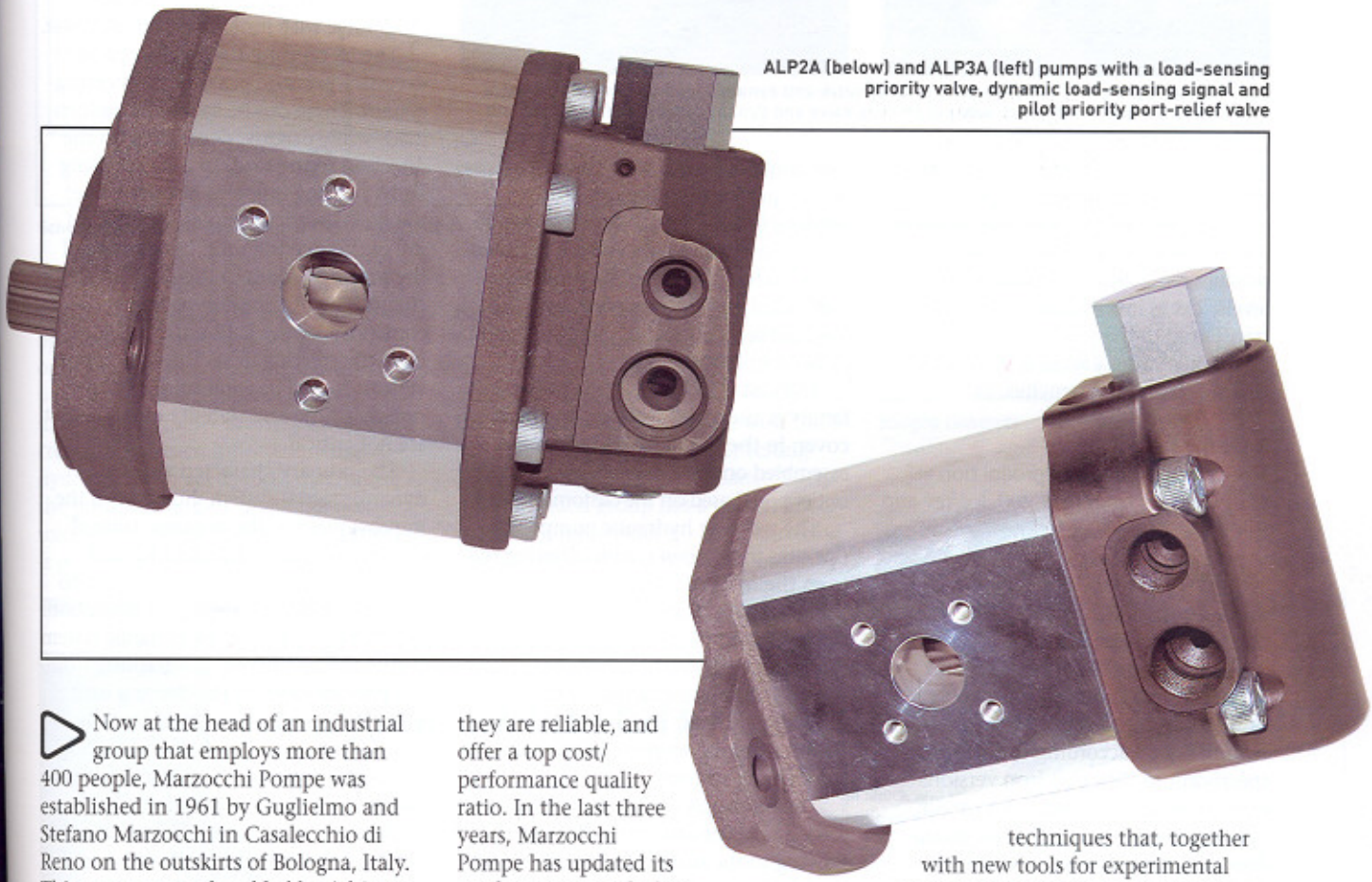
DANILO PERSICI

MATTER OF PRIORITY

AS HYDRAULIC APPLICATIONS CONTINUE TO EVOLVE, A NEW RANGE OF PUMPS WITH INTEGRATED VALVES HAS BEEN LAUNCHED, SUPPLEMENTING THOSE WITH PRIORITY VALVES, AND COMPLETING AN EXTENSIVE PRODUCT LINE-UP



