

P21CA00 And Other Power Faults Leading To Communication Faults And SCR Inducement (Derate)



Background

Related links and attachments

No content available

It is possible that a progressive loss of electrical power to the Aftertreatment Control Module (ACM) will result in the ACM cutting power to the Exhaust Aftertreatment System (EATS) sensors – NOx, Particulate Matter (PM) and DEF Quality, Level and Temperature sensor. This triggers communication faults for these sensors and ultimately puts the system into SCR Inducement. The root cause is often related to loss of power or battery voltage and/or grounding issues. The instruction below describes the most likely causes and provides steps for troubleshooting.

Symptoms

- Presence of P21CA along with other ACM power and communication faults P220A, P220B, P24D0, U029D, U029E, U02A2, U02A3, P0562.
- SCR inducement and/or derate.

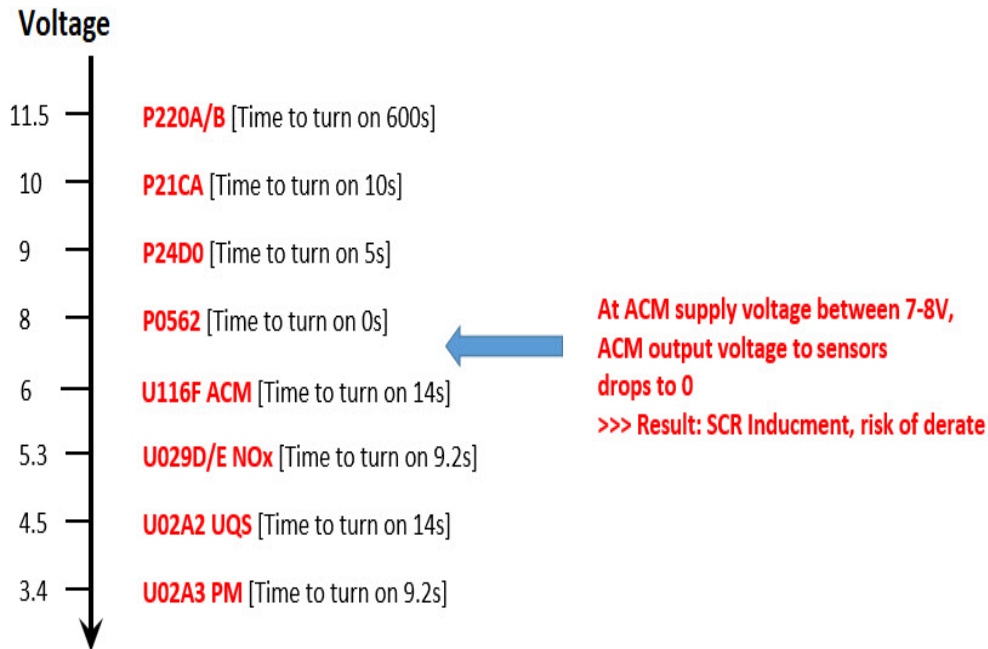
P21CA00	Reductant Control Module Supply Voltage
P220A1C	NOx Sensor Supply Voltage Circuit (Bank 1 Sensor 1)
P220B1C	NOx Sensor Supply Voltage Circuit (Bank 1 Sensor 2)
P24D000	Particulate Matter Sensor Supply Voltage Circuit Low
U029D00	Lost Communication With NOx Sensor "A"
U029E00	Lost Communication With NOx Sensor "B"
U02A200	Lost Communication with Reductant Quality Module
U02A300	Lost Communication With PM Sensor
P056200	ECU Battery Potential Below Range

This pattern of codes indicates that there are issues with the ACM power supply or ground connections. Typically, this combination develops over time as a connection deteriorates. Eventually the effective voltage to the ACM drops below 8V and there is insufficient power to support the sensors controlled by the ACM - NOx, PM and DEF level/temp sensors. Communication is lost to these devices.

Once sensor communication codes (U029D, U029E, U02A2) are triggered, the truck will go into SCR Inducement followed by derate.

The graphic below shows the voltage related DTCs for emissions components, as well as the voltage at which they will set and the amount of time that voltage must remain at that level for the fault to

log. **This graphic is for informational purposes only and should not be used for diagnosis.**



Diagnosis And Repair

IMPORTANT

Presence of any combinations of P24D0, P21CA, P0562, generally does NOT indicate the ACM is 'bad' or a PM sensor is 'bad'.

Required Tools

Part Number	Description	Quantity
9998699	Break-Out Box	1
9990014	62-Pin ACM Connector Harness	1
88890074 (or equivalent)	Multimeter	1

Initial Checks

This combination of faults is frequently caused by a loose or faulty connection on battery power or ground (but not fully disconnected - if fully disconnected, DTCs U116F and U010E would also be present).

- **Check that ALL the ACM power and ground connections are securely tightened.**

- Ensure battery nuts are tightened to 15 lb-ft (20 Nm).

- Ensure multiple ring terminals on a common stud are fanned out and lying flat against each other.
- Ensure ring terminals and other contact points are clean and free from any terminal protectant coating or wax.

• **If there is no evidence of loose battery connections:** Continue to the checks below.

Other items to check

1. Check the battery condition as follows:

1.1. Check the complete battery pack voltage.

1.1.1. Start the truck.

1.1.2. Run the engine at fast idle (1000 RPM) for 1 minute.

1.1.3. Turn the truck off, then return the key to the ON position.

1.1.4. Check voltage with all of the batteries still connected to one another.

- All battery positive terminals are connected together by busbars or cables, and all battery negative terminals are connected together.

