

## Air Separation Units

### Fidas24 – Preventing explosions in liquid oxygen

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Why do ASUs explode? The most feared reason is accumulation of hydrocarbons in liquid oxygen which can take place in the main condenser unit.

#### Measurement made easy

#### Introduction

With so much at stake, there is no space for compromising on the quality and reliability of these measurements.

- Fidas24 FID instrument has been the choice of leading ASU operators over many years. Our scientists know precisely why this analyser is used on ASUs and we have engineered it to be 100% fit-for-purpose in this safety-critical application.

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01 Measuring point on Air Separation Unit

On Friday the 19<sup>th</sup> of July 2019 a massive explosion and fire at the coal gasification plant of the Henan Gas Group caused more than 30 fatalities and major injuries. Damage to property within 3km of the facility resulted from the blast. The root cause lay within the Air Separation Unit complex where oxygen was produced to feed the gasification reaction.

This incident which took place in Yima city, Henan province, is not common but is not isolated. There have been eight explosions on Chinese ASUs since 1973. And the problem is not restricted to China. On the 6<sup>th</sup> of August 2007 an explosion at an Air Separation Unit, or ASU, operated by NIGC feeding the SABIC Ethylene Oxide production facility in Al-Jubail, Saudi Arabia suffered an explosion that ceased ASU operations on the site for many months and delayed the ramp up of Ethylene Oxide and MEG production significantly.

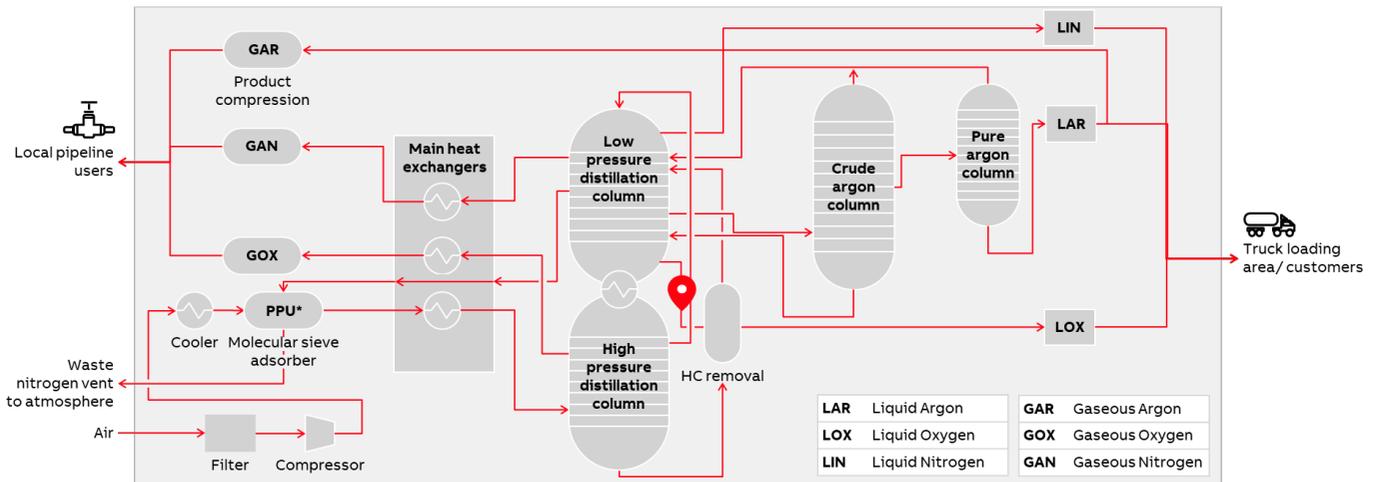
Why do ASUs explode? The most feared reason is accumulation of hydrocarbons in liquid oxygen which can take place in the main condenser unit.

The intense concentration of combustible hydrocarbons with the densely packed oxidising potential of liquid oxygen is the principle that fired some of the first rockets more than 79 years ago.

Intake of hydrocarbons with the air that is sucked into the ASU is inevitable. Extremely low concentrations of methane, acetylene and other light hydrocarbons are present in the air from natural causes or due to emissions from neighbouring petrochemical processing operations. At low concentrations in gaseous air, these hydrocarbons present no risk because the gas mixture is not within a flammable range.

However, when the air is separated to nitrogen and oxygen the hydrocarbons accumulate with the liquid oxygen. Over time, they can build up to levels that form an explosive mixture and detonation would be catastrophic for the ASU and surrounding people, property and process equipment.

01



## 02 Basic air separation unit

Several process steps are taken to mitigate the risk of explosion from this cause. They include: pre-purification of the air prior to liquefaction; maintaining the condenser unit in a fully submerged condition; use of adsorbers in the liquid oxygen phase to remove hydrocarbons and purging liquid oxygen from the main condenser to prevent accumulation.

Beyond mitigation, of equal importance, is the need to monitor the effectiveness of these measures. This requires measurement of either total hydrocarbons in the liquid oxygen or a speciated analysis of the hydrocarbons which will typically be searching for methane, acetylene, ethylene, ethane, propylene and propane. For the total hydrocarbons a cap of 500ppm is generally considered to be the maximum acceptable measured value. For individual species the maximum concentration will range from as little as 0.5ppm for acetylene to 250ppm for ethane and 500ppm for methane.

With so much at stake, there is no space for compromising on the quality and reliability of these measurements.

At ABB, we are proud that our Fidas24 FID instrument has been the choice of leading ASU operators over many years. Our scientists know precisely why this analyser is used on ASUs and we have engineered it to be 100% fit-for-purpose in this safety-critical application. And for speciated measurements, ASU instrumentation engineers and SHEQ managers can opt to bolt on additional speciated measurement using the ABB PGC5000 process gas chromatograph.

