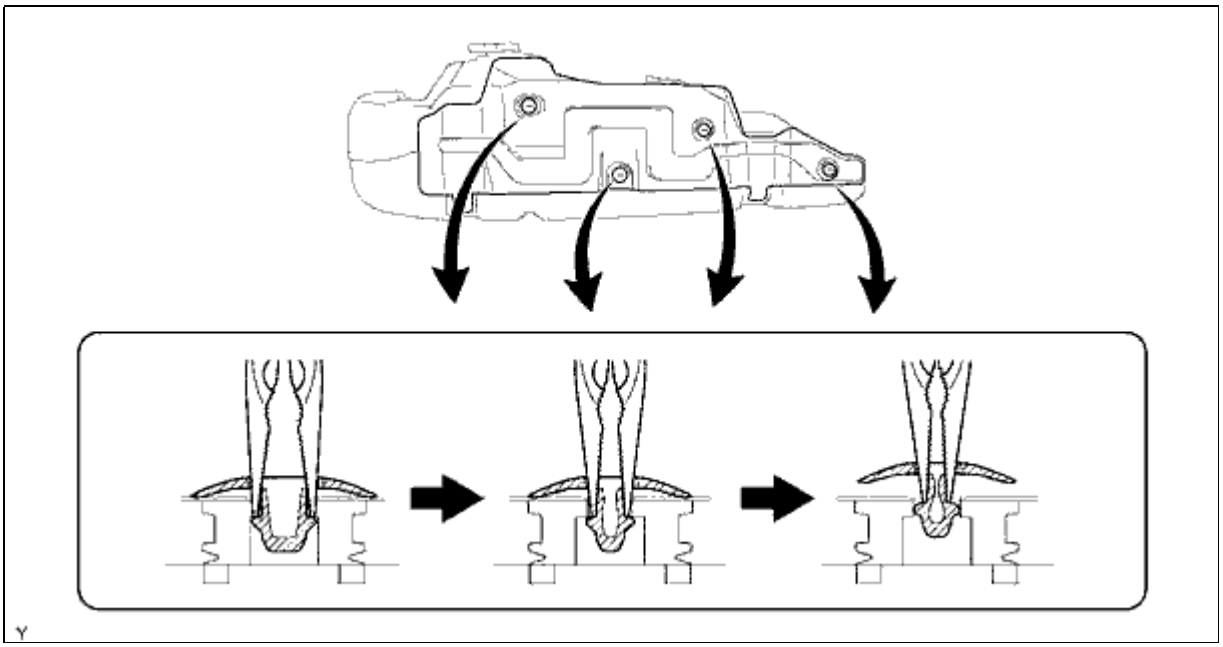


8. REMOVE FUEL TANK TO FILLER PIPE HOSE

(a) Loosen the clamp bolt, then remove the fuel tank to filler pipe hose.

9. REMOVE NO. 1 FUEL TANK PROTECTOR

(a) Remove the 4 clips, then remove the fuel tank protector.



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000SM607KX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE IGNITION: IGNITION SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

HINT:

Perform "Inspection After Repair" after replacing an ignition coil assembly or spark plug INFO .

1. PERFORM SPARK TEST

(a) Check for DTCs INFO .

NOTICE:

If any DTC is output, perform troubleshooting procedures for that DTC.

(b) Remove the 4 ignition coil assemblies and 4 spark plugs .

(c) Install the spark plug to the ignition coil assembly and connect the ignition coil connector.

(d) Disconnect the 4 fuel injector connectors.

(e) Ground the spark plug.

(f) Visually check that sparks occur while the engine is being cranked.

NOTICE:

- When performing the inspection, be sure to ground the hexagonal portion or the threaded portion of the spark plug.
- Do not crank the engine for more than 2 seconds.
- Be sure to ground the spark plug when checking.
- If an ignition coil assembly is struck or dropped, replace it with a new one.
- If a spark plug is struck or dropped, replace it with a new one.

(g) If sparks do not occur normally in 1 or more cylinders, perform the "Ignition Coil and Spark Test" below.

2. INSPECT IGNITION COIL AND SPARK TEST

HINT:

Perform "Inspection After Repair" after replacing an ignition coil assembly or spark plug INFO .

(a) Spark test flowchart.

(1) Check that the wire harness side connector of the ignition coil assembly is securely connected.

RESULT	PROCEED TO
NG	Connect securely
OK	Go to next step

(2) Perform spark test on each ignition coil assembly.

1. Replace the ignition coil assembly with a normal one.
2. Perform spark test again.

RESULT	PROCEED TO
OK	Replace ignition coil assembly
NG	Go to next step

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(3) Inspect the spark plug.

1. If there is a cylinder in which ignition does not occur, interchange the spark plug of that cylinder and the spark plug of a cylinder in which ignition properly occurs.
2. Check that sparks occur in the cylinder in which the properly functioning spark plug was installed.

RESULT	PROCEED TO
OK	Replace spark plug
NG	Inspect ignition system

(b) Connect the 4 fuel injector connectors.

(c) Install the 4 ignition coil assemblies and 4 spark plugs INFO .

(d) Clear DTCs INFO .

3. INSPECT SPARK PLUG

NOTICE:

- Do not use a wire brush for cleaning.
- Do not attempt to adjust the electrode gap of a used spark plug.

HINT:

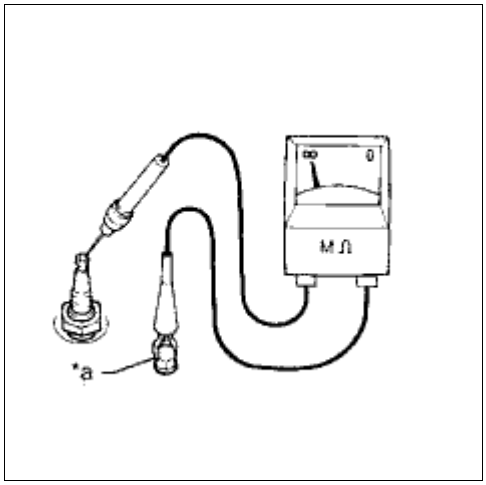
Perform "Inspection After Repair" after replacing an ignition coil assembly or spark plug INFO .

(a) Check the electrode.

(1) Using a megohmmeter, measure the insulation resistance.

Text in Illustration

*a	Body Ground



Standard Insulation Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Spark plug (Terminal part) - Body ground	Always	10 MΩ or higher

HINT:

If a megohmmeter is not available, perform the following simple inspection.

(b) Alternative inspection method:

(1) Quickly accelerate the engine to 4000 rpm 5 times.

(2) Remove the spark plug.

(3) Visually check the spark plug.

If the electrode is dry, the spark plug is functioning properly. If the electrode is damp, proceed to the next step.

(c) Check the spark plug for any damage to its thread and insulator.

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If there is damage, replace the spark plug. If not, reinstall the spark plug.

Recommended Spark Plug:

MANUFACTURER	SPARK PLUG TYPE
DENSO	FK20HR-A8

(d) Check the spark plug electrode gap.

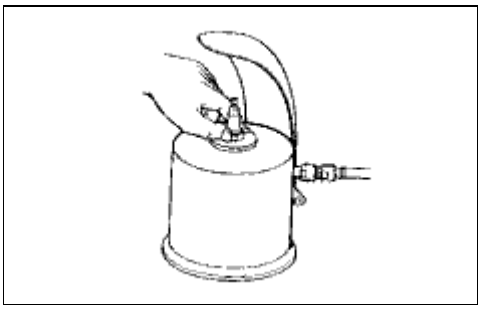
Maximum electrode gap for used spark plug:
1.1 mm (0.0433 in.)

If the gap is more than the maximum, replace the spark plug.

Electrode gap for new spark plug:
0.7 to 0.8 mm (0.0276 to 0.0315 in.)

(e) Clean the spark plugs.

If the electrode has traces of wet carbon, clean the electrode with a spark plug cleaner and then dry it.



Air pressure:
588 kPa (6.0 kgf/cm ^{2} , 85 psi)
Duration:
20 seconds or less

HINT:

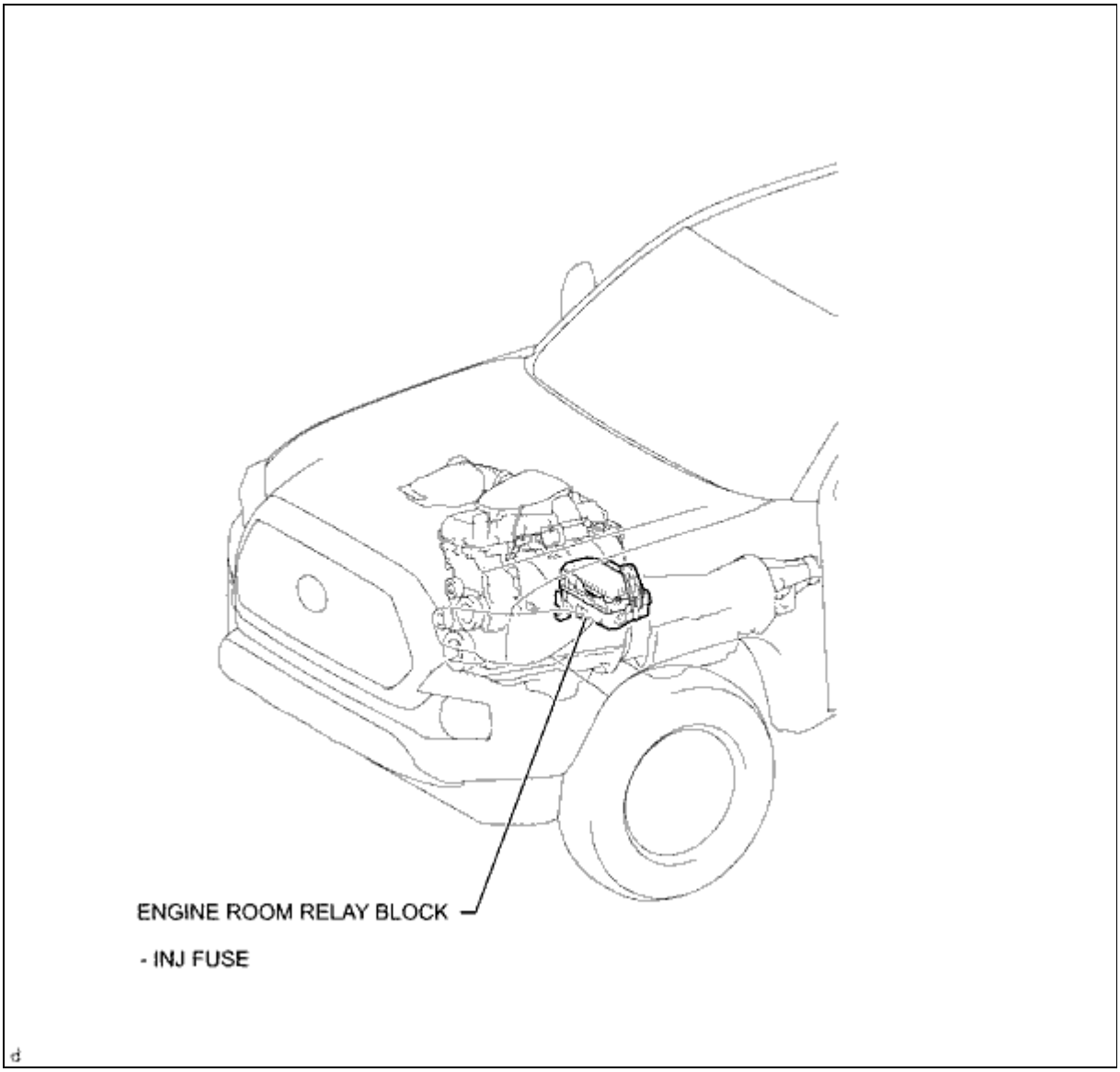
Only use a spark plug cleaner when the electrode is free of oil. If the electrode has traces of oil, use gasoline to clean off the oil before using the spark plug cleaner.

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM000000VX801XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE IGNITION: IGNITION SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

