YEOFLAG

OXYGEN SENSOR

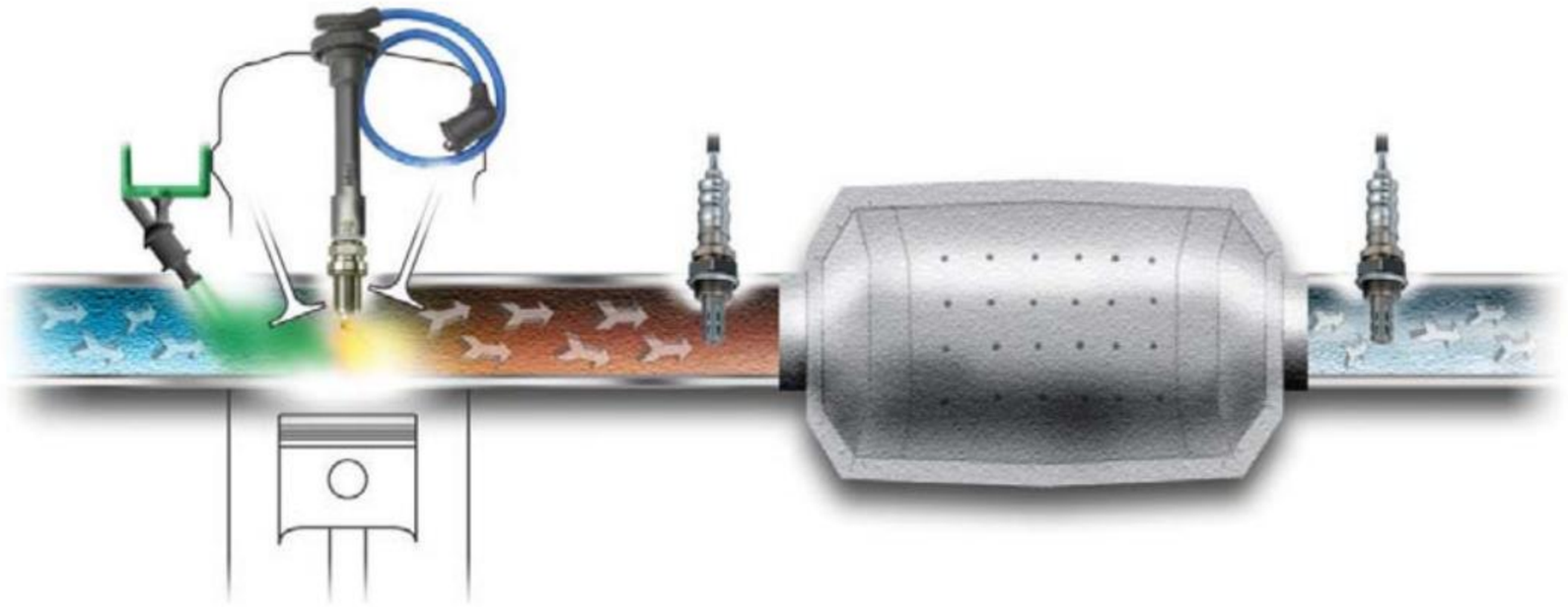
Directions for use

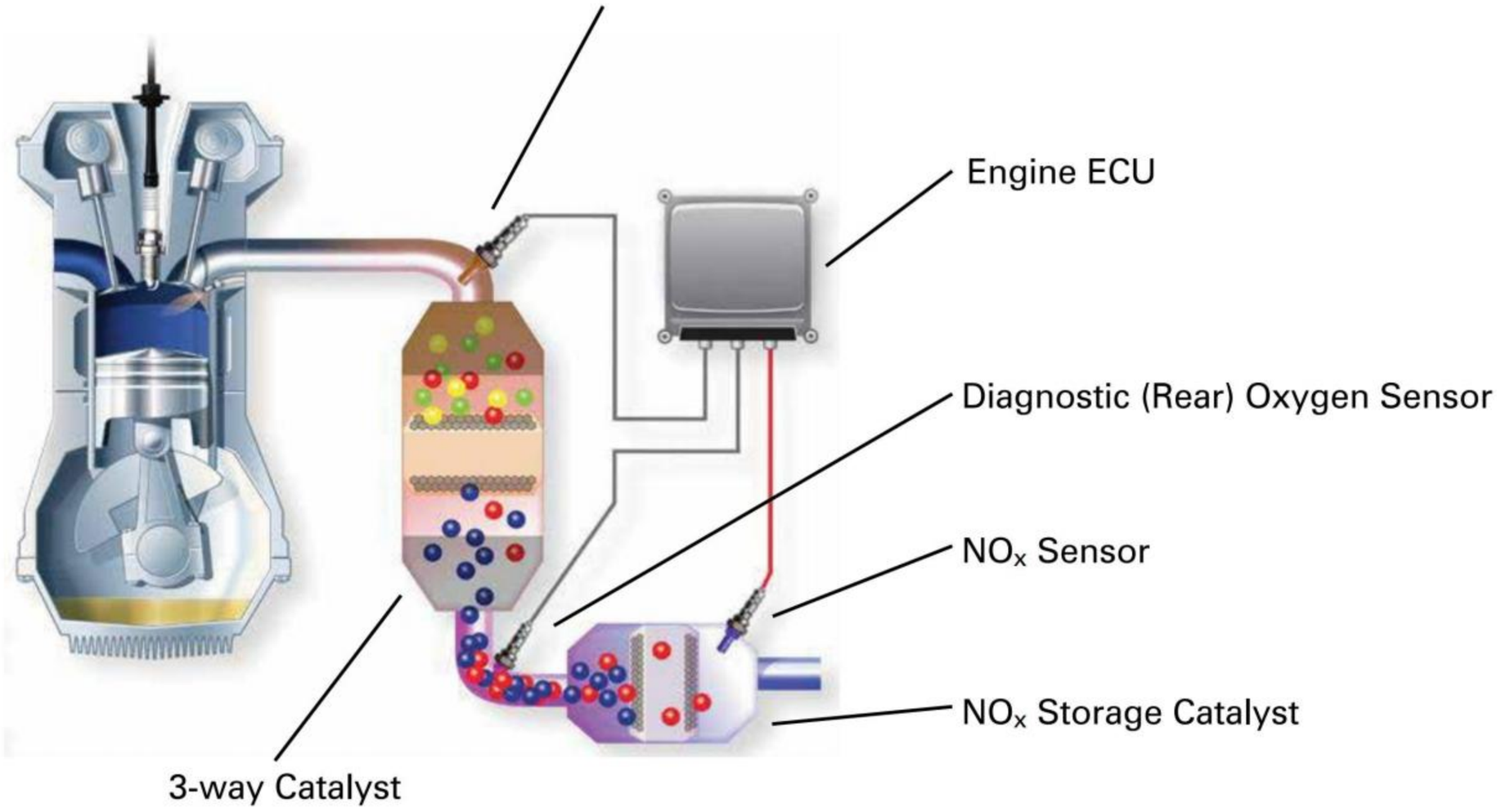
2023

Q1

Q: What is an Oxygen Sensor?

A: An emission control component that senses the presence of oxygen in the exhaust stream.





Q2

Q: Why is an Oxygen Sensor needed?

A: Vehicles are one of the leading causes of air pollution in the world. As a result, government legislation has enacted regulation in many parts of the world to reduce vehicle emissions and increase fuel efficiency. By more closely controlling a vehicle's air fuel ratio, fuel efficiency can be increased, while tailpipe emissions are reduced.

The oxygen sensor functions as the eyes and ears for the ECU. Its role is to communicate with the ECU whether a vehicle is running rich or lean. The goal is to have the engine run close to 14.7 parts of air to 1 part of fuel. 14.7:1 is known as the Stoichiometric Point. At this point, optimum combustion under normal conditions occurs and the least amount of harmful gases are produced.

