ARMSTRONG®

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ARMEX Selection Guide

Armstrong Armex *Expansion Systems*

for hot and chilled water hydronic systems

In any hot water heating or chilled water system, a provision must be made to accommodate thermal expansion of water.

An expansion tank is the primary device to accomplish this. The expanded water in the system, resulting from the increased temperature, is stored in the expansion tank during periods of high temperature and is returned to the system when the temperature is lower. In a closed hydronic system, the expansion equipment must be designed to store the required volume of water when the system is at maximum temperature without exceeding the maximum pressure allowable and maintain the minimum required pressure when the system is cold.

Bladderless compression expansion tanks allow air into the system with a resulting corrosion problem. Additionally the percentage of expansion volume to total tank volume is very low. Armstrong pre-charged bladder tanks resolve the corrosion problem and improve the acceptance levels and as such they are the first choice for small systems. However for larger systems where space is at a premium, or where it is desired to limit the pressure rise pressure resulting from expansion, Armex with its one atmosphere *SAFE* receptacle provides the optimum choice giving almost 100% acceptance with minimal pressure rise.

Where system volume is not known an approximate volume can be selected using Table 1 below.

Useful Data

Table 1- Approximate System Volume * US gal/1000 BthU/Hr (MBU)

Temp Difference	10°F	20°F	40°F
One Boiler	1.	0.65	0.55
Two Boilers	1.1	0.75	0.6
Three Boilers	1.15	0.8	0.65
Heat Exchanger	0.75	0.4	0.3

This table is an approximation. Accurate water content may be determined from capacities of boilers, heating or cooling units, given by manufacturers, plus the volume of pipe or tube per Table 1.
This table is based on non-ferrous radiation – for cast iron radiation use 1.1 Gal/MBH.
For chilled water Systems use 8 Gallons/Ton.

Table 2 – Water Content Pipe and Tubing

Pipe Diam Sch # 40	Steel Pipe Usgal/ft	Copper Tube Usgal/ft
½	0.0157	0.0121
¾	0.0277	0.0251
1	0.0449	0.0429
1¼	0.0779	0.0653
1½	0.0106	0.0924
2	0.174	0.161
2½	0.249	0.248
3	0.384	0.354
4	0.661	0.622
5	1.04	0.97
6	1.50	1.39
8	2.66	2.43
10	4.19	3.78
12	5.96	5.46

Table 3 – Water Content Heat Exchangers

Shell Dia.	Usgal/ft of Shell length	
	In Shell	In Tubes
4	0.425	0.225
6	1.0	0.5
8	1.85	1.0
10	2.4	1.2
12	4.0	2.2
14	5.0	2.5
16	6.5	3.5
18	8.0	4.4
20	10.0	5.5
24	15.0	7.5

Selection Procedures

1.	Enter Total System Water Content (refer to Tables 1, 2, & 3 for assistance)	_____US gal
2.	Enter Minimum System Operating Temperature (Ambient fill for heating systems or chilled temperature for chilled water systems)	_____ °F
3.	Enter Maximum System Operating Temperature (Boiler supply temperature or week-end shutdown or ambient temperature for chillers)	_____ °F
4.	Determine Expansion Factor from Table 4	_____
5.	Calculate Expanded Water (Multiply line 1 by line 4)	_____ US gal
6.	Calculate Total *SAFE* tank Volume (Divide line 5 by 0.95)	_____ US gal
7.	Select *SAFE* tank Model from Table 7	_____
8.	Enter Static Height (Above Armex *SAFE tank*)	_____ feet
9.	Determine Vapour Head Allowance (Vpa) from Table 5 (Required above 200 deg.F)	_____ feet
10.	Positive Head Required at Top of System (Usually 5 to 12 feet)	_____ feet
11.	Calculate Minimum Pressure (Add lines 8, 9 & 10, and divide by 2.31)	_____ psig
12.	Enter Total Installed Heat Load	_____ Btu/hr x 10^6
13.	Determine Transfer Factor (Ft) from Table 5	_____
14.	Determine Boiler Factor from Table 6	_____
15.	Calculate Transfer Rate (Multiply line 12 by line 13, and by line 14)	_____ usgpm
16.	Select Transfer Unit Size from Table 8	_____

Armex model numbers (size/configuration)

AMX- -

- D = direct makeup from city main (through suitable valving)
  or T = break-tank required for feed
- Size reference for safe (see table 7)

Example **AMX-1000-D**: Armex with *SAFE* size ref. 1000 (nominal Capacity 264 gallons), horizontal transfer pumps and direct feed from city main

