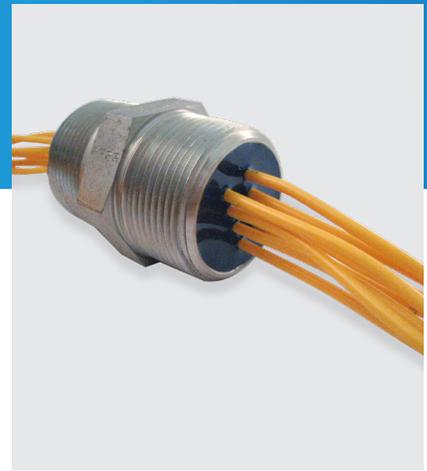




Douglas Electrical Components

# WIRE BUSHINGS FOR HAZARDOUS LOCATIONS



To design safe electrical systems for hazardous locations, you'll have to pay close attention to each and every electrical component that you use—including any wire bushings.

It may be easy to overlook these bushings or conduit sealing hubs since they're typically just one, seemingly minor part of a more complex electrical system. But these components actually play an outsized safety role in hazardous areas. Applications ranging from liquid natural gas (LNG) handling to factories with combustible dust all have a compelling need to prevent leaks around wires that pass through pressure walls, ensuring safety and compliance with agency requirements.

In the past, it was difficult to find feedthroughs and wire or line bushings that you could customize to your needs while meeting compliance standards for hazardous locations. Now, however, there's an approach to feedthrough and wire bushing design that makes it far easier to meet all the relevant regulations without sacrificing design freedom. The key to this approach involves the use of epoxies to create hermetic seals around the wires.

# SERVING HAZARDOUS-AREA APPROVED HERMETIC ELECTRICAL SOLUTIONS TO THE OIL & GAS INDUSTRY.



## EPOXY COMPONENTS GET UL-LISTING

Epoxy-based wire bushings have been used in hazardous locations for years, offering true hermetic seals around the wires and conductors. Hermetic seals are commonly defined by leak rates less than  $1 \times 10^{-8}$  cc-He/sec, which exceeds UL, ATEX, IEC and FM leakage requirements. The UL leakage rate requirement, for example, is less than 0.007 cubic-feet of air/hour ( $5.5 \times 10^{-2}$  ccAir/sec). Using true hermetic seals in these applications has an obvious benefit when it comes to preventing potentially dangerous leaks of flammable gasses or combustible materials including those stored at cryogenic temperatures

However, epoxy-based feedthroughs and bushings would typically require a lengthy and sometimes expensive UL certification process. We have taken some of that certification friction out of the equation by obtaining a key UL listing for our explosion-proof wire bushings. Our epoxy-based NPT bushings now have a UL 1203 listing under file E228634, which addresses explosion-proof electrical equipment design. The UL listing saves you the step of individually certifying wire bushings for explosion-proof applications.



## EXAMPLE APPLICATIONS

- Upstream monitoring
- Compression, storage, and transportation equipment
- Cryogenic systems
- Sensors & instrumentation
- Analytical systems & controls
- Fiber optic communications
- Marine & offshore equipment.



Create high density feedthroughs for power and signal applications.



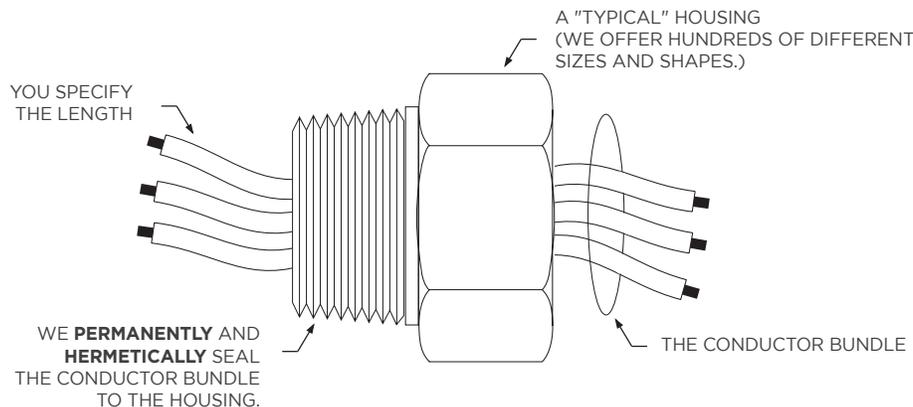
Turnkey Terminated NPT Cable Feedthrough  
Designed for plug-and-play application

