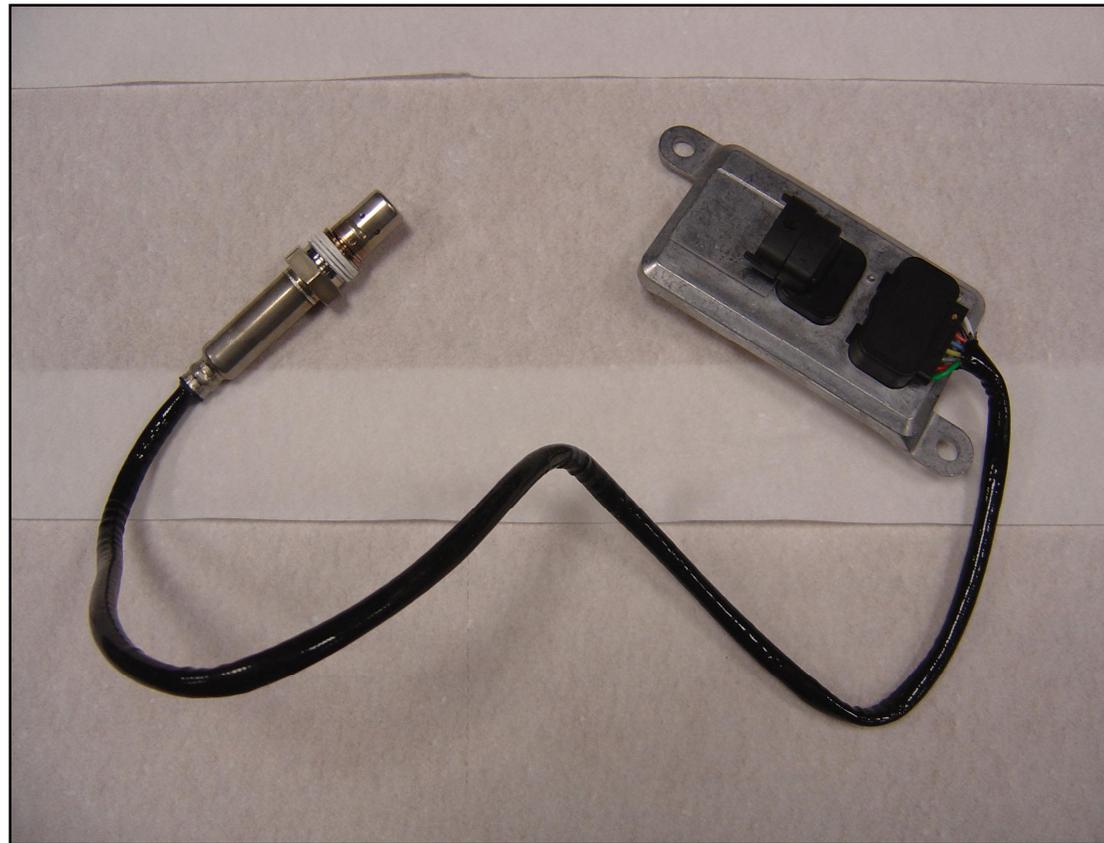
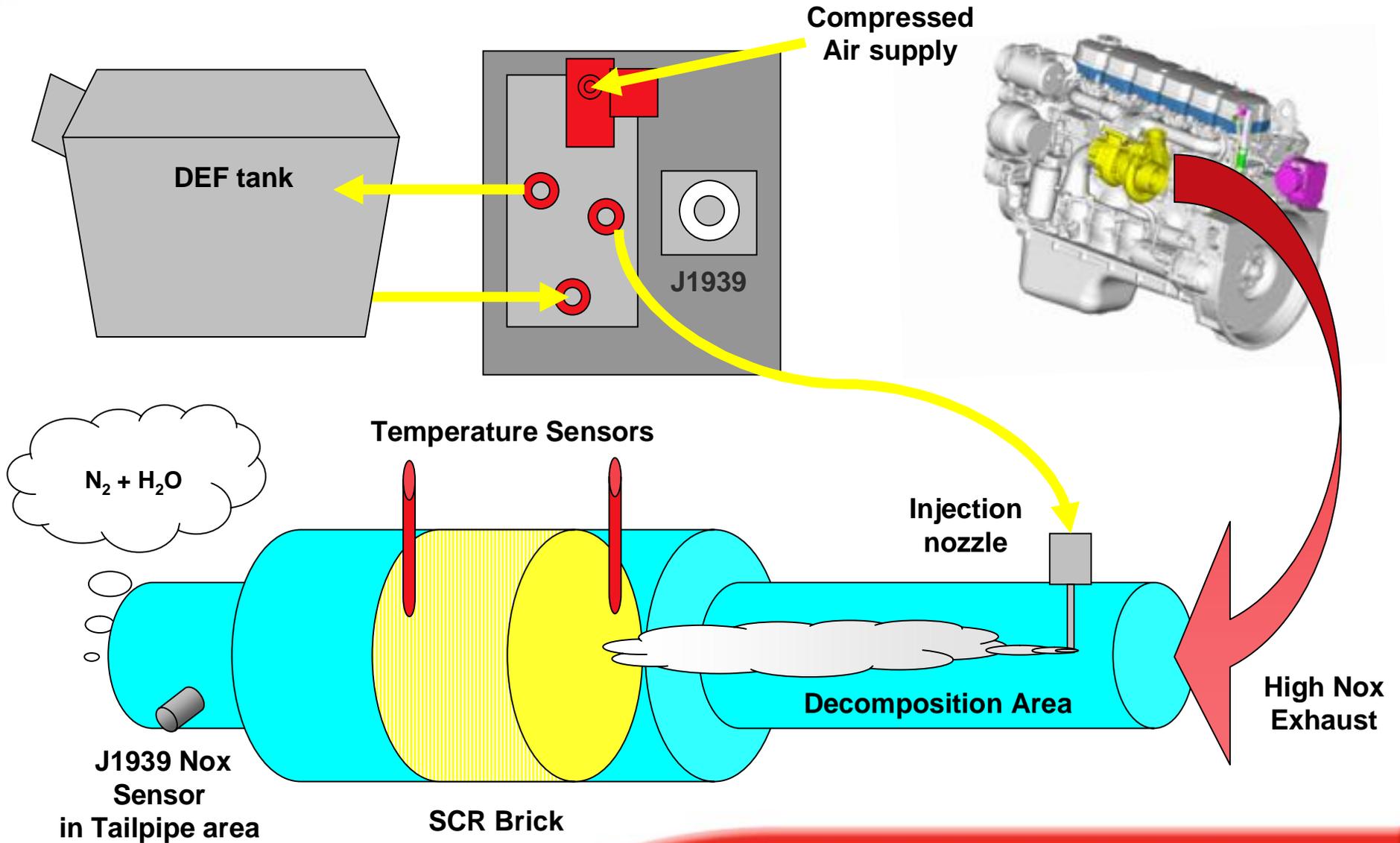


