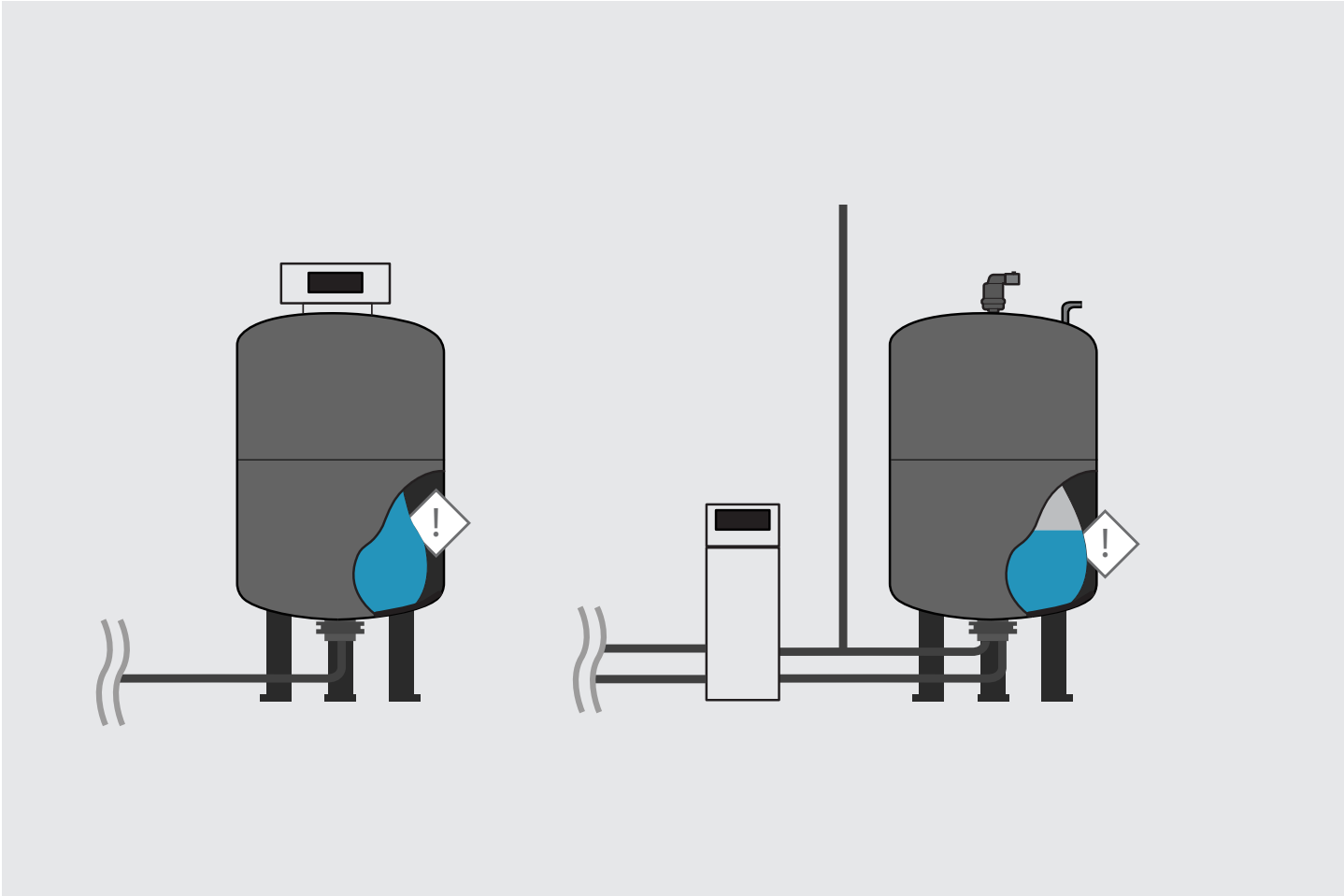
risycard

RICA 05 - constant pressure expansion systems and the danger of oxygen permeable bladders



RISK OF OXYGEN ENTRY

The constant pressure expansion system is a risk component due to the danger of an oxygen permeable bladder.

