Douglas Electrical Components

Ductorseal® Hermetic Feedthrus

Feedthru

Design Guide

About Douglas Electrical Components

Douglas Electrical Components pioneered the development and practical application of epoxies to feedthru technology in 1977. Our first product was an NPT epoxy body sealing short lengths of #14 and #24 AWG wires. From that first innovative wire harness feedthru we developed the product lines which are offered in the following pages.

The evolution of these product lines has been in response to solving conductor sealing problems which our customers brought to us.

It is this precept which has resulted in the diversification of the product - virtually every product innovation has been in response to a design challenge by a customer.

One of our first challenges was to convince potential customers that our epoxy seal technology was valid for the range of operating environments. We are now accepted for applications over an astonishing dynamic range... 1x10^{-9} Torr through 15,000 psi. Our products have been used from 4°K (LHe) through 200°C. And we do seal.

The conductors that we have sealed include AWG #38 through 500MCM wires, cables and harnesses. Conductor counts have ranged from single wires through 3,200 wires in a single feedthru, cable lengths have ranged from "stubs" through 2,000 meters.

As an example of our capabilities for size and quantity, we have produced one-of-a-kind special assemblies that weigh 2,000lbs. and have produced production lot sizes to 20,000 pieces per year.

We are interested in working with you in developing high quality solutions to your conductor sealing problems and look forward to meeting your challenge.

Duncan E. Douglas
President

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feedthrus

Sealed Wire Harness Feedthru Assemblies

This section describes our unique line of sealed conductors, including wires, cables, and harnesses. We can permanently and hermetically seal virtually any conductor through any housing.

Advantages of Direct Wire Harness Hermetic Feedthrus:

- You can specify the exact conductors you need.
- You can purchase a complete interconnecting harness which is pre-wired and pre-tested; ready to install.
- Typical problems associated with connectors or "pin" style feedthrus are eliminated... no more bent pins, mismated connector sets, miswired harnesses, spurious readings due to contact resistance or special order delays.
- Cables can be functionally grouped without having to allocate circuits based on connector pin sizes, counts, insert arrangements, polarization, or clocking.
- Wires, cables, or harnesses can be "mixed and matched" according to function and routing considerations. For example, a single feedthru/harness can contain a mixture of copper wires, fiber optic cables, thermocouples (including different alloys), power cables, shielded pairs, triplets, and quads.
- There is a significant cost and schedule savings realized over hermetic connectors.
- The circuit density (number of circuits per square inch of port plate) can be increased by a factor of up to 10, versus hermetic pin and socket connectors. This can eliminate entire ports or penetration plates and can free up existing space for other circuits or penetrations.

The product line is described in three sections:

Standard Wire Harness Feedthru
The user selects an appropriate housing, then selects a wire bundle from a list of standard bundles. The bundle lengths on each side of the housing may be specified. See pages 4 through 6.

Custom Wire Harness Feedthrus
The user may select an appropriate standard housing, then specify the exact wire bundle needed for the application. The bundle length on each side of the housing may be specified. See pages 7 through 9.

Application Engineered Wire Harness Feedthrus
For situations that don't lend themselves to solutions with either a standard or a custom harness, we can design a feedthru explicitly for your application. The feedthru design can include the exact conductor/harness you need as well as the housing or enclosure for the best installation. In fact, most of our OEM accounts are using feedthrus that have been Application Engineered for their specific needs. Please turn to page 8 for a discussion of our various capabilities.

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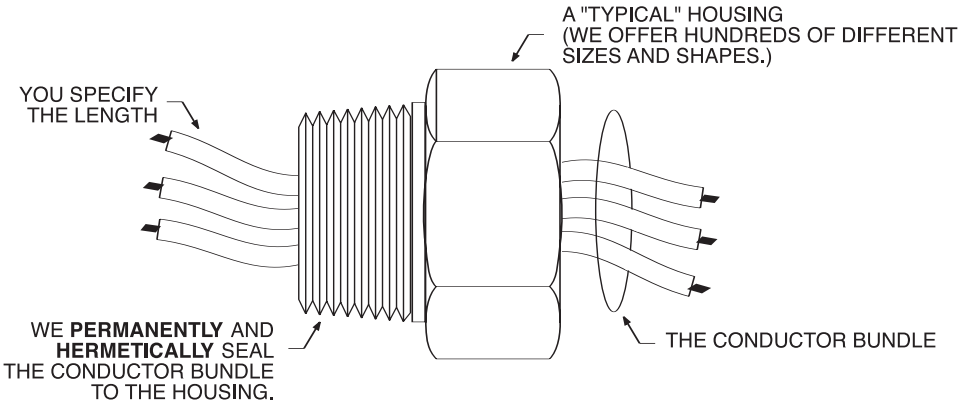
A Typical Wire Harness Feedthru



General Notes, Specifications

Material Specifications

Brass:
ANSI CDA 360

Stainless Steel:
300 Series

Epoxy:
See below

Insulation:
As described in charts

Pressure or Vacuum Limits (-40ºF to 250º F)*		
Housing	**Vacuum Limit**	**Pressure Limit**
NPT Plugs	$1x10^{-6}$ Torr	300 PSI
NPT Epoxy Plugs	$1x10^{-4}$ Torr	300 PSI
NPT Nipples	$1x10^{-6}$ Torr	300 PSI
NPT In-Line Adapter	$1x10^{-6}$ Torr	300 PSI
"O" Ring Bullet Hub	$1x10^{-5}$ Torr	100 PSI
Straight Thread	$1x10^{-7}$ Torr	1000 PSI
Vacuum Face Seal	$1x10^{-9}$ Torr	100 PSI
Vacuum Flange	$1x10^{-9}$ Torr	100 PSI
Radial "O" Ring	$1x10^{-7}$ Torr	1000 PSI

*Consult us if higher limits are needed.

Standard Epoxy Characteristics

Vacuum Outgassing:
25mm^2 x 1mm sample at 125ºC vs optical condensing surface at 25ºC, <1 x 10^{-6}mm Hg

RESULTS: <0.22% Wt Loss and <0.002% VCM. No visible deposits on the condensing plate.

Thermal Conductivity: 10 BTU in/hr ft^2 ºF

Volume Resistivity: $5x10^{16}$ Ωcm

Specific Gravity: 2.3

Dielectric Constant: 60 Hz 6.5, 1 KHz 6.3, 1 MHz 5.9

Thermal Expansion: 29 X 10^{-6}/ ºC

Maximum Service Temperature of Epoxy: 250ºF*

Water Absortion: <0.15% in 7 days

Dielectric Strength: 550v/mil

*See page 60 for higher limits.

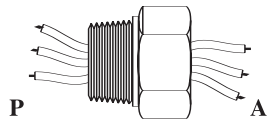
Water Vapor Transmission (Per ASTM E-96-80):
0.7 ± 0.2 gms/m^2 day, 0.125 mil sample thickness

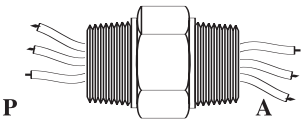
Flame Resistance:
UL File No. E92366 rated UL-94HB

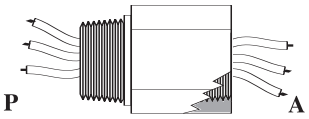
Also tested at White Sands by NASA:
WSTF 79-11713, JSC #0945, NASA NHB 8060.1A. Passed. Self extinguished and no ignition @ 130 amps on a #12 AWG wire.

L.O.C.A. Radiation Withstand:
@ 1.5 x 10^6 Rads/hr for 200 x 10^6 Rads total. Leakage to He <3.0 x 10^{-8} Std cc He/sec, Pin-Pin resistance>$1x10^{12}$ Ω.

Standard Wire Harness Feedthrus (NPT Housings)*





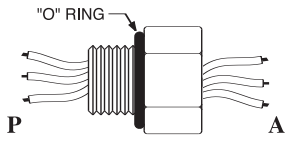


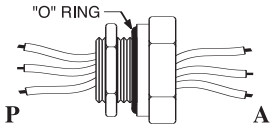
	Type	NPT Plug				NPT Nipple				NPT In-Line Adapter		
	Material	Brass				Brass				Brass		
	Size	3/8"	1/2"	3/4"	1"	3/8"	1/2"	3/4"	1"	1/2"	3/4"	1"
Stranded, MIL -spec **#24 AWG** 1000v Teflon® Insulation	3	28000	28003	28013	20830	28052	28055	28065	28082	28105	28115	28130
	6	28001	28004	28014	28031	28053	28056	28066	28083	28106	28116	28131
	12	--	28005	28015	28032	--	28057	28067	28084	28107	28117	28132
	20	--	--	28016	28033	--	--	28068	28085	--	28118	28133
	32	--	--	--	28034	--	--	--	28086	--	--	28134
Stranded, MIL -spec **#20 AWG** 1000v Teflon® Insulation	3	--	28006	28017	28035	--	28058	28069	28087	28108	28119	28135
	6	--	28007	28018	28036	--	28059	28070	28088	28109	28120	28136
	12	--	--	28019	28037	--	--	28071	28089	--	28121	28137
	20	--	--	28020	28038	--	--	28072	28090	--	--	28138
	32	--	--	--	28039	--	--	--	28091	--	--	28139
Stranded, MIL -spec **#16 AWG** 1000v Teflon® Insulation	3	--	28008	28021	28040	--	28060	28073	28092	28110	28122	28140
	6	--	28009	28022	28041	--	28061	28074	28093	28111	28123	28141
	12	--	--	28023	28042	--	--	28075	28094	--	28124	28142
	20	--	--	--	28043	--	--	--	28095	--	--	28143
	32	--	--	--	--	--	--	--	--	--	--	--
Stranded, MIL -spec **#12 AWG** 1000v Teflon® Insulation	3	--	28010	28024	28044	--	28062	28076	28097	28112	28125	28144
	6	--	--	28025	28045	--	--	28077	28098	--	28126	28145
	12	--	--	--	28046	--	--	--	28099	--	--	28146
	20	--	--	--	--	--	--	--	--	--	--	--
	32	--	--	--	--	--	--	--	--	--	--	--
Thermocouple **#24 AWG Duplex** Teflon® Insulation ISA Type E,J,K or T	2	28002	28011	28026	28047	28054	28063	28078	28100	28113	28127	28147
	5	--	28012	28027	28048	--	28064	28079	28101	28114	28128	28148
	10	--	--	28028	28049	--	--	28080	28102	--	28129	28149
	20	--	--	28029	28050	--	--	28081	28103	--	--	28150
	30	--	--	--	28051	--	--	--	28104	--	--	28151
	40	--	--	--	--	--	--	--	--	--	--	--
	60	--	--	--	--	--	--	--	--	--	--	--

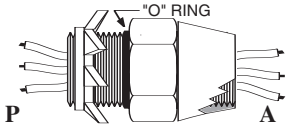
* Housing dimensions are on page 10 and 11.

To Order: Specify the catalog number of the housing style, wire style, and count you need. For copper conductors, append two dash numbers for the **A** lead length and the **P** lead length (in feet) respectively, i.e.: **28010-3-4** is a 28010 feedthru whose **A** lead length is 3 feet and **P** length is 4 feet. For the thermocouples, add another suffix after the length suffixes specifying the ISA code, i.e.: **28013-3-4 Type J**.

Standard Wire Harness Feedthrus (Pressure Housings)*





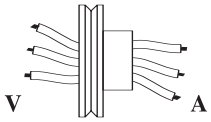


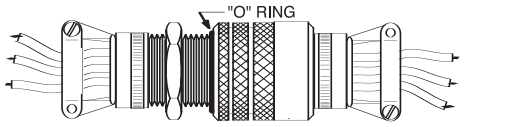
	Type	SAE		Face Seal Housing, Pressure Appl.			Bullet Hub		
	Material	Stainless Steel		Stainless Steel			Steel (Zinc Chromate)		
	Size	3/4"	1-1/16"	1/2"	3/4"	1-1/16"	1/2"	3/4"	1"
Stranded, MIL -spec **#24 AWG** 1000v Teflon® Insulation	3	28155	28168	28185	28189	28196	28213	28226	28248
	6	28156	28169	28186	28190	28197	28214	28227	28249
	12	28157	28170	--	--	28198	28215	28228	28250
	20	--	28171	--	--	28199	28216	28229	28251
	32	--	--	--	--	28200	--	28230	28252
Stranded, MIL -spec **#20 AWG** 1000v Teflon® Insulation	3	28158	28172	28187	28191	28201	28217	28231	28253
	6	28159	28173	--	28192	28202	28218	28232	28254
	12	28160	28174	--	--	28203	28219	28233	28255
	20	--	28175	--	--	28204	--	28234	28256
	32	--	--	--	--	--	--	28235	28257
Stranded, MIL -spec **#16 AWG** 1000v Teflon® Insulation	3	28161	28176	--	28193	28205	28220	28236	28258
	6	28162	28177	--	--	28206	28221	28237	28259
	12	--	28178	--	--	28207	--	28238	28260
	20	--	--	--	--	--	--	28239	28261
	32	--	--	--	--	--	--	--	28262
Stranded, MIL -spec **#12 AWG** 1000v Teflon® Insulation	3	28163	28179	--	--	28208	28222	28240	28263
	6	28164	28180	--	--	28209	--	28241	28264
	12	--	--	--	--	--	--	28242	28265
	20	--	--	--	--	--	--	--	28266
	32	--	--	--	--	--	--	--	--
Thermocouple **#24 AWG Duplex** Teflon® Insulation ISA Type E,J,K or T	2	28165	28181	28188	28194	28210	28223	28243	28267
	5	28166	28182	--	28195	28211	28224	28244	28268
	10	28167	28183	--	--	28212	28225	28245	28269
	20	--	28184	--	--	--	--	28246	28270
	30	--	--	--	--	--	--	28247	28271
	40	--	--	--	--	--	--	--	28272
	60	--	--	--	--	--	--	--	28273

* Housing dimensions are on page 10 and 11.

To Order: Specify the catalog number of the housing style, wire style, and count you need. For copper conductors, append two dash numbers for the **A** lead length and the **P** lead length (in feet) respectively, i.e.: **28210-3-4** is a 28210 feedthru whose **A** lead length is 3 feet and **P** length is 4 feet. For the thermocouples, add another suffix after the length suffixes specifying the ISA code, i.e.: **28213-3-4 Type J**.

Standard Wire Harness Feedthrus (Vacuum Housings)*



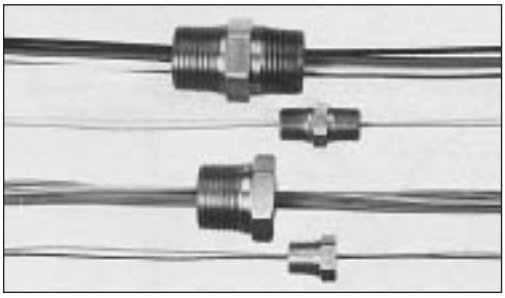


	Type	Flange (Varian® Style)		Vacuum Face Seal with Cable Clamps			
	Material			Stainless Steel Housing, Aluminum Clamps			
	Size	1.33"	2.75"	1.00"	1.25"	1.75"	2.75"
Stranded, MIL -spec **#24 AWG** 1000v Teflon® Insulation	3	28274	28289	28316	28339	28366	28393
	6	28275	28290	28317	28340	28367	28394
	12	28276	28291	28318	28341	28368	28395
	20	28277	28292	28319	28342	28369	28396
	32	--	28293	28320	28343	28370	28397
Stranded, MIL -spec **#20 AWG** 1000v Teflon® Insulation	3	28278	28294	28321	28344	28371	28398
	6	28279	28295	28322	28345	28372	28399
	12	28280	28296	28323	28346	28373	28400
	20	28281	28297	28324	28347	28374	28401
	32	--	28298	28325	28348	28375	28402
Stranded, MIL -spec **#16 AWG** 1000v Teflon® Insulation	3	28282	28299	28326	28349	28376	28403
	6	28283	28300	28327	28350	28377	28404
	12	--	28301	28328	28351	28378	28405
	20	--	28302	28329	28352	28379	28406
	32	--	28303	--	28353	28380	28407
Stranded, MIL -spec **#12 AWG** 1000v Teflon® Insulation	3	28284	28304	28330	28354	28381	28408
	6	28285	28305	28331	28355	28382	28409
	12	--	28306	28332	28356	28383	28410
	20	--	28307	--	283587	28384	28411
	32	--	28308	--	28358	28385	28412
Thermocouple **#24 AWG Duplex** Teflon® Insulation ISA Type E,J,K or T	2	28286	28309	28333	28359	28386	28413
	5	28287	28310	28334	28360	28387	28414
	10	28288	28311	28335	28361	28388	28415
	20	--	28312	28336	28362	28389	28416
	30	--	28313	28337	28363	28390	28417
	40	--	28314	28338	28364	28391	28418
	60	--	28315	--	28365	28392	28419

* Housing dimensions are on page 11.

To Order: Specify the catalog number of the housing style, wire style, and count you need. For copper conductors, append two dash numbers for the **A** lead length and the **V** lead length (in feet) respectively, i.e.: **28310-3-4** is a 28310 feedthru whose **A** lead length is 3 feet and **V** length is 4 feet. For the thermocouples, add another suffix after the length suffixes specifying the ISA code, i.e.: **28313-3-4 Type J**.

Custom Feedthrus Fabricated to Your Specifications



A

B

C

D

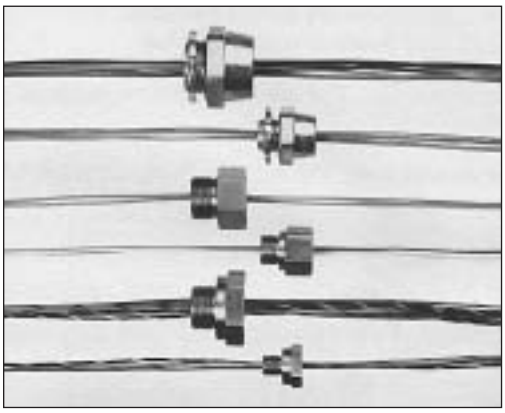
Illustrations of various NPT housings with wire harnesses sealed through:

A - 1" NPT Nipple

B - 3/8" NPT Nipple

C - 1" Plug

D - 3/8" Plug



E

F

G

H

I

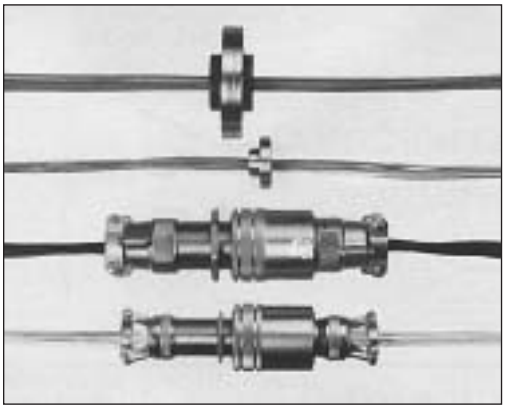
J

Face Seal "O" Ring pressure housings seal harnesses over wide pressure ranges:

E & F - NPT Female to Face Seal Bullet Hub housings, 1" and 1/2" sizes

G & H - 1 1/16" and 3/4" SAE fittings seal to 3,000 psi.

I & J - Pressure face seal housings install through bored hole for an easy solution to mounting problems... 1 1/16" and 3/8" sizes illustrated.



K

L

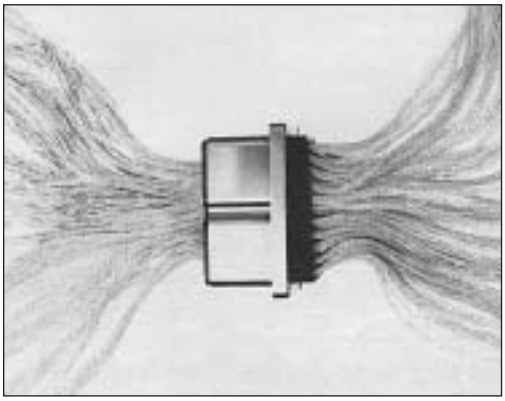
M

N

Vacuum seals with flange or vacuum face seal housings:

K & L - 2 3/4" and 1 1/3" Flanges mount easily to conventional vacuum ports.

M & N - These vacuum feedthrus mount through a hole bored in a port plate. 1 1/4" and 1" shown, available to 4" diameter.



O

Custom Housing:

O - This housing measures 1 1/4" x 4" and seals 1,024 **PAIRS** of wires.

Custom Wire Harness Feedthrus in Standard Housings

Design Instructions

To specify housings for your custom designed feedthru using the worksheet below:

1. Define your wire "packages". For multiple feedthru jobs, group wires for your convenience either for physical location, electrical considerations (i.e., not having power lines next to low level circuits) or both.

2. For each wire type and gauge, look up the wire area in the wire area table on page 9.

3. For each bundle, look up the area factor in the area factor chart on page 9.

4. For each bundle, multiply the wire area times the area factor. This yields the area of that bundle.

5. For each feedthru, add all the bundle areas to obtain the total harness area.

6. Using the Housing Specifications on pages 10 and 11, select the housing which has an area larger than the total harness area. Please contact us directly if a larger capacity housing or higher density wire packing is needed.

Note that this process may be reversed if you know which housing you require and need to calculate the number of wires which can fit into it.

