

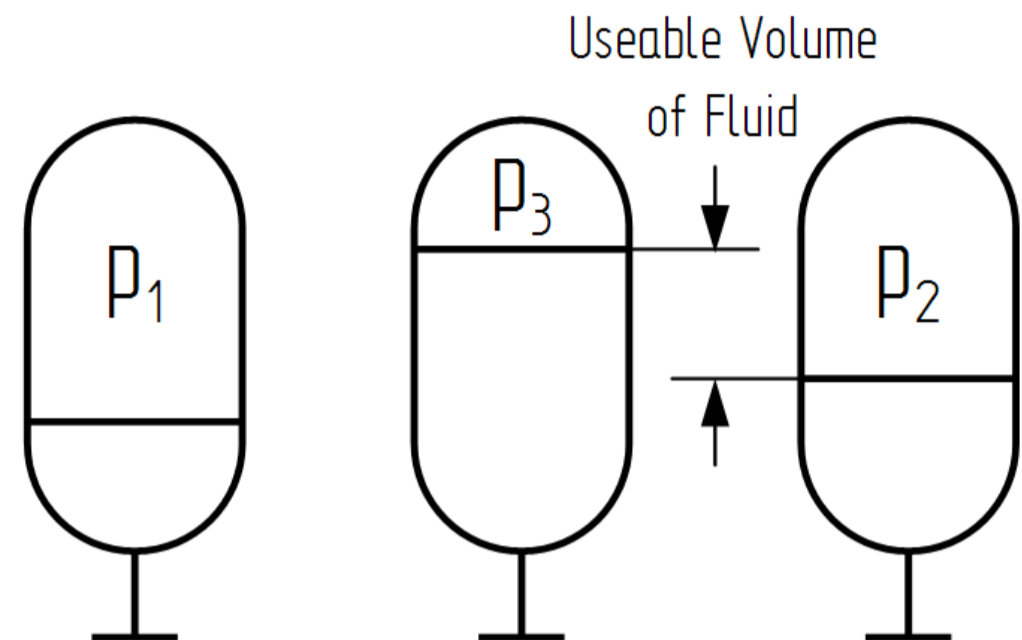
HYDRAULIC FORMULAE

ACCUMULATORS

Application	Gas Pressure (p ₁)	Formula
Storage	90%	0.90 p ₁
Shock Elimination	60%	0.60p ₁
Pulsation dampening	70%	0.70p ₁

The pre-charge pressure (p₂) is chosen as per the table above.

n varies between 1 and 1.4 depending on whether the charge is slow (isothermal) or fast (adiabatic)



V_a – Working volume of fluid
V₁ – Effective gas volume

p₁ – Pre charge gas pressure
p₁ – Minimum working gas pressure
p₁ – Maximum working gas pressure

Slow Charge Slow Discharge

$$V_1 = \frac{V_a \times (p_2/p_1)}{1 - (p_2/p_3)}$$

Fast Charge Fast Discharge

$$V_1 = \frac{V_a \times (p_2/p_1)^{1/1.4}}{1 - (p_2/p_3)^{1/1.4}}$$

Slow Charge Fast Discharge

$$V_1 = \frac{V_a \times (p_3/p_1)}{(p_3/p_2)^{1/1.4} - 1}$$

PRESSURE LOSSES IN PIPES

Flow in lpm	Tube bore size (mm)								
	5	7	10	13	16	21	25	30	36
1	0.69	0.22							
2	1.38	0.44							
3	2.07	0.66	0.17						
5	4.14	1.24	0.24						
7.5	6.55	1.72	0.31						
10		3.10	0.38	0.14					
15		5.38	0.69	0.21	0.08				
20			1.10	0.30	0.14				
30			2.21	0.69	0.25	0.04			
40				1.17	0.45	0.08	0.04		
50					0.59	0.12	0.07	0.03	
75					1.31	0.23	0.14	0.06	0.02
100						0.41	0.22	0.13	0.03
150							0.45	0.23	0.06
200								0.41	0.10
250									0.16

This chart gives the approx. pressure drop in smooth bore straight pipes in 'bar' per 3m length. Bends and fittings will increase the above pressure losses. (Source BFFA Engineers Data book)