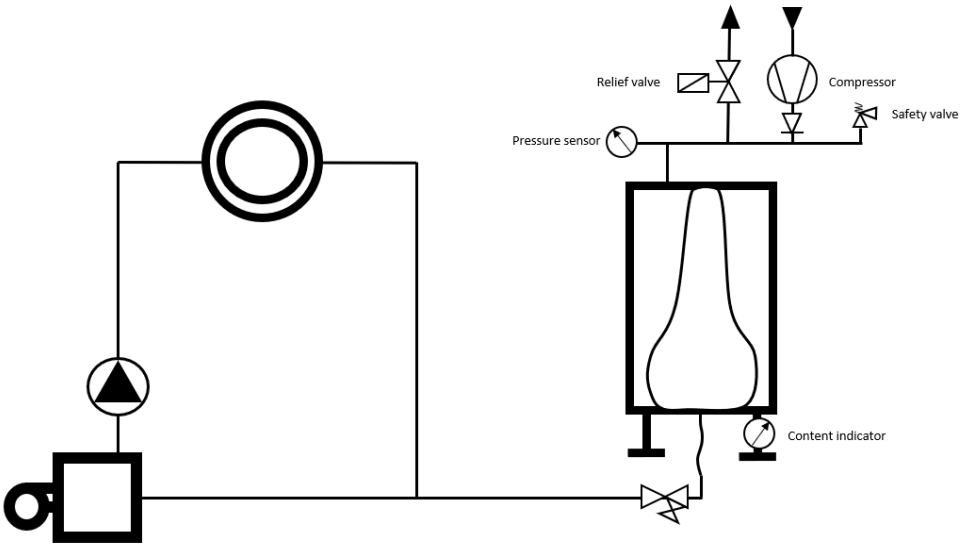
The bladder in the expansion vessel separates the oxygen-depleted system water (“dead water”) from the oxygen in the compressed air cushion (compressor system) or atmospheric air (pump system). This barrier is of the utmost importance to prevent oxygen entering the system and thus causing corrosion. Most common are butyl rubber (IIR) bladders which have the best resistance to permeation of all commercial rubbers. EPDM is also sometimes used, but has an oxygen permeability approx. 17x higher than that of butyl.

Compressor System

When the central heating system heats up (expansion phase), the pressure in the installation rises, causing the expanding system water to flow into the bladder. The pressure of the compressed air cushion in the expansion tank around the bladder also rises until a solenoid valve opens to allow compressed air to escape.

When cooling (contraction), the pressure in the installation drops and the compressed air cushion pushes the contracting water back into the system. The pressure in the expansion vessel drops until the compressor starts and pumps air into the space around the bladder again.

The pressure in the installation and in the expansion vessel (both in and around the bladder) is the same.