Design Example

1. Define the wire/cable bundle for the feedthru: (10) #24 AWG Teflon® wires into an NPT plug.

2. Look up the wire areas: The wire table below yields an area for this wire of 0.009 in^2.

3. Look up the area factors: The area factor from the table below yields an area factor of 20.

4. Multiply wire area x area factor: 0.009 in^2 x 20 = 0.180 in^2 for the bundle's area.

5. Select the housing: Page 10 yields a 1/2" NPT plug with an area of 0.19 in^2.

Design Worksheet

Wire Bundle Information

Do you want the wires identified with a numbered tag?
☐ Yes or ☐ No

What is your unit of measure for the lead lengths?
☐ Meters ☐ Feet or ☐ Inches

Housing Information

Style *(See pages 10-11):*
Size:
Material:
Part Number:
Area:

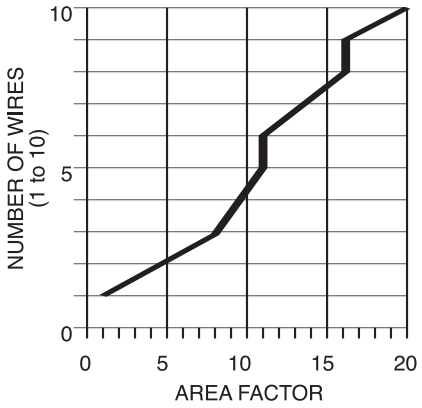
Bundle	Wire ID	AWG	Wire Area	Number of Wires	Area Factor	Bundle Area	Length of Wire on Thread End*	Length of Wire on "Other" End*
1								
2								
3								
4								
5								
6								

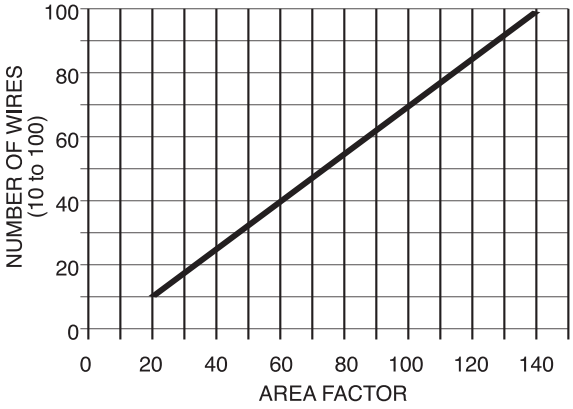
* **"Thread"** End Vs. **"Other"** End
The NPT, Pressure, and Vacuum Face Seal housings all have obvious "Thread" (male thread) and "Other" ends or there is no difference (NPT Nipples). With Vacuum Flanges and Radial "O" Ring Housings we will use these conventions: Vacuum Flanges will have the Thread End as the end **without** the epoxy extension. Radial "O" Ring Housing will have the "long" end as the "Thread End".

If you would like us to design your feedthru, please call Toll Free 1.800.533.8068.

Conductor Data

Area Factors





Areas for Common Wire Types (Virtually Any Wire/Cable Can Be Used)

Insulation		PVC		Tefzel	Teflon	Teflon	Teflon	Teflon	Teflon	Optical Fibers
Temperature		105°C		150°C	200°C	200°C	200°C	200°C	200°C	Inquire about our ability to seal fibers from 50µ thru 110µ
Voltage		600V		600V	1000V	600V	600V	No Rating	600V	
No. Of Conductors		1		1	1	1	2	1 Pair (Duplex)	1	
Conductor Material		Copper		Copper	Copper	Copper	Copper	Thermocouple	Copper	
Plating		Tin		Silver	Silver	Silver	Silver	Standard Calib.	Silver	
Stranding		See Below		Yes	19X	19X	19x	Solid	Yes	
Shielding		No		No	No	Yes	Yes	No	Coax	
Rating Agency and Specifications		CSA-TEW UL-1015		0.020" Insul.	MIL-W-22759/9	MIL-W-16878/4	MIL-W-16878/4	ISA/ANSI Extension Grade	RG-178 B/U	
Wire Id		PVC		Tefzel	Single	SS	TSP	E,J,K, or T	Coax	Fiber
No. Of Strands or Area		#Str	Area	Area	Area	Area	Area	Area	Area	Area
AWG	10	105	0.043	0.043	0.032	0.108	--	--	--	--
AWG	12	65	0.035	0.035	0.026	0.084	0.168	--	--	--
AWG	14	41	0.029	--	0.021	0.066	0.130	--	--	--
AWG	16	26	0.024	--	0.017	0.054	0.103	--	--	--
AWG	18	16	0.021	--	0.014	0.047	0.085	--	--	--
AWG	20	10	0.018	--	0.012	0.040	0.068	0.016	--	--
AWG	22	7	0.017	--	0.010	0.034	0.057	--	--	--
AWG	24	7	0.015	--	0.009	0.032	0.050	0.012	0.026	0.024

Wire Ampacity (In Air)

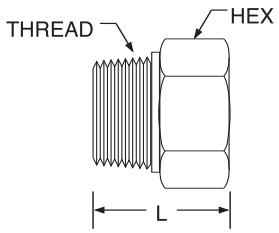
	105°C Wire Installation				150°C Wire Installation				200°C Wire Installation			
AWG	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires
24	7	6	5	4	8	6	6	4	10	8	6	5
22	10	8	7	5	12	10	8	6	13	10	7	7
20	13	10	9	7	15	12	11	8	17	14	10	9
18	18	14	13	9	21	17	15	11	24	19	13	12
16	24	19	17	12	27	22	19	14	32	26	18	16
14	33	26	23	17	42	34	29	21	45	36	25	23
12	45	36	32	23	53	42	37	27	55	44	31	28
10	58	46	41	29	74	59	52	37	75	60	42	38

Standard Housing Data

Custom Housings Are Common–Contact Our Applications Engineer

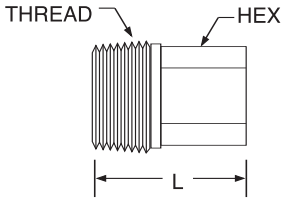
NPT Housings

NPT Plug
(Brass or Stainless Steel)



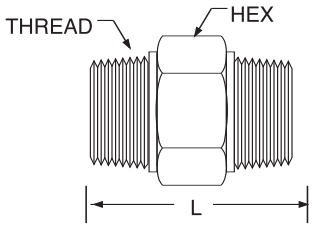
NPT Thread	Brass Part No.	Stainless Part No.	Area (Sq. In.)	Hex Size	L
1/4" NPT	6096-1-1	9559-2	0.06	0.63"	0.84"
3/8" NPT	13904	9559-4	0.10	0.75"	0.75"
1/2" NPT	9281	9559-7	0.19	0.88"	1.09"
3/4" NPT	13783	9559-10	0.36	1.13"	1.17"
1" NPT	9026	9559-13	0.64	1.38"	1.36"

NPT Plug
(Epoxy)



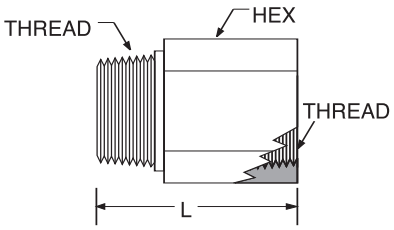
NPT Thread	Epoxy Part No.	Area (Sq. In.)	Hex Size	L
1/4" NPT	5890-2	0.07	0.38"	1.00"
3/8" NPT	5890-3	0.10	0.50"	1.00"
1/2" NPT	5890-7	0.18	0.63"	1.20"
3/4" NPT	5890-8	0.28	0.81"	1.20"
1" NPT	5890-6	0.51	1.00"	1.75"

NPT Nipple
(Brass or Stainless Steel)



NPT Thread	Brass Part No.	Stainless Part No.	Area (Sq. In.)	Hex Size	L
1/4" NPT	6098-4-1	6098-4-3	0.06	0.63"	1.45"
3/8" NPT	6098-7-1	6098-7-3	0.10	0.75"	1.45"
1/2" NPT	6098-9-1	6098-9-3	0.19	0.88"	1.89"
3/4" NPT	6098-11-1	6098-11-3	0.36	1.13"	1.97"
1" NPT	6098-12-1	6098-12-3	0.64	1.38"	2.34"

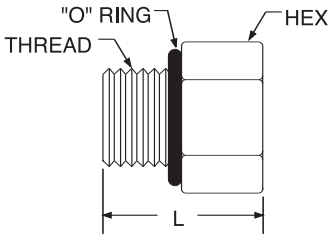
NPT In-Line Adapter
Female to Male (Brass or Stainless Steel)



NPT Thread	Brass Part No.	Stainless Part No.	Area (Sq. In.)	Hex Size	L
1/4" NPT	26568-2-1	26568-2-2	0.06	0.75"	1.22"
3/8" NPT	26568-3-1	26568-3-2	0.10	0.88"	1.44"
1/2" NPT	26568-4-1	26568-4-2	0.19	1.12"	1.88"
3/4" NPT	26568-5-1	26568-5-2	0.36	1.38"	1.95"
1" NPT	26568-6-1	26568-6-2	0.63	1.63"	2.20"

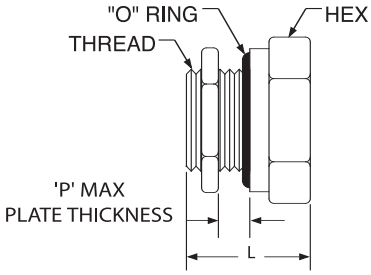
"O" Ring Face Seal Housings (Pressure or Vacuum)

SAE Face Seal



Thread Size	Stainless Steel Part No.	Area (Sq. In.)	Hex Size	L
3/4"-16	12271-3	0.22	1.00"	1.19"
1 1/16"-12	12271-6	0.42	1.63"	1.27"

Pressure Face Seal



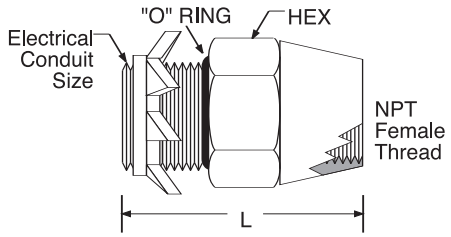
Thread Size	Stainless Steel Part No.	Part No. (Sq. In.)	Hex Size	L	P
3/8"-24	26436-3-4	0.03	0.62	0.73"	0.16"
1/2"-20	26436-5-4	0.07	0.88	0.88"	0.13"
3/4"-16	26436-7-4	0.16	1.13	0.95"	0.16"
1 1/16"-12	26436-8-4	0.37	1.50	1.19"	0.15"

Standard Housing Data

Custom Housings Are Common–Contact Our Applications Engineer

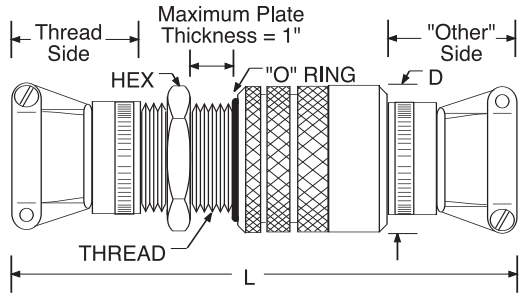
"O" Ring Face Seal Housing *(Pressure or Vacuum, continued)*

Face Seal
To NPT
Adapter *(Steel)*
("Bullet Hub")



Electrical Conduit Size	Knockout Size	Steel (Zinc Chromate) Part No.	Area (Sq. In.)	Hex Size	L
1/2"	7/8"	26539-1	0.33"	1.38"	1.30"
3/4"	1-3/32"	26539-2	0.63"	1.63"	1.30"
1"	1-11/32"	26539-3	1.02"	2.09"	1.55"

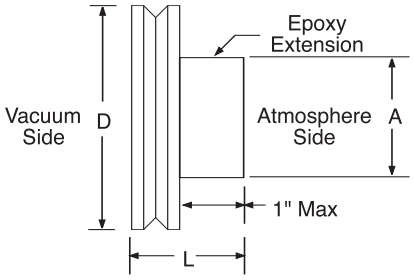
"O" Ring Face Seal Housing *(Vacuum Face Seal)*



Thread	Stainless Steel Part No. w/o clamps	Stainless Steel Part No. with clamps	Area (Sq. In.)	D	Hex Size	L
1"-20	12385	12386	0.75	1.63"	1.38"	5.63"
1 1/4"-18	12388	12389	1.00	1.75"	1.63"	6.60"
1 3/4"-18	12391	12392	2.00	2.25"	2.00"	7.07"
2"-20	12394	12395	3.50	2.75"	2.38"	9.10"
2 3/4"-16	12397	12398	5.00	3.50"	3.25"	11.73"

We also offer a very large capacity feedthru housing which clamps onto a vacuum port plate entirely from the outside *(eliminates having to spin a jam nut)*. Please refer to the **Unique Feedthrus** section on Face Mount housings, page 50.

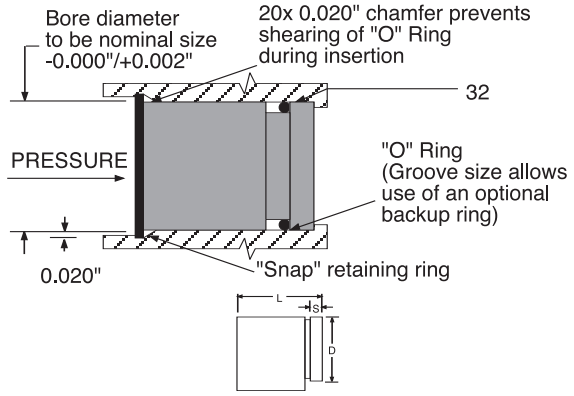
Vacuum Flange Housings



Nominal Size	Part No.	Area (Sq. In.)	D	A	L
1 1/3"	13173	0.30	1.33"	0.75"	0.92"
2 3/4"	12347	1.76	2.75"	1.50"	1.50"

We can fabricate a feedthru seal with virtually any flange, limited only by the area available vs. the wire or conductor areas. We welcome your inquiry about providing specialized feedthrus. Vacuum flanges are fabricated of 303 Stainless Steel and are compatible with the Varian® Conflat design.

Radial "O" Ring Housings



Nominal Size	Part No.	Area (Sq. In.)	D	L	S
1/4"	7458-5	0.004	0.248	0.50	0.13
3/8"	7458-1	0.028	0.373	0.50	0.13
1/2"	7458-2	0.075	0.498	0.75	0.25
3/4"	7458-3	0.196	0.748	1.00	0.25
1"	7458-4	0.385	0.998	1.25	0.50
1 1/4"	7458-7	0.785	1.248	1.75	0.63

Housing is molded of epoxy.

PotCon™ Sealed Connectors

Common MIL-C Designs

When we conceived this section for PotCon™ Hermetic Connectors, our first priority was to make it a truly useful document for designers... with particular emphasis on a "Single-Page-Lookup" concept of its organization.

Our motivation to do this was our own confusion and frustration with "classic" connector catalog pages. A quick search for a specific connector set soon degenerated into a multi-page and sometimes multi-catalog task.

This catalog section is the result of the "Single-Page-Lookup" challenge. With just one look at the Table of Contents you can identify the page which covers your mounting and connector configuration.

We have then listed on that one page a complete compilation of a wide selection of contact configurations from the three most popular connector series... but in hermetically sealed versions. As an additional benefit, if you need to purchase mating connector sets or mating harness-and-connector assemblies, you can easily specify them from the same page.

Of particular note should be our "In-Line PotCon™ Connector" which allows you to mate your inside and outside cable sets with or without the bulkhead feedthru. This was accomplished by our arrangement of plugs/receptacles and pins/sockets on both sides of the bulkhead to allow the interconnection. Please look at our **PBTR** *(page 14)* and **RBTP** *(page 16)* for these features.

In addition to our standard line of hermetic connectors, we have also offered a very comprehensive, complementary line of our hermetically sealed wire harnesses in some of the other sections. This approach can offer significant technical, cost, and lead time benefits over the classic bulkhead mounted connector. These advantages are particularly great in the case where thermocouple alloys are to be routed through the bulkhead or port.

Requests from our customers for a complete line of high frequency and high voltage hermetic feedthrus for coaxial cable connectors has prompted the expansion of our product line to include bulkhead feedthrus incorporating coaxial cable connectors.

We have also introduced a full line of hermetically sealed fiber optic feedthru connectors in both bulkhead face seal mountings and in vacuum flanges.

For those applications that require ultra clean components, we have introduced a Vacuum Outgassing Service which offers to thoroughly clean components. Please refer to the **Unique Feedthrus** section of this catalog for further information. We have also "packaged" two of the more popular PotCon™ Connectors (37 pins and 128 pins) as "kits" for your ordering convenience.

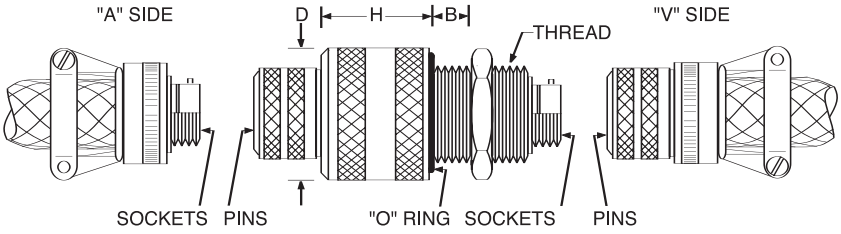
If you can't find one of our standard PotCon™ Connector products to solve your problem, feel free to call us Toll Free at **1.800.533.8068** for a full discussion of alternates or custom designed feedthrus for your specific application.

Challenge us!

PotCon™ Sealed Connectors

Table of Contents

PotCon™ Connector Model PBTR Plug/Receptacle



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
3	1.75''-18	2.25''	1.10''	1.25''
4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <5 x 10^{-8} cc/sec
Vacuum levels to 1 x 10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

To order a PotCon™ Hermetic Connector:
Specify the catalog number.

To order an unassembled Mating Connector:
Prefix either an **A** or a **V** (depending on which side you want) to the catalog number of the PotCon™ Connector you selected. Note that you must individually specify both an **A** and a **V** if you want one of each. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

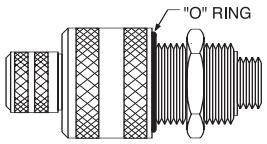
To order a Mating Harness-and-Connector:
Prefix either an **A** or a **V** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24012-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of HALAR® will be placed over the **V** side harness, polyester over the **A** side. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

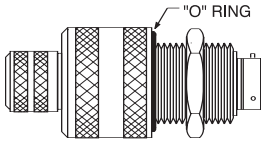
Complete ordering instructions are on the inside back cover of this catalog.

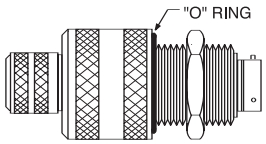
A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

PBTR

Catalog No.
Housing size





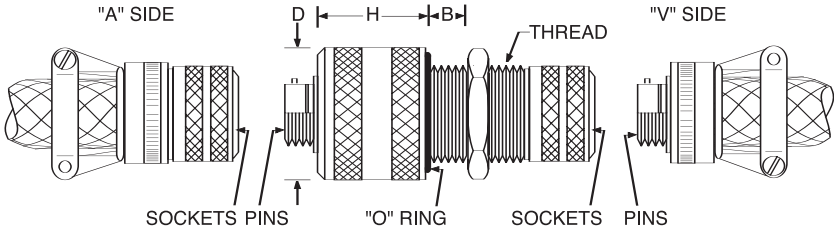


Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24000 Hsg 3	24003 Hsg 2	24008 Hsg 1	--	24021 Hsg 1	24026 Hsg 1	--	--	24045 Hsg 1	--
	4	24001 Hsg 3	24004 Hsg 2	24009 Hsg 1	24018 Hsg 2	--	--	--	24039 Hsg 1	24046 Hsg 1	--
	5	--	24005 Hsg 2	24010 Hsg 2	--	24022 Hsg 2	--	--	24040 Hsg 2	24047 Hsg 1	--
	6	--	--	24011 Hsg 1	--	--	24028 Hsg 1	24036 Hsg 2	--	24048 Hsg 1	24057 Hsg 1
	7	24002 Hsg 3	24006 Hsg 3	24012 Hsg 2	--	--	--	--	--	24049 Hsg 1	--
	8	--	24007 Hsg 3	24013 Hsg 3	24019 Hsg 3	24023 Hsg 3	24029 Hsg 1	--	24041 Hsg 2	24050 Hsg 2	--
	11	--	--	24014 Hsg 3	--	24024 Hsg 3	--	24037 Hsg 3	24042 Hsg 3	--	--
	19	--	--	24015 Hsg 3	24020 Hsg 3	--	24030 Hsg 2	24038 Hsg 3	--	24051 Hsg 2	--
	21	--	--	--	--	24025 Hsg 3	--	--	24043 Hsg 3	--	--
	26	--	--	24016 Hsg 4	--	--	24031 Hsg 2	--	--	24052 Hsg 2	--
	29	--	--	--	--	--	--	--	24044 Hsg 3	--	--
	32	--	--	--	--	--	24032 Hsg 3	--	--	24053 Hsg 3	--
	41	--	--	--	--	--	24033 Hsg 3	--	--	24054 Hsg 3	--
	48	--	--	24017 Hsg 4	--	--	--	--	--	--	--
	55	--	--	--	--	--	24034 Hsg 3	--	--	24055 Hsg 3	24058 Hsg 2
	61	--	--	--	--	--	24035 Hsg 3	--	--	24056 Hsg 3	--
	100	--	--	--	--	--	--	--	--	--	24059 Hsg 3
	128	--	--	--	--	--	--	--	--	--	24060 Hsg 3

PotCon™ Connector Model RBTP

Receptacle/Plug



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
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4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak $<5x10^{-8}$ cc/sec
Vacuum levels to 1×10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

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Prefix either an **A** or a **V** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24112-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of HALAR® will be placed over the **V** side harness, polyester over the **A** side. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

Complete ordering instructions are on the inside back cover of this catalog.

