

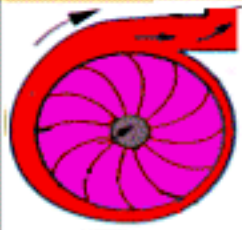
# Estimating the Volume "V" of one movement of one displacer.



"Displacer" means one vane, 1 gear tooth, 1 lobe, one cavity, one piston, plunger, or diaphragm  
From this figure, & according to the pump type "F" number, a damper volume may be estimated.

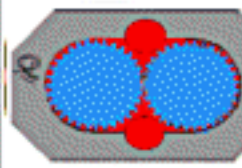
Note : These estimates ignore all of the dynamics , delta time / "dt" considerations, so are quasi static and do not take into consideration pipe system responses. The answers can be valid for residual acceleration head flow fluctuation purposes , but not for pressure pulsation system response, (for which flow through multi connection pressure pulsation dampers are essential above 5 Hz.)

## EXAMPLES : Volume Of One Movement Of One Displacer or "One Flow Fluctuation."



A centrifugal pump has 11 blades, at 725 RPM it Displacers 500 gpm,  
500 gls. x 231 in<sup>3</sup> per Gallon / 11 blades x 725 rpm = 14.5 in<sup>3</sup> displacement

@ 133 Hz  
& Use F=7



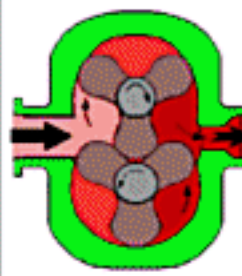
A gear pump has 17 teeth, @ 440 rpm it produces 2 Kg per second.  
2 Kg per second x 60 secs per minute x 1000 gms per Kg / 17 teeth per rev x 440 rpm x SG 1.35 = 12 cm<sup>3</sup> per tooth

@ 125 Hz.  
& Use F=3



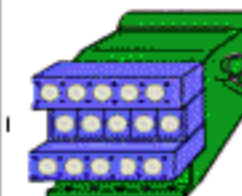
A vane pump with 23 vanes, driven at 2,900 rpm, pumps 380 barrels per day  
40 Liters x 1000 cm<sup>3</sup> per Liter / 23 vanes x 2900 rpm = 0.6 ml displacement

@ 111 Hz.  
& Use F=5



A tri-lobe pump at 173 rpm, discharges 3 tons per hour  
100 lbs per minute x 25 in<sup>3</sup> per pound / 3 lobes per rev x 173 rpm = 4.8 in<sup>3</sup> per lobe

@ 8.7 Hz.  
& Use F=1



A quintuplex plunger pump turned at 880 rpm, generates 60+ M3 per 8 Hr shift  
2000 gls per hour x 3,800 ml per gallon / 60 minutes per Hr. x 5 piston per rev x 880 rpm = 28.8ml / stroke

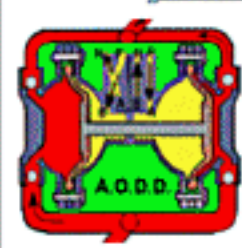
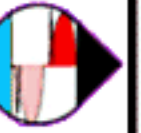
@ 73.5 Hz.  
& Use F=0.6



**F for duplex diaphragm heads also = 0.8**

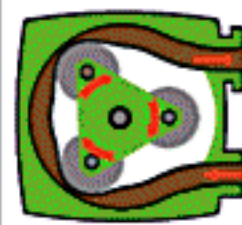
A simplex diaphragm head pump is pushed by a 100mm diam. piston with a 150mm stroke @ 205 spm  
5 cm Piston Radius x 5 cm pist. rad. x (Pi) 3.142 x 15 cm stroke = 1.18 Liters per stroke

@ 3.4 Hz.  
& Use F=0.8



The F figure assumes that the air supply to the A.O.D.D. is enough to ensure no return stroke delay.  
An air operated double end diaphragm pump empties a 40gl drum in 4 mins., on a 2 second cycle .  
10 gls per minute x 231 in<sup>3</sup> per gallon / 2 diaphragms per cycle x 30 cycles per min. = 38 in<sup>3</sup> per end

@ 1.0 Hz.  
& Use F=1.8



The F figure assumes that the size of the shoe or wheel is approx one third of the volume between shoes or wheels.  
A hose pump squelches out 150 liters of effluent sludge per minute, with 3 shoes revolving 15 times per minute.

150 litres / 3 shoes x 15 revs = 3.33 Liters between shoes

& Use F=0.4 @ 0.75 Hz.



Additional "F" correction factors, for Progressive cavity, Screw, Packed Plunger, Dosing, and Intensifiers, please see page 28.

## Using the estimated volume of one pulse to find approx damper volume

100 x Volume Of One Movement Of One Displacer

Number of displacers<sup>2</sup> x F x The percentage figure of allowable residual flow fluctuation

Abbreviation  $\frac{100 \cdot V}{N^2 \cdot F \cdot \% \text{ age fig.}}$

"F" is a correction Factor on the square of number of displacers,  
Example , Centrifugals are intrinsically good - have a high F, Sandwich diaphragm metering pumps have a low F.

N : N Squared, N<sup>2</sup>, N Exponent 2, means multiply the Number of displacers by that same number.

Example N<sup>2</sup> : 1 Diaphragm head 1x1=1, 11 Blades 11x11=121, 2 Lobes 2x2=4, 3 Plungers 3x3=9

"%age figure" : 0.5% allowable residual fluctuation - use the figure 0.5 in the equation, for a residual fluctuation of say +&- 3% , 3 positive plus 3 negative = 6 - use 6 in the equation, ± 5% total 10, use the figure 10.

EXAMPLE  $\frac{100 \times 90 \text{ ml per stroke}}{[ \text{From a triplex} ] 9 \times [ \text{plunger factor} ] 0.6 \times 0.75 [ \text{For } 3/4\% \text{ residual} ]} = 2,222 \text{ ml} = 2.22 \text{ Litres} = 0.59 \text{ US Gls.}$   
Use a 135 in<sup>3</sup> or greater Damper

IT REALLY IS JUST THAT EASY TO OVERSIZE A DAMPER BY IGNORING HOW MUCH PULSATION YOU WOULD HAVE WITHOUT ONE



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