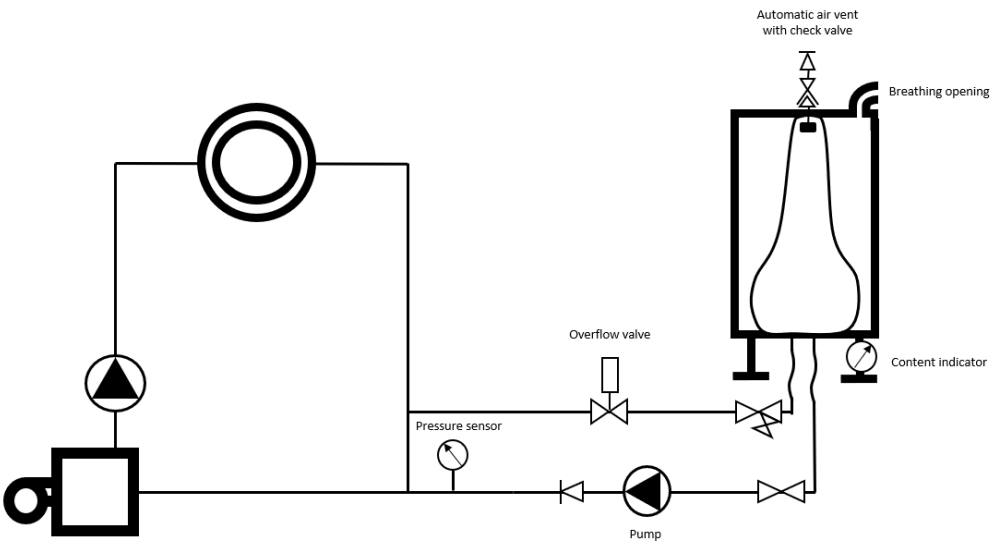


Pump system

When the central heating system heats up (expansion phase), the pressure in the installation rises, causing a solenoid valve to open that allows expanding system water to flow in to the bladder of the (pressure less) expansion vessel. This would increase the pressure in the space around the bladder, but it can escape through a breathing opening.

During cooling (contraction), the pump will start which pumps installation water from the expansion vessel into the installation in order to maintain the installation pressure. The pressure of the space around the bladder would fall as a result, but atmospheric air can enter through the breathing opening.

The pressure in the system and in the expansion, vessel is different: the expansion vessel with its breathing opening is pressure less (atmospheric).



RISK OF OXYGEN ENTRY

The oxygen diffusion barrier of the bladder is very important, because **if there is insufficient "resistance" to permeation (oxygen diffusion), the difference in partial pressure will cause oxygen to be pushed through the bladder wall in to the system water.** During a contraction phase, the oxygen will migrate with the water from the vessel to the system where it will cause corrosion. Then during an expansion phase, the water that has now been depleted of the dissolved oxygen by the corrosion process, will return to the expansion vessel, where it can once again absorb fresh oxygen.
Avoiding oxygen ingress through good permeation resistance of the bladder is all the more important with:

- **compressor systems**

Because the difference in partial pressure can be much greater than with pump expansion systems due to the compressed air cushion having a higher total pressure.

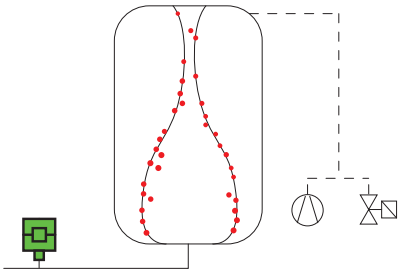


Fig.: Oxygen-permeable bladder in compressor system

- **combined-pump expansion systems with degassing in the bladder**

Because the exchange between the expansion vessel and the system of oxygen-enriched water increases greatly when the degassing function is switched on. After all, in such a mode, system water depleted in oxygen permanently flows through the bladder to be degassed. If the bladder does not have a good resistance to permeation, it will permanently absorb oxygen.

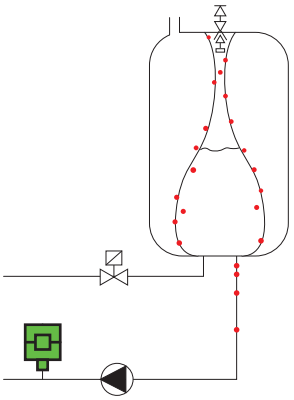


Fig.: Oxygen-permeable bladder in combined-pump expansion system

Note:
a. some combination systems that, according to the manufacturer, have butyl rubber bladders, are actually made of EPDM.
b. see also RICA 04 "failing air inlet barrier"
c. see also RICA 09 "CI-Open systems"

The most extreme form of oxygen entry occurs with a defective (eg torn) bladder. In that case, the pressure maintenance system still continues to operate normally, but resulting in massive oxygen entry and thus corrosion.

