

Living with Cooled-EGR Engines

Although cooled-EGR systems are designed to be essentially maintenance-free, support systems can affect performance

QUICK TIP

On-Board Coolant

If you have a safe and practical compartment in your truck, carrying a gallon or two of the correct antifreeze mixed 50/50 with deionized water may be a way to keep the cooling system filled with the right stuff. Also, deionization units, which work like water softeners, can provide mineral-free water at a reasonable cost.

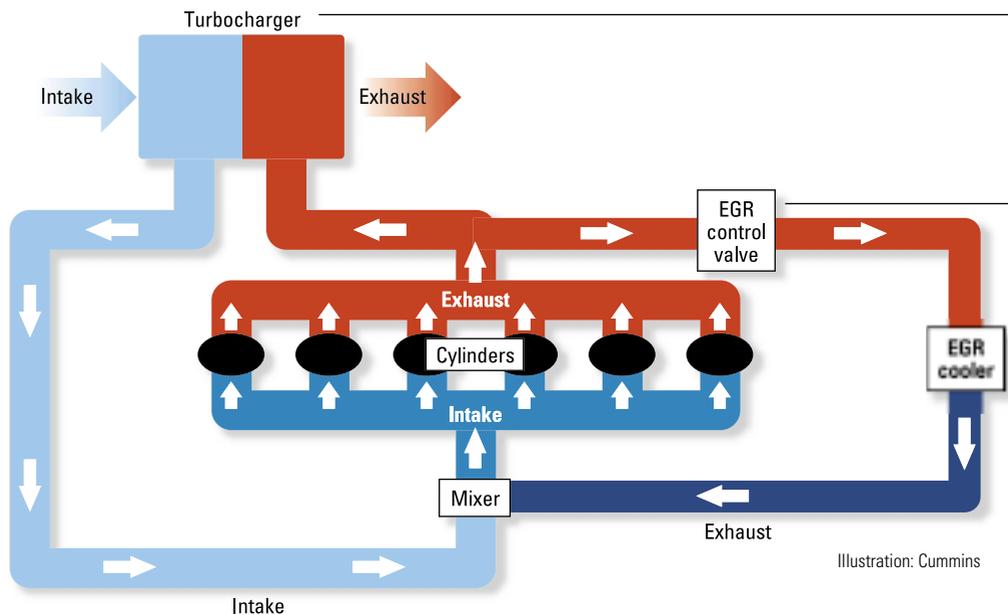


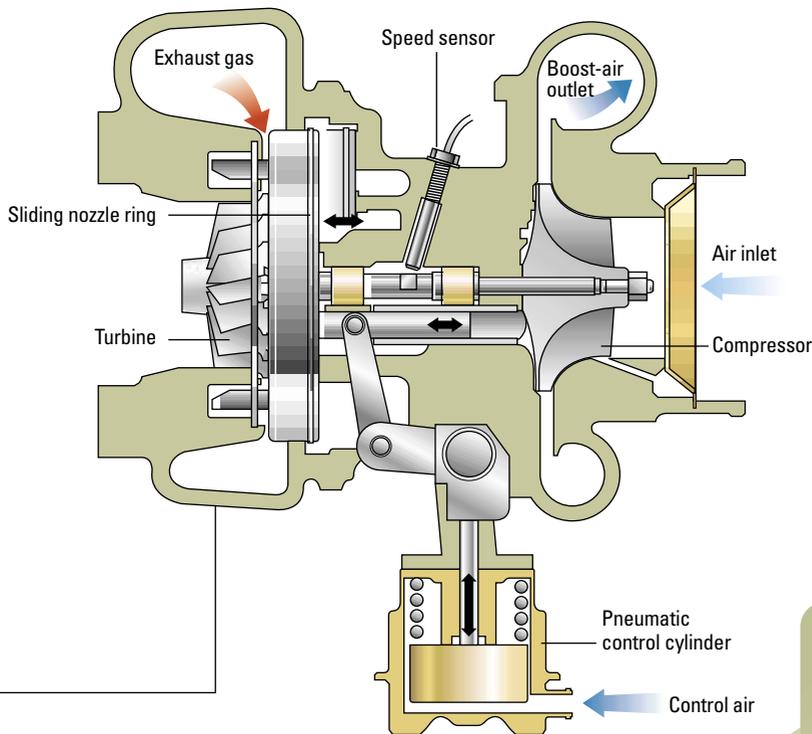
Illustration: Cummins

Cooled-EGR (Exhaust Gas Recirculation) systems have been used since October 2002 by five major engine manufacturers (Cummins, Detroit Diesel, International, Mack and Volvo) to reduce emissions of smog-producing nitrogen oxides (NO_x) from diesel truck engines. Depending on engine operating conditions, these systems divert from 5 to 30 percent of an engine's exhaust stream through an air-to-water cooler, then back into the combustion chambers, where the cooled gases reduce peak tempera-

tures and, thus, retard NO_x formation.

Cooled-EGR systems incorporate a number of sensors and actuators that are controlled and monitored by the engine's electronics, and any malfunctions show up as fault codes in the diagnostic log. On a routine basis, however, cooled-EGR systems are virtually maintenance free. But, that said, the day-to-day health of a cooled EGR system—and that of an engine running with such a system—depends closely on the health of related systems.

With the advent of cooled-EGR, turbo-



Variable-Geometry Turbocharger

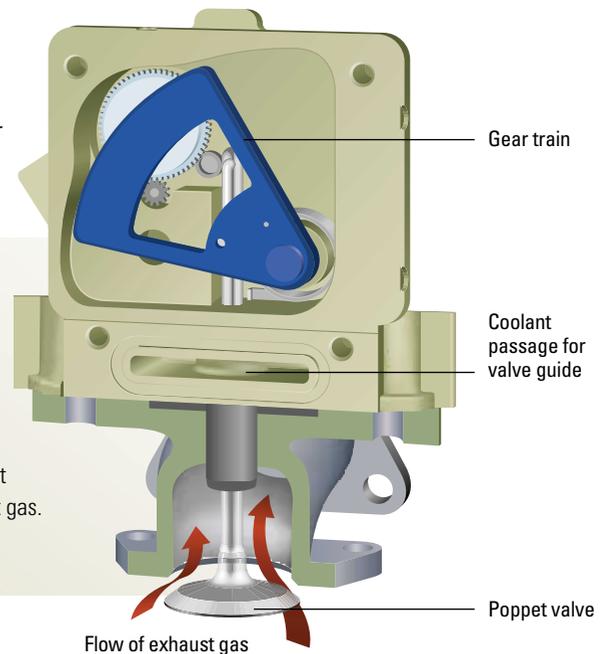