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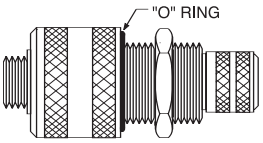
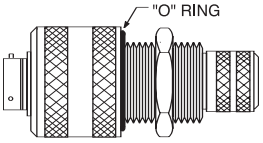
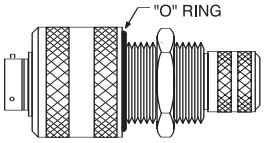
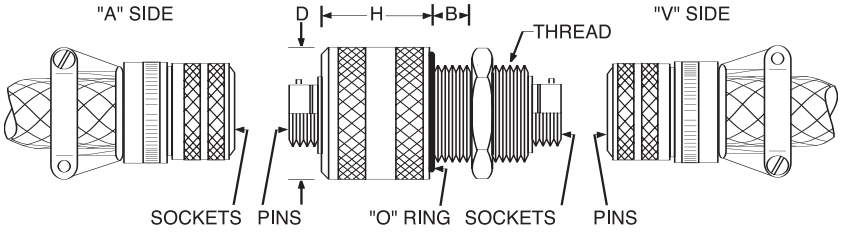
RBTP **Catalog No.** **Housing size**										
Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24100 Hsg 3	24103 Hsg 3	24108 Hsg 2	––	24121 Hsg 2	24126 Hsg 1	––	––	24145 Hsg 1	––
	4	24101 Hsg 3	24104 Hsg 3	24109 Hsg 2	24118 Hsg 2	––	24127 Hsg 1	––	24139 Hsg 2	24146 Hsg 1	––
	5	––	24105 Hsg 3	24110 Hsg 2	––	24122 Hsg 2	––	––	24140 Hsg 2	24147 Hsg 2	––
	6	––	––	24111 Hsg 2	––	––	24128 Hsg 1	24136 Hsg 2	––	24148 Hsg 1	24157 Hsg 1
	7	24102 Hsg 4	24106 Hsg 3	24112 Hsg 3	––	––	––	––	––	24149 Hsg 1	––
	8	––	24107 Hsg 3	24113 Hsg 3	24119 Hsg 3	24123 Hsg 3	24129 Hsg 2	––	24141 Hsg 3	24150 Hsg 2	––
	11	––	––	24114 Hsg 3	––	24124 Hsg 3	––	24137 Hsg 3	24142 Hsg 3	––	––
	19	––	––	24115 Hsg 3	24120 Hsg 4	––	24130 Hsg 2	24138 Hsg 4	––	24151 Hsg 3	––
	21	––	––	––	––	24125 Hsg 3	––	––	24143 Hsg 3	––	––
	26	––	––	24116 Hsg 4	––	––	24131 Hsg 3	––	––	24152 Hsg 3	––
	29	––	––	––	––	––	––	––	24144 Hsg 4	––	––
	32	––	––	––	––	––	24132 Hsg 3	––	––	24153 Hsg 3	––
	41	––	––	––	––	––	24133 Hsg 3	––	––	24154 Hsg 3	––
	48	––	––	24117 Hsg 4	––	––	––	––	––	––	––
	55	––	––	––	––	––	24134 Hsg 3	––	––	24155 Hsg 4	24158 Hsg 3
	61	––	––	––	––	––	24135 Hsg 4	––	––	24156 Hsg 4	––
	100	––	––	––	––	––	––	––	––	––	24159 Hsg 4
	128	––	––	––	––	––	––	––	––	Hsg 4	24160

PotCon™ Connector Model RBTR

Receptacle/Receptacle



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
3	1.75''-18	2.25''	1.10''	1.25''
4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to 1×10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

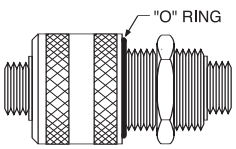
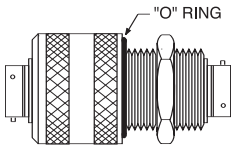
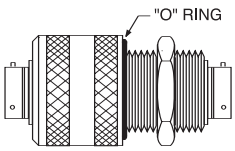
To order a PotCon™ Hermetic Connector:
Specify the catalog number.

To order an unassembled Mating Connector:
Prefix either an **A** or a **V** (depending on which side you want) to the catalog number of the PotCon™ Connector you selected. Note that you must individually specify both an **A** and a **V** if you want one of each. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

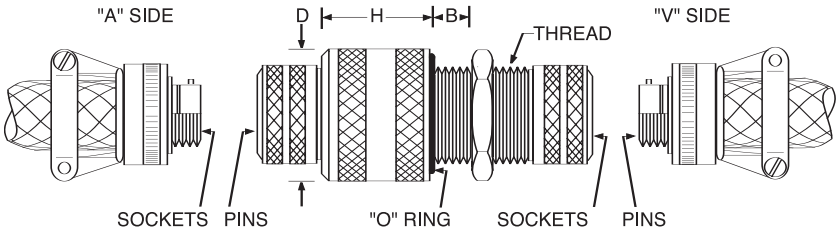
To order a Mating Harness-and-Connector:
Prefix either an **A** or a **V** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24212-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of HALAR® will be placed over the **V** side harness, polyester over the **A** side. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

Complete ordering instructions are on the inside back cover of this catalog.

A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

RBTR **Catalog No.** **Housing size**										
Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22
Number of Contacts										
3	24200 Hsg 3	24203 Hsg 2	24208 Hsg 1	––	24221 Hsg 1	24226 Hsg 1	––	––	24245 Hsg 1	––
4	24201 Hsg 3	24204 Hsg 2	24209 Hsg 2	24218 Hsg 2	––	24227 Hsg 1	––	24239 Hsg 1	24246 Hsg 1	––
5	––	24205 Hsg 2	24210 Hsg 2	––	24222 Hsg 2	––	––	24240 Hsg 2	24247 Hsg 1	––
6	––	––	24211 Hsg 1	––	––	24228 Hsg 1	24236 Hsg 2	––	24248 Hsg 1	24257 Hsg 1
7	24202 Hsg 3	24206 Hsg 3	24212 Hsg 2	––	––	––	––	––	24249 Hsg 1	––
8	––	24207 Hsg 3	24213 Hsg 3	24219 Hsg 3	24223 Hsg 2	24229 Hsg 1	––	24241 Hsg 2	24250 Hsg 1	––
11	––	––	24214 Hsg 3	––	24224 Hsg 3	––	24237 Hsg 3	24242 Hsg 3	––	––
19	––	––	24215 Hsg 3	24220 Hsg 3	––	24230 Hsg 2	24238 Hsg 3	––	24251 Hsg 2	––
21	––	––	––	––	24225 Hsg 3	––	––	24243 Hsg 3	––	––
26	––	––	24216 Hsg 4	––	––	24231 Hsg 2	––	––	24252 Hsg 2	––
29	––	––	––	––	––	––	––	24244 Hsg 3	––	––
32	––	––	––	––	––	24232 Hsg 3	––	––	24253 Hsg 3	––
41	––	––	––	––	––	24233 Hsg 3	––	––	24254 Hsg 3	––
48	––	––	24217 Hsg 4	––	––	––	––	––	––	––
55	––	––	––	––	––	24234 Hsg 3	––	––	24255 Hsg 3	24258 Hsg 2
61	––	––	––	––	––	24235 Hsg 3	––	––	24256 Hsg 3	––
100	––	––	––	––	––	––	––	––	––	24259 Hsg 3
128	––	––	––	––	––	––	––	––	––	24260 Hsg 3

PotCon™ Connector Model PBTP Plug/Plug



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
3	1.75''-18	2.25''	1.10''	1.25''
4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to 1 x 10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

To order a PotCon™ Hermetic Connector:
Specify the catalog number.

To order an unassembled Mating Connector:
Prefix either an **A** or a **V** (depending on which side you want) to the catalog number of the PotCon™ Connector you selected. Note that you must individually specify both an **A** and a **V** if you want one of each. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

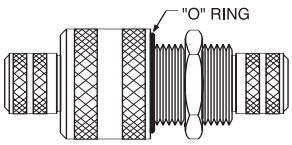
To order a Mating Harness-and-Connector:
Prefix either an **A** or a **V** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24612-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of HALAR® will be placed over the **V** side harness, polyester over the **A** side. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

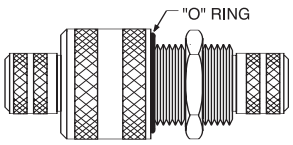
Complete ordering instructions are on the inside back cover of this catalog.

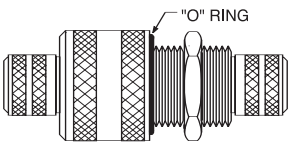
A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details*.

PBTP

Catalog No.
Housing size

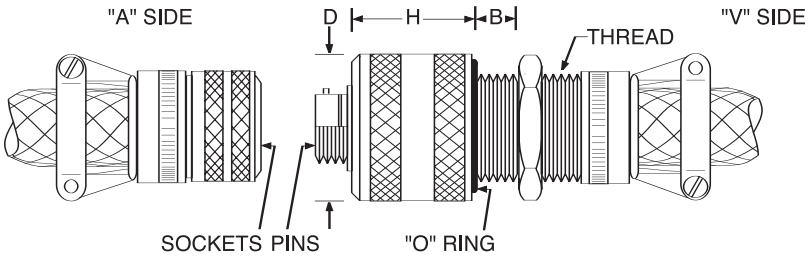






Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22
Number of Contacts										
3	24300 Hsg 3	24303 Hsg 3	24308 Hsg 2	––	24321 Hsg 2	24326 Hsg 1	––	––	24345 Hsg 1	––
4	24301 Hsg 3	24304 Hsg 3	24309 Hsg 2	24318 Hsg 2	––	24327 Hsg 1	––	24339 Hsg 2	24346 Hsg 1	––
5	––	24305 Hsg 3	24310 Hsg 2	––	24322 Hsg 2	––	––	24340 Hsg 2	24347 Hsg 1	––
6	––	––	24311 Hsg 2	––	––	24328 Hsg 1	24336 Hsg 3	––	24348 Hsg 1	24357 Hsg 1
7	24302 Hsg 3	24306 Hsg 3	24312 Hsg 3	––	––	––	––	––	24349 Hsg 1	––
8	––	24307 Hsg 3	24313 Hsg 3	24319 Hsg 3	24323 Hsg 3	24329 Hsg 2	––	24341 Hsg 3	24350 Hsg 2	––
11	––	––	24314 Hsg 3	––	24324 Hsg 3	––	24337 Hsg 3	24342 Hsg 3	––	––
19	––	––	24315 Hsg 3	24320 Hsg 3	––	24330 Hsg 2	24338 Hsg 4	––	24351 Hsg 2	––
21	––	––	––	––	24325 Hsg 3	––	––	24343 Hsg 3	––	––
26	––	––	24316 Hsg 4	––	––	24331 Hsg 3	––	––	24352 Hsg 3	––
29	––	––	––	––	––	––	––	24344 Hsg 4	––	––
32	––	––	––	––	––	24332 Hsg 3	––	––	24353 Hsg 3	––
41	––	––	––	––	––	24333 Hsg 3	––	––	24354 Hsg 3	––
48	––	––	24317 Hsg4	––	––	––	––	––	––	––
55	––	––	––	––	––	24334 Hsg 3	––	––	24355 Hsg 4	24358 Hsg 3
61	––	––	––	––	––	24335 Hsg 4	––	––	24356 Hsg 4	––
100	––	––	––	––	––	––	––	––	––	24359 Hsg 4
128	––	––	––	––	––	––	––	––	––	24360 Hsg 4

PotCon™ Connector Model RBTW Receptacle/Wire



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
3	1.75''-18	2.25''	1.10''	1.25''
4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Wire Harness:
Indicated AWG, Teflon® insulation to MIL-W-16878E/5
1000V, expandable braid on **V** side is **Halar®**

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to 1 x 10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

To order a PotCon™ Hermetic Connector:
Specify the catalog number number and add as a suffix a dash number, the length of the **V** side wire harness in feet, e.g: a 24412-23 would be a 24412 PotCon™ with a 23 foot long **V** side harness of 7 #16 AWG wires.

To order an unassembled Mating Connector:
Prefix an **A** to the catalog number of the PotCon™ Connector you selected. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

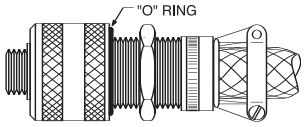
To order a Mating Harness-and-Connector:
Prefix either an **A** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24412-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of polyester will be placed over the **A** side harness. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

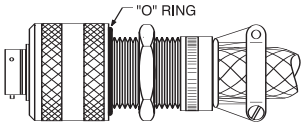
Complete ordering instructions are on the inside back cover of this catalog.

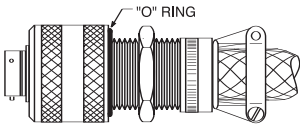
A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

RBTW

Catalog No.
Housing size





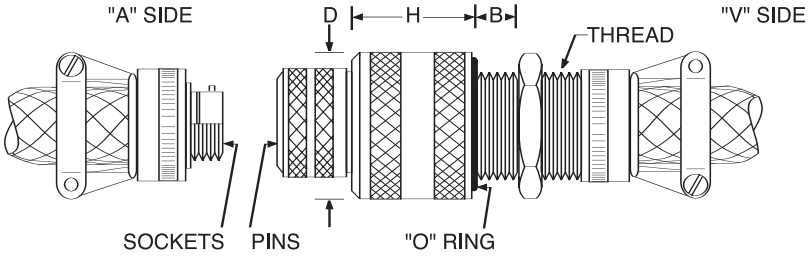


Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24400 Hsg 2	24403 Hsg 1	24408 Hsg 1	––	24421 Hsg 1	24426 Hsg 1	––	––	24445 Hsg 1	––
	4	24401 Hsg 2	24404 Hsg 1	24409 Hsg 1	24418 Hsg 1	––	24427 Hsg 1	––	24439 Hsg 1	24446 Hsg 1	––
	5	––	24405 Hsg 1	24410 Hsg 1	––	24422 Hsg 1	––	––	24440 Hsg 1	24447 Hsg 1	––
	6	––	––	24411 Hsg 1	––	––	24428 Hsg 1	24436 Hsg 1	––	24448 Hsg 1	24457 Hsg 1
	7	24402 Hsg 3	24406 Hsg 2	24412 Hsg 1	––	––	––	––	––	24449 Hsg 1	––
	8	––	24407 Hsg 2	24413 Hsg 2	24419 Hsg 2	24423 Hsg 1	24429 Hsg 1	––	24441 Hsg 2	24450 Hsg 1	––
	11	––	––	24414 Hsg 2	––	24424 Hsg 2	––	24437 Hsg 2	24442 Hsg 2	––	––
	19	––	––	24415 Hsg 2	24420 Hsg 3	––	24430 Hsg 1	24438 Hsg 3	––	24451 Hsg 1	––
	21	––	––	––	––	24425 Hsg 3	––	––	24443 Hsg 3	––	––
	26	––	––	24416 Hsg 3	––	––	24431 Hsg 1	––	––	24452 Hsg 1	––
	29	––	––	––	––	––	––	––	24444 Hsg 3	––	––
	32	––	––	––	––	––	24432 Hsg 2	––	––	24453 Hsg 2	––
	41	––	––	––	––	––	24433 Hsg 2	––	––	24454 Hsg 2	––
	48	––	––	24417 Hsg 4	––	––	––	––	––	––	––
	55	––	––	––	––	––	24434 Hsg 3	––	––	24455 Hsg 3	24458 Hsg 1
	61	––	––	––	––	––	24435 Hsg 3	––	––	24456 Hsg 3	––
	100	––	––	––	––	––	––	––	––	––	24459 Hsg 3
	128	––	––	––	––	––	––	––	––	––	24460 Hsg 3

PotCon™ Connector Model PBTW

Plug/Wire



Hsg	Thread	D	B	H
1	1.00''-20	1.63''	1.10''	1.88''
2	1.25''-18	1.75''	1.10''	1.63''
3	1.75''-18	2.25''	1.10''	1.25''
4	2.75''-16	3.50''	1.10''	3.56''

Connectors are available with either **Thread** or **Bayonet** couplings.

Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing and Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Wire Harness:
Of indicated AWG, Teflon® insulation to MIL-W-16878E/5 1000V, expandable braid on **V** side is of **Halar**®

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to 1 x 10^{-8} mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

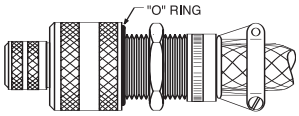
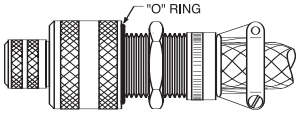
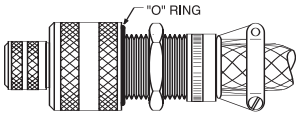
To order a PotCon™ Hermetic Connector:
Specify the catalog number number and add as a suffix a dash number, the length of the **V** side wire harness in feet, e.g: a 24512-23 would be a 24512 PotCon™ with a 23 foot long **V** side harness of 7 #16 AWG wires.

To order an unassembled Mating Connector:
Prefix an **A** to the catalog number of the PotCon™ Connector you selected. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

To order a Mating Harness-and-Connector:
Prefix either an **A** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A24512-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of polyester will be placed over the **A** side harness. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

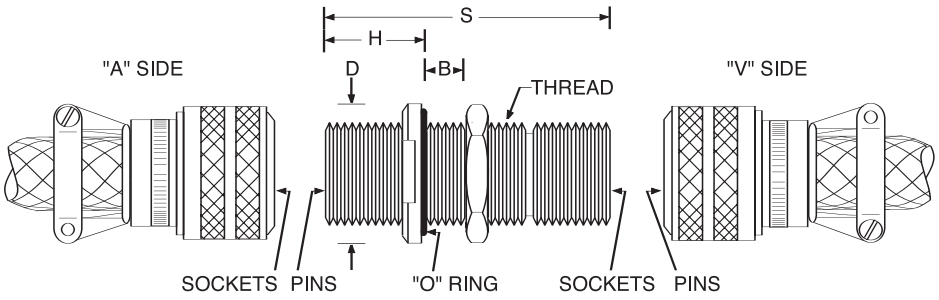
Complete ordering instructions are on the inside back cover of this catalog.

A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

PBTW **Catalog No.** **Housing size**										
Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24500 Hsg 2	24503 Hsg 1	24508 Hsg 1	––	24521 Hsg 1	24526 Hsg 1	––	––	24545 Hsg 1	––
	4	24501 Hsg 2	24504 Hsg 1	24509 Hsg 1	24518 Hsg 1	––	24527 Hsg 1	––	24539 Hsg 1	24546 Hsg 1	––
	5	––	24505 Hsg 1	24510 Hsg 1	––	24522 Hsg 1	––	––	24540 Hsg 1	24547 Hsg 1	––
	6	––	––	24511 Hsg 1	––	––	24528 Hsg 1	24536 Hsg 1	––	24548 Hsg 1	24557 Hsg 1
	7	24502 Hsg 3	24506 Hsg 2	24512 Hsg 1	––	––	––	––	––	24549 Hsg 1	––
	8	––	24507 Hsg 2	24513 Hsg 2	24519 Hsg 2	24523 Hsg 1	24529 Hsg 1	––	24541 Hsg 1	24550 Hsg 1	––
	11	––	––	24514 Hsg 2	––	24524 Hsg 2	––	24537 Hsg 2	24542 Hsg 2	––	––
	19	––	––	24515 Hsg 2	24520 Hsg 3	––	24530 Hsg 1	24538 Hsg 3	––	24551 Hsg 1	––
	21	––	––	––	––	24525 Hsg 3	––	––	24543 Hsg 3	––	––
	26	––	––	24516 Hsg 3	––	––	24531 Hsg 1	––	––	24552 Hsg 1	––
	29	––	––	––	––	––	––	––	24544 Hsg 3	––	––
	32	––	––	––	––	––	24532 Hsg 2	––	––	24553 Hsg 2	––
	41	––	––	––	––	––	24533 Hsg 2	––	––	24554 Hsg 2	––
	48	––	––	24517 Hsg 4	––	––	––	––	––	––	––
	55	––	––	––	––	––	24534 Hsg 3	––	––	24555 Hsg 3	24558 Hsg 1
	61	––	––	––	––	––	24535 Hsg 3	––	––	24556 Hsg 3	––
	100	––	––	––	––	––	––	––	––	––	24559 Hsg 3
	128	––	––	––	––	––	––	––	––	––	24560 Hsg 3

TBFH Thru-Bulkhead Feedthru



Note: These connectors are fully intermatable with MIL-C-5015 Series Connectors.

Specifications

Materials & Construction

Connector Bodies & Jam Nut:
Aluminum, Electroless Nickel Plated

Housing:
Aluminum

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG and #16 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <5x10^{-8}cc/sec
Vacuum levels to 1x10^{-8} mm Hg
#8 AWG is hipot tested @ 1000VAC
#12 AWG and #16 AWG at 600VAC
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

To order a PotCon Hermetic Connector:
Specify the catalog number.

To order an unassembled Mating Connector:
Prefix either an **A** or a **V** (depending on which side you want) to the catalog number of the PotCon™ Connector you selected. Note that you must individually specify both an **A** and a **V** if you want one of each. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

To order a Mating Harness-and-Connector:
Prefix either an **A** or a **V** as above, then add as a suffix a dash number which will be the cable harness length in feet, e.g.: A25212-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and tagged with the contact ID. Expandable braid of HALAR® will be placed over the **V** side harness, polyester over the **A** side. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

Complete ordering instructions are on the inside back cover of this catalog.

A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

Reference Charts

Contact AWG		8	12	16
Number of Contacts	3	25200 Hsg 5	25203 Hsg 2	25207 Hsg 1
	4	25201 Hsg 5	25204 Hsg 3	25208 Hsg 3
	5	--	25205 Hsg 3	25209 Hsg 2
	7	25202 Hsg 6	25206 Hsg 4	25210 Hsg 2
	14	--	--	25211 Hsg 4
	17	--	--	25212 Hsg 4
	19	--	--	25213 Hsg 5
	26	--	--	25214 Hsg 7
	37	--	--	25215 Hsg 7
	48	--	--	25216 Hsg 8

Cross Reference Chart ITT Cannon to PotCon™	
14-7	25207
16-1	25210
16-8	25209
16-10	25203
18-04	25208
18-10	25204
18-11	25205
20-15	25206
20-27	25211
20-29	25212
22-02	25200
22-14	25213
22-22	25201
24-10	25202
28-12	25214
28-21	25215
36-10	25216

Alternate Insert Arrangements	
PotCon™ Catalog#	Arrangements
25200	NWXYZ
25201	NXY
25202	NWZ
25203	NWXY
25204	NXY
25205	NXY
25206	NWZ
25207	NWXY
25208	NWXYZ
25209	NXY
25210	NWZ
25211	NWXYZ
25212	NWZ
25213	NWZ
25214	NWXY
25215	NWXYZ
25216	NWXYZ

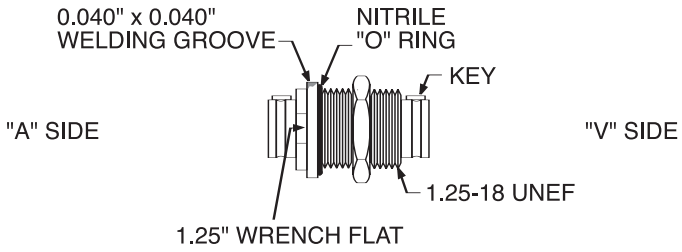
Dimensions of Housings on Page 26

Housing	Shell Size	Thread	B (Max)	D	H (Max)	S (Max)
1	14	.878-20	.375	1.447	.921	2.859
2	16	1.000-20	.375	1.572	1.135	2.859
3	18	1.125-18	.750	1.697	1.135	2.859
4	20	1.250-18	.750	1.822	1.135	2.859
5	22	1.375-18	.750	1.947	1.135	2.859
6	24	1.500-18	.750	2.072	1.135	2.859
7	28	1.750-18	.750	2.322	1.135	2.859
8	36	2.250-18	.750	2.822	1.135	2.859

PotCon™ Model "125/37"

Hermetic Bulkhead Feedthru Connectors

"Deutsch Equivalent" Model



Specifications

Dielectric Withstand:
2000 VAC Sea Level
1250 VAC 50,000 ft.
900 Vac 110,000 ft.

