reflex
Thinking solutions.

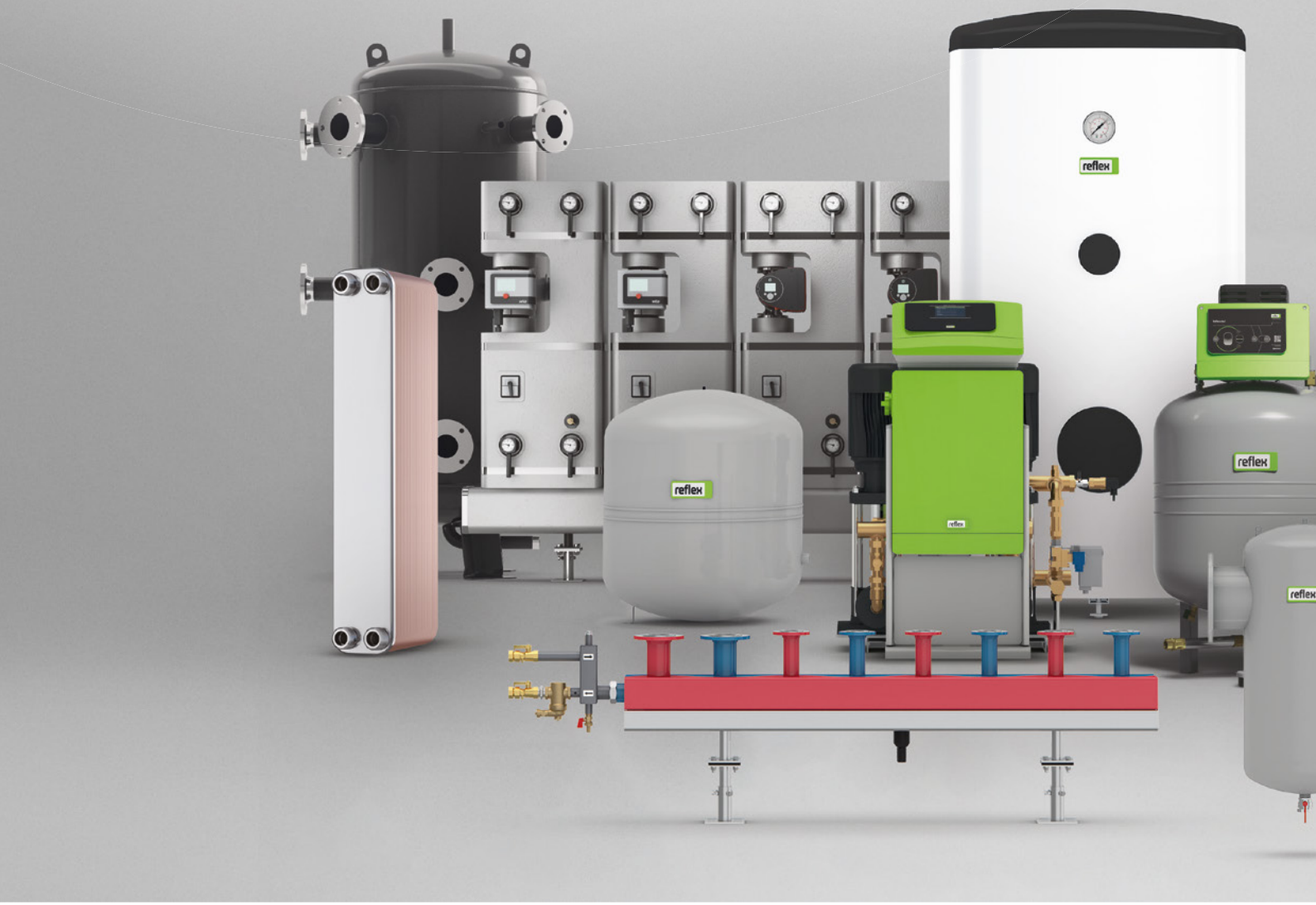
Expansion vessels

Reflex
Refix

Reflex—
a powerful brand for decades

Reflex Winkelmann GmbH is a leading provider of highquality heating and hot water supply technology systems. Under its Reflex brand, the company, which has its headquarters in Ahlen in the German region of Westphalia, develops, produces and sells not only diaphragm expansion vessels, but also innovative components and holistic solutions for pressure maintenance, water make-up, degassing and water treatment, storage water tanks and plate heat exchangers, as well as hydraulic manifold and tank components. Reflex Winkelmann GmbH has about 2,000 employees worldwide, giving it an international presence in all major markets.

With its energy-efficient and sustainable products, the company is already doing its bit to help the environment, as evidenced by its commitment to sustainability and the climate policy goals agreed by the German Federal Government. This support is built on proven technologies and future-oriented innovations. What's more, Reflex Winkelmann GmbH works together with others as equals, always maintains its focus on the customer and offers additional services such as its own factory service centre fleet and a comprehensive range of training options.



Contents

Our configuration software

Reflex Solutions **Pro**
rsp.reflex.de/en

→ Read more on page 58

Reflex City

Reliable pressure maintenance for all requirements
Living, shopping, working and producing: city-life means diversity. Supply technology requirements are as individual as the buildings themselves. Whether it's a 5 kW facility in a detached home or a safety-related cooling system in a computer centre — Reflex offers products and solutions for systems of all sizes and complexities. As shown in our Reflex City concept.

Wherever there is a need for the correct pressure, that's where you will find Reflex pressure maintenance systems. As the market leader, Reflex services many different application areas: from solar systems in homes, via direct installation in boilers, to potable water supplies in residential complexes.

Pressure maintenance

Pressure maintenance system tasks

Correct pressure ratios are a basic precondition for correct functioning of heating, solar and cooling water systems and pressure booster systems. Like all other substances, the volume of water changes with its temperature. Unlike other liquids, water does not expand proportionately to the temperature. As water cannot be compressed, this means the pressure increases significantly in closed systems as the temperature changes.

Optimum pressure maintenance is achieved with two different pressure maintenance systems depending on the application:

- Static pressure maintenance systems (expansion vessels)
- Dynamic pressure maintenance systems

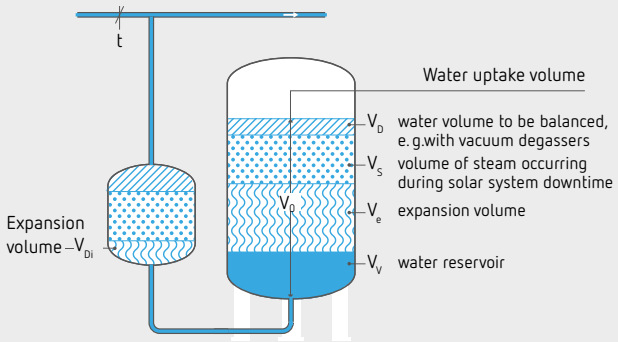
Further information can be found in the brochure: Pressurisation Systems

Essentially, pressure maintenance systems have to fulfil three fundamental tasks:

1. Maintain the pressure within permissible limits at all points in the facility system. This means ensuring the permissible operating pressure is not exceeded but also maintaining a minimum pressure to avoid negative pressures, cavitation and evaporation.
2. Compensating fluctuations in the volume of the facility water as a result of fluctuations in temperature.
3. Balancing systemic water losses using a water reservoir.

Water uptake volume of a pressure expansion vessel

Pressure maintenance is required to compensate fluctuations in volume between the maximum and the minimum system temperature and thus to maintain the pressure within a permissible range. To achieve this, there must be a sufficient water uptake volume which must correspond to the expansion volume V_e and the water reservoir V_v. If devices are installed which extract and feed back a volume of water V_D from the system during operation, such as a vacuum degasser, this must also be taken into consideration. This also applies to volumes of steam V_S which occur during downtimes in solar collectors. If the temperature of the medium drops below 0 °C or exceeds 70 °C at the connection point of the pressure maintenance in the facility system, an auxiliary vessel is to be installed in order to protect the bladder of the expansion vessel.

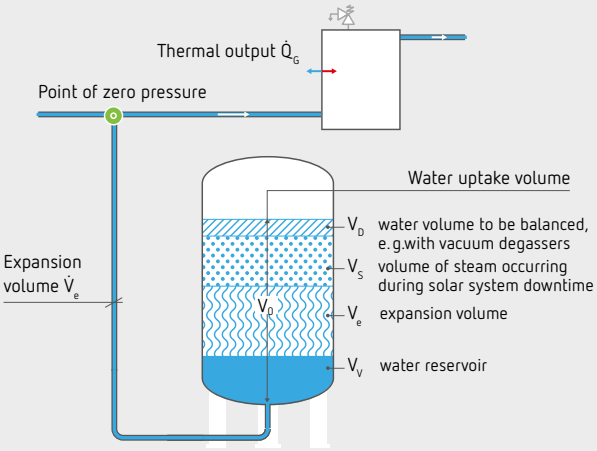


in heating systems proportion of V_e for t > 70 °C
in cooling systems proportion of V_e for t < 0 °C

Expansion volume flow and point of zero pressure

A balancing volume flow must be transported via the expansion line between the system and pressure maintenance such that the calculated pressures for the pressure maintenance are produced correctly at the point of zero pressure.

In closed heating, solar and cooling systems, it is assumed that the expansion volume flow $\dot{V}_e$ is the largest possible balancing volume flow. It occurs when the thermal output $\dot{Q}_G$ of heating or cooling sources is switched on or off.



Static pressure maintenance systems

Expansion vessels work as expansion or buffer vessels without electricity, a compressor or pump. Expansion vessels have to balance the volume fluctuations between the greatest and the lowest temperature. Product in the Reflex portfolio are used as expansion vessels in heating, solar and cooling water systems and products in the Refix portfolio are used to save potable water in hot water heating systems.

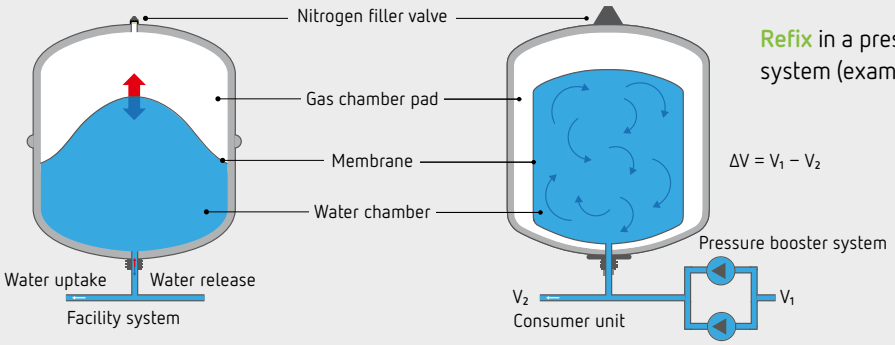
Buffer and control vessels have to provide an intermediate storage for the difference between the requested and the required volume flow. If the requirement is to reduce the switching frequency of the feed device, this is also known as a control vessel. In principle, the Refix product range is used as a buffer vessel in a pressure booster system while the Reflex range is used as a control vessel in pump-driven pressure maintenance stations.

Reflex for closed heating, solar and cooling water systems

Refix for potable and process water systems as well as special applications

Installation and function

Reflex in a heating system (example)

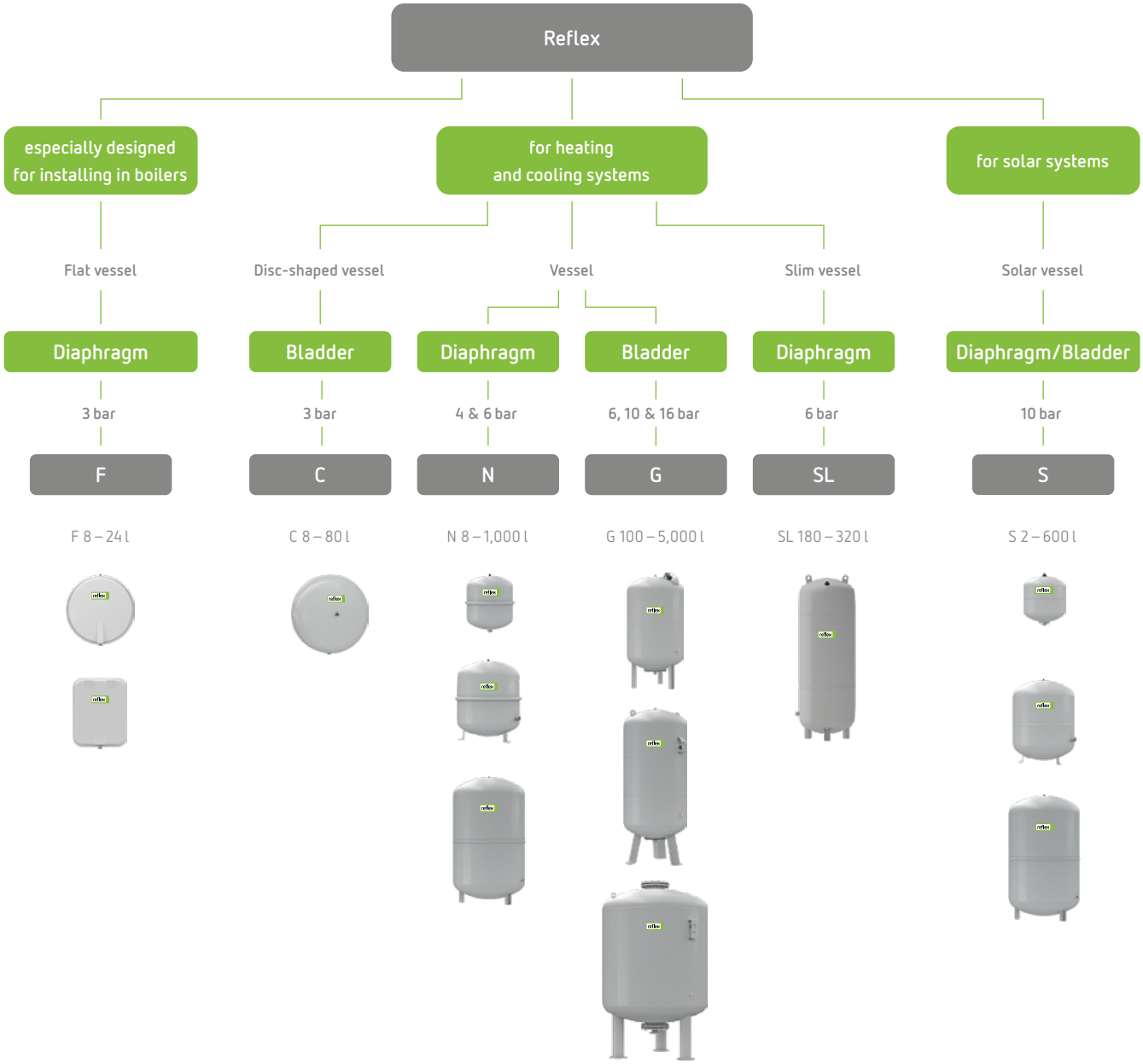


Refix in a pressure booster system (example)

The pressure pad supports the water column in the system and is adjusted accordingly before the vessel is filled with a volume of water. As the system is heated, the pressure increases resulting in the expanding water flowing from the facility system to the water chamber. The pressure pad in the gas chamber is compressed and the pressure increases. As the system cools, the volume decreases and the pressure drops: the expansion water flows out of the water chamber back into the facility system. The pressure pad in the gas changer is adjusted to just under the cut-in pressure of the feed device. When the pressure drops below the cut-in pressure, the pump switches on and feeds the water. If the consumer units remove a lesser amount, the difference is temporarily stored in the buffer tank until the pressure pad is compressed to the cut-out pressure and the pressure booster system switches off. The resulting pressure drop leads to a reduction in volume. If the consumer units draw water, temporarily stored water is extracted from the buffer tank until the cut-in pressure occurs at the pressure pad and the pressure booster system is switched on again.

Expansion vessels

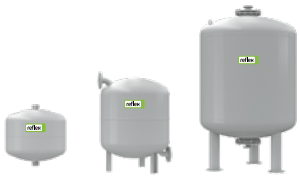
for heating, solar and cold water systems



V Auxiliary vessels

Without membrane

V 500 – 5,000 → 6 bar / 110 °C
V 6 – 5,000 → 10 bar / 110 °C



Other pressure ratings available on request

for potable and non-potable systems

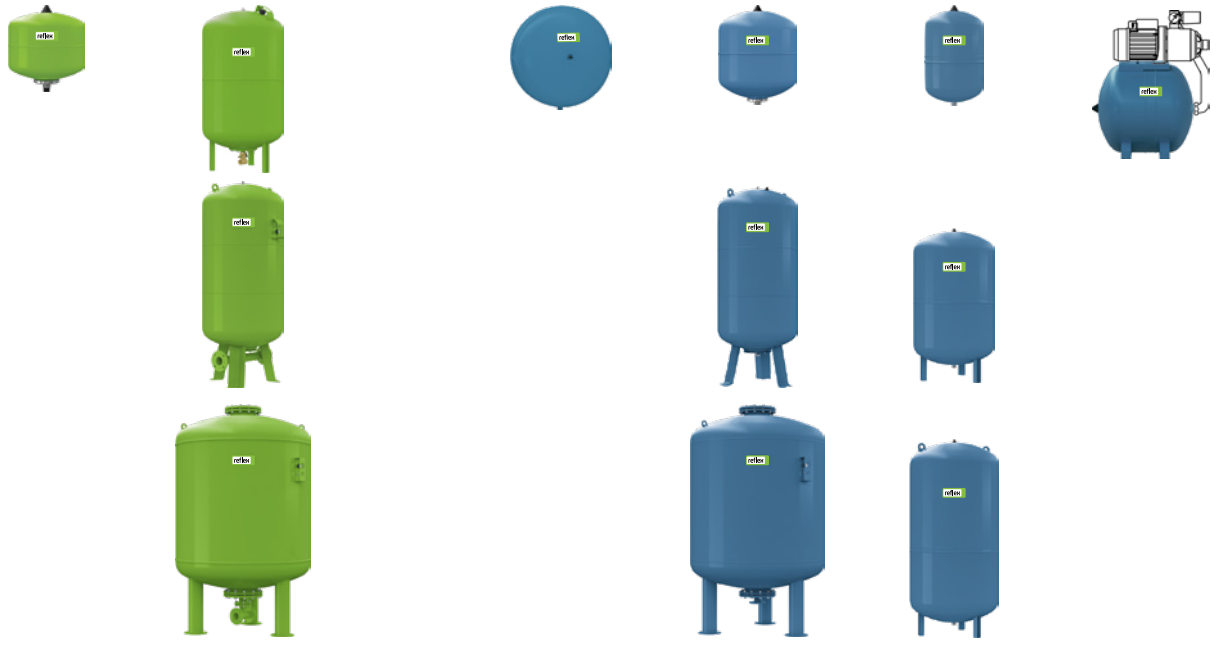
Refix

for potable water, pressure-boosting and water heating systems according to DIN 1988 norm

- Small vessel → **Bladder** → 10, 16 & 25 bar → **DD** → DD 2 – 33 l
- Large vessel → **Bladder** → 10 & 16 bar → **DT** → DT 60 – 3,000 l

only for systems not subject to the requirements of the DIN 1988 norm*

- Disc-shaped vessel → **Bladder** → 10 bar → **C-DE** → C-DE 8 – 80 l
- Vessel → **Bladder** → 10, 16 & 25 bar → **DE** → DE 2 – 5,000 l
- Vessel → **Diaphragm** → 10 bar → **DC** → DC 25 – 600 l
- Vessel for domestic water systems → **Bladder** → 10 bar → **HW** → HW 25 – 100 l



Water shock arrestor | Diaphragm | WD**

0.165 l / 10 bar**

For example, installation directly at the draw-off point

* For example, fire extinguishing and non-potable water systems, underfloor heating, geothermal energy...