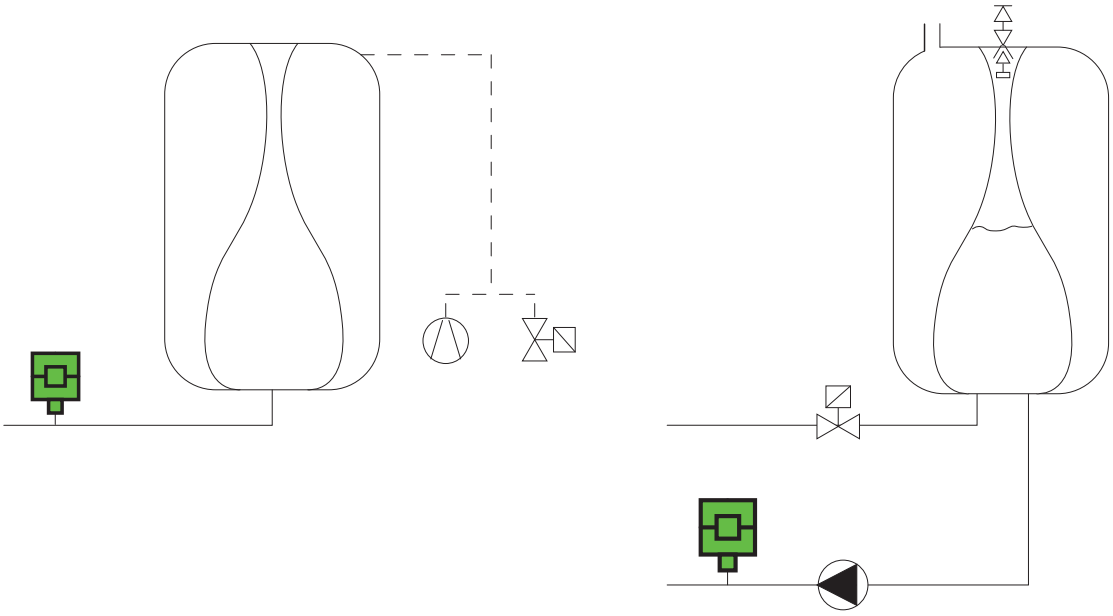
- **Compressor expansion systems** operate at relatively high pressures in installations with large expansion and contraction fluctuations. A ruptured bladder can sometimes be noticed because venting problems begin to occur at the highest point of the installation. However, if a vacuum degasser is also present in the installation, these problems are not noticed, resulting in massive corrosion.

- **pump expansion systems,** a ruptured bladder may not be noticed because the system will continue to operate completely normally as with an open expansion vessel. Often the expansion vessel does not even have an inspection opening to check the space around the bladder at the bottom of the vessel, so that even a manual check is not possible.

There are several case studies available from Resus that illustrate the Risks covered in the Risycard series.

THE IMPORTANCE OF RISYCOR

In addition to the Risycor in the general return of the installation (see Risycor Application Guideline), we recommend installing a Risycor in the return from the expansion vessel to the installation for these risk components. Oxygen entry through a defective or oxygen permeable bladder will thus be detected. In this way, Risycor can also function as a reliable bladder leak detection.
For a good follow-up of the entire installation, the recorded data should be checked using the Resus dashboard at least once a year.



ABOUT US

Resus is the manufacturer of Risycor, a system for continuous corrosion monitoring in closed heating and cooling systems. Like a smoke detector, a Risycor is an early warning system that prevents problems by providing an early warning.

Corrosion is ALWAYS the result of oxygen ingress, which in 90% of the cases
Is the result of poor pressure control. The remainder of the cases are often the result of failing risk components. Read more about this in our Risycards and Risybasics.
The application of Risycor is explained in the Risycor Application Guidelines.

READ ALSO

RICA 01 - automatic air vents
RICA 02 - green zone
RICA 03 - neutral point
RICA 04 - failing air non return valve
RICA 05 - oxygen diffusion open bladder
RICA 06 - breakdown of PWH water
RICA 07 - oxygen diffusion
RICA 08 - content indication constant pressure
RICA 09 - clopen systems
RICA 10 - pre-pressure

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