STANDARD®

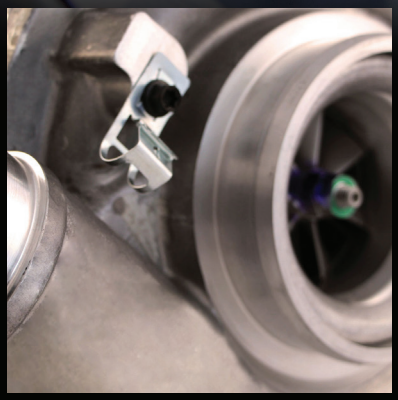
Pro Training Magazine

Featuring our
2018 On-Demand
Training Calendar

Insights from ASE-Certified Technicians on...

How Variable Valve Timing Systems Work

Tips for Diagnosing Turbochargers



When to Replace Mass Air Flow Sensors

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2018 Pro Training On-Demand Calendar

Jan
Relay Testing and Diagnosis Fundamentals

Feb
Scan Data Diagnostics Fundamentals

Mar
HVAC r1234yf Update

Apr
Electronic Transmission Fundamentals

May
Chevy Colorado Diesel Overview

Jun
Electronic Throttle Control Fundamentals

Jul
6.7 Cummins Tips & Tricks

Aug
Vehicle Electronics Fundamentals

Sept
Communication Fault Diagnostics

Oct
Driver Assist Systems Overview

Nov
More Electrical Puzzles Part III

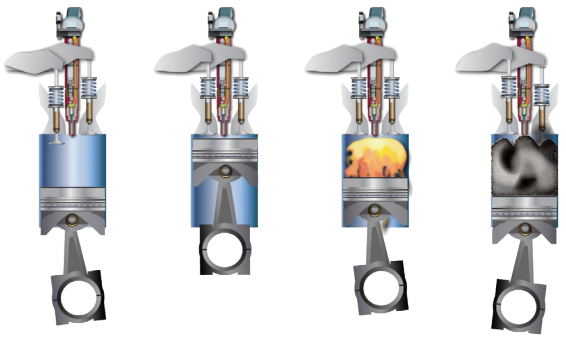
Dec
Brain Teasers: Diagnostic Puzzles from the Field Part V

Our new on-demand training classes for 2018 are just 12 of the more than 100 on-demand classes available right now at **pts.smpcorp.com/std**.

For face-to-face training, our professional trainers perform thousands of clinics a year at locations throughout North America. Contact your local Standard® sales rep or distributor for dates, times, topics, and locations.

Ford 6.0L Diesel Injectors Explained

The Ford 6.0L Powerstroke engine uses Hydraulic Electronic Unit Injectors (HEUI). These injectors receive energy to open from engine lube oil that's pressurized by a gear-driven high-pressure pump.



How They Fire and Release

The PCM communicates to the fuel injection control module (FICM) that it's time to fire the injector. When that happens, an electrical signal is sent from the FICM to the electrical coils on the injector. The signal magnetizes one coil at a time, drawing the spool valve to the apply side to allow high-pressure oil to flow past the spool and push on the intensifier piston. The intensifier piston then travels down on the fuel plunger to deliver fuel to the nozzle area. The fuel achieves the "crack" pressure, lifting the pintle from its seat and delivering the fuel to the combustion chamber.

When the PCM decides that it's time to close the injector, an electrical signal is sent to the opposite magnetic coil on the injector to pull the spool valve in the opposite direction that it was previously pulled. The spool valve moves to the release side, allowing the contained high-pressure oil to flow past the spool and exit the vent port. The intensifier piston travels upward from spring pressure, allowing the fuel chamber to recharge with fuel for the next injection cycle.

What to Keep in Mind During Repairs

A faulty injector will cause the engine to smoke or run rough. You can identify the cylinder with the faulty injector by using a scan tool that's capable of performing a power balance test. For efficiency's sake, many technicians replace all of the injectors on a bank or even the entire engine at the same time. Here's what you need to know about this job:

Rail Sealing - A standpipe delivers high-pressure oil to the oil manifold. A common problem is that the seals warp under the heat and pressure, leading to a high-pressure oil leak that causes loss of injector control. Use updated plugs and standpipes when replacing injectors. Another common leak point is the ball tube in the high-pressure rail that connects the injector to the rail.

