



Expansion Tank



For Heating and Sanitary Systems



HEATING SYSTEM APPLICATION

Calculation of the Tank Volume

Tank volume (lt) can be calculated with the next formula.

- V_{tank} : Expansion tank volume (lt)
- V_{su} : Total water volume in the installation (lt)
- e : Expansion coefficient of the heating water
- P_{min} : Absolute static pressure of the water in installation (bar)
- P_{max} : Max. absolute pressure that can be applied to the system. This is also the value for open the safety valve (bar).

$$V_{\text{tank}} = \frac{V_{\text{water}} \cdot e}{1 - \frac{P_{\text{min}}}{P_{\text{max}}}}$$

Calculation

Water : The total volume of the water in the installation (lt). When the absolute calculation is difficult, the following table can be used.

TABLE: 1 RADIATOR WATER VOLUMES ACCORDING TO THE BOILER CAPACITY

Heating Element	Water Volume (lt) required for each 1000 kcal/hr	Water Volume (lt) required for each 1 kW
Convactor	6	5.2
Panel Radiator	9.7	8.33
Cast Radiator	14	12
Steel Radiator	14	12
Floor Heating	21.5	18.5

- e : The expansion coefficient for the water heating from 10° to 90° is taken 0,0355 .
- P_{min} : The absolute static pressure of the water in the installation where the expansion tank is connected. (1 m. building height: 1 mSS=0.1 bar)
- P_{max}: Maximum absolute pressure that can be applied to the system. This is at the same time the value for opening the safety valve (bar).

Not: To make the tank selection without any calculation, Alarko Closed Expansion Tank Selection Table can be used.

Sample Calculation

Examp: What is the tank volume to be used in a building with 8 normal+1 basement storey using 450.000 kcal/hr capacity boiler and panel radiator? Safety valve opening pressure is set to 4 bar. The expansion tank is located next to the boiler at the basement.

The calculation of the total water volume in the system. For panel radiator, 9,7 coefficient is found from the Table 1. V_{water}=450.000 . 9,7/1000=4365 lt.

Generally, the volume of the boiler and piping is neglectable as compared to the radiator volumes. However, an increase of 10 % of the radiator volumes can be considered for the boiler and piping system. V_{water}=4365+0,1 . 4365=4801,5 lt

P_{min}: The absolute static pressure of the water in the installation where the expansion tank is connected. 8 storey +1 basement =9 storeysx3 m/storey =27mSS=2.7 bar (pressure difference) Absolute pressure=2.7 bar+1 bar=3.7 bar. P_{min}=3.7 bar.

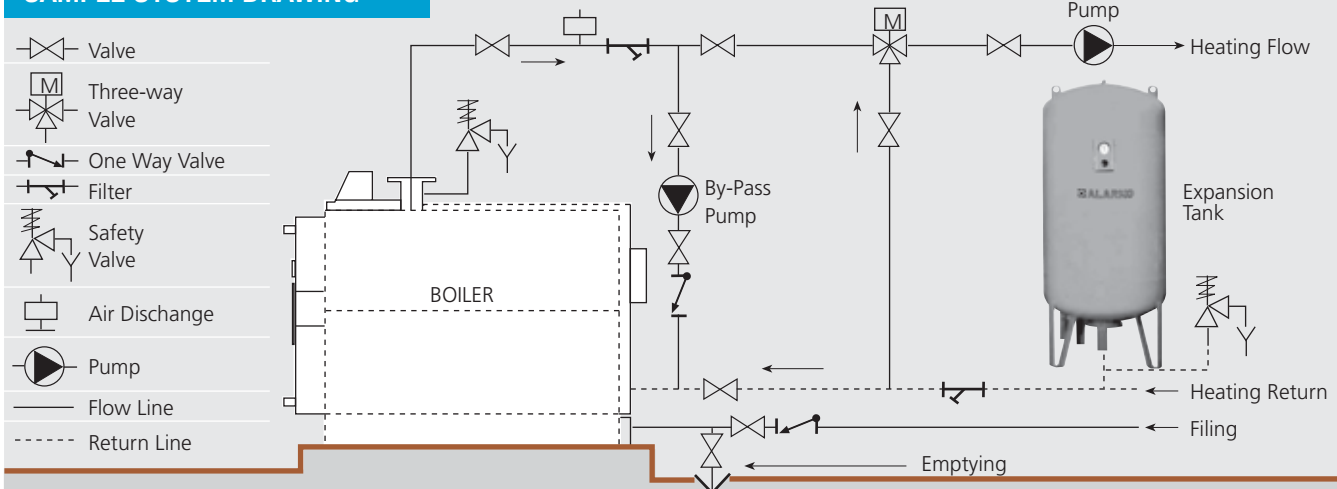
e: The expansion coefficient for the water heating from 10° to 90° is taken =0.0355 .

