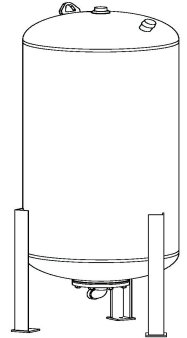


Sizing and Selection Guide

ASME Bladder Type Hydro-Pneumatic Tanks For Potable Water Systems



APPLICATION

ASME Bladder Type Hydro-Pneumatic Tanks can be used in a variety of applications ranging from well water and pressure boosting systems to sprinkler systems. The tanks control system shock and pressure fluctuations and provide pump protection by reducing surge pressures and by dampening pressure spikes. The tanks deliver water under pressure between pump cycles to meet the required demand. By minimizing pump starts the benefits include extended pump motor service life and energy cost savings.

These tanks utilize a flexible full acceptance butyl rubber bladder to separate the incoming water from the compressible air cushion. Butyl has proven superior for application with water storage tanks for several reasons:

1. The bladder can be flexed repeatedly with little wear or stress during normal operation.
2. The material does not foster bacterial growth.
3. The material has a very low air permeability characteristic.
4. The material generally does not impart taste and odor into the treated water.

OPERATION

The air charge pressure in the tank is typically set 2 PSI below the pressure switch pump cut-in pressure or 10% to 20% below the system pressure for surge applications. Upon operation of the system, water is pumped into the flexible bladder in the tank. As the bladder fills with water the air cushion is compressed, causing a rise in the pressure in the system. The pressure continues to rise until it reaches the desired maximum system pressure (pump cut-out setting), causing the pump to shut off. Water remains in the system piping and the tank until required. As water is drawn down from the system, the air pressure in the tank decreases. When the system pressure reaches the minimum pressure setting (pump cut-in setting), the pump will turn on and start the cycle again.

SIZING

Proper tank sizing requires a basic understanding of compressible gases – in this case, air. If a gas is held in a sealed container at constant temperature, the gas pressure increases at the same rate as the volume of the gas is reduced. As water fills the bladder, the volume of the air cushion is reduced. As the volume is reduced, the pressure will rise. If the air cushion is reduced to half its original volume, the pressure will rise to two times its original value. If the air cushion is further squeezed to one-third of its original volume, the pressure will rise to 3 times the original value.

Boyle's law is commonly used to predict the result of introducing a change in volume and pressure to the initial state of a fixed quantity of gas. The "before" and "after" volumes and pressures of the fixed amount of gas are related by the equation:

$$p_1V_1=p_2V_2$$

Forcing the volume V of the fixed quantity of gas to increase, the pressure p must decrease proportionally. Conversely, reducing the volume of the gas increases the pressure.

SIZING INFORMATION REQUIREMENTS

Proper tank sizing is important for two reasons:

1. The system will run more efficiently and as a result, use less electricity.
2. The system will last longer – providing long term cost savings through reduced maintenance charges and fewer replacement parts.

Determine the following:

1. Maximum drawdown required
2. Minimum operating pressure
3. Maximum operating pressure

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STEP 1: DETERMINE THE REQUIRED DRAWDOWN

1. Pump delivery rate: _____ GPM
2. Desired minimum pump run time: _____ minutes
(example: 1 minute, 15 seconds = 1.25 minutes)
3. Multiply Line #1 times Line #2: _____ GPM x _____ minutes = _____ Gallons
(This is the minimum drawdown or available water volume required in Gallons)

STEP 2: DETERMINE THE REQUIRED TANK SIZE

1. Enter the following:

Maximum drawdown required	(A) _____ Gallons
Minimum system pressure (pump cut-in)	(B) _____ PSIG
Maximum system pressure (pump cut-out)	(C) _____ PSIG
Air precharge pressure (if different than minimum system pressure)	(D) _____ PSIG
2. Find the drawdown factor from Table 1 on page 3 (E) _____
NOTE: If the precharge pressure does not equal the minimum system pressure or if the minimum and maximum operating pressures are not listed in Table 1, use the following formula to determine the drawdown factor:

$$\text{Drawdown factor} = \frac{(D) + 14.7}{(B) + 14.7} - \frac{(D) + 14.7}{(C) + 14.7}$$

3. Determine the minimum total volume required (F) _____

Divide the maximum drawdown required (A) by the drawdown factor (E):

$$(A) \text{ _____ Gallons} \div (E) \text{ _____ Drawdown factor} = (F) \text{ _____ Gallons}$$

STEP 3: SELECT THE REQUIRED BLADDER TANK

1. Select a bladder tank from Table 2, 3, or 4. Choose the tank with the lowest tank capacity greater than or equal to the minimum total volume required (G). Standard pressure ratings are listed. Higher working pressures are available upon request.

