



NOVA PUMPED EXPANSION PRESSURIZATION UNIT

AIRLESS OPERATION, SUPERIOR EFFICIENCY!



What is a Tanpera Pumped Expansion / Pressurization Unit

It is a technological device developed to keep the plant pressure constant by absorbing the expansion that occurs in heating and cooling systems. It eliminates the pressure increases that may occur during heating by storing the expanded amount in the tank in a controlled manner during the heating of the installation water.

The expansion system ensures that the remaining amount of the installation water that shrinks during the cooling of the water is sent back to the installation with the help of the pump in the pumped expansion system and thus prevents the installation pressure from dropping. The purpose of the system is to keep the set pressure constant in heating and cooling installations.

Advantages

Space Saving

Tanpera Pumped Expansion Unit occupies a much smaller area and saves space as it has an average of five times higher expansion capacity than the classic type membrane expansion

Energy Saving

It improves heat transfer and thus allows pumps to operate with less head and energy savings are provided to the plant. By reducing the air intake and the oxygen in the air, the plant system is able to keep equipment (pipes, fittings, valves, heating apparatus and pumps) protected from corrosion. Installation significantly reduces the need for maintenance and renewal of equipment, proportionally extends the life of the

Controlled Operation

Thanks to the controlled operation, the plant pressure is kept constant to a precision of (+/-) 0.1 bar. Keeping the pressure constant significantly reduces the air intake into the plant, with the advantages of less air entering the plant.

Automation Possibilities

LCD display and fault reporting facility make it easy to identify the cause of the fault and to intervene. The system is problem-free and safe.

Low Maintenance Cost

Maintenance items such as air and nitrogen gas boosters, which are needed in conventional expansion tanks, are not required in the Pumped Expansion unit, because in the Pumped Expansion unit the outer surface of the membrane inside the tank is open to the atmosphere and unpressurized. Maintenance and operating costs are lower.

PUMPED EXPANSION PRESSURIZATION UNIT



Areas of Application

It used in heating and cooling system for balancing the volume of water that changes due to temperature changes in all building and industrial applications.



Life Centers

Balances water pressure in residential and mixed-use buildings in major cities. It particularly helps in delivering water at equal pressure to all floors in high-rise buildings.



Social Amenities and Facilities

Ensures the continuous and balanced flow of water in municipal, public housing, and public facilities, protecting infrastructure and enhancing energy efficiency.

Factories and Industrial Facilities
Maintains pressure stability of water used in production processes, ensuring more efficient and safe operation of systems. It also contributes to the protection of steam and hot water systems.



Tourism and Hospitality Facilities

Optimizes hot water use in hotels and resorts, enhancing guest comfort and ensuring efficient system operation.



Shopping Malls

In large shopping centers, it balances the installation pressure for high-capacity heating-cooling systems, providing a comfortable environment and preventing system failures.



Residential Sites and Apartments

In housing projects with central water systems, it ensures uninterrupted and correct pressure distribution, optimizing pump use and providing energy savings.