** Not approved for potable water.

Reflex

Key advantages

High-quality expansion vessels

- For closed heating and cooling water systems as well as solar applications and process water
- Long-lasting, wear-resistant membrane reliably maintains the pressure
- Approved in accordance with pressure equipment guidelines 2014/68/EU

Wide range of designs

- Extremely broad pressure ranges and vessel volumes
- Extremely wide range of forms, types and comprehensive range of accessories
- With diaphragm or bladder
- Many years of experience with special, customer-specific solutions

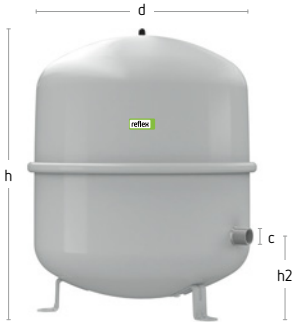
Rapid design and installation

- Intuitive design configuration software for rapid selection and calculation
- Rapid installation

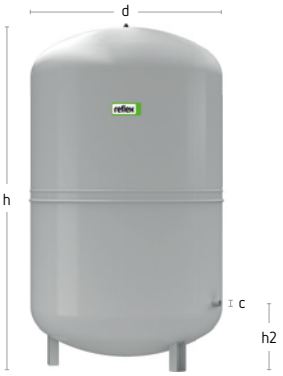
Reflex product portfolio

Reflex N

N 8 – 25 l



N 35 – 140 l



N 200 – 1,000 l

Technical Features

- for closed heating and cooling systems
- with threaded connections
- vertical from 35 litres, wall mounting up to size N 80
- non-replaceable diaphragm according to DIN EN 13831
- max. permissible operating temperature 70 °C
- for antifreeze additive of at least 25 – 50 %
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- max. permissible system temperature 120 °C

	Type	Art. No.		Inlet pressure	Connection c	Ø d	Height h	Height h2	Weight
		grey	white	[bar]		[mm]	[mm]	[mm]	[kg]
4 bar 70 °C	N 8	8202501	7202801	1.50	R ¾"	272	236	–	2.35
	N 12	8203301	7203501	1.50	R ¾"	272	317	–	2.75
	N 18	8204301	7204401	1.50	R ¾"	308	360	–	3.60
	N 25	8206301	7206401	1.50	R ¾"	308	477	–	4.35
	N 35	8208401	7208501	1.50	R ¾"	376	466	130	5.60
6 bar 70 °C	N 50	8209300	7209400	1.50	R ¾"	441	487	175	9.60
	N 80	8210200	7210600	1.50	R 1"	512	558	172	13.28
	N 100	8216300	–	1.50	R 1"	512	669	172	15.84
	N 140	8211400	–	1.50	R 1"	512	890	172	19.90
	N 200	8213300	–	1.50	R 1"	634	767	205	23.80
	N 250	8214300	–	1.50	R 1"	634	896	205	24.70
	N 300	8215300	–	1.50	R 1"	634	1,101	238	30.00
	N 400	8218000	–	1.50	R 1"	740	1,093	245	47.00
	N 500	8218300	–	1.50	R 1"	740	1,313	245	52.00
	N 600	8218400	–	1.50	R 1"	740	1,538	245	66.00
	N 800	8218500	–	1.50	R 1"	740	2,003	245	96.00
	N 1000	8218600	–	1.50	R 1"	740	2,413	245	118.00

Reflex C

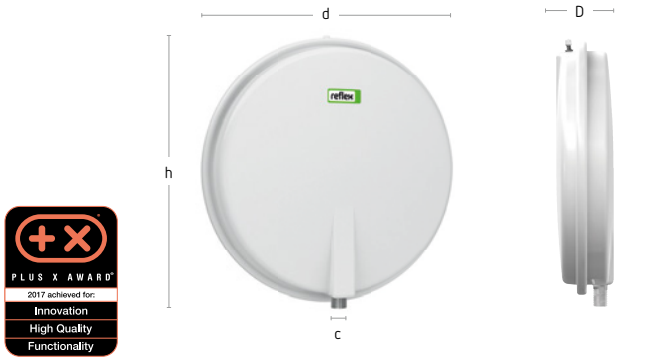
C 8 – 80 l

Technical Features

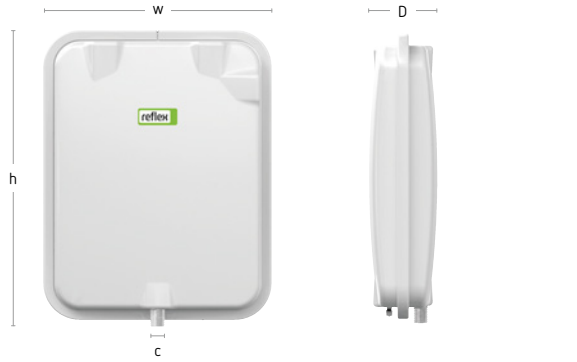
- for closed heating and cooling systems
- with threaded connections
- including brackets for easy installation
- non-replaceable bladder according to DIN EN 13831
- max. permissible operating temperature 70 °C
- for antifreeze additive of at least 25 – 50 %
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- max. permissible system temperature 120 °C

	Type	Art. No. grey	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Depth D [mm]	Depth D2 [mm]	Weight [kg]
3 bar 70 °C	C 8	8280000	1.00	G ½"	280	296	176	52	2.71
	C 12	8280100	1.00	G ½"	354	370	182	64	3.65
	C 18	8280200	1.00	G ¾"	356	370	236	76	4.38
	C 25	8280300	1.00	G ¾"	409	427	253	93	5.10
	C 35	8280400	1.00	G ¾"	480	465	256	97	6.55
	C 50	8280500	1.50	G ¾"	480	465	332	125	8.00
	C 80	8280600	1.50	G ¾"	634	621	338	135	15.70

Reflex F



F 8 l



F 12 – 24 l

PLUS X AWARD®
2017 achieved for:
Innovation
High Quality
Functionality

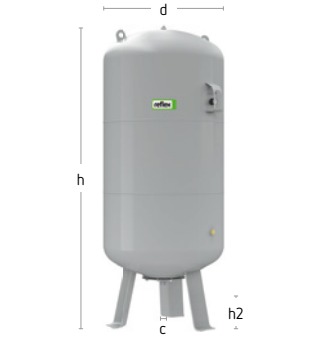
Technical Features

- flat vessel for closed heating and cooling systems, especially for installation in boilers
- with threaded connections
- from 18 litres, with mounting lug
- non-replaceable diaphragm according to DIN EN 13831
- max. permissible operating temperature 70 °C
- for antifreeze additive of at least 25 – 50 %
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- max. permissible system temperature 120 °C
- Reflex F 8 vessel recognised with the Plus X-Award

	Type	Art. No. white	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Width w [mm]	Depth D [mm]	Depth D2 [mm]	Weight [kg]
3 bar 70 °C	F 8	2407000	0.75	G ⅜"	389	389	350	88	72	4.15
	F 12	2211900	1.00	G ½"	–	444	350	108	81	6.60
	F 15	2215500	1.00	G ¾"	–	444	350	134	97	7.12
	F 18	2218300	1.00	G ¾"	–	444	350	158	109	7.70
	F 24	2219000	1.00	G ¾"	–	444	350	180	120	9.10

Reflex G

G 100 – 500 l



G 600 – 1,000 l

G 1,000 (Ø1,000) – 2,000 l

G 3,000 – 5,000 l

Technical Features

- for closed heating and cooling systems
- upright configuration
- connections:
  → up to 1,000 l / Ø 740 mm with threaded connections
  → from 1,000 l / Ø 1,000 mm with flange connections DN 65 / PN 6 or DN 65 / PN 16
- replaceable bladder according to DIN EN 13831
- max. permissible operating temperature 70 °C
- for antifreeze additive of at least 25 – 50 %
- approval according to Pressure Equipment Directive 2014 / 68 / EU
- the following types are equipped with a diaphragm break detector coupling:
  → 6 bar
  → 10 bar
  → 16 bar
- with inspection opening (from 1,000 litres with Ø 1,000 mm)
- pressure gauge and supply pressure valve protected by clip
- durable epoxy resin coating
- with factory-pressurised gas chamber
- max. permissible system temperature 120 °C

Reflex G

CE

	Type	Art. No. grey	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
6 bar 70 °C	G 100	8519000	3.50	G1"	480	850	145	14.80
	G 200	8519100	3.50	G 1¼"	634	967	144	36.00
	G 300	8519200	3.50	G 1¼"	634	1,267	144	45.00
	G 400	8521605	3.50	G1"	740	1,276	146	53.00
	G 500	8521705	3.50	G1"	740	1,494	146	56.00
	G 600	8522605	3.50	G1"	740	1,739	146	74.00
	G 800	8523610	2.00	G1"	740	2,186	149	98.00
	G 1000/740	8546605	2.00	G1"	740	2,593	146	150.00
	G 1000/1000	8524605	2.00	DN 65/PN 6	1,000	1,973	307	228.00
	G 1500	8526605	2.00	DN 65/PN 6	1,200	1,971	305	280.00
	G 2000	8527605	2.00	DN 65/PN 6	1,200	2,451	291	300.00
	G 3000	8544605	2.00	DN 65/PN 6	1,500	2,490	334	620.00
	G 4000	8529605	2.00	DN 65/PN 6	1,500	3,065	334	770.00
	G 5000	8530605	2.00	DN 65/PN 6	1,500	3,598	334	849.00
10 bar 70 °C	G 100	8518000	3.50	G1"	480	850	146	14.80
	G 200	8518100	3.50	G 1¼"	634	966	144	36.00
	G 300	8518200	3.50	G 1¼"	634	1,267	144	45.00
	G 400	8521005	3.50	G 1¼"	740	1,275	133	59.00
	G 500	8521006	3.50	G 1¼"	740	1,494	133	68.00
	G 600	8522006	3.50	G 1½"	740	1,859	263	143.00
	G 800	8523005	2.00	G 1½"	740	2,324	263	166.00
	G 1000/740	8546005	2.00	G 1½"	740	2,804	263	190.00
	G 1000/1000	8524005	2.00	DN 65/PN 16	1,000	2,001	286	335.00
	G 1500	8526005	2.00	DN 65/PN 16	1,200	1,991	291	390.00
	G 2000	8527005	2.00	DN 65/PN 16	1,200	2,451	291	528.50
	G 3000	8544005	2.00	DN 65/PN 16	1,500	2,542	320	830.00
	G 4000	8529005	2.00	DN 65/PN 16	1,500	3,117	320	1,120.00
	G 5000	8530005	2.00	DN 65/PN 16	1,500	3,652	320	1,274.00
16 bar 70 °C	G 100	8518400	3.50	DN 25/PN 16	480	992	231	31.00
	G 200	8518500	3.50	DN 25/PN 16	634	1,088	221	57.00
	G 300	8518600	3.50	DN 25/PN 16	634	1,392	221	67.00
	G 400	8510206	3.50	DN 40/PN 16	740	1,373	198	110.00
	G 500	8518700	3.50	DN 40/PN 16	740	1,618	197	130.00
	G 600	8522007	3.50	DN 40/PN 16	740	1,871	198	158.00
	G 800	8523906	2.00	DN 40/PN 16	740	2,336	198	221.00
	G 1000/740	8546906	2.00	DN 40/PN 16	740	2,804	201	260.00
	G 1000/1000	8524205	2.00	DN 65/PN 16	1,000	2,031	276	468.00
	G 1500	8526305	2.00	DN 65/PN 16	1,200	2,021	281	650.00
	G 2000	8527100	2.00	DN 65/PN 16	1,200	2,481	281	731.00
	G 3000	8544705	2.00	DN 65/PN 16	1,500	2,550	310	960.00
	G 4000	8529405	2.00	DN 65/PN 16	1,500	3,110	310	1,450.00
	G 5000	8529705	2.00	DN 65/PN 16	1,500	3,645	310	1,636.00

Reflex SL

SL 180 l

SL 220 l

SL 280 l

SL 320 l

Technical Features

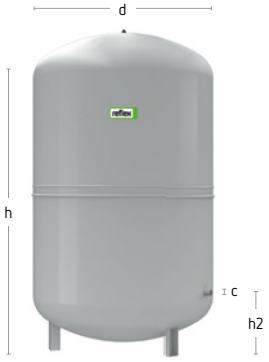
- the footprint of Reflex SL vessels corresponds to the footprint and usable capacity of the OTTO Expansomats, making a direct exchange possible
- for closed heating and cooling systems
- slim, space-saving vessel
- non-replaceable diaphragm according to DIN EN 13831
- with factory-pressurised gas chamber
- durable epoxy resin coating
- with threaded connections
- for antifreeze additive of at least 25 – 50 %
- max. permissible operating overpressure 6 bar
- max. permissible operating temperature 70 °C
- max. permissible system temperature 120 °C

	Type	Art. No. grey	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
6 bar 70 °C	SL 180	8200200	1.50	G1"	480	1,156	214	27.38
	SL 220	8200250	1.50	G1"	480	1,386	214	33.34
	SL 280	8200300	1.50	G1"	480	1,716	214	41.82
	SL 320	8200350	1.50	G1"	480	1,946	214	47.78

Reflex S

S 2 – 33 l

S 50 – 250 l



S 300 – 600 l

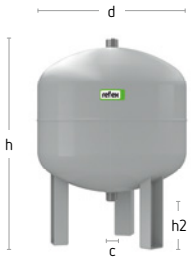
Technical Features

- for solar, heating and cooling systems
- with threaded connections
- 33 litres with brackets, from 50 litres with adjustable feets
- for antifreeze additive of at least 25 – 50 %
- up to 33 litres non-replaceable bladder, non-replaceable diaphragm for 50 – 600 litres
- max. permissible operating temperature 70 °C
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- max. permissible system temperature 120 °C

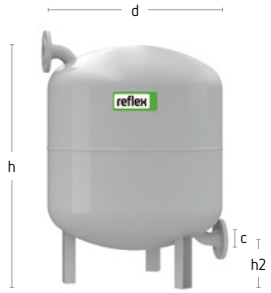
	Type	Art. No.		Inlet pressure	Connection c	Ø d	Height h	Height h2	Weight
		grey	white	[bar]		[mm]	[mm]	[mm]	[kg]
10 bar 70 °C	S 2	8707700	–	0.50	G ¾"	132	260	–	0.98
	S 8	8703900	9702600	1.50	G ¾"	206	332	–	1.80
	S 12	8704000	9702700	1.50	G ¾"	280	300	–	2.16
	S 18	8704100	9702800	1.50	G ¾"	280	409	–	2.95
	S 25	8704200	9702900	1.50	G ¾"	280	518	–	3.68
	S 33	8706200	9706300	1.50	G ¾"	354	455	–	4.80
	S 50	8209500	–	3.00	R ¾"	415	468	158	8.02
	S 80	8210300	–	3.00	R 1"	486	565	170	11.30
	S 100	8210500	–	3.00	R 1"	486	667	165	12.90
	S 140	8211500	–	3.00	R 1"	486	886	172	19.20
	S 200	8213400	–	3.00	R 1"	640	758	205	28.00
	S 250	8214400	–	3.00	R 1"	640	888	205	32.00
	S 300	8215400	–	3.00	R 1"	640	1,092	235	38.00
	S 400	8219000	–	3.00	R 1"	746	1,102	245	55.00
	S 500	8219100	–	3.00	R 1"	746	1,321	245	72.00
	S 600	8219200	–	3.00	R 1"	746	1,559	245	80.00

Reflex V

V 6 – 20



V 40 – 60



V 200 – 350

V 500 – 750

V 1,000 – 2,000

V 3,000 – 5,000

Technical **Features**

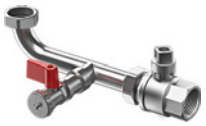
- auxiliary vessel without membrane
- approval according to Pressure Equipment Directive 2014/68/EU
- from V 40 with feet
- required for systems with return temperatures greater than the maximum permissible operating temperature of the diaphragm expansion vessel or in cooling systems with temperatures less than the maximum permissible operating temperature of the diaphragm expansion vessel
- can also be used as a buffer storage tank
- special vessel >10 bar/> 110 °C available upon request
- durable epoxy resin coating

