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## **2019 Ram 1500 Hauls More, Tows More and Uses Less Fuel With eTorque Mild Hybrid Technology Applied to Pentastar V-6 and HEMI® V-8 Engines**

- 2019 Ram 1500 delivers significant gains in fuel economy with eTorque mild hybrid system
- eTorque combines a belt-driven motor generator unit with 48-volt battery pack to enable quick and seamless start/stop function, short-duration torque addition to the engine crankshaft in certain driving situations and brake energy regeneration, which improves responsiveness and efficiency
- 3.6-liter Pentastar V-6 upgrade and legendary 5.7-liter HEMI® V-8 engines equipped with fuel-saving eTorque mild hybrid technology
- eTorque adds up to 90 lb.-ft. of torque to the 3.6-liter Pentastar V-6 and up to 130 lb.-ft. to the 5.7-liter HEMI V-8
- eTorque restarts the engine in half the time of starter-driven engine start/stop systems
- A DC-to-DC converter enables eTorque to power 2019 Ram 1500's 12-volt accessories and charge the traditional 12-volt battery
- Frame-mounted active vibration dampers and Active Noise Cancellation in cabin expand use of Fuel Saver Technology cylinder cutoff on 5.7-liter HEMI V-8
- New generation of TorqueFlite eight-speed automatic transmissions provide improved efficiency, more powerful control computers
- Thermal exchange system uses engine coolant to quickly warm lubricants, maximizing efficiency during warm-up
- 5.7-liter HEMI V-8 equipped with 850-watt electric cooling fan; eliminates parasitic loss and noise from traditional mechanical fan mounted on engine

January 15, 2018, Auburn Hills, Mich. - The all-new 2019 Ram 1500 leverages the power of the innovative eTorque mild hybrid system on the proven Pentastar V-6 and legendary HEMI® V-8 powertrains to improve fuel economy without sacrificing horsepower, torque or capability, and requires no extra effort by the driver.

eTorque enables the all-new Ram 1500 to achieve significant gains in fuel economy. All Ram 1500s equipped with eTorque offer improved fuel economy when compared to the previous model.

"The eTorque mild hybrid system amplifies our award-winning combination of power, performance and fuel economy in the powertrains for the 2019 Ram 1500," said Bob Lee, Head of Engine Powertrain and Electrified Propulsion Systems Engineering, FCA - North America. "Today's truck owners highly value fuel economy but also demand payload, towing and drivability. The 2019 Ram 1500 exceeds expectations."

### **eTorque gives a boost to V-6 and V-8 engines**

The eTorque mild hybrid system is one of several changes made to the powertrains for the 2019 Ram 1500. The goal: Improve fuel economy, performance, payload, towing capabilities and drivability. The changes include upgraded TorqueFlite eight-speed automatic transmissions, strategic weight reductions and innovations, such as quickly heating lubricants to minimize viscosity-related efficiency losses.

The eTorque mild hybrid system replaces the traditional alternator on the engine with a belt-driven motor generator

unit that performs several functions. The motor generator unit works with a 48-volt battery pack to enable quick and seamless start/stop function, short-duration torque addition to the engine crankshaft in certain driving situations and brake energy regeneration, which improves responsiveness and efficiency.

With the engine running, eTorque's motor generator unit feeds 48-volt current to a 430 watt-hour lithium-ion Nickel Manganese Cobalt (NMC)-Graphite battery. The battery pack includes a 3-kilowatt DC-to-DC converter to maintain the battery's state of charge and convert 48 volts to 12 volts to power the Ram 1500's accessories and charge its conventional 12-volt lead-acid battery.

The small-suitcase-sized, air-cooled battery pack mounts to the rear wall inside the Ram 1500's cabin. The case is insulated to dampen noise from the dual cooling fans. Cooling air is drawn from inside the truck and vented via the built-in cabin exhausters.

The V-6 and V-8 engines with eTorque retain a conventional 12-volt starter motor, used for cold starts and first start of the day due to its greater efficiency in extreme temperatures.

In addition to spinning the engine for restarts, the eTorque also recaptures energy during deceleration and braking to feed charge to the battery pack. eTorque also enhances the driving experience of the 2019 Ram 1500 by adding torque to the crankshaft during gear changes to minimize noise, vibration and harshness (NVH).

