reflex
Thinking solutions.

Expansion vessels

Reflex, Refix

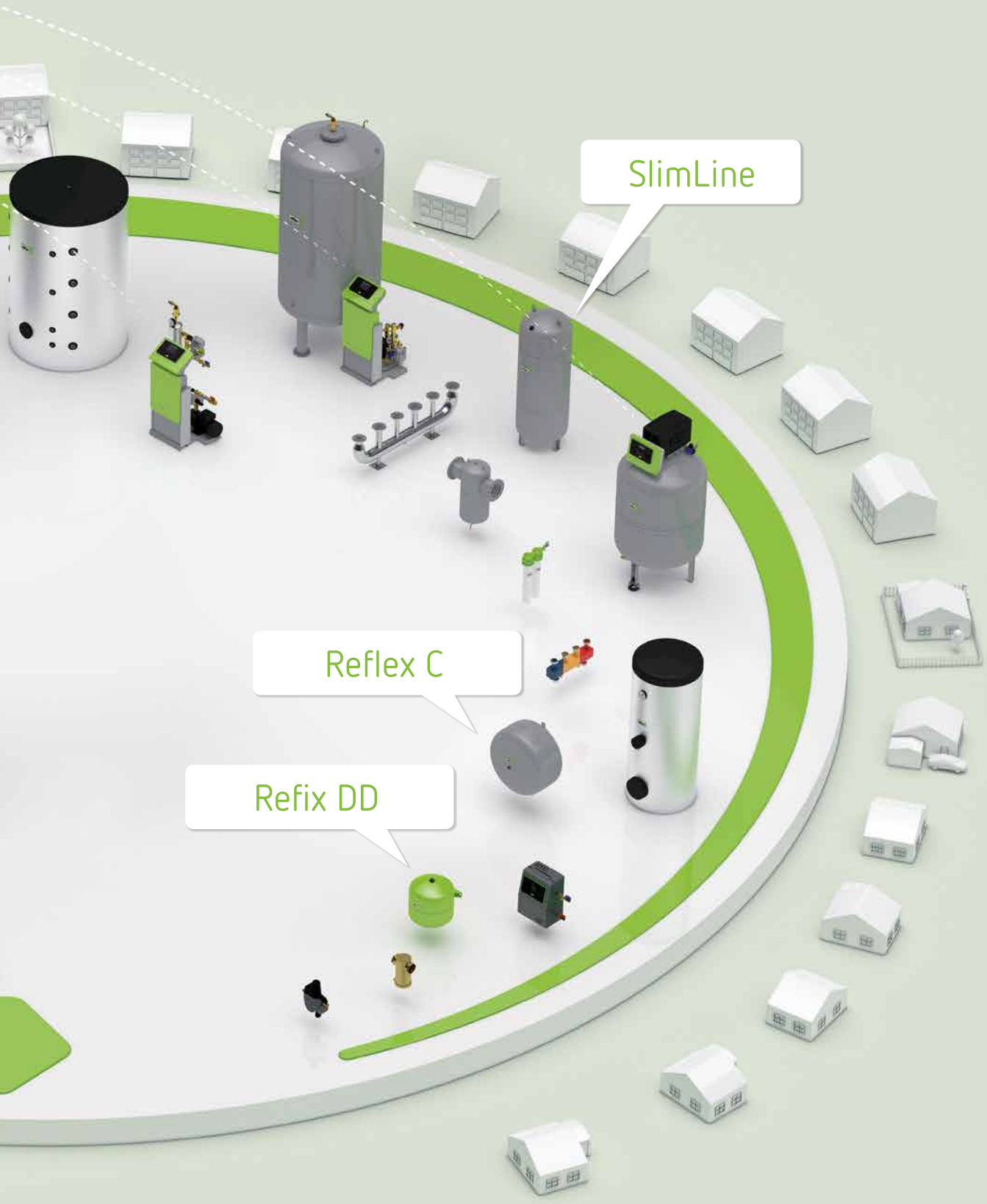
Reflex—
A strong brand for decades

Reflex Winkelmann GmbH—part of the Building+Industry division—is a leading provider of high-quality 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 expansion vessels, but also innovative components and holistic solutions for pressure maintenance, water make-up, degassing and water treatment, hot water storage tanks and heat exchangers, as well as hydraulic manifolds and storage components. Reflex Winkelmann GmbH has over 1500 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

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 drinking 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:

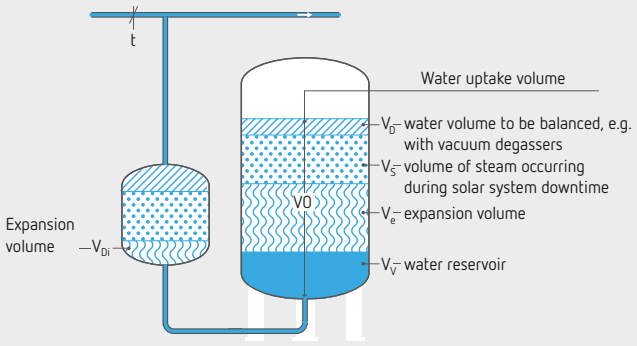
1. Maintain the pressure within permissible limits at all points in the facility system. This means ensuring the permissible operating pressure is not exceeded but also maintaining a minimum pressure to avoid negative pressures, cavitation and evaporation.

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

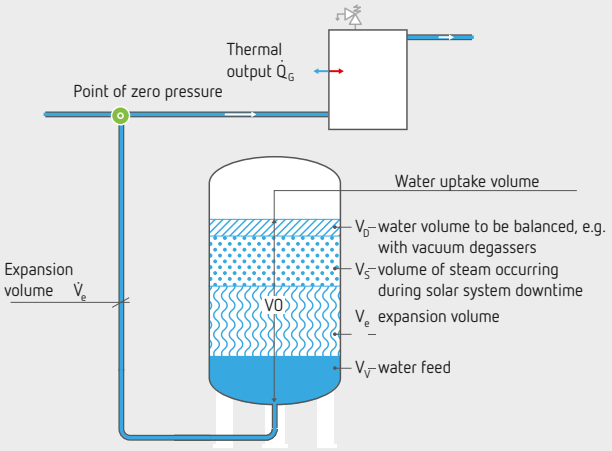
Pressure maintenance is required to compensate fluctuations in volume between the maximum and the minimum system temperature and thus to maintain the pressure within a permissible range. To achieve this, there must be a sufficient water uptake volume which must correspond to the expansion volume V_e 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.

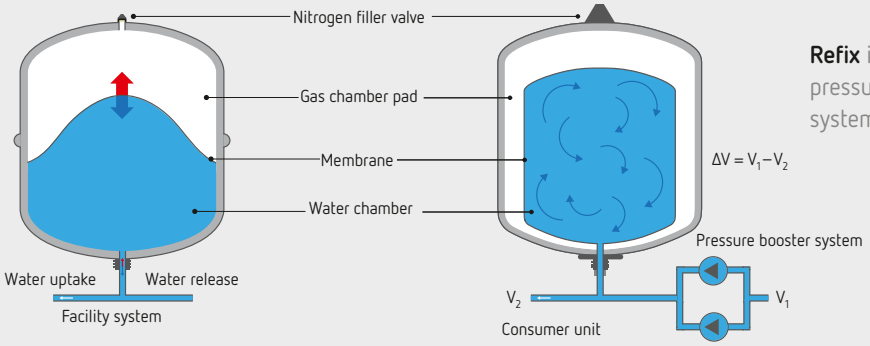
Buffer and control vessels have to provide an intermediate storage for the difference between the requested and the required volume flow. If the requirement is to reduce the switching frequency of the feed device, this is also known as a control vessel. In principle, the Refix product range is used as 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

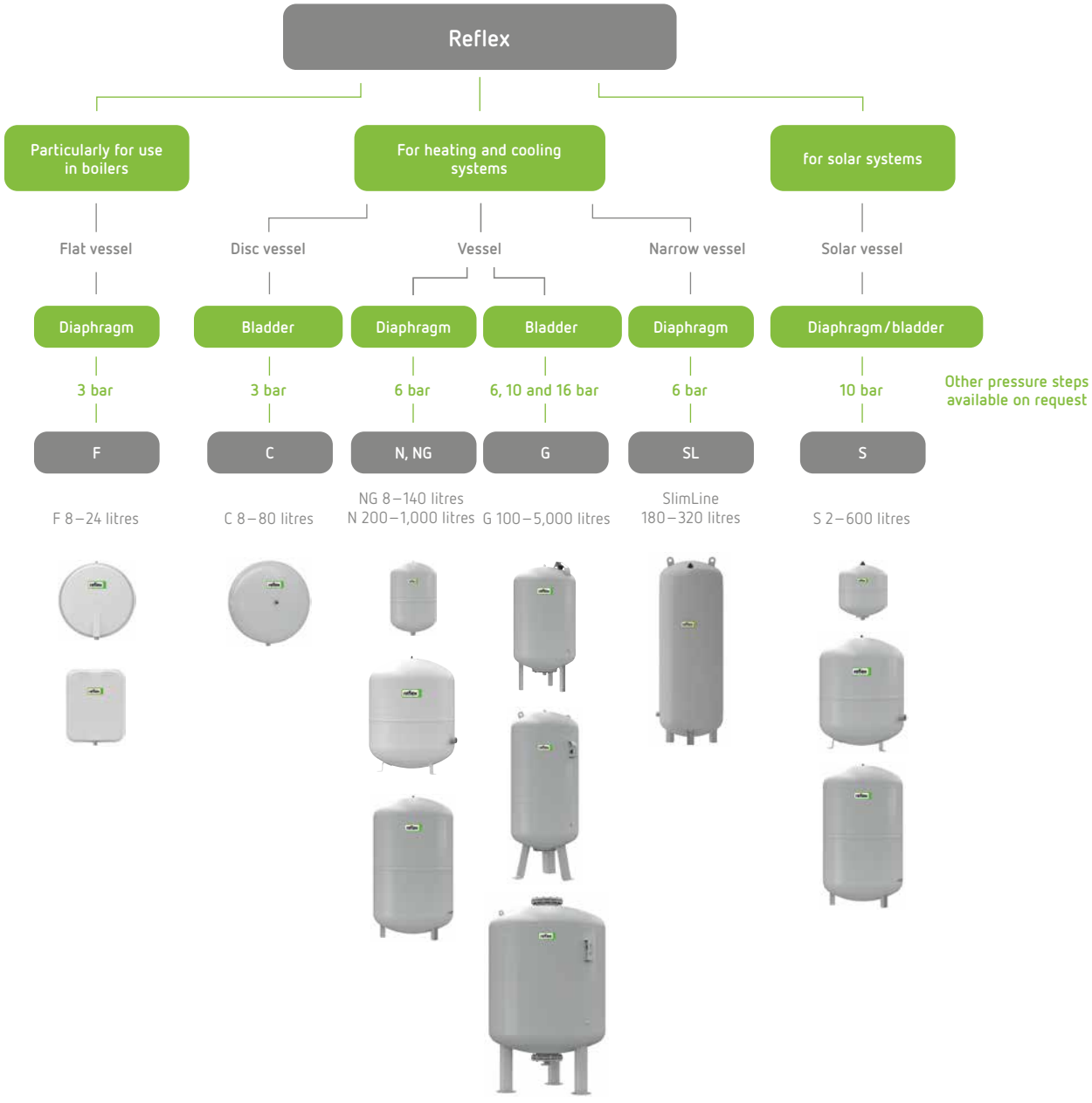
Reflex in a heating system (example)



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 the cut-in pressure occurs at the pressure pad and the pressure booster system is switched on again.

Expansion vessels for heating, solar and cooling water systems



V Auxiliary vessel

No bladder

V 6 – V 350 → 10 bar/110 °C
V 500–5,000 litres → 6 bar/120 °C
V 1,000–5,000 litres → 10 bar/120 °C

CE

Expansion vessels for potable and process water systems

Refix

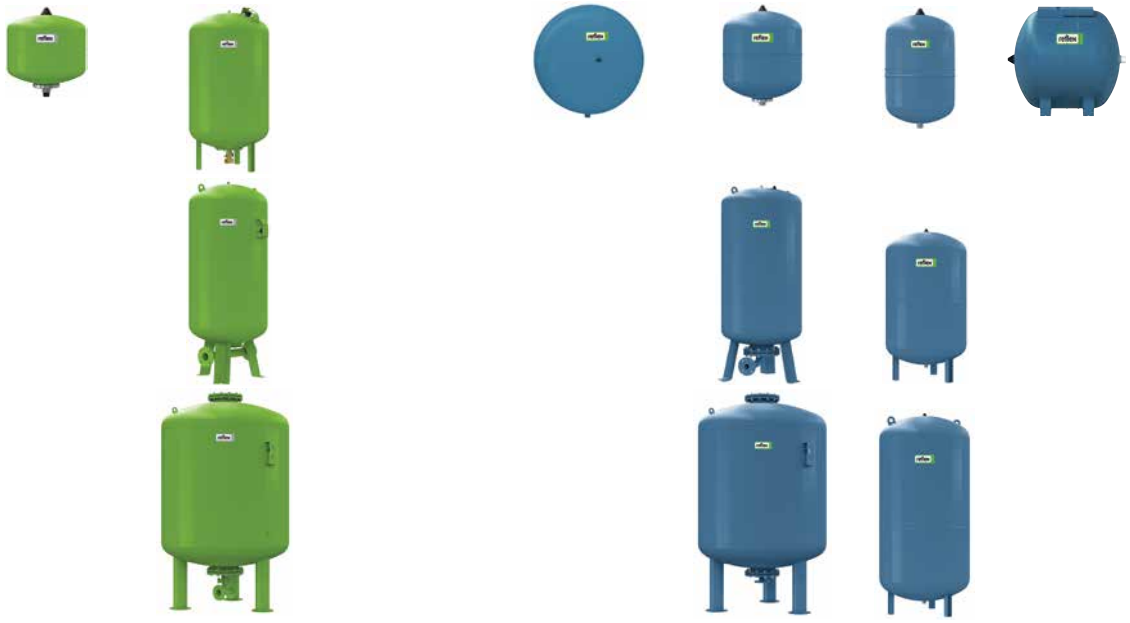
For potable water, pressure booster systems and water heating systems to DIN 1988

- Small vessel
  - Bladder
  - 10 and 25 bar
  - DD
  - DD 2–33
- Large vessel
  - Bladder
  - 10 and 16 bar
  - DT
  - DT 60–3,000

Other pressure steps available on request

Only for systems which are not covered by DIN 1988*

- Disc vessel
  - Bladder
  - 10 bar
  - C-DE
  - C-DE 8–80
- Vessel
  - Bladder
  - 10, 16 and 25 bar
  - DE
  - DD 2–5,000
  - Diaphragm
  - 10 bar
  - DC
  - DD 25–600
- Vessel for domestic water systems
  - Bladder
  - 10 bar
  - HW
  - HW 25–100



Water shock arrestor

Diaphragm | WD** | 0.165 litres/0 bar**

For example for installation directly at the tap point

* e.g. fire extinguishing and process water systems, underfloor heating, geothermal ...