P_{max}: Maximum absolute pressure that can be applied to the system. This is at the same time the value for opening the safety valve, that is 4 bar. Absolute pressure=4 bar+1 bar=5 bar.

$$V_{\text{tank}} = \frac{\text{Water} \cdot e}{1 - \frac{P_{\text{min}}}{P_{\text{max}}}} = \frac{4801,5 \cdot 0,0355}{1 - \frac{3,7}{5}} = 655,6 \text{ lt}$$

The closer tank volume bigger than this value is 750 lt. The correct selection should be GT 750.

SAMPLE SYSTEM DRAWING



WARNINGS

- ✓ The expansion tanks should absolutely be used with safety valve. Valve manufacturers inform about the utmost capacity with which their products are used. However, general the Table 2 can be used for this selection.
- ✓ There should not be any valve between the boiler, safety valve and expansion tank.
- ✓ The expansion tank should be adjusted so that the front pressure shall be (P_{min}) 0.1 bar lower than the minimum statically pressure of the system.
- ✓ The connection of the tank either to the flow or return pipe does not effect the selection of the tank.
- ✓ The expansion tank liquid is used with fuel or natural gas boilers. It is not used with coal boilers.

TABLE: 2

BOILER CAPACITY (kcal/hr)	SAFETY VALVE
Up to 45.000	1/2"
45.000-90.000	3/4"
90.000-175.000	1"
175.000-300.000	1 1/4"
300.000-500.000	1 1/2"
More then 750.000	2"

SANITARY SYSTEM APPLICATION

Calculation of the Tank Volume

$$V_{\text{tank}} = Q_{\text{max}} \frac{P_{\text{max}}}{3 \cdot \Delta P \cdot a}$$

Q_{max} : The maximum flow ratio given by pump to system. In case of new system installed, the maximum flow ratio needed by the building should be calculated from table 3 and table 4. Maximum Required Flow Ratio= Daily Consumption (Table 3). Factor (Table 4) (lt/hr)

TABLE: 3 WATER CONSUMPTION PER PERSON FOR SAMPLE LOCALITIES		
LOCATION TYPE	DAILY CONSUMPTION PER PERSON (lt/person)	
House	with washbasin	60-80
	with shower	80-115
	with bathtub	120-200
Hotel	with shower	100
	with bathtub	150-200
Hospital	200-500	
School	5	
Nursery	80-100	
Kinder garden	100-150	
Barracks	60-80	
Restaurant	10-20	
Garden Irrigation	1,5 lt/m ² at ones	
Car Washing	100 lt/day	

TABLE: 4 MULTIPLYING FACTOR FOR WATER CONSUMPTION PER PERSON		
LOCATION TYPE	FACTOR	
Houses	1-5 apartment	0.66
	6-10 apartment	0.45
	11-20 apartment	0.40
	21-50 apartment	0.35
	51-100 apartment	0.30
	100 apartment and more	0.25
Hotels	1-20 beds	0.40
	20-50 beds	0.40-0.30
	50 beds and more	0.30-0.20
Hastaneler	50-500 beds	0.30-0.20
	500-1000 beds	0.20-0.15
	1000-2000 beds	0.15-0.10
Schools	0.30	
Nursery	0.40	
Barracks	0.40-0.30	
Business Centers	0.30	

P_{max} : Maximum absolute pressure in the system. In domestic applications, it is enough to have the maximum pressure 2-3 bar higher than the minimum pressure.

