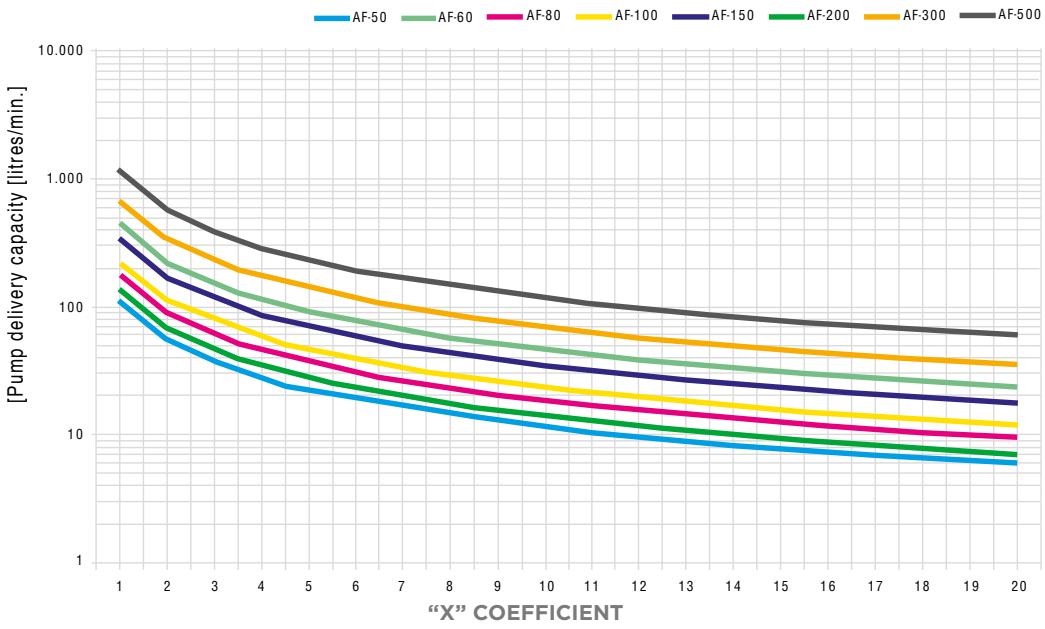
Bladder accumulator selection chart



To make sizing easier, a chart has been drawn up to select the most appropriate accumulator according to both working pressure and delivery criteria. Note that the chart is based on the following hypothesis: standard precharge and 15 pump starts per hour (see p. 27 to identify the "X" coefficient)

Maximum delivery capacity of the pump [litres/min.]	Δp System working pressure											
	1,5 - 3,0			2,0 - 3,5			2,5 - 4,0			2,5 - 4,0		
	Number of pump starts per hour											
	15	**8**	**5**	**15**	**8**	**5**	**15**	**8**	**5**	**15**	**8**	**5**
10		50	60	35	50	100	50	100	150	35	50	80
20	50	80	150	60	100	200	100	200	300	50	100	200
25	60	100	150	80	150	250	150	250	300	80	150	250
40	100	200	250	150	250	500	200	300	500	100	250	300
45	100	200	300	150	200	500	250	500	-	150	250	500
55	150	250	300	200	300	500	300	500	-	150	300	500
75	200	300	500	250	500	-	300	-	-	200	500	-
95	200	500	-	300	500	-	500	-	-	300	500	-
115	250	500	-	500	-	-	500	-	-	300	-	-
150	300	-	-	500	-	-	-	-	-	500	-	-
200	500	-	-	-	-	-	-	-	-	-	-	-

AUTOCLAVE EFFICIENCY (DRAW-DOWN)

Autoclave efficiency is the quantity of water that the bladder tank can supply within the maximum (p2) and minimum (p1) working pressure of the pump.

Called:
Va=total volume of the pressure tank
p1=switch (on) of the pump
p2=switch (off) of the pump
pc=air precharge pressure

NOTE: All pressure are referred to as gauge pressure.

The formula to calculate the efficiency of the tankis as follows:

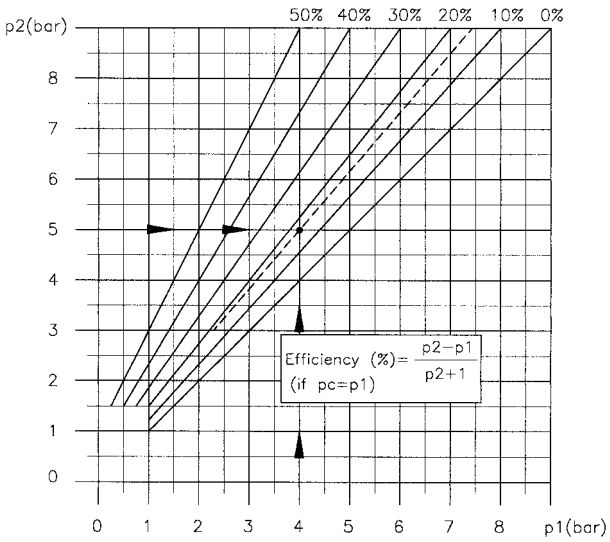
$$R = \frac{(p2 - p1) \times (pc + 1)}{(p2 + 1) \times (pc + 1)} \times Va; \quad \text{Stated } pc = p1$$

