

HARD ROCK CACHE

The secrets to productivity and reliability improvements as well as reduced downtime on this aggregates crusher lie in the pumps and motors that have been integrated

With nearly 50 years of know-how and expertise in the field of hydraulic pumps and motors, after having established itself in the field of hydraulic pumps, motors and suspension systems for motorbikes and mountain bikes, Marzocchi Pompe is today also well positioned in the off-highway market. In fact, in the past few years the company has been busy renewing one of its off-highway product ranges by creating two entirely new lines.

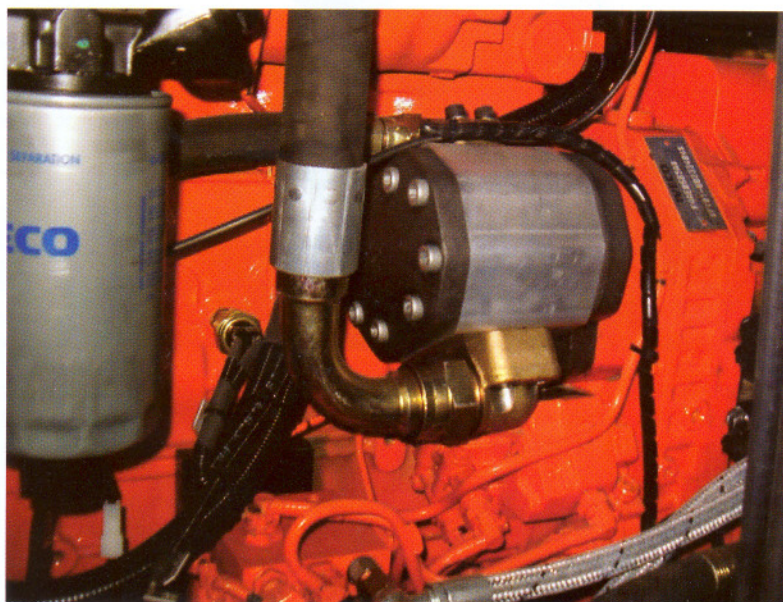
The first, the ALP and ALM, includes pumps and motors with aluminium flanges and covers respectively. The second, the GHP and GHM, is a new line with cast iron flanges and covers, specifically for high-pressure mobile applications.

This product update has led to several changes in-house. The project design department, for instance, has completely revised the design of the products and consequently the production processes involved. Likewise, R&D has had to apply the latest FEM simulation tools that, with the new tools for the experimental mechanics, have produced specific product optimisation aimed at satisfying current market demands for efficiency, reliability and reduced noise levels.

Marzocchi's current range varies between 0.19-200.3cm³/rev (0.0104-12.223in³/rev) and is divided into eight groups according to gear size (0.25, 0.5, 1P, 1, 2, 3, 3.5, 4). Within each group the different displacements are obtained by changing the gear width. A wide range of flange, shaft and coupling configurations are also available, while these components can also be manufactured according to bespoke specifications.

The cast iron versions can be found in groups 1, 2 and 3. Maximum operating pressure depends on pump displacement and type and varies on average between 230 bar (3,300psi) on aluminium models and 280 bar (4,100psi) for cast iron versions. All products can also be supplied with Viton seals while special versions are available for temperatures between -40 to +120°C (-40 to +248°F).

Monodirectional and bi-directional motors are divided into three families



Power unit of UTM with GHP3AD60 pump

[1,2,3] and cover a range of displacements between 2.8-87cm³/rev (0.17-53.1in³/rev). The maximum working pressures for these motors are similar to those established for the pumps, delivering torque up to 250Nm and power up to 60kW.

As a result of these specific characteristics, the GHP products are therefore highly suitable for most heavy-duty mobile applications, as the following application from CAMS testifies.

Application of GHP

CAMS is a manufacturer of roadbuilding machinery and in the past few years has added to its portfolio with the acquisition of TEM, a specialist in the area of aggregate crushing and recycling machines. The UTM is one such piece of equipment, a self-propelled machine that benefits from compact dimensions, thereby allowing its use in confined areas.

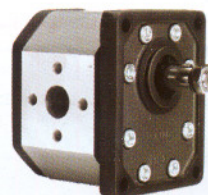
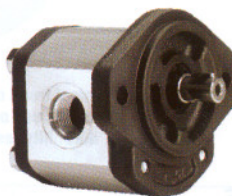
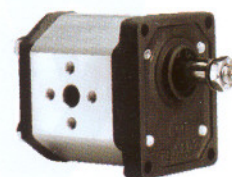
The UTM employs a system that is completely different from normal crushers or mills. Designed for an FTR1500MC crusher featuring two axes counter-rotating at low speed with a high-resistance three-blade cutter manufactured in Hardox 400 steel, the UTM is capable of crushing the hardest of materials. Rock and construction materials

offer minimal resistance to shearing stress; the UTM works on this principle and optimises crushing to ensure higher productivity and a reduction of the energy consumption.

