

# K8V-Series – Closed Loop Swash Plate Type Axial Piston Pump, and M7V-Series – Swash Plate Type Axial Piston Motor



*With the globally growing demand for infrastructure construction, the demand for construction machinery, including wheel loaders and cranes, is increasing. Kawasaki developed the K8V series, which is a pump for closed circuits adopted mainly for construction machinery, and the M7V series, a motor for actuators used mainly in winches. In addition, using a combination of the K8V series and M7V series enables optimal configuration of hydraulic continuously variable transmission systems (HST: Hydro-Static Transmission).*

*For the K8V series, we applied the technologies we have accumulated over the course of many years along with new technologies, including the efficiency simulation adopted for the latest flagship pump, thereby achieving high efficiency and low noise. For the M7V series, we used a swash plate motor, which is one of Kawasaki's strong suits, as the base and applied new design technologies, including an 11-piston configuration, thereby improving the maximum speed and stability at low speeds at the same time.*

## Introduction

Because of the remarkable economic growth in emerging countries, the demand for infrastructure construction is expanding globally. Accordingly, the demand for construction machinery essential for infrastructure construction, including wheel loaders and cranes, is increasing.

## 1 Background

Closed circuits, which are common in construction machinery, use only pumps and motors to circulate oil, which eliminates the need to install valves in circuits to change the oil flow direction. Therefore, unlike hydraulic pumps for open circuits, such as Kawasaki's K7V series and K3VLS series, hydraulic pumps for closed circuits need to have a mechanism to discharge oil in both

directions. In addition, hydraulic motors that serve as actuators for cranes and other machines are required to be capable of rotating at higher speeds and rotating stably even at low speeds at the same time.

For entry into these fields, Kawasaki has developed the K8V series—swash plate axial piston pump suitable for use in closed circuits, and the M7V series—swash plate axial piston motor suitable mainly for crane winding. In addition, using a combination of the K8V series and M7V series enables optimal configuration of hydraulic continuously variable transmission systems (HST: Hydro-Static Transmission). HST is a transmission that discharges oil with a pump driven by an engine or other prime mover and allows the oil to rotate a motor to drive the wheels or the like (**Fig. 1**). HST can adjust the transmission ratio steplessly by adjusting the displacement, and change the direction of wheel rotation by changing the direction of the oil flow from the pump.

† The K8V Series, a dual-tilting hydraulic pump with the world's highest-level pump efficiency and low noise, is suited to closed-circuit systems, such as HST drive systems, in industrial vehicles.

†† The M7V Series, a hydraulic motor with the world's highest power density and low noise, is suited mainly to HST drive and winch winding systems in industrial vehicles.

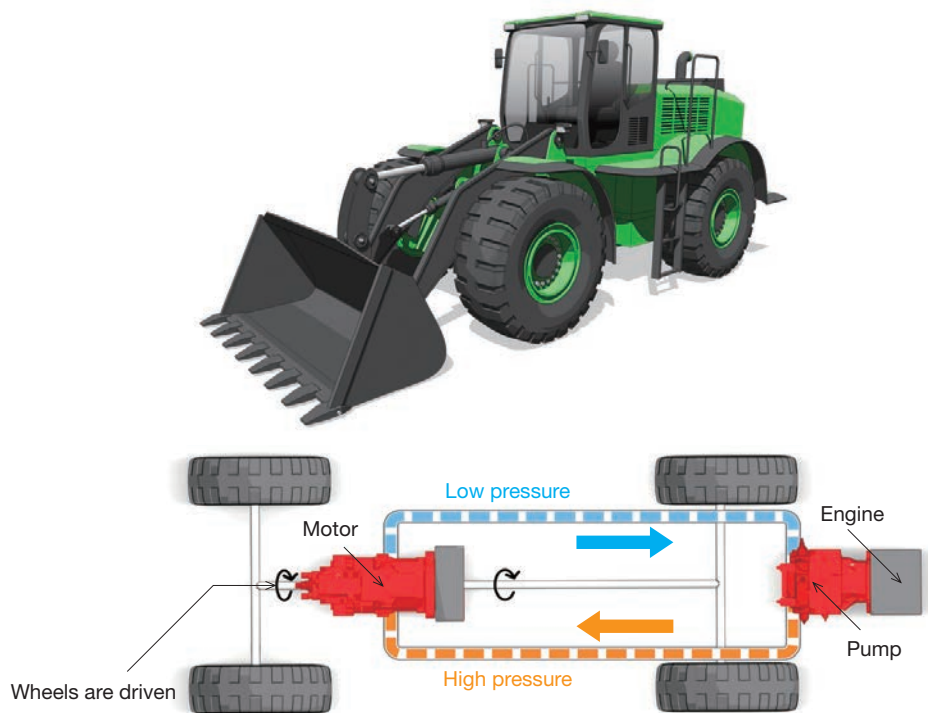


Fig. 1 HST system

## 2 Specifications

Generally, hydraulic pump and motor sizes are classified according to the displacement, and the K8V series offers a lineup of three different sizes, while the M7V series offers a lineup of four different sizes. **Table 1** and **Table 2** shows the specifications of the K8V series and M7V series. Both series have high-pressure specifications for use with HST, and the M7V series has high-speed specifications.