Injector Bolt - To avoid damaging the injector solenoids, use a long shank T40 (not a short shank T40) on the bolt that secures the injector hold-down bracket. When you loosen the injector clamp bolt, be careful not to drop the clamp and bolt into the engine. Before installation, remove oil and debris from the threaded injector clamp hole in the cylinder head. Otherwise, the injector may not be fully seated, which can lead to compression leakage in the fuel system.

Injector Seals - Make sure the compression seal on the injector tip comes out with the injector. Also, check for signs of fuel contamination at the injector fuel inlet screen. Any source of contamination must be located or the replacement injectors will fail. Use clean engine oil to lubricate any seals before installing the injector.

Installation - To install, assemble the clamp and bolt to the injector. Be careful to note the orientation notch. Once the engine is assembled, crank the engine over (without starting it) to bleed any air out of the high-pressure oil system. Don't forget to change the oil, oil filter, and fuel filters, and install an upgraded fuel pressure regulator.

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Mass Air Flow Sensor FAQs

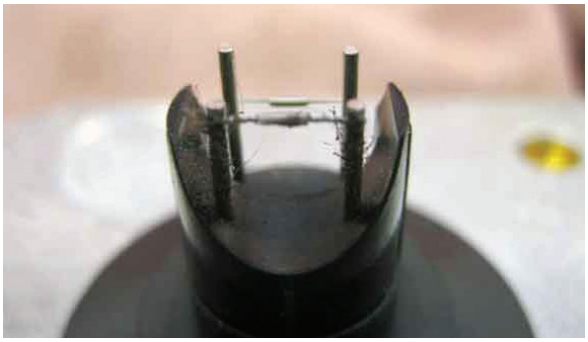
How does a mass air sensor work?

Modern mass air flow sensors use either a hot wire(s) or hot film element. The sensor's internal circuitry heats up the element to a specific temperature. As air flows past the element and cools it off, the sensor increases the current to the element to maintain the specified temperature. There is a direct correlation to the amount of current needed to maintain the element's temperature to the mass of airflow past it. It's important to note that the sensor's element is only a sample of a small part of the air stream. If the intake system has been modified or changed due to a failure, the element may not receive an adequate sample of incoming airstream, which may cause a measurement error to occur.

When do mass air flow sensors need to be replaced?

Road debris and other contaminants that get past the air filter can coat the mass airflow sensor's sensing element. The coating insulates the element, causing under-reporting of airflow off-idle and over-reporting of air at low air speeds.

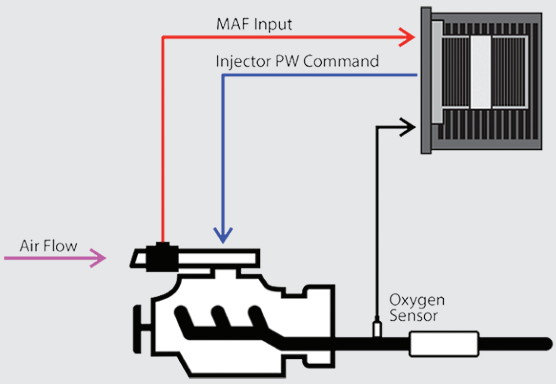
Cleaning a contaminated MAF may seem to bring the performance back, but it rarely brings it to 100% operation and accuracy. Plus, if the internal circuitry is damaged or shorted, the sensor needs to be replaced.



"In the past, I've replaced the MAF and the car ran worse. What should I do?"

There's nothing more demoralizing for a technician than making a diagnosis, replacing a part, and learning that it didn't cure the condition. If the technician isn't confident with their diagnosis, they often chase their tail by going in a different direction and replacing other components.