** Not for use with 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 NG & N

NG 8–25

NG 35–140

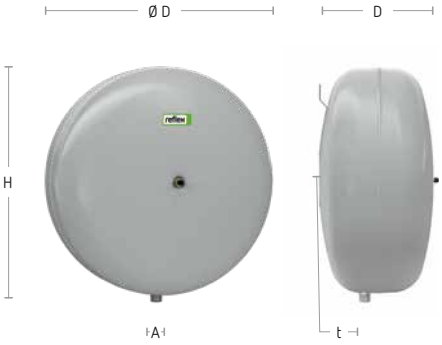
N 200–1000

Technical features

- For closed heating and cooling systems
- With threaded connection
- From 35 litres, with feet — up to size N 80, wall mounted
- Non-replaceable diaphragm in accordance with DIN EN 13831
- Permissible operating temperature: 70 °C
- For anti-freeze additives with a concentration of 25 to 50 %
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Max. permissible system temperature 120 °C

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height H [mm]	Connection A	Inlet pressure [bar]	Weight [kg]
6 bar 70 °C	NG 8	8230100	96	grey	209	318	-	R ¾"	1.5	1.7
	NG 8	7230107	96	white	209	318	-	R ¾"	1.5	1.7
	NG 12	8240100	72	grey	280	275	-	R ¾"	1.5	2.3
	NG 12	7240107	72	white	280	275	-	R ¾"	1.5	2.3
	NG 18	8250100	56	grey	283	382	-	R ¾"	1.5	2.9
	NG 18	7250107	56	white	280	382	-	R ¾"	1.5	2.9
	NG 25	8260100	42	grey	280	494	-	R ¾"	1.5	3.7
	NG 25	7260107	42	white	280	494	-	R ¾"	1.5	3.7
	NG 35	8270100	24	grey	354	459	130	R ¾"	1.5	4.75
	NG 35	7270107	24	white	354	459	130	R ¾"	1.5	4.75
	NG 50	8001011	24	grey	409	469	158	R ¾"	1.5	5.65
	NG 50	7001100	24	white	409	469	158	R ¾"	1.5	5.65
	NG 80	8001211	12	grey	480	565	165	R 1"	1.5	9.2
	NG 80	7001300	12	white	480	565	165	R 1"	1.5	9.2
	NG 100	8001411	10	grey	480	675	165	R 1"	1.5	11.5
	NG 100	7001500	10	white	480	675	165	R 1"	1.5	11.5
	NG 140	8001611	8	grey	480	886	165	R 1"	1.5	21.9
	NG 140	7001700	8	white	480	886	165	R 1"	1.5	21.9
	N 200	8213300	4	grey	634	758	205	R 1"	1.5	23.8
	N 250	8214300	4	grey	634	888	205	R 1"	1.5	24.7
	N 300	8215300	1	grey	634	1.092	235	R 1"	1.5	27.0
	N 400	8218000	1	grey	740	1.102	245	R 1"	1.5	47.0
	N 500	8218300	1	grey	740	1.321	245	R 1"	1.5	52.0
	N 600	8218400	1	grey	740	1.531	245	R 1"	1.5	66.0
	N 800	8218500	1	grey	740	1.996	245	R 1"	1.5	96.0
	N 1000	8218600	1	grey	740	2.413	245	R 1"	1.5	118.0

Reflex C



C 8–80 litres

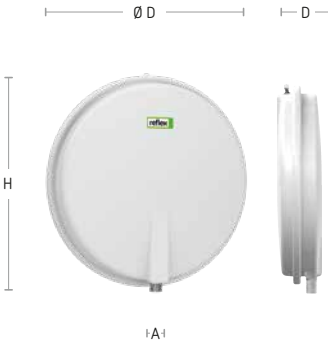
Technical features

- For closed heating and cooling systems
- With threaded connection
- Incl. fixing bracket for easy installation
- Non-replaceable bladder in accordance with DIN EN 13831
- Permissible operating temperature: 70 °C
- For anti-freeze additives with a concentration of 25 to 50 %
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Max. permissible system temperature 120 °C

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Depth T [mm]	Depth t [mm]	Connection A	Inlet pressure [bar]	Weight [kg]
3 bar 70 °C	C 8	8280000	96	-	280	296	176	52	G ½"	1.0	2.8
	C 12	8280100	60	-	354	370	182	64	G ½"	1.0	3.2
	C 18	8280200	42	-	356	370	236	76	G ¾"	1.0	4.7
	C 25	8280300	42	-	409	427	253	93	G ¾"	1.0	5.5
	C 35	8280400	24	-	480	465	256	97	G ¾"	1.0	7.3
	C 50	8280500	20	-	480	465	332	125	G ¾"	1.5	8.1
	C 80	8280600	8	-	634	621	338	135	G ¾"	1.5	14.5

Reflex F

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



F 8 litres

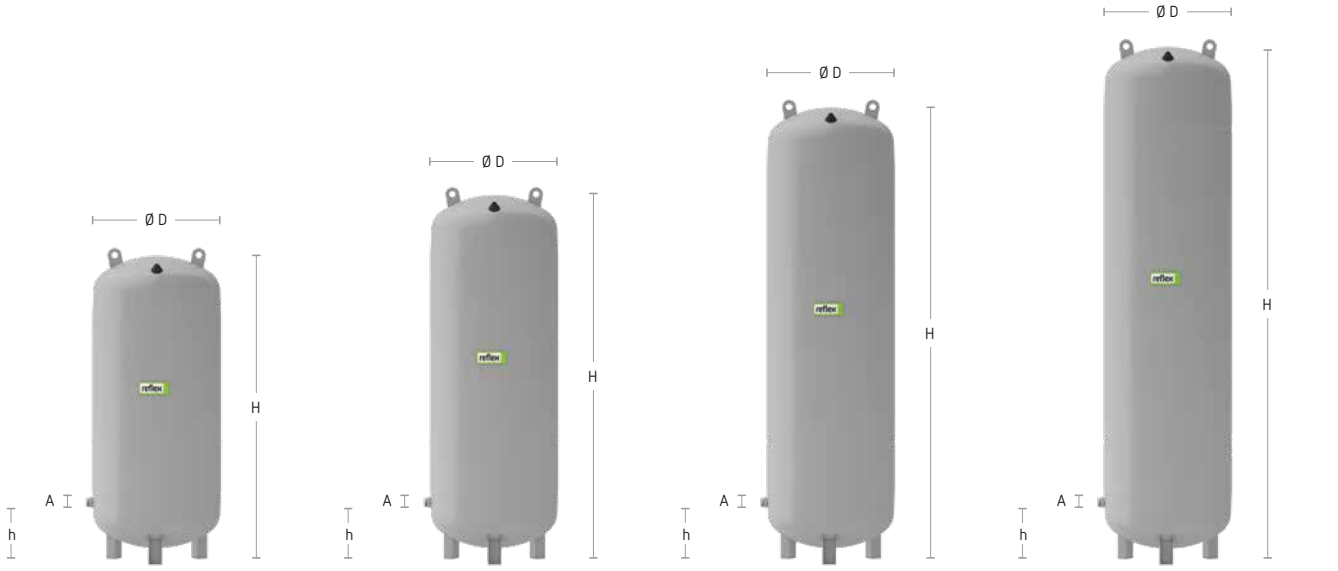
F 12–24 litres

Technical features

- Flat vessel for closed heating and cooling systems, specifically for use in a boiler
- With threaded connection
- From 18 litres with fixing bracket
- Non-replaceable diaphragm in accordance with DIN EN 13831
- Permissible operating temperature: 70 °C
- For anti-freeze additives with a concentration of 25 to 50 %
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Max. permissible system temperature 120 °C
- Reflex F 8 vessel honoured with Plus X Award

	Model	Product no.	VPE	Colour	Height H [mm]	Depth T [mm]	Ø D [mm]	Width B [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
3 bar 70 °C	F 8	9600011	54	white	-	88	389	-	G ⅜"	0.75	6.3
	F 12	9600030	36	white	444	108	-	350	G ½"	1.00	7.7
	F 15	9600040	36	white	444	134	-	350	G ¾"	1.00	8.2
	F 18	9600000	28	white	444	158	-	350	G ¾"	1.00	8.7
	F 24	9600010	25	white	444	180	-	350	G ¾"	1.00	9.4

Reflex SL



SlimLine 180 litres | SlimLine 220 litres | SlimLine 280 litres | SlimLine 320 litres

The footprint of the Reflex SlimLine vessels correspond to the footprint and the usable volume of the OTTO Expansomat: direct exchange is therefore possible.

Technical features

- Slimline, space-saving vessel for closed heating and cooling systems
- Non-replaceable diaphragm in accordance with DIN EN 13831
- Supply pressure: 1.5 bar
- External coating
- G 1" connection
- Permissible operating pressure: 6 bar
- Permissible operating temperature: 70 °C
- Permissible max. system temperature: 120 °C
- For anti-freeze additives with a concentration of 25 to 50 %

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height H [mm]	Connection A	Inlet pressure [bar]	Weight [kg]
6 bar 70°C	SL 180	8200200	1	grey	480	1,156	214	G 1"	1.5	27.4
	SL 220	8200250	1	grey	480	1,386	214	G 1"	1.5	33.3
	SL 280	8200300	1	grey	480	1,716	214	G 1"	1.5	41.8
	SL 320	8200350	1	grey	480	1,946	214	G 1"	1.5	47.8

Reflex G

G 100–500 litres

G 600–1,000 (Ø 740) litres

G 1,000 (Ø 1000) –2,000 litres

G 3,000–5,000 litres

Technical **features**

- For closed heating and cooling systems
- With feet
- Connections
  - → up to 1,000 litres/Ø 740 mm with threaded connections
  - → from 1,000 litres/Ø 1.000 mm with flange connections DN 65/PN 6 or DN 65/PN 16
- Replaceable bladder in accordance with DIN EN 13831
- Permissible operating temperature: 70 °C
- For anti-freeze additives with a concentration of 25 to 50 %
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- With bushing for optional flaw detector (from 1,000 litres and Ø 1,000 mm)
- With inspection opening bushing (from 1000 litres and Ø 1,000 mm)
- Pressure gauge and supply pressure valve protected by clamp
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Max. permissible system temperature 120 °C

	Model	Product no.	Colour	Ø D [mm]	Height H [mm]	Height H [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
6 bar 70 °C	G 100	8519000	grey	480	850	145	G 1"	3.5	19.2
	G 200	8519100	grey	634	967	144	G 1¼"	3.5	36.5
	G 300	8519200	grey	634	1,267	144	G 1¼"	3.5	41.6
	G 400	8521605	grey	740	1,276	146	G 1"	3.5	43.0
	G 500	8521705	grey	740	1,494	146	G 1"	3.5	51.0
	G 600	8522605	grey	740	1,739	146	G 1"	3.5	66.0
	G 800	8523610	grey	740	2,186	149	G 1"	3.5	94.0
	G 1000	8546605	grey	740	2,593	146	G 1"	3.5	150.0
	G 1000	8524605	grey	1,000	1,973	307	DN 65/PN 6	3.5	228.0
	G 1500	8526605	grey	1,200	1,971	305	DN 65/PN 6	3.5	280.0
	G 2000	8527605	grey	1,200	2,451	291	DN 65/PN 6	3.5	300.0
	G 3000	8544605	grey	1,500	2,490	334	DN 65/PN 6	3.5	620.0
	G 4000	8529605	grey	1,500	3,065	334	DN 65/PN 6	3.5	770.0
	G 5000	8530605	grey	1,500	3,598	334	DN 65/PN 6	3.5	849.0
10 bar 70 °C	G 100	8518000	grey	480	850	146	G 1"	3.5	19.2
	G 200	8518100	grey	634	966	144	G 1¼"	3.5	33.4
	G 300	8518200	grey	634	1,267	144	G 1¼"	3.5	34.6
	G 400	8521005	grey	740	1,275	133	G 1¼"	3.5	52.0
	G 500	8521006	grey	740	1,494	133	G 1¼"	3.5	60.0
	G 600	8522006	grey	740	1,859	263	G 1½"	3.5	118.0
	G 800	8523005	grey	740	2,324	263	G 1½"	3.5	166.0
	G 1000	8546005	grey	740	2,648	263	G 1½"	3.5	190.0
	G 1000	8524005	grey	1,000	2,001	286	DN 65/PN 16	3.5	335.0
	G 1500	8526005	grey	1,200	1,991	291	DN 65/PN 16	3.5	390.0
	G 2000	8527005	grey	1,200	2,451	291	DN 65/PN 16	3.5	485.0
	G 3000	8544005	grey	1,500	2,542	320	DN 65/PN 16	3.5	830.0
	G 4000	8529005	grey	1,500	3,117	320	DN 65/PN 16	3.5	1,064.0
	G 5000	8530005	grey	1,500	3,652	320	DN 65/PN 16	3.5	1,274.0
16 bar 70 °C	G 100	8518400	grey	480	992	231	DN 25/PN 16	3.5	25.0
	G 200	8518500	grey	634	1,088	221	DN 25/PN 16	3.5	57.0
	G 300	8518600	grey	634	1,392	221	DN 25/PN 16	3.5	66.0
	G 400	8510206	grey	740	1,373	198	DN 40/PN 16	3.5	118.0
	G 500	8518700	grey	740	1,618	197	DN 40/PN 16	3.5	130.0
	G 600	8522007	grey	740	1,871	198	DN 40/PN 16	3.5	158.0
	G 800	8523906	grey	740	2,336	198	DN 40/PN 16	3.5	221.0
	G 1000	8546906	grey	740	2,804	201	DN 40/PN 16	3.5	260.0
	G 1000	8524205	grey	1,000	2,031	276	DN 65/PN 16	3.5	468.0
	G 1500	8526305	grey	1,200	2,021	281	DN 65/PN 16	3.5	650.0
	G 2000	8527100	grey	1,200	2,481	281	DN 65/PN 16	3.5	731.0
	G 3000	8544705	grey	1,500	2,550	310	DN 65/PN 16	3.5	805.0
	G 4000	8529405	grey	1,500	3,110	310	DN 65/PN 16	3.5	890.0
	G 5000	8529705	grey	1,500	3,645	310	DN 65/PN 16	3.5	1,020.0

