EASTERN CATALYTIC™

CONVERTER QUARTERLY

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O2 Sensors: FYI

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QUESTION: How many oxygen sensors are on today's engines?

ANSWER:
It depends on the model year and type of engine. On most four- and straight six-cylinder engines, there is usually a single oxygen sensor mounted in the exhaust manifold. On V6, V8 and V10 engines, there are usually two oxygen sensors, one in each exhaust manifold. This allows the computer to monitor the air/fuel mixture from each bank of cylinders. When displayed on a scan tool, the right and left oxygen sensors are typically labeled "Bank 1, Sensor 1" and "Bank 2, Sensor 1."

On later-model vehicles with OBD II (some 1993 and '94 models, and all 1995-and-newer models), one or two additional oxygen sensors are also mounted in or behind the catalytic converter to monitor converter efficiency. These are referred to as the "downstream" O2 sensors, and there will be one for each converter if the engine has dual exhausts with separate converters.

On a scan tool, the downstream sensor on a four- or straight six-cylinder engine with single exhaust is typically labeled "Bank 1, Sensor 2." On a V6, V8 or V10 engine, the downstream O2 sensor might be labeled "Bank 1 or Bank 2, Sensor 2." If a V6, V8 or V10 engine has dual exhausts with dual converters, the downstream O2 sensors would be labeled "Bank 1, Sensor 2" and Bank 2, Sensor 2." Or, the downstream oxygen sensor might be labeled Bank 1, Sensor 3 if the engine has two upstream oxygen sensors in the exhaust manifold (some do to more accurately monitor emissions).

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Inside This Issue

Leading The Exhaust Industry With E–Technology!

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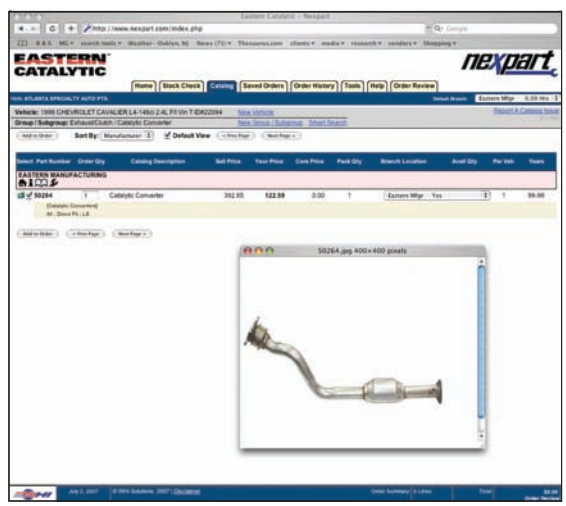

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Get Started Today! Contact your Sales Representative to get your **Username** and **Password** today. Once you're ready, go to **www.easterncatalytic.com**, log in, and connect with us in a whole new way.

What Is A Troy Ounce?

The troy ounce is the unit of weight traditionally used for precious metals such as platinum.

1 troy ounce = 0.0311 kilograms
32.1507 troy oz = 1 kilogram

The troy ounce (troy oz) differs from the more common ounce (oz) used in the U.K. and U.S.A., being slightly heavier, with 1 troy oz = 1.097 oz.

The troy system of weight is named after the city of Troyes in France, and was widely used in Europe during the Middle Ages. It fell into disuse when other systems began to be preferred, continuing to be used only in the highly specialised fields of precious metals, gems and medicines, up to the nineteenth century. Today it is only used for the trading of precious metals and gemstones.

A History Of Platinum

Early Occurrences

Although the modern history of platinum only begins in the 18th century, platinum has been found in objects dating from 700 BC, in particular the famous Casket of Thebes (see image). This little box is decorated with hieroglyphics in gold, silver and an alloy of the platinum group metals.

Casket of Thebes

For the Spanish Conquistadors of the 16th century, platinum was a nuisance. While panning for gold in New Granada they were puzzled by some white metal nuggets which were mixed with the nuggets of gold and which were difficult to separate. The Spanish called this metal Platina, a diminutive of Plata, the Spanish word for silver. Some thought that the platinum was a sort of unripe gold, so that for many years it had no value except as a means of counterfeiting.

Scientific Developments

In the 18th century platinum was a tough challenge to European scientists trying to understand and use the metal. Their difficulties came from the very properties which make platinum suitable for so many applications, such as its high melting point and its great resistance to corrosion. The problems were compounded by the other metals of the platinum group, which were present in raw platinum in varying quantities.

In 1751, a Swedish researcher named Sheffer succeeded in melting platinum by adding arsenic to it. He also recognized platinum as a new element. In 1782, Lavoisier achieved the first true melting of platinum using oxygen, which had recently been discovered; even so, it was another 25 years before commercial quantities of platinum could be produced by this method. During this period, platinum was used for the decoration of porcelain as well as for making laboratory ware and ornaments.

