Input Conditions

$loadTorque := 0.85 \cdot N \cdot m$ See Oildyne Data Sheet H865 Pump (to right)

$loadTorque = 120.37\, ozf \cdot in$ $loadTorque = 7.523\, lbf \cdot in$

$loadSpeed := 1000 \cdot \frac{rev}{min}$ Just as a starting point try this speed

$gearRatio := 1$ $gearEff := 1.0$

Maxon 353301 250W 70V brushed motor

$terminalResistance := 1.41 \cdot ohm$ $torqueConstant := 0.253 \cdot \frac{N \cdot m}{A}$ $speedConstant := 37.7 \cdot \frac{\frac{rev}{min}}{V}$

$noLoadCurrent := 0.120\, A$ $speedConstant \cdot torqueConstant = 0.999$

$stallTorque := 12.6 \cdot N \cdot m$ $frictionTorque := torqueConstant \cdot noLoadCurrent = 0.03 \cdot N \cdot m$

$loadPower := loadTorque \cdot loadSpeed = 89.012W$

$$motorTorque := \frac{loadTorque}{gearRatio \cdot gearEff} = 0.85 \cdot N \cdot m$$

$$motorSpeed := loadSpeed \cdot gearRatio = 1 \times 10^{3} \cdot \frac{rev}{min}$$

$$motorPowerIn := \left(\frac{motorTorque}{torqueConstant} \cdot terminalResistance + \frac{motorSpeed}{speedConstant}\right) \cdot \frac{motorTorque}{torqueConstant} = 105.032W$$

$$motorVoltage := torqueConstant \cdot motorSpeed + terminalResistance \cdot \frac{motorTorque}{torqueConstant} = 31.231V$$

$$motorVoltage2 := \frac{1}{speedConstant} \cdot \left(motorSpeed + \frac{terminalResistance}{torqueConstant^{2}} \cdot motorTorque\right) = 31.268V$$

$$\frac{motorSpeed}{speedConstant} + terminalResistance \cdot \frac{motorTorque}{torqueConstant} = 31.262V$$

$$motorCurrent := \frac{motorTorque}{torqueConstant} + noLoadCurrent = 3.48A$$

$motorVoltage \cdot motorCurrent = 108.675W$

$$eff := \frac{motorSpeed \cdot (motorTorque - frictionTorque)}{motorVoltage \cdot motorCurrent} = 0.79$$

Maxon 429271 90W 36V brushless EC90 flat motor

$$\text{terminalResistance} := 0.522\cdot\text{ohm} \qquad \text{torqueConstant} := 0.109\cdot\frac{\text{N}\cdot\text{m}}{\text{A}}$$

$$\text{speedConstant} := 88.0\cdot\frac{\frac{\text{rev}}{\text{min}}}{\text{V}} \qquad \text{noLoadCurrent} := 0.348\cdot\text{A}$$

$$\text{stallTorque} := 7.48\cdot\text{N}\cdot\text{m} \qquad \text{frictionTorque} := \text{torqueConstant}\cdot\text{noLoadCurrent} = 0.038\cdot\text{N}\cdot\text{m}$$

$$\text{speedConstant}\cdot\text{torqueConstant} = 1.004$$

$$\text{loadPower} := \text{loadTorque}\cdot\text{loadSpeed} = 89.012\ \text{W}$$

$$\text{motorTorque} := \frac{\text{loadTorque}}{\text{gearRatio}\cdot\text{gearEff}} = 0.85\cdot\text{N}\cdot\text{m}$$

$$\text{motorSpeed} := \text{loadSpeed}\cdot\text{gearRatio} = 1\times10^{3}\cdot\frac{\text{rev}}{\text{min}}$$

$$\text{motorPowerIn} := \left(\frac{\text{motorTorque}}{\text{torqueConstant}}\cdot\text{terminalResistance} + \frac{\text{motorSpeed}}{\text{speedConstant}}\right)\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 120.359\ \text{W}$$

$$\text{motorVoltage} := \text{torqueConstant}\cdot\text{motorSpeed} + \text{terminalResistance}\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 15.485\ \text{V}$$

$$\text{motorCurrent} := \frac{\text{motorTorque}}{\text{torqueConstant}} + \text{noLoadCurrent} = 8.146\ \text{A}$$

$$\text{motorVoltage}\cdot\text{motorCurrent} = 126.144\ \text{W}$$

$$\text{motorVoltage2} := \frac{1}{\text{speedConstant}}\cdot\left(\text{motorSpeed} + \frac{\text{terminalResistance}}{\text{torqueConstant}^{2}}\cdot\text{motorTorque}\right) = 15.416\ \text{V}$$

$$\frac{\text{motorSpeed}}{\text{speedConstant}} + \text{terminalResistance}\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 15.434\ \text{V}$$

$$\text{eff} := \frac{\text{motorSpeed}\cdot(\text{motorTorque} - \text{frictionTorque})}{\text{motorVoltage}\cdot\text{motorCurrent}} = 0.674$$