## OTHER DESIGN BENEFITS

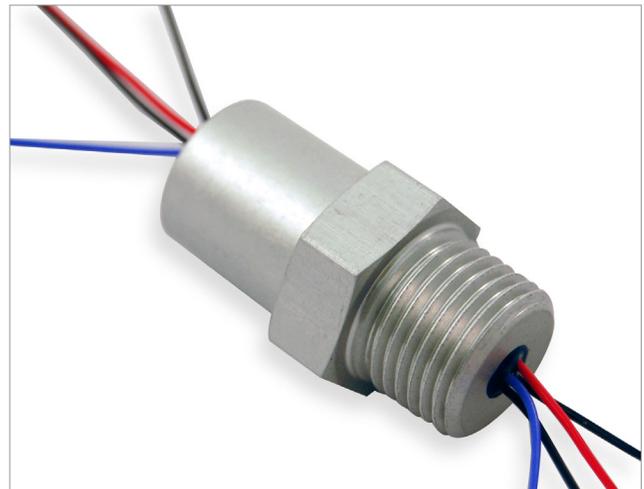
Our UL 1203 bushings have two less obvious design features that can reduce your engineering effort when you need to pass wires or cables into or out of a hazardous location:

- **Full chemical compatibility.** One issue with many previous explosion-proof designs is that they used cement-based sealants that can be prone to cracking and fatigue due to mechanical and environmental stresses. Epoxy, by contrast, is well known for its excellent fatigue properties and resistance to environmental stress cracking. Not only does epoxy create a true hermetic seal around the wires, it also creates sealing that lasts out in the field.
- **Combined explosion and process seal.** Most UL1203 wire bushings seal against the direct causes of explosions such as sparks, flames or even dust. However, many applications in hazardous locations also need reliable process sealing—for example, in a pressurized environment like a hazardous location pump. In these applications, two seals are often needed, one for primary process sealing and a second for explosion proofing. We took a different, simpler approach. Our UL 1203 bushings handle the explosion proofing and provide a true hermetic process seal with leakage rates down to less than  $1 \times 10^{-8}$  cc-He/sec, operating pressures up to 10,000psi and burst pressures greater than 15,000psi.

## A TYPICAL WIRE HARNESS FEEDTHRU



UL approved wire bushings are available in various materials.



Explosion-proof NPT Conduit Seal with male and female threaded ends

# BASED ON PROVEN EPOXY



We had previously received a UL 1203 listing for our 7113-1481 epoxy formulation, which has been used in applications that comply with a wide variety of explosion-proof and hazardous standards (see sidebar). This stand-alone approval simplifies UL approval of custom designs that don't use NPT fittings.

This epoxy, which is used in the UL 1203 wire bushings and other feedthrough designs, has been certified by UL for use in conduit fittings after

passing the required chemical analysis and aging evaluation.

This epoxy has over the years proven itself in demanding applications such as refrigeration, HVAC, military and automotive applications. This long track record made it possible to receive the UL 1203 listing for the complete bushing. These new UL 1203 wire bushings are available in 3/8- to 1-inch NPT sizes in brass, aluminum, plated steel and stainless steel. Approvals for larger sizes are pending.

