HYDRAULIC FORMULAS

1. Cylinder Area:

$$= \frac{\text{Tons} \times 1000 \times 9.81}{\text{Mpa}}$$

Area = mm^2
Mpa = Working pressure

2. Piston Diameter :

$$= \sqrt{\frac{\text{Area} \times 4}{\pi}}$$

Diameter = mm
Area = mm^2
π = 3.142

3. Pump Flow Rate:

$$= Q = A \times V \times 10^{-6}$$

Q = Litres/min
A = Piston area
V = Cylinder/Piston speed in mm/min
10^{-6} is the same as dividing by 1 000 000

4. Motor Kilowatt:

$$KW = \frac{\text{Mpa} \times \text{Liters/Min}}{60}$$

KW = Kilowatt
Mpa = Relief valve pressure
Litres/Min = Pump flow rate

5. Suction Line Diameter:

$$DIA = \sqrt{\frac{Q \times 21.22}{V}}$$

DIA = mm (D)
Q = Pump flow rate
V = 1m/sec

6. Pressure Line Diameter:

$$DIA = \sqrt{\frac{Q \times 21.22}{V}}$$

DIA = mm
Q = Pump flow rate
V = recommended fluid velocity starting at 4,5 m/sec
(check Reynolds number refer. 7)

7. Check Reynolds Number (Re):

$$RE = \frac{V \times D \times 1\,000}{cSt}$$

V = Fluid velocity in m/sec
D = Pipe I.D. in mm
cSt = Centistoke, use 46 cSt
Reynolds number must be <2500

8. Piston Area to Annulus Area Ratio:

$$\text{Ratio} = \frac{D^2}{D^2 - d^2}$$

D = Piston DIA
d = Rod dia

9. Return Line Flow Rate:

Q = Ratio x Pump Flow Rate

10. Return Line Diameter:

$$DIA = \sqrt{\frac{Q \times 21.22}{V}}$$

DIA = mm
Q = Area ratio x Pump flow rate
V = Fluid velocity *(starting at 3m/sec)*

11. Directional Control Valve Flow Rate:

Litres/min =
Cylinder area ratio x Pump flow rate

12. Return Line Filter Size:

= Cylinder area ratio x Pump flow rate

13. Convert CC to Litres/min:

$$\text{Flow} = \frac{\text{CC/per Rev} \times \text{RPM } \textit{(of drive)}}{1000}$$

14. Hydraulic Motor Torque:

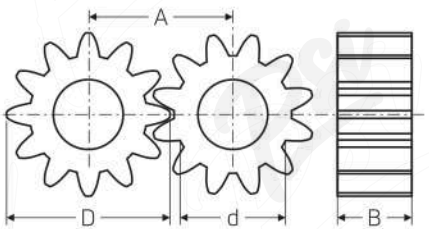
$$\text{Torque} = \frac{P \times CC}{2\pi}$$

15. Hydraulic Motor KW:

$$KW = \frac{\text{Torque} \times \text{RPM}}{9550}$$

16. Flow Capacity

How to work out approximate flow capacity of a gear pump in cm^3 per revolution.



FORMULA: Using two gears
Note: all dimensions in mm + by 1000 to get cc/rev.
A = centre to centre of shafts D = gear OD
B = gear width d = gear ID

EXAMPLE:
1.3682 x A x B x (D-d)
1.3682 x 44.3 x 32 x (53.3 -33.5)
= 38403.2 ÷ by 1000 to get cc/rev.
38.4 cc/rev.