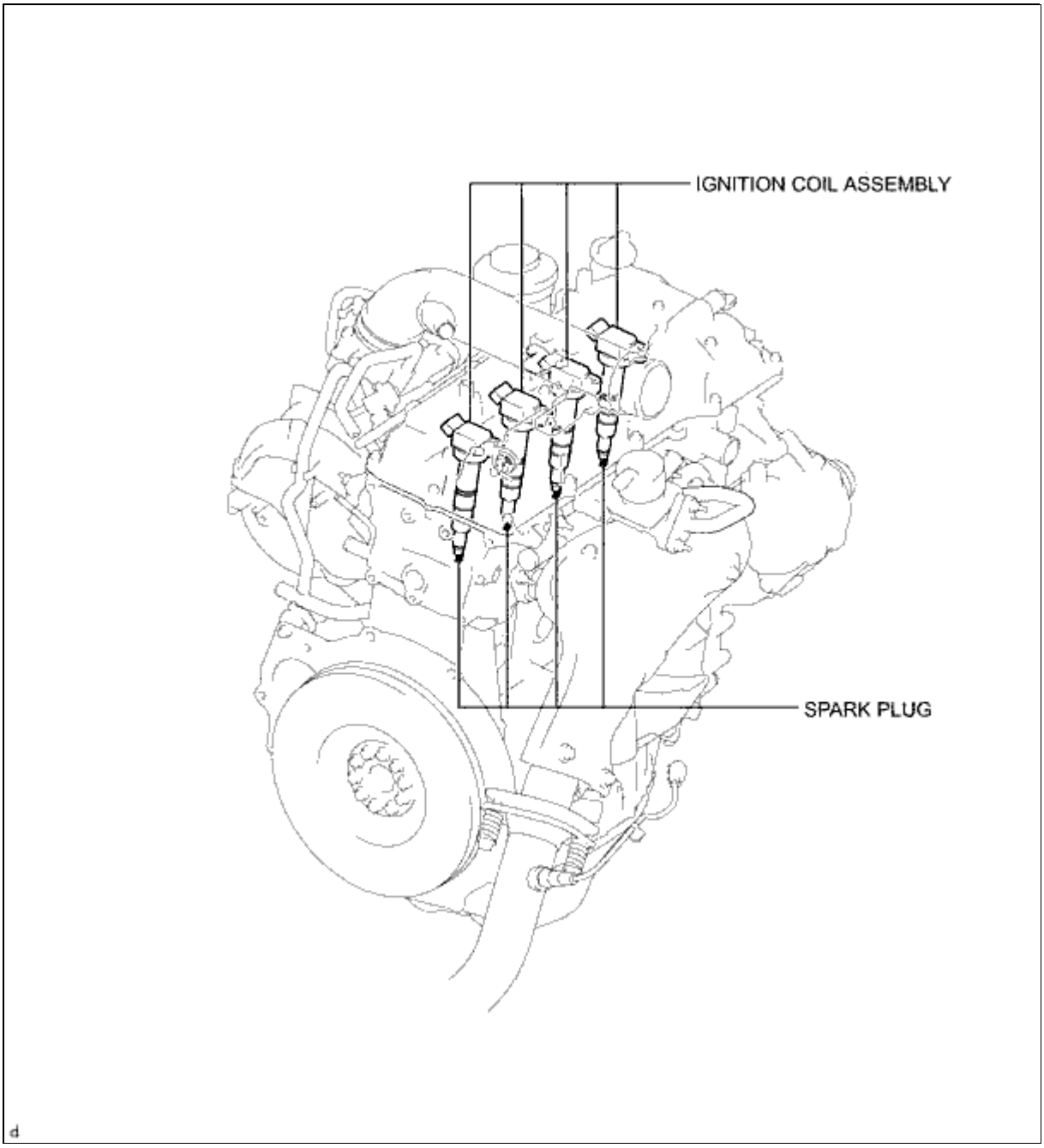
PARTS LOCATION

ILLUSTRATION



ILLUSTRATION

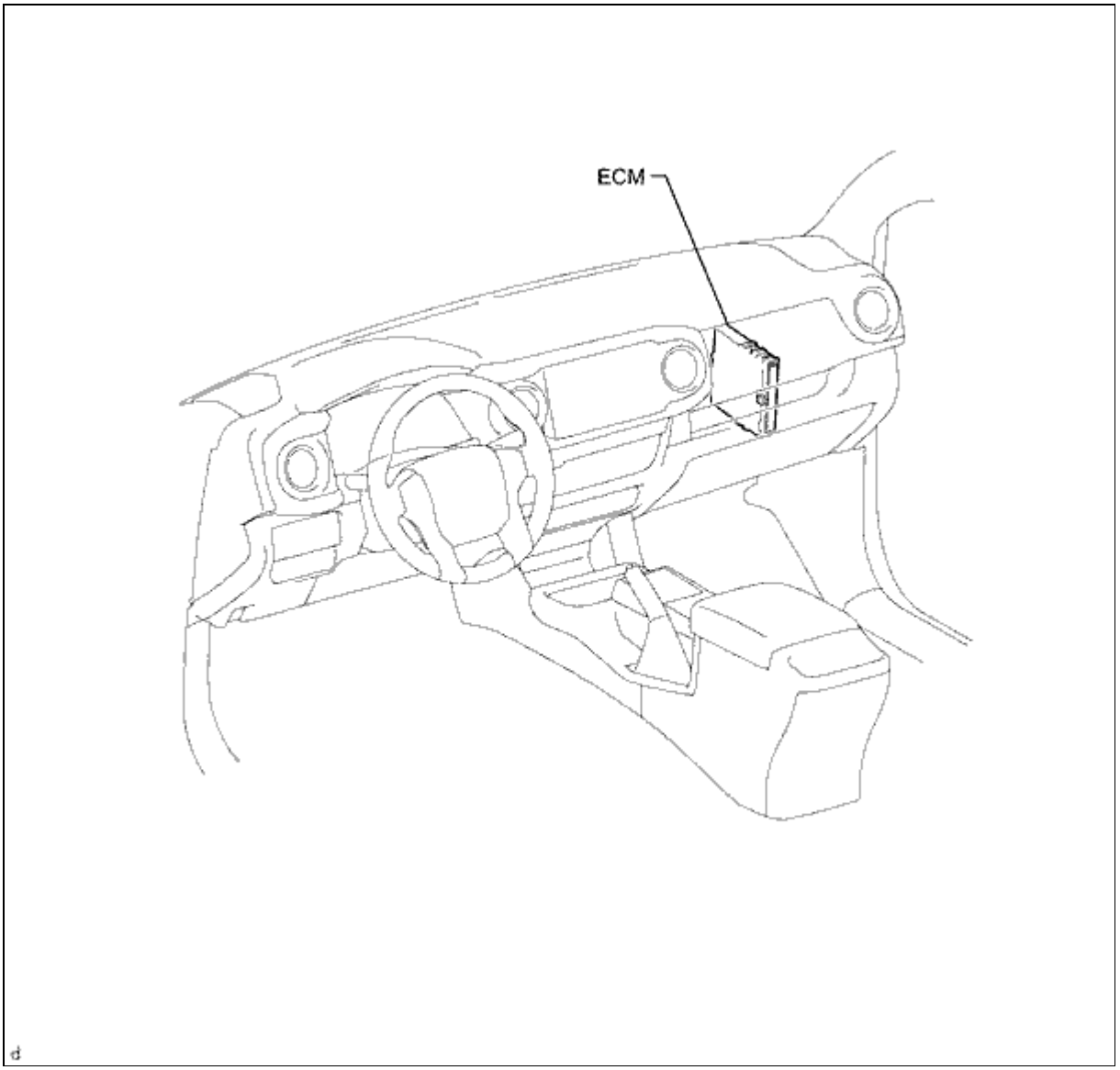
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ILLUSTRATION

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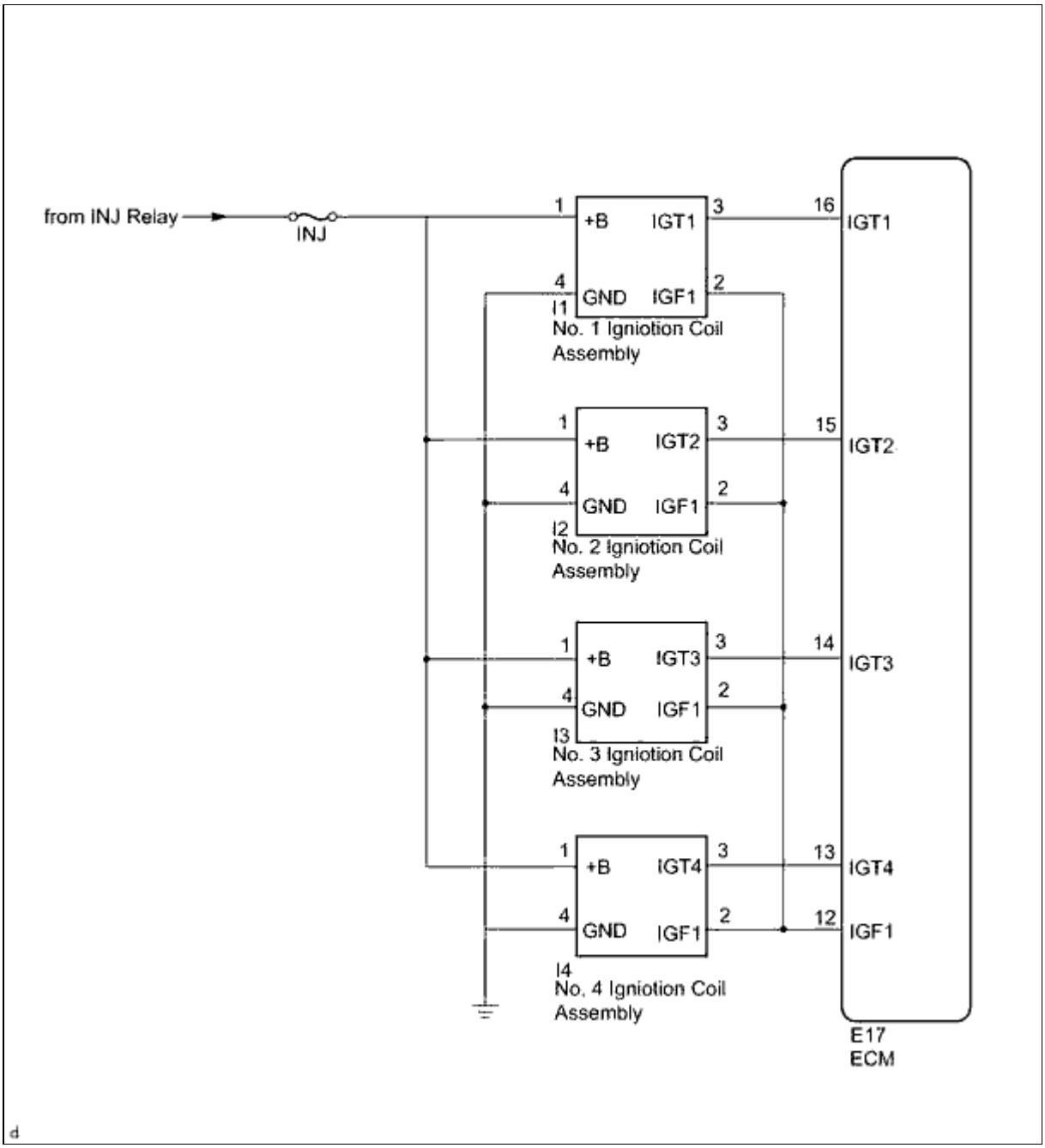


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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM000000SM5028X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE IGNITION: IGNITION SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000003PKS02HX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: LUBRICATION SYSTEM: ON-VEHICLE INSPECTION; 2016 MY Tacoma [08/2015 -]		

ON-VEHICLE INSPECTION

1. INSPECT ENGINE OIL LEVEL

(a) Warm up the engine, stop the engine and wait 5 minutes.

(b) Check that the engine oil level is between the dipstick low level mark and full level mark.

If the level is low, check for leakage and add engine oil up to the full level mark.

NOTICE:

Do not fill engine oil above the full level mark.

HINT:

A certain amount of engine oil will be consumed while driving. In the following situations, oil consumption may increase, and engine oil may need to be refilled in between oil maintenance intervals.

- When the engine is new, for example directly after purchasing the vehicle or after replacing the engine.
- If low quality oil or oil of an inappropriate viscosity is used.
- When driving at a high engine speed or with a heavy load, when towing, or when driving while accelerating or decelerating frequently.
- When idling for a long time, or when driving frequently through heavy traffic.

When judging the amount of oil consumption, keep in mind that the oil may have become diluted, making it difficult to judge the true level accurately.

2. INSPECT ENGINE OIL QUALITY

(a) Check the oil for deterioration, water contamination, discoloration or thinning. If the quality is visibly poor, replace the engine oil and oil filter sub-assembly INFO .

3. INSPECT OIL PRESSURE

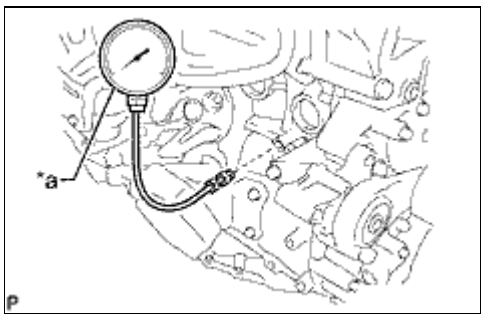
(a) Remove the No. 1 engine under cover sub-assembly.

(b) Remove the engine oil pressure switch assembly.

(1) Disconnect the engine oil pressure switch assembly connector.

(2) Using a 24 mm deep socket wrench, remove the engine oil pressure switch assembly.

(c) Install an oil pressure gauge.



Text in Illustration

*a	Oil Pressure Gauge

(d) Warm up the engine.

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(e) Measure the oil pressure.

Standard Oil Pressure:

CONDITION	SPECIFIED CONDITION
Idle	29 kPa (0.3 kgf/cm ^{2} , 4.2 psi) or higher
3000 rpm	160 to 490 kPa (1.6 to 5.0 kgf/cm ^{2} , 23 to 71 psi)

If the result is not as specified, check the quality of the engine oil and check the oil paths for clogging.

Repair or replace if necessary. If the oil pressure is still not as specified, check the oil pump INFO .

(f) Remove the oil pressure gauge.

(g) Install the engine oil pressure switch assembly.

(1) Apply adhesive to 2 or 3 threads of the engine oil pressure switch assembly.

Adhesive:
TOYOTA Genuine Adhesive 1344, Three Bond 1344 or equivalent

NOTICE:

Do not let adhesive adhere to the oil hole.

(2) Using a 24 mm deep socket wrench, install the engine oil pressure switch assembly.

Torque:

15 N·m {153 kgf·cm, 11ft·lbf}

NOTICE:

Do not start the engine within 1 hour of installation.

(3) Connect the engine oil pressure switch assembly connector.

(h) Inspect for oil leak INFO .

(i) Inspect the engine oil level.

(j) Install the No. 1 engine under cover sub-assembly.

Torque:

30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000YM501UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL AND OIL FILTER: REPLACEMENT; 2016 MY Tacoma [08/2015 -]		

REPLACEMENT

CAUTION:

- Prolonged and repeated contact with engine oil will result in the loss of natural oil from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Wear protective clothing and gloves. Avoid contact with used oil. If contact occurs, wash the area thoroughly with soap and waterless hand cleaner. Never use gasoline, thinners, or solvents to wash the skin.
- In order to protect the environment, dispose of used oil and used oil filters at designated disposal sites only.

1. DRAIN ENGINE OIL

(a) Remove the oil filler cap.

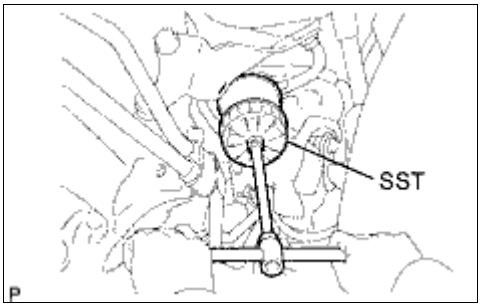
(b) Remove the oil pan drain plug and gasket, and drain the oil into a container.

2. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

3. REMOVE OIL FILTER SUB-ASSEMBLY

(a) Using SST, remove the oil filter sub-assembly.

SST: 09228-07501

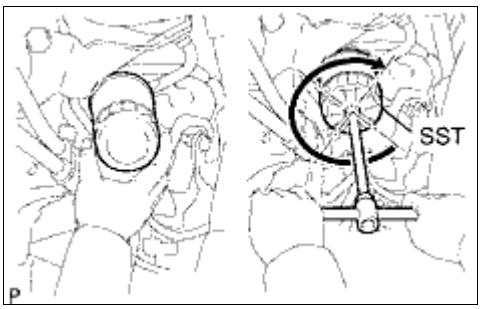


4. INSTALL OIL FILTER SUB-ASSEMBLY

(a) Check and clean the oil filter sub-assembly installation surface.

(b) Apply clean engine oil to the gasket of a new oil filter sub-assembly.

(c) Lightly screw the oil filter sub-assembly into place by hand. Tighten it until the gasket contacts the seat.



(d) Using SST, tighten the oil filter sub-assembly.

SST: 09228-07501

(1) Depending on the work space available, choose from the following.

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If enough space is available, use a torque wrench to tighten the oil filter sub-assembly.

Torque:

17 N·m {175 kgf·cm, 13ft·lbf}

If enough space is not available to use a torque wrench, tighten the oil filter sub-assembly a 3/4 turn by hand or use a common wrench.

5. ADD ENGINE OIL

(a) Clean and install the oil pan drain plug and a new gasket.

Torque:

38 N·m {382 kgf·cm, 28ft·lbf}

(b) Add fresh engine oil.

Standard Oil Grade:

OIL GRADE	OIL VISCOSITY (SAE)
API grade SL "energy-conserving", SM "energy-conserving", SN "resource-conserving" or ILSAC multigrade engine oil	• 0W-20

Standard Capacity:

ITEM	SPECIFIED CONDITION
Drain and refill without oil filter sub-assembly change	5.5 liters (5.8 US qts, 4.8 Imp. qts)
Drain and refill with oil filter sub-assembly change	5.9 liters (6.2 US qts, 5.2 Imp. qts)
Dry fill	6.4 liters (6.8 US qts, 5.6 Imp. qts)

(c) Install the oil filler cap.

6. INSPECT FOR ENGINE OIL LEAK

(a) Start the engine. Make sure that there are no oil leaks from the areas that were worked on.

7. INSPECT ENGINE OIL LEVEL INFO

8. INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY

Torque:

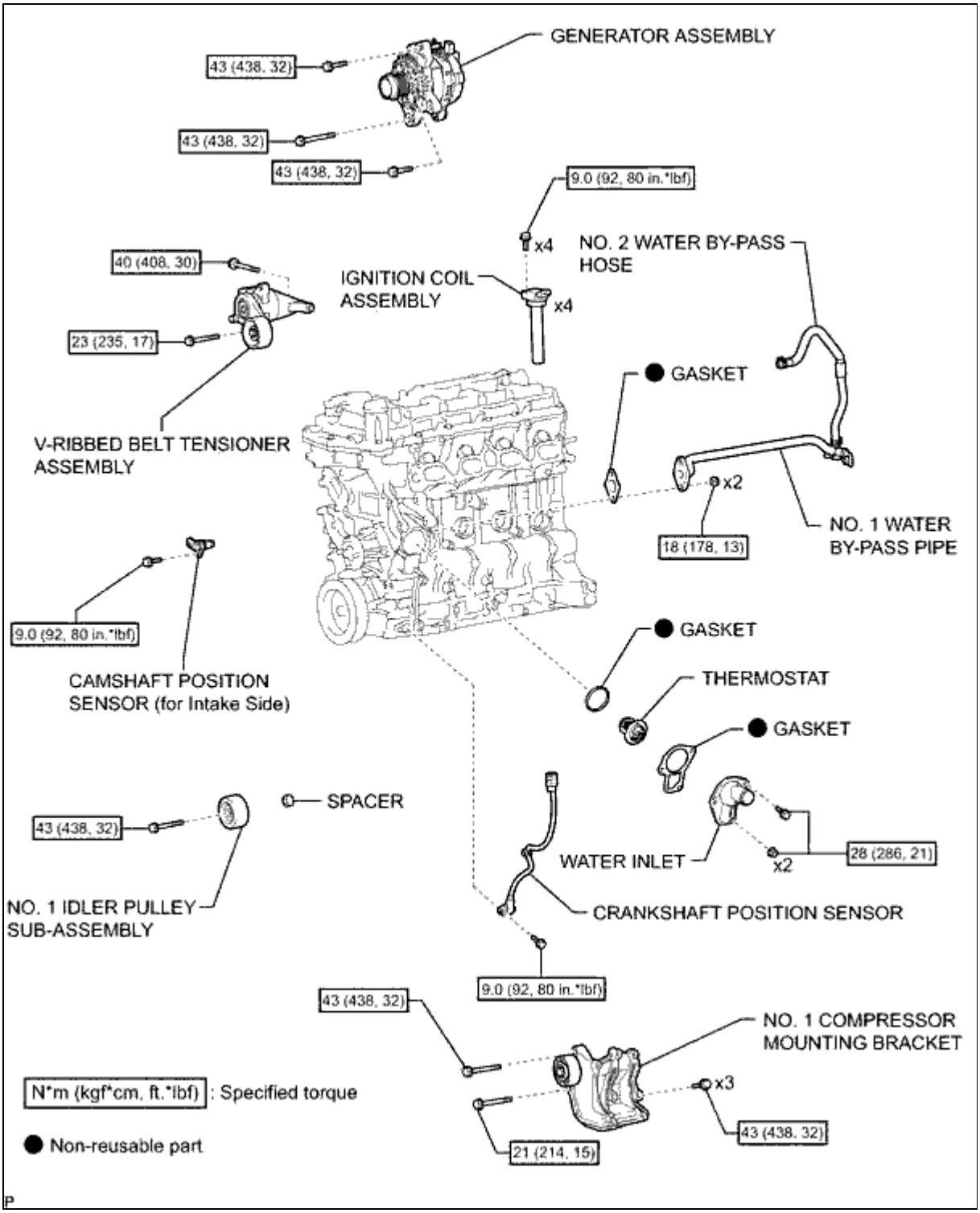
30 N·m {306 kgf·cm, 22ft·lbf}

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000004Z8400AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

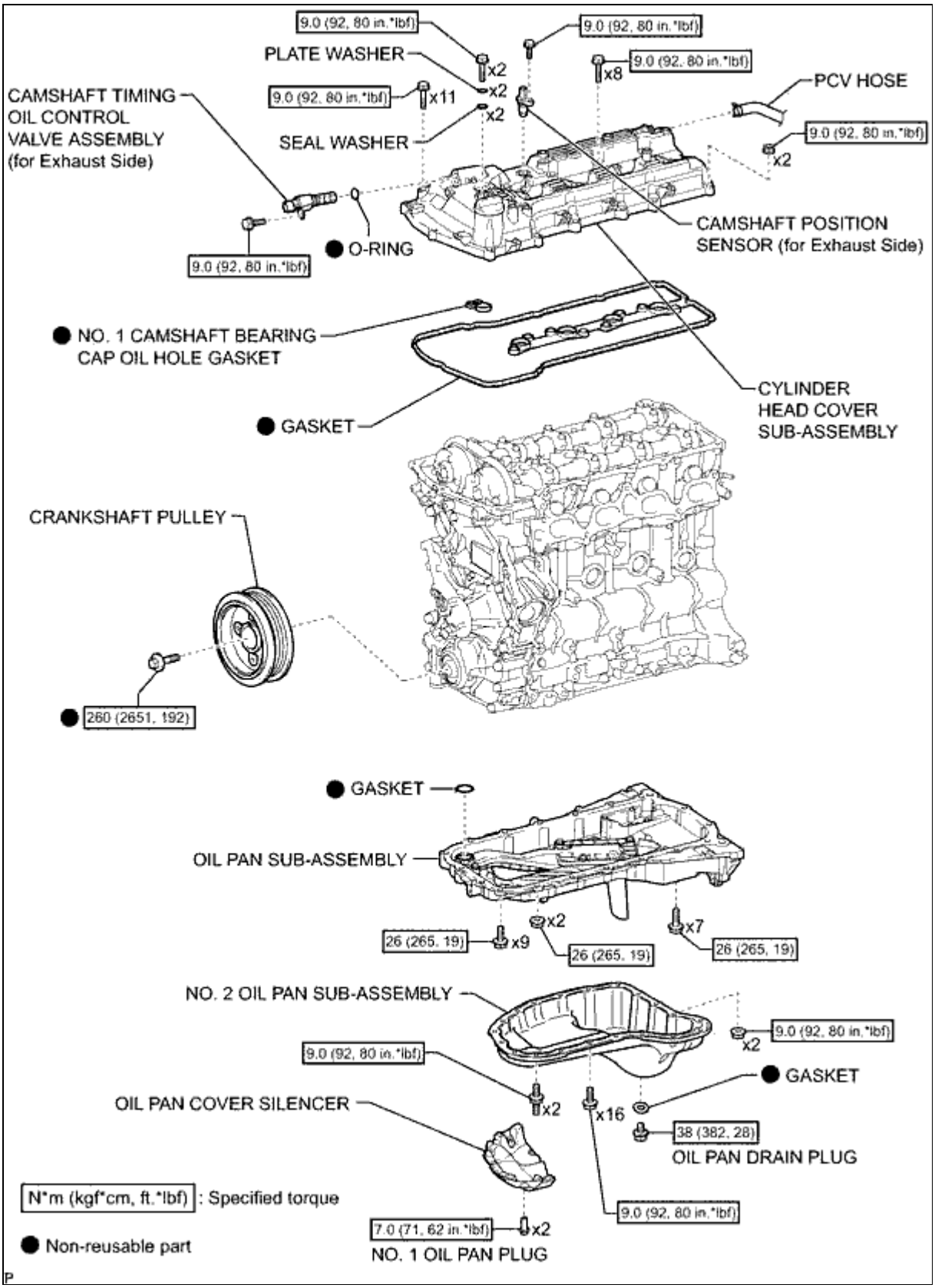
COMPONENTS

ILLUSTRATION



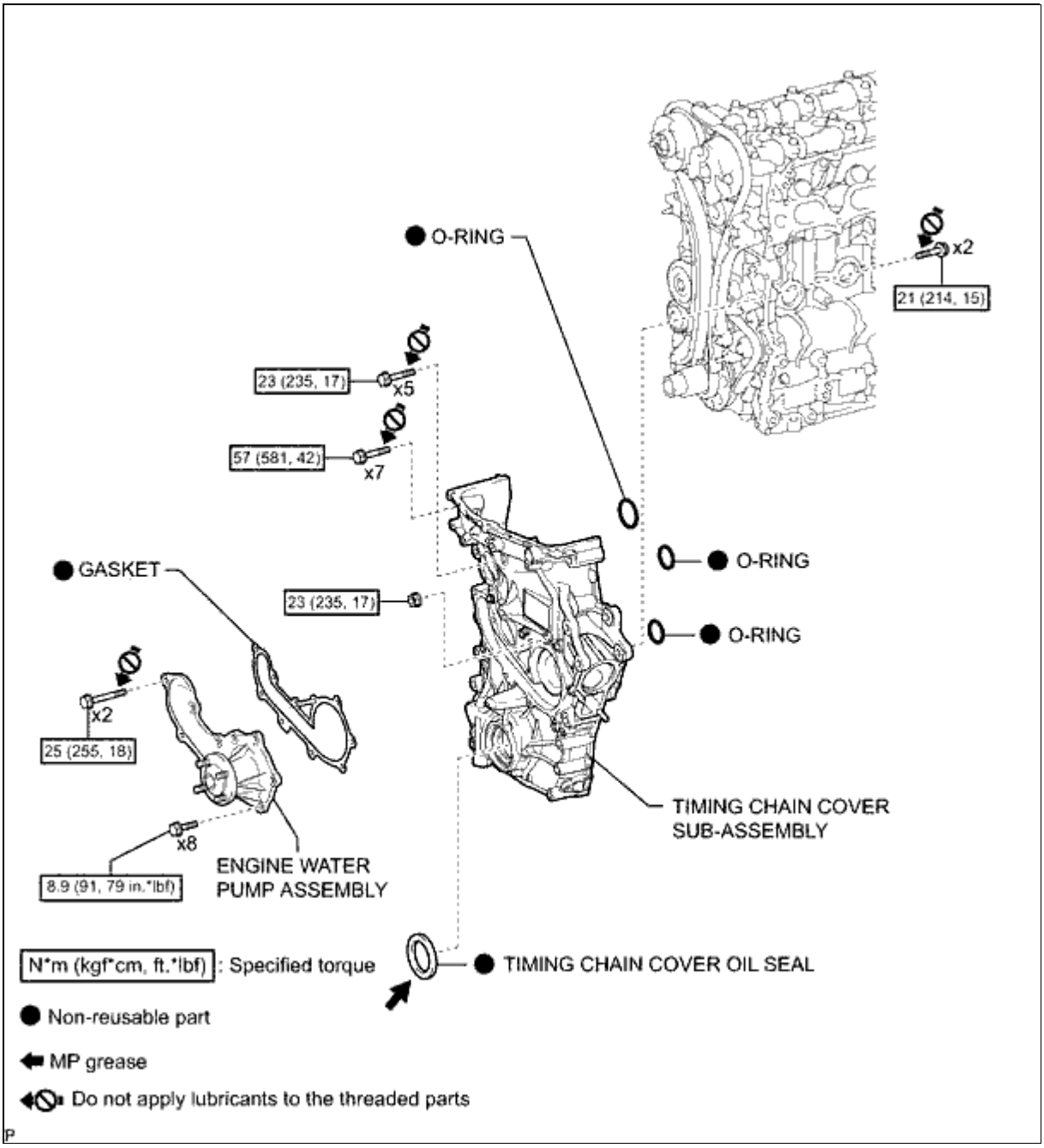
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ILLUSTRATION



