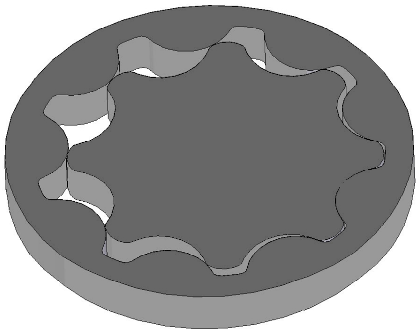


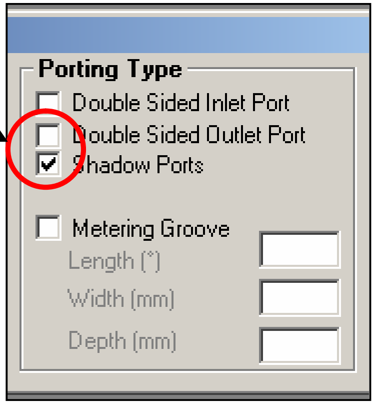
Gerotor Design Studio

Calculation of Power in Gerotor Design Studio from Version 2.0.30

07/03/2016

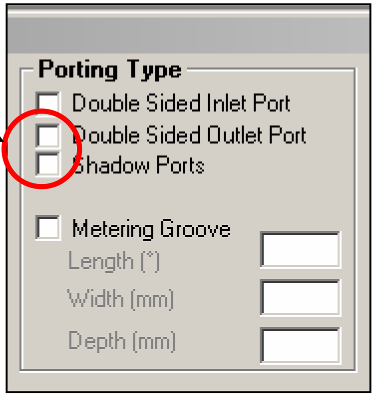
Calculation from Version 2.0.30 onwards

Any selection here

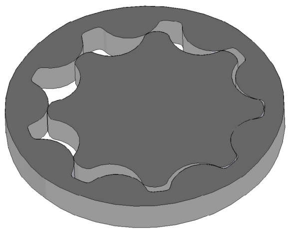


Drive Power =Hydraulic Power
+ Inner Rotor Face Viscous Drag (both sides of housing)
+ Outer Rotor Face Viscous Drag (both sides of housing)
+ Outer Rotor Circumferential Viscous Drag

No selection here



Drive Power =Hydraulic Power
+ Inner Rotor Face Viscous Drag (port side of housing)
+ Outer Rotor Face Viscous Drag (port side of housing)
+ Outer Rotor Circumferential Viscous Drag
+ Rotor Face Friction (bottom of housing)



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Hydraulic Power

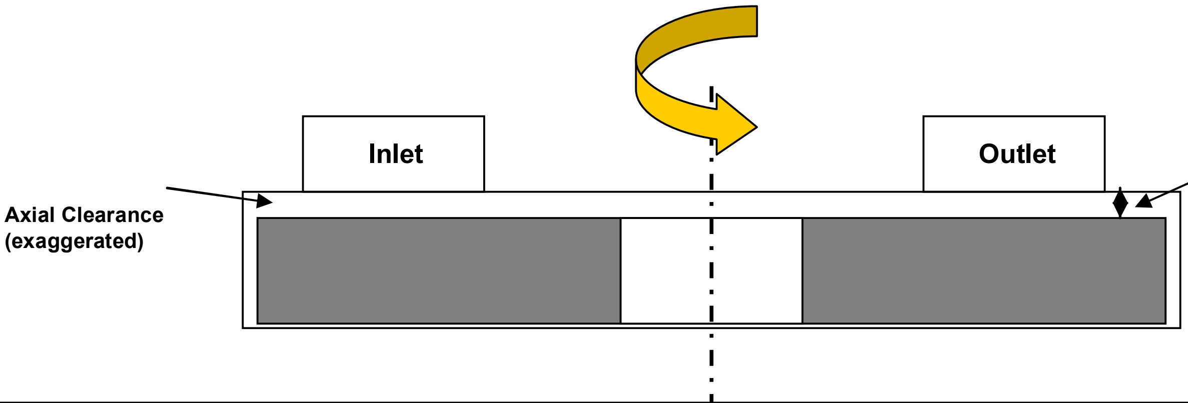
$$= \text{Volume Flow} \times \text{Outlet Pressure}$$

