Expansion vessels for primary circuit in solar thermal systems

259 series

01246/13 GB

ISO 9001 FM 21654 ISO 9001 No. 0003

Function

The closed expansion vessel with membrane consists of a closed container divided into two parts by a membrane which separates water from gas (nitrogen or air) and which acts as an expansion compensation device.
After the temperature of the medium increases, the pressure inside the vessel keeps rising from its cold preset value, until the maximum expansion value is reached.

CE 0045

Product range

259 series Welded expansion vessel for primary circuit in solar thermal systems, CE certified — capacity (litres): 8, 12, 18, 25, 33, 50

Technical specifications

Materials:

Body:	steel
Membrane:	8–33 l, butyl; 50 l SBR
Type of membrane:	8–33 l, with bladder; 50 l with diaphragm
Pipe connection:	galvanised steel
Colour:	white

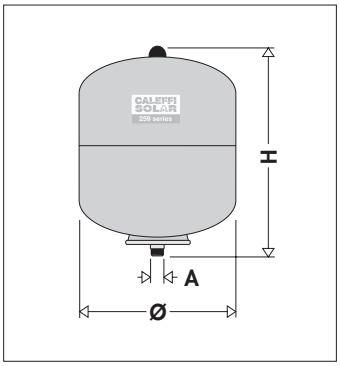
Performance:

Medium:	water, glycol solutions
Max. percentage of glycol:	50%
Maximum working pressure:	10 bar
Pre-charge pressure:	2,5 bar
System working temperature range:	-10–120°C
Membrane working temperature range:	-10–70°C
Construction:	conforms to EN 13831

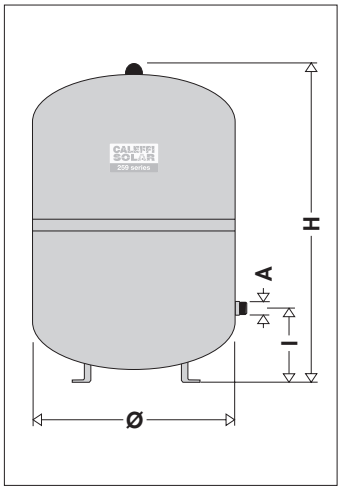
Application: primary circuit in solar thermal systems

Connections: 8–33 l, 3/4" M (ISO 228-1); 50 l, 3/4" M (ISO 7-1)

Dimensions



Code	Litres	A	Ø	H	Mass (kg)
259008	8	3/4"	206	325	2,5
259012	12	3/4"	280	300	3,5
259018	18	3/4"	280	380	4,5
259025	25	3/4"	280	500	5,5
259033	33	3/4"	354	450	6,3



Code	Litres	A	Ø	H	I	Mass (kg)
259050	50	3/4"	409	469	168	13,2

Solar thermal systems

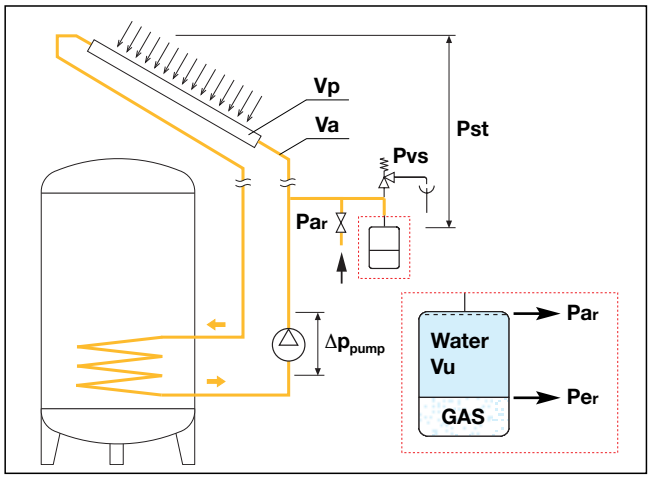


Table 1 - Indicative coefficient "n" as the temperature "T (°C)" varies in relation to the temperature of 10°C, with and without glycol "%"

°C	-20	-10	0	10	20	30	40	50	60	70	80	90	100	110	120	130
% glycol																
0			0	0,1	0,2	0,4	0,8	1,2	1,7	2,3	2,9	3,6	4,3	5,2	6,0	6,9
10			0,1	0,3	0,5	0,7	1,1	1,5	2,0	2,6	3,2	3,9	4,6	5,5	6,3	7,3
20			0,2	0,5	0,8	1,1	1,4	1,8	2,3	2,9	3,5	4,2	4,9	5,8	6,7	7,6
30		0,1	0,4	0,7	1,0	1,3	1,6	2,1	2,6	3,1	3,8	4,4	5,2	6,0	6,9	7,8
40	0,4	0,7	1,0	1,3	1,5	1,7	2,1	2,5	3,0	3,6	4,2	4,9	5,6	6,4	7,3	8,2
50	0,6	0,9	1,2	1,5	1,8	2,0	2,4	2,8	3,3	3,9	4,5	5,2	5,9	6,7	7,6	8,5

