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Leakage detection spray and result interpretation

Background and Requirements

All over the world the simple detection of leaks is done by using a leakage detection spray. A pipeline or a pressure vessel is pressurized by a gas (most of the times it gets connected to the compressed air system (6bar/87 psi). The leakage detection liquid is sprayed onto the sealing system in order to make any leak visible by showing bubbles. The variety of detection liquids used is widespread and ends at a self-made soap water mixture.

The advantage of this procedure is obvious: There is not much preparation needed. It is easy to apply and results are received immediately. The disadvantage is more unapparent, because of the result is not quantifiable, it is almost impossible to evaluate the leakage rate in a technical manner.

The main field of application of this method is found at the gas detection industry in public housing applications, which are mostly used at > 0.2 bar (2.9 psi). The parameter shows the sensitivity of the detecting process in an impressing way. But the interpretation of the results is almost not possible. The different parameter of the added pressure system (i.e. 6 bar /87 psi) compressed air) are blurring the test results further on.

The following description of the leakage detection test illustrates the combination between the appearance of bubbles at a DIN flange act upon 6 bar (87 psi) test pressure and the actual leakage rate.

Spray test

Modern high quality fiber based gaskets (novapress) are performing perfectly without any appearance of bubbles under optimal assembling conditions.

Improper mounting conditions, e.g. no bolt lubrication or non-uniform bolt torque will lead to reduced surface pressure on the gasket. In this case bubbles or froth will show up instantly.

Damage on the flange surface can also be a reason for the appearance of bubbles. According to that the surface pressure was set on the relatively low level of 15 N/mm² (2175 psi). The tests have been done on a DN40/PN40 test flange approaching the practical conditions. It was not tested in a conventional test rig. The roughness of the flange surface is much smoother at a test flange (Rz < 6.3). The surface pressure is adjusted via calibrated bolts, see picture 2.

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Picture 2
test flange open

Picture 3
test flange
assembled

Test procedure

The test material was novapress BASIC. It is a commonly used standard quality product of Frenzelit. The practically used test medium nitrogen was selected.

After assembling the flange, nitrogen with a pressure of 6 bar was pumped into the pipe system and the leakage detection spray (brand Alltec) was spayed extensively all over the flange/gasket connection. Because of the different surface of the gasket (production wise caused), the first bubbles appeared at the rougher gasket flank after a while.

The following pictures show the formation of froth and bubbles after 30, 180 and 300 seconds. (For measuring the 300 seconds test result the test pressure was increased to 16 bar).

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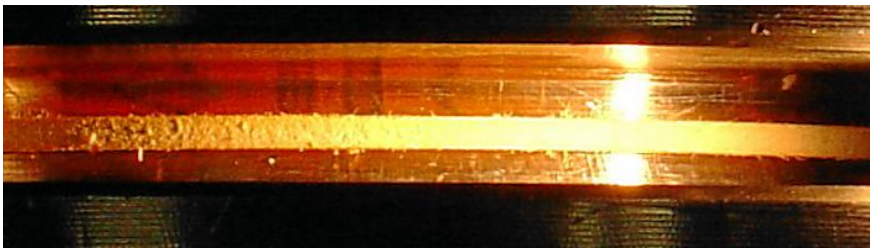
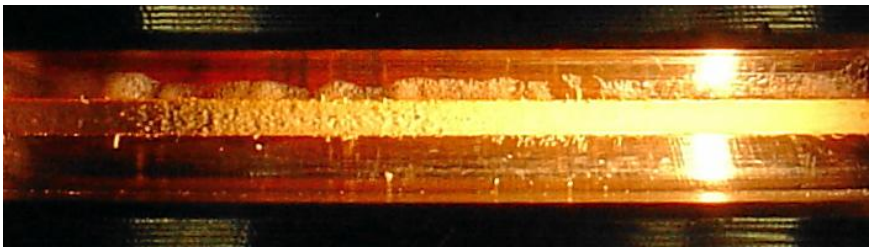
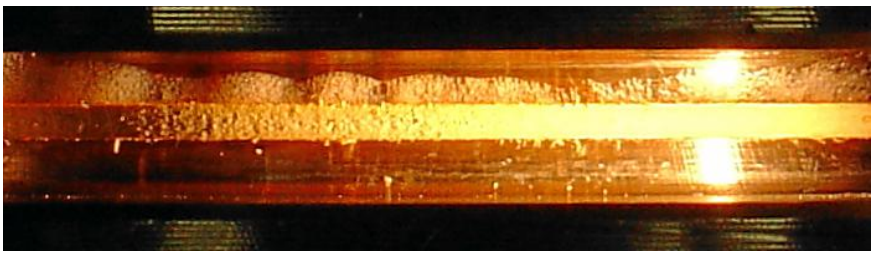


