

Precision Sealing Solutions for Hybrid-Electric Engines and Hydrogen Fuel Pumps

From [Omniseal Solutions](#)

Dec 19 2024

insights from industry

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Explore cutting-edge precision sealing solutions tailored for hybrid-electric engines and hydrogen fuel pumps with Dongyeop Shin, Aviation District Sales Manager at Omniseal Solutions.

Can you provide an overview of Omniseal Solutions and its role in advanced sealing technologies for hybrid-electric engines and hydrogen fuel systems?

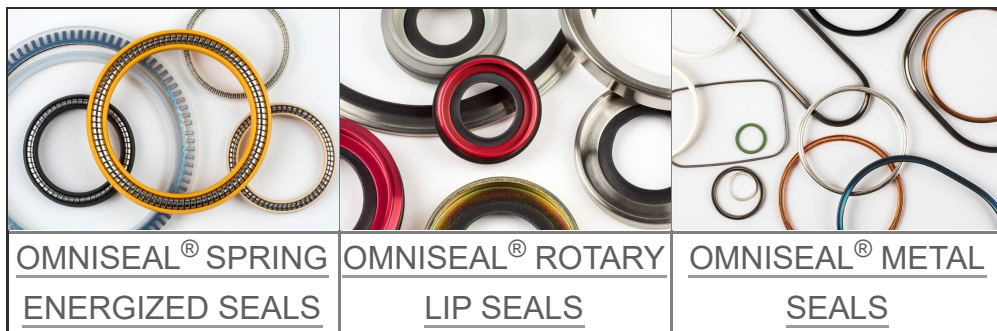
Omniseal Solutions is a trusted global provider of advanced sealing and wear technologies. We specialize in custom-engineered polymer and metal seals for the most demanding applications. Our solutions are integral to critical systems in aviation, space, energy, and life sciences, where reliability and precision are paramount.

In the aviation industry, we support hybrid-electric engine technology by providing high-performance Omniseal[®] Rotary Lip Seals for generators. These seals, made from advanced polymer materials, offer lifetime protection for bearings. These solutions prevent oil leaks at variable speeds, crucial for reliable, low-maintenance performance. We also develop tailor-made sealing solutions to address the unique challenges of hydrogen environments. Our sealing systems ensure safety, efficiency, and reliability in hydrogen fuel pumps and within the hydrogen value chain.

In hybrid-electric engines and hydrogen fuel systems, where extreme temperatures, pressures, and aggressive media present unique requirements, our innovative sealing solutions ensure optimal performance and durability. Here's a closer look at some of our key products:

- **Omniseal® Spring-Energized Seals:** These precision seals combine a high-performance polymer jacket with a corrosion-resistant metal spring to deliver consistent performance in extreme environments, such as cryogenic temperatures and high-pressure conditions. They are especially suited for hydrogen storage and aerospace applications.
- **Omniseal® Rotary Lip Seals:** Engineered with durable polymers and metal casings, these seals excel under extreme temperatures, high speeds, and exposure to aggressive chemicals, making them ideal for hybrid-electric engine components.
- **Omniseal® Metal Seals:** Designed to endure extreme pressure and temperature fluctuations, these high-performance seals offer exceptional reliability and flexibility for demanding systems, including those found in hydrogen-fueled applications.

For more details, visit our product pages to explore specifications and capabilities tailored to your application needs.



What are some of the most significant challenges facing the aviation industry when developing hybrid-electric engines? How is Omniseal Solutions addressing these challenges?

The development of hybrid-electric engines within aviation markets presents several challenges, including optimizing power density, high-speed performance, and fuel flexibility. Achieving high efficiency in a compact design requires components such as high-speed rotating shafts (operating at speeds exceeding 11,500 RPM or 44 m/s) that connect the turbine to the power converter. These generator shafts must perform reliably across variable speeds while maintaining low leakage rates throughout the full-speed range. Additionally, seals must be durable enough to last the engine's lifetime, reducing engine downtime and minimizing maintenance needs.

In your recent case study Generator Seal In Hybrid Engine Aircraft, you discuss the role of the Omniseal[®] Rotary Lip Seals in hybrid-electric aircraft engines. Could you explain the importance of this sealing technology in enhancing engine performance and efficiency?

Omniseal[®] Rotary Lip Seals (Series 10/20/30/40) are designed with a flexible inner lip that adapts to the shaft's surface, creating a gas-tight seal that supports proper lubrication and helps keep contaminants out. This feature is essential for ensuring the reliability and longevity of hybrid-electric engines, which often operate under challenging conditions, including high speeds and varying temperatures. Thanks to proprietary materials, these seals are capable of withstanding demanding environments.

In addition to meeting the previously discussed requirements, these seals improve engine durability, which is critical as the aviation industry moves toward cleaner and more efficient propulsion systems. Initially developed to prolong the service life of bearings and rotating shafts, rotary lip seals have evolved significantly—from basic leather washers to advanced materials like polytetrafluoroethylene (PTFE).

For a more detailed explanation of the design and function of Omniseal[®] Rotary Lip Seals, you can refer to our blog post, ["What is a Rotary Lip Seal?"](#)



Exploded 3D view of an Omniseal[®] Rotary Lip Seal, highlighting its key components and structure. Image Credit: Omniseal Solutions.

What important factors were considered in designing a generator shaft seal for hybrid engines that can withstand variable speeds and high temperatures?

Our shaft seals, also known as rotary lip seals, are engineered with unique lip configurations and materials that can withstand high temperatures. These solutions are specifically tailored to meet the needs of generators in hybrid electric aircraft. Key design considerations include the properties of the mating hardware (such as chromium-hardened shafts), vibration tolerance, shaft speeds, and concentricity.



Our proprietary high-performance fluoropolymer offers the necessary tribological, mechanical, and thermal properties required for critical aviation application parts. These PTFE-based materials are carefully engineered to meet the demands of high-performance applications. With tailored grades that comply with various certifications, they are a key material in many advanced sealing solutions.

One of the notable advantages of our material is its ability to enable weight

reduction, which is particularly beneficial in aerospace and other weight-critical industries. This characteristic helps improve the overall system efficiency without compromising its performance. This fluoropolymer also demonstrates strong resistance to electrical environments, offering reliability in applications exposed to electrical stresses. Furthermore, Fluoroloy® now offers a PFAS-free alternative, demonstrating a commitment to more sustainable and environmentally conscious materials. This innovation aligns with emerging regulatory and industry standards while preserving the material's renowned durability and exceptional functionality.

In addition to all the properties mentioned above, fluoropolymers offer robust chemical and corrosion resistance, along with low friction characteristics and non-stick properties. These features make them a reliable choice for demanding applications where performance and compliance are critical. Furthermore, its temperature stability guarantees dependable performance across cryogenic to elevated temperature conditions, solidifying its suitability for use in harsh environments.

Discover more about our fluoropolymer and how it can elevate your applications by visiting the product page [here](#).

How do Omniseal Solutions' sealing technologies contribute to a more sustainable future in aviation, particularly in hybrid-electric and hydrogen-fueled engines?

Omniseal Solutions is advancing sustainable aviation through innovative sealing technologies that address critical challenges in emerging propulsion systems. Our engineered seals for hybrid-electric engines optimize performance by reducing weight and space requirements, improving fuel efficiency and enabling more compact, environmentally friendly designs.

In hydrogen-powered applications, particularly fuel pumps, we've developed proprietary seal materials that maintain exceptional wear resistance and dimensional stability under extreme conditions. This ensures safe and reliable hydrogen transport across challenging operational environments.

Moreover, our research focuses on two primary sustainability objectives: material innovation and performance optimization. We're developing PFAS-Free* sealing materials that extend durability and maintenance intervals while meeting stringent environmental regulations. Simultaneously, we're implementing advanced simulation tools and comprehensive material testing to minimize system emissions and improve overall seal design.

By continuously refining our sealing technologies, we're not just supporting sustainable aviation—we're engineering the solutions that will define next-generation aerospace propulsion systems.

** PFAS-Free here means we do not intentionally add PFAS material in the product, but does not exclude the possibility of traces, as these materials are common in the environment.*

About Dongyeop Shin

Dongyeop Shin is a District Sales Manager at Omniseal Solutions for the aviation market, bringing a decade of specialized expertise in advanced sealing technologies. With a strong foundation in Research Engineering from Saint-Gobain and a Bachelor of Science in Chemical Engineering, Dongyeop possesses deep knowledge of engineered sealing solutions for high-performance aviation applications. His technical prowess spans R&D, product management, and sales operations, enabling him to deliver innovative solutions that meet the aviation industry's stringent performance and reliability demands.



Dongyeop plays a key role in driving strategic initiatives for emerging aviation technologies, supporting Omniseal Solutions' mission to advance mobility and aerospace innovations



This information has been sourced, reviewed and adapted from materials provided by Omniseal Solutions.

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Omniseal Solutions is an engineering leader with over 65 years of global history and longevity, relentlessly dedicated to the design and manufacture of precision sealing and wear control solutions that protect critical applications in space, aviation, hydrogen, nuclear, life science and industrial extreme environments.

We are passionately driven to push *Beyond the Boundaries of Possible*; going beyond is what our team is known for! Customers trust Omniseal Solutions to swiftly resolve seemingly insoluble engineering and technology challenges that are extremely difficult, rapidly changing, unpredictable or not the norm.

With 17 manufacturing sites in 10 countries, we are not only global but also local to provide rapid response to customers and the communities they serve. We focus on collaboration to make positive changes - sharing experience and ideas to build unique solutions - to go beyond together.

BEYOND

the boundaries of possible