Solution K65527708
Friday, July 26, 2019 7:21:49 PM CEST

** SOLUTION **

Title	Diagnostic Trouble Codes (DTC) P20EE And P103C, Diagnostic Procedure; REPLACES GUIDED DIAGNOSTICS IN PREMIUM TECH TOOL (PTT) - US17+OBD16 And Newer Chassis ONLY

Mack Models

Mack Model	LR , MRU - TerraPro , TE - TerraPro , AN - Anthem , CHU - Pinnacle, Axle back , CXU - Pinnacle, Axle front , GR - Granite , GU - Granite , PI - Pinnacle

Volvo Models

Volvo Model	VNL , VNM , VNR , VAH , VHD

Emission Standard

Emission Standard	US17+OBD16 , US17+OBD18 , US17+OBD19

Engine family

Engine family	11L Engine , 13L Engine , MP7 , MP8

** SOLUTION **

Cause	Procedures and checks to follow for P20EE and P103C on US17 and newer chassis.

Solution

WARNING

If this solution is being reviewed for P225E-00, solution K15560422 must be utilized FIRST, and this solution should only be followed if the NOx sensors are determined to be functioning properly. The tests performed in K15560422 do not need to be duplicated for this solution.

The following checklist should be used for diagnosis of P20EE or P103C on GHG17 chassis instead of Guided Diagnostics.

DO NOT REPLACE ANY PARTS UNTIL ALL ACTIVITIES LISTED IN THIS CBR ARE COMPLETE.

NOTE: The Malfunction Indicator Lamp (MIL) may still be lit even if P20EE shows inactive on a DTC Readout.

I. Vehicle History

- The following information should be obtained prior to beginning diagnosis.

- Is this the chassis's first visit to the dealer for either of these codes?
- Have there been any previous failures or problems that may have caused problems with the Exhaust Aftertreatment System (EATS)?

  Examples:
  - Turbocharger failure
  - EGR Cooler failure
  - Coolant passage through the exhaust
  - Excessive fuel through the exhaust (Injector failure, AHI failure)
  - DPF failure
  - Contaminated DEF

NOTE: If this is Truck MY2020 (OBD2019) first or repeat visit for P20EE, please create an E-service case to get support from Tech Support prior to doing any additional inspections.

NOTE: If this is the chassis's first visit for either code, a Sulfur Regeneration should be performed and the chassis released after confirming the items below.

II. Check the DTC Readout

- Are there any other NOx sensor DTCs present?

- **P225E** and **P0422** are very similar to P20EE and should be checked with the same steps below.
- Any other NOx sensor codes may suggest intermittent NOx sensor failure.

- Are there any codes present for other engine components that would indicate an issue contributing to or causing either P20EE or P103C?

- Examples:

  EGR System

  Fuel System (Includes AHI)

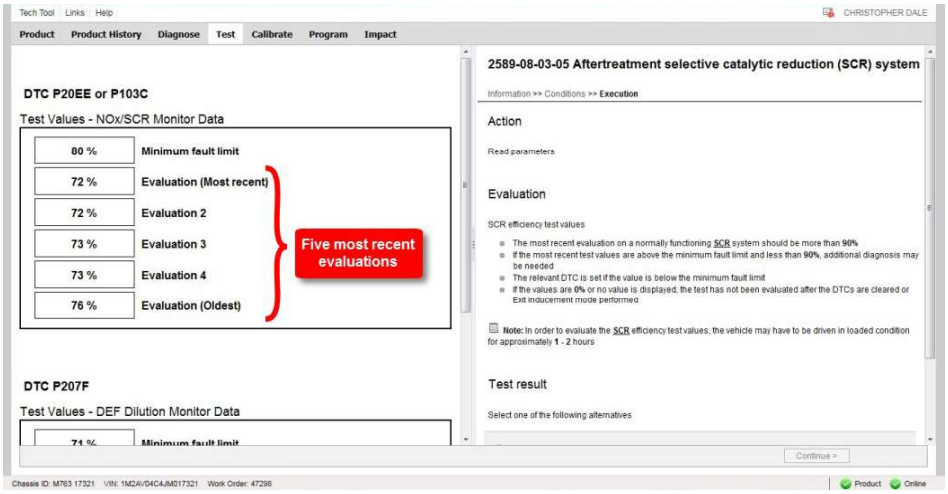
  Turbocharger/Boost

  DPF

  Exhaust temperature

III. Check SCR Efficiency Evaluations

- SCR Efficiency values can be found in Premium Tech Tool (PTT) Operation 2589-08-03-05 Aftertreatment Selective Catalytic Reduction (SCR) System.



