

Accumulator Selection



Storage application

Data required

1. Maximum working pressure (bar)
2. Minimum allowable working pressure (bar)
3. Volume of stored fluid required (litres)
4. System flow rate
5. System fluid
6. Temperature

Notes

P3 = Maximum reliable system pressure

P2 = Minimum permitted system pressure

P1 = 90% of P2

Volumes delivered based on

P1 V1 = P3 V3 = Isothermal Compression

P3 V3ⁿ = P2 V2ⁿ = Adiabatic Expansion where n = 1.4

Storage

The sizing of accumulators applies the law for the expansion and compression of gases which state $PV^n=C$, where 'n' depends on the type, temperature and pressure of the gas being used. When sizing an accumulator using nitrogen gas, n=1.4 is normally taken. The relationship between P1 V1, P2 V2 and P3 V3 is as follows:

P1 V1 = P3 V3 where an isothermal compression of the gas is assumed.

P3 V3ⁿ = P2 V2ⁿ where an adiabatic expansion of the gas is assumed.

If you are considering using additional back-up vessels it is essential that:

- a) The accumulator to which the back-up bottle(s) is connected is not holding more than four-fifths its own volume of fluid between precharge (P1) and maximum system pressures (P3).
- b) Flow rate from accumulator does not exceed gas flow capability through back-up pipe work.

Accumulator Discharge Volumes (Litres)																
Standard Bladder Accumulator Sizes											Transfer Barrier with 50 litre Gas Back-up Bottle (BUB) fitted					
P3 / P2	0B	0F	01	03	04	10	20	28	37	54	28+ 1 BUB	37+ 1 BUB	37+ 2 BUB	54+ 1 BUB	54+ 2 BUB	P3/92
1.05	0.005	0.018	0.035	0.08	0.12	0.29	0.57	0.78	1.07	1.49	2.20	2.46	3.87	2.87	4.28	1.05
1.10	0.010	0.035	0.066	0.14	0.22	0.34	1.09	1.49	2.03	2.84	4.18	4.69	7.37	5.49	8.16	1.10
1.15	0.015	0.049	0.094	0.21	0.31	0.78	1.55	2.12	2.90	4.04	5.96	6.73	10.56	7.88	11.73	1.15
1.20	0.019	0.063	0.120	0.26	0.39	0.98	1.97	2.69	3.68	5.13	7.58	8.60		10.06	14.97	1.20
1.25	0.022	0.074	0.143	0.31	0.47	1.17	2.35	3.20	4.39	6.12	9.06	10.20		11.94	17.76	1.25
1.30	0.026	0.086	0.149	0.36	0.54	1.35	2.69	3.68	5.03	7.02		11.91		13.94		1.30
1.35	0.029	0.096	0.183	0.40	0.60	1.50	3.01	4.11	5.62	7.84		13.11		15.35		1.35
1.40	0.032	0.104	0.201	0.44	0.66	1.65	3.29	4.51	6.16	8.60				16.77		1.40
1.45	0.034	0.113	0.217	0.47	0.71	1.78	3.56	4.87	6.65	9.28				18.09		
1.50	0.036	0.121	0.231	0.50	0.76	1.90	3.80	5.20	7.11	9.98				19.33		
1.55	0.038	0.128	0.245	0.53	0.81	2.01	4.03	5.51	7.53	10.50						
1.60	0.041	0.135	0.258	0.56	0.85	2.12	4.23	5.79	7.89	11.04						
1.65	0.042	0.141	0.270	0.59	0.89	2.21	4.43	6.05	8.27	11.54						
1.70	0.044	0.146	0.280	0.61	0.92	2.30	4.60	6.30	8.60	12.01						
1.75	0.046	0.152	0.290	0.63	0.95	2.38	4.77	6.52	8.91	12.44						
1.80	0.047	0.157	0.300	0.65	0.98	2.46	4.92	6.73	9.20	12.84						
1.85	0.048	0.161	0.310	0.67	1.00	2.53	5.06	6.93	9.47	13.21						
1.90	0.049	0.165	0.320	0.69	1.04	2.60	5.20	7.11	9.71	13.56						
1.95	0.051	0.169	0.325	0.71	1.06	2.66	5.32	7.28	9.95	13.88						
2.00	0.052	0.173	0.331	0.72	1.09	2.72	5.44	7.44	10.17	14.19						
2.10	0.054	0.179	0.344	0.75	1.13	2.83	5.65	7.73	10.56	14.74						
2.20	0.056	0.186	0.355	0.77	1.17	2.92	5.84	7.98	10.91	15.23						
2.30	0.057	0.191	0.365	0.80	1.20	3.00	6.00	8.21	11.22	15.66						
2.40	0.059	0.195	0.374	0.82	1.23	3.07	6.18	8.41	11.49	16.04						
2.50	0.060	0.200	0.382	0.83	1.26	3.14	6.28	8.58	11.74	16.38						
2.60	0.061	0.203	0.389	0.85	1.28	3.20	6.39	8.74	11.95	16.68						
2.70	0.062	0.207	0.395	0.86	1.30	3.25	6.50	8.88	12.15	16.95						
2.80	0.063	0.210	0.401	0.87	1.32	3.29	6.59	9.01	12.32	17.19						
2.90	0.064	0.212	0.406	0.88	1.34	3.34	6.67	9.12	12.42	17.41						
3.00	0.065	0.215	0.411	0.89	1.35	3.37	6.75	9.22	12.61	17.60						
3.20	0.066	0.219	0.419	0.91	1.38	3.44	6.88	9.40	12.85	17.94						
3.40	0.067	0.222	0.425	0.92	1.40	3.49	6.98	9.54	13.04	18.20						
3.60	0.068	0.224	0.430	0.94	1.41	3.53	7.06	9.65	13.20	18.42						
3.80	0.069	0.227	0.434	0.95	1.43	3.57	7.13	9.75	13.33	18.60						
4.00	0.070	0.228	0.437	0.96	1.44	3.59	7.18	9.82	13.43	18.74						
4.50	0.075	0.231	0.443	0.97	1.46	3.64	7.28	9.45	13.61	18.98						

- Above volumes in litres discharged between P₃/P₂
- Pressure Ratio P₃/P₁>5

Above volumes in litres discharged between P₃/P₂

How to use the chart (Standard Bladder Accumulator selection)

Problem: What size of accumulator will discharge 1.4 litres of liquid between 140 bar and 120 bar.

- 1) $P_3/P_2 = \frac{140}{120} = 1.17$
- 2) Find the value of P₃/P₂ which is equal to or next lowest to 1.17. In this case the value is 1.15.
- 3) Select the accumulator reference equal to or next greater to 1.4 litres from the values located in the row 1.15 i.e. 1.55. Project upwards and read off the accumulator reference i.e. 20.

How to use the chart (Transfer Barrier selection)

- 1) Use this chart the same way as above but limiting volume discharged to that shown, so that V₁ - V₃ does not exceed 0.80 of actual accumulator shell volume. The corresponding pressure ratio is seen under the P₃/P₂ column.
- 2) See datasheet for dimension details of Transfer Barrier Accumulators and Back-up Bottles.

The information in this datasheet is subject to change without prior notice.