Net Expansion of Water

Table 4 Net Expansion of Water													
Max Temp	Minimum Temperature F												
F	40	45	50	55	60	65	70	75	80	85	90	95	100
50	0.00006	0.00008											
55	0.00025	0.00027	0.00019										
60	0.00055	0.00057	0.00049	0.0003									
65	0.00093	0.00095	0.00087	0.00068	0.000380								
70	0.00149	0.00151	0.00143	0.00124	0.00094	0.00056							
75	0.00194	0.00196	0.00188	0.00169	0.00139	0.00101	0.00045						
80	0.00260	0.00262	0.00254	0.00235	0.00205	0.00167	0.00111	0.00066					
85	0.00326	0.00328	0.00320	0.00301	0.00271	0.00233	0.00177	0.00132	0.00066				
90	0.00405	0.00407	0.00399	0.00380	0.00350	0.00312	0.00256	0.00211	0.00145	0.00079			
95	0.00485	0.00487	0.00479	0.00460	0.00430	0.00392	0.00336	0.00291	0.00225	0.00159	0.00080		
100	0.00575	0.00577	0.00569	0.00550	0.00520	0.00482	0.00426	0.00381	0.00315	0.0249	0.00170	0.00090	
110	0.00771	0.00773	0.00765	0.00746	0.00716	0.00678	0.00622	0.00577	0.00511	0.00445	0.00366	0.00286	0.00196
120	0.01004	0.01006	0.00998	0.00979	0.00949	0.00911	0.00855	0.00810	0.00744	0.00678	0.00599	0.00519	0.00429
130	0.01236	0.01238	0.01230	0.01211	0.01181	0.01143	0.01087	0.01042	0.00976	0.00910	0.00831	0.00751	0.00661
140	0.01501	0.01503	0.01495	0.01476	0.01446	0.01408	0.01352	0.01307	0.01241	0.01175	0.01096	0.01016	0.00926
150	0.01787	0.01789	0.01781	0.01762	0.01732	0.01694	0.01638	0.01593	0.01527	0.01461	0.01382	0.01302	0.01212
160	0.02092	0.02094	0.02086	0.02067	0.02037	0.01999	0.01943	0.01898	0.01832	0.01766	0.01687	0.01607	0.01517
170	0.02418	0.02420	0.02412	0.02393	0.02363	0.02325	0.02269	0.02224	0.02158	0.02092	0.02013	0.01933	0.01843
180	0.02763	0.02765	0.02757	0.02738	0.02708	0.02670	0.02614	0.02569	0.02503	0.02437	0.02358	0.02278	0.02188
190	0.03127	0.03129	0.03121	0.03102	0.03072	0.03034	0.02978	0.02933	0.02867	0.02801	0.02722	0.02642	0.02552
200	0.03510	0.03512	0.03504	0.03485	0.03455	0.03417	0.03361	0.03316	0.03250	0.03184	0.03105	0.03025	0.02935
210	0.03911	0.03913	0.03905	0.03886	0.03856	0.03818	0.03762	0.03717	0.03651	0.03585	0.03506	0.03426	0.03336
220	0.04355	0.04357	0.04349	0.04330	0.04300	0.04262	0.04206	0.04161	0.04095	0.04029	0.03950	0.03870	0.03780
230	0.04816	0.04818	0.04810	0.04791	0.04761	0.04723	0.04667	0.04622	0.04556	0.04490	0.04411	0.04331	0.04241
240	0.05295	0.05296	0.05289	0.05270	0.05240	0.05202	0.05146	0.05101	0.05035	0.04969	0.04890	0.04810	0.04720
250	0.05793	0.05794	0.05787	0.05768	0.05738	0.05700	0.05644	0.05599	0.05533	0.05467	0.05388	0.05308	0.05218
260	0.06310	0.06312	0.06304	0.06285	0.06255	0.06217	0.06161	0.06116	0.06050	0.05984	0.05905	0.05825	0.05735
270	0.06848	0.06849	0.06842	0.06823	0.06793	0.06755	0.06699	0.06654	0.06588	0.06522	0.06443	0.06363	0.06273
280	0.07406	0.07407	0.07400	0.07381	0.07351	0.07313	0.07257	0.07212	0.07146	0.07080	0.07001	0.06921	0.06831
290	0.07985	0.07986	0.07979	0.0796	0.07930	0.07892	0.07836	0.07791	0.07725	0.07659	0.07580	0.07500	0.07410
300	0.08585	0.08587	0.08579	0.08560	0.08530	0.08492	0.08436	0.08391	0.08325	0.08259	0.08180	0.08100	0.08010

