Cannerweg 123
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AMMO LASER Leak Detection System

The #1 Safety Measure for Urea Plants with a Guaranteed Pay Back

Question 13:
What is reason number 7 to choose for a vacuum system ?

High pressure urea equipment consists of a carbon steel pressure bearing wall, which is protected against corrosion by a protective layer. This protective layer is typically an overlay welding or a loose liner. Any leak in a loose liner will lead to a dangerous situation in that a large surface of the carbon steel pressure bearing wall underneath the leaking loose liner compartment will be exposed to the extremely corrosive ammonium carbamate. Experience has shown that ammonium carbamate can corrode carbon steels with very high corrosion rates up to 1,000 mm (40 inch) per year.

When talking about active leak detection systems, one can distinguish a pressurized system, in which an inert carrier gas stream flows through the leak detection circuits and a vacuum based system, where one pulls vacuum pressure behind the liner (refer to FAQ 5)

It is a real challenge to avoid clogging as urea easily crystallises at any temperature even above its melting point due to its polymerisation behaviour forming biuret, triuret etc. with high melting points. This is the main reason that we strongly recommend to upgrade any passive leak detection system (FAQ 3).

We recommend to use a vacuum based leak detection system for several important reasons:

Reason #1: No risk of liner bulging (refer to FAQ 6)

Reason #2: Direct coverage of the complete carbon steel surface of a compartment (refer to FAQ 7)

Reason #3: A vacuum system is less prone to clogging (refer to FAQ 9)

Reason #4: A vacuum system does not restrict the leaking flow and does not built-up pressure or introduces risks for backflow (refer to FAQ 10)

Reason #5: A vacuum system also works when there is only one leak detection hole in a liner compartment (refer to FAQ 11)

Reason #6: A vacuum system also works when there are clogged grooves or no grooves (refer to FAQ 12)

Reason #7 is: A pressurised system requires a dedicated ammonia analyser for each high pressure equipment item whereas a vacuum system needs only one ammonia analyser for all high pressure equipment items to realise the same reliability.

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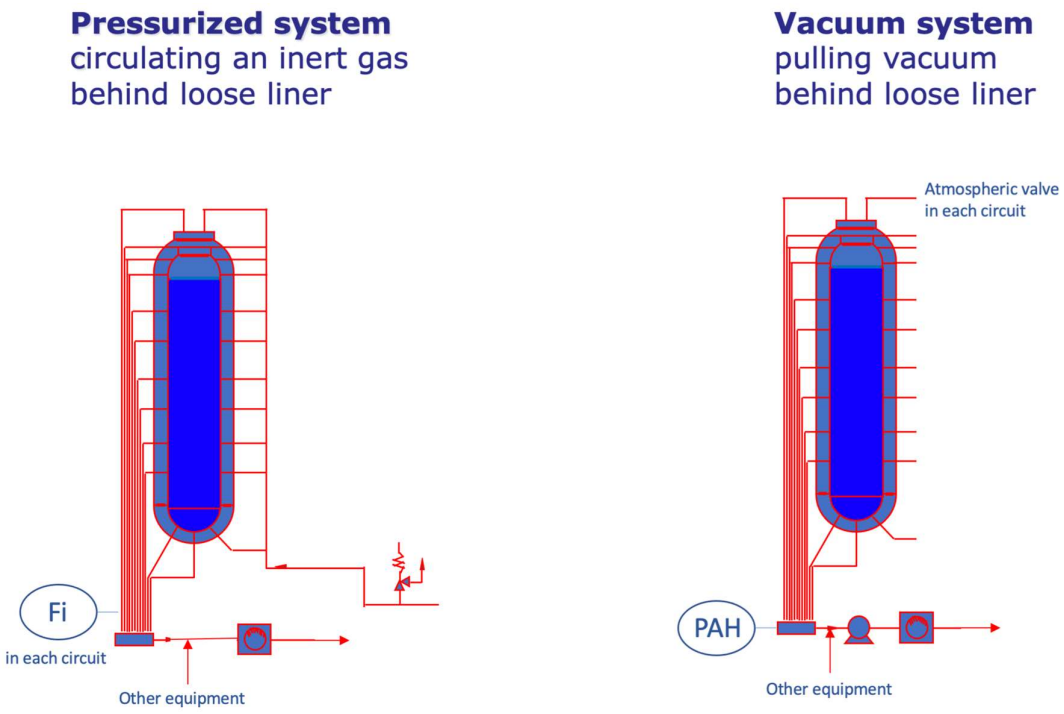

Figure 1: Pressurized (left) and vacuum (right) based active leak detection systems.

