

THINK SMALL

MICRO GEAR PUMPS CAPABLE OF WITHSTANDING EXTREME OPERATING CONDITIONS CALL FOR EXCEPTIONAL CONTAMINATION CONTROL AT THE PRODUCTION STAGE IF THEY ARE TO IMPROVE MACHINE RELIABILITY

▷ By working closely with many world-leading automotive companies on the development of micro pumps for automatic clutches, directional stability control, and several more applications, Marzocchi Pompe has gained a great deal of expertise. For the past 20 years, its R&D department has worked with the DIEM department of Bologna University to increase its know-how and improve its products.

In particular, it has worked very hard on optimising the inner parts of its pumps and motors, thereby improving their mechanical and volumetric efficiencies. For this purpose, the R&D department has been equipped with new experimental test benches for mechanical, hydraulic, acoustic and vibration performance analysis, and durability test benches to simulate the toughest working conditions.

This kind of approach reduces the costs and time typically associated with the development of new products, and offers the market a top-class solution at a very competitive price. In addition, Marzocchi's know-how is regularly transferred to the production line to maintain the highest levels of quality.

All of the company's 0.25/0.5 series pumps (displacement from 0.19 to 2.0cm³/rev; 0.01 to 0.12in³/rev) are specially developed for mounting on mini hydraulic power packs for industrial and automotive applications. Over recent years, there has been a notable increase in the demand for micro pumps with high efficiency and reliability from manufacturers of equipment for the production of offline oil filtration filters.

C.C. Jensen is a family-owned company, established in 1953, and based in Denmark. The company started out by manufacturing lubrication oil filters for marine engines and, since then, has refined offline oil filtration for a wide range of applications in marine, mining, industrial and energy markets. A key area of focus is maintaining up-to-date know-how about oil filtration and oil contamination sources specific to a wide range of applications within sectors such as industry, mining, marine, offshore, power and wind.

Hydraulics and other fluid systems must handle extreme operating conditions



Contamination causes about 80% of all oil system failures. This can take the form of insoluble materials, such as metals, dust particles, sand and rubber. Equipment reliability and lifetime can be drastically increased by introducing an oil maintenance system.

Operating conditions for hydraulics and other fluid systems in mines and quarries are harsh: crushers, mills, dump trucks, excavators and drilling rigs suffer from these hard conditions. Dust ingresses the oil systems and exposure to rough weather places strain on the equipment and fluid systems.

Earthmoving equipment operates under severe operating conditions. Water ingress from the cooling system and the environment creates rapid oil degradation and can cause corrosion of bearings. Exposure to extreme weather, dusty environments and high vibrations can seriously stress the sensitive system components. The particle contamination in the oil is often very high.

Problems also occur with moisture due to frequent start/stops. Tough operation conditions cause oil

degradation, leading to reliability issues and loss of production. By installing CJC Offline Oil Filtration Systems, these problems can be reduced to a minimum level. Highly sensitive components, such as gear transmission, hydraulic pumps, motors, steering systems and injector pumps, will operate more efficiently and for longer, thereby increasing reliability and equipment lifetime.

Contamination control

With its decades of experience in the automotive sector, Marzocchi Pompe is highly aware of contamination issues. The company takes great care to wash all components before assembly. All of its gear pumps then go through run-in and testing phases on dedicated test benches.

The run-in is the final stage of the manufacturing process, and is one of the most important operations as it permits the optimisation and checking of the products' efficiency. During this phase, increasingly higher pressure levels are submitted; the gears, inflected by the hydraulic load, act as tools machining the pump body, creating the best



LEFT: Filtration systems are very important in offshore wind turbine installations, where undertaking repairs can be very expensive

BELOW: Marzocchi Pompe gear pump and manifold

tolerances among the parts. This process is performed under computer control.

The definition of the gradual increase of the pressure is particularly important as it establishes the machining speed of the material by the gears and therefore the particle dimensions. These must be small enough not to interfere with the running of the product under testing or its future performance. Each pump in each group has a dedicated pressure ramp to ensure that no contaminating material remains in the circuit and the pump is able to immediately achieve the maximum performance levels.

Reversible motors and pumps follow a rotations run-in procedure. After these phases, the product's efficiency is measured at certain parameters. The depth of the milling depends on many factors, including the elastic and plastic deformation of the pump's components. Tolerances and dynamical effects will contribute to the milling process, but the most important factor which ensures correct milling is the pressure that bends the gears, pushing them against the inner surface of the body

and producing an increased depth in the centre of the milling.

At the end of the run-in process comes the test phase, where efficiencies, performances, flow, temperature, torque and absorbed power are measured and recorded to produce updated statistics on product performances. If the measured values do not comply with the limits of acceptance set in the test bench, the pump is discarded and sent to Maintenance for revision.

The final test

A further task of test operation is held to ensure complete cleanness and prevent any release of contaminants into the hydraulic circuit of the final user. During testing, there is a specific phase where the oil flows through the pump to remove contaminant particles produced during the run-in phase.

The use of pumps that have not been fully run-in could lead to the fast deterioration of the cleaning plant. If the pump is not fully run-in and is tested to its maximum operating pressure, once it is part of a hydraulic system capable of exploiting the entire range of its pressure, it could continue to release contaminants.

Marzocchi's current production ranges from 0.19 to 200.3cm³/rev (0.0104 to 12.223in³/rev). All of its products can also be supplied with Viton seals or in other special versions, and can cover an operational temperature range between -40 to 120°C (-40 to 248°F).

A wide range of flange, shaft and coupling configurations is available. These components can also be manufactured according to the customer's requirements; a

typical example being the application developed for C.C. Jensen. This special

product integrates the manifold with a built-in valve in the micro pump which is in charge of pushing the contaminated oil through the CJC Offline Oil Filtration System. The pump's successful design is a result of the intensive collaboration between Marzocchi and C.C. Jensen's technical offices. Every one of these units is manufactured, assembled and fully tested on Marzocchi's premises before being supplied to C.C. Jensen ready for assembly in the filtration unit.

All 0.25/0.5 series pumps are able to withstand a high continuous pressure of 190 bar and peak of 230 bar for the standard version. The 0.25-05 pump series are also available in RO version, where due to the particular run-in, they can withstand continuous pressure up to 230 bar, and 270 bar of peak pressure.

The feasibility of these micro gear pumps has been made possible mainly through the introduction of new automated production systems which can assure high repeatability, therefore maintaining high quality standards through the entire process. This is because high efficiencies, high pressures and superb reliability – especially for such micro pumps – are not just a luxury but are the minimum requirements that must be guaranteed.

Marzocchi Pompe was established in 1961 by Guglielmo and Stefano Marzocchi, in Casalecchio di Reno, on the outskirts of Bologna, Italy. Today, the organisation, which is still family-owned and is led by Adriano and Paolo Marzocchi, operates primarily in the field of hydraulic pumps and motors. Over the years, it has grown and increased its product range to reach its present position as one of the most important Italian manufacturers of external gear pumps and motors. As a result of the trust and the respect gained over a long period of time, the company is considered a very reliable partner on the market, able to provide customers with specific know-how, high quality products and excellent service for all hydraulic applications. **IVT**

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