EPOXY PHYSICAL PROPERTIES			
	Test Method	Unit	Value
<b>Flexural Strength</b>	ASTM-D-790	mPA	92
		psi	13,300
<b>Compressive Strength</b>	ASTM-D-695	mPA	155
		psi	22,500
<b>Linear Shrinkage</b>	ASTM-D-2566	cm/cm	0.0020
<b>Water Absorption (24hrs)</b>	ASTM-D-570	%	0.03
<b>Outgassing</b>	ASTM-D-595		
<b>TML</b>		%	0.25
<b>CVCM</b>		%	0.01
EPOXY MECHANICAL PROPERTIES			
<b>Hardness, Shore D</b>	ASTM-D-2240	SHORE D	
EPOXY ELECTRICAL PROPERTIES			
<b>Dielectric Strength</b>	ASTM-D-149	kV/mm	14
		V/mil	365
<b>Dielectric Constant @ 1mHz</b>	ASTM-D-150		5.01
<b>Dielectric Constant @ 1mHz</b>	ASTM-D-150		5.01
<b>Volume Resistivity @ 25C</b>	ASTM-D-257	Ohm-cm	>10 <sup>15</sup>
EPOXY THERMAL PROPERTIES			
<b>Coefficient of Thermal Expansion</b>	ASTM-D-3386		
<b>alpha 1</b>		10 <sup>-6/c</sup>	35.0
<b>alpha 2</b>		10 <sup>-6/c</sup>	98.9
<b>Glass Transition Temp</b>	ASTM-D-3418	C	86.0
<b>Thermal Conductivity</b>	TP-557W	W/m.K	1.3
		Btu-in/hr-ft <sup>2-F</sup>	8.7

# DESIGN TO INTERNATIONAL STANDARDS

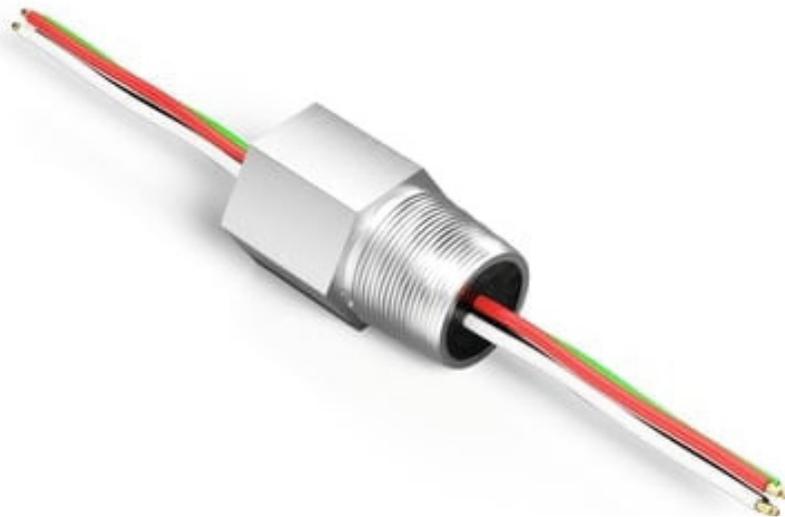


**Meeting Hazardous Location Standards with Epoxy** Long before we had taken the step to pursue a stand alone UL-listing of our NPT wire bushings, our customers often used our epoxy-based feedthroughs, connectors, bushings and conduit fittings in a variety of equipment that complies with the stringent hazardous location requirements, including: IEC/EN 60079-0 General Requirements, IEC/EN 60079-1 Flameproof, IEC/EN 60079-2 Pressurized System, EN 60079-6 Liquid Immersion, IEC/EN 60079-7 Increased Safety

and IEC/EN 60079-11 Intrinsic Safety. ATEX Ex d Flameproof Enclosure, ATEX Ex e Increased Safety, ATEX Ex de Flameproof with Increased Safety, and ATEX Ex pD Pressurized Equipment. CSA 22.2, CSA E60079 Increase Safety. UL 1203 Explosion Proof, UL 886 Hazardous Conduit Fittings, UL 674 Hazardous Locations for Motors and Generators, and UL 913 Intrinsically Safe Apparatus. FM 3611 Equipment in Hazardous Locations, FM 3615 Explosion Proof, FM 3620 Electrical Equipment in Explosive Atmospheres and FM 3610 Intrinsic Safety. And others.

