

Safety & Technology
POWERTRAIN**Chrysler Canada: World-First Driveline, Breakthrough Transmission, Four New Engines Mark Milestone Model-Year for Chrysler Group**

- World's first front-wheel-drive-based 4x4 system with rear-axle disconnect
- World's first nine-speed automatic transmission – one of three new gearboxes
- New 6.4-litre HEMI® V8, mightiest gasoline engine in heavy-duty pickup segment
- New 3.0-litre EcoDiesel V6 – lone diesel engine in the light-duty pickup segment
- New 3.2-litre Pentastar™ V6, derived from the award-winning 3.6-litre Pentastar™
- New 3.0-litre EcoDiesel I-4 commercial truck engine

Chrysler Group mashes the throttle on engine, transmission and driveline debuts for model-year 2014.

The introductions, which span multiple model lines, send a clear message to the world.

“We are steadfast in our commitment to innovate for the benefit of our customers,” said Mircea Gradu, Vice President — Powertrain Transmission and Driveline Engineering and Head of Virtual Analysis. “Nowhere is this more evident than on the all-new 2014 Jeep® Cherokee.”

The all-new Jeep Cherokee's stylish appearance belies the rugged capability delivered by its unique 4x4 system.

It is the first mid-size sport-utility (SUV) to feature a front-wheel-drive-based rear-axle disconnect system. It delivers four-wheel traction whenever it's needed, without driver intervention.

A fully variable wet clutch housed in the rear drive module supplies the proper amount of torque for any traction condition. This capability also is a boon to aggressive starts.

Sophisticated algorithms enable the system to benefit driving dynamics by interacting with Electronic Stability Control (ESC). When conditions are more favourable, it seamlessly switches to two-wheel-drive for optimum efficiency.

The system is available with either a one- or two-speed driveline (PTU and RDM). A locking differential is available with the two-speed PTU.

In low range, the 2.92:1 gear reduction also sets up aggressive crawl ratios – 56:1 when the vehicle is powered by the 2.4-litre Tigershark I-4 engine, and 47.8:1 when powered by the new 3.2-litre Pentastar™ V6. Such specifications benefit off-road performance.

An available locking rear differential enhances control in extreme off-road conditions and is selectable in any low-range terrain mode.

Geared up

Model-year 2014 also marks the world debut of Chrysler Group's nine-speed automatic transmission.

The advanced-technology gearbox enables aggressive launches, smooth power delivery at highway speeds and greater fuel efficiency than a six-speed automatic transmission. Its ratios are:

1st – 4.71	4th – 1.38	7th – 0.70
2nd – 2.84	5th – 1.00	8th – 0.58
3rd – 1.91	6th – 0.81	9th – 0.48

The wide ratio spread delivers outstanding low-end performance while small gear-ratio steps contribute to smooth transitions. Four overdrive ratios benefit highway fuel economy and reduce overall noise, vibration and harshness (NVH) levels.

The all-new, fully electronic nine-speed automatic features on-the-fly shift map changing with manual-shifting capability via Electronic Range Select. More than 40 shift maps correspond to specific conditions to optimize shift quality and shift points for improved fuel economy, performance and drivability.

To determine the appropriate shift mode, the sophisticated software accounts for variables such as engine torque gradients, kick-down events, longitudinal and lateral acceleration and grade changes. For improved driving comfort and refinement, additional parameters integrated into the transmission control strategy include: temperature, speed and ESC. The result is automatic shifting attuned to the performance requirements of almost any driving situation.

Internally the transmission has four gear sets and six shift elements – multi-disc clutches, dog clutches and brakes. Only two friction-plate clutches are open in every gear, minimizing power loss.

Other new transmissions are the AS66RC six-speed automatic featured in 2014 Ram chassis cab models, and the M40 six-speed automated manual in the all-new Ram ProMaster full-size commercial van.

Sourced from Aisin, the AS66RC allows for optional 45HP and 250 lb.-ft. left- or right-side Power-Take-Off (PTO). Paired with the HEMI[®], efficiency is improved with FuelSaver cylinder deactivation operation while in PTO mode.

The new M40 automated manual is mated to the 3.0-litre EcoDiesel I-4 in the ProMaster. The unique gearbox delivers the efficiency of a manual transmission with the functionality of an automatic.

At its core, it is a manual, but gearshifts and clutch functions are accomplished with an electro-hydraulic actuation system.

However, the driver can opt for manual shift-lever inputs when desired. But the driver needn't do all the work. Shift logic is adjusted according to grade steepness so the gearbox responds intuitively to driving conditions.

