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2019 Ford Transit-250 Service and Repair Manual

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objectives of the OBD (on-board diagnostic) II system are to improve air quality by reducing high in use emissions caused by emission related concerns, reducing the time between the occurrence of a concern and its detection and repair, and assisting in the diagnosis and repair of emission related problems.

OBD II Systems

The OBD (on-board diagnostic) II system monitors virtually all emission control systems and components that can affect tailpipe or evaporative emissions. In most cases, concerns must be detected before emissions exceed 1.5 times the applicable 120,000 or 150,000 mile emission standards. Partial zero emission vehicles (PZEV) and super ultra low emission vehicles (SULEV-II) can use 2.5 times the standard in place of the 1.5 times the standard. If a system or component exceeds emission thresholds or does not operate within a manufacturer's specifications, a DTC (diagnostic trouble code) is stored and the MIL (malfunction indicator lamp) is illuminated within 2 drive cycles.

The OBD (on-board diagnostic) II system monitors for concerns either continuously (regardless of driving mode) or non-continuously (once per drive cycle during specific drive modes). A pending DTC (diagnostic trouble code) is stored in the PCM (powertrain control module) KAM (keep alive memory) when a concern is initially detected. Pending DTCs are displayed as long as the concern is present. The OBD (on-board diagnostic) regulations require a complete concern free monitoring cycle to occur before erasing a pending DTC (diagnostic trouble code) . This means that a pending DTC (diagnostic trouble code) is erased on the next power up after a concern free monitoring cycle. However, if the concern is still present after 2 consecutive drive cycles, the MIL (malfunction indicator lamp) is illuminated. Once the MIL (malfunction indicator lamp) is illuminated, 3 consecutive drive cycles without a concern being detected are required to extinguish the MIL (malfunction indicator lamp) . The DTC (diagnostic trouble code) is erased after 40 engine warm up cycles once the MIL (malfunction indicator lamp) is extinguished.

In addition to specifying and standardizing much of the diagnostics and MIL (malfunction indicator lamp) operation, OBD (on-board diagnostic) requires the use of a standard DLC (data link connector) , standard communication links and messages, standardized DTCs and terminology. Examples of standard diagnostic information are freeze frame data and inspection/maintenance (I/M) readiness indicators.

Freeze frame data describes data stored in KAM (keep alive memory) at the point the concern is initially detected and the pending DTC (diagnostic trouble code) is stored. Freeze frame data consists of parameters such as engine RPM (revolutions per minute) , engine load, vehicle speed or throttle position. Freeze frame data is updated when the concern is detected again on a subsequent drive cycle and a confirmed DTC (diagnostic trouble code) is stored; however, a previously stored freeze frame is overwritten if a higher priority fuel or misfire concern is detected. This data is accessible with the scan tool to allow duplicating the conditions when the concern occurred in order to assist in repairing the vehicle.

OBD I/M readiness indicators show whether all of the OBD (on-board diagnostic) monitors have been completed since the last time the KAM (keep alive memory) or the PCM (powertrain control module) DTCs have been cleared. Ford vehicles blink the MIL (malfunction indicator lamp) after 15 seconds of ignition ON engine OFF time to indicate that some monitors have not completed. In some states, it may be necessary to

Power and Ground Signals

Accelerator Pedal Position Reference Voltage (APPVREF)

The APPVREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Accelerator Pedal Position Return (APPRTN)

The APPRTN is a return path for APPVREF circuit.

Electronic Throttle Control Reference Voltage (ETCREF)

The ETCREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Electronic Throttle Control Return (ETCRTN)

The ETCRTN is a return path for ETCREF circuit.

Gold Plated Pins

Some engine control hardware has gold plated pins within the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The engine control (EC) components equipped with gold plated pins vary by vehicle application. Only replace gold plated pins with new gold plated pins.

Keep Alive Power (KAPWR)

The KAPWR provides a constant voltage input independent of ignition switch state to the PCM. This voltage is used by the PCM (powertrain control module) to maintain the KAM (keep alive memory) .

Power Ground (PWRGND)

The PWRGND circuits provides a return path for the PCM (powertrain control module) vehicle power (VPWR) circuits.

Signal Return (SIGRTN)

The SIGRTN is a dedicated return path for VREF applied components.

