UHF/VHF Bicycle Antenna and Cable Connector Weatherproofing System Technologies

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Bicycle Antenna System

- Consist of a Rugged Radios VHF ½ wave no ground plane antenna connected to a weBoost 3/8” NMO mount with 14’ RG58 cable and SMA connectors
  - The weBoost mount is in turn connected to a Tosuny 2-axis adjustable NMO lip mount
  - The Tosuny lip mount is bolted to a 1 foot long piece of 2" x 1/8" aluminum angle which is in turn clamped to a wooden detachable bicycle wood crate

Bicycle Antenna System

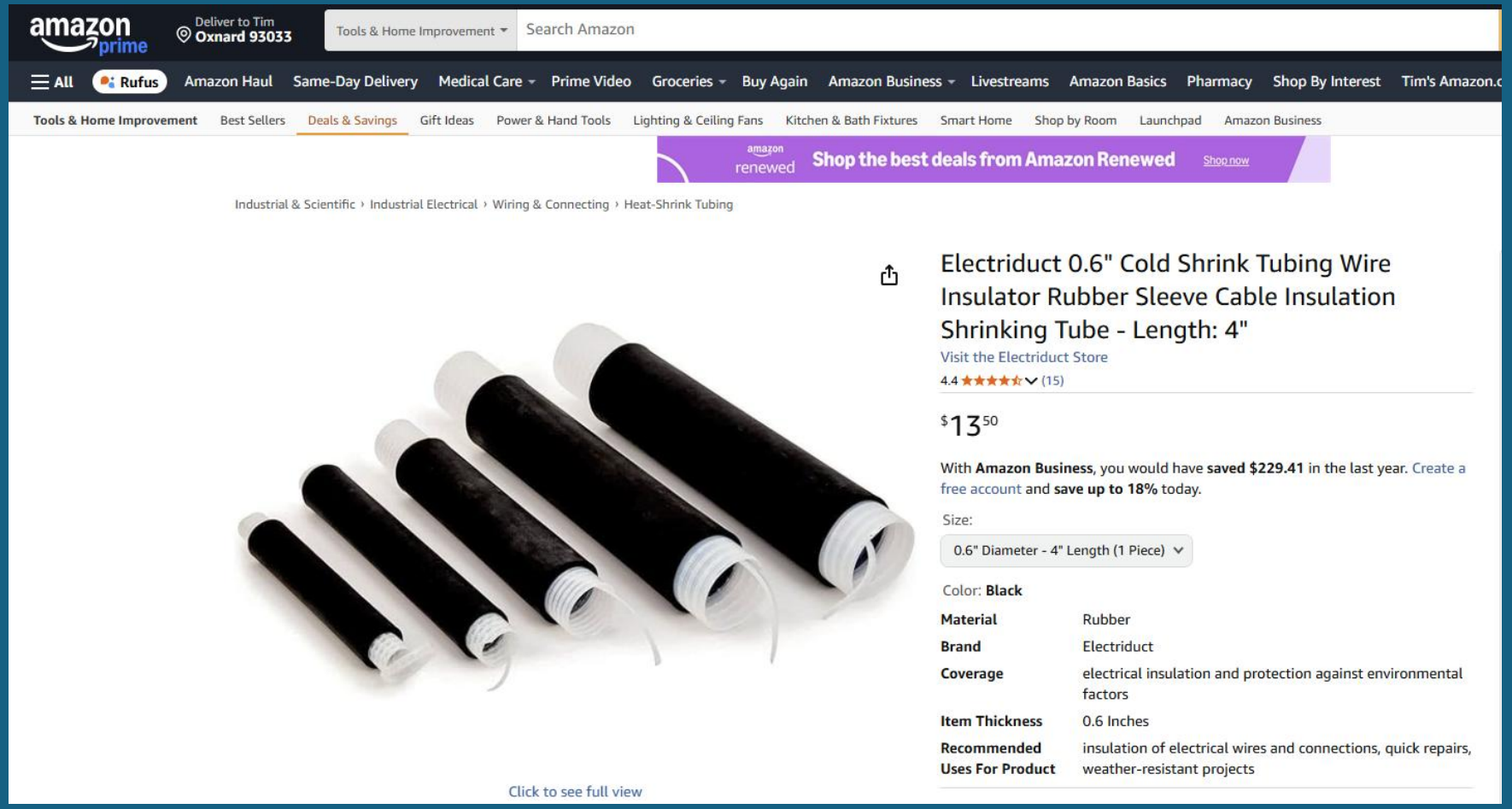
Cold Shrink Tubing

- What is it?
  - Consist of open-ended, tubular, rubber sleeves which are factory expanded and assembled onto a removable core
  - The core is removed after the tube has been positioned over an inline connection, terminal lug, etc., allowing the tube to shrink and form a water-resistant seal
  - The insulating tube is made of EPDM rubber, which contains no chlorides or sulfides
  - Made by a variety of manufacturers, such as 3M and Electriduct
  - Designed to provide reliable insulation, sealing, and protection for electrical and cable connections

