Tanpera

EXPANSION TANKS

HIGH CAPACITY, UNINTERRUPTED PERFORMANCE!

What Is an Expansion Tank?

They are used to ensure the safety and efficiency of closed-loop heating and cooling systems. Their main function is to balance pressure fluctuations caused by the expansion (increase in volume) or contraction (decrease in volume) of water in the system due to temperature changes. Thanks to the membrane structure inside, they temporarily store excess water volume or feed the missing water back into the system, keeping the pressure within the desired range. In this way, they protect the piping, boiler, and pumps, and prevent water loss and energy waste.

Pressure Balancing: It keeps the system pressure stable within the specified range during heating and cooling cycles.

System Protection: By preventing damage that high pressure could cause to the boiler, pump, pipes, and fittings, it extends the system's service life.

Diaphragm Structure: The durable diaphragm that separates the system water from the air ensures long-lasting and efficient operation.

Corrosion Prevention: By keeping the system closed, it prevents oxygen ingress and therefore helps reduce corrosion.

What Is the Working Principle?

The operating principle of an expansion tank is based on continuously balancing the volumetric changes of water through a flexible diaphragm and a compressible gas cushion (air).

Inside the tank, there is a diaphragm that separates the system water from the pressurized gas. When the water in the system heats up, it expands, and this increased volume flows into the tank, pushing the diaphragm toward the gas cushion; the gas compresses and absorbs the pressure increase. When the system cools down, the water contracts; this time, the compressed gas cushion expands, pushes the diaphragm in the opposite direction, and feeds the stored water back into the system.

This continuous, bidirectional “breathing” movement protects the system pressure against both dangerous increases and drops that could create vacuum conditions, ensuring that the system always operates within a stable and safe pressure range.

