

Diagnostic Trouble Codes (DTC) P20EE And P103C, Diagnostic Procedure; - US17+OBD16 and US17+OBD2018 Emissions, Model Year 2018,2019



> Internal Content

5 JANUARY 2020 UPDATE

There is no longer an eService case required for ANY STEP of the process below. A case should ONLY BE OPENED if further assistance is required to complete diagnosis.

If test results determine an SCR replacement is required, A CASE IS NOT REQUIRED TO ORDER A REPLACEMENT.

Cases submitted solely to request approval to replace an SCR WILL BE REFUSED.

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.

****IMPORTANT****

If this solution is being reviewed for **P225E-00**, solution **CBR-107** must be utilized **FIRST**, and this solution should only be used if the NOx sensors are determined to be functioning.



ng properly. The tests performed in CBR-107 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:

Tech Tool

Tech Tool Links Help

Product Product History Diagnose Test Calibrate Program Impact

Selected Product (N 997222)

Refresh Settings... Manual Selection... Latest Selections... OBD/LVD

Product Details

Chassis ID:	VIN:
N 997222	4V4NC9EH2JN997222
Model:	Company:
VN	Volvo Trucks
Emission Level:	
US17 + OBD2016	
Electrical System:	
VERSION3	

- **If the vehicle is US17+OBD16 or US17+OBD2018:**

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- **Perform Sections II and III below, then:**

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 screenshot shows the Premium Tech Tool (PTT) interface for the 2589-08-03-05 Aftertreatment selective catalytic reduction (SCR) system. The main window is titled "DTC P20EE or P103C" and displays "Test Values - NOx/SCR Monitor Data". The data is presented in a table with the following values:

Value	Description
80 %	Minimum fault limit
72 %	Evaluation (Most recent)
72 %	Evaluation 2
73 %	Evaluation 3
73 %	Evaluation 4
76 %	Evaluation (Oldest)

A red callout box with the text "Five most recent evaluations" is positioned to the right of the evaluation rows, indicating that the last five rows of the table represent the most recent evaluations.

The interface also shows "DTC P207F" and "Test Values - DEF Dilution Monitor Data" with a value of 71 % for the Minimum fault limit. The right-hand pane displays "Action" and "Evaluation" sections, including a note: "Note: In order to evaluate the SCR efficiency test values, the vehicle may have to be driven in loaded condition for approximately 1 - 2 hours".

- The last five efficiency evaluations are displayed as shown in the screenshot above.

Live UI

- 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

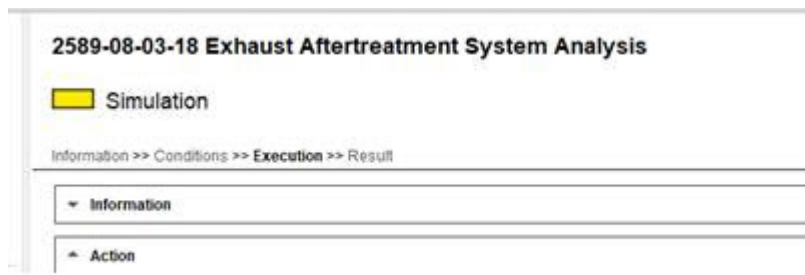
- Located in Operation [2589-08-03-05 Aftertreatment Selective Catalytic Reduction \(SCR\) System](#)
 - Test B from the first screen of the operation
- Test two is the **Small Dosing Test**
 - The test should be run twice and results noted to an accuracy of 2 milliliters
 - Nominal Volume is **55 mL**
 - Acceptable range is 55 mL ± 3 mL

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

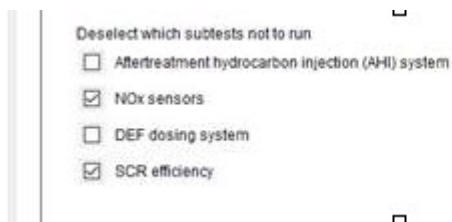
- If vehicle has Turbo-compound system, then do not update EECU MSW. Only EECU MSW 23470187 and older have capability to run NOx conversion test on Turbo-compound vehicles.
- If vehicle has VGT system, then update EECU MSW to 23766686 or newer.

6. If vehicle has a Turbo-compound System, run NOx Conversion, Operation 2549-08-03-03. (only possible if vehicle still has 23470187 and older EECU MSW).

7. If vehicle has a VGT System run Exhaust After-treatment System Analysis, Operation 2589-08-03-18.



Make sure to select only SCR efficiency(priority) and NOx sensors (2nd priority), during selection phase of the test.



