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2018 Ford Transit-350 Service and Repair Manual

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Sample

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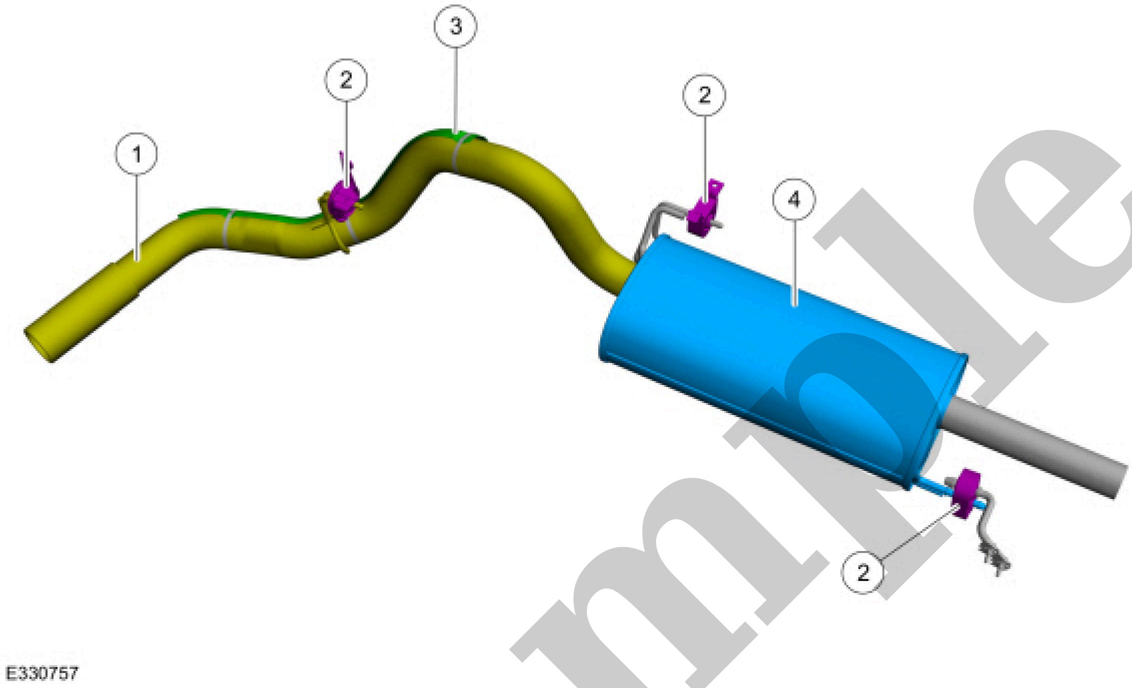
Item	Description
1	Resonator
2	Exhaust clamp



Muffler and tailpipe assembly

Item	Description
1	Tailpipe
2	Isolators
3	Heat shield
4	Muffler

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Some exhaust fasteners must be discarded and new ones installed as indicated in the procedures. Discard any damaged or heavily corroded fasteners and install new ones as necessary. Some exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Tighten the fasteners to the specified torque during reassembly to make sure of correct retention of exhaust components.

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Sample

harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Light Off Catalyst

As the catalyst heats up, converter efficiency rises rapidly. The point at which conversion efficiency exceeds 50% is called catalyst light off. For most catalysts this point occurs between 246°C to 302°C (475°F to 575°F). A light off catalyst is a three way catalytic (TWC) converter that is located as close to the exhaust manifold as possible. Because the light off catalyst is located close to the exhaust manifold it achieves the required temperature faster and reduces emissions more quickly than the catalyst located under the body. Once the catalyst lights off, it quickly reaches the maximum conversion efficiency for that catalyst.

Three Way Catalytic (TWC) Converter Conversion Efficiency

A TWC convertor requires a stoichiometric air fuel ratio of 14.7 pounds of air to 1 pound of gasoline, or 14.7 to 1, for high conversion efficiency. To achieve these high efficiencies, the air to fuel ratio must be tightly controlled with a narrow window of stoichiometry. Deviations outside of this window greatly decrease the conversion efficiency. For example a rich mixture decreases the HC and CO conversion efficiency while a lean mixture decreases the NO_x conversion efficiency.

For vehicles using E85 the required air to fuel ratio is 9.8 to 1. Other gasoline/ethanol mixtures require a variable air to fuel ratio between 14.7 to 1 to 9.8 to 1 dependent on the percentage of ethanol content.

Exhaust System

The exhaust system conveys engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. A universal HO2S (heated oxygen sensor) is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of CO, unburned HCs, and NO_x in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter past another HO2S (heated oxygen sensor) mounted in the rear exhaust pipe and then on into the muffler. Finally, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

Underbody Catalyst

The underbody catalyst is located after the light off catalyst.