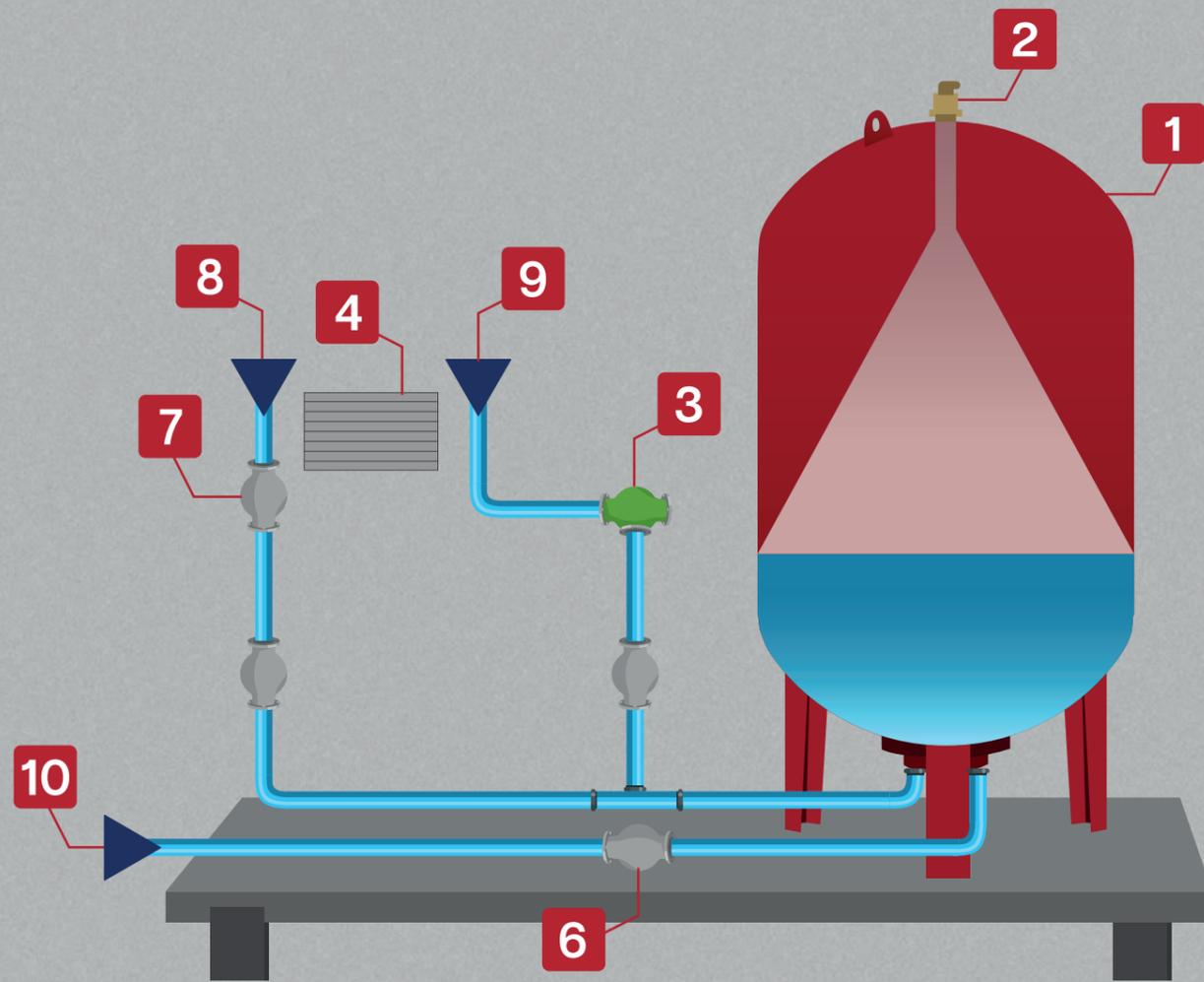
Dormitories and Boarding Schools
Balances pressure in hot water and heating systems suitable for use by many people, offering a comfortable living space.



Hospital

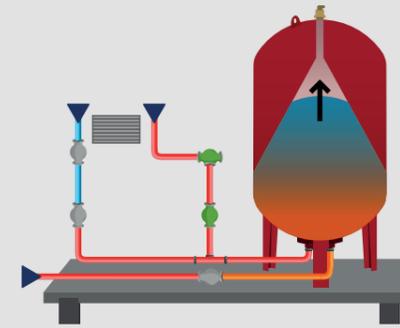
In hospitals, where hygiene is critical, it provides pressure control in hot water and sterilization systems, ensuring uninterrupted service.





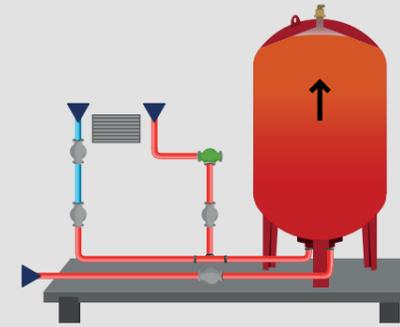
- 1** Expansion Tank
- 2** Air Exhaust Purifier
- 3** Solenoid Valve
- 4** Command and Control Panel
- 5** Control Unit
- 6** Pump
- 7** Flow Meter
- 8** Connection Network
- 9** Connection Port from the Installation
- 10** Connection Port from the Installation

There is a small amount of water in the Pumped Expansion / Pressurization filled with domestic water, the system is ready for operation.

