

Dynamic Cylinder Deactivation Going Mainstream

03 Apr 2020 | ARTICLE | INSIGHTS



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Executive Summary

Dynamic Fuel Management, the fuel-saving system that regulates cylinder shutdown in 17 different firing patterns in GM's V-8 engines, is poised to double its take-rate as the automaker incorporates it into many of its fullsize SUV and truck engines. The company that developed the technology plans to expand its use in 3-, 4- and 6-cyl. engines, as well as diesels.



TULA'S DYNAMIC SKIP FIRE, DUBBED DYNAMIC FUEL MANAGEMENT BY GENERAL MOTORS, IS STANDARD EQUIPMENT ON THE AUTOMAKER'S '21 FULLSIZE SUVS.

General Motors plans a massive expansion of its Dynamic Fuel Management cylinder-deactivation system by installing the fuel-saving technology in all of its top-selling V-8-powered SUVs and pickups for the '21 model year.

Engineered for GM products under a licensing agreement with the developer of the technology, Silicon Valley's Tula Technology, DFM installation will double to more than 1 million vehicles later this year, says Tula CEO R. Scott Bailey. Tula calls its proprietary technology Dynamic Skip Fire.

DFM in GM engines can shut down any number of cylinders, following 17 different patterns, depending on driving conditions and throttle input. The system helps GM's OHV 6.2L V-8 achieve a 2-mpg (0.9 km/L) gain in real-world fuel efficiency without sacrificing any of the engine's 420 hp and 460 lb.-ft. (623 Nm) of torque, the automaker says.



GM'S OHV 6.2L V-8 WITH DFM.

Editors cited the smooth-operating system when they bestowed a 2019 Wards 10 Best Engines award on the 6.2L V-8 in the '19 Chevrolet Silverado. All GM trucks with 5.3L and 6.2L V-8 engines equipped with 8- and 10-speed transmissions have been fitted with DFM since then. The less-sophisticated Active Fuel Management system that shuts down four cylinders under low-load conditions has been standard on the same engines hitched to 6-speed automatics.

The re-engineered Cadillac Escalade large SUV will be the first '21 model-year GM vehicle equipped with DFM in its 6.2L V-8, the Escalade's only powertrain. Escalade platform-mates Chevy Tahoe/Suburban and the GMC Yukon fitted with 5.3L or 6.2L V-8s and 8- or 10-speed transmissions will feature DFM standard for the '21 model year. GM also offers a 3.0L inline 6-cyl. turbodiesel, a 2020 Wards 10 Best Engines &

Propulsion Systems award winner, as an option on many of its Chevy and GMC pickups and in the '21 SUVs.

GM plans to produce nearly 850,000 V-8-powered GM SUVs and pickups with 8- and 10-speed transmissions in the 2021 calendar year, all of which would get DFM. That's more than double the DFM installation rate for prior model years, according to Wards Intelligence data.

GM isn't confirming it will offer DFM on all its V-8-powered '21 fullsize pickups, but it is unlikely the automaker will continue to field trucks with the 6-speed transmission once the new models that share powertrains with the large SUVs arrive. LMC Automotive forecasts GM plans to produce nearly 850,000 V-8-powered GM SUVs and pickups with 8- and 10-speed transmissions in the 2021 calendar year, all of which would get DFM. That's more than double the DFM installation rate for prior model years, according to Wards Intelligence data.

The larger worry, amid the coronavirus pandemic, is whether GM will be able to adhere to its product plans. The company already has had to delay the planned April start of production of the SUVs at its Arlington, TX, plant, and may push back the introduction of the pickups and several other models to 2021, introducing them as '22s, *Reuters* reports.

On the plus side, Tula's CEO Bailey says despite the relative complexity of Dynamic Skip Fire, the company hasn't received any reports of problems with GM's DFM system. GM's "extensive experience with cylinder deactivation and controls undoubtedly contributed to this strong track record," he says.

Furthermore, Bailey notes GM's initial introduction of DSF/DFM was conservative, with limited functionality during the first year. The latest editions of DFM with enhanced functionality show ongoing improvements in fuel efficiency, he says.



DFM IS STANDARD ON '21
CADILLAC ESCALADE.

Jordan Lee, GM's global chief engineer-small block engines, says the technology on the hardware side is nearly identical to the AFM system GM has had in production since 2005 "with many modifications and optimizations over the years to improve response rate and control."

"The control system though is really unique and something we are extremely proud of – the algorithms we developed, how the system analyzes the number of cylinders needed to optimize fuel economy, etc.," Lee says. "Effectively the control system determines the optimum number of cylinders needed to maximize fuel economy while providing the torque needed to push the vehicle down the road based on the driver's throttle position and vehicle speed. This system really does deliver improved fuel economy."

In addition, Bailey says "next generation" systems hold the potential for further increases in fuel efficiency, including eDSF which pairs the system with mild hybridization, or dDSF which can reduce CO₂ and NO_x in diesel applications.

While declining comment on specific customer projects, Bailey confirms Tula is actively working on 3-, 4-, 6- and 8-cyl. engine programs in the U.S., Asia and Europe, most of which are high-volume engines and involve gasoline, diesel and alternative-fuel applications.