

## 2006 Explorer Powertrain



### **MOST POWERFUL AND REFINED EXPLORER EVER**

The 2006 Ford Explorer's advanced engine technologies improve both the drive experience and the environment.

The 2006 Explorer with the standard V-6 engine produces 74 percent less smog-forming emissions than the previous model. In fact, V-6-powered Explorers are expected to be certified to the same federal tailpipe emissions standards as the Ford Escape Hybrid, the world's cleanest SUV.

Additionally, fuel economy for the all-new 4.6-liter three-valve V-8 engine paired with the new six-speed transmission is expected to increase by up to 10 percent, while delivering 53 more horsepower.

"Performance and fuel economy can go hand-in-hand if you invest in the right technologies," says Dave Szczupak, vice president, Powertrain Operations. "That's why Ford is investing in six-speed automatic transmissions, electronic throttles, variable cam timing and other advanced powertrain technologies."

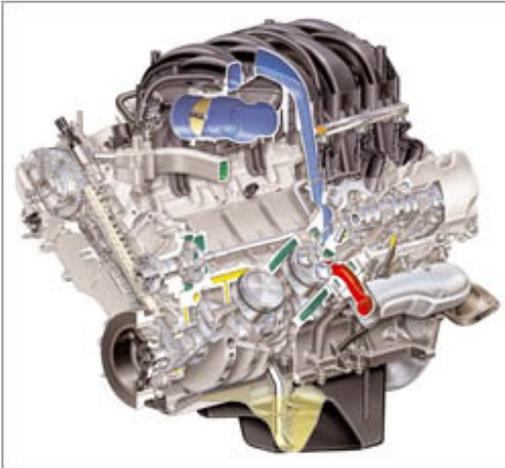
Ford has a leadership position in powertrain technologies such as six-speed automatic transmissions to simultaneously boost performance — without necessarily going to larger engines — and fuel economy with the wider ratio spreads allowed by the extra gear. This investment in technology is

particularly appropriate in the SUV market, where Ford is increasing capability without resorting to larger-displacement engines that consume more fuel.

"The new V-8 and six-speed automatic drivetrain is a tremendous advantage for the 2006 Explorer," says Raj Nair, SUV and Body-on-Frame Vehicles executive director. "Not only does it offer more power, more refinement and better fuel economy, but it also offers increased utility. The additional power output helps Explorer deliver improved payload — up to 1,520 pounds — and a 7,300-pound maximum towing capacity when properly equipped."

Explorer's standard powertrain is a refined version of the SOHC 4.0-liter V-6, paired with a five-speed automatic. Both powertrains boast modifications to improve noise, vibration, and harshness.

### Three-valve heads, variable cam timing, muscle car power



*The 2006 Ford Explorer features a new, 4.6-liter, 3-valve V-8 with variable cam timing, delivering 292 hp and 300 ft.-lbs. of torque.*

The most significant powertrain improvement, from the driver's perspective, is the new 4.6-liter V-8, with three-valves per cylinder, and single overhead cams with variable cam timing. These features are common with the highly lauded 2005 Ford Mustang GT, as well as the 5.4-liter V-8 in the F-Series pickups and Expedition. With the introduction of the Explorer, Ford Motor Company is approaching one million three-valve V-8s produced. This multi-application approach to Ford's "modular" V-8s delivers benefits in manufacturing efficiencies, proven customer reliability, and performance.

In the Explorer, the 4.6-liter V-8 delivers 292 horsepower. The slight decrease in output from Mustang's 300 horsepower can be attributed to a more restrictive exhaust necessary to accommodate Explorer's available four-wheel-drive system.

The new head enables a higher compression ratio on regular grade 87 Octane gasoline. Two of the three valves assigned to each cylinder are intake valves because more airflow into the engine means more power output. A new, tuned-length exhaust manifold offers optimized exhaust flow to help scavenge burned gases from the cylinders.

The three-valve heads feature center-mounted sparkplugs that offer three benefits:

- Placing the sparkplug in the center of the cylinder provides symmetrical flame for more complete fuel combustion. This extracts more power from the engine while decreasing the amount of unconsumed fuel in the exhaust system, resulting in low emissions
- A longer and narrower spark plug design enabled powertrain engineers to use larger-diameter valves, for increased economy and performance
- The compact coil-on-plug ignition system enables the powertrain control module (PCM) more precise spark control, again for improved efficiency

The three-valve heads are smaller and lighter than equivalent four-valve heads. Their large dual intake ports provide a direct path to the twin intake valves for better airflow at peak engine speeds. At lower speeds and loads, a charge motion control valve (CMCV) closes, increasing air velocity and in-cylinder motion for optimum fuel economy. Likewise, lightweight intake and exhaust valves reduce inertia for high-speed performance capability, while enabling lower friction for fuel economy. The cylinder heads are capped with lightweight magnesium cam covers that help suppress valvetrain noise.