Reflex S

S 2–33 litres

S 50–250 litres

S 300–600 litres

Technical features

- For solar, heating and cooling systems
- With threaded connection
- Up to 33 litres with fixing bracket, from 50 litres with feet
- For anti-freeze additives with a concentration of 25 to 50 %
- Non-replaceable bladder up to 33 litres, non-replaceable diaphragm 50–600 litres
- Permissible operating temperature: 70 °C
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Max. permissible system temperature 120 °C

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height H [mm]	Connection A	Inlet pressure [bar]	Weight [kg]
10 bar 70 °C	S 2	8707700	280	grey	132	260	-	G ¾"	0.5	1.0
	S 8	9702600	96	white	206	332	-	G ¾"	1.5	1.8
	S 8	8703900	96	grey	206	332	-	G ¾"	1.5	1.8
	S 12	9702700	60	white	280	300	-	G ¾"	1.5	2.5
	S 12	8704000	60	grey	280	300	-	G ¾"	1.5	2.5
	S 18	9702800	56	white	280	409	-	G ¾"	1.5	3.5
	S 18	8704100	56	grey	280	409	-	G ¾"	1.5	3.5
	S 25	9702900	42	white	280	518	-	G ¾"	1.5	3.8
	S 25	8704200	42	grey	280	518	-	G ¾"	1.5	3.8
	S 33	9706300	24	white	354	455	-	G ¾"	1.5	6.3
	S 33	8706200	24	grey	354	455	-	G ¾"	1.5	6.3
	S 50	8209500	20	grey	415	469	158	R ¾"	3.0	9.5
	S 80	8210300	12	grey	486	562	166	R 1"	3.0	12.1
	S 100	8210500	10	grey	486	667	165	R 1"	3.0	14.2
	S 140	8211500	6	grey	486	886	172	R 1"	3.0	17.4
	S 200	8213400	-	grey	640	758	205	R 1"	3.0	35.6
	S 250	8214400	-	grey	640	888	205	R 1"	3.0	40.8
	S 300	8215400	-	grey	640	1,092	235	R 1"	3.0	47.0
	S 400	8219000	-	grey	746	1,102	245	R 1"	3.0	61.0
	S 500	8219100	-	grey	746	1,321	245	R 1"	3.0	72.0
	S 600	8219200	-	grey	746	1,559	245	R 1"	3.0	87.0

Reflex V

V 6–20 litres

V 40–60 litres

V 200–350 litres

V 500–750 litres

V 1,000–2,000 litres

V 3,000–5,000 litres

Technical features

- Auxiliary vessel
- Up to 20 litres with fixing bracket, from 40 litres with feet
- No bladder
- Required for systems with return temperatures > 70 °C or in cooling systems with temperatures < 0 °C
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- May also be used as buffer tank
- Special container > 10 bar/> 120 °C available on request
- Long-lasting epoxy resin coating
- Max. permissible system temperature 110 °C or 120 °C (depending on design and size)

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height H [mm]	Connection A	Weight [kg]
6 bar 120 °C	V 500	8852800	-	grey	750	1,717	208	DN 40/PN 6	160.0
	V 750	8851800	-	grey	750	2,323	208	DN 40/PN 6	205.0
	V 1000	8851905		grey	1,000	2,020	305	DN 65/PN 6	310.0
	V 1500	8852305	-	grey	1,200	2,020	305	DN 65/PN 6	445.0
	V 2000	8852405	-	grey	1,200	2,478	305	DN 65/PN 6	545.0
	V 3000	8852505	-	grey	1,500	2,556	337	DN 65/PN 6	775.0
	V 4000	8853405	-	grey	1,500	3,131	337	DN 65/PN 6	1,060.0
	V 5000	8854805	-	grey	1,500	3,666	337	DN 65/PN 6	1,095.0
10 bar 110 °C	V 6	8303100	96	grey	206	244	-	R ¾"	2.0
	V 12	8303200	72	grey	280	244	-	R ¾"	3.0
	V 20	8303300	42	grey	280	360	-	R ¾"	3.5
	V 40	8303400	18	grey	409	562	113	R 1"	7.8
	V 60	8303500	12	grey	409	732	172	R 1"	23.0
	V 200	8303600	-	grey	634	901	142	DN 40/PN 16	43.0
	V 300	8303700	-	grey	634	1,201	142	DN 40/PN 16	48.0
	V 350	8303800	-	grey	634	1,341	142	DN 40/PN 16	51.0
10 bar 120 °C	V 1000	8400205	-	grey	1,000	2,055	286	DN 65/PN 16	560.0
	V 1500	8400305	-	grey	1,200	2,045	284	DN 65/PN 16	780.0
	V 2000	8400405	-	grey	1,200	2,505	284	DN 65/PN 16	940.0
	V 3000	8400505	-	grey	1,500	2,600	313	DN 65/PN 16	1,405.0
	V 4000	8400605	-	grey	1,500	3,178	313	DN 65/PN 16	1,930.0
	V 5000	8400705	-	grey	1,500	3,713	313	DN 65/PN 16	2,015.0

Reflex accessories

Safe shut-offs

According to DIN EN 12828 "the water chamber in expansion vessels must be ... able to be emptied. All expansion vessels are to be designed such that they can be shut-off from the heating system."

We recommend the following for standard systems:
- use same size Reflex cap valve as the expansion vessel for expansion vessel with R ¾ threaded connections and R 1
- for expansion vessel with flange connections the same size as the expansion line (see page 21 for range)

Reflex cap valve

- Secure shut-off for maintaining and dismantling expansion vessels
- With drain
- To DIN EN 12828
- PN 10/120 °C
- Use 1" connectors from size N/S/G 80

AG connection group

- For particularly rapid assembly and maintenance of expansion vessels (recommended for series G)
- Includes safe shut-off and connecting bends with screw connection
- With G ½" drainage cock and hose fitting
- To DIN EN 12828
- PN 16/120 °C

Wall-hung holders

Holder with multiple connections

- Holder with multiple connections for Reflex 8–25 litres
- With vessel connection as above
- 10 bar

Wall-hung holder

- Bracket with strap for Reflex 8–25 litres, vertical mounting

Bladder rupture detector II flaw detector

- Indicates bladder flaws in Reflex vessels
- Comprises an electric relay and an electrode (factory assembled)
- Voltage supply 230 V/50 Hz
- Floating output (change-over contact)
- Only supplied with a vessel with flaw detector bushing

Digital test pressure gauge

DIN EN 12828: "Expansion vessels are to be maintained on an annual basis. The inlet gas pressure p_0 is to be checked with a fitting while waterless and corrected if necessary."

- Supply pressure test device up to approx. 9 bar

Model	Product no.	VPE	Weight [kg]
Connection group 1"	9119204	-	0.9
Connection group 1¼"	9119205	-	1.0
Connection group 1½"	9119206	-	1.2
Digital test pressure gauge	9119198	-	0.1
Flaw detector	7857700	-	0.2
Cap valve R ¾"	7613000	-	0.4
Cap valve R 1"	7613100	-	0.6
Bracket with strap	7611000	36	0.3
Holder with multiple connections	7612000	-	0.9

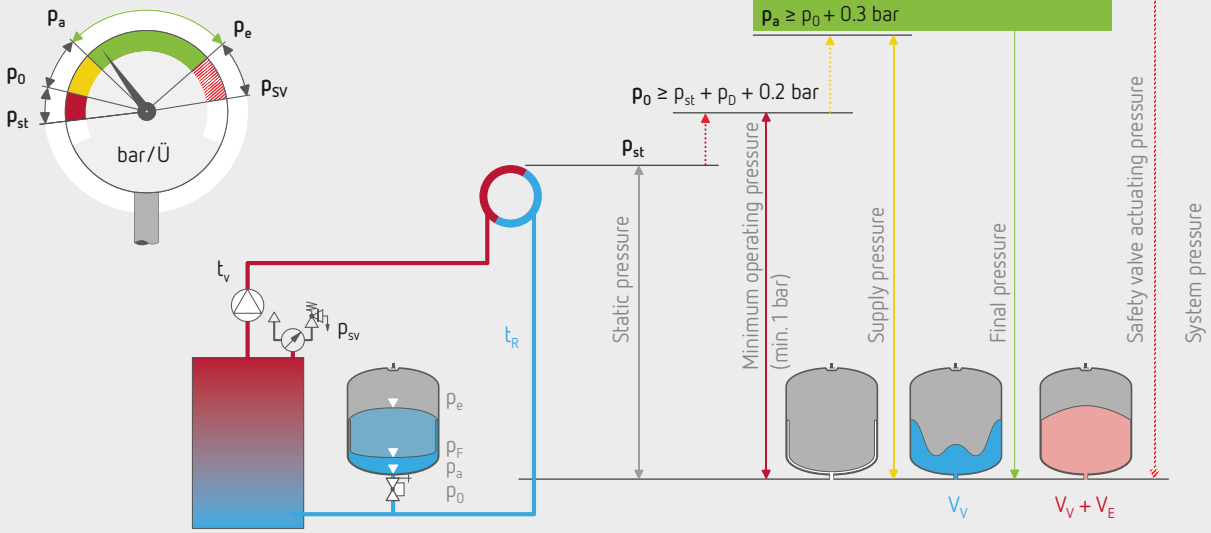
Selection and calculation

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

Customised planning with the Reflex Pro calculation program

www.reflex-winkelmann.com/en/services-downloads/planning-calculations-and-software/reflex-pro/

Selection example

Water content (approximately)

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

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

Selection example

p_{SV} = 3 bar
H = 13 m
$\dot{Q}$ = 40 kW (90/70 °C panel)
V_{PH} = 1,000 l (V buffer storage)

Calculation:
→ $V_A = 40\ kW \times 8.5\ l/kW + 1000 = 1340\ l$

$p_0 \geq (\frac{13}{10} + 0.2\ bar) = 1.5\ bar$

Results table

p_{SV} = 3 bar
p_0 = 1.5 bar
V_A = 1,411 l
V_n = 200 l
(for V_A, max. 1,360)

Selected:
1 x Reflex N 200, 6 bar → page 11
1 x cap valve → page 18

Heating systems: 70/50 °C		Marker shows selection for Reflex S — other table: Selection for Reflex N											
Safety valve p_{SV}	bar	5.0					V_n	6.0					
Upstream pressure p_0	bar	2.0	2.5	3.0	3.5	4.0	Litres	2.0	2.5	3.0	3.5	4.0	5.0
Volume V_A	Litres	91	58	26	-	-	8	118	90	63	35	7	-
		136	88	39	-	-	12	177	136	94	52	10	-
		231	158	85	12	-	18	293	230	167	105	42	-
		373	272	170	69	-	25	459	372	285	197	110	-
		576	434	292	150	8	33	679	574	452	330	208	-
		829	664	475	272	69	50	969	827	684	529	354	6
		1,327	1,062	796	515	191	80	1,551	1,323	1,095	867	639	89
		1,659	1,327	995	664	272	100	1,939	1,654	1,369	1,083	798	145
		2,322	1,858	1,393	929	434	140	2,714	2,315	1,916	1,517	1,118	257
		3,318	2,654	1,991	1,327	664	200	3,878	3,307	2,737	2,167	1,597	424
		4,147	3,318	2,488	1,659	829	250	4,847	4,134	3,422	2,709	1,996	564
		4,977	3,981	2,986	1,991	995	300	5,817	4,961	4,106	3,250	2,395	684
		6,636	5,309	3,981	2,654	1,327	400	7,755	6,615	5,474	4,334	3,193	912
		8,295	6,636	4,977	3,318	1,659	500	9,694	8,269	6,843	5,417	3,992	1,141
		9,954	7,963	5,972	3,981	1,991	600	11,633	9,922	8,212	6,501	4,790	1,369
		13,271	10,617	7,963	5,309	2,654	800	15,511	13,230	10,949	8,668	6,387	1,825
		16,589	13,271	9,954	6,636	3,318	1,000	19,389	16,537	13,686	10,835	7,984	2,281

Customised models available on request: Special vessel > 5.000 litres; special vessels > 10 bar

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.