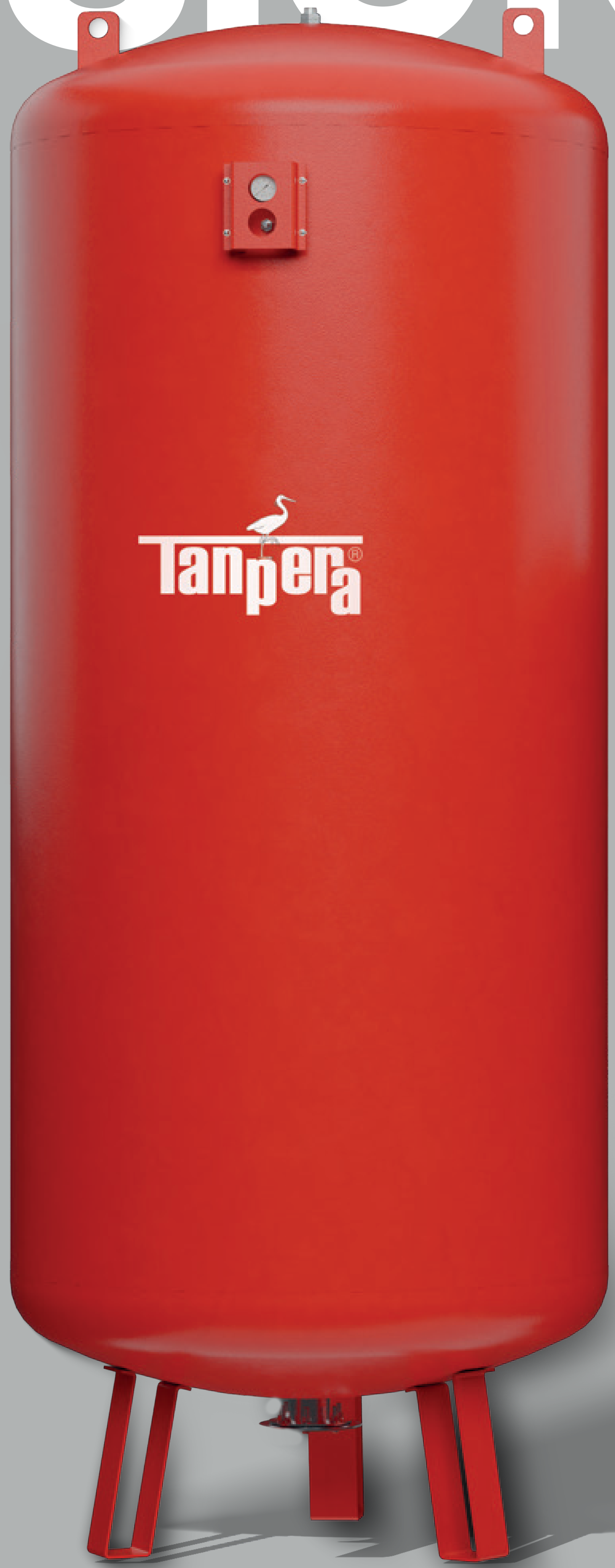
General Features

- It is suitable for use as an expansion and contraction tank in closed heating and cooling systems to balance the increase and decrease in water volume caused by temperature changes.
- In booster systems, it is suitable for use as a pressure storage and shock absorption tank to reduce system switching frequency, lower energy consumption, increase user comfort, and dampen shocks and pressure fluctuations in the system.
- It is offered to our customers in various capacities ranging from 24 liters to 5,000 liters.
- It is manufactured with standard operating pressures of 10 bar and 16 bar.
- It is suitable for use with water temperatures ranging from -10°C to +100°C.
- It features a replaceable diaphragm made of hygienic EPDM material that does not impart any odor to the water.
- It is sized according to the tank volume and comes with a ready-to-install connection pipe with a drain plug for system installation.
- To monitor the gas pressure inside, tanks larger than 100 liters are equipped with a pressure gauge protected against shocks.
- Before delivery to the customer, it is tested at a pressure 1.3 times its operating pressure.

TGT Series

Expansion Tank

EXPANSION TANK



Advantages

An expansion tank is an integral part of a piping system, and its use provides direct benefits for the system as a whole.

- **Uninterrupted Hot Water Comfort**
  System Safety and Installation Protection
  This is its most important advantage. By absorbing the high pressure generated during heating, it prevents damage to the installation, boiler, pumps, and pipes. It helps avoid costly failures and potential hazards.

- **Energy Efficiency and System Protection**
  Energy and Water Savings by balancing pressure increases, it prevents the safety valve from opening unnecessarily (water discharge). In this way, both the loss of hot water in the system and the energy spent to heat that water are avoided.

- **Integrated Electric Heater**
  Extended Equipment Life by keeping the system continuously at a stable pressure, it reduces mechanical stress. Components such as pumps, valves, the boiler heat exchanger, and connection elements are subjected to less strain, extending their service life.

- **Enamel Coating**
  High system efficiency and comfort prevent excessive drops in system pressure (vacuum) during cooling. This prevents air from entering the system. An air-free installation operates more quietly, eliminates air-related heating problems in radiators, and reduces the risk of corrosion.

- **High Thermal Insulation**
  Low Maintenance Cost since the system remains closed (does not discharge water to the outside and does not allow air to enter), issues such as corrosion, scaling, and sludge formation are minimized. This reduces maintenance requirements and associated costs.

Technical Specifications

For correct and proper operation of the system, the expansion tank's capacity and design pressure must be determined/designed by an authorized technical specialist.

The TANPERA Expansion Tank is manufactured in accordance with the Pressure Equipment Directive (2014/68/EU), which was published in the Official Gazette dated 03.03.2018 and numbered 30349 and entered into force.

- Wide Tank Volume Option
  Capacity: 24 – 5000 Liters
- Operating Pressure: 10 bar / 16 bar
  (8 bar for 50 and 24 liter tanks only)
- The maximum operating pressure is 16 bar. Upon special request, expansion tanks with an operating pressure of 25 bar can also be supplied.
- Gas Charge: 4 bar dry air
  (1.5 bar for 50 and 24 liter tanks only)
- Body Material: Manufactured from S235JR (ST37) material. Upon special request, the tank can also be supplied in stainless steel.
- A replaceable EPDM diaphragm is used. Upon special request, the tank can also be supplied with a “butyl” diaphragm.
- Protective Electrostatic Powder Coating is applied against corrosion.
- The tanks are floor-mounted.