Enter Standard's new MAF program. Standard is the only supplier to offer 'OE or Better' quality in a full-line new MAF program. Plus, Standard® is the only aftermarket supplier with U.S. manufacturing. Each SMP-manufactured new MAF sensor is calibrated and tested to ensure 100% accuracy. No more installing a reman unit that has been cut apart and glued back together, and no more tapping it with the handle of a screwdriver and hoping that it works.



Steps to prolong MAF sensor lifespan

- Install OE-design air filters. Cheaper filters have designs that can alter airflow direction and skew readings.
- Make sure the air box seals properly and there are no obstructions
- No "performance" airflow devices in the air intake (like those tornado devices you've seen on infomercials). These devices disrupt the planar airflow required for accurate readings.

The New Benchmark for Mass Air Flow Sensor Accuracy

With onsite engineering, design, and test labs at our TS16949- and ISO14001-certified facility, Standard® and Intermotor® are able to produce MAF sensors that are 100% new and 100% airflow calibrated to precisely match the OE output and perform flawlessly under all operating conditions.

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Tips for Diagnosing Turbochargers

Vehicle manufacturers are adding turbochargers at a double-digit rate. Over the next five years, the turbo market is expected to grow to more than eight million turbocharged vehicles. As the number of turbocharged vehicles increases, more technicians will see vehicles with turbocharger issues in their shops. But there's already confusion in the field.

To help technicians diagnose turbocharger repairs, here are a few important diagnostic and repair tips to keep in mind. As a note upfront, most turbocharger diagnoses (aside from noise and low power issues) require scan data and an understanding of operation at the technician-level.

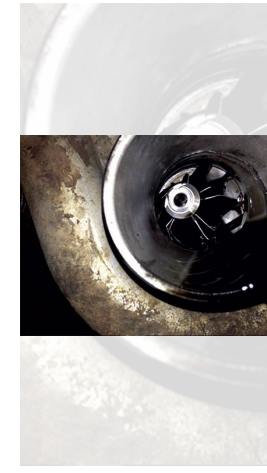
Common Trouble Codes

DTC: P0299 (Underboost)

Potential Issue: Wastegate stuck in open position or leak between compressor and throttle

DTC: P0234 (Overboost)

Potential Issue: Wastegate stuck in closed position, wastegate vent solenoid stuck in vent position, or leaking or disconnected control hoses



What Causes a Turbocharger to Malfunction?

Before we start, let's highlight what causes a turbocharger to malfunction in the first place. Symptoms of a malfunctioning turbocharger include loss of power, excess smoke, high fuel consumption, overheating, high exhaust temperature, and oil leaks from the turbocharger. But it's important to note that defects in other components can produce the same symptoms. Before wrongly attributing the issues to the turbocharger, remember that turbocharger performance can only be impaired by mechanical damage or blockage caused by debris.

Signs of a Damaged Turbocharger

If you hear whistling noises coming from the turbocharger, it's likely due to an air/gas leakage caused by pre-turbine exhaust gas or air/boost leaks. Your first course of action should be checking all of the joints. If the noise continues, check the turbo clearances and wheels for housing contact.

Turbocharger Tips

- Pre-lube the turbocharger by adding oil in the oil feed hole
- Verify the oil feed to the turbo
- Make sure the vehicle has the proper, clean oil
- Make sure there's a quality air filter
- Allow the turbo to cool after strenuous work

