

Track Motor for 7-9-ton Excavators, MAG-50VP-1100

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Introduction

In recent years, excavator weight has tended to increase due to operability enhancement and additional functions. In the market, needs for traveling and running-through performance have been increasing, leading to increased needs for higher-output torque of hydraulic motors for traveling.

In this review, we would like to introduce the characteristics/structure/specifications of the Track Motor for 7-9-ton Excavators, the MAG-50VP-1100 series.

2 Overview of the Product

2.1 Internal structure of the product

This product is a hydraulic motor with a gear reducer with a rotational case for crawlers. The KYB product lineup is shown in Fig. 1. The output torque (8.83 kN·m) of the conventional product (MAG-50VP-900 series) cannot respond to the torque required by excavator manufacturers (approximately 10 kN·m). Therefore, we urgently needed to develop this product (MAG-50VP-1100 series) with higher-output torque based on the conventional product.



Fig. 1 Product lineup for track motors

The appearance of this product is as shown in Fig. 2. The internal structure of the track motor consists of the control valve component, swashplate-type piston motor component, and gear reducer, as Fig. 3 shows.



Fig. 2 Appearance of MAG-50VP-1100



Fig. 3 Cross-section of a track motor

2.2 Main characteristics

Below are the main characteristics of our traveling motor.

- (1) This motor with a rotational case was specially designed to be optimal for a crawler drive. Its compact design fits within the crawler width.
- ② We achieved that the running-through performance (=high output) required in excavators by utilizing a case rotation type simple planetary reduction gear and hydraulic piston motor.
- ③ It comes with a runaway-prevention mechanism for downhill traveling with a counter-balance valve.
- (4) It comes with a shifting system for transport mode and traction mode. An automatic shifting system, which detects the load and shifts to the traction mode in case of a heavy load, is also available. The transport mode and traction mode enable high-speed transportation up to twice the speed with the same flow by utilizing the shifting system.
- (5) Depending on the working condition of excavators, operability and retention performance on angled surfaces are required. With the parking brake feature, users can operate/park on slope. In addition, some areas control the parking brake feature.

3 Tasks to Increase Output

The gear reducer component must be strengthened in order to increase the output of track motors. Reinforcing the weak points with the existing method would result in the size being too large. The outer dimension comparison with the existing product is as shown in Fig. 4.



b) If the output was increased with the existing method



One of the excavator manufacturers' requirements is maintenance of interchangeability with the existing product that allows the new product to be mounted on the existing unit. Therefore, it required "higher output" without changing the fit diameter on the vehicle side and the fit diameter on the output side that are shown in Fig. 5.



Fig. 5 Fit diameter for verticle mounting

4 Specification Target of This Product

Fig. 6 shows the distribution of the output torque required by mother machine manufacturers and vehicle weight. Excavator mass has been on an upward trend due to the enhancement of excavator work efficiency. As a result, output torque required by mother machine manufacturers has also been on an upward trend.

With this MAG-50VP-1100, we aimed to increase the output torque by at least approximately 20% compared to the current product without changing the mounting dimensions of the current product, based on the trend of the future market.



Fig. 6 Output forque required by 7-9-ton excavator manufacturers and excavator weight

5 Development Technology for Higher Output

5.1 Principle of gear reducer functions

Let us explain the principle of how a case rotation type simple planetary reduction gear works.



Fig. 7 Gear reducer skeleton diagram

Fig. 7 shows the skeleton diagram ^{Note 1)} of a planetary dual gear reducer.

[1] The drive gear engages with the [2] planetary gear A contained in the [3] holder, and [4] the sun gear engages with [5] planetary gear B. [6] The flange holder is fixed on the equipment body, and [2] and [5] planetary gears engage with the [7] ring gear. The driving force from the piston motor is transmitted to the [1] drive gear, and the speed is decelerated by each gear. Due to this, the driving force is transmitted to the [7] ring gear via [5] planetary gear B in the [6] flange holder, which is fixed onto the equipment body on the last level. The driving force is also transmitted from [2] planetary gear A.

Note 1) "Skeleton diagram" refers to schematic diagrams that simply describes structures.

5.2 Method to increase the output

With this MAG-50VP-1100, we enhanced the output without changing the current outer dimensions. Let us explain part of the modification contents below:

(1) Gear strength

The larger the module is, the greater the strength/ durability of a gear is. However, changing the module would enlarge the gear reducer in the perpendicular direction. This would make it difficult to make up the system with the same mounting dimensions as the existing product.