Smog filled skyline due to air pollution

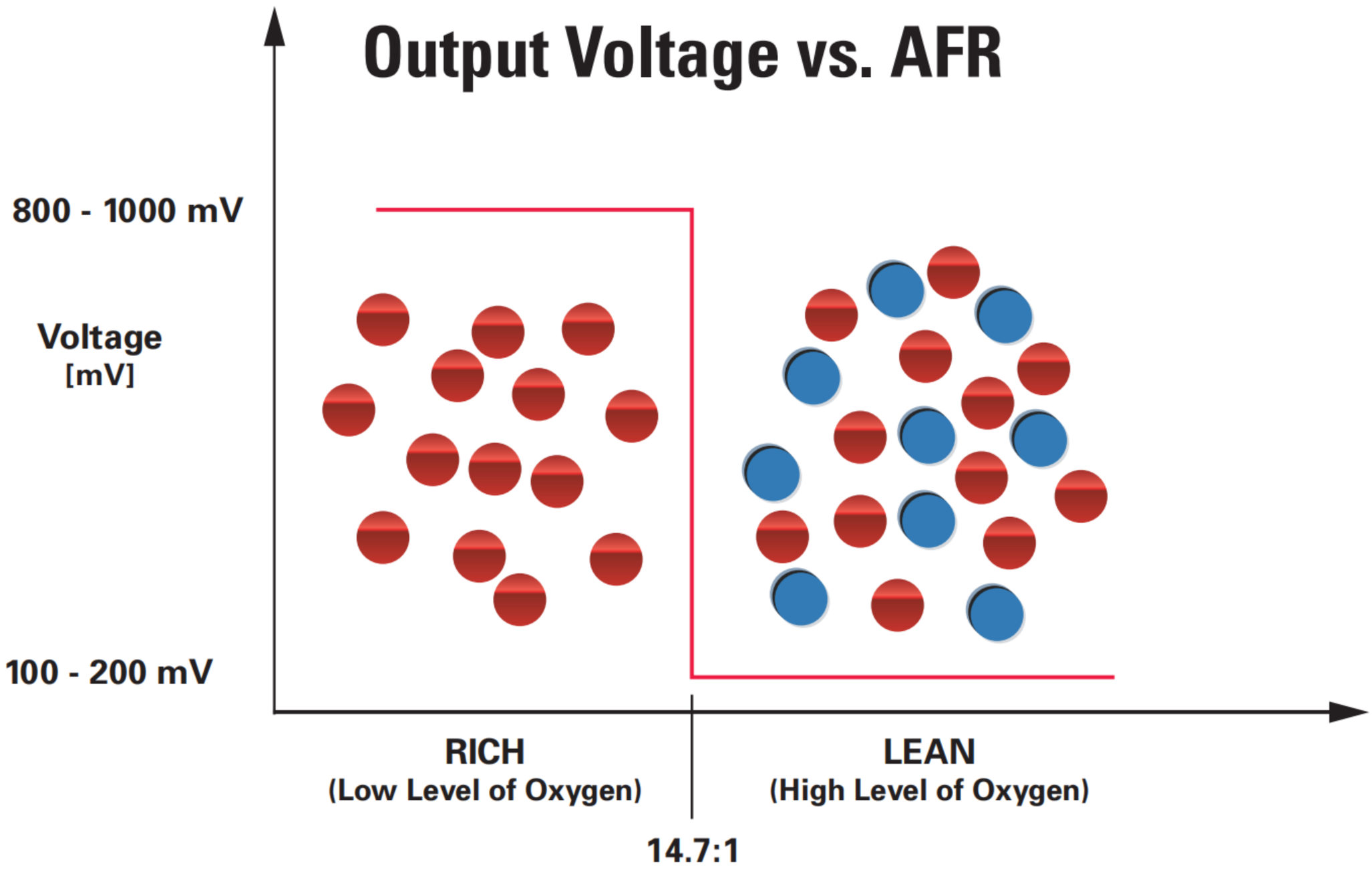
Q3

Q: How does an Oxygen Sensor work?

A: The sensor becomes operational at approximately 350˚C (650˚F).

At this point a chemical reaction occurs producing a high or low voltage based upon high or low levels of oxygen in the exhaust stream.

The oxygen sensor generates 800-1000 mV when the exhaust gas air/fuel ratio is rich. It will generate 100-200 mV when the exhaust gas air/fuel ratio is lean.



Q4

Q: Does my vehicle have an Oxygen Sensor?