1.1.5. Make a note of the voltage and evaluate results:

- For a fully charged system, in good condition, the voltage should be 12.4 - 12.6V for standard flooded lead-acid batteries, or 12.6 - 12.8V for AGM-type batteries.
- Low battery voltage is indicative of an inadequate charging system
 - Potential causes include corroded cables, dirty connections and/or weak or defective batteries.

1.2. Check individual battery condition.

1.2.1. Disconnect the busbars and cables.

1.2.2. Inspect and clean all interconnecting terminals. Ensure there is no corrosion.

1.2.3. Check each battery voltage and perform a load test on each battery individually.

1.2.4. Evaluate results:

- **If one battery's voltage is significantly lower than the others, or lower than the measurement from Step 1.1.5, OR fails a load test:** The battery may be bad or there may be a connection issue such as excessive corrosion on the busbar or terminal, inhibiting proper charging.

1.2.5. Replace or clean any corroded part as needed.

1.2.6. Reconnect the busbars and/or cables.

1.3. Check the battery pack voltage while charging system is active.

1.3.1. Start the truck.

1.3.2. Run the engine at fast idle (1000 RPM) for 1 minute.

1.3.3. With the engine still running, recheck battery voltage:

- Voltage should rise to 13.5-14.5V rapidly.
- **If the voltage is less than 13V:** Run then engine for an additional minute and recheck, as the batteries may have been deeply discharged.

1.3.4. Evaluate results:

- **If the voltage remains less than 13V:** There is an issue with the alternator or the alternator belt.
- If the alternator belt is in good condition, there is an issue with the alternator.

For the following 2 checks, use the ACM ring terminal at the frame rail as a reference.

NOTE: Ensure clean contact is made to the meter probes.

2. With key on, engine off, verify battery power feed to ACM pins 53, 57, and 60 is the same as same as battery voltage (Vbat).

3. Verify that ACM pin 3 also sees Vbat (this is the ignition voltage pin). If the ACM is not seeing Vbat there is an issue in the power supply path from battery power to ACM (check in-line fuse, wiring, etc.).

4. Verify voltage at the ACM grounds pins 55, 58, and 61, relative to the battery negative is <0.5V with ignition on.

- **If the difference is greater than 0.5V:** there may be an issue with elevated resistance on the ground path (corrosion on the ring terminal; corroded, damaged, or loose pins; etc.).

5. Verify that ACM pin 49 shows a constant voltage close to Vbat relative to the ground ring terminal as follows:

- **If pin 49 shows 9-11V:** This is a sign of reduced voltage. There could be something causing an intermittent voltage drop.

- Examples include corrosion on the ground path, chafed wire, water intrusion, etc.

- **If pin 49 shows <5 V:** There is a definite voltage drop below normal—see potential causes above.

For the following checks, individual sensors will trigger communication faults when they are disconnected from the EATS harness. These steps are necessary for diagnosis and the faults may be cleared afterward.

If pin 49 voltage is still dropping below expected voltage:

Work through the following steps one sensor at a time in the following order:

- PM Sensor
- DEF Quality (level and temperature) Sensor
- Inlet NOx Sensor
- Outlet NOx Sensor

• **For each sensor:**

1. Cycle the key off.
2. Allow the system to fully power down for 1 minute.
3. Unplug the sensor and cycle power back on.

- **If the voltage at pin 49 recovers to Vbat:** There is an issue with the sensor being checked.
- **If the voltage reading remains unchanged:** Another component is the culprit. Reconnect the sensor being checked

and proceed to the next sensor

- **If a sensor is found to be faulty:**

- Check for the presence of corrosion or contamination in the sensor connector.
- Corrosion can also appear on the mating harness connector and this should be addressed to ensure integrity of connection.

- **For any trucks that show PM sensor issues:** Verify that the exhaust pipe contamination fix is implemented.

- See [FSB 284-069 Exhaust Particulate Sensor, Repair \(2017 Vehicles\)](#). This applies to vehicles manufactured between 1/1/2017 and 11/15/2017.
 - FSB 284-069 can be found under the Service tab of [Impact](#).
 - Search for "284-069" (Without quotes) under the Additional Search Values section. Make sure 'Titles' is selected from the dropdown menu.

- **If sensors are NOT found to be the problem and pin 49 voltage is still dropping below expected voltage:**

1. Cycle the key off. Allow the system to fully power down for 1 minute.
2. Disconnect the DPF/EATS harness.

- **If voltage is restored from this exercise:** Then the issue is in the harness.
- **If voltage remains the same:** Repeat for the jumper harness to the DEF Quality Sensor and pump.

3. Inspect the harness found to be causing voltage drop..

- Harness issues such as water intrusion, damaged harness, etc. can cause short circuits, and affect voltage.

 Tags

[P21CA00](#)

[P220A1C](#)

[P220B1C](#)

[P24D000](#)

[U029D00](#)

[U029E00](#)

[U02A200](#)

[U02A300](#)

P056200	P21CA-00	P220A-1C	U02A3-00
P0562-00	ACM POWER	EATS DATALINK	
P220B-1C	P24D0-00	U029D-00	U029E-00
U02A2-00			



Feedback

[Give feedback](#) to help improve the content of this article

Service

Chassis ID	Path 284/Bulletins/Information//FSB 284-069, Exhaust Particulate Sensor, Repair (2017 Vehicles)
Model	Identity 145526930
Publish date	ID/Operation 7/16/2020

FSB 284-069, Exhaust Particulate Sensor, Repair (2017 Vehicles)

(July 2020)

Some trucks built between 1/1/2017 and 11/15/2017 may experience a Particulate Matter (PM) Sensor fault that can result in the MIL lamp illuminating. These faults may be P24DA, "PM Sensor Exhaust Sample Error," or P24D1, "PM Sensor Regen Incomplete." These faults may be caused by contamination of the PM sensor. In order to reduce the likelihood of sensor contamination, new exhaust pipe parts are being made available that contain an internal water management feature along with an integrated drain that will prevent contamination of the sensor. If either of these two faults occur, follow the instructions outlined in this bulletin to clean the exhaust pipes and install a new exhaust pipe with the new contamination prevention measures.