## COMING SOON

Douglas Electrical Components is adding standard ATEX and IECEx certified wire bushings and conduit seals to our portfolio. Configurations will be available in both NPT and metric threads, simplifying the specification process for our customers. A variety of conductor materials, sizes, and wire densities will be available as well as housing materials. Contact a technical sales engineer today to discuss your application.



# HERMETICALLY SEAL BEYOND WIRES



## OPTICAL FIBERS

Optical fibers are an efficient way to transmit fast, noise-free signals over long distances. If you're looking for reliable fiber optic feedthroughs, Douglas Electrical Components has got you covered with our OptiSeal™ products. Our pre-wired and pre-tested interconnecting harnesses and feedthroughs can be configured to accommodate any combination of optical fibers you need. Our team carefully hermetically seals directly to the optical fiber to ensure a true hermetic seal within the bulkhead of the assembly. With OptiSeal, you can create a hybrid feedthrough harness that can combine a mixture of copper wires, fiber optic cables, thermocouples, power cables, shielded pairs, triplets, and quads; this can reduce cost and weight, while increasing reliability within your equipment or assembly.



Hermetic fiber optic NPT feedthrough with SM and MM fiber in the same mechanical interface.

## ENCAPSULATE CIRCUITS

CircuitSeal™ is the process of hermetically sealing and encapsulating connectors and electronic circuits within a low-outgassing, chemically inert hermetic epoxy. By encapsulating the circuit board, connector, or flex circuit, customers have increased design flexibility to design a small, lightweight electronic package. CircuitSeal can integrate a variety of circuit board and electrical connection types including flex, rigid, hybrid and flat flex cable (FFC). Douglas encapsulates customer electronics and circuits to protect against corrosion and electrical shorts caused by water vapor and condensation or creates a hermetic barrier between the circuit and housing assembly or enclosure. This product line is commonly used in instrumentation and controls at the sensing element or electrical connection



Hermetically sealed sensor assembly where the sensing element is exposed to the operating environment, but the housing and wire are hermetically sealed

# WIRE FEEDTHROUGH PRODUCT SERIES

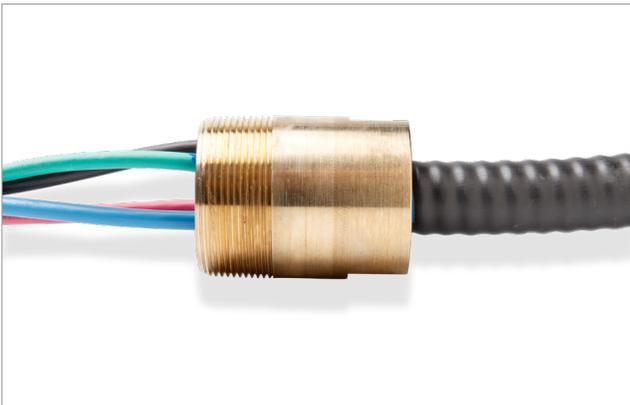


## HERMETIC WIRE FEEDTHROUGHS

DuctorSeal® hermetic wire feedthroughs and sealed cable assemblies provide custom, liquid- and gas-tight electrical pass-throughs for various applications. Our hermetic feedthroughs come pre-wired and pre-tested, ensuring seamless drop-in use. DuctorSeal supports virtually any electrical connection combination on vacuum and atmospheric sides, accommodating conductor counts of up to 3,000 wires for demanding applications.

## SEALED WIRE & CABLE FEEDTHROUGHS

JacketSeal™ sealed electrical feedthroughs provide a liquid/fluid/water-tight sealing solution where a true hermetic seal is not required. Sealed electrical feedthroughs are commonly used applications that require mild water blocking or sealing to IP-67, IP-68, NEMA, and explosion-proof standards. JacketSeal™ technology can be integrated into various sensor, instrumentation, and transmitter designs, simplifying the manufacturing process while reducing exposure of electronics to environmental conditions. As the cable or wire passes through the mechanical interface, the epoxy bonds to the conductors using a proprietary process to protect against liquid and gas penetration.





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