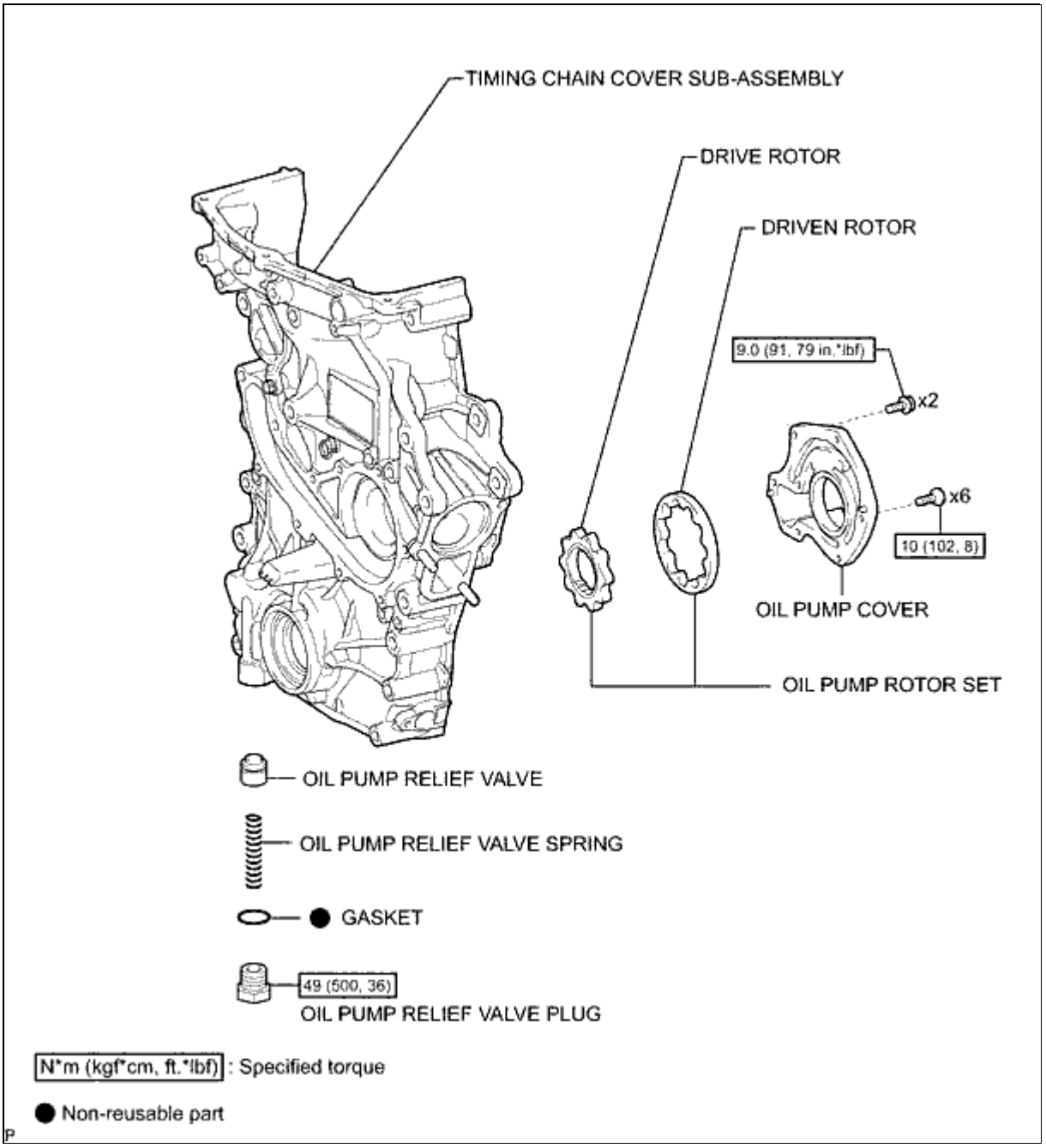
ILLUSTRATION

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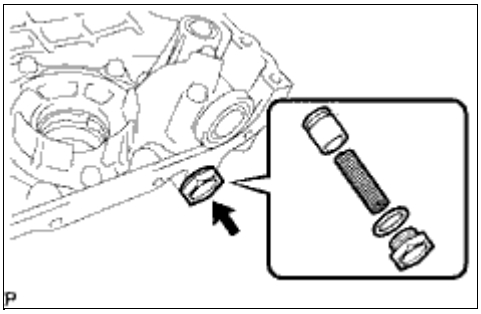
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000465F00MX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: DISASSEMBLY; 2016 MY Tacoma [08/2015 -]		

DISASSEMBLY

1. REMOVE OIL PUMP RELIEF VALVE

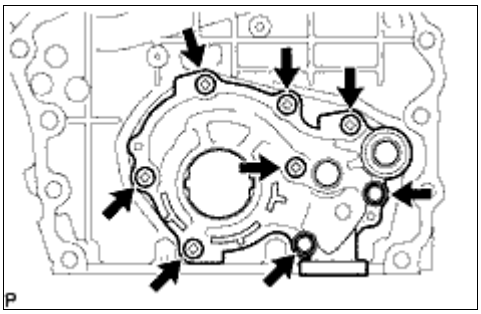
(a) Using a 27 mm socket wrench, remove the oil pump relief valve plug and gasket.



(b) Remove the oil pump relief valve spring and oil pump relief valve from the timing chain cover sub-assembly.

2. REMOVE OIL PUMP COVER

(a) Remove the 2 bolts, 6 screws and oil pump cover from the timing chain cover sub-assembly.



(b) Remove the oil pump rotor set from the timing chain cover sub-assembly.

3. REMOVE OIL PUMP ROTOR SET

(a) Remove the oil pump rotor set from the timing chain cover sub-assembly.

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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM000000YM8029X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

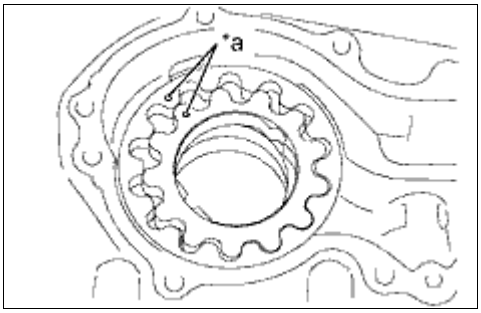
1. INSPECT OIL PUMP RELIEF VALVE

(a) Coat the oil pump relief valve with engine oil and drop it into the oil pump relief valve hole.

(b) Check that the oil pump relief valve falls in smoothly by its own weight. If it does not, replace the oil pump relief valve. If necessary, replace the timing chain cover sub-assembly.

2. INSPECT OIL PUMP ROTOR SET

(a) Install the oil pump rotor set to the oil pump body with the alignment marks facing outward (oil pump cover side). Check that the oil pump rotor set revolves smoothly.

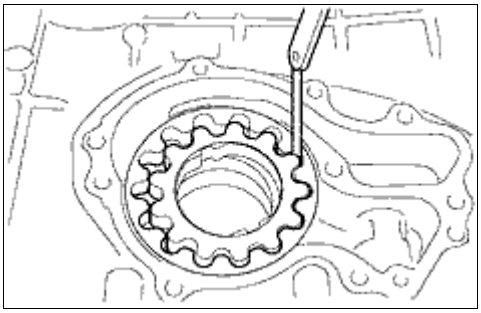


Text in Illustration

*a	Alignment Mark

(b) Check the tip clearance.

(1) Using a feeler gauge, measure the clearance between the drive rotor and driven rotor tips as shown in the illustration.

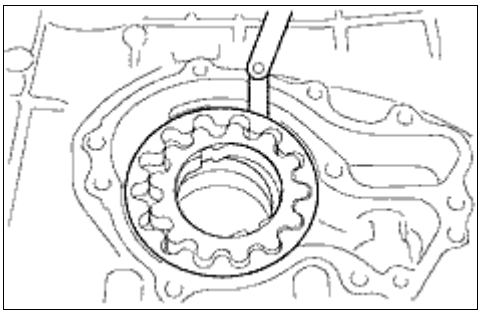


Standard tip clearance:
0.040 to 0.160 mm (0.00157 to 0.00630 in.)
Maximum tip clearance:
0.260 mm (0.0102 in.)

If the tip clearance is more than the maximum, replace the timing chain cover sub-assembly.

(c) Check the body clearance.

(1) Using a feeler gauge, measure the clearance between the oil pump body and driven rotor as shown in the illustration.



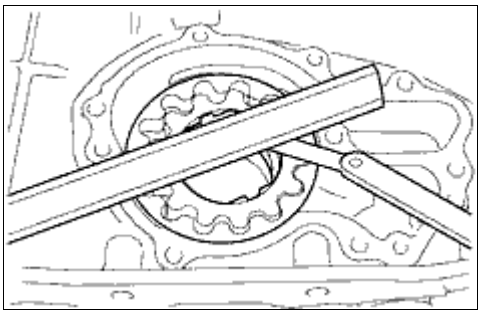
Standard body clearance:
0.250 to 0.325 mm (0.00984 to 0.0128 in.)
Maximum body clearance:
0.425 mm (0.0167 in.)

If the body clearance is more than the maximum, replace the timing chain cover sub-assembly.

(d) Check the side clearance.

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(1) Using a feeler gauge and precision straightedge measure the clearance between the oil pump rotor set and precision straightedge as shown in the illustration.



Standard side clearance:
0.030 to 0.070 mm (0.00118 to 0.00276 in.)
Maximum side clearance:
0.130 mm (0.00512 in.)

If the side clearance is more than the maximum, replace the timing chain cover sub-assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000YM703XX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL ENGINE WATER PUMP ASSEMBLY

(a) Install a new gasket and the engine water pump assembly with the 8 bolts.

Torque:

8.9 N·m {91 kgf·cm, 79in·lbf}

2. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

(a) Install 3 new O-rings to the timing chain cover sub-assembly.

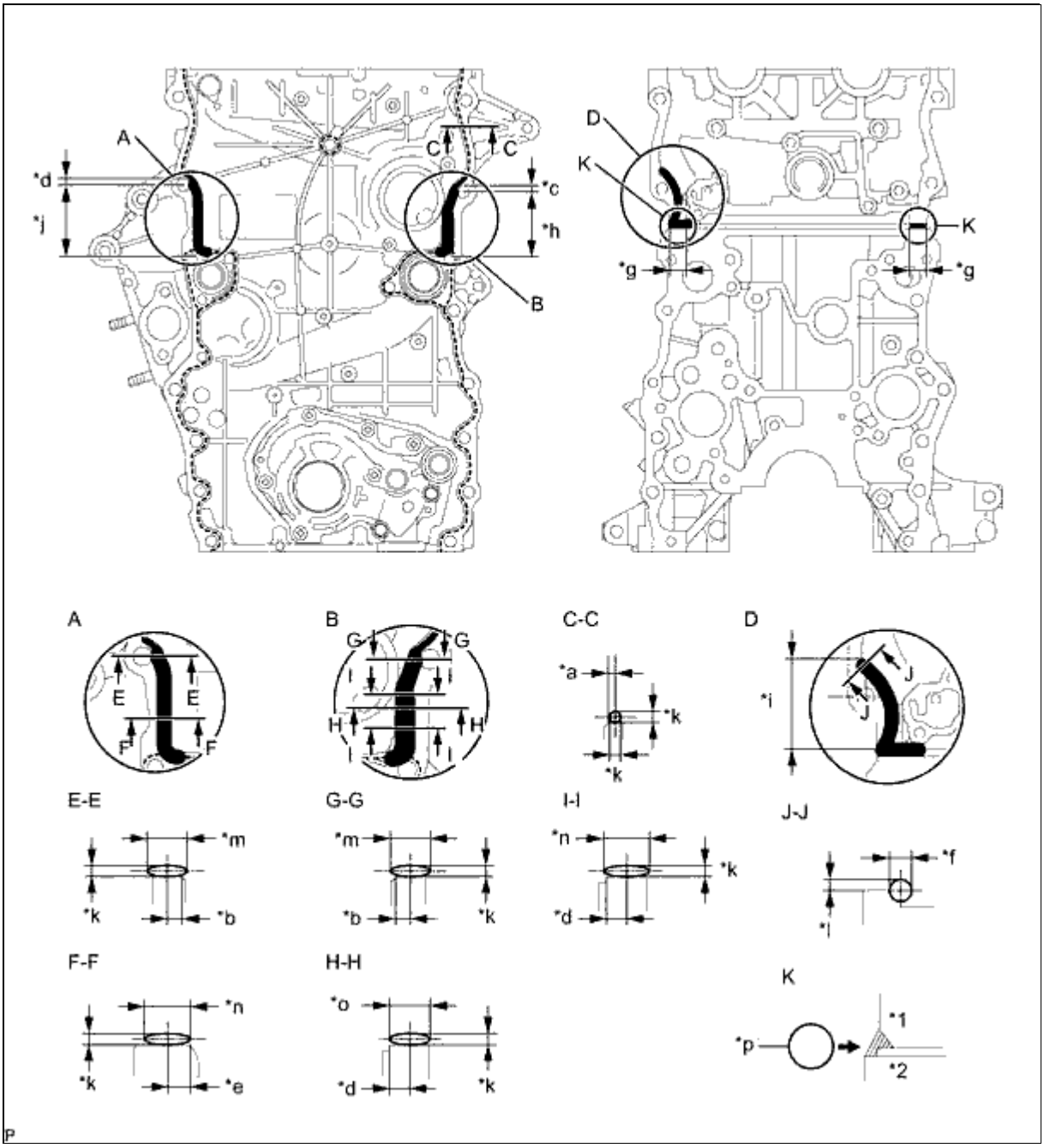
(b) Clean and degrease the contact surfaces of the timing chain cover sub-assembly, cylinder head sub-assembly and cylinder block.