Expansion lines	DN 25 1"	DN 32 1¼"	DN 40 1½"	DN 50 2"	DN 65	DN 80	DN 100
$\dot{Q}$/kW Length ≤ 10 m	2,100	3,600	4,800	7,500	14,000	19,000	29,000
$\dot{Q}$/kW Length > 10 m ≤ 30 m	1,400	2,500	3,200	5,000	9,500	13,000	20,000

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	$V_W = v_W * \dot{Q}_W$
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	$V_K = v_K * A_G$
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	$V_A = v_A * \dot{Q}_{ges}$
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 x 2	25 x 2.3	32 x 2.9	40 x 3.7	50 x 4.6	63 x 5.8	75 x 6.8	90 x 8.2	110 x 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 30) 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 maximum nominal 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

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.

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.

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 $\dot{Q}_W$ [k_W] ... volume of water V_W [l]		Total for all heat generators	$\dot{Q}_{ges}$ = ... k_W
Design ... inlet temperature t_V [°C] ... return flow temperature t_R [°C] Volume of water V_A [l]		At t_R > 70 °C install auxiliary vessel!	V_A = ... Litres
Maximum target value setting Temperature controller t_{TR} [°C] Anti-freeze additive [%]		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: $p_{SV} \geq p0 + 1.5$ bar for $p_{SV} > 5$ bar: $p_{SV} \geq p0 + 2.0$ 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: $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_o}$ for $V_n \leq 15$ l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_o}$ **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 23.

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.

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.

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.

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 Inlet temperature Minimum system temp. Maximum system temp.	t_R [°C] t_V [°C] t_{Smin} [l] t_{Smin} [l]	To the chiller; at t_R > 70 °C install auxiliary vessel! From the chiller e.g. downtime during winter 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
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: $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_o}$ for Vn ≤ 15 l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_D^*) \times \frac{p_e + 1}{p_e - p_o}$	V_n = ... litres
Control Supply pressure	p_a [bar]	$p_a = \frac{\frac{p_e + 1}{(V_e + V_D^*)(p_e + 1)}}{1 + \frac{(V_e + V_D^*)(p_e + 1)}{V_n (p_0 + 1)}} - 1$ bar **Precondition: $p_a \geq p0 + 0.25...0.3$ bar, otherwise calculate for larger nominal volume**	p_a = ... bar
Filling pressure	p_F [bar]	$p_F = V_n \times \frac{p_0 + 1}{V_n - V_A \times n_F^* - V_V} - 1$ bar	p_F = ... 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 23.

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 $p_0 \leq 4$ 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* u and the percentage expansion n* are dependent on the downtime temperature of the panel.

Supply pressure p_0, minimum operating pressure

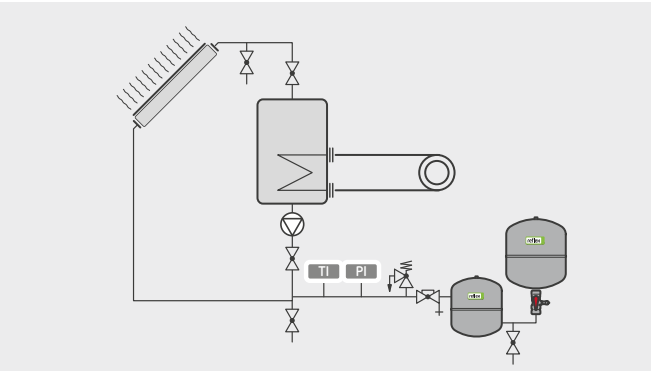
Depending on the calculation method, the minimum operating pressure (= supply pressure) is adjusted to the downtime temperature in the panel (= without evaporation) or the boiling temperature (= with evaporation). In both cases, the usual circuit for the circulating pump Δp_P stated above is to be taken 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 [°C] t_a [°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: **$p_{SV} \geq p_0$ + 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 = cooling coil + pipelines + buffer storage + other	V_A = ... litres
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: $V_n = (V_e + V_V + V_{Kges}^*) \times \frac{p_e + 1}{p_e - p_o}$ for $V_n \leq 15$ l: Water reservoir $V_V \geq 0.2 \times V_n$ $V_n = (V_e + V_V + V_{Kges}^*) \times \frac{p_e + 1}{p_e - p_o}$	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: $p_a \geq p_0 + 0.25...0.3$ bar,** **otherwise calculate for larger nominal volume**	p_a = ... bar
Filling pressure	p_F [bar]	$p_F = V_n \times \frac{p_0 + 1}{V_n - V_A \times n_F^* - V_V} - 1$ 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 23

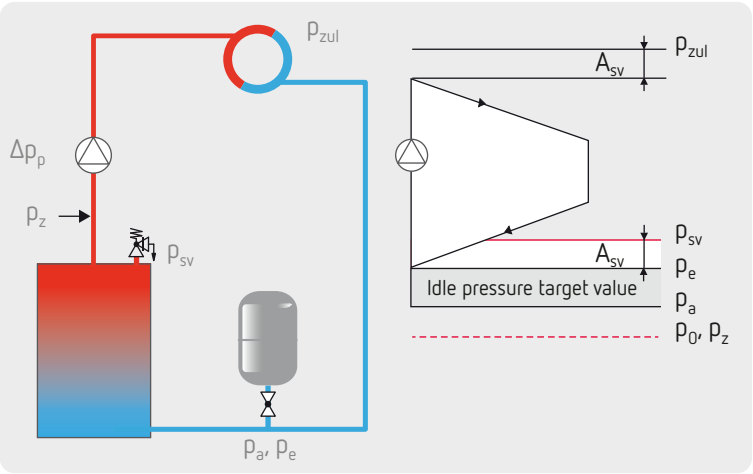
Installation and commissioning

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.
- 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.

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

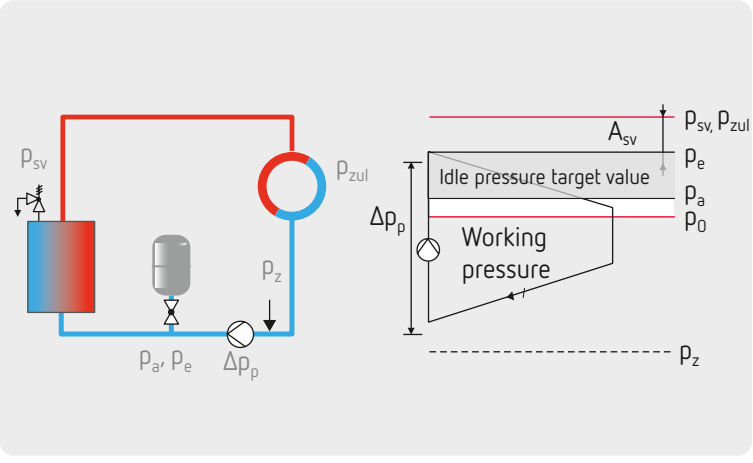
Supply pressure maintenance (suction pressure maintenance)



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}

Follow-up pressure maintenance



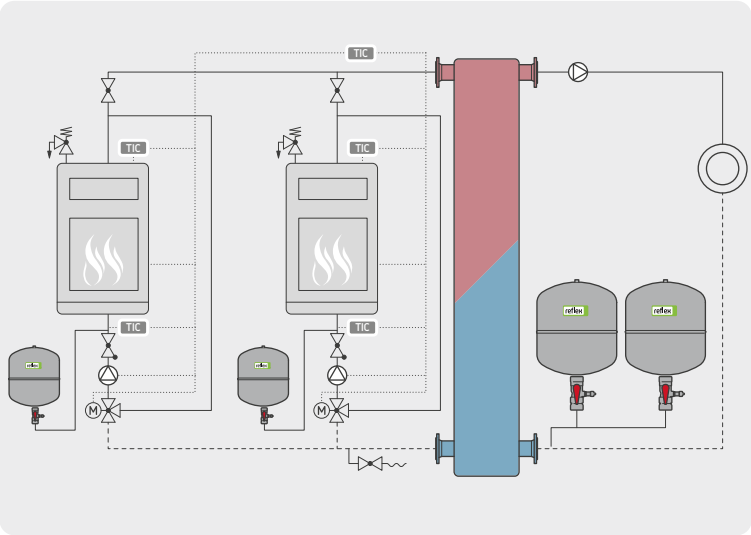
Pressure maintenance is integrated **downstream** of the flow-through pump, i.e. on the pressure side. When determining the idle pressure, a facility-specific differential pressure component for the flow-through pump (50 ... 100 %) must be included in the calculation. For use in only a limited number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

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.

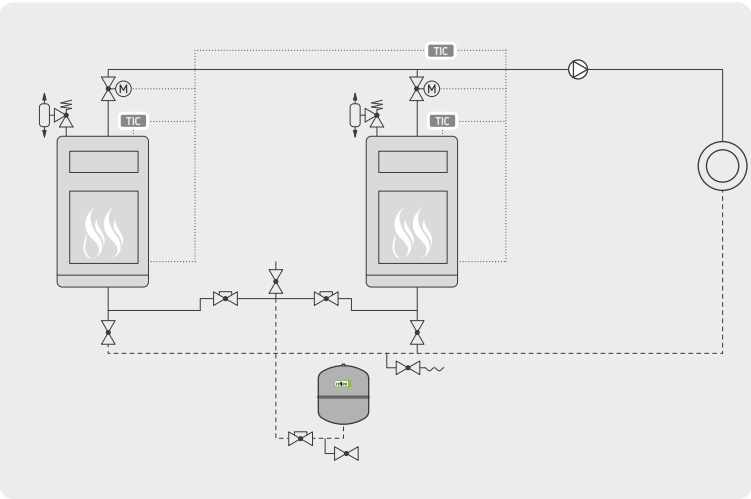
Reflex N serial circuit in a multi-boiler system with individual protection



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

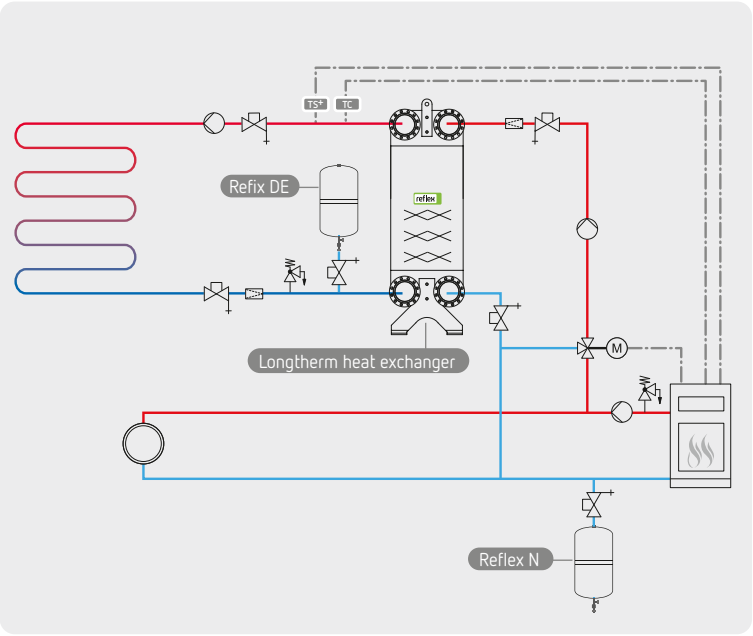


When the burner is switched off, the final control element Ⓜ is closed by the temperature controller TIC, preventing incorrect circulation via the shut-off boiler. Joining the boiler expansion line above the centre of the boiler prevents gravity circulation. Preferred inset in systems without minimum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

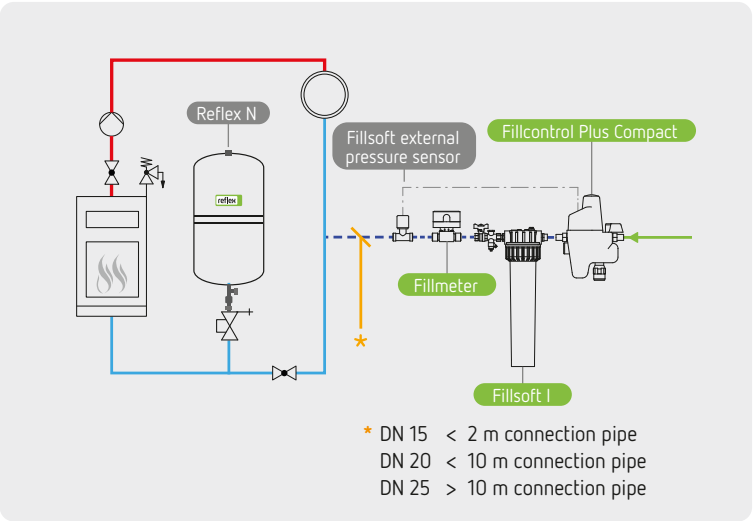
Systems with pipework at risk of corrosion

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 oxygen-rich underfloor heating circuit medium) using a Reflex 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



