EASTERN CATALYTIC

www.easterncatalytic.com

CONVERTER QUARTERLY

Volume IV, Issue I • March, 2010

2151 Cabot Boulevard West, Langhorne, PA 19047 USA • **USA / Canada:** Ph (800) 553.7199 Fax (215) 702.3606 • **Worldwide:** Ph (001) 215.702.3600 Fax (001) 215.702.3606

New ECO-GM Cats keep "CEL" in the dark.

Our new **ECO-GM** converters are just what shops need to handle MIL issues on specific GM vehicles and help keep the 'Check Engine Light' off. The new series has been developed specifically to meet the emissions challenges of GM 2.2, 3.1, 3.4, and 3.8L engines. We've engineered the catalyst with specially formulated precious metal and chemical content to meet the special requirements of these engines.

The new converters use a catalyst washcoat that is designed to maximize catalyst performance and oxygen storage capability. The catalyst was developed by the same supplier that produced the original equipment.

You can get Eastern **ECO-GM** catalytic converters in direct-fit models for select GM applications and a 12" (16" OAL) universal configurations. The **ECO-GM** series is backed by Eastern's 5-year / 50,000 mile warranty.

Your one-stop shop for components.

With the exceptional availability and competitive pricing on its new components program, Eastern is now your best source for flex pipes, boss and plugs, cowbells, shells, heat shields, and end caps. Eastern Flex Pipes come in a wide range of configurations, including outer braid, inner and outer braid, interlock, and double bellows style pipes. The shell line includes both stainless steel and fully aluminized steel shells. Our heat shields and end caps are all fully aluminized steel. Complete listings, descriptions and specifications are available in our new full line catalog.

Also in this issue:

Properly Diagnosing FAILURE Can Reduce Comebacks, Boost Profitability

Although modern OBD II technology has simplified catalytic converter diagnostics, it's still important to understand the basics of catalytic converter operation when dealing with a P0420 or P0430 diagnostic trouble code (DTC). DTCs P0420/P0430 indicate that catalyst efficiency is below predetermined thresholds on cylinder banks 1 and 2, respectively. In the following text, I'll explore the basics of catalytic converter chemistry and summarize how common catalytic converter failures can be diagnosed. **See Photo 1**.

LAMBDA NUMBERS

Understanding Lambda is important because the catalytic converter neither creates nor destroys atoms. Instead, it simply changes how atoms are assembled into chemical compounds. The term "Lambda" represents a stoichiometric or chemically correct air/fuel (a/f) ratio of 14.7 unit weights of "pure" gasoline to 1.0 unit weights of air. Catalytic converters operate most efficiently at Lambda because all of the gasoline and air inducted into an engine can theoretically be oxidized into water vapor and carbon dioxide.

…it's still important to understand the basics of catalytic converter operation

Lambda is determined by dividing the current a/f ratio by 14.7. A "rich" 12:1 a/f ratio therefore produces a Lambda number of 0.82 when 12.0 is divided by 14.7. A "lean" 16:1 a/f ratio produces a Lambda of 1.09 when 16.0 is divided by 14.7.

Lambda is maintained by modern closed-loop fuel control systems using an upstream oxygen (O2) or air/fuel ratio (AFR) sensor to measure the oxygen content of the feed gases entering the catalytic converter. The powertrain control module (PCM) uses that data to modulate a/f ratio by changing the fuel injector opening time. Remember that a false Lambda number can result if an exhaust leak exists ahead of the upstream oxygen sensor.

FEED GASES

During the combustion process, atoms of HC and N2 are oxidized by bonding with atoms of O2. The chemical symbols "H" and "C" indicate that hydrogen and carbon exist in their natural states as single atoms while "O2" and "N2" exist in their natural states as two atoms bonded together. The resulting combinations of HC, CO, NOx, CO2 and O2 entering the catalytic converter are called "feed" gases, which are the source of atmospheric pollution.

