

Ensuring Consistent Aviation Fuel Quality Through Advanced Filtration and Coalescing



FCAVIAFQEN

Executive Summary

Aviation Turbine Kerosene (ATK / Jet A 1) must meet stringent cleanliness and water content specifications to ensure safe and reliable aircraft operation. At a large Middle Eastern refinery, persistent variability in ATK quality led to operational disruptions, off-spec production, and reduced confidence in product consistency.

Following the implementation of a downstream polishing solution combining high-efficiency filtration and advanced polymeric coalescing, the refinery achieved consistent compliance with aviation fuel standards while maintaining uninterrupted production. This case study demonstrates how integrating robust separation technologies downstream of conventional treatment systems can significantly improve fuel quality stability, operational reliability, and overall processing efficiency.

The Challenge:

Limitations of Conventional ATK Treatment

ATK production presents complex separation challenges due to the need to remove both fine particulate contamination and trace water to meet stringent aviation specifications. Final fuel quality must achieve cleanliness levels of ISO 4406 19/17/14 or better, while also reducing free water content to 15 ppmv or lower.

At the refinery, ATK was processed using a conventional electrostatic coalescer located upstream of storage tanks. Electrostatic coalescers function by applying a high-voltage electric field to promote droplet coalescence, allowing bulk water to separate from the hydrocarbon phase. While effective for removing large volumes of water, these systems are inherently sensitive to process conditions and fuel chemistry.

Operational performance was negatively impacted by the presence of fine solid contaminants and surfactants within the fuel. These surface-active compounds stabilized emulsions and reduced interfacial tension, inhibiting effective droplet coalescence. At the same time, electrostatic systems are not designed to remove fine particulates, leaving suspended solids in the product stream.

As a result, the refinery experienced frequent off-spec cleanliness measurements, increased settling times in storage tanks, and recurring disruptions to ATK production. These challenges highlighted the limitations of relying solely on conventional electrostatic separation for final fuel polishing and underscored the need for a more robust and reliable solution.

The Solution:

Integrated Downstream ATK Polishing

To address these limitations, a compact downstream polishing solution was implemented following the existing electrostatic coalescer. This approach allowed the refinery to enhance fuel quality without requiring major changes to existing infrastructure.

The solution combined high-efficiency filtration with advanced polymeric coalescing technology to provide comprehensive removal of both solid and liquid contaminants. The filtration stage, as shown in figure 2, was designed to capture fine suspended particles, ensuring that the ATK product consistently met ISO cleanliness requirements. By removing these particulates upstream of final storage, the system stabilized overall product quality and prevented downstream contamination issues.

In parallel, the polymeric coalescing stage was engineered to deliver reliable water removal performance under conditions where traditional electrostatic systems struggle. Unlike electrostatic coalescers, polymeric media are less sensitive to surfactants, additives, and other surface-active impurities. This enables consistent droplet capture and coalescence, even when interfacial tension is reduced or emulsions are present.

By integrating both filtration and coalescing into a single downstream polishing step, the system provided a robust and complementary solution that addressed the root causes of variability in ATK quality, ensuring consistent performance across a wide range of operating conditions.



Ensuring Consistent Aviation Fuel Quality Through Advanced Filtration and Coalescing

