



APPLICATION NOTE

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A Real-Life Case Study

Increasing argon process efficiency using ASDevices fast crude argon analyzer

Date:

April 2023

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ABSTRACT

This case study demonstrates the real cost saving benefits of ASDevices crude argon technology after 2 years of operation on an air separation plant that produces argon. The fast analysis time, 15 to 30 sec (10x to 20x faster than competitor solution), of ASDevices solution is the key breakthrough that allows argon producers to capture the full potential of this application now fully. This fast analysis performance is only possible using ASDevices patented SePdd detector (Scalable Enhanced Plasma Discharge Detector), spectral compensation and innovative PLSV (Purge Lip Sealing Valve) technology which last well above 1,000,000 actuations. The data obtained from a customer over a 2-year period are used in this application note to show the benefits.

Further information on this application can be found in ASDevices AN-04 – Improving Argon Recovery in Air Separation Plants with the Use of Proper Process Analytical Tools and AN-16 – Fast crude argon analysis with the Mini GC Sense platform technical report.

The path towards higher argon process efficiency

The argon draw-off mixture must be properly controlled to have and maintain the optimum argon extraction efficiency. It is not an easy task, and there are two possible problems. First, if the column profile is too low, i.e., the nitrogen content in the mixture draw-off from the low-pressure column is high, the crude argon column will stop working. At the limit, too much nitrogen will block the condenser of the crude argon column, eliminating the reflux. The liquid in the trays (mostly argon) will fall in the low-pressure column. There will be a fast drop in O₂ concentration in the low-pressure column. The result is a loss of O₂ and argon production. Many costly hours must be spent to restart the process. Secondly, adjusting the low-pressure profile too high i.e., the O₂ level is high, results in a loss of argon in the waste nitrogen. Furthermore, doing so increases the O₂ level in the crude argon column.