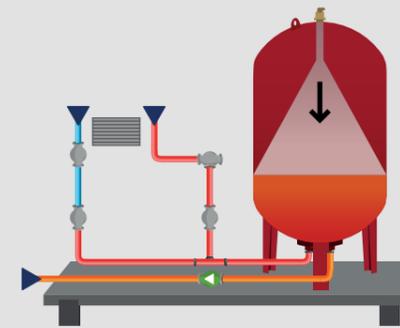


As the temperature of the plant water increases, the water begins to expand and the pressure rises. The pump expansion automation system evaluates the information and ensures that the motorized valve opens and the expanded water in the plant is transferred to the tank.

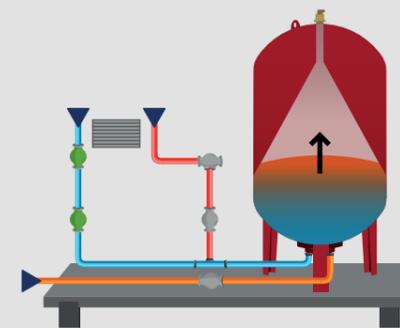
This keeps the installation pressure constant.



When the plant water temperature enters the regime, the plant pressure is kept constant thanks to the pressure control of the Pumped Expansion / Pressurization Unit until the maximum load is reached.



Due to the operating conditions, the water in the plant starts to cool and shrink and the pressure drops. The water stored in the Expansion Tank is pumped back into the plant when the pump is activated, pressurizing the plant to the desired pressure and keeping the plant pressure constant. When the plant pressure reaches the desired pressure, the pump is deactivated.



Depending on the conditions of use, there may be deficiencies in the installation water. The amount of water deficiency is measured with the integrated flow automation system and flowmeter on the Pumped Expansion / Pressurization Unit and automatic water supply is made from the mains line to the installation. The installation pressure is kept constant with automatic water boosters.

Control Unit

Tanpera Pumped Expansion / Pressurization Unit is the unit where many important equipments in the system are collected. The control unit includes solenoid valves, pumps, safety valves, check valves, shut-off valves, sensors, integrated circuits for automation, user display and connections.

The control unit is easy to carry and houses all equipment on a platform. It has protection against wetting and vibration. The exterior of the control unit is covered with materials suitable for environmental conditions and is resistant to mechanical impacts. When the pressure rises in the installation system, the solenoid valve is opened and some of the water is taken into the expansion tank. In this way, the system pressure in the installation is kept constant.

In the event that the pressure in the installation system falls below the set value due to various reasons, the water in the expansion tank is pumped to the installation system thanks to the operation of the pump. In this way, the system pressure in the plant is kept constant. The function of the pump used in the control unit is to pressurize the unpressurized water taken from the tank and feed it back to the heating or cooling system. There is a safety valve set to the opening pressure suitable for the system. Cooling system applications must be specified by the user. In order to prevent possible condensation problems, insulation suitable for the cooling system must be made.



Modes of Operations

Manual Mode

It allows the individual equipment (solenoid valve, motorized valve and pump) to be opened one by one, depending on the user's wishes.

Auto Mode

According to the set operating pressure, the pressurizing and depressurizing process is carried out automatically.

Stop Mode

It turns off all equipment on the device in a safe way and puts the device in standby mode.

Air Receive Mode

With the programmable bleed mode, the Pumped Expansion / Pressurization Unit can automatically provide the necessary circulation, separating the air in the plant and discharging it through the air purge on the tank.

Information Menu

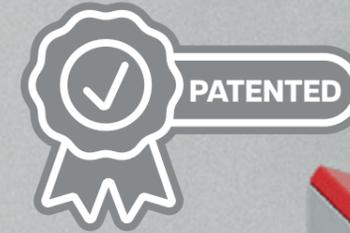
This section contains information such as the place where the system is operated, the system serial number, code, operating conditions, etc.



Automation

The Pumped Expansion/Pressurization Unit is designed with advanced automation capabilities to meet high technological standards.