VI. eService Case

If further assistance is required to complete diagnosis and an eService case is 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 **KC-908 - 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).

 Tags

p042200 p103c00 p20ee00 p225e00
p0422-00 p103c-00 p20ee-00 p225e-00
k65527708 mack volvo

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Related links and attachments

No links or attachments available



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Methods For Taking A Screenshot / Screen Capture For eService Cases Or Other Use; Premium Tech Tool (PTT) And Other Software



> Internal Content

Overview

There are a variety of reasons a screenshot may be needed for review. Diagnostic Trouble Code Readouts, PTT errors, product or control unit information, diagnostic test results, steps and messages, and oscilloscope readings name a few.

There are tools available to capture a screenshot, and Windows itself also has the ability to copy a screenshot to the clipboard without launching a program. This solution will cover the two methods that can be used on most every computer. If there is other imaging software installed on a computer that allows screen captures (Snagit, Jing, and FastStone Capture are a few examples), the software instructions will need to be followed.

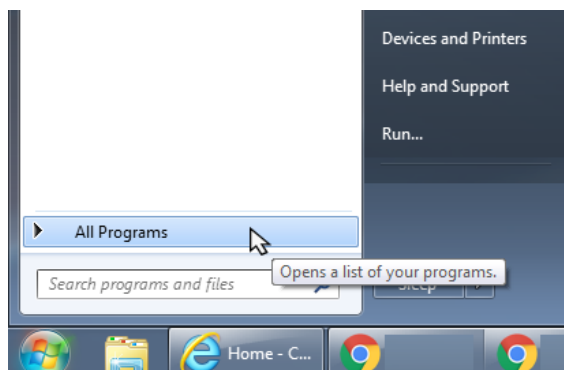
Procedure

I. Using The Windows Snipping Tool

Computers running Windows XP or newer (Windows 7, Windows 8, Windows 10) have the Snipping Tool utility installed as part of the Windows software package. The Snipping Tool allows shots to be taken of specific parts of the screen, speeding the process of capturing and saving a screenshot.

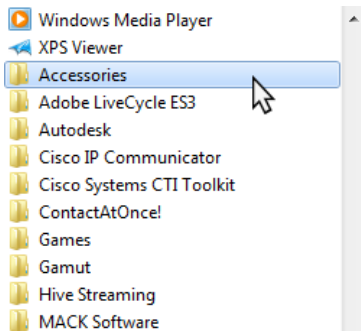
For Windows XP, Windows 7, and Windows 10:

1. Click on the Start Menu, then mouse over or click on All Programs:

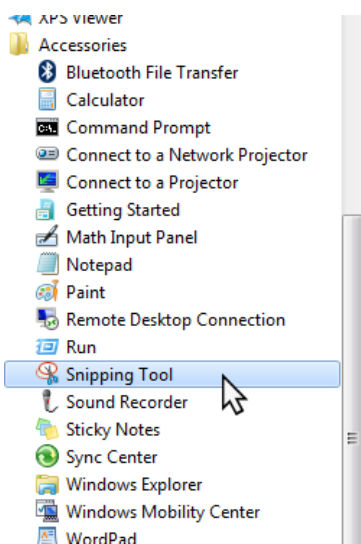


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2. Scroll through the list of programs and find the Accessories folder:



3. Click on the Accessories folder, then find the Snipping Tool. Click to open the program.



For Windows 8:

1. Click the Start button to bring up the Start Screen

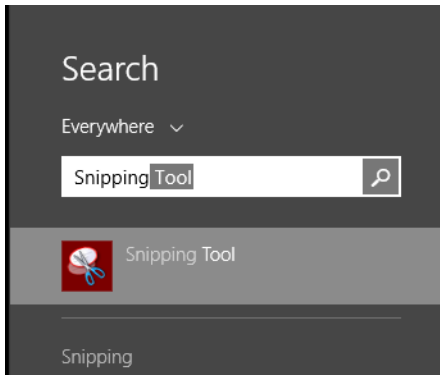


2. Click the Search button (magnifying glass) in the upper right-hand corner of the screen



Live UI

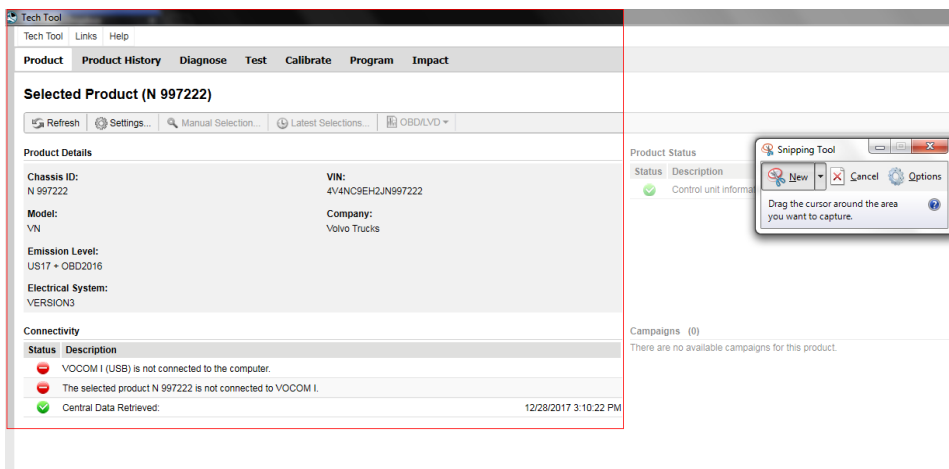
3. Type "Snipping Tool" into the search bar. Click on Snipping Tool to open the program



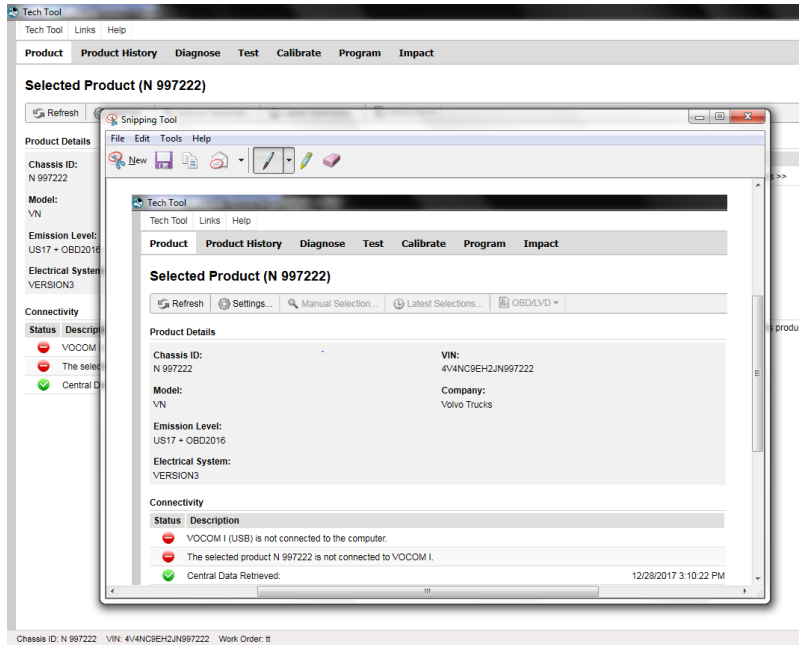
For all Windows versions:

4. The Snipping Tool will open ready to capture a shot. The cursor should change to a cross icon. If the capture doesn't start automatically, click the New button in the Snipping Tool Window.

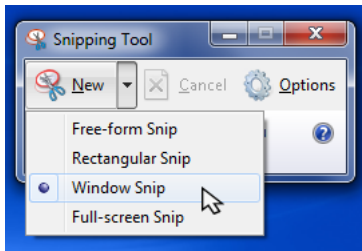
4a. Move the cursor to where one corner of the screenshot should be. Click and hold the left mouse button, then drag the mouse to the opposite corner of the desired shot:



4b. When the left mouse button is released, Snipping Tool will capture the highlighted area and open it in a preview window:



5. If a shot of a complete window is needed, click the dropdown icon (down arrow) next to the New button in the Snipping Tool and select Window Snip. Clicking once on the desired window to copy will open a screenshot of the full window in the preview pane:



6. Click on the Save (Disk) icon in the preview window. Save the file to desktop or a folder where it can be located. Attach the file to the eService case as needed.

