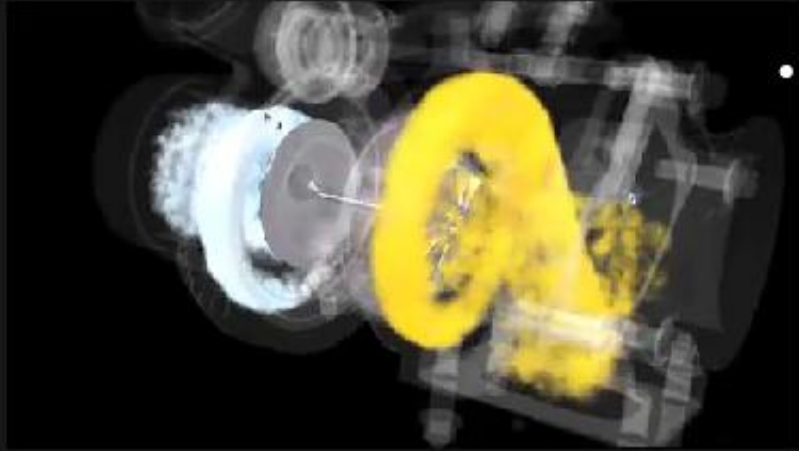




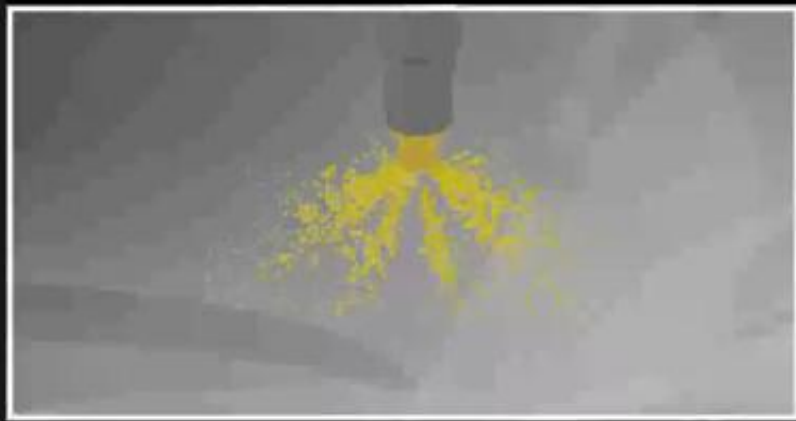
While an engine can breathe in and operate on surrounding air collected through intake valves, it's not ideal. Oxygen density changes depending on air temperature and altitude. To address this, Cummins introduced the first turbochargers in the 1950s.



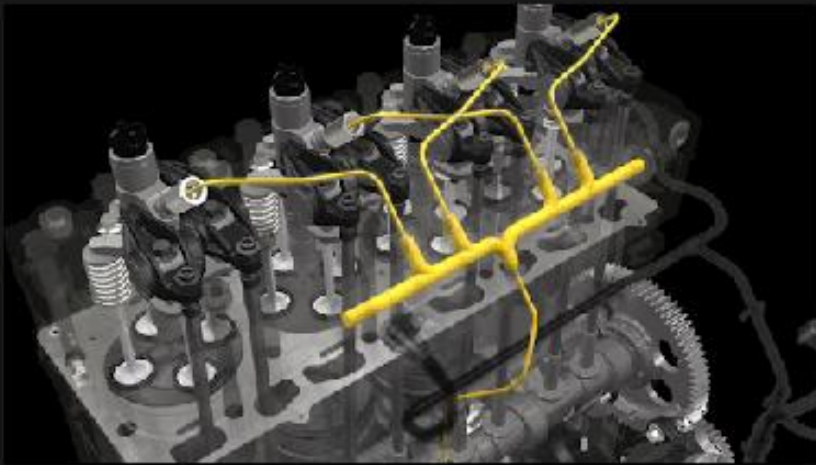
A turbocharger compresses intake air to optimize combustion efficiency. Spinning the compressor is done through the force of exhaust gases coming out of the cylinders. These gases spin a turbine, which then spins the compressor wheel on the other side, sending compressed fresh air to the intake valves.



As with air and exhaust valves, Cummins fuel systems use the camshaft to control the injection process. The amount of fuel delivered to the cylinder is controlled in part by the speed at which the engine turns, since the camshaft is connected to the crankshaft.

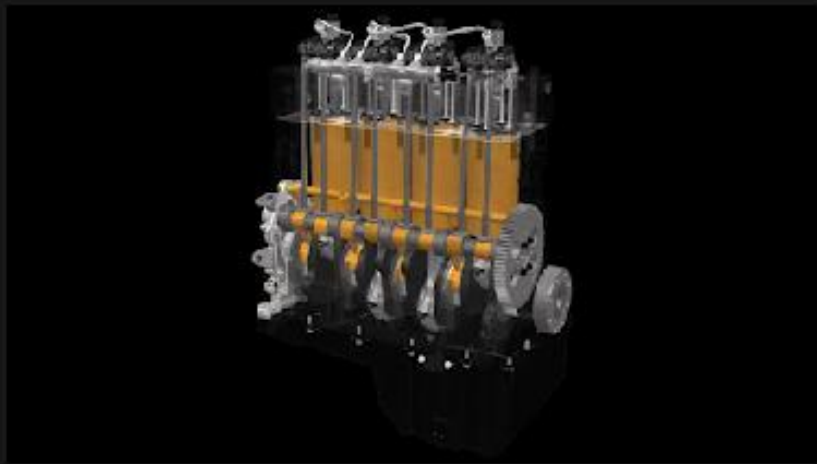


The injection system must atomize fuel for it to combust, so the spray nozzles have either a single hole near the tip or a series of holes around the side.