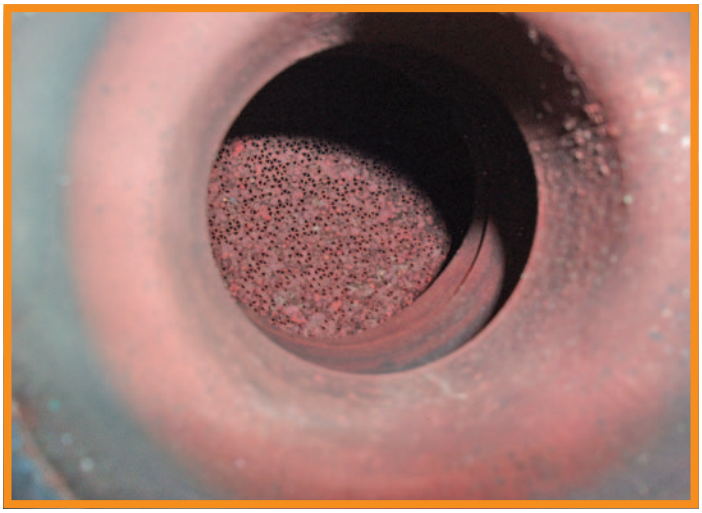


Photo 1: Although this catalytic converter didn't set a P0420 DTC, it accumulated enough contamination on the substrate to cause significant exhaust backpressure during a snap-throttle test.

By Gary Goms

Gary Goms is a former educator and shop owner who remains active in the aftermarket service industry. Gary is an ASE-certified Master Automobile Technician (CMAT) and has earned the L1 advanced engine performance certification. He is also a graduate of Colorado State University and belongs to the Automotive Service Association (ASA) and the Society of Automotive Engineers (SAE).

Article printed from ImportCar with permission of Babcox Publications

CATALYTIC CHEMISTRY

The function of the modern three-way catalytic (TWC) converter is to convert the various compounds of HC, O2 and N2 into more environmentally friendly gases. To illustrate, gasoline is a complex hydrocarbon compound in which atoms of hydrogen (H) are bonded in various forms with atoms of carbon (C). When a 14.7:1 a/f ratio is oxidized within the confines of a combustion chamber, the theoretical exhaust product should be pure carbon dioxide (CO2), water vapor (H20) and nitrogen (N2).

In reality, the microscopic layers of fuel (HC) touching the surfaces of the combustion chamber remain unburned. Carbon monoxide (CO) is generally formed when an insufficient amount of oxygen is available to fully oxidize carbon and oxygen into carbon dioxide (CO2). CO might be also caused by an unequal distribution of fuel within the combustion chamber.

An engine produces nitrogen oxide emissions because our atmosphere is composed of about 78% nitrogen. Under the high pressures and temperatures of the combustion process, the normally chemically inert nitrogen gas bonds with oxygen to form nitrogen oxides or NOx.

THREE-WAY CATALYTIC CONVERTER CONSTRUCTION

Although construction can vary according to engine application, the common three-way catalytic converter (TWC) contains a reduction and oxidation stage. To create maximum surface area, each stage is generally a ceramic or stainless steel honeycomb substrate covered with a rough silica and alumina wash coat. Both stages of the converter are coated with precious metal catalysts that accelerate chemical reactions without themselves being consumed.

The reduction catalyst generally includes platinum, rhodium and cerium. Cerium stores excess oxygen during periods of "lean" operation that can later be used to oxidize HC and CO during periods of "rich" operation. The oxidation catalyst is generally coated with platinum and palladium. Throughout these simultaneous chemical processes, the catalysts — platinum, rhodium, palladium and cerium — remain unchanged.

The reduction stage breaks nitrogen oxide molecules (2NOx) into their component parts of oxygen (O2) and nitrogen (N2). The oxidation stage uses some of the oxygen generated by the reduction stage to change lethal carbon monoxide (CO) to non-toxic carbon dioxide (CO2) by adding an atom of oxygen. Similarly, the oxidation stage oxidizes hydrocarbons (HC) by adding two atoms of hydrogen (H) to one atom of oxygen (O), which produces water vapor (H2O).