(c) Apply seal packing as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

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Text in Illustration

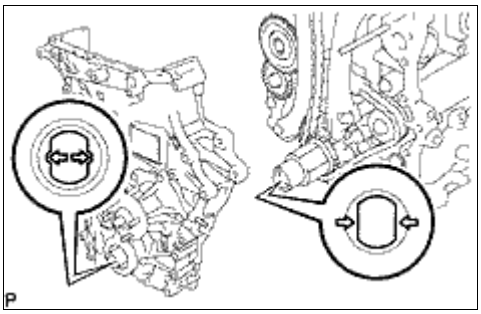
*1	Cylinder Head Sub-assembly	*2	Cylinder Block
*a	2.0 mm (0.0787 in.)	*b	2.5 mm (0.0984 in.)
*c	5.0 mm (0.197 in.)	*d	6.0 mm (0.236 in.)
*e	7.0 mm (0.276 in.)	*f	8.0 mm (0.315 in.) or more
*g	20 mm (0.787 in.)	*h	54 mm (2.13 in.)
*i	56.5 mm (2.22 in.)	*j	58 mm (2.28 in.)
*k	2.5 to 4.0 mm (0.0984 to 0.157 in.)	*l	2.0 to 3.0 mm (0.0787 to 0.118 in.)
*m	9.0 to 13 mm (0.354 to 0.512 in.)	*n	10 to 14 mm (0.394 to 0.551 in.)
*o	12 to 16 mm (0.472 to 0.630 in.)	*p	Seal Packing

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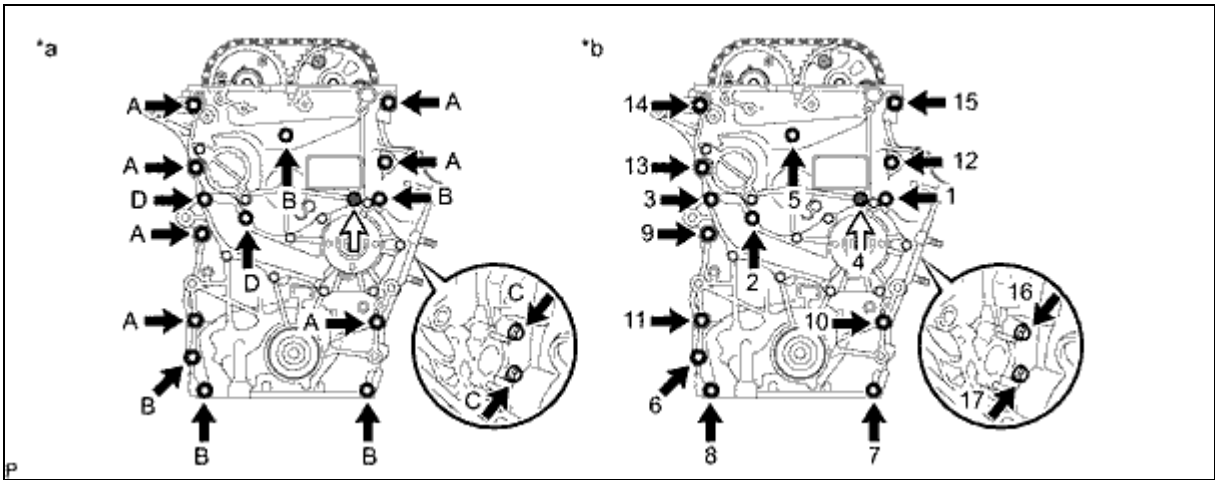
NOTICE:

- Remove any oil from the contact surface.
- When the contact surfaces are wet, wipe them with an oil-free cloth before applying seal packing.
- Install the timing chain cover sub-assembly within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.
- Do not start the engine for at least 4 hours after the installation.

(d) Align the width of the joint portion of the oil pump drive rotor and the crankshaft timing gear, and then install the timing chain cover sub-assembly.



(e) Temporarily install the timing chain cover sub-assembly with the 16 bolts and nut.



Text in Illustration

*a	Types of nut and bolt	*b	Tightening Order
➡	Bolt	⇨	Nut

Torque:

for bolt A -

57 N·m {581 kgf·cm, 42ft·lbf}

for bolt B and nut -

23 N·m {235 kgf·cm, 17ft·lbf}

for bolt C -

21 N·m {214 kgf·cm, 15ft·lbf}

for bolt D -

25 N·m {255 kgf·cm, 18ft·lbf}

Bolt Length:

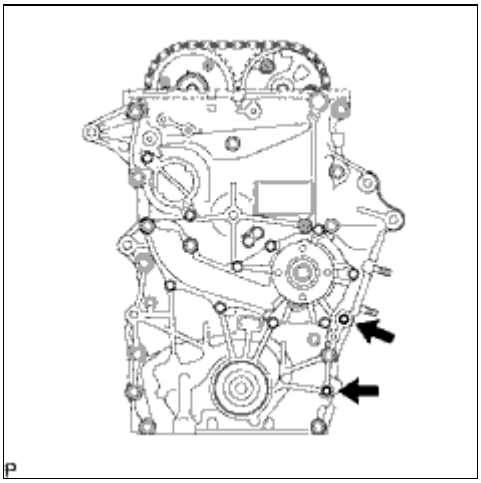
ITEM	LENGTH	THREAD DIAMETER

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ITEM	LENGTH	THREAD DIAMETER
Bolt A	75 mm (2.95 in.)	10 mm (0.394 in.)
Bolt B	75 mm (2.95 in.)	8.0 mm (0.315 in.)
Bolt C	40 mm (1.57 in.)	8.0 mm (0.315 in.)
Bolt D	90 mm (3.54 in.)	8.0 mm (0.315 in.)

NOTICE:

- Make sure that there is no oil on the threads of bolts.
- Check the bolts and bolt holes, and clean and degrease them.

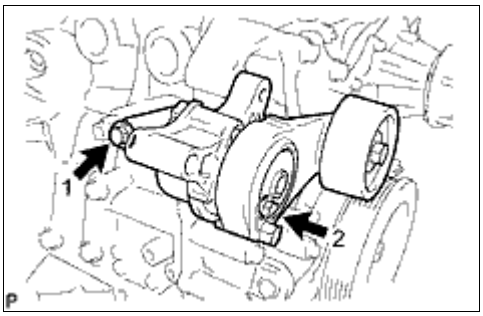


(f) Remove the seal packing from the 2 bolt holes for the No. 1 compressor mounting bracket.

NOTICE:

Do not use any cleaners to remove the seal packing.

3. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY



(a) Temporarily install the V-ribbed belt tensioner assembly with the 2 bolts.

HINT:

Make sure that the V-ribbed belt tensioner assembly is in contact with the timing chain cover sub-assembly.

(b) Install the V-ribbed belt tensioner assembly by tightening the 2 bolts in the order shown in the illustration.

Torque:

for bolt 1 -

40 N·m {408 kgf·cm, 30ft·lbf}

for bolt 2 -

23 N·m {235 kgf·cm, 17ft·lbf}

4. INSTALL OIL PAN SUB-ASSEMBLY

(a) Install a new gasket to the oil strainer sub-assembly.

(b) Clean and degrease the contact surfaces of the oil pan sub-assembly and cylinder block sub-assembly.

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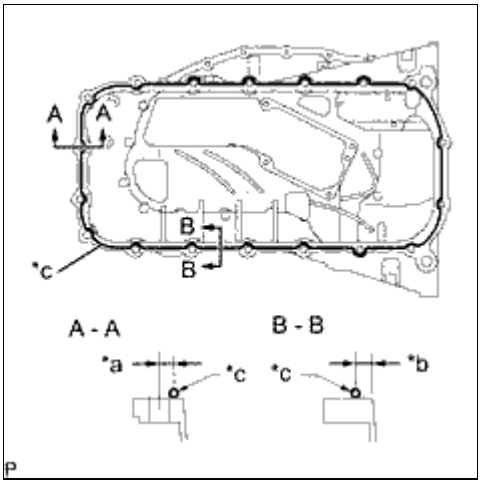
(c) Apply seal packing as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard seal diameter:

2.0 to 3.0 mm (0.0787 to 0.118 in.)



Text in Illustration

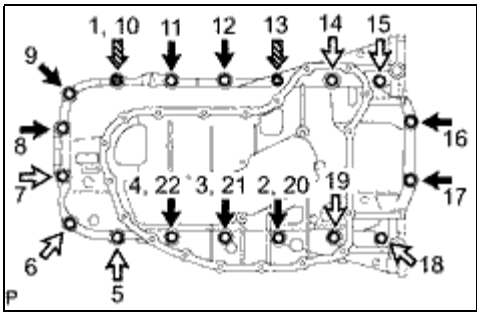
*a	8.0 mm (0.315 in.)
*b	6.5 mm (0.256 in.)
*c	Seal Packing

NOTICE:

- Remove any oil from the contact surface.
- Install the oil pan sub-assembly within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.
- Do not start the engine for at least 4 hours after the installation.

(d) Install a new gasket to the oil strainer sub-assembly.

(e) Temporarily install the oil pan sub-assembly with the 16 bolts and 2 nuts.



Bolt Length:

ITEM	LENGTH
Bolt A	20 mm (0.787 in.)
Bolt B	40 mm (1.57 in.)

Text in Illustration

➡	Bolt A
⇨	Bolt B
⇛	Nut

(f) Uniformly tighten the 16 bolts and 2 nuts in the order shown in the illustration.

Torque:

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26 N·m {265 kgf·cm, 19ft·lbf}

5. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

(a) Clean and degrease the contact surfaces of the oil pan sub-assembly and No. 2 oil pan sub-assembly.

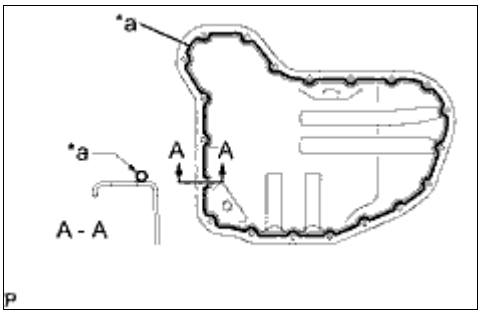
(b) Apply seal packing in a continuous line as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Seal packing diameter:

3.0 to 4.0 mm (0.118 to 0.157 in.)



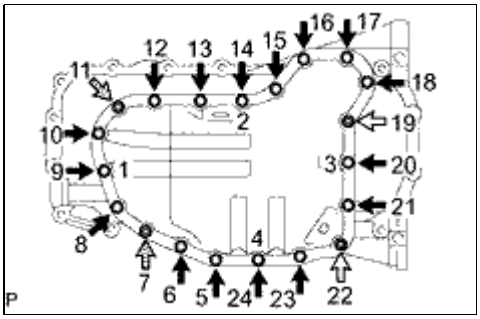
Text in Illustration

*a	Seal Packing

NOTICE:

- Remove any oil from the contact surface.
- Install the No. 2 oil pan sub-assembly within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.
- Do not start the engine for at least 4 hours after the installation.

(c) Temporarily install the No. 2 oil pan sub-assembly with the 16 bolts and 2 adjusting screws, 2 nuts.



Text in Illustration

➡	Bolt
⇨	Nut
⇛	Adjusting Screw

(d) Uniformly tighten the 16 bolts and 2 adjusting screws, 2 nuts in the order shown in the illustration.

Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

(e) Install a new gasket and the oil pan drain plug.

Torque:

38 N·m {382 kgf·cm, 28ft·lbf}

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6. INSTALL OIL PAN COVER SILENCER

(a) Install the oil pan cover silencer with the 2 No. 1 oil pan plugs.

Torque:

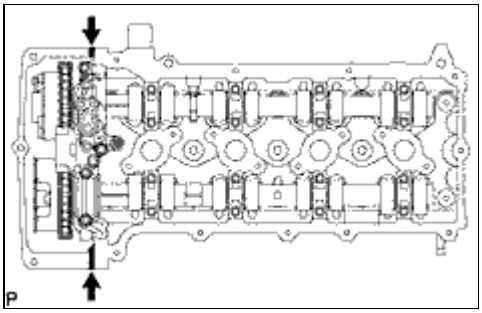
7.0 N·m {71 kgf·cm, 62in·lbf}

7. INSTALL TIMING CHAIN COVER OIL SEAL INFO

8. INSTALL CRANKSHAFT PULLEY INFO

9. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

(a) Clean and degrease the contact surfaces of the cylinder head cover sub-assembly, timing chain cover sub-assembly and cylinder head sub-assembly.



(b) Apply seal packing as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Seal packing diameter:

4.0 mm (0.157 in.)

Text in Illustration

➡	Seal Packing

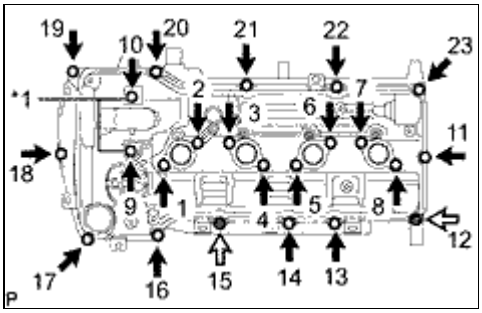
NOTICE:

- Install the cylinder head cover sub-assembly within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not add the engine oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.

(c) Install a new No. 1 camshaft bearing cap oil hole gasket to the cylinder head cover spacer.

(d) Install a new gasket to the cylinder head cover sub-assembly.

(e) Install the cylinder head cover sub-assembly, 2 plate washers and 2 seal washers with the 21 bolts and 2 nuts, and tighten the 21 bolts and 2 nuts in the sequence shown in the illustration.



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Torque:

9.0 N·m {92 kgf·cm, 80in·lbf}

Text in Illustration

*1	Plate Washer and Seal Washer
➡	Seal Packing
⇨	Nut

NOTICE:

Make sure that the metal face of the seal washer is facing upward.

(f) Connect the PCV hose to the PCV valve sub-assembly and slide the clip to secure the hose.

10. INSTALL NO. 1 WATER BY-PASS PIPE

(a) Install a new gasket and the No. 1 water by-pass pipe with the 2 nuts.

Torque:

18 N·m {178 kgf·cm, 13ft·lbf}

11. INSTALL CRANKSHAFT POSITION SENSOR INFO

12. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

13. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

14. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

15. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY

(a) Install the spacer and No. 1 idler pulley sub-assembly with the bolt.