Expansion Tank Applications

Expansion tanks play a critical role in nearly all closed-loop liquid systems that operate under pressure and are exposed to temperature changes.

Individual and Central Heating Systems
It balances the expansion of water due to temperature changes in combi boilers, apartment heating systems, and central boiler rooms. By keeping system pressure under control, it ensures the safety of the installation and equipment.

Domestic Hot Water Systems (Water Heaters)
It absorbs the pressure increase caused by expansion in domestic water heated by a water heater and heat exchanger. By preventing water discharge from the safety valve, it extends the service life of the installation.

Solar Energy Systems
It balances expansion caused by high temperatures in closed-loop solar collector systems. It prevents safety components from being activated unnecessarily.

HVAC and Air Conditioning Systems
It controls pressure fluctuations occurring in chiller and air handling unit lines.
It ensures uninterrupted air conditioning performance in hotels, shopping malls, and hospitals.

Industrial Process Systems
It balances system pressure in industrial process heating and cooling water circuits.
It contributes to the safe and stable operation of production lines.

Booster and Water Pressurization Systems
It prevents frequent pump start-stop cycles in booster systems. It provides energy savings and extends the service life of pumps and equipment.

What Are the Components of the Product?

Body
The tank body is the outer shell of the tank, manufactured from high-quality carbon steel. It is designed to withstand the system's maximum operating pressure, and its outer surface is coated with corrosion-resistant electrostatic powder paint.

Diaphragm
The replaceable diaphragm, which is the "heart" of the tank, is a bag (bladder) shaped component made of flexible and high-strength EPDM material. The system water fills this bladder and never comes into contact with the metal body of the tank. This design completely prevents corrosion and allows the diaphragm to be easily replaced when necessary.

System Connection Fitting
It is the point where the expansion tank is connected to the installation and where water inlet and outlet take place. Depending on the volume, it can be in the form of a threaded coupling or a flanged connection.

Mounting Feet
Mounting feet include legs for fixing the tanks to the floor or mounting brackets for wall installation of small tanks.

Gas Charging Valve
It is a valve used to measure or adjust the pressure of the gas chamber and to set the pre-charge pressure.

Product Notation and Descriptions

TANPERA-TGT 1000/10

- 10 — Nominal Operating Pressure (Bar)
- 1000 — Nominal Capacity (Liter)
- TGT — Expansion Tank Type Code

