

Tenneco's Award-Winning PRiME 3D® Simulation Cuts Engine Cylinder Component Development Time by up to 70 Percent

Proprietary software tool enables accurate prediction of piston and ring pack performance for early optimizations and elimination of multiple process iterations

SOUTHFIELD, Michigan, June 18, 2019 ... At the 2019 IAA Frankfurt (Hall 4.1, Stand C04, September 10 – 13, Press and Trade days only), Tenneco's (NYSE: TEN) Powertrain division will present its award-winning PRiME 3D® simulation software which has been shown to cut development time for engine cylinder components by up to 70 percent. An industry first, the software tool enables the generation of a physically realistic virtual model of the power cylinder unit in a running combustion engine during the design process, allowing emissions and fuel consumption reductions to be achieved through the early optimization of piston and piston ring design.

"All application sectors around the world are facing increasingly difficult emissions and fuel economy challenges, and growing pressures to reduce engine and component development time and costs without compromising quality, reliability or performance," said Gian Maria Olivetti, Vice President Global Engineering, Tenneco Powertrain. "PRiME 3D can provide a 'right first time' design at an early stage of the engine development process, eliminating many iterations of design, prototyping and physical testing."

Combining 20 years of cumulative engine know-how with the most advanced simulation tools, PRiME 3D enables the optimization of piston and piston ring performance with an accuracy level close to 95%. It has already supported engine manufacturers in more than 450 projects to achieve emissions targets on relevant driving cycles such as WLTP. Successfully completed developments have shown reductions of up to 70% in blow-by; up to 20% in friction; up to 40% in oil consumption; and up to 70% in particulate emissions.

PRiME 3D is unique because it combines accurate simulation of both gas flow physics and physical behavior of the power cylinder unit to provide a clear vision of the effects of potential design changes. It solves the physics of compressible fluid flow through the clearances of the piston and the closed gap of the piston ring under conditions of subsonic gas flow in real engine operating conditions.

The detailed calculation of gas flow and its pressure gradients is fundamental in predicting the reactions and behavior of a real running combustion engine. PRiME 3D has the capability to determine pressure gradients, heat exchange and gas velocity in the flow channels. This is important, as the magnitude of the gas pressure contributes directly to the reaction forces, twisting and arching of the piston rings.

“PRiME 3D simulation makes friction, oil consumption and blow-by loss data for any piston and ring pack directly visible under all driving cycle conditions,” explained Dr. Steffen Hoppe, Director of Technology, Global Rings & Liners, Tenneco Powertrain. “This allows accurate and immediate assessment of the effects of design changes on emissions and fuel consumption without requiring multiple iterations of physical prototypes. It is particularly valuable in helping customers gain early confidence that new designs will produce optimum results under test conditions of relevant driving cycles, not just at maximum power and torque,” Richard Mittler, Senior Expert, Pre-Development and Analysis, Global Rings & Liners, at Tenneco Powertrain added.

Input data for the simulation can be simply transferred from design drawings using the “drag & drop” functionality provided by the PRiME 3D Wizard. Powerful animations combine 2D and 3D results to produce easily interpreted output, enabling rapid identification of potential design improvements. To enhance customer interaction, PRiME 3D has been developed as a web-based server solution, providing users with secure worldwide access to their developments and improving communication between different locations.

For further information on PRiME 3D, please see video at: <https://youtu.be/VJkGj1Rbdsc>

IMAGE:

	<p>Tenneco’s award-winning PRiME 3D® simulation tool helps manufacturers, cutting engine cylinder component development time by up to 70 percent. The proprietary software enables accurate prediction of piston and ring pack performance at an early stage of the development process, allowing emissions and fuel consumption reductions to be achieved while eliminating many iterations of design, prototyping and physical testing. © 2019 Tenneco Inc.</p>
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About the new Tenneco – the future Powertrain Technology company

Following Tenneco's expected separation to form two new, independent companies, an Aftermarket and Ride Performance company (DRiV™), as well as a new Powertrain Technology company, the new Tenneco will be one of the world's largest pure-play powertrain companies serving OE markets worldwide with engineered solutions addressing fuel economy, power output, and criteria pollution requirements for gasoline, diesel and electrified powertrains. The new Tenneco would have 2018 pro-forma revenues of \$11.4 billion, serving light vehicle, commercial truck, off-highway and industrial markets.

Safe Harbor

This release contains forward-looking statements. These forward-looking statements include, among others, statements relating to our plans to separate into two independent public companies. Forward-looking statements are subject to a number of risks and uncertainties that could cause actual results to materially differ from those described in the forward-looking statements, including the possibility that Tenneco may not complete the spin-off of the Aftermarket & Ride Performance business from the Powertrain Technology business (or achieve some or all of the anticipated benefits of such a spin-off); the possibility that the acquisition of Federal-Mogul or the separation may have an adverse impact on existing arrangements with Tenneco, including those related to transition, manufacturing and supply services and tax matters; the ability to retain and hire key personnel and maintain relationships with customers, suppliers or other business partners; the risk that the benefits of the acquisition of Federal-Mogul or the separation, including synergies, may not be fully realized or may take longer to realize than expected; the risk that the acquisition of Federal-Mogul or the separation may not advance Tenneco's business strategy; the risk that Tenneco may experience difficulty integrating all employees or operations; the potential diversion of Tenneco management's attention resulting from the separation; as well as the risk factors and cautionary statements included in Tenneco's periodic and current reports (Forms 10-K, 10-Q and 8-K) filed from time to time with the SEC. Given these risks and uncertainties, investors should not place undue reliance on forward-looking statements as a prediction of actual results. Unless otherwise indicated, the forward-looking statements in this release are made as of the date of this communication, and, except as required by law, Tenneco does not undertake any obligation, and disclaims any obligation, to publicly disclose revisions or updates to any forward-looking statements. Additional information regarding these risk factors and uncertainties is detailed from time to time in the company's SEC filings, including but not limited to its annual report on Form 10-K for the year ended December 31, 2018.

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