

## **P20EE-SCR NO<sub>x</sub> CATALYST EFFICIENCY BELOW THRESHOLD - BANK 1**

For a complete wiring diagram, refer to the **Wiring Information**.

### **Theory of Operation**

Selective Catalytic Reduction (SCR) is a technology that uses a urea based Diesel Exhaust Fluid (DEF) and a Catalytic Converter to significantly reduce Nitrous Oxides (NO<sub>x</sub>) emissions. The system accomplishes this by injecting small quantities of Diesel Exhaust Fluid into the exhaust system upstream of the catalyst, where it vaporizes and decomposes to form ammonia and carbon dioxide. The ammonia is the desired product which in conjunction to the SCR Catalyst, converts the NO<sub>x</sub> to harmless nitrogen and water. Excessive fuel or oil entering the exhaust system due to a failed engine component or Fuel Injector can cause the temperature to rise and will result in damage to the SCR Catalyst. The Diesel Exhaust Fluid (DEF) Dosing Control Unit is used to control the operation and monitoring of the Diesel Exhaust Fluid system.

The DEF Dosing Control Unit communicates with the Powertrain Control Module over the J1939 Data Link. The SCR system is equipped with two Nox Sensors and modules that are used to monitor the efficiency of the SCR Catalyst and diesel exhaust fluid system. The NO<sub>x</sub> Sensors and NO<sub>x</sub> Sensor Modules are calibrated to each other and must be replaced as an assembly. The two NO<sub>x</sub> Sensor and Module assemblies are not interchangeable. The NO<sub>x</sub> Sensor Modules are smart devices that communicate with the Powertrain Control Module (PCM) over the J1939 Data Link. The NO<sub>x</sub> Sensor Modules perform their own internal diagnostics and report malfunctions back to the PCM.

- **When Monitored:**

This monitor has to meet specific engine and aftertreatment conditions to run and complete. NO<sub>x</sub> sensor data is gathered over varying engine speeds and loads. When enough data has been gathered, the diagnostic will run, make a pass/fail decision, and begin to gather data again.

- **Set Condition:**

The Powertrain Control Module detects that the NO<sub>x</sub> conversion across the SCR catalyst is lower than expected. A steady state highway drive cycle will encompass the conditions necessary to run the monitor.

#### **Possible Causes**

POWERTRAIN CONTROL MODULE (PCM) HAS AN OUTDATED FLASH UPDATE  
DEGRADED, DILUTED OR INCORRECT DIESEL EXHAUST FLUID  
DIESEL EXHAUST FLUID DEPOSITS IN THE DECOMPOSITION TUBE  
EXHAUST SYSTEM LEAKS  
MALFUNCTIONING DEF DOSING SYSTEM  
DEFECTIVE SCR CATALYST

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).**

## **1. CHECK FOR FLASH UPDATES**

1. Turn the ignition on.
2. With the scan tool, verify that the Powertrain Control Module (PCM) has the latest Flash Update available.

### **Does the PCM have the latest Flash Update?**

**Yes** • Go To [2](#)

- No** • Perform the latest Flash Update to the PCM. Then, with the scan tool, erase the DTC. Test drive the vehicle duplicating the environmental conditions that set the DTC (Review 'When Monitored' and 'Set Conditions'). If the DTC does not return, the Test is complete. If the DTC does return, continue on with this Diagnostic, beginning with Test Step 2. Active DTC.
- Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

## **2. ACTIVE DTC**

**NOTE:** Troubleshoot all other active NOx Sensor and DEF Dosing System related fault codes before this fault.

1. Turn the ignition on.
2. With the scan tool, select View DTCs.

### **Is the DTC active?**

**Yes** • Go To [3](#)

- No** • Perform the INTERMITTENT CONDITION - 6.7L diagnostic procedure. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

## **3. CHECK THE DIESEL EXHAUST FLUID**

1. Turn the ignition off.
2. Collect a sample of diesel exhaust fluid from the system.
3. Visually inspect the fluid for signs of contamination or debris.

**NOTE:** The Refractometer test is only done to test the general quality of the fluid. It will not identify any specific contaminants that may be present.

4. Test the quality of the DEF using the DEF/UREA Refractometer (16-5025) available through MoparEssentialTools.com . Then, ENTER EQUIPMENT CATALOG. Or call (855)-298-2687.

**NOTE:** The DEF should register approximately 32.5 percent using the Refractometer.

5. To test for hydrocarbons in the DEF tank use Hydroscopic test paper (223-44-863) available through MoparEssentialTools.com . Then, ENTER EQUIPMENT CATALOG. Or call (855)-298-2687. The test strip must come in contact with the DEF fluid in the tank in order to get a valid reading for hydrocarbons present in tank.
6. Remove the test paper from the package and inspect for color consistency. If the color is not consistent replace strip.
7. Disconnect the DEF fill pipe from tank and try to get a sample or remove the DEF tank.
8. Place the test paper directly into the DEF fluid in the tank. If the light blue paper turns dark blue, that is an indication that oil or hydrocarbon contamination is present.