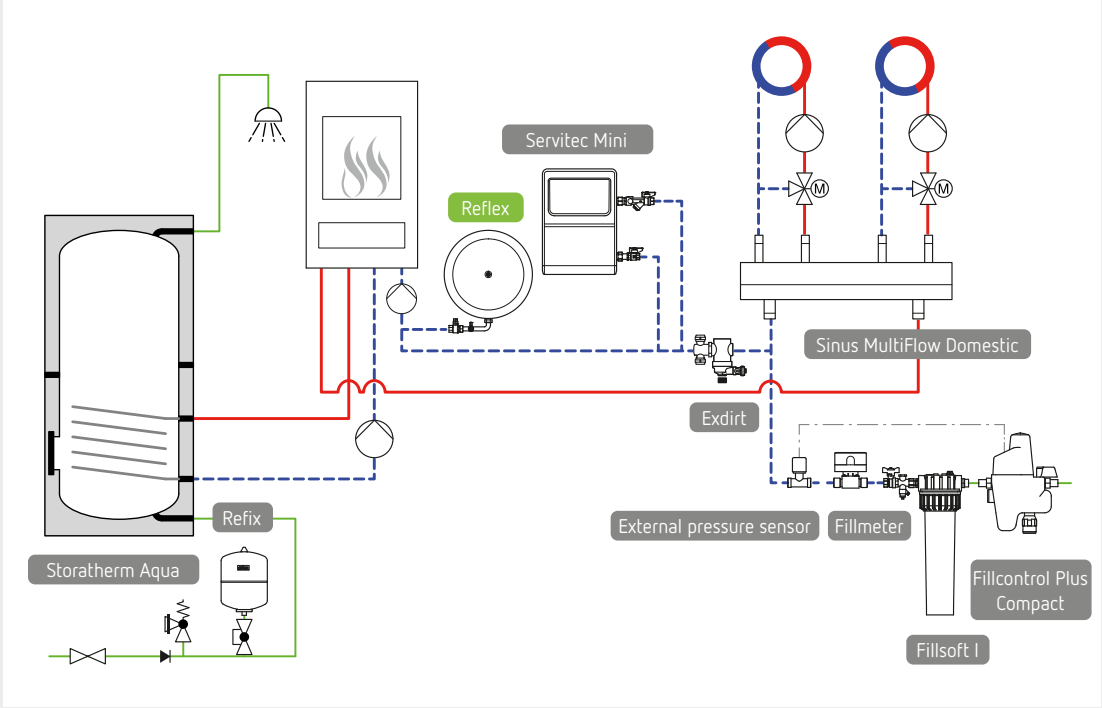
- To ensure compliance with VDI 2035, use a Reflex Fillsoft housing with a softening or demineralising cartridge (depending on the quality of the water or the specifications of the operator/boiler manufacturer).
- The Fillcontrol Plus Compact automatic make-up station which also has a system separator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

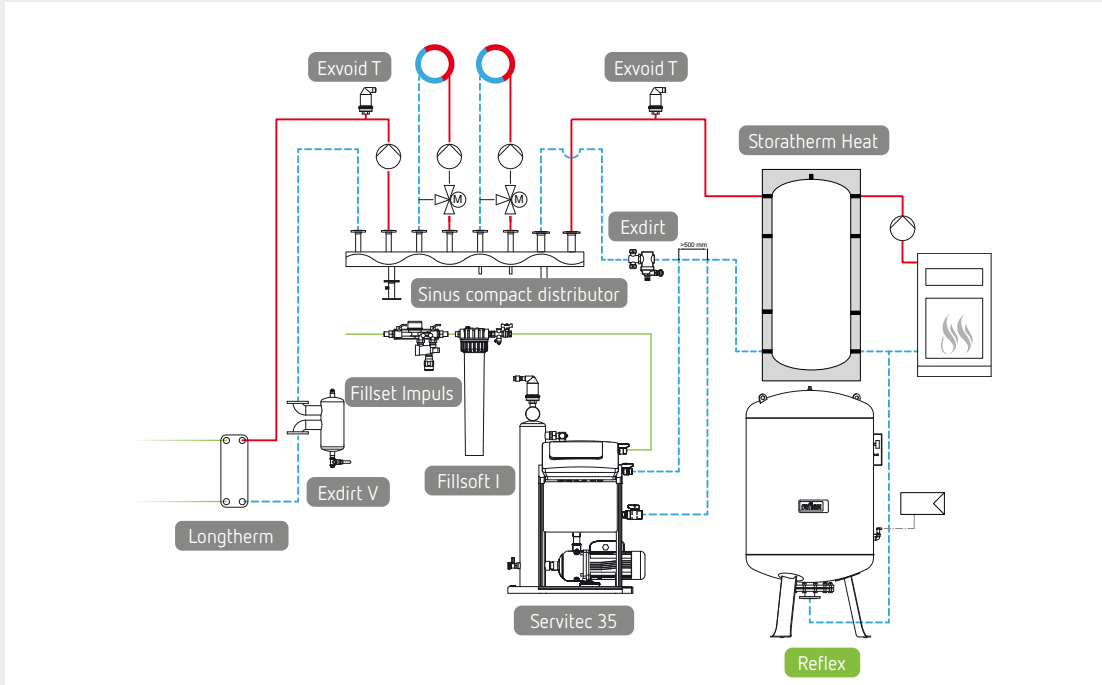


We recommend the use of an automatic make-up such as Reflex Fillcontrol Plus Compact combined with static pressure maintenance in order to ensure an adequate water seal.

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).

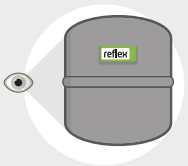
A Longtherm heat exchanger is used to separate the heating and potable water circuit.

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.

Operation & Maintenance

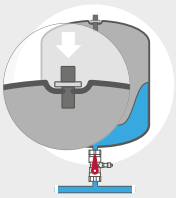
Industrial Safety Regulations require expansion vessels to be checked on an annual basis. The relevant notes for installers and operators in the Reflex Assembly, Operating and Maintenance Instructions are to be observed.

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.

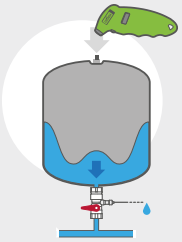
2. Check bladder



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.

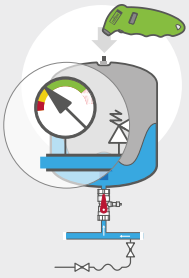
$$p_0\,[\text{bar}] = p_{st} + 0.2\ \text{bar} + p_D{}^{*} + \Delta p_p{}^{**}$$

* Evaporation pressure p_D 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

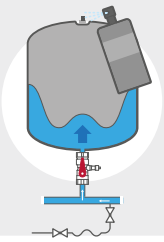


- Close drain at the cap valve and carefully open cap valve.
- Note system pressure and do not allow it to fall below p_0.
- Fill the system up to the filling pressure p_F in accordance with the system temperature.

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

- 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

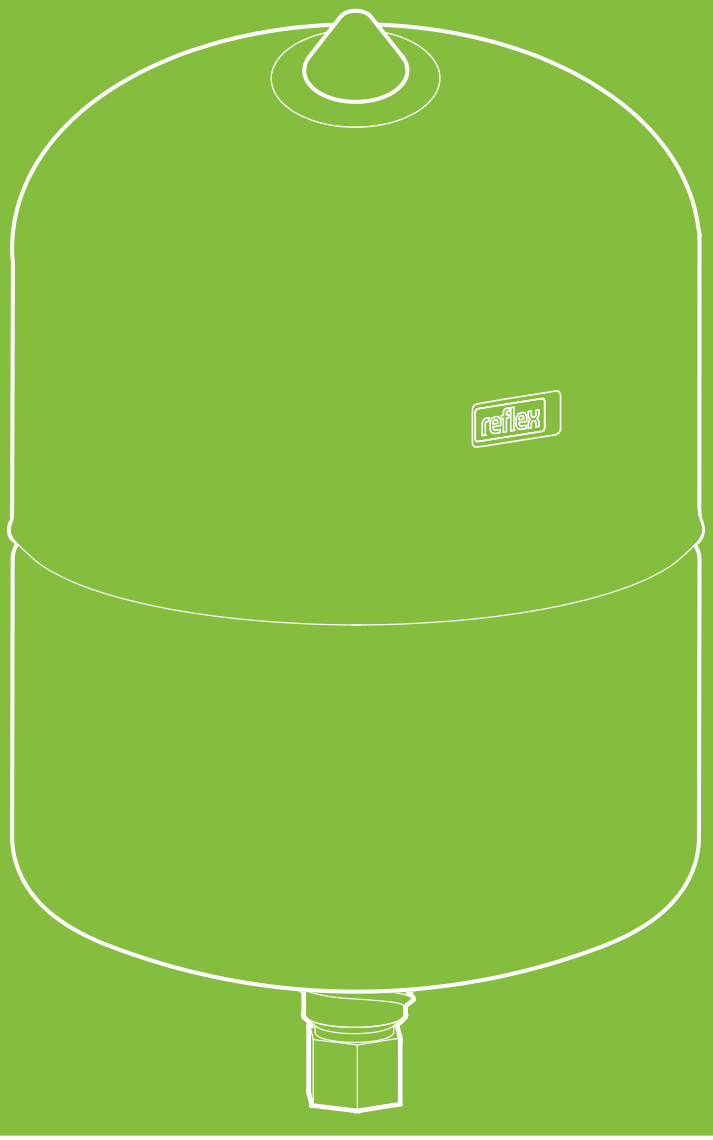
- Long operating life due to high-quality membrane and stable vessel
- Due to the use of a bladder on all DD, DT, C-DE, DE and hot water vessels, the vessel is not in contact with the medium and is therefore more resistant to corrosion
- Approved in accordance with pressure equipment guidelines 2014/68/EU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

DD 8–25 litres

Flowjet flow through, shut-off and drain valve (optional)

DD 33 litres with fixing brackets (rear view)

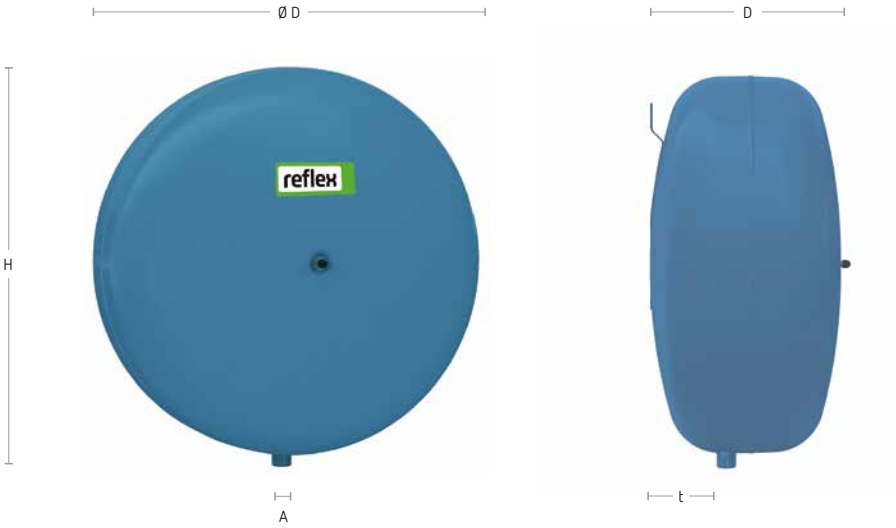
Refix DD with Flowjet flow through, shut-off and drain valve ensures simple and DIN-compliant installation as the Refix vessel can be shut off, drained and flowed through.

Technical features

- For potable water, pressure booster systems and water heating systems to DIN 1988
- With threaded connection, made from corrosion resistant steel
- 33 litres with fixing brackets
- Flow-through with high-flow star-shaped flow-through connector
- Non-replaceable bladder to DIN EN 13831, DIN 4807 T5, elastomer guideline and W270
- Manufactured and checked to DIN 4807 T5, DIN DVGW (German association for gas and water) Reg. No. NW-0411AT2534
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- With external and internal coating to KTW-A
- With ex-works pressurised gas chamber
- Vessels certified to WRAS and ACS available on request
- **Only for use in cold water pipes** (observe fitting and operating instructions)

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	DD 2	7381500	288	green	132	269	G ¾"	4.0	1.0
	DD 8	7308000	96	green	206	345	G ¾"	4.0	1.9
	DD 8	7307700	96	white	206	345	G ¾"	4.0	1.9
	DD 12	7308200	60	green	280	318	G ¾"	4.0	2.0
	DD 12	7307800	60	white	280	318	G ¾"	4.0	2.0
	DD 18	7308300	56	green	280	418	G ¾"	4.0	2.8
	DD 18	7307900	56	white	280	418	G ¾"	4.0	2.8
	DD 25	7308400	42	green	280	528	G ¾"	4.0	3.6
	DD 25	7380400	42	white	280	528	G ¾"	4.0	3.6
	DD 33	7380700	24	green	354	468	G ¾"	4.0	5.8
	DD 33	7380800	24	white	354	468	G ¾"	4.0	5.8
25 bar 70 °C	DD 8	7290200	60	green	206	344	G ¾"	4.0	3.4
	DD 8	7290300	60	white	206	344	G ¾"	4.0	3.4

Refix C-DE



C-DE 8 – 80 Liter

Technical features

- Vertical disc-shaped flat vessel for heating, heat pump, cooling and solar applications as well as process water applications which do not fall within the scope of DIN 1988.
- With threaded connection, made from corrosion resistant steel
- Non-replaceable bladder to DIN EN 13831
- No flow-through, no shut-off
- Components in contact with water have corrosion protection
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- For anti-freeze additives with a concentration of 25 to 50 %
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Depth T [mm]	Depth t [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	C-DE 8	7270900	96	blue	280	296	176	52	G ½"	4.0	3.8
	C-DE 12	7270910	60	blue	354	370	182	64	G ½"	4.0	5.2
	C-DE 18	7270920	42	blue	356	370	236	76	G ¾"	4.0	5.7
	C-DE 25	7270930	42	blue	409	427	253	93	G ¾"	4.0	8.3
	C-DE 35	7270940	24	blue	480	465	256	97	G ¾"	4.0	13.0
	C-DE 50	7270950	20	blue	480	465	332	125	G ¾"	4.0	15.4
	C-DE 80	7270960	8	blue	634	621	338	135	G ¾"	4.0	22.4

