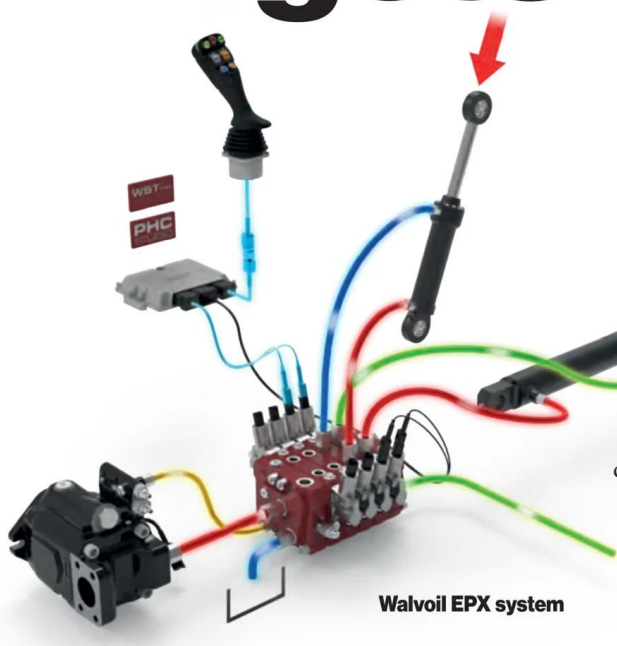


Smart valve compensation gets test results

Walvoil completes testing of its new adaptive load sensing (ALS) system with meter-out compensation. By **Roberta Prandi**



Walvoil EPX system

Walvoil has presented its new adaptive load sensing (ALS) system combined with meter-out compensation on its EPX Series directional control valves (EPX).

The company described the advantages of the combination as ‘the ideal match of two highly-flexible technologies that allow for a variety of configurations and a strong electronic integration to be adapted to a wide variety of circuit configurations’.

DEVELOPMENT PHASE

Early studies conducted by Walvoil and the application of ALS to various types of vehicles demonstrated energy savings of up to 5%; but the potential for energy recovery is far broader, with the EPX system potentially reaching an overall energy savings of up to 20%, depending on the type of application.

Walvoil’s R&D manager, Davide Mesturini, explained that energy efficiency is a key requirement for the working machines market, especially now the entire segment is looking more at electric power options.

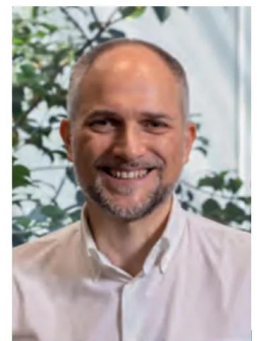
“Walvoil is a specialist in hydraulic directional

control valves, which is the element in the hydraulic circuit usually associated with most energy losses. Therefore, the traditional hydraulic configuration with one pump and one central directional valve delivering oil pressure to all the actuators on the machine is often questioned from an energy efficiency point of view, as it forces the fluid through the circuit, resulting in power loss and heat generation,” Mesturini said.

Some solutions propose to move away from using a directional control valve. “These valve-free solutions usually utilize electro-mechanic devices to activate the actuators but are not exactly cost-effective,” explained Mesturini. “Therefore, Walvoil is studying efficient solutions to adopt a cost-efficient system even with one central pump, while at the same time delivering the kind of energy efficiency that the market requires.”

