HOW TO SELECT A BACKSHELL

INTRODUCTION

TE Connectivity (TE) offers an extensive range of circular and rectangular backshells to meet the challenges of today's demanding environments for Aerospace, Defense, and Marine applications. A backshell (also known as an adapter) fits on to the back of a connector to provide strain relief and cable support to help from bending or over-flexing. This brochure will serve as a general guide to help select the best product for an interconnect system. A full offering of standard product can be found on our website while TE's product managers and design engineers are available if a customer is looking for something custom.

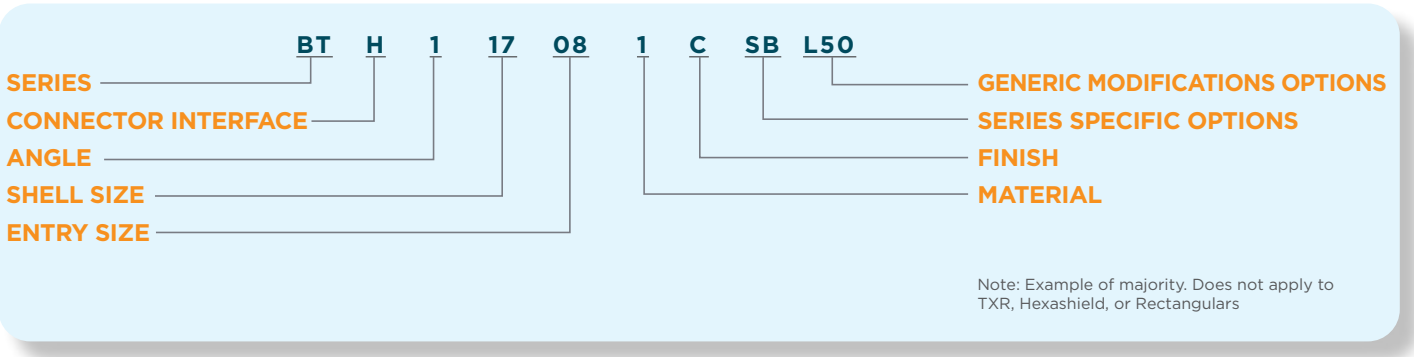
INTENDED ENVIRONMENT

Choosing the right backshell requires knowledge of its intended use and application. There are electrical, mechanical, and environmental considerations to ensure effective strain relief, environmental sealing, and electromagnetic interference (EMI) / radio frequency interference (RFI) over the life of the interconnect system. Below is a list of suggested qualifying questions specific to the working environment that will need to be considered.

1. What is the mating connector part number or mil spec part number? In almost all cases, material and plating should match between the backshell and connector.
2. Will this need to be sealed against the elements? If so, what level of sealing is required?
3. What is the operating temperature required? What are the max and min temperature requirements?
4. Is strain relief required?
5. What EMI protection is required?
6. Is a specific termination style needed?
7. Does the backshell need to meet specific dimensional requirements?
8. Is repairability important?
9. Does the application require a specification conformance of any type or will an off the shelf product work?

BACKSHELL PART NUMBER DEVELOPMENT

TE offers an extensive standard range of backshell styles to suit a wide variety of applications and requirements. The part number, a sequence of numbers and letters that describes the adapter family (or series), size, angle, material, finish, and modifications, can be built using the standardized process outlined below. A typical part number could be developed as seen in this example below.

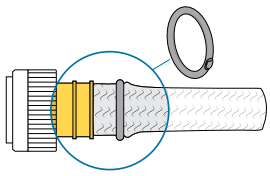


Note: Example of majority. Does not apply to TXR, Hexashield, or Rectangulars

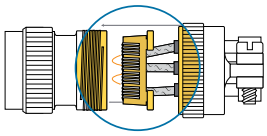
SELECT THE PRODUCT SERIES

TE offers several families (or series) of circular and rectangular backshells. Each part number begins with a numerical or alphanumeric prefix for the series. There is no single shield termination that will meet every customer requirement. For this reason, the graphic below outlines the different termination styles which can then be crossed to our standard series using the full catalog.