Torque:

43 N·m {438 kgf·cm, 32ft·lbf}

16. INSTALL THERMOSTAT INFO

17. INSTALL WATER INLET INFO

18. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET INFO

19. INSTALL GENERATOR ASSEMBLY INFO

20. INSTALL INTAKE MANIFOLD

INFO

21. INSTALL IGNITION COIL ASSEMBLY INFO

22. INSTALL ENGINE ASSEMBLY

INFO

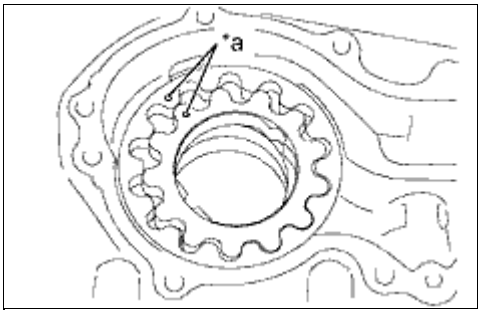
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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000465G00TX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: REASSEMBLY; 2016 MY Tacoma [08/2015 -]		

REASSEMBLY

1. INSTALL OIL PUMP ROTOR SET

(a) Coat the oil pump rotor set with engine oil and place it into oil pump body with the alignment marks facing outward (oil pump cover side). Check that the oil pump rotor set revolves smoothly.



Text in Illustration

*a	Alignment Mark

2. INSTALL OIL PUMP COVER

(a) Install the oil pump cover to the timing chain cover sub-assembly with the 2 bolts and 6 screws.

Torque:

for bolt -

9.0 N·m {91 kgf·cm, 79in·lbf}

for screw -

10 N·m {105 kgf·cm, 8ft·lbf}

3. INSTALL OIL PUMP RELIEF VALVE

(a) Coat the oil pump relief valve with engine oil.

(b) Insert the oil pump relief valve and oil pump relief valve spring into the oil pump relief valve hole.

(c) Install a new gasket to the oil pump relief valve plug.

(d) Using a 27 mm socket wrench, install the oil pump relief valve plug.

Torque:

49 N·m {500 kgf·cm, 36ft·lbf}

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM000000YMA03UX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE LUBRICATION: OIL PUMP: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

1. REMOVE ENGINE ASSEMBLY

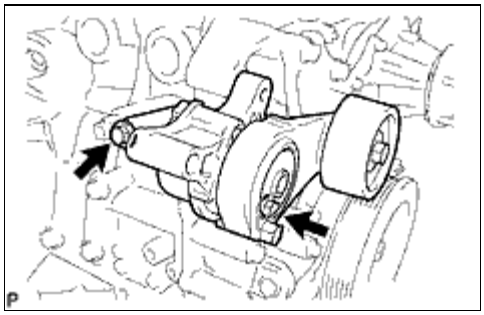
INFO

2. REMOVE IGNITION COIL ASSEMBLY INFO

3. REMOVE GENERATOR ASSEMBLY INFO

4. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

(a) Remove the 2 bolts and V-ribbed belt tensioner assembly.



5. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET INFO

6. REMOVE WATER INLET INFO

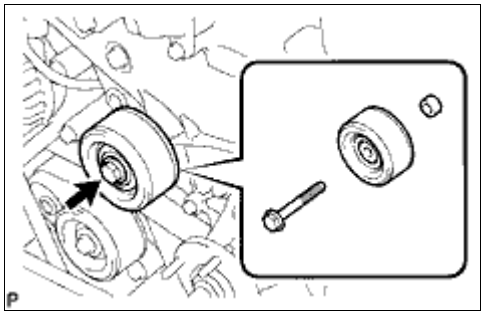
7. REMOVE THERMOSTAT INFO

8. REMOVE INTAKE MANIFOLD

INFO

9. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY

(a) Remove the bolt, No. 1 idler pulley sub-assembly and spacer.



10. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

11. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

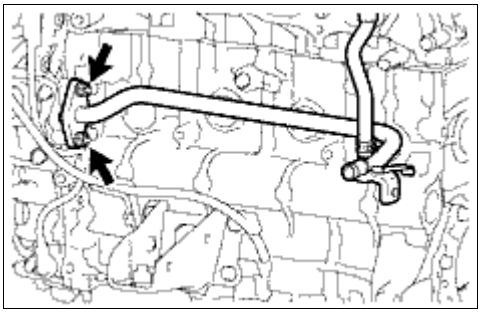
12. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

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13. REMOVE CRANKSHAFT POSITION SENSOR INFO

14. REMOVE NO. 1 WATER BY-PASS PIPE

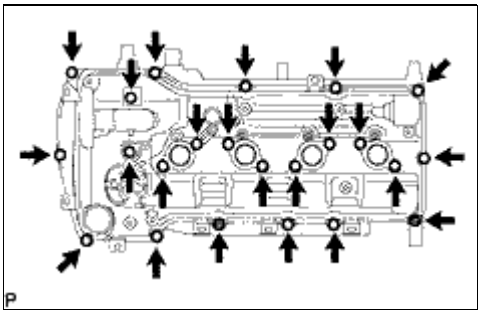
(a) Remove the 2 nuts, No. 1 water by-pass pipe and gasket.



15. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

(a) Slide the clip and disconnect the PCV hose from the PCV valve sub-assembly.

(b) Remove the 21 bolts, 2 nuts, 2 plate washers, 2 seal washers and cylinder head cover sub-assembly.



(c) Remove the gasket from the cylinder head cover sub-assembly.

(d) Remove the No. 1 camshaft bearing cap oil hole gasket from the cylinder head cover spacer.

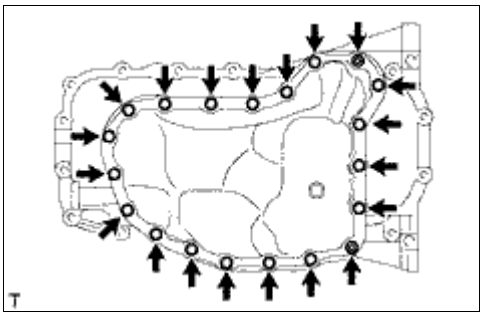
16. REMOVE CRANKSHAFT PULLEY INFO

17. REMOVE OIL PAN COVER SILENCER

(a) Remove the 2 No. 1 oil pan plugs and oil pan cover silencer.

18. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

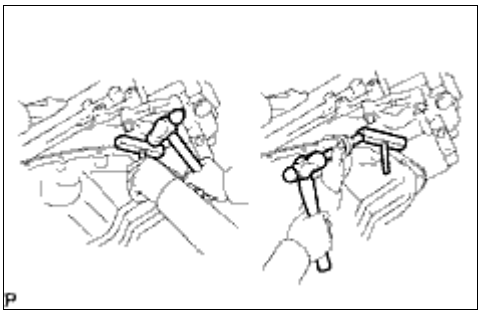
(a) Remove the oil pan drain plug and gasket.



(b) Remove the 16 bolts, 2 adjusting screws, and 2 nuts.

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(c) Insert the blade of an oil pan seal cutter between the oil pans. Cut through the applied sealer and remove the No. 2 oil pan sub-assembly.

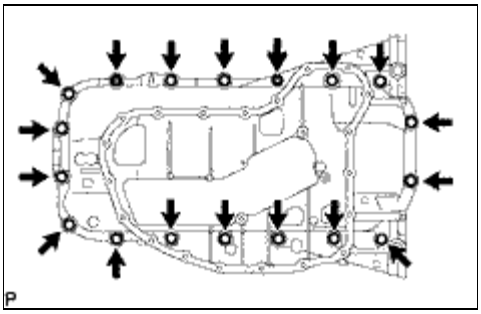


NOTICE:

Be careful not to damage the contact surfaces of the oil pans.

19. REMOVE OIL PAN SUB-ASSEMBLY

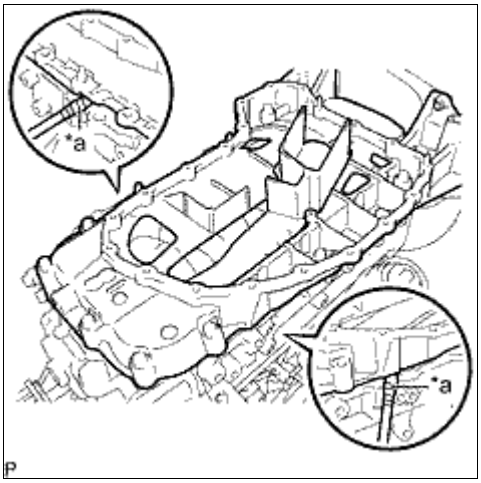
(a) Remove the 16 bolts and 2 nuts.



(b) Remove the oil pan sub-assembly by prying between the oil pan sub-assembly and cylinder block with a screwdriver.

Text in Illustration

*a	Protective Tape



NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and oil pan sub-assembly.

HINT:

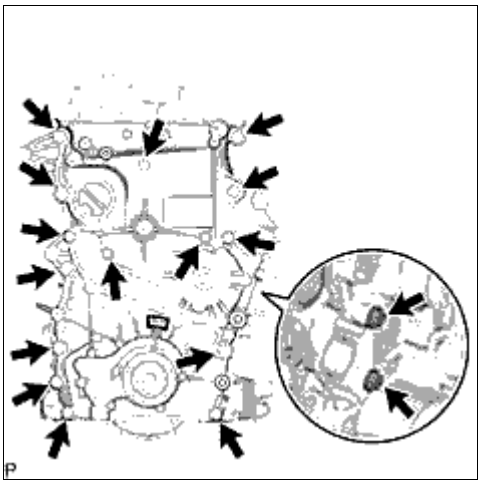
Protective tape the screwdriver tip before use.

(c) Remove the gasket from the oil strainer sub-assembly.

20. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

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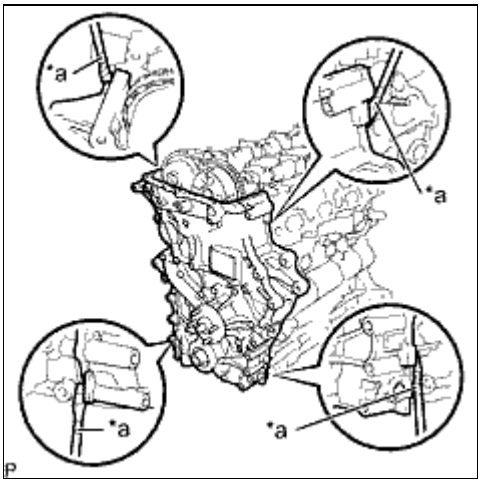
(a) Remove the 16 bolts and nut shown in the illustration.



(b) Using a screwdriver wrapped in protective tape, remove the timing chain cover sub-assembly by prying the points in the illustration.

Text in Illustration

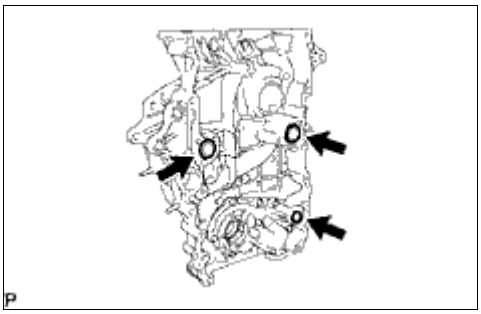
*a	Protective Tape



NOTICE:

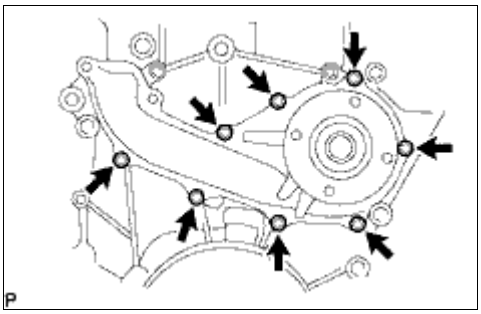
Do not damage the surrounding parts.

(c) Remove the 3 O-rings from the timing chain cover sub-assembly.



21. REMOVE ENGINE WATER PUMP ASSEMBLY

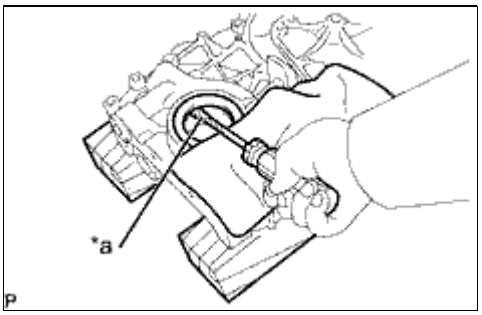
(a) Remove the 8 bolts, engine water pump assembly and gasket.



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22. REMOVE TIMING CHAIN COVER OIL SEAL

(a) Using a screwdriver wrapped in protective tape, pry out the timing chain cover oil seal from the timing chain cover sub-assembly.