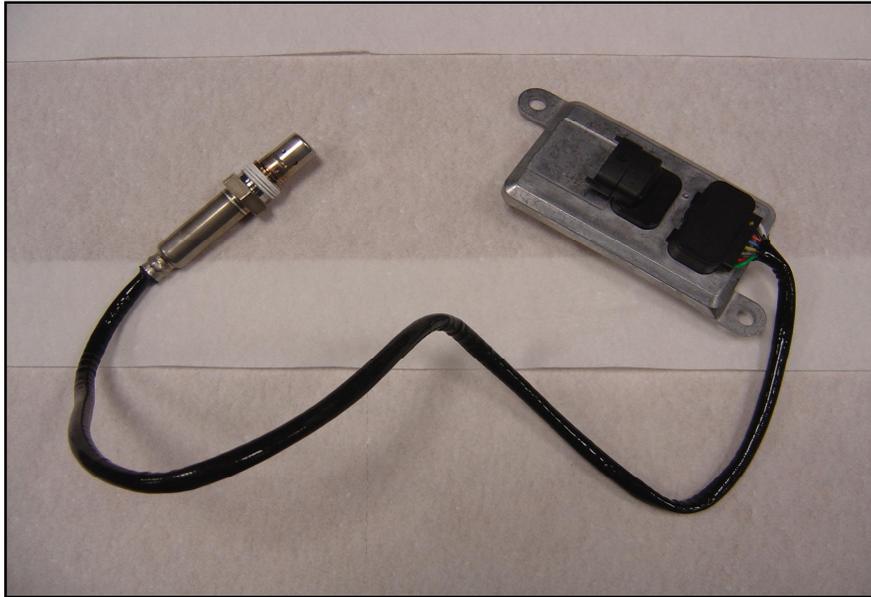
Nox sensor / diagnostic impacts



Mobile Selective Catalytic Reduction



NOx Sensor monitor



Component Location:
The aftertreatment outlet NOx sensor location can vary depending on engine application. It is usually located in the exhaust system in the acoustic section of the EGP.

The sensor can be damaged by water.

The Nitrogen Oxides (NOx) sensor is a “smart device” consisting of three components. i.e, NOx sensor, Connecting cable, NOx sensor Control Module. It's used to measure the outlet NOx emissions from the engine. It receives and sends information to the Engine ECM via the J1939 datalink. The NOx sensor performs its own Internal diagnostics and reports malfunctions back to the Engine ECM using J1939. The assembly is a single part, the sub components cannot be replaced individually!

NOx sensor functionality.

At key on the NOx sensor heats up to 100C.

It then waits for a “Dew Point” signal from the engine ECM.

- “Dew Point” is the point after which there is no moisture or condensation in the exhaust that would cause the NOX sensor to fail. The dew point is currently set to 120C. This measurement is taken from the outlet EGP temperature sensor.

When the dew point signal is received from the Engine ECM the sensor then heats up to 800C. Note: Water contact at this point will damage the sensor.

It then starts to take NOx measurements.

NOX information is broadcasted on the J1939 to the engine ECM

This information is acted on every time the NOx monitor runs.



