A pelletized type converter is a shell that contains a bed of small catalyst-coated ceramic beads. The exhaust gases are forced to flow around these beads in their path to the outlet of the exhaust system.

There are four basic types of converter functions—oxidation, reduction, dual bed threeway and single-bed threeway. Each one of these converter functions (or a combination of two or more) is designed to meet the requirements of the specific emission control system.

- Oxidation—The carbon monoxide (CO) and hydrocarbons (HC) that have not been totally consumed by combustion are channeled into an oxidation converter and then changed into harmless water (H_2O) and carbon dioxide (CO_2).
- Reduction—The converter reduces the nitrous oxides (NOx) produced during combustion into nitrogen and carbon dioxide (CO_2).
- Reduction and Oxidation (Dual Bed)—A reduction catalyst requiring an oxygen deficient environment is followed by an oxidation catalyst requiring an oxygen rich environment.
- Threeway—Reduction and oxidation functions take place simultaneously. Used only on cars with electronic fuel injection, the mixture cycles from rich to lean and the converter operates alternately in a reduction mode when the mixture is rich and in an oxidation mode when the mixture is lean.

Converter Problems

A catalytic converter can be harmed or destroyed in many ways. Under normal conditions, a catalytic converter will last at least 50,000 miles, or even longer. But with the wrong fuel, excessive combustion heat, or an incorrect air-fuel mixture, a catalytic converter can be seriously damaged or destroyed.

Leaded Fuel

Catalytic converters must be used with unleaded fuel only. Lead and phosphorus will severely reduce the catalyst effect and performance. When leaded fuel is used, lead coats the catalyst in the converter and forms a barrier, preventing the exhaust gases from contacting it. The result is a less active chemical reaction or, in the event of severe lead contamination, no chemical reaction at all.

Sometimes, returning to unleaded fuel will allow the converter to regain some of its functional efficiency. The efficiency regained depends on how much and how long leaded fuel has been used.

It is a violation of federal law to sell leaded fuel for use in vehicles equipped with converters. To help regulate this, converter-equipped cars and trucks have a restrictor in the fuel tank filler that will only allow the use of an unleaded gasoline pump nozzle. Unleaded gasoline pump nozzle spouts are smaller in diameter than are spouts of leaded gasoline nozzles.

Heat and Engine Conditions

Heat is a normal part of converter operation. The optimum temperature for high converter efficiency is 1500 degrees F. If the temperature in the catalyst area rises, however, the substrate of the converter may break up or melt.

Poor engine conditions usually cause this problem. Engines in need of a tune-up will deliver a too-rich exhaust gas to the converter, having either not enough air or too much fuel.

When this rich fuel mixture reaches the catalyst, the converter becomes a furnace. The catalyst converts the pollutants, heat is released in the process, and combustion takes place while raw fuel is present. The additional heat ruins the converter substrate.

A similar problem can be caused by spark plugs that misfire. When more than two spark plugs misfire simultaneously, raw fuel is pumped into the converter. If this misfiring condition occurs over an extended period, the raw fuel causes the internal temperature of the converter to rise quickly. This can lead to a meltdown, as we've already described.

Even an engine in good operating condition can have converter problems. These are normally caused by a severe service condition, such as a long idling period. More heat builds up when idling; so if more than ten minutes of idling is required it's usually better to turn the engine off and restart it later.