



Aerospace & Defense Capabilities

We design and manufacture hermetic solutions for your military and aerospace applications.

Military and aerospace systems and equipment face environmental challenges beyond where standard connectors and wires can take them. Douglas Electrical Components manufactures hermetic and environmentally sealed feedthroughs with a broad range of connectivity capabilities. Our hermetic portfolio can seal wires, cables, connectors, optical fibers, circuit boards, or some combination thereof with the opportunity to reduce weight and simplify designs.

Our epoxy technology creates a hermetic, water-proof seal capable of protecting electronics from water, water vapor, and a variety of other liquids and gases. Additionally, a hermetic seal can be used to keep fluids within a cavity or system such as a fuel pump. Through our Electronic Products (EPI) portfolio, microelectronic hermetic packages are designed to hermetically seal electronic devices in harsh environments using glass-to-metal seal and HTCC ceramic technologies. Douglas' hermetic solutions are available for land, air, and sea applications.

Designed and manufactured in the US, Douglas Electrical can design and manufacture using COTS (Commercial Off-the-Shelf) components as well as support ITAR (International Traffic in Arms Regulations) regulated assemblies through design, tooling, certification, and testing. Our technologies allow the use of a variety of materials and connection types to create lightweight, high-density hermetic electrical connections. Our team of IPC-certified cable harness technicians assemble high quality assemblies, creating plug-and-play solutions in a wide range of production volumes. Our team can provide the basic hermetic seal and cable harness work like labeling, bundling, twisting, shielding, filtering, solder, and crimping.

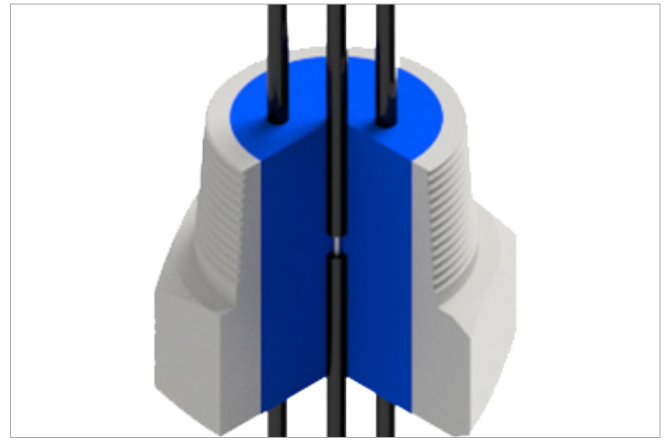
APPLICATIONS

- Antennas
- Actuators
- Complex, ruggedized wire and cable harnesses
- Fiber-optic systems
- Fuel pumps
- Hydraulics
- Legacy system design and retrofit
- Military medical devices
- Optics/LiDAR
- RF/Microwave components
- Rigid, flexible and hybrid bomb fuse circuit boards
- Satellite communications
- Sensors and monitoring devices
- Towed Arrays and ROV's
- Transmissions
- Weapons, munitions, and missile controls systems



DOUGLAS' EPOXY TECHNOLOGY

Douglas Electrical employs a low-outgassing epoxy tested per ASTM E-595- 93 (0.33% TML, 0.00% CVCM) while meeting various moisture-tight standards including those in MIL-STD-883 and MIL-STD-750. This sealing method enables customers to increase signal density, mix conductor types, reduce weight, and integrate connectors, terminals, conductors, and circuits for a hermetically sealed connection for power or signal. In military and aerospace applications, our custom feedthroughs and connections create a moisture-tight seal from non-hermetic electrical connections, creating a robust design for harsh environments.