A: Most vehicles produced for the North American market after 1981 have at least one oxygen sensor.

EPA laws required the introduction of oxygen sensors to decrease vehicle tailpipe emissions and improve fuel efficiency.

Early 1 Wire Sensor Design

Q5

Q: Where are Oxygen Sensors located?

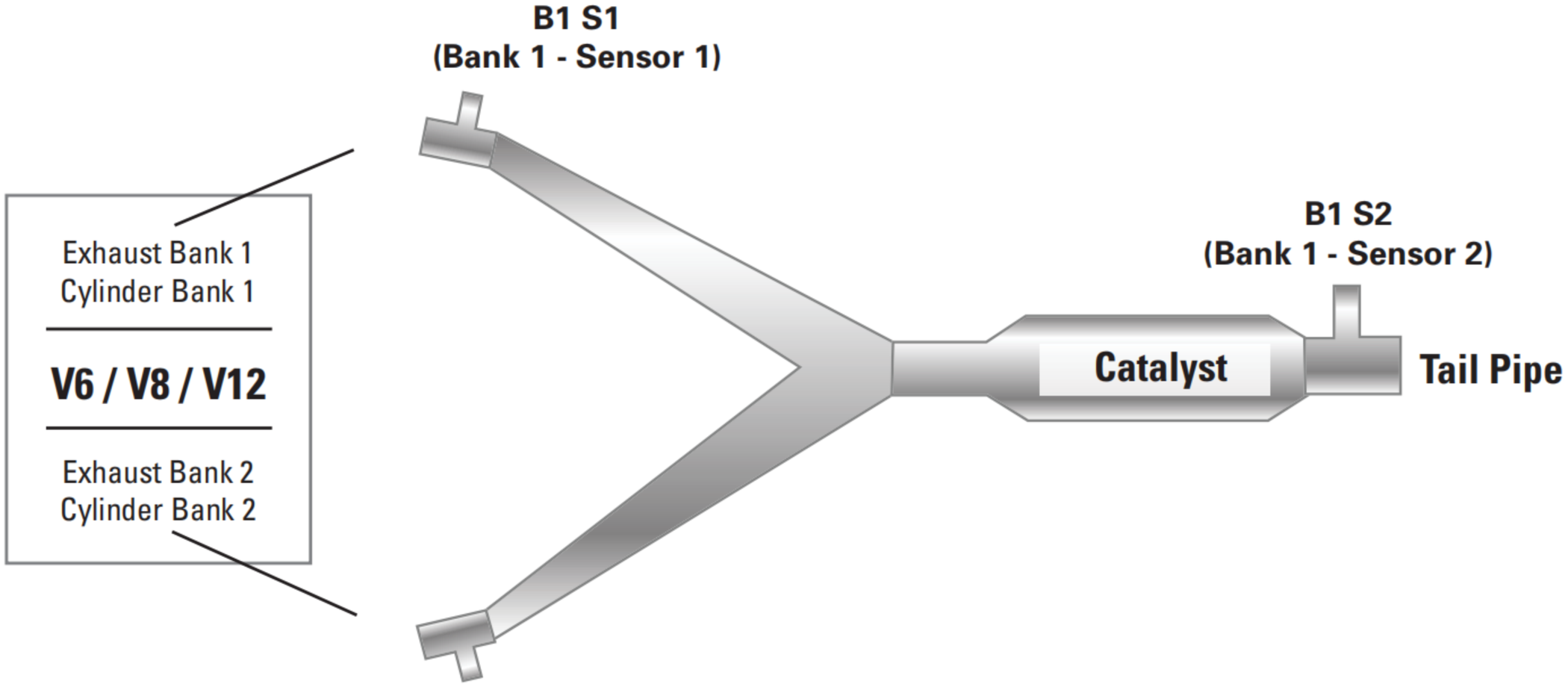
A: Vehicles produced before 1996 (OBDI) will have one or two sensors upstream of the three-way catalyst (catalytic converter). Vehicles produced after the 1995 model year (OBDII) will have oxygen sensors both upstream and downstream of the three-way catalyst.