ALP2A (below) and ALP3A (left) pumps with a load-sensing priority valve, dynamic load-sensing signal and pilot priority port-relief valve

Now at the head of an industrial group that employs more than 400 people, Marzocchi Pompe was established in 1961 by Guglielmo and Stefano Marzocchi in Casalecchio di Reno on the outskirts of Bologna, Italy. This group, owned and led by Adriano and Paolo Marzocchi, operates in the fields of hydraulic pumps, and motors and suspension systems for motorbikes and mountain bikes.

Over the years, Marzocchi Pompe has expanded and increased its product range to reach its present position as one of the most important Italian manufacturers of external gear pumps and motors. Thanks to the trust and respect accumulated over a long period of time, the company is considered a very reliable partner, able to provide customers with specific know-how, high-quality products and excellent service for all hydraulic applications.

Gear pumps and motors are volumetric machines widely used in hydraulic system design. They have a simple construction and compact size; they are reliable, and offer a top cost/performance quality ratio. In the last three years, Marzocchi Pompe has updated its product range with the creation of two new lines: the first, called ALP (pumps) and ALM (motors) with aluminium flanges and covers, is the natural evolution of the previous product range.

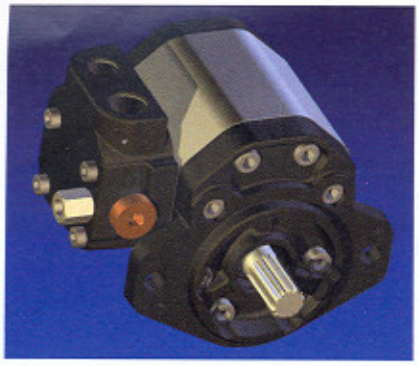
The second line, called GHP and GHM, is a new line of products with cast-iron flanges and covers, dedicated to high-pressure applications and the mobile market.

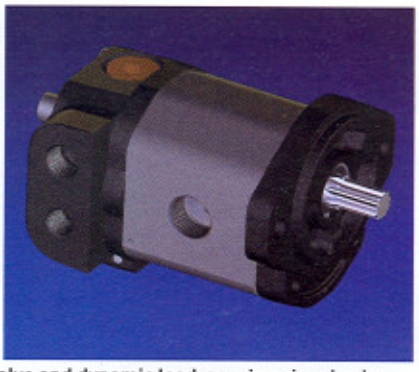
This change has involved the company's entire production cycle. With its 40 years' experience in this sector, the project design department has completely revised the design of the products and their production process, revolutionising the industrialisation of all the components.

Research and development has applied the latest FEM and CFD simulation techniques that, together with new tools for experimental mechanics, have produced specific product optimisation aimed at satisfying current market demands for optimum efficiency, reliability and reduced noise levels.

For 20 years, the company's R&D department has co-operated with the DIEM department of Bologna University to increase its know-how and improve its products. There has been a great deal of research into the internal mechanical and hydraulic conditions of pumps and motors; 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 that can simulate the toughest working conditions.

This new test equipment has led to the optimisation of the compensation





LEFT: **Group 3 pump with load-sensing priority valve and dynamic load-sensing signal valve**
RIGHT: **Group 2 pump with load-sensing priority valve and dynamic load-sensing signal and pilot priority port-relief valve**

geometry (used to balance the dynamic thrust caused by pressure in gear vanes), gear profiles and the undercut drain on the bushings in order to increase product reliability and reduce noise levels. These innovations were then transferred to the production department after a wide-scale renewal of the run-in and test benches.