Cold Shrink Tubing

- 5 diameter ranges
  - Range in sizes and lengths to cover cable connector diameters from 0.35 inches to 1.94 inches

Cold Shrink Tubing

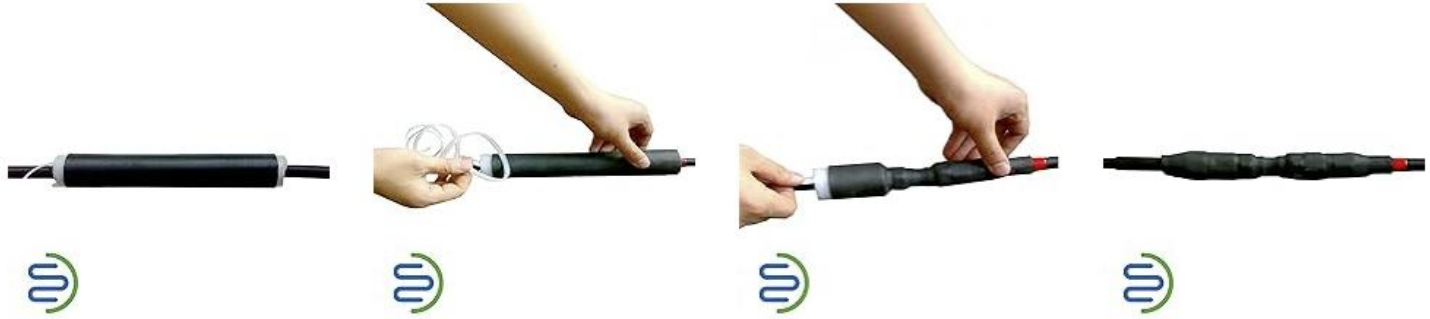


Cold Shrink Tubing

- If there is a large difference in diameters between the cable connector and cable to the point that the selected cold shrink tubing will not properly compress on the cable, build up the diameter of the cable where the cold shrink will cover with 3M Scotch 13 tape before installing the cold shrink

Cold Shrink Tubing

Installation Instructions:



Steps 1 - Step 3

1. Set cold shrink tube on cable or wire prior to connecting.

2. Install connector and clean cable installation.

3. Slide cold shrink tube on connector in a counter-clockwise direction.

Step 4

4. Hold cold shrink tube and cable in desired position in one hand, pull core gently in counterclockwise direction with the other hand.

Step 5

5. Installation complete.

Important Note

Before utilizing the product, the user should make sure that if the product meets the requirements, and if it needs that the waterproof sealing tape is designed to build up the diameter of the smaller cable. This ensures proper sealing when the product is applied to a connection

Cold Shrink Connector Tubing

- To extend the useful life of these products in applications which are continuously exposed to high levels of ultra-violet radiation, overwrapping with Scotch® Super 33+™ Vinyl Electrical Tape or Scotch® Self-Fusing Silicone Rubber Electrical Tape 70 is recommended

Cold Shrink Tubing

- Advantages
  - Does not require tools to use
- Disadvantages
  - Must destroy tubing to remove it by cutting
  - Higher price than sealants or tape wrap methods, but far more effective to prevent corrosion

Heat Shrink Tubing

- Similar to cold shrink tubing, except that the tubing is shrunk by heat
- Typically made of flexible polyolefin
- Available with or without adhesive lining inside
- 3M™ Heat Shrink Tubing MDT series recommended for radio applications
  - Abrasion, tear, chemical, solvent, and UV resistant
  - Adhesive lined for environmental sealing
  - Flame retardant
  - Mechanically tough and can be easily surface printed