To explain the sensor locations as found on a scan tool, you must first find the #1 cylinder location. Bank one (1) will always be the side of the engine with the #1 cylinder. Sensor one (1) will always be upstream of the three-way catalyst, while sensor two (2) will be downstream.

To determine left and right, as this is how the sensors are cataloged, you must first establish the front and rear of an engine.

Front will be the side of the engine with the accessory drive belts for alternator, air conditioning, power steering, etc.

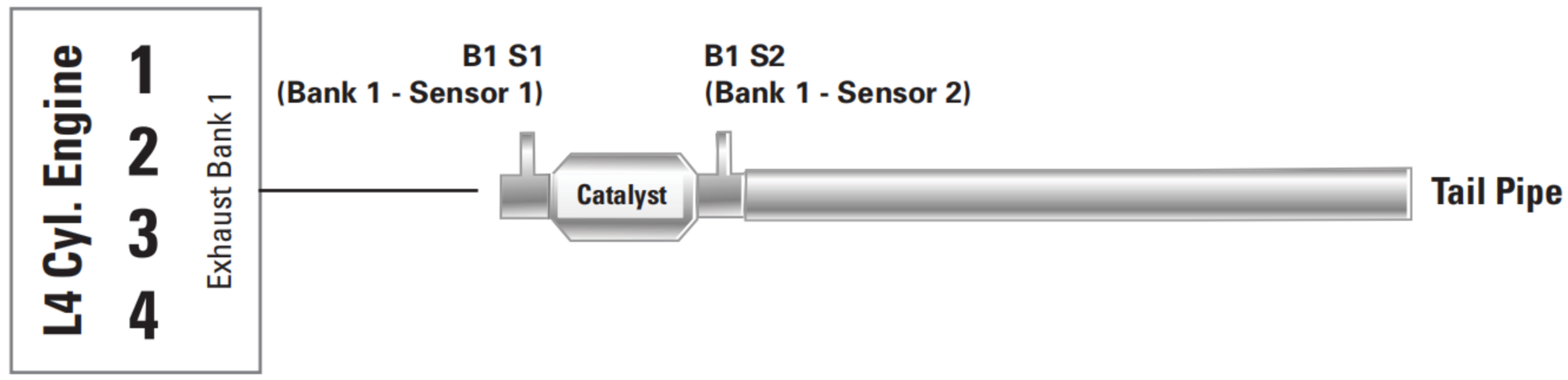
The left side of the engine will be the side to the left of the accessory drive belts when standing behind the engine. The right side of the engine will be the side to the right of the accessory drive belts when standing behind the engine.