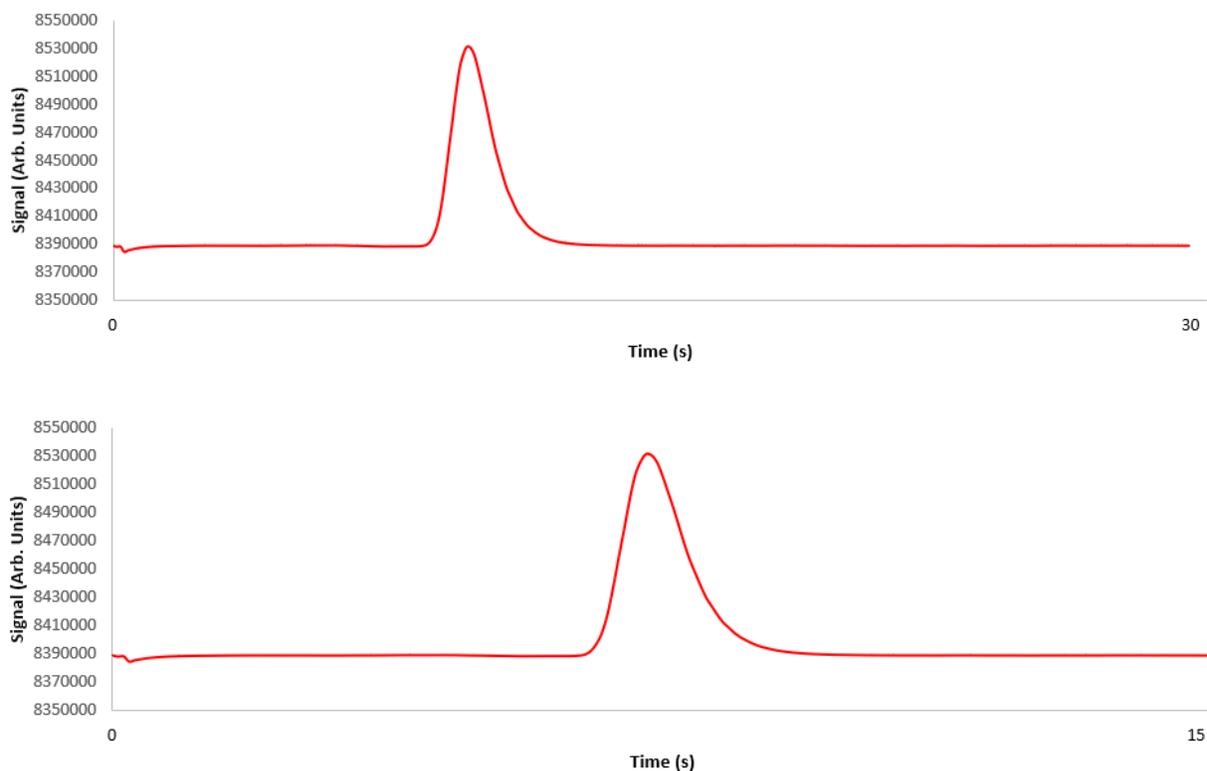


Figure 1 – Typical chromatogram from crude argon analyzer

The challenge is to rapidly monitor the level of nitrogen in the argon draw-off from the low-pressure column. Until recently, crude argon analyzers needed 5 to 10 minutes to perform the analysis. This was a major limitation to capture the full economic benefits.

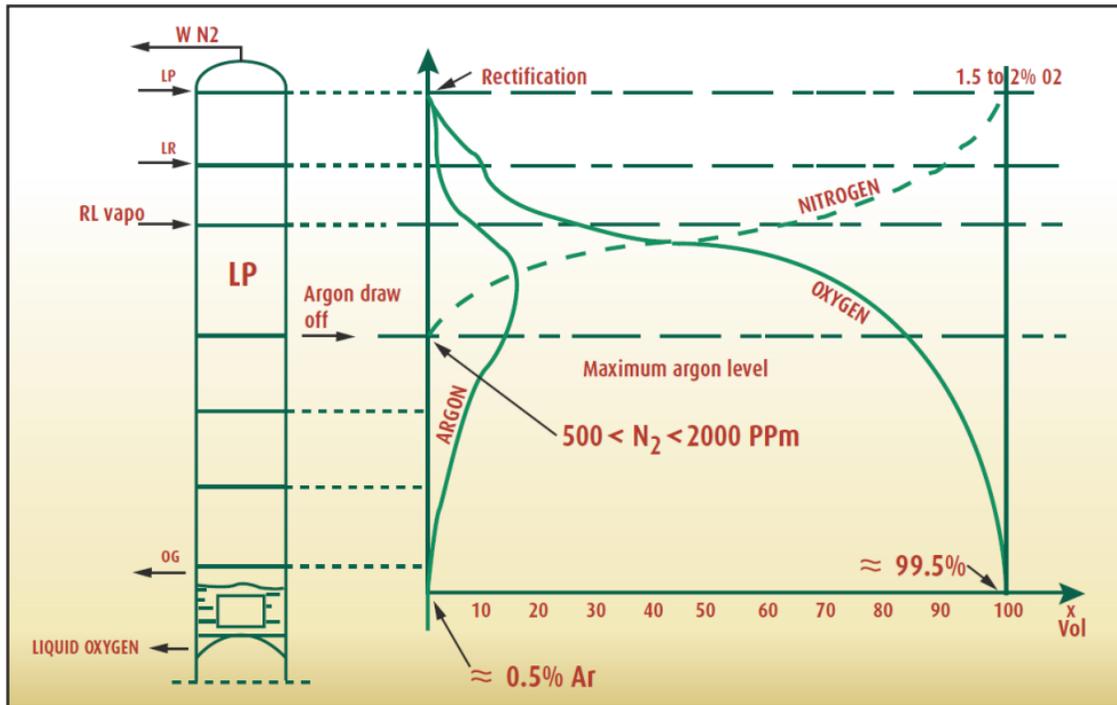


Figure 2 – Air Separation distillation column profile

Processes are typically operated at a suboptimal point to avoid the previous problems at the expense of process efficiency and consequently, the lower output of argon gas. With ASDevices' fast crude argon analysis instrument, this is now a story of the past as demonstrated by the results obtained from a customer site.