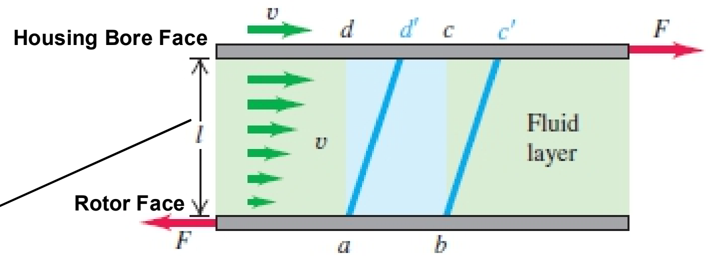
$$= \frac{m^3}{s} \times \frac{N}{m^2}$$

$$= \frac{Nm}{s}$$

$$= \text{Watts}$$

Rotor Face Viscous Drag





$$\eta = \frac{\text{Shear stress}}{\text{Strain rate}} = \frac{F/A}{v/l} \quad \text{(definition of viscosity)}$$

⇓

$$F = \eta A \frac{v}{l}.$$

Diagram shows ‘single sided’ porting arrangement. Rotor set is forced against the housing floor (all axial clearance assumed to be at porting side of housing)

For ‘shadow porting’ or ‘double sided outlet’ porting arrangements, the rotors are ‘balanced’ in the housing bore, due to equalisation of pressure.

Assumption for this case is to calculate the viscous drag for both sides and assume an equal clearance at both sides (equal to half the inputted axial clearance for each side).

This effectively raises the total viscous drag of the rotor set by a factor of four, compared to the ‘single sided’ porting arrangement.

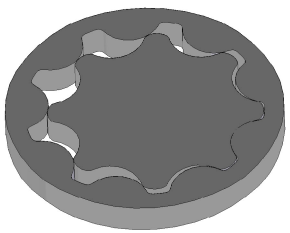
A = Area of rotor faces moving against housing face
v = Velocity of rotors (at effective radius)
l = Rotor Axial Clearance
η = Dynamic Viscosity

Torque = F x R

R=Effective Radius of rotors

(factor of shaft size, OD)

Power = Torque x Speed



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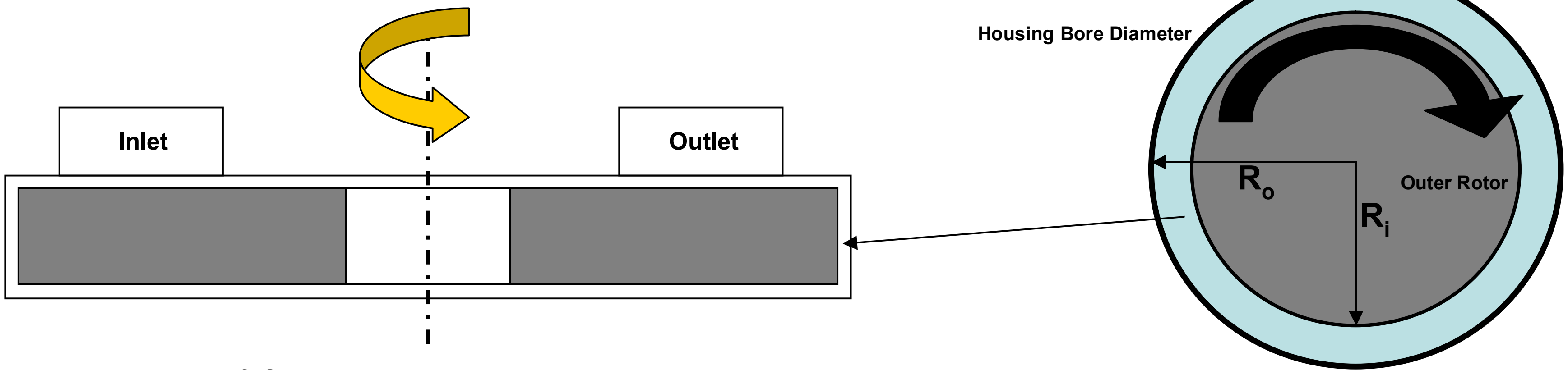
Rotor Circumferential Viscous Drag