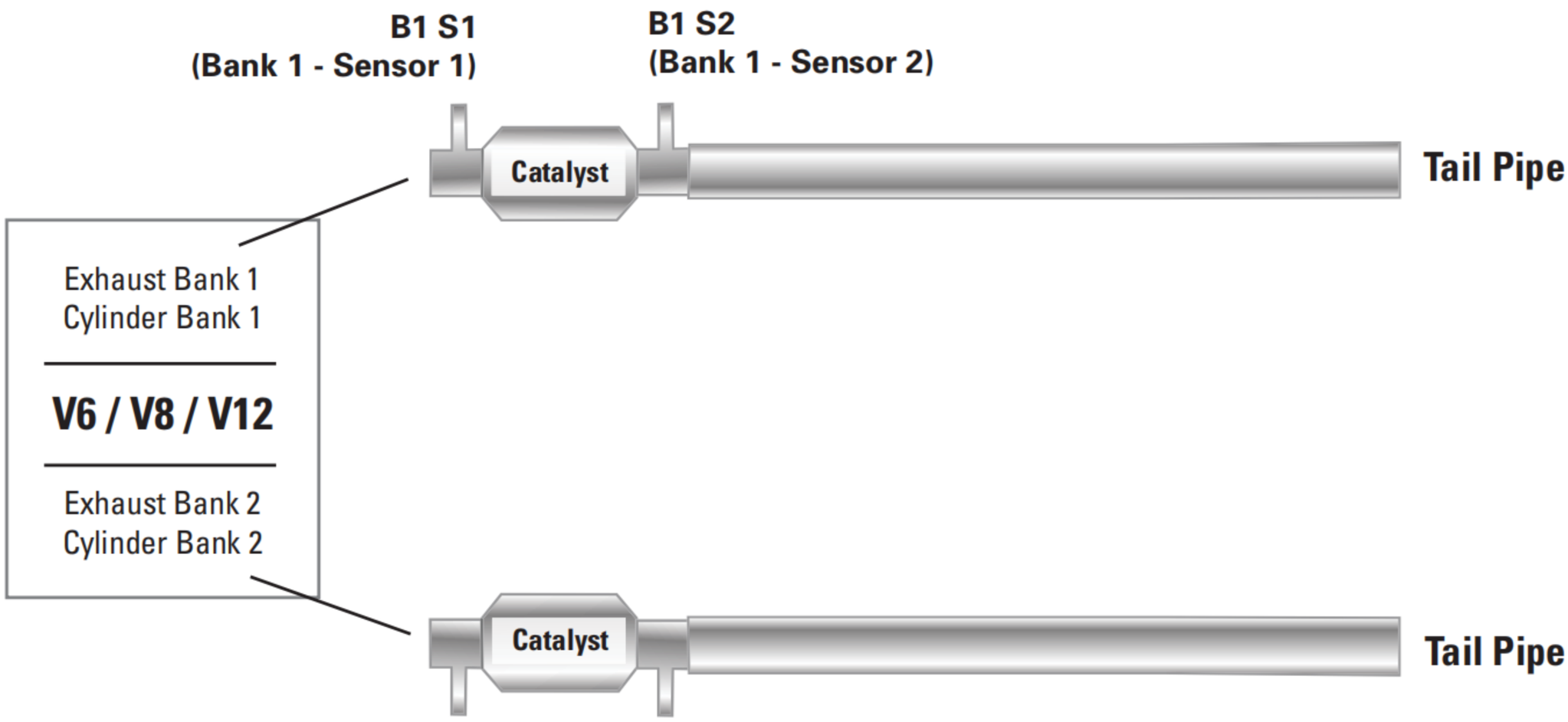


YEOFLAG

Q5

Q: Where are Oxygen Sensors located?