NOx sensor modes



“Un-Powered Mode”

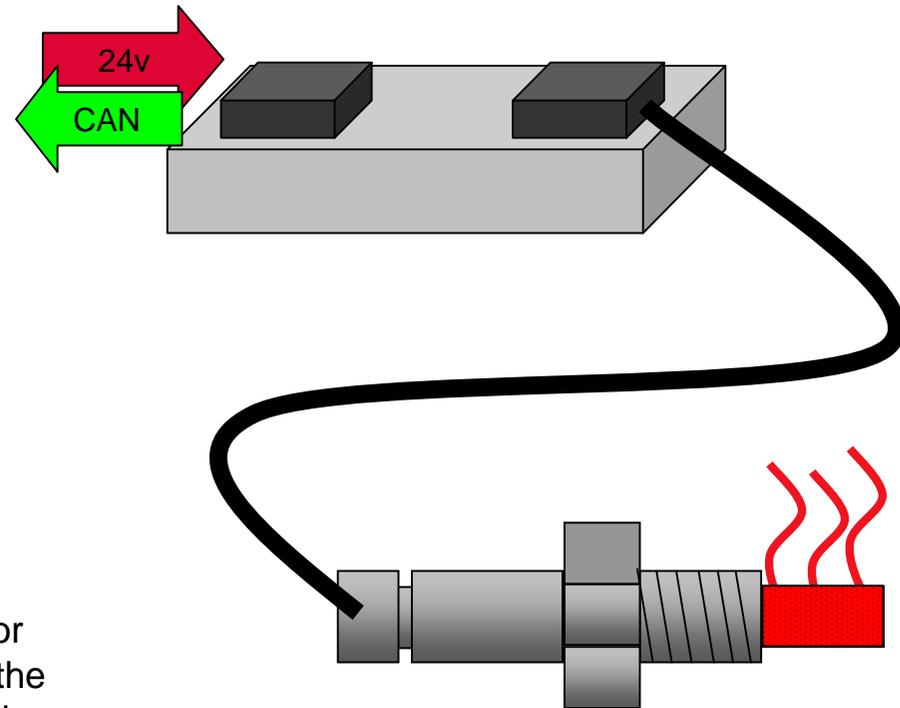
In this condition, voltage supply to the device is OFF. This is the normal state of the sensor when the vehicle is in an OFF condition. There is no output from the sensor.

Powered - Sensor Inactive

Power is supplied to the sensor via the vehicle keyswitch. The sensor enters the pre-heat phase, to remove any moisture which may be present. This preheat phase lasts for approximately 60 seconds.

Powered – Sensor Active

On receipt of the ‘Dewpoint’ message the sensor element is heated to approximately 800C. Once the sensor has reached the necessary temperature the measured NOx and oxygen concentrations are broadcast by the sensor.