Variable Reluctance Sensor Return (VRSRTN)

The VRSRTN circuit is a dedicated return path for variable reluctance (VR) type sensors.

Vehicle Buffered Power (VBPWR)

The VBPWR is a regulated voltage supplied by the PCM (powertrain control module) to vehicle sensors. These sensors require a constant 12 volts for operation and cannot withstand VPWR voltage variations. The VBPWR is regulated to VPWR minus 1.5 volts and is also current limited to protect the sensors.

Vehicle Power (VPWR)

The VPWR is the primary source of PCM (powertrain control module) power. VPWR is switched through the PCM (powertrain control module) power relay.

Vehicle Speed Limiter

The PCM (powertrain control module) disables some or all of the fuel injectors whenever a vehicle over speed condition is detected. The purpose of the vehicle speed limiter is to prevent damage to the powertrain. Once the driver reduces the excessive vehicle speed, the engine returns to the normal operating mode. No repair is required. However, the technician should clear the DTCs and inform the customer of the reason for the DTC (diagnostic trouble code) .

Either excessive wheel slippage caused by sand, gravel, rain, mud, snow, ice or excessive RPM (revolutions per minute) increase in neutral may cause the vehicle speed limiter to activate even though the vehicle has not exceeded the maximum speed limit.

Component Description

Camshaft Position (CMP) Sensor

The CMP (camshaft position) sensor detects the position of the camshaft. The CMP (camshaft position) sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM (powertrain control module) and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP (camshaft position) sensor signal to select the correct ignition coil to fire.

Engines with 4 camshafts and with VCT are equipped with 4 CMP sensors. The 4 sensors identify the position of each camshaft.

The 4 sensor system uses the following CMP sensor signal circuit names:

- CMP11 - bank 1, sensor 1 (intake camshaft)
- CMP12 - bank 1, sensor 2 (exhaust camshaft)
- CMP21 - bank 2, sensor 1 (intake camshaft)
- CMP22 - bank 2, sensor 2 (exhaust camshaft)

Crankshaft Position (CKP) Sensor

The CKP (crankshaft position) sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP (crankshaft position) sensor is the primary sensor for ignition information to the PCM (powertrain control module) . The pulse wheel has a total of 58 teeth spaced 6 degrees apart with 2 empty spaces for timing. By monitoring the pulse wheel, the CKP (crankshaft position) sensor signal indicates crankshaft position and speed information to the PCM (powertrain control module) . By monitoring the missing tooth, the CKP (crankshaft position) sensor is able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP (crankshaft position) sensor configuration. The PCM (powertrain control module) also uses the CKP sensor signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.

Crankshaft Position System

303-14B Electronic Engine Controls - 3.3L Duratec-V6	***2022 F-150***
Diagnosis and Testing	***Procedure revision date: 10/30/2020***

Crankshaft Position System

Diagnostic Trouble Code (DTC) Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: Diagnostic Methods

(100-00 General Information, Description and Operation).

Diagnostic Trouble Code Chart

Module	DTC (diagnostic trouble code)	Description	Action
PCM (powertrain control module)	P0315:00	Crankshaft Position System Variation Not Learned: No Sub Type Information	GO to Pinpoint Test JD
PCM (powertrain control module)	P0335:00	Crankshaft Position Sensor A Circuit: No Sub Type Information	GO to Pinpoint Test JD
PCM (powertrain control module)	P0339:00	Crankshaft Position Sensor A Circuit Intermittent: No Sub Type Information	GO to Pinpoint Test JD
PCM (powertrain control module)	P033F:00	Crankshaft/Camshaft Loss Of Synchronization: No Sub Type Information	GO to Pinpoint Test JD

		identification) while cranking the engine. A value of 0 RPM (revolutions per minute) indicates a CKP (crankshaft position) concern.
PCM (powertrain control module) P0339:00	Crankshaft Position Sensor 'A' Circuit Intermittent: No Sub Type Information	Sets when the PCM (powertrain control module) detects several erratic PIP (profile ignition pick-up) pulses have occurred in the CKP (crankshaft position) sensor signal within a calibrated time period when the camshaft speed exceeds the equivalent speed of engine idle or the starter motor is engaged.
PCM (powertrain control module) P033F:00	Crankshaft/Camshaft Loss Of Synchronization: No Sub Type Information	Sets when the PCM (powertrain control module) detects the input signal from the CKP (crankshaft position) sensor or the CMP (camshaft position) sensor is erratic.