This Holset turbocharger uses a sliding nozzle ring to vary the flow of exhaust gases through the turbine section. A pneumatic cylinder, supplied with air from the truck's braking system, controls the ring's actuating mechanism. A speed sensor communicates with the engine's electronic control module, which determines when and how much the exhaust stream must be closed down to regulate exhaust-manifold and boost pressures.

Illustration: Holset/Cummins

EGR Valve

The EGR valve, controlled by the engine's electronic control module, regulates the volume of exhaust gas diverted from the exhaust manifold and into the EGR cooler. This EGR valve used in the Cummins system employs a stepper motor and a gear train to open and close the poppet valve by precise amounts to regulate the volume of exhaust gas.

Illustration: Cummins



chargers have become more complex. Most now have moving parts in the turbine section that allow continuous adjustment of exhaust-manifold and boost pressures to keep the combustion process efficient and legal. Turbocharger manufacturer Holset handles these adjustments with a variable-geometry turbine (VGT), which uses a sliding nozzle ring to vary the turbine-blade area upon which exhaust gases can act. Garrett, another major supplier, employs a variable-nozzle turbine (VNT), which uses a set of adjustable vanes, or nozzles,



EGR Cooler

EGR cooler design differs among engine manufacturers, but all use engine coolant to reduce exhaust temperature from around 1,100F to 300F. Corrosion-resistant alloys help protect coolers from acidic exhaust gases and poorly maintained coolant. Cooled exhaust gases are channeled to a mixer, which ensures that intake air and exhaust gases are thoroughly blended before reaching the engine's cylinders.

Illustration: Garrett