Required Parts – All Years

Inspect and replace the v-band clamp as needed

A new gasket will be needed when disconnecting the SCR exit.

Note: No gasket needed for vertical SCR.

Part Description	Part Number
SCR Gasket	21095726
V-band Clamp	21021850
Particulate Matter Sensor	23320447

Note: Customer adaptations can change required parts. Check for adaptations before ordering parts. (For example, under-slung exhaust)

Repair Procedure

Determine which Flex Pipe and Clamp the truck currently has installed on it. If the truck you are repairing has the Flex Pipe and Clamp shown in scenario 1, you will need to order the improved Flex Pipe (P/N 21142254) and Clamp (P/N 25172497). If the truck you are repairing has the Flex Pipe and Clamp shown in scenario 2, this truck already has the improved parts and ordering a new Flex Pipe and Clamp is NOT required.

	<p>Scenario 1</p> <p>This style Flex Pipe and Clamp will no longer work with the upper adjacent connecting pipe. The below parts in scenario 2 are required to perform this FSB.</p>
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Follow the repair below that is applicable for your configuration.

Scenario 2

This style Flex Pipe and Clamp only needs the upper adjacent pipe replaced. Reuse the existing Flex Pipe and Clamp, or order as needed.

Flex Pipe –
21142254

Clamp –
25172497



Follow the repair below that is applicable for your configuration.

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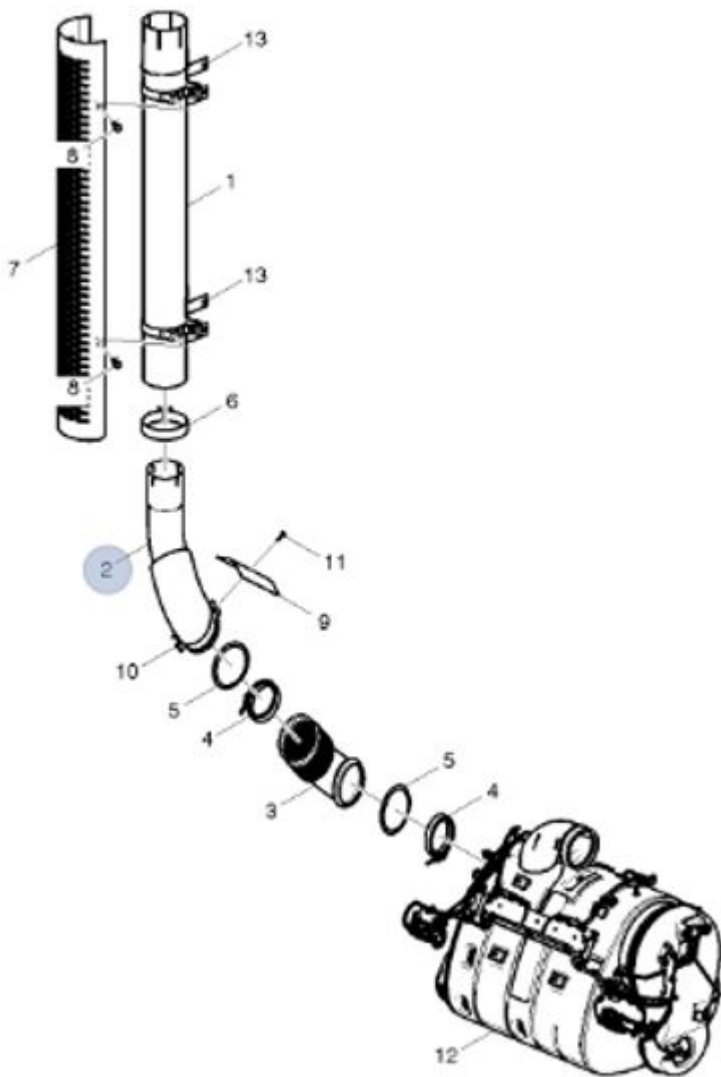
Model	Cab Type	Exhaust Configuration	Repair Number
VNL	Day Cab	Single Outlet Right Side Outboard	1
VHD Axle Fwd	Day Cab	Single Outlet Right Side Outboard	2
VNM, VHD Axle Bwd	Day Cab	Single Outlet Right Side Outboard	3
VHD Axle Bwd	Day Cab	Dual Outlet	4
VHD Axle Fwd	Day Cab	Dual Outlet	4
VNM, VHD, VNL	Sleeper Cabs	Single Outlet Right Side	5

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		Outboard Dual Outlet	
VNM, VHD, VNL	Sleeper Cabs	Single Outlet Right Side Outboard Dual Outlet	6

