



# Customer Owned Copper Outside Plant Guidelines

December 2017

COMMSCOPE®

# Introduction

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CommScope offers several products to extend high performance copper connectivity to the outdoor environment where cabling may be exposed to sunlight, high humidity, condensation and wet locations. In many cases surge protection from electrical hazards may also be needed. The most common applications requiring this infrastructure support are security cameras and wireless access points.

Several standards and code documents would be important to apply at these installations. In the United States, most campus installations would be guided by NFPA 70 National Electrical Code and local adoptions for the parts of the installation within buildings, and IEEE National Electrical Safety Code (NESC) for outdoor installation including aerial and underground requirements. NFPA 780 Standard for the Installation of Lightning Protection Systems may also be referenced. It should also be recognized that outdoor installations can present a wide range of hazards to installers and occupants. and so, measures and procedures for safety must be established. NESC Part 4 outlines “Work Rules”, many of which apply to communications installation.

There are also a wide range of ICC, NFPA, IEEE, TIA, ISO, ANSI, ASTM, RUS, Telcordia, USDA and NEMA, documents providing additional regulations, requirements, specifications and recommendations. Local authorities having jurisdiction over construction and contracting should be consulted on specific safety and code requirements as well as general recommendations. The following documents provide useful guidance for low voltage outside plant installations:

- TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard
- TIA-607-C Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- BICSI Telecommunications Distribution Methods Manual
- BICSI Outside Plant Design Reference Manual

Applications equipment manufacturers may have additional requirements and should be consulted for their equipment cabling and protection guidelines.

# Products

## Outside Plant (OSP) cables are designed and qualified differently than Inside Plant (ISP) cables. The following cables are:

- Gel filled and suitable for routing through water exposed and flooded pathways, including direct burial
- Suitable for aerial, building attached, underground and direct burial
- Suitable in direct sunlight over an extended temperature range; -40 °C to +70 °C (-40 °F to +158 °F)
  - Installation temperature range is limited between -30 °C to +70 °C (-22 °F to +158 °F)

PRODUCT CODE	DESCRIPTION	MATERIAL ID
5NF4	Category 5e U/UTP	<a href="#">4286104/10</a>
6NF4+	Category 6 U/UTP	<a href="#">4665904/10</a>
TE620OSP	Category 6 U/UTP	<a href="#">2171028-1</a>
1571	Category 6 U/UTP	<a href="#">760008888</a>
1572A	Category 6 F/UTP	<a href="#">760170886</a>
1592A	Category 6A F/UTP	<a href="#">760178129</a>

These OSP cables are used in designing categorized solutions up to 100 meters. They are all small and light cables and maximum installation and operating tension must be limited to 111 N (25 lbf). Aerial installations require a messenger line and lashing. They may be directly buried, although underground is preferred for physical protection.

They can be terminated on conventional indoor outlets and panels and on high performance surge protectors where protection from electrical exposure is also needed, but the ends should be blocked with sealant to minimize leakage of the gel flooding compound. These cables are not listed for indoor placement so designs must ensure that all local codes are followed. Typical requirements include minimizing the distance that these cables are routed through the indoor environment.

Note: the 1572A and 1592A gel fill lowers the NVP and the delay has been de-rated by 6% so maximum permanent link length is reduced from 295 feet to 277 feet.

CommScope also offers a similar Category 5e F/UTP Low Smoke Zero Halogen cable, 5ENS4ZH. This cable is not filled and has a more restricted temperature range -20 °C to +60 °C (-4 °F to +140 °F). It is suitable for water and sunlight exposure, but not suitable for underground or buried.

The following Indoor/Outdoor rated modular cords are also available.

MATERIAL ID	DESCRIPTION
<a href="#">CO11152-01</a>	PCOSP-6S-BK (Category 6 F/UTP)
<a href="#">CO15542-01</a>	PCOSP-6U-BK (Category 6 U/UTP)
<a href="#">CO11192-01</a>	PCOSP-6AS-BK (Category 6A F/UTP)
<a href="#">CO15582-01</a>	PCOSP-6AU-BK (Category 6A U/UTP)

These cords are suitable for pole and building mounted applications with exposure to sunlight and water, but the end plugs must be protected inside the application equipment or a sealed enclosure (NEMA4 or IP 66 rated). They are also CM and LSZH listed and have an IEC 332-1 rating, and can be routed indoor in locations suitable for CM cables and where halogen materials are prohibited. They have the more restricted temperature range -20 °C to +60 °C (-4 °F to +140 °F), and are not suitable for buried or underground locations.