The eTorque motor generator is slightly different between the 3.6-liter Pentastar V-6 and 5.7-liter HEMI V-8 applications. The Pentastar eTorque unit is liquid cooled and mounted on the front of the engine. The HEMI V-8 eTorque unit is air cooled and mounted toward the top of the engine in the traditional alternator location.

Both eTorque motor generator units employ a pair of belt tensioners to keep the 8-rib drive belt tight when the unit is generating electricity or adding torque to the crankshaft.

The 5.7-liter HEMI V-8 will also be available without the eTorque system.

### **3.6-liter Pentastar V-6: 305 horsepower plus outstanding fuel economy**

The all-aluminum Pentastar V-6's versatility, with significant horsepower and torque production throughout the rpm range, makes it a workhorse engine throughout the FCA US vehicle lineup and the ideal base engine for the 2019 Ram 1500.

The upgraded version of the Pentastar V-6 is the standard engine in most trim levels of the 2019 Ram 1500, specifically tuned for truck duty and rated at 305 horsepower and 269 lb.-ft. of torque.

The newest Pentastar V-6's advanced technologies, such as wide-range variable valve timing and two-step variable valve lift, deliver the optimal blend of power and fuel economy, based on the driver's demand. A cooled exhaust gas recirculation (EGR) system enables improved fuel economy and emissions performance at higher loads.

The compact, 60-degree, all-aluminum block is constructed of high strength die-cast T380 aluminum with cast iron bore liners. Six bolt main bearing caps contribute to an extremely rigid lower engine structure. Cast aluminum pistons, treated with a friction-reducing coating and piston rings, drive forged connecting rods. Aluminum cylinder heads carry dual overhead cam shafts, four valves per cylinder and utilize high-tumble intake ports. The exhaust manifolds are cast integral with the cylinder heads.

The Pentastar V-6's 11.3:1 compression ratio delivers an optimal balance of power, fuel efficiency and refinement. Despite the high compression ratio, the Pentastar V-6 runs on regular 87-octane fuel to reduce the cost of ownership.

The two-step variable-valve lift (VVL) system remains in low-lift mode in most driving situations. When the driver demands more power, VVL switches to high-lift mode for improved performance.

The variable valve timing (VVT) system, with dual-independent cam phasing and 70 degrees of authority, helps reduce pumping losses in the engine.

In the 2019 Ram 1500, the 3.6-liter Pentastar V-6 engine is available in most configurations, including the four-wheel-drive powertrain and Crew Cab models.

#### **Legendary HEMI power: 5.7-liter V-8 delivers 395 horsepower**

The brawny 5.7-liter HEMI V-8 combines the muscle of 395 horsepower and 410 lb.-ft. of torque – in a smooth, broad power band that avoids the hesitation and peakiness of turbocharged engines – with performance-enhancing and fuel-saving technologies that include variable-valve timing and Fuel Saver Technology (cylinder deactivation).

With Fuel Saver Technology, the engine control computer turns off fuel and spark, and closes the valves to four of the engine's eight cylinders during light load operation, such as highway cruising when full power is not needed.

For the 2019 Ram 1500, FCA engineers broadened the operating zone of the Fuel Saver Technology via the addition of a pair of active vibration dampers, mounted on the frame, and Active Noise Cancellation technology in the truck cabin. The expanded range of operation yields an additional 0.5 miles per gallon (mpg) on the highway. Transparent to the driver, the system operates between 1,000 and 3,000 rpm while continuing to enable V-8 power for acceleration and heavy loads.

Variable valve timing helps maximize fuel economy by reducing the engine's pumping work via a delayed closing of the intake valve, which increases the expansion process of the combustion event.

Another change for the HEMI V-8 in the 2019 Ram 1500 is the switch to an electric cooling fan, replacing the previous 400-watt electric/mechanical fan hybrid setup. Precisely controlled by the engine control computer, the new 850-watt electric fan, mounted to the radiator, uses Pulse Width Modulation to tailor the fan's energy draw to the cooling demand. Eliminating the traditional fan blade mounted to the front of the engine helps improve fuel economy by reducing parasitic losses and fan noise.