TECHNICAL ADVANTAGES

- ITAR-, DDTC-, DFARS-, Conflict Materials-, and ROHS-compliant assemblies
- AS9102 First Article Inspections available upon request; contact factory.
- Robust, long-term sealing producing decades of reliable performance
- Chemically compatible with a variety of liquids and gases
- Design power solutions > 30,000V AC
- Choose from mechanical interface materials including MIL-certified stainless steel, brass, plated steel, or lightweight options of aluminum, titanium, and plastics
- Use a variety or combination of wire and cable materials, wire conductor types, gauges, and lengths
- Integrate hermetic seals directly into active sensing elements, circuit boards, and flex circuits to save weight and space

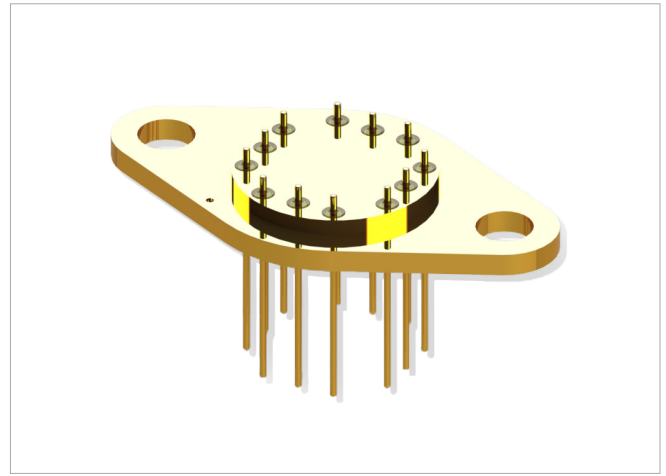


VALUE ADDED CAPABILITIES

- Connectorized wire and cable feedthrough assemblies
- Full cable harnessing with integral braided or spiral shielding
- Directly integrate existing connectors, wires, cables, and termination boxes
- Hermetically sealing of customer-furnished mechanical and electrical connections
- Bundle mating cables, assemblies, and harnesses to reduce suppliers

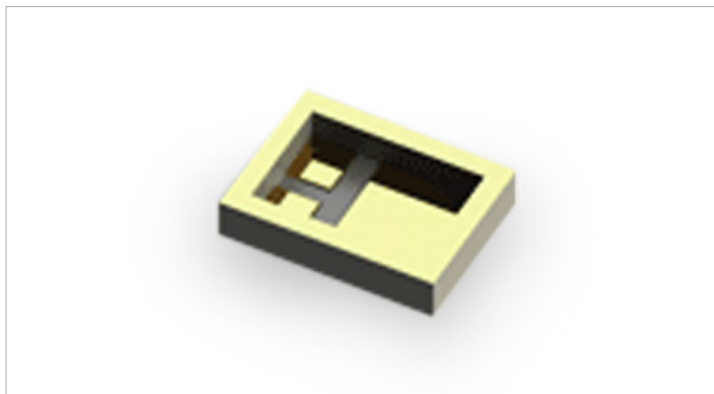
MICROELECTRONIC HERMETIC PACKAGING

Electronic Products, Inc. (EPI) is a powder-to-package, fully integrated HTCC technical ceramics and glass-to-metal package manufacturer. Acquired in July 2022, EPI manufactures standard and custom hermetic seals for military and aerospace applications. The portfolio expands Douglas Electrical's hermetic electrical sealing capabilities into miniaturized packages as well as those requiring packaging in ultra-high temperatures. EPI is fully-equipped in its Newburyport, MA headquarters to deliver turnkey custom designed and standard electronics packages for these applications, and many more: RF and microwave, wireless, optical, vertical-cavity surface-emitting laser (VCSEL), laser diode, and power semiconductor.



TECHNICAL ADVANTAGES

- High-Temperature Co-Fired Ceramic (HTCC) multilayer AlN circuits fired at +1800°C are fully dense hermetic structures that provide low Coefficient of Thermal Expansion (CTE) and 170 W/mK Thermal Conductivity (TC). Ideally suited for high power electronics.
- Various ceramic materials to find the right material for the application include: Aluminas (AL₂O₃), Zirconia Toughened Alumina (ZTA), and Aluminum Nitride (AlN).
- Small footprint, standard and custom packages for optical, LEDs, sensing elements, and those with demanding focal plane arrays; packages available with clear flat or convex lenses.
- Standard and custom RF/microwave hermetic packages for military, aerospace, and satellite communications.
- Matched and compression-based glass-to-metal seal capabilities in standard and customized packages in nickel, copper, silver, and gold.