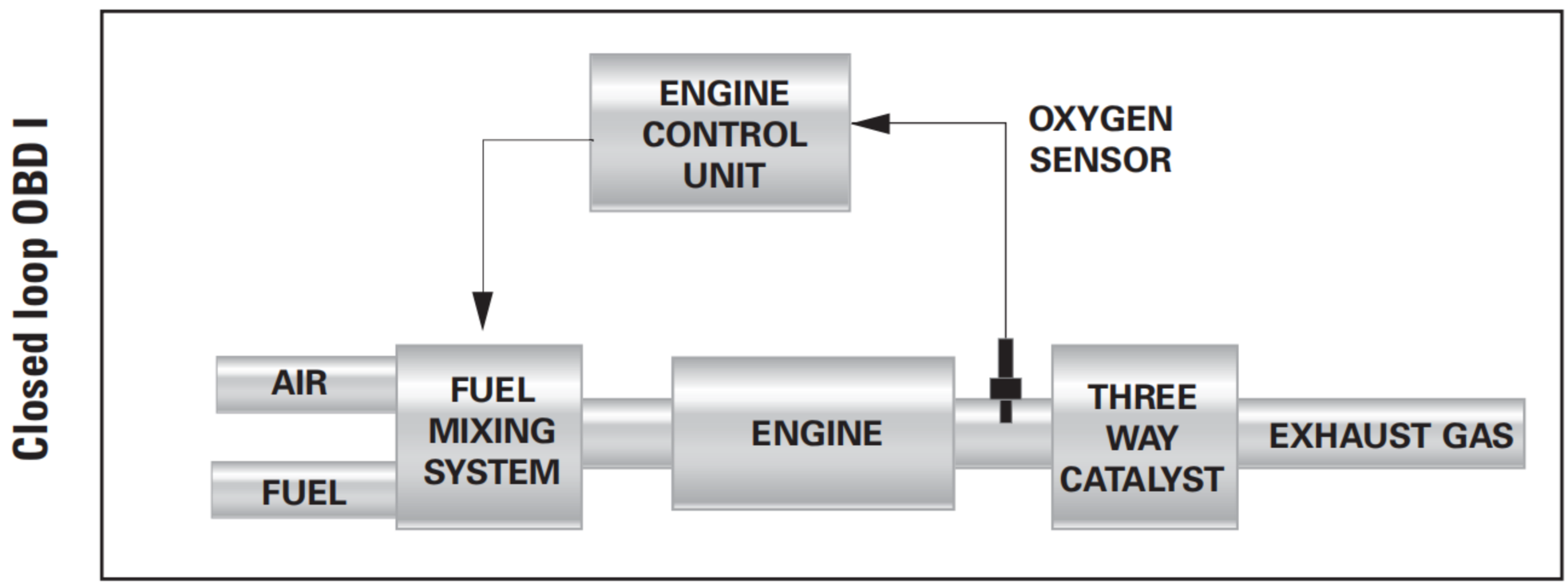


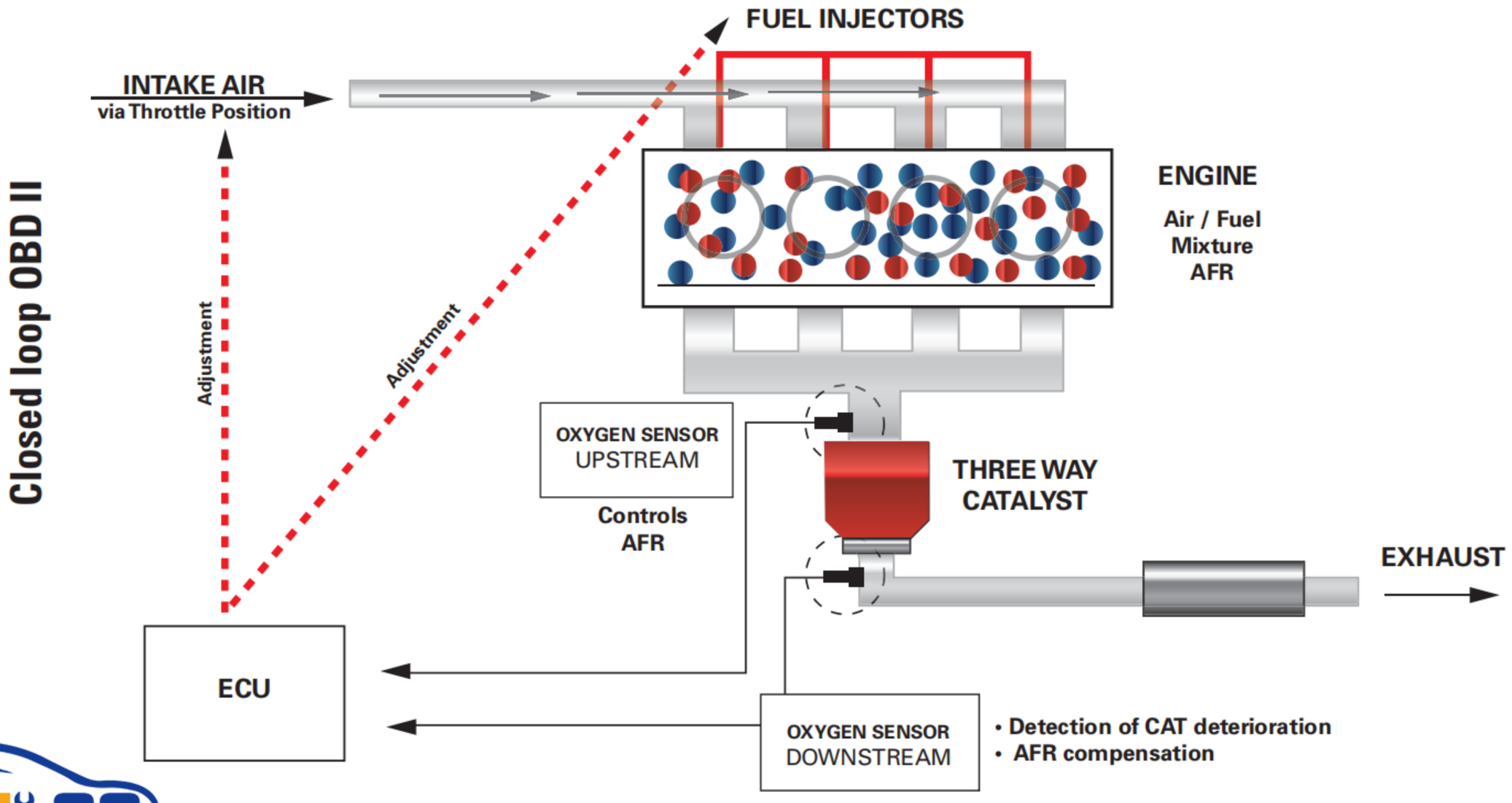
Q6

Q: What are “Open Loop” and “Closed Loop” modes?

