



Cooling System

- Badlands models have upgraded cooling systems
- Transmission oil cooler
- Power Transfer Unit (PTU) cooler
- Helps keep the systems at optimal temperatures during grueling off-road use



NOTE: For availability of product features, please see Availability by Model and/or the [Dealer Ordering Guide](#).

EcoBoost Technologies

ECOBOOST DIRECT-INJECTION

Direct-injection is a fuel delivery technology used to precisely inject fuel directly into the combustion chamber of each cylinder, providing a balance of engine performance and efficiency.

MORE DETAILS

- Fuel is injected directly into the combustion chamber of each cylinder by solenoid-controlled, high-pressure injectors, compared to traditional fuel delivery where fuel is mixed with intake air prior to entering the chamber
 - Fuel is pumped from the tank to the engine compartment at a normal pressure of around 200 psi
 - A cam-driven high-pressure fuel pump increases fuel pressures of up to 2150 psi, depending on the demands of the engine
- Direct-injection fuel injectors are positioned inside the combustion chamber
- Each injector delivers a precise fuel spray into each cylinder, allowing a higher compression ratio to help improve engine performance and reduce fuel consumption
- An electronic control system varies the timing and intensity of the fuel delivery according to the engine's operating conditions
- Precise control of the fuel provides increased protection against engine knock/detonation to help allow for enhanced performance compared to traditional (port) fuel injection, as well as excellent transient response

ECOBOOST TURBOCHARGER

The more air an engine breathes, the more power it generates. The result is quick torque delivery when the driver needs it for passing, merging or towing. A turbocharger consists of an exhaust gas-driven turbine and an air compressor. The turbine supplies the drive energy for the compressor while the compressor pressurizes air going into an engine. The pressurized air creates "boost" which allows a smaller engine to breathe in air as if it were a larger engine, since more air is "forced" into the intake.

MORE DETAILS

- A turbocharger uses otherwise wasted energy from the engine's exhaust to rotate a turbine wheel
- Key benefits of a turbocharger:
 - Compact design and low NVH (noise, vibration and harshness) characteristics
 - Broad, flat torque curve
 - Rightsized for power and efficiency
 - Drivers will feel an immediate response when they step on the accelerator
- The 2.0L EcoBoost engine features a single twin-scroll turbocharger

MAKE-THE-POINT: Turbocharging 101

A turbocharger uses the engine's exhaust gases to spin a turbine, which in turn drives a compressor to force more air into the engine. Increasing the airflow allows more power to be generated. A turbo consumes very little power under light loads or easy engine use and allows smaller engines to generate the power of a larger displacement. When extra power is needed, the turbo spins into action.

ECOBOOST INTERCOOLER

An intercooler is a heat exchanger, similar to a radiator, that is used to cool down the turbocharger's hot compressed air before it enters the engine. It helps maintain optimum engine operating temperature, resulting in enhanced efficiency.

SYSTEM DETAILS

- Works on the same principle as the cooling system radiator, but in this case, warm air inside the intercooler is cooled by outside air passing over the fins and tubes
- With the radiator, the warm water inside is cooled by the outside airstream
- Typically located at the front of the vehicle within the airstream so that ambient air can flow over the outer places and fins, helping cool the charged air inside the intercooler
 - This action generates a cooler, dense intake charge and increases the ability of the engine to produce torque and horsepower
 - It also promotes more thorough combustion with reduced emissions

ENGINEERING INSIGHT: THE INTERCOOLER

When a turbocharger compresses air, it creates heat. The job of the intercooler is to cool this air before it enters the intake and ultimately the cylinders. While the boost from the turbocharger creates more power, the heat generated by the turbo reduces the density of the intake air. The less dense the air that enters the combustion chamber, the less power will be generated. An intercooler helps decrease this heat significantly, allowing for cooler, more dense air to enter the intake. The colder the air is, the more oxygen it carries and the more oxygen you have, the more fuel you can burn, which increases power output.

NOTE: For availability of product features, please see Availability by Model and/or the [Dealer Ordering Guide](#).