Reflex V

	Type	Art. No. grey	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
6 bar 110 °C	V 500	8852803	DN 40/PN 6	750	1,652	208	160.00
	V 750	8851801	DN 40/PN 6	750	2,273	208	205.00
	V 1000	8851908	DN 65/PN 6	1,000	2,020	305	310.00
	V 1500	8852306	DN 65/PN 6	1,200	2,020	305	405.10
	V 2000	8852408	DN 65/PN 6	1,200	2,478	305	545.00
	V 3000	8852506	DN 65/PN 6	1,500	2,537	337	775.00
	V 4000	8853406	DN 65/PN 6	1,500	3,112	337	1,060.00
	V 5000	8854806	DN 65/PN 6	1,500	3,648	337	1,095.00
10 bar 110 °C	V 6	8303100	R ¾"	206	244	–	1.60
	V 12	8303200	R ¾"	280	244	–	2.56
	V 20	8303300	R ¾"	280	360	–	3.28
	V 40	8303400	R 1"	409	562	113	9.75
	V 60	8303500	R 1"	409	732	172	12.40
	V 200	8303600	DN 40/PN 16	634	901	142	35.25
	V 300	8303700	DN 40/PN 16	634	1,201	142	48.00
	V 350	8303800	DN 40/PN 16	634	1,341	142	46.00
	V 500	8854807	DN 40/PN 16	750	1,652	208	290.00
	V 750	8854808	DN 40/PN 16	750	2,283	197	420.00
	V 1000	8854809	DN 65/PN 16	1,000	2,055	286	560.00
	V 1500	8854810	DN 65/PN 16	1,200	2,045	284	636.10
	V 2000	8854811	DN 65/PN 16	1,200	2,505	284	940.00
	V 3000	8854812	DN 65/PN 16	1,500	2,563	313	1,405.00
	V 4000	8854813	DN 65/PN 16	1,500	3,138	313	1,930.00
	V 5000	8854814	DN 65/PN 16	1,500	3,674	313	2,015.00

Reflex Accessories CE

AG connection set



- for rapid assembly and maintenance of membrane expansion vessels
- incl. secured shut-off and connecting bend with screw connection
- with drainage cock (G ½") and hose nozzle
- according to DIN EN 12828
- 10 bar / 100 °C

Bladder rupture detector

- membrane rupture detector in vessels
- consisting of an electrode relay and an electrode (factory fitted)
- power supply 230 V / 50 Hz
- floating output (changeover contact)

Cap valve

- secured shut-off for maintenance and disassembly of expansion vessels
- with drainage
- according to DIN EN 12828
- 10 bar / 120 °C

Digital pressure gauge

- inlet pressure tester up to about 9 bar

Wall-hung console with multi-connections

- console with multi-connections for Reflex 8 – 25 litres
- With vessel connection

Wall mounting bracket with clamping strap

- console with clamping strap for Reflex 6 – 25 litres
- upright assembly

Type	Art. No.	Weight [kg]
AG connection set AG 1"	9119204	0.85
AG connection set AG 1 ¼"	9119205	1.00
AG connection set AG 1 ½"	9119206	1.15
Bladder rupture detector MBM II	7857700	0.62
Cap valve SU R ¾" × ¾"	7613000	0.26
Cap valve SU R 1" × 1"	7613100	0.57
Digital pressure gauge	9119198	0.06
Wall-hung console with multi-connections	7612000	0.90
Wall mounting bracket with clamping strap	7611000	0.22

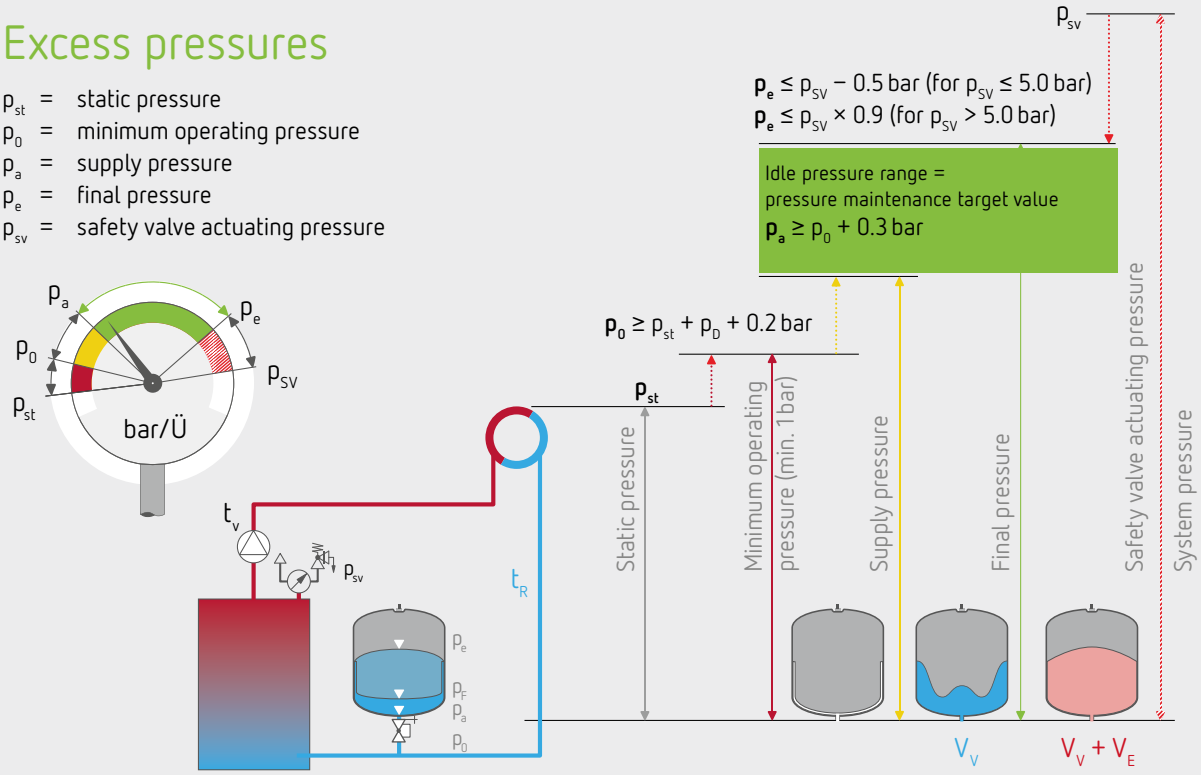
Selection and calculation

Pressures in the system

Valid for supply pressure maintenance in heating, cooling and solar thermal systems

Excess pressures

p_{st} = static pressure
p_0 = minimum operating pressure
p_a = supply pressure
p_e = final pressure
p_{sv} = safety valve actuating pressure



Calculation values

Pressures are given as excess pressures and relate to the connecting pieces for the expansion vessel up to the highest point in the system.

Reflex recommendations

- Set the safety valve operating pressure sufficiently high: $p_{SV} \geq p_0 + 1.5$ bar
- If possible, when calculating the inlet gas pressure, select an extra 0.2 bar: $p_0 \geq \frac{H\,[m]}{10} + 0.2$ bar
- Select an supply pressure of at least 1 bar on account of the necessary supply pressure for the flow-through pumps — even for rooftop infrastructure centres: $p_0 \geq 1$ bar
- Set the fill or supply pressure on the water side in vented systems in cold condition at least 0.3 bar above the supply pressure to ensure a water reservoir inthe expansion vessel ($V_V = 0.005 \times V_A$ **at least** 3 l for $V_n > 15$ l minimum volume indication according to the standard): $p_F \geq p_0 + 0.3$ bar

Reflex — quick selection table

Heating Systems: 70/50 °C

	Safety Valve p_{SV} [bar]	2.5			3.0				4.0			
	Inlet Pressure p_0 [bar]	0.5	1.0	1.5	0.5	1.0	1.5	1.8	1.5	2.0	2.5	3.0
	V_n [litres]	Contents V_A [litres]										
Reflex	8	107	48	–	133	82	31	–	87	48	8	–
	12	161	71	–	199	122	46	–	131	71	12	–
	18	268	134	–	325	210	96	27	223	134	45	–
	25	424	238	52	504	344	185	89	362	238	114	–
	35	639	387	126	730	536	313	179	561	387	213	–
	50	912	608	238	1,043	782	504	313	811	608	362	114
	80	1,460	973	461	1,668	1,251	834	580	1,298	973	649	263
	100	1,825	1,217	608	2,086	1,564	1,043	730	1,622	1,217	811	362
	140	2,555	1,703	852	2,920	2,190	1,460	1,022	2,271	1,703	1,135	561
	200	3,650	2,433	1,217	4,171	3,128	2,086	1,460	3,244	2,433	1,622	811
	250	4,562	3,041	1,521	5,214	3,910	2,607	1,825	4,055	3,041	2,028	1,014
	300	5,474	3,650	1,825	6,257	4,692	3,128	2,190	4,866	3,650	2,433	1,217
	400	7,299	4,866	2,433	8,342	6,257	4,171	2,920	6,488	4,866	3,244	1,622
	500	9,124	6,083	3,041	10,428	7,821	5,214	3,650	8,110	6,083	4,055	2,028
	600	10,949	7,299	3,650	12,513	9,385	6,257	4,380	9,732	7,299	4,866	2,433
	800	14,599	9,732	4,866	16,684	12,513	8,342	5,839	12,976	9,732	6,488	3,244
	1,000	18,248	12,165	6,083	20,855	15,641	10,428	7,299	16,221	12,165	8,110	4,055

Key data

Safety valve	p_{SV}	= 3 bar
Static height	H_{st}	= 13 m
Heat generator capacity	$\dot{Q}$	= 40 kW
Panel radiators rated temperature	T	= 70/50 °C
Volume buffer storage tank	V_{PH}	= 1,000 l

Calculation

Water content (approximately)

Radiators:
V_A = $\dot{Q}$ [kW] × 13.5 l/kW

Panel radiators:
V_A = $\dot{Q}$ [kW] × 8.5 l/kW

V_A = 40 kW × 8.5 l/kW + 1,000 l = 1,340 l

$$p_0 \geq \frac{H_{st}\,[m]}{10}\ \text{bar} + 0.2\ \text{bar}$$

$$p_0 \geq \frac{13}{10}\ \text{bar} + 0.2\ \text{bar} \quad = 1.5\ \text{bar}$$

Result

From the table

with p_{SV} = 3 bar
and p_0 = 1.5 bar
V_A = 1,340 l

→ V_n = **140 l** (for V_A max. 1,460 l)

selected

1 × **Reflex N 140,** 6 bar, → page 11

1 × **cap ball valve,** → page 22

Example calculation
Reflex N

Reflex — quick selection table

Heating Systems: 70/50 °C

	Safety Valve p_{SV} [bar]	5.0					6.0					
	Inlet Pressure p_0 [bar]	2.0	2.5	3.0	3.5	4.0	2.0	2.5	3.0	3.5	4.0	5.0
	V_n [litres]	Contents V_A [litres]										
Reflex	8	91	58	26	–	–	118	90	63	35	7	–
	12	136	88	39	–	–	177	136	94	52	10	–
	18	231	158	85	12	–	293	230	167	105	42	–
	25	373	272	170	69	–	459	372	285	197	110	–
	35	576	434	292	150	8	679	574	452	330	208	–
	50	829	664	475	272	69	969	827	684	529	354	6
	80	1,327	1,062	796	515	191	1,551	1,323	1,095	867	639	89
	100	1,659	1,327	995	664	272	1,939	1,654	1,369	1,083	798	145
	140	2,322	1,858	1,393	929	434	2,714	2,315	1,916	1,517	1,118	257
	200	3,318	2,654	1,991	1,327	664	3,878	3,307	2,737	2,167	1,597	424
	250	4,147	3,318	2,488	1,659	829	4,847	4,134	3,422	2,709	1,996	564
	300	4,977	3,981	2,986	1,991	995	5,817	4,961	4,106	3,250	2,395	684
	400	6,636	5,309	3,981	2,654	1,327	7,755	6,615	5,474	4,334	3,193	912
	500	8,295	6,636	4,977	3,318	1,659	9,694	8,269	6,843	5,417	3,992	1,141
	600	9,954	7,963	5,972	3,981	1,991	11,633	9,922	8,212	6,501	4,790	1,369
	800	13,271	10,617	7,963	5,309	2,654	15,511	13,230	10,949	8,668	6,387	1,825
	1,000	16,589	13,271	9,954	6,636	3,318	19,389	16,537	13,686	10,835	7,984	2,281

Special configurations on request: Special tank > 5,000 litres; special tank > 10 bar

Customised planning with our configuration software

Reflex Solutions **Pro**
rsp.reflex.de/en

Selecting expansion lines

Expansion lines are to be sized and installed in accordance with local provisions. DIN EN 12828 requires that, each heat generator is connected to at least one expansion line with one or more expansion vessels. It is essential to ensure frost-free conditions.

If the length of the expansion line is **> 10 m,** we recommend selecting the nominal diameter one dimension larger.

Comprehensive calculation and design notes

Before selecting the products, first collate the most important system data for temperature, pressure and water content and calculate the parameters for selecting the products from this information.

Water volume	V_A
Heat output	$\dot{Q}_{ges}$
Expansion volume flow	$\dot{V}_e$
Water uptake volume	V_0
Safety valve actuating pressure	p_{SV}
Minimum operating pressure	p_0
Final pressure	p_E

- The necessary basic data are preferable to be taken from the design documents/manufacturer's data. If these are not available, the data must be collected on site or estimated. Proxy values for calculating and estimating the water volumes are given in the tables. The extreme requirements of industrial heat supply and district heat supply can be accommodated thanks to the Variomat Giga.

Proxy values for calculation

Coefficient of expansion n for anti-freeze additives* z

z	t_{max} °C	30	40	50	60	70	80	90	100	105	110	120	130	140	150
0 %	n %	0.37	0.72	1.15	1.66	2.24	2.88	3.58	4.34	4.74	5.15	6.03	6.96	7.96	9.03
34 %		1.49	1.99	2.53	3.11	3.71	4.35	5.01	5.68	-	6.39	7.11	7.85	8.62	9.41

* Values apply for Antifrogen N. We recommend a concentration of 25 to 50 %. Lower doses lead to a risk of corrosion!

Evaporation pressure** p_D for anti-freeze additives* z

z	t_{max} °C	30	40	50	60	70	80	90	100	105	110	120	130	140	150
0 %	p_D bar	−0.96	−0.93	−0.88	−0.80	−0.69	−0.53	−0.3	0.01	0.21	0.43	0.98	1.7	2.61	3.76
34 %				−0.90	−0.80	−0.70	−0.60	−0.40	−0.10	–	0.23	0.70	1.33	2.13	3.15

* Values apply for Antifrogen N. We recommend a concentration of 25 to 50 %. Lower doses lead to a risk of corrosion!
** p_D with respect to ±0 m NN, we recommend an additional 0.1 bar for each 1 km height.

Standard values for sizing expansion lines, make-up pipes and lines to control vessel

DN		20	25	32	40	50	65	80	100
$\dot{V}$ l/h	1	630	1,040	1,830	2,410	3,700	6,960	9,450	14,130
	2	2,500	4,150	7,300	9,600	14,800	27,800	37,800	56,500

$\dot{V}$ permissible volume flow:

1 up to a maximum line length of 30 m
2 for a line length up to 1 m and to reductions, e. g. to vessel connections.
Not permissible for pressure controlled devices between pressure sensors and systems

When using anti-freeze, we recommend remaining within 25–50 % glycol in order to minimise the risk of corrosion.

Estimating the volume of water in heat generators

The volume of water V_W is calculated from the volume of water v_W and the nominal performance of the heat generator $\dot{Q}_W$ or from the installed collector area in solar panels A_G.

Conventional heat generators	v_W l/kW	
Cast iron boiler with atmospheric burner	1.10	$V_W = v_W \times \dot{Q}_W$
Cast iron boiler with forced-air burner	1.40	
Steel boiler with forced-air burner	1.80	
Solid fuel boiler	2.00	
Wall-mounted condensing boiler	0.15	
Heat exchanger	0.60	
CHP	0.60	
Heat pump	0.60	
Solar panels	v_K l/m²	
Flat panel	2.0	$V_K = v_K \times A_G$
Direct vacuum tube	1.0	
Heat-pipe vacuum tube	3.0	

Estimating the volume of water in heat surfaces and distribution lines

The volume of water V_A is determined from the specific volume of water v_A and the installed output of the heat consumer unit $\dot{Q}_{ges}$. It includes the water content of the heating surfaces, the distribution pipes and the pipelines in the central heating system. Pipelines between the central heating plant and the heating system should be considered separately.

Types of heating surface	$t_{max\,C}$ | t_R °C	90 | 70	70 | 55	70 | 50	55 | 45	45 | 35	35 | 30	
Elements	v_A l/kW	11.5	17.6	18.1	27.7	44.6	83.3	$V_A = v_A \times \dot{Q}_{ges.}$
Pipes		15	23.2	24.1	36.3	59.3	111.5	
Plates		6.5	9.6	9.4	14.9	21.9	41.0	
Convectors		4	5.9	5.4	9.4	13.4	27.1	
Ventilation		3.3	4.7	4.1	7.4	9.8	19.7	
Underfloor heating system		–	–	–	–	21.1	35.6	

Volume of vacuum spray pipe degasser V_D ,which has to be absorbed by pressure maintenance

Degassing	V_D l
Servitec 25...30	1
Servitec 35...120	6
Special Servitec ... – 2...4	35
Special Servitec ... – 6...8	70

Specific volume of water V_P in pipelines

The volume of water V_P is determined from the specific volume of water v_P and the length of the installed pipeline L.

Example for steel pipelines

DN	25	32	40	50	60	65	80	100	125	150	200
v_P l/m	0.58	1.01	1.34	2.1	3.2	3.9	5.3	7.9	12.3	17.1	34.2

Example for plastic pipelines (PE_X pipes)

Model	20 × 2	25 × 2.3	32 × 2.9	40 × 3.7	50 × 4.6	63 × 5.8	75 × 6.8	90 × 8.2	110 × 10
d_i in mm	16	20	26	33	41	51	61	74	90
v_P l/m	0.20	0.33	0.54	0.83	1.31	2.07	2.96	4.25	6.36

Expansion vessels in heating systems

Calculation

To DIN 4807 T2 and DIN EN 12828.

Circuit

Usually maintaining suction pressure (see sketch page 34) with upstream flow-through pump and expansion vessel in the return flow, i.e. on the suction side after the flow-through pump.

