

2ND STAGE INTERCOOLER KO DRUM RETROFIT

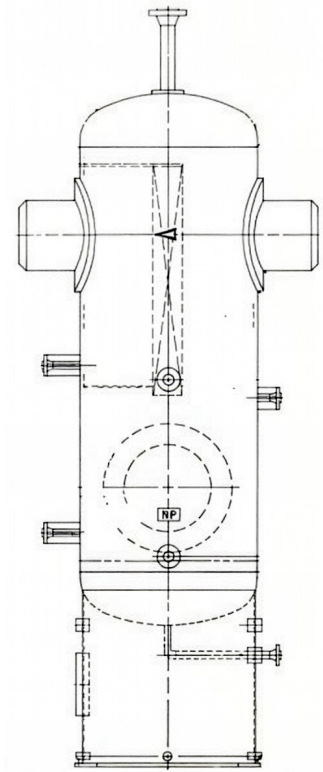
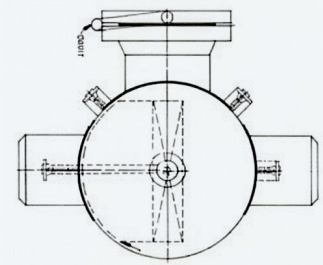


Figure 1

A user was operating a vessel that was severely undersized for current flow rates due to unfavorable inlet and outlet locations. As a result, liquid carryover into downstream equipment was observed, creating operational challenges within the plant.

The multiple vendors were engaged to evaluate potential solutions. Conventional approaches recommended replacing the vessel and modifying the piping. In addition to the limited vessel size, the short inlet-to-outlet length and non-ideal geometry directed vapor toward undersized separation media, further increasing the risk of carryover (Figure 1).

Given these constraints, the challenge was to determine whether the existing vessel could be effectively retrofitted to meet performance requirements.

Engineering Approach

Koch-Glitsch evaluated several retrofit concepts utilizing iterative Computational Fluid Dynamic (CFD) modeling to better understand internal flow behavior and separation performance.

The analysis focused on quantifying vapor velocity distribution, local C-factors, and entrainment risk within the vessel. These insights were combined with more than 60 years of phase separation experience to develop a practical and high-confidence solution.

Solution

The selected design integrates a VORSOMAX® cyclone mist eliminator with a purpose-built inlet device. The inlet device redistributes the incoming vapor radially, reducing direct impingement on the separation media, while the cyclone tubes provide effective droplet capture within the constrained vessel footprint (Figure 2).

This configuration enabled reuse of the existing vessel while meeting performance, pressure drop, and space constraints.

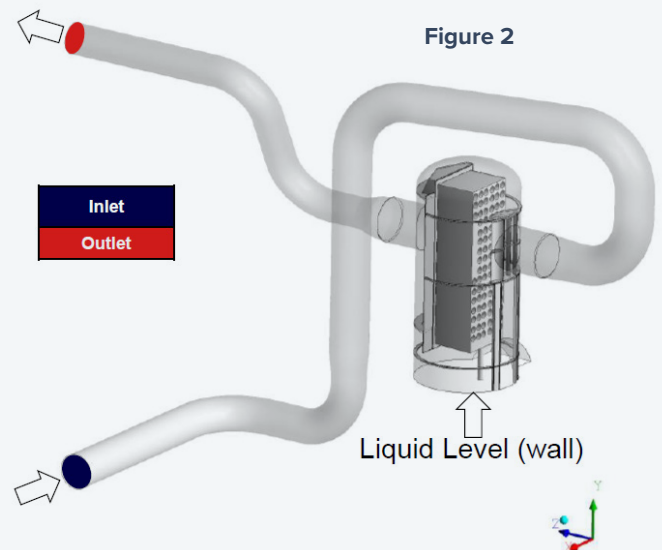


Figure 2

Solution (continued)

To further refine the design, vapor distribution across the cyclone tubes was evaluated. CFD results indicated a relative distribution of approximately 20% (Figure 3), which is acceptable on its own. However, additional due diligence was required to ensure that localized variations in C-factor would not result in vapor blocking liquid drainage between adjacent tubes in the same drainage box.

This led to optimization of the final arrangement to prevent interference between vapor flow and liquid removal.

An internal drainage system was developed to support proper liquid handling and avoid disruption of vapor flow. External drainage configurations were evaluated but found to introduce flow shadowing, negatively impacting vapor distribution.

CFD visualization confirmed that directing vapor toward the outer regions of the vessel allowed sufficient redistribution before entering the separation zone, further improving performance (Figure 4).

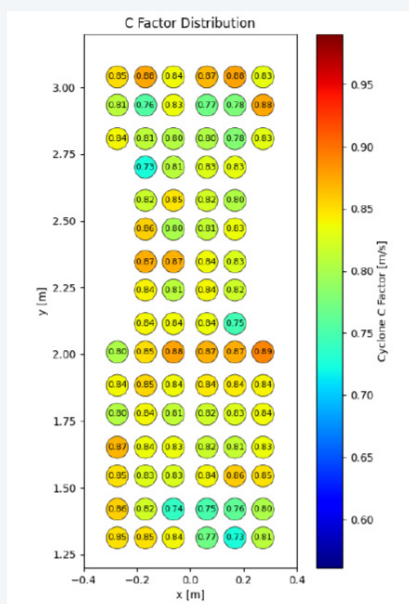


Figure 3

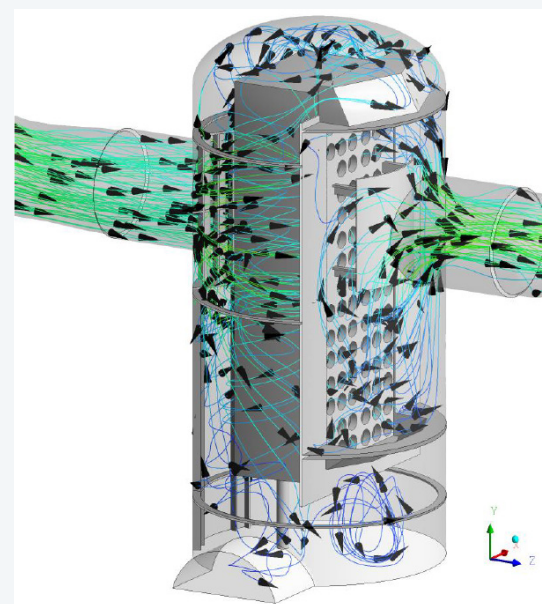


Figure 4

Results

Following implementation, liquid carryover was eliminated and operators reported no further operational issues.

The customer subsequently applied the same retrofit approach to two additional vessels. Despite differences in geometry, both installations achieved the desired elimination of liquid entrainment, demonstrating the repeatability of the solution.

Value Delivered

By combining CFD analysis with practical separation expertise, Koch-Glitsch enabled the customer to avoid vessel replacement and associated piping modifications, maintain use of existing equipment despite geometric limitations, reduce overall revamp costs, and achieve value exceeding twice the cost of the supplied internals.

Conclusion

This case demonstrates how targeted CFD analysis, combined with applied separation expertise, enables retrofit solutions in vessels with constrained geometry.

By understanding vapor distribution, C-factor variation, and liquid drainage behavior, Koch-Glitsch can identify and validate solutions that extend the life of existing equipment while delivering reliable performance.

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