Vacuum or pressure step degassing?

Spirotech recommends following the VDI 4708 and VDI 2035-2 guidelines. In order to achieve the best possible degassing performance in heating and cooling installations, a separate vacuum degasser is recommended in addition to the more commonly used deaeration function in pressurization systems.

The maximum amount of gas in heating installations, which is predominantly nitrogen and oxygen, is specified in VDI 4708 (design guideline for degassing and deaeration, August 2019) and VDI 2035-2 (guideline for the prevention of damage in water heating installations) respectively.

According to VDI 2035-2, the maximum value for oxygen in heating water is max 0.1 mg/l (low saline) and 0.02 mg/l (saline). These values are theoretical values that depend more on system design and corrosion processes than the degassing process. Furthermore, the values specified by VDI 2035-2 are only achievable in oxygen-sealed water heating installations (an installation that is impossible for oxygen to penetrate while it's in operation).

Nitrogen gas concentration, on the other hand, has a more direct correlation with the degassing process. This means that in order to absorb gas (nitrogen) from the system and fully degas it, the maximum partial gas pressure in the degasser should be lower than the lowest partial gas pressure in the system. The VDI 4708 guideline indicates therefore that the value for dissolved nitrogen in heating water should be between 10 and 15 mg/l (depending on the temperature of the system).

When degassing a heating installation, the figure 1 below can be used (see also VDI 4708, Figure 23) to ensure compliance with the VDI guidelines. It contains the applicable ranges for the different degassing techniques as well as the reference values for the gas concentration.

On the right hand side of figure 1, it can be seen that a vacuum degasser can reach a very low concentration of dissolved oxygen. However, the chosen vacuum degasser must be able to reach oxygen pressures of 0.01 bara (0.02 mg/l O_2) or lower to comply with VDI2035-2. It's debatable whether a vacuum degasser can reach these pressures.

When an atmospheric degasser is used, the VDI 2035-2 values are far from achievable. Alternatively, in corrosion-sealed water heating installations that consists largely of steel part (majority of the systems), the dissolved oxygen will be consumed very quickly by corrosion processes to levels mentioned by VDI2035-2.

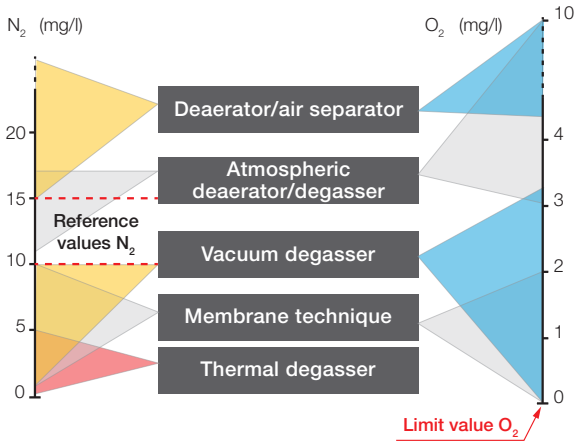

Figure 1. Simplified representation of the applicable ranges of deaerators, atmospheric degassers, vacuum degassers and other degassing techniques for oxygen and nitrogen.

Regarding Nitrogen, figure 1 shows that the minimum nitrogen concentration of 10 mg/l, which corresponds to a nitrogen gas pressure of approximately 1 bara, can be reached with a vacuum degasser and not with an atmospheric degasser. The reason for this is that a gas pressure of 1 bara (10 mg/l N_2) is hard to achieve with atmospheric degassers, since the minimum degassing pressure is at least 1 bara (and often above).

For the Spirotech products this means that the Spirotech Superiors will have no trouble in reaching the VDI 4708 values but the SpiroPress units (e.g. the SpiroPress EMCK) which degas down to approximately 1.5 bara, will not reach these values.

The degassing function of the SpiroPress units, however, will reduce air related issues in closed water circuits, but it is not a guarantee to reach a gas pressure which is lower than the lowest pressure in the system (gas absorption condition).

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