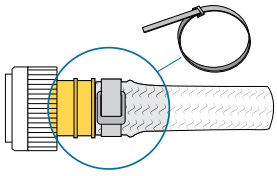
Customer selection depends on many factors including cost, screening, cable diameter, weight, strain relief. The primary factor is cable construction and how difficult the wire bundle is to work with. Customer preference, manual skill level, and repairability must also be considered. For most series, strain relief to help prevent the wires from pulling on the contacts and damaging the termination can typically be achieved with a heat shrink boot or cable clamp.



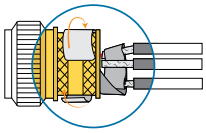
Tinel Ring: Memory ring shrunk by the application of heat
Used on: TXR



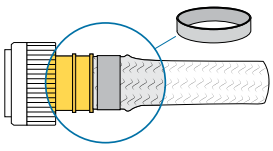
Cone: Braid/Pigtails clamped between cones
Used on: 64/308/ HexaShield Series



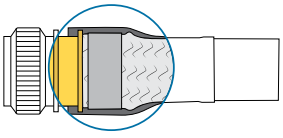
Band: Band clamped with calibrated tool
Used on: BT/88/AP/DS Series



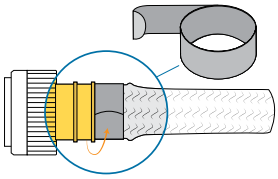
Mesh Tape: Wraps mesh tape wraps around individual screens to eliminate EMC windows
Used on: KMA Series



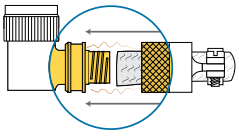
Braid Tail: Product supplied with pre-terminated braid tail
Used on: 70 Series



Pre-Fabricated: Backshell with pre-installed braid tail and heatshrink boot. Installed on cable with heat gun.
Used on: KTKK/TAK



Spring: Spring wrapped around braid (without tooling)
Used on: 91 Series



Braid Trap: Braid trapped in loose fitting thread
Used on: 95/77 Series

How to Select a Backshell

SELECT THE CONNECTOR INTERFACE AND SHELL SIZE

The mating connector part number will need to be available in order to determine the interface (also known as adapter code) and shell size. These two selections will help ensure the correct backshell thread and interface dimensions fit the connector.

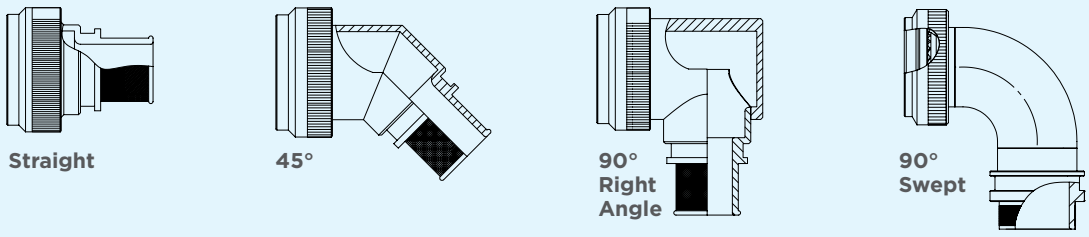
CONNECTOR INTERFACE CODE		
BACKSHELLS DESIGNED TO BE USED IN CONJUNCTION WITH:	POLAMCO BACKSHELL	RAYCHEM BACKSHELL
MIL-DTL-26482 SERIES I	DG, KG, DM, K, DS, UT	21
PATT 105 / PATT 603	D	76
MIL-DTL-26482-SERIES II / MIL-DTL-83723 SERIES I and II	A	54
MIL-DTL-38999 SERIES I	F (odd numbered shell sizes)	41
MIL-DTL-38999 SERIES II	F (even numbered shell sizes)	41
MIL-DTL-38999 SERIES III / EN3645	H	40
MIL-DTL-38999 SERIES IV	H	40
AS50151	L, LS, LM, LV	18
MIL-DTL-5015D CANNON CA-BAYONET	LC, LCS	58
MIL-DTL-5015 "ABB M.S"	Q	78
MIL-DTL-5015H	A	54
MIL-DTL-83723 SERIES III (BAYONET)	A	54
MIL-DTL 83723 SERIES III (THREADED)	A	54
MIL-DTL-28840	Z	30
EN2997 (SAME AS 83723 SERIES III (STAINLESS))	A	54
ESC10	A	54
ESC11	A	54
VG96912	SM	47
PAT 608	S	79

