

# Gear pump applications

Advances in efficiency, size reduction and cost-effective manufacture make gear pumps a simple and compact solution to a wide range of automotive applications

▶ For the past 50 years, Marzocchi Pompe has been a leading supplier of gear pumps in industrial and off-highway mobile applications. But not many people know that it is also a key player in the on-highway automotive sector.

Gear pumps are volumetric machines, widely used in hydraulic system design because of their cost-effectiveness, simple construction and compactness. Marzocchi Pompe offers the broadest range of displacement – as low as 0.12cm<sup>3</sup>/rev and as high as 2cm<sup>3</sup>/rev – something widely appreciated in applications where a mini power pack is required. A reputation for quality and reliability has ensured that Marzocchi's products have gained a share in the automotive market.

The pumps are designed specifically to be part of the electrohydraulic system, generating a flow of pressurized oil in a controlled manner in order to drive the actuators required in most of the aforementioned systems.

Standard applications of Marzocchi products require up to 300 bar, while the limited operating pressure of the automotive applications, generally up to 100 bar, has enabled designers and



The stages in the E05's development, from rapid prototyping (using FDM 3D printing, shown on the left) through to final product

engineers to introduce several optimizations aimed at maintaining – and even enhancing – very high performance, specifically in terms of efficiency, noise and reducing overall size – as well as optimizations to decrease manufacturing costs with adequate levels of automation in the production and assembly process of the units.

The family of E05 pumps has been specifically designed for integration into the assemblies of a large number of applications, including automatic transmissions,

semi-automatic clutches, electrohydraulic power steering, AWD systems, and assistance in hybrid types of propulsion.

The main parts of the pump, before being assembled, have been subjected to structural verification through FEA simulations. This is to check the structure of the pump when subject to the stresses of work, and also to verify the behavior during the most critical stages of the manufacturing process. Despite their small size, E05 pumps are internally bi-compensated. The compensation system ensures that contact between the compensation plates and the gears is maintained in all operating conditions, a drastic reduction of internal leakage, adequate lubrication of the moving parts, and excellent volumetric and mechanical efficiency. Synthetic oils used in the automotive industry generally have a low viscosity, as they must maintain adequate fluidity even at temperatures as low as -40°C. The low viscosity of the oil has necessitated a fine-tuning of the compensation system, which has been designed to reduce the inevitable friction of components,

increasing the mechanical efficiency of the system. High mechanical efficiency has a direct effect on consumption, and enables a reduction in the size of other components, such as the electric motor required to move the micro pump. A reduction of internal friction also entails a reduction of the heat input in the hydraulic circuit. Reducing the volumetric losses makes it possible to reduce the size of other components, such as the radiators – lowering the internal leakage of the pump means reducing heat that must then be taken away through oil cooling.

As a result, Marzocchi Pompe can provide the right solution to the specifications that worldwide Tier 1 engineers require to cope with limited current and voltage requirements, NVH requirements, limited overall dimensions to address packaging restraints, and competitive pricing compared with standard pump solutions. ©



Marzocchi Pompe's automotive department in their Bologna, Italy, facility

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