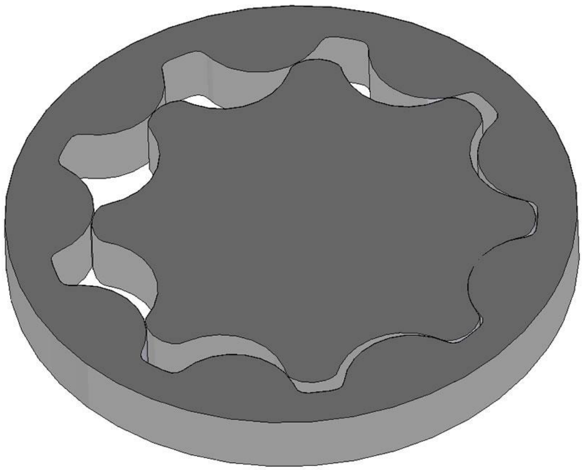


Gerotor Design Studio

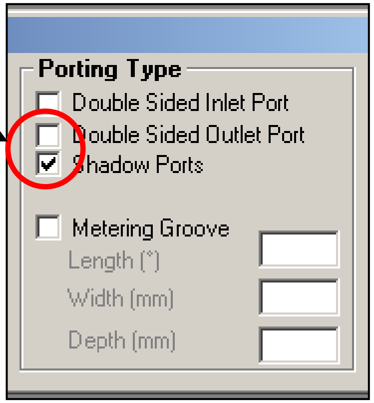
# Calculation of Power in Gerotor Design Studio from Version 2021.1

**Issue 1: 7th March 2016**
**Issue 2: 28th January 2017**
**Issue 3: 29th April 2021**

Calculations within Gerotor Design Studio are based upon published, well known, theories and principles.
Calculations predominantly are for macro conditions, not micro conditions.
Calculations are given for design guidance and absolute accuracy is not implied.

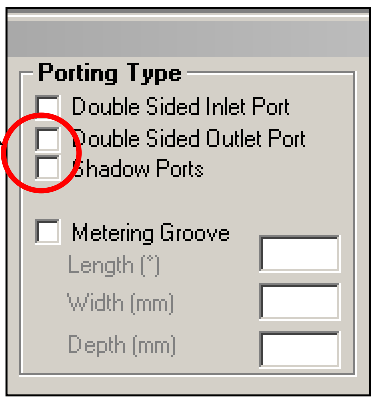
# Calculation from Version 2.0.30 onwards

**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)

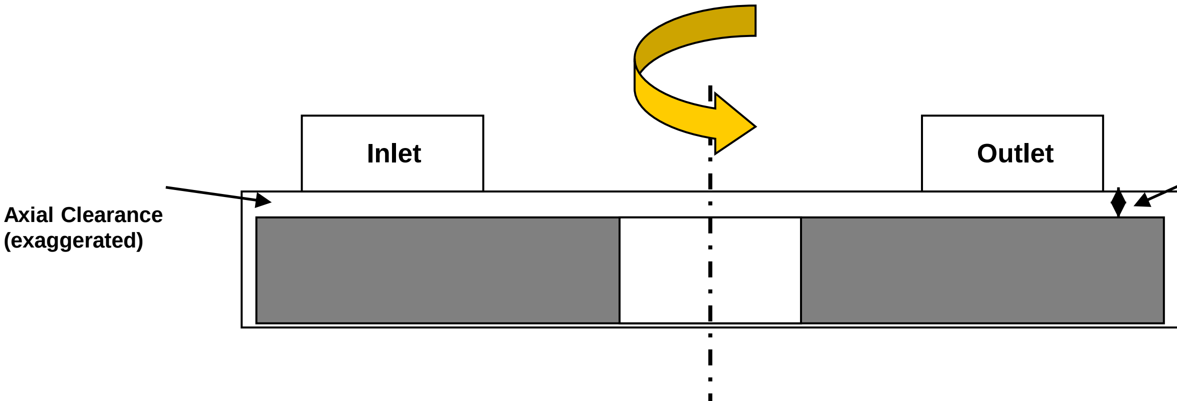
**Hydraulic Power** = Volume Flow x Outlet Pressure

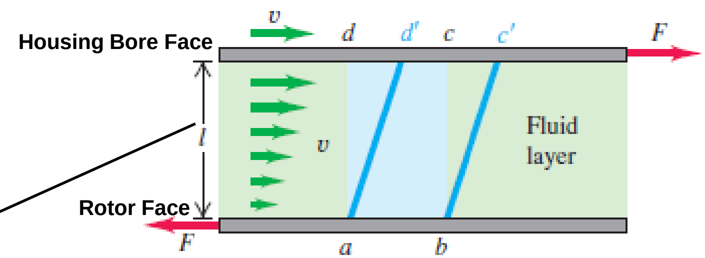
$$= \frac{m^3}{s} \times \frac{N}{m^2}$$

