



# Breaking the Ice: Aerospace Innovations in Cryogenics

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# The Final Frontier

There are both monumental challenges and limitless opportunities in the aerospace market, but one thing that remains constant amongst those various challenges and opportunities: the need for precise, reliable, and innovative technologies that are able to meet the demands of the next-generation manufacturing techniques that are being used to enable humankind's expanded reach into the constantly evolving realm of space.

Specifically, this includes space-launch services that involve activities related to the manufacture, preparation, and launch of space vehicles and satellites. These services are among the most significant factors that are driving the growth of the aerospace market, with the looming introduction of space tourism expected to provide lucrative growth opportunities for both manufacturers and providers of space-launch services.

**Exploring the depths of  
cold, where innovation  
meets the cosmos.**





# The role of cryogenic liquids

In many instances, this requires the use of cryogenic liquids, or those that have been intensely cooled below ambient temperature so that they have a boiling point – the point at which the liquid will return to its natural gaseous state – that can be  $-73^{\circ}\text{C}$  ( $-100^{\circ}\text{F}$ ) and lower. This includes helium, the boiling point of which ( $-268.9^{\circ}\text{C}$  [ $-452^{\circ}\text{F}$ ]) is lower than any other known substance.

No matter the element or its boiling point, the cryogenic-cooling process not only leaves these liquids intensely cold, but it also reduces their volume to mere fractions of what the substance is when in a gaseous state. This means that when a cryogenic liquid is exposed to the atmosphere, a relatively small amount of the liquid substance can rapidly expand into large volumes of a gas.

That makes it extremely important that the proper systems and equipment are used in all aerospace applications. It also means that these products should not only meet, but surpass, the exacting standards and demands that are inherent in ensuring the successful completion of an aerospace or space-launch mission. It subsequently makes it imperative that all OEMs produce solutions that are perfectly tailored for the unique needs of all mission-critical applications, since there are generally no cookie-cutter, one-size-fits-all solutions in the aerospace realm.



## Key Pieces of Equipment

Admittedly, the sheer volume of valve and piping products that have been specifically designed to meet the precise demands of an aerospace manufacturing operation that relies on cryogenic liquids can be daunting or intimidating. With that in mind, here is an overview of the major pieces of equipment that can be necessary to use in the creation of a safe, reliable, efficient, and cost-effective aerospace-manufacturing regime.

# Essential Aerospace Tools: Key Equipment for Advanced Operations

## Vacuum-jacketed piping

Vacuum-jacketed piping (VJP) systems are engineered to handle a wide spectrum of cryogenic substances, from liquid nitrogen, oxygen, and argon to helium, natural gas, carbon dioxide, hydrogen, and LNG, many of which are used extensively in aerospace applications. A properly designed VJP system will effectively and reliably mitigate heat leaks, thereby enhancing operational efficiency and minimizing costs. When deploying a dual stainless-steel pipe setup, a VJP system can ensure optimal insulation, creating a vacuum-sealed layer that maximizes thermal performance. This superior insulation capability, which surpasses that of traditional foam and dynamic vacuum-pipe systems, also delivers exceptional efficiency throughout the aerospace operation.





# Non-jacketed valves

These items offer a blend of efficiency and reliability when used in an array of aerospace applications. These precision-engineered valves deliver seamless operation and robustness in diverse usage settings. Their design ensures optimal flow control while maintaining structural integrity. When crafted with quality materials and in accordance with stringent regulatory standards, these valves can offer durability and performance excellence, making them an ideal choice for critical aerospace processes.

# Vacuum-jacketed valves

These jacketed valves are designed to combine the preservation of cryogenic temperatures with seamless flow control. Able to withstand extreme conditions, they guarantee reliability and safety in critical applications, safeguarding the integrity of cryogenic processes across diverse industries.

# Pressure and safety valves

These valves are purpose-built for ensuring safe product containment in cryogenic-liquid containers. They are also compatible with a wide a spectrum of gases, including oxygen, nitrogen, argon, helium, LNG, and carbon dioxide. The design features an efficient and eco-friendly flow path that significantly reduces discharge noise, making them ideal for deployment in noise-sensitive indoor environments, such as aerospace laboratories.



# Vaporizers and accessories

Vaporizers and accessories cornerstone components in creating efficient gas-vaporisation processes in aerospace manufacturing operation. They play a vital role in transforming liquefied gases into usable forms, ensuring seamless transitions from liquid to gas states.

# Non-jacketed hoses, piping, and accessories

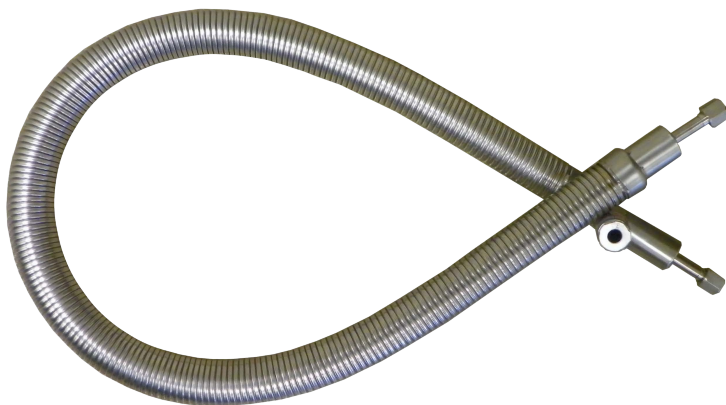
Whether for use in fluid transportation or system integration activities, non-jacketed hoses, piping, and accessories are designed to deliver optimal performance in various aerospace applications. Effective hoses, piping, and accessories will ensure efficient flow while maintaining structural integrity within the aerospace system.

# Pressure regulators and accessories

These are crucial component in precision gas control systems, possessing the ability to ensure reliable and accurate pressure management in aerospace processes. The regulators provide stability and control and the accompanying accessories complement the regulators while offering comprehensive solutions that result in the seamless functioning of aerospace systems.



Embarking into the expansive and continually evolving realm of space, precision, reliability, and innovation transcend being mere objectives; they become imperatives.



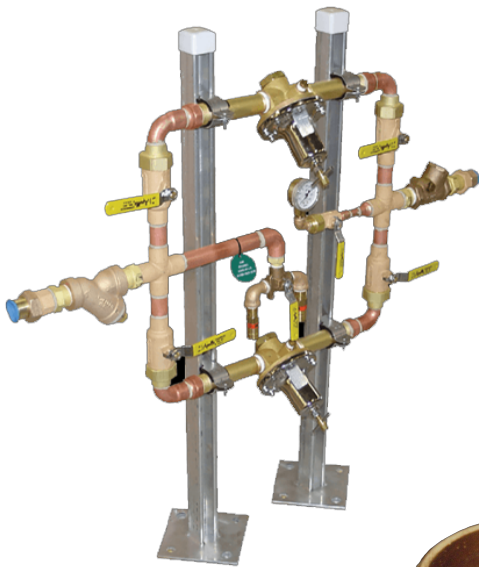


# Gas-handling and liquid-transfer systems

These systems encompass a wide range of solutions that are typically designed to facilitate safe and efficient handling, transfer, and distribution of cryogenic gases and liquids. From advanced pumping mechanisms to sophisticated transfer technologies, these systems ensure seamless and controlled movement of fluids, optimizing productivity and safety standards.

## Repair kits and other accessories

These are the unsung heroes of maintenance and efficiency in cryogenic-liquid systems. Crafted with precision and built for durability, these kits and accompanying accessories are tailored to address a spectrum of operational needs. From quick fixes to comprehensive repair solutions, these kits ensure seamless functionality and sustained performance of cryogenics-related equipment. They are complemented by a range of accessories designed to enhance the operational capacity of cryogenic systems, offering versatility, reliability and ease of use.

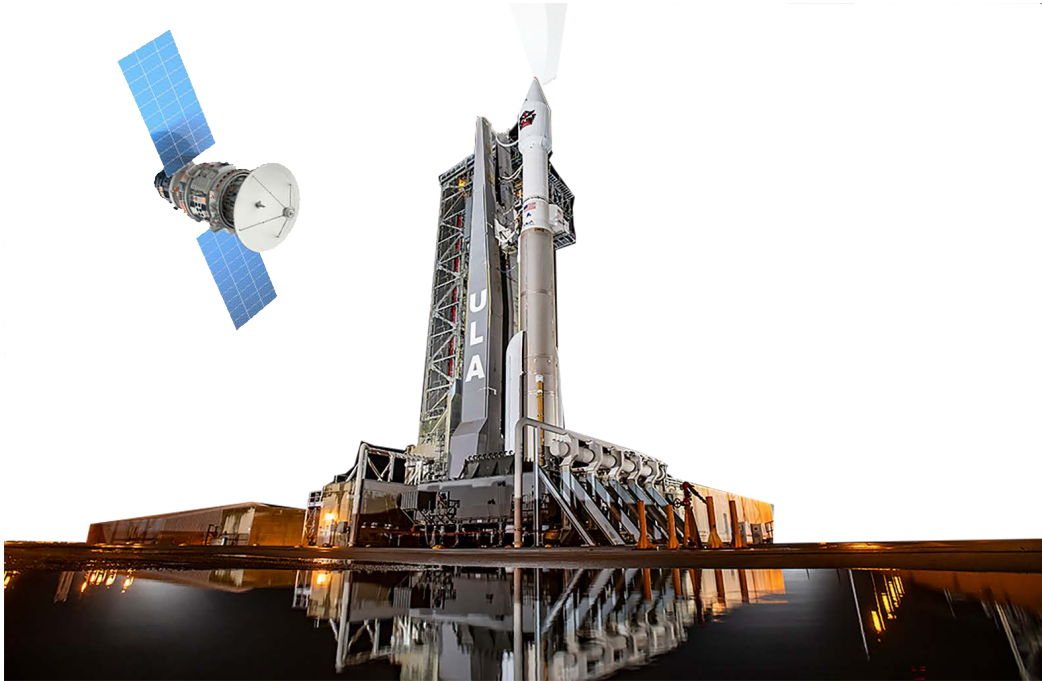


At OPW CES, we grasp the monumental challenges and limitless opportunities that define space launch endeavors. It's this profound understanding that drives our unwavering commitment to crafting products that not only meet but surpass the exacting demands of space missions.



If, as the old saying goes, “space is the final frontier,” then it will only be conquered if the equipment and systems that are needed to facilitate the exploration of space by human beings satisfy all of the application-specific characteristics that help ensure safe, reliable and efficient operation.

When it comes to handling cryogenic liquids, numerous different types of components, all with precise duties to reliably perform, must function together harmoniously in order to not only ensure the success of the mission, but – more importantly – to guarantee that it is completed in the safest manner possible with little threat to humans or the greater environment.



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OPW Clean Energy Solutions was formed in December 2021 when OPW acquired both ACME Cryogenics and RegO Products. ACME is a leading provider of mission-critical cryogenics products and services that facilitate the production, storage and distribution of cryogenics liquids and gases. RegO is a leading provider of highly engineered flow-control solutions for cryogenic and liquified gas end markets. Together, they are taking OPW beyond conventional fueling solutions and helping define what's next for alternative energy markets.

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