Insulation Resistance:
5000 meg Ω Minimum per MIL-C-26482

Hermetic Seal

Vacuum: <5x10^{-8} std cc/sec
Pressure: 1000 psi

Materials

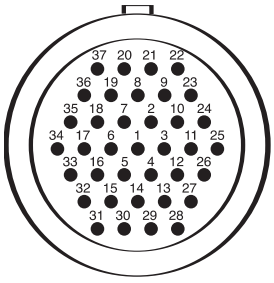
Body & Nut:
303 Series Stainless Steel

Casting Material:
Epoxy with extremely low outgassing characteristics; <0.2% weight loss and 0.002% VCM; 25°C condensing surface, 125°C sample temperature; <1x10^{-6}mm Hg Vacuum

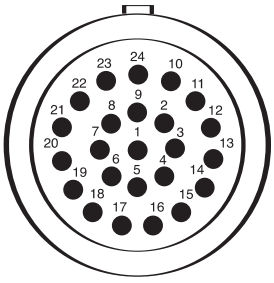
"O" Ring: Nitrile Rubber

Equivalent Part No.	PotCon™ Part No.	Pin Size	Number of Pins	Ampacity (Amperes)	Pin Material	Notes
DM5623-37PP	12474	20	37	7.5	Copper	
DM5623-37-40PP	12475	20	37	N/A	ISA Type E	Odd pins are Chromel, even are Constantan
DM5623-37-39PP	12476	20	37	N/A	ISA Type J	Odd pins are Iron, even are Constantan
DM5623-37-38PP	12477	20	37	N/A	ISA Type K	Odd pins are Chromel, even are Alumel
DM5623-37-37PP	12478	20	37	N/A	ISA Type T	Odd pins are Copper, even are Constantan
DM5623-37-2PP	12479	16	24	N/A	Copper	
DM5623-37-23PP	12480	12	12	N/A	Copper	

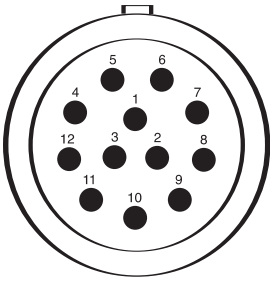
Pin Layouts (viewed from atmosphere end)



37 #20 AWG



24 #16 AWG



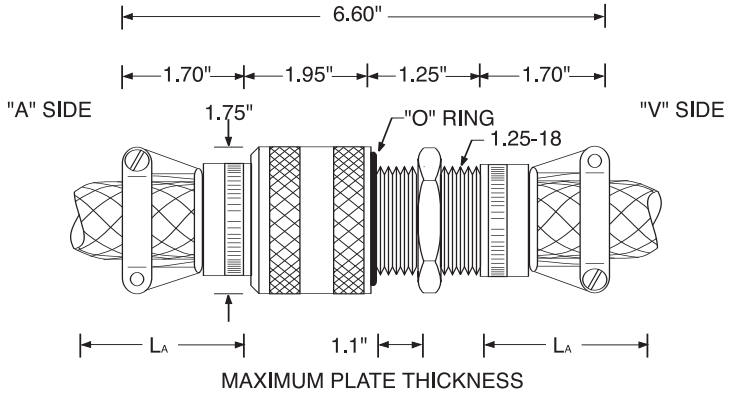
12 #12 AWG

To order PotCon™ Connector Model "125/37" Hermetic Bulkhead Feedthru

Specify the Part Number of the Conductor. **We do not offer mating partners for this product.** For the "fit and function" equivalent to a connected and assembled "125/37" Harness, *see page 29*.

PotCon™ Model "125/37" Cable Equivalents

Sealed Wire Harness Feedthrus



Specifications

Housing and Cable Clamps

Body Material:
300 Series Stainless Steel

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*.

"O" Ring:
Nitrile Rubber

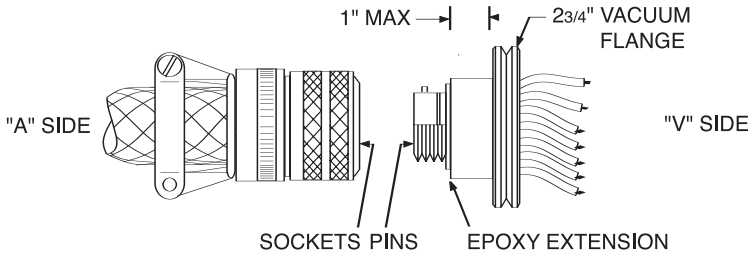
Wires:
See page 36 for Thermocouple Alloys. Wire harnesses are covered with expandable braid of polyester on the **A** side and of **Halar**® on the **V** side. Wires are tagged. Wires may be skinned 0.25 inches on one end for testing.

Limits and QC Testing:
Helium leak <$5x10^{-8}$cc/sec
Vacuum levels to $1x10^{-8}$ mm Hg
Assembly is hipot tested at 100VAC for thermocouples, 1000VAC for others
Temperature Range: -40°F to +250°F, may be baked-out to +250°F *(see page 57)*

Catalog Number	Wire Complement	Ampacity (Amperes)	Wire and Insulation	PotCon™ "125/37" Equivalent *(See page 28)*
13896-L_A-L_V	37 # 20 AWG Wires	7.5a	Mil-W-16878E/5 Teflon,® 1000V, 19x	12474
13897-L_A-L_V	20 Duplex Pairs of ISA Type E, #20 AWG	N/A	Teflon® Insulation ISA Color Codes	12475
26787-L_A-L_V	20 Duplex Pairs of ISA Type J, #20 AWG	N/A	Teflon® Insulation ISA Color Codes	12476
26788-L_A-L_V	20 Duplex Pairs of ISA Type K, #20 AWG	N/A	Teflon® Insulation ISA Color Codes	12477
13898-L_A-L_V	20 Duplex Pairs of ISA Type T, #20 AWG	N/A	Teflon® Insulation ISA Color Codes	12478
13899-L_A-L_V	24 #16 AWG Wires	25a	Mil-W-16878E/5 Teflon® , 1000V, 19x	12479
13901-L_A-L_V	12 #12 AWG Wires	40a	Mil-W-16878E/5 Teflon® , 1000V, 19x	12480

To Order Harness Feedthrus:
Wire Harness Feedthrus are specified by the catalog number followed by two dash numbers. The dash numbers are cable lengths (in feet) expressed as follows: First dash number is L_A, the **A** side length and the second dash is L_V, the **V** side length. For example a 13898-17-28 is a catalog number 13898 containing 20 duplex pairs of #20 AWG ISA Type T thermocouple wire 17 feet long on the **A** side and 28 feet long in the **V** side.

PotCon™ Connector Model RFW Receptacle/Wire



Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Flange and Hardware

Flange:
300 Series Stainless Steel, Knife Edge Design

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to $1x10^{-8}$ mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

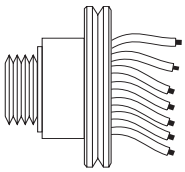
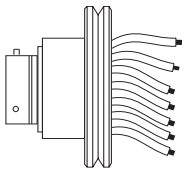
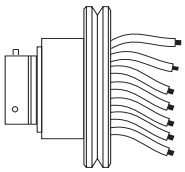
To order a PotCon™ Hermetic Connector:
Specify the catalog number and add as a suffix a dash number, the length of the **V** side wire harness in feet. There is no cable jacket sleeve on the **V** side harness.

To order an unassembled Mating Connector:
Prefix an **A** to the catalog number (use the number only) of the PotCon™ Connector you selected. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

To order a Mating Harness-and-Connector:
Prefix an **A** to the catalog number (use the number only) as above, then add as a suffix a dash number which will be the mating cable harness length in feet, e.g.: A24712-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and jacketed with polyester expandable sleeving. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

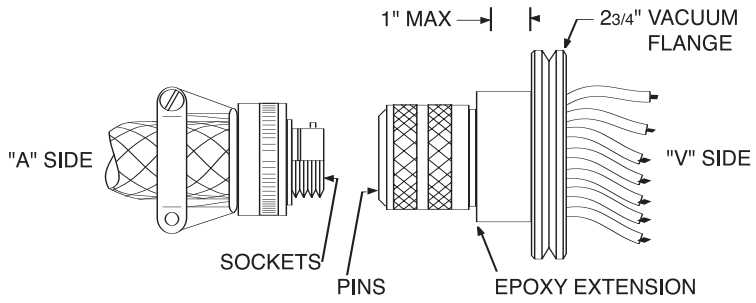
Complete ordering instructions are on the inside back cover of this catalog.

A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details*.

RFW **Catalog No.**										
Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24700	24703	24708	--	24721	24726	--	--	24745	--
	4	24701	24704	24709	24718	--	--	--	24739	24746	--
	5	--	24705	24710	--	24722	--	--	24740	24747	--
	6	--	--	24711	--	--	24728	24736	--	24748	24757
	7	24702	24706	24712	--	--	--	--	--	24349	--
	8	--	24707	24713	24719	24723	24729	--	24741	24750	--
	11	--	--	24714	--	24724	--	24737	24742	--	--
	19	--	--	24715	24720	--	24730	24738	--	24751	--
	21	--	--	--	--	24725	--	--	24743	--	--
	26	--	--	24716	--	--	24731	--	--	24752	--
	29	--	--	--	--	--	--	--	24744	--	--
	32	--	--	--	--	--	24732	--	--	24753	--
	41	--	--	--	--	--	24733	--	--	24754	--
	48	--	--	24717	--	--	--	--	--	--	--
	55	--	--	--	--	--	24734	--	--	24755	24758
	61	--	--	--	--	--	24735	--	--	24756	--
	100	--	--	--	--	--	--	--	--	--	24759
	128	--	--	--	--	--	--	--	--	--	24760

PotCon™ Connector Model PFW Plug/Wire



Specifications

Connectors and Cable Clamps

Connector Body Material:
Aluminum, Electroless Nickel Plated

Cable Clamp Material:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
#8 AWG are Silver on Copper
#12 AWG- #22 AWG are Gold on Copper
(See Page 36 for Thermocouple Alloys)

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Flange and Hardware

Flange:
300 Series Stainless Steel, Knife Edge Design

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to $1x10^{-8}$ mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*

To Order PotCon™ Connectors & Accessories

PotCon™ Connectors, unassembled Mating Connectors, and Mating Harness-and-Connectors are all ordered as separate items.

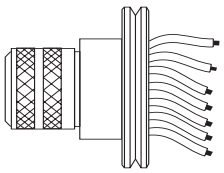
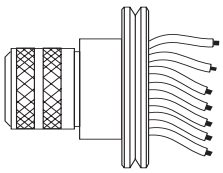
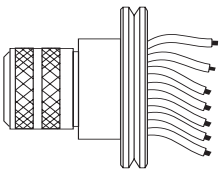
To order a PotCon™ Hermetic Connector:
Specify the catalog number and add as a suffix a dash number, the length of the **V** side wire harness in feet. There is no cable jacket sleeve on the **V** side harness.

To order an unassembled Mating Connector:
Prefix an **A** to the catalog number of the PotCon™ Connector you selected. Contacts are included at no charge. To order a crimp tool for the contacts, *see page 38*.

To order a Mating Harness-and-Connector:
Prefix an **A** to the catalog number (use the number only) as above, then add as a suffix a dash number which will be the mating cable harness length in feet, e.g.: A24812-17 is an **A** side harness-and-connector with 17 feet of cable. Harnesses are provided fully assembled and jacketed with polyester expandable sleeving. Wire conforms to MIL-W-16878E/5, 1000V, TEFLON® insulated, silver plated, stranded conductors.

Complete ordering instructions are on the inside back cover of this catalog.

A full line of optional designs and accessories are available for PotCon™ Connectors including hand crimp tooling, thermocouple alloy pins and sockets, alternate housing designs and sizes plus alternate insert arrangements. *See the Table of Contents on page 13 for more details.*

PFW **Catalog No.**										
Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	24800	24803	24808	--	24821	24826	--	--	24845	--
	4	24801	24804	24809	24818	--	--	--	24839	24846	--
	5	--	24805	24810	--	24822	--	--	24840	24847	--
	6	--	--	24811	--	--	24828	24836	--	24848	24857
	7	24802	24806	24812	--	--	--	--	--	24849	--
	8	--	24807	24813	24819	24823	24829	--	24841	24850	--
	11	--	--	24814	--	24824	--	24837	24842	--	--
	19	--	--	24815	24820	--	24830	24838	--	24851	--
	21	--	--	--	--	24825	--		24843	--	--
	26	--	--	24816	--	--	24831	--	--	24852	--
	29	--	--	--	--	--	--	--	24844	--	--
	32	--	--	--	--	--	24832	--	--	24853	--
	41	--	--	--	--	--	24833	--	--	24854	--
	48	--	--	24817	--	--	--	--	--	--	--
	55	--	--	--	--	--	24834	--	--	24855	24858
	61	--	--	--	--	--	24835	--	--	24856	--
	100	--	--	--	--	--	--	--	--	--	24859
	128	--	--	--	--	--	--	--	--	--	24860

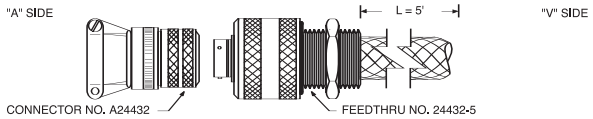
Mating Connectors and Connector-Harness Assemblies

The connector-only or connector-and-harness assembly for either side of a feedthru is specified individually. The specification is based upon the feedthru catalog number which you should have already selected. (Examples below also apply to Flange Mounted Feedthrus.)

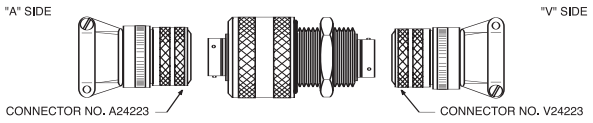
Unassembled Mating Connector:

To specify an unassembled Mating Connector for one of the feedthru sides, prefix the letter **A** or **V** to the feedthru catalog number.

For example, you have selected Feedthru Catalog No. 24432-5 and want to order the **A** side unassembled mating plug only. The catalog number of the mating connector shown at right (**A** side) is A24432.



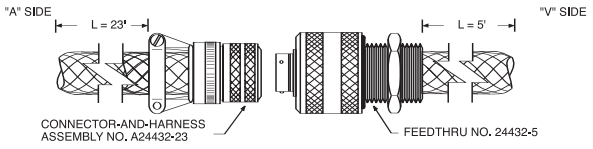
Or, another example



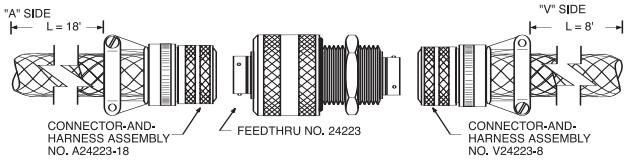
Mating Connector-And-Harness Assemblies:

To specify a connector-and-harness assembly for either side, prefix the letter **A** or **V** to the feedthru catalog number and add as a dash number the length (L) in feet of the assembly.

For example, you have selected Feedthru Catalog No. 24432-5 and want to order the mating Connector-and-Harness assembly which you want to be 23 feet long.



Or, another example



General Specifications:

(For unassembled Mating Connectors and Connector-and-Harnesses)

All connectors-only are provided complete with pins or sockets and insertion/extraction tool. Connectors are aluminum with electroless nickel plating. Strain relief back shell is also aluminum with electroless nickel. Screws are stainless steel. *Please see page 39 for alternate insert arrangements.*
For crimp tooling see page 38.

All connector-and-harness assemblies are provided fully assembled and tested at rated component voltage. Ends may be skinned and tinned 0.25". Harness wire ends will be tagged with connector contact number. Wires have silver plated, stranded conductors with 1000V Teflon® insulation (MIL-W-16878E/5). All **A** side harnesses are sleeved with expandable polyester braid. **V** side harnesses on Face Seal models will be covered with Halar® expandable braid. **V** side harnesses on Vacuum Flange Models are not sleeved.

Specials:

We can provide a mate/harness to virtually any customer requirement using other wires/stranding/plating/insulation, etc. Contact us for details.

PotCon™ Hermetic Connectors for Fiber Optics and Coaxial Cables

Specifications

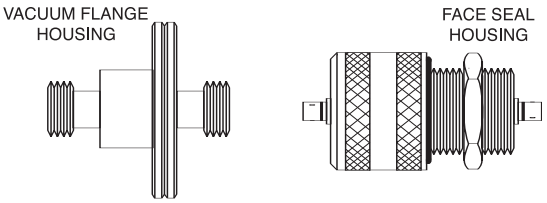
PotCon™ Face Seal Housing

Housing and Jam Nut:
300 Series Stainless Steel. *See page 11 for dimensions.*

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

PotCon™ Vacuum Flange

Flange:
300 Series Stainless Steel. *See page 11 for dimensions.*



Limits and QC Testing:
Helium leak <$5x10^{-8}$ cc/sec
Vacuum levels to $1x10^{-8}$ mm Hg
Assembly is hipot tested @ connector rating
Temperature Range: -40°F to +250°F *(see page 57)*
For electrical assemblies, connector shell "floats".

OptiSeal™ Optical Fiber Hermetic Connectors

Attenuation in optical fiber feedthrus is primarily a function of the connector's limits (as installed). For a virtually ZERO attenuation feedthru, you can specify a custom designed and fabricated direct optical fiber feedthru where the fiber itself is sealed within the housing or flange and the fiber extends out from each end to any length specified.

Because the fiber is not interrupted within the housing, negligible attenuation is introduced.

Custom Fiber Optic Feedthru:
If a "standard" design OptiSeal™ Feedthru doesn't fit your requirements, *please see page 8*, or call **Toll Free at 1.800.533.8068** for a full discussion of alternatives.

Connector Type	Fiber Size	1" Face Seal	1.25" Face Seal	2.75" Vacuum Flange
Biconic	125 NM	25300	25310	25320
2.5 MM Bayonet	125 NM	25301	25311	25321
SMA (Stainless Steel)	100-140 Microns	25302	25312	25322
SMA (Stainless Steel)	50-125 Microns	25303	25313	25323

Coaxial Cable Connector Hermetic Feedthrus

Coaxial Connector Type	Nominal Cable Impedance	Withstand Voltage	1" Face Seal	1.25" Face Seal	2.75" Vacuum Flange
BNC	50Ω	500 VAC	25400	25407	25414
SMA	50Ω	500 VAC	25401	25408	25415
N	50Ω or 50Ω	1500 VAC	25402	25409	25416
Triaxial	50Ω	1500 VAC	25403	25410	25417
UHF	Non-constant	500 VAC	25404	25411	25418
SHV	N/A	3500 VAC	25405	25412	25419
MHV	N/A	5000 VAC Non-constant	25406	25413	25420

*Housing dimensions are given on page 11.
To order PotCon™ Hermetic Feedthrus: For electrical assemblies, select the feedthru configuration. Order by catalog number. For OptiSeal™ fiber optic feedthrus, contact us Toll Free at **1.800.533.8068** to discuss the internal fiber specifications. Complete ordering instructions are on the inside back cover of this catalog.

Thermocouple Alloy PotCon™ Connectors

We offer three alternates for Hermetically Sealed Connectors-and-Harnesses needing Thermocouple Alloys. They are:

A- Use copper conductors in the T/C circuit.

B- Specify connectors and harnesses which will use T/C alloy contacts and T/C alloy extension lead wires.

C- Feed T/C lead wire directly through the bulkhead with our Direct Wire Harness Feedthru.

These alternates are detailed below.

Alternate A

Standard Connectors with Copper Contacts

Some applications can tolerate a combination of T/C lead wires with copper leads. Here the T/C alloy lead wires are routed up to but not thru the bulkhead connector set. Standard copper contacts are fed thru the bulkhead connector set, then alloy lead wires are used again on the other side. Technical issues to resolve should include the loss of accuracy due to thermal gradients across the (copper) bulkhead connector set. A significant advantage of this approach is the lower cost of the (copper) connector set and shorter lead times.

To order PotCon™ Connectors for Alternate A, specify the catalog number of the connector/harness set you need.

Alternate B

Thermocouple Alloy Contacts in the Connectors

Our PotCon™ Hermetic Connector line can use T/C alloy pins, sockets, and interconnecting wires. The advantage of using alloy contact materials over Alternate A is in the accuracy of the thermoelectric reading. This advantage can be lost if cost or lead time is an important factor since alloy contacts are very expensive and can add substantially to lead times.

To order PotCon™ Connectors with Thermocouple Alloy Contacts, specify the catalog number of the PotCon™ Connector selected and add the ISA type code from the alloy data on page 37. For example, 24014 TYPE J specifies a catalog 24014 PotCon™ Connector with ISA TYPE J (Iron vs. Constantan) contacts. The negative and positive alloys *(see the chart on page 37)* will be assigned alternating connector positions starting with odd in the lowest (or "A") position. For connectors with an odd total number of contacts, the last contact position will be a single copper wire or contact.

Where the PotCon™ Connector specified has a wire harness or for mating harness-and-connectors. the thermocouple wire will be Extension Grade Duplex wire with Teflon® insulation. ISA Color Codes will be used for the wire and the tagged number will be the "lower" of the two contact positions occupied by the Duplex pair.

(See the Connector Contact Availability chart on page 37).