Material values n, p_D

Generally material values for pure water without anti-freeze.

Expansion volume V_e, maximum temperature t_{TR}

Determine the percentage expansion generally between the minimum temperature = fill temperature = 10 °C and the maximumnominal value setting for the temperature controller t_{TR}.

Minimum operating pressure p_0

Particularly in the case of low-rise buildings and roof-mounted systems, the minimum supply pressure for the flow-through pump is to be taken from the manufacturer's specifications due to the low static pressure p_{st}. We also recommend a minimum operating pressure p_0 of no less than 1 bar is selected for lower static heads.

Note: Take care with low-rise buildings and roof-mounted systems Reflex recommendation: $p_0 \geq 1$ bar

Use Refix for systems where corrosion is a potential risk!
In systems with oxygen-rich water (e.g. geothermal systems or underfloor heating without any impermeable pipes), Refix D, Refix DE or Refix C is used up to 70 °C as all water-bearing parts are corrosion protected.

In order to achieve permanently safe automatic operation in cooling water systems, it is advisable to fit the pressure maintenance devices with make-up systems and to supplement this with Servitec degassing systems. This is particularly important in cooling water systems as there must be no thermal deaeration effects.

Filling pressure p_F, supply pressure p_a

As the the filling temperature of 10 °C is generally the lowest system temperature, the filling pressure = the supply pressure for the expansion vessel. In pressure maintenance stations, it should be noted that the filling and make-up devices may have to run against the final pressure in some circumstances. This is only the case with Reflexomat.

Pressure maintenance

Static pressure maintenance with Reflex N, F, S, G also in combination with make-up and degassing systems or as Variomat pressure maintenance station for pressure maintenance, degassing and make-up or as Reflexomat compressor controlled pressure maintenance station.

Degassing, venting, make-up

In order to achieve permanently safe automatic operation of the heating system, it is advisable to fit the pressure maintenance devices with make-up systems and to supplement this with Servitec degassing systems.

Auxiliary vessel

If a temperature of 70 °C is permanently exceeded at the pressure maintenance, an auxiliary vessel must be installed in order to protect the bladders.

Individual protection

According to DIN EN 12828, each heat generator must be connected to at least one expansion vessel. Only secured shut-offs (against unintentional closure) are permitted. If a heat generator is hydraulically blocked (e.g. sequential switching of the boiler), the connection to an expansion vessel must still be guaranteed. In systems with more than one boiler, each boiler is therefore usually secured with its own expansion vessel. This is only calculated for the respective boiler water content.

Due to the good degassing performance of Variomat pressure maintenance stations, we recommend to install an expansion vessel (e.g. Reflex N) is installed at the heat generator in order to minimise the switching frequency, even on single boiler systems.

Expansion vessel calculation in heating systems

Circuit: Maintaining supply pressure, expansion vessel in the return flow, upstream flow-through pump, follow-up pressure maintenance.

Initial data			see manufacturer's specifications / proxy values for calculation	
Heat generator ... heat output ... volume of water	 $\dot{Q}_W$ V_W	 [kw] [l]	Total for all heat generators	$\dot{Q}_{ges}$ = ... kw
Design ... inlet temperature ... return flow temperature Volume of water	 t_V t_R V_A	 [°C] [°C] [l]	At t_R > 70 °C install auxiliary vessel!	V_A = ... Litres
Maximum target value setting Temperature controller Anti-freeze additive	 t_{TR} 	 [°C] [%]	Percentage expansion n (with anti-freeze additive n*)	n = ... %
Safety temperature limiter	t_{STB}	[°C]	Evaporation pressure p_D at > 100 °C (with anti-freeze additive p_D*)	p_D = ... bar
Static pressure	p_{st}	[bar]		p_{st} = ... bar
Pressure calculation				
Supply pressure	p_0	[bar]	$p_0 = p_{st} + p_D + 0.2$ bar (safety factor) Reflex recommendation: **$p_0 \geq 1.0$ bar** Req. Check supply pressure for flow-through pump (NPSH value) from manufacturer's specifications and maintenance of permissible operating pressure.	p_0 = ... bar
Safety valve actuating pressure	p_{SV}	[bar]	Reflex recommendation: for $p_{SV} \leq 5$ bar: **$p_{SV} \geq p_0 + 1.5$ bar** for $p_{SV} > 5$ bar: **$p_{SV} \geq p_0 + 2.0$ bar**	p_{SV} = ... bar
Final pressure	p_e	[bar]	$p_e \leq p_{SV}$ – final pressure differential for $p_{SV} \leq 5$ bar: $p_e \leq p_{SV} - 0.5$ bar for $p_{SV} > 5$ bar: $p_e \leq p_{SV} - 0.1 \times p_{SV}$	p_e = ... bar
Expansion vessel				
Expansion volume	V_e	[l]	$V_e = \frac{n}{100} \times V_A$	V_e = ... litres
Water reservoir	V_V	[l]	$V_V = 0.005 \times V_A$ **at least 3 l** for V_n > 15 l minimum water seal volume to standard	V_V = ... litres
Nominal volume	V_n	[l]	for V_n > 15 l: $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_0}$ for $V_n \leq 15$ l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_0}$ **Note:** The pressure factor is used for simplified calculation of the nominal volume, which is larger than the water reservoir + expansion volume by the pressure factor.	V_n = ... litres
Control supply pressure	p_a	[bar]	$p_a = \frac{p_e + 1}{1 + \frac{(V_e + V_D^*)(p_e + 1)(n + n_R)}{V_n (p_0 + 1) 2n}} - 1$ bar Precondition: $p_a \geq p_0 + 0.25...0.3$ bar, otherwise calculate for larger nominal volume	p_a = ... bar
Result				
Reflex .../... bar ...litres			p_0 = ... bar Check before commissioning!	
			p_a = ... bar Check make-up setting!	
			p_e = ... bar	

* Only applies when using Reflex Servitec in accordance with the 'Degassing' table see page 25

Expansion vessels in cooling water systems

The calculation is carried out in accordance with DIN EN 12828 and DIN 4807 part 2.

Material values n*

Anti-freeze additives (recommendation: 25–50 % concentration), depending on the lowest temperature of the system,must be taken into consideration when determining the percentage expansion n* according to the manufacturer's specifications.

Expansion volume V_e

Determination of the percentage expansion n* generally between the lowest system temperature (e.g. downtime during winter – 20 °C) and the highest system temperature (e.g. downtime during summer +40 °C).

Minimum operating pressure (supply pressure) p_0

As temperatures do not exceed 100 °C, special factors are not required.

Filling pressure p_F, supply pressure p_a

The lowest system temperature is frequently less than the filling temperature which means the filling pressure is greater than the supply pressure.

Pressure maintenance

Generally used for static pressure maintenance with Reflex, also in combination with Control and Servitec make-up and degassing stations.

In order to achieve permanently safe automatic operation in cooling water systems, it is advisable to fit the pressure maintenance devices with make-up systems and to supplement this with Servitec degassing systems. This is particularly important in cooling water systems as there must be no thermal deaeration effects.

Degassing, venting, make-up

In order to achieve permanently safe automatic operation in cooling water systems, it is advisable to fit the pressure maintenance devices with make-up systems and to supplement this with Servitec vacuum spray pipe degassing systems. This is particularly important in cooling water systems as there must be no thermal deaeration effects.

Auxiliary vessels

The Reflex bladders are suitable for temperatures as low as – 20 °C and the vessels to – 10 °C however, this does not mean the bladder will not 'freeze up' in the vessel. We therefore recommend an auxiliary vessel is installed in the return flow to the chiller at temperatures ≤ 0 °C.

Individual protection

As with heating systems, we recommend individual protection if there is more than one chiller.

Expansion vessel calculation in cooling water systems

Circuit: Maintaining supply pressure, expansion vessel on the suction side, flow-through pump, with follow-up pressure maintenance.

Initial data			see manufacturer's specifications / proxy values for calculation	
Return flow temperature	t_R	[°C]	To the chiller; at t_R > 70 °C install auxiliary vessel!	
Inlet temperature	t_V	[°C]	From the chiller	
Minimum system temp.	t_{Smin}	[l]	e.g. downtime during winter	
Maximum system temp.	t_{Smin}	[l]	e.g. downtime during summer	
Anti-freeze additive		[%]	Percentage expansion with anti-freeze additive n*	n* = … %
Percentage expansion		[%]	Between minimum temperature (– 20 °C) and filling temperature (usually 10 °C)	n*F = … %
Static pressure	p_{st}	[bar]		p_{st} = … bar
Pressure calculation				
Supply pressure	p_0	[bar]	$p_0 = p_{st} + 0.2$ bar (safety factor) Reflex recommendation: **$p_0 \geq 1.0$ bar** Check permissible operating pressure is maintained.	p_0 = … bar
Safety valve actuating pressure	p_{SV}	[bar]	Reflex recommendation: for $p_{SV} \leq 5$ bar: **$p_{SV} \geq p_0 + 1.5$ bar** for $p_{SV} > 5$ bar: **$p_{SV} \geq p_0 + 2.0$ bar**	p_{SV} = … bar
Final pressure	p_e	[bar]	$p_e \leq p_{SV}$ – final pressure differential to TRD 721 for $p_{SV} \leq 5$ bar: $p_e \leq p_{SV} - 0.5$ bar for $p_{SV} > 5$ bar: $p_e \leq p_{SV} - 0.1 \times p_{SV}$	p_e =… bar
Expansion vessel				
System volume	V_A	[l]	V_A = chiller + cooling coil + pipelines + buffer storage + other	V_A = … litres
Water reservoir	V_V	[l]	$V_V = 0.005 \times V_A$ **at least 3 l** for V_n > 15 l minimum water seal volume to standard	V_V = … litres
Nominal volume	V_n	[l]	for V_n > 15 l: $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_0}$ for $V_n \leq 15$ l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_0}$	V_n = … litres
Control supply pressure	p_a	[bar]	$p_a = \frac{p_e + 1}{1 + \frac{(V_e + V_D^*)(p_e + 1)}{V_n (p_0 + 1)}} - 1$ bar Precondition: $p_a \geq p_0 + 0.25 \ldots 0.3$ bar, otherwise calculate for larger nominal volume	p_a = … bar
Result				
Reflex … / … bar … litres			p_0 = … bar Check before commissioning!	
			p_a = … bar Check make-up setting!	
			p_F = … bar Refill the system!	
			p_e =… bar	

* Only applies when using Reflex Servitec in accordance with the 'Degassing' table → see page 25

Expansion vessels in solar systems

The calculation is carried out in accordance with VDI 6002 and DIN 4807 part 2.

Solar systems have a peculiarity in that the maximum temperature cannot be defined by the controller on the heat generator but is determined by the downtime temperature on the panel.

Nominal volume calculation without evaporation in the panel

The percentage expansion n* and the evaporation pressure p_D* are related to the downtime temperature. As a temperature of over 200 °C can be reached on certain panels, this calculation procedure is no longer valid at this point. Some indirectly heated pipe panels (system heat pipe) systems have a limit on the downtime temperature. If a minimum operating pressure of $p_0 \leq 4$ bar is sufficient to avoid evaporation, the calculation can usually be completed with evaporation. In this variant, it should be noted that increased temperature loading reduces the anti-freeze effect of the heat transfer medium in the long term.

Nominal volume calculation with evaporation in the panel

Evaporation cannot be excluded in panels with downtime temperatures over 200 °C. The evaporation pressure is only taken into consideration up to the required evaporation point (110 – 120 °C). In this instance, the total panel volume V_K is taken into consideration in addition to the expansion volume V_e and the water reservoir V_V when determining the nominal volume of the expansion vessel. This variant is preferred as the lower temperature places less strain on the heat transfer medium and the frost protection effect has a longer duration.

Material values n*; p_D*

Anti-freeze additives of up to 40 % are to be taken into consideration when establishing the percentage expansion n* and the evaporation pressure p_D* in accordance with manufacturers' specifications. If evaporation is included in the calculation, the evaporation pressure p_D* is taken into account up to the boiling point of 110 °C or 120 °C. The percentage expansion n* is then determined between the lowest external temperature (e. g. –20 °C) and the boiling temperature. If evaporation is not included in the calculation, the evaporation pressure p_D* and the percentage expansion n* are dependent on the downtime temperature of the panel.

Supply pressure p_0, minimum operating pressure

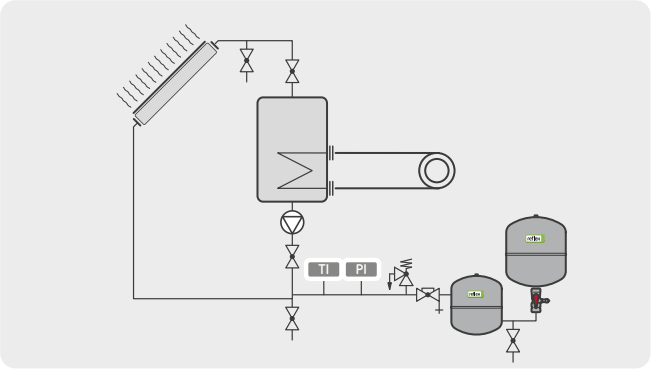
Depending on the calculation method, the minimum operating pressure (= supply pressure) is adjusted to the downtime temperature in the panel (= without evaporation) or the boiling temperature (= with evaporation). In both cases, the usual circuit for the circulating pump Δp_P stated above is to be taken into consideration as the expansion vessel is connected downstream of the flow-through pump on the pressure side (follow-up pressure maintenance).

Filling pressure p_F, supply pressure p_a

The filling temperature (10 °C) is usually well above the minimum system temperature which means the filling pressure is greater than the supply pressure.

Auxiliary vessels

If a stable return flow temperature of ≤ 70 °C cannot be guaranteed on the consumer side, an auxiliary vessel is to be installed on the expansion vessel.



Expansion vessel calculation in solar systems

Circuit: follow-up pressure maintenance, expansion vessel in the return flow to the panel.

Initial data			see manufacturer's specifications / proxy values for calculation	
Panels Volume of water	V_K	[l]	Total of all panels	V_{Kges} = … litres
Maximum inlet temp. Minimum external temp. Anti-freeze additive	t_V t_a	[°C] [°C] [%]	(110 °C or 120 °C for solar systems with evaporation) -20 °C Percentage expansion with anti-freeze additive n* and evaporation pressure with anti-freeze additive p_D*	 n* = … % p_D* = … bar
Percentage expansion		[%]	Between minimum temperature (– 20 °C) and filling temperature (usually 10 °C)	n*F = … %
Static pressure	p_{st}	[bar]		p_{st} = … bar
Differential at the flow-through pump	Δp_P	[bar]	Evaporation pressure p_D at > 100 °C (For anti-freeze additive p_D*) Req. Check supply pressure forflow-through pumps according to manufacturers' specifications.	Δp_P = … bar
Pressure calculation				
Supply pressure	p_0	[bar]	$p_0 = p_{st} + \Delta p_D + p_D$* Check permissible operating pressure is maintained.	p_0 = … bar
Safety valve actuating pressure	p_{SV}	[bar]	Reflex recommendation: for $p_{SV} \leq 5$ bar: $\mathbf{p_{SV} \geq p_0 + 1.5\ bar}$ for $p_{SV} > 5$ bar: $\mathbf{p_{SV} \geq p_0 + 2.0\ bar}$	p_{SV} = … bar
Final pressure	p_e	[bar]	$p_e \leq p_{SV}$ – final pressure differential to TRD 721 for $p_{SV} \leq 5$ bar: $p_e \leq p_{SV} - 0.5$ bar for $p_{SV} > 5$ bar: $p_e \leq p_{SV} - 0.1 \times p_{SV}$	p_e = … bar
Expansion vessel				
System volume	V_A	[l]	V_A = cooling coil + pipelines + buffer storage + other	V_A = … litres
Expansion volume	V_e	[l]	V_e = × V_A	V_e = … litres
Water reservoir	V_V	[l]	$V_V = 0.005 \times V_A$ **at least 3 l** for $V_n > 15$ l minimum water seal volume to standard	V_V = … litres
Nominal volume	V_n	[l]	for $V_n > 15$ l: $V_n = (V_e + V_V + V_{Kges}^*) \times \frac{p_e + 1}{p_e - p_0}$ for $V_n \leq 15$ l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_{Kges}^*) \times \frac{p_e + 1}{p_e - p_0}$	V_n = … litres
Control Supply pressure	p_a	[bar]	$v_{pa} = \frac{p_e + 1}{1 + \frac{(V_e + V_{Kges}^*)(p_e + 1)}{V_n (p_0 + 1)\, 2n}} - 1$ bar Precondition: $p_a \geq p_0 + 0.25 \ldots 0.3$ bar, otherwise calculate for larger nominal volume	p_a = … bar
Filling pressure	p_F	[bar]	$p_F = V_n \times$ – 1 bar	p_F = … bar
Result				
Reflex S / … bar … litres			p_0 = … bar Check before commissioning!	
			p_a = … bar Check make-up setting!	
			p_F = … bar Refill the system!	
			p_e = … bar	

* Only applies when using Reflex Servitec in accordance with the 'Degassing' table see page 25

Installation and commissioning

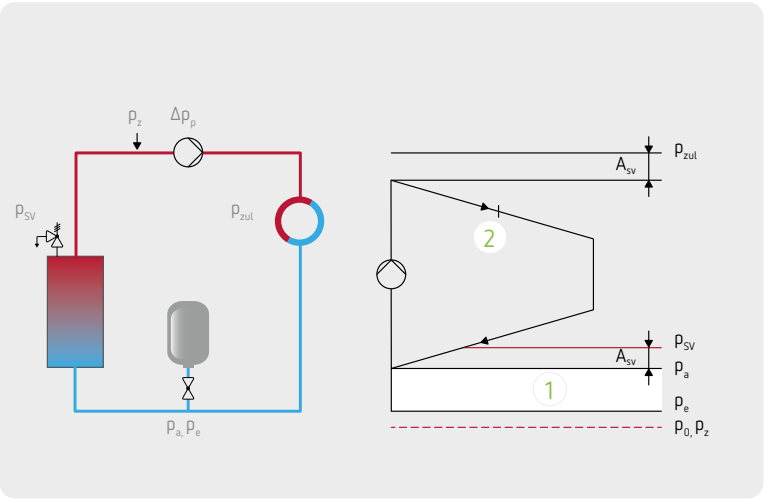
Hydraulic integration

- Integration should preferably be on the suction side of the flow-through pump and in the return flow to the boiler, solar panel or chiller
- At return temperatures of > 70 °C a V auxiliary vessel is required, at return temperatures of < 0 °C, it is recommended.
- Provide a secured shut-off with drain to DIN EN 12828 (applies to all hydraulic systems) for maintenance work (order separately). In larger systems, it is also possible to arrange the drain and shut-off separately.