$\text{loadTorque} = 0.85\,\text{N}\cdot\text{m}$ $\quad$ $\text{loadSpeed} = 1 \times 10^{3}\,\frac{\text{rev}}{\text{min}}$

$\text{loadSpeed} := 400\cdot\frac{\text{rev}}{\text{min}}$

Maxon 244879 90W 48V brushless EC90 flat motor

$\text{terminalResistance} := 2.28\cdot\text{ohm}$ $\quad$ $\text{torqueConstant} := 0.217\cdot\frac{\text{N}\cdot\text{m}}{\text{A}}$

$\text{speedConstant} := 44.0\cdot\frac{\frac{\text{rev}}{\text{min}}}{\text{V}}$ $\quad$ $\text{noLoadCurrent} := 0.135\cdot\text{A}$

$\text{stallTorque} := 4.67\cdot\text{N}\cdot\text{m}$ $\quad$ $\text{frictionTorque} := \text{torqueConstant}\cdot\text{noLoadCurrent} = 0.029\cdot\text{N}\cdot\text{m}$

$\text{speedConstant}\cdot\text{torqueConstant} = 1$

$\text{loadPower} := \text{loadTorque}\cdot\text{loadSpeed} = 35.605\,\text{W}$

$$\text{motorTorque} := \frac{\text{loadTorque}}{\text{gearRatio}\cdot\text{gearEff}} = 0.85\cdot\text{N}\cdot\text{m}$$

$$\text{motorSpeed} := \text{loadSpeed}\cdot\text{gearRatio} = 400\cdot\frac{\text{rev}}{\text{min}}$$

$$\text{motorPowerIn} := \left(\frac{\text{motorTorque}}{\text{torqueConstant}}\cdot\text{terminalResistance} + \frac{\text{motorSpeed}}{\text{speedConstant}}\right)\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 70.592\,\text{W}$$

$$\text{motorVoltage} := \text{torqueConstant}\cdot\text{motorSpeed} + \text{terminalResistance}\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 18.021\,\text{V}$$

$$\text{motorVoltage2} := \frac{1}{\text{speedConstant}}\cdot\left(\text{motorSpeed} + \frac{\text{terminalResistance}}{\text{torqueConstant}^{2}}\cdot\text{motorTorque}\right) = 18.023\,\text{V}$$

$$\frac{\text{motorSpeed}}{\text{speedConstant}} + \text{terminalResistance}\cdot\frac{\text{motorTorque}}{\text{torqueConstant}} = 18.022\,\text{V}$$

$$\text{motorCurrent} := \frac{\text{motorTorque}}{\text{torqueConstant}} + \text{noLoadCurrent} = 4.052\,\text{A}$$

$\text{motorVoltage}\cdot\text{motorCurrent} = 73.02\,\text{W}$

$$\text{eff} := \frac{\text{motorSpeed}\cdot(\text{motorTorque} - \text{frictionTorque})}{\text{motorVoltage}\cdot\text{motorCurrent}} = 0.471$$

$numTorqueSteps := 20 \qquad n := 0 .. numTorqueSteps \qquad torqueIncr := \frac{motorTorque}{numTorqueSteps} = 0.043 \cdot N \cdot$

$torqueSteps_n := n \cdot torqueIncr$

$motorVoltage := 10V$

$$effSteps_n := \frac{\left[\left(speedConstant \cdot motorVoltage - \frac{terminalResistance}{torqueConstant^2} \cdot torqueSteps_n\right) \cdot \left(torqueSteps_n - friction\right.\right.}{motorVoltage \cdot \left(\frac{motorTorque}{torqueConstant} + noLoadCurrent\right)}$$

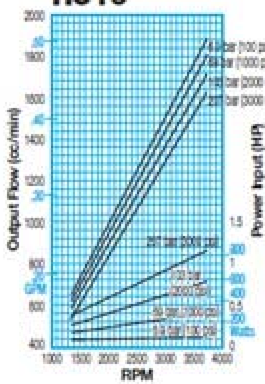
effSteps =

	0
0	-0.033
1	0.014
2	0.058
3	0.097
4	0.131
5	0.162
6	0.188
7	0.21
8	0.227
9	0.24
10	0.249
11	0.253
12	0.254
13	...