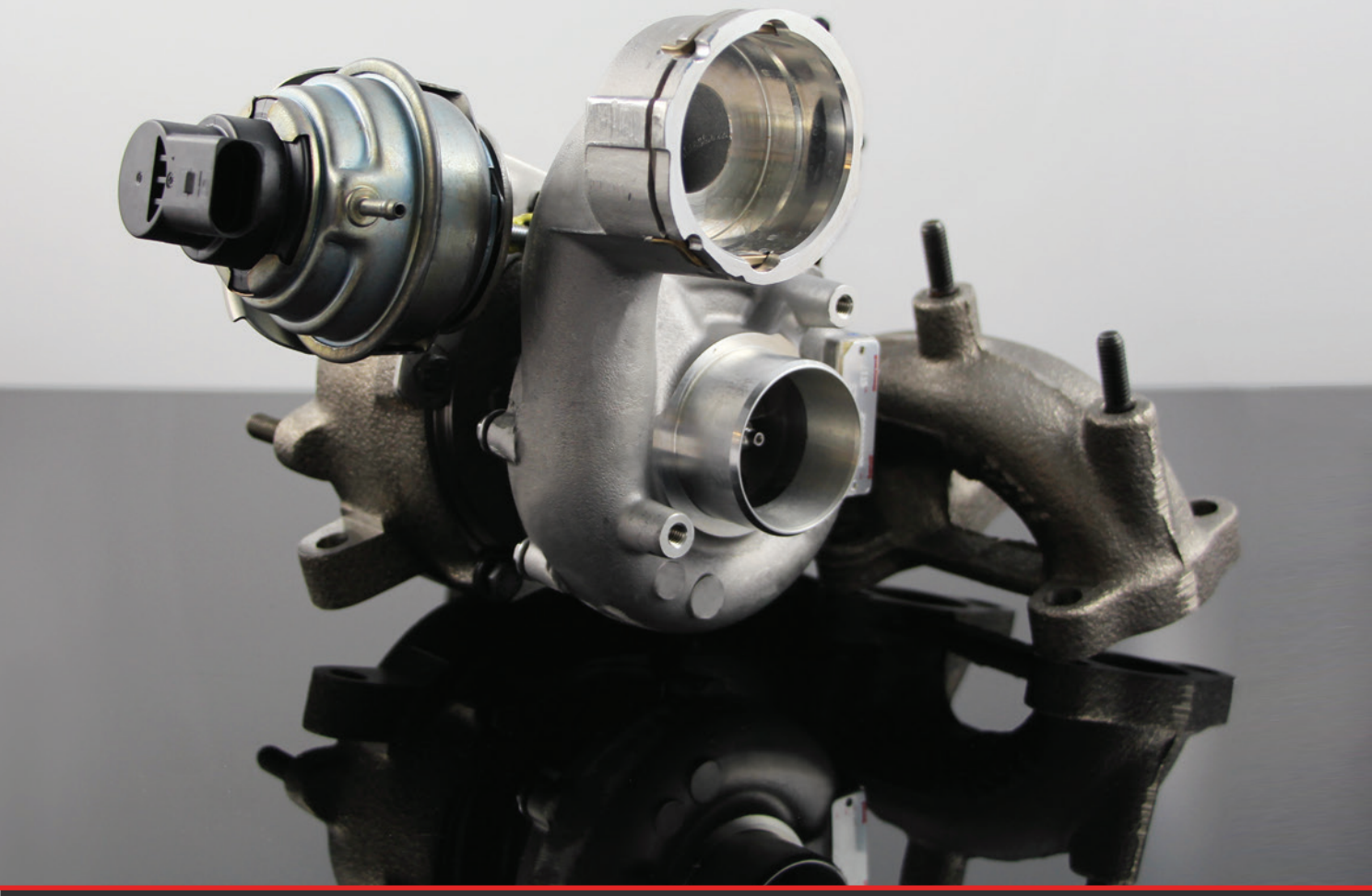
If the turbocharger rotor assembly has seized up or is difficult to rotate, the problem is likely tied to the degradation of the lubricating oil. When the oil degrades, it can lead to carbon buildup in the bearing housing interior. The carbon buildup will ultimately restrict rotation. Two other issues that can cause the rotor to seize up include insufficient or intermittent drop-in oil pressure and dirt in the lubricating oil. Another important detail to keep in mind is that a turbocharger has specific axial and radial rotor clearances. Sometimes, the clearances can be misdiagnosed as worn bearings. In reality, clearances that are out of specification may be associated with a lubricating oil issue. Check for insufficient oil, or oil contaminated with dirt or coolant.