## The ABCs of VCT

Variable camshaft timing (VCT) plays an important part in generating more power as well as improving efficiency and reducing emissions.

The VCT system allows up to 50 degrees of cam variation in relation to the crankshaft angle. Ford's "dual-equal" variable cam timing design shifts the timing of both the intake and exhaust valves together, with a single camshaft per cylinder head. This provides all the benefits of variable valve timing — but creates far less complexity and adds less weight than VCT systems that actuate the intake valves separately.

The cam in each cylinder head operates both sets of valves using low-profile roller-finger followers, helping reduce friction. The powertrain control module (PCM) directs solenoids to alter the oil flow in the hydraulic cam timing mechanism, which rotates the camshafts in relation to their drive sprockets. The unit can shift between fully advanced and fully retarded in milliseconds.

The result is enhanced efficiency under low-load conditions, such as at idle or highway cruising, and increased power for brisk acceleration for times of high demand.

Paired with the six-speed automatic, 4x4 V-8 models are expected to deliver up to a 10 percent increase in fuel economy, or two miles per gallon. Just as significant, it is anticipated to qualify for Tier II Bin 5 emissions certification, which is compliant with California's Low Emissions Vehicle II (LEV II) standards.

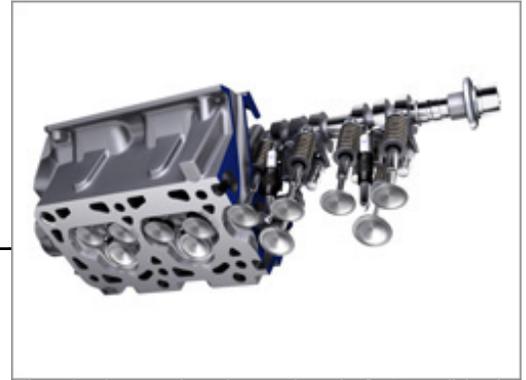
### Class-leading six-speed automatic transmission

The 4.6-liter V-8 comes standard with a new six-speed 6R automatic transmission, introducing transmission technology normally found only in luxury vehicles to the mid-price mid-size SUV segment.

For the best possible shift quality, each 6R transmission is bench tested at Ford's Livonia ( Mich.) Transmission Plant. There, the transmission build quality is verified, detecting even minute variabilities in the manufacturing process. These variances would normally lead to changes in shift feel. However, the 6R's electronic controller is programmed with its own unique software to account for these variances, producing smooth, precisely controlled shifts that improve durability and customer satisfaction.



*The class-leading, six-speed 6R electronically controlled transmission features the first console-mounted shifter in an Explorer.*



*The single-overhead-cam heads feature "dual equal" variable cam timing that rotates the camshafts up to 50 degrees in relation to the crankshaft.*

The electronically controlled transmission offers the smooth shift quality of a luxury car, but is fully tested for heavy-duty use. In fact, it contributes to the 7,300-pound maximum towing capacity of the V-8 drivetrain. For example, the torque converter assembly features three friction plates with improved durability, and increased cooling flow for heavy-duty, high-load use.

New for 2006, the transmission selector is mounted on the center console (rather than the steering column.) As a result, the transmission can be shifted manually with crisp response, thanks to full electronic solenoid control of the clutch

elements. Lastly, focalized transmission mounts mean an even greater reduction in NVH levels.

The 6R has a 6.04:1 gear-ratio span. The company's 5R55W5 automatic has a span in the range of 4.5:1. The wide ratio span of the 6R enables the engine to spend more time in the optimum powerband — either at peak power for acceleration, or at peak efficiency for more fuel economy.

#### **Cleaner emissions on standard V-6 engine**

Explorer's standard 4.0-liter SOHC V-6 engine received significant improvements for the 2006 model year as well. New engine calibrations and an improved emission controls cut smog-forming emissions by 74 percent. Idle quality was improved by 50 percent, thanks to a new camshaft and spark plugs.

Additionally, the 2006 Explorer V-6 is expected to be certified to the same federal tailpipe emissions standards as Ford's Escape Hybrid, the world's cleanest SUV.

The 4.0-liter V-6 is rated at 210 horsepower at 5,100 revolutions per minute and 254 foot-pounds at 3,700 revolutions per minute.

The torque curve is designed to be relatively flat across the entire engine range and to provide strong performance at nearly any engine speed. An equal-length composite plastic intake system improves sound quality.

The V-6 engine comes with a five-speed automatic transmission. The wide-ratio five-speed 5R55W provides good acceleration and fuel economy. In addition, the 5R55W has a single aluminum transmission casting that greatly reduces NVH and powertrain bending at higher speeds. To reduce noise, it utilizes a quieter oil pump and planetary gear designs.