1 & 2 Port Power Over Ethernet Extenders are available and can be mounted with outdoor cameras, access points and other Ethernet powered devices at cabling distances as far as 3000 meters. This application uses Powered Fiber Cable, a hybrid type with 2, 4 or 12 OM3 or OS2 fibers and either 12 or 16 AWG power conductors. Powered Fiber Cable is available with Outdoor Rated polyethylene jacket or Indoor/Outdoor Rated (riser/LSZH). Designed for long underground cable pulls, the maximum installation tension is 440 N (98.92 lbf). Operating tension is 132 N (29.67 lbf). Also, suitable for building attached and aerial with lashing to a messenger. Installation temperature range is -10 to 60 °C with an operating temperature range of -40 to 70 °C.

# Solutions

When planning Outside Plant designs, temperature extremes should be considered. The filled cables are rated to extended temperatures, but other cabling products are more limited. Installation below lower temperature specifications can cause jacket cracking, although operational limits can be lower. Many areas such as northern Arizona can be exposed to high temperature extremes, especially over rooftop or in other confined sun exposed locations. For extreme locations, some application equipment is available with cover shields to minimize the solar loading, but designers should also consider solar exposure on cable routing and placement. ANSI/TIA-568-C.2 has an informative Annex G showing maximum length derating calculations for cable installation in higher temperature environments. These calculations can be extrapolated up to 70 °C, but it should also be proportional to the exposed length.

Equipment grounding is an important part of ensuring reliable system performance. Depending on distance and pathway, local codes may also require electrical protection. Primary surge protectors and suitable grounding may also be specified and supplied by the application equipment manufacturers but is available from several independent suppliers such as:

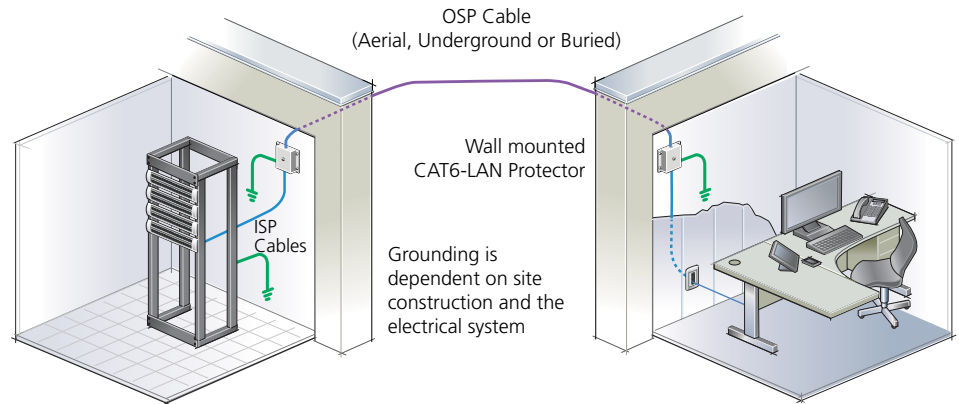
<http://www.itwlinx.com/>

<http://www.ditekssurgeprotection.com/>

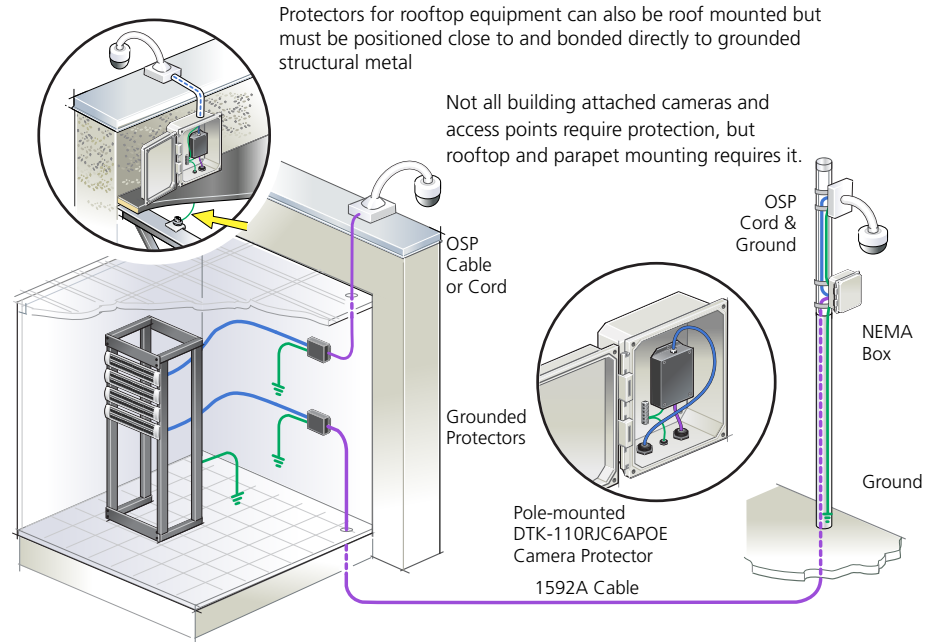
<https://www.erico.com/erico.asp>

<http://www.harger.com>

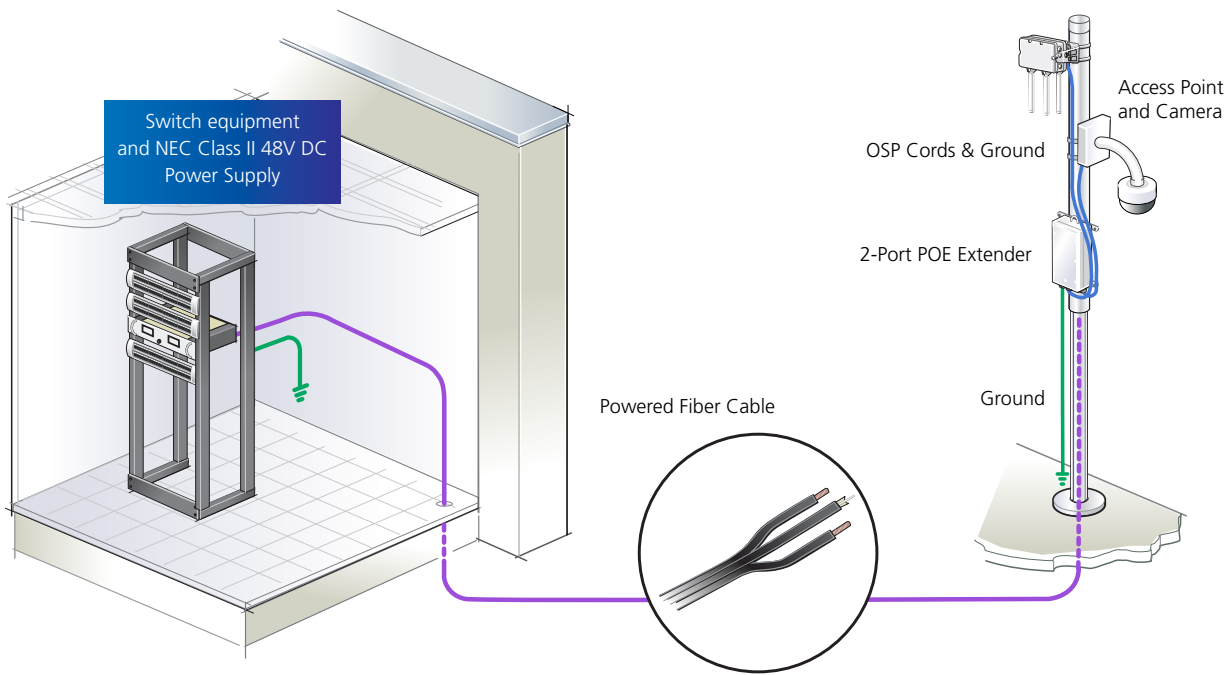
A common application is extension to a second building.



Other application examples are pole and building mounted equipment.

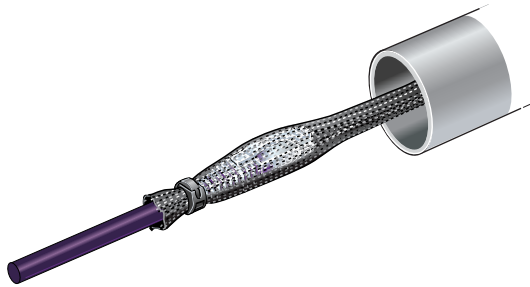


Another option especially suited for extended distance is the use of the Power Over ethernet Extender. Refer to [www.commscope.com/Product-Catalog/Networking-Systems/Product/Powered-Fiber-Cable-Systems/](http://www.commscope.com/Product-Catalog/Networking-Systems/Product/Powered-Fiber-Cable-Systems/). These units are connected to the equipment room through Powered Fiber Cable that is driven by a 48V SELV source. Local power is not needed at the endpoint and protection is built into the equipment at both ends. Use CommScope's Powered Fiber Distance and Voltage Calculator at [www.Commscope.com/Resources](http://www.Commscope.com/Resources) to calculate support distance based on design details.



## CABLE AND CORD HANDLING

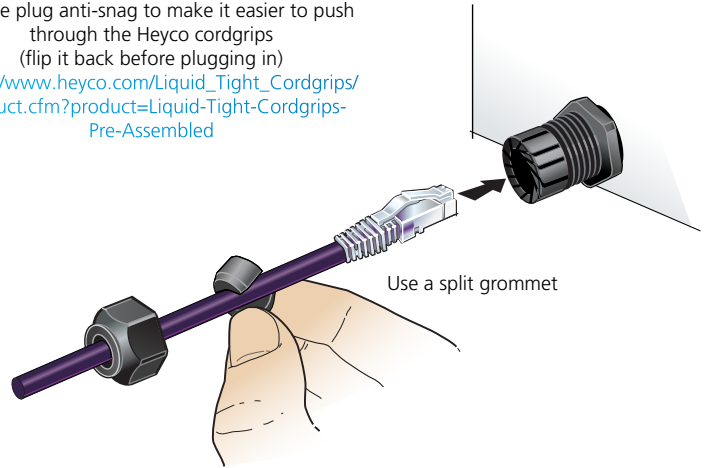
In outside environments, avoid contamination or damage to plugs. Plugs must be protected from sunlight and water in a suitable equipment housing or NEMA 4 rated box. Also, avoid exposure to water at cut ends of unfilled cables and cords.