Alternate C

Direct T/C Leadwire Feedthrus

We can provide hermetic seals directly on any thermocouple lead wire. This allows you to route your T/C lead wires directly through the bulkhead with no interruption whatsoever. Contact resistance and/or corrosion, breakage, and gradient problems are eliminated and the frequently long lead times and high costs associated with T/C alloy connector contacts are avoided.

With our direct T/C lead wire feedthrus you may either select from our standard harness designs for both Face Seals and Vacuum Flanges or you can design-it-yourself (or ask for assistance) using the ReadySeal Feedthru designs starting on page 2.

Thermocouple Alloy PotCon™ Connectors

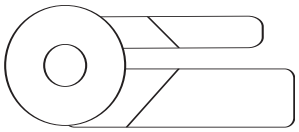
Availability of Thermocouple Alloys Contacts

MIL Spec	MIL-C-5015 MIL-C-83723 II			MIL-C-83723 I MIL-C-26482 2			MIL-C-38999 I			
Connector Type	Standard Circular w/Threaded Coupling			Miniature Circular w/Bayonet Coupling			Scoop Proof Miniature Circular w/Bayonet Coupling			
Contact (AWG)	8	12	16	12	16	20	12	16	20	22
Copper	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constantan	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Chromel	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Alumel	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

Thermocouple Alloy Data

ISA Code	Alloy	Color Codes	Limits of Error (Whichever is greater) Doesn't include use or installation errors. For reference only.	Range for Thermocouple Centigrade	Fahrenheit
E	Chromel Vs. Constantan	Purple+ Red-	±1.7°C or ±0.50% ±1.7°C or ±1.0%	0 to 900 -200 to 0	32 to 1652 -328 to 32
J	Iron Vs. Constantan	White+ Red-	±2.2°C or ±0.75%	0 to 750	32 to 1382
K	Chromel Vs. Alumel	Yellow+ Red-	±2.2°C or ±0.75% ±2.2°C or ±2.0%	0 to 1250 -200 to 0	32 to 2282 -328 to 32
T	Copper Vs. Constantan	Blue+ Red-	±1.0°C or ±0.75% ±1.0°C or ±1.50%	0 to 350 -200 to 0	32 to 662 -328 to 32

Connector Specifications and Crimp Tooling



MIL Spec	MIL-C-5015 MIL-C-83723 Series II	MIL-C-83723 Series I MIL-C-26482 Series 2	MIL-C-38999 Series I
Connector Type	Standard Circular	Miniature Circular	Scoop Proof Miniature Circular
Coupling	Threaded	Bayonet	Bayonet

Connectors

Plugs **Receptacles**	MS 3456 MS 3451	MS 3476 MS 3471	MS 27467 MS 27466
Connector Class	R	L (Fluid Resistant)	T (Environment Resistant)
Shell Material	Aluminum Alloy	Aluminum Alloy	Aluminum Alloy
Finish	Electroless Nickel	Electroless Nickel	Electroless Nickel
Elastomer	Silicone Rubber	Silicone Rubber	Silicone Rubber
Insulator	Rigid Dielectric	Rigid Dielectric	Rigid Dielectric
Contact Material	Copper Alloy	Copper Alloy	Copper Alloy
Plating	#16 AWG Gold on Nickel #8 & #12 AWG Silver	Gold per MIL-G-45204	Gold Plating
Polarization	Key & Keyway	5 Way Key	5 Way Key
Contact Termination	Crimp, Rear Release	Crimp, Rear Release	Crimp, Rear Release

Crimp Tools *(Listed as: tool/positioner)*

#8 AWG	25500/25501 *(see note)*	N/A	N/A
#12 AWG	25502/25503	25502/25503	25502/25504
#16 AWG	25502/25503	25502/25503	25502/25504
#20 AWG	N/A	25502/25503	25502/25504
#22 AWG	N/A	N/A	Pins: 25505/25506 Sockets: 25505/25507

Note: Crimp Tool catalog No. 25500 is pneumatically operated. Contact us Toll Free at **1.800.533.8068** for details. All other tools are hand operated. Tools are furnished with instructions and required gauges for operation.

Alternate Connector Insert Positions

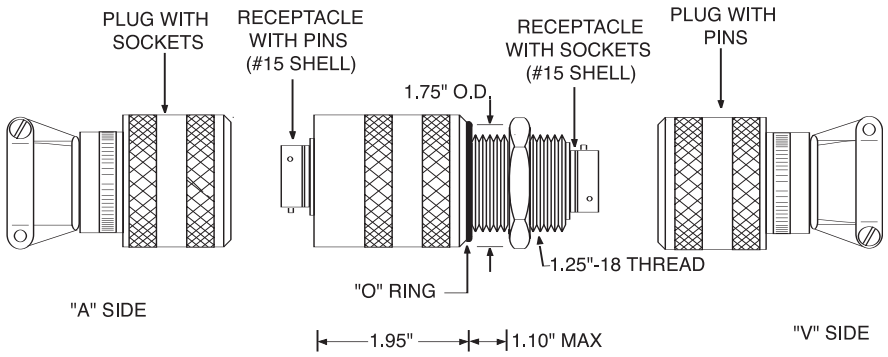
Configurations listed are for alternate positions available. Listing the displacement angles from the N, or Normal, position is beyond the scope of this guide, but we can supply the MIL-Spec diagrams upon request. To order PotCon™ Connectors with Alternate Insert Positions, specify the PotCon™ Connector catalog number and note "Alternate Insert Position__" with each item ordered. NOTE that you must explicitly specify alternate for each component (PotCon™ , Mates, and Mating Harness-and-Connectors). Unless specified, the N position will be provided.

Connector Type	Standard Circular			Miniature Circular			Scoop Proof Miniature Circular			
Coupling	Threaded			Bayonet			Bayonet			
MIL Spec	MIL-C-5015 MIL-C-83723 Series II			MIL-C-83723 Series I MIL-C-26482 Series 2			MIL-C-38999 Series I			
MS No. Plug	MS 3456			MS 3476			MS 27467			
MS No. Receptacle	MS 3451			MS 3471			MS 27466			
Amps/Contact	46	23	13	23	13	7.5	23	13	7.5	5
Test Voltage@Sea Level	2000	2000	1000	1500	1500	1500	1800	1800	1800	1300
Test Voltage@Altitude	N/A	N/A	N/A	375	375	375	200	200	200	200
AWG of Contacts	8	12	16	12	16	20	12	16	20	22

Number of Contacts											
	3	NWXYZ	NWXY	NWXY	--	NY	NWX	--	--	NAD	--
	4	NXY	NXY	NXY	NW	--	NW	--	NABCD	NABCD	--
	5	--	NXY	NXY	--	NWXYZ	--	--	NABCD	NABCD	--
	6	--	--	N	--	--	NW	NABCD	--	NABCD	NABCD
	7	NWZ	NWZ	NWZ	--	--	--	--	--	NABCD	--
	8	--	NWY	NWXYZ	NW	NWXYZ	NWXYZ	--	NABCD	NABCD	--
	11	--	--	N	--	NWXYZ	--	NABCD	NABCD	--	--
	19	--	--	NWZ	NWXY	--	NWXY	NABCD	--	NABCD	--
	21	--	--	--	--	NWXYZ	--	--	NABCD	--	--
	26	--	--	NWXY	--	--	NWYZ	--	--	NABCD	--
	29	--	--	--	--	--	--	--	NABCD	--	--
	32	--	--	--	--	--	NWXYZ	--	--	NABCD	--
	41	--	--	--	--	--	NWXYZ	--	--	NABCD	--
	48	--	--	NWXYZ	--	--	--	--	--	--	--
	55	--	--	--	--	--	NWXYZ	--	--	NABCD	NABCD
	61	--	--	--	--	--	NWXYZ	--	--	NABCD	--
	100	--	--	--	--	--		--	--	--	NABCD
	128	--	--	--	--	--	--	--	--	--	NABCD

PotCon™ Bulkhead Connector Set*

37 #22 AWG Contacts, 1.250" Mounting Hole, Hermetically Sealed



* Includes all mounting hardware, "O" Ring, mating connectors and contacts for both Atmosphere and Vacuum sides, and cable clamps.

Specifications

Connectors and Cable Clamps

Specifications:
MIL-C-38999 Series I, Miniature Circular, Scoop Proof, Bayonet Coupling, MS 27467 and MS 27466, #15 Shell Size.

Connector Body and Cable Clamps:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
Copper, Gold Plated
#20 AWG (Solid only, not stranded), #22 AWG, and #24 AWG wires may be crimped into the #22 AWG contacts provided.

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing & Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Vacuum Outgassing (Tests of Epoxy):
25mm^2 x 1mm sample at 125° vs. optical condensing Surface at 25°C, <1x10^{-6}mm Hg. Results: <0.22% Wt Loss and <0.002% VCM. No visible deposits on the condensing plate.

Limits and QC Testing:
Helium leak <1x10^{-8} cc/sec
Vacuum levels to 1x10^{-8} mm Hg
Assembly is hipot tested @ 1300VAC
Temperature Range: -40°F to +250°F *(see page 57)*

Ordering Information

Complete sets are specified by our Catalog Number **26064.**

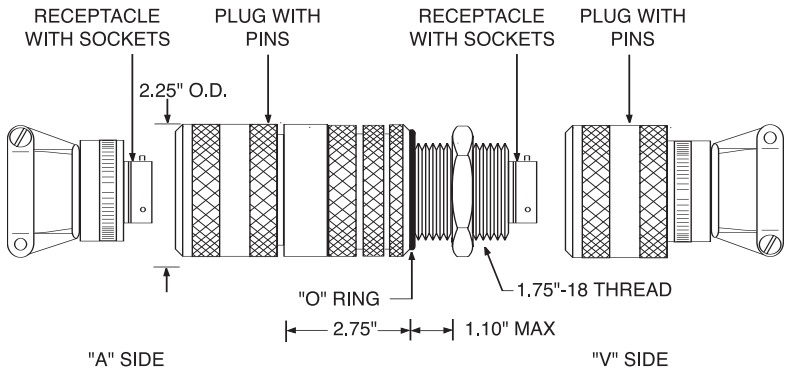
Delivery:
Stock to 4 weeks

Options:
Many alternate configurations are available. These include:

- Thermocouple contacts
- Wire harness feedthru seals
- Other combinations of plugs and receptacles
- Alternate clocking arrangements

PotCon™ In-Line Bulkhead Connector Set*

128 #22 AWG Contacts, 1.750" Mounting Hole, Hermetically Sealed



* Includes all mounting hardware, "O" Ring, mating connectors and contacts for both Atmosphere and Vacuum sides, and cable clamps.

Specifications

Connectors and Cable Clamps

Specifications:
MIL-C-38999 Series I, Miniature Circular, Scoop Proof, Bayonet Coupling, MS 27467 and MS 27466, #15 Shell Size.

Connector Body and Cable Clamps:
Aluminum, Electroless Nickel Plated

Hardware Material:
Stainless Steel

Pins and Sockets:
Copper, Gold Plated
#20 AWG (Solid only, not stranded), #22 AWG, and #24 AWG wires may be crimped into the #22 AWG contacts provided.

All Connectors Have:
Insert Position N
Elastomeric Interfacial Seals

PotCon™ Seal: Housing and Hardware

Housing & Jam Nut:
300 Series Stainless Steel

"O" Ring:
Nitrile Rubber

Epoxy Sealant:
Low outgassing material *(See page 60 for details)*

Vacuum Outgassing (Tests of Epoxy):
25mm^2 x 1mm sample at 125° vs. optical condensing Surface at 25°C, <1x10^{-6}mm Hg. Results: <0.22% Wt Loss and <0.002% VCM. No visible deposits on the condensing plate.

Limits and QC Testing:
Helium leak <1x10^{-8} cc/sec
Vacuum levels to 1x10^{-8} mm Hg
Assembly is hipot tested @ 1300VAC
Temperature Range: -40°F to +250°F *(see page 57)*

Ordering Information

Complete sets are specified by our Catalog Number **26269.**

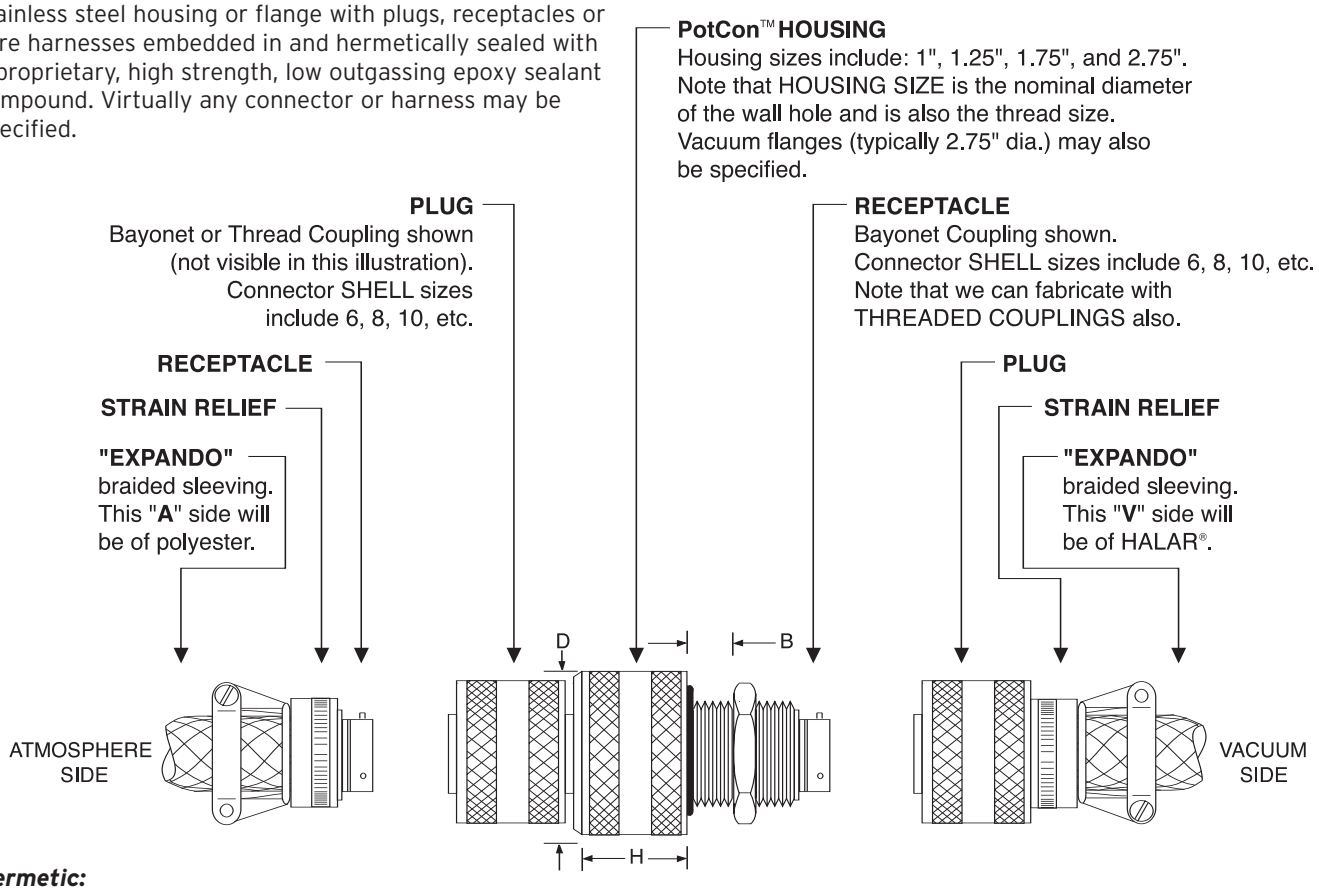
Delivery:
Stock to 4 weeks

Options:
Many alternate configurations are available. These include:

- Thermocouple contacts
- Wire harness feedthru seals
- Other combinations of plugs and receptacles
- Alternate clocking arrangements

PotCon™ Hermetic Connectors Nomenclature

A PotCon™ Hermetic feedthru Connector consists of a stainless steel housing or flange with plugs, receptacles or wire harnesses embedded in and hermetically sealed with a proprietary, high strength, low outgassing epoxy sealant compound. Virtually any connector or harness may be specified.



Hermetic:
After 5 minutes exposure to 100% Helium on side "**A**" and vacuum on side "**V**", the detectable leakage shall be less than 5 x 10^{-8} std cc He/sec.

Hsg	Thread	D	B	H
1	1.00"-20	1.63"	1.10"	1.72"
2	1.25"-18	1.75"	1.10"	1.95"
3	1.75"-18	2.25"	1.10"	2.75"
4	2.75"-16	3.50"	1.10"	3.56"

The "**V**", or vacuum, or inside-the-glovebox side usually has **Sockets** in the connector because power is normally fed from the "**A**" side to the "**V**" side. The socket configuration is partially shrouded as a means of preventing short circuits or shocks.

We can fabricate PotCon™ assemblies with either **Plugs** or **Receptacles** or **Wire Harnesses** in either or both ends. Additionally, the **Contacts** in the connector **Shell** may be either **Pins** or **Sockets** on either side of the Potcon™ **Housing** depending on customer preference. (See note above.)

The MIL-Connector Series offered in this line include:
- **MIL-C-5015**
- **MIL-C-83723 Series I & II**
- **MIL-C-26482 Series 1 & 2**
- **MIL-C-38999 Series I**

All the contact configurations available for these series can be fabricated in Hermetically Sealed versions. *See our* ***Connector Configurations*** *on page 43*. Wire is per MIL-W-16878/5 (Teflon® insulation, stranded, plated conductors.)

Notice...
You never want to specify either:
- **Pins on both sides of Potcon™ or**
- **Sockets on both sides of Potcon™**

Never.....ever.
You will have major clocking problems with the mating connectors.

PotCon™ Hermetic Connectors

Connector Configurations

This is a compilation of popular contact configurations for our three standard MIL-connector series. We offer all of them as hermetically-sealed assemblies. Configurations marked • are described in detail (for Contact sizes #8...#22 AWG) on pages 14 through 33.

# of Contacts	MIL-C-5015 MIL-C-83723 II Standard Circular Threaded Coupling AWG 0	4	8	12	16	MIL-C-83723 I MIL-C-26482 2 Miniature Circular Bayonet Coupling AWG 12	16	20	MIL-C-38999 I Scoop Proof Miniature Circular Bayonet Coupling AWG 12	16	20	22
1	1	1	1	1	1							
2	2	2		2	2			2		2		
2		1			1							
2	1			1								
3 •			3	3	3		3	3			3	
3				2	1							
3			1		2							
4 •	4	4	4	4	4	4		4		4	4	
4	1				3							
4			1	3								
4				2	2							
4			2		2							
5 •		5		5	5		5			5	5	
5			2		3	4		1				
5		3			2							
5		2		1	2							
5			2	3								
5		2		3								
5	2			3								
6 •					6			6	6		6	6
6				2	4							
6			2		4							
6			3		3							
6		3			3							
6				5	1							
6	3			3								
6	2	4										
7 •			7	7	7						7	
7				2	5							
7			1	3	3							
7		2	2	3								
8 •				8	8	8	8	8		8	8	
8				1	7							
8	2			6								
9			3		6	4		5	9			
9				2	7							
9				1	8							
9			1		8							
9				3	6							
9	1	2		2	4							
10					10			10			10	
10			1		9							
10				4	6							
11 •					11		11		11	11		
11				2	9							
12					12	12						
12				6	6		4	8		4	8	
12				2	10							
13						8		5				13
14					14	6		8				
14				2	12							
14		2			12							
14				10	4							
15					15		1	14		1	14	
15	3	2	4	6		12		3				

# of Contacts	MIL-C-5015 MIL-C-83723 II Standard Circular Threaded Coupling AWG 0	4	8	12	16	MIL-C-83723 I MIL-C-26482 2 Miniature Circular Bayonet Coupling AWG 12	16	20	MIL-C-38999 I Scoop Proof Miniature Circular Bayonet Coupling AWG 12	16	20	22
16					16		16			16		
16				2	14							
17					17							
18								18			18	
19 •					19	19		19	19		19	
20					20							
21 •							21			21		
22												22
22				4	18							
22	2			2	18							
23					23							
23				5	18		2	21		2	21	
23		1		4	18		1	22				
23		2	3	2	16							
24					24			24			24	
24									12	12		
25	1	1	1	4	18						25	
26 •					26			26			26	
26	1			1	24							
27								27			27	
27						16		11				
28										2	26	
29 •										29		
29		4	9		16							
30				6	24		1	29		1	29	
31		1	2	14	14		31					
32 •								32			32	
32						6		26				
34								34			34	
35					35							
35				7	28							
36											36	
37					37							37
39							2	37		2	37	
41 •								41			41	
41							14	27				
43										20	23	
46					46							
47				1	46							
47				7	40							
47			1	22	24							
48 •					48							
52					52							
53											53	
54					54							
55 •								55			55	55
56				4	52					8	48	
60					60							
61 •								61			61	
66												66
67												67
79												79
85					85							
100 •												100
128 •												128

Sealed Studs/Motor Terminals

Our line of StudSeal™ Sealed Studs/Motor Terminals have been designed to offer a selection of solid copper, heavy current conductors sealed in a wide variety of standard housings... easy to specify and mount.

The environment to be sealed can range from high pressure to high vacuum, liquids or gasses and with a maximum current loading to 750 amps at 5KV.

The pressure environment seals on page 45 have been accepted for use in power transformers, and air conditioning and refrigeration hermetic compressors. Our materials have been subjected to rigorous testing in oils, R-12, R-22, R134a, and R-123 with no effect noted during elevated temperature exposure nor during numerous pressure cycles.

In vacuum systems ranging from "industrial" vacuums to high vacuums operating at 10^{-9} Torr, our studs have been successfully specified at significant cost savings.

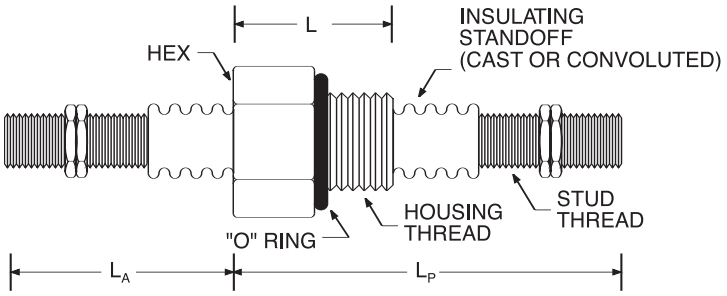
In addition to the standard models listed in the following pages, we can seal virtually any size or style stud in a housing of your choice, inexpensively priced, in quantities from single pieces to thousands per year.

