

EHPS

Electro Hydraulic Power Steering



**SAUER
DANFOSS**

What really matters is inside®

On loaders, large forklift trucks, dumpers, heavy tractors, combine harvesters, maize harvesters and other similar machines there is often need for electrically actuated steering either in the form of a joystick for control, or fully automatic steering. Electrically actuated steering supplements the hydraulic steering wheel control and facilitates optimisation of steering characteristics to cater for driving conditions. In other words, it increases vehicle productivity and improves driver comfort.



Sauer-Danfoss offers electrohydraulic steering systems for such applications. A basic system consists of a pilot-controlled unit as the signal source and an EHPS type 0 valve block which flow controls oil flow to the steering cylinders proportional to the pilot flow. The system can be extended to include an electrical actuator so that, as an alternative, it becomes possible to steer with a joystick (EHPS type 1).

In addition, the valve block can be supplied with built-in microcontroller and steering software (EHPS type 2).

The electrohydraulic steering system from Sauer-Danfoss is characterised by:

- High steering pressure requiring smaller cylinders and oil flow
- Low pilot pressure (max. 30 bar) giving an extremely low noise level in the cab
- The possibility of manual steering even on very heavy vehicles in the event of pump failure

- Minimization of side acceleration on vehicles with articulated steering
- With microcontroller: No steering wheel drift and the possibility of variable steering ratio between steering wheel and steered wheels. This option also gives the possibility of “interfacing” with automatic steering
- Facility for CAN-bus interface
- EHPS can be combined with Sauer-Danfoss PVG 32 proportional valves.

Steering systems with EHPS can gain approval for road use with active electrical steering, due to the fact that active hydraulic backup is always available in the system. EHPS is available with built-in valve functions: priority, pilot pressure relief, shock, suction, and/or check valves.

When vehicles operate only off-road, full “steer by wire” systems (without active hydraulic backup) are permissible. Here, steering can be achieved solely by joystick. Sauer-Danfoss PVG 32 proportional valves can be used for this application.





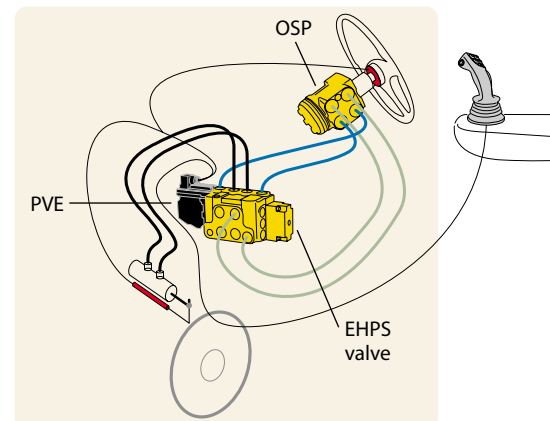
EHPS is an electrohydraulic steering system developed for vehicles with conventional hydraulic steering, where the additional advantages gained by steering with an electric signal are wanted.

The core of the system is a valve which can be controlled by both a hydraulic signal from a hydraulic steering unit (OSP) and an electric signal from an electric actuator (PVE). The EHPS valve controls oil flow to the steering cylinders.

The steering unit (OSP) operates as a pilot unit in which hydraulic oil pressure is limited to a maximum of 30 bar. The steering unit displacement can be chosen to give optimum manual steering characteristics. In some applications this means that a special wheel-driven or electric pump can be omitted.

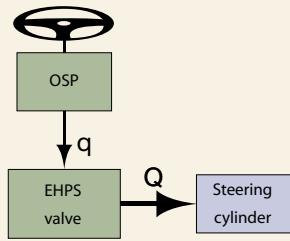
The EHPS valve can be considered to be a combination of a hydraulic flow amplifier activated by a hydraulic steering unit (OSP) and a proportional valve activated by an electric signal. Of specific benefit is that both functions can be in operation at the same time. This gives the possibility of "steer by wire" with active hydraulic backup when steering is performed via the steering wheel. The signal from a steering wheel sensor is sent to a microcontroller in the electric activation unit (PVE) so enabling variable steering ratio on the steering wheel. In "precision farming"/automatic steering mode, it is possible to interface with the EHPS valve.

To ensure optimum system safety, the steering unit (OSP) automatically has higher priority than the electrical activation unit (PVE). There are also three safety levels built into the new steering concept: 1) Electrohydraulic, 2) Hydraulic, and 3) Manual steering.



EHPS systems are available in three versions.

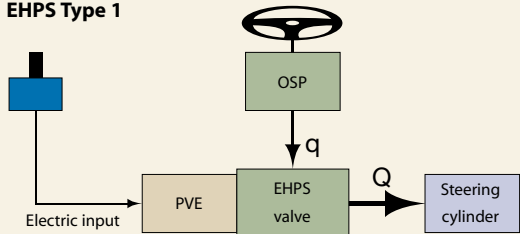
EHPS Type 0



EHPS Type 0:

A purely hydraulic steering system with the EHPS valve acting as flow amplifier. The characteristics of this system are low noise level in the cab (low pressure and flow in the OSP steering unit), high steering pressure (max. 250 bar), steering unit displacement optimised for manual steering and reduction of side acceleration on vehicles with articulated steering. It is simple to retrofit an electric activation unit (PVE) to extend the system into a Type 1.

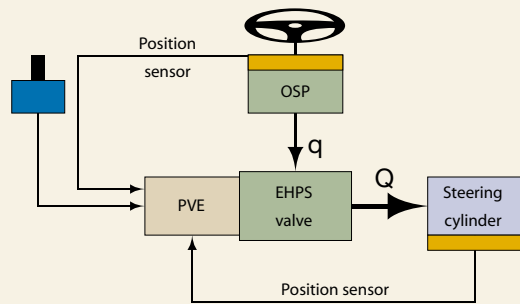
EHPS Type 1



EHPS Type 1:

EHPS valve equipped with an electric activation unit (PVE). Possibility of hydraulic steering with OSP and electrical steering using a signal from, for example, a joystick or a mini steering wheel. The valve gives highest priority to the hydraulic steering.

EHPS Type 2



EHPS Type 2:

Microcontroller with steering software integrated into the electric actuator. The use of a steering wheel sensor gives steer by wire (steering with an electric signal) with active hydraulic backup. The safety system in the integrated microcontroller gives steering with an electrical signal a very high level of safety. The characteristics are variable steering ratio on the steering wheel, elimination of steering wheel drift and the possibility of communicating with automatic steering.

General characteristics:

- Low noise level in cab
- Steering pressure up to 250 bar
- Improved manual steering characteristics
- Reduced side acceleration forces on vehicles with articulated steering
- Possibility of integrated priority valve
- Possibility of flanged-on proportional valves (PVG 32).

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