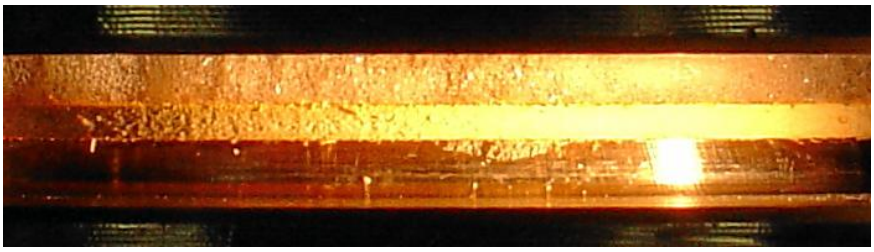
picture 4
gap without spray
6 bar (87 psi)



picture 5
gap with spray after 30 sec.
6 bar (87 psi)



picture 6
gap with spay after 180 sec.
6 bar (87 psi)



picture 7
gap with spray after 300 sec.
16 bar (232 psi)

A cross section leak was not detected despite the low surface pressure. An open bubbling was rarely noticed. Forth comes out very slowly. By increasing the internal pressure to 16 bar the frothing is easier to be recognized.

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Leakage test 1 (nitrogen)

Target: To show the relation between obvious bubbles and existing leakage.

The test was based on the gas leakage standard test DIN 28090-2. Some parameters, however, were adapted to the “more practical oriented” test flange.

Parameter	**Gas leackage test acc. To DIN 28090-2**	**fixed parameter**
Flange	DN40/PN40 Rz < 6,3	DN40/PN40 Rz < 6,3
Test medium	nitrogen	nitrogen
Surface pressure (net)	30 N/mm² (4351 psi)	**15 N/mm² (2175 psi)**
Internal pressure	40 bar (560 psi)	**16 bar (232 psi)**
Leakage limit acc. to DVGW	< 0,1 mg/(s*m)	
Leakage (measured)	0,054 mg/(s*m) (long-term. QS-average)	0,098 mg/(s*m)

The test result of 0.098 mg/(s*m) shows impressively the compliance with the DVGW requirements even at an internal pressure of 16 bar (232 psi) nitrogen and a surface pressure of 15 N/mm^2 (2175 psi), even though bubbles can be clearly seen.

Leakage test 2 (liquid medium)

Sometimes pipe systems are approved by the same leakage test and afterwards are filled up with a liquid process medium. Therefore the knowledge about the relation between gas leakage and liquid leakage is needed. It is easy to figure out the lower viscosity of gas and its higher leakage rate compared to liquids at same test conditions. The above test reflects such a gas sealed application.

In order to receive result concerning liquid medias more test with purified water were performed. Out of the leakage perspective it is much more critical matched with ordinary water or other liquids like oil. The tests were made at 16 (232 psi) and 40 bar (580 psi) in order to increase the conditions and use the most common pressure limits of pipe systems. At both pressure levels there was no leakage detected, therefore no visible leakage (bubbles) appeared.

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Conclusion, Evaluation and Summery

Test	medium	Surface Pressure	Internal pressure	result
Spray	Nitrogen	15 N/mm² (2175 psi)	6 bar (87 psi)	Minimal frothing (bubbles) after a while
Spray	Nitrogen	15 N/mm² (2175 psi)	16 bar (232 psi)	Minimal frothing
DIN 28090-2	Nitrogen	15 N/mm² (2175 psi)	16 bar (232 psi)	0,098 mg/(s*m) = conforming to standard
Liquid (72h)	Purified water	15 N/mm² (2175 psi)	16 bar (232 psi)	No leakage detected
Liquid (16h)	Purified water	15 N/mm² (2175 psi)	40 bar (580 psi)	No leakage detected

Depending on the installation situation sometimes frothing might appear by using a leakage detection spray test. That does not mean a failure of the jointing system. To reduce the amount of bubbles, by no means „sealing agents“shall be applied. They may attack the gasket. It may only have a short time effect. Which means, the first minutes the bubbles will disappear, but at least, the leakage might be even worse, due to foreign substances in the system.

The detection of froth is not to be considered as an unacceptable leakage. Despite the detection of froth and bubbles the leakage is far below the limits of a standard leakage rate e.g. acc. To DIN 28090-2, but it is not quantifying the leakage rate.

The flange surfaces in praxis are mostly much rougher than the “ideal” flange surface at the test flange. This will help to reduce the surface leakage. Likewise common DIN-Flanges with suitable bolts and regular mounting conditions (bolt lubrication!) are showing a much higher loading pressure than 15 N/mm^2 (2175 psi). In sealing systems against liquid media usually no leakage will occur even when bubblesare detected with the leakage detecting spray.

The second important fact in the summery of the leakage tests is the impact of the temperature. If the gas leakage test is made at ambient temperature, the leakage at e.g. 100°C will be significantly reduced. Using the leakage detection spray test one has to consider, that the test results are successfully used at very low pressure of < 0.2 bar in gas systems in residential houses.

The leakage detection spray test is basically not to be dismissed, because of extreme frothing with big blasting bubbles one can detect unacceptable weak points. But only some bubbles with a slight frothing effect is mostly not a sign of failure. A controlled leakage, which is lower than the leakage standard is considered as technically leak free.

Application engineering questions?

We help you at: gaskets@frenzelit.com, Phone: +49 9273 72-140 Status: May 2012

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