Vapour Pressure Allowance & Transfer Factors

Table 5 – Vapour Pressure Allowance and Transfer Factors												
Temp. (F)	50	55	60	65	70	75	80	85	90	95	100	105
Ft	0.050	0.093	0.133	0.172	0.208	0.243	0.276	0.307	0.337	0.365	0.392	0.418
Temp. (F)	110	115	120	125	130	135	140	145	150	155	160	165
Ft	0.000	0.096	0.101	0.105	0.110	0.114	0.119	0.123	0.127	0.131	0.135	0.139
Temp. (F)	170	175	180	185	190	195	200	205	210	215	220	225
Ft	0.696	0.715	0.734	0.753	0.771	0.790	0.809	0.827	0.846	0.865	0.883	0.902
Vpa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.4	4.5	6.6	8.9
Temp. (F)	230	235	240	245	250	255	260	265	270	275	280	
Ft	0.921	0.940	0.959	0.978	0.997	1.017	1.036	1.056	1.076	1.096	1.116	
Vpa	11.5	14.1	17.0	20.1	23.4	27.0	30.8	34.8	39.1	43.6	48.5	

Boiler Factors

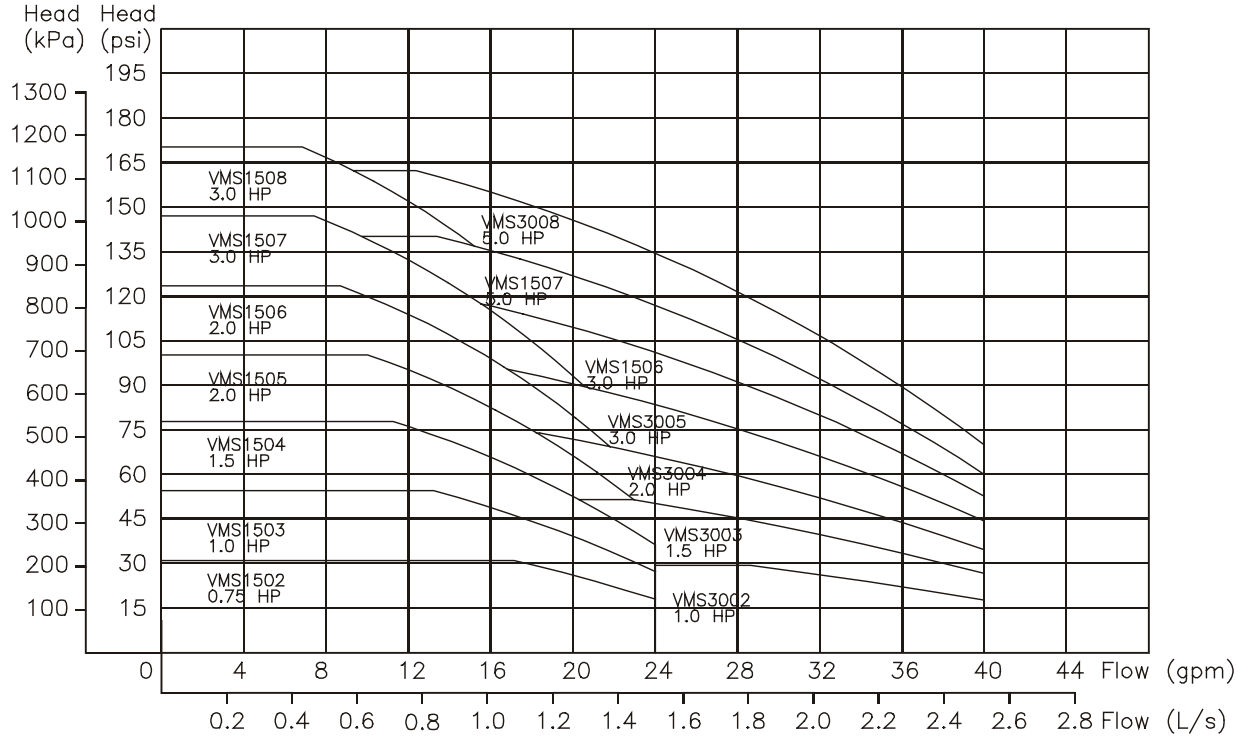
Table 6- Boiler Factors	
If system is off over night and for all chilled systems	0.50
Systems with night set back	0.59
Systems running 24 hours each day	1.00

SAFE Sizes

Table 7								
SAFE Size Ref	500	700	1000	1500	2000	3000	4000	5000
Capacity	132	200	264	395	528	792	1054	1319

Transfer Unit Size

Table 8



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