KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

Expansion Vessels - Knowing the facts

What is an Expansion Vessel?

An expansion vessel is a pressurised vessel that incorporates a bladder or diaphragm in its design and is installed in unvented heating, cooling, potable water and solar heating systems. These are also referred to by some manufacturers as Expansion Tanks or Pressure Vessels.

It consists of a fabricated pressure vessel, water system connection, air valve and a membrane (diaphragm) or bladder. The membrane or bladder separates the pre-charged air or nitrogen from the system water.

Membranes are usually retained centrally in the vessel by crimping the two halves together. Bladders are usually retained by the water system connection.

What do they do?

The expansion vessel accommodates any increases in water volume which occurs during heating or cooling, keeping the pressure of the system stable by absorbing the extra volume. This helps maintain a constant pressure which can aid a reduction in energy consumption.

Why is this important?

Within a pressurised heating or cooling system, it is important to maintain the pressure within the required limits, therefore reducing the risk of excess pressure or to maintain a minimum pressure to reduce the risk of vacuum or cavitation in the system (prevalent in superheated water and solar heating systems). It is also important to prevent negative pressure at high points to reduce the potential for air pockets or to compensate for variations in volumes due to temperature fluctuations.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

How does it work?

A pressurised membrane (also called a bladder or diaphragm) allows the ingress or egress of water from the system to maintain a constant pressure.

As water cannot be compressed in a closed water circuit, any increase in temperature needs to be accommodated and this is done by the expansion vessel.
When cold the pre-charged pressure allows the bladder to collapse and it remains in this state until the pump is switched on which then causes the bladder to inflate.
As the water temperature increases, there is an increase in volume and pressure.
The increased volume of water enters the bladder which lowers the pressure.
As the temperature reduces, the pre-charged pressure forces the water from the bladder and back into the main water circuit.

Expansion vessels are also available which specifically combat water hammer.
In these types of Expansion Vessels, the liquid is contained within the rubber bladder while the air (nitrogen) is trapped in the space between the outside of the bladder and the wall of the vessel.
The liquid is therefore not in contact with the steel walls of the vessel and since the water is contained in a minimum permeability butyl rubber bladder, there is no air dissolution.
Once installed, commissioned and set at the adequate pre-charge pressure, the bladder will help dampen any water hammer pressure waves which may result resulting from quick opening or shutting of valves.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

What Types of Expansion vessels are there?

There are many different types available to suit the specific application and the operating conditions so careful selection is vital.

Options available include:

- Expansion vessel shape can be cylindrical or tubular design for installation horizontally or vertically.
- Compact or flat designs (for built in boiler applications). Shaped tanks to prevent sediment or bubbles becoming trapped in corners are also available.
- Capacity, bladder or diaphragm design and membrane type will also influence the product selection.
- Fixed or replaceable (Interchangeable) bladder or membrane design.
- Rolling diaphragm design having a ribbed profile to reduce or prevent the diaphragm from sticking to the inside wall.
- Seamless diaphragm design to prevent stretching and creasing
- Bladders or diaphragms can be manufactured from synthetic compounds, butyl, SBR and EPDM. Special membranes are also available for high temperatures in solar applications.
- Expansion vessels can have a pre-pressurised air chamber or a charged air valve (some are nitrogen filled).
- Expansion Vessel bodies can be manufactured from noryl plastic, carbon steel (with internal surfaces coated against corrosion), epoxy coated steel, stainless steel or coated stainless steel for hygienic applications

Some common selections include:

- Heating expansion vessels with non-replaceable diaphragms suitable for capacities between 8 to140 litres.
- Specially designed expansion vessels for potable water applications with a synthetic rubber compound bladder for capacities from 2 to 1000 litres (replaceable in sizes 60 to 1000 litres).
- PVA flow through potable water vertical installation 8-33 litres, complete with "flowjet" 4 function valve and tee for capacities between 60 and 1000 litres.
- PVH potable water horizontal installation replaceable bladder expansion vessels 25 to 100 litre capacity (replaceable except for 25 litre capacity).
- Mini expansion vessels being available for 0.16litre to 2 litre capacity.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

What Standards do I need to be aware of?

There are a variety of standards referred to in various leaflets and publications for Expansion Vessels.

These include:

• BS EN13831:2007 – Closed expansion vessels with built-in diaphragm for installation in water.

• BS EN 12828:2012+A1: 2014 – Heating systems in buildings. Design for water-based heating systems.

• Pressure Equipment Directive 2014/68/EU (formerly PED 97/23/EC)- this sets out the standards for the design and fabrication of pressure equipment (steam boilers, pressure vessels, piping, safety valves) and other components and assemblies subject to pressure loading, generally over one litre in volume and having a maximum pressure more than 0.5bar.