VALUE ADDED CAPABILITIES

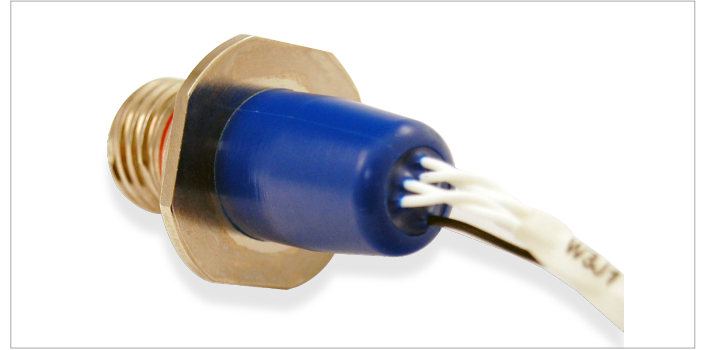
- Powder-to-package multilayer ceramic process capabilities up to 3" x 3" and up to 10+ layers.
- Hermetic hybrid packages that combine ceramic and glass-to-metal technologies in a single design.
- Screen printing in Tungsten, Molybdenum/ Manganese, and dielectrics.
- Glass-to-metal hermetic seal packaging with in-house plating in nickel, copper, silver, and gold.
- In-house tooling, clean room, and inspection equipment to meet all quality requirements.

BPC SERIES

Hermetic Backpotted Connectors

Douglas Electrical Components offers hermetic, moisture-tight connector solutions through our BPC backpotted connector series. Standard commercial off-the-shelf (COTS) connectors can be converted to a hermetic design by backpotting the connector using our proprietary process. Douglas Electrical can also hermetically seal

obsolete hermetic connector options for customers to maintain backwards compatibility, redesign a legacy product, or source a replacement. Our hermetically sealed connectors protect power and signal connections from environmental conditions. The enclosure contents and electronics are protected against liquids and gases from water vapor to fuels.



"Hermetically seal the connector of your choice to simplify your design and integration"

FEATURED CONNECTORS

- MIL-DTL-38999
- MIL-DTL-5015
- MIL-DTL-26482
- MIL-DTL-24308
- MIL-DTL-83513
- MIL-DTL-32139
- SMA, BNC, N, and Triaxial Coaxial connectors.
- Thermocouple type connectors.
- USB, RJ-45, and other commercial connectors.



KEY BENEFITS

- Create hermetic, moisture-tight connectors from commercially available non-hermetic connector designs
- Seal the connector as-is, or integrate other mechanical and electrical features including optical fibers
- Plug-and-play drop-in assembly
- Increased availability by hermetically sealing non-hermetic connectors in stock or readily available versus hermetic connectors with long lead times



POTCON SERIES

Hermetic Bulkhead Connectors

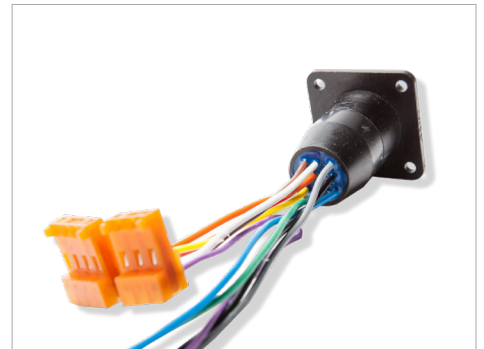
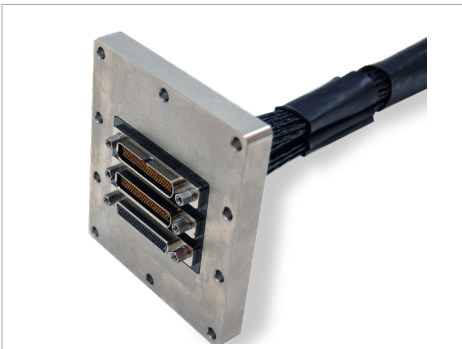
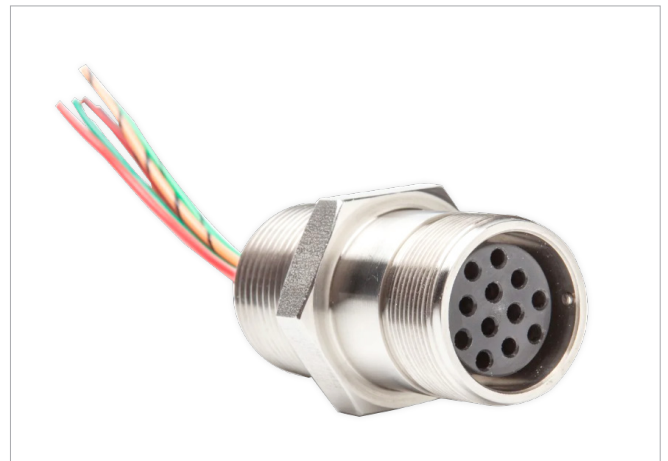
The PotCon® line of hermetic bulkhead connector feedthroughs incorporate standard connectors in a single, fully sealed housing. PotCon feedthroughs feature connection points at the pressure bulkhead or vacuum port while maintaining a hermetic seal for both power and signal applications. PotCon connectors can integrate various electrical connection types into a customized package for your exact requirements.