Capacity and Main Dimensions

Type	Pressure Class (Bar)	Capacity (L)	Dimensions		Pressure Gauge Connection Port	Connection Port	Empty Weight (Kg)
			OD (mm)	H (mm)			
TGT-24/8-Spherical	8	24	360	330	-	1"	6
TGT-24/8	8	24	280	465	-	1"	6
TGT-50/8-Horizontal	8	50	380	590	-	1"	12
TGT-50/8	8	50	380	750	-	1"	12
TGT-100/10	10	100	460	970	1/4"	1"	20
TGT-200/10	10	200	590	1120	1/4"	1 1/4"	45
TGT-300/10	10	300	640	1230	1/4"	1 1/4"	45
TGT-500/10	10	500	750	1500	1/4"	1 1/4"	70
TGT-750/10	10	750	750	1900	1/4"	2"	120
TGT-900/10	10	900	800	1950	1/4"	2"	140
TGT-1000/10	10	1000	800	2180	1/4"	2 1/2"	160
TGT-1250/10	10	1250	800	2400	1/4"	2 1/2"	200
TGT-1500/10	10	1500	960	2400	1/4"	2 1/2"	260
TGT-2000/10	10	2000	1100	2520	1/4"	2 1/2"	400
TGT-2500/10	10	2500	1100	2800	1/4"	2 1/2"	420
TGT-3000/10	10	3000	1200	2800	1/4"	2 1/2"	450
TGT-4000/10	10	4000	1450	3180	1/4"	2 1/2"	750
TGT-5000/10	10	5000	1450	3720	1/4"	3"	880
TGT-100/16	16	100	460	970	1/4"	3"	50
TGT-200/16	16	200	590	1120	1/4"	3"	55
TGT-300/16	16	300	640	1230	1/4"	1"	65
TGT-500/16	16	500	750	1500	1/4"	1 1/4"	95
TGT-750/16	16	750	750	1900	1/4"	1 1/4"	220
TGT-900/16	16	900	800	1950	1/4"	1 1/4"	240
TGT-1000/16	16	1000	800	2180	1/4"	2"	400
TGT-1250/16	16	1250	800	2400	1/4"	1 1/4"	350
TGT-1500/16	16	1500	960	2400	1/4"	2"	400
TGT-2000/16	16	2000	1100	2520	1/4"	2"	530
TGT-2500/16	16	2500	1100	2800	1/4"	640	640
TGT-3000/16	16	3000	1200	3720	1/4"	770	770
TGT-4000/16	16	4000	1450	2800	1/4"	1000	1000
TGT-5000/16	16	5000	1450	3180	1/4"	1200	1200

Design Recommendations / Capacity Selection Guide

Heating Systems

In a heating system, the water that expands when heated from the initial filling temperature—when it is at its coldest—to the operating temperature must be absorbed by an expansion tank. In this way, during heating and cooling cycles, it is ensured that the system pressure does not exceed the strength limits of the component with the lowest pressure resistance in the circuit.

When calculating the required expansion tank capacity, the following system-related parameters must first be determined.

Static Height: Hst (m)
The height of the water column between the highest point of the system and the expansion tank.

Static Height Pressure: Pst (bar) = Hst / 10.2

Pressure Margin: Pp ~ 0.3 bar
To prevent water evaporation and/or to ensure the discharge of air from the highest point of the system.

Pre-Charge Gas Pressure: Pög (bar) = Pst + Pp
The pre-charge gas pressure to be filled into the tank when the system is cold must not be below 0.7 bar.

System Operating Pressure: Pi (bar)
The pressure allowed to occur in the tank when the system is heated to operating temperature and the pump is not running. If the tank is located at the lowest point of the system and on the suction side of the pump, this value is determined by subtracting the safety valve opening margin (~0.5 bar) from the design pressure of the component with the lowest pressure rating in the system.

Total Water Volume in the System: Vs (liter)
To calculate this, depending on the type of heating elements in the system, Table 1 can be used as an approximate method. Here, the total heating capacity of the system in kCal/h can be multiplied by the factor in the table to obtain an approximate value in liters. However, if the system includes different equipment such as air handling units and/or is an extensive system with long piping runs, it is recommended to perform a more precise calculation by determining the total water volume of the pipes from Table 2 and obtaining the water volumes of boilers, radiators, etc. from catalogs.

Expansion Coefficient: E
The expansion ratio between the initial and final temperatures of the water in the system. It can be taken from Table 3. The initial filling temperature of the water can be assumed as 4°C, and the final temperature can be taken as the average of the operating regime. Based on these parameters and the assumptions made, the following calculations can be performed.

Pressure Factor: a = 1 - ((Pög + 1) / (Pi + 1))

Expanded Water Volume: Vg (liter) = Vs · e

Required Expansion Tank Volume: Vt (liter) = Vg / a

Selected Tank Volume: Vs (liter) > Vt × 1.1

HEATING ELEMENT	VOLUME FACTOR (liter/kCal/h)
Cast Iron Radiator	0,012
Panel Radiator	0,010
Steel Radiator	0,014
Fan Coil	0,008
Underfloor Heating	0,023

SAMPLE CALCULATION

Let's select an expansion tank to be installed at the lowest point and on the pump suction side in a heating system where the weakest component has a pressure rating of 6 bar, heated by a boiler with a capacity of 550,000 kCal/h, operating at 80/60°C, with a static height of 40 m (Hst), and using panel radiators as heating elements.