EXAMPLE

1. Select a bladder tank for an application with a 50 GPM pump with a minimum run time of 2 minutes and a 20 to 50 PSIG system operating pressure range.

Determine the maximum drawdown required (50 GPM x 2 minutes)	A	100 Gallons
Minimum system pressure	B	20 PSI
Maximum system pressure	C	50 PSI
Air precharge pressure	D	18 PSI
Use the formula shown in Step 2 to determine the drawdown factor	E	0.437
Divide the required drawdown (A) by the drawdown factor (E) (100 Gallons ÷ 0.437)	F	228.8 Gallons
Select the required bladder tank from Table 2, 3, or 4	G	264 Gallons

TECHNICAL BULLETIN

Form 002

TABLE 1

MAXIMUM OPERATING PRESSURE PSIG	MINIMUM OPERATING PRESSURE AT TANK LOCATION (PSIG)										
	5	10	12	15	20	30	40	50	60	70	80
27	0.527	0.408	0.360	0.288	0.168						
30	0.560	0.447	0.403	0.336	0.224						
35	0.604	0.503	0.463	0.403	0.302	0.101					
40	0.640	0.548	0.512	0.457	0.366	0.183					
45	0.670	0.586	0.553	0.503	0.419	0.251	0.084				
50	0.696	0.618	0.587	0.541	0.464	0.309	0.155				
55	0.717	0.646	0.617	0.574	0.502	0.359	0.215	0.072			
60	0.736	0.669	0.643	0.602	0.536	0.402	0.268	0.134			
65	0.753	0.690	0.665	0.627	0.565	0.439	0.314	0.188	0.062		
70	0.767	0.708	0.685	0.649	0.590	0.472	0.354	0.236	0.118		
75	0.780	0.725	0.702	0.669	0.613	0.502	0.390	0.279	0.167	0.056	
80	0.792	0.739	0.718	0.686	0.634	0.528	0.422	0.317	0.211	0.106	
90	0.812	0.764	0.745	0.716	0.669	0.573	0.478	0.382	0.287	0.191	0.096
100	0.828	0.785	0.767	0.741	0.698	0.610	0.523	0.436	0.347	0.261	0.174
110	0.842	0.802	0.786	0.762	0.723	0.642	0.561	0.481	0.401	0.321	0.241

TABLE 2 (ASME Bladder Type Hydro-Pneumatic Tanks with Top Connection / Type IV – see Submittal Sheet No. 621)

MODEL NUMBER	MAWP	TANK VOLUME		DIAMETER		OVERHEADS		SYS. CONN	BASE DIAMETER		SHIPPING WEIGHT	
		PSIG	GAL	L	IN	MM	IN		MM	INCH (NPT)	IN	MM
JAPR-20-601	150	10	40	12	305	23	584	1	8 $\frac{5}{8}$	219	50	23
JAPR-20-602	150	15	60	12	305	33 $\frac{1}{2}$	851	1	8 $\frac{5}{8}$	219	65	30
JAPR-20-603	150	24	90	12	305	52	1321	1	8 $\frac{5}{8}$	219	90	41
JAPR-20-604	150	30	110	14	356	48	1219	1	8 $\frac{5}{8}$	219	90	41
JAPR-20-605	150	35	130	14	356	55 $\frac{1}{2}$	1410	1	8 $\frac{5}{8}$	219	100	45
JAPR-20-606	150	40	150	14	356	63	1600	1	8 $\frac{5}{8}$	219	115	52
JAPR-20-607	150	60	230	16	406	72 $\frac{3}{4}$	1838	1 $\frac{1}{2}$	11 $\frac{1}{2}$	292	155	70
JAPR-20-608	125	80	300	20	508	63	1600	1 $\frac{1}{2}$	18	457	175	79
JAPR-20-668	125	105	400	24	610	56	1422	1 $\frac{1}{2}$	18	457	225	102
JAPR-20-609	125	120	450	24	610	66	1676	1 $\frac{1}{2}$	18	457	255	116
JAPR-20-610	125	135	500	24	610	72	1829	1 $\frac{1}{2}$	18	457	285	129

