

A1VO Variable Axial Piston Pump: Economical load-sensing now for the smaller power classes



The new A1VO: Up to 10,000 liters of fuel savings

The “big” machines already have it: axial piston variable pumps in their energy-efficient load-sensing systems provide only as much power as is actually needed. Mobile machinery in the lower power classes has traditionally made do with energy-intensive open-center systems using constant pumps. The variable pumps previously available for this price-sensitive segment are usually over-dimensioned. Rexroth has developed the A1VO variable axial piston pump specifically for the smaller power classes of mobile machinery. Rexroth is the first manufacturer to offer a cost-effective alternative to constant pumps and to facilitate the economical switch to a load sensing system. In tractors of 100 hp or less or forklifts up to around four tons the A1VO reduces fuel consumption by several thousand liters over the entire service life – and all without sacrificing performance.

Calculations based on a 90 hp diesel motor commonly used in tractors and a corresponding load range (see p. 4) indicate fuel savings between 10 and 15% per operating hour in mixed use. Assuming a life time of 6,000 hours for the tractor, this translates into fuel savings of up to 10,000 liters. Depending on the respective load cycles, similarly great fuel savings can be achieved in many other areas of application, including smaller forklifts or bus fan drives. The A1VO enables such an attractive price/performance ratio among other things by moving all the ports to the

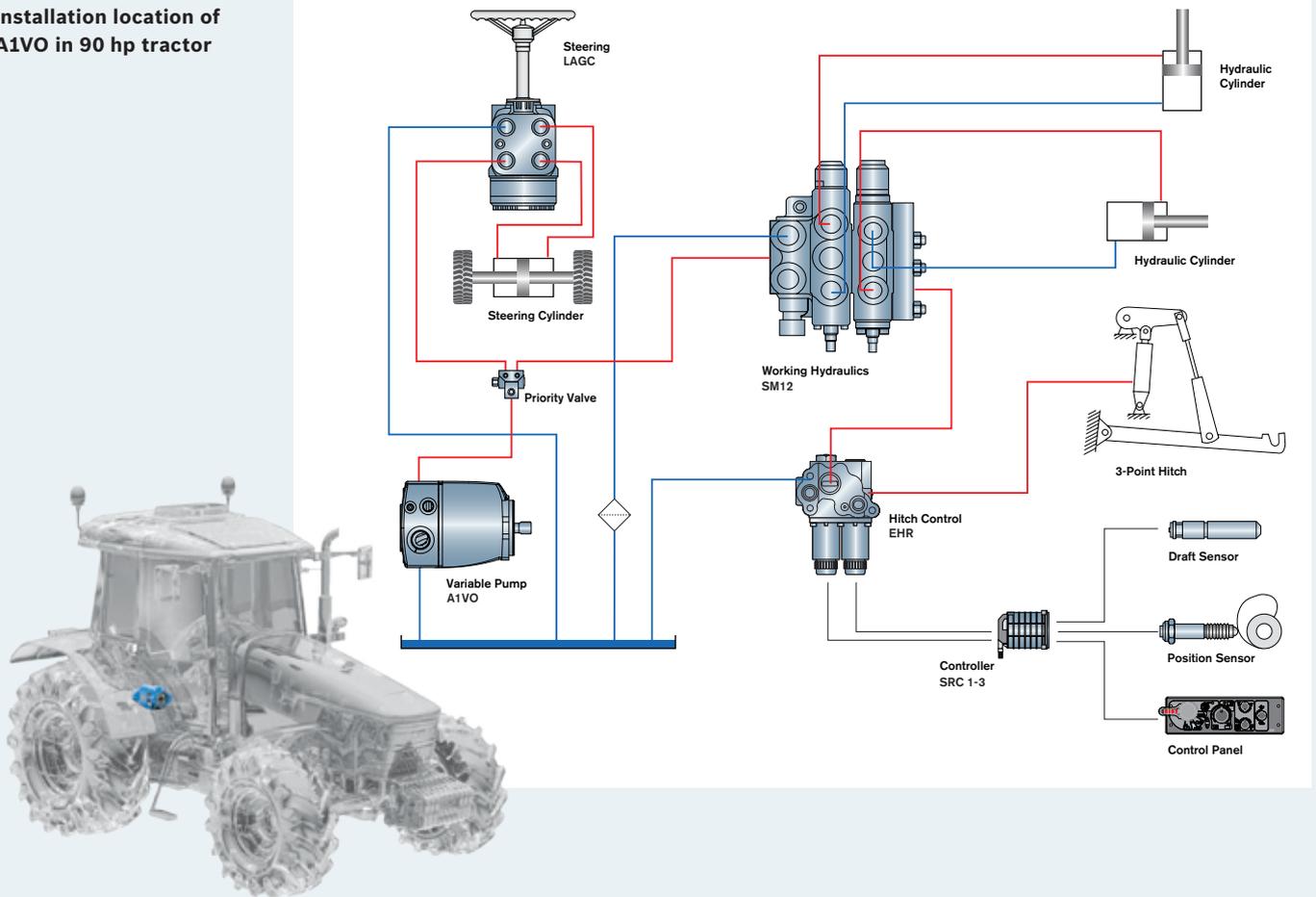
port plate and by significantly reducing the number of different variants. To make it easier for vehicle and machine designers to switch from a constant to a variable pump, the new A1VO is comparable to the generally used constant pump both in dimensions and performance data. A universal through drive with easily interchangeable adapter makes it simple to combine with other pumps. The efficiency rate of the new A1VO is almost 90 percent. Its life time is comparable with the A10VO and A10VNO pumps used in large tractors.