- With MODBUS RS-485 compatibility, it can send 6 different types of information signals to the building automation center.
- Through software with MQTT infrastructure, it can transmit desired data to the building automation center and provide screen mirroring when an internet connection is established via Wi-Fi or Ethernet.
- Devices connected to the internet are monitored 24/7 by the Tanpera Service Management Center, offering user notifications and real-time intervention in case of errors.
- Connectivity and control are available through a mobile application compatible with all devices running the Android operating system.



PUMPED EXPANSION PRESSURIZATION UNIT

Nova System Expansion Tanks

The exterior of the expansion tank is painted with industrial paint to withstand the conditions in heat centers. The inner part of the tank is painted with anti-corrosion paint to increase corrosion resistance. Plant water is contained in the membrane. The outside of the membrane is open to the atmosphere and is non-pressurized. A small diameter inverted U-tube mounted on the top bulge of the tank provides free air inlet and outlet. Air can be discharged from the system through a purge valve mounted at the top of the tank. Problem-free and long-lasting operation of the installation system is ensured.

In order to ensure a safe operation, there is a liquid detection sensor in the tank body. When the sensor detects liquid due to membrane bursting etc., it recognizes this information as a malfunction. The command and control panel gives a fault indication and a signal is transmitted to the building automation. Membranes are of a replaceable type and can be supplied as spare parts if desired. Depending on the operating condition of the tank, the weight of the water stored in it varies. There is a weight sensor built into one of the legs. The digital data from the weight sensor is fed to the control panel and the display shows the amount of water in the tank. The operating conditions of the Pumped Expansion / Pressurization Unit are provided according to these parameters.

Stainless flexible connection sets between the tank and the control unit are supplied as standard in TPG systems.

The expansion tanks used in these systems are specially manufactured in accordance with Tanpera Pumped Expansion / Pressurization Unit.

Pressure Equalization Tank

Dynamic Pressure Balance Tank is used to absorb the pressure differences caused by sudden load changes of the plant pressure, which can be considered constant in the system, or by the pressurization pump switching on and off, and to minimize the pressure difference.

Dynamic pressure balancing tanks (50, 100, or 200 liters), provided depending on the water volume in the system and operating pressure, are included as standard in the delivery scope.



SHIPPING, INSTALLATION, ASSEMBLY AND COST CONDITIONS

ROW	EQUIPMENT, FUNCTIONS	TPG	TGT	EXPLANATION
	Shipping, freight, and transportation costs.	High	Low	TPG Systems, use approximately 1/5 as much low-volume product for the same job.
	Ease of installation.	Hard	Easy	For the same operation, TPG systems use products with approximately 1/5 less volume.
	Ease of initial commissioning and installation.	Hard	Easy	Air supplementation is not required for operating pressure adjustment.
	Special flange with multiple connection outlets under the tank.	None	Yes	It provides the ability to control additional tanks from a single system and easily drain water from the bottom of the tank when needed.
	Initial investment cost for large expansion volumes.	High	Low	It allows providing the same expansion amount at a lower cost for expansion tank requirements of 3000 liters and above.

OPERATION

	Expansion - Contraction Function	Yes	Yes	In expansion tanks, the line is always open. In TPG systems, expansion is achieved by opening the open line control valve, while the contraction function is achieved by pressurizing the water with the pump.
	Effective Expansion Volume (*)	%20	%95	
	Mandatory periodic pressure resistance inspection requirement.	Yes	None	The expansion tanks used in all buildings must be inspected once a year by accredited organizations (TS 1203 EN 286-1).
	Bleed mode or air purge.	None	None	With the deaeration mode in the TPG-PRO system, the water in the plant is automatically circulated and the air entering the tank is separated and discharged through the purge on the tank.
	Membrane lifetime.	Short	Yes	In TPG systems, membrane life is prolonged because there is no high-pressure gas outside the membrane.
	Membrane air diffusion.	Short	Long	Since there is no high-pressure gas outside the membrane in TPG systems, air diffusion is very low.

SAFETY AND CONTROL OPTIONS

	System control unit.	None	Yes	TPG systems provide all command and control operations from an ergonomic user panel.
	Ability to control the water level in the tank.	None	Yes	Thanks to the load sensor in the special tanks of TPG systems, the tank fullness rate is measured instantaneously.
	Ability to maintain constant pressure in expansion - contraction function (+/- 0.1 bar)	None	Yes	TPG systems stabilize the plant pressure with high precision thanks to sensitive sensors and control unit.
	Reading the operating pressure	None	Yes	In TPG systems, it offers the opportunity to read the operating pressure instantly on the panel.
	Possibility to change the operating pressure setting if necessary.	Hard	Easy	In TPG systems, the operating pressure can be easily changed without any authorized intervention by simply adjusting the setting on the control panel.