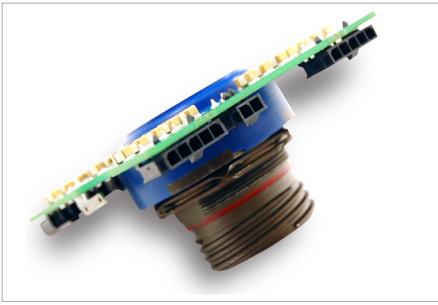


RFW / PFW SERIES

Sealed Connector Assemblies

PFW (plug) and RFW (receptacle) series sealed connector assemblies offer a combination of mechanical and electrical flexibility to design a plug-and-play electrical connection that is hermetic and moisture-tight. Douglas Electrical will start with the connector type required for the application; options include circular MIL-spec and industrial connectors, push-pull connectors, high-voltage connectors, and fiber optic connectors. The connector can be mechanically integrated into the flange or hardware of choice for flange mounting, bulkhead mounting, or threaded options for integration in whatever form is required.

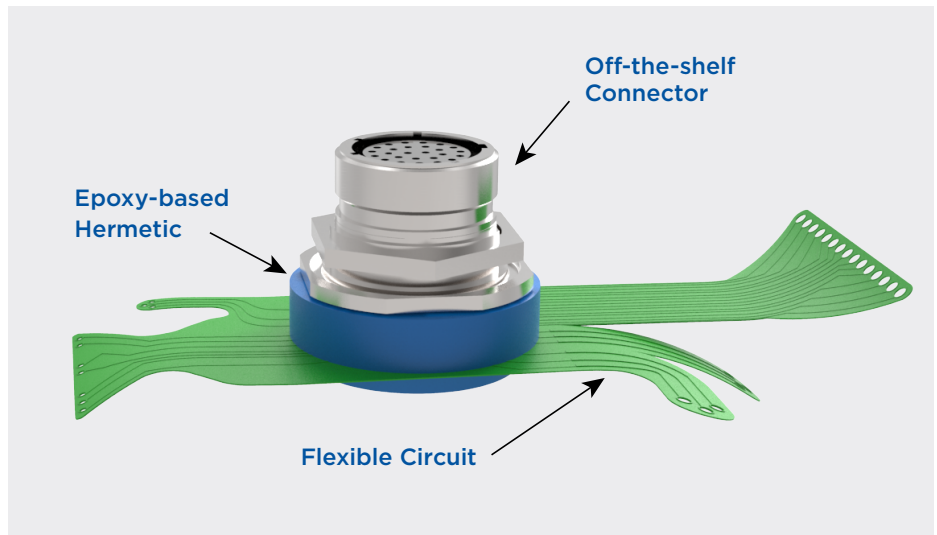
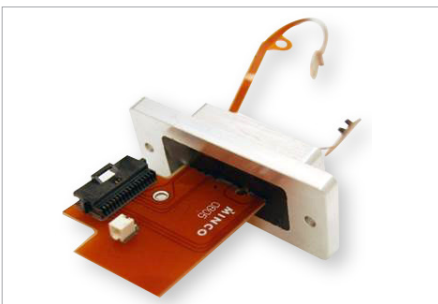
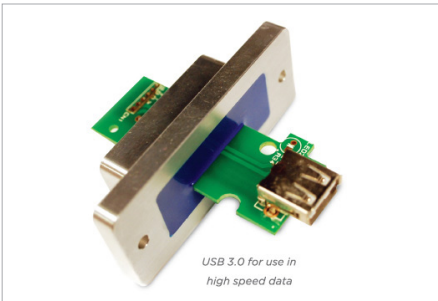




