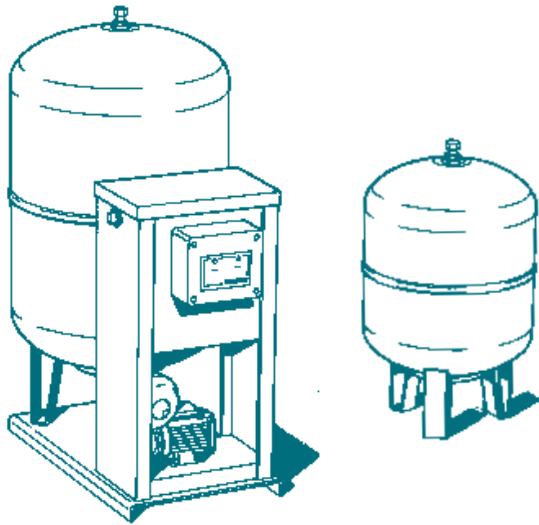


THERMOFLO

SEALED SYSTEM SELECTION



THERMOFLO SEALED SYSTEMS FOR HEATING, COOLING AND WATER SUPPLY APPLICATIONS

ThermoFlo sealed systems eliminate the need for an open expansion cistern and feed pipe, they do not have an open vent, thus corrosion risks due to the ingress of air are minimized. They also allow, in appropriate installations, the use of smaller pipes and heating surfaces by operating at temperatures in excess of 100°C.

DESIGN CONSIDERATIONS

In a sealed water system, allowance has to be made to accommodate the increased volume of water resulting from thermal expansion, therefore satisfactory operation depends on correctly selected expansion vessels and ancillary equipment, installed and applied according to good customary design practice.

Generally the selection and application procedures outlined are in compliance with British Standard code of practice BS7074 Parts 2&3:1989.

Equipment selection is based on the following design stage data:

Total system volume (litres)-the total volume of water in the complete system.

System flow temperature (°C) - the maximum design temperature of the water circulating in the system.

Maximum ambient temperature (°C) - in chilled water system applications, the maximum ambient temperature is used to calculate the expansion volume.

Static height pressure (bar) - the pressure created by the system height between the uppermost part of the circuit and the expansion vessel level.

Final system design pressure (bar) - the pressure occurring at the expansion vessel at maximum design temperature.

SELECTION PROCEDURE

- Determine the **initial system design pressure** at the **initial cold water fill temperature**, taken to be 4°C, calculated as:

initial pressure = static pressure + pressure margin (see table) - bar

- Calculate the system **expansion volume**, the increase in volume of water when raised to the design temperature, according to:

expansion volume = total system volume x expansion factor (see table) - litres

- The expansion vessel can be selected, from the vessel chart, to accommodate the calculated **expansion volume** within the **maximum acceptance volume** of the vessel and allowing at least a 10% margin.

- Calculate the **design acceptance factor**, the ratio of the **expansion volume** to the **total vessel volume**, thus:

acceptance factor = $\frac{\text{expansion volume}}{\text{total vessel volume}}$

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SELECTION PROCEDURE

- As a consequence of raising the system water temperature to the **maximum design temperature**, the system pressure will increase to the **final system design pressure** calculated as:

$$\text{final pressure} = \frac{\text{initial pressure} + \text{acceptance factor}}{1.0 - \text{acceptance factor}}$$
- If the calculated **final pressure** is higher than required, it can be reduced by reselecting a larger volume expansion vessel.
- The initial system design pressure will be automatically maintained by a Thermoflo pressurizer incorporating high and low pressure switches, set to interrupt the heat source or chiller when predetermined maximum or minimum system pressures are reached.

SELECTION EXAMPLE

- An office building is to be provided with a low temperature hot water heating system, having flow and return temperatures of 82°C and 71°C respectively.
 The expansion vessel and pressurizer will be located in the basement plantroom and subject to the maximum pressure, - the distance from the equipment level to the uppermost part of the heating circuit is 20 metres.
 The component having the lowest working pressure is the boiler at 5 bar, from which a safety valve lifting margin of 0.7 bar is subtracted leaving 4.3 bar.
 The pressure head of the circulating pump is 60 kN/m² and it is located so that the boiler and expansion vessel connection are on its suction side, the effect of the pump head will be to lower the pressure at the boiler, therefore the 4.3 bar can be considered as the maximum allowable pressure at the expansion vessel.
Total system volume 5,000 litres
Flow temperature 82°C
Static pressure 2.0 bar
Maximum allowable pressure 4.3 bar
- Initial pressure = static pressure + pressure margin**
 The pressure margin at 82°C from table is 0.5 bar
Initial pressure = 2.0 + 0.5 = 2.5 bar
- Expansion volume = total system volume x expansion factor**
 The expansion factor at 82°C from table is 0.03
Expansion volume = 5,000 x 0.03 = 150 litres
- From the expansion vessel chart, model DA500 is selected to accept 150 litres expansion volume with at least 10% margin.
Acceptance factor = $\frac{\text{expansion volume}}{\text{total vessel volume}}$
Acceptance factor = $\frac{150}{500} = 0.3$
- The final pressure is calculated according to:
Final pressure = $\frac{\text{initial pressure} + \text{acceptance factor}}{1.0 - \text{acceptance factor}}$
Final pressure = $\frac{2.5 + 0.3}{1.0 - 0.3} = 4.0$ bar
 The safety valve set pressure will be 4.0 + 0.7 = 4.7 bar or nearest practical setting within the maximum allowable system pressure.
- The appropriate pressurizer can be selected to maintain the **initial system design pressure**.
- The expansion vessel and pressuriser can be combined as a factory assembled, base mounted sealed system to reduce on-site installation.

MAXIMUM TEMPERATURE °C	PRESSURE MARGIN BAR	EXPANSION FACTOR			
		WATER	WATER WITH ANTI-FREEZE		
			20%	35%	50%
20	0.5	0.002	0.006	0.008	0.010
30	0.5	0.005	0.010	0.012	0.015
40	0.5	0.008	0.013	0.017	0.021
50	0.5	0.012	0.018	0.022	0.026
60	0.5	0.017			
70	0.5	0.023			
82	0.5	0.030			
90	0.8	0.036			
100	1.3	0.044			
110	2.0	0.052			
120	2.5	0.060			

Pressure margin - The additional pressure imposed on the circuit to exclude air from the system at the highest point.

At temperatures of 100°C and above the **pressure margin** includes an **anti-flash margin** of 17°C in accordance with Health and Safety Executive (PM5) guidance.