THE CATALYST MONITOR

All passenger car and light truck OBD II emissions systems built since 1996 test the efficiency of the catalytic converter by running a catalyst test or "monitor." The catalyst monitor is a non-continuous monitor, which means the monitor runs only once during any single warm-up cycle.

The "cat" monitor must meet a set of application-specific driving conditions called "enabling criteria" before it can run. The enabling criteria for a Honda product might include DTCs P0137, P0138 and P0141 not set, cold engine start-up completed and running in closed loop with vehicle speed at 40-55 mph for two minutes, followed by a deceleration period to 35 mph at closed throttle. **See Photo 2.**

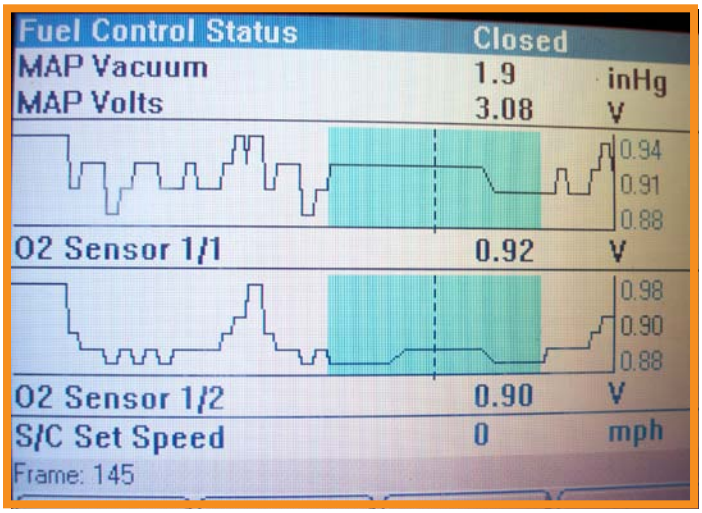


Photo 2: This scan tool graph of upstream and downstream oxygen sensor activity indicates that, while the converter hasn't stored a DTC P0420, it is approaching the threshold of failure. In general, the downstream graph should not fluctuate in relation to the upstream graph.

Most professional scan tools indicate when the cat monitor is ready. When the cat monitor begins, the PCM performs a mathematical analysis of the difference between the upstream and downstream oxygen sensor inputs to determine converter efficiency. The math formula is also designed to filter "false" data. When efficiency falls below a predetermined threshold, a P0420 is stored in the PCM's diagnostic memory and the Malfunction Indicator Light (MIL) is turned on.

…An engine produces nitrogen oxide emissions because our atmosphere is composed of about 78% nitrogen…

DIAGNOSTIC SUMMARY

Catalytic converters can fail due to physical damage, normal degradation, contamination, overheating, internal disintegration and restriction in the substrate. Physical damage should be an obvious reason for a DTC P0420/430 being stored in the diagnostic memory. Normal degradation or wear, on the other hand, varies widely among different nameplates and applications. Modern original equipment converters covered under an EPA warranty are built to last at least 8 years or 80,000 miles, whichever occurs first. This warranty has been extended to 10 years and 100,000 miles in some states like California.

Converters failing with a P0420/430 DTC under that warranty should be referred to an OE authorized dealer for warranty replacement. While OE converters will degrade, they are generally designed to last well beyond the normal EPA warranty period. Aftermarket converters have a significantly shorter warranty period and generally won't meet the "8/80" standard.

Before replacing a converter that stores a P0420/430 DTC, always check TSBs to make sure that downloading new threshold calibrations into the PCM can't instead cure the problem. After replacing a converter, be sure to follow federal and state regulations regarding documentation, storage and disposal of the old unit.

Although lead, sulfur, silicon, zinc and phosphorous contamination hasten the degradation process, very little of these materials exist in modern automotive environments. To illustrate, ethyl lead is found only in racing gasoline. While sulfur can be found in some fuels, it will eventually burn away when the converter reaches high temperatures. Silicon found in plain dirt can, to some extent, contaminate gasoline. Using non-approved silicone gasket sealants commonly causes silicon contamination. Although oils containing phosphorus have been phased out, phosphorus can still be found in some motor oils designed for flat-tappet racing engines. Before replacing a converter, an engine should nevertheless be evaluated for excess coolant or fluid consumption to prevent possible contamination of the new converter.