## 3 Features

### (1) K8V series

#### (i) High efficiency

The efficiency of the latest flagship pump is improved by performing prior verification, including accurately grasping the internal behavior and conditions, with

advanced measurement technologies and simulations. This has allowed the K8V series to achieve the world's top-class efficiency. As shown in **Fig. 2**, the K8V series has high efficiency especially in the high-pressure region, higher than a competitor's pump by up to 4 points.

#### (ii) Low noise

The noise level of the latest flagship pump is improved significantly by means of simulation and analysis, and the noise level of the K8V series has been improved in the same way. For example, the K8V125 has a sound power level of 89 dB (A) when the displacement is 125 cm<sup>3</sup>, the pressure is 15 MPa, and the pump speed is 2,100 min<sup>-1</sup>, lower than a competitor's pump by 2 dB (A).

### (2) M7V series

#### (i) Improvement of maximum speed and stability at low speeds

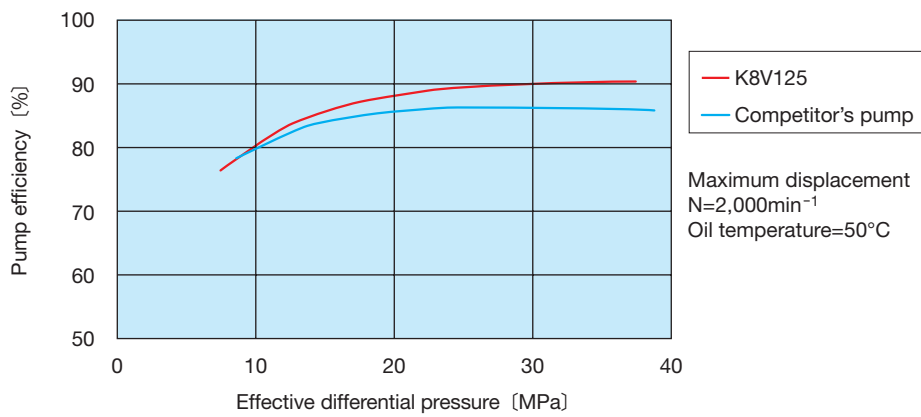
In improving the maximum speed, particular attention

**Table 1 Specifications of K8V series**

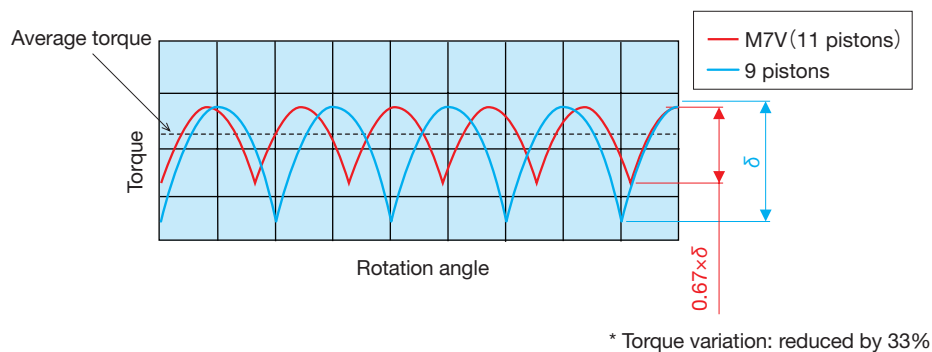
Model code		K8V71	K8V90	K8V125
Displacement [cm <sup>3</sup> ]		71	90	130
Pressure [MPa]	Rating	42		
	Max	50		
Rated speed [min <sup>-1</sup> ]		3, 300	3, 050	2, 850

**Table 2 Specifications of M7V series**

Model code		M7V85	M7V112	M7V160	M7V212
Displacement [cm <sup>3</sup> ]	q max	68 to 88.5	90 to 112	128 to 160	172 to 215
	q min	0 to 68	0 to 90	0 to 128	0 to 172
Pressure [MPa]	Rating	42			
	Max	50			
Maximum speed [rpm]	at q max	3, 900	3, 550	3, 100	2, 900
	at $q_1 < 0.6q_{max}$	6, 150	5, 600	4, 900	4, 600 (0.4q <sub>max</sub> )



**Fig. 2 Comparison of pump efficiency**



**Fig. 3 Torque fluctuations with the motor rotation**

must be paid to the heat generated in sliding parts. Heat transfer and fluid analyses were used to design the M7V series to reduce heat generation and release heat, thereby doubling the maximum speed from the conventional model.

Stability at low speeds is affected by torque fluctuations, which depend on the number of pistons on the high-pressure side while the motor is rotating. The number of pistons has been increased from 9 to 11, thereby achieving stable rotation at low speeds with reduced torque fluctuations, as shown in **Fig. 3**.

(ii) Low noise

The M7V series uses a high-rigidity swash plate type design to reduce vibration, which causes noise, and adopts

noise reduction technology as the pump does, thereby achieving low noise. For example, the M7V85 has a sound power level of 89 dB (A) when the displacement is 51 cm<sup>3</sup>, the pressure is 10 MPa, and the motor speed is 6,150 min<sup>-1</sup>, lower than a competitor's motor by 4 dB (A).

## Conclusion

The K8V series and M7V series have been developed as the culmination of Kawasaki's latest technologies. We will be expanding the sales of these series so more and more customers will be able to benefit from their excellent features.

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