

**** SOLUTION ****

Title Diagnostic Trouble Codes (DTC) P20EE And P103C, Diagnostic Procedure; **REPLACE S GUIDED DIAGNOSTICS IN PREMIUM TECH TOOL (PTT) - US17+OBD16 And US17+OBD2018 Emissions, Model Years 2018 And 2019**

Mack Models

Mack Model LR , MRU - TerraPro , TE - TerraPro , AN - Anthem , CHU - Pinnacle, Axle back , C XU - 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

Engine family

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

**** SOLUTION ****

Cause Procedures and checks to follow for P20EE and P103C on US17+OBD2016 and US17+OBD2018 chassis.

Solution

PRIOR TO PROCEEDING

Review open campaigns for the vehicle and ensure that it is NOT listed for Recalls EC0020a, EC0022a, EC0022b, or EC0022c.

IF THE CAMPAIGN APPLIES TO THE VEHICLE:

- No diagnostics are necessary.
- No eService case is necessary.

Follow the recall instructions if the vehicle is listed. This solution should only be utilized if the vehicle is not included in any of the recalls.

CASES AND DIAGNOSTIC TIME REQUESTS OPENED FOR CHASSIS AFFECTED BY ONE OF THE ABOVE RECALLS WILL BE REFUSED.

 **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.

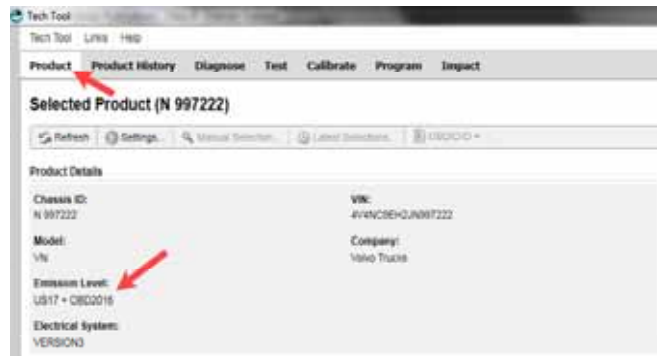
DO NOT REPLACE ANY PARTS UNTIL ALL ACTIVITIES LISTED IN THIS CBR ARE COMPLETE.

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

I. Vehicle Emissions Level

Review the vehicle emissions level

- Details can be found in the Product Details box on the Product tab in PTT as seen below:



- **If the vehicle is US17+OBD16 or US17+OBD18:**
 - Perform Sections II and III below.
 - **If this is the vehicle's FIRST VISIT and there are no contributing DTCs:** Perform a sulfur regen and release the vehicle.
 - **If the vehicle has been in previously for this issue:** Complete all sections below.

II. 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

III. 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.

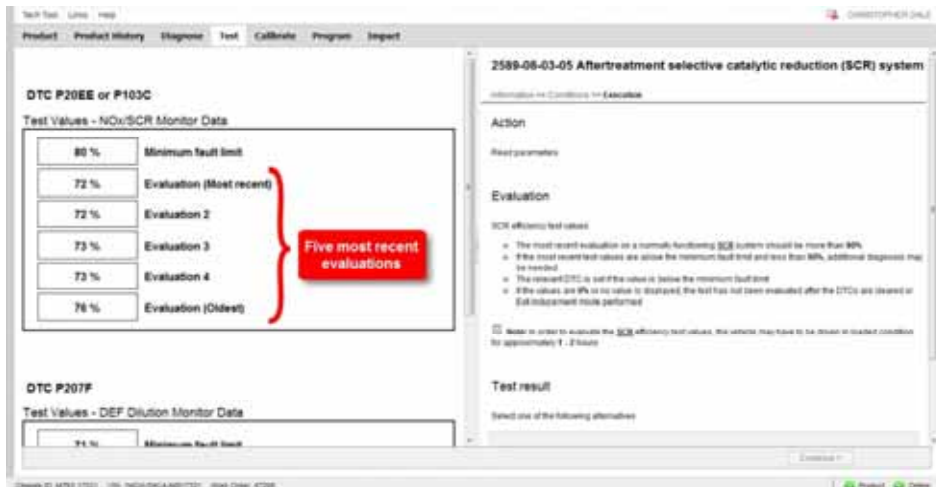
- Are there any codes present for other engine components that would indicate an issue contributing to or causing either P20EE or P103C?