- The last five efficiency evaluations are displayed as shown in the screenshot above.
  If all five tests are below the fault limit, SCR conversion has been poor for an extended amount of time.
  If only one or two are below the fault limit, conversion is only intermittently poor.
  - Information on driving conditions when the poor conversion is occurring may provide insight into the cause of the codes.

IV. SCR System Checks

All steps below should be performed to verify proper function of each component.

1. Check DEF quality with a refractometer

2. Physically check for any contamination in the DEF tank

- Examples
  - Dirt or Debris
  - Coolant
  - Water
  - Fuel
  - Oil

3. Physically inspect the DEF Dosing Valve, Diffuser Pipe, and SCR Inlet for crystallized DEF

- Ensure there is no significant/excessive crystal buildup in any component.
  NOTE: A small amount of crystal accumulation is normal.
- **If significant accumulation is noted clean it as first step and then** ensure that the DEF dosing valve is correctly installed with all gaskets and clamps positioned properly.

4. Perform DEF Dosing Test 2 to confirm proper function

- Located in Operation 2589-08-03-05 Aftertreatment Selective Catalytic Reduction (SCR) System.
  Test B from the first screen of the operation
- Test two is the **Small Dosing Test**

The test should be run twice and results noted to an accuracy of 2 milliliters

Nominal Volume is **55 mL**

Acceptable range is 55 mL ± 3 mL

5. Check the Main Software part number for the Engine Control Module (EMS)

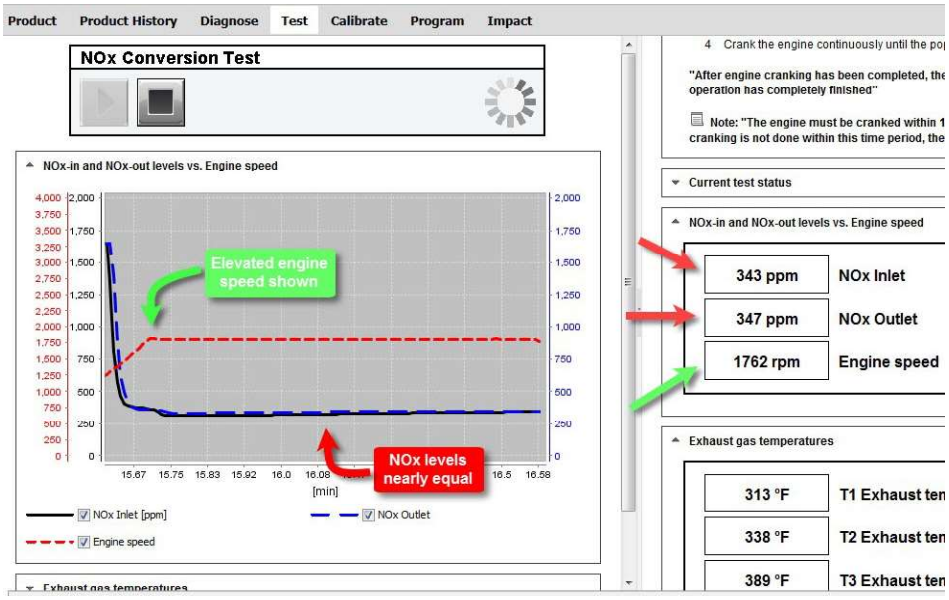
- Make a note of the number. It will be used in the next step.

6. Run a NOx Conversion, Operation 2549-08-03-03.

> **⚠ WARNING**
>
> **Read all of the parts of this step prior to performing the test to prevent repeated steps.**
>
> **This test checks the function of both NOx sensors. It does not evaluate SCR efficiency.**

- While running NOx conversion test, if any new NOx sensor codes are logged (Egs: P220E-93, P220F-93), make sure to troubleshoot those codes.
- Inlet and Outlet NOx Sensor values should be close to each other at high engine speed (last portion of the test) as shown below.
- If during the test difference between NOx sensors are greater than 10%, it is recommended to replace the sensor reading the higher value and re-do the test.

