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# SPACE CASE STUDY

## LAUNCH VEHICLE CRYOGENIC VALVE POLYMER SEALS

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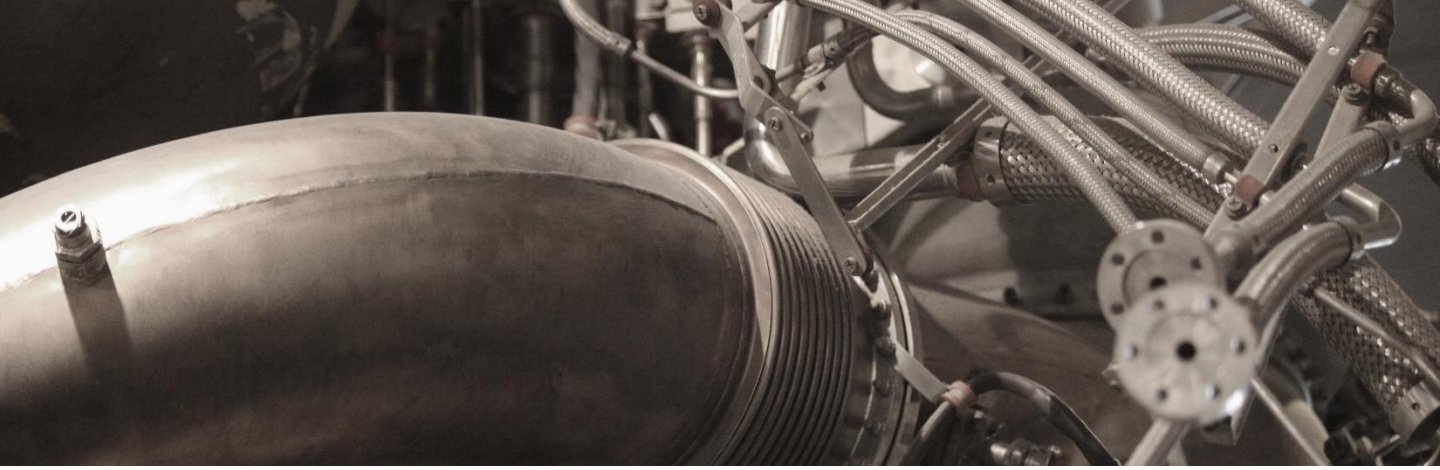

OMNISEAL® SPRING-ENERGIZED SEALS

# Launch Vehicle Cryogenic Valve Polymer Seals

Kha Le April 2024

SPACE CRYOGENIC EXTREME ENVIRONMENT

## Environment

To control the flow of cryogenic propellants such as liquid oxygen, liquid hydrogen or liquid methane on launch vehicles, cryogenic valves are used within these rockets. To meet the industry's goals of safety and success in these critical fluid control systems, there are requirements set for not only the launch vehicle manufacturer but also the designer of these valves and their components (e.g., sealing solutions). All parties must have knowledge of operating conditions such as pressure ranges, temperature ranges, speeds, loads, and installation procedures.. Failure in these valves during launch could have catastrophic results.

## Challenge

In this dynamic application, sealing is quite challenging due to the cryogenic temperatures of fluids and the resulting dynamic motion. For solenoid valves, in particular, a key requirement for the seal and the jacket material is low friction. For polymer seals and most other seal types, the friction usually increases due to shrinkage of materials. Why is this mission-critical? Friction control ensures that the valve actuator will operate according to the valve planned lifetime. In fact, a precision sealing solution grants the correct opening and closing of the valve; thus, regulating the amount of fluid circulating and the necessary functionality in the launch vehicle combustion and engine.

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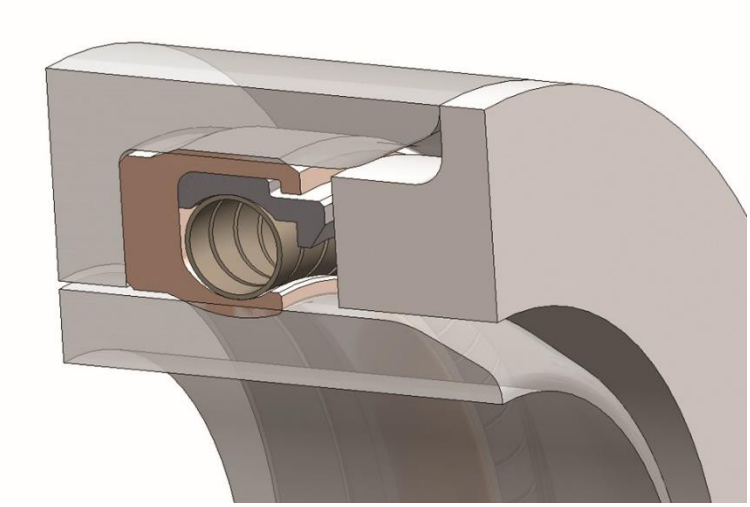

## Solution

The Omniseal® 103A spring-energized seal with Anti-Thermal Shrinkage (ATS) technology is a custom-design sealing solution engineered to handle the natural shrinkage of polymers used in seal jackets at cryogenic temperatures. This metal band is added between the jacket and the spring to provide consistent sealing on the outer diameter (OD) of the seal, which tends to suffer due to shrinkage of the polymer jacket.

By using this critical precision metal-band, the seal can meet the stringent leakage requirements that are typically around 0.1 to 0.01 sccs while not generating excessive friction on the reciprocating or rotating shaft.

# Protect your cryogenic propellants by using the Omniseal® 103A Spring-Energized Seal with Anti-Thermal Shrinkage (ATS) Technology

## Benefits

- Friction control
- Low leakage in cryogenic conditions
- Limits polymer shrinkage effect

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# Design Expertise & Customized Solutions for Your Critical Applications

Omniseal Solutions is a global engineering leader with over 65 years of historical legacy, relentlessly dedicated to the design and manufacture of precision sealing and wear control solutions that protect critical applications in the most demanding environments and passionately driven to push "*Beyond the Boundaries of Possible*."

## About the Author


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