Therefore, we enhanced the rigidity of the gear shaft by reviewing the gear shape and changing the layout and simultaneously optimized the engagement between gears in order to increase the output.

(2) Gear shaft rigidity

Even if the strength of gears itself improves, the gear surface would be damaged due to pitching, etc., unless the engagement between gears is appropriate. In this case, we cannot improve the durability. In order to ensure appropriate engagement, shaft rigidity becomes an important factor.

Therefore, we ensured the shaft rigidity that can maintain the same level of shaft deflection as the existing product even under the higher output condition by considering and optimizing the overall rigidity balance while combining the gear reducer components.

(3) Bearings

As the output increases, high-load capacity-type bearings become more necessary. However, high-load/ capacity-type bearings that can withstand the required load would be bigger, meaning that we have no choice but to also increase the product dimensions. With this product, we ensured the durability by optimizing the roller shape.

(4) Vehicle mounting part

As the torque increases, the reaction force on the vehicle mounting part also increases. Due to this, the number of fastening bolt holes on the vehicle side as well as the output side needs to be increased. On the vehicle side, we added the fastening holes without changing the locations of the fastening bolt holes of the existing product. On the output side, we increased the number of fastening bolts by using the same fastening bolt spacing (refer to Fig. 8) as the existing products. This provided compatibility with the existing product, ensuring a wide scope of mounting flexibility.



Fig. 8 Fastening bolt spacing for vehicle mounting

6 Characteristics of MAG-50VP-1100

The main characteristics of this product are as shown in Table 1. We have achieved approximately 20% higher output compared to conventional motors while maintaining the exact outer dimensions. While we have increased the number of fastened bolts to enhance the torque, the fit diameter on the vehicle side and output side is the same.

7 Future Tasks

In recent years, people's awareness toward the environment is becoming more and more heightened. The market also requires higher efficiency in traveling motors for energy saving.

While there are currently not many needs for higher efficiency in traveling motors for 7-9-ton excavators and mini excavators, we expect that needs for higher efficiency will increase along with higher torque in the future. We hope to promote product development with the aim of swiftly responding to such needs, and we hope to continue producing products that always respond to market needs.

8

In Closing

delivering this product to customers.

in the development and mass production.

Development of this product has allowed us to enhance our track motor product lineup. We have already started

As shown in Table 2, the completion of the development of this product has enabled us to provide the hydraulic system as a set of a pump, control valve, cylinder, swing motor, and traveling motor for 7-9-ton excavators.

Finally, we would like to express our sincere gratitude for the great support and cooperation of everyone involved

 Table 2
 Hydraulic equipment for 7-9-ton excavators

For load sensing

KVMX-18-14

PSVL-84

For 7-9-ton excavator

KCM MSG-44P

MAG-50VP-1100

For open center

KVMM-80-XD

PSVD2-42

Table 1List of specifications of MAG-50VP-1100 and
existing product

Model		Existing product	This product (higher output)
		MAG-50VP-900	MAG-50VP-1100
Maximum equivalency capacity (cm³/rev)		2574	3038
Maximum motor capacity (cm³/rev)		50.9	<-
Maximum pressure (MPa)		32.0	<-
Maximum volume (L/min)		92.0	<-
Maximum motor speed (rpm)		3600	<-
Reduction ratio		50.579	50.579 59.716
Maximum output (kN·m)		8.826	10.787 (22% up)
Outer dimension (height x maximum outer diameter)		354 x ø332	356.5 x ø332
Installation dimensions (vehicle side)		Fit diameter: ø210 Number of fastening holes: 12 x M16 x 2.0	<- Number of fastening holes: 14 x M16 x 2.0
Installation dimensions (output side)		Fit diameter: ø265 Number of fastening holes: 12 x M14 x 2.0	<- Number of fastening holes: 16 x M14 x 2.0
Peripheral features	Shifting system	Available	<-
	Parking brake feature	Standard equipment	<-
	Relief valve	Standard equipment (shock-less)	<-
Product weight (kg)		86.0	<-

— Authors -



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Joined the company in 2004. Pump & Motor Design Sect. Sagami Hydraulics Engineering Dept., Engineering Headquarters, Hydraulic Components Operations. Engaged in development of hydraulic motors.

Category

Control valve

Pump

Cylinder

Swing motor

Traveling motor

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