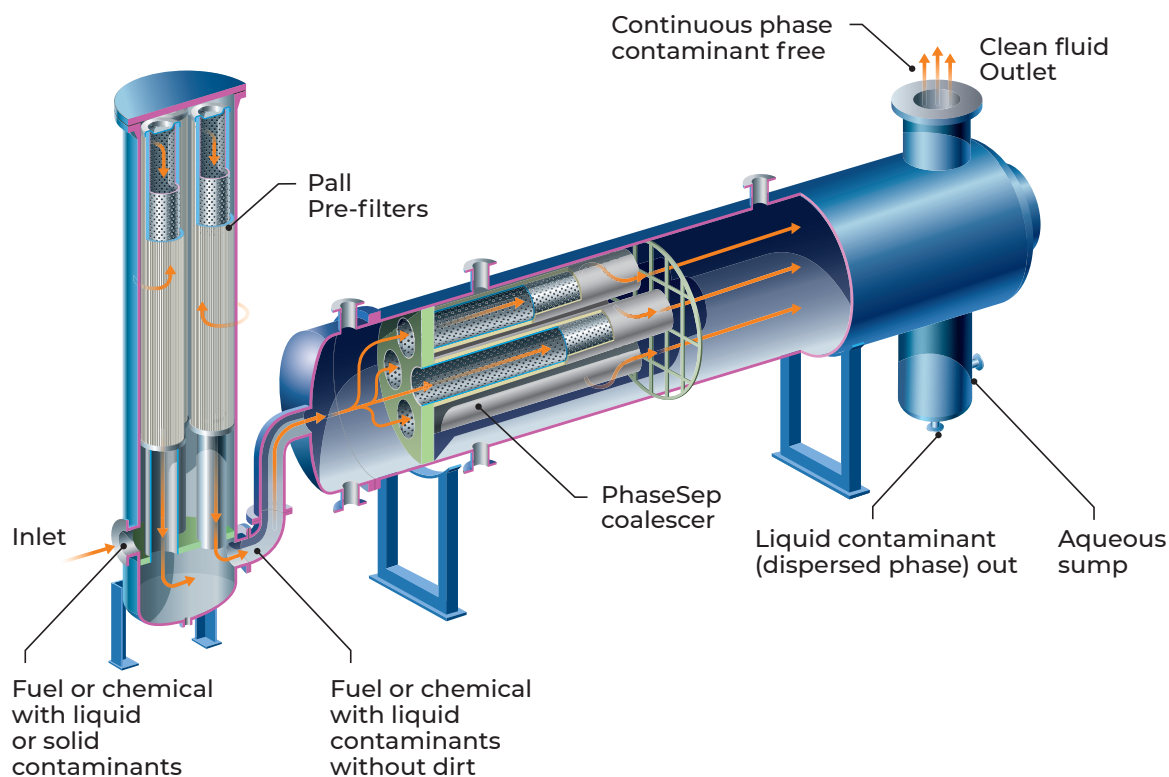


Figure 1: Pall's Liquid-Liquid coalescer plus prefilter



Figure 2: Highlighted sections show the process updates to enhance contamination control performance

Implementation and Operational Integration

The polishing system was installed downstream of the existing electrostatic coalescer as a modular addition to the process. This configuration enabled the refinery to retain its existing separation infrastructure while enhancing overall system performance.

Because of its compact and modular design, the solution was deployed with minimal disruption to ongoing operations. The refinery was able to continue normal production while integrating the additional polishing step, allowing for rapid validation of performance improvements. This flexible implementation approach also provided an opportunity to optimize operations without requiring significant capital investment or extended downtime.

Performance Results: Consistency, Compliance, and Throughput

Following implementation, the refinery achieved consistent and measurable improvements in both fuel quality and operational performance. The system

enabled the refinery to reliably meet aviation fuel cleanliness requirements, with ISO 4406 levels of 19/17/14 or better consistently achieved across production runs.

Free water content was also reduced to 15 ppmv or below, meeting stringent aviation specifications and ensuring product integrity. In addition, the majority of product samples consistently fell within specification limits, demonstrating stable and repeatable separation performance.

Operationally, the refinery was able to maintain continuous ATK production at design capacity without interruption. The elimination of off-spec batches significantly reduced process variability and removed bottlenecks associated with reprocessing or extended tank settling times. Furthermore, the reduced reliance on downstream storage tanks for final polishing improved overall operational efficiency and reduced residence time requirements.

These improvements collectively enhanced process stability, enabling the refinery to operate with greater confidence in meeting both production and quality targets.

Ensuring Consistent Aviation Fuel Quality Through Advanced Filtration and Coalescing



Value Delivered to Refinery Operations

The implementation of advanced filtration and polymeric coalescing delivered significant value by addressing both process reliability and product quality assurance. The integrated system provided a robust barrier against fine solids and dispersed water, ensuring effective separation even under challenging conditions influenced by surfactants and variable feed composition.

Consistent achievement of aviation fuel specifications reduced the risk of off-spec production and supported compliance with strict regulatory and performance requirements. At the same time, improvements in separation efficiency enabled the refinery to optimize throughput by minimizing delays associated with reprocessing and settling operations.

The ability to deploy the solution without major infrastructure modifications further enhanced its value, allowing for rapid improvements in performance with minimal disruption. This combination of reliability, flexibility, and efficiency demonstrates the advantages of adopting a downstream polishing strategy to complement existing separation systems.

CONCLUSION

Enabling Confidence in Aviation Fuel Production

As aviation fuel standards continue to demand higher levels of cleanliness and water removal, conventional separation technologies alone may not be sufficient to ensure consistent product quality. This case study illustrates how a targeted, integrated polishing approach can overcome these limitations and deliver reliable, repeatable performance.

By combining high-efficiency filtration with advanced polymeric coalescing, the refinery was able to consistently meet stringent ATK specifications while maintaining full production capacity. The result is a more stable and controllable process, reduced operational risk, and increased confidence in product quality.

Advanced filtration and separation solutions therefore play a critical role in enabling refiners to meet evolving industry requirements, protect product integrity, and maintain operational excellence in high-demand aviation fuel markets.

By combining high-efficiency filtration with advanced polymeric coalescing, the refinery was able to consistently meet stringent ATK specifications.



PALL CORPORATION

Corporate Headquarters

Port Washington, NY, USA
+1-800-717-7255 toll free (USA)
+1-516-484-5400 phone

European Headquarters

Fribourg, Switzerland
+41 (0)26 350 53 00 phone

Asia-Pacific Headquarters

Singapore
+65 6389 6500 phone

Visit us on the Web at www.pall.com
Contact us at www.pall.com/contact

Pall Corporation has offices and plants throughout the world. To locate the Pall office or distributor nearest you, visit www.pall.com/contact.

The information provided in this literature was reviewed for accuracy at the time of publication. Product data may be subject to change without notice. For current information consult your local Pall distributor or contact Pall directly.

IF APPLICABLE Please contact Pall Corporation to verify that the product conforms to your national legislation and/or regional regulatory requirements for water and food contact use.

© Copyright 2025, Pall Corporation. Pall and  are trademarks of Pall Corporation. ® Indicates a trademark registered in the USA.

FCAVIAFQEN
June 2026