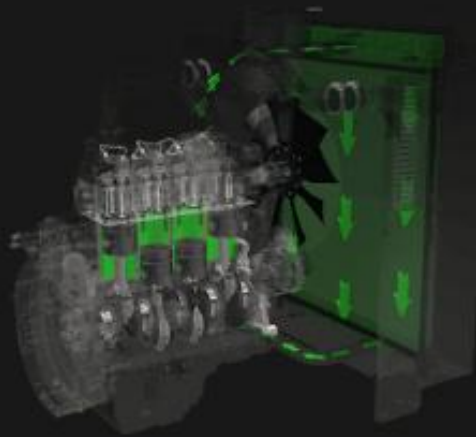
Almost all modern diesels use a high-pressure common rail system, in which fuel is supplied to a common tube, or “rail,” by a pump to keep fuel available to the injectors when needed. These injectors work with extreme pressures and an electronically controlled injection system.

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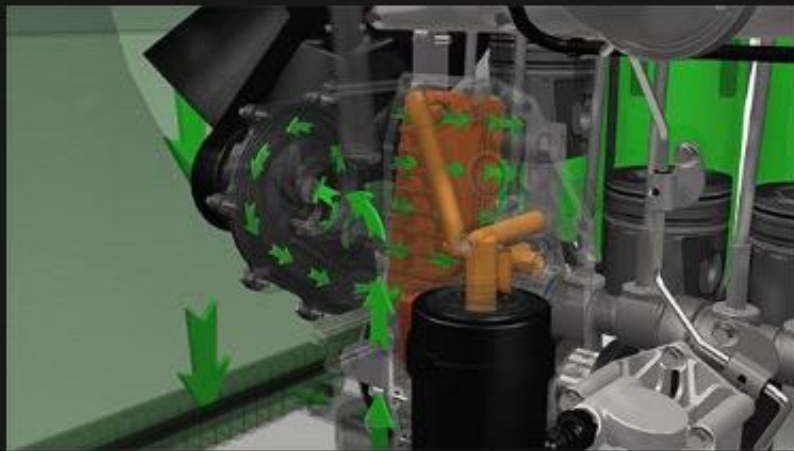


All these moving parts create substantial friction. Without proper lubrication, severe damage would result. A sump pan under the crankshaft, lube pump and various drillings in the block supply lubricating oil to friction surfaces throughout the engine. This oil reduces wear and suspends microscopic particles from the engine and the combustion process to prevent them from damaging the engine.

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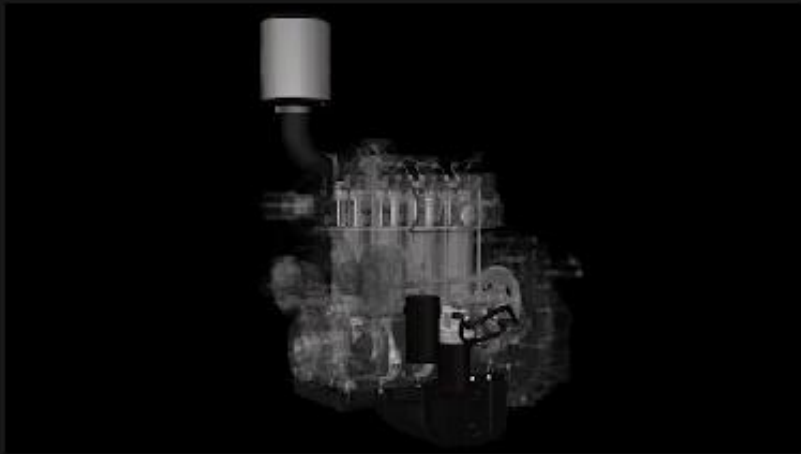


To offset the heat produced by friction and combustions in the engine, coolant is pumped throughout tubes and passages in the block, flowing around the sides of the cylinder walls and liner. Heat in the coolant is then dissipated through the radiator.



The turbocharger, injector cups, some optional accessory equipment and the oil system also warrant coolant flow. To cool the lubricating system, coolant is pumped into a series of cooling plates in areas where oil tends to reach high temperatures. Each plate is exposed to ambient air.





All the fluids and the air in today's precision engines need to be kept clean to prevent damage to parts working within close tolerances of each other. Advanced filters supplied by Cummins Filtration, a leader in the technologies required to protect these systems, designs and manufactures advanced filters that clean the air coming into the cylinder, oil in the system and fuel coming into the injectors.



Even with the most highly optimized combustion processes, there is still some level of emissions.

- Cummins invests heavily in technologies to manage these substances to near zero emissions. Cummins Emission Solutions works closely with our engine design teams to deliver the best performance while meeting varying emission regulations around the world.