CIRCUITSEAL SERIES

Hermetically Sealed Circuit Assemblies

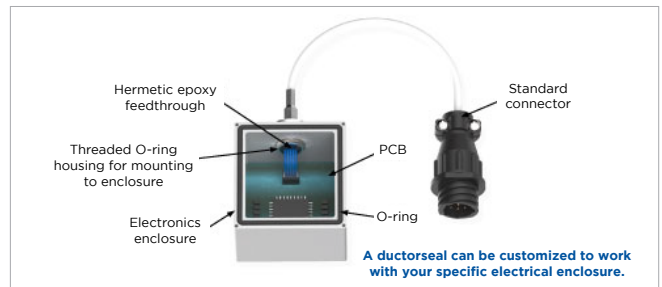
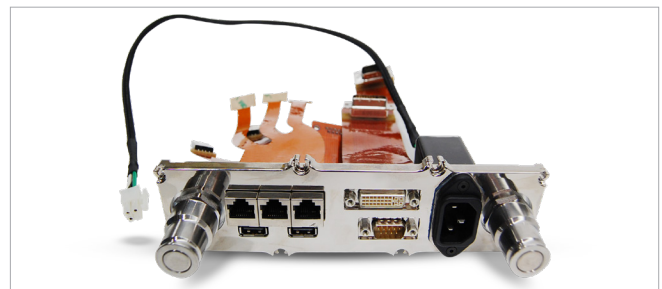
CircuitSeal™ high-reliability hermetic circuit board sealed connectors are custom designed for applications where space or weight constraints exist. Our hermetic sealing epoxy minimizes failure points at the electrical connection and allows for increased conductor density; the output is a smaller, lighter, and less expensive solution. CircuitSeal can integrate a variety of circuit board styles including flex, rigid, hybrid and flat flex cable (FFC). Hermetically sealed circuit boards are useful for enclosure projects with complex computations as well as sensors, switches, diodes, and capacitors. This hermetic seal technology is also trusted in flexible circuit board connectors and their applications along with hermetic bulkhead applications that require lightweight, compact sealing methods for feedthroughs like missiles, bomb fuses, or even batteries.



One CircuitSeal design uses an additional cap layer of epoxy potting material to provide electrical isolation in standard off-the-shelf connectors.

CAPABILITIES

- Hermetically seal flex, rigid, hybrid and flat flex cable (FFC) styles as well as PCB's, terminal headers, and connectors to create a drop-in ready hermetic electrical connection.
- Suitable for applications with space or weight constraints.
- Minimize the number of components required to electrically connect between two separate environments.



DUCTORSEAL SERIES

Hermetic Wire & Cable Feedthroughs

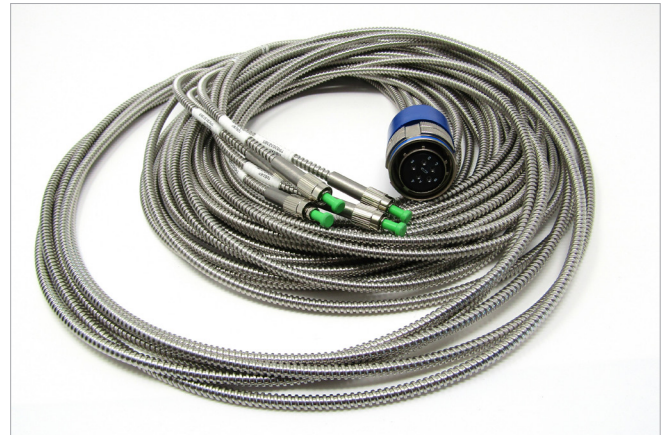
DuctorSeal® hermetic feedthroughs incorporate custom wire harnesses and bundles into a custom hermetic seal. Further, the wire feedthrough leaves our facility pre-wired and pre-tested for drop-in use. DuctorSeal supports different combinations of wires and cables on the vacuum and atmospheric sides and can accommodate conductor counts of up to three thousand wires for applications that require it. Each end of the bulkhead can be customized to wires, jacketed cables or connectors, with the hermetic connection point within the epoxy within the bulkhead.