Solutions for other interfaces may be available – contact TE for further information

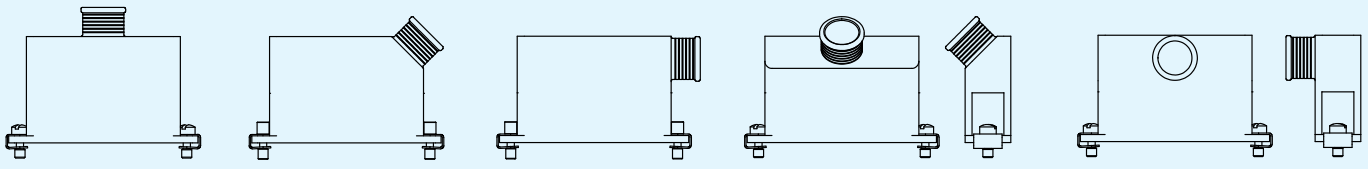
SELECT THE ANGLE AND PROFILE

Specifying the most appropriate shape is dependent on working room, repairability, cable routing, and the elimination of acute angles. In addition, the low-profile options are available if the system size needs reduced for tight spaces.

CIRCULAR BACKSHELLS



RECTANGULAR BACKSHELLS



SELECT THE MATERIAL AND PLATING

The mating connector part number will need to be available in order to determine the material and plating. Best practice is to match the base material and plating where possible to help prevent dissimilar metal corrosion. Composite products can help eliminate corrosion and have weight benefits over metal so should also be considered in harsh environments.

MATERIAL DESCRIPTION		
POLAMCO	RAYCHEM	
1	A	ALUMINIUM ALLOY
2	B	NICKEL ALUMINIUM BRONZE (MARINE APPLICATIONS)
4	S/K*	STAINLESS STEEL 303
46	—	STAINLESS STEEL 316 (MARINE APPLICATIONS)
6	S*	STAINLESS STEEL NUT / ALUMINIUM BODY
74	—	PEI (30% GLASS FILLED HIGH TEMPERATURE COMPOSITE)

* HexaShield backshells only. Code B not available for HexaShield backshells
Refer to TE material specification DM0076

Electroless Nickel plating provides low resistance conductive finish appropriate for a nonenvironmental application. For environmental applications where exposed to harsh conditions such as salt spray, cadmium plate over electroless nickel is recommended to provide a minimum of 500 hours of protection. If Restriction of Hazardous Substance (ROHS) compliance is required, zinc over electroless nickel is best providing the same environmental protection.

Rectangular backshells tend to be deployed in less aggressive environments so resistance against the effects of salt spray, for example, could be less of an issue. Choice of material could then be dictated by the required performance of other factors. If one of these requirements outweigh another, this may be taken into consideration when straying from best practice since one of the primary functions of plating is to act as a common middle-ground between dissimilar base materials.

PLATING DESCRIPTION					
POLAMCO	RAYCHEM		ROHS COMPLIANT	CONDUCTIVITY	ENVIRONMENTAL PROTECTION
B	B	CADMIUM, OLIVE DRAB OVER ELECTROLESS NICKEL	NO	CONDUCTIVE	500 HRS
C	C	ELECTROLESS NICKEL	YES	CONDUCTIVE	48 HRS
D	G	BLACK ANODISE	YES	NON CONDUCTIVE	500 HRS
J	J	PASSIVATE (STAINLESS STEEL ONLY)	YES	—	MATERIAL CODE 4 - 500 HRS MATERIAL CODE 46 - 1000 HRS
TN	X	PTFE OVER HIGH PHOSPHORUS ELECTROLESS NICKEL	YES	CONDUCTIVE	500 HRS
U	/	UNPLATED CLEAN FINISH NOT SHOT BLASTED	YES	—	NOT TESTED
Z	W	SHOT BLAST FOR NON-REFLECTIVE FINISH (NICKEL ALUMINIUM BRONZE ONLY)	YES	CONDUCTIVE	1000 HRS
ZB	U	ZINC COBALT OVER ELECTROLESS NICKEL WITH AN OLIVE DRAB CHROMATE CONVERSION	YES	CONDUCTIVE	500 HRS
ZK	—	ZINC COBALT OVER ELECTROLESS NICKEL WITH A BLACK CHROMATE CONVERSION	YES	CONDUCTIVE	350 HRS
ZN	Z	ZINC NICKEL BLACK PASSIVATE OVER ELECTROLESS NICKEL	YES	CONDUCTIVE	500 HRS