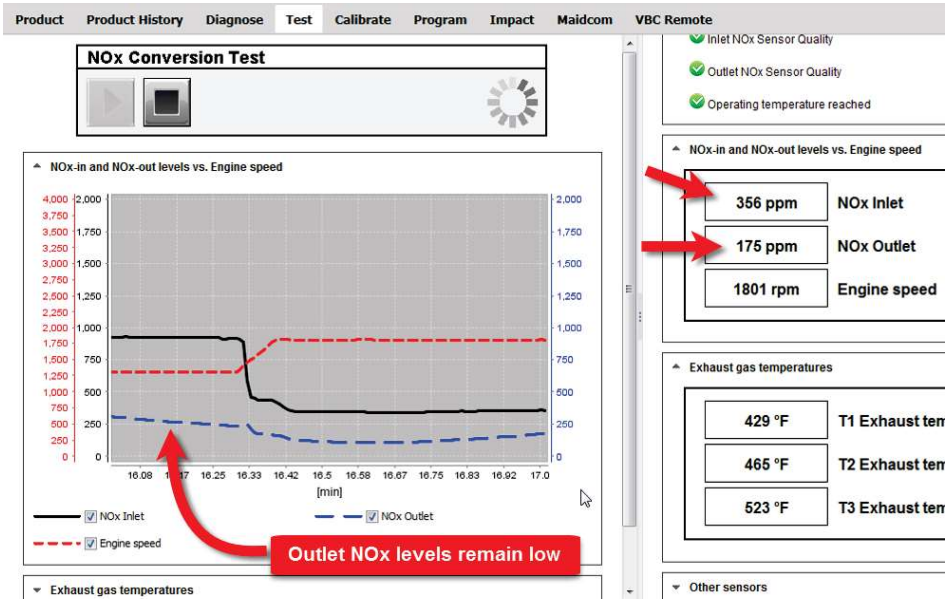
The likelihood that both sensors require replacement at once is low. Replacement of both sensors at once should not be considered immediately unless affected by an upstream failure.



- **If the vehicle has EMS Software Part Number 23470183 or 23470187:** Refer to the comments below:

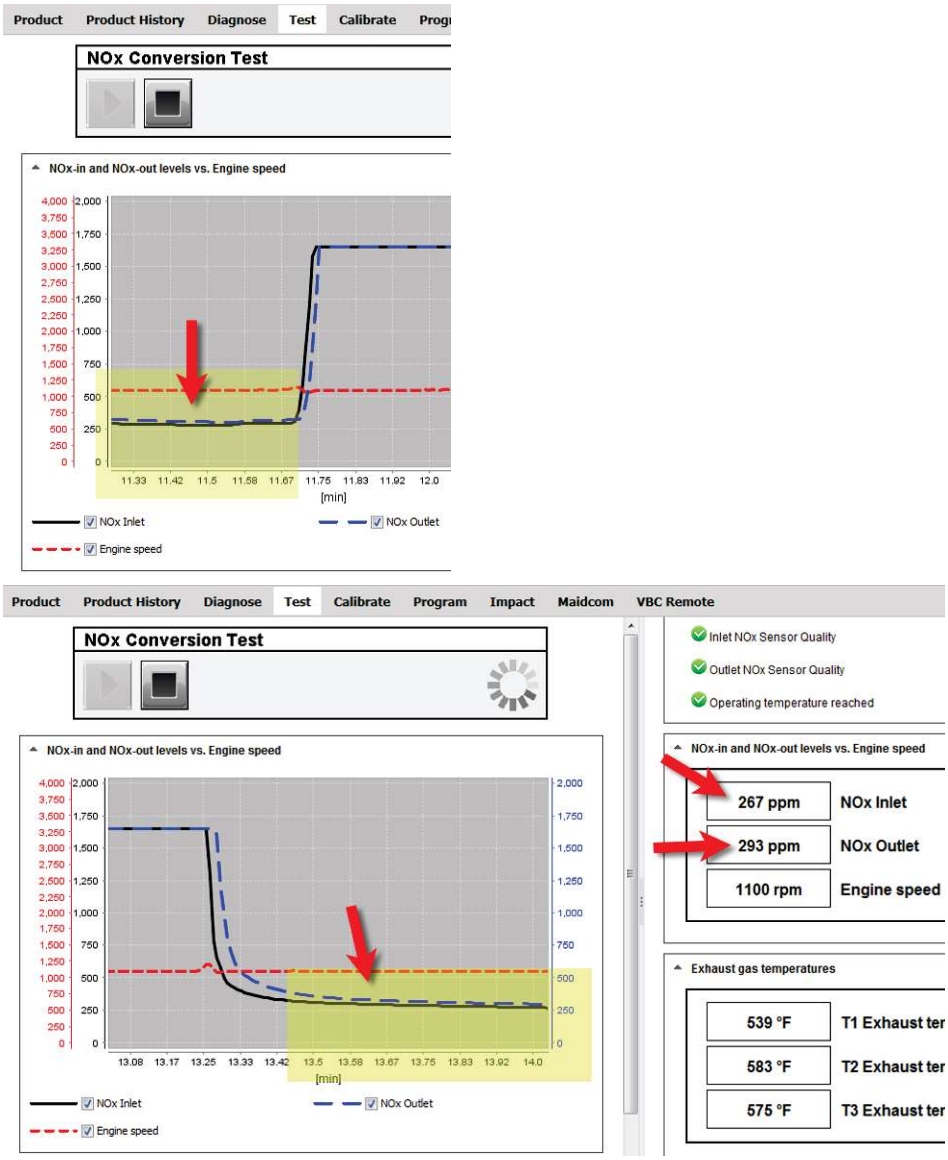
EMS Main Software Part Numbers 23470183 and 23470187, used for US17+OBD18 emissions, has a bug that allows DEF dosing to continue during the NOx conversion test. This causes continued low Outlet NOx sensor values as seen in the screen shot below and prevents

