

1. Based on information provided by the Petitioner, I understand that the following P codes were set: P2111, P2112, and P2119. Is this consistent with Toyota's understanding?

### **Response 1**

Toyota's understanding is that the dealer retrieved the three P codes, P2111, P2112 and P2119.

2. Based on information provided by the Petitioner, I understand the following Freeze Frame data was stored in the ECM:
  - a. Fuel System: open loop;
  - b. Load Value: 0%;
  - c. Coolant Temp: 177F;
  - d. Short Term Fuel trim: 0%;
  - e. Long Term Fuel Trim: 0.7%;
  - f. Engine RPM: 0;
  - g. Vehicle Speed: 0;
  - h. Ignition Timing Advance: 5 degrees;
  - i. Intake Air Temperature: 91F;
  - j. Air Flow Rate: 0.05 lb/min;
  - k. Throttle Position: 29%.

### **Response 2**

Toyota's understanding is that the dealer retrieved the following Freeze Frame data:

- |                            |                       |
|----------------------------|-----------------------|
| a. Fuel system status      | : open loop           |
| b. Calculated load         | : 0 %                 |
| c. Coolant temperature     | : 177.8 deg.          |
| d. Short term fuel trim    | : 0.1 %               |
| e. Long term fuel trim     | : 0.7 %               |
| f. Engine Speed            | : 0 rpm               |
| g. Vehicle Speed           | : 0 mph               |
| h. Ignition timing advance | : 5.0 deg.            |
| i. Intake air temperature  | : 91.4 deg.           |
| j. Air flow rate           | : 4 gm/s (0.5 lb/min) |

k. Throttle position sensor : 29 %

In addition to the above Freeze Frame Data, the dealer confirmed the following Freeze Frame Data:

- l. Closed throttle position switch : off
- m. Idle fuel cut : off
- n. Starter signal : off
- o. PNP switch signal : on
- p. Electrical load signal : off
- q. Power steering oil pressure signal : off
- r. Power steering signal : on
- s. Engine run time : 0

3. For each item in the list above (11 in total);

- a. Describe in detail what the item means or represents (what engine/vehicle parameter is it monitoring/indicating);
- b. State the unique values, or the max/min range, that can be stored in Freeze Frame data;

### **Response 3**

Toyota is providing the appropriate pages of the Repair Manual (hand-held tester data list) which contains the Freeze Frame data elements and max/min range for each item.

4. Describe any actions that could be undertaken by a subject vehicle (SV) owner (such as unplugging an engine sensor and turning the ignition on, etc) which could explain, and result in, the P Codes and Freeze Frame data that was allegedly stored in the Petitioner's vehicle.

### **Response 4**

Toyota tried to duplicate the condition using an actual vehicle in which the same P codes (P2111, P2112, P2119) could be stored in ECM and confirmed that, if the following steps are taken, P2111 and P2119 could be detected.

- 1. Turn the ignition switch OFF
- 2. Hold throttle plate open (Toyota inserted a 20 mm diameter rod into the throttle bore)
- 3. Turn the ignition switch ON (but do not start the engine)

4. Step on the accelerator pedal multiple times
5. Detect P2111
6. Turn the ignition switch OFF and wait until the main relay powers off (subject vehicles need at least 4 seconds)
7. Keep the throttle plate held open
8. Turn the ignition switch ON
9. Start the engine
10. Detect P2119 in addition to P2111

If the throttle plate is held in the closed position after the above steps are taken and the accelerator pedal is actuated multiple times, P2112 could be detected in addition to P2111 and P2119 (if the codes have not already been reset).

5. I need to better understand the sequence of events that occur when the ECU detects that a fault has occurred, sets P Codes, and stores Freeze Frame data. Explain in detail the timing and sequence of events that occur during the detection of P codes and recording of Freeze Frame data in the SV ECM.
  - a. Is the Freeze Frame data representative of the exact conditions at the precise moment the fault is detected, or the conditions before, or after, and how much before or after.
  - b. When in this sequence is the Service/Check Engine light illuminated; does illumination occur as soon as the fault is detected, and before or after the Freeze Frame data is written?

### **Response 5**

- a. The timing for failure detection occurs at the time when the OBD system finalizes the failure detection. In most cases, the OBD system judges that there is a failure when certain conditions are met for a certain length of time and a defined number of trips\*. The length of time differs for each DTC. For example, in case of P2111 and P2112, it takes 0.5 seconds to detect the failure and 1 second for P2119.
- b. The Check Engine light is also illuminated at the same time as above. In the subject vehicle DTC's case, failure is detected within 1 trip\*.

\* A "trip" is defined as the period from the time when the ignition switch is turned ON to the next time the ignition switch is turned ON.

6. State the values for each item in Request 2 that would be expected to be stored in the Freeze Frame data if a P code(s) were detected under the following vehicle operating conditions: the vehicle is stationary and has been parked for a 2 to 3 hour period at ambient temperatures of about 60F, the engine is started

and immediately goes to 3000 rpm for 7 seconds, and simultaneously the Service/Check Engine light illuminates, and the engine then stalls.