TABLE 3 (ASME Bladder Type Hydro-Pneumatic Tanks with Top Connection / Type I – see Submittal Sheet No. 615)

MODEL NUMBER	MAWP	TANK VOLUME		DIAMETER		OVERHEADS		SYS CONN	BASE DIAMETER		SHIPPING WEIGHT	
	PSIG	GAL	L	IN	MM	IN	MM	INCH (NPT)	IN	MM	LBS	KG
JBPR-22-011	125	158	600	30	762	58	1473	1½	24	610	380	172
JBPR-22-012	125	211	800	30	762	76	1930	1½	24	610	450	204
JBPR-22-013	125	264	1000	36	914	67	1702	2	30	762	650	295
JBPR-22-014	125	317	1200	36	914	78½	1994	2	30	762	750	340
JBPR-22-015	125	370	1400	36	914	91	2311	2	30	762	865	392
JBPR-22-016	125	422	1600	48	1219	63½	1613	2	42	1067	1050	476
JBPR-22-017	125	528	2000	48	1219	77¼	1962	2	42	1067	1225	556
JBPR-22-018	125	660	2500	48	1219	94	2388	2	42	1067	1445	655

TABLE 4 (ASME Bladder Type Hydro-Pneumatic Tanks with Bottom Connection / Type I – see Submittal Sheet No. 645)

MODEL NUMBER	MAWP	TANK VOLUME		DIAMETER		OVERHEADS		SYS CONN	LEG CLEARANCE		SHIPPING WEIGHT	
	PSIG	GAL	L	IN	MM	IN	MM	INCH (NPT)	IN	MM	LBS	KG
JOPR-22-080	125	80	300	20	508	62⅞	1597	2	14	356	230	104
JOPR-22-105	125	105	400	24	610	56	1422	2	14	356	325	147
JOPR-22-009	125	120	450	24	610	66	1676	2	14	356	335	152
JOPR-22-135	125	135	500	24	610	71½	1816	2	14	356	340	154
JOPR-22-011	125	158	600	30	762	58	1473	2	14	356	435	197
JOPR-22-012	125	211	800	30	762	76	1930	2	14	356	515	234
JOPR-22-013	125	264	1000	36	914	67	1702	2	14	356	715	324
JOPR-22-014	125	317	1200	36	914	78½	1994	2	14	356	815	370
JOPR-22-015	125	370	1400	36	914	91	2311	2	14	356	935	424
JOPR-22-016	125	422	1600	48	1219	63½	1613	2	14	356	1075	488
JOPR-22-017	125	528	2000	48	1219	77⅞	1965	2	14	356	1235	560
JOPR-22-018	125	660	2500	48	1219	94	2388	2	14	356	1435	651
JOPR-22-019	125	793	3000	48	1219	122⅞	3121	2	14	356	1900	862
JOPR-22-020	125	1056	4000	54	1372	132	3429	2½	14	356	2400	1089
JOPR-22-021	125	1320	5000	54	1372	151	3835	2½	14	356	2700	1225
JOPR-22-022	125	1600	6050	72	1829	107	2718	2½	14	356	3425	1554
JOPR-22-023	125	2000	7600	72	1829	130	3302	2½	14	356	4000	1814
JOPR-22-024	125	2640	10000	72	1829	164	4166	2½	14	356	4875	2211
JOPR-22-028	125	2800	10600	72	1829	174	4420	3	14	356	5300	2404
JOPR-22-030	125	3000	11400	72	1829	186	4724	3	14	356	5700	2585
JOPR-22-039	125	3963	15000	72	1829	230	5842	3	14	356	7100	3220



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