HangYang Crude Argon Field Test Report

On December 2021, a crude argon analyzer was installed on an ASU. Before the installation of such a system, the operator was purely monitoring the N_2 level and interrupting the process manually in the case of N_2 build-up. The plant analytical system was upgraded with a KA5000plus crude argon analyzer to automate the process and optimize the plant operation using ASDevices technology.

According to the communication with Quzhou plant operators and the observation of operation data, before installing the KA5000plus crude argon analyzer, the operators of Quzhou Hangyang mainly relied on the analysis of crude argon purity and crude argon venting to prevent nitrogen plugging (as shown in figure 3, 2AI_705 is the crude argon purity, 2HC_712 is the crude argon vent valve opening).

After installation of the KA5000plus crude argon analyzer, if the trace nitrogen level exceeds 200ppm in the argon fraction, the nitrogen content is adjusted by controlling the oxygen output to avoid nitrogen plugging and reduce crude argon venting. This is only possible due to the fast measurement of the crude argon analyzer. The trace N_2 measurement from the crude argon has proven to be faster and more sensitive than the crude argon purity analyzer which measures argon purity between 0 and 100%. This faster response is what is allowing process operators to improve argon recovery (figure 2) and avoid N_2 plugging.

Figure 4 - Shows the process improvement achieved (2AI_702A is the trace nitrogen analyzer, 2AI_705 is the crude argon purity, and 2HC_712 is the crude argon vent valve). No argon is vented resulting in economic savings.