Refix DT

DT 60–500 litres (with Flowjet)

DT 600–1.000 litres (Ø 740)

DT 1,000 (Ø 1,000)–2,000 litres

DT 3,000 litres

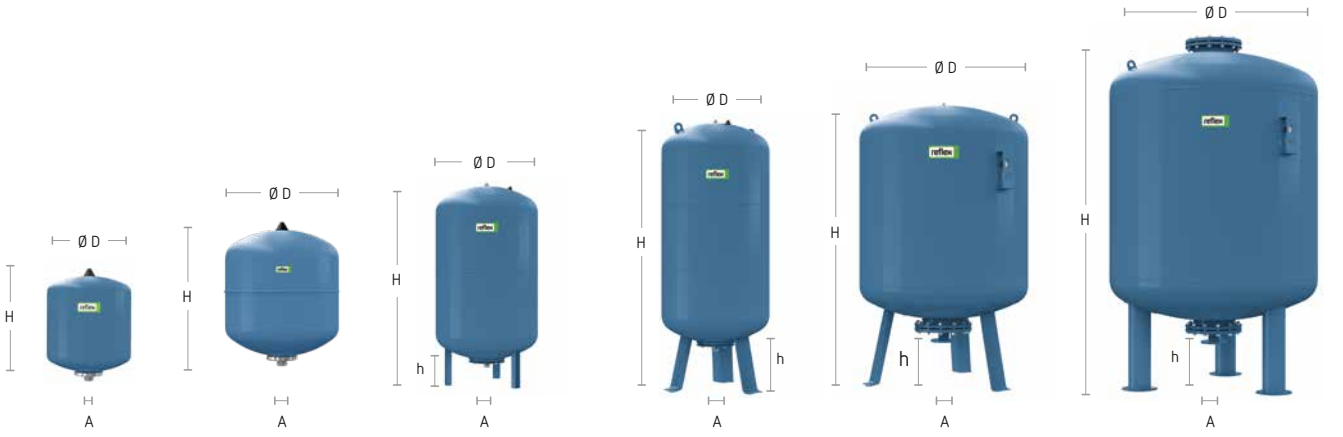
Technical features

- For potable water, pressure booster systems and water heating systems to DIN 1988 with flow-through
- Flowjet including lock and drain or twin connection
- Replaceable bladder to DIN EN 13831, DIN 4807 T5, manufactured to elastomer guidelines and W270 and checked to DIN 4807 part 5, DIN DVGW Reg. No. NW-0411BR0350
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- With external and internal coating to KTW-A
- From 600 litres with bushing for optional flaw detector
- Pressure gauge and supply pressure valve protected by metal clamp
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Vessels certified to WRAS and ACS available on request
- **Only for use in cold water pipes** (observe fitting and operating instructions)

	Model	Product no.	Colour	Ø D [mm]	Height H [mm]	Height h [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	DT 60	7309000	green	409	766	80	Rp 1¼"	4.0	15.0
	DT 80	7309100	green	480	750	56	Rp 1¼"	4.0	17.0
	DT 80	7365000	green	480	750	97	DN 50/PN 16	4.0	23.7
	DT 80	7335705	green	480	750	107	DN 65/PN 16	4.0	24.7
	DT 80	7335805	green	480	750	115	DN 80/PN 16	4.0	26.8
	DT 100	7309200	green	480	834	56	Rp 1¼"	4.0	19.2
	DT 100	7365400	green	480	834	97	DN 50/PN 16	4.0	26.8
	DT 100	7365405	green	480	834	107	DN 65/PN 16	4.0	27.8
	DT 100	7365406	green	480	834	114	DN 80/PN 16	4.0	28.9
	DT 200	7309300	green	634	973	80	Rp 1¼"	4.0	37.0
	DT 200	7365100	green	634	973	105	DN 50/PN 16	4.0	53.0
	DT 200	7365105	green	634	973	115	DN 65/PN 16	4.0	54.0
	DT 200	7365106	green	634	973	120	DN 80/PN 16	4.0	57.0
	DT 300	7309400	green	634	1,273	80	Rp 1¼"	4.0	51.0
	DT 300	7365200	green	634	1,273	105	DN 50/PN 16	4.0	59.0
	DT 300	7336305	green	634	1,273	115	DN 65/PN 16	4.0	60.0
	DT 300	7336405	green	634	1,273	120	DN 80/PN 16	4.0	63.0
	DT 400	7319305	green	740	1,245	69	Rp 1¼"	4.0	74.0
	DT 400	7365500	green	740	1,245	95	DN 50/PN 16	4.0	80.0
	DT 400	7336505	green	740	1,245	105	DN 65/PN 16	4.0	81.0
	DT 400	7336605	green	740	1,245	110	DN 80/PN 16	4.0	83.0

	Model	Product no.	Colour	Ø D [mm]	Height H [mm]	Height h [mm]	Connection A	Supply pressure [bar]	Weight [kg]
10 bar 70 °C	DT 500	7309500	green	740	1,475	69	Rp 1¼"	4.0	72.0
	DT 500	7365300	green	740	1,475	90	DN 50/PN 16	4.0	88.0
	DT 500	7365307	green	740	1,475	100	DN 65/PN 16	4.0	89.0
	DT 500	7365305	green	740	1,475	110	DN 80/PN 16	4.0	92.0
	DT 600	7365600	green	740	1,859	233	DN 50/PN 16	4.0	164.0
	DT 600	7336705	green	740	1,859	233	DN 65/PN 16	4.0	165.0
	DT 600	7336806	green	740	1,859	235	DN 80/PN 16	4.0	168.0
	DT 800	7365700	green	740	2,324	233	DN 50/PN 16	4.0	204.0
	DT 800	7336905	green	740	2,324	233	DN 65/PN 16	4.0	205.0
	DT 800	7337006	green	740	2,324	233	DN 80/PN 16	4.0	208.0
	DT 1000	7365800	green	740	2,804	233	DN 50/PN 16	4.0	260.0
	DT 1000	7337105	green	740	2,804	233	DN 65/PN 16	4.0	261.0
	DT 1000	7337205	green	740	2,804	233	DN 80/PN 16	4.0	264.0
	DT 1000	7320105	green	1,000	2,001	160	DN 65/PN 16	4.0	386.2
	DT 1000	7337305	green	1,000	2,001	150	DN 80/PN 16	4.0	386.2
	DT 1000	7337405	green	1,000	2,001	140	DN 100/PN 16	4.0	386.2
	DT 1500	7320305	green	1,200	2,001	158	DN 65/PN 16	4.0	502.4
	DT 1500	7337505	green	1,200	2,001	150	DN 80/PN 16	4.0	502.4
	DT 1500	7337605	green	1,200	2,001	140	DN 100/PN 16	4.0	502.4
	DT 2000	7320505	green	1,200	2,461	158	DN 65/PN 16	4.0	686.5
	DT 2000	7337705	green	1,200	2,461	150	DN 80/PN 16	4.0	686.5
	DT 2000	7337805	green	1,200	2,461	140	DN 100/PN 16	4.0	686.2
	DT 3000	7320705	green	1,500	2,580	187	DN 65/PN 16	4.0	1,054.0
	DT 3000	7337905	green	1,500	2,530	180	DN 80/PN 16	4.0	1,057.0
	DT 3000	7338005	green	1,500	2,530	170	DN 100/PN 16	4.0	1,057.0
16 bar 70 °C	DT 80	7316005	green	480	750	56	Rp 1¼"	4.0	27.8
	DT 80	7370000	green	480	750	97	DN 50/PN 16	4.0	33.0
	DT 80	7310306	green	480	750	107	DN 65/PN 16	4.0	34.0
	DT 80	7310307	green	480	750	114	DN 80/PN 16	4.0	36.0
	DT 100	7365408	green	480	834	56	Rp 1¼"	4.0	29.9
	DT 100	7370100	green	480	834	97	DN 50/PN 16	4.0	35.0
	DT 100	7370101	green	480	834	107	DN 65/PN 16	4.0	36.0
	DT 100	7370102	green	480	834	114	DN 80/PN 16	4.0	38.0
	DT 200	7365108	green	634	973	80	Rp 1¼"	4.0	55.0
	DT 200	7370200	green	634	973	105	DN 50/PN 16	4.0	61.0
	DT 200	7370205	green	634	973	115	DN 65/PN 16	4.0	62.0
	DT 200	7370206	green	634	973	120	DN 80/PN 16	4.0	65.0
	DT 300	7319205	green	634	1,273	115	Rp 1¼"	4.0	64.0
	DT 300	7370300	green	634	1,273	105	DN 50/PN 16	4.0	70.0
	DT 300	7314205	green	634	1,273	80	DN 65/PN 16	4.0	71.0
	DT 300	7314206	green	634	1,273	120	DN 80/PN 16	4.0	74.0
	DT 400	7370400	green	740	1,394	235	DN 50/PN 16	4.0	115.0
	DT 400	7339006	green	740	1,394	235	DN 65/PN 16	4.0	121.0
	DT 400	7339005	green	740	1,394	235	DN 80/PN 16	4.0	124.0
	DT 500	7370500	green	740	1,615	235	DN 50/PN 16	4.0	136.0
	DT 500	7370507	green	740	1,615	235	DN 65/PN 16	4.0	137.0
	DT 500	7370505	green	740	1,615	235	DN 80/PN 16	4.0	140.0
	DT 600	7370600	green	740	1,859	235	DN 50/PN 16	4.0	174.0
	DT 600	7339105	green	740	1,859	235	DN 65/PN 16	4.0	175.0
	DT 600	7339205	green	740	1,859	235	DN 80/PN 16	4.0	178.0
	DT 800	7370700	green	740	2,324	235	DN 50/PN 16	4.0	224.0
	DT 800	7339305	green	740	2,324	235	DN 65/PN 16	4.0	225.0
	DT 800	7339406	green	740	2,324	235	DN 80/PN 16	4.0	228.0
	DT 1000	7370800	green	740	2,804	235	DN 50/PN 16	4.0	275.0
	DT 1000	7339505	green	740	2,804	235	DN 65/PN 16	4.0	276.0
	DT 1000	7339605	green	740	2,804	235	DN 80/PN 16	4.0	279.0
	DT 1000	7320205	green	1,000	2,001	160	DN 65/PN 16	4.0	488.0
	DT 1000	7339705	green	1,000	2,001	150	DN 80/PN 16	4.0	488.0
	DT 1000	7339805	green	1,000	2,001	140	DN 100/PN 16	4.0	488.0
	DT 1500	7320405	green	1,200	2,220	158	DN 65/PN 16	4.0	630.0
	DT 1500	7339905	green	1,200	2,220	150	DN 80/PN 16	4.0	630.0
	DT 1500	7340005	green	1,200	2,220	140	DN 100/PN 16	4.0	630.0
	DT 2000	7320605	green	1,200	2,480	158	DN 65/PN 16	4.0	850.5
	DT 2000	7340105	green	1,200	2,480	150	DN 80/PN 16	4.0	850.5
	DT 2000	7340205	green	1,200	2,480	140	DN 100/PN 16	4.0	850.5
	DT 3000	7320805	green	1,500	2,580	187	DN 65/PN 16	4.0	1,240.0
	DT 3000	7340305	green	1,500	2,580	180	DN 80/PN 16	4.0	1,240.0
	DT 3000	7340405	green	1,500	2,580	170	DN 100/PN 16	4.0	1,200.0

Refix DE



DE 2–25 litres | DE 33 litres | DE 50–500 litres | DE 600–1.000 litres (Ø 740) | DE 1,000–2.000 litres (Ø 1000) | DE 3,000–5,000 litres

Technical features

- For systems which do not fall within the scope of DIN 1988, e.g. fire extinguishing systems, process water systems, underfloor heating, geothermals
- 33 litres with fixing brackets
- From 50 litres, with feet
- Components in contact with water have corrosion protection
- Bladder to DIN EN 13831/replaceable from 50 litres
- No flow-through, no shut-off and no drain
- From Ø 1,000 mm, includes pressure gauge
- Pressure gauge and upstream valve protected by metal clamp
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Vessels certified to WRAS and ACS available on request
- Designs with flaw detector available on request

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height h [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	DE 2	7200300	288	blue	132	260	-	G ¾"	4.0	1.0
	DE 8	7301000	96	blue	206	332	-	G ¾"	4.0	1.8
	DE 12	7302000	60	blue	280	310	-	G ¾"	4.0	2.4
	DE 18	7303000	56	blue	280	407	-	G ¾"	4.0	3.2
	DE 25	7304000	42	blue	280	518	-	G ¾"	4.0	3.8
	DE 33	7303900	24	blue	354	457	-	G ¾"	4.0	5.7
	DE 33 with feet	7305500	24	blue	354	520	66	G ¾"	4.0	6.5
	DE 50	7306005	20	blue	409	604	102	G 1"	4.0	9.5
	DE 60	7306400	18	blue	409	734	161	G 1"	4.0	11.2
	DE 80	7306500	10	blue	480	737	143	G 1"	4.0	14.0
	DE 100	7306600	10	blue	480	852	143	G 1"	4.0	16.0
	DE 200	7306700	4	blue	634	967	150	G 1¼"	4.0	36.5
	DE 300	7306800	-	blue	634	1,267	150	G 1¼"	4.0	41.6
	DE 400	7306850	-	blue	740	1,245	139	G 1¼"	4.0	74.0
	DE 500	7306900	-	blue	740	1,475	133	G 1¼"	4.0	106.0
	DE 600	7306950	-	blue	740	1,859	263	G 1½"	4.0	128.0
	DE 800	7306960	-	blue	750	2,324	263	G 1½"	4.0	176.0
	DE 1000	7306970	-	blue	740	2,804	261	G 1½"	4.0	210.0
	DE 1000	7311405	-	blue	1,000	2,001	286	DN 65/PN 16	4.0	427.0
	DE 1500	7311605	-	blue	1,200	1,991	291	DN 65/PN 16	4.0	542.0
	DE 2000	7311705	-	blue	1,200	2,451	291	DN 65/PN 16	4.0	717.0
	DE 3000	7311805	-	blue	1,500	2,531	320	DN 65/PN 16	4.0	962.0
	DE 4000	7354000	-	blue	1,500	3,080	320	DN 65/PN 16	4.0	1,132.0
	DE 5000	7354200	-	blue	1,500	3,645	320	DN 65/PN 16	4.0	1,292.0

