



# Case Study

## Pall Technologies Solve Operational Problems in Amine Unit

### Application

A major International Oil Company operates an oil field in continental Europe. The associated gas produced with the crude oil is sweetened in seven amine-based (MDEA) acid gas treatment units, and then dehydrated before it feeds the local gas pipeline network. From the initial plant design phase, the amine trains were equipped with cartridge filters to remove solid particles from the amine solution. Contaminants in the form of solid particles and liquid hydrocarbons are well-known foaming promoters in amine units.

The three cartridge filters in use on the amine loop each originated from different suppliers: A, B and C. Filter A was a pleated polypropylene cartridge, filter B was a pleated metallic cartridge. Both were rated at 10 micron by the filter suppliers, with no removal efficiency stated (so called 'nominal' filters). Filter C was a pleated polypropylene cartridge, rated at 10 micron at 99.98% according to the ISO 4572 standard. Filters that have a removal rating tested to a recognized standard are typically designated as 'absolute' filters. Solid particles present in amine solutions typically exhibit sizes ranging between 5 and 10 micron, so in principle an efficient 10 micron rated filter is expected to eliminate most of the particles and keep the amine solution clean with a few ppm or mg/L solid content.

### Problem

The operator was facing operating issues on all seven amine units since the start-up of the plant. They included foaming incidents, loss of amine due to carry-over, unstable operation, and off-spec H<sub>2</sub>S content in the sales gas. The latter was the most significant concern as it was impacting the gas distribution company and creating contractual issues.



Despite the presence of filters, the operator could not keep the amine solution clean. The Total Suspended Solids (TSS) content was monitored by the plant laboratory and constantly exhibited very high suspended solids, ranging from 100 to 1000 mg/L. To try to keep the TSS content low, the operator was blowing down amine and refilling the loop with fresh solvent. As a consequence of the high TSS content, the filters were fouling frequently, typically every one to five days, and the operator was keeping them by-passed to minimize maintenance costs. In turn, this was allowing even more solid contamination to accumulate in the system.

### Solution

Over the years it became obvious the existing filter technologies were not effective enough. Pall convinced the operator to qualify the problem and to provide appropriate solutions.

From the examination of the supplier's technical datasheets for filters A and B, it was apparent that these filters were nominally rated, and consequently they would not deliver the required 10 micron removal performance. Field experience with nominal filters shows that particles larger than the claimed rating can pass through the filter.

Filter C had a 99.98% absolute removal rating to ISO 4572; this test, however, is a 'multi-pass' test, where the solid particles are recirculated in a closed loop through the filter. While a recognized standard, this test is not appropriate to the duty.

Pall proposed replacement filter cartridges for filters A, B and C. The proposed filter cartridges could fit in lieu of the existing elements, without any modifications to the housings.

Filters A and C were replaced by Poly-Fine® II pleated polypropylene filters, 90% rated according to a single pass test standard, where the solid particles flow through the filter once only. The differences between a single-pass test and a multi-pass test are key to understanding the differences in performance.

Filter B was replaced by Profile® II absolute-rated polypropylene depth filters. The filter performance of the Profile II cartridges is validated by the modified OSU-F2 test, also a single-pass test. The removal efficiency of the Profile II filter is 99.98%.

The operator targeted 50 mg/L TSS content in the amine to maintain optimal operation. A 5 micron filter rating was proposed for filters A and C, and a 10 micron filter rating for filter B. To avoid fouling the filters instantaneously, given the high solid loading in the loops, an *in situ* clean-up of the amine was proposed, by installing coarser filters initially, and reducing the filter rating progressively while the loop was getting cleaner. In filters A and C for example, removal ratings of 30, 10 then 5 micron were used.

## Benefits

The operator observed the benefits of the better filter performance very quickly. The TSS content gradually decreased and reached the 50 mg/L specification within four weeks of operation. The visual appearance of the amine solution improved simultaneously, from dark black to a pale yellow color, confirming that the filters were capturing most of the solid particles from the system. Most importantly, the operator reported more stable operation of the amine units and a consistent quality of the sales gas. Solving the operating problems eventually enabled the operator to sustain its business with the gas distribution company.

## Conclusion

The consistent, reliable performance of absolute rated filters is key to maintaining the cleanliness of the amine solution, and so to maintaining the operational stability of the amine units and optimum plant economics. The performance of absolute rated filters used in process applications is validated by industry standards using a 'single-pass' test. When specifying particulate filters, it is important that the micron rating is defined as 'absolute', and that a reference to a single-pass test is made.



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