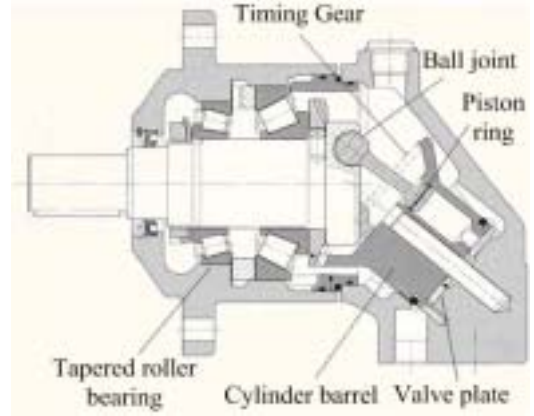




EHA 350bar  
10,000rpm 85%

**Table 1.** Specification of the pump

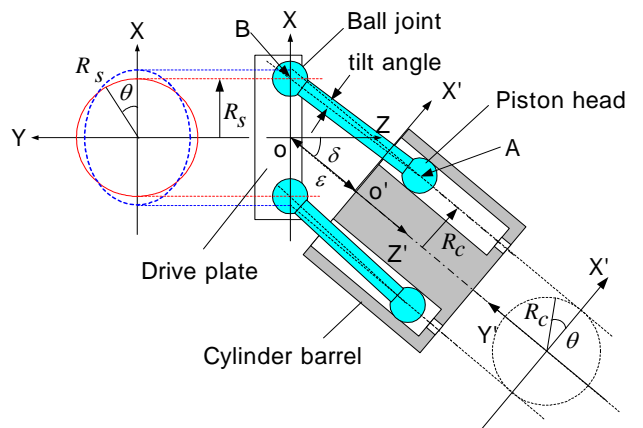
	4.88cc/rev		5
	9.5 mm		13.77 mm



**Fig. 1** Schematic diagram of the pump

가  
[2,3,4,5,6,9,10].

[1]



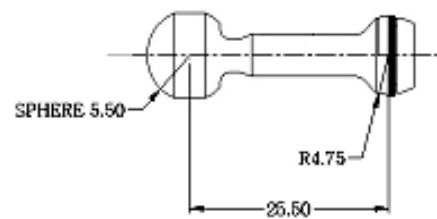
		40 deg
	$R_s$	10.75 mm
	$R_c$	9.5 mm

(a) Coordinate systems and geometrical parameters

2.

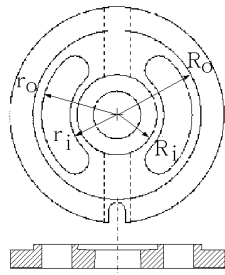
Fig. 1

Table 1



(b) Geometry of the spherical piston

Fig.2

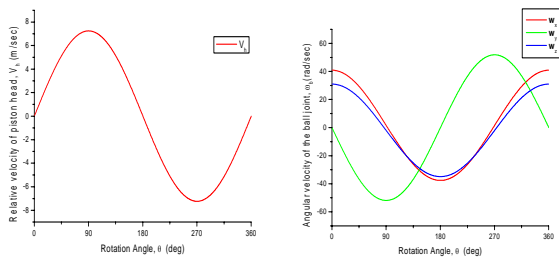


$R_i$	6.25 mm	$r_i$	7.4 mm
$R_o$	13.25 mm	$r_o$	11.6 mm

(c) Geometry of the valve plate

Fig. 2 Principal parameters of the pump

rpm 가 10,000  
 rpm 가  
 Fig. 3  
 7m/s,  
 50 rad/sec  
 5.5mm  
 0.275 m/s



(a) Velocity of piston head (b) Angular velocity of ball joint

Fig. 3 Relative velocity of piston head and ball joint (n=10,000 rpm)

3.  
 3.1

Fig. 4

가

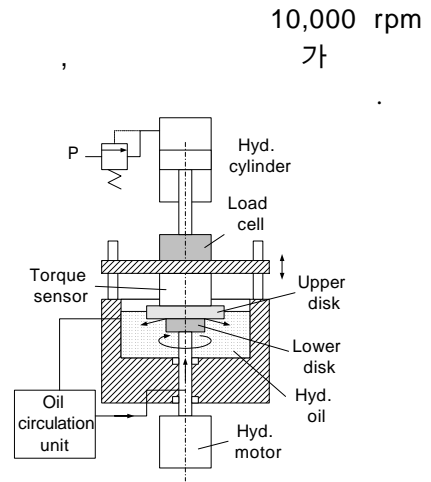


Fig. 4 Schematic diagram of the tribometer

3.2

i)  
 ii)