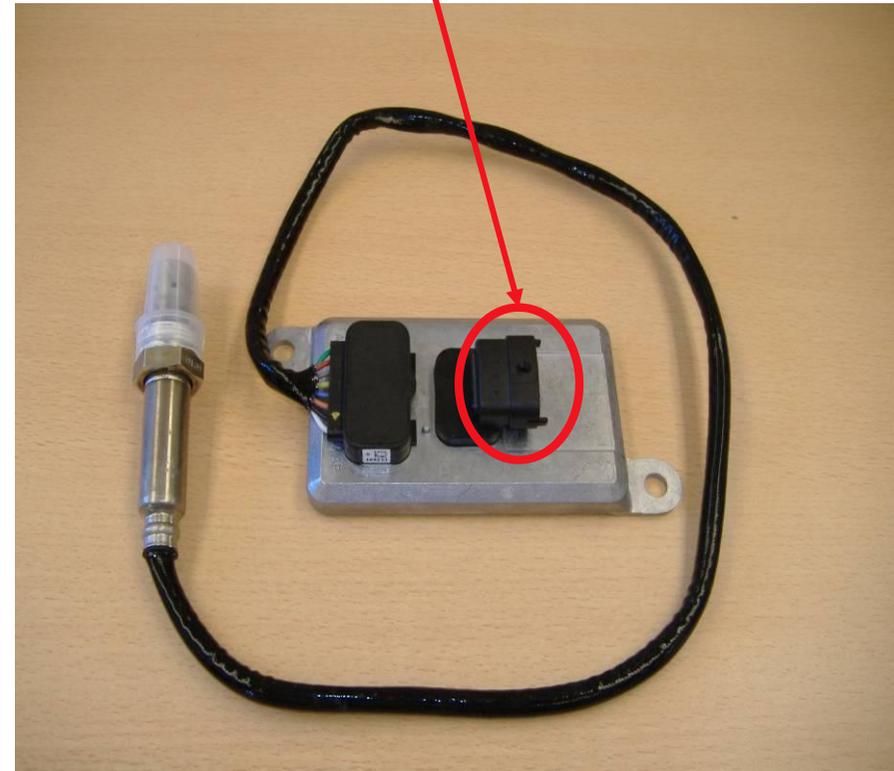


NOx Sensor

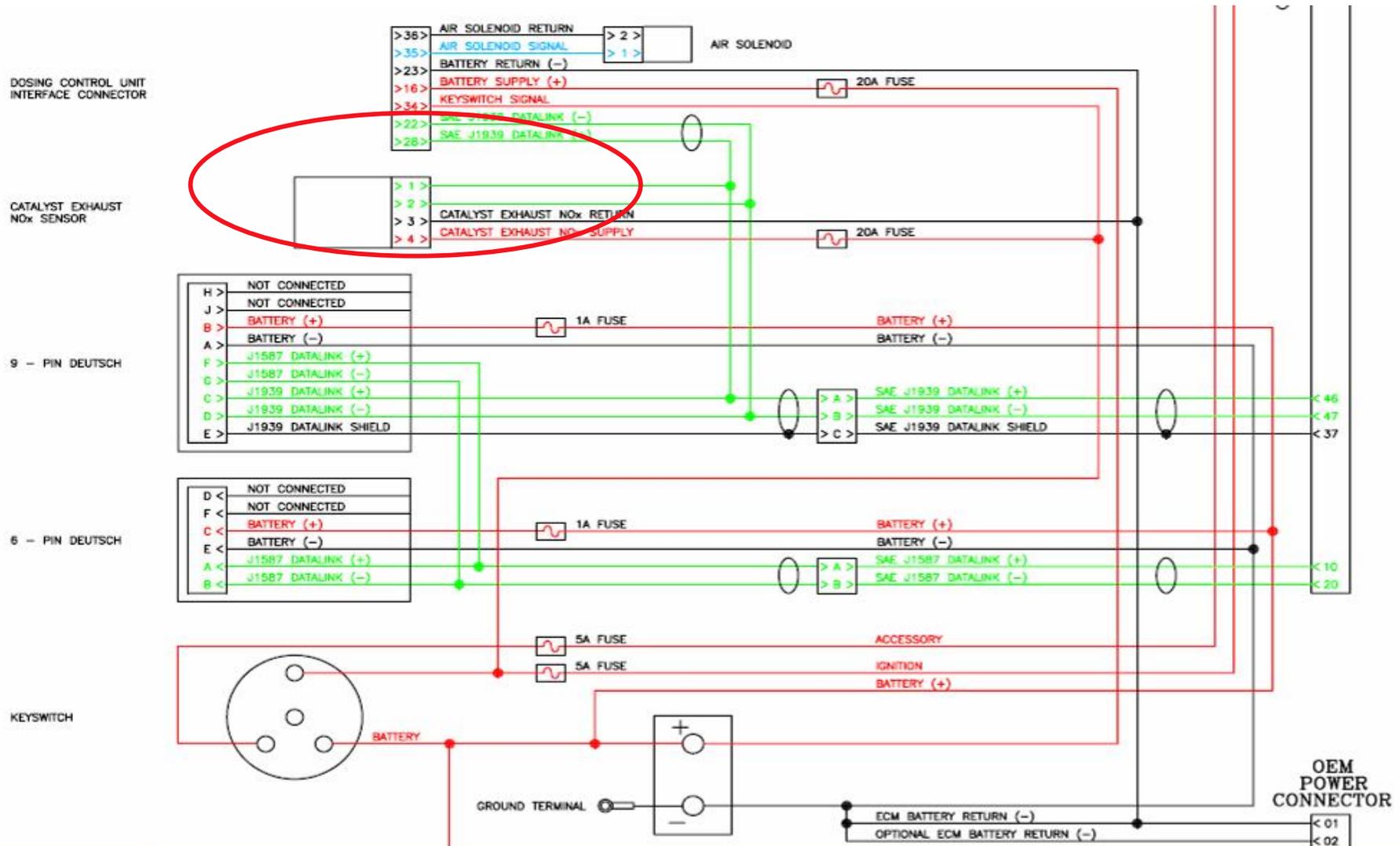


Cummins Part Number – 4954222
- 4984577

Pin 1 – Can +
Pin 2 – Can –
Pin 3 – Battery –
Pin 4 – Ignition + 20 amp fuse



NOx Sensor Wiring.



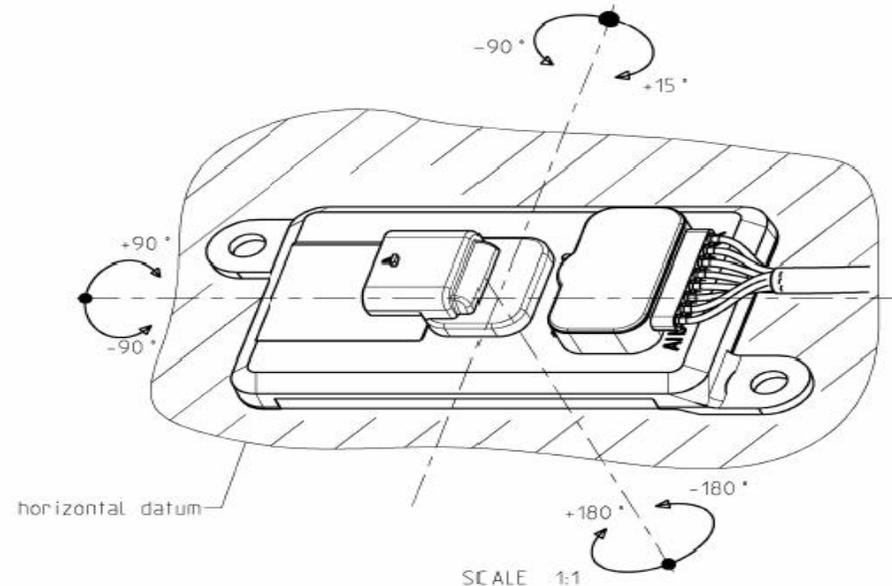
NOx Sensor mounting



The NOx sensor Electronic Control Unit (ECU), must be mounted in a location close enough to the sensor element to ensure adequate stress relief of the connected cable, but sufficiently protected from excessive temperatures.