These lists are not exhaustive – contact TE for further information

SELECT THE CABLE ENTRY DIAMETER

An understanding of the overall cable and harness make-up is also important in the backshell selection. Accurate descriptions and measurements will determine the entry size which is where the cable enters the adapter. When selecting the backshell cable entry size, it is a good idea to err on the side of too large as an undersized cable can be enlarged with tape or a grommet to fit the cable clamp. Where it is not possible to physically measure the wire bundle diameter it can be calculated using the following steps.

STEPS

1. Determine each wire diameter. When calculating wire bundle diameters, note that the gauge # of the wire describes only the diameter of the metal conductor, and not the overall diameter (OD) including insulation and/or braids

2. Choose the appropriate multiplication factor to use in next step

MULTIPLICATION FACTORS							
NUMBER OF WIRES	1	2	3	4	5	6	7 AND MORE
1	1	1.415	1.242	1.205	1.208	1.225	1.15

3. Calculate the bundle diameter

$$\text{(Bundle Diameter)} = \text{Factor} \times \sqrt{n_1 \times d_1^2 + n_2^2 + d_2^2 + n_3 \times d_3^2 + \ldots + n_n \times d_n^2}$$

Where $d_1 \ldots d_n$ are diameters of each type of wire in the bundle (when using wires from different diameters)
$n_1 \ldots n_n$ the quantity of wires with the same diameter

4. Add thickness of shielding or jacketing to core wire bundle diameter

$$\text{(Final OD)} = \text{(Bundle Diameter)} + 2 \times \text{(Shield Thickness)} + 2 \times \text{(Jacket Thickness)}$$

SELECT NECESSARY MODIFICATIONS

TE's standard range of backshells can be extensively modified to create a solution to suit most customer needs. The applicable modification codes would act as a suffix and can be comprised of a series specific modification or generic standard modification. Separately for some series, the auxiliary options (such as bands and springs) may be omitted from the part number if it is not needed. Consult TE for assistance regarding the use of modifications.