In the 19th century scientific and technological progress gathered pace. During 1802, Wollaston (pictured right) and Tennant developed refining of platinum and discovered palladium, followed in 1804 by rhodium, iridium and osmium. Meanwhile Wollaston perfected a method of producing malleable platinum. Grove studied the catalytic properties of platinum and in 1842 devised the very first fuel cell using platinum electrodes.

There are other metals within the platinum ore, the Platinum Group Metals or PGM's are Platinum, Palladium, and Rhodium.

In England, Percival Norton **Johnson** began work on refining the platinum group metals. He took as his apprentice in 1838 George **Matthey**, and this collaboration gave birth to the partnership of Johnson and Matthey in 1851. The two men perfected the techniques of separation and refining of platinum group metals and the melting and casting of pure and homogeneous ingots. Matthey went on to create the standard metre in platinum and iridium, at the request of the French Academy of Science, in 1879.

Growth in Supplies

Until 1820 Colombia was the only known source of platinum. As production began to decline, deposits were by chance discovered in the Ural mountains of Russia. These became the principal source of platinum for the next 100 years.

In Canada in 1888, platinum was discovered in the nickel-copper ores of Ontario. Between the end of the First World War and the 1950s, Canada was the world's major source of supply. In 1924 a farmer in the Transvaal province of South Africa discovered several nuggets of platinum in a riverbed. Following this up, the geologist Hans Merensky discovered two deposits each of around 100 kilometers in length. These became known as the Bushveld Igneous Complex and its mines today provide three quarters of the world's platinum output.

The Last 50 Years

Platinum mine production has grown continuously since the Second World War in response to the development of new applications. One of the principal new uses of platinum was in the petroleum industry, where platinum catalysts were introduced to increase the octane rating of gasoline and to manufacture important primary feedstocks for the growing plastics industry.

During the 1960s, demand for platinum in jewelry experienced a spectacular rise in Japan, appealing to the Japanese public by virtue of its purity, color, prestige and value. Platinum jewelry later succeeded in penetrating other markets – in Germany in the 1970s, Switzerland and Italy in the 1980s and the United Kingdom, the USA and China – today the world's biggest single market for platinum jewelry – in the 1990s.

In 1974, with its new regulations on air quality, the United States inaugurated the era of the autocatalyst, a technology which uses platinum group metals to convert the noxious gases in vehicle exhausts into harmless substances. Use of autocatalysts has spread worldwide and since its introduction has prevented over 12 billion tonnes of pollution from entering the earth's atmosphere.

During the 1980s the rapid increase in the value of precious metals, including platinum, gave rise to the production of a variety of bars and coins, many of them collectable items, to meet demand for platinum as a physical investment product.

By the 1990s, platinum was growing in use as a medical treatment against certain forms of cancer and the same decade saw a multiplication in the uses of machined platinum alloy components (as seen right) to treat cardiac and other disease.

NEW!! Direct-Fit High Performance Catalytic Converters

– Full line covers over 380 applications for cars, SUVs, and light trucks –

Eastern has just launched the **industry's first and only line of Direct-Fit High Performance Catalytic Converters.** The line offers an easy, bolt-on performance upgrade with vehicle-specific coverage for over 380 cars, SUVs, and light trucks on the market today.

Eastern Performance Converters feature a 200 cell/sq. in. metal catalyst to deliver significantly less backpressure than the 400 cell/sq. in. configurations used in typical OE and aftermarket converters. **The 200 cell catalyst's** large holes create better flow, higher horsepower, and increased torque. Eastern's high-tech **NANO wash coat** enables the new converters to meet OBD II compliance in 49 states*, despite the reduced surface area of the large cell catalyst design.

The metallic catalysts used in Eastern Performance Converters can withstand the extreme pressures and vibration that can crumble ceramic catalysts. Because there's no ceramic catalyst to hold in place, no Interam™ matting is needed, eliminating pressure-caused blowouts in turbo-charged and high performance engines.

All of Eastern's Direct-Fit High Performance Converters are made from 409 stainless steel. They're built on precision-made fixed platforms and feature OE-style flanges for an easy bolt-on fit. Full-length heat shields are included whenever present on OE versions.

EASTERN™ Performance CATALYTIC

Eastern Catalytic also offers a **complete range of Universal Performance Converters** in standard oval and large oval sizes, as well as welded/spun round configurations. A complete range of inlet and outlet sizes is offered.

More information on the new Direct-Fit line, including Eastern Catalytic's High Performance Converter Catalog, is available at **www.easterncatalytic.com.**

Continued from page 1, O2 Sensors

It's important to know how the O2 sensors are identified because a diagnostic trouble code that indicates a faulty O2 sensor requires that sensor to be replaced. Bank 1 is usually the front bank of cylinders on a transverse mounted V6 engine. But on a longitudinal V6, V8 or V10, it could be either the right or left bank. It may therefore be necessary to refer to the vehicle service literature to determine how the cylinder banks and oxygen sensors are labeled.