Proper operation of the sensor requires that fresh air be able to pass to the sensor element through the air permeable membrane in the ECU. To ensure that this membrane is not obstructed or blocked by standing moisture or other debris, the ECU must be mounted within the constraints shown in the drawing below.

permissible installation position for ECU - in reference to the horizontal datum



Painting and vibration

Painting/Coating

The NOx Sensor Electronic Control Unit is equipped with a Gortex vent which allows for the transfer of fresh air into the sensor as a reference gas. It is important to ensure that this vent is not obstructed by any paint or coatings applied to the vehicle chassis after sensor installation.

If painting or coating is required, the vent shall be protected by masking during the process, with the masking material removed before sensor operation.

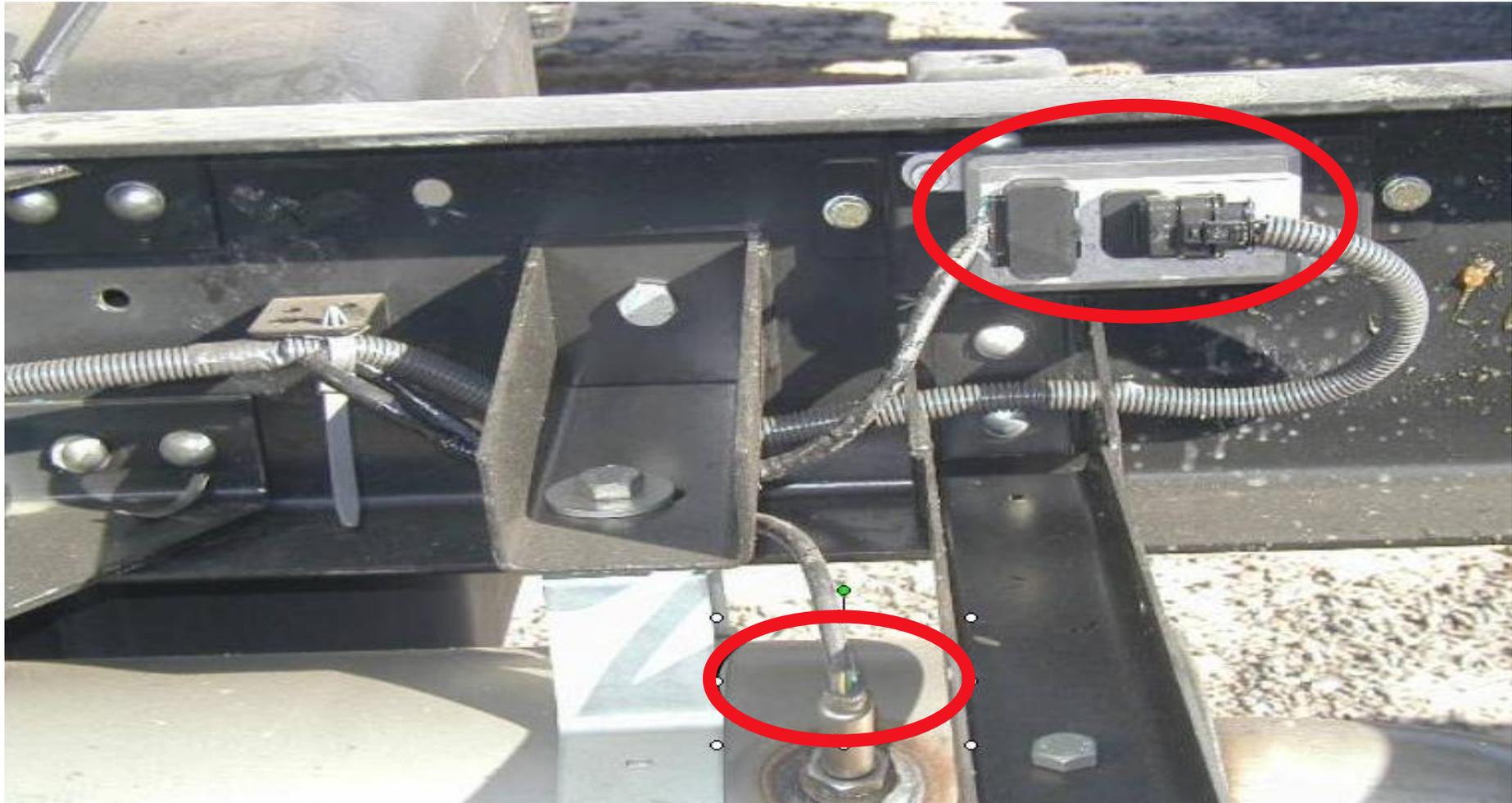
Vibration Levels

The Nox sensor probe and associated electronic control unit must be protected from excessive vibration levels. The sensor probe is installed in the exhaust pipe work or inside the EGP, and is designed to withstand vibration levels under normal operating conditions. .