the desired behavior shown above.



In this instance,review earlier sections of the test to ensure that both sensors are responding to changes in the same manner. Examples of different stages to review are shown below.

COMPARISON SHOULD BE DONE WHEN BOTH NOx SENSORS ARE READING BELOW 600 PPM.



V. eService Case

If further assistance is required or tests determine a likely SCR failure, an eService case needs to be opened, the case MUST INCLUDE:

1. The vehicle history as described in Section I.

2. A complete DTC Readout from the time of the vehicle's arrival.

3. Screenshots of:

   - SCR Efficiency values as shown in Section III
   - The NOx Conversion Test as shown in the picture in Section IV.

NOTE: Refer to CBR Solution K52225504 - Methods For Taking A Screenshot

4. A description of findings for each item checked in Section IV, **including numerical values for the**

dosing tests ("Good", "Okay", "In spec", etc. are not acceptable values).

5. Once approval has been received refer to CBR solution K05618059 for an up to date P/N list.

Internal comments (BO)	**For OBD2019 (Truck MY2020, with VIN number ending with LNxxxxxx or LMxxxxxx),** **a. If customer is waiting for the vehicle let dealership follow normal process mentioned in this CBR.** **b. If customer has dropped the vehicle off at dealer in US,please contact Nataraj Bhat (wk1936 onwards), John Whelan (wk1932, wk1933), Nelson Burkholder (wk1934, wk1935) for evaluation. Since we see many P20EE cases, we would like to visit, install data logger or get EATS back for ~10-15 total vehicles.** For GHG 2017 and 2018 cases with P20EE (and /or P103C) evaluate following 6 items: 1. SCR efficiency looks bad (all 5 evaluations hovering around or lower than 80%) 2. NOx conversion just before shutdown looks good (Both NOx sensors are within 10% of each other and values between 200-500ppm). When in doubt replace sensor reading higher value (higher by atleast 10%). 3. DEF quality inspection is good 4. Dosing flow test is good (52-58cc) 5. No other relevant fault codes (EGR system, fuel system) 6. Prior visit got Sulfur regeneration completed and truck is back within 2 weeks for same issue or Truck has P103C (SCR inducement code). If all 6 of the above items are OK, we are OK with replacing SCR (2 Box). Only vehicles having P103C or customers who decides to park the vehicle when MIL is ON (for P20EE) would be considered as requiring one box replacement for Mack vehicles (due to parts shortage of one box mack). Please make sure to collect all the data as per checklist prior to recommending SCR replacement.
Solution visibility	Dealer distribution

Function(s)/component(s) affected

Function affected	Diagnostic tool , SCR , DEF Dosing

Function Group

Function Group	254 catalytic converter; exhaust emission control equipment , 258 emissions after-treatment

Customer effect

Main customer effect	regeneration , diagnostics/methodology , efficiency/abnormal behavior , fault code /display
Fluid implicated	Diesel Exhaust Fluid (DEF)

Fault Codes And Error Codes

OBDII Diagnostic Trouble

Codes (P, U, B Format)	P0422-00 , P103C , P20EE-00 , P225E-00

Conditions

Vehicle operating mode	when driving , when stationary
Frequency of occurrence of problem	random

Administration

Author	UT0031H
Dealer ID	UT0031H
Last modified by	RU4469V
Creation date	05-06-2018 17:06
Date of last update	26-07-2019 15:07
Review date	01-10-2018 00:10
Status	Published
Average score	3.75
Number of scores	4
NA_Reviewer	ut0031h
NA_Author_Group	GTT