Thermal or overheating damage occurs when a cylinder misfire causes excessive amounts of unburned oxygen and gasoline to enter the converter. In general, the catalyst begins to function at 550° F and will begin to lose efficiency at 1,800° F. Temperatures approaching 2,500° F will melt the substrate. While many newer vehicles will disable the fuel injector on a misfiring cylinder to prevent overheating of the catalyst, others may not. **See Photo 3.**

In these cases, it pays to replace spark plugs, wires, coils and other ignition parts as a preventive measure if the catalyst substrate appears to have melted or if the PCM's diagnostic memory contains any current P0300-series misfire codes or has misfires recorded in the misfire history.

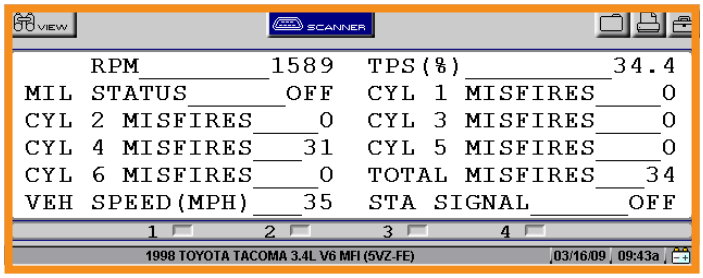


Photo 3: This scanner screen indicates a light misfire on a single cylinder. Because misfires can overheat the catalyst on many import applications, check the scan tool's trouble code and misfire history when diagnosing a failed catalytic converter.

Internal disintegration can be tested by lightly rapping the converter shell with a rubber mallet. If the converter rattles, the wrap insulating the substrate against the converter shell has come loose or the substrate itself might be disintegrating. **See Photo 4.**

Photo 4: A snap-throttle test on this converter revealed an exhaust restriction that had passed conventional testing methods.

Exhaust restriction often occurs if the substrate is contaminated or if it begins to disintegrate. Restriction can become so severe that the engine stalls or so mild that the driver barely notices a power loss during acceleration. Remember, too, that a restricted converter may not store a P0420/430 DTC.

While other testing methods are effective, the most definitive test for exhaust backpressure is to place an adaptor in the upstream oxygen sensor port and attach a low-pressure gauge of at least 15 psi capacity. At idle, the pressure should be less than one psi. During a snap-throttle test, the pressure generally shouldn't exceed 4 psi. While the P0420/430 DTCs can occasionally be tough to diagnose, you'll find yourself with fewer comebacks and greater profitability if you remember the basics of catalytic converter diagnostics.

Eastern - #1 manufacturer of Manifold Converters!

Manifold converters are fast becoming one of the hottest parts in emissions service, with more and more shops seeing new application needs every day. That's why Eastern has made such a tremendous investment in its manifold converter business. We've boosted our R&D efforts dramatically in order to bring more new parts to market sooner and continue our rapidly expanding coverage and availability, especially for late-model vehicles.

Eastern's new manifold converter for 2001-06 Ford Escape / Mazda Tribute 3.0L, and 2005-07 Mercury Mariner 3.0L

As the go-to-choice for manifold converters, our coverage is second to none. We offer thousands of applications for cars, vans, light trucks and SUVs from 1987 to 2010, including hard-to-find units for Ford, Honda, Hyundai, Infiniti, Lexus, Mercury, Nissan, and Toyota.

...We've boosted our R&D efforts dramatically to bring more new parts to market

Eastern Manifold Converters are designed and built to meet OE specs for exact fit and performance. All post '96 manifold converters use Eastern's ECO advanced Series catalysts. Our manifold converters come complete with gasket, studs, and nuts, as required. All of the converters are checked in special QC control fixtures after production to assure exact OE fit before final packaging.

Eastern's new manifold converter for 2001-05 Honda Civic 1.7L (exc VTEC engine)

California, here we come!