OPTISEAL SERIES

Hermetic Hermetically Sealed Optical Fiber Cables, & Connectors

Optical fiber offers fast, noise-free signals to transmit over long distances. Douglas Electrical Components manufactures OptiSeal™ fiber optic feedthroughs, hermetic fiber optic cable seals, and connectors as a pre-wired, pre-tested interconnecting harnesses. Choose any combination of optical fibers you need. A pressure feedthrough can contain a mixture of copper wires, fiber optic cables, thermocouples, power cables, shielded pairs, triplets, quads, data cables, etc... Sealed wire feedthrough cables can be grouped without having to allocate fiber optic feedthrough connector circuits based on connector pin sizes, counts, insert arrangements, polarization, and clocking. Douglas Electrical can work with any optical fiber cable and connector type including MM, SM, LC, MTP, and more.

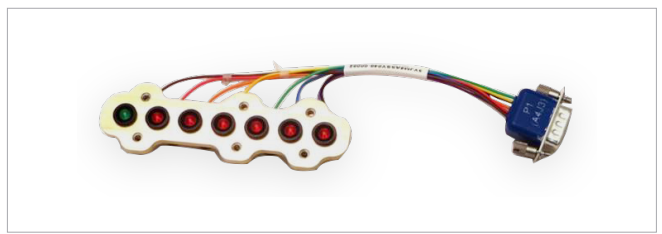
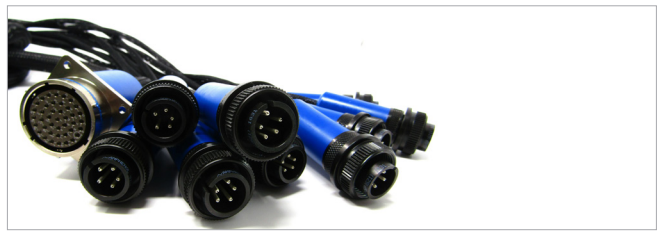


CAPABILITIES

- Achieve a custom hermetic seal no matter the cable construction, configuration or jacket the assembly requires
- Create high-density hermetic electrical feedthroughs with integral wires, cables, and optical fibers
- Use the same wire and insulation types already approved for use elsewhere in your system
- $< 1 \times 10^{-9}$ cc/sec per feedthrough
- Wide operating temperature range utilizing a variety of cable and wire jacket materials
- High-voltage cables $> 30,000$ V
- Full cable harness options with connectorization available
- Custom bifurcated fiber assemblies with a combination of optical and copper conductors for complex camera systems
- Qualifications to MIL-spec environmental standards such as MIL-STD-810
- Ingress Protection available to IP-69K and NEMA 6P

WIRE & CABLE HARNESSSES

Custom engineered and manufactured by IPC-620 certified technicians, our wire and cable harness assemblies serve in military, aerospace, and space simulation applications. Our portfolio of epoxy potting materials and over-molded rubbers meet wire harness standards and can meet a variety of technical needs. Directly integrate a hermetic connection into the wire/cable harness or design a non-hermetic mating assembly to pair with the hermetic seal. Douglas has experience integrating various electrical connections and wire and cable types. Other value-added services are available including custom sheathing and braiding, labeling, and overmolded connectors.



STUDSEAL SERIES

Hermetic Terminal Seals

StudSeal™ hermetic terminal seals are used in high vacuum and pressure applications where high current or high voltages penetrate a barrier such as a motor or battery. The StudSeal hermetic seal product family offers a selection of solid copper, heavy-current conductors sealed in standard housing styles and materials. Primarily used for the transfer of power in and out of a sealed environment, StudSeal products will handle operational loads of up to 1,000 amps and 15kV.



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