A family feeling

The current Marzocchi production family ranges from 0.19-200.3cc/rev and it 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 is available; these components can also be manufactured according to customer specifications. The cast-iron versions exist in groups 1, 2 and 3. Maximum operating pressure depends on pump displacement and type: it 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 ranging from -40° to +120°C. Monodirectional and bidirectional motors are divided into three families (1, 2, 3) covering a range of displacements between 2.8-87cc/rev. The maximum working pressures for the motors are similar to those established for the pumps, and they can deliver torque up to 250Nm and power up to 60kW.

To complete the renewal of its product range and satisfy the requirements of the mobile market, Marzocchi Pompe has introduced new pumps with integrated valves to supplement those with priority valves.

The range of pumps with priority valves is only produced in the cast-iron version, in the 2 and 3 families; they cover a range of displacements between 4.5-87cc/rev. The priority valves, the controlled and priority ports, and the load-sensing connection are situated on a cast-iron block.

The cast-iron block in the pump 2 family is assembled without the standard cover; in the pump 3 family it can be assembled on the cover, or directly at the outlet port, based on the customer's needs.

The working hydraulic pump operates in an open circuit, drawing oil from the hydraulic tank and pumping it to the control block integrated on the cover. The flow of the working hydraulic pump depends on the speed. The job of the priority valve attached to the working hydraulic pump is to distribute the oil from the working hydraulics and the steering system.

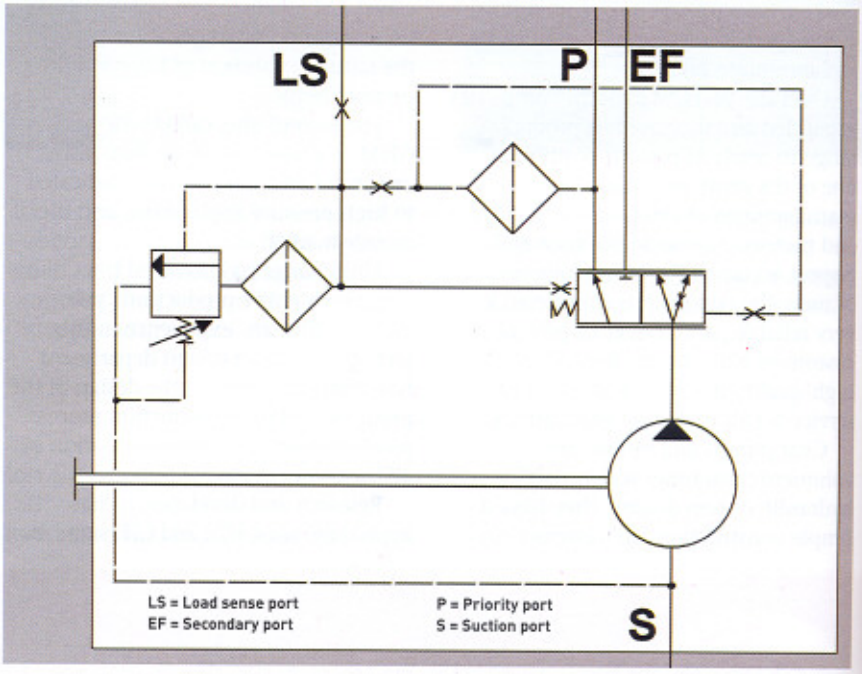
The oil supply to the steering system always takes priority, with the rest flowing to the working hydraulics. The load-sensing system ensures each part only receives as much oil as it needs. The servostat only supplies oil to the steering cylinder when the steering wheel is moved.

The pumps with the priority valve are available in two versions – i.e. with and without the load-sense signal in both static and dynamic versions. If the VP cast-iron block is mounted on the cover, it is also possible to integrate a relief valve with inner drain on the cover.