Eastern recently received several executive orders from CARB for converters in the State of California. The first order (D-665) was for our new Series 840100 three-way catalytic converters (TWC), which can be used as converter replacements for selected 1996 -2002 Honda/Acura passengers (PC) equipped with on-board diagnostics II (OBD II) systems. Application coverage includes: 1996 Accord EX 2.2 and 2.7, 1996 Prelude Si 2.3, 1997 Prelude and Prelude Type SH 2.2, 1998 Prelude VETC and VTEC-R 2.2, 1998-9 Accord 2.3, 1999 Accord 3.0, 2000-01 Accord 2.3, 2001-02 Accord 3.0, 1997 Acura CL 3.0 and TL 3.2, and 1998 Acura CL 3.0 and Acura TL 3.2.

Two other orders cover GM Passenger cars (D-665-2) and T1 certification trucks with one converter, pre-OBD II (D-665-2). According to Henry Hippert, Executive Sales Director, "These new orders will add over 275 new SKUs to our program and result in several thousand California vehicle applications. Eastern has made a substantial investment in engineering and R&D to develop its California converter program and is currently testing and near completion on several other California vehicle applications."

Check engine light problems?

Eastern ECO II and ECO III Converters are designed to help keep the Check Engine Light (MIL) off.

ECO II **ECO III**

Will the real California Cat please stand up?

When it comes to replacing a catalytic converter, there seems to be a lot of concern and some confusion by shops across the country about the rules and regulations for installing a California converter versus non-California converter.

To clarify this situation, you need to understand that there are two regulating authorities at work here: the California Air Resources Board (CARB), which covers California emissions, and the EPA, which addresses the remaining 49 states.

CA vehicles must meet CARB standards.

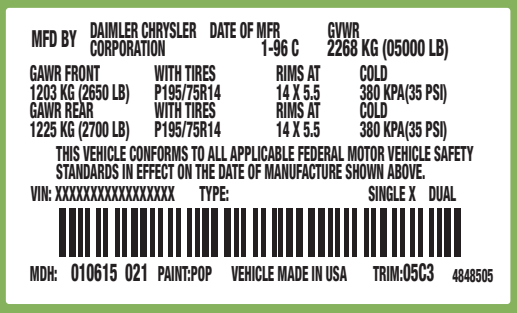
The State of California mandates that all catalytic converters, both OEM and aftermarket, must be certified to meet CA emissions. On top of this, 17 states have followed California's lead and require any new vehicle sold in those states to meet CA emissi ons. However, this only applies to new vehicles. These states do not impose the same CA emission standards on aftermarket replacement converters. The rest of the country abides by Federal emissions standards.

Vehicle labels identify emissions system.

To properly determine whether the vehicle has a CA or Federal converter, you should check the vehicle's emissions system label, which is usually found on the front radiator support, the strut tower plate, or under the engine hood.

So basically, it means that a California registered vehicle can only be serviced with a California certified aftermarket converter. These converters are available, depending on coverage, from either the OE dealer or a select group of aftermarket suppliers that are permitted to sell CA legal converters. Eastern has recently joined that select group of manufacturers and is able to provide coverage for certain applications.

Converters approved for Federal EPA standards can be used to service vehicles in the remaining 49 states.



Typical label showing a Federal system

Typical label showing a California system

Common vehicle emissions label locations are:

1) On the front radiator support
2) On the strut tower plate
3) Under the engine hood

New catalog delivers the whole enchilada.

Our new 352-page full line catalog is Eastern's largest and most comprehensive to date. It includes application listings for all of our Direct-fit, Universal, High Performance, Diesel, and Manifold lines, as well as our new ECO Series (ECO II, ECO III, and ECO-GM) and our accessories line. The catalog also incorporates an engine size conversion chart, VIN Chart, vehicle emissions labels, and OBD II Oxygen sensor locator, along with valuable information on converter basics, diagnostics, causes of converter failures, selecting direct-fit and universal converters, EPA requirements, and Eastern Catalytic's Limited Warranty and return policy.