



Clean Air Facts

The Catalytic Converter: Technology for Clean Air

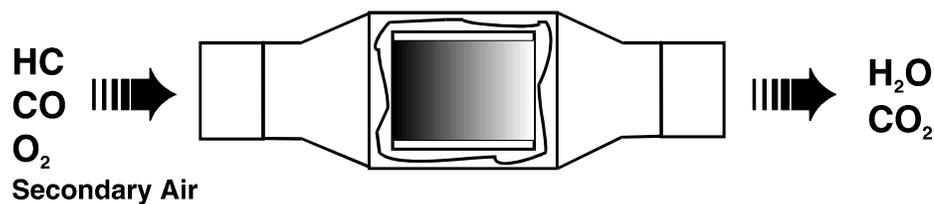
Overview

The catalytic converter has been the centerpiece of mobile source emission control throughout the world. Since the mid-1970s, catalysts equipped on passenger cars, from the first two-way oxidation catalysts to today's advanced three-way catalysts, have cut pollution by more than 10 billion tons in the U.S. Catalyst technology frequently has been hailed as one of the great automotive engineering achievements. Catalytic converters have been developed for use on trucks, buses, and motorcycles, as well as on construction equipment, lawn and garden equipment, and other non-road engines. The technology has been used on vehicles and equipment fueled with gasoline, diesel, propane, and natural gas.

The History of the Automotive Catalyst

- When strict vehicle emission standards were first set in the Clean Air Act Amendments of 1970, automakers did not possess the technology to significantly lower vehicle emissions. Catalytic converters for automobiles were developed to meet the standards set by the U.S. Congress.
- Catalytic converters, or “catalysts,” were first installed on cars in the mid-1970s.
- Over the past 30 years, catalyst technology has continued to advance to meet increasingly tighter emissions standards and greater durability requirements.

Two-Way Converter

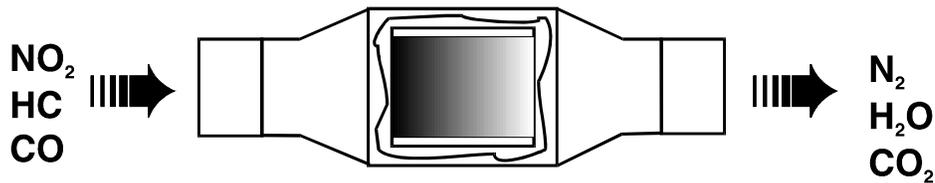


How a Catalytic Converter Works

- First generation catalytic converters, called “two-way converters,” only controlled carbon monoxide (CO) and hydrocarbon (HC) emissions.
- In the early 1980s, catalysts were introduced that could control nitrogen oxides (NO_x), in addition to controlling CO and HC. All cars sold in the U.S. today are equipped with this type of catalytic converter, called a three-way converter.
- A catalytic converter has no moving parts. The technology behind the catalytic converter involves

a very small amount of catalytic metal -- platinum, rhodium, and/or palladium -- applied to acres of surface area contained within a stainless steel canister. The active metals cause a chemical reaction, converting NO_x, HC, and CO to N₂, H₂O, and CO₂, without being changed or consumed.

Three-Way Converter



- The catalytic technology used today is part of an integrated emission control technology system that often includes enhanced engine and fuel management strategies.
- Three-way catalysts can be applied in applications where the engine operates in a stoichiometric condition (near perfect balance of available oxygen and unburned fuel).
- Three-way catalysts are utilized on gasoline powered passenger cars, light trucks, motorcycles, heavy trucks, and certain off-road applications, such as forklifts.

Achievements of the Catalytic Converter

- Today's automobiles are meeting emission standards that require reductions of up to 99+ percent for HC, CO, and NO_x compared to the uncontrolled levels of automobiles sold in the 1960s.
- In the 1970s and 1980s, many predicted that tight vehicle emissions standards would make automobiles prohibitively expensive, as well as decrease fuel economy, vehicle performance, and model selection. To the contrary, today's consumers can buy a wide variety of affordable, high-performance, lower-polluting vehicles.
- Fuel economy began a dramatic, continuous rise beginning with catalyst-equipped 1975 model automobiles that were meeting much tighter emission requirements. This was largely because the use of the catalyst to control emissions allowed manufacturers to design for efficiency.
- Because the catalyst is poisoned by lead, the use of catalytic converters helped bring about the elimination of gasoline containing lead, which has been found to be a serious health hazard.
- Today, a catalytic converter is an integral part of a vehicle's high-tech, computerized engine system designed for optimal fuel economy, performance, and emission control.
- Catalytic converters have also been developed for use on trucks, buses, and motorcycles, as well as on construction equipment, lawn and garden equipment, marine engines, and other non-road engines.
- Catalytic converters are also used to reduce emissions from alternative fuel vehicles powered by natural gas, methanol, ethanol, and propane.
- To date, more than 500 million vehicles equipped with catalytic converters have been sold worldwide.

- In 2005, 100 percent of new cars sold in the U.S. were equipped with a catalytic converter, and worldwide over 90 percent of new cars sold had a catalyst.
- *Car and Driver* magazine called the catalytic converter one of the century's 10 best automotive breakthroughs and the Society of Automotive Engineers selected the catalytic converter as one of the automobile industry's 10 greatest achievements over the past 100 years.

The Catalytic Converter into the Future

- On December 21, 1999, EPA announced its Tier 2 program which established more stringent emission standards starting in 2004 for all passenger vehicles, including sport-utility vehicles (SUVs), minivans, vans, and pick-up trucks. The Tier 2 standards are expected to be completely phased in by 2009. In conjunction with the Tier 2 Program, EPA also announced lower standards for sulfur in gasoline, which will ensure the effectiveness of catalytic converters to reduce automobile emissions. Vehicles meeting the Tier 2 standards are up to 99 percent cleaner than vehicles sold in the 1960s. Many new passenger cars and light duty trucks have already been introduced since 2004 that comply with the EPA Tier 2 emission regulations
- On November 1998, ARB amended the California's Low Emission Vehicle (LEV) regulations. The new amendments, known as LEV II affect passenger cars, light-duty trucks, and medium-duty vehicles. It started its phase-in in 2004 and will be fully implemented in 2007. LEV II advances the state's clean air goals through improved emission reduction standards for automobiles.
- As part of California's LEV II program, vehicle manufacturers have introduced more than 30 models of vehicles that meet California's near-zero tailpipe emission standards [so-called Partial Zero Vehicles (PZEVs) or Super Ultra-Low Emission Vehicles (SULEVs)]. These vehicles use state-of-the-art emission control systems featuring advanced three-way catalytic converters and advanced engine controls.
- In countries where car ownership is rapidly increasing, such as in China and India, legislation has been put in place requiring the use of three-way catalysts on all new passenger cars.
- Emission control manufacturers continue to work on enhancing the design of the catalytic converter and optimizing its performance as part of a vehicle's high-tech, computerized engine system.

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