The Nox sensor control module is usually mounted on the chassis or superstructure.

Any cables should not be “tight” or under tension and allow for movement.

NOX Sensor location vehicle



NOx Monitor Operation – OBD 1.5 engine

Conditions for the NOx monitor to run:

Dosing Rate to be between

- **800 to 3800 ml/h 6cyl engine.**
- **600 to 3800 ml/h 4cy engine.**

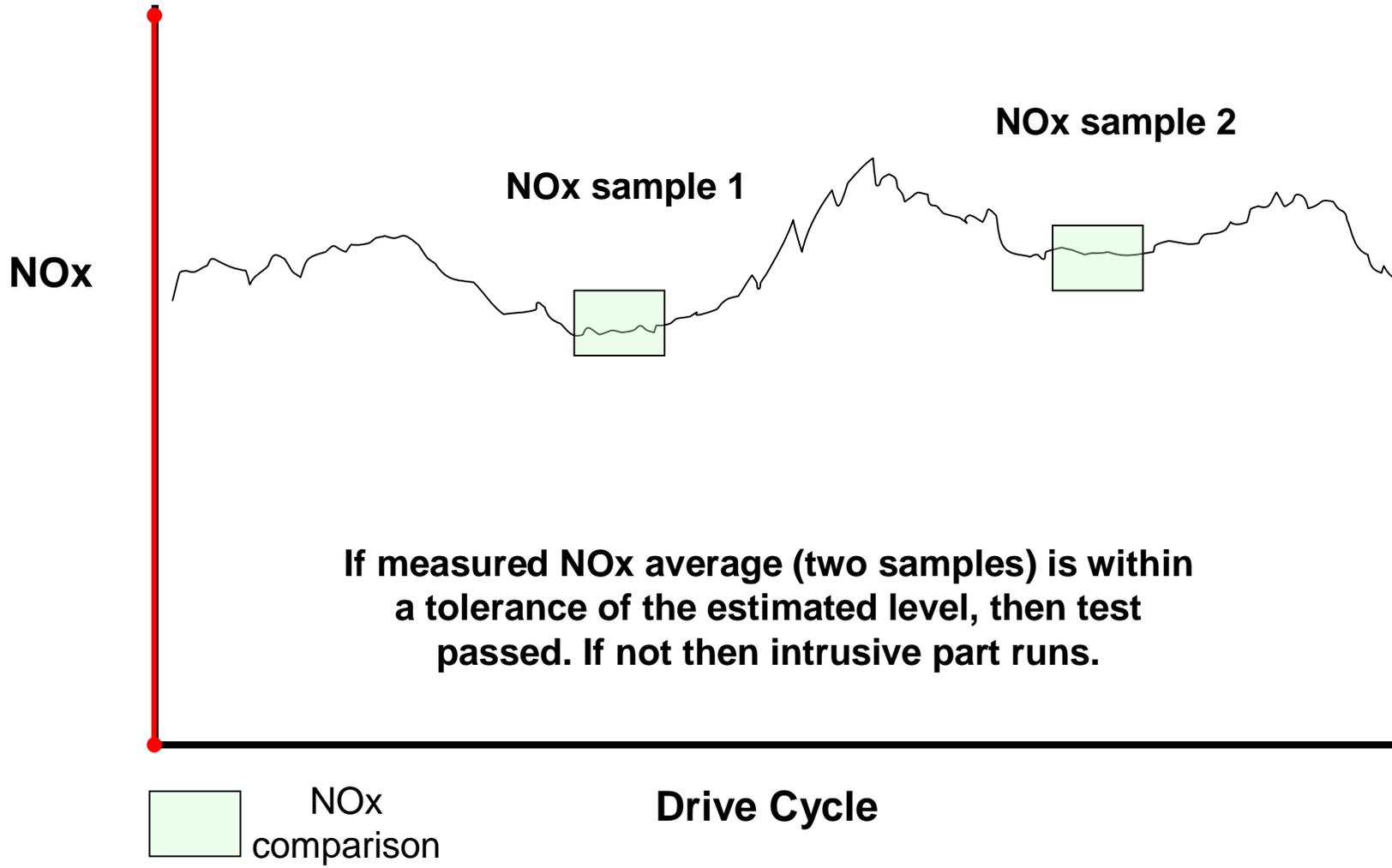
Engine Speed to be between

- **1400 - 1700 rpm 6 cylinder engine.**
- **1400 – 1750 rpm 4 cylinder engine.**

NOx Out sensor giving a stable reading

Fueling stable for 15 seconds

The un-intrusive stage will take two readings then work out the average, if the average reading is within specification then the monitor will have passed, if it is outside specification then the intrusive part of the algorithm will run.



If measured NOx average (two samples) is within a tolerance of the estimated level, then test passed. If not then intrusive part runs.