II. Using The Print Screen Key

1. If the screenshot will be of a specific window, make sure the window is maximized first.



2. To capture a screenshot of the full screen, press the Print Screen key on the keyboard. **NOTE:** Many laptops have Print Screen sharing a key with another function. It may be necessary to hold the Function key

... (key marked as Fn) as Print Screen is pressed





Wired keyboard

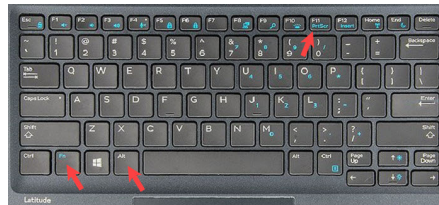


Laptop keyboard

2a. If taking a shot of a specific window, holding the Alt key and pressing Print Screen (Alt+Fn+Print Screen on a laptop) will only capture the contents of the currently selected window



Wired keyboard



Laptop keyboard

3. Open MS Paint

- **For Windows XP and Windows 7** Paint is located in the Accessories folder of the Start menu, follow the above steps for locating Snipping Tool

- **For Windows 8** Follow the steps for the Snipping Tool above to go to the Search box on the Start screen. Search for Paint

4. With Paint open, press either Ctrl+V on the keyboard to paste the screenshot, click the Paste button in the upper left-hand corner of the screen (Windows 7), or select Paste from the Edit menu at the top of the screen (Windows XP). The screenshot will appear in the drawing area.

5. Save the screenshot to Desktop or another folder where it can be easily located. Attach it to the eService case as needed.

 Tags

[k52225504](#) [us04](#) [us07](#) [us10](#) [us10+obd13](#)
[us14+obd13](#) [us14+obd15](#) [us14+obd16](#)
[us17+obd16](#) [us17+obd18](#) [vn](#) [vah](#) [vhd](#)
[vt](#) [11l engine](#) [13l engine](#) [16l engine](#) [mp7](#)
[mp8](#) [mp10](#) [cu15](#) [cu12 cng](#) [cu9 cng](#)
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Related links and attachments

No links or attachments available

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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 20



> Internal Content

DO NOT REPLACE EITHER NOx SENSOR FOR ANY OF THE FOLLOWING CODES (P2201, P221A, P225C, P225E, P20EE, P207F, P103C) PRIOR TO REVIEWING THE INSTRUCTIONS BELOW

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



View 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, FMI 2: Data erratic, intermittent, or incorrect	Active
Engine Control Module (EMS)	P229F64: NOx Sensor Gas Outlet Removed, Signal Plausibility Failure	Active 

NOx Sensor Gas Outlet Removed

⊖ 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

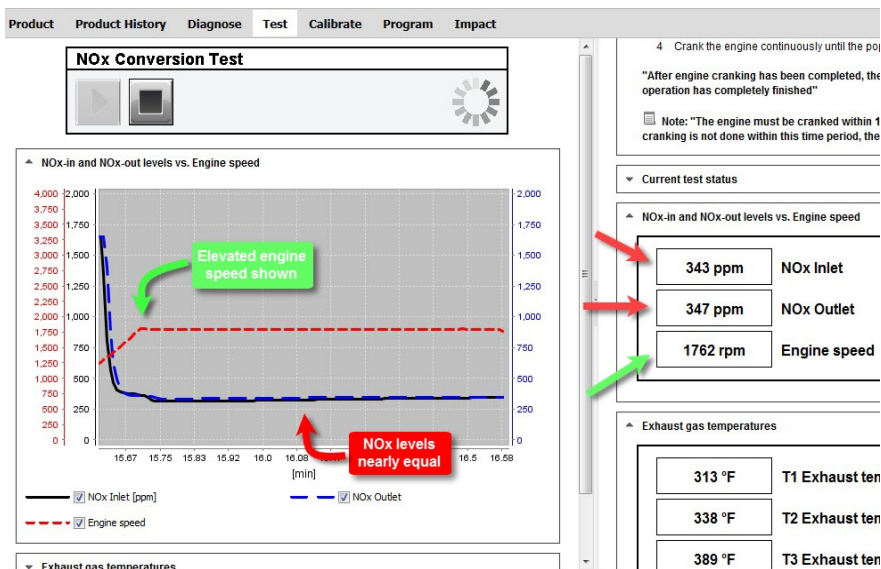
- If Confirmed DTC is **TRUE**: Proceed with diagnostics
- If Confirmed DTC is **FALSE**: Disregard and focus on other symptoms or DTCs relevant to the complaint.

- 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. While running the routine if you get new NOx sensor fault code (Egs: P220E-93 , P220F-93), then troubleshoot that fault code. Typically P220E-93 fault code suggests replacement of NOx1 sensor.
3. 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:



4. 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.

5. 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.

6. 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.

 Tags

- [k15560422](#)
- [p2201-64](#)
- [p221a-00](#)
- [p225c-00](#)
- [p225e-00](#)
- [p220164](#)
- [p221a00](#)
- [p225c00](#)
- [p225e00](#)

Related links and attachments

- [KC-104](#)
- [KC-908](#)

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