Repair 1

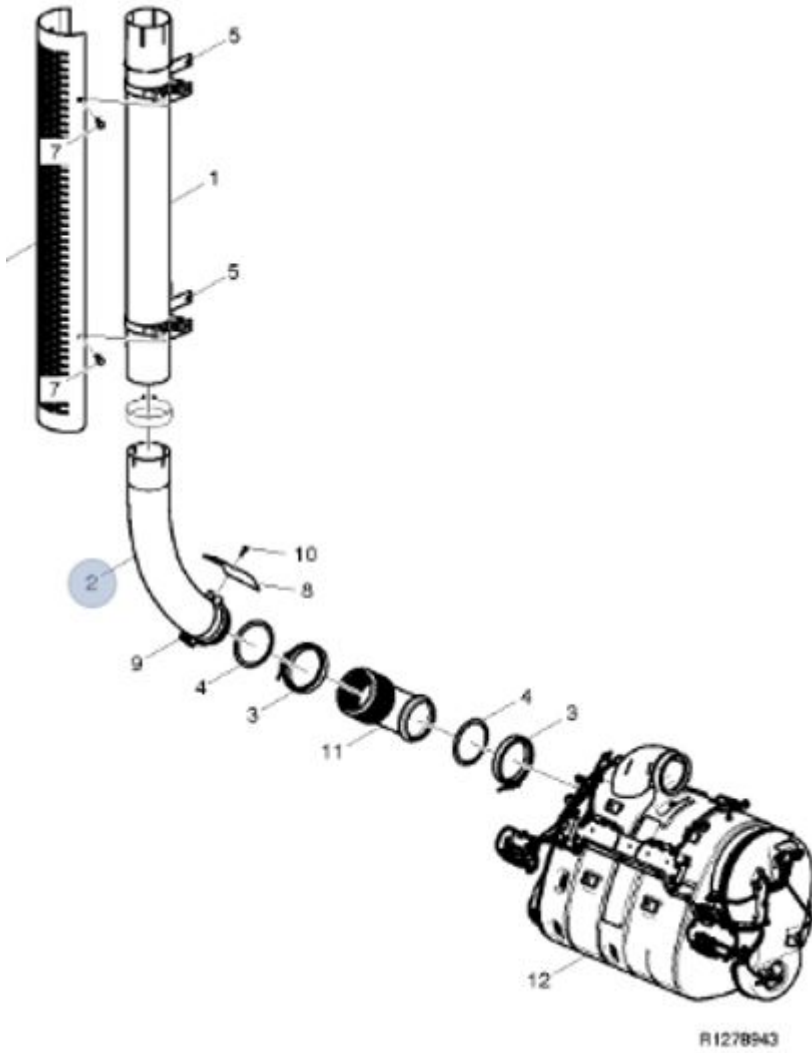


Model	Cab Type	Exhaust Configuration	Pipe 1 (Stack)	Pipe 2 (SCR Elbow)	Flex Pipe	Clamp
VNL	Day Cab	Single Outlet Right Side Outboard	23873123	22181981	20442244	Clamp 25172497 x 2

Repair 2

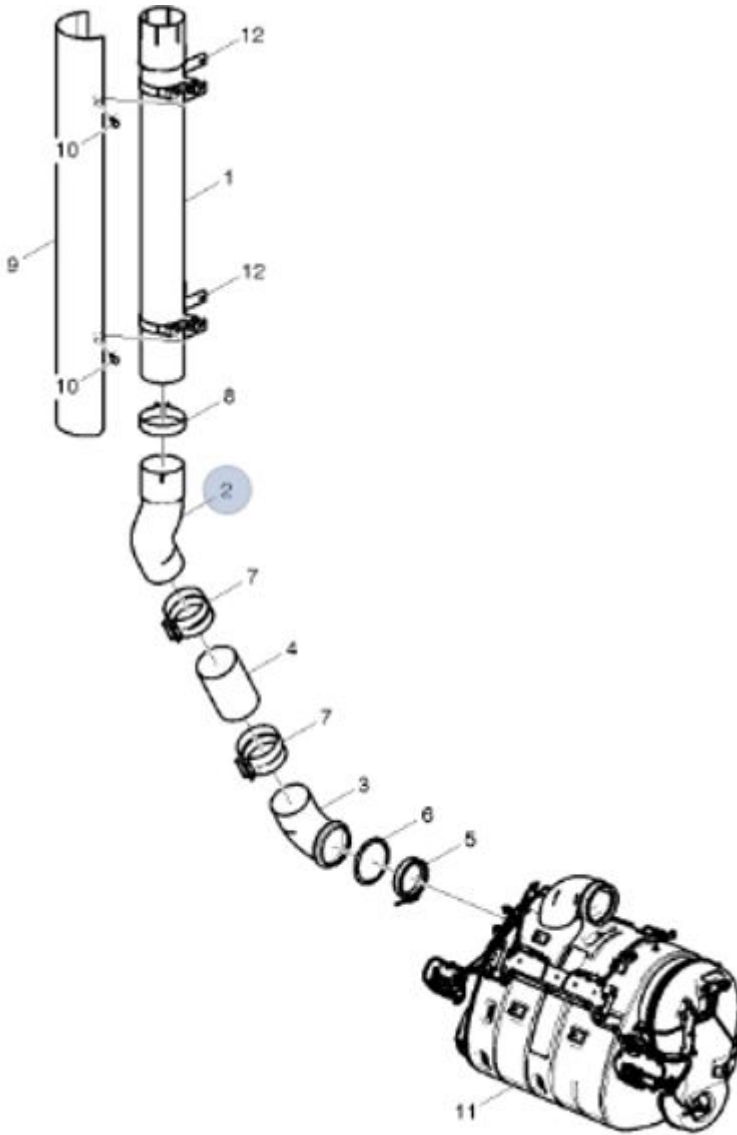
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Model	Cab Type	Exhaust Configuration	Pipe 1
VNM	Day	Single Outlet Right Side	23630037
VHD	Cab	Inboard	