For pulling cords into long pipes a 3/8" sock fits the end plug  
<http://www.lsdinc.com/installation/7314/Fish-Tailz---#item>

Lock with a low profile tie  
<http://www.cobraties.com/low-profile-ties.html>

Flip the plug anti-s snag to make it easier to push through the Heyco cordgrips (flip it back before plugging in)  
[https://www.heyco.com/Liquid\\_Tight\\_Cordgrips/product.cfm?product=Liquid-Tight-Cordgrips-Pre-Assembled](https://www.heyco.com/Liquid_Tight_Cordgrips/product.cfm?product=Liquid-Tight-Cordgrips-Pre-Assembled)

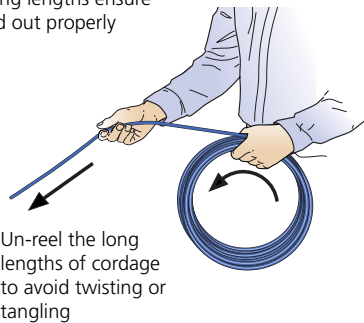


Use a split grommet

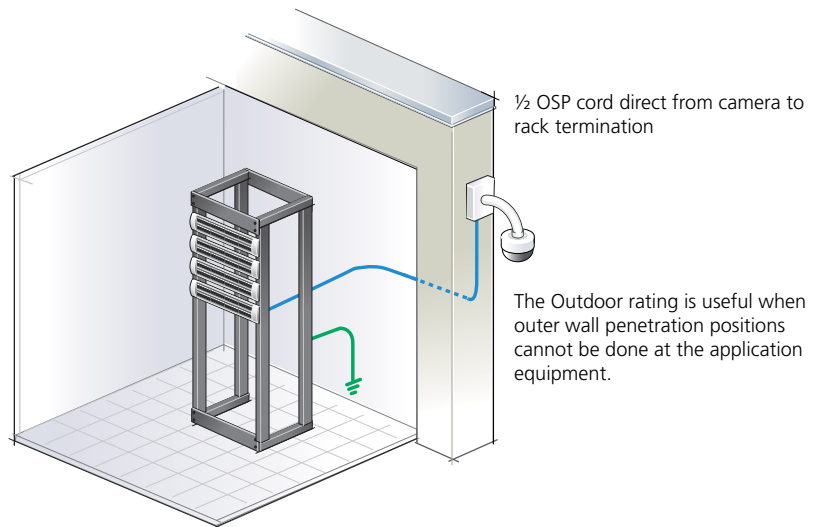
Coat the Grommet with silicone grease to aid in sealing (avoid getting grease on the plug)

The Indoor/Outdoor cords can be routed outdoors above ground and indoors, and can be ordered in lengths long enough for direct (home-run) installations from switch to end equipment. Cords have 20% Insertion Loss De-rating so only 85 meters total can be supported. Extended lengths can be cut in two for terminating the indoor ends at protectors or panels. Terminations are similar to typical 4-pair indoor cables.

When handling long lengths ensure that cords are paid out properly



Un-reel the long lengths of cordage to avoid twisting or tangling

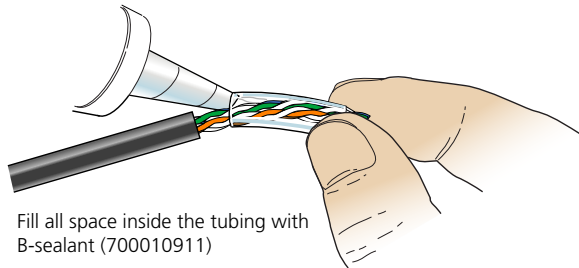


1/2 OSP cord direct from camera to rack termination

The Outdoor rating is useful when outer wall penetration positions cannot be done at the application equipment.