The 2019 Ram 1500 meets ULEV70 emissions regulations via revised computerized powertrain controls and upgraded emissions hardware.

#### **TorqueFlite eight-speed automatic transmissions: The right gear at the right time**

Every 2019 Ram 1500 is equipped with a fully electronic TorqueFlite eight-speed automatic transmission with a wide spread of gear ratios that keeps engine rpm in the right range for the task – whether putting in a full day of off-road work or highway cruising.

Trucks equipped with the 3.6-liter Pentastar V-6 use an FCA-produced TorqueFlite 850RE transmission. The 2019 Ram 1500 with the 5.7-liter HEMI V-8 uses an upgraded TorqueFlite 8HP75 transmission. Both TorqueFlite transmissions use a new generation of computer controllers that process data faster and coordinate transmission operation with the eTorque mild hybrid system. The transmissions employ on-the-fly shift map changing, enabling them to respond quickly to changes in driver demand.

There are more than 40 individual shift maps, to optimize shift changes and points for fuel economy, performance and drivability. Shift strategy takes into account a number of variables, including:

- Engine torque changes
- Gear downshifts
- Longitudinal and lateral acceleration
- Hill detection
- Vehicle speed control
- Electronic stability control interaction
- Temperature

The transmissions use shift-by-wire technology, eliminating a mechanical linkage between the transmission and the gear selector. The 2019 Ram 1500 retains an innovative rotary e-shift dial mounted on the left side of the instrument panel's center stack – freeing up space traditionally occupied by a console- or column-mounted shift lever.

The TorqueFlite 850RE and 8HP75 transmissions use identical gear ratios. Sixth gear is a direct drive, while gears 7 and 8 have overdrive ratios. The wide gear ratio spread helps maximize fuel economy by helping lower engine rpm in city and highway driving. Internally, both transmissions have four gear sets and five shift elements (multi-disc clutches and brakes). Only two shift elements are open at any time. With fewer open shift elements, drag losses due to multiple parts rotating relative to one another are reduced.

2019 Ram 1500s equipped with eTorque technology feature a hydraulic pressure accumulator, for instant response following a stop/start event.

### **Thermal management**

The Ram 1500 employs a thermal management system that taps into heated engine coolant to speed up the warmup of the automatic transmission fluid and engine oil to maximize the fuel-saving benefits of those fluids.

The engine control unit manages a three-way valve in the engine cooling circuit. Heating the truck cabin always takes priority, based on the HVAC temperature setting. The 2019 Ram 1500 uses the thermal management system to bring the transmission fluid and engine oil to operating temperature quickly. The system also serves a cooling function under high-load/high-ambient temperature conditions to ensure the transmission fluid temperature is controlled.

### **Transfer cases get upgrades**

Buyers who equip their 2019 Ram 1500 with a four-wheel drive drivetrain can choose between two electronically controlled transfer cases: the BorgWarner 48-12 for part-time 4WD operation with Hi and Low ranges; and the BorgWarner 48-11 for on-demand 4WD. Both transfer cases engage via a push-button control mounted underneath the rotary gear selector on the instrument panel.

The transfer cases are upgraded internally for more robust performance in conjunction with the increased payload and towing capabilities of the new truck. Changes include a larger-diameter main shaft, relocation of the chain and sprocket for improved bearing support, and improved lubrication. Also, the on-demand system is enhanced for quicker response and higher front output torque capacity.

The 48-12 part-time transfer case provides three operating ranges 2Hi (2WD), 4Hi (4WD) and 4Lo (low-range reduction 4WD) plus a neutral position. 2Hi is designed for any road surface at any time, while 4Hi and 4Lo are for off-road use or slick surfaces. The driver can switch between 2Hi and 4Hi while the truck is in motion. To engage 4Lo, the transmission must be in neutral.

The low-range reduction ratio (crawl ratio) for 4Lo is 2.64:1, which provides increased low-speed torque capability for pulling power and improved driver control in off-road conditions.

The on-demand transfer case has 4Auto, 2Hi, 4Hi and 4Lo selections. 4Auto provides full-time 4WD, responding automatically to provide maximum traction in all road conditions. 2Hi, 4Hi and 4Lo function equally to the part-time transfer case.