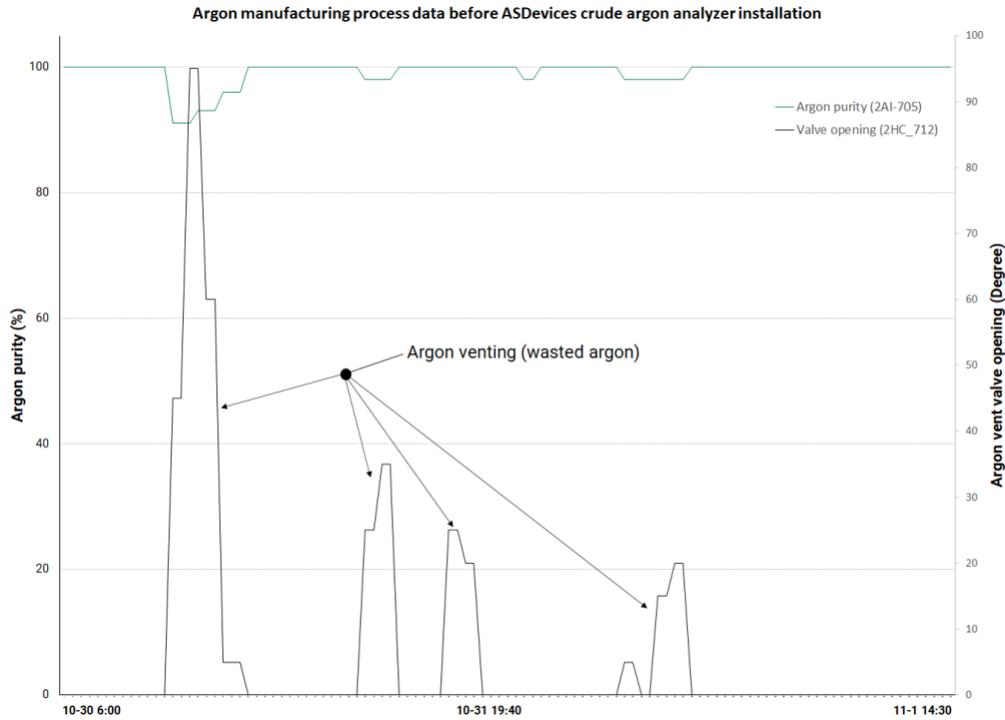


Figure 3 – Argon process before crude argon analyzer installation

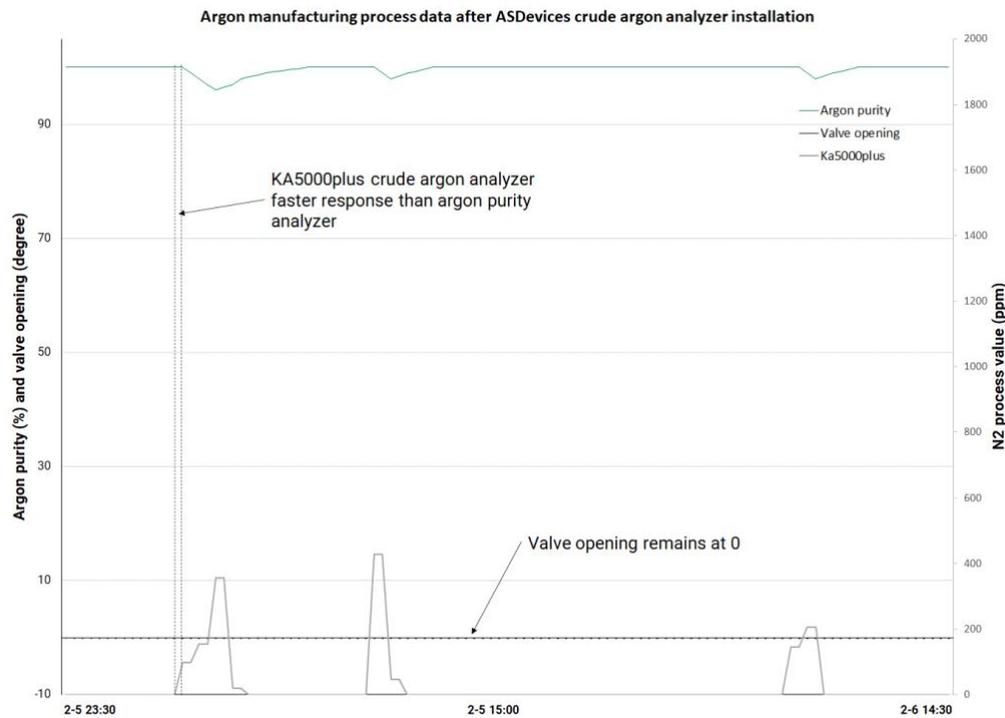


Figure 4 – Argon process after crude argon analyzer installation

Substantial savings and efficiency gains

According to the analysis of October to December 2020 data (before installation of the KA5000plus Crude argon analyzer) and the first 2 months of data obtained between January to February 2021 (after ASDevices crude argon analyzer installation), the data analysis shows that before the installation of the fast crude argon analyzer, the average crude argon extraction rate was 87.877%, and the vent valve opened 55 times to its maximum output (95 degrees opening). After the installation of the fast crude argon analyzer, the average crude argon extraction rate increased to 88.720%, resulting in a 1% efficiency gain. Based on this initial data, the trial was continued, and new data was analyzed in October and November (10 and 11 months after the installation). It was demonstrated that the argon recovery process can reliably produce an extra 17.85 standard cubic meters per hour of argon for this process and more optimizations could be done to drive up to 3% efficiency gain. Based on the argon price, this 1% efficiency gain is equivalent to USD 50k of extra profit excluding the cost associated with process shutdown due to the N₂ plug. Consequently, the savings are even more substantial.

Rapid payback

In summary, it has been demonstrated by the data collected on this air separation plant that ASDevices fast crude argon analyzer can deliver real and quantifiable savings to industrial gas manufacturers. The 1% process increase is enough to justify the installation of such an instrument to generate a rapid payback that can be well within a year.

Related Documents

[AN-04 – Improving Argon Recovery in Air Separation Plants with the Use of Proper Process Analytical Tools.](#)

[AN-16 – Fast crude argon analysis with the Mini GC Sense platform technical report](#)

[TN-05 – The Power of Spectral Compensation for Fast Nitrogen Measurement in Oxygen with the Enhanced Plasma Discharge Technology.](#)

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