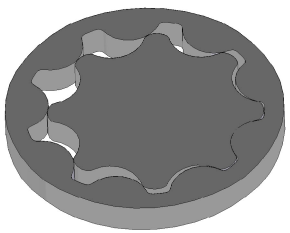


R_i = Radius of Outer Rotor
R_o = Radius of Housing Bore
h = Rotor Thickness
η = Dynamic Viscosity
ω = Angular velocity of outer rotor
$R_o - R_i$ = 0.5 x Circumferential clearance

$$\text{Torque} = \frac{2\pi R_i^3 h \eta \omega}{R_o - R_i}$$

Circumferential clearance is not an input from the user (yet..). For these calculations, it is assumed to be equal to the axial clearance value.

Power = Torque x Speed



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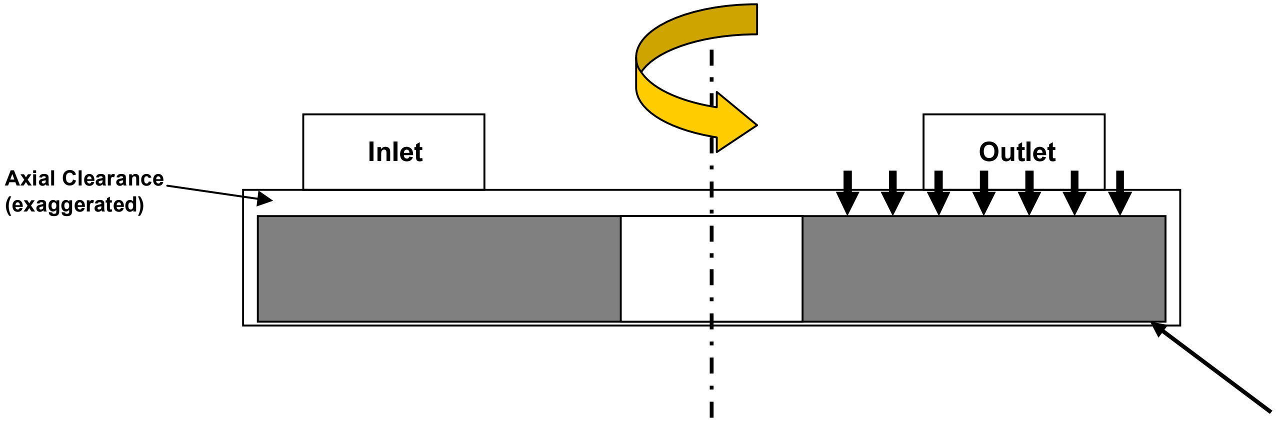
Rotor Face Friction Power



$F = \mu N$

μ=coefficient of friction

N=Pressure x 0.5Area of rotor faces

Torque = F x R

R=Effective Radius of rotors

(factor of shaft size, OD)

Power = Torque x Speed

Diagram shows 'single sided' porting arrangement. Rotor set is forced against the housing floor (all axial clearance assumed to be at porting side of housing)

For 'shadow porting' or 'double sided outlet' porting arrangements, the rotors are 'balanced' in the housing bore, due to equalisation of pressure.

Assumption for this case is to delete the friction force (F) entirely and replace it with viscous drag forces on both sides of the rotors (see slide 4).