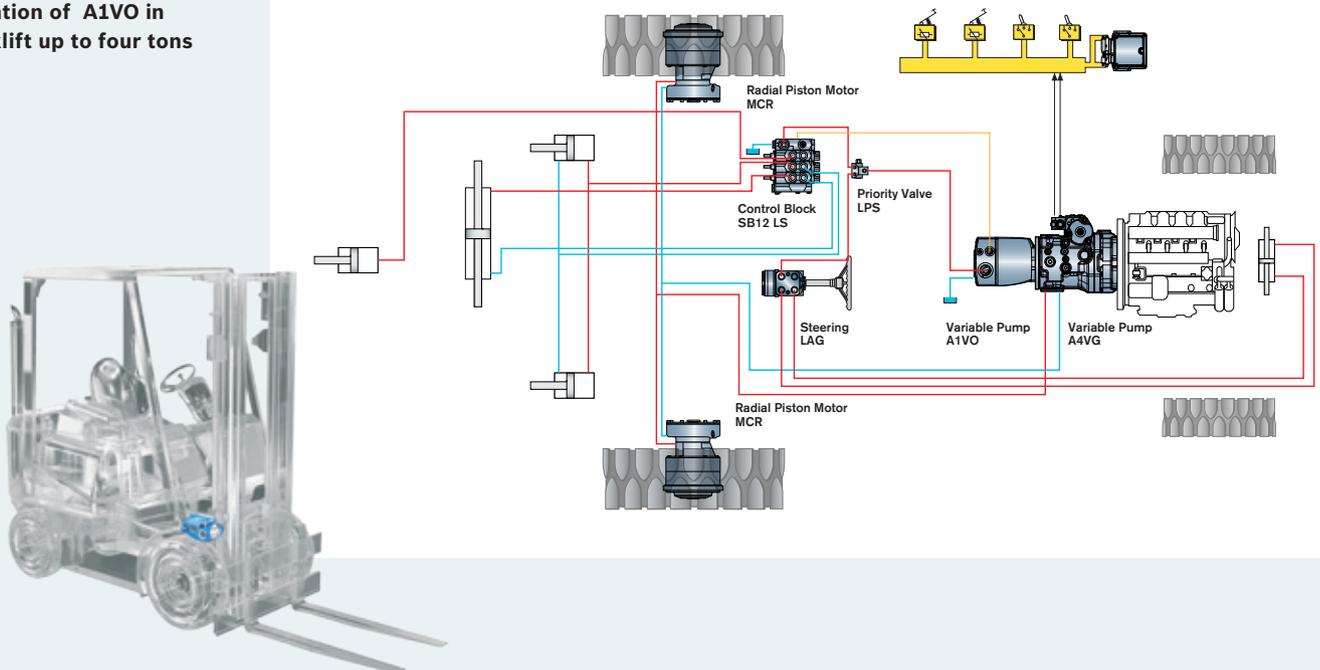
Technical data

Size:	35 cm ³
Nominal pressure:	250 bar
Maximum pressure:	280 bar
Speed:	3,000 min ⁻¹
Through drives:	Universal through drive makes it simple to change the through drive type without changing the part number
Hydraulic ports:	Available with inch threads
Mounting flange:	SAE-B
Shafts:	1" 15T
Data sheet:	RE 92650

Schematic and installation location of A1VO in 90 hp tractor



Schematic and installation location of A1VO in forklift up to four tons



Basis for calculation: 90 hp tractor

The A1VO opens up significant savings potential in the partial load range. This includes all work which does not demand full hydraulic power, such as vibration damping of the attachment, the chassis and the cabin while traveling on field and road, steering movements or various other activities in the yard and the field. Accounting for more than two thirds, such operations considerably outweigh the times under full load or in standby mode when the possible savings are nearly zero due to system considerations.