A: Open loop mode is the period of time before the oxygen sensor becomes operational, usually at vehicle start up. It is also the default mode should a sensor problem occur.

Closed loop mode is the desired mode where the oxygen sensor is operational. At this time AFR and exhaust emissions are being controlled.



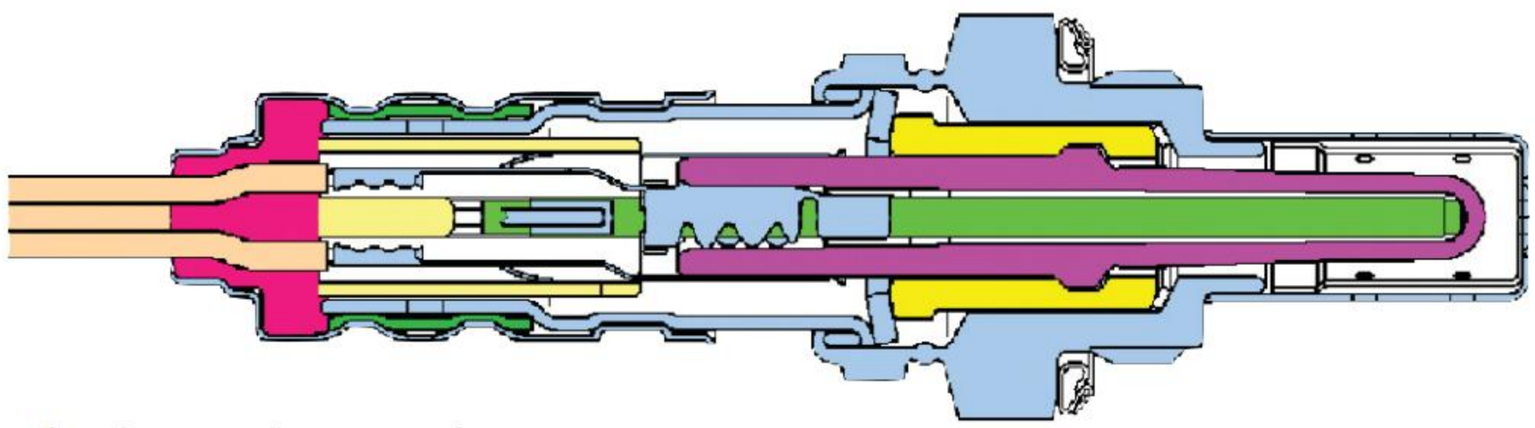


Q7

Q: What are the different types of Oxygen Sensors?

A: Zirconia

- Most popular (90% of the market)
- 1-4 wire configuration
- Heated or unheated
- Thimble or Planar type
- 18mm thread size
- Requires reference air



1 wire (unheated sensor)

- Signal wire
- Ground achieved through sensor body (earth ground)

2 wire (unheated sensor)

- Signal wire
- Ground wire (ground achieved through case or isolated ground)

3 wire (heated sensor)

- Signal wire
- Ground achieved through sensor body (earth ground)
- Two heater wires

4 wire (heated sensor)

- Signal wire
- Ground wire (ground achieved through case or isolated ground)
- Two heater wires

Q8

Q: What are the obvious signs and impact of worn Oxygen Sensors?

A: The most obvious sign an oxygen sensor is failing or has failed is a check engine light. Vehicles are designed to inform the driver if there is a problem with the emissions system. A check engine light may point to a problem with the emissions system but does not necessarily mean the oxygen sensor is faulty.

Other signs of worn oxygen sensors are increased fuel consumption and an increase in vehicle emissions.

Q9

Q: How can I check my Oxygen Sensors to ensure they are working properly?

A: There are three (3) ways a sensor can be checked to see if it is functioning properly.

A professional repair shop will have scan tools to check sensor operation.

Advanced shops may have a tool called an oscilloscope. This tool will graphically display oxygen sensor output as it switches voltage from high to low.

Removed from the vehicle, a oxygen sensor can be checked using a common multi-meter to check for heater resistance. In the case of a faulty heater element, the resistance will read as an open circuit.

Scan Tool In Use

Q10

Q: What can shorten the life of an Oxygen Sensor?

A: Common causes for oxygen sensor failure are poisoning from substances such as engine coolant, silicone gasket materials or soot.

Often these problems can point to other mechanical issues with an engine.

Thermal shock from raw fuel or moisture in the exhaust can also cause a sensor heater element to crack.

The root cause of the problem should be addressed along with replacement of the oxygen sensor if needed.

PROBLEM -
Lead Poisoning

SYMPTOM - Shiny deposits are evidence of lead in the fuel. Lead attacks the precious metal of the sensor element & the catalytic converter.

