Calculating Bowl Lateral Requirement

200.A.09 *(Effective June 1, 2006)*

When determining the bowl lateral required, shaft and impeller weight are not considered. When the impeller is correctly positioned prior to start up, any stretch due to the shaft and impeller weight has already occurred. Also, Head Shaft or Mechanical Seal Sleeve force is not considered as this force affects only the elongation of the line shaft above the sleeve. Impeller thrust then is the only force normally affecting lateral.

Bowl lateral requirement may be calculated by determining impeller thrust and then referring to Shaft Elongation Charts 2 or 2a. The impeller thrust equation is:

$$T_{imp} = K \times H_L \times SG$$

NOTE: For bowl lateral calculations, Lab Head and "K" value selected should be the maximum anticipated. (Example: if unit operates near shut-off, the Lab Head and "K" value corresponding to this flow should be selected.)

EXAMPLE:

What is the load carried by the motor bearing at design conditions when:

Capacity	400 GPM	Bowl Model	10 AHC
Head	1800 ft.	Speed	3550 RPM
SpGr	1.03	Head Shaft Dia.	$1^{11}/_{16}$
Discharge Pressure	803 PSI	Setting (Product Lube)	100'
Suction Pressure	Flooded		

From the 10 AHC thrust capacity curve, Pg. 2J.3, the "K" factor at design is 2.6.

Impeller Thrust: T_{imp} = $K \times H_L \times SG$
= 2.6 x 1800 x 1.03
= 4820 lbs.

Dead Weight: Wt. = Shaft wt. per ft. x Setting
= 6.7 x 100
= 670 lbs.

Shaft Area Force: S.A.F. = Shaft Area x Suction Pressure
= 2.2 x 0.0
= 0

Seal Sleeve Force: S.F. = Sleeve Area x Discharge Pressure
= 1.5 x 803
= 1204 lbs.

Motor Bearing Load: = T_{imp} + wt. – Shaft Area Force – Sleeve Force
= 4820 + 670 – 0 – 1204
= 4286 lbs.

NOTE: In addition to the design point, the motor bearing load should be calculated at shutoff and runout. Should these points indicate excessive down thrust or any upthrust, a simple plot of shutoff, design and runout thrust against capacity will establish the maximum allowable operating range of the pump.

Calculating Motor Bearing Load

200.A.10 *(Effective June 1, 2006)*

MOTOR BEARING SIZING

As previously stated, for short setting non-hydraulic balanced umps below 50 feet with discharge pressures below 600 psi and can pump with suction pressures below 100 psi, only impeller thrust need be considered.

Under these condtions:

Motor Bearing Load (lbs.) $T_{imp} = K \times H_L \times SG$

Where:

Impeller Thrust (lbs.)

K = Thrust Factors (lbs./ft.)

HL = Lab Head (ft.)

SG = Specific Gravity

For more demanding applications, the forces which should be considered are impeller thrust plus dead weight minus any sleeve or shaft area force.

In equation form:

Motor Bearing Load = T_{imp} + Wt.(1) – Sleeve Force(2) – Shaft Area Force(3)

Shaft Diameter (in.)	Shaft Dead Weight (lbs./ft.)		Shaft Area (in^2)	Sleeve Area (in.)
	Open Lineshaft	Closed Lineshaft		
1	2.3	2.6	0.78	1.0
$1^3/_{16}$	3.3	3.8	1.1	1.1
1½	5.3	6.0	1.8	1.1
$1^{11}/_{16}$	6.7	7.6	2.2	1.5
$1^{15}/_{16}$	8.8	10.0	2.9	1.8
$2^3/_{16}$	11.2	12.8	3.7	2.0

(1) Weight = Shaft Dead Weight x Setting in Feet

(2) Sleeve Force = Sleeve Area x Discharge Pressure

(3) Shaft Area Force = Shaft Area x Suction Pressure

NOTE: Also see complete weight chart on Page 200.B2. *Oil Lube shaft does not displace liquid above the pumping water level and therefore has a greater net weight.

GOULDS WATER TECHNOLOGY

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