(2)(3)(4).

$$T_f^V = \left[ \sum_{n=1}^N A_b P_C \right] \mu_p R_c \quad \text{--- (1)}$$

$$A_b = A_p - \frac{\pi}{2N} \left\{ \frac{(R_o^2 - r_o^2)}{\ln(R_o / r_o)} - \frac{(R_i^2 - r_i^2)}{\ln(R_i / r_i)} \right\} \quad \text{-- (2)}$$

Fig.5

10µm , 가 70cSt ,

Fig.6

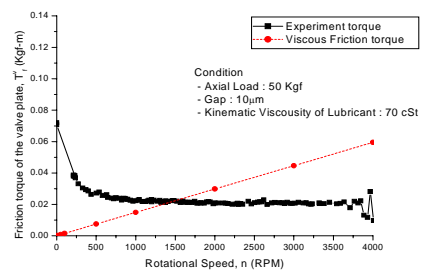


Fig. 5 Friction torque of the valve plate

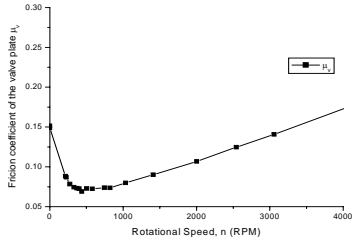


Fig. 6 Friction coefficient of the valve plate

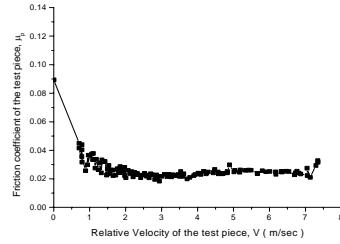


Fig. 8 Friction coefficient of the test piece

3.3

220kg

Palmgren

$$T_f^b$$

10,000 rpm

$$T_m$$

0.3m/s

$$T_v$$

$$(12)$$

$$f_1, f_0, a, b$$

(13)

$$T_f^b = T_m + T_v \quad \text{---(3)}$$

$$T_m = f_1 F_B^a d_m^b$$

$$T_v = 10^{-7} f_0 (vn)^{2/3} d_m^3 \quad (\text{if } vn \geq 2000)$$

$$= 160 \times 10^{-7} f_0 d_m^3 \quad (\text{if } vn < 2000)$$

$$F_B =$$

Fig.7

Fig.4

Palmgren

Palmgren

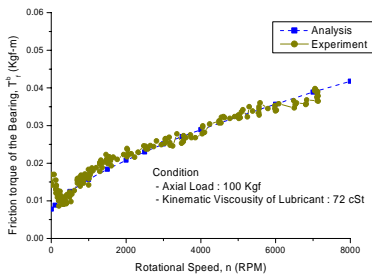


Fig. 7 Friction torque of the bearing

3.4

(1).

$$F_f^h = \mu_p F_h \quad \text{---(4)}$$

$$T_f^b = \mu_p R_b F_b \quad \text{---(5)}$$

$$F_h, F_b =$$

$$\mu_p =$$

$$R_b =$$

Fig.8 0.3 m/s

stick-slip

가, 0.07 0.09

0.08 가

10,000 rpm 7 m/s

150N 가

1.0 가

0.5%

Fig.8 1 m/s

0.025 가

가

4.