### **Is the Diesel Exhaust Fluid (DEF) quality within specification and free of debris, hydrocarbons, or other contamination?**

**Yes** • Go To 4

- No**
- If the DEF fails the Refractometer quality test, but passes the Hydrosopic test paper test and shows no other signs of hydrocarbons or other contaminants: Just drain the Diesel Exhaust Fluid (DEF) and replace it with fresh fluid.
  - If the DEF fails the Hydrosopic test paper test or shows signs of other contaminants: Drain the Diesel Exhaust Fluid (DEF). Replace the DEF Tank, DEF Supply Pump Assembly, DEF Injector, DEF Supply Tube, DEF Filler Tube, and DEF Filler Cap in accordance with the service information.
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

#### **4. CHECK FOR DIESEL EXHAUST FLUID LEAK**

1. Turn the ignition on.
2. With the scan tool, navigate to Systems Tests and actuate the DEF Prime Test.

**NOTE:** This will pressurize the system, making a leak easier to see.

3. Inspect for signs of a Diesel Exhaust Fluid leak at:
  - DEF Injector and Injector connectors.
  - DEF Heater Line.
  - DEF Supply Pump Assembly.

#### **Were any leaks found?**

- Yes**
- Repair or replace the faulty component in accordance with the service information.
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

**No** • Go To 5

#### **5. CHECK THE EXHAUST SYSTEM FOR LEAKS**

1. Visually inspect the entire exhaust system for signs of a leak.

#### **Were any exhaust leaks found?**

- Yes**
- Perform the appropriate repair.
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

**No** • Go To 6

#### **6. CHECK FOR DEPOSITS IN THE DECOMPOSITION TUBE**

1. Remove the DEF Injector from the Decomposition Tube. (Refer to 25 - Emissions Control/Diesel Exhaust Fluid Emissions/INJECTOR, Diesel Exhaust Fluid - Removal).
2. Visually inspect the Decomposition Tube for diesel exhaust fluid deposits.

#### **Were any deposits found?**

- Yes** • Clean the deposits from the Decomposition Tube.

- Perform the POWERTRAIN VERIFICATION TEST – 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

**No** • Go To **7**

## **7. CHECK THE DEF INJECTOR**

- 1.
2. Reconnect the DEF Injector harness connector.
3. Place the DEF Injector in a clean, graduated cylinder (showing milliliters or cubic centimeters) to capture the fluid sprayed.
4. Turn the ignition on.
5. With the scan tool, navigate to Systems Tests and actuate the DEF Reductant Doser PUMP Override Test. This test is not to be confused with the DEF Reductant Doser PRIME Override Test.

### **NOTE:**

- This Test will run for six minutes before timing out. The amount of flow may fluctuate through out the test, therefore the test must be allowed to run completely in order for the results to be accurate. The fluid should spray out as a mist. There should be no dripping from the holes in the DEF Injector at any time during the duration of the test procedure.
- Also, an injector may have white deposits on the tip that would appear to block the holes. These deposits are dry urea, they do not impact the injector performance and will wash off as soon as the injector is actuated. **DO NOT** replace the injector without running the bucket test first.
- During testing some residual fluid may collect on the DEF Injector. Do not replace an Injector for that reason alone. Run the entire volume flow test to determine a course of action.

6. Measure the amount of fluid sprayed after the test times out.

### **Does the fluid sprayed measure between 85 ml and 115 ml?**

- Yes**
- Replace the DEF injector seal when re-installing the DEF Injector.
  - Replace the SCR Catalyst in accordance with the service information. (Refer to 11 - Exhaust System/CATALYST, Selective Catalytic Reduction (SCR) - Removal).
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).
- No**
- If the fluid sprayed measured above 115 ml: Replace the DEF Injector in accordance with the Service Information.
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).
  - If the fluid sprayed measured below 85 ml: Check the DEF Injector for debris. If there is debris collected on the DEF Injector, clean the debris and re-run this test. If there was no debris present: Go To **8**

## **8. CHECK THE DEF SUPPLY LINE FOR A RESTRICTION**

1. Check the DEF Supply line for a restriction. Starting at the DEF Injector, follow the line to the DEF Supply Pump Assembly looking for kinks or for objects pinching the line.

### **Was there a restriction in the DEF Supply Line?**

- Yes**
- Replace the DEF Supply Line in accordance with the Service Information.

- Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

**No** • Go To 9

## **9. DEF SUPPLY PUMP**

1. Turn the ignition off.
2. Replace the DEF Injector, but do not install the DEF Injector into the decomposition tube.

**NOTE:** After the DEF Injector is replaced, the Diesel Exhaust Fluid Doser Pump Override Test must be performed again.

3. Connect the DEF Injector harness to the new DEF Injector.
4. Place the DEF Injector in a container to capture the fluid sprayed.
5. Turn the ignition on.
6. With the scan tool, navigate to Systems Tests and actuate the Diesel Exhaust Fluid Doser Pump Override Test.

**NOTE:** This Test will run for six minutes before timing out. The amount of flow may fluctuate through out the test, therefore the test must be allowed to run completely in order for the results to be accurate. The fluid should spray out as a mist. There should be no dripping from the holes in the DEF Injector at any time during the duration of the test procedure.

7. Measure the amount of fluid sprayed after the test times out.

### **Is the volume of fluid sprayed still below 85 ml?**

- Yes**
- Replace the DEF Supply Pump in accordance with the Service Information.
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).
- No**
- Repair Complete. Install the DEF Injector in accordance with the Service Information. (Refer to 25 - Emissions Control/Diesel Exhaust Fluid Emissions/INJECTOR, Diesel Exhaust Fluid - Removal).
  - Perform the POWERTRAIN VERIFICATION TEST - 6.7L. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).