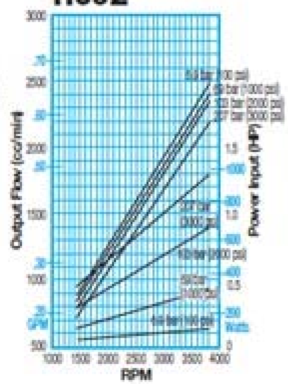
$$\frac{\left(speedConstant \cdot motorVoltage - \frac{terminalR}{torqueCo}\right.}{motorVoltage \cdot \left(\frac{m}{tor}\right.}$$

$$speedConstant \cdot motorVoltage - \frac{terminalResistan}{torqueConstant}$$

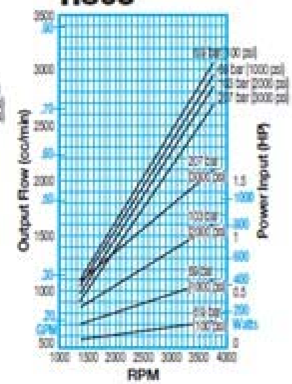
H519



H692



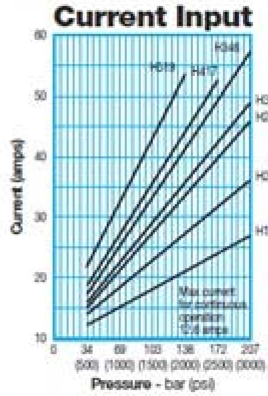
H865



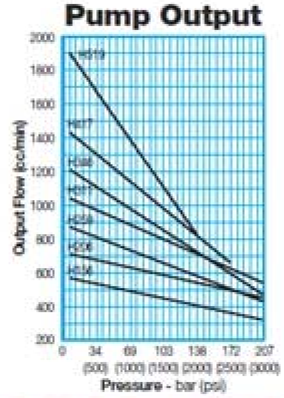
Typical Performance Data

at 12 VDC as assembled with a standard DC motor

Current Input

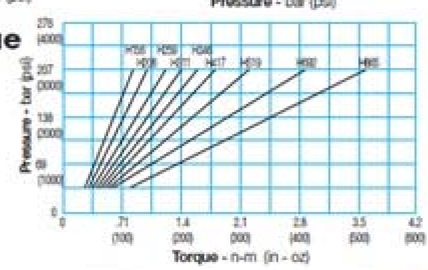


Pump Output



Average Input Torque

Speed: 3000 RPM



Parker Hannifin Corporation
Oildyne Division
Minneapolis, MN 55428 USA

n

$\rightarrow$

nTorque)

$$\text{torqueSteps} = \begin{array}{c|c} & 0 \\ \hline 0 & 0 \\ 1 & 0.043 \\ 2 & 0.085 \\ 3 & 0.128 \\ 4 & 0.17 \\ 5 & 0.212 \\ 6 & 0.255 \\ 7 & 0.297 \\ 8 & 0.34 \\ 9 & 0.382 \\ 10 & 0.425 \\ 11 & 0.467 \\ 12 & 0.51 \\ 13 & \ldots \end{array} \cdot \text{N}\cdot\text{m}$$

$\text{frictionTorque} = 0.029\cdot\text{N}\cdot\text{m}$

$\text{torqueSteps}_2 = 0.085\cdot\text{N}\cdot\text{m}$

$$\frac{\frac{\text{esistance}}{\text{nstant}^2}\cdot\text{torqueSteps}_2\Big)\cdot\left(\text{torqueSteps}_2 - \text{frictionTorque}\right)}{\frac{\text{otorTorque}}{\text{queConstant}} + \text{noLoadCurrent}\Big)} = 0.058$$

$$\frac{\text{ce}}{2}\cdot\text{torqueSteps}_2 = 41.961\,\frac{1}{\text{s}}$$