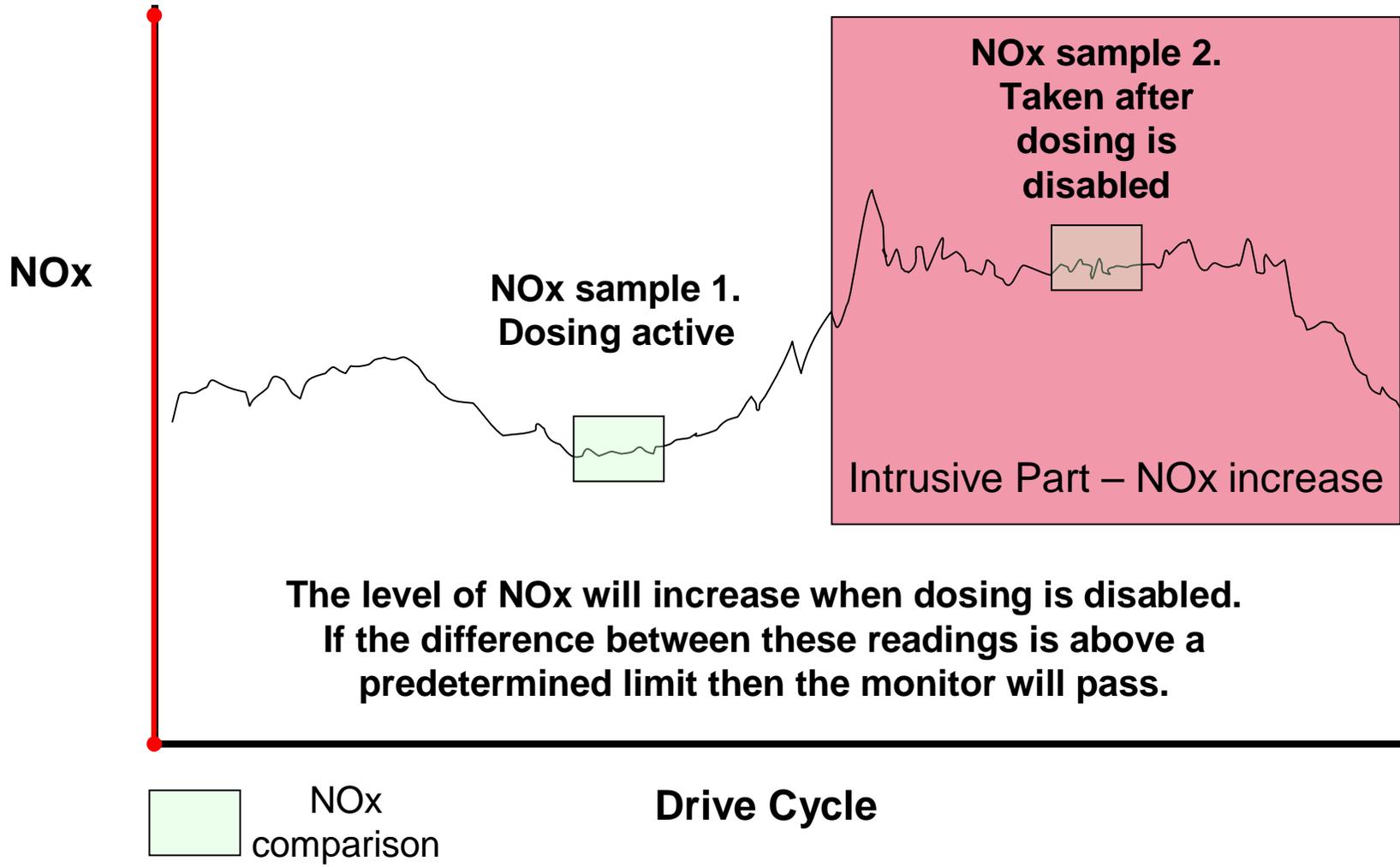
NOx Monitor Operation - Intrusive

The intrusive part of the algorithm uses these conditions to run:

- Engine speed over
 - ***1500 rpm 6 cylinder engine.***
 - ***1500 rpm 4 cylinder engine.***
- Estimated engine NOx needs to be between 800 to 1800 ppm, this will mean that load will need to be applied to the engine.
- Doser to be in dosing state
- NOx Out sensor giving a stable reading

The system will monitor for 15 seconds at these conditions and take a reading, it will then switch off dosing and wait another 20 seconds and take a second reading.

If the engine goes out of these conditions then the intrusive part will abort and attempt to restart.



NOx Monitor Operation - Intrusive

Once completed the monitor will then compare the two readings:

If the difference between the two readings is too low the monitor will fail for the first time, if the monitor has a second failure fc(s) 2772 / 2773 will log and the MIL will illuminate.

If the difference between these readings is above the predetermined limit then the monitor will pass.

NOx Monitor Operation - Intrusive

Note: The Intrusive part will only run if the first part of the NOx monitor fails, if the monitor passes then the intrusive part will not run.

To remove the derate the monitor will have to run and pass.