Years of testing in actual field installations of refrigeration compressors have yielded no failures or defects.

Table of Contents

Studs for Pressure Applications

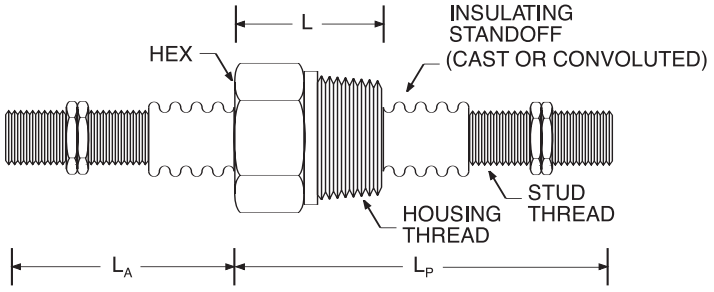
SAE Housing



Stud Thread	Housing Thread	Housing Material	L_A	L_P	L	HEX	Maximum Current	Catalog Number
1/4" - 20	3/4" - 16	S.S.	1.95"	3.14"	1.19"	1.0"	105 amps	27404
3/8" - 16	3/4" - 16	S.S.	1.95"	3.14"	1.19"	1.0"	275 amps	27405
1/2" - 13	7/8" - 14	S.S.	2.85"	2.51"	1.34"	1 13/16"	500 amps	27406
5/8" - 11	1 1/16" - 12	S.S	4.36"	3.31"	1.27"	1 3/8"	750 amps	27407

"O" Ring is nitrile rubber. See page 59 for mounting boss dimensions. S.S. = Stainless Steel.

NPT Housing



Stud Thread	Housing Thread	L_A	L_P	L	HEX	Maximum Current	Catalog Number
1/4" - 20	1/2" NPT	2"	3.09"	1.09"	7/8"	105 amps	27408
3/8" - 16	3/4" NPT	2"	3.17"	1.17"	1 1/8"	275 amps	27409
1/2" - 13	1" NPT	2"	3.36"	1.36"	1 3/8"	500 amps	27410
5/8" - 11	1" NPT	3.38"	4.29"	1.36"	1 3/8"	750 amps	26212

Specifications

Insulation: Epoxy

Standoff: Epoxy or Ryton

Conductor: Copper Alloy 110

Nuts: Brass, four per conductor

Operating Parameters

Pressure: To 5000 psi

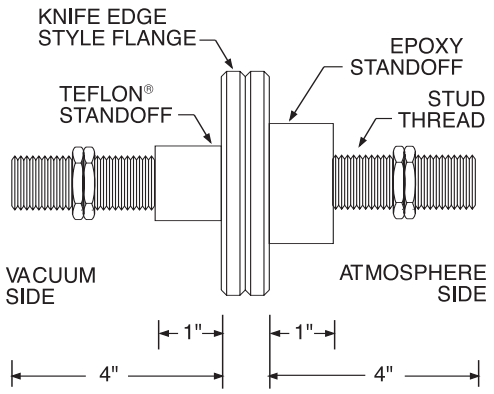
Temperature: -40°F to 400°F

Vacuum: To 29 in Hg
High vacuum should use our vacuum housings on page 46.

Voltage: 5KV
Voltage for 27406 and 27407 is limited to 1000V.

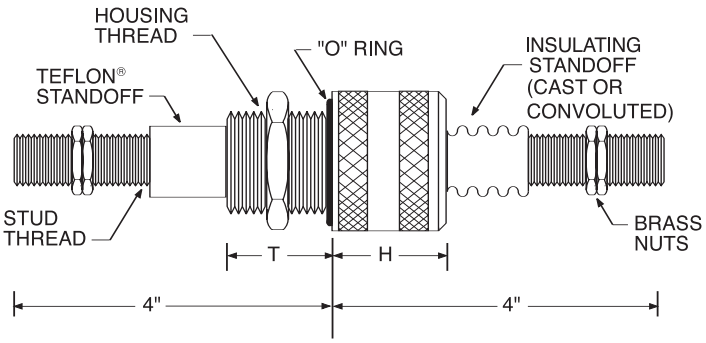
Studs for Vacuum Applications

Flange Housing



Flange Size	Stud Thread	Catalog Numbers			
		1 Stud	2 Studs	3 Studs	4 Studs
1.33"	3/8"-16	27387	N/A	N/A	N/A
2.75"	1/2"-13	27388	N/A	N/A	N/A
2.75"	5/8"-11	27389	N/A	N/A	N/A
4.50"	3/8"-16	27391	27392	27393	27394
4.50"	1/2"-13	27395	27396	27397	N/A

"O" Ring Face Seal Housings



Stud Thread	Catalog Numbers	
	1"-20 HSG	1 1/4"-18 HSG
3/8"-16	27398	27399
1/2"-13	N/A	27401
5/8"-11	N/A	27403

Size of Stud	Ampacity in Vacuum
3/8"	137 Amps
1/2"	250 Amps
5/8"	375 Amps

Housing Thread	T	H
1"-20	1.25"	1.88"
1.25"-18	1.25"	1.63"

Specifications

Materials

Housing: Stainless Steel

Conductor: Copper

Standoff: Epoxy or Ryton

Sealant: Low outgassing epoxy, see page 60

Nuts: Brass, four per conductor

"O" Ring: Nitrile Rubber

Operating Parameters

Pressure: To 25 psi

Temperature: -40°F to 225°F

Vacuum: To 10^{-9} Torr

Voltage: To 5KV

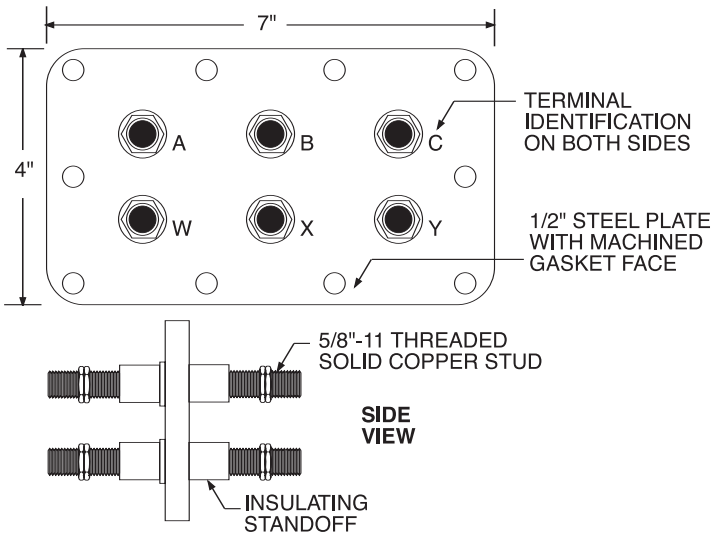
Leak Rate: <1 x 10^{-8} cc/sec (He)

Terminal Plate Feedthru Seals

Terminal Plate Feedthru Seals provide hermetic sealing capability for multi-conductor, medium to heavy current requirements. Here are some examples of successful designs. Call us to discuss your design requirements.

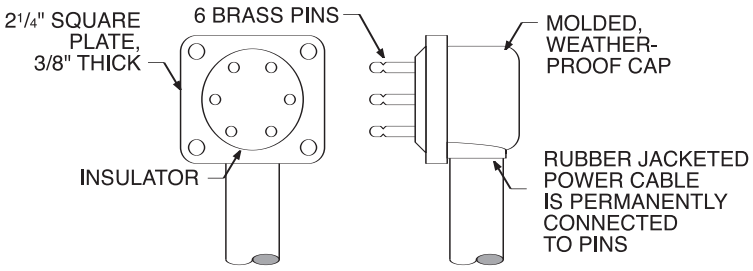
Stud Plate

Threaded, heavy current studs mounted through a large plate, hermetically sealed to 500 psi operating pressure (proof pressures to 1000 psi) and feed up to 750 amps at 440V through as many as 15 conductors per plate. Our helium leak rate is less than $1x10^{-8}$ cc/sec per conductor.



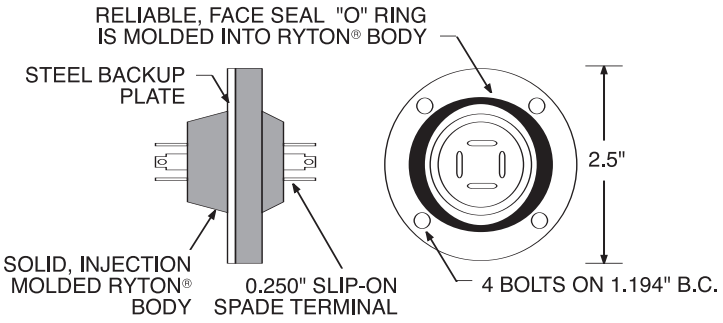
Pin Plate

Sealed copper alloy pins provide the convenience of individual slip-on terminals while offering reliability and vibration resistance.



Slip-on Plate

Standard 1/4" slip-on terminals are sealed within a solid, molded Ryton® body providing hermetically sealed penetrations to 350 psi (operating). Custom designs are easily accommodated for medium to high quantity production requirements.



These are three examples of our capacity to provide special feedthru plates for multi-conductor, medium to heavy current requirements. These plates can be used to penetrate hermetically sealed compressors with current loadings to 750 amps per leg, operating voltages to 440V, operating pressures to 350 psi (proof pressures to 1,000 psi) with as many as 15 conductors per plate. Our helium leak rate is less than $1x10^{-8}$ cc/sec per conductor.

Due to variations in mounting dimensions, conductor layouts and operating environments, feedthru plates must be custom application engineered to your specific requirements. We welcome your inquiries.

Unique Feedthru Systems

Multiple Feedthru Systems/Port Plates

In addition to providing a full line of hermetically sealed electric and fiber optic conductors. Douglas Electrical Components also offers to furnish complete, fully assembled and tested Multiple Feedthru Port Plates.

We can offer finished, ready-to-pump feedthru plates in heretofore unimaginable density and conductor counts, all from a single source, and ready to go.

Our 15 years of performance-proven experience is designed into each assembly. Our own vacuum test facility has a 3-foot diameter by 4-foot deep vacuum chamber for Helium leak testing. We have fabricated and vacuum tested feedthru assemblies that have weighed over one ton. This same chamber can be evacuated to 10^{-7} Torr at 300°F to outgas bake large plates or feedthru assemblies.

Electrical testing assures 100% performance and our hipot test gear has a capacity to test 1,024 leads at 1500VAC to each other and to ground. An automatic sequencing controller assures full conformance as well as preventing higher voltage inductive/capacitive kicks created by connectional switching.

We encourage your inquiries.

Specialty Feedthru Systems

We welcome challenging design problems and this section has been created to give you an overview of various products and services which have been developed in response to our customers needs for feedthrus.

The dynamic range of application environments for our feedthru products is astonishing, from 10^{-9} Torr through 15,000 psi and LHe (4°K) through 600°F.

We can provide a solution to your feedthru problem. Call us for an application engineering discussion.

Challenge Us!

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Multiple Feedthru Systems

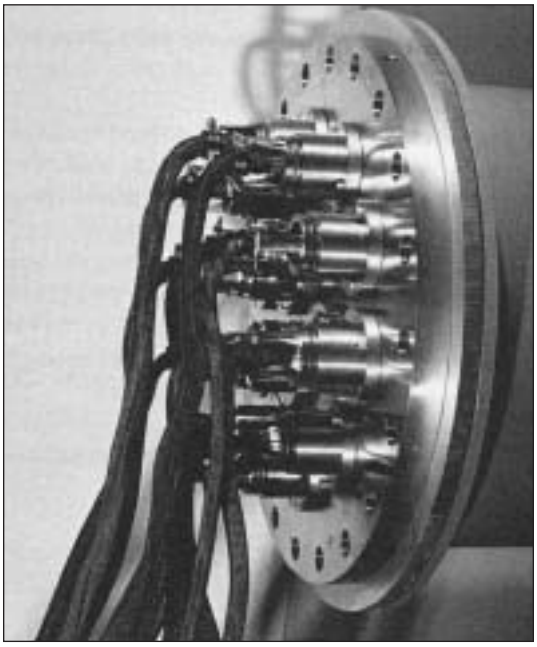
Specialty Feedthrus and Services

Multiple Feedthru Portplates

Pre-Assembled and Pre-Tested

Pre-assembled, pre-tested multiple feedthru portplates are available from 6" through 48" in diameter. Features include:

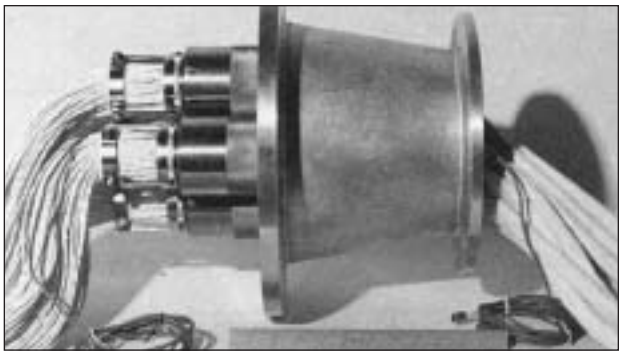
- Vacuum outgassing bakeout for components or entire assembly.
- Shipped to your facility as a complete assembly, ready to install and pump.
- Can be provided with or without connectors.
- Full Helium leak testing to less than 1 x 10^{-9} cc/sec per feedthru.
- Custom designed and fabricated.
- Over 15 years of field-proven experience.
- Full strain relief available.



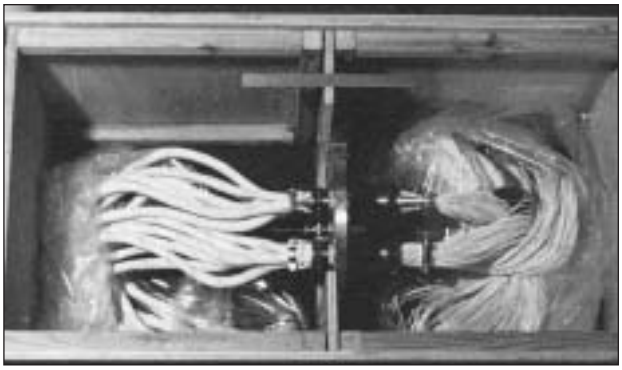
An assembled 36" port plate.

Layout Rules of Thumb

- Call us as early in the project as possible.
- PotCon™ connectors require a 2" minimum clearance around the housing for a hand access to tighten or loosen connector locking ring.
- Face seal housings for harness feedthrus (jam nut mounting) require a 1" minimum clearance for wrench access to make up the jam nut.
- Face mount housings (see page 50) require only a 1/2" clearance around the housing OD for the clamps (be sure to stagger the clamps of adjoining housings).
- Never try to fit too many feedthrus onto a plate, allow for unanticipated extra feedthrus.



A custom adapter port plate.



A large port plate assembly in its shipping crate.

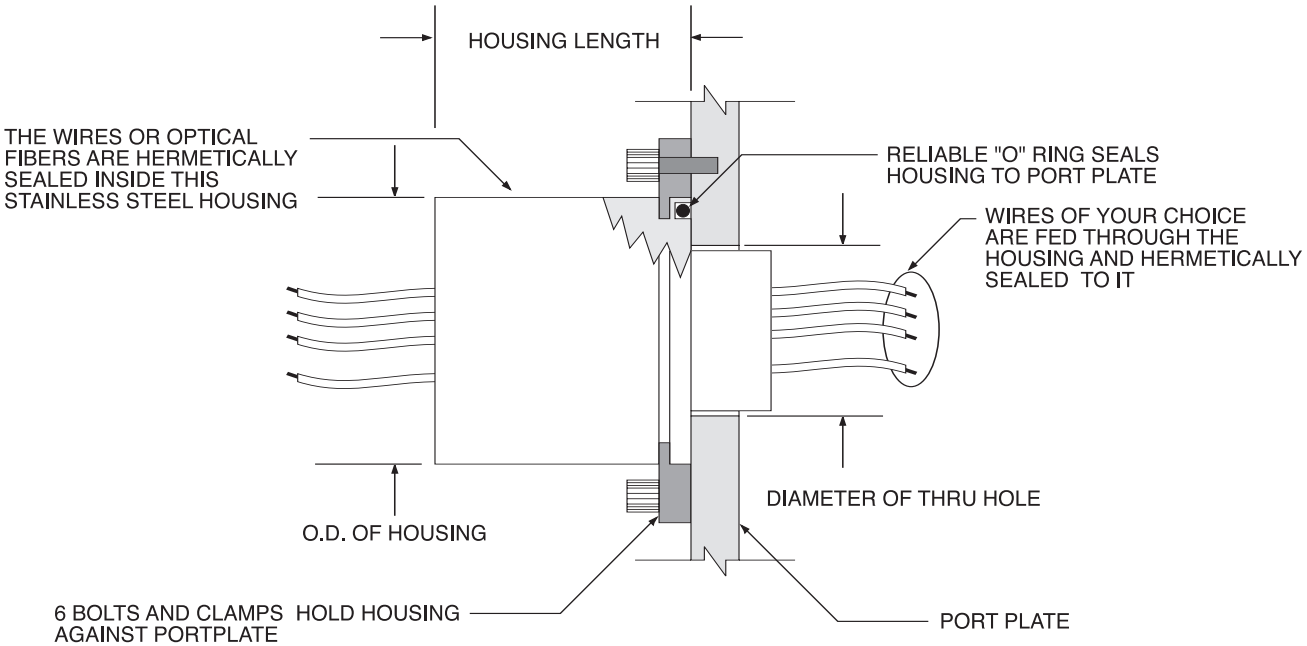
Face Mount Housings

Face Mounting Housings for Hermetic Feedthrus improve feedthru density and ease installation. Features include:

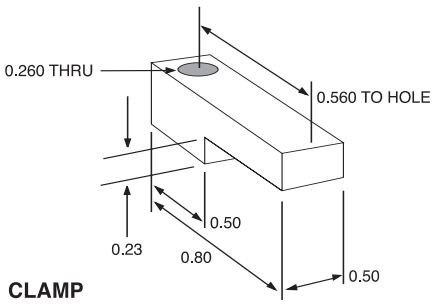
- Complete installation from the atmosphere side of the port plate.
- No nuts to turn inside chamber.
- Easy change-out of the "O" Ring (if ever needed).
- Broad range of housing sizes significantly increase the area available for your wires.
- Eliminate the tendency to tighten the housing rather than the jam nut (poor vacuum practice).
- Optional strain relief available for both ends.
- Allow much denser packing of feedthrus on your port plate.
- Allow easy visual (or physical) confirmation of complete torque-up of mounting bolts.

Nominal Size	2.75"	3.75"	4"
Diameter of thru hole	2.760"	3.260"	4.010"
OD of Housing	3.40"	3.88"	4.63"
Clamping Bolts,Bolt Circle	3.92"	4.40"	5.15"
Diameter of Spot Face	4.50"	5.00"	5.75"
Area Available for Wires (Sq. In.)	7.0	10.3	15.0
Housing Length	3.50"	3.50"	3.50"
* #20 AWG Wires	475	640	933
* #12 AWG Wires	145	200	285
* #20 AWG Twisted Shielded Pairs	80	110	160

* Typical Capacity of Housing



PARTIAL SECTION VIEWS SHOW "O" RING, HOUSING, AND CLAMPING SCHEME



CLAMP

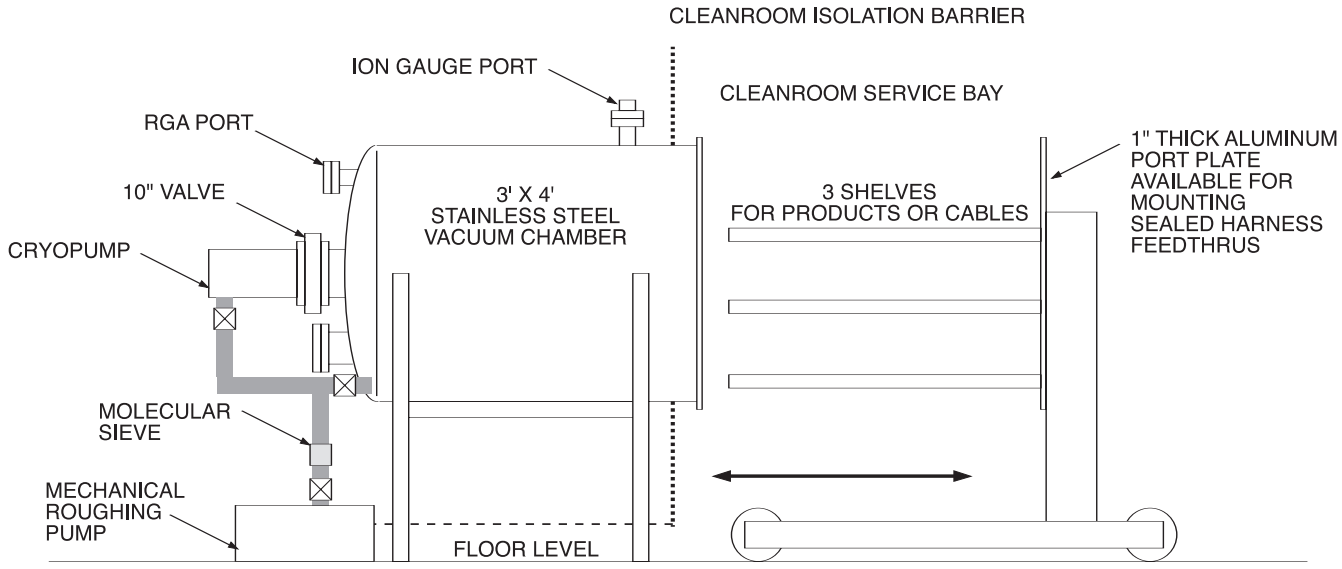
Vacuum Outgassing Service

We now offer Vacuum Outgassing Service for contract vacuum bakeout and cleanup of: Connectors, Harnesses, Feedthrus, Assemblies, and Components.