The relevant assembly and operating instructions are to be taken into consideration when installing and commissioning.

- Expansion lines are to be sized and installed in accordance with local provisions. DIN EN 12828 requires that each heat generator is connected to at least one expansion line with one or more expansion vessels. It is essential to ensure frost-free conditions.
- Make-up pipes are to be integrated into the flow-through facility water, not into the expansion line.

Supply pressure maintenance (suction pressure maintenance)

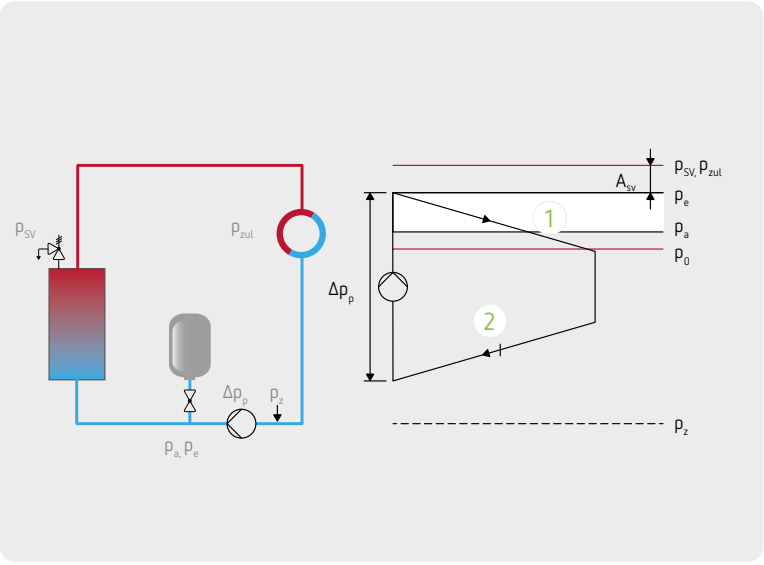


The pressure maintenance is integrated **upstream** of the flow-through pump, i.e. on the suction side. This method is used almost exclusively because it is the easiest to control.

- **Benefits**:
  + low idle pressure level
  + working pressure → idle pressure, therefore no risk of vacuum formation
- **Disadvantages:**
  – at high flow-through pump pressure (large systems) with high working pressure, observe the network load p_{zul}

1. Operating pressure
2. Idle pressure target value

Follow-up pressure maintenance



Pressure maintenance is integrated **downstream** of the flow-through pump, i.e. on the pressure side. When determining the idle pressure, a facility-specific differential pressure component for the flow-through pump (50 ... 100 %) must be included in the calculation. For use in only a limited number of cases → solar systems.

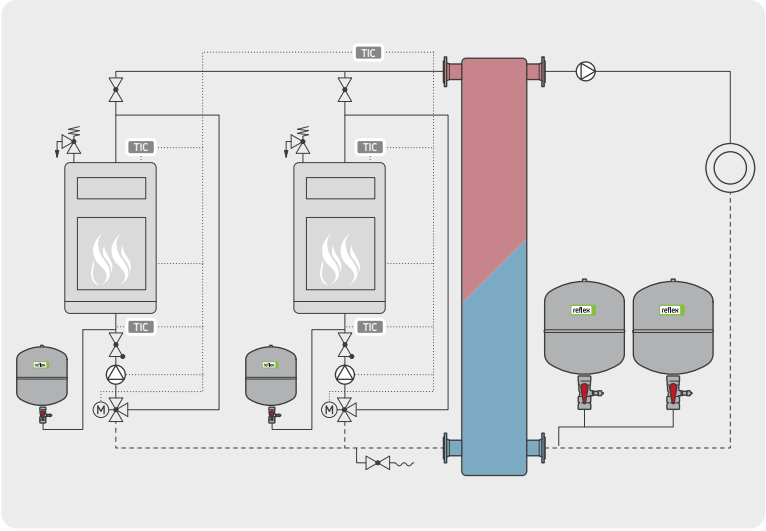
- **Benefits**:
  + low idle pressure level providing the entire pump pressure does not have to be loaded
- **Disadvantages:**
  – high idle pressure
  – greater attention to maintaining the required supply pressure p_z in accordance with manufacturers' specifications

1. Operating pressure
2. Idle pressure target value

Integrating multi-boiler systems

It is possible to have either individual protection for each boiler with an expansion vessel or overall boiler and system protection. Care should be taken to ensure the relevant boiler remains connected to at least one expansion vessel when shutting off the boiler's sequential switching. Always agree the best switching sequence with the boiler manufacturer. The system pressure and the medium characteristics (glycol component) must be the same in both circuits.

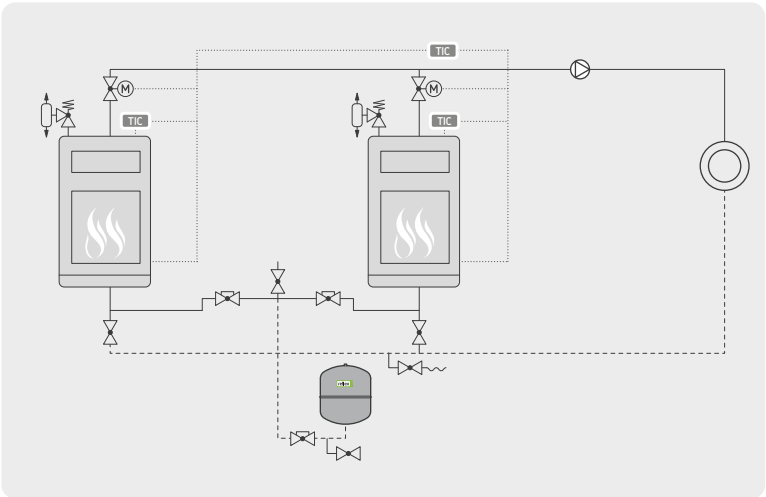
Reflex N serial circuit in a multi-boiler system with individual protection



The serial circuit of several Reflex N 6 or 10 bar vessels generally produces economical alternatives to Reflex G large vessels.

With the burner, the corresponding boiler circuit pump is switched off via the temperature control TIC and the motor valve Ⓜ is closed. The boiler remains connected to its Reflex vessel. The most frequent switching occurs with boilers with minimum return temperature. Switching the burner off reliably prevents circulation via the boiler.

Reflex in a multi-boiler system with common boiler and system protection

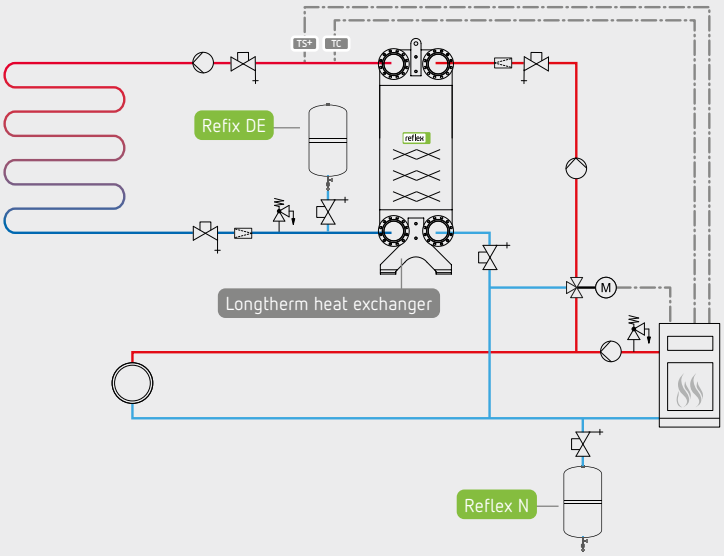


When the burner is switched off, the final control element Ⓜ is closed by the temperature controller TIC preventing incorrect circulation via the shut-off boiler. Joining the boiler expansion line above the centre of the boiler prevents gravity circulation. Preferred inset in systems without minimum boiler return flow temperature (e.g. condensing boiler systems).

The diagrams serve only as illustrations of the connections.
They are to be amended to local conditions and to be made more specific.

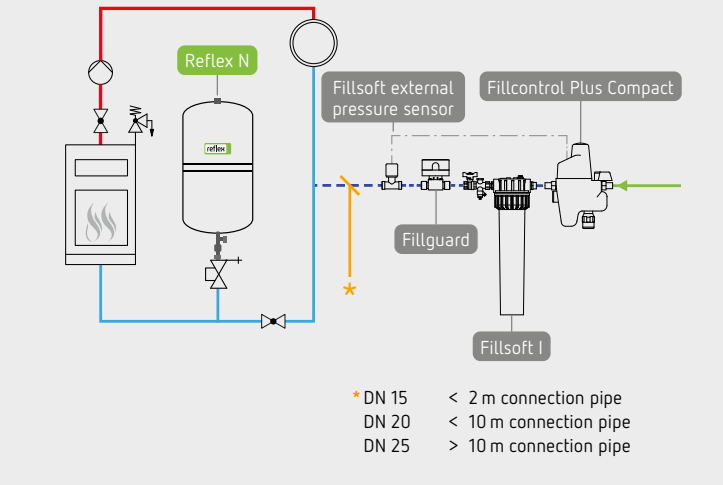
Systems with pipework at risk of corrosion

Underfloor heating without any impermeable pipes



- In systems with oxygen-rich water such as underfloor heating without any impermeable pipes, we recommend the systems are separated (separate the boiler heating circuit medium from the oxygenrich underfloor heating circuit medium) using a Longtherm heat exchanger.
- A Refix expansion vessel is used in underfloor heating circuits due to the risk of corrosion (corrosion protection for all water-bearing parts).

Maintaining VDI 2035



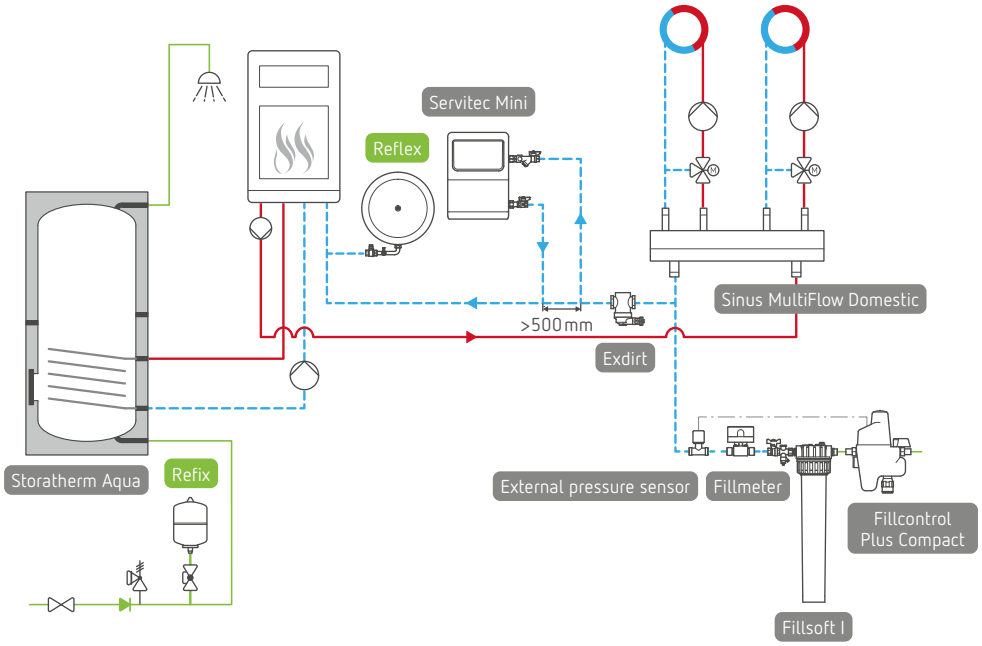
- To ensure compliance with VDI 2035, use a Fillsoft housing with a softening or demineralising cartridge (depending on the quality of the water or the specifications of the operator/boiler manufacturer).
- The Fillcontrol Plus Compact automatic make-up station which also has a system separator for the potable water supply system ensures an adequate water reservoir.

The directive VDI 2035 describes the state of the art for water quality in hot water heating systems and contributes to minimising damage due to corrosion and scale deposits in these systems. The Fillsoft series of Reflex products comply with this directive. Further information can be found in our Make-up and Water Treatment brochure.

Installation examples

Reflex vessel with automatic make-up

Solution № 01

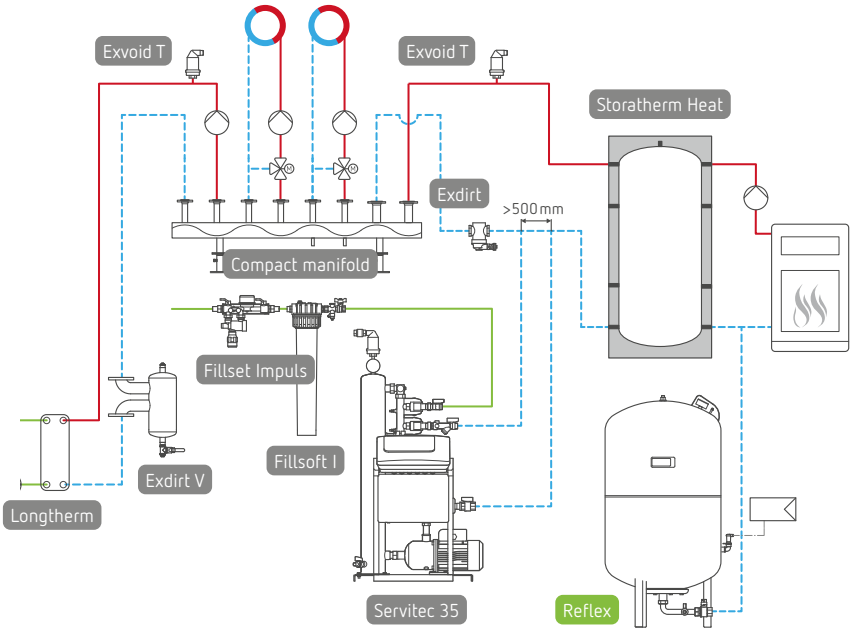


We recommend the use of an automatic make-up such as Reflex Fillcontrol Plus Compact combined with static pressure maintenance in order to ensure an adequate water seal.

Servitec vacuum spray pipe degassing and the dirt and sludge separators remove disruptive factors such as gasses and dirt from the facility water.

Reflex with flaw detector

Solution № 04



Reflex vessel with flaw detector for monitoring the bladder (from 1,000 litres and Ø 1,000 mm).

A Longtherm heat exchanger is used to separate the heating and potable water circuit.

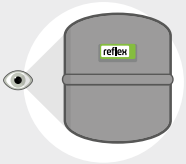
Fillset Impuls acts as a system separator to the potable water supply system. The contact water meter for determining filling and make-up quantities is connected with the Servitec controller and evaluated by it.

The diagrams serve only as illustrations of the connections.
They are to be amended to local conditions and to be made more specific.

Operation & Maintenance

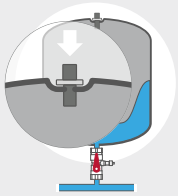
Industrial Safety Regulations require expansion vessels to be checked on an annual basis. The relevant notes for installers and operators in the Reflex Assembly, Operating and Maintenance Instructions are to be observed.

1. Visual inspection



- Inspect vessel for damage, corrosion, etc.
  In the event of damage, complete repairs or replace and determine the possible cause.
- Match vessel suitability to on-site use.

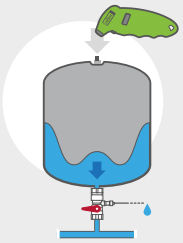
2. Check bladder



Briefly activate the gas filling valve. If water leaks out:

- For vessels which do not have a facility for replacing the bladder, replace the expansion vessel.
- For vessels which have a facility for replacing the bladder, replace the bladder or alternatively contact Reflex Service for further advice.

3. Setting gas supply pressure



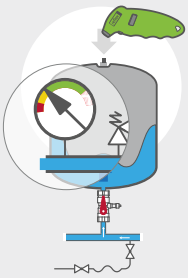
Isolate the Reflex vessel from the system using the cap valve and empty on the water side (check system pressure).
Measure supply pressure p_0 at the gas filling valve and if necessary reset to the required minimum operating pressure for the system.

$$p_0\,[\text{bar}] = p_{st} + 0.2\ \text{bar} + p_D^{*} + \Delta p_p^{**}$$

* Evaporation pressure p_0 only relevant for hot water systems >100 °C.
** Used to maintain follow-up pressure maintenance (expansion vessel downstream of the pump on the pressure) e.g. In solar thermal systems.

- If the pressure is too high, blow off the gas with the gas filling valve.
- If the pressure is too low, refill with nitrogen from a pressurised container.
- Enter the reset or corrected supply pressure p_0 on the type plate.

4. Functional inspection during operation

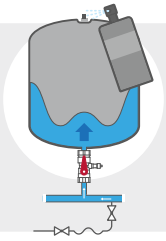


- Close drain at the cap valve and carefully open cap valve.
- Note system pressure and do not allow it to fall below p_0.
- Fill the system up to the filling pressure p_F in accordance with the system temperature.

$$p_F\,[\text{bar}] \geq p_0 + 0.3\ \text{bar}\ (\text{at filling temperature } 10\ °\text{C})$$

- Checking gas pressure during operation: the gas pressure must now be the same as the system pressure (working vessel).

5. Gas filling valve leak test



Remove optional aids for filling and measuring at the gas filling valve and inspect with leak test spray to see whether the gas filling valve leaks after use. Finally, refit the cap valve, which provides the seal, on the gas filling valve.