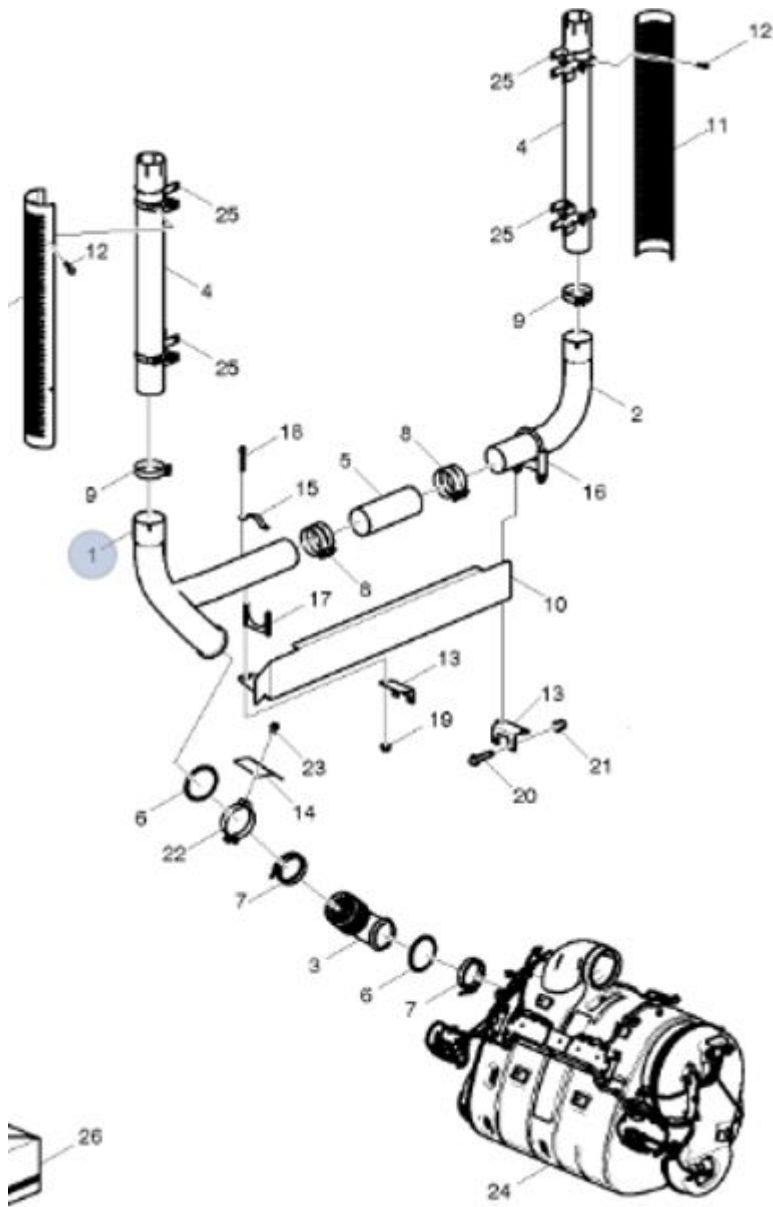
Repair 3



R1229745

Model	Cab Type	Exhaust Configuration	Pipe 1
VNM /VHD	430/630 Sleeper	Single Outlet Right Side Inboard	(Not Bright) 23154798
			 <p>Caution</p>
			(Bright) 23154799