P_{st} = 40 / 10,2 = 3,92 bar
$P_{ög}$ = 3,92 + 0,3 = 4,22 bar
P_i = 6 - 0,5 = 5,5 bar
V_s = 550.000 x 0,01 = 5500 liter (Table 1)
e = % 2,28 (Table 3)
a = 1 - ((4,22 + 1) / (5,5 + 1)) = 0,2
V_g = 5500 x % 2,28 = 126 liter
V_t = 126 / 0,2 = 630 liter
V_s = 630 x 1,1 = 693 liter

Selected Tank: TANPERA-TGT 750/10 with a volume of 750 liters. In addition, a safety valve with an opening pressure of 6 bar should be selected.

Design Recommendations / Capacity Selection Guide

Cooling Systems

Unlike a heating system, in a cooling system, when the water is cooled from the initial filling temperature—when it is at its hottest—to the operating temperature, the volume of water in the system decreases. If this amount of water is not supplied back into the system by a contraction tank, air may enter through weak points, causing corrosion and other damage in the system.
When calculating the required contraction tank capacity, the following system-related parameters must first be determined.

Static Height: Hst (m)
The height of the water column between the highest point of the system and the contraction tank.

Static Height Pressure: Pst (bar) = Hst / 10.2

Pre-Charge Gas Pressure: Pög (bar) = Pst
The gas pressure that must be charged into the tank before the system is commissioned.

System Filling Pressure: Pi (bar)
The pressure allowed to occur in the tank when the system is filled with water and the pump is not running. If the tank is located at the lowest point of the system and on the suction side of the pump, this value must not exceed the value obtained by subtracting the safety valve opening margin (~0.5 bar) from the pressure rating of the component with the lowest pressure class in the system.

Total Water Volume in the System: Vs (liter)
Since cooling systems generally include equipment such as air handling units and large-diameter piping, it is recommended to perform a more accurate calculation by determining the total water volume of the pipes from Table 2 and obtaining the water volumes of devices such as fan coils and chillers from catalogs.

Contraction Coefficient: E
The contraction ratio between the initial and final temperatures of the water in the system can be taken from Table 3. The initial filling temperature of the water can be assumed as 30°C, and the final temperature can be taken as the average of the operating regime.

Based on these parameters and the assumptions made, the following calculations can be performed.

Pressure Factor: a = 1 - ((Pög + 1) / (Pi + 1))
Contracted Water Volume: Vb (liter) = Vs · e
Required Contraction Tank Volume: Vt (liter) = Vb / a
Selected Tank Volume: Vs (liter) > Vt × 1.1

PIPE DIAMETER (inch)	WATER CAPACITY (l/m)
1/2"	0,2
3/4"	0,3
1"	0,5
1 1/4"	0,8
1 1/2"	1,3
2"	2,1
2 1/2"	3,1
3"	4,8
4"	8,3
5"	13,0
6"	18,8
8"	32,4
10"	51,1
12"	72,8

SAMPLE CALCULATION

Let's select a contraction tank to be installed at the lowest point and on the pump suction side in a cooling system where the weakest component has a pressure rating of 6 bar, operating at 6/12°C, with a total water volume of 10,000 liters (Vs), and a static height of 25 m (H).

Pst = Pög = 25 / 10.2 = 2.45 bar
Pi = 6 - 0.5 = 5.5 bar
e = 0.415% (Table 3)
a = 1 - ((2.45 + 1) / (5.5 + 1)) = 0.47
Vb = 10,000 × 0.415% = 42 liters
Vt = 42 / 0.47 = 90 liters
Vs = 90 × 1.1 = 100 liters

Selected tank: TANPERA-TGT 100/10 with a volume of 100 liters. In addition, a safety valve with an opening pressure of 6 bar should be selected.