#### **Cooling system designed to pass rigors of Ford truck towing tests**

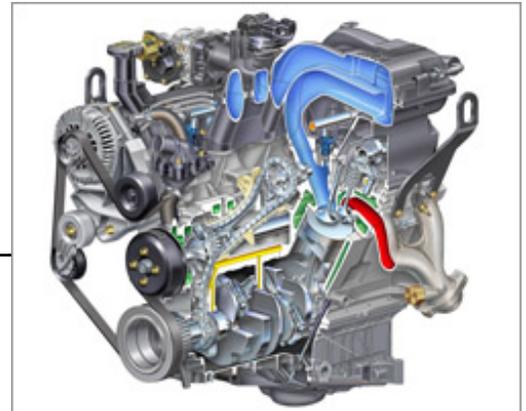
The 2006 Explorer also features an improved cooling system, delivering increased capability, decreased NVH, and improved fuel economy.

The clutch that operates the cooling system fan is now under the command of the powertrain control module. This electronic control allows the fan to be operated at just the right time to keep the engine within the proper range of operating temperature yet not run so long as to draw off engine power and draw down fuel economy. Controlling when the fan operates, how long it operates and how fast it operates also makes it less intrusive in terms of NVH.

The cooling system is a key component in the Explorer's impressive payload and towing capability. One of the most tortuous tests Explorer is subject to is the Davis Dam towing test in Arizona. The truck is loaded down to its maximum gross vehicle weight, and then climbs up the Davis Dam grade as the ambient temperature peaks over 100 degrees. This is just one of the battery of towing tests Explorer must pass to certify that its engine and transmission cooling systems are up to the task, not to mention its engine calibration and system hardware.

#### **New driveshafts improve NVH**

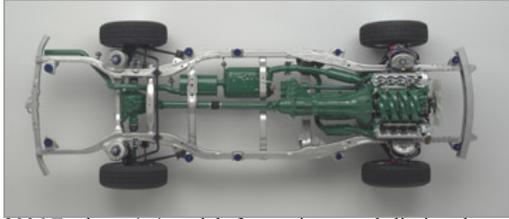
As part of its campaign to elevate refinement of the 2006 Explorer, Explorer also features new driveshafts.



The 4.0-liter SOHC V-6 produces the same 210 hp of its predecessor, but now produces 74 percent less smog-forming emissions.

On V-6 models, the traditional aluminum-tube driveshaft is engineered for improved balance and decreased run-out.

To accommodate the longer 6R transmission, V-8 Explorers have new, improved "slip-in-tube" driveshafts. These feature a pair of splined tubes that plunge into one another, eliminating the need for the steel slip and forged stud yokes used in conventional slip-between-center driveshafts.



2006 Explorer 4x4 models feature improved slip-in-tube driveshafts, differential mounts and transfer-case mounts for improved NVH isolation.

The slip-in-tube driveshaft is more resistant to bending than conventional driveshafts and thus is inherently less prone to NVH. In addition, the increased overlap between the tubes — enables increased driveshaft extension, as well as increased durability.

A computer numerically controlled (CNC) cold rolling spline process is used to make the slip-in-tube driveshaft. That means that no material — inside or outside — is machined away.

The primary benefit of this process is that it allows the tubes to slide in and out of each other easily, even under heavy torque, which eliminates unpredictable NVH behavior and provides a smooth, quiet ride.

Finally, the rear differential mounts of all 2006 Explorers have been reconfigured for improved isolation, greater durability and reduced NVH. The differential is suspended by four mounts: Two, close-set, vertical mounts are connected to the front of the differential casing, while two vertical mounts have a wider stance at the rear of the casing. Like the legs of a table, these wide set mounts better stabilize the differential, for improved isolation and durability.

#### **Control Trac® delivers automatic torque split, low-range**

Explorer continues to offer the advanced Control Trac® four-wheel-drive system. It includes electronic logic and a two-speed transfer case.

Control Trac® is an advanced four-wheel-drive system that allows a driver to select between three driving modes:

- The 4x4 AUTO (or A4WD) mode engages the transfer case clutch as required to provide maximum traction in all driving conditions. The system constantly monitors throttle, steering, and wheel speeds to determine the required level of clutch activation. This mode is appropriate for any driving condition.
- The 4x4 HIGH (4H) mode effectively locks the transfer case clutch, maintaining the same speed for the front and rear driveshafts. It is intended only for severe winter or off-road conditions, such as deep snow, ice and shallow sand.
- The 4x4 LOW (4L) mode locks the transfer case clutch and engages a torque-multiplying gear set in the transfer case. It is intended only for off-road conditions that require extra power, including deep sand, steep grades, and towing a boat trailer out of water.

These powertrain changes help Explorer retain its leadership, offering genuine SUV capability to tow or go off-road, without compromising the fuel-economy, refinement, or performance that have made the Explorer the benchmark of its class.