

**Mack Models**

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| Mack Model | Cabover , Conventional |
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Volvo Models

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| Volvo Model | VNR , VNX , VNL , VNM , VHD , VAH |
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Engine family

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| Engine family | 11L Engine , 13L Engine , 16L Engine , Mack , MP7 , MP8 , MP10 |
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Emission Standard

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|-------------------|---|
| Emission Standard | 2018 , OBD2017 , US17 GHG , US16 , US15 , US13 OBD , US14 GHG |
|-------------------|---|

**** SOLUTION ****

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| Title | Selective Catalytic Reduction (SCR) Efficiency And NOx Sensor Diagnostic Trouble Codes (DTC) P225C, P225E, P221A and P2201: NOx Sensor Diagnostic Information TO BE USED BEFORE SENSOR REPLACEMENT - OBD13 And Newer Emissions (Commonly Model Year 2014 And Newer) |
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| Cause | Diagnostics for codes related to SCR efficiency and NOx sensors may lead to replacement of NOx sensors that are functioning properly. |
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| Solution | DO NOT REPLACE EITHER NOx SENSOR FOR ANY OF THE ABOVE CODES PRIOR TO REVIEWING THE INSTRUCTIONS BELOW |
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The purpose of this article is to prevent unnecessary component replacement. **ALL OTHER DIAGNOSTIC TESTS AND CHECKS MUST BE PERFORMED** when diagnosing one of the codes above if the tests below do not immediately reveal an issue.

If an eService case must be submitted, **ALL INFORMATION** specified in Step Five **MUST** be included at the time the case is opened. Cases missing required information will be Refused.

Overview

Guided Diagnostics for SCR efficiency or NOx sensor fault codes will often result in No Fault Found. This often leads to replacement of one or both sensors despite no indication from diagnostic steps to do so. NOx sensor function is a possible cause, and is listed as such for the code description in the DTC description in Premium Tech Tool (PTT). However although the sensors themselves are a possibility, **NOx sensor codes are most often a symptom, not a cause of emissions issues**. NOx sensors should be confirmed to be reading incorrectly or functioning erratically before they are replaced.

Fault Codes

A complete list of DTCs related to this Solution can be found in the Fault Codes section below.

Procedure

- Review the Detailed Status Information for the relevant code on the DTC Readout.



DTC List (2 items)

| Control Unit | DTC | Status |
|-----------------------------|--|--------|
| Brake ECU (MD 136) | SID 69: Axel load sensor, FM 2: Data erratic, intermittent, or incorrect | Active |
| Engine Control Module (EMS) | P229F64: NOx Sensor Gas Outlet Removal, Signal Plausibility Failure | Active |

NOx Sensor Gas Outlet Removal

Detailed status information

| Title | Value |
|---|-------|
| Confirmed DTC | True |
| Pending DTC | False |
| Test failed | True |
| Test failed since last clear | True |
| Test failed this operation cycle | True |
| Test not completed since last clear | False |
| Test not completed this operation cycle | False |
| Warning indicator requested | False |

- If Confirmed DTC is **TRUE**: Proceed with diagnostics
- If Confirmed DTC is **FALSE**: Disregard and focus on other symptoms or DTCs relevant to the complaint.

- A NOx Conversion should be run to check NOx sensor signal and function for any of the above codes.

NOTE: A NOx conversion test only checks NOx sensor function. The test compares the readings of the two sensors as the engine cycles through multiple conditions to confirm they are in agreement. **The results of the NOx Conversion test do not indicate anything about the condition of the SCR itself.**

1. In PTT, run Operation [2549-08-03-03 NOx Conversion](#), located under the Test tab.
2. Take screenshots of the graph and sensor values approximately 2-3 minutes prior to engine shutdown. A guide to taking screenshots can be found in [THIS](#) solution.
 - Inlet and Outlet NOx values should be within 40 parts per million (ppm) of one another just before the engine shuts down. Shown below is an example of how a graph