- Examples:

EGR System
 Fuel System (Includes AHI)
 Turbocharger/Boost
 DPF
 Exhaust temperature

IV. 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.

V. 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](#).

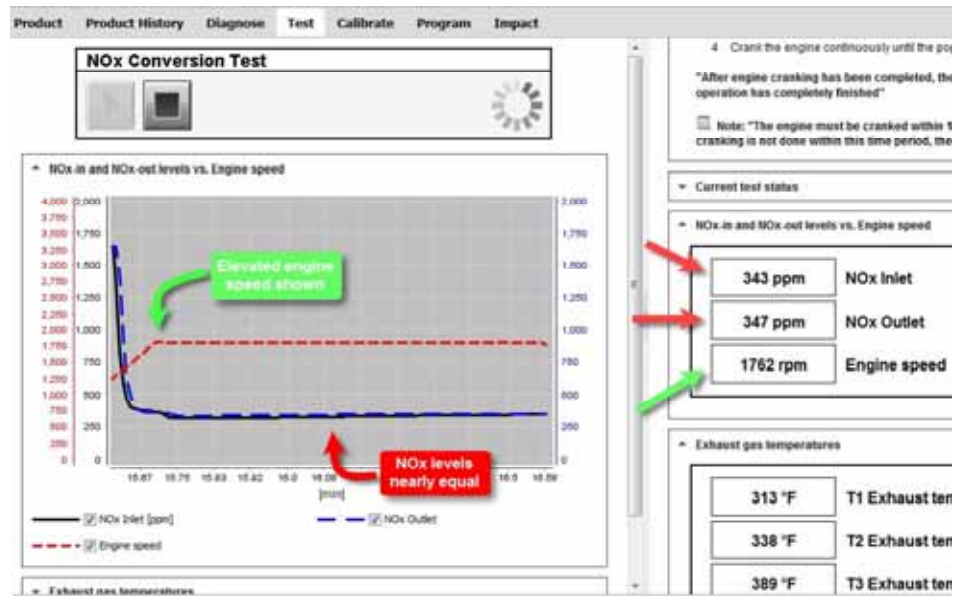
 **WARNING**

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.

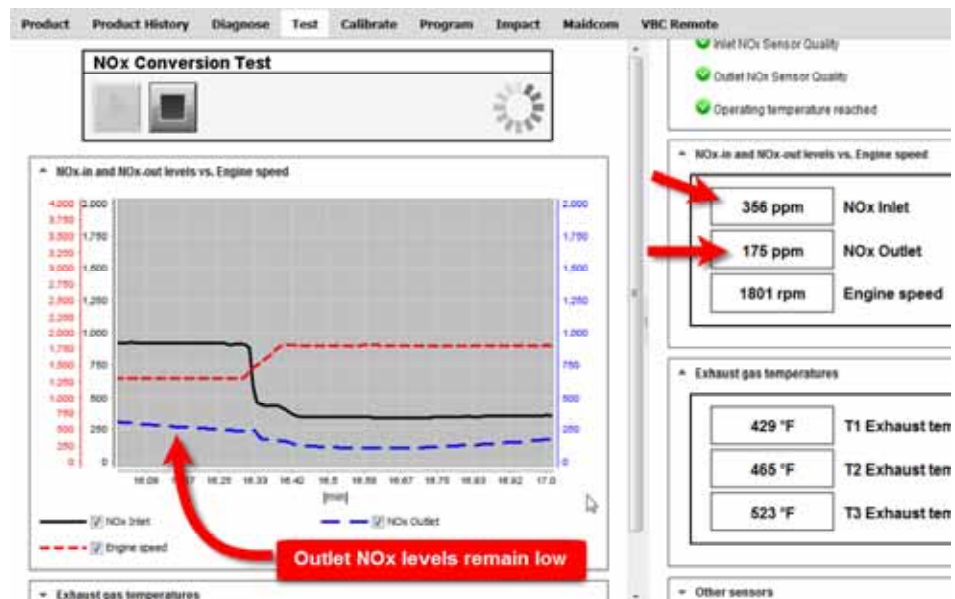
- While running NOx conversion test, if any new NOx sensor codes are logged (Egs: P220E-93, P220F-93), make sure to troubleshoot those codes.
- Inlet and Outlet NOx Sensor values should be close to each other at high engine speed (last portion of the test) as shown below.
- If during the test difference 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.