Text in Illustration

*a	Protective Tape

NOTICE:

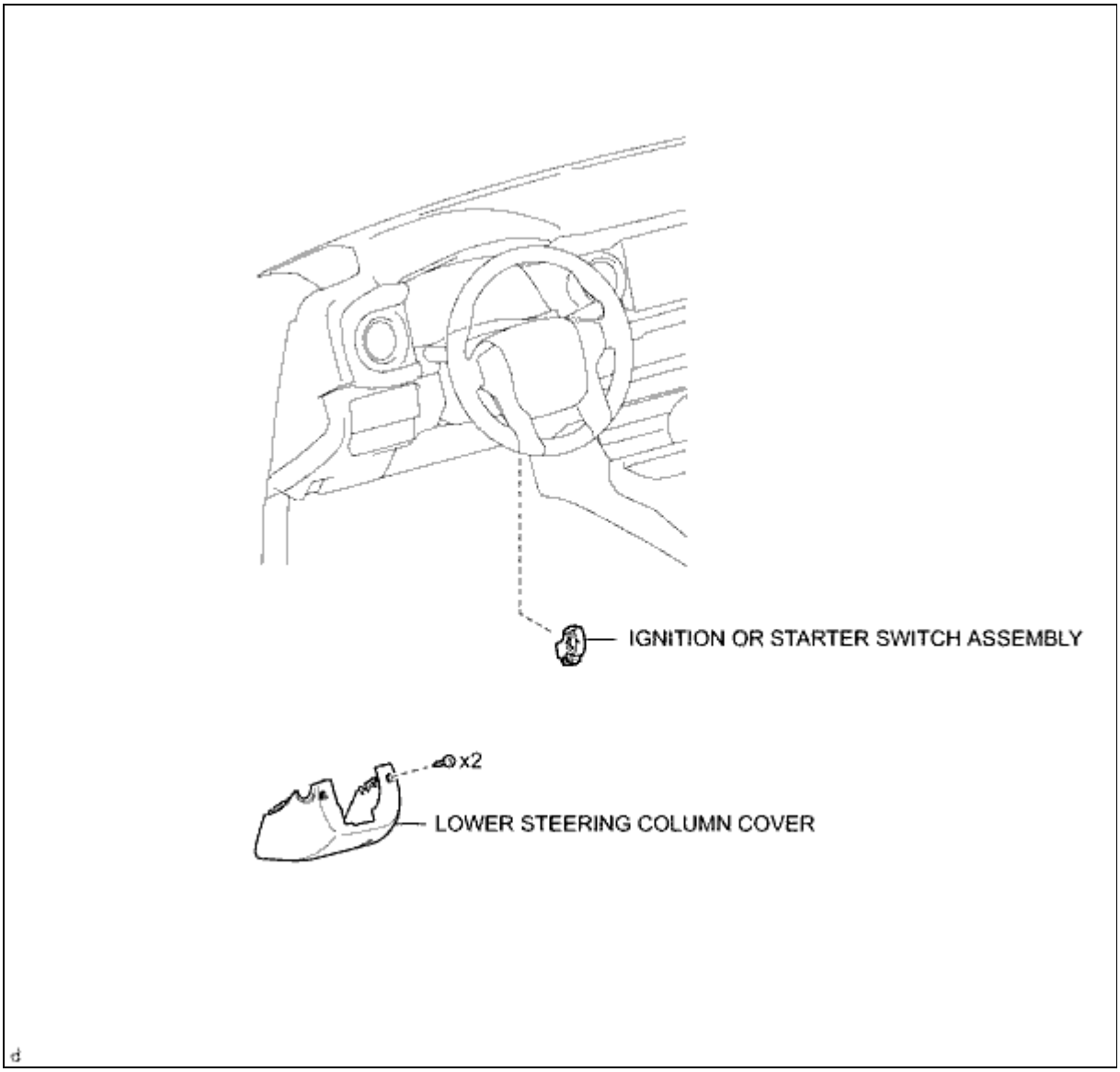
Be careful not to damage the timing chain cover sub-assembly.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM000005VTJ001X
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: IGNITION SWITCH: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM0000017A300DX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: IGNITION SWITCH: INSPECTION; 2016 MY Tacoma [08/2015 -]		

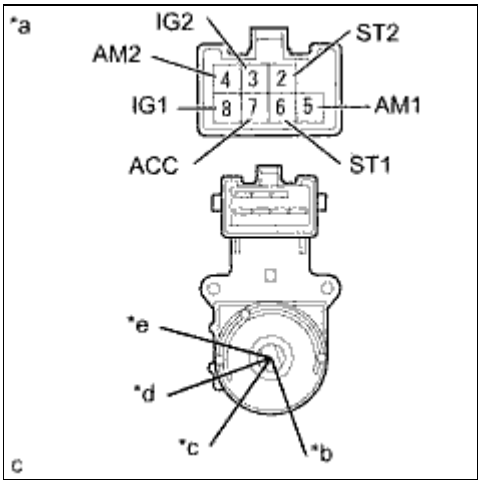
INSPECTION

1. INSPECT IGNITION OR STARTER SWITCH ASSEMBLY

(a) Check the resistance.

Text in Illustration

*a	Component without harness connected (Ignition or Start Switch Assembly)
*b	LOCK
*c	ACC
*d	ON
*e	START



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

Standard Resistance:

TESTER CONDITION	SWITCH CONDITION	SPECIFIED CONDITION
Between all terminal	LOCK	10 kΩ or higher
2 (ACC) - 4 (AM1)	ACC	Below 1 Ω
1 (IG1) - 2 (ACC) - 4 AM1)	ON	Below 1 Ω
5 (AM2) - 6 (IG2)		
1 (IG1) - 4 (AM1)	START	Below 1 Ω
5 (AM2) - 6 (IG2) - 7 (ST2)		

If the result is not as specified, replace the ignition or starter switch assembly.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017A200BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: IGNITION SWITCH: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL IGNITION OR STARTER SWITCH ASSEMBLY

(a) Engage the 2 claws and install the ignition or starter switch assembly.

(b) Connect the connector.

2. INSTALL LOWER STEERING COLUMN COVER

(a) Engage the 2 claws and install the lower steering column cover.

(b) Install the 2 screws.

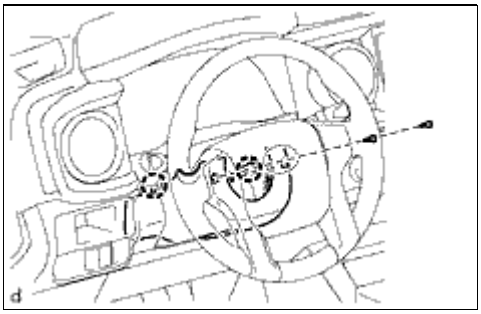
HINT:

Turn the steering wheel to the right and left as necessary to install the 2 screws.

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000017A400BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: IGNITION SWITCH: REMOVAL; 2016 MY Tacoma [08/2015 -]		

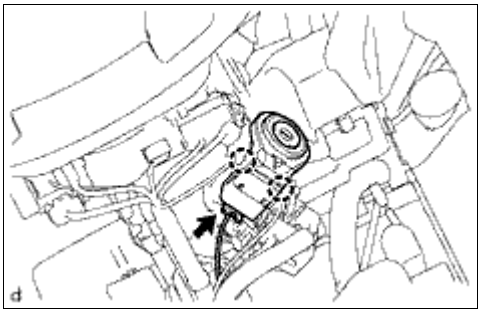
REMOVAL



1. REMOVE LOWER STEERING COLUMN COVER

(a) Remove the 2 screws.

(b) Disengage the 2 claws and remove the lower steering column cover.



2. REMOVE IGNITION OR STARTER SWITCH ASSEMBLY

(a) Disconnect the connector.

(b) Disengage the 2 claws and remove the ignition or starter switch assembly.

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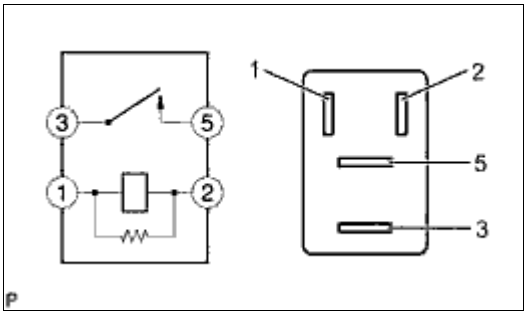
Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000179S00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTER RELAY: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT STARTER RELAY

(a) Check the resistance.

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



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to terminal 1 and 2	10 kΩ or higher
3 - 5	Battery voltage applied to terminal 1 and 2	Below 1 Ω

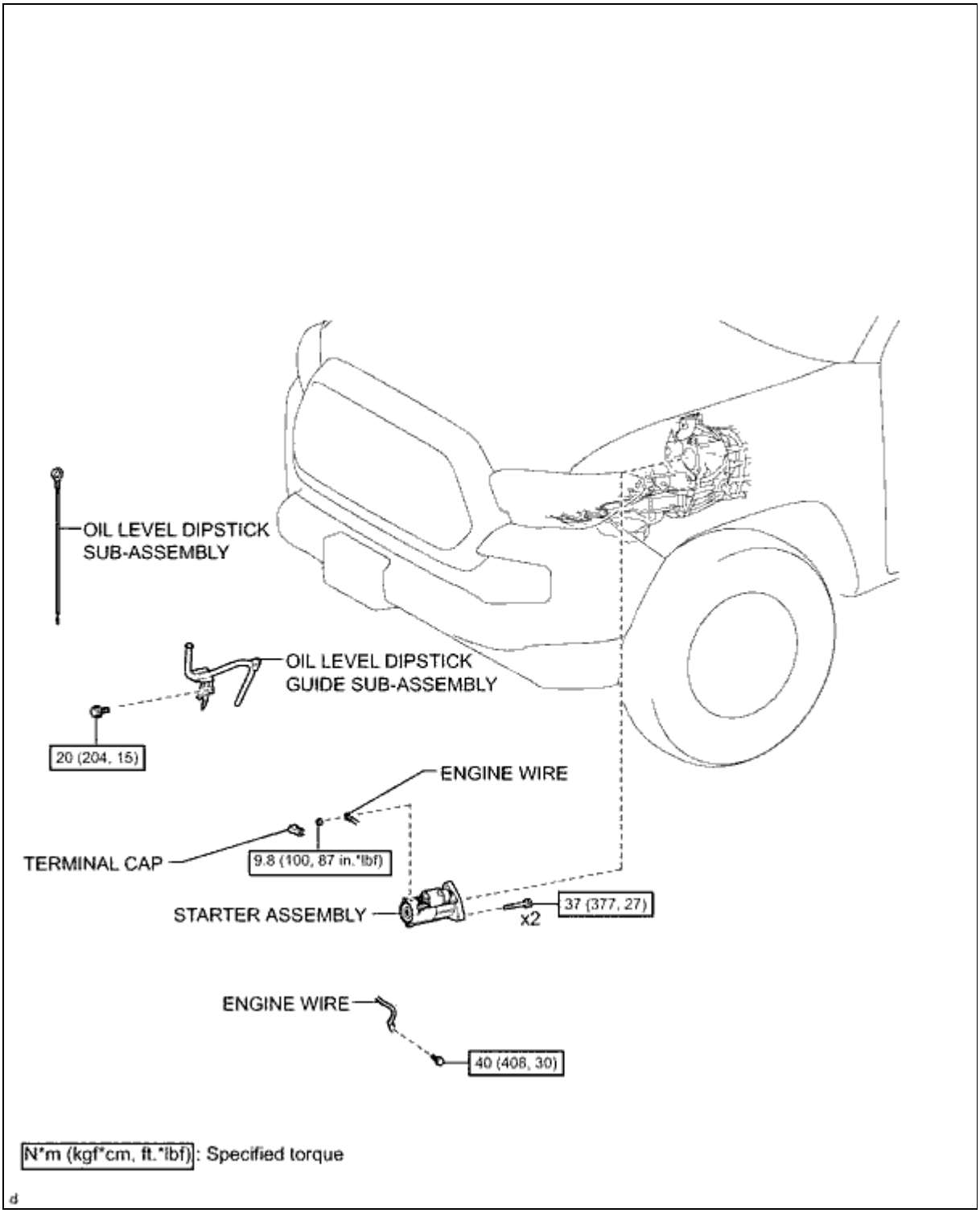
If the result is not as specified, replace the starter relay.

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Last Modified: 11-13-2015	6.6 K	**Doc ID:** RM00000179L00BX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTER: COMPONENTS; 2016 MY Tacoma [08/2015 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM0000179J00WX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTER: INSTALLATION; 2016 MY Tacoma [08/2015 -]		

INSTALLATION

1. INSTALL STARTER ASSEMBLY

(a) Install the starter assembly to the cylinder block sub-assembly with the 2 bolts.

Torque:

37 N·m {377 kgf·cm, 27ft·lbf}

(b) Connect the engine wire to the starter assembly and cylinder block sub-assembly with the bolt and nut.

Torque:

BOLT -

40 N·m {408 kgf·cm, 30ft·lbf}

Torque:

NUT -

9.8 N·m {100 kgf·cm, 87in·lbf}

(c) Connect the starter assembly connector.

(d) Install the terminal cap.

2. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque:

5.4 N·m {55 kgf·cm, 48in·lbf}

3. INSTALL OIL LEVEL GAGE SUB-ASSEMBLY INFO

4. INSTALL OIL LEVEL GAGE GUIDE

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Last Modified: 11-13-2015	6.6 A	**Doc ID:** RM00000179M00WX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTER: REMOVAL; 2016 MY Tacoma [08/2015 -]		

REMOVAL

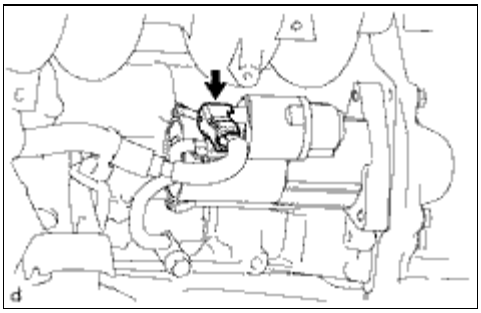
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

2. REMOVE OIL LEVEL GAGE GUIDE

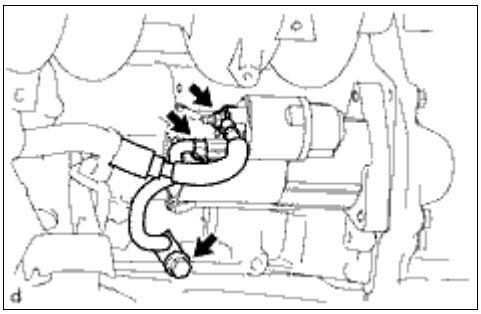
3. REMOVE OIL LEVEL GAGE SUB-ASSEMBLY INFO

4. REMOVE STARTER ASSEMBLY

(a) Remove the terminal cap.

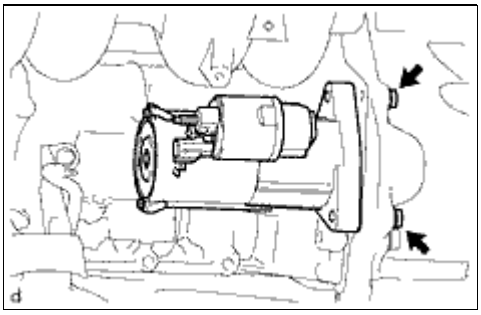


(b) Disconnect the starter assembly connector.



(c) Remove the bolt, nut and disconnect the engine wire from the starter assembly and cylinder block sub-assembly.

(d) Remove the 2 bolts and starter assembly from the cylinder block sub-assembly.