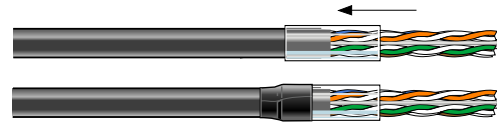
The 5ENS4ZH cable is terminated the same as typical 4-pair indoor cables, but the other cables are gel filled and the termination involves cleaning the excess gel and blocking the end with silicone sealant to prevent future leakage. A typical Blocking Method uses a 2 cm length of Alpha Wire PVC-105-2 tubing or equivalent:

<http://www.alphawire.com/zh-CN/Products/TubingAccessories/FIT-Wire-Management/Tubing/PVC1052>



Fill all space inside the tubing with B-sealant (700010911)

Position the filled tube to overlap the end of the inner jacket and seal the gel

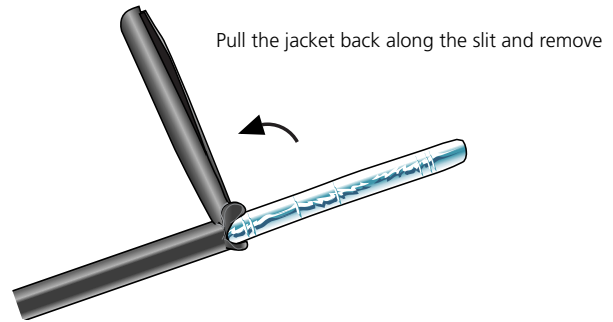


Clean off all excess sealant – Tape can be used to stabilize the tube for immediate termination before the sealant sets

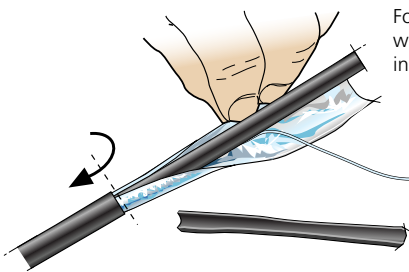
The 1572A and 1592A cables are shielded and the shield must be properly terminated, either grounded or isolated. For exposed installations requiring protection, the end of the shield can be bonded in various ways.



Lengthwise slit helps avoid tearing the foil shield <https://www.jokari.de/>



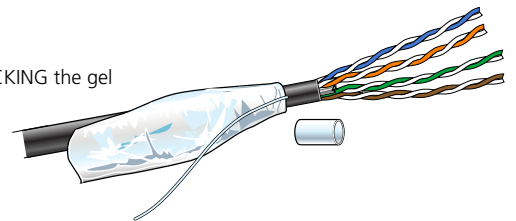
Pull the jacket back along the slit and remove



Fold the foil and drain wire back to work on the inner jacket

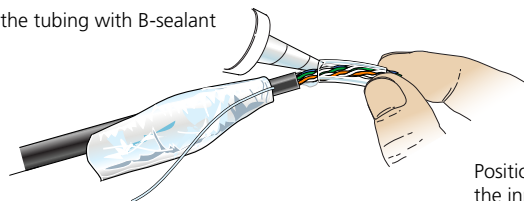
Prepare the inner jacket for BLOCKING the gel and direct burial

- Cut back the inner jacket
- Trim the flute
- Clean the excess gel



The flute can be cut longer to match the blocking tube length

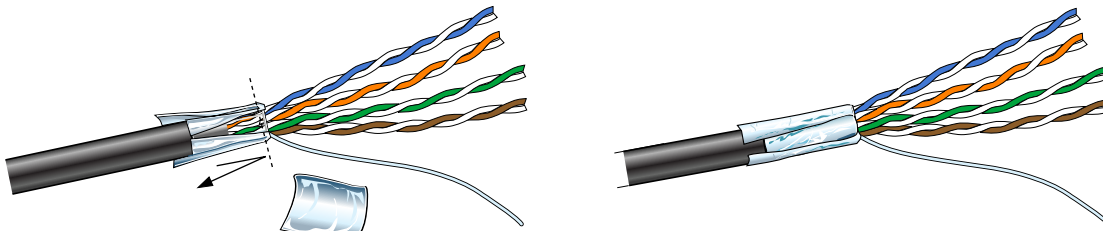
Fill all space inside the tubing with B-sealant (700010911)



Position the filled tube to overlap the end of the inner jacket and seal the gel

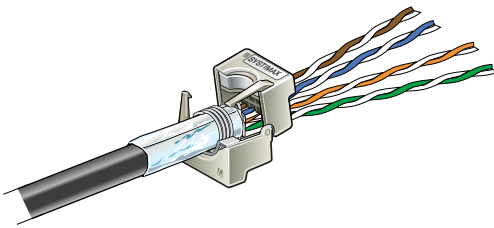


Fold the drain wire and foil back over the tube and position the foil to be folded back over the tube



An extra piece of foil can be used to cover the foil seam

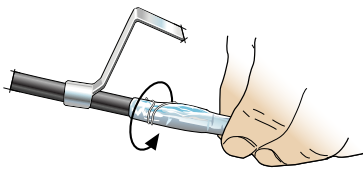
For an HGS620 termination, wrap the drain wire at least two times around and position it where the spring clips will capture them



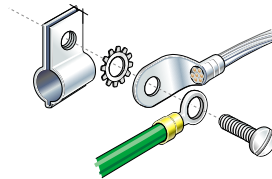
Tape over the foil for stability



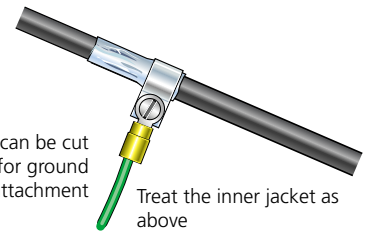
An alternative method is to use the ground lug and B-bond clip that are available in the 12A1 Grounding Kit.