Effective Expansion Volume=Trade volume in buildings (hotels, offices, hospitals, and high-rise residences), the operating pressure and safety valve opening pressure are close to each other in terms of material pressure class economics. Pressure factors calculated in various applications give an average value of $D_f=0.2$, i.e., 20%. In TPG systems, the pressure factor $D_f=0.95$ i.e., 95% is applied.



ABBREVIATIONS AND FORMULAS

WITH DIRECT HEATER THAT DOES NOT EXCEED 90°C WATER TEMPERATURE SPECIFIED IN EN 12828 VDI 4708 STANDARD (BOILER VS.) PUMPED EXPANSION UNIT CALCULATION CRITERIA, ABBREVIATIONS, FORMULAS AND EXAMPLE CALCULATION

Q = Heat capacity of the system. (MW, kW, W)
Vs = Water quantity of the system (lt)
Ve = Amount of water that can expand in the system (lt)
Vn = Amount of water to be added to the system (lt)
V = Nominal volume of the tank in the selected or used closed and Pumped Expansion Unit
e = Heat transfer equipment used or planned to be used in the system (Radiator, Convector, Specific amount of water (lt/kW) at 1 kW heat capacity (fancoil etc.) Table 1
f = It is the rate of filling the tank of the Pumped Expansion Unit with water at a rate of %. Our company uses 90% rate its own system.
Hst = Static height above the system (m), for pressure value $p_o = Hst/10$ (bar)
p_o = Minimum required pressure (bar)
p_a = Initial pressure (bar)
p_e = End pressure (bar)
p_{s vs} = Set opening pressure (bar)
p_{s vc} = Tolerance of the safety valve in the closing direction (bar)
p_{s vo} = Tolerance of the safety valve in the opening direction (bar) For pressure up to 5 bar, the p _{s vs} value is accepted as 0.5 bar. For higher pressure values, %10 of the P _{s vs} value can be used, i.e. p _{s vo} = 0.1 x p _{s vs} .
For pressure up to 5 bar, the p _{s vs} value is accepted as 0.5 bar.
t_{s max} = Maximum temperature of the system water (C)
t_r = System return water temperature (C)
t_{s min} = The lowest water temperature (C) of the system, minimum 0 C if no antifreeze is to be used. Depending on the suitability of the environmental conditions, however, 5-10 C is acceptable.

Effective Working Range



$$p_{st} = Hst (m)/10 = p_{st} \text{ (bar)}$$

$p_o = p_{st} + (0.1 - 0.4)$ bar, usually 0.2 or 0.3 bar is taken
Our company's recommendation is 0.3 bar

$p_a = p_o + (0.1 - 0.3)$ bar, usually 0.2 or 0.3 bar is taken
Our company's recommendation is 0.3 bar

$p_e = p_o + (0.2 - 0.6)$ bar, usually 0.2 or 0.3 bar is taken
Our company's recommendation is 0.3 bar*

The details of the safety valve are explained with the example below. In the system design, it must be ensured that $p_e \leq p_{svo}$ *

EXAMPLE CALCULATION

MEMBRANE TANK AND PUMPED EXPANSION / PRESSURIZATION SYSTEM
SAMPLE CALCULATION AND SELECTIONS

Table 1: Specific water quantity based on the characteristics of heat exchangers and operating temperatures (lt/kW)

	90/70°C	80/60°C	75/55°C	65/50°C	60/45°C	55/45°C	50/40°C	45/35°C	35/28°C
Cast Iron Radiator	14	16,5	20,5	24	28	32	37		
Panel Radiator	9	10	12	14	16	18	20		
Convector	6,5	7	8	9	10,5	12	13,5		
Fancoil	6	6,5	7	8	9	10	11		
Underfloor Heating							20,5	29	28