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

= 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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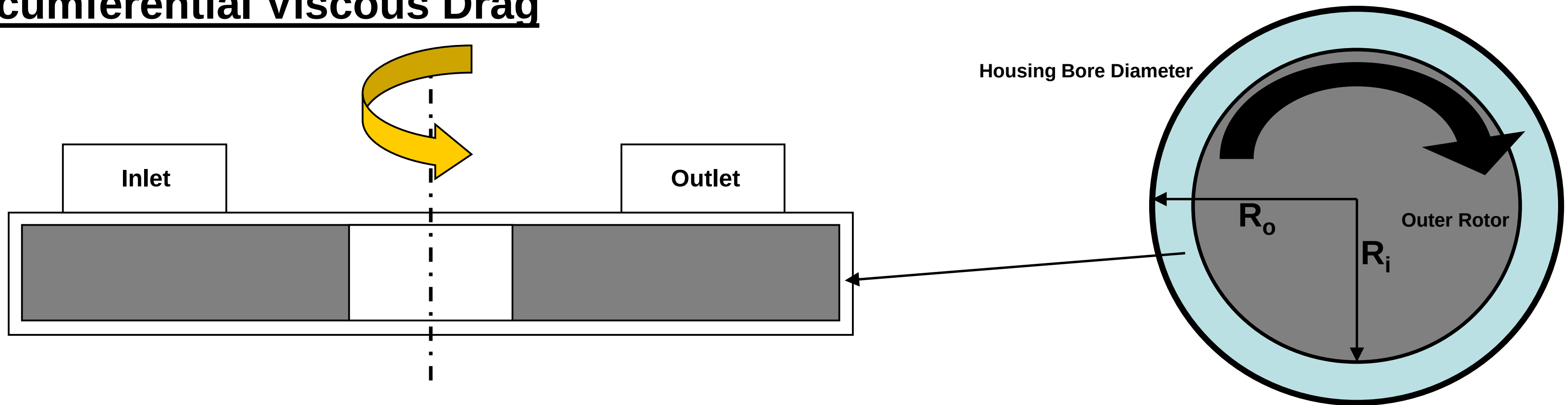
## Rotor Circumferential Viscous Drag



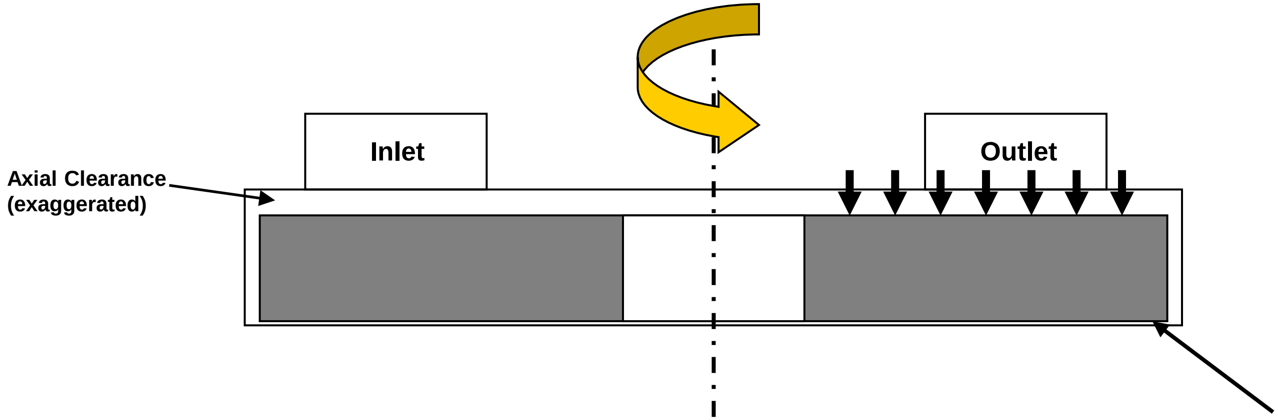

**$R_i$ = Radius of Outer Rotor**
**$R_o$ = Radius of Housing Bore**
**h = Rotor Thickness**
**η = Dynamic Viscosity**
**ω = Angular velocity of outer rotor**
**$R_o - R_i$ = Radial Clearance**

**From V2021.1 Radial Clearance is an input on the Design form.**

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

$$\text{Power} = \text{Torque} \times \text{Speed}$$

## Rotor Face Friction Power




$F=\mu N$

$\mu$=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).