Note:
Some components may not be suitable for outgassing at the temperature and vacuum levels listed. Please contact us for a discussion of your needs.

Features:
- 300°F bakeout at $1x10^{-7}$ Torr
- 28 ft^3 chamber capacity
- Clean room service bay
- 12 zones of temperature monitoring to assure uniform heating
- Post-bakeout helium MSLD (non-contaminating) test capability for feedthrus or sealed articles
- Pre-bake (optional) up to 500°F to reduce chamber load and time
- RGA monitoring and certification available
- Witness plate verification available
- Three independent controllers assure overtemperature protection
- Distributed radiant heating eliminates cold spots
- Ion gauge with strip chart recorder output
- Large capacity, oil-free cryo-pumped high vacuum system
- Separate, high efficiency condensate collection system

We welcome your inquiries about this new, unique service.



We have installed a high capacity, vacuum bake outgassing facility at our Rockaway, NJ plant. Originally developed to service our line of hermetic feedthrus, its unique capability is now available to the Aerospace community on a contract basis. A typical outgassing contract would entail the following:

1. A wire harness or feedthru/harness assembly would be fabricated either by us or by others and received at our facility.

2. An optional pre-bake (up to 500°F) would be performed to reduce the vacuum oven gas load and schedule.

3. The article would then be placed in the vacuum oven, or in the case of a feedthru/harness it would then be "fed through" the oven's endplate.

4. The oven would then be preheated to the specified bake temperature while monitoring the thermocouple test points for hot spots. The oven would be vented to atmosphere during this procedure.

5. Upon reaching temperature, the mechanical roughing cycle would be initiated. Roughing proceeds until a maximum vacuum level of 100μ is reached.

6. At 100μ, valve sequencing would expose the heated oven to the cryo pump. Cryo pumping continues until either:
   a) the target vacuum level is attained for the specified time (e.g. 10^{-7} Torr for 72 hours), or
   b) the desired atmosphere in the chamber, as determined by the RGA, is achieved.

7. The chamber would then be back-filled with dry N_2, and upon cool down the product would be packaged in antistatic, heat sealed bags with optional dessicant.

Push-In Feedthru Seals

All models feature the ability to change conductor modules (feedthru seals) by abandoning the old module into a contaminated environment and inserting the new module from the outside.

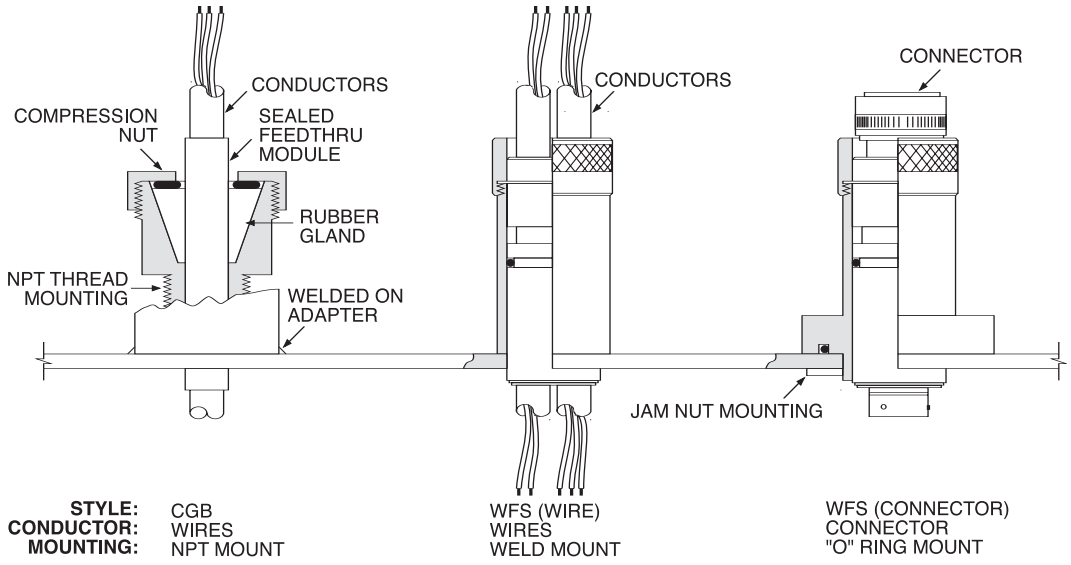
All leak paths are 100% sealed and tested with helium.

Three options allow NPT, "O" Ring, or weld mounts.

A wide variety of conductors may be specified, including:

- Wires, all alloys including thermocouples
- Cables
- Complete wire harnesses
- Shielded wires-including coaxial twisted pairs, etc.
- Connectors-either as a harness or cast as part of the conductor module
- Combinations- including wires on one side and connectors on the other

Contact us for a technical discussion about your specific needs.

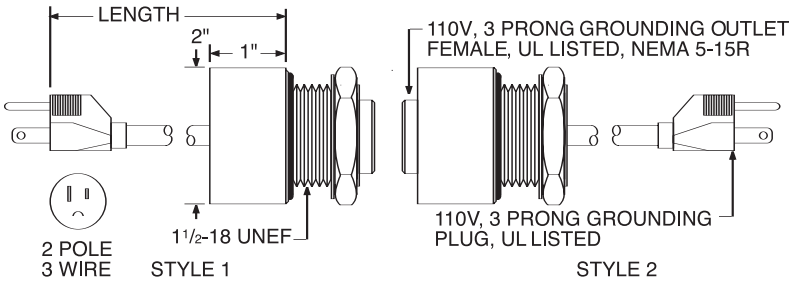


Convenience Feedthrus (110V)

Features:

- Convenient and easy
- Installs in box wall or blank glove port
- Choice of two models allows change to inside or to outside
- Provides a quick-fix 110 VAC outlet through a spare (or conveniently located) glove port
- Pre-tested and reliable
- Cost effective
- Custom models are readily available

Virtually any commercially available outlet or plug may be sealed using our procedures. For special applications, contact us Toll Free at 1.800.533.8068.



Both styles are supplied with "O" Ring, washer, and nut.

Wire-AWG	Length	Catalog Numbers Style 1	Style 2
14 AWG	(Potted Stub)	12628-1	12628-2
16 AWG	0'-6"	12646-1	12646-2
16 AWG	9'-0"	12629-1	12629-2

Solid Stainless Plug with no outlet... Catalog Number 12660

Feedthru Housings-Design Variations

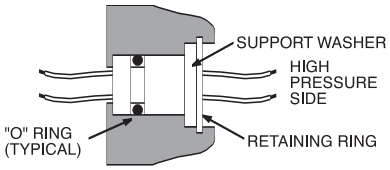


Figure 1
- An excellent design for high pressures.
- Removal requires access with a suitable tool.
- Difficult to verify full and complete installation of the retaining ring.
- Epoxy housings are generally suitable for most applications.

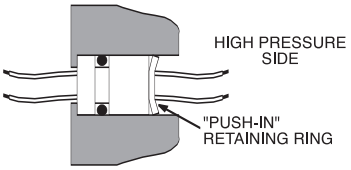


Figure 2
- Superior for high pressure.
- Installation is permanent. (Removal of retaining ring will leave deep scratches and will damage "O" Ring upon reinsertion.)
- Epoxy housings are generally suitable for most applications.

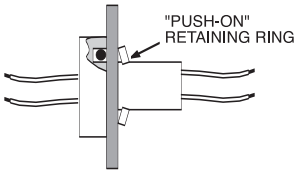


Figure 3
- "Semi-permanent" installation. (Removal of push-on is difficult and will probably damage the body.)
- Requires good surface finish on wall.
- Requires "forced bottoming" of the assembly to pre-load the face seal "O" Ring.

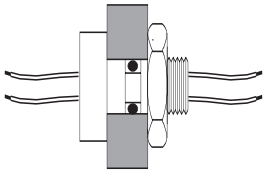


Figure 4
- Suitable for walls as thin as 0.100 inch.
- Easily removable with a suitable tool.
- Not recommended with epoxy body.

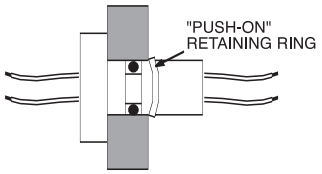


Figure 5
- Very fast assembly with push-on retaining ring.
- Suitable for both metal and epoxy bodies.
- "Semi-permanent" installation. (Difficult to remove the push-on ring.)

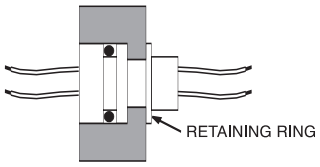


Figure 6
- For thick wall installation.
- Removal of ring requires access with a suitable tool.

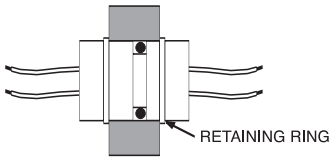


Figure 7
- With double chamfer, can be installed or removed from either direction.
- Minimum machining of the wall is required.

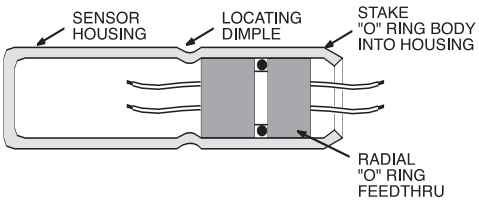


Figure 8
- Fast, inexpensive and extremely reliable for sealing transducer leads.
- Needs fewer solder points.
- Eliminates the need to weld a joint at the seal body.

High Pressure Feedthru Seals for 15,000 psi Service

Specifications

Materials

Housing: High strength epoxy resin and stainless steel composite housing

Seal: Epoxy, bonded to the conductor(s)

Conductor: Copper

"O" Ring: Viton A, 70º Durometer

Backup Ring: Teflon®

Performance

Pressure: 15,000 psi maximum
Certification to your specification is available

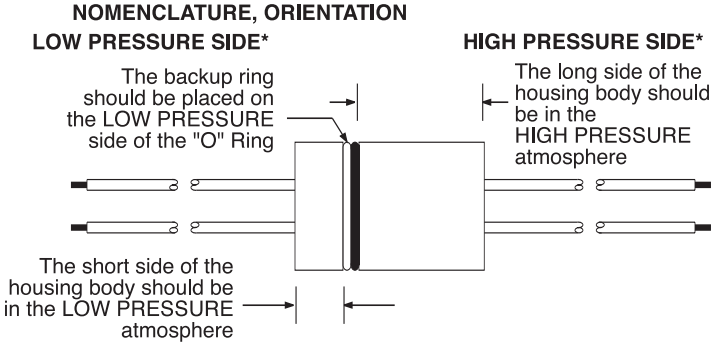
Hipot Test: Available to 5,000 VAC

Temperature: Usable from 0ºF to 150ºF

Conductor Lengths: Low-pressure length unlimited, high-pressure length is limited by the volume of our test chamber (200cu. inches)

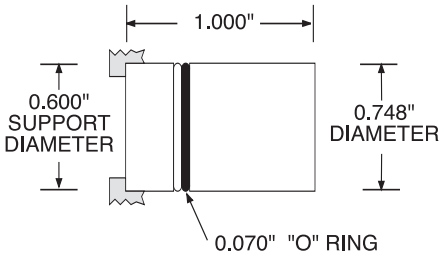
Conductor Materials: Virtually any metallic conductor, including stranded and shielded cables, thermocouple alloys, fiber optic harness, etc.

NOMENCLATURE, ORIENTATION

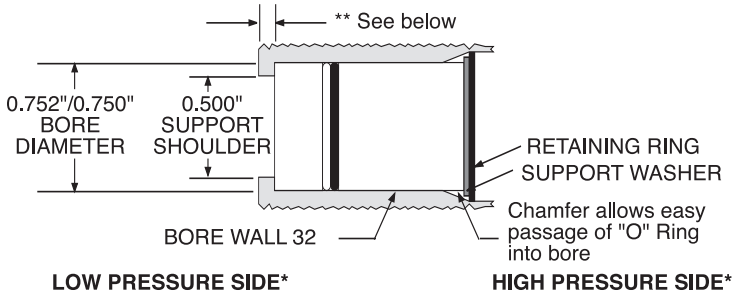


* Orientation is critical

SINGLE "O" RING DESIGN
(Custom designed housings are available.)



MOUNTING DIAGRAM

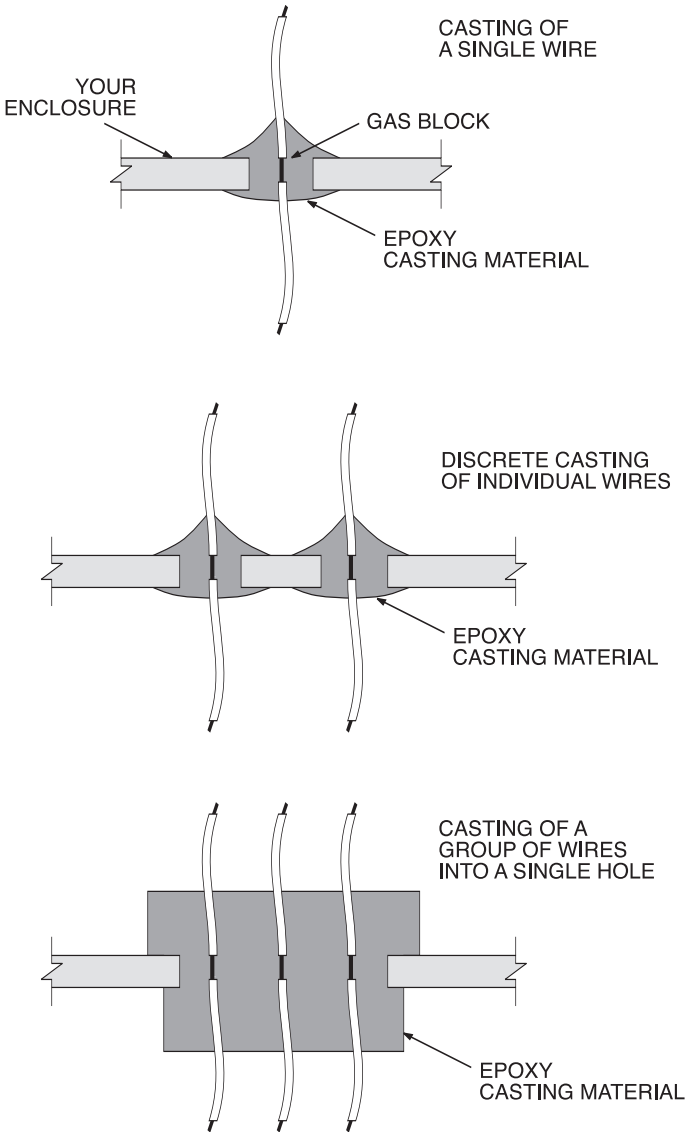


* Orientation is critical

** Allow enough shoulder material to support an axial force of 13,000 lbs at 15,000 psi (This includes a 100% safety factor)

Warning: High pressures are potentially very dangerous. Only knowledgeable and experienced persons should attempt to design or use high pressure equipment or components.

Direct-Cast Seals



Features:

- We seal directly to your housing or enclosure
- Eliminates unnecessary housing expanse
- 100% fool-proof
- Avoids assembly labor cost and quality problems
- Pre-testable for gas leakage and all electrical parameters
- Epoxy seals to gas-blocked conductors
- Cost-effective

This technique can hermetically seal your conductors directly to:

- Brass
- Aluminum (plates or castings)
- Stainless steel
- Engineering thermoplastics
- Many other materials

Custom conductors are available, including:

- Fiber optics
- Coaxial cables
- Shielded wires including twisted shielded pairs
- Multiconductor cables and harnesses
- Thermocouple alloys

All forms of direct-cast seals are custom designed and manufactured. Please feel free to discuss your particular needs with our engineering staff.

Product Developments

Douglas Electrical Components is interested in developing new products or refining products currently in development. We have identified areas of potential customer interest, including:

- **Cryogenic Feedthrus**
- **UL or FM Listed Devices**
- **High Temperature Seals**

Please call Toll Free at 1.800.533.8068 for further information or to discuss your needs.

Technical Data

Table of Contents

Test on Feedthrus and Compounds

Gamma Radiation Exposure

Two PotCon™ connectors were exposed to gamma radiation at a rate if 1.5 x 10^6 R/Hour and helium leak tested after doses of 100 m rad. Leak rates after this test were less than 4.3 x 10^{-11} cc/sec and all pin-pin resistance was greater than 10^{12} ohms. Tests were performed on compound 1469/1481. (AECL 29-63174-300-000)

Flammability Tests

Potting flammability test on three harness feedthrus with two #12 AWG wires. Ultimate current applied 175a in air and 145a in 100% oxygen. No flame was noted throughout and the test was concluded after conductor fusion. Tests were performed on compound 1469/1481. (WSTF #79-11713)

Upward flammability test also in air and 100% oxygen exposure resulted in a "self-extinguished" report. Tests were performed on compound 1469/1481. (WSTF #79-11713)

A UL® flammability test was performed on compounds 1469/1470, 1469/1481, 7113/1470 and 7113/1481. All achieved a 94HB classification. (E92366, 84ME10295)

Water Vapor Transmission

Three samples of 1469/1481 epoxy at 0.125" thickness were tested per ASTM-E-96-80. The average for the tests was 7 x 10^{-5} gms/day/cm^2.

Outgassing Tests

Samples of the materials were heated in a 10^{-6} Torr vacuum to 125ºC. The chamber was pumped through, and the flow during the test was passed over an optical glass condensing surface at 25ºC. The results are detailed:

Compound	% Wt. Loss	% VCM	Visible Deposits
1469/1470	0.33%	<0.002%	None
1469/1481	0.22%	<0.002%	None

Explosion-Proof Testing

The following tests were performed by UL® labs on lead wires sealed in a fitting using compound 26987, with the results indicated:

Leakage of Sealing Fitting Test: Passed <. 007 FT^3
Hydrostatic Pressure Test: Passed 6,000 psi
Accelerated Air Oven Aging: Passed 168h @ + 70ºC.
Solvent Vapor Resistance Test: Passed 13 chemical vapor exposure tests.

We will participate willingly in the testing of samples of other designs.

Leachable Cations and Anions

A sample of our 1469/1481 Epoxy 150ºC and 100% RH was analyzed for leachable cations and anions:

Cations (ug/g)		Anions (ug/g)	
Al	0.40	F^-	<0.1
Ca	0.27	Cl^-	2.4
Li	0.03	NO_3^-	<0.2
Mg	0.024	SO_4^-	<0.2
Na	6.3	Br^-	<0.2
K	0.016	NO_2^-	<0.1
Cu	0.026	HPO_4^-	<0.2
Zn	0.045		

Testing For Leaks

There are many methods of testing for leaks in enclosures. The more commonly used methods along with the range of accuracy provided are listed below:

Water Immersion (Air Bubble Observation)
This method is good to approximately 10^{-4} std cc/sec, and can be more sensitive if internal pressure is increased. This method is limited because of the difficulty in differentiating between leakage bubbles and surface desorbtion bubbles. It is used to test industrial items such as valves, hydraulic components, castings, and automotive and air conditioning components. We can pressure test to 15,000 psi.

Helium Method
This method is good to 10^{-11} std cc/sec. and is capable of finding leaks of any size. This method is used for testing hermetic seals, vacuum enclosures, and vacuum systems; and is the most versatile of industrial and laboratory leak detection testing methods.

Facts about Leak Rates

Visualizing Leaks in Everyday Terms:
10^{-5} std cc/sec = approximately 1 cc/day
10^{-7} std cc/sec = approximately 3 cc/year

Audible or Visual Detection by Observer:
Bubbles rising in water = 10^{-4} std cc/sec or larger
Audible leaks = 10^{-3} std cc/sec or larger

Sizes of Leaks in Manmade Joints:
Studies indicate that almost all leaks at joints are about 5×10^{-7} std cc/sec (about 1 cc/month) or larger. Diffusion of helium through glass may be as high as 10^{-8} std cc/sec per square centimeter of surface area.

Variations in Leak Sizes:
Leaks unintentionally "built in" at joints during manufacture may vary from hour to hour and day to day. Breathing on a 10^{-6} std cc/sec vacuum leak provides enough moisture to close it temporarily, perhaps for days. Atmospheric dust particles can close a leak of this size.

Equivalent Leak Rates

In the following table, all numbers on the same line (reading across) are approximate leak values AT THE SAME PRESSURE through the same physical leak and for all practical purposes may be used interchangeably.

Experimental data indicates that no visible water will leak when dry air at the same pressure will leak at the rate of 1×10^{-4} cc/sec, probably because of the surface tension. To be on the safe side, it is believed that enclosures containing liquids (water, oil, etc) should have no leaks at RATED PRESSURE that will pass more than 1×10^{-4} std cc of air per second.

Air at Standard Condition			Refrigerant R-12 Leakage	
cc/sec	cu.in/ day	oz./yr.	time for 1 lb. to leak	immersion test bubble time
1.8×10^{-2}	100	100	0.16 yr.	1.3 sec.
1.8×10^{-3}	10	10	1.6 yrs.	13.3 sec.
1.0×10^{-4}	1	1	16 yrs.	145 sec.
9×10^{-5}	0.5	0.5		
1.8×10^{-5}	0.1	0.1		
1.8×10^{-6}	0.01	0.01		

Testing at High Voltage

As appropriate, feedthrus are tested at high voltage to confirm their performance. We have testing facilities adequate for testing up to 50,000 volts and can test an unlimited number of circuits to each other at high voltage.

Our specialized test equipment for multiple contact circuits prevents high voltage "ringing" failures during testing of long lengths of multi-conductor cables by controlling the rate of voltage applied during both "on" and "off" cycles.

Thermal Exposure

Temperature Limits:
Recommended operating limits are –40ºF to +250ºF. Exposures to –50ºF through + 300ºF have been reported by customers who have evaluated individual feedthru designs under controlled environments and applications. However, we do not guarantee performance beyond the recommended –40ºF to +250ºF.

Thermal shock:
Our feedthrus have passed leak testing (at room temperature) after being immersed in LN_2 and after cycling from +250ºF to ice water and back to +250ºF.

