Expansion Tank Sizing, Commissioning & Maintenance

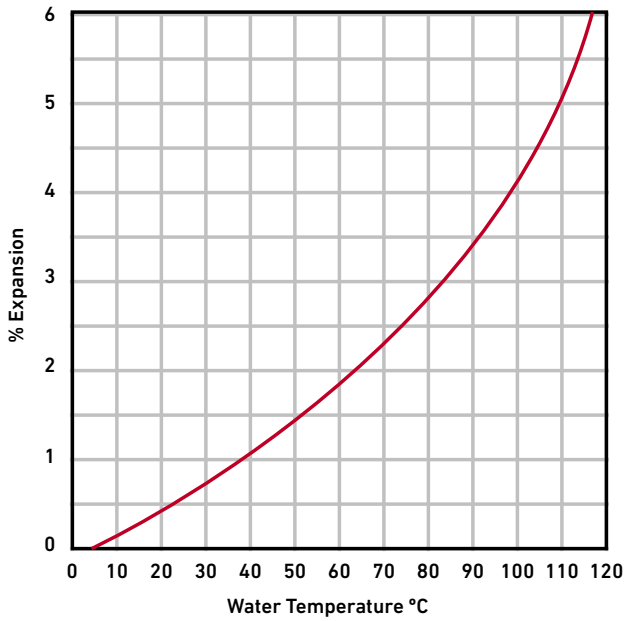
Sizing an Expansion Tank

Careful calculation of the expansion tank size is critical to the correct functioning of the system.

Expansion Coefficient

Calculate the expansion coefficient for your system by calculating the difference between the cold system water temperature (heating off) and the max working temperature.

°C	Coefficient
0	0.00013
10	0.00025
20	0.00174
30	0.00426
40	0.00782
50	0.01207
60	0.0145
65	0.01704
70	0.0198
75	0.02269
80	0.0258
85	0.02899
90	0.0324
95	0.0396
100	0.04343



Heating System

The expansion tank sizing formula is as follows:
(based on Boyles Law)

$$Vt = \frac{e \times C}{1 - (Pi/Pf)} = \frac{Vu}{1 - (Pi/Pf)}$$

where:

Vu = Total useful volume of tank = Vi - Vf

Vi = Initial volume

Vf = Final volume

e = Expansion coefficient

Pi = Initial charge pressure (absolute) of vessel.
This pressure must not be lower than the hydrostatic pressure at the point where the tank is connected to the system.

Pf = Maximum operating pressure (absolute) of the relief (safety) valve
taking into account any differences in level between the vessel and the safety valve.

C = Total water capacity of the system in litres: boiler, pipework, radiators etc
(as a general approximation, C is between 4 and 8 litres for every kW of boiler output)

Note: Calculations must be done in Absolute Pressure e.g. 100kPa = 200kPa absolute.

In standard heating systems:

e = 0.04318 (Tmax = 99°C, Tmin = 10°C, Δt = 89°C, C = 0.035)

Cooling System

The vessel sizing formula is as follows:
(based on Boyles Law)

$$Vt = \frac{e \times C}{1 - (Pi/Pf)}$$

In standard cooling systems:

e = 0.011 (Tmax = 50°C, T min =4°C)

Pi = Maximum plant pressure, corresponding to the maximum achievable temperature, equal to the ambient temperature, which is recommended to be fixed at 50°C

Pf = The final working pressure achieved at minimum temperature, using 4°C

Example

C = 500 litres

Pi = 150kPa (250kPa Abs)

Pf = 400kPa (500kPa Abs)

V = 0.04318 x 500 = 43.2 litres

1 - (250/500)

Select the next largest sized tank 50 litres

Calculating Expansion Tank Pre-charge Pressure

Please use the below calculation to correctly determine the expansion tank pre-charge pressure:

Pi = [Hm x 10] + 20kPa

where:

Pi = Initial charge pressure (absolute) of vessel

Hm = System height (metres) above the location of the expansion tank

Installation

1. The expansion tank must be installed on the suction side the system pump and preferably in the coolest part of the system e.g. on return to boiler.
2. Ensure water entering the tank is less than 70°C, to prevent premature diaphragm failure. If water temperature is higher than 70°C, an intermediate tank must be installed between the expansion tank and the system.
3. The expansion tank must be installed with a lockable service valve and drain point. This is to ensure the tank can be serviced properly in the future.
4. The expansion tank must be installed with a pressure relief valve between the tank and the lockable service valve, to protect the tank from overpressure situations.
5. The pressure relief valve rating must be no higher than the safe working pressure of the expansion tank.

Commissioning

Please follow the below 4 step process for commissioning an expansion tank:

1. **Disconnect**
   a. Isolate the expansion tank from the system via the lockable service valve. This is crucial to ensure an accurate pressure reading.
   b. Disconnect from the system and drain the tank.
2. **Test**
   a. Calculate the correct expansion tank pre-charge pressure.
   b. Test the pre-charge pressure in the expansion tank via the Schrader valve.
3. **Charge**
   a. Charge the expansion tank to the correct (see note on calculating pre-charge pressure) pressure via the Schrader valve, using an air compressor or nitrogen canister.
   b. Recheck tank charge to ensure pre-charge pressure is holding. If a leak is found, the Schrader valve or the expansion tank will need replacing.
4. **Reconnect**
   a. Reconnect the expansion tank to the system.
   b. Re-pressurise the system and check for leaks.

Maintenance

Please follow the below 5 step process for maintaining an expansion tank:

1. **Inspect**
   a. Perform a visual check of expansion tank to ensure no obvious damage or corrosion is present.
   b. To check the integrity of the diaphragm, press down the Schrader valve. If water exits the valve, the diaphragm has ruptured and the expansion tank will need replacing.
2. **Disconnect**
   a. Isolate the expansion tank from the system via the lockable service valve. This is crucial to ensure an accurate pressure reading.
   b. Disconnect from the system and drain the tank.
3. **Test**
   a. Calculate the correct expansion tank (see note on calculating pre-charge pressure)
   b. Test the pre-charge pressure in the expansion tank via the Schrader valve.
4. **Charge**
   a. Charge the expansion tank to the correct pre-charge pressure via the Schrader valve, using an air compressor or nitrogen canister.
   b. Recheck tank charge to ensure pressure is holding. If a leak is found, the Schrader valve or the expansion tank will need replacing.
5. **Reconnect**
   a. Reconnect the expansion tank to the system.
   b. Re-pressurise the system and check for leaks.