When talking about active leak detection systems, one can distinguish a pressurized system, in which an inert carrier gas flows through the gaps underneath the liner and a vacuum based system, where one pulls vacuum pressure behind the liner. Figure 1 shows the schematics of both these systems.

In a pressurized system an inert carrier gas circulates via machined grooves in the pressure vessel wall behind the liner compartments through the various leak detection circuits. Typically, each leak detection circuit includes a flow indicator with a low flow alarm. All these leak detection circuits of a specific equipment item come together in an equipment header.

A vacuum system pulls vacuum behind the liner compartments by means of a vacuum pump. That means that the whole area underneath the liner is under vacuum. In the suction side of the vacuum pump a pressure transmitter with a high pressure alarm is present. Also here all leak detection circuits of one equipment come together in an equipment header.

In a pressurised leak detection system, it is strongly recommended to install a flow meter with a low flow alarm to DCS in each leak detection circuit. This flow meter will warn when there is a blockage in a leak detection circuit. These flow meters should be installed nearby the ammonia analyser because any leak in the leak detection tubing downstream the flow meter will not be notified. As in that situation (as illustrated in Figure 2), the flow meter will still indicate a flow but cannot assure that the flow will go to the atmosphere or to the ammonia analyser.

In case one combines one ammonia analyser for more pieces of high pressure equipment in a pressurized leak detection system, it will not be possible to install all the flow meters near the ammonia analyser and typically significant lengths of tubing will be present between the flow meters / equipment headers and the ammonia analyser. This will make the system not sufficient reliable anymore as one is not notified of a leak in this tubing. To prevent this risk there is only one solution and that is to install

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a dedicated ammonia analyser for each high pressure equipment item as close as possible to the flow meters.

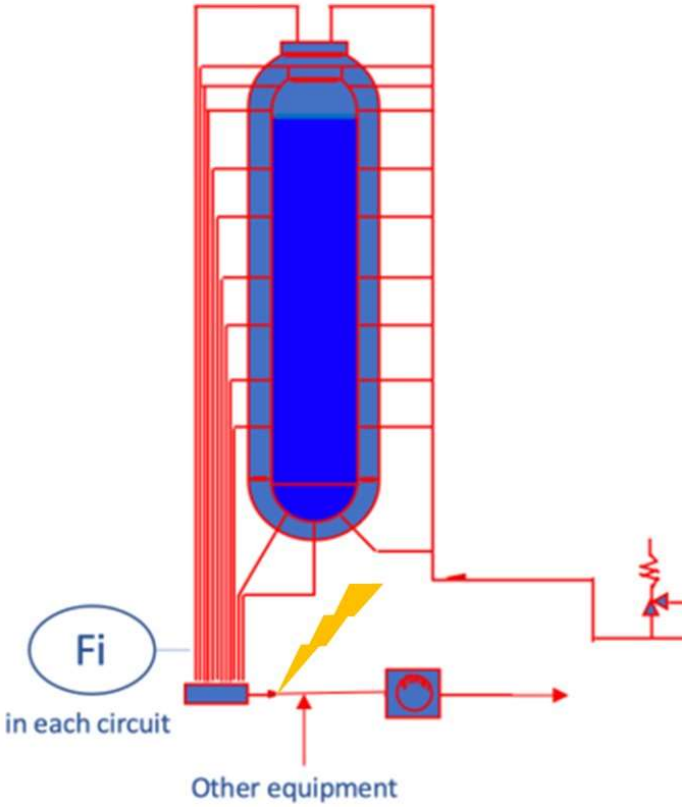

Figure 2: A Pressurized leak detection system with a leak in the tubing downstream the flow meters.

In a vacuum leak detection system one can combine the ammonia analyser for all pieces of high pressure equipment, as such a leak in the tubing will be immediately notified by an increase in the vacuum pressure including an alarm in DCS.

This is the 7th reason why we believe a vacuum leak detection system is preferred above a pressurised leak detection system.