- a. In this scenario, what affect would the act of restarting the vehicle (without a key-off event) have on any fail safe mode of operation that may have been set due to a P code being detected; would it reset or clear the failsafe mode?
- b. In general, when a fail safe mode of operation has been enabled, does the ignition switch need to be fully switched off to clear the fail safe mode, and is there any minimal amount of time that the ignition key must be switched off to clear/reset the fail safe mode, or will simply turning the key off and immediately back on again clear the fail safe?

**Response 6**

We cannot assume that the engine can keep running at 3000 rpm for 7 seconds because the ECM can detect this as a failure and will immediately put the vehicle into fail-safe mode. Fail-safe mode is not cleared until the key is turned to the “OFF” position and remains “OFF” until the main relay powers off (subject vehicles need more than 4 seconds for this to occur).

- 7. State all P codes and Freeze Frame data which would be expected to be stored if:
  - a. The throttle actuator was disconnected while the ignition switch was in the on/run state with the engine off and the vehicle stationary;
  - b. The throttle actuator was disconnected while the engine was at idle and the vehicle stationary;
  - c. The ignition switch was turned on after the throttle actuator was disconnected (while the vehicle was stationary);
  - d. And under the above scenarios, if code P2102 and P2103 would not be detected or stored in the ECU, state why not?

**Response 7**

Toyota simulated each condition specified in Request 7 using an actual vehicle. The result of simulation for each condition is as follows:

| Condition         |              | a                   | b       | c     |
|-------------------|--------------|---------------------|---------|-------|
| Detected DTC      |              | P0121, P0123, P2135 |         |       |
| Freeze Frame Data | TROUBLE CODE | P2135               |         |       |
|                   | ENGINE SPD   | 0 rpm               | 591 rpm | 0 rpm |
|                   | COOLANT TEMP | 181F                | 187F    | 190F  |
|                   | VEHICLE SPD  | 0 MPH               |         |       |

|  |             |         |       |    |
|--|-------------|---------|-------|----|
|  | CALC LOAD   | 0%      | 63.9% | 0% |
|  | FUEL SYS #1 | OLDRIVE |       |    |
|  | FUEL SYS #2 | UNUSED  |       |    |
|  | SHORT FT #1 | 0%      |       |    |
|  | LONG FT #1  | -1.5%   |       |    |

In the above conditions, the ECM detects a throttle position sensor malfunction first. Once the ECM detects a throttle position sensor malfunction, the ECM cuts the power supply to the throttle body. As a result, there is no possibility that the ECM can detect P codes, P2102 and P2103, under those scenarios.

- Convert 29% throttle position to degrees throttle blade angle, and convert 16 degrees throttle blade angle to % throttle position.

**Response 8**

This information was discussed during our conversation of 12/21.

- State the typical (or typical range of) Throttle Position, Load Value, Air Flow Rate and Ignition Timing for a 4 cylinder engine at idle in Park gear?

**Response 9**

Toyota confirmed the value of the each item specified in Request 9 using an actual Camry vehicle equipped with a 4-cylinder engine (2AZ engine). The result of the each item is as follows:

- Throttle position : 14.9%
- Load Value : 15.6%
- Air Flow Rate : 0.36 lb/min
- Ignition Timing : 13.0 degrees

Please note that the data set above is one example obtained from one test vehicle in one condition. Therefore, these values may vary based on the tolerances of the parts, other vehicle/environmental conditions and circumstances.

In addition, the typical range of each item for a 4-cylinder engine (2AZ engine) is included in the repair manual provided in Response 3.

10. State the typical Throttle Position, Load Value, Air Flow Rate and Ignition Timing for a 4 cylinder engine when the ignition key is on, the engine is off, and the vehicle is at rest in Park gear?

**Response 10**

Toyota confirmed the value of the each item specified in Request 10 using an actual Camry vehicle equipped with a 4-cylinder engine (2AZ engine). The result of the each item is as follows:

Throttle position : 18.8%  
Load Value : 0%  
Air Flow Rate : 0.05 lb/min  
Ignition Timing : 5.0 degrees

Please note that the data set above is one example obtained from one test vehicle in one condition. Therefore, these values may vary based on the tolerances of the parts, other vehicle/environmental conditions and circumstances.

11. State what engine conditions (engine speed/RPM and load value) an Air Flow Rate of .05 lb/min represents?

**Response 11**

When the Air Flow Rate is 0.05 lb/min, the engine speed should be 0 rpm and the load value is 0%. It means that the engine is not running.

12. The Petitioner provided NHTSA a copy of a repair invoice from Fred Anderson Toyota in Raleigh, NC (dated 11/6/2006) which referenced case # TA063100058. Advise whether TA063100058 is a Toyota case ID and if so, provide a copy of all information related to it.

**Response 12**

TA063100058 is a Toyota case number. Toyota provides an electronic copy of the case information available for TA063100058.