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Last Modified: 11-13-2015	6.6 G	**Doc ID:** RM00000179H00AX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTING SYSTEM: INSPECTION; 2016 MY Tacoma [08/2015 -]		

INSPECTION

1. INSPECT STARTER ASSEMBLY

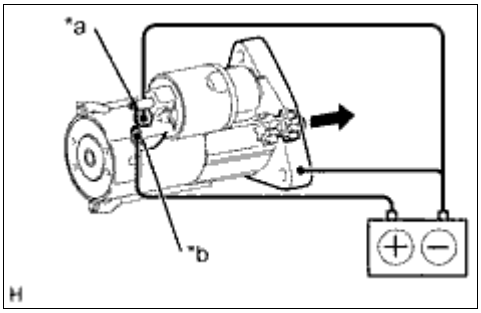
NOTICE:

These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

(a) Perform the pull-in test.

(1) Disconnect the field coil lead wire from the terminal C.

(2) Connect the battery to the magnetic switch as shown in the illustration. Check that the clutch pinion gear protrudes.

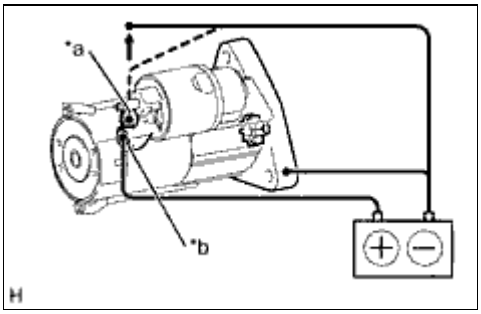


Text in Illustration

*a	Terminal C
*b	Terminal 50

(b) Perform the hold-in test.

(1) Disconnect the negative (-) lead from terminal C with the above condition (a) being sustained. Check that the pinion gear remains extended.

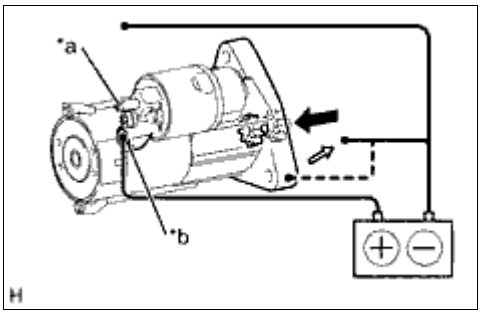


Text in Illustration

*a	Terminal C
*b	Terminal 50

(c) Check the operation.

(1) Disconnect the negative (-) lead from the starter body. Check that the clutch pinion gear returns inward.



Text in Illustration

*a	Terminal C
*b	Terminal 50

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(d) Perform the operation test without any load.

(1) Connect the field coil lead wire to the terminal C.

Torque:

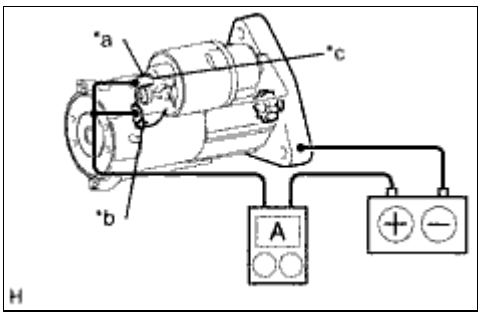
9.8 N·m {100 kgf·cm, 87in·lbf}

(2) Clamp the starter assembly in a vise.

NOTICE:

Do not over tighten the vise.

(3) Connect the battery and ammeter to the starter assembly as shown in the illustration.



Text in Illustration

*a	Terminal C
*b	Terminal 50
*c	Terminal 30

(4) Check that the ammeter indicates the specified current.

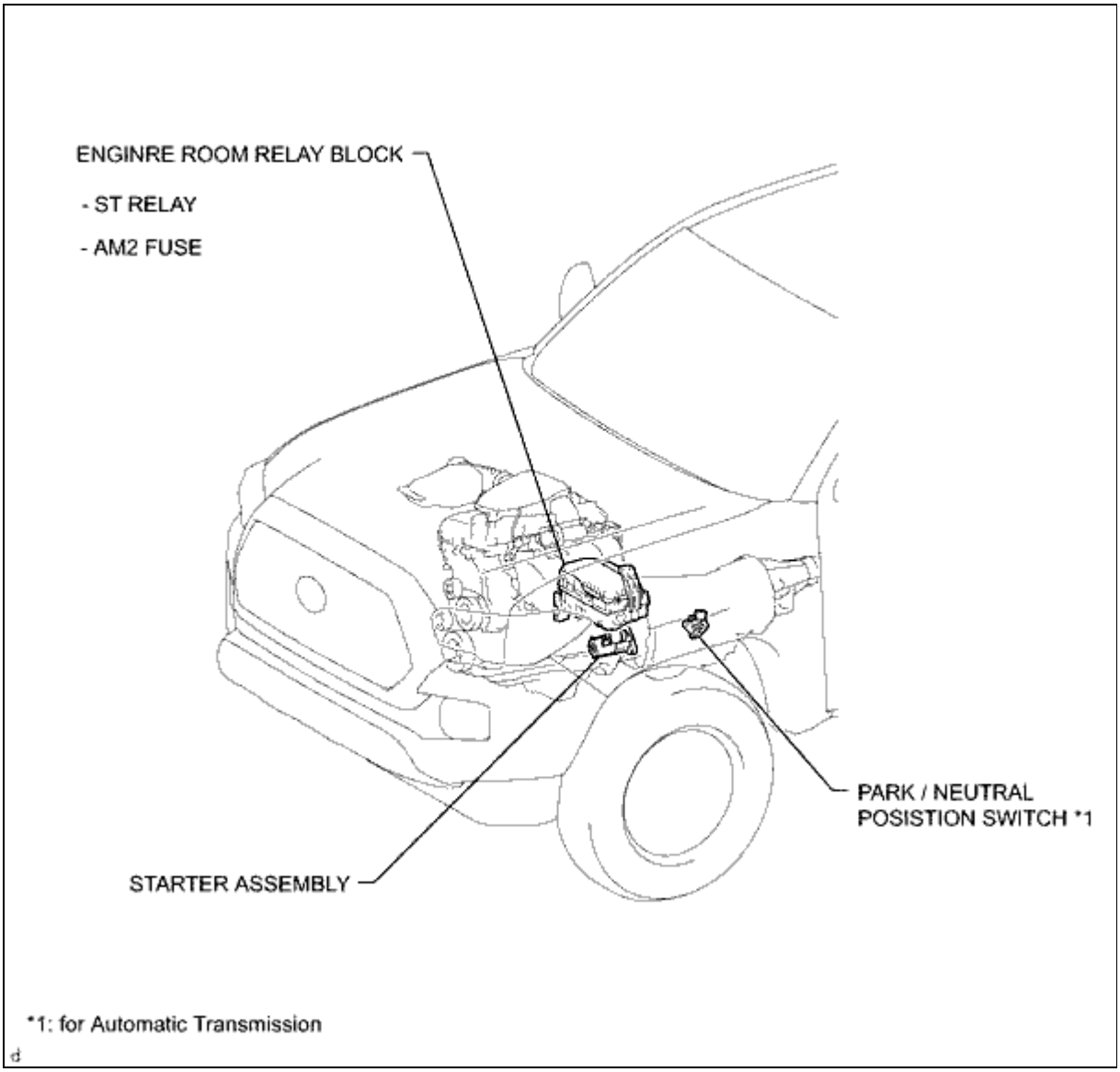
Specified current:
120 A or less at 11 V

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Last Modified: 11-13-2015	6.6 R	**Doc ID:** RM00000179G00CX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTING SYSTEM: PARTS LOCATION; 2016 MY Tacoma [08/2015 -]		

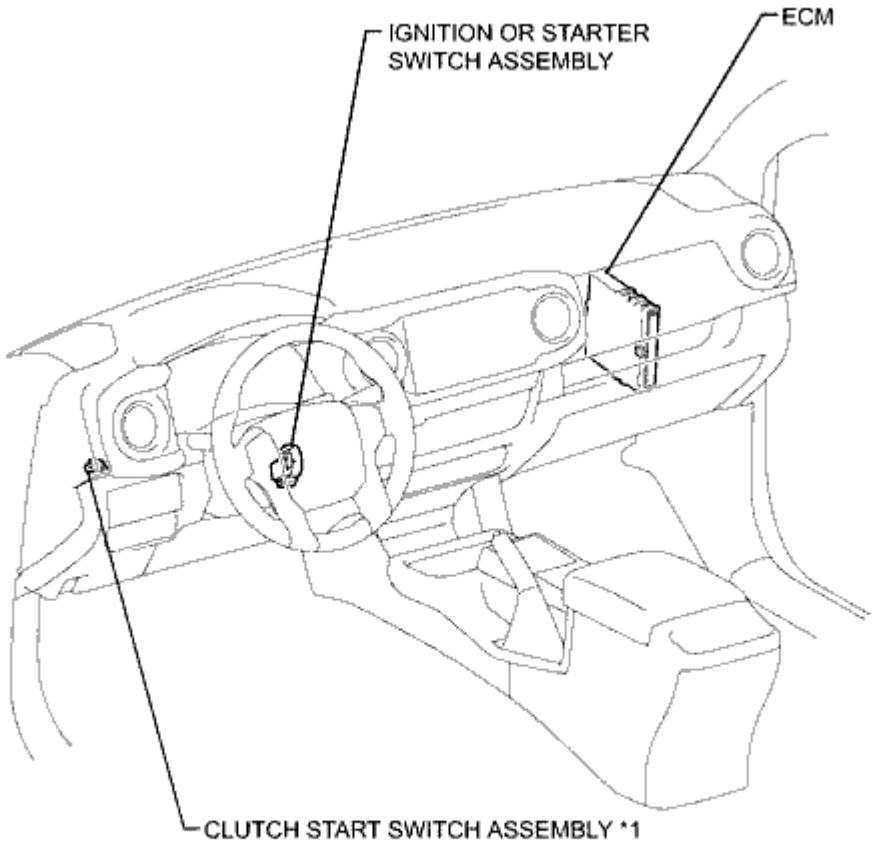
PARTS LOCATION

ILLUSTRATION



ILLUSTRATION

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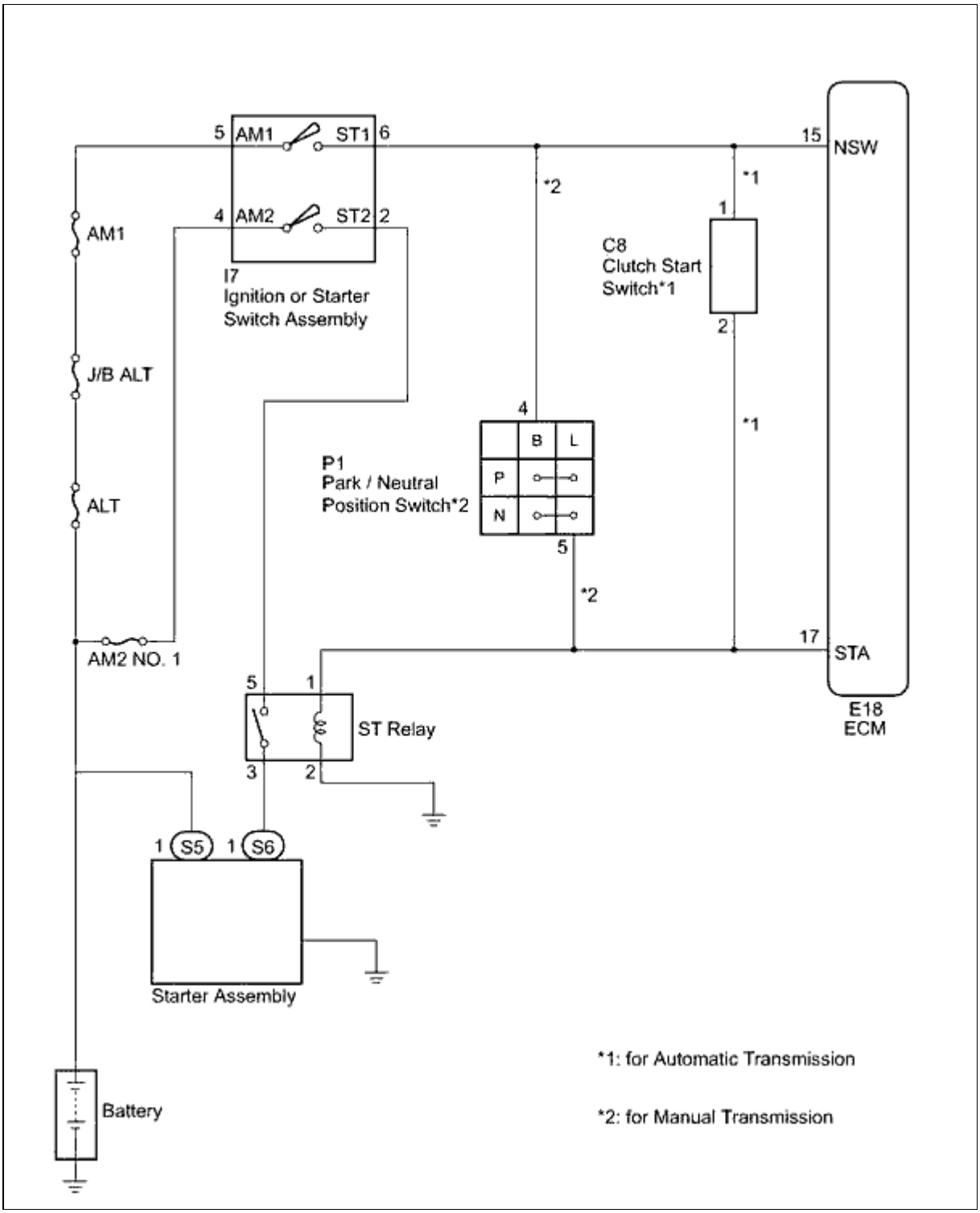
*1: for Manual Transmission

d

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Last Modified: 11-13-2015	6.6 U	**Doc ID:** RM0000179I00IX
Model Year Start: 2016	**Model:** Tacoma	**Prod Date Range:** [08/2015 -]
Title: 2TR-FE STARTING: STARTING SYSTEM: SYSTEM DIAGRAM; 2016 MY Tacoma [08/2015 -]		

SYSTEM DIAGRAM



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