The UTM does not require an operator aboard the machine to dose the inlet flow – just an excavator operator to feed it. As the in-feed hopper is fed into the machine directly, a pre-dosing system is no longer necessary either, resulting in reduced maintenance and wear. The low rotating speed of the crusher also means that the consumption of milling disks is reduced. The hopper itself is quite large, which allows maximum processing of the crushed material, while a magnetic device sifts out the inert material from the ferrous, which also facilitates the recycling due to the fine-tuned separation process.

In the case of reinforced concrete, the dimensions of the UTM machine allow the iron bars to fall directly into the magnetic device, thereby avoiding machine downtime – i.e. the machine does not have to be halted for metal parts to be removed from the non-metal materials.

In this application, a GHP3AD60 Marzocchi pump is employed to carry out all of the hydraulics controls. As a result of the compact dimensions and high specific



Marzocchi's GHP1, GHP2 and GHP3 pumps with cast iron flanges and covers



Transportation of the UTM machine



The UTM machine at work on site

power of this pump range, Marzocchi engineers found it possible to make the movements of the crushing machine independent by equipping it with an efficient and economic hydraulic circuit.

The GHP3AD60 pump is connected directly to the PTO motor and provides power to the piston motors that drive the tracks (over 30kW). The pump is also used in another four important auxiliary functions. A CETOP 5 valve is connected to the pump's outlet, after the pressurised filter. This valve controls the folding of the transportation belt, the closure of the in-feed hopper, and a CAMS-patented device which allows the size of crushed materials to be regulated.

During the material-crushing operation, the pump's only aim is to filter the oil in the hydraulic circuit, thereby increasing the machine's reliability. The characteristics of the circuit are such that the pump's energetic input is lower. The consequential high mechanical efficiency

has made the integration of the undercarriage to the machine possible without major changes to the power unit.

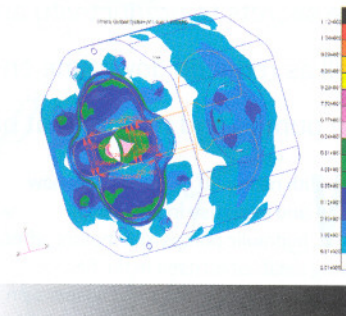
Although the GHP3AD60 is a very compact unit, its small dimensions do not affect robustness, due to the spheroid cast iron flange and cover construction that allows the pump to easily handle peak pressure up to 295 bar and rotational velocity up to 3,500rpm, while covering displacements from 20cc/rev-87cc/rev. Unlike the flange and cover, the body of the pump is constructed from very high-quality extruded bar aluminium. Alongside the FEA, this optimised design guarantees high strength, a prerequisite for tough applications – and for a much lower cost than a full cast iron body.

Space optimisation

This GHP3AD60 belongs to a series specifically developed for the mobile market and provides great benefits where space constraints can be problematic.

The optimised design provides users with outstanding volumetric and mechanical efficiency in the majority of the working conditions. Such high values of efficiency – in the region of 97% – provide users with both improved autonomy and economy of the machine.

The research into this new range of pumps and motors has been intensive. As a consequence, Marzocchi's R&D department has been equipped with new experimental test benches for mechanical, hydraulic, acoustic and vibration performance analysis and durability test benches, which are able to simulate the toughest working conditions.



FEA analysis of aluminium pump body

Tests using this equipment led to further optimisation of the compensation geometry (used to balance the dynamic thrust caused by pressure in the gear vanes), gear profiles and the undercut drain on the bushings, which increased product reliability and reduced noise levels at the same time.

All of Marzocchi's new pumps are developed and designed using state-of-the-art of numerical simulation software, such as FEM and CFD. Such packages provide great levels of flexibility for Marzocchi's engineers, from the initial specifications required for the pump to the verification work with 3D numerical models, which as a consequence prevent unnecessary testing before any real prototype is actually produced.

This kind of approach reduces costs somewhat and also the time typically associated during the development of new products. It also helps Marzocchi to offer the market top-class solutions at very competitive prices. In addition, all of the innovations for a cost-effective assembly, testing and run-in are constantly improved in the R&D department and the know-how in terms of new processes, tools and test benches is regularly transferred to the production line – all of which goes towards continuous improvement of product quality. **IVT**

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Typical trend of pressure used on durability test