• 2014/108/EC – Directive of the European Parliament and Council on harmonisation of the laws of the Member States on electromagnetic compatibility.

• BS EN12977-3:2018 - Thermal solar systems and components. Custom built systems. Performance test methods for solar water heater stores.

• DIN 4757-1 – Solar Heating Plants operating on water or water mixtures as the heat transfer medium: requirements relating to safe design and construction.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

How should I size or select the expansion vessel?

There are expansion vessels available for various hot water systems. These need to be sized correctly for the capacity required. Different sources of heat can be applied to unvented hot water systems and it is important to control the temperature within normal limits. Installations where the heat source and input temperatures could be uncontrolled such as in solid fuel or solar thermal systems, require specific expansion vessels designed for these applications. Larger capacity expansion tanks are available where irrigation pumps, centrifugal pumps or booster sets are installed. To correctly size an expansion vessel, you will need to know the highest water temperature (flow temperature), the static height, the safety valve setting and either the system volume or the boiler or chiller power rating.

What is the expansion vessel capacity?

The capacity declared for the vessel is related to the volume of the tank and not the quantity of water that it can accommodate. The quantity of water in the tank is 60% of the tank's volume, which is considered a 'rule of thumb" when sizing pressure vessels.

Where should the expansion Vvessel be installed?

Expansion Vessels are typically used in unvented central heating systems in domestic and commercial projects. The expansion vessel is normally installed on the cold return pipework to the boiler, as this is typically less than 71°C. It is important to ensure that there is no obstruction between the expansion vessel and the system. The maximum allowable temperature of the diaphragm should be checked for suitability.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

Depending on the design selected, expansion vessels can be suitable for horizontal or vertical installation. Expansion vessels installed in the vertical orientation should be located so that the length of the connecting pipework is kept to a minimum. Ideally, these should be installed downwards to avoid any potential sediment build up.

In solar applications, it is recommended that the expansion vessel is installed in the return pipeline from the solar collector. If the return flow temperature is more than 70°C then it is recommended that an intermediate vessel is installed before the expansion vessel.

Expansion vessels can be installed on pressure booster systems in order to reduce pump starts at small draw-offs and help reduce pump wear and extend the pump life. In this case the expansion vessel is installed on the discharge side of the booster system. Maintenance of the vessel can also be carried out without shutting off the water supply. They can also be installed on the suction side, if the water pressure from the mains is too low which helps reduce the risk of cavitation in the pump or the creation of vacuum on start-up.

Do I need an anti-gravity loop?

An anti-gravity loop is a loop of pipe connecting the expansion vessel to the system. The loop is installed at a higher level than the vessel and forms a thermal trap, with the high temperatures from the system remaining at the top of the loop and cooler water remaining in the pipe-work to the vessel. However, if the expansion vessel is installed on the coolest part of the system, in most cases, an anti-gravity loop is unnecessary.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

What approvals are required?

The design and product conformity standards (PED & CE marking) are covered earlier in this guide sheet. For potable water applications, expansion vessels must be WRAS approved to show conformance to the UK Water Regulations.

The Water Supply (water fittings) Regulations and Water Supply (water fittings) (Scotland) Byelaws, play an important role in protecting public health, safeguarding water supplies and promoting the efficient use of water within customers' premises across the UK. They set legal requirements for the design, installation, operation and maintenance of plumbing systems, water fittings and water-using appliances. They have a specific purpose to prevent misuse, waste, undue consumption or erroneous measurement of water and, most importantly, to prevent contamination of drinking water.

Are expansion vessels suitable for anti-freeze or glycol mixtures?

Generally, these are suitable for addition of glycol-based anti-freeze up to 50% (between 25% and 50%) but the type of membrane should be checked for compatibility with the additive.

How often should the Expansion vessel be serviced?

The vessel should be inspected at least once each year or more regularly if a drop in system performance is observed.The vessel should be checked for external damage or corrosion and, where fitted, the air or nitrogen valve tested.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group

KNOWING THE FACTS

Technical Bulletin
Expansion Vessels

Got a Problem? - Common Trouble Shooting Issues

Ensure that the expansion vessel is installed and commissioned in accordance with the manufacturers installation and maintenance instructions. Check that all connections are tight and that joints are sealed but not over tightened.

Every morning my system has no pressure, I top up from the mains and next morning the pressure has gone, what is happening?

It is highly likely that the vessel has been installed for some time without the gas charge being checked (which must be carried out annually with the vessel disconnected from the system) or that the vessel is too small for the system and an additional expansion vessel is required.

I have extended my heating system to include my new extension, the needle on my pressure gauge seems higher than before - what is happening?

It is highly likely that the vessel is too small for the system and an additional expansion vessel is required.

t: +44 (0)1785 218 200
e: technical@altecnic.co.uk
w: www.altecnic.co.uk

altecnic
CALEFFI group