Custom designs are also available for true cryogenic applications.

Temperature

Formula

°F
= [°R] - 459.69
= [°C] 9/5 + 32
= ([°K] - 273.16) 9/5 + 32

°C
= [°K] - 273.16
= ([°F] - 32) 5/9
= ([°R] - 491.69) 5/9

°R
= [°F] + 459.69
= [°C] 9/5 + 491.69
= ([K] - 273.16) 9/5 + 491.69

°K
= [°C] + 273.16
= ([°F] - 32) 5/9 + 273.16
= ([°R] - 491.69) 5/9 + 273.16

Quick Conversion

°C	°F
-50	-58
-40	-40
0	32
25	77
105	221
125	257
135	275
150	302
175	347
200	392

Cryogen Boiling Points

	°F	°C	°R	°K
He	-452.1	-268.9	7.6	4.22
H_2	-423.2	-252.8	36.5	20.3
N_2	-320.5	-195.8	139.2	77.1
Air	-380.9	-194.4	141.8	78.8
O_2	-297.2	-182.9	162.3	90.3

Absolute Zero
- 459.69°F
- 273.16°C
0°R
0°K

Vacuum/Pressure

	Pascal (N/m_2) (Pa)	Torr	Standard Atmosphere (atm)	Millibar (mbar)	Dyne per Sq. Centimeter ($dyne/cm^2$)	Pounds per Sq. In. psi
1 Newton per Square Meter (N/m^2) = Pascal	1	7.5×10^{-3}	9.87×10^{-6}	10^{-2}	10	1.45×10^{-4}
1 Torr = 1 mm Hg	133	1	1.32×10^{-3}	1.33	1,330	1.933×10^{-2}
1 Standard Atmosphere (atm)	101,000	760	1	1,010	1,010,000	14.69
1 Millibar (mbar)	100	0.75	9.87×10^{-4}	1	1,000	1.45×10^{-2}
1 dyne/square Centimeter ($dyne/cm^2$)	10^{-1}	7.5×10^{-4}	9.87×10^{-7}	10^{-3}	1	1.45×10^{-5}
1 psi	6.873×10^3	51.7	6.8×10^{-2}	68.8	68.8×10^3	1

Altitude (Above Sea) km	miles	Pressure (mm Hg or Torr)
0	0	760
10	6.21	210
20	12.43	42
50	31.07	7.5×10^{-1}
100	62.14	4.2×10^{-4}
150	93.21	3×10^{-6}

Selection of Insulations

Value Analysis

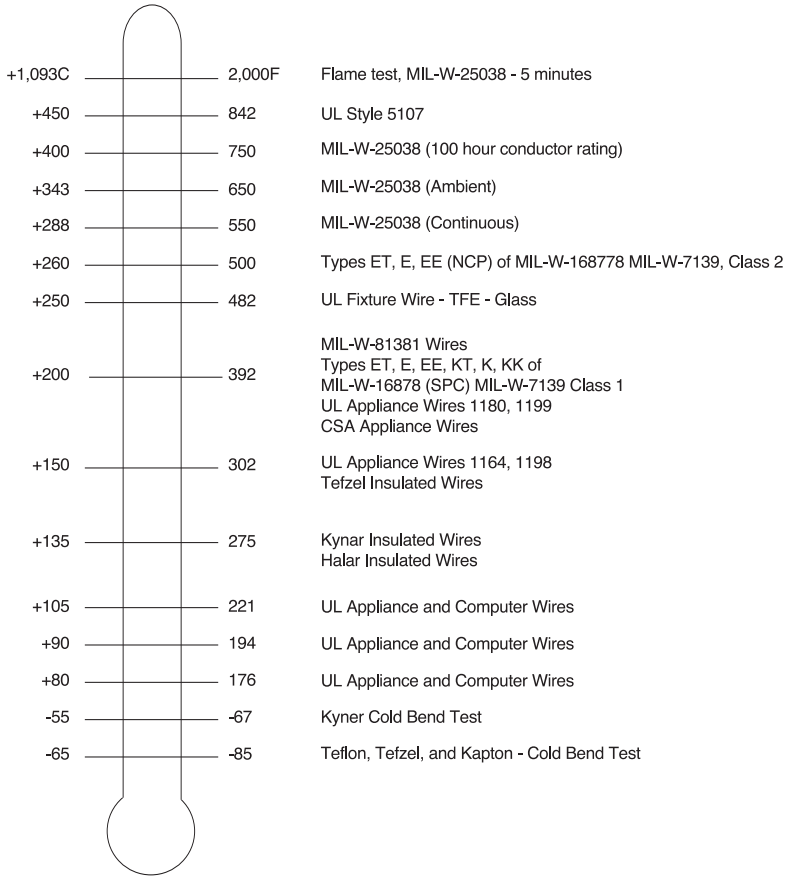
Design Factors
Service Temperature Range
Current Carrying Capability
Size and Weight
Opportunity for Innovation

Production Factors
Soldering Iron Resistance
Solder Resistance
Rework Characteristics
Flexibility
Conformability
Ease of Stripping
Ease of Secondary Operations
Notch Sensitivity
Solvent Resistance
Shield Pushback Characteristics

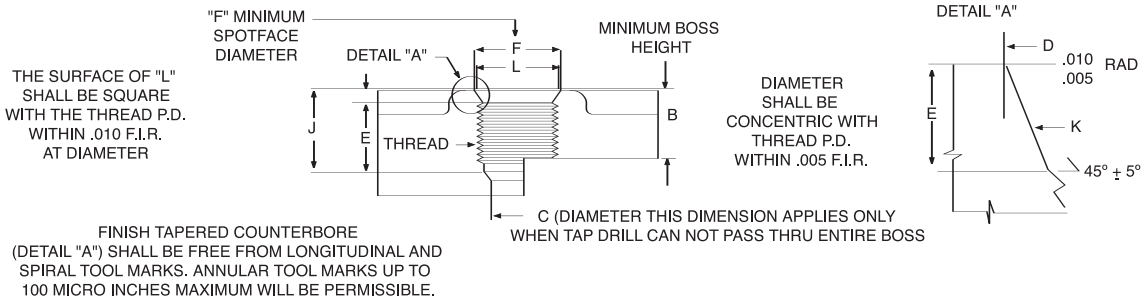
Performance Factors
Flammability
Overload Endurance
Aging Characteristics
Stress Cracking
Low Temperature Toughness
Cut-through Resistance
Abrasion Resistance
Fungus Resistance

Economic Factors
Price
Availability
Preparation Costs
Installation Costs
Rework Costs
Project Reliability
Corporate Image
Proprietary Designs
Standardization

Thermometer



SAE Housing: Mounting Boss Dimensions



Dimensions for Industrial Straight Thread Fitting With "O" Ring Gaskets

Thread	Minimum Thread Depth	C Min.	D +.015 -.000	E +.015 -.000	F Min.	J Min.	K ±1°	L Min.
3/4-16 UNF-2B	.562	.391	.811	.100	1.188	.688	15°	.875
7/8-14 UNF-2B	.656	.484	.942	.100	1.344	.781	15°	1.000
$1^{1/16}$-12 UNF-2B	.750	.609	1.148	.130	1.625	.906	15°	1.250
$1^{3/16}$-12 UNF-2B	.750	.719	1.273	.130	1.765	.906	15°	1.375

Physical Properties of Molding and Casting Compounds

Compound No.	Units	1469 / 1481	7113 / 1481	26987 / 26988	5041	Ryton R4
Type		Epoxy	Epoxy	Epoxy	Epoxy (Thermoset)	Thermoplastic
Use		General purpose casting compound	High voltage casting compound	Explosion proof casting compound	Molding compound for housings	Molding compounds for housings
Color		Black	Blue	Black	Black	Black
Specific Gravity		2.3	2.3	1.49	1.84	1.67
Tensile Strength	psi (kg/cm^2)	8,400 (588)	8,400 (588)	8,600 (600)	11,000 (780)	17,500 (1,225)
Compressive Strength	psi (kg/cm^2)	16,500 (1,155)	16,500 (1,155)	– –	30,000 (2,100)	21,000 (1,470)
Flexural Strength 23º	psi (kg/cm^2)	13,300 (931)	13,300 (931)	– –	18,000 (1,260)	26,000 (1,820)
Flexural Modules 23º	psi (kg/cm^2)	$2x10^8$ ($1.4x10^7$)	$2x10^8$ ($1.4x10^7$)	– –	– –	$17x10^6$ ($1.2x10^7$)
Flexural Modules 260º	psi (kg/cm^2)	– –	– –	– –	– –	1,700,000 (119,00)
Maximum Temp. Service	ºF (ºC)	400 (205)	400 (205)	302 (150)	302 (150)	400 (205)
Deflection Temp. @ 264 psi	ºF	– –	– –	200ºF	200ºF	500ºF
IZOD Impact (FT Lbs./In.)		0.3	0.3	0.32	0.60	1.3
Coefficient of Expansion	ºF (ºC)	$29X10^{-6}$ ($14X10^{-6}$)	$29X10^{-6}$ ($14X10^{-6}$)	$57X10^{-6}$ ($30X10^{-6}$)	$23X10^{-6}$ ($11X10^{-6}$)	$16X10^{-6}$ – –
Water Absorbtion		0.15% in 7 days	0.15% in 7 days	0.15% in 24 hrs	0.25% in 48 hrs @50ºC	0.5% in 1 day
Dielectric Constant 60Hz		6.5	6.5	– –	– –	– –
Dielectric Constant 1Hz		6.3	6.3	– –	– –	3.9
Dielectric Constant 1MHz		5.9	5.9	4.5	4.7	4.0
Dissipation Factor 60Hz		0.02	0.02	– —	– –	0.014
Dissipation Factor 1KHz		0.008	0.008	– –	– –	– –
Dissipation Factor 1MHz		0.02	0.02	0.040	0.012	0.0014
Dielectric Strength	V mil (kv/mil)	550 (21.7)	550 (21.7)	460 (18.2)	400 (15.8)	450 (17.8)

Typical Insulation System Properties

THERMAL	PVC	Halar-E-CTFE	PVC-Mylar	Kynar	Teflon-PFA	Poly sulfone	FEP	Kapton	TFE	Tefzel ETFE
Maximum Continuous Rating (ºC)	105	135	105	135	260	150	200	200	260	150
Low Temperature (ºC)	-50	-100	-60	-70	-200	-100	-200	-200	-200	-100
Non-Flammability	Very Good	Excellent	Very Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent
Solder Resistant	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Excellent	Excellent	Excellent	Excellent
Smoke	Moderate	Slight	Moderate	Slight	None	Moderate	None	None	None	Slight

ELECTRICAL	PVC	Halar-E-CTFE	PVC-Mylar	Kynar	Teflon-PFA	Poly sulfone	FEP	Kapton	TFE	Tefzel ETFE
Volume Resistivity (Ohm-cm)	10^{12}	10^{13}	10^{16}	$2x10^{14}$	10^{18}	$5x10^{16}$	$2x10^{18}$	10^{18}	10^{12}	10^{16}
Dielectric Strength VPM, 1/8" thick	350	490	(1mil film) 350	450	430	400	430	420	430	400
Dielectric Constant	5.70	2.60	3.50	7.70	2.06	3.13	2.00	2.40	2.00	2.60
Dissipation Factor (1kHz)	.09	.002	.03	.02	.0002	.001	0.4	.001	.0002	.0008
Capacitive Frequency Stability	Fair	Excellent	Good	Poor	Excellent	Good	Excellent	Excellent	Excellent	Excellent

MECHANICAL	PVC	Halar-E-CTFE	PVC-Mylar	Kynar	Teflon-PFA	Poly sulfone	FEP	Kapton	TFE	Tefzel ETFE
Density (gm/cc)	1.36	1.68	1.48	1.76	2.15	1.24	2.18	1.68 (67% polymide)	2.20	1.70
Tensile, psi	4,000	7,000	15,000	6,000	4,000	10,000	2,700	17,000	2,500	6,500
Elongation %	250	200	50	250	300	100	250	75	225	100-400
Abrasion Resistance	Fair	Fair	Good	Excellent	Good	Excellent	Good	Excellent	Good	Excellent
Cut-through Resistance	Good	Good	Excellent	Excellent	Fair	Excellent	Fair	Excellent	Fair	Excellent
Bondability	Good	Good	Good	Good	Poor (without special treatment)	Good	Poor (without bonding treatment)	Excellent	Poor (without bonding treatment)	Good

ENVIRONMENTAL	PVC	Halar-E-CTFE	PVC-Mylar	Kynar	Teflon-PFA	Poly sulfone	FEP	Kapton	TFE	Tefzel ETFE
Nuclear Radiation	Fair	100 megarads	Fair	Excellent	Fair	Good	Fair	200 megarads	Fair	approx. 100 megarads
UV Radiation	Fair	Excellent	Fair	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent

CHEMICAL	PVC	Halar-E-CTFE	PVC-Mylar	Kynar	Teflon-PFA	Poly sulfone	FEP	Kapton	TFE	Tefzel ETFE
Water Absorbtion	0.7%	.01%	.06%	.04%	.03%	.05%	.01%	.8%	.01%	.1%
Acids	Good	Excellent	Good	Very Good	Excellent	Good	Excellent	Fair	Excellent	Excellent
Alkali	Good	Excellent	Poor	Very Good	Excellent	Good	Excellent	Fair	Excellent	Excellent
Alcohol	Fair	Excellent	Fair	Very Good	Excellent	Fair	Excellent	Very Good	Excellent	Excellent
Cleaning Solvents (tri-chlor, carbon tetr.)	Slight Swell	Excellent	Good	Very Good	Excellent	Crazes	Excellent	Very Good	Excellent	Excellent
Aliphatic Hydocarbons (gasolione, kerosene)	Slight Swell	Excellent	Fair	Very Good	Excellent	Good	Excellent	Very Good	Excellent	Excellent
Aromatic Hydocarbons (benzene, toulene)	Slight Swell	Excellent	Fair	Very Good	Excellent	Crazes	Excellent	Very Good	Excellent	Excellent
Long Term Stability	Fair	Excellent	Good	Very Good	Excellent	Very Good	Excellent	Excellent	Excellent	Excellent

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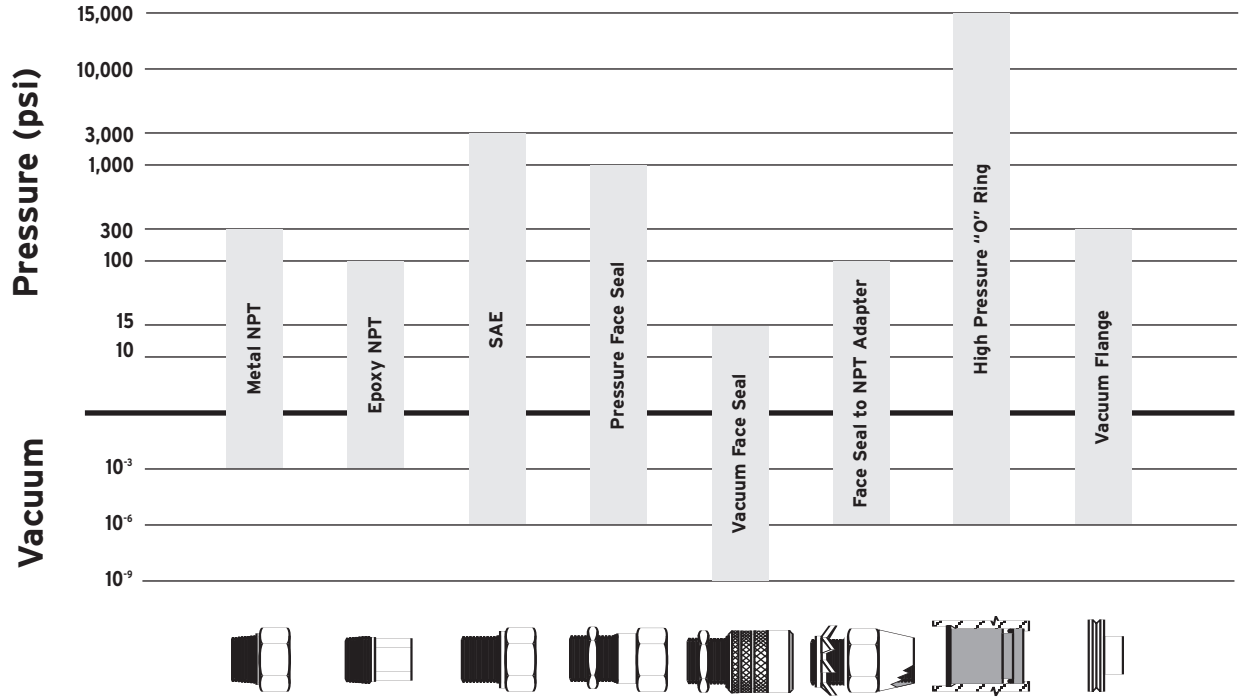
Performance Summary Of Housings And Wires

Pressure and Vacuum



Temperature*								
High Limit (ºF)	+250	+250	+250	+250	+250	+250	limited	+250
Low Limit (ºF)	-40	-40	-40	-40	-40	-40	0	-40

*See temperature note on page 57.

Ampacity of Insulated Copper Conductors (In Air)

(For vacuum applications, derate by 50%)

	105°C Wire Installation				150°C Wire Installation				200°C Wire Installation			
AWG	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires	1 Wire	2-5 Wires	6-15 Wires	16-30 Wires
30	3	2	2	2	3	2	2	2	4	3	2	2
28	4	3	3	2	5	4	4	3	6	5	3	3
26	5	4	4	3	6	5	4	3	7	6	4	4
24	7	6	5	4	8	6	6	4	10	8	6	5
22	10	8	7	5	12	10	8	6	13	10	7	7
20	13	10	9	7	15	12	11	8	17	14	10	9
18	18	14	13	9	21	17	15	11	24	19	13	12
16	24	19	17	12	27	22	19	14	32	26	18	16
14	33	26	23	17	42	34	29	21	45	36	25	23
12	45	36	32	23	53	42	37	27	55	44	31	28
10	58	46	41	29	74	59	52	37	75	60	42	38
8	75	60	53	38	95	76	67	48	100	80	56	50
6	105	84	74	53	131	105	92	66	135	108	76	68
4	145	116	102	73	179	143	125	90	180	144	101	90
2	200	160	140	100	236	189	165	118	240	192	134	120

Ordering Information

To order
You may place an order directly with our sales staff at 973.627.8230.

Technical Questions or Design Assistance
Please call our Product Engineering Department 973.627.8230.

Standard Terms and Conditions
Domestic shipments: All products are shipped F.O.B. Rockaway, NJ. We offer a prompt payment discount of 1% 10 days, Net Cash 30 days to customers who have had their credit approved.

Prices and specifications are subject to change without notice.

Foreign shipments: All terms and conditions will be negotiated at time of order placement.

Note to Purchaser
While we believe all statements, representations, and recommendations are correct and reliable, we cannot guarantee accuracy or completeness. It is the user's responsibility to determine and confirm suitability for use. All sales of Douglas Electrical Components' products are subject to our Standard Terms and Conditions.

A copy of our Standard Terms and Conditions may be obtained by calling our Sales Administrator at 973.627.8230.

Douglas Electrical will provide Special Certificates of Compliance, Test Reports, and certificates of origin but only if they are requested at the time of order.

Warranty
All products are warranted to be free of defects in materials and workmanship for a period of twelve months from date of shipment.

Our liability, unless explicitly changed by us, is strictly limited to the repair or replacement (at our option) of defective parts. Any defective parts must be returned to us in order to receive credit or replacement. Returned product must be accompanied by an RMA number. RMA numbers may be obtained by calling our Sales Administrator at 973.627.8230.

Customer Furnished Materials
On occasion, it is mutually convenient to use material furnished by our customer.

Work with customer furnished materials (CF Materials) will be at "mutual risk," where we will exercise reasonable care and caution in handling but we will not assume any responsibility for that material in the event of breakage, loss or functional failure of the finished part.

Where there is a loss, our responsibility will be limited solely to repair/replacement of our materials and/or labor, not for CF Materials.

Special Note for Optical Fibers
Processing of optical fibers is risky. While we are very diligent in processing fibers, they are very delicate and prone to fracture. Please discuss including spare fibers in your part. Due to many variables in the manufacture of fibers, we generally insist on receiving an extra meter or two of fiber for "proving" our processing and material.

In addition, the fibers we use for evaluation testing may sometimes be significantly different than those we receive for production, (CF Materials or not). In this event, we cannot be responsible for performance.

Errors
While we believe that all information in this catalog is accurate and correct, we do not take responsibility for typographical errors.

To Contact Us
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Fax: 973.627.5798

Our hours are Monday through Friday from 8:00am to 4:30pm EST.

Vacuum or Pressure Feedthru Products

Ductorseal Hermetic Feedthrus offer standard or custom wires hermetically sealed to a wide variety of housing designs and sizes. They are easy to specify solutions to pressure or vacuum penetration problems and can include from 1 to 1,000's of individual conductors, from vacuum to 10,000+ PSI.

PotCon™ Feedthrus incorporate standard connectors and/or wire harnesses in a single fully sealed housing. Virtually any connector may be specified and sealed to the housing for reliable mounting for vacuum or pressure use.

OptiSeal™ Feedthrus now allow you to specify a hermetic seal on your fiberoptic cable(s) or connectors for vacuum or pressure use in any of our standard housings or in special housings. Multiple channel feedthrus are available.

StudSeal™ Hermetic Stud Feedthrus seal large copper studs in three housing configurations and in a wide range of sizes. They are useful for vacuum or pressure applications where heavy current or high voltages penetrate a barrier.

Vacuum Flange Hermetic Feedthrus seal virtually any conductor (including fiberoptics, thermocouples, shielded wires, etc.) in standard vacuum fittings. These units are suitable for use to 10^{-7}mm Hg.

Custom Interconnect Cables or Assemblies are also available to provide a fully engineered solution for one-stop vacuum or pressure penetration requirements.

Additional Capabilities to our standard lines of hermetically sealed feedthrus, we also offer:

- Standoffs
- Splash proof feedthrus
- Strain reliefs
- Dust proof feedthrus
- Custom application specific designs with special housings, conductors or environments

ISO Registered

Certificate No. 3415

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