Refix

Key advantages

High-quality expansion vessels

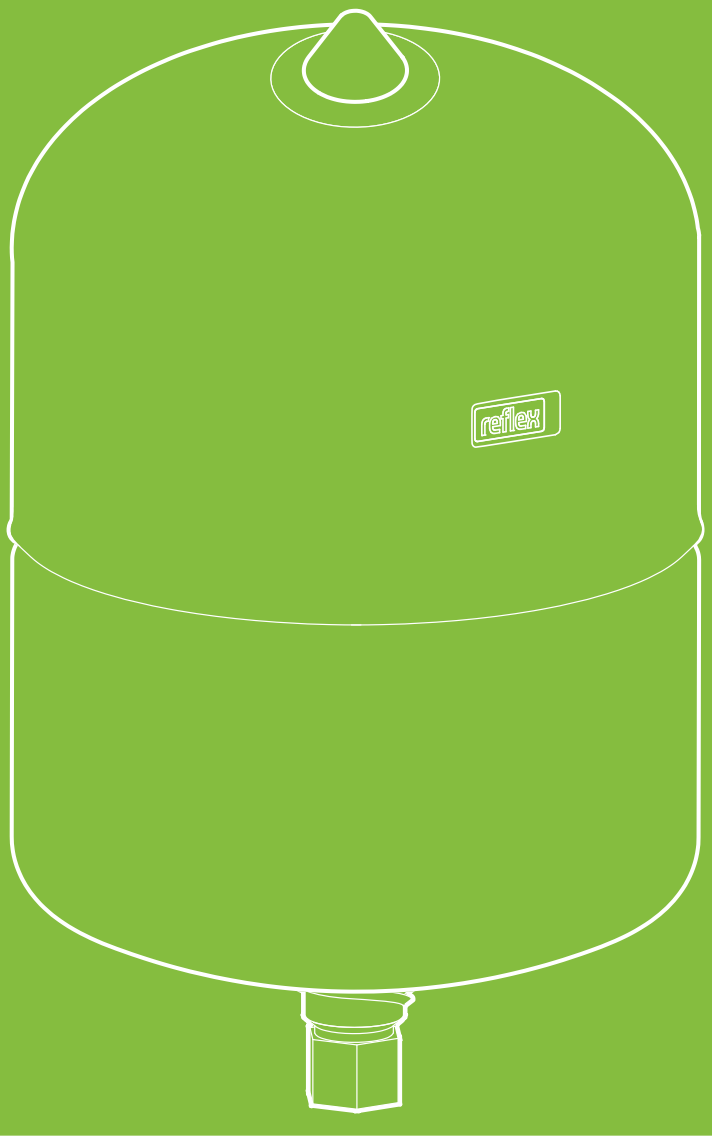
- Long operating life due to high-quality membrane and stable vessel
- Due to the use of a bladder on all DD, DT, C-DE, DE and hot water vessels, the vessel is not in contact with the medium and is therefore more resistant to corrosion
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Refix DD and DT meet all the requirements of DIN 4807 T5

Wide range of designs and application areas

- For potable water, pressure booster systems and water heating systems to DIN 1988
- For heating, heat pump, cooling and solar applications as well as process water applications which do not fall within the scope of DIN 1988.

Rapid design and installation

- Intuitive design configuration software for rapid selection and calculation
- Vessels are supplied ready for use
- Low-maintenance operation

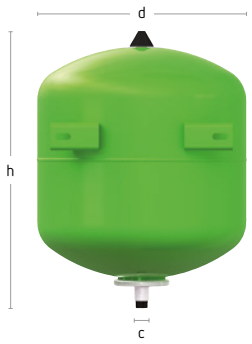


Refix product portfolio

Refix DD CE

DD 2 – 25 l

Flowjet–flow through valve
Includes Rp ¾ T-piece (for DD 8–33 l)



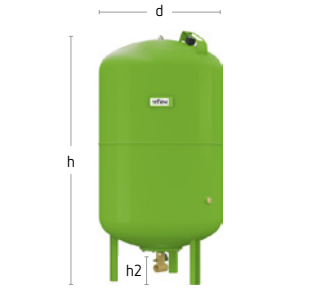
DD 33 l with brackets (rear view)

Technical **Features**

- for potable water, pressure-rising and water-heating systems according to DIN 1988
- with stainless steel thread connection
- 33 litres with brackets
- circulation with high-flow circulation star
- non-replaceable bladder according to DIN EN 13831, DIN 4807 T5, KTW-C and W270
- built and tested to DIN 4807 T5, DIN DVGW Reg. No. NW-0411AT2534 (applicable for 8 – 33 litres and 10/16 bar in combination with Flowjet flow through valve)
- approval according to Pressure Equipment Directive 2014/68/EU
- interior and exterior coating in compliance with KTW-A
- may be combined with the Flowjet — flow through valve
- with factory-pressurised gas chamber
- vessels certified to WRAS and ACS upon request
- **only for use in cold water pipes** (consider installation and operating instructions)

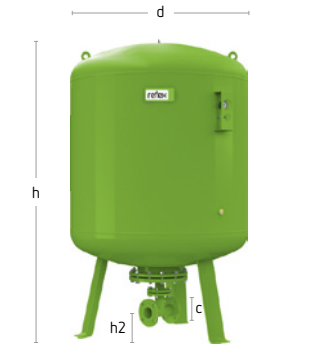
	Type	Art. No.		Inlet pressure	Connection c	Ø d	Height h	Weight
		green	white	[bar]		[mm]	[mm]	[kg]
10 bar 70 °C	DD 2	7381500	–	4.00	G ¾"	132	269	1.00
	DD 8	7308000	7307700	4.00	G ¾"	206	352	2.00
	DD 12	7308200	7307800	4.00	G ¾"	280	319	2.20
	DD 18	7308300	7307900	4.00	G ¾"	280	426	3.04
	DD 25	7308400	7380400	4.00	G ¾"	280	528	4.18
	DD 33	7380700	7380800	4.00	G ¾"	354	468	5.10
16 bar 70 °C	DD 8	7301905	–	4.00	G ¾"	206	345	2.40
	DD 12	7303805	–	4.00	G ¾"	280	318	2.96
25 bar 70 °C	DD 8	7290200	7290300	4.00	G ¾"	206	344	3.50

Refix DT



DT 60 – 500 l (with Flowjet)

DT 600 – 1,000 l (Ø740)



DT 1,000 (Ø1000) – 2,000 l

DT 3,000 l

Technical **Features**

- for potable water, pressure-rising and water-heating systems according to DIN 1988
- Flowjet incl. shut-off and draining or dual connection
- replaceable bladder according to DIN EN 13831, DIN 4807 T5, KTW-C and W270, built and tested to DIN 4807 T5, DIN DVGW Reg. No. NW-0411BR0350
- approval according to Pressure Equipment Directive 2014/68/EU
- interior and exterior coating in compliance with KTW-A
- the following types are equipped with a diaphragm break detector coupling:
  → 10 bar
  → 16 bar
- pressure gauge and supply pressure valve protected by clip
- with factory-pressurised gas chamber
- vessels certified to WRAS and ACS upon request
- **only for use in cold water pipes** (consider installation and operating instructions)

Refix DT

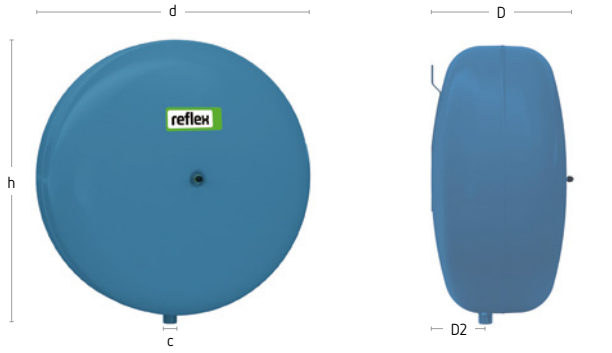
CE

	Type	Art. No. green	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
10 bar 70 °C	DT 60	7309000	4.00	Rp 1¼"	409	766	80	13.10
	DT 80	7309100	4.00	Rp 1¼"	480	750	56	17.00
	DT 80	7365000	4.00	DN 50/PN 16	480	750	97	22.20
	DT 80	7335705	4.00	DN 65/PN 16	480	750	107	24.70
	DT 80	7335805	4.00	DN 80/PN 16	480	750	115	26.80
	DT 100	7309200	4.00	Rp 1¼"	480	834	56	17.00
	DT 100	7365400	4.00	DN 50/PN 16	480	834	97	22.90
	DT 100	7365405	4.00	DN 65/PN 16	480	834	107	23.90
	DT 100	7365406	4.00	DN 80/PN 16	480	834	114	26.70
	DT 200	7309300	4.00	Rp 1¼"	634	973	80	37.00
	DT 200	7365100	4.00	DN 50/PN 16	634	973	105	53.00
	DT 200	7365105	4.00	DN 65/PN 16	634	973	115	54.00
	DT 200	7365106	4.00	DN 80/PN 16	634	973	120	57.00
	DT 300	7309400	4.00	Rp 1¼"	634	1,273	80	51.00
	DT 300	7365200	4.00	DN 50/PN 16	634	1,273	105	59.00
	DT 300	7336305	4.00	DN 65/PN 16	634	1,273	115	60.00
	DT 300	7336405	4.00	DN 80/PN 16	634	1,273	120	63.00
	DT 400	7319305	4.00	Rp 1¼"	740	1,245	69	61.00
	DT 400	7365500	4.00	DN 50/PN 16	740	1,245	95	68.00
	DT 400	7336505	4.00	DN 65/PN 16	740	1,245	105	68.00
	DT 400	7336605	4.00	DN 80/PN 16	740	1,245	110	83.00
	DT 500	7309500	4.00	Rp 1¼"	740	1,475	69	69.00
	DT 500	7365300	4.00	DN 50/PN 16	740	1,475	90	77.00
	DT 500	7365307	4.00	DN 65/PN 16	740	1,475	100	89.00
	DT 500	7365305	4.00	DN 80/PN 16	740	1,475	110	92.00
	DT 600	7365600	4.00	DN 50/PN 16	740	1,859	233	150.00
	DT 600	7336705	4.00	DN 65/PN 16	740	1,859	233	165.00
	DT 600	7336806	4.00	DN 80/PN 16	740	1,859	235	153.00
	DT 800	7365700	2.00	DN 50/PN 16	740	2,324	233	204.00
	DT 800	7336905	2.00	DN 65/PN 16	740	2,324	233	205.00
	DT 800	7337006	2.00	DN 80/PN 16	740	2,324	233	208.00
	DT 1000/740	7365800	2.00	DN 50/PN 16	740	2,804	233	260.00
	DT 1000/740	7337105	2.00	DN 65/PN 16	740	2,804	233	261.00
	DT 1000/740	7337205	2.00	DN 80/PN 16	740	2,804	233	264.00
	DT 1000/1000	7320105	2.00	DN 65/PN 16	1,000	2,001	160	386.20
	DT 1000/1000	7337305	2.00	DN 80/PN 16	1,000	2,001	150	386.20
	DT 1000/1000	7337405	2.00	DN 100/PN 16	1,000	2,001	140	386.20
	DT 1500	7320305	2.00	DN 65/PN 16	1,200	2,001	158	502.40
	DT 1500	7337505	2.00	DN 80/PN 16	1,200	2,001	150	444.30
	DT 1500	7337605	2.00	DN 100/PN 16	1,200	2,001	140	502.40
	DT 2000	7320505	2.00	DN 65/PN 16	1,200	2,461	158	686.50
	DT 2000	7337705	2.00	DN 80/PN 16	1,200	2,461	150	686.50
	DT 2000	7337805	2.00	DN 100/PN 16	1,200	2,461	140	686.50
	DT 3000	7320705	2.00	DN 65/PN 16	1,500	2,580	187	1,054.00
	DT 3000	7337905	2.00	DN 80/PN 16	1,500	2,530	180	1,057.00
	DT 3000	7338005	2.00	DN 100/PN 16	1,500	2,530	170	1,057.00

Refix DT

	Type	Art. No. green	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
16 bar 70 °C	DT 80	7316005	4.00	Rp 1¼"	480	750	56	27.80
	DT 80	7370000	4.00	DN 50/PN 16	480	750	97	33.00
	DT 80	7310306	4.00	DN 65/PN 16	480	750	107	29.10
	DT 80	7310307	4.00	DN 80/PN 16	480	750	114	36.00
	DT 100	7365408	4.00	Rp 1¼"	480	834	56	29.90
	DT 100	7370100	4.00	DN 50/PN 16	480	834	97	35.00
	DT 100	7370101	4.00	DN 65/PN 16	480	834	107	36.00
	DT 100	7370102	4.00	DN 80/PN 16	480	834	114	38.00
	DT 200	7365108	4.00	Rp 1¼"	634	973	80	55.00
	DT 200	7370200	4.00	DN 50/PN 16	634	973	105	55.00
	DT 200	7370205	4.00	DN 65/PN 16	634	973	115	56.00
	DT 200	7370206	4.00	DN 80/PN 16	634	973	120	59.00
	DT 300	7319205	4.00	Rp 1¼"	634	1,273	115	64.00
	DT 300	7370300	4.00	DN 50/PN 16	634	1,273	105	70.00
	DT 300	7314205	4.00	DN 65/PN 16	634	1,273	80	71.00
	DT 300	7314206	4.00	DN 80/PN 16	634	1,273	120	71.00
	DT 400	7370400	4.00	DN 50/PN 16	740	1,394	235	115.00
	DT 400	7339006	4.00	DN 65/PN 16	740	1,394	235	117.00
	DT 400	7339005	4.00	DN 80/PN 16	740	1,394	235	124.00
	DT 500	7370500	4.00	DN 50/PN 16	740	1,615	235	136.00
	DT 500	7370507	4.00	DN 65/PN 16	740	1,615	235	137.00
	DT 500	7370505	4.00	DN 80/PN 16	740	1,615	235	140.00
	DT 600	7370600	4.00	DN 50/PN 16	740	1,859	235	174.00
	DT 600	7339105	4.00	DN 65/PN 16	740	1,859	235	175.00
	DT 600	7339205	4.00	DN 80/PN 16	740	1,859	235	178.00
	DT 800	7370700	2.00	DN 50/PN 16	740	2,324	235	224.00
	DT 800	7339305	2.00	DN 65/PN 16	740	2,324	235	208.00
	DT 800	7339406	2.00	DN 80/PN 16	740	2,324	235	228.00
	DT 1000/740	7370800	2.00	DN 50/PN 16	740	2,804	235	275.00
	DT 1000/740	7339505	2.00	DN 65/PN 16	740	2,804	235	276.00
	DT 1000/740	7339605	2.00	DN 80/PN 16	740	2,804	235	248.00
	DT 1000/1000	7320205	2.00	DN 65/PN 16	1,000	2,001	160	488.00
	DT 1000/1000	7339705	2.00	DN 80/PN 16	1,000	2,001	150	488.00
	DT 1000/1000	7339805	2.00	DN 100/PN 16	1,000	2,001	140	488.00
	DT 1500	7320405	2.00	DN 65/PN 16	1,200	2,220	158	630.00
	DT 1500	7339905	2.00	DN 80/PN 16	1,200	2,220	150	630.00
	DT 1500	7340005	2.00	DN 100/PN 16	1,200	2,220	140	630.00
	DT 2000	7320605	2.00	DN 65/PN 16	1,200	2,480	158	850.50
	DT 2000	7340105	2.00	DN 80/PN 16	1,200	2,480	150	850.50
	DT 2000	7340205	2.00	DN 100/PN 16	1,200	2,480	140	850.50
	DT 3000	7320805	2.00	DN 65/PN 16	1,500	2,580	187	1,240.00
	DT 3000	7340305	2.00	DN 80/PN 16	1,500	2,580	180	1,240.00
	DT 3000	7340405	2.00	DN 100/PN 16	1,500	2,580	170	1,200.00

Refix C-DE



C-DE 8 – 80 l

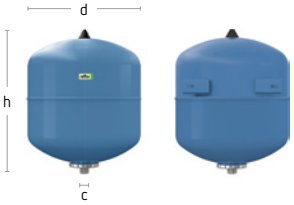
Technical Features

- vertical flat disc-shaped shallow vessels for heating, heat pump, cooling and solar applications as well as service water applications **not** required to meet the DIN 1988 requirements
- with stainless steel thread connection
- non-replaceable bladder according to DIN EN 13831
- no medium circulating, without shut-off
- parts in contact with water are corrosion-protected
- approval according to Pressure Equipment Directive 2014/68/EU
- for antifreeze additive of at least 25 – 50 %
- durable epoxy resin coating
- with factory-pressurised gas chamber

	Type	Art. No. blue	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Depth D [mm]	Depth D2 [mm]	Weight [kg]
10 bar 70 °C	C-DE 8	7270900	4.00	G ½"	280	296	176	52	3.84
	C-DE 12	7270910	4.00	G ½"	354	370	182	64	4.92
	C-DE 18	7270920	4.00	G ¾"	356	370	236	76	5.82
	C-DE 25	7270930	4.00	G ¾"	409	427	253	93	8.78
	C-DE 35	7270940	4.00	G ¾"	480	465	256	97	12.90
	C-DE 50	7270950	4.00	G ¾"	480	465	332	125	16.24
	C-DE 80	7270960	4.00	G ¾"	634	621	338	135	23.36

Refix DE

DE 2 – 25 l



DE 33 l

DE 33 – 500 l

DE 600 – 1,000 l (Ø740)

DE 1,000 – 2,000 l (Ø1000)

DE 3,000 – 5,000 l

Technical **Features**

- only for systems **not** required to meet DIN 1988, such as fire-fighting and service water systems, underfloor heating and geothermal installations
- parts in contact with water are corrosion-protected
- bladder according to DIN EN 13831/ replaceable from 50 litres
- for antifreeze additive of at least 25 – 50 %
- no medium circulating, without shut-off and without draining
- the following types incl. pressure gauge:
  → 10/16 bar: from Ø 1,000 mm
  → 25 bar: from Ø 450 mm
- pressure gauge and supply pressure valve protected by clip
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- vessels certified to WRAS and ACS upon request
- the following types are equipped with a diaphragm break detector coupling:
  → 10/16 bar: ≥ 1,000 l/Ø 1,000 mm
  → 25 bar: ≥ 80 l