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height h [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
16 bar 70 °C	DE 8	7301006	96	blue	206	337	-	G ¾"	4.0	2.8
	DE 12	7302105	72	blue	280	310	-	G ¾"	4.0	3.5
	DE 25	7304015	42	blue	280	518	-	G ¾"	4.0	5.8
	DE 80	7348600	4	blue	480	744	138	G 1"	4.0	18.0
	DE 100	7348610	4	blue	480	849	132	G 1"	4.0	21.0
	DE 200	7348620	-	blue	634	967	150	G 1¼"	4.0	57.0
	DE 300	7348630	-	blue	634	1,267	150	G 1¼"	4.0	66.0
	DE 400	7348640	-	blue	740	1,394	263	G 1½"	4.0	118.0
	DE 500	7348650	-	blue	740	1,614	263	G 1½"	4.0	133.0
	DE 600	7348660	-	blue	740	1,859	263	G 1½"	4.0	158.0
	DE 800	7348670	-	blue	740	2,324	263	G 1½"	4.0	202.0
	DE 1000	7348680	-	blue	740	2,804	263	G 1½"	4.0	240.0
	DE 1000	7312805	-	blue	1,000	2,001	286	DN 65/PN 16	4.0	530.0
	DE 1500	7312905	-	blue	1,200	1,991	291	DN 65/PN 16	4.0	685.0
	DE 2000	7313005	-	blue	1,200	2,451	291	DN 65/PN 16	4.0	895.0
	DE 3000	7313105	-	blue	1,500	2,531	320	DN 65/PN 16	4.0	1,240.0
	DE 4000	7354100	-	blue	1,500	3,120	320	DN 65/PN 16	4.0	1,442.0
	DE 5000	7354300	-	blue	1,500	3,655	320	DN 65/PN 16	4.0	1,844.0
25 bar 70 °C	DE 8	7290100	60	blue	206	338	-	G ¾"	4.0	2.4
	DE 80	7317600	-	blue	450	942	159	DN 50/PN 40	4.0	70.0
	DE 120	7313700	-	blue	225	1,253	159	DN 50/PN 40	4.0	100.0
	DE 180	7313500	-	blue	450	1,528	159	DN 50/PN 40	4.0	116.0
	DE 300	7313800	-	blue	750	1,318	160	DN 50/PN 40	4.0	150.0
	DE 400	7313300	-	blue	750	1,423	160	DN 50/PN 40	4.0	245.0
	DE 600	7321500	-	blue	750	1,868	159	DN 50/PN 40	4.0	290.0
	DE 800	7321200	-	blue	750	2,268	159	DN 50/PN 40	4.0	355.0
	DE 1000	7321000	-	blue	750	2,768	159	DN 50/PN 40	4.0	245.0
	DE 1000	7322200	-	blue	1,000	2,051	242	DN 65/PN 40	4.0	800.0
	DE 1500	7322100	-	blue	1,200	2,071	291	DN 65/PN 40	4.0	850.0
	DE 2000	7313400	-	blue	1,200	2,531	240	DN 65/PN 40	4.0	960.0
	DE 3000	7345700	-	blue	1,500	2,619	269	DN 65/PN 40	4.0	1,550.0

Refix DC

DC 50–400 litres

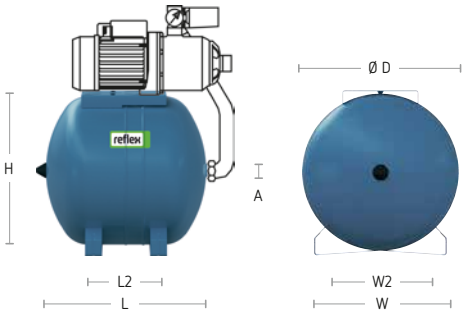
DC 500–600 litres

Technical features

- For systems which do not fall within the scope of DIN 1988, e.g. fire extinguishing systems, process water systems, underfloor heating
- Components in contact with water have corrosion protection
- Non-replaceable diaphragm in accordance with DIN EN 13831
- No flow-through, no shut-off and no drain
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Vessels certified to WRAS and ACS available on request

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Height h [mm]	Connection A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	DC 25	7200400	42	blue	289	510	-	G 1"	2.0	4.8
	DC 50	7309600	20	blue	418	588	115	R 1"	4.0	12.5
	DC 80	7309700	12	blue	489	676	103	R 1"	4.0	17.5
	DC 100	7309800	10	blue	489	782	103	R 1"	4.0	21.1
	DC 140	7309900	-	blue	489	997	104	R 1"	4.0	29.0
	DC 200	7363500	-	blue	643	883	91	R 1"	4.0	40.0
	DC 300	7363600	-	blue	643	1,184	93	R 1"	4.0	52.0
	DC 400	7363700	-	blue	749	1,173	81	R 1"	4.0	78.0
	DC 500	7363800	-	blue	749	1,392	82	R 1"	4.0	80.0
	DC 600	7363900	-	blue	749	1,629	75	R 1"	4.0	103.0

Refix HW



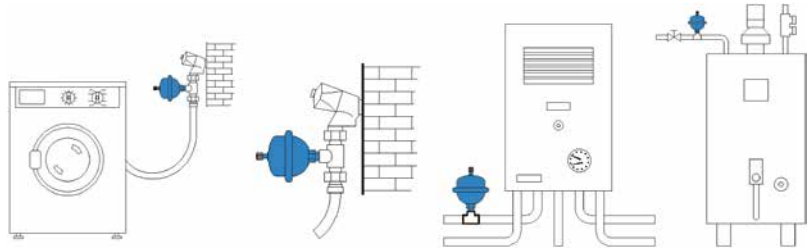
HW 25–100 litres

Technical features

- Buffer vessel for domestic water systems which are **not** covered by DIN 1988
- Vessel surface and parts in contact with water have corrosion protection
- Bladder to DIN EN 13831 replaceable from 50 litres
- Permissible operating temperature: 70 °C
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Long-lasting epoxy resin coating
- With ex-works pressurised gas chamber
- Vessels certified to WRAS and ACS available on request

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	L [mm]	L 2 [mm]	W [mm]	W 2 [mm]	Connec-tion A	Upstream pressure [bar]	Weight [kg]
10 bar 70 °C	HW 25	7200310	36	blue	280	301	518	227	270	214	G ¾"	2.0	5.5
	HW 50	7200320	20	blue	409	432	503	175	350	285	G 1"	2.0	15.0
	HW 60	7200330	16	blue	409	432	577	175	350	285	G 1"	2.0	16.0
	HW 80	7200340	16	blue	480	504	593	185	350	285	G 1"	2.0	17.4
	HW 100	7200350	16	blue	480	504	706	305	350	285	G 1"	2.0	19.4

Refix WD



WD 0.165 litres

Technical features

- For devices with rapid-closing fittings, e.g. washing machines, dishwashers
- Approved in accordance with pressure equipment guidelines 2014/68/EU
- Total volume 165 cm^3
- Permissible operating temperature: 70 °C
- Vessels certified to WRAS and ACS available on request
- Non-replaceable diaphragm in accordance with DIN EN 13831
- Not suitable for potable water

	Model	Product no.	VPE	Colour	Ø D [mm]	Height H [mm]	Connection A	Supply pressure [bar]	Weight [kg]
10 bar 70 °C	Water shock arrestor	7351000	576	white	83	111	G ½"	3.5	0.3

Refix accessories

Flowjet flow through, shut-off and drain valve

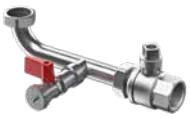
- Isolating shut-off device with drain for Refix DD to DIN 4807 part 5
- Permissible operating pressure 16 bar
- Permissible operating temperature: 70 °C
- G ¾" connections on both sides, int./ext. threads
- Can be combined on-site with T-pieces
- With 1" nominal through diameter

Wall-hung holder

- Bracket with strap for Reflex 8 – 25 litres, vertical mounting

AG connection group

- For particularly rapid assembly and maintenance of expansion vessels (recommended for Refix DE and DC)
- Includes safe shut-off and connecting bends with screw connection
- With G ½" drainage cock and hose fitting
- To DIN EN 12828



Digital test pressure gauge

DIN EN 12828: "Expansion vessels are to be maintained on an annual basis. The inlet gas pressure p_0 is to be checked with a fitting while waterless and corrected if necessary."

- Supply pressure test device up to approx. 9 bar

Reflex cap valve

- Secure shut-off for maintaining and dismantling expansion vessels
- With drain
- To DIN EN 12828
- PN 10 / 120 °C
- Use 1" connectors from size N/S/G 80

Model	Product no.	VPE	Weight [kg]
Digital test pressure gauge	9119198	-	0.1
Flowjet flow through, shut-off and drain valve	9116799	5	0.3
Bracket with strap	7611000	36	0.3
Connection group 1"	9119204	-	0.9
Connection group 1¼"	9119205	-	1.0
Connection group 1½"	9119206	-	1.2
Cap valve R ¾"	7613000	-	0.4
Cap valve R 1"	7613100	-	0.6
Flaw detector	7857700	-	0.2

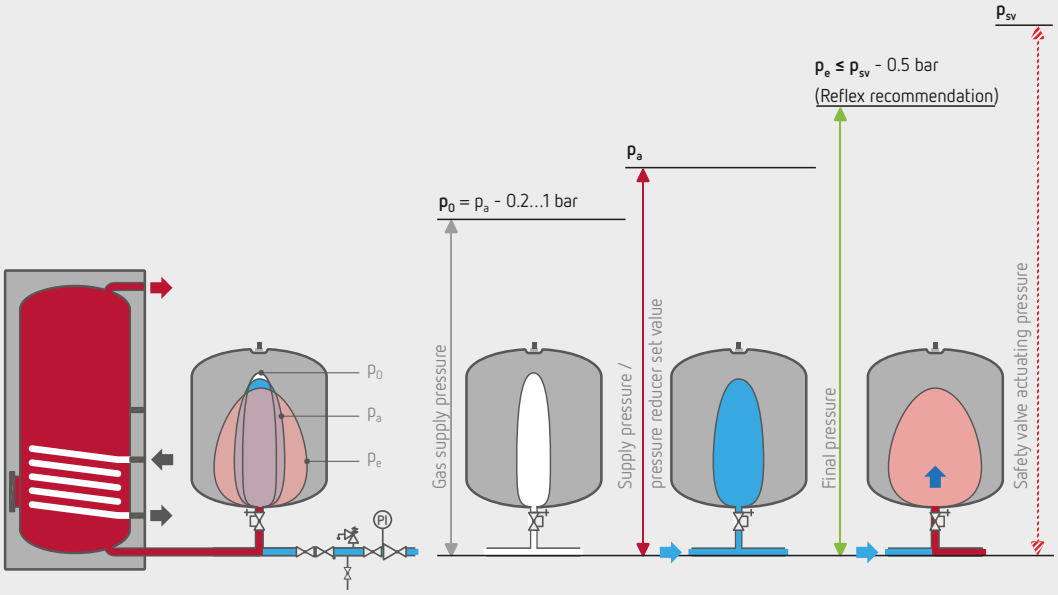
Selection and calculation

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



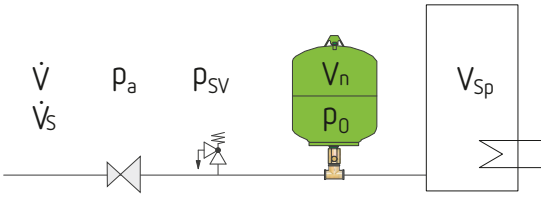
Application limits according to DVGW

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_o = 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_w = 60 °C constant
Water expansion	n = 1.67 %

Refix quick selection

Selection by nominal volume V_n



Selection by nominal volume V_n

10 °C Cold water feed temperature

60 °C Vessel temperature

- Gas supply pressure p_0 = 3.0 bar
- Pressure reducer preset pressure p_a ≥ 3.2 bar

- Gas supply pressure p_0 (= 4.0 bar) = standard
- Pressure reducer preset pressure p_a (≥ 4.2 bar)

Refix quick selection

p_{SV}[bar]	6	7	8	10
V_{sp} [litres]	V_n Refix nominal volume [litres]			
90	8	8	8	8
100	8	8	8	8
120	8	8	8	8
130	8	8	8	8
150	8	8	8	8
180	12	8	8	8
200	12	12	8	8
250	12	12	12	8
300	18	18	12	12
400	25	18	18	18
500	25	25	18	18
600	33	25	25	18
700	33	33	25	25
800	60	33	33	25
900	60	60	33	25
1,000	60	60	33	33
1,500	80	80	60	60
2,000	100	100	80	80
3,000	100	100	100	100

p_{SV}[bar]	6	7	8	10
V_{sp} [litres]	V_n Refix nominal volume [litres]			
90	8	8	8	8
100	12	8	8	8
120	12	8	8	8
130	12	8	8	8
150	18	12	8	8
180	18	12	8	8
200	18	12	12	8
250	25	18	12	12
300	25	18	18	12
400	33	33	15	25
500	60	33	25	25
600	60	60	33	25
700	60	60	33	25
800	80	80	60	25
900	80	60	60	33
1,000	100	60	60	60
1,500	200	100	80	60
2,000	200	200	100	80
3,000	300	200	200	100

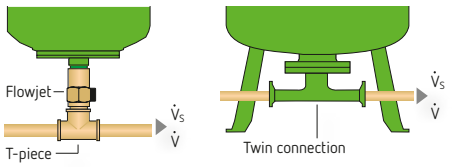
Selection example

Vessel volume (V_{sp})	**900 litres**	Safety valve (p_{sv})	**10.0 bar**	Vessel volume (V_{sp})	31.5 litres
Hot water temperature (T_{ww})	**60 °C**	Expansion (60 °C/10 °C) (n)	**1.7 %**		
Pressure reducer preset pressure (p_a)	**4.2 bar**	Supply pressure (p_0)	**4.0 bar**		

Selection by peak volume flow V_s

In potable water expansion vessels with **flow-through**, determining just the nominal volume V_n is not enough. Further checks are to be carried out to establish whether the maximum recommended peak volume flow V_s has not been exceeded as well as the pressure drop Δp.