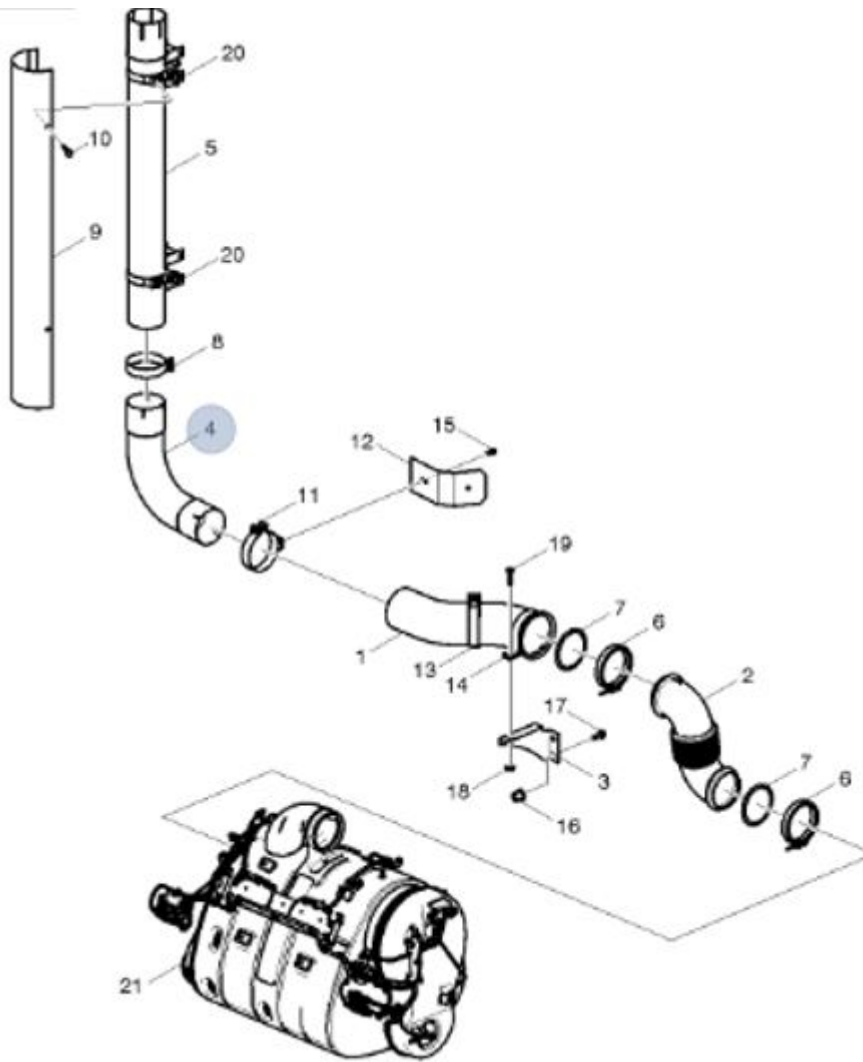
Repair 4



R1241574

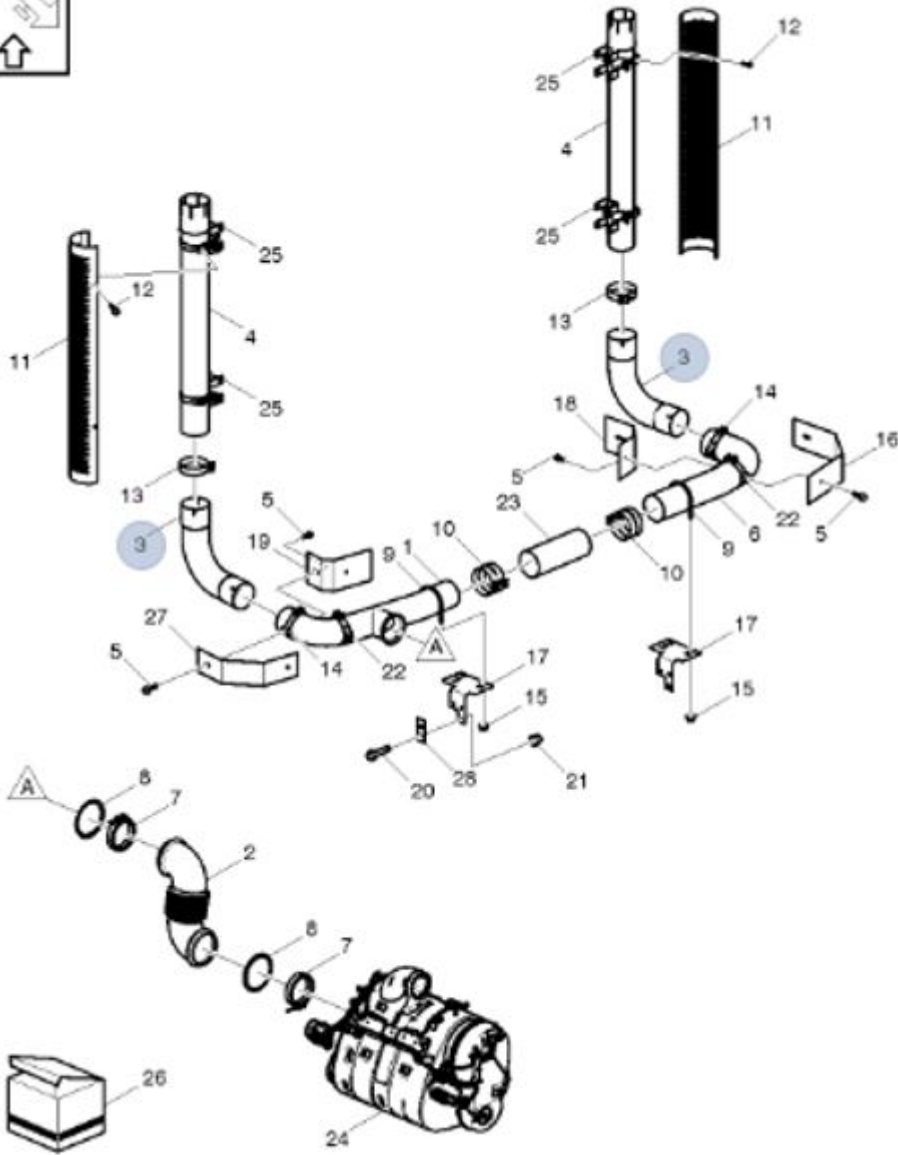
Model	Cab Type	Exhaust Configuration	Pipe 1
VHD Axle Bwd	Day Cab	Dual Outlet	23155774
VHD Axle Fd	Day Cab	Dual Outlet	23155785

Repair 5



Model	Cab Type	Exhaust Configuration	Pipe 1
VNM	Sleeper	Single Outlet Right	(Not Bright)
VHD	Cabs	Side Outboard	23154798
VNL			(Bright) 23154799

