



INDUSTRIAL LEAK DETECTION AT BELLOWS AND COMPENSATORS

Bellows and compensators are vital for many industrial applications. They are present in exhaust lines of vehicles, for example, as well as in the pressure switches of cooling technology. For their correct function, tightness is crucially important. Industrial leak detection of these parts must be adjusted to the specific field of their application. Therewith, some boundary conditions for leak detection are already set:

1. The test procedure has to be non-destructive. The maximum test pressure is thus given by the elastic limit of the material that is tested.
2. The test procedure must at least simulate the real use of the part but better contain a security limit. This requirement determines the pressure direction as well as the pressure in a burst pressure test, which is carried out upstream the actual leak test.
3. The production processes must be controllable at least qualitatively, but better quantitatively. Changes in the material that are caused by the production process have to be measurable.

Highest demands on tightness: laser welding of bellows and corrugated tubes

In industry, bellows or corrugated tubes are often connected to flanges or housings by laser welding. Laser welding causes optically homogenous seams which often pass visual tests. The main advantage of laser welding is its small heat input, which maintains the characteristics of the material even directly next to the welding seam. Especially in the production of pressure switches with bellows, the life time of the bellows is significantly lengthened by laser welding compared to other, conventional procedures. The pressure switches have to endure at least two million cycles of operation. Even in case of a malfunction due to damaged bellows, the switches have to be tight. This requirement is often realized by coating the working shaft with a second bellow. The active surface of the second bellow is significantly larger than the working shaft. This guarantees the requested safety shutdown even in case of pressure decay down to a mere fraction of the operational pressure.

The requested function is thus ensured by a double-walled design but comes with several disadvantages:

- The double-construction is much more rigid than the one with only one corrugated pipe
- The working direction requires a high pressure side inside the bellow. Corrugated pipes, in contrast, are mechanically resilient if the high vacuum side is outside and they are thus compressed.

If these boundary conditions are considered already in the design phase, compensators of high flexibility and long life time are produced thanks to the use of thin-walled bellows and suitable materials.

Helium leak detection: popular solution for industrial applications

For ensuring the quality standards and the serial testing after production, many notable providers use helium leak detection for tightness tests. They have integrated it into their production by considering the specific requirements of the part to be tested.

Conventional procedures such as dye penetrant testing, sniffing of refrigerants or bubble test only reach a mere fraction of the sensitivity of helium leak detection and do not reach their productivity or adaptability to industrial serial production.

Helium leak detection, in contrast, convinces with a number of advantages:

- Highest dynamical range of all test methods
- High proof sensitivity
- The test gas helium is atoxic, colorless, non-flammable, does not condensate, and is chemically completely inert.
- The part to be tested is neither polluted nor damaged by chemical attacks
- A low signal underground is ensured due to the low natural presence of helium (5 ppm in air)
- Helium can be mixed randomly with other gases. This makes it possible to use an even more inexpensive test gas with a lower helium content if only low sensitivity is needed
- Helium can be verified in a mass spectrometer without cross-sensitivity
- Crosstalk or incorrect measurements of other gases do not appear
- In contrast to many refrigerants, helium is no greenhouse gas
- By the aid of special recovery systems, helium can be recycled and used again



Figure 1: With its broad product portfolio, Pfeiffer Vacuum offers the optimal leak detector for every application.

Leak detection solutions by Pfeiffer Vacuum

With its broad portfolio of helium leak detectors, Pfeiffer Vacuum offers optimal solutions for the demands of different industrial applications. They convince with a high degree of sensitivity, are high performant and reliable. The Pfeiffer Vacuum leak detectors find leaks that are 10.000 times smaller than the typical threshold values for refrigerant cycles. Moreover, they are available in different versions and are as diverse as the range of industrial products: portable leak detectors such as the MiniTest or the ASM 310 for mobile on-site tests, universal versions such as the ASM 340 as well as high performance detectors for the use in processes with very short cycle times and a fast decay of the helium background.

Advantages of the leak detection solutions by Pfeiffer Vacuum

Portable devices:

- Very light and easy to operate
- Ideal for worldwide use
- Remote control for comfortable operation

Universal leak detectors:

- Suitable for a large number of leak detection applications
- Powerful and reliable
- Clear design for easy handling

High performance leak detectors:

- Extremely short pump-down times even with large volumes
- Highly sensitive detection limits at parts of every size and volume
- Highly reliable in clean processes as well as in rough environments

Working stations:

- Ideal for tests in mass production with short cycle times
- Completely automatic operation at closed components
- Ergonomic design for operation while sitting

Modular leak detectors:

- Easy, flexible integration into leak detection systems
- Continuous operation thanks to low need for maintenance
- Broad selection of interfaces in accordance with all actual industrial standards

Sniffing leak detectors:

- Ideal solution for detecting small leaks
- Status reports via voice output facilitate working processes
- Comfortable operation thanks to remote control

Besides its broad leak detector portfolio, Pfeiffer Vacuum also offers helium recovery units (HRU). With these stand-alone systems, already used helium can be recycled – depending on the individual process conditions, up to 98 % of the used helium can be regained.

In general, there are two different principles of helium recovery at hand: balloon recovery and tank recovery. They can both be adapted individually to the customers' processes.

Customer benefits of helium recovery units:

- Remarkably reduced operating costs thanks to reduced helium consumption
- Reduced dependency on helium availability fluctuations caused by world market
- Stand-alone system operates independently from the leak detection system connected
- Adherence to environmental regulations thanks to resource-conserving treatment of helium (e.g. DIN EN ISO 14001)
- Completely automated operation
- Automated evacuation of the test objects by the detection systems connected

We would be happy to assist you in optimizing your vacuum solutions for specific applications – go ahead and ask us!



Figure 2: With the stand-alone helium recovery units by Pfeiffer Vacuum, already used helium can be recycled.

VACUUM SOLUTIONS FROM A SINGLE SOURCE

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

COMPLETE RANGE OF PRODUCTS

From a single component to complex systems:

We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE

Benefit from our know-how and our portfolio of training opportunities!

We support you with your plant layout and provide first-class on-site service worldwide.

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perfect vacuum solution?
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