QUESTION: I was wondering – how does a downstream O2 sensor monitor converter efficiency?

ANSWER:

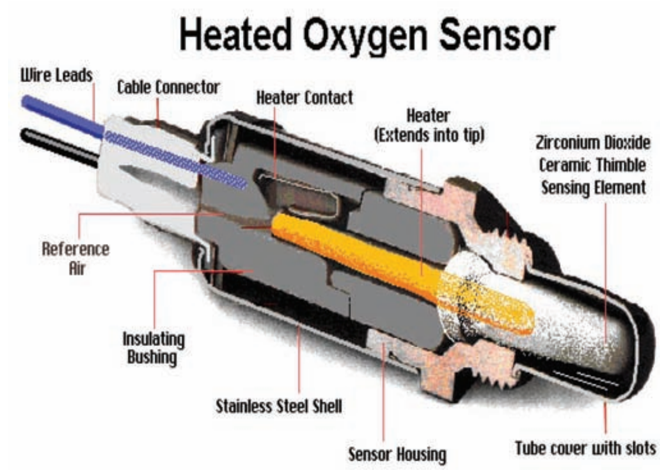
A downstream oxygen sensor in or behind the catalytic converter works exactly the same as an "upstream" O2 sensor in the exhaust manifold. The sensor produces a voltage that changes when the amount of unburned oxygen in the exhaust changes. If the O2 sensor is a traditional zirconia type sensor, the voltage output drops to about 0.2 volts when the fuel mixture is lean (more oxygen in the exhaust). When the fuel mixture is rich (less oxygen in the exhaust), the sensor's output jumps up to a high of about 0.9 volts. The high or low voltage signal tells the PCM the fuel mixture is rich or lean.

On some newer vehicles, a new type of "wideband" oxygen sensor is used. Instead of producing a high or low-voltage signal, the signal changes in direct proportion to the amount of oxygen in the exhaust. This provides a more precise measurement for better fuel control. These sensors are also called "air/fuel ratio sensors" because they tell the PCM the exact air/fuel ratio, not just a rich or lean indication like a conventional O2 sensor.

The OBD II system monitors converter efficiency by comparing the upstream and downstream oxygen sensor signals. If the converter is doing its job and is reducing the pollutants in the exhaust, the downstream oxygen sensor should show little activity (few lean-to-rich transitions, which are also called "crosscounts"). The sensor's voltage reading should also be fairly steady (not changing up or down), and average 0.45 volts or higher.

If the signal from the downstream oxygen sensor starts to mirror that from the upstream oxygen sensor(s), it means converter efficiency has dropped off and the converter isn't cleaning up the pollutants in the exhaust. The threshold for setting a diagnostic trouble code (DTC) and turning on the Malfunction Indicator Lamp (MIL) is when emissions are estimated to exceed federal limits by 1.5 times.

If converter efficiency has declined to the point where the vehicle may be exceeding the pollution limit, the PCM will turn on the Malfunction Indicator Lamp (MIL) and set a diagnostic trouble code. At that point, additional diagnosis may be needed to confirm the failing converter. If the upstream and downstream O2 sensors are functioning properly and show a drop off in converter efficiency, the converter must be replaced to restore emissions compliance. The vehicle will not pass an OBD II emissions test if there are any converter codes in the PCM



QUESTION: I would like to know, what's the difference between a "heated" and "unheated" oxygen sensor?

ANSWER:

Heated oxygen sensors have an internal heater circuit that brings the sensor up to operating temperature more quickly than an unheated sensor. An oxygen sensor must be hot (about 600 to 650 degrees) before it will generate a voltage signal. The hot exhaust from the engine will provide enough heat to bring an O2 sensor up to operating temperature, but it may take several minutes depending on ambient temperature, engine load and speed. During this time, the fuel feedback control system remains in "open loop" and does not use the O2 sensor signal to adjust the fuel mixture. This typically results in a rich fuel mixture, wasted fuel and higher emissions.

By adding an internal heater circuit to the oxygen sensor, voltage can be routed through the heater as soon as the engine starts to warm up the sensor. The heater element is a resistor that glows red hot when current passes through it. The heater will bring the sensor up to operating temperature within 20 to 60 seconds depending on the sensor, and also keep the oxygen sensor hot even when the engine is idling for a long period of time.

Heated O2 sensors typically have two, three or four wires (the extra wires are for the heater circuit). Note: Replacement O2 sensors must have the same number of wires as the original, and have the same internal resistance.

The OBD II system also monitors the heater circuit and will set a trouble code if the heater circuit inside the O2 sensor is defective. The heater is part of the sensor and cannot be replaced separately, so if the heater circuit is open or shorted and the problem is not in the external wiring or sensor connector, the O2 sensor must be replaced.•

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