Repair 6

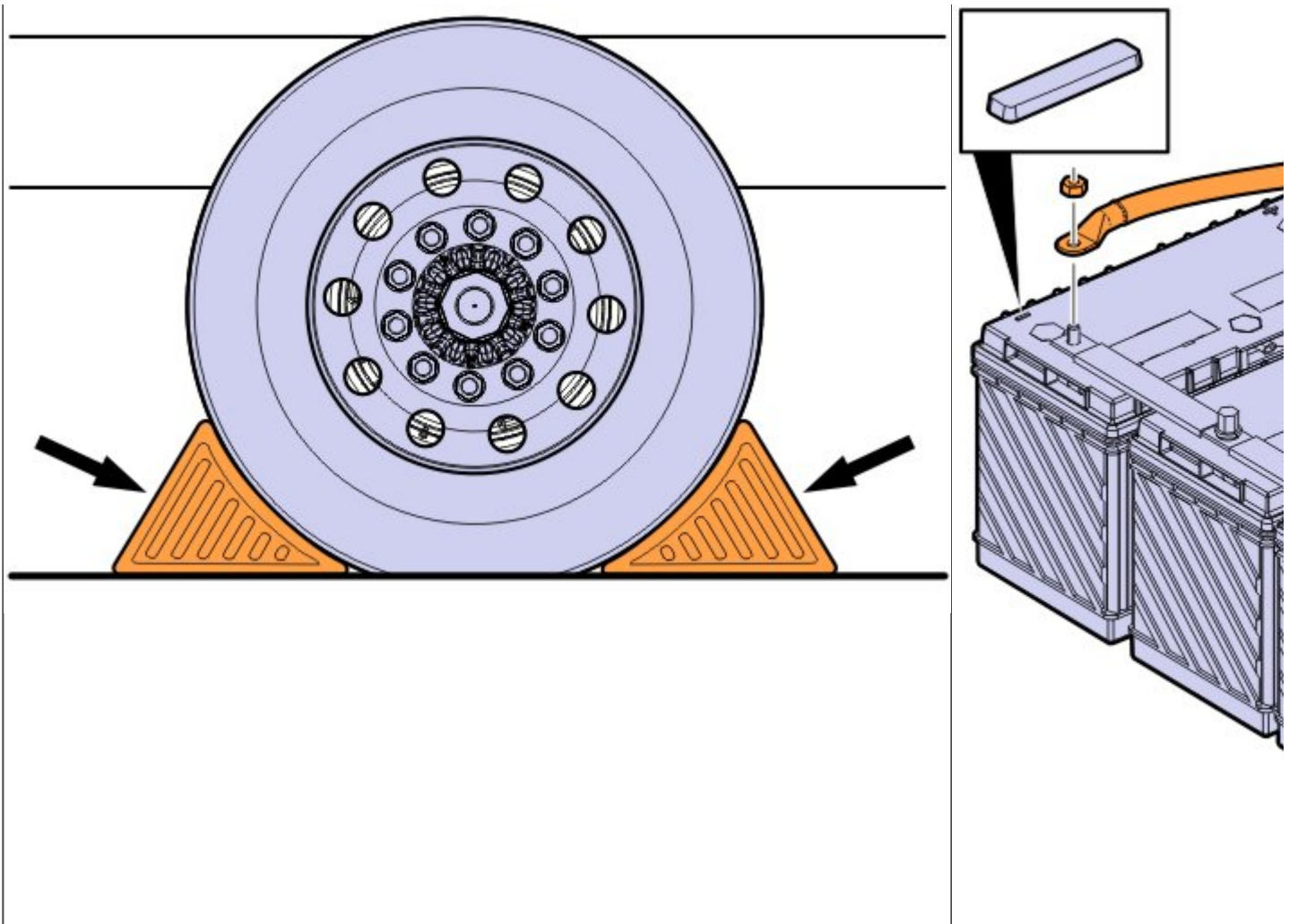


Model	Cab Type	Exhaust Configuration	Pipe 1	Note
VNM	Sleeper	Dual Outlet	(Not Bright)	Requires 2 elbows per chassis
VHD	Cabs	Right Side	23154798 (Bright)	
VNL		Outboard	23154799	

Instructions

- Decommission the vehicle. Install wheel chocks and disconnect the battery.





- . Remove the PM sensor and module.
- . Remove all exhaust pipes up to the SCR outlet pipe.
- . Pressure wash the inside of each pipe that will be reused.
- . Reassemble the exhaust system using the new parts referenced in the table above.
- . Mark the SCR outlet pipe 1.5" from the end also mark the new pipe (not flex) 1.5" from its inlet.
- . Slip the flex pipe as far over the SCR outlet pipe as possible.
- . Install the new exhaust pipe.
- . Using a new clamp assemble the new exhaust pipe to the new flex pipe using the 1.5" mark to get the correct amount of overlap.
- . Slide the assembly into place using the 1.5" mark on the SCR outlet as a reference point and to ensure the correct amount of overlap, once in both pipes are in place use clamps to secure.

Note: Correct installation is achieved when the flex pipe is in a "relaxed" state, there should be no compression or expansion visible on opposing sides of the pipe after installed.

- . Install the new PM sensor and module.

Note: Do not use any lubricant of any kind on the PM sensor threads.

Note: Align the tab on the sensor with the slot.

- . Torque the sensor to 35 +/- 5 Nm (26 +/- 4 Ft lb)
- . Install the sensor module.
- . Torque the nuts to
 - M6: 10 +/- 5 Nm (88 +/- 3 in lb)
 - M8: 24 +/- 4 Nm (17.1 +/- 3 ft lb)

