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Where the urea industry meets

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AMMO LASER Leak Detection System

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

Question 7: What is reason #2 to choose for a vacuum system?

This question 7 is in continuation of question 6 in which we started explaining why an active vacuum leak detection system is superior over an active pressurized system.

As explained earlier high pressure urea equipment consists of a carbon steel pressure bearing wall, protected against corrosion by a protective layer. Such a 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.

A liner compartment is defined as being that part of a liner that is comprised between four welds connecting the lining material to the carbon steel of the pressure vessel wall as is shown in figure 1.

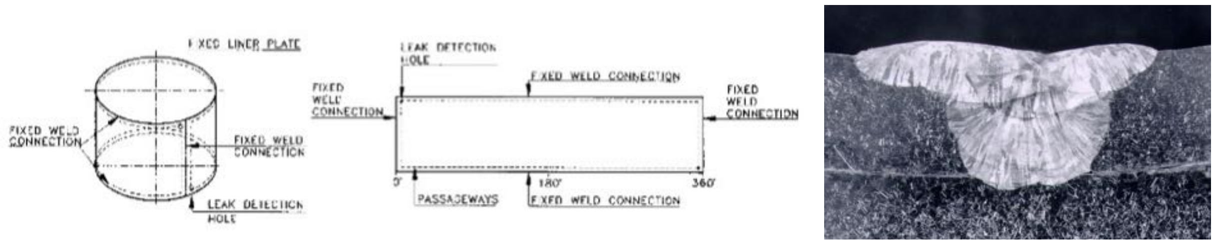

Figure 1: A liner compartment (left) and a fixed liner weld (right)

Active leak detection systems can be either a pressurized system, in which an inert carrier gas stream flows through the leak detection circuits most probably only via the machined leak detection grooves present in the carbon steel and a vacuum system, where one pulls vacuum pressure underneath the liner.

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

Reason #2: Direct detection of the complete carbon steel surface

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A leak detection circuit consists of a number of liner compartments, connected in series in a logical way so that tracing a leak can be done in an efficient manner minimising down time and production losses.

Preferably (minimum) two leak detection holes per liner compartment are drilled through the carbon steel pressure bearing wall in order to be able to check for an open (free flow) of the leak detection circuit and to allow the detection and define the exact location of a leak (or leaks).

The quality of the fixed liner welds cannot be verified by means of radiography or ultrasonics and thus these welds are susceptible for leaks and special measures are typically present to assure its integrity: grooves (also called passageways) along these fixed liner welds. Thus the grooves enable an early detection of a liner leak due to a weld defect in a fixed liner weld. Refer to figure 2.

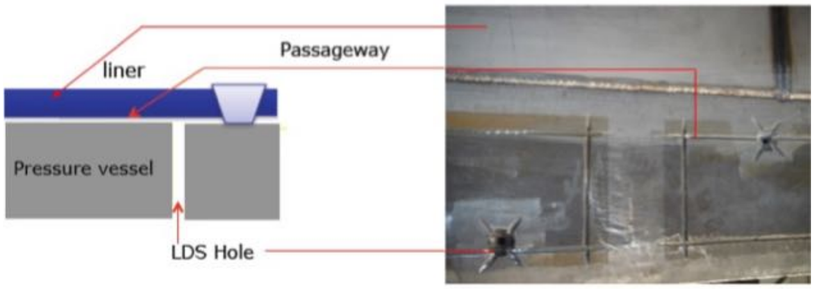

Figure 2:
A liner compartment with grooves (passageways) and leak detection (LDS) holes.

But not only leaks occur in fixed liner welds. More failure modes do exist which can cause a leak in the loose liner, for example a weld defect in a tray clip connection (refer to figure 3), a weld defect in a nozzle weld, condensation corrosion, chloride stress corrosion cracking, crevice corrosion, strain induced intergranular corrosion, fatigue cracks, etc.

Note that a significant number of incidents are related to above failure modes and typically there are no grooves at these liner leak locations!

Figure 3:
An end crater weld defect of a tray clip weld

In an active pressurised leak detection system, an inert carrier gas flows through the grooves. Note that there are two parallel grooves through which the carrier gas will flow.

As indicated above there are several failure modes causing liner leaks relatively far from the grooves and thus one has to wait until the ammonia from the leak reaches the carrier gas flowing through the grooves.

Another important issue is that one cannot be assured that the inert carrier gas flows through both the grooves. Maybe one groove is clogged as a result from an earlier leak. This situation one cannot identify and the majority part of the carbon steel surface plus half of the fixed liner welds are not under direct detection.

In an active vacuum leak detection system, one is assured that the complete carbon steel surface underneath the loose liner of a liner compartment will be reached because the total area is under vacuum pressure and ammonia from any location will be directly pulled to the analyser.

This is a major and our second reason why we prefer a vacuum leak detection system above a pressurised leak detection system.