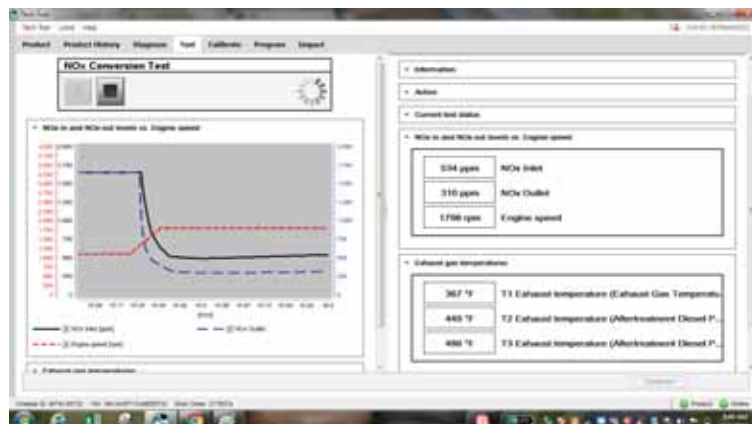
with two properly functioning sensors will look:



3. If no issues are found with the sensor readings from the NOx Conversion review, the sensors are not the source of the conditions causing the codes to log. Further diagnostic steps of other components will need to be performed to determine the cause of the faults.
4. If this solution is being reviewed for P20EE, P207F, P225E or P103C, [the DEF Dosing Valve Solution](#) for the same DTCs should be reviewed for further information.
5. If diagnostic steps do not locate a root cause for the code(s), open an eService case with Dealer Technical Support
 - The screenshot(s) taken of the NOx conversion screen prior to engine shutdown (as shown in the screenshot above) should be attached to the case.
 - A **complete** summary of all tests performed along with **numeric measurements**, a DTC Readout, and any information concerning previous visits and parts replaced must be included when the case is opened.
 - "Ok", "Good" and "Followed GD" are not acceptable descriptions of tests performed and test results.
 - Add the solution numbers for **all** CBR articles followed.

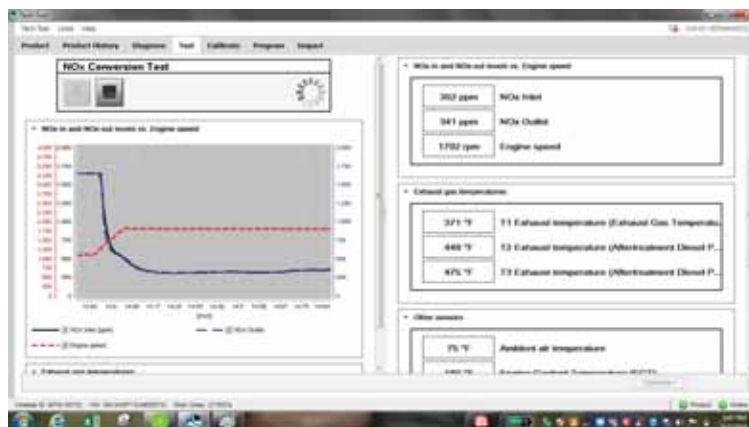
Internal comments (BO)

Multiple cases of the conditions shown in the screenshot below have been observed:



- During the high speed portion of the test, inlet NOx levels remain above 500 ppm, and outlet NOx levels are approximately 300 ppm as expected.
- DTC P220E may be generated when this condition is observed.

Replacement of the sensor returns values to the expected range:




- If the above condition is present:

- Replace the Inlet NOx Sensor
- Have the old NOx sensor sent to Nataraj Bhat:

Volvo Group Trucks Technology (Q&CS)
Drop Area B-3 (Attn – Nataraj Bhat)
13302 Pennsylvania Avenue
Hagerstown, MD 21742

- NOx sensors should be sent to Hagerstown for review on any eService cases opened through 30 June 2018

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| Solution visibility | Dealer distribution |
| Function(s)/component(s) affected | |
| Function affected | DEF Dosing , SCR , 1 1 0 EMS , 2 1 0 ACM , Diagnostic tool |
| 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 | AdBlue |
| Lights/Messages on information display |  Driver's information warning pictogram |

Fault code(s)

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|--------------------------------------|---|
| OBD 2013 Diagnostic Trouble Codes | P221A , P103C , P207F , P20EE , P2201 , P225C , P225E |
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Conditions

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

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| Author | UT0031H |
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| Dealer ID | UT0031H |
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| Last modified by | RU4469V |
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| Creation date | 09-04-2018 19:04 |
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| Date of last update | 16-05-2018 16:05 |
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| Review date | 01-11-2019 00:11 |
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| Status | Published |
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| NA_Reviewer | Nataraj Bhat |
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| NA_Author_Group | GTT |
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