$$R = \frac{(p2 - p1)}{(p2 + 1)} \times Va$$

Example:
Va = 750 lt. p1 = 4 bar
p2 = 5 bar pc = p1 = 4 bar

The autoclave efficiency is: $R = \frac{(5 - 4)}{(5 + 1)} \times 750 = 125$ lt, equal to 16%.

The efficiency diagram (Fig. 1) shows the efficiency in % according to the min. and max. working pressures of the pump



(Fig. 1)

How to size a bladder autoclave

General formula to size a bladder autoclave:

$$Vt = 16{,}5 \times \frac{Qmax}{A} \times \frac{Ps \times Pa}{Ps - Pa} \times \frac{1}{Pp}$$

Vt= Accumulator global volume	[litres]
Qmax= Pump max. delivery capacity or system maximum consumption	[lt/min.]
A = Number of pump starts - stops per hour	(12 - 15)
Ps= Pump stop (absolute) pressure	[bar]
Pa= Pump starting (absolute) pressure	[bar]
Pp= (absolute) precharge pressure (Pa - 0.5)	[bar]

The pump may be sized according to two different techniques:

A. Sizing the accumulator by using the pump maximum delivery capacity

Replace Qmax in the formula by the pump delivery capacity.

The Pa pump starting pressure must be higher than the Pp precharge pressure.

In order to optimise the accumulator yielding, the precharge pressure must be 0.5 bars lower than the pump starting pressure.

B. Sizing the accumulator by using the maximum consumption of the system:

In that case, define the maximum consumption of users by applying the calculation method in accordance with UNI 9182;

- Identify types of users (shower, WC, sink, etc.) equipped on the system;
- Assess the number of users for each type;
- Refer to table 1 for private buildings and to table 2 for public buildings, calculate the number of total system charge units (CU) by multiplying each type of user by the corresponding CU listed in the table

TAB.1 PRIVATE BUILDINGS

UTILITIES	CU
Wash-basin	1
Bidet	1
Bath	2
Shower	2
Box toilet	3
Direct flush toilet	6
Kitchen sink	2
Washing machine	2
Dishwasher	2
Small hydrant 3/8"	1
Small hydrant 1/2"	2
Small hydrant 3/4"	3
Small hydrant	6

TAB.2 PUBLIC BUILDINGS

UTILITIES	CU
Wash-basin	2
Bidet	2
Bath	4
Shower	4
Box toilet	5
Direct flush toilet	10
Kitchen washbasin	4
Sink	3
Foot bath	2
Fountain	0,75
Small hydrant 3/8"	2
Small hydrant 1/2"	4
Small hydrant 3/4"	6
Small hydrant	10

Once the total charge units have been computed, turn them into litres per minute by referring to table 3.

TAB.3

CU CONVERSION TABLE (Litres/min.)

CU	Q [lt/min]	CU	Q [lt/min]	CU	Q [lt/min]
6	18	100	189	1250	930
8	24	120	219	1500	1050
10	30	140	234	1750	1128
12	36	160	255	2000	1230
14	40.8	180	276	2250	1320
16	46.8	200	297	2500	1410
18	51	225	321	2750	1470
20	55.8	250	345	3000	1560
25	67.8	275	366	3500	1680
30	78	300	387	4000	1830
35	87.6	400	468	4500	1950
40	97.2	500	540	5000	2070
50	114	600	600	6000	2280
60	132	700	660	7000	2460
70	144	800	714	8000	2640
80	159	900	774	9000	2820
90	174	1000	828	10000	3000

Once the system maximum consumption (Qmax) has been defined, proceed to size the accumulator by applying the cor-responding formula

TAB.4

"X" COEFFICIENT

Pump stop pressure (bar) (max)	PUMP STARTING PRESSURE (bar) (min)					
	0,5	1	1,5	2	2,5	3
1	1					
1,5	0,7	3				
2	0,66	2	6			
2,5	0,62	1,66	3,75	10		
3	0,6	1,5	3	6	15	
3,5	0,58	1,4	2,65	4,66	8,75	21
4	0,57	1,33	2,4	4	6,66	12
4,5	0,56	1,28	2,25	3,6	5,62	9
5	0,55	1,25	2,14	3,33	5	7,5
5,5	0,55	1,22	2,06	3,14	4,58	6,6
6	0,54	1,2	2	3	4,28	6
6,5	0,541	1,181	1,95	2,88	4,06	5,57
7	0,538	1,16	1,90	2,8	3,88	5,25
7,5	0,53	1,15	1,87	2,72	3,75	4,5
8	0,53	1,14	1,84	2,66	3,63	4,8