### **Axles**

FCA engineers reworked the rear axle for the 2019 Ram 1500 with the aim of increasing performance, durability and efficiency.

The standard 235 mm rear axle incorporates a variety of changes, including optimized material usage in the carrier and axle tubes and elimination of brake adapter plates, to cut more than 10 pounds from the assembly.

Front and rear wheels adopt six-lug hubs, combined with 14.9-inch front and 14.8-inch rear discs, delivers impressive stopping distances. The new Ram 1500 is also fitted with a new electronic parking brake.

Three final drive ratios are available on 2WD and 4WD models – 3.21, 3.55 and 3.92. Each combination is available with a traditional open or limited-slip differential, which automatically divides torque among the rear wheels to maximize traction available at each wheel.

New for 2019 is an electronic locking differential, available on 4WD trucks with the 3.21 and 3.55 final drive ratio and lifted suspension, and 2WD and 4WD trucks with the 3.92 ratio and the base or lifted suspension (Rebel and 4x4 Off-road Package). The electronic system gives the driver the capability to lock or unlock the differential on demand while traveling up to 10 mph, providing maximum traction to the vehicle when needed.

Also new for 2019 is a Max Tow Package, an option with the 3.92 final drive ratio offering up to 12,700 pounds of towing capability. The Max Tow Package is based around a Dana Super 60 center section and open differential with a 256-millimeter gear set, and uses 35-spline axle shafts. It is available on 2WD trucks powered by the 5.7-liter HEMI V-8 eTorque.

### **Small changes help save fuel**

The V-6 and V-8 powertrains in the 2019 Ram 1500 also reduce fuel consumption with an Interactive Deceleration Fuel Shut Off (iDFSO) feature that pauses fuel flow to the engine cylinders when the vehicle is decelerating. For the 2019 model year, the iDFSO feature is improved to be active in third gear and higher.

The exhaust system has been re-engineered to reduce weight. Changes such as optimizing the thickness of the exhaust pipes and using aluminum for the hanger brackets cut more than nine pounds from the system. Extensive tuning of system components enables the 2019 Ram 1500 to maintain the throaty roar from the dual exhaust tips that is one of its trademarks.

A new, forward-facing air intake mounted behind the grille of the 2019 Ram 1500 feeds cooler air to the intake of the system of the Pentastar V-6 and HEMI V-8 engines for improved performance. The intake system for both powertrains includes a hydrocarbon adsorption filter to reduce evaporative emissions. The filter is good for the life of the vehicle and does not need regular maintenance.

### **Warranty**

The 2019 Ram 1500 is backed with a five-year/60,000-mile Powertrain Limited Warranty. The Powertrain Limited Warranty covers the cost of all parts and labor needed to repair a covered powertrain component – engine, transmission and drive system. Coverage also includes free towing to the nearest Ram dealer, if necessary. The warranty also is transferable allowing customers who sell their truck during the warranty period, to pass the coverage onto the new owner.

The standard three-year/36,000-mile Basic Limited Warranty provides bumper-to-bumper coverage for the 2019 Ram 1500, from the body to the electrical system.

### **Ram Truck Brand**

In 2009, the Ram Truck brand launched as a stand-alone division, focused on meeting the demands of truck buyers and delivering benchmark-quality vehicles. With a full lineup of trucks, the Ram 1500, 2500/3500 Heavy Duty, 3500/4500/5500 Chassis Cab, ProMaster and ProMaster City, the Ram brand builds trucks that get the hard work done and families where they need to go.

Ram continues to outperform the competition and sets the benchmarks for:

- Segment first 1,000 lb.-ft of torque with Cummins Turbo Diesel
- Towing capacity of 35,100 lbs. with Ram 3500
- Payload of 7,680 lbs. with Ram 3500
- Most luxurious: Ram Limited with real wood, real leather and 12-inch Uconnect touchscreen
- Best ride and handling with exclusive link coil rear and auto-level air suspensions
- Most interior space with Ram Mega Cab
- Most capable full-size off-road pickup – Ram Power Wagon
- Most awarded light-duty truck in America
- Highest owner loyalty of any half-ton pickup
- Over the last 30 years, Ram has the highest percentage of pickups still on the road

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