Table 2: Expansion factors based on the mixture of water and antifreeze and ambient temperature (taking into account that ambient temperature for the fluid in cold environments will be 10°C) The maximum ambient temperature that can occur in cooling applications for Turkey is 40 °C

	0°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
%100 Water		0,0016	0,0041	0,0077	0,0119	0,0169	0,0226	0,0288	0,0357
%30 Ethylene Glycol + %70 Water	(-14,5°C)	0,0093	0,0129	0,0169	0,0224	0,0286	0,0352	0,0422	0,0497
%40 Ethylene Glycol + %60 Water	(-23,9°C)	0,0144	0,0189	0,024	0,03	0,0363	0,0432	0,0505	0,0582
%50 Ethylene Glycol + %70 Water	(-35,6°C)	0,0198	0,0251	0,0307	0,037	0,0437	0,0507	0,0581	0,066
%30 Ethylene Glycol + %70 Water	(-12,9°C)	0,0151	0,0207	0,0267	0,0333	0,0401	0,0476	0,0554	0,0639
%40 Ethylene Glycol + %60 Water	(-20,9°C)	0,2111	0,272	0,338	0,408	0,481	0,561	0,644	0,731
%50 Ethylene Glycol + %50 Water	(-33,2°C)	0,2888	0,355	0,425	0,05	0,0577	0,066	0,0747	0,0839

CALCULATIONS AND DATA USED

Required minimum pressure = PST + (0.2 bar) = 3.0 + 0.2 = 3.2 bar.
With a safety margin added, Pa (initial operating pressure) = Po + 0.2 bar = 3.2 + 0.2 = 3.4 bar.
Pe (final operating pressure) = Pa + 0.2 bar = 3.4 + 0.2 = 3.6 bar.
The optimum operating pressure is between Pa and Pe, Popt = 3.5 bar.

The predicted safety valve opening pressure P_{s vs} = 5.0 bar, based on the material's pressure resistance class and operating pressure.
After accounting for a 10% working tolerance (0.5 bar), P_{s v} = 5.0 - 0.5 = 4.5 bar.

The specific water quantity based on the operating temperature of 80/60°C and the type of heat exchanger is V_s = 10 lt/kW (data is taken from the table).

The fluid expansion factor = (100%water and 80-10°C) e = 0.0288 (data is taken from the table).
For the membrane tank, Df (pressure factor) = ((4.5 + 1) - (3.5 + 1)) / (4.5 + 1) = 1 / 5.5, Df=0.18.

For the Tanpera Pumped Expansion / Pressurization Unit we use (TPG/S or TPG/P) the pressure factor (tank useful volume or usage percentage is 90% = Df = 0.9. For safety reasons, this ratio can be used as 100% = 1.0.