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 a larger nominal connection diameter is required, for Refix DD, a 60 litre Refix DT is to be used instead of the 8 – 33 litre vessel for greater flow.



10 °C Cold water feed temperature

60 °C Vessel temperature

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

* Determined at a speed of 2 m/s.

Comprehensive calculation and design notes

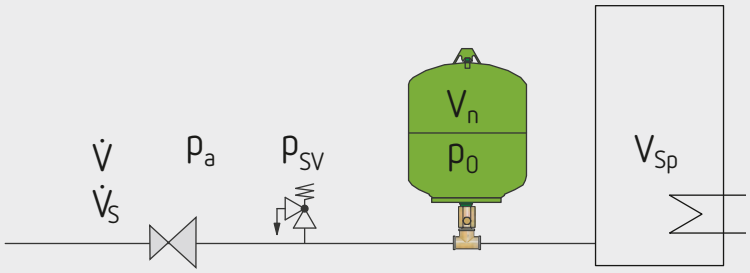
Potable water is a food stuff. Expansion vessels in potable water installations therefore have to meet specific requirements to DIN 4807 part 5. Only vessels with flow-through are permitted.

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.

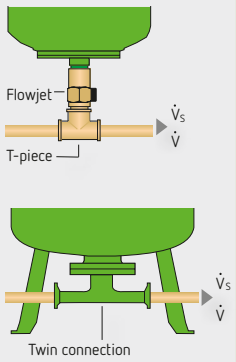
Expansion vessel

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 Heat output Water temperature	V_{Sp}[l] $\dot{Q}_W$ [kW] t_{STB} [°C]	Depending on the controller setting 50 ... 60 °C	
Percentage expansion	[%]		n = ...%
Pressure reducer Safety valve Peak flow	p_a [bar] p_{SV} [bar] $\dot{V}_S$ [m³/h]	Setting pressure Reflex recommendation 10 bar	p_a = ... bar p_{SV} = ... bar $\dot{V}_S$ = ... [m³/h]
Selection by nominal volume V_n			
Supply pressure	p_0 [bar]	$p_0 = p_a$ - (0.2 ... 1.0 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.

	Rec. max. peak volume flow $\dot{V}_S$*	Actual pressure loss at volume flow $\dot{V}$
Refix DD 8–33 litres with or without Flowjet T-piece bore Rp ¾" = standard T-piece Rp 1" (on site)	 ≤ 2.5 m³/h ≤ 4.2 m³/h	 $\Delta p = 0.03 \text{ bar} \cdot \left(\frac{\dot{V} p_0 \text{ [m³/h]}}{2.5 \text{ m³/h}}\right)^2$ negligible
Refix DT 60–500 litres with Flowjet Rp 1¼"	≤ 7.2 m³/h	$\Delta p = 0.04 \text{ bar} \cdot \left(\frac{\dot{V} \text{[m³/h]}}{7.2 \text{ m³/h}}\right)^2$
Refix DT 80–3.000 litres Twin connection DN 50 Twin connection DN 65 Twin connection DN 80 Twin connection DN 100	 ≤ 15 m³/h ≤ 27 m³/h ≤ 36 m³/h ≤ 56 m³/h	 $\Delta p = 0.14 \text{ bar} \cdot \left(\frac{\dot{V} \text{[m³/h]}}{15 \text{ m³/h}}\right)^2$ $\Delta p = 0.11 \text{ bar} \cdot \left(\frac{\dot{V} \text{[m³/h]}}{27 \text{ m³/h}}\right)^2$ negligible
Refix DC (No flow-through)	unlimited	Δp = 0



Δp = ... bar

G = ...

Result	
Refix DT5 l	V_n = ... l
Refix DD ..... l G = ... (Standard Rp ¾" incl.)	p_0 = ... bar
Refix DT5 l	

Refix in pressure booster systems

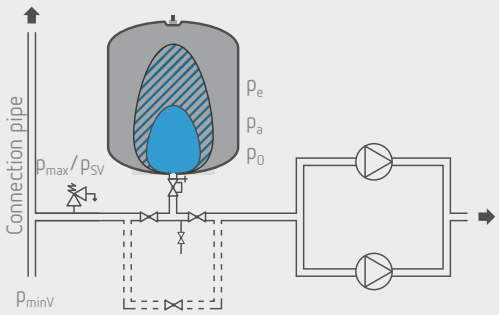
Potable water is a food stuff. Expansion vessels in potable water installations therefore have to meet specific requirements to DIN 4807 part 5. Only vessels with flow-through are permitted.

Calculation

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

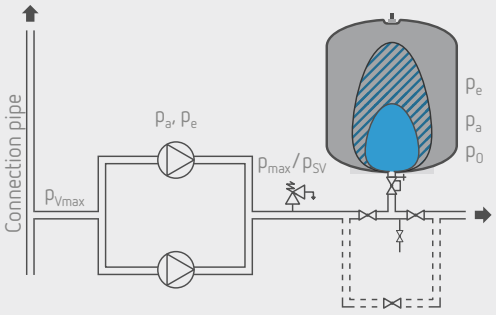
Circuit

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 p_a 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.

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.

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

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	p_{minV} [bar]	Selection in accordance with DIN 1988 part 5			V_n = ... litres
max. feed flow	$\dot{V}_{maxP}$ [m³/h]	max. feed flow $\dot{V}_{maxP}$ / m³/h	Refix DT with twin connection V_n / litre	Refix DT V_n / litre	
		≤ 7	300	300	
		> 7 ≤ 15	500	600	
		> 15	---	800	
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				

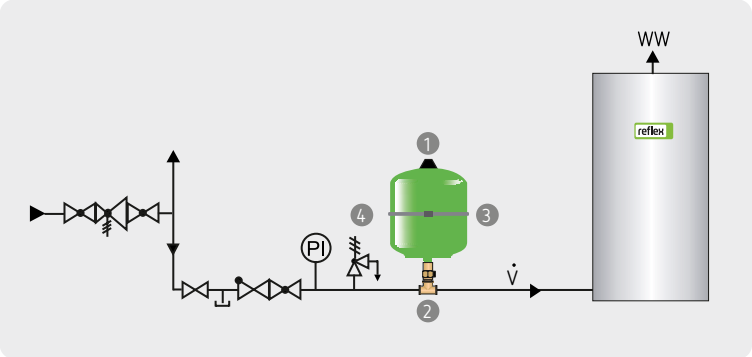
Pressure side circuit Refix on the downstream side of the DEA

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	H_{max} [mWs]				
Max. supply pressure	p_{max} [bar]				
Cut-in pressure	p_E [bar]				
Cut-out pressure	p_A [bar]				
Max. feed flow	$\dot{V}_{maxP}$ [l/h]				
Switching frequency	s [1/h]	s - Switching frequency 1/h	20	15	10
No. of pumps	n [pieces]	Pump output kW	≤ 4.0	≤ 7.5	≤ 7,5
Electrical power of the more powerful pump	P_{el} [kW]				
Nominal volume	Vn [l]	$Vn = 0.33 \times V_{maxP} \frac{p_A + 1}{(p_A - p_E) \times s \times n}$			V_n = ... litres
For storing the minimum feed quantity V_e between On and Off for the DEA					
Cut-in pressure	p_E [bar]				
Cut-out pressure	p_A [bar]				
Refix supply pressure	p_o [bar]	Reflex recommendation: for $p_0 = p_E - 0.5$ bar			p_0 = ... bar
Feed quantity	V_e [l]				
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 examples

Refix in water heating systems – installation examples

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

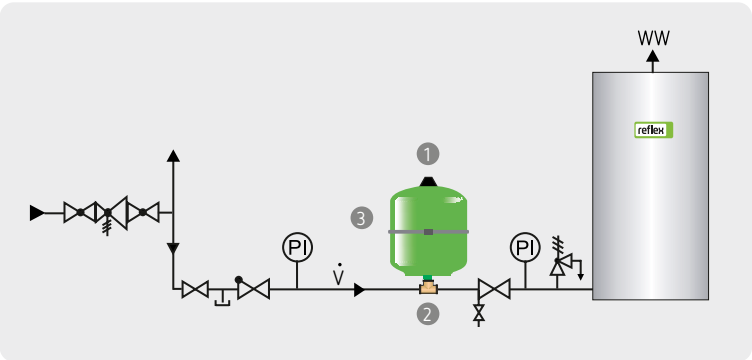


- The **complete solution** with Flowjet flow through, shut-off and drain valve
- **Benefits** Flowjet is easy to fit and DIN-compliant Guaranteed shut off, drainage and flow-through for Refix.

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", V̇ ≤ 2,5 m³/h
   - for T-piece Rp 1" V̇ ≤ 4.2 m³/h

   for Refix DT 60 – 500' with Flowjet:
   - standard with Rp 1¼" V̇ ≤ 7.2 m³/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 ≤ than the downstream storage feed.

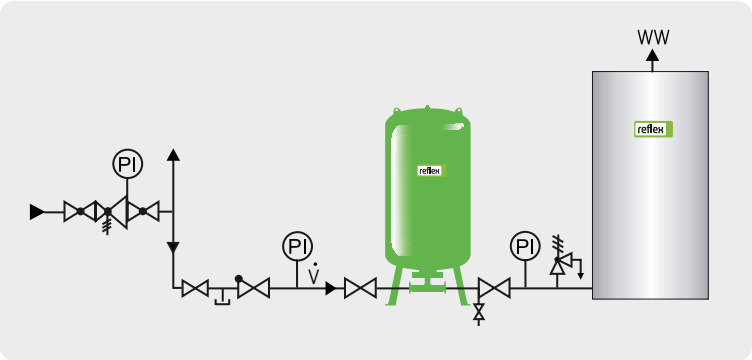
Refix DD without Flowjet flow through, shut-off and drain valve



- 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", V̇ ≤ 2.5 m³/h
   For T-piece Rp 1" V̇ ≤ 4.2 m³/h
3. Reflex wall-hung holder for 8 – 25 litres (33 l with butt straps feet)

Refix DT with twin connection



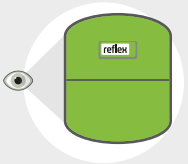
- Additional fittings are required when shutting off and draining the Refix DT with twin connection.
- The safety valve can not be shut off at the cold water inlet on the vessel.

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

Operation & Maintenance

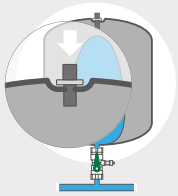
Industrial Safety Regulations require expansion vessels to be checked on an annual basis. The relevant notes for installers and operators in the Reflex Assembly, Operating and Maintenance Instructions are to be observed.

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.

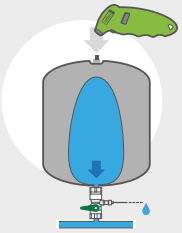
2. Check bladder



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.

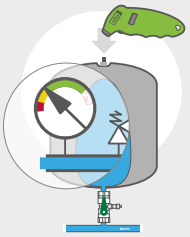
Measure supply pressure p_0 at the gas filling valve and if necessary reset to the required minimum operating pressure for the system.

$$p_0\ [bar] = p_a - 0.2\ bar^*$$

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

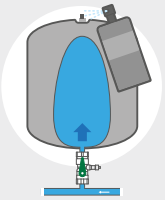
- If the pressure is too high, blow off the gas with the gas filling valve.
- If the pressure is too low, refill with nitrogen from a pressurised container.
- Enter the reset or corrected supply pressure p_0 on the type plate.

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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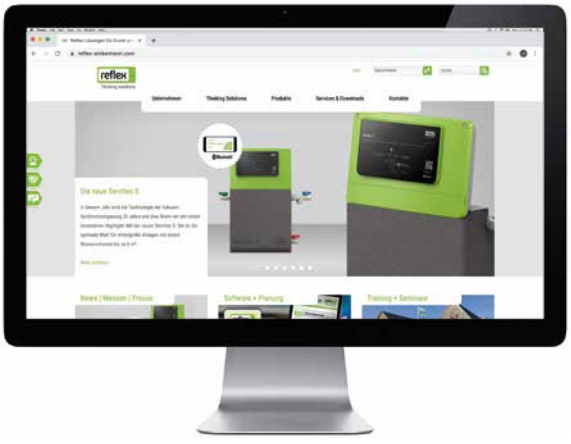

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Contact the training team

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