P_{min} : Minimum absolute pressure in the system.

$$1,2 \cdot \left(\begin{array}{l} \text{Static pressure} \\ \text{caused by the } + \\ \text{highest and farthest} \\ \text{building height} \\ \text{locality (for houses 1,5 bar)} \end{array} \right) \cdot \left(\begin{array}{l} \text{Necessary pressure for} \\ \text{stop-operate in 1 hour)} \end{array} \right)$$

ΔP : Pressure difference ($P_{\text{max}} - P_{\text{min}}$) (bar)

a : The maximum start up number of the pump motor (number of motor stop-operate in 1 hour). It is defined by the manufacturer of the pump. Generally, it is around 10-15.

Sample Calculation

Examp: A 5-storey and 40-room hotel shall drag water from its well with submersible pump and use in its installation. There stay maximum 80 persons in the hotel. What should the expansion tank selected be?

Q_{max} : Maximum flow ratio

$$Q_{\text{max}} = 80 \text{ persons} \times 200 \text{ lt/person (Table 3)} \times 0,3 \text{ (Table 4)}$$

$$Q_{\text{max}} = 4800 \text{ lt/hour}$$

a: Let's take maximum reverse motion of the pump in an 1 hour =15.

P_{min} : 5 storeysx3 m/storey+5 m (basement)=20 m=20mSS=2 bar

$$P_{\text{min}} \text{ (indicator)} = 1,2 (2 \text{ bar} + 1,5 \text{ bar}) = 4,2 \text{ bar}$$

$$\text{Absolute pressure} = 4,2 \text{ bar} + 1 \text{ bar}$$

$$P_{\text{min}} = 5,2 \text{ bar.}$$

P_{max} : Let's lower the maximum utilization pressure higher than the 3 bar.

$$P_{\text{max}} = 5,2 \text{ bar} + 3 \text{ bar} = 8,2 \text{ bar}$$

$$\text{Pressure Difference} = 8,2 - 5,2 = 3 \text{ bar}$$

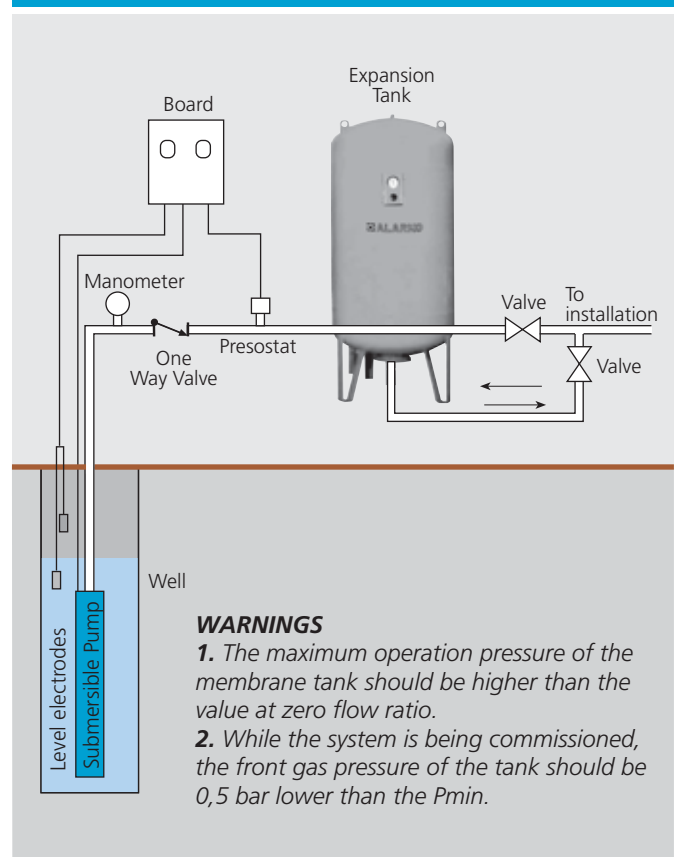
ΔP : $\Delta P = 3 \text{ bar}$

$$V_{\text{tank}} = 4800 \frac{8,2}{3 \cdot 3 \cdot 15} = 291 \text{ litre.}$$

The standard tank volume bigger than this value is 300 lt. The correct selection should be GT 300.