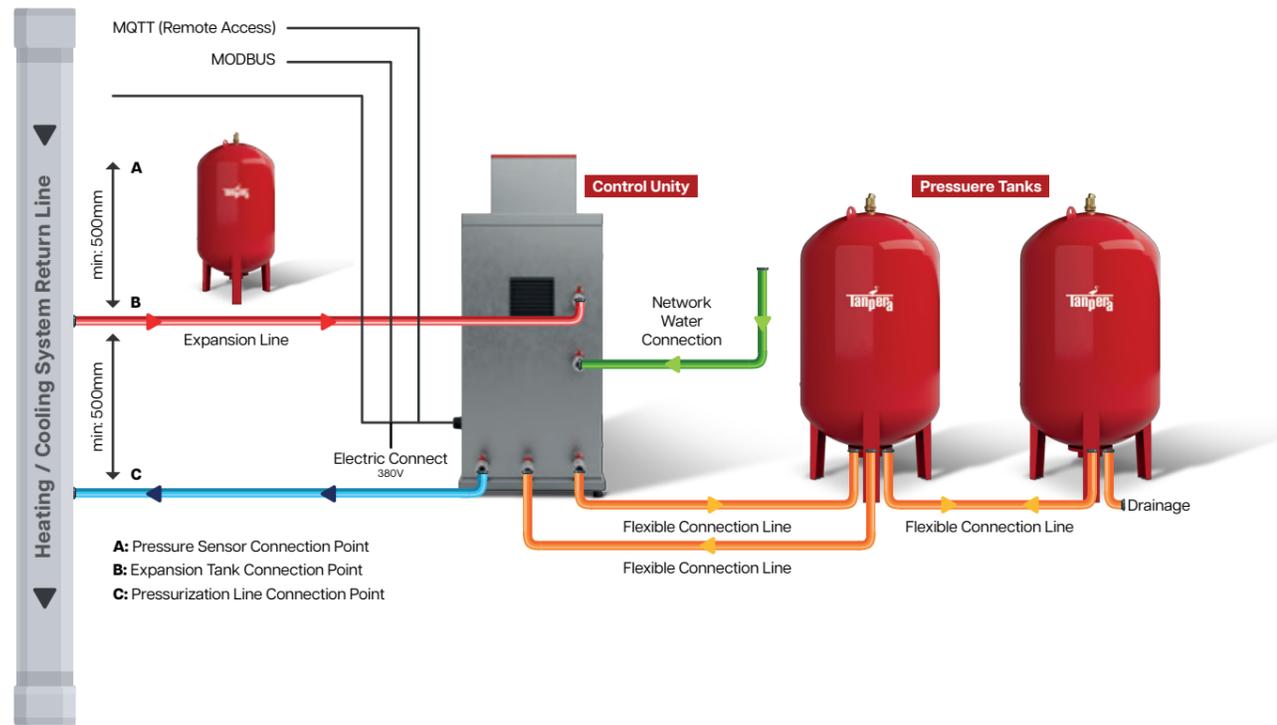
The water volume in the system V_s = Q x V_s, V_s = 1,300 lt x 10 lt/kW = 13,000 lt.
For the initial water reserve to account for water loss: V_{wr} = V_s x 0.005
The amount of expandable water V_e = (V_s x e) + V_{wr} = (13,000 lt x 0.0288) + V_{wr} = 374 lt + 65 lt = 439 lt.

The nominal tank volume for the membrane tank is V_n = V_e / Df, V_n = 439 lt / 0.18 = 2,439 lt.
According to the production schedule, since the next available tank volume after 2,439 liters is 2.500 liters.

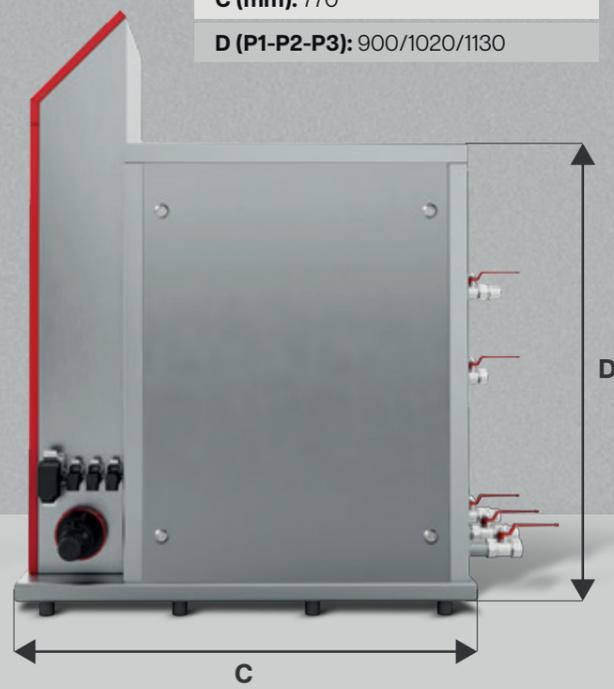
The selected membrane tank model is TGT 2500/10.

Nominal tank volume for the pumped expansion unit: V_n = V_e / Df V_n = 439lt / 0,9 = 487 lt

Selected pumped expansion unit TPG 1Tx500/10-1PxP1v-50



Tanpera TP Dimensioning	
A (mm):	420
B (mm):	1200
C (mm):	770
D (P1-P2-P3):	900/1020/1130



TANPERA EXPANSION TANK DIMENSIONING			
Volume (lt)	D (mm)	H (mm)	Connection Diameters
300	650	650	1"
500	750	750	1"
750	850	850	1"
1000	960	960	1"
1500	960	960	1"
2000	1200	1200	1"
2500	1200	1200	1"
3000	1500	1500	1"
4000	1450	1450	1"
5000	1450	1450	1"



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

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