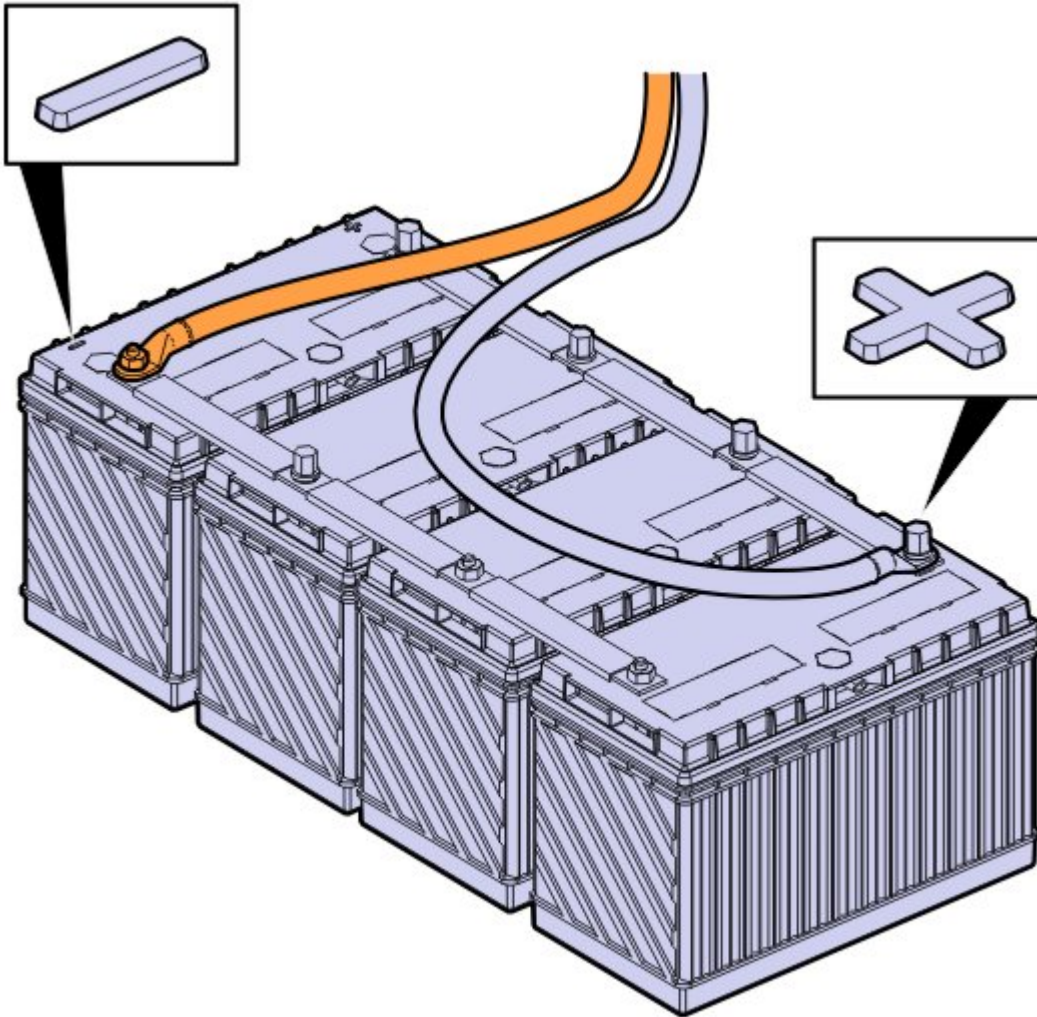
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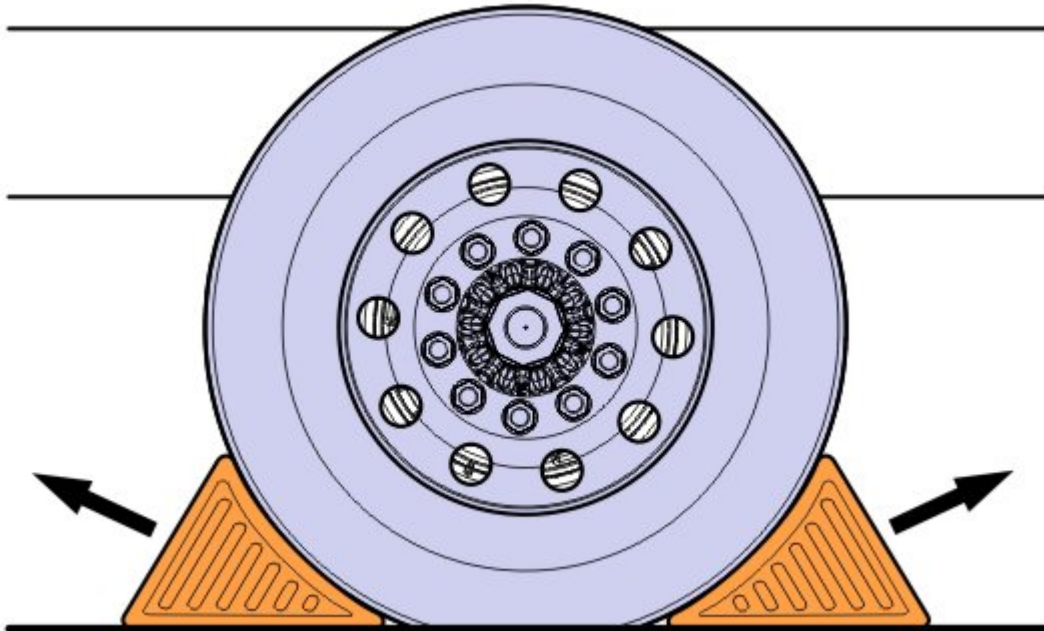
- . Install the wire ties and clamps.

Note: Use high temperature cable ties.

- . Connect the battery.



- . Clear any DTC codes.
- . Remove the wheel chocks.



Reimbursement

This repair may be eligible for reimbursement if a product failure was experienced within time and mileage limits of the applicable Warranty coverage. Reimbursement is obtained via the normal claim handling process.	UCHP Reimbursement
Claim Type (used only when uploading from the Dealer Bus. Sys.)	W
Labor Code	
Primary Labor Code (Exhaust Particulate Sensor, Repair)	2846-16-09-02 See table for times.
Causal Part	22946032

Labor Times Reference – 2017 Vehicles

Model	Cab Type	Exhaust Configuration	Pipe 1
VNL VNM VHD	Day Cab	Single Outlet Right Side Outboard	1.5
VHD	Day Cab	Dual Outlet	2.9
VNM VHD VNL	Sleeper Cabs	Single Outlet Right Side Outboard Dual Outlet	3.5