Possible Sources

- CKP (crankshaft position) sensor circuitry concern
- Crankshaft pulse wheel
- CKP (crankshaft position) sensor (6C315)
- PCM (powertrain control module) (12A650)

Pinpoint Test Steps available in the on-line Workshop Manual.

PCM (powertrain control module)	P0604:00	Internal Control Module Random Access Memory (RAM) Error: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P0605:00	Internal Control Module Read Only Memory (ROM) Error: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P0606:00	Control Module Processor: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P0607:00	Control Module Performance: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P0610:00	Control Module Vehicle Options Error: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P061E:00	Internal Control Module Brake Signal Performance: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P062F:00	Internal Control Module EEPROM Error: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P0630:00	VIN Not Programmed Or Incompatible - ECM/PCM: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P064F:00	Unauthorized Software/Calibration Detected: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	P06DA:00	Engine Oil Pressure Control Circuit/Open: No Sub Type Information	GO to Pinpoint Test S
PCM (powertrain control module)	P06DB:00	Engine Oil Pressure Control Circuit Low: No Sub Type Information	GO to Pinpoint Test S

PCM (powertrain control module)	P264F:00	Engine Serial Number Not Programmed Or Incompatible: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	U0103:00	Lost Communication With Gear Shift Control Module A: No Sub Type Information	GO to Pinpoint Test A
PCM (powertrain control module)	U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	GO to Pinpoint Test B
PCM (powertrain control module)	U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module "A": No Sub Type Information	GO to Pinpoint Test C
PCM (powertrain control module)	U0126:00	Lost Communication With Steering Angle Sensor Module: No Sub Type Information	GO to Pinpoint Test D
PCM (powertrain control module)	U0131:00	Lost Communication With Power Steering Control Module "A": No Sub Type Information	GO to Pinpoint Test F
PCM (powertrain control module)	U0137:00	Lost Communication With Trailer Brake Control Module: No Sub Type Information	GO to Pinpoint Test G
PCM (powertrain control module)	U0138:00	Lost Communication with All Terrain Control Module: No Sub Type Information	GO to Pinpoint Test H
PCM (powertrain control module)	U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test I
PCM (powertrain control module)	U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test J
PCM (powertrain control module)	U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test K

PCM (powertrain control module)	U1012:00	Invalid Internal Control Module Monitoring Data Received from Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test P
PCM (powertrain control module)	U1022:00	Invalid Internal Control Module Monitoring Data Received from Body Control Module: No Sub Type Information	GO to Pinpoint Test P
PCM (powertrain control module)	U2100:00	Initial Configuration Not Complete: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	U2101:00	Control Module Configuration Incompatible: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	U2200:00	Control Module Configuration Memory Corrupt: No Sub Type Information	GO to Pinpoint Test QA
PCM (powertrain control module)	U3003:00	Battery Voltage: No Sub Type Information	GO to Pinpoint Test Q

Pinpoint Tests

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: Diagnostic Methods

(100-00 General Information, Description and Operation).

PINPOINT TEST A : U0103

Normal Operation and Fault Conditions

If the PCM (powertrain control module) does not receive messages from other modules within a certain time frame the PCM (powertrain control module) sets a DTC (diagnostic trouble code) for lost communication.

DTC Fault Trigger Conditions

DTC (diagnostic trouble code)	Description	Fault Trigger Condition

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: External Controls - Vehicles With: Column Shift(307-05B Automatic Transmission External Controls - 10-Speed Automatic Transmission – 10R80, Diagnosis and Testing). REFER to: External Controls - Vehicles With: Column Shift (307-05B Automatic Transmission External Controls - 10-Speed Automatic Transmission – 10R80, Diagnosis and Testing).
No	GO to A4

A4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM (gateway module A) Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Controller Area Network (CAN) Module Communications Network(418-00A Controller Area Network (CAN) Module Communications Network, Diagnosis and Testing).
No	GO to A5

A5 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM (powertrain control module) self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to PCM DTC Chart in this section.
No	GO to A6

A6 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE