

Hermetic Windows



Hermetic Waveguide & Sight Windows

Hermetic windows from PA&E are reliable in the extreme conditions space & defense-related LADAR, laser designation/acquisition systems and medical endoscopic tools must operate in.

Sealing Options ■ Ceramic, braze & solder

Reliable ■ Laser weldable into Al, Ti and iron/nickel alloys

Flexible Solutions ■ Variety of glass options available



Hermetic Windows

Our hermetic windows offer engineers additional advantages beyond high hermetic performance, They are designed to be laser welded to a range of metals, including aluminum, titanium and iron/nickel alloys and accommodate a variety of optical glasses such as sapphire, quartz and BK10.

PA&E also offers a number of window sealing options including: proprietary active braze sealing; a patented direct sealing process; standard braze sealing solder sealing and a patented ceramic sealing process.



Window Type	Window Material	Frame Material	Sealing Method
Optical	BK10	Iron/Nickel Alloy	Solder*
	Corning 7056		Direct Seal
	Sapphire	Titanium	Active Braze™ Kryoflex®
Laser	Sapphire	Titanium	Active Braze Kryoflex
	Fused Silica	Iron/Nickel Alloy	Solder*
	Sapphire	Titanium	Active Braze
	Corning 7070	Iron/Nickel Alloy	Direct Seal

PA&E hermetic window configuration examples

**Metalization required*

Hermetic Windows

The Kryoflex Advantage

PA&E has pioneered the use of ceramic-to-metal sealing technology to manufacture hermetically sealed windows for optical, laser and infrared applications. The unique bonding properties and polycrystalline structure of PA&E's Kryoflex material now allow the company to produce sight or wave-guide windows that maintain the highest levels of hermetic integrity under the extreme environmental conditions. This new product is particularly well suited for space or defense-related LADAR, laser designation/acquisition systems and medical endoscopes.

PA&E's ceramic-sealed hermetic windows offer engineers additional advantages beyond high hermetic performance. Because Kryoflex seals at relatively low temperatures, they can now choose from a variety of optical glasses such as sapphire, quartz and BK10. Windows produced with this new process are extremely robust and reliable because a key point of failure – solder joint fatigue – is eliminated.

They provide a leak rate equal to or less than 1×10^{-9} cc/sec helium at 1 atmospheric differential pressure, even when subjected to extreme thermal and mechanical shock and, in medical applications, will maintain integrity after repeated (1,000+) autoclave sterilization cycles. PA&E's ceramic-sealed windows have passed cytotoxicity testing so the materials are proven safe for use within the human body.

Unlike solder- or braze-sealed windows, PA&E's ceramic-sealed hermetic windows do not require metallization. Eliminating this step can, reduce costs and processing time and allows anti-reflective coatings to be applied after the sealing process, ensuring that the critical A/R coating is not impacted by subsequent processing.



Ceramic-sealed hermetic windows require no metallization.

Laser Welding for Robust Reliability

PA&E utilizes the latest state-of-the-art Lasag laser welding systems to integrate windows using the radiation from a focused, energy-dense, beam of infrared light. This non-contact welding process minimizes thermal and mechanical stresses, and provides an extremely small heat-affected zone, ensuring components or electronic packaging are exposed to the least-hostile welding environment possible.

Our welding systems are completely computer controlled including all laser parameters and motion systems axes. This, in combination with an extensive document control system, assures you consistency and repeatability from the first component today through the last component years down the road.

PA&E's experienced engineers are consistently developing the latest material combinations to offer customers all the advantages of laser welding a connector/window/electronic packaging design. Further, PA&E also

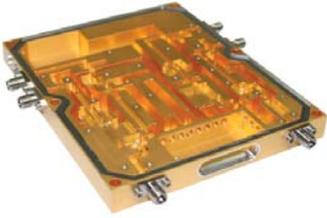
provides welds that produce hermetic seals as small as .009" nominal spot size for your micro requirements or up to .04" nominal for the largest requirements designers may have.



Waveguide window laser welded into an aluminum housing

Hermetic Solutions for Extreme Environments

Integrated Packaging



Using technologies such as Kryoflex® and explosively bonded metals, PA&E designs and manufactures hermetic packaging for extreme environments — whether it's integrating components that protect satellites deep in space or connectors for oil-drilling tools that bore deep below the earth's surface. By pairing our Kryoflex and explosively bonded metal technologies, we can build hermetic packages using precision laser welding rather than solder joints, thus eliminating the two most common causes for hermetic package failure: solder joint fatigue and cracked glass.

DC Connectors



PA&E's hermetically-sealed rectangular DC connectors exceed most mil-spec requirements and are designed for use in military and commercial applications, where environmental conditions require an extremely rugged and reliable hermetic seal. The uniquely-controlled CTE characteristics, chemical bonding properties and polycrystalline structure of Kryoflex allows PA&E to manufacture these hermetic connectors with 304L stainless steel shells and gold-plated beryllium-copper contacts to maintain excellent electrical performance and environmental characteristics

RF/Microwave Connectors



PA&E's 50 Ohm hermetic RF/Microwave connectors are designed for use in military and commercial applications where environmental conditions require an extremely rugged and reliable hermetic seal. Low-loss Corning 7070 glass is used for dependable electrical performance. PA&E manufactures these hermetic RF connectors from a variety of compatible shell and contact materials, in both laser weld and solder-in styles, which provide excellent electrical and environmental performance characteristics.

Bonded Metals



PA&E has been the innovative leader in the explosive metal working field for over 30 years. Our customers have access to some of the world's most exciting metal working technologies, such as: Explosive Metal Bonding, Explosive Metal Forming, Explosive Shock Hardening and Dynamic Powder Metal Compaction. These high-strain rate technologies offer unique metal working advantages that can help our customers achieve the impossible.

For further information contact us at sales@pacaero.com
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