Design Recommendations / Capacity Selection Guide

Domestic Hot Water Systems

Especially in domestic hot water systems where hot water is stored by a device such as a water heater or an accumulation tank, the expansion that occurs when the water is heated during periods of no usage must be absorbed by an expansion tank. Otherwise, the pressure increase in the system due to expansion can damage system components, especially faucets.

When calculating the required expansion tank capacity, the following system-related parameters must first be determined.

e	WATER TEMPERATURE (°C)														
FINAL WATER TEMPERATURE (°C)	0	2	4	6	8	10	20	30	40	50	60	70	80	90	100
2	-0,01	0	0,01	0	0,01	0,17	0,17	0,43	0,77	1,20	1,70	2,27	2,90	3,59	4,34
4	-0,02	-0,01	0	-0,01	-0,02	-0,03	-0,18	-0,44	-0,78	-1,21	-1,71	-2,28	-2,91	-3,60	-4,35
6	-0,01	0	0,01	0,01	0	-0,01	-0,02	-0,17	-0,77	-1,20	-1,70	-2,27	-2,90	-3,59	4,34
8	0	-0,01	0,02	2,27	2,26	2,25	2,10	1,84	1,50	1,07	0,57	0	-0,63	-1,32	-2,07
10	-0,01	0,02	0,03	0,02	0,01	0	-0,15	-0,41	-0,75	-1,18	-1,68	-2,25	-2,88	-3,57	-4,32
20	-0,16	0,17	0,18	0,17	0,16	0,15	0	-0,26	-0,60	-1,03	-1,53	-2,10	-2,73	-3,42	-0,75
30	-0,42	0,43	0,44	0,43	0,42	0,41	0,26	0	-0,34	-0,77	-1,27	-1,84	-2,47	-3,16	-3,91
40	-0,76	0,77	0,78	0,77	0,76	0,75	0,60	0,34	0	-0,43	0,93	-1,50	-2,13	-2,82	-3,57
50	1,19	1,20	1,21	1,20	1,19	1,18	1,03	0,77	0,43	0	0,50	-1,07	-1,70	-2,39	-3,14
60	1,69	1,70	1,71	1,70	1,69	1,68	1,53	1,27	0,93	0,50	0	-0,57	-1,20	-1,89	-2,64
70	2,26	2,27	2,28	2,27	2,26	2,25	2,10	1,84	1,50	1,07	0,57	0	-0,63	-1,32	-2,07
80	2,89	2,90	2,91	2,90	2,89	2,88	2,73	2,47	2,13	1,70	1,20	0,63	0	-0,69	-1,44
90	3,58	3,59	3,60	3,59	3,58	3,57	3,42	3,16	2,82	2,39	1,89	1,32	0,69	0	-0,75
100	4,33	4,34	4,35	4,34	4,32	4,32	4,17	3,91	3,57	3,14	2,64	2,07	1,44	0,75	0

System Operating Pressure: Pi (bar)
If the system is supplied from the municipal water network, the network pressure should be taken as the operating pressure; if it is pressurized by a booster system, the upper pressure of the booster should be taken as the operating pressure.

Pre-Charge Gas Pressure: Pög (bar) = Pi
The gas pressure to be charged into the tank before the system is commissioned. This value must not exceed 5.5 bar.

Expansion Coefficient: E
The expansion ratio between the initial and final temperatures of the water in the system. It can be taken from Table 3. The initial filling temperature of the water can be assumed as 4°C, and the final temperature can be taken as the temperature at which the domestic hot water is stored.

Based on these parameters and the assumptions made, the following calculations can be performed.

Pressure Factor: a = 1 - ((Pög + 1) / (Pmaks + 1))
Expanded Water Volume: Vg (liter) = Vs · e
Required Expansion Tank Volume: Vt (liter) = Vg / a
Selected Tank Volume: Vs (liter) > Vt × 1.1

Maksimum Sistem Basıncı: Pmaks (bar)
The pressure allowed to occur in the tank when the system heats up and expands. If the tank is located at the lowest point of the system, this value must not exceed the value obtained by subtracting the safety valve opening margin (~0.5 bar) from the pressure rating of the component with the lowest pressure class in the system.