Refix DE

CE

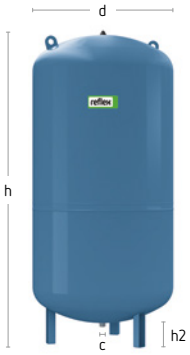
	Type	Art. No. blue	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
10 bar 70 °C	DE 2	7200300	4.00	G ¾"	132	260	–	1.02
	DE 8	7301000	4.00	G ¾"	206	332	–	1.96
	DE 12	7302000	4.00	G ¾"	280	310	–	2.42
	DE 18	7303000	4.00	G ¾"	280	407	–	3.30
	DE 25	7304000	4.00	G ¾"	280	518	–	4.12
	DE 33	7303900	4.00	G ¾"	354	457	–	4.92
	DE 33 st*	7305500	4.00	G ¾"	354	520	66	5.76
	DE 50	7306005	4.00	G1"	409	604	102	8.92
	DE 60	7306400	4.00	G1"	409	734	161	10.48
	DE 80	7306500	4.00	G1"	480	737	143	12.96
	DE 100	7306600	4.00	G1"	480	852	143	14.70
	DE 200	7306700	4.00	G 1 ¼"	634	967	150	35.00
	DE 300	7306800	4.00	G 1 ¼"	634	1,267	150	44.00
	DE 400	7306850	4.00	G 1 ¼"	740	1,245	139	58.00
	DE 500	7306900	4.00	G 1 ¼"	740	1,475	133	68.00
	DE 600	7306950	4.00	G 1 ½"	740	1,859	263	139.00
	DE 800	7306960	2.00	G 1 ½"	750	2,324	263	171.00
	DE 1000	7306970	2.00	G 1 ½"	740	2,804	261	210.00
	DE 1000	7311405	2.00	DN 65/PN 16	1,000	2,001	286	308.00
	DE 1500	7311605	2.00	DN 65/PN 16	1,200	1,991	291	426.00
	DE 2000	7311705	2.00	DN 65/PN 16	1,200	2,451	291	693.50
	DE 3000	7311805	2.00	DN 65/PN 16	1,500	2,531	320	962.00
	DE 4000	7354000	2.00	DN 65/PN 16	1,500	3,080	320	1,132.00
	DE 5000	7354200	2.00	DN 65/PN 16	1,500	3,645	320	1,292.00
16 bar 70 °C	DE 8	7301006	4.00	G ¾"	206	337	–	2.44
	DE 12	7302105	4.00	G ¾"	280	310	–	2.90
	DE 25	7304015	4.00	G ¾"	280	518	–	5.00
	DE 80	7348600	4.00	G1"	480	744	138	20.50
	DE 100	7348610	4.00	G1"	480	849	132	23.50
	DE 200	7348620	4.00	G 1 ¼"	634	967	150	48.00
	DE 300	7348630	4.00	G 1 ¼"	634	1,267	150	60.00
	DE 400	7348640	4.00	G 1 ½"	740	1,394	263	118.00
	DE 500	7348650	4.00	G 1 ½"	740	1,614	263	127.00
	DE 600	7348660	4.00	G 1 ½"	740	1,859	263	151.00
	DE 800	7348670	2.00	G 1 ½"	740	2,324	263	195.00
	DE 1000	7348680	2.00	G 1 ½"	740	2,804	263	240.00
	DE 1000	7312805	2.00	DN 65/PN 16	1,000	2,001	286	530.00
	DE 1500	7312905	2.00	DN 65/PN 16	1,200	1,991	291	685.00
	DE 2000	7313005	2.00	DN 65/PN 16	1,200	2,451	291	895.00
	DE 3000	7313105	2.00	DN 65/PN 16	1,500	2,531	320	1,240.00
	DE 4000	7354100	2.00	DN 65/PN 16	1,500	3,120	320	1,442.00
	DE 5000	7354300	2.00	DN 65/PN 16	1,500	3,655	320	1,844.00
25 bar 70 °C	DE 8	7290100	4.00	G ¾"	206	338	–	3.52
	DE 80	7317600	4.00	DN 50/PN 40	450	942	159	70.00
	DE 120	7313700	4.00	DN 50/PN 40	450	1,253	159	108.00
	DE 180	7313500	4.00	DN 50/PN 40	450	1,528	159	124.00
	DE 300	7313800	4.00	DN 50/PN 40	750	1,318	160	243.00
	DE 400	7313300	4.00	DN 50/PN 40	750	1,423	160	258.00
	DE 600	7321500	4.00	DN 50/PN 40	750	1,868	159	290.00
	DE 800	7321200	2.00	DN 50/PN 40	750	2,268	159	355.00
	DE 1000	7321000	2.00	DN 50/PN 40	750	2,768	159	245.00
	DE 1000	7322200	2.00	DN 65/PN 40	1,000	2,051	242	800.00
	DE 1500	7322100	2.00	DN 65/PN 40	1,200	2,071	291	850.00
	DE 2000	7313400	2.00	DN 65/PN 40	1,200	2,531	240	960.00
	DE 3000	7345700	2.00	DN 65/PN 40	1,500	2,619	269	1,550.00

* oB = without feet
st = vertical design with feet

Refix DC

DC 25 l

DC 50 – 400 l



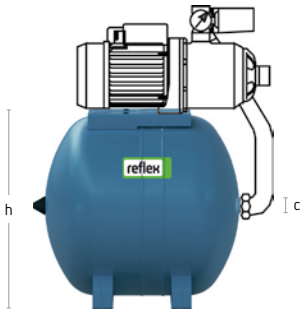
DC 500 – 600 l

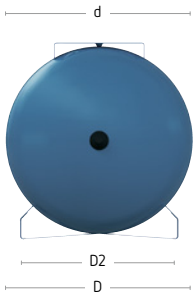
Technical Features

- only for systems **not** required to meet DIN 1988, such as fire-fighting and service water systems, underfloor heating and geothermal installations
- parts in contact with water are corrosion-protected
- for antifreeze additive of at least 25 – 50 %
- non-replaceable diaphragm according to DIN EN 13831
- no medium circulating, without shut-off & without draining
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- vessels certified to WRAS and ACS upon request

	Type	Art. No. blue	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Height h2 [mm]	Weight [kg]
10 bar 70 °C	DC 25	7200400	2.00	G1"	289	510	–	3.34
	DC 50	7309600	4.00	R 1"	418	588	115	9.20
	DC 80	7309700	4.00	R 1"	489	676	103	12.82
	DC 100	7309800	4.00	R 1"	489	782	103	14.28
	DC 140	7309900	4.00	R 1"	489	997	104	20.30
	DC 200	7363500	4.00	R 1"	643	883	91	29.30
	DC 300	7363600	4.00	R 1"	643	1,184	93	38.00
	DC 400	7363700	4.00	R 1"	749	1,173	81	54.00
	DC 500	7363800	4.00	R 1"	749	1,392	82	63.00
	DC 600	7363900	4.00	R 1"	749	1,629	75	80.00

Refix HW





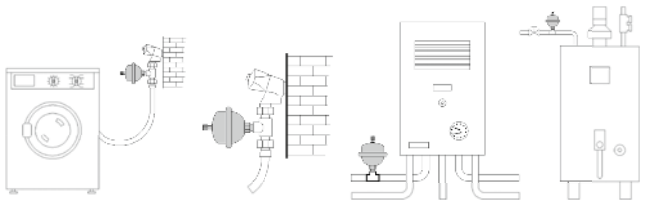
HW 25 – 100 l

Technical Features

- as a buffer vessel for domestic water systems not subject to the DIN 1988 requirements
- parts in contact with water are corrosion-protected
- bladder according to DIN EN 13831/replaceable from 50 litres
- max. permissible operating temperature 70 °C
- approval according to Pressure Equipment Directive 2014/68/EU
- durable epoxy resin coating
- with factory-pressurised gas chamber
- vessels certified to WRAS and ACS upon request

	Type	Art. No. blue	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Width w [mm]	Wide w2 [mm]	Depth D [mm]	Depth D2 [mm]	Weight [kg]
10 bar 70 °C	HW 25	7200310	1.50	G ¾"	280	301	518	227	270	214	5.05
	HW 50	7200320	2.00	G1"	409	432	503	175	350	285	9.00
	HW 60	7200330	2.00	G1"	409	432	577	175	350	285	10.00
	HW 80	7200340	2.00	G1"	480	504	593	185	350	285	12.50
	HW 100	7200350	2.00	G1"	480	504	706	305	350	285	14.06

Refix WD



WD 0.165 l

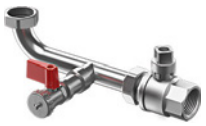
Technical Features

- for appliances with quick-closing fittings such as washers and dishwashers
- parts in contact with water are corrosion-protected
- approval according to Pressure Equipment Directive 2014/68/EU
- total volume 165 cm^3
- non-replaceable diaphragm according to DIN EN 13831
- max. permissible operating temperature 70 °C
- vessels certified to WRAS and ACS upon request

	Type	Art. No. white	DG	PQ [pce]	Inlet pressure [bar]	Connection c	Ø d [mm]	Height h [mm]	Weight [kg]
10 bar 70 °C	WD	7351000	0074	576	3.50	G ½"	83	111	0.28

Refix Accessoires

AG connection set



- for rapid assembly and maintenance of membrane expansion vessels
- incl. secured shut-off and connecting bend with screw connection
- with drainage cock (G ½") and hose nozzle
- according to DIN EN 12828
- 10 bar / 100 °C

Flowjet

- secured shut-off fitting with drain for Refix DD to DIN 4807 T5
- max. permissible operating overpressure 16 bar
- max. permissible operating temperature 70 °C
- connections both sides ¾", internal/external threads
- may be combined with user-provided T-pieces
- nominal passage width: 1"

Bladder rupture detector

- membrane rupture detector in vessels
- consisting of an electrode relay and an electrode (factory fitted)
- power supply 230 V / 50 Hz
- floating output (changeover contact)

Digital pressure gauge

- inlet pressure tester up to about 9 bar

Wall mounting bracket with clamping strap

- console with clamping strap for Reflex 6 – 25 litres
- upright assembly

Cap valve

- secured shut-off for maintenance and disassembly of expansion vessels
- with drainage
- according to DIN EN 12828
- 10 bar / 120 °C

Type	Art. No.	Weight [kg]
AG connection set AG 1"	9119204	0.85
AG connection set AG 1 ¼"	9119205	1.00
AG connection set AG 1 ½"	9119206	1.15
Bladder rupture detector MBM II	7857700	0.62
Cap valve SU R ¾" × ¾"	7613000	0.26
Cap valve SU R 1" × 1"	7613100	0.57
Digital pressure gauge	9119198	0.06
Flowjet G ¾"	9116799	0.24
Wall mounting bracket with clamping strap	7611000	0.22

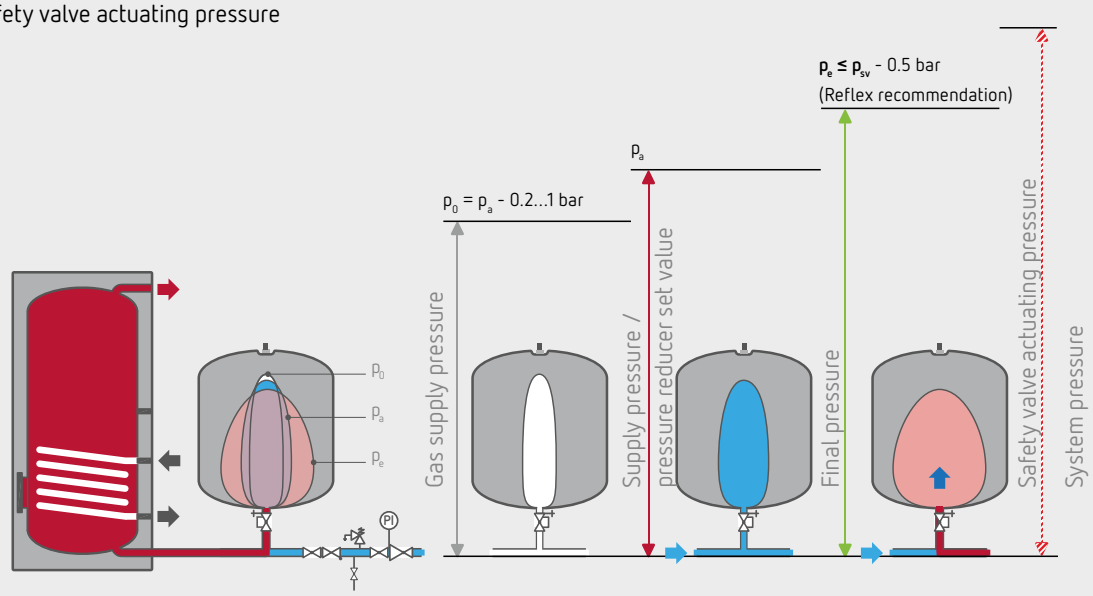
Selection and calculation

Pressures in the system

Applies to expansion vessels in hot water heating systems

Excess pressures

p_{st} = static pressure
p_0 = minimum operating pressure
p_a = supply pressure
p_e = final pressure
p_{sv} = safety valve actuating pressure



Application limits according to DVGW

The following design parameters in accordance with DIN 4708 part 5 are decisive when using MAG-W:

Potable water heater capacity	V_{Sp}	in l
Nominal volume of the MAG-W	V_n	in l
Safety valve actuating pressure	p_{sv} =	6.0 or 10.0 bar
Working pressure differential	d_{pA} =	20 % of p_{SV} in bar
Facility pressure ($p_e = p_{SV} - d_{pA}$)	p_e =	4.8 or 8.0 bar
Supply pressure in the MAG-W	p_0 =	p_a – 0.2 in bar
Supply pressure p_a (idle pressure behind the pressure reducer)	p_a	in bar
Cold water temperature	t_w =	10 °C constant
Hot water temperature	t_{ww} =	60 °C constant
Water expansion	n =	1.67 %

Quick selection table for Refix — according to the nominal volume V_n

Cold water inlet temperature: 10 °C / Storage temperature: 60 °C

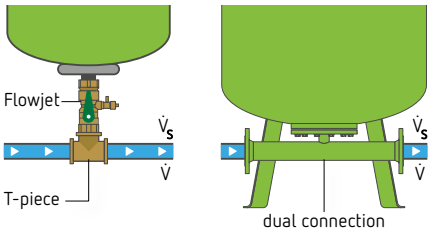
	Gas inlet pressure p_0 [bar]	3.0				4.0 = Standard			
	Pressure reducer set-point pressure p_a [bar]	≥ 3.2				≥ 4.2			
	Safety Valve p_{SV} [bar]	6	7	8	10	6	7	8	10
	V_{sp} [litres]	V_n [litres]							
Refix	90	8	8	8	8	8	8	8	8
	100	8	8	8	8	12	8	8	8
	120	8	8	8	8	12	8	8	8
	130	8	8	8	8	12	8	8	8
	150	8	8	8	8	18	12	8	8
	180	12	8	8	8	18	12	8	8
	200	12	12	8	8	18	12	12	8
	250	12	12	12	8	25	18	12	12
	300	18	18	12	12	25	18	18	12
	400	25	18	18	18	33	33	15	25
	500	25	25	18	18	60	33	25	25
	600	33	25	25	18	60	60	33	25
	700	33	33	25	25	60	60	33	25
	800	60	33	33	25	80	80	60	25
	900	60	60	33	25	80	60	60	33
	1,000	60	60	33	33	100	60	60	60
	1,500	80	80	60	60	200	100	80	60
	2,000	100	100	80	80	200	200	100	80
	3,000	100	100	100	100	300	200	200	100

Quick selection table for Refix — according to peak volumetric flow $\dot{V}_s$

Cold water inlet temperature: 10 °C / Storage temperature: 60 °C

	available connections		recommended max. peak volume flow $\dot{V}_s$*	actual pressure loss at volume flow $\dot{V}$
Refix DD 8 – 33 l	with or without Flowjet	Rp ¾" = standard	≤ 2.5 m³/h	$\Delta p = 0.03\ \text{bar} \times \left(\frac{\dot{V}\ \text{m}^3/\text{h}}{2.5\ \text{m}^3/\text{h}}\right)^2$
	passing T-piece	Rp 1" (on-site)	≤ 4.2 m³/h	negligible
Refix DT 60 – 500 l	with Flowjet Rp 1 ¼"		≤ 7.2 m³/h	$\Delta p = 0.04\ \text{bar} \times \left(\frac{\dot{V}\ \text{m}^3/\text{h}}{2.5\ \text{m}^3/\text{h}}\right)^2$
Refix DT 80 – 3,000 l	dual connection DN 50		≤ 15 m³/h	$\Delta p = 0.14\ \text{bar} \times \left(\frac{\dot{V}\ \text{m}^3/\text{h}}{2.5\ \text{m}^3/\text{h}}\right)^2$
	dual connection DN 65		≤ 27 m³/h	$\Delta p = 0.11\ \text{bar} \times \left(\frac{\dot{V}\ \text{m}^3/\text{h}}{2.5\ \text{m}^3/\text{h}}\right)^2$
	dual connection DN 80		≤ 36 m³/h	negligible
	dual connection DN 100		≤ 56 m³/h	negligible
Refix DE, Refix DC	(no medium circulating)		unlimited	Δp = 0

* determined for a speed of 2 m/s



After the nominal volume of the Refix has been selected, a check as to whether the peak volumetric flow $\dot{V}_s$ (resulting from a tube network analysis according to DIN 1988 norm) can be realised at the Refix must be made with the medium circulating in the vessels.

If this is the case, then a 60 litre Refix DT must be used at the Refix DD instead of a 8–33 litre vessel to ensure a greater flow.