Fold the foil back over the jacket end and wrap the drain wire around the end and push the ground lug over the wrap



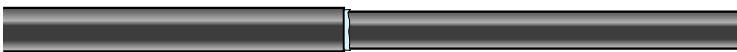
Open the B-bonding clip to be placed and closed over the grounding lug



The lug tail can be cut off or used for ground attachment

Treat the inner jacket as above

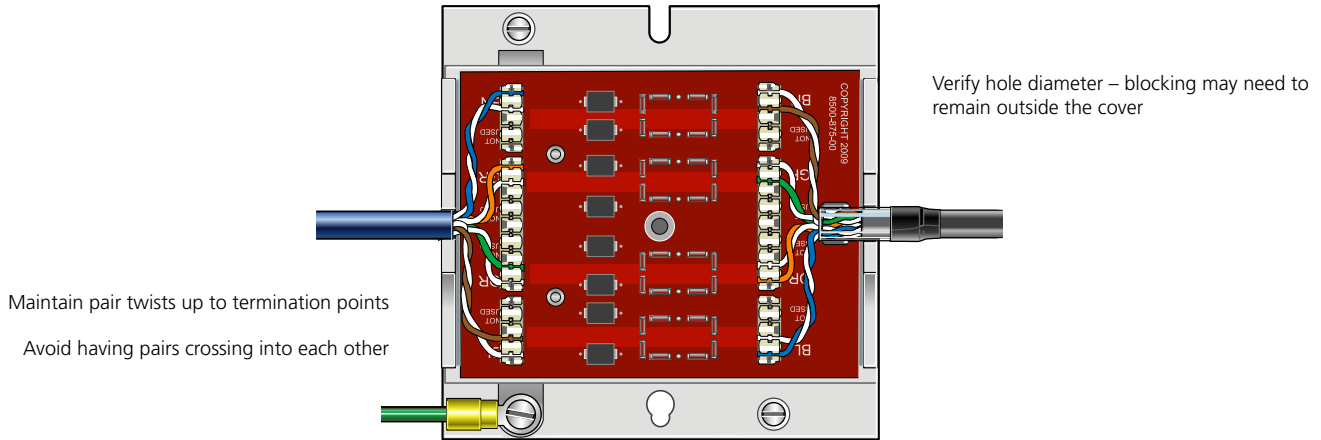
For an isolated shield termination, the 1572A and 1592A outer jacket foil and drain wire are removed a short distance back from the termination and electrical tape is used to isolate the foil end





A protector can provide the transition to indoor cable, but the gel filled outdoor cable types will still need blocking.

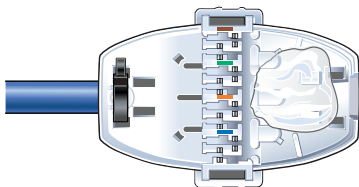
ITW Linx CAT6-LAN Protector  
<http://www.itwlinx.com/products/surrogate-modular-communication-protectors/cat6-lan>



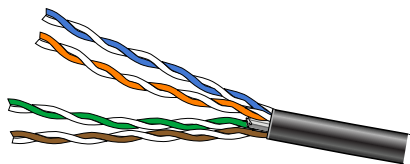
If surge protection is not needed, Gel flooded U/UTP cables can also be blocked and transitioned to indoor cable using a Ceiling Connector:

[http://www.commscope.com/catalog/cable\\_assemblies/product\\_details.aspx?id=46345&sayt=1](http://www.commscope.com/catalog/cable_assemblies/product_details.aspx?id=46345&sayt=1)

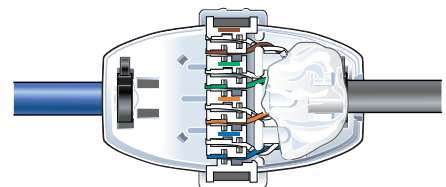
Terminate the indoor cable first – then lay down a bed of B sealant



Clean all gel from the end of the OSP cable



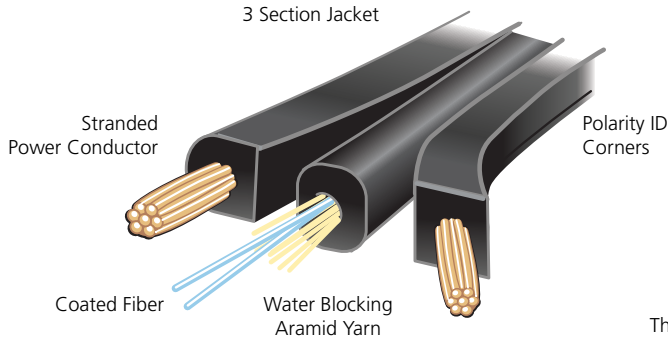
After the OSP cable and conductors are positioned, fill the area around the cable end with sealant and close the connector housing



Powered Fiber Cable is a hybrid flat cable with a loose tube fiber bundle and power conductors on each side. The jacket is designed to easily split the power conductors away from the fiber bundle so they can be separately terminated.