Total Water Volume in the System: Vs (liter)
Since the water in the system will be stagnant during periods of no usage, only the expansion of the water stored in the boiler or accumulation tank should be taken into account.

ÖRNEK HESAPLAMA

Let's select an expansion tank for a domestic hot water system where the weakest component has a pressure rating of 8 bar, the system is pressurized by a booster with an upper pressure of 4 bar, and the water is heated and stored at 60°C in a 2,000-liter water heater.

Pög = Pi = 4 bar
Pmaks = 8 - 0.5 = 7.5 bar
Vs = 2,000 liters
e = 1.71% (Table 3)
a = 1 - ((4 + 1) / (7.5 + 1)) = 0.41
Vg = 2,000 × 1.71% = 35 liters
Vt = 35 / 0.41 = 86 liters
Vtl = 86 × 1.1 = 95 liters

Selected tank: TANPERA-TGT 100/10 with a volume of 100 liters. In addition, a safety valve with an opening pressure of 8 bar should be selected.

Design Recommendations / Capacity Selection Guide

Booster Systems

The capacity of the balance tank of a multi-pump booster system controlled by a pressure switch can be calculated as follows, provided that the pumps operate sequentially. When calculating the required expansion tank capacity, the following system-related parameters must first be determined.

Pump Flow Rate: Q (m^3/h)
The pump flow rate at the activation (lower) pressure of the pressure switch controlling the upper pressure range.

Pompa Üst Basıncı: Püst (bar)
The cut-out pressure of the pressure switch controlling the upper pressure range.

Pump Lower Pressure: Palt (bar)
The cut-in pressure of the pressure switch controlling the upper pressure range.

Pre-Charge Gas Pressure: Pög (bar) = Palt × 0.9
The gas pressure to be charged into the tank before the system is commissioned.

Maximum Pump Switching Frequency: S (1/h)
It can be obtained from Table 4 depending on the pump's motor power.

Total Number of Pumps: Np (Units)
The number of pumps in the booster set, including standby pumps.

Based on these parameters and the assumptions made, the following calculations can be performed.

Pressure Factor: a = 1 - ((Palt + 1) / (Püst + 1))
Required Booster Tank Volume:
Vt (liter) = (Qp × 1000) / (a × S × Np)
Selected Tank Volume: Vs (liter) > Vt × 1.1

Hourly Switching Limits (S) for Electric Motors

Motor Power (kW)	S (l/h)
≤ 3,7	≤ 60
3,7 - 7,5	≤ 30
7,5 - 15	≤ 20
15 - 18	≤ 20

SAMPLE CALCULATION

Let's calculate the required tank capacity for a 3-pump booster system where the pressure switch controlling the upper pressure range has a cut-in pressure of 6 bar (Palt) and a cut-out pressure of 8 bar (Püst), the pump delivers a flow rate of 23 m^3/h (Qp) at 6 bar discharge head, the pump's closed-valve pressure is 9 bar, the electric motor power is 7.5 kW, and there are 3 pumps (Np) in the system.

Selected tank: TANPERA-TGT 2000/10 with a volume of 2,000 liters.

Tanpera

By achieving effective heat transfer between blood coming from the heart at 40°C and returning from the feet at 1°C, it can remain in cold water for long periods without freezing. Using these natural principles, we design our engineering marvel heat exchangers.

Tanpera Türkiye

+90 850 308 01 14

Şeyhli Mh. Ankara Cd. No: 380/C,
34906, Pendik, İstanbul, Türkiye

info@tanpera.com.tr

www.tanpera.com.tr

Tanpera GmbH

+49 1590 4138428

Hermann-Essig-Str. 36 71701
Schwieberdingen, Stuttgart, Germany

info@tanpera.de

www.tanpera.de