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MODIFICATION CODES				
POLAMCO	Raychem	MEANING	APPLIES TO SERIES	AFFECTS
TE	F	Internal blue polytetrafluoroethylene (PTFE) coating	All	Finish
TEG	-	Internal green PTFE coating	All (TE and TEG are mutually exclusive)	Finish
TAH	-	Internal PTFE coating, anti-decoupling, hex nut (wire retained)	Replaces codes TE, AD and HEX	Finish
BN	-	Nickel aluminium bronze nut, shot blast finish	Aluminium backshells	Material / finish
ESC	-	ESC style interface	A-interface only	Interface
NGP	-	No grommet profile	Consult engineering for availability	Interface
AD	S	Anti-decoupling	All non-direct coupling	Interface
TD	-	Torque-differential anti-decoupling	All non-direct coupling (AD and TD are mutually exclusive)	Interface
G	P	Coupling nut with grub screw	L and LV interface	Interface
FB	-	Wide body	All – consult engineering for dimensions	Body shape
SE	-	Swept elbow (cast centre section)	All 90° except 96 series *	Body shape
AP	-	Spanner holes in coupling nut	All except AP series, where spanner holes are standard	Nut
FN	-	Coupling nut with flats	All	Nut
HEX	-	Coupling nut hex	All (FN and HEX are mutually exclusive)	Nut
WN	-	Wire-retained nut (hex shape)	All non-direct coupling (WN and HEX are mutually excl.)	Nut
TH	-	Tooth inspection holes in coupling nut	All interfaces with anti-rotation teeth	Nut
W	-	Wire-locking holes in coupling nut	All except A-interface	Nut
NW	-	No wire-locking holes in coupling nut	A-interface only	Nut
WL	-	Drilled-head screws in cable clamp, tangential hole in adaptor body	Backshells with cable clamp	Body
WLT	-	Safety wire holes at all threaded junctions plus drilled head screws in cable clamp	Backshells with cable clamp	Body
BS	-	Body strap	All *	Body
F	-	Wrench flats on follower	All *	Body
2F	-	Two flats instead of four	All *	Body
DH	D	Drain holes in follower body	All *	Body
PH	-	Potting hole	All *	Body
PH2	-	Two potting holes, 180° apart	All *	Body
PHG	-	Potting hole + outgassing hole	All *	Body
TB	-	With added boot groove	Backshells without cable clamp	Boot groove
NG	-	No boot groove	Backshells that have a boot groove	Boot groove
ET	ET	Earth tag	BT, 91 and 97 series	Termination
WS	-	Drilled-head screws in cable clamp	Backshells with cable clamp	Cable clamp
CL	-	Clinch nuts in cable clamp	Backshells with cable clamp	Cable clamp
S	-	Short screw modification	Backshells with cable clamp	Cable clamp
TS	-	Telescoping screws	Backshells with cable clamp	Cable clamp
LP	-	Low-profile (non-preferred: use kxx or exx)	90° *	Body shape
RW	-	Reduced weight	*	Body shape
Lxx	-	Non-standard length **	All straight *	Body shape
Cxx	-	Non-standard front length **	All 45° *	Body shape
Dxx	-	Non-standard rear length **	All 45° *	Body shape
Kxx	-	Non-standard front length (to entry c/l) **	All 90° except 96 series *	Body shape
Exx	-	Non-standard can length **	All plug-in style 90° *	Body shape
Fxx	-	Non-standard rear length **	All 90° except 96 series *	Body shape
Bxx	-	Non-standard coupling nut diameter **	All *	Body shape
Txx.x	-	Non-standard throat diameter **	All *	Body shape
CON	-	Conductive o-ring	All backshells with o-rings	O-ring
FS	U	Fluorosilicone o-rings / seals	All backshells with o-rings	O-ring
NIS	N	Nitrile o-ring	All backshells with o-rings	O-ring
VS	V	Fluoroelastomer o-ring	All backshells with o-rings	O-ring
NS	-	No seal	All backshells with o-rings	O-ring

* consult TE for availability / available values / dimensions
** xx / xx.x specified in mm

VIRTUAL BACKSHELL SAMPLE KIT

MANY CHOICES FOR SHIELD TERMINATIONS, SHIELDING, AND STRAIN RELIEF

TE Connectivity offers a range of adapter options to enable you to select the product that best meets your performance and cost requirements. With one click on the product name below, you can obtain product information, download drawings, check availability, and request samples. For a complete view of TE's standard offering, please visit our website.

Tinel Ring (TXR) Backshells
Heat-recoverable Tinel metal ring shrinks when heated to help permanently attach the shield to the adapter body.

AS85049/82 through 90
Industry-standard straight and right-angle bandstrap adapters (also available in commercial versions)

Spring Termination Backshells
Tool-free, screen termination by stainless steel constant-force spring.

Braided Adapters
Accommodates different cable braid diameters without using different entry sizes reducing backshell part number count

Cone Termination Backshells
An individual screen termination option using a castellated cone to compress braid.

TAK Termination Backshells
A pre-installed heat-shrink boot provides a high-reliability magna-form screen termination.

HexaShield Adapters
Provides 360° shield termination and wire management with fast assembly.

Rectangular Backshells
A wide range of options for D-subminiature, micro-D, ARINC, and other connectors.

AS85049/128 Bandstraps
Three styles of stainless steel bands in both pre-coiled and side-entry configurations.

Protection Caps for Circular and Rectangular Connectors
Caps and covers are compatible with mil-spec dimensions with various options of lanyard styles and gasket materials.

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We make it easy to connect with our experts and are ready to provide all the support you need.
Visit **te.com/support** to chat with a Product Information Specialist.

QUALITY STARTS WITH THE RIGHT APPLICATION TOOLING

Creating a quality crimp connection is essential to delivering high performance and reliability in extreme environments. From low to high volume wire processing, TE has you covered with a full range of application tooling and a global field service team.

- **View all application tooling**
- **Connect with our experts to find the right tool for your application**

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