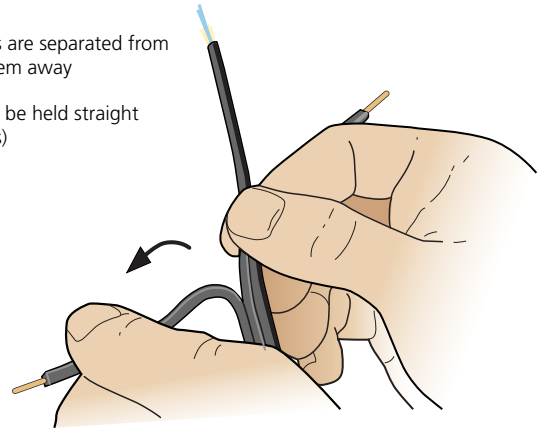
Minimum bend radius to protect the fiber performance is 5 cm. For the overall cable, bending should only be done in the flat direction, but the separated fiber can bend in all directions. The separated power conductors have no bending restrictions. Long cable pulls can be aided by cable lubricant, but verify the correct type for the jacket material.

American Polywater provides various pulling lubricants as well as conduit sealants  
<http://www.polywater.com/>

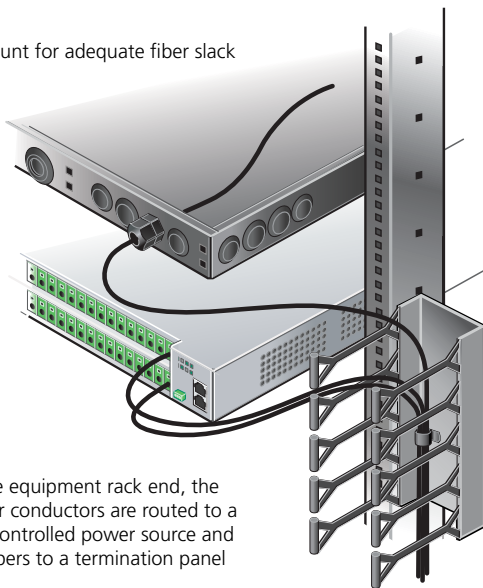


The power conductors are separated from the fiber by pulling them away

The fiber section must be held straight (minimum 5 cm radius)

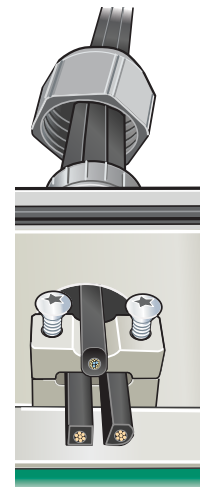


Account for adequate fiber slack



At the equipment rack end, the power conductors are routed to a 48V controlled power source and the fibers to a termination panel