Three Way Catalytic (TWC) Converter

The TWC converter contains either platinum (Pt) and rhodium (Rh) or palladium (Pd) and rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NO_x. The 3 way conversion can be best accomplished by always operating the engine air fuel ratio at or close to stoichiometry.

Catalyst Efficiency Monitor

The catalyst efficiency monitor uses an oxygen sensor before and after the catalyst to infer the HC (hydrocarbon) efficiency based on the oxygen storage capacity of the catalyst. Under normal closed loop fuel

Sample

- Vehicle speed is between 8 and 112 km/h (5 and 70 MPH)
- Fuel level is greater than 15%
- First Airflow Cell
  - Engine RPM (revolutions per minute) 1,000 to 1,300 RPM (revolutions per minute)
  - Engine load 15 to 35%
  - Inferred catalyst temperature 454°C - 649°C (850°F - 1,200°F)
  - Number of universal HO2S (heated oxygen sensor) switches is 50
- Second Airflow Cell
  - Engine RPM (revolutions per minute) 1,200 to 1,500 RPM (revolutions per minute)
  - Engine load 20 to 35%
  - Inferred catalyst temperature 482°C - 677°C (900°F - 1,250°F)
  - Number of universal HO2S (heated oxygen sensor) switches is 70
- Third Airflow Cell
  - Engine RPM (revolutions per minute) 1,300 to 1,600 RPM (revolutions per minute)
  - Engine load 20 to 40%
  - Inferred catalyst temperature 510°C - 704°C (950°F - 1,300°F)
  - Number of universal HO2S (heated oxygen sensor) switches is 30

Six drive cycles may be required to illuminate the MIL (malfunction indicator lamp) during normal customer driving, because an exponentially weighted moving average algorithm is used to determine a concern. If the KAM (keep alive memory) is reset, a concern illuminates the MIL (malfunction indicator lamp) in 2 drive cycles.

General Catalyst Monitor Operation

The catalyst monitor duration is 12 to 30 seconds, once per drive cycle. If the catalyst monitor conditions are met, the catalyst monitor may run and complete after all of the upstream HO2S (heated oxygen sensor) functional tests are complete and the EVAP (evaporative emission) system is functional, with no stored DTCs; however, the catalyst monitor may run and complete before the downstream HO2S (heated oxygen sensor) deceleration fuel shut off (DFSO) test is complete. In this case, the catalyst monitor inspection maintenance (I/M) readiness flag may indicate complete before the O2S I/M readiness flag indicates complete. If the catalyst monitor does not complete during a particular driving cycle, the already accumulated switch/signal data is

Sample

For the clog monitor test, the PCM (powertrain control module) determines a pressure threshold value for the amount of pressure that should be present in the filter for a calibrated exhaust flow rate. The PCM (powertrain control module) compares the measured pressure to the pressure threshold value. A fault filtering metric starts when the clog monitor begins to run. When the measured pressure is greater than the pressure threshold, the metric value increases. When the measured pressure is less than the pressure threshold, the metric value decreases. If the metric value at the end of the clog monitor exceeds a calibrated limit, a DTC (diagnostic trouble code) sets, and the MIL (malfunction indicator lamp) illuminates.

The severely clogged monitor test works the same way same way as the clog monitor test, but uses a higher restriction threshold.

For the missing substrate monitor test, the PCM (powertrain control module) determines a pressure threshold for the amount of pressure that should be measured by the particulate filter pressure sensor, for a calibrated exhaust flow rate. The PCM (powertrain control module) compares the measured pressure value to the pressure threshold value. A fault filtering metric starts when the missing substrate monitor begins to run. When the measured pressure is less than the threshold value, the metric value increases. When the measured pressure is greater than the threshold value, the metric value decreases. If the metric value at the end of the missing substrate monitor exceeds calibrated limit, a DTC (diagnostic trouble code) sets, and the MIL (malfunction indicator lamp) illuminates.

Particulate Filter Regeneration

Particulates in the exhaust are trapped by the particulate filter. Regeneration is the process by which the exhaust gas temperatures are increased and the higher exhaust temperatures burn off the particulates in the filter. Under normal driving conditions, regeneration is an ongoing passive process. When necessary, the PCM (powertrain control module) may initiate regeneration by creating a lean condition along with retarding the spark advance, raising the exhaust temperature to regeneration conditions.

During normal vehicle operation, the PCM (powertrain control module) estimates the amount of particulates that accumulate in the particulate filter. The estimated amount of particulates is based on a number of different vehicle operating conditions, including vehicle speed, engine run time, and load. Additionally the PCM (powertrain control module) monitors the following:

- Battery voltage.
- Engine coolant temperature.
- Engine speed.
- Exhaust gas temperature (EGT) sensors.
- Fuel level.
- Fuel temperature.
- Intake air temperature.