Not : As can be seen from the example, the depth of the well is not important in this calculation.

SAMPLE SYSTEM DRAWING



ALARKO - CLOSED EXPANSION TANKS

Alarko closed expansion tanks are designed to compensate the changing volume of the heated water in heating systems, to maintain the static pressure created by the pump at the utilisation level in water production, and to compensate the changes in water flow rate. A right choice of expansion tank prevents sudden changes in pressure and provides a longer life for the pump and other elements of the system. Thanks to their hygienic EPDM membranes, Alarko expansion tanks are reliable in both heating and drinking water systems.

TECHNICAL FEATURES

Type	Volume (lt)	Max. Operation Pressure (bar)	Membrane	Dimension (mm)			Water Connection (inch)
				Wide (G)		Diameter (D)	
Horizontal Tanks							
GT 24Y	24	10	EPDM	280	470	-	1
GT 50Y	50	10	EPDM	409	480	-	1
GT 60Y	60	10	EPDM	409	560	-	1
GT 80Y	80	10	EPDM	480	720	-	1
GT 100Y	100	10	EPDM	480	800	-	1
Spherical Tank							
GT 24K	24	10	EPDM	-	470	280	1
Vertical Tanks							
GT 50D	50	10	EPDM	-	600	409	1
GT 60D	60	10	EPDM	-	660	409	1
GT 80D	80	10	EPDM	-	840	480	1
GT 100D	100	10	EPDM	-	970	480	1
GT 150D	150	10	EPDM	-	1100	500	1
GT 200D	200	10	EPDM	-	980	634	11/4
GT 300D	300	10	EPDM	-	1230	634	11/4
GT 500D	500	10	EPDM	-	1550	740	11/4
GT 750D	750	10	EPDM	-	1950	740	2
GT 1000D	1.000	10	EPDM	-	2200	800	2
GT 1500D	1.500	10	EPDM	-	2400	960	2
GT 2000D	2.000	10	EPDM/Bütıl	-	2450	1100	2
GT 2500D	2.500	10	Bütıl	-	2750	1100	DN 65
GT 3000D	3.000	10	Bütıl	-	2800	1200	DN 65
GT 4000D	4.000	10	Bütıl	-	3100	1450	DN 65
GT 5000D	5.000	10	Bütıl	-	3700	1450	DN 65

- ✓ Alarko tanks and membranes are designed to perfectly match. There is no contact between the water and the tank, and thus all tanks are suitable for both heating cooling and drinking water production.
- ✓ Membranes are made of EPDM material, with is the best quality, odourless and suitable to be used with food produces.
- ✓ Operating temperature range of tanks are -10°C and +100°C.
- ✓ Anti-freeze used in cooling system does not have any undesirable impact on the membrane.
- ✓ Tanks are coated with electrostatic powder paint.
- ✓ 100 liter and bigger tanks have manometers.
- ✓ Tanks are delivered with a factory-filled pre gas pressure of 1,5 bars. If required, the pressure can be readjusted during the installation. Refer to the Instruction Manuel for these operations.
- ✓ Tanks are guaranteed for one year against any faults in production.
- ✓ All tanks are delivered with their Guarantee Form and Instruction Manual.

Note: The manometer indicates the gas pressure as the tanks is empty and the pressure of the water in the installation, as the tank is connected. The water in the tanks should be removed if the gas pressure wanted to measure.

The right to amend specifications under technologic developments is reserved

ALARKO



**ALARKO CARRIER
SANAYİ VE TİCARET A.Ş.**

GOSB-Gebze Organize Sanayi Bölgesi
Şahabettin Bilgisu Cad. 41480 Gebze-Kocaeli/TURKEY
Phone : (90)(262) 648 60 00 PBX
Telefax : (90)(262) 648 61 01
web : www.alarko-carrier.com.tr
e-mail : info@alarko-carrier.com.tr



A.9.1.1 111111 MINERAL

