Question 5: What are your experiences with alternatives to gauge glasses in alkylation units? Are there any specific services where you prefer glass gauges?

Kurt Detrick (UOP)

API RP 751 (Safe Operation of Hydrofluoric Acid Alkylation Units) states “The use of gauge glasses should be minimized in HF service.”

Although gauge glasses can and have been used successfully in HF service, it is essential that proper design and very special operating procedures be followed in order to prevent serious incidents. In the past, gauge glasses were sometimes the only option to provide a reliable secondary indication of liquid levels in the HF Alky units in order to verify the sometimes-unreliable primary level instruments. However, with the advances in level instrument technology over the past decade, there are alternatives to gauge glasses to provide reliable confirmation of liquid levels in the unit.

In many cases, a magnetic level indicator can be used to replace the existing gauge glass relatively easily. Certainly, this has been the most common replacement technology for gauge glasses. When this is done, we typically recommend that instead of just a local reading for the magnetic instrument, a signal should also be sent to the control panel to allow tracking and trending of the magnetic level reading. This allows comparison of the level indication from the mag and from the primary level instrument and the operator can easily identify when there is a problem with one of the two instruments when the two signals diverge. So, you might give up something by replacing the gauge glass with a mag (the ability to visually verify the level), but you gain something (faster identification of a possible problem with the primary instrument).

We are also seeing increased use of remote-seal differential pressure level instruments in HF service. When properly designed and installed, this type of level instrument will have less potential to have a problem due to accumulation of iron fluoride scale in the instrument (compared to a typical displacement type level instrument). However, the remote seal DP cells are typically used as a primary level indicator and not as a replacement for the gauge glasses. We are also seeing some use of guided wave radar level instruments in HF service. The low conductivity of LPG and the presence of iron fluoride scale particles in the process fluid present some challenges for the guided wave instruments, but these can be overcome in some applications, and there are a few guided wave instruments in HF service.

At UOP, we typically specify a magnetic type of level instrument as the secondary level instrument in all acid services – with one exception. The only service where we might still specify a gauge glass in a new design is the Acid Ratio Glass in a pumped acid circulation unit, because indication of the time it takes for the separation of the two liquid phases and the ability to see the color of the acid are two things that a level instrument cannot give. However, it is possible to run the unit without the Acid Ratio Glass and we only include these in designs where the refiner requests it.

Note that the bottom of the fractionation columns in the HF Alky unit are not always considered “HF

Service” at all locations. However, the column bottoms level glasses and instruments should be designed and operated as if it were HF Service because upsets can occur (such as power failures) that can result in significant HF in the bottom of these columns. If a gauge glass is lined up to the process when a power failure occurs, HF could get into the glass and cause a failure of the glass. So, it is best to avoid the use of gauge glasses on the bottom of these columns, and if a gauge glass is used, the special design and operating procedures for HF Service must be used.

Jim Norton and **Chris Steves** (Norton Engineering)

Glass on HF Alkylation units must have appropriate liners (e.g. Kel-F) so that the glass is not etched by the HF. Even with HF resistant liners installed gauge glasses should be equipped with isolation and purging facilities so that they can be flushed with clean material (i.e. isobutane) and isolated after use. Magnetic sight glasses have been successfully used in many refineries to replace gauge glasses and are especially good at detecting the acid/oil interface in acid settlers and separator boots.

Tags

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HF Alkylation (HF Alky)

Operations

Process

Safety

Sulphuric Alkylation

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