Sample

forced to flow through the walls of the porous substrate and exit through the adjoining channels. The particulates that are larger than the pore size of the walls are trapped for regeneration. During normal operation, particulate filter temperatures may be greater than 550°C (1,022°F). These conditions provide an opportunity for passive regeneration. During deceleration conditions, the vehicle will enter deceleration fuel shutoff and provide additional oxygen at temperatures that are sufficient to burn soot, allowing the particulate filter to regenerate passively. The precious metal washcoat promotes the regeneration of the trapped particulates through the heat generating reaction and catalyzes the untreated exhaust gas. The substrate filter is held in the metal shell by a ceramic fiber support system. The support system makes up the size differences that occur due to thermal expansion and maintains a uniform holding force on the substrate filter.

Particulate Filter Pressure Sensor

The particulate filter pressure sensor is an input to the PCM (powertrain control module) and measures the pressure before the particulate filter. The sensor is a gauge type sensor. The particulate filter pressure sensor is referenced to atmospheric pressure and is located at the exhaust system upstream of the particulate filter. At ignition ON, engine OFF the particulate filter pressure sensor pressure value reads 0 kPa (0 psi). The range of the sensor is 0-80 kPa (0-11.6 psi). The PCM (powertrain control module) calculates soot load based on the particulate filter pressure and initiates regeneration conditions when the soot load reaches a threshold.

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Customer Symptom	Action
Start/Run/Move > Running > Failed Emissions Testing > Catalyst	GO to Pinpoint Test EM
Start/Run/Move > Odor > Chemical > Always	GO to Pinpoint Test HF

Pinpoint Tests

PINPOINT TEST EM : EMISSION COMPLIANCE

NOTE

Canada and some states or metropolitan areas in the United States require periodic emission, or inspection/maintenance tests. All Ford products are designed to pass these tests. If a Ford product fails the test, the most likely causes are:

- The engine or catalyst temperature are not warm and stabilized before the test.
- Excessive idling by the vehicle before the test.

Normal Operation and Fault Conditions

If any new emission components are installed, carry out the following steps before repeating the inspection/maintenance test procedure:

- Reset the KAM (keep alive memory) . Refer to Resetting The KAM (keep alive memory) .
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM (revolutions per minute) for 1 minute and idle the engine for 2 minutes.

Sample

from the verification trip must be at least half of the baseline reading, or an average of 220 ppm or less.

- This method only gives a general idea of how much the ppm reading needs to be reduced in order for the vehicle to pass an inspection/maintenance test that calculates gpm. This test is not exact. Experience still has to be used to determine if the emission readings are reduced enough for the vehicle to pass the inspection/maintenance test.

Possible Sources

- Intake air system concern
- Exhaust system concern
- Fuel system concern
- Ignition system concern

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

Sample

PINPOINT TEST HF : CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

Normal Operation and Fault Conditions

Refer to the DTC (diagnostic trouble code) Fault Trigger Conditions.

DTC Fault Trigger Conditions

DTC (diagnostic trouble code)	Description	Fault Trigger Condition
PCM (powertrain control module) P0420:00	Catalyst System Efficiency Below Threshold (Bank 1): No Sub Type Information	Sets when PCM (powertrain control module) detects the bank 1 catalyst system efficiency is below the acceptable threshold. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage capability. As catalyst efficiency deteriorates, its ability to store oxygen declines. Refer to the Catalyst Efficiency Monitor description for additional information. Diagnose any base engine concerns. Refer to the appropriate 303-00 section, Engine System.
PCM (powertrain control module) P0430:00	Catalyst System Efficiency Below Threshold (Bank 2): No Sub Type Information	Sets when PCM (powertrain control module) detects the bank 2 catalyst system efficiency is below the acceptable threshold. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage capability. As catalyst efficiency deteriorates, its ability to store oxygen declines. Refer to the Catalyst Efficiency Monitor description for additional information. Diagnose any base engine concerns. Refer to the appropriate 303-00 section, Engine System.

Exhaust System

309-00E Exhaust System - 5.0L 32V Ti-VCT	***2022 F-150***
Diagnosis and Testing	***Procedure revision date: 10/12/2020***

Exhaust System

Global Customer Symptom Code (GCSC) 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).

Global Customer Symptom Code Chart

Customer Symptom	Action
Fit/Finish/Body > Paint/Finish > Exhaust > Corrosion/Rust	GO to Pinpoint Test C
Start/Run/Move > Noise > Exhaust > Always	GO to Pinpoint Test D
Driving Performance > Lack/Loss of Power > Acceleration > Always	GO to Pinpoint Test A
Safe & Secure > Smoke/Odor > Exhaust > Hot	GO to Pinpoint Test B

Symptom Chart(s)

Symptom Chart - Exhaust System

NOTE

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