The load cycle distribution used as a basis categorizes the various partial load activities into seven different cycles (Nos. 2–8) with the corresponding hydraulic power demands in the form of pressure and flow. The engine characteristics of the diesel can be used to calculate the actual fuel consumption per cycle, enabling a comparison between the A1VO variable displacement pump and a constant displacement

pump. The maximum savings results – as shown in the table – when the diesel motor only provides as much power as is actually needed.

Data assumed for the calculation

Diesel motor:	Output 90 hp
Fuel:	Density 0.85
Period:	1 hour
Constant pump:	Transmission ratio 0.667; max. pressure 210 bar; suction volume 35 cm ³ ; system pressure 7 bar
Variable pump:	Transmission ratio 0.667; max. pressure 210 bar; suction volume 35 cm ³ ; standby power 1 kW

Load cycle distribution for 90 hp tractor

Standby

e.g. transport trip with no steering, vehicle stopped

100% flow, 200 bar

e.g. field end management

10% flow, 120 bar

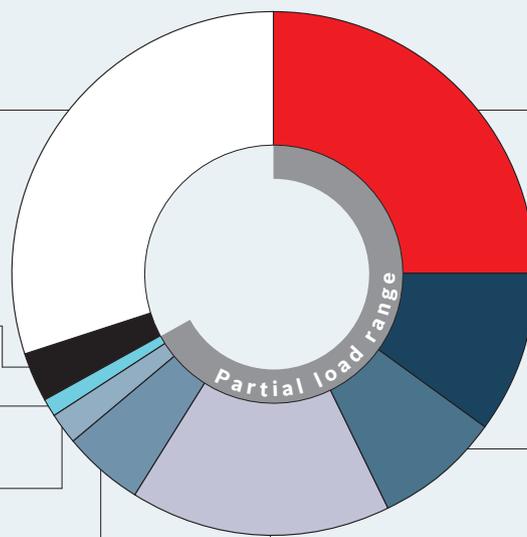
e.g. off-road, light steering

10% flow, 80 bar

e.g. on-road, heavy steering

50% flow, 100 bar

e.g. working in the field



<5% flow, 200 bar

e.g. vibration damping

50% flow, 200 bar

e.g. working in the yard

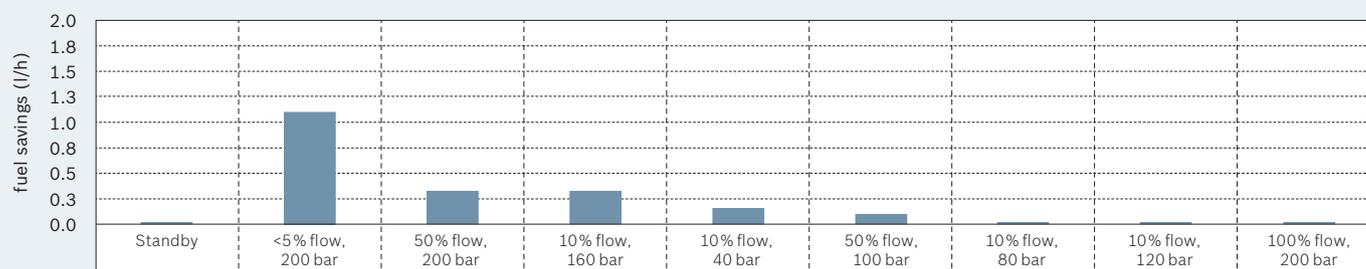
10% flow, 160 bar

e.g. off-road, heavy steering

10% flow, 40 bar

e.g. on-road, light steering

Maximum savings potential per operating hour based on the load cycle distribution shown above



Basis for calculation: 90 hp tractor

The calculation of the specific savings potential shown in the table is based on three pillars:

1. A realistic load cycle distribution, see chart (provided by a major tractor manufacturer)
2. The detailed characteristics of the diesel motor (provided by the engine manufacturer)
3. Rexroth expertise about the respective hydraulic system (load-sensing with A1VO variable axial piston pump vs. open-center with external gear constant pump)

Advantages at a glance

- ▶ Significant fuel savings up to 15% compared with constant system
- ▶ Optimized efficiency at same power with less consumption
- ▶ Compact design with controller integrated into port plate
- ▶ Increased life expectancy compared with constant system
- ▶ High flexibility as pumps can be combined using interchangeable through drive adapter (universal through drive)
- ▶ Maximum flow of 105 l/min thanks to high self-suction speeds



◀ Applications

Tractors

40–100 hp
(working hydraulics, steering)

Forklifts

Up to 4 t (working hydraulics)

Buses

(hydrostatic fan drive)

Agricultural machinery

(working hydraulics, steering)

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