New Engines Empower

Chrysler Group's expanding product lineup demands new engines. So powertrain engineers delivered four new ones – or is it five?

6.4-litre HEMI[®] V8

The all-new 6.4-litre HEMI[®] V8 is actually two engines. Chrysler Group is producing one version for Ram HD pickups and another for Ram Chassis Cab models.

Each is optimized for its respective duty cycle. Both are expected to provide Ram with best-in-class bragging rights among gasoline-powered competitors.

The new 16-valve engine will make 410 horsepower (hp) at 5,600 rpm while generating peak torque of 429 lb.-ft. at 4,000 rpm.

The legendary HEMI[®] architecture provides the foundation of the 90-degree V8. But its advanced technology is decidedly forward-looking.

Cooled exhaust-gas recirculation (EGR) delivers greater efficiency and elevated refinement. These attributes are manifested in reduced pumping losses and lower emissions. Pumping losses are further reduced by variable-valve timing (VVT).

Efficiency is a hallmark of the new 6.4-litre HEMI® V8, starting with Chrysler Group's celebrated FuelSaver cylinder-deactivation technology. When conditions allow, as in highway cruising, the system seamlessly shuts down four cylinders to conserve fuel.

Upgraded valve-seat material, aluminum cylinder heads, a forged-steel crankshaft and a cast-iron block contribute to durability.

Computational fluid dynamic simulations were employed to optimize the cooling circuit in the block, heads and water pump. Other features that mitigate heat include a robust/high-volume oil cooler, oil jets for piston cooling and – in the HD pickup application – a stainless-steel exhaust manifold and sodium-filled exhaust valves.

3.0-litre EcoDiesel V6

The new 3.0-litre 24-valve, dual-overhead-cam (DOHC) EcoDiesel debuts in the 2014 Jeep® Grand Cherokee and 2014 Ram 1500. It is a turbocharged 60-degree V6 that generates 240 hp at 3,600 rpm and makes torque like a V8 – 420 lb.-ft. at 2,000 rpm – without V8 fuel consumption.

The new turbo diesel is designed and produced by VM Motori, a Chrysler Group diesel engine supplier since 1992.

The engine is shouldered by a bedplate and cylinder block of Compacted Graphite Iron (CGI), which is engineered to deliver higher strength. This enhances durability and reduces noise, vibration and harshness – a focus of many EcoDiesel design features, such as its structural aluminum oil pan.

The EcoDiesel's 60-degree cylinder-bank angle and 1-2-3-4-5-6 firing order is optimized to manage inertia and firing loads, eliminating the need for a balance shaft.

Durability is further ensured by the EcoDiesel's forged steel crankshaft and connecting rods – which provide additional NVH benefits – and its aluminum alloy pistons. These pistons, which benefit from cooling oil jets, reduce reciprocating mass inside the engine for enhanced efficiency and performance feel.

The EcoDiesel V6 features Fiat's innovative MultiJet II common-rail fuel-injection system. High-dispersion nozzles enable fuel-injection events that occur with greater precision up to eight times per cylinder cycle.

The interval between two consecutive injections also is better modulated to mitigate noise and benefit fuel consumption and emissions reduction. This is known as Injection Rate Shaping.

A key enabler is the EcoDiesel's cooled Exhaust Gas Recirculation (EGR) system, which is controlled by an electric valve instead of the conventional pneumatic variety.

A state-of-the-art Selective Catalytic Reduction (SCR) system also reduces emissions. It incorporates a unique Diesel Exhaust Fluid (DEF) system that, unlike competitive systems, alerts the driver to low DEF levels while also allowing the engine to maintain full power.

Other features include an insulated DEF tank with heated lines mitigates the effects of cold-weather operation and an exhaust-system strategy that reduces soot output while also improving fuel economy and meeting emissions standards.

The DEF tank holds 30 litres of fluid. Duty cycle determines refills, but the average interval is about 16,000 kilometres. DEF is commonly available at fuel stations and is also offered by Mopar®, Chrysler Group's dealer network and Cummins dealers and distributors.

The standard engine oil cooler, when the EcoDiesel is used with 5W30 synthetic oil, contributes to a 16,000 kilometre oil-change interval. The use of B-20 biodiesel is validated and approved for the new 3.0-litre EcoDiesel.

3.2-litre Pentastar™ V6

The new 3.2-litre Pentastar™ V6 bows in the all-new 2014 Jeep® Cherokee. It carries over all the design features that make smooth power delivery one of the most captivating traits of the 3.6-litre Pentastar™ V6, named one of *Ward's Autos* "10 Best Engines" in the industry for three years running.