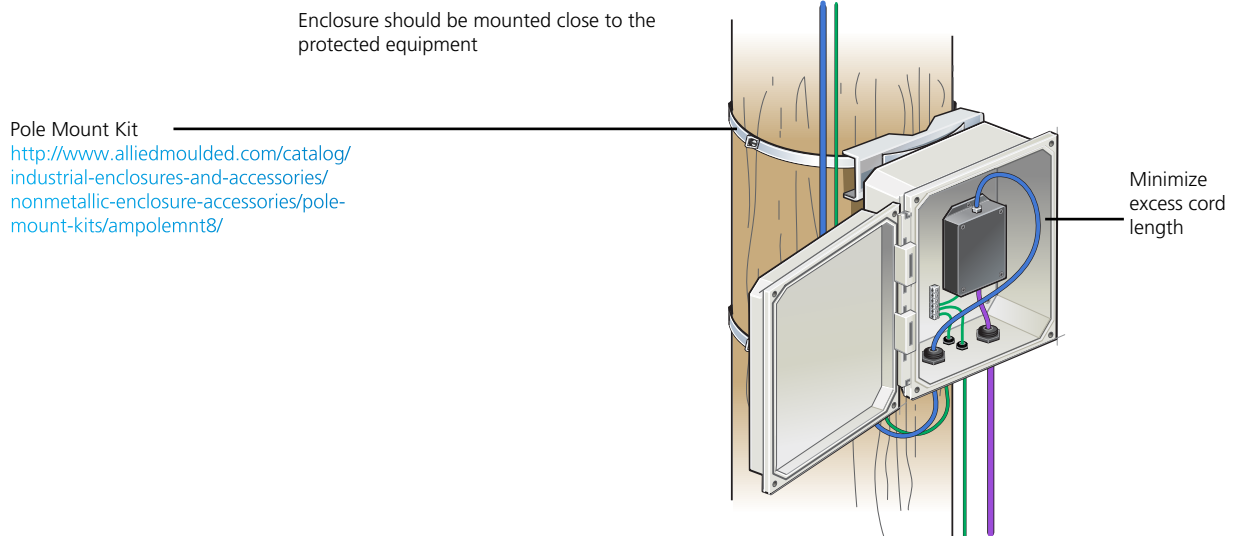
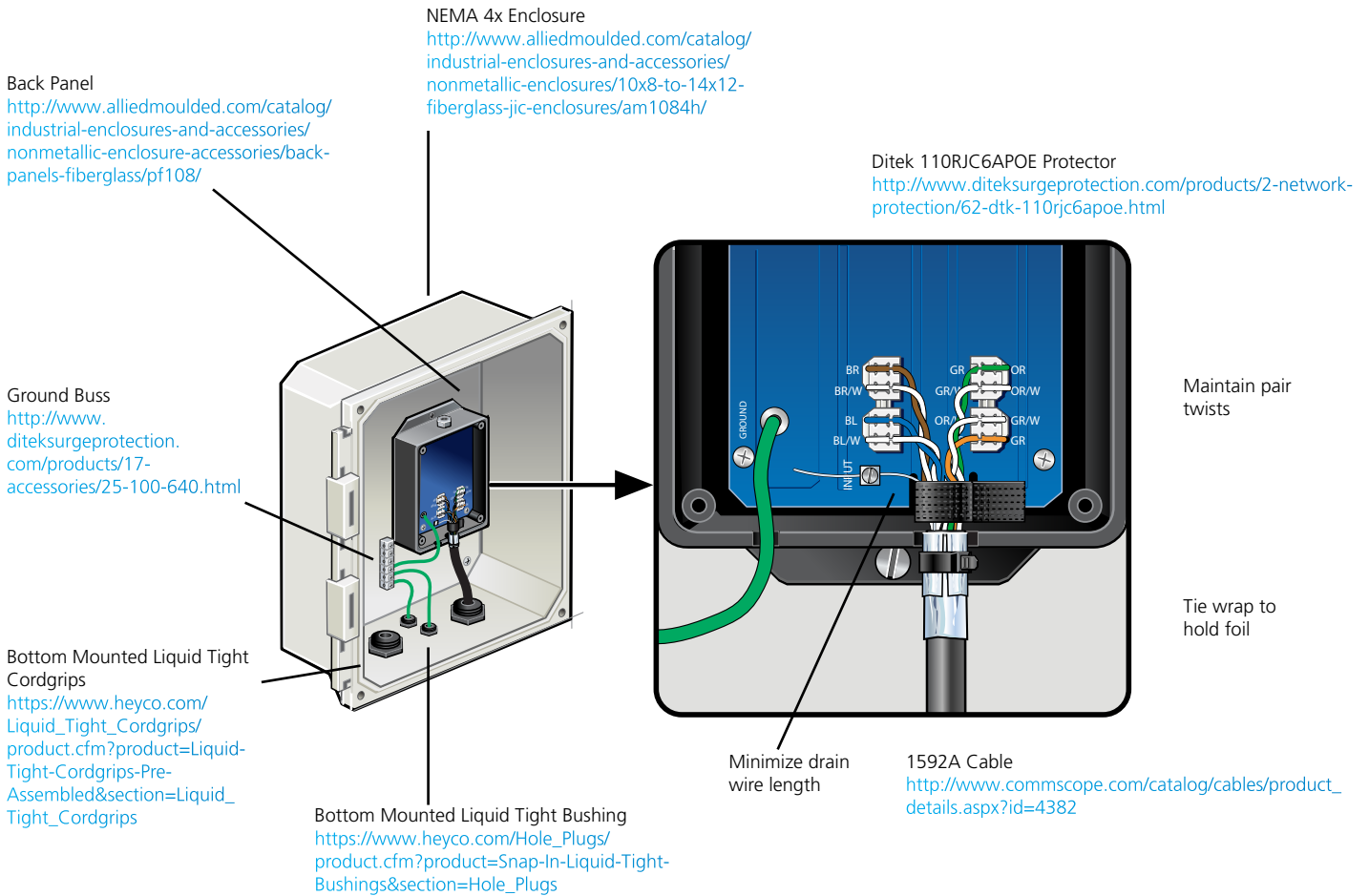
Some of the POE Extenders rely on the sealing grommet and power conductor terminations



Others have a power conductor clamp for holding the cable

## APPLICATION EXAMPLE:

### Pole mounted category 6A protector for protecting remote equipment



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