Table 2 - Glycol solution vaporisation pressure (bar)

°C	100	110	120	130	140	150	160	170	180	190
% glycol										
30	0	0,3	0,8	1,4	2,3	3,2	4,4	5,7	7,2	8,8
40	0	0,2	0,6	1,2	2,0	2,9	4,0	5,5	6,6	8,1

Sizing method - Solar thermal systems

e = medium expansion coefficient at various temperatures (see table 1)

$$e = n/100$$

k = 1,1; safety coefficient which takes into account:
- the possible evaporation of the medium due to stagnation in the panel
- an initial water reserve in the vessel to compensate for any loss of medium in the circuit as a whole
- the contribution of the pump head in relation to the position of the vessel (positioned on the circuit flow line)

Definition of volumes
Vn = vessel volume (l), to be calculated
Vp = content of medium in the solar panels (l)
Va = content of water in the system (l) = Vp + volume in the pipes (l)
Ve = expansion volume due to the water heating up (l)
Vu = useful volume of the vessel:

$$Vu = (Va \cdot e + Vp) \cdot k$$

Pressure definition - all the pressures listed below are measured at the pressure gauge (relative pressure):

Pst = hydrostatic pressure at the point of installation (bar)
Pvs = safety relief valve setting pressure (bar)
Pd = vaporisation pressure (bar) (Table 2)
ΔP_{pump} = pump head (bar)
P0 = vessel pre-charge pressure at the gas side (bar)

$$P_0 = Pst + Pd + \Delta p_{pump}$$

Par = relative filling pressure at the water side (bar) **= P0**

P0 = average recommended value = Pst + 0,5 (bar)

Per = maximum system working pressure at the gas side (bar), i.e. Pvs decreased by a pressure value which prevents the safety relief valve from opening

$$Per = Pvs - 0,5 \text{ bar (10\% Pvs if Pvs} > 5 \text{ bar)}$$

The capacity of a closed expansion vessel with membrane (diaphragm) for solar thermal systems is calculated by applying the following formula:

$$Vn = Vu \cdot (Per + 1) / (Per - P_0) \quad (1)$$

Example:

Sizing an expansion vessel for a solar thermal system with the following technical specifications:

Vp = *content of medium in the solar panels =* ***4 l***
Va = *content of water in the system (Vp + volume in the pipes) =* ***20 l***
e = *medium expansion coefficient for glycol solutions =* ***0,07*** *(at 120°C and 30% glycol)*
Pvs = *safety relief valve setting pressure =* ***6 bar***
Pst = *hydrostatic pressure =* ***1,5 bar***

Solution:

Par = *relative filling pressure at the water side (recommended average value) = Pst + 0,5 = 1,5 + 0,5 =* ***2 bar***
P0 = *vessel pre-charge pressure at the gas side = Par =* ***2 bar***
Per = *maximum relative system working pressure at the gas side = Psv – 0,5 = 6 – 0,5 =* ***5,5 bar***
Vu = *useful volume of the vessel = (Va · e + Vp) · k = (20 · 0,07 + 4) · 1,1 =* ***5,94 l***

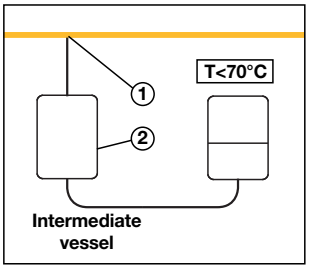
Formula (1) above is applied to calculate the volume of the vessel ***Vn****:*

$$Vn = 5,94 \cdot (5,5 + 1) / (5,5 - 2) = 11,03 \text{ l}$$

A 12 l vessel should therefore be selected *(this must be preset to 2 bar)*

Installation

If the temperature at the point of installation (1) causes the vessel to reach a temperature over 70°C, it is advisable to adopt suitable system devices, such as an intermediate through-vessel (2).



SPECIFICATION SUMMARY

259 series
Expansion vessel for primary circuit in solar thermal systems, CE certified. Connection 3/4" M (from 8 to 33 l ISO 228-1 thread; 50 l ISO 7-1 thread). Steel body. Bladder membrane in butyl (from 8 to 33 l); diaphragm membrane in SBR (50 l). Galvanised steel connection to pipe. White colour. Medium water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 10 bar. Pre-charge pressure 2,5 bar. System working temperature range -10–120°C; membrane working temperature range -10-70°C.

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