A 60-degree, deep-skirt, die-cast-aluminum cylinder block with six-bolt main caps afford optimal stiffness for mitigation of NVH. Also contributing to NVH reduction are:

- A structural windage tray to complement block stiffness
- A structural aluminum oil pan
- Direct-mounted alternator and A/C compressor that increases stiffness
- Select-fit pistons with polymer-graphite-coated piston skirts
- "Silent chain" timing drive with inverted teeth for minimal sprocket NVH
- Contoured composite cylinder-head covers
- Glass-reinforced nylon composite intake manifold

Further enhancing the driving experience is the specially designed intake manifold, which also features low-rumble tuning.

The Jeep Cherokee's V6 engine boasts forged-steel connecting rods and piston-squirter jets, and its cam drive and valve-train components require no scheduled maintenance.

The new 3.2-litre Pentastar™ V6 engine was subjected to 5.3 million customer-equivalent kilometres prior to production.

3.0-litre EcoDiesel I-4

The 2014 Ram ProMaster full-size commercial van marks the North American introduction of the potent 174-hp 3.0-litre inline 4-cylinder EcoDiesel engine that generates peak torque of 295 lb.-ft. at just 1,400 rpm.

Designed by Fiat, which employs the engine in numerous applications including Class 2, 3 and 4 commercial vehicles, the 16-valve, dual-overhead cam I-4 has been adapted for the North American market with a wide range of modifications that enable regulatory compliance, while also enhancing performance.

A new common-rail fuel-delivery system managed by the engine control unit (ECU) allows for variable timing and duration of multiple fuel-injection events. The combined effect of the extreme injection pressure and optimized injection strategy mitigates emissions, improves fuel economy and offers significant reduction in noise, vibration and harshness (NVH).

Further refinement comes from a host of design features, such as:

- Hydraulic tappets and roller-finger followers for valve-lash mitigation and friction reduction
- Cast-iron engine block stiffened by bed-plate construction
- Lightweight alloy pistons
- Dual-mass flywheel
- High-efficiency exhaust-gas recirculation (EGR) cooler (which also benefits emissions compliance)

Also new for North America is a quick-response variable-geometry turbocharger that delivers higher boost at low engine speeds. The result is improved driving satisfaction that comes from superior throttle response.

The engine's block has been modified to accommodate a heater, which is standard equipment in Canada and optional in the U.S. The block heater improves cold starts at temperatures as low as minus 40 degrees, the same threshold as the transmission heater on the economical M40 automated manual gearbox that is exclusive to the turbo diesel.

To comply with emissions standards, the engine combines the benefits of a new EGR module with a highly efficient after-treatment system.

The urea diesel exhaust fluid (DEF) is integrated with heated lines. The 19 litre DEF tank promises nearly 6,437 kilometres of service. Low-level warnings alert the driver to replenish the supply via a filler neck conveniently adjacent to the optional locking fuel cap.

Reduced total ownership cost is a primary objective of the engine's design. Key components from the camshaft chain drive to power-steering pump to the high-pressure fuel pump with automatic tensioner (which also benefits NVH) are designed for long life.

Similarly, thoughtful innovations such as wear-resistant cylinder liners, oil-cooled pistons and electronic engine-control units for continuous diagnosis and monitoring are specifically designed to ensure durability.

About Chrysler Canada Inc.

Founded as the Chrysler Corporation in 1925, Chrysler Canada Inc. is based in Windsor, Ontario, and celebrates its 88th anniversary in 2013. Chrysler Canada's product lineup features some of the world's most recognizable vehicles, including the Dodge Grand Caravan, Jeep® Wrangler, Chrysler 300 and Ram trucks.

Chrysler Canada is a wholly owned subsidiary of Chrysler Group LLC, one of the world's leading automotive companies. Chrysler Group LLC, formed in 2009 from a global strategic alliance with Fiat Group, produces Chrysler, Jeep®, Dodge, Ram Truck, SRT, FIAT and Mopar® vehicles and products. With the resources, technology and worldwide distribution network required to compete on a global scale, the alliance builds on Chrysler's culture of innovation – first established by Walter P. Chrysler in 1925 – and Fiat's complementary technology – from a company whose heritage dates back to 1899. Fiat will contribute world-class technology, platforms and powertrains for small- and medium-sized cars, allowing Chrysler Group to offer an expanded product line including environmentally friendly vehicles.