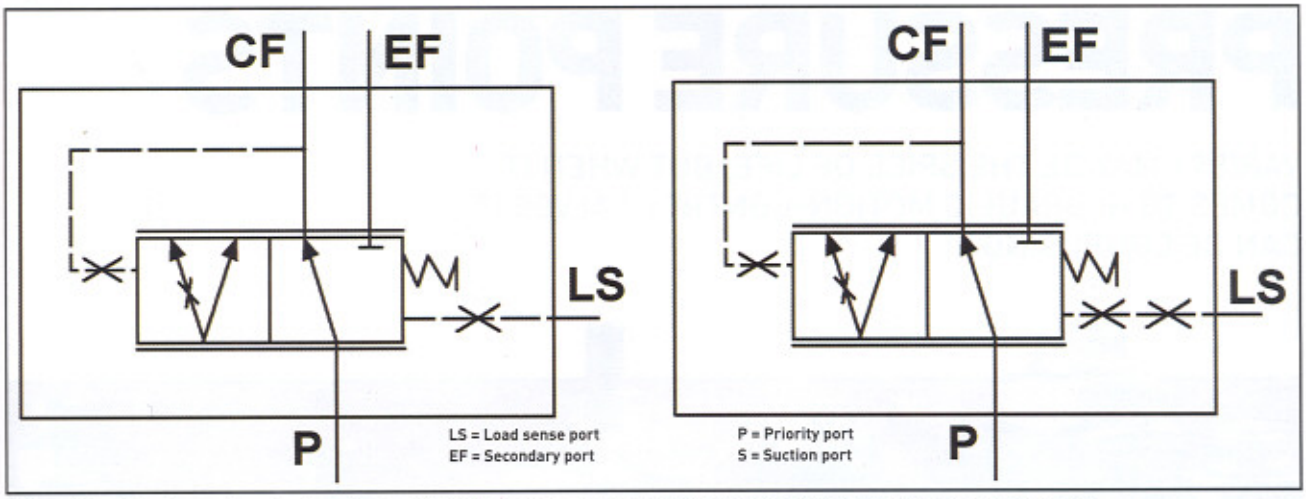
The LS pressure-relief valves prevent excessive pressure peaks in the steering system. These can be caused by sudden loads while driving, depending on the direction of the load. In a circuit using an LS steering unit and priority valve, the flow always promotes the optimal use of the steering unit, irrespective of the pressure values in the auxiliary circuit. The distribution of flow is controlled by the load-sensing signal from the steering unit. The static signal version is used in applications where response time and stability of the circuit are not critical.

The primary characteristic of a dynamic signal system, however, is the improvement of the response time of the priority valve. The steering unit with dynamic signal is always ready to respond on demand, with no hesitation. Another advantage of the dynamic system is that the small flow rate draining from the priority valve to the steering unit heats the steering unit itself, thereby avoiding thermal shock in the steering unit after long periods of inactivity in low-temperature environments.

Before they leave the Marzocchi factory, all products are subjected to specific run-in and testing. The run-in is



RIGHT: **Schematic of load-sensing priority valve and dynamic load-sensing signal and pilot priority port-relief valve**



Schematics of load-sensing priority valves, with (left) static load-sensing signal and (right) dynamic load-sensing signal

the last stage of the manufacturing process. It is one of the most important operations because it permits optimisation and checking of the product efficiencies. During run-in tests, increasingly higher pressure levels are created; the gears, inflected by the hydraulic load, act as tools machining the pump body, and create the best tolerances among the parts. This process is performed under computer control.

The definition of the gradual increase of the pressure is particularly important because it establishes the machining speed of the material by the gears as well as the particle dimensions; these must be small enough not to interfere with the running of the product under testing and during its future performance. Each motor of each group has a personalised pressure ramp so that no contaminating material remains in the circuit and the pump is immediately able to attain maximum performance levels. **iVT**

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