500rpm, 10,000rpm

Fig.9, Fig.10

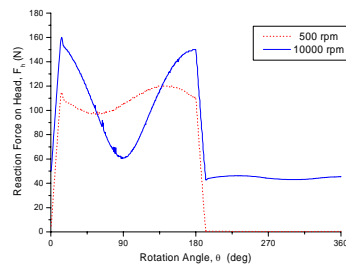


Fig.9 Change of reaction force on piston head

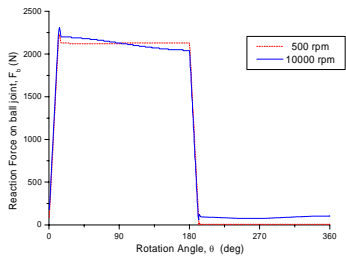


Fig.10 Change of reaction force on ball joint

가 가 ,  
가  
가 150 N

Fig. 13  
가 ,  
가  
0.1914 Nm  
가  
10  
1.637 Nm

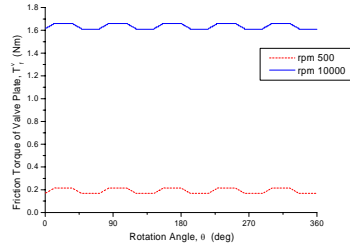


Fig.13 Change of friction torque at valve plate

Fig.11  
10,000rpm  
300bar  
4.88cc/rev  
0.12 Nm  
(23.09Nm) 0.52%

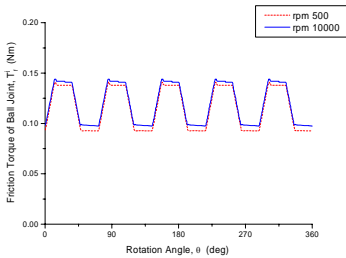


Fig. 11 Change of friction torque at ball joint

Fig.12  
가 0.01 Nm

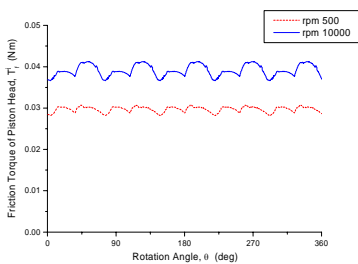


Fig. 12 Change of friction torque at piston head

Fig.14  
가 가  
500rpm  
가 0.377 Nm , 10,000rpm 0.91 Nm  
가  
300 bar  
Fig.  
15 가 5  
1 10  
, 10,000rpm 2.7 Nm  
11.7%

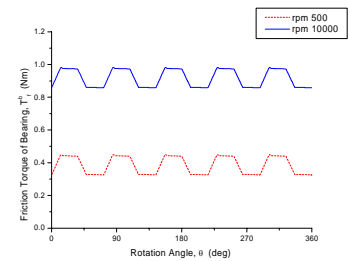


Fig. 14 Change of friction torque at bearing

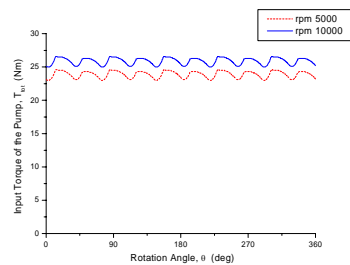


Fig. 15 Change of the pump input torque

Fig. 16

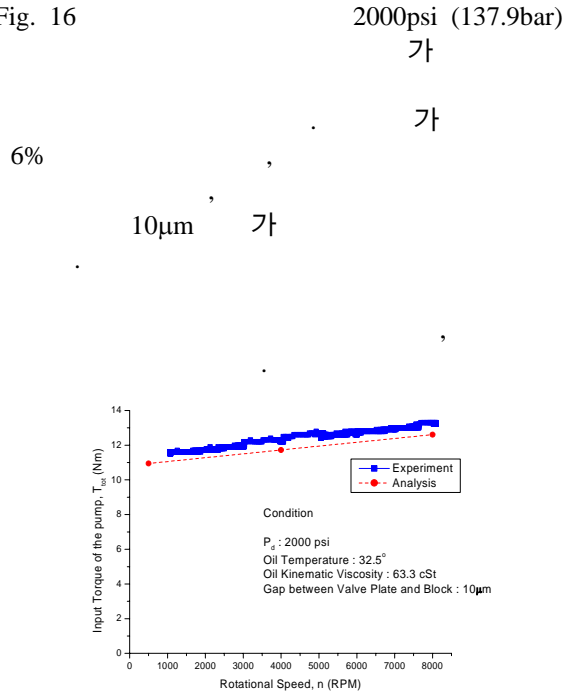


Fig.16 Practical & analytical pump input torque

Fig.16

가  
75%

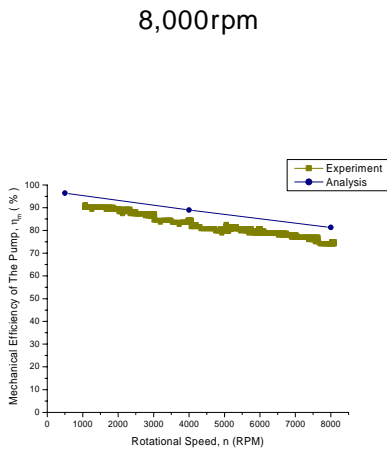


Fig. 17 Change of pump mechanical efficiency

5.

가

가 6%

가