Comprehensive calculation and design notes

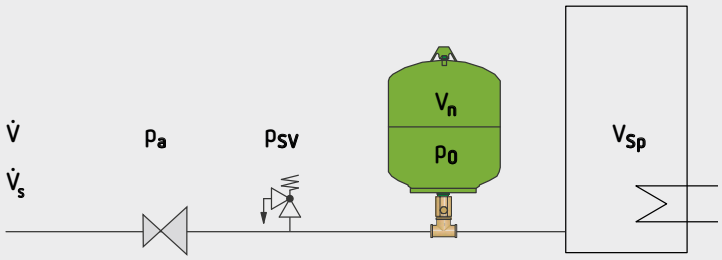
Potable water is a food stuff. Expansion vessels in potable water installations therefore have to meet specific requirements to DIN 4807 part 5. Only vessels with flow-through are permitted.

Refix in water heating systems

Calculation

The calculation is completed in accordance with DIN 4807 part 5 see next page

Circuit



The safety valve is usually installed directly at the cold water inlet on the water heater. On Refix DD and DT, the safety valve may also be installed immediately upstream of the flow through, shut-off and drain valve when viewed from the direction of flow if the following conditions are met:

Refix DD with T-piece:	Rp ¾"	max. 200 l water heater
	Rp 1"	max. 1,000 l water heater
Refix DT flow-through fitting:	Rp 1¼"	max. 5,000 l water heater

Material values n, p_D

Usually determined between cold water temperature 10 °C and maximum hot water temperature 60 °C.

Thermal disinfection

With thermal disinfection, the entire hot water network is heated to > 70 °C. As expansion vessels are installed in the cold water feed, they are not affected by the increased temperature. If thermal disinfection is included, this must only be included in the calculation.

Supply pressure p_0, minimum operating pressure

The minimum operating pressure or supply pressure p_0 in the expansion vessel must be at least 0.2 bar less than the minimum flow pressure. Depending on the distance between the pressure reducer and the Refix, supply pressure settings of 0.2 to 1.0 bar less than the preset pressure on the pressure reducer are required.

Supply pressure p_a

This is identical to the preset pressure on the pressure reducer. Pressure reducers to DIN 4807 part 5 are required in order to achieve a stable supply pressure and therefore the full capacity of the Refix.

Expansion vessel

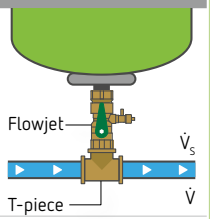
In potable water systems to DIN 1988, only Refix vessels with flow-through to DIN 4807 part 5 may be used. Refix with a connection may be used for non-potable water.

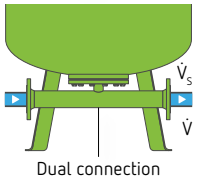
Initial data			see manufacturer's specifications / proxy values for calculation	
Vessel volume	V_{Sp}	[l]		
Heat output	$\dot{Q}_W$	[kW]		
Water temperature	t_{WW}	[°C]	Depending on the controller setting 50 … 60 °C	
Percentage expansion		[%]		n = … %
Pressure reducer	p_a	[bar]	Setting pressure	p_a = … bar
Safety valve	p_{SV}	[bar]	Reflex recommendation: 10 bar	p_{SV} = … bar
Peak flow	$\dot{V}_S$	[m³/h]		$\dot{V}_S$ = … [m³/h]
Selection by nominal volume V_n				
Supply pressure	p_0	[bar]	$p_0 = p_a - (0.2 \ldots 1.0\,\text{bar})$ Set supply pressure 0.2 … 1.0 bar less than pressure reducer (depending on distance between pressure reducer and Refix)	p_0 = … bar
Nominal volume	V_n	[l]	$V_n = V_{Sp} \times \frac{n \times (p_{sv} + 0.5)\,(p_0 + 1.2)}{100 \times (p_0 + 1)\,(p_{sv} - p_0 - 0.7)}$	V_n = … litres

Selection by peak volume $\dot{V}_S$

Once the nominal volume of the Refix has been selected, checks must be carried out on vessels with flow-through to establish whether the peak volume flow $\dot{V}_s$, resulting from the calculation of the pipe network in accordance with DIN 1988 can be implemented on the Refix vessels. If this is the case, for Refix DD, a 60 litre Refix DT is to be used instead of the 8 – 33 litre vessel for greater flow. Alternatively, a Refix DD with a suitably larger T-piece can be used whereby it should be noted that the flow-through insert of the DD vessel protrudes into the full bore of the T-piece.

	Available connections		recommended max. peak volume flow $\dot{V}_S$*	actual pressure loss at volume flow $\dot{V}$
Refix DD 8 – 33 l	with or without Flowjet	Rp ¾" = Standard	≤ 2.5 m³/h	$\Delta p = 0.03\,\text{bar} \times \left(\frac{\dot{V}\,\text{m}^3/\text{h}}{2.5\,\text{m}^3/\text{h}}\right)^2$
	T-piece bore	Rp 1" (on site)	≤ 4.2 m³/h	negligible
Refix DT 60 – 500 l	with Flowjet Rp 1¼"		≤ 7.2 m³/h	$\Delta p = 0.04\,\text{bar} \times \left(\frac{\dot{V}\,\text{m}^3/\text{h}}{7.2\,\text{m}^3/\text{h}}\right)^2$
Refix DT 80 – 3,000 l	Twin connection DN 50		≤ 15 m³/h	$\Delta p = 0.14\,\text{bar} \times \left(\frac{\dot{V}\,\text{m}^3/\text{h}}{15\,\text{m}^3/\text{h}}\right)^2$
	Twin connection DN 65		≤ 27 m³/h	$\Delta p = 0.11\,\text{bar} \times \left(\frac{\dot{V}\,\text{m}^3/\text{h}}{27\,\text{m}^3/\text{h}}\right)^2$
	Twin connection DN 80		≤ 36 m³/h	negligible
	Twin connection DN 100		≤ 56 m³/h	negligible
Refix DE, Refix DC	(No flow-through)		unlimited	Δp = 0





Δp = … bar

G = …

* determined for a speed of 2 m/s

Result	
Refix DT5 l	V_n = … l
Refix DD ..... l G = ... (Standard Rp 3/4" incl.)	p_0 = … bar
Refix DT5 l	

Refix in pressure booster systems

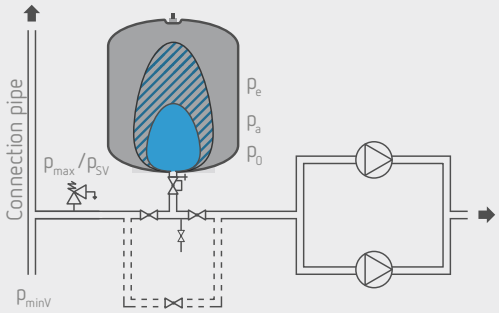
Potable water is a food stuff. Expansion vessels in potable water installations therefore have to meet specific requirements to DIN 4807 part 5. Only vessels with flow-through are permitted.

Calculation

The calculation is completed in accordance with DIN 1988 part 5, Codes of practice for potable water installations, pressure boosting and pressure reduction.

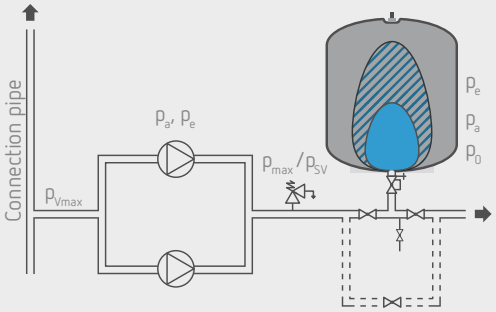
Circuit

Refix in pressure booster systems
Suction side



On the **upstream side of a pressure boosting system (DEA)**, Refix expansion vessels relieve the pressure on the connection pipe and the supply network. Installation is to be agreed with the water supply company.

Refix in pressure booster systems
Pressure side



On the **downstream side of a pressure booster system (DEA)** the switching frequency is reduced when installing Refix, particularly in cascade controlled systems. Installation on both sides of the DEA may be necessary.

Supply pressure p_0, supply pressure p_a

The minimum operating pressure or the supply pressure p_0 in the Refix must be set to approximately 0.5 to 1 bar less than the minimum supply pressure when installed on the suction side and 0.5 to 1 bar less than the cut-in pressure on the pressure side of a DEA. As the supply pressure pa is at least 0.5 bar greater than the supply pressure, there is always an adequate water reservoir available which is an important precondition for low-wear operation.

Care should be taken to ensure the pressure surges do not exceed the maximum permissible operating pressure.

In potable water systems to DIN 1988, only Refix vessels with flow-through to DIN 4807 part 5 may be used. Refix with a connection may be used for non-potable water.

Suction side circuit: Refix on the upstream side of the DEA

Installation is to be agreed with the relevant water supply company. This is necessary if the following criteria cannot be met:

- if a pump fails in the DEA, the flow speed in the connection pipe of the DEA may not alter by more than 0.15 m/s
- if all the pumps fail, by not more than 0.5 m/s
- when the pump is in operation, the minimum supply pressure p_{minV} may not drop below 50 % and must be at least 1 bar

Initial data			see manufacturer's specifications / proxy values for calculation	
min. supply pressure max. feed flow	p_{minV} $\dot{V}_{maxP}$	[bar] [m³/h]	Selection in accordance with DIN 1988 part 5 max. feed flow $\dot{V}_{maxP}$ / m³/h: ≤ 7 / > 7 ≤ 15 / > 15 Refix DT with twin connection V_n / litre: 300 / 500 / – Refix DT V_n / litre: 300 / 600 / 800	V_n = ... litres
Supply pressure	p_0	[bar]	$p_0 = p_{minV} - 0.5$ bar	p_0 = ... bar
Result				
Refix DT5		 l	V_n = ... l	
with twin connection DN 50			p_0 = ... bar	
Refix DT5		 l		

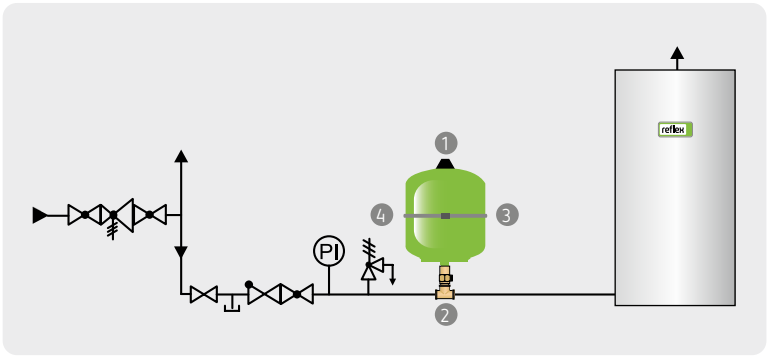
Pressure side circuit Refix on the downstream side of the DEA

Initial data			see manufacturer's specifications / proxy values for calculation	
For limiting the switching frequency in pressure-controlled systems				
Max. pump head for the DEA Max. supply pressure Cut-in pressure Cut-out pressure Max. feed flow Switching frequency No. of pumps Electrical power of the more powerful pump	H_{max} p_{max} p_E p_A $\dot{V}_{maxP}$ s n P_{el}	[mWs] [bar] [bar] [bar] [l/h] [1/h] [pieces] [kW]	s – Switching frequency: 1/h: 20 / 15 / 10 Pump output: kW: ≤ 4.0 / ≤ 7.5 / ≤ 7.5	
Nominal volume	V_n	[l]	$V_n = 0.33 \times V_{maxP} \frac{p_A + 1}{(p_A - p_E) \times s \times n}$	V_n = ... litres
For storing the minimum feed quantity V_e between On and Off for the DEA				
Cut-in pressure Cut-out pressure Refix supply pressure Feed quantity	p_E p_A p_0 V_e	[bar] [bar] [bar] [l]	Reflex recommendation: for $p_0 = p_E - 0.5$ bar	p_0 = ... bar
Nominal volume	V_n	[l]	$V_n = V_e \frac{(p_E + 1)(p_A + 1)}{(p_0 + 1)(p_A - p_E)}$	V_n = ... litres
Check permissible operating excess pressure		p_{max} [bar]	$p_{max} = \leq 1.1\ p_{zul} \frac{H_{max}\ [mWs]}{10}$	p_{max} = ... bar
Initial data				
Refix DT5..... l			V_n = ... l	
with twin connection DN 50			V_n = ... l	
Refix DT5 l			p_0 = ... bar	

Installation and commissioning

Refix in water heating systems–installation examples

Refix DD, DT 60–500 with Flowjet flow through, shut-off and drain valve



- The **complete solution** with Flowjet flow through, shut-off and drain valve
- **Benefits:** Flowjet is easy to fit and DIN-compliant Guaranteed shut off, drainage and flow-through for Refix.

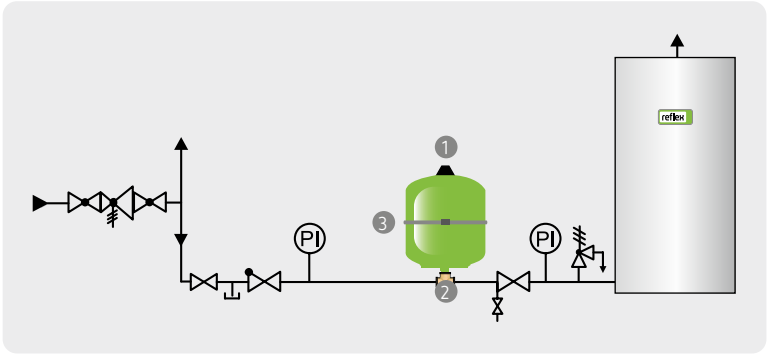
1. Refix DD or Refix DT 60–500
2. Flowjet flow through, shut-off and drain valve optional accessory for Refix DD:
   - standard with T-piece Rp ¾", $\dot{V} \leq 2.5\ m^3/h$
   - for T-piece Rp 1" $\dot{V} \leq 4.2\ m^3/h$

for Refix DT 60–500' with Flowjet:

- standard with Rp 1¼" $\dot{V} \leq 7.2\ m^3/h$

3. Reflex wall-hung holder for 8–25 litres (33 l with butt straps, DT with feet)
4. A safety valve may also be fitted upstream in the direction of flow of the Refix DD or the DT5 with Flowjet provided the nominal diameter of the required $S_V \leq$ than the downstream storage feed.

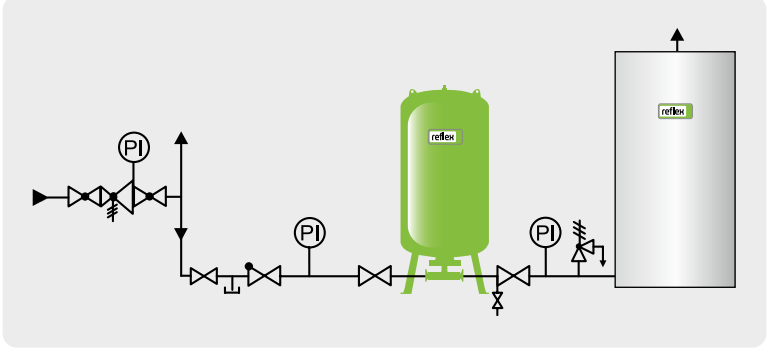
Refix DD without Flowjet flow through, shut-off and drain valve



- If no Flowjet flow through, shut-off and drain valve is fitted, the feed to the water heater must be shut-off during maintenance work and the Refix DD drained via an on-site fitting.

1. Refix DD
2. T-piece Rp ¾", $\dot{V} \leq 2.5\ m^3/h$
   For T-piece Rp 1" $\dot{V} \leq 4.2\ m^3/h$
3. Reflex wall-hung holder for 8–25 litres (33 l with butt straps feet)

Refix DT with twin connection



- Additional fittings are required when shutting off and draining the Refix DT with twin connection.
- The safety valve can not be shut off at the cold water inlet on the vessel.

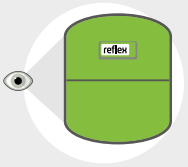
Vessel charging systems are sometimes subjected to high temperatures. Please contact your Reflex representative.

Operation & Maintenance

Industrial Safety Regulations require expansion vessels to be checked on an annual basis. The relevant notes for installers and operators in the Reflex Assembly, Operating and Maintenance Instructions are to be observed.

1. Visual inspection

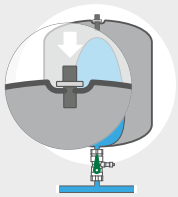
- Inspect vessel for damage, corrosion, etc.
  In the event of damage, complete repairs or replace and determine the possible cause.
- Match vessel suitability to on-site use.



2. Check bladder

Briefly activate the gas filling valve. If water leaks out:

- For vessels which do not have a facility for replacing the bladder, replace the expansion vessel.
- for vessels which have a facility for replacing the bladder,replace the bladder or alternatively contact Reflex Service for further advice.



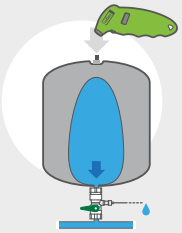
3. Setting gas supply pressure

Isolate the Reflex vessel from the system using the cap valve (Flowjet) and empty on the water side.
Measure supply pressure p_0 at the gas filling valve and if necessary reset to the required minimum operating pressure for the system.

p_0 [bar] = p_a – 0.2 bar*

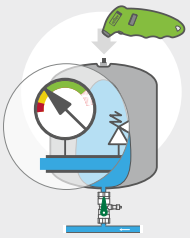
* At greater distances (pressure loss) to the pressure reducer, increase the difference to p_a to up to 1 bar.

- If the pressure is too high, blow off the gas with the gas filling valve.
- If the pressure is too low, refill with nitrogen from a pressurised container.
- Enter the reset or corrected supply pressure p_0 on the type plate.



4. Functional inspection during operation

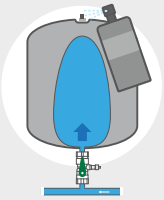
- Close drain at the cap valve and carefully open cap valve (Flowjet).
- Checking gas pressure during operation the gas pressure must now be the same as the system pressure (compare with pressure gauge on the pressure reducer) then the vessel is operational.
- If the vessel has heated up, the pressure in the vessel may be approximately 0.5 bar less than the safety valve actuating pressure.



5. Gas filling valve leak test

Remove optional aids for filling and measuring at the gas filling valve and inspect with leak test spray to see whether the gas filling valve leaks after use. Finally, refit the cap valve, which provides the seal, on the gas filling valve.

The Refix expansion vessel is now ready to be used again.



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