SOLUTION - Sensor needs to be replaced and care taken to use only lead-free fuels.

PROBLEM -
Excessive Carbon / Soot Deposits

SYMPTOM - Thick soot deposits lead to blockage of the sensor protection tube and have a negative effect on reaction time. Causes can be a mixture that is too fuel-rich or the result of damage to the sensor heater.

SOLUTION - Sensor must be replaced in all cases with new sensor.

PROBLEM -
Silicone Contamination

SYMPTOM - White deposits are evidence of silicone poisoning. Silicone based adhesives/products will contaminate the sensor element.

SOLUTION - Sensor must be removed and replaced with new sensor; care must be taken to use ONLY “oxygen sensor-friendly” products.

Q11

Q: How do I install an Oxygen Sensor?

A: Sensor installation will first require the proper tools. A specialty oxygen sensor socket is recommended for removal of the old sensor and installation of a new sensor.

1. Disconnect the battery.
2. Disconnect wiring harness from the old sensor.
3. Remove any hardware or clips if applicable.
4. Use the oxygen sensor socket (shown below) to remove the old sensor.
5. Apply anti-seize compound to the threads of the sensor (if not already pre-applied).
6. Use specialty socket to install the new sensor to the recommended torque.
7. Put in place any hardware or clips if applicable.
8. Connect the wiring of the new sensor to the existing vehicle wiring.
9. Reconnect the battery.

Q12

Q: What is the expanded role an Oxygen Sensor plays in OBDII vs. OBDI ?

A: In OBDII equipped vehicles there is a sensor downstream of the three-way catalyst to monitor catalyst function and can also assist in controlling AFR by adjusting fuel trim.

If a catalyst has failed or there is a problem elsewhere in the system, the downstream sensor may trigger a MIL light or check engine light to warn of a possible problem.

In OBDII, the ECU is also monitoring the condition of the sensor signal response time, heater light-off time and heater resistance.

Downstream Oxygen Sensor

Common Trouble Codes That Require Replacement Of Oxygen Sensor

Explanation Of Oxygen Sensor	The Computer's Malfunctioning P Code	Explanation Of Product Failure
It's not responding well or responding slowly	UP：P0133,P0134，P0153 Forward Oxygen Sensor:P0133,P0134,P0153	1.Sensor heating failure or oxygen sensor dirt poisoning 2.Throttle Valve Position Sensor failure.3.It's malfunctioning of Air Mass meter 4.Vehicle 12Voltage The power's not like normal.
	Down：P0139,P0140,P0159 After Oxygen Sensor:P0139,P0140,P0159	1.Sensor heating failure or oxygen sensor dirt poisoning 2.Three-way catalyst Machine Aging.
Abnormal heater current (low current)	UP：P0135,P0155,P0031,P0051，	1.Sensor heating failure,Machine Aging or Use Mismatch. 2.Vehicle 12Voltage The power's not like normal.
	Down;P0141,P0161 P0036,P0037,P0057	
Abnormal heater current (high current)	UP：P0032，P0052	
	Down：P0038，P0058	
Theoretical air-fuel ratio output anomaly (low output)	UP：P0130，P0131，P0151	1.Sensor heating failure or oxygen sensor dirt poisoning.2.Fuel injector There's been a leak. 3.The Electromagnetic Valve of the activated carbon tank is always open 4.Fuel pressure's too high 5.It's malfunctioning of Air Mass meter

Common Trouble Codes That Require Replacement Of Oxygen Sensor

Explanation Of Oxygen Sensor Failure	The Computer's Malfunctioning P Code	Explanation Of Product Failure
Theoretical air-fuel ratio output anomaly (low output)	**Down： P0137， P0157**	1.Sensor heating failure or oxygen sensor dirt poisoning. 2.Three-way catalyst Mach ne Aging.
Theoretical air-fuel ratio output anomaly (high output)	**UP： P0132， P0152，**	1.Oxygen Sensor heating failure or oxygen sensor dirt poisoning 2.Fuel injector There's a blockage. 3.Fuel pressure's too low. 4.The unmeasured air between the air mass meter and the throttle valve 5. The Unmeasured Air at Exhaust manifold gaskets 6.It's malfunctioning of Air Quality Sensor
	Down： P0138， P0158	1.Sensor heating failure or oxygen sensor dirt poisoning 2.Three-way catalyst Machine Aging.
Failure Code not covered by warranty (not refundable if not resolved after replacement)	**P0420-P0423， P2271-P2278， P0171-P0175， P2297-P2298， P2096-P2099**	Three-way catalyst Machine Fault Code,fuel fault code(reason:Too Thin too Thickened)
Trouble Code B 1 is Group 1, B 2 is Group 2, Oxygen Sensor 1 is Forward Oxygen Sensor, Oxygen Sensor 2 is After Oxygen Sensor (s 1 = Forward)(s 2 = After)(B 1 = Group 1)(b 2 = Group 2)		