The correlation between % load and Dosing for estimated NOx ppm are as follows:

- Greater than 50% load will give a dosing rate of over:
 - **800ml/h 6 cylinder engine.**
 - **600ml/h 4 cylinder engine.**
- Greater than **60% - 6 cylinder / 45% - 4 cylinder** load will give an estimated NOx output of over 800ppm

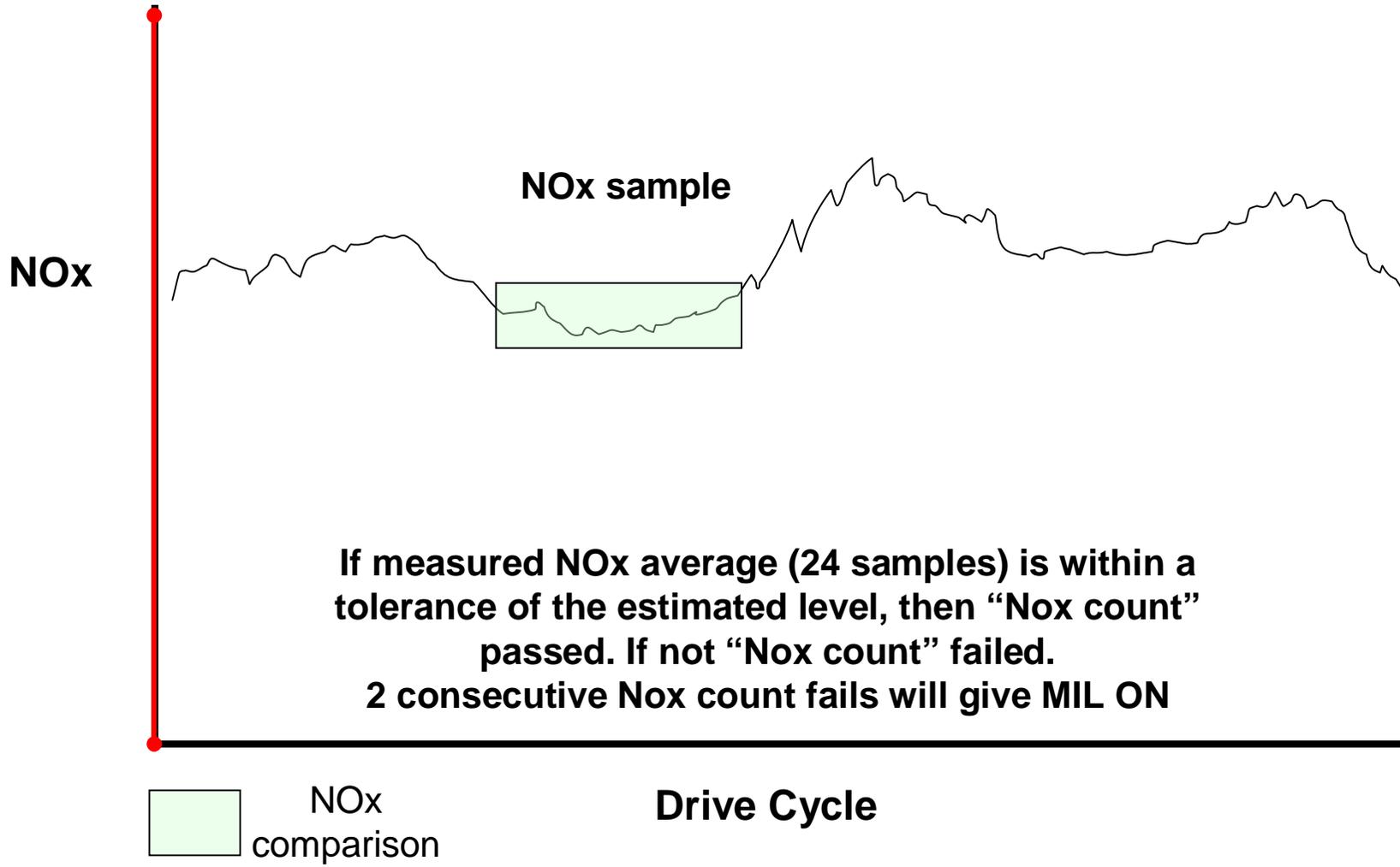
NOx Monitor Operation – OBD 2 engine

The conditions and operation of the NOx monitor have been revised: The exact conditions to run the Nox count vary per application and power rating.

The Nox monitor will now operate once per drive cycle. It will take 24 samples and calculate a Nox average, if this average is within specification then the count has passed, if not the Nox count has failed.

If the Nox count fails on a given drive cycle, an active, pending MIL off code is stored. If the Nox count then fails on a second consecutive test, the code will be active, confirmed, MIL ON.

If the test passes the pending code is erased.



New INSITE™ 7.2 Aftertreatment NOx Reset Test Information

New INSITE™ 7.2 electronic service tool Aftertreatment High NOx Reset Test will help clear OBD malfunction indicator lamps (MIL) for Fault Codes 1694, 2772 and 2773.

About:

The Aftertreatment High NO_x Reset Test is used to turn off a malfunction indicator lamp (MIL), once the issue causing the fault has been corrected. The faults that cause the MIL lamp can **not** be reset by INSITE™ electronic service tool.

Lets look at this on Insite !

What have we learnt so far?