DIMENSIONS

MODEL	CODE	LITRES	Ppre bar	Pmax bar	max	mm	mm	DN1 mm	NOTES
DL 750/10 CE	A282L59	750	2,5	10	+99°C	800	1920	G 2"	
DL 1000/10 CE	A282L62	1000	2,5	10	+99°C	800	2370	G 2"	
DL 2000/10 CE	A282L70	2000	2,5	10	+99°C	1100	2690	G 3"	
DL 3000/10 CE	A282L74	3000	2,5	10	+99°C	1250	3100	G 3"	
DL 5000/10 CE	A282L80	5000	2,5	10	+99°C	1550	3315	G 3"	
DL 750/16 CE	A282R59	750	2,5	16	+99°C	800	1920	G 2"	
DL 1000/16 CE	A282R62	1000	2,5	16	+99°C	800	2370	G 2"	
DL 2000/16 CE	A282R70	2000	2,5	16	+99°C	1100	2690	G 3"	
DL 3000/16 CE	A282R74	3000	2,5	16	+99°C	1250	3100	G 3"	

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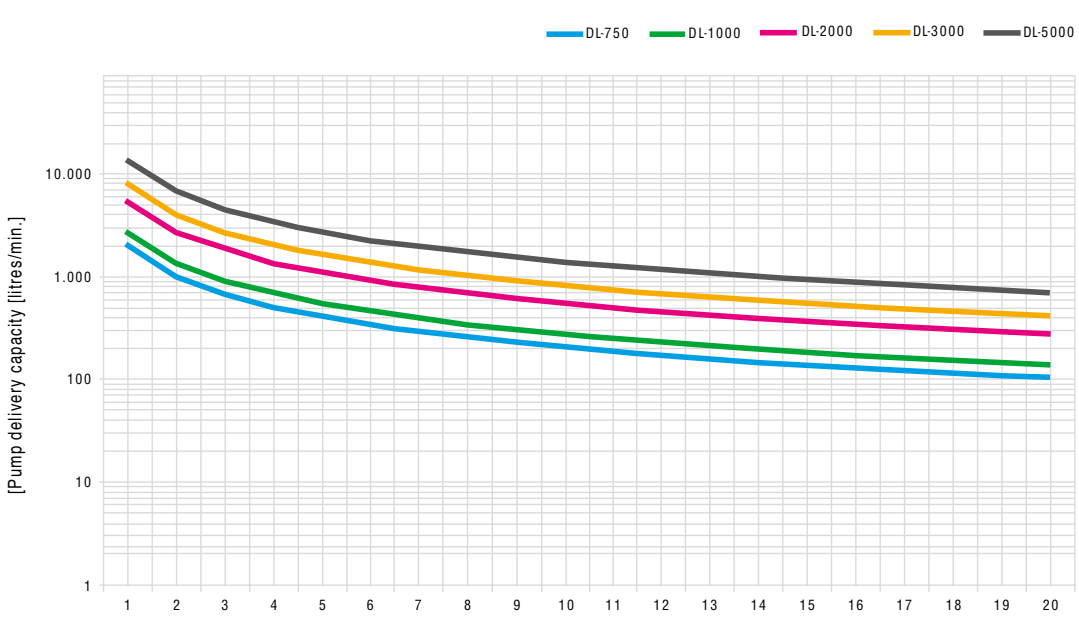

To make sizing easier, a chart has been drawn up to select the most appropriate accumulator according to both working pressureand delivery criteria. Note that the chart is based on the following hypothesis: standard precharge and 15 pump starts per hour (see p. 27 to identify the "X" coefficient).

Pump max delivery capacity [litres/min.]	Δp System working pressure 1,5 - 3,0			2,0 - 3,5			2,5 - 4,0			2,5 - 4,0		
	Number of pump starts per hour											
	15	8	5	15	8	5	15	8	5	15	8	5
75	200	300	500	250	500	750	300	750	1000	250	500	750
95	200	500	750	300	750	1000	500	1000	2x750	300	500	1000
115	250	500	750	500	750	1000	500	1000	2x750	300	750	1000
150	300	750	1000	500	1000	2x750	750	2x750	2000	500	1000	2x750
200	500	1000	2x750	750	2x750	2000	1000	2000	3000	750	2x750	2000
300	750	2x750	2000	1000	2000	3000	2x750	3000	2x2000	1000	2x750	3000
500	2x750	2000	3000	2000	3000	5000	3000	5000	5000+3000	2x750	3000	2x2000
800	2000	3000	5000	3000	5000	4x2000	2x2000	5000+3000	2x5000	2000	2x2000	5000+2000
1000	2000	2000	2x3000	2x2000	2x3000	2x5000	5000	2x5000	3x5000	3000	5000	5000+3000