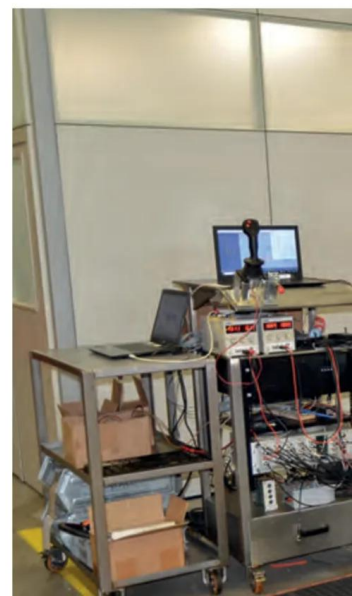
Considering the increased trend for electric traction solutions for mobile working machines, Walvoil has developed a system that brings together the efficiency of a load-sensing, flow sharing hydraulic circuit with smart hydraulic energy recuperation via a three-way compensator on the meter-out circuit that recuperates hydraulic energy on its way back from the actuators and converts it via an hydraulic motor operating a generator into electricity that is fed into the vehicle batteries.

“Our ALS+EPX system is very reliable, thanks to the purely hydraulic and mechanical control of the directional valve. Also, the manoeuvrability of machine operations is unimpaired, the operator will not perceive the difference between the meter-out compensated



Hydraulics will still have the upper hand when it comes to linear movements”

DAVIDE MESTURINI,
Walvoil



solution and a traditional flow-sharing hydraulic circuit,” he said.

TECH TESTING

Empirical tests on the solution have been carried out in cooperation with the Federico II University in Naples and the Italian National Council of Research CNR-STEMS in Ferrara, Italy.

Mesturini observed that these tests have included a simulation based on the model of the complete system, after calibration from the actual system prototype that has been created for testing.

“The simulation was carried out comparing a conventional flow-sharing circuit and the meter-out recuperation system. The result was a 32% energy saving, measured at the pump or the inlet of the hydraulic circuit.”

Walvoil also tested the system at its Innovation Center, applying the solution to a front loader for agricultural use. The test assumed a machine with a hybrid powertrain (diesel engine and electric motor as a booster) and loaded with 1,750 kg.

The test carried out 10 automatic cycles covering rising and lowering of the boom, opening and closing of the forks. “The novelty with this system test is that energy recuperation was measured for the inertial movements (loaded weight in the descent phase) but also when the boom and fork movements were happening simultaneously, as the system compensated the loads between the two,” said Mesturini.

“Results showed that the meter-out recuperation system performed with 34% less energy utilization compared to the conventional flow-sharing circuit, reconfirming the results of the simulation with a real operational case.”

According to Mesturini, with machines in actual working situations and operating different



Field test of Walvoil EPX on front loader



Hydraulic systems have an excellent energy density, which is difficult to reach with purely electric actuation.”

DAVIDE MESTURINI,
Walvoil

Walvoil front loader test of the EPX system at the Innovation Center



cycles, the expectation had to be reduced: estimates showed that energy savings of over 20% can be expected on average.

POWER RECUPERATION

Walvoil is still researching the energy recuperation portion of the system, with extensive work on the electronic element.

Mesturini explained that the system has been presented at Bauma and Eima trade shows in 2022. “The majority of interest [at the fairs] has been shown by construction OEMs using some type of machinery ideal for this kind of system thanks to the regular working cycles. These include wheel loaders and excavators, but also forklifts, which is a segment already almost totally electrified.”

On the topic of fully-electrical versus Walvoil's hydraulic solution, Mesturini pointed out that a full electric system in an excavator with eight or nine different working functions would involve a complex and expensive system, using an electro-mechanic actuator for each function. This would significantly add to cost and complexity.

“Hydraulic systems have an excellent energy density, which is difficult to reach with purely electric actuation. And we also have to remember that a hydraulic system has a dampening from the fluid, as it gets compressed and acts as a damper on the various machine movements.

“Less complex machines might benefit from replacing a hydraulic cylinder with an electro-mechanical actuator, as might machines with operations involving rotating movements; but hydraulics will still have the upper hand when it comes to linear movements.”

Mesturini is convinced that mobile hydraulics still have a long life in the field of off-highway machinery, but integration of hydraulics with electro-actuated circuits will play a growing role. It will be crucial for hydraulic system manufacturers to continue research in the field of increased efficiency and quieter operation, which has emerged as a problem in vehicles adopting electric drivelines.