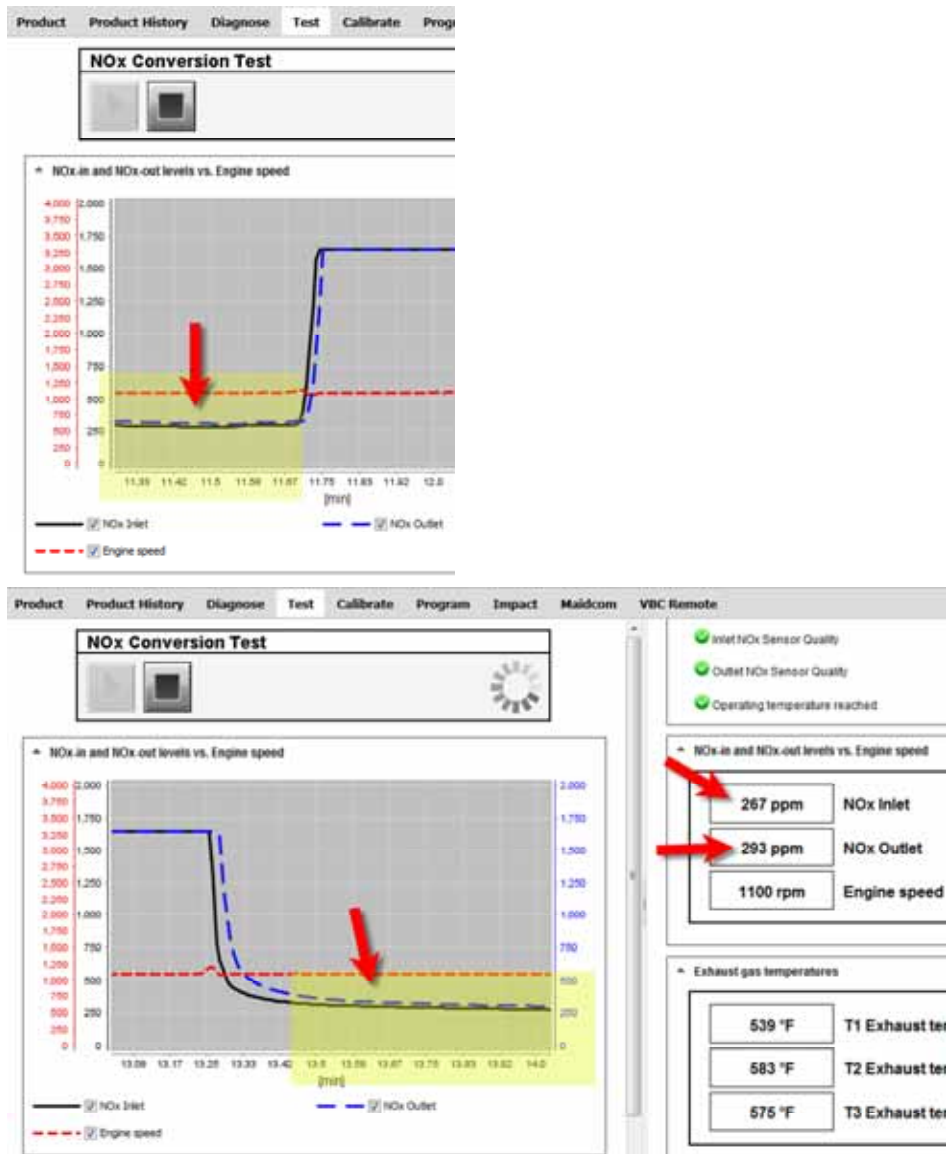
- If the vehicle has EMS Software Part Number 23470183 or 23470187: Refer to the comments below:

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.



VI. 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), there is a new CBR.

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-00 , 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	16-10-2019 20:10
Review date	01-10-2018 00:10
Status	Published
Average score	3.75
Number of scores	4
NA_Reviewer	ut0031h
NA_Author_Group	GTT

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