To determine if the turbocharger has been damaged by foreign material, inspect the turbine wheel or impeller. You will clearly see any foreign material that has entered through the turbine or compressor housings. If the blades are damaged, the turbo is already destroyed. Look for metal that has come off the turbo in the intake tubes. Metal particles in this area may indicate a damaged engine.

Choose the Right Replacement

Once you've diagnosed your turbocharger and determined that you need a replacement unit, remember that Standard® and Intermotor® offer both 100% new and quality-remanufactured turbochargers for import and domestic applications.

FULL-COVERAGE
TURBOCHARGER
DOMINATION



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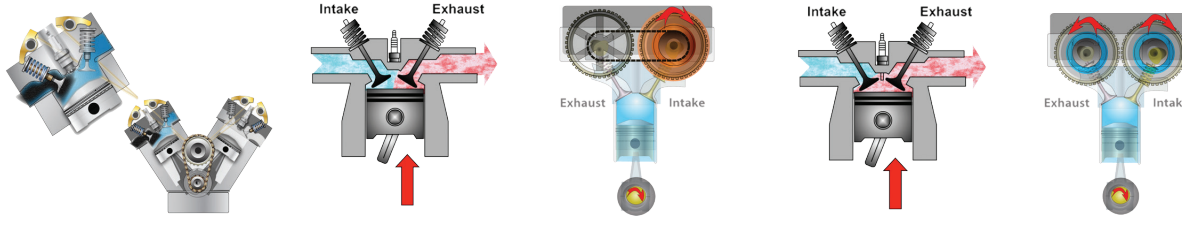
How Variable Valve Timing (VVT) Systems Work

Variable Valve Timing (VVT) or Variable Cam Timing (VCT) is common on most newer engines. It's responsible for increased performance and fuel economy on many engines, and for the elimination of many EGR valves.

Most systems are lube oil-activated, and they use a control solenoid as well as the camshaft sensor, crankshaft sensor, and PCM for control. Newer systems operate off rotational torque from the engine.

With a fixed camshaft, engineers have to balance between idle quality and performance on one side and low emission and fuel economy on the other. As a result, none of these goals are achieved completely. Variable valve timing allows the engine to obtain a smooth idle while achieving the rest of the goals. Modern VVT systems combined with technologies like electronic throttle control and direct fuel injection allow smaller engines to produce high horsepower and torque at lower RPM.



For increased performance, the exhaust cam is retarded a small amount to promote engine breathing. Higher engine speeds mean shorter valve open times and higher air velocity. The increased velocity pushes more exhaust out of the cylinder. The retarded exhaust valve timing increases Volumetric Efficiency. The exhaust valve is still open when the intake opens. Outgoing exhaust pulse creates a low-pressure zone behind the valve, which increases the pressure differential between the intake port and the combustion chamber. The result is better cylinder filling. Remember, this can't be done at idle due to low air speeds.

To provide an EGR function, the exhaust cam is fully retarded, which adds lots of valve overlap. As a result, the exhaust gas remains trapped in the cylinder. This ability allows a reduction in hardware and service issues from carbon. Opening the exhaust valve later retains more exhaust pressure in the cylinder, causing pushback to the intake charge and exhaust gas retention.

On some systems, the intake camshaft is advanced at part throttle and Wide Open Throttle (WOT). The placement opens the intake valve sooner and allows some exhaust gas into the intake stroke, which has an EGR effect. It also closes the intake valve sooner, which increases the compression stroke. On a cold engine, opening the intake valve sooner will also warm the intake charge and assist in reducing startup emissions.

Some newer systems utilize the best of both worlds; they control multiple cams independently of each other. In dual independent systems, the exhaust camshaft is retarded and the intake valve is advanced independent of each other. Doing so maximizes the EGR effect and further reduces pumping losses for maximum efficiency.

Tip: Have a vehicle that is setting VVT or VCT codes? Hear rattling sounds from your cam phaser? You may need a new VVT actuator or solenoid, and Standard® has you covered with a selection of VVT actuators and solenoids.

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