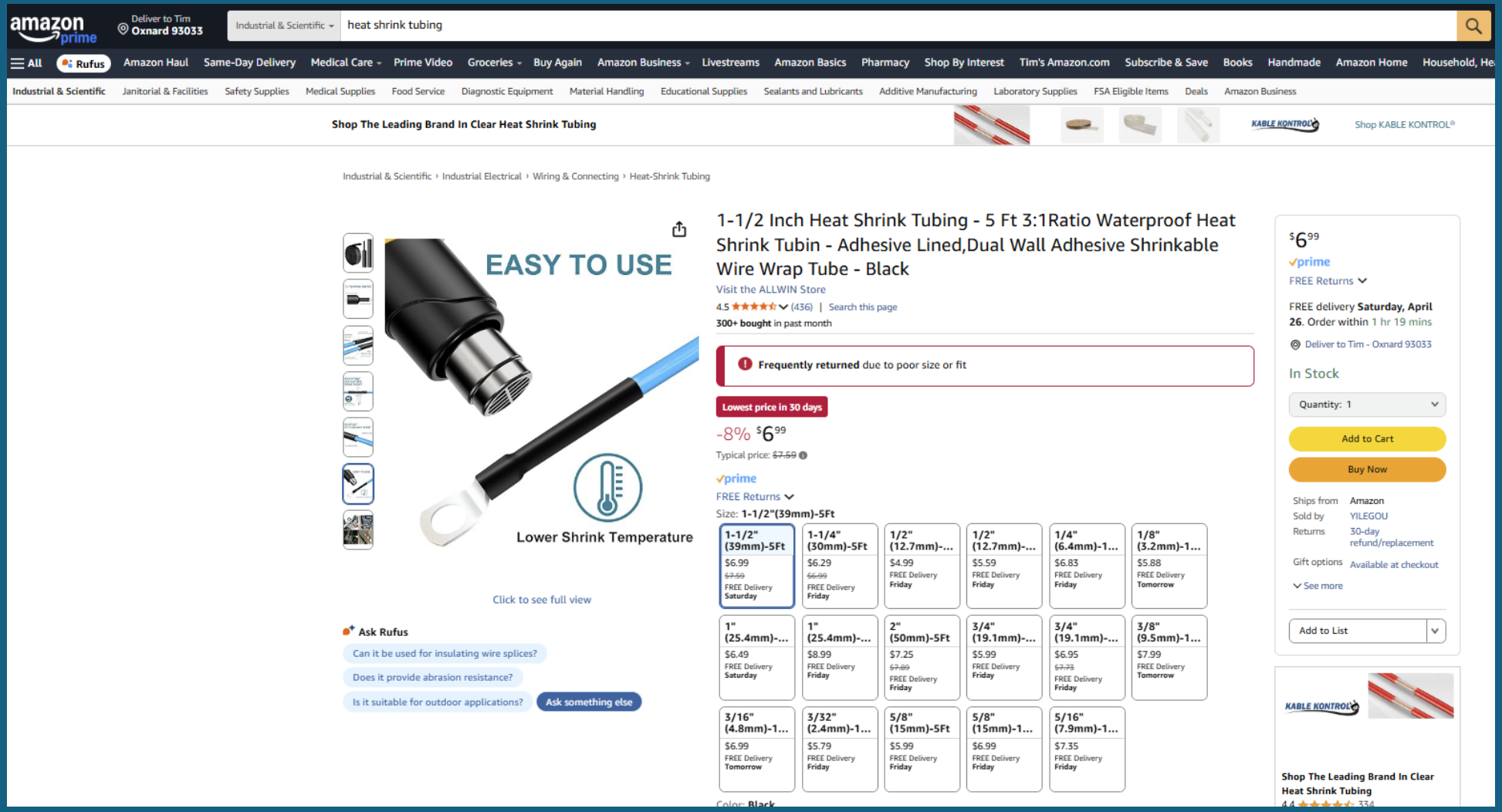
Heat Shrink Tubing

- 3M™ Heat Shrink Tubing MDT series sizes

Part Number	Cable Range	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Outer Wall Thickness (Nominal)		Length	Std. Pkg. Pieces/ Carton	Color
		in.	(mm)	in.	(mm)	in.	(mm)	in.		
MDT-0400-48A	#12 - #6 AWG	.40	(10,2)	.15	(3,8)	.09	(2,3)	48	20	Red and Black
MDT-0800-48A	#8 - #3 AWG	.80	(20,3)	.22	(5,6)	.10	(2,5)	48	20	Red and Black
MDT-1100-48A	#2 - 2/0 AWG	1.10	(27,9)	.37	(9,4)	.10	(2,5)	48	20	Red and Black
MDT-1300-48A	#1 - 4/0 AWG	1.30	(33,0)	.43	(10,9)	.10	(2,5)	48	15	Black Only
MDT-1500-48A	1/0 - 250 MCM	1.50	(38,1)	.50	(12,7)	.10	(2,5)	48	20	Black Only
MDT-1700-48A	4/0 - 400 MCM	1.70	(43,2)	.60	(15,2)	.10	(2,5)	48	20	Black Only
MDT-2000-48A	300 - 500 MCM	2.00	(50,8)	.75	(19,1)	.10	(2,5)	48	15	Black Only
MDT-3000-48A	600 - 1250 MCM	3.00	(76,2)	1.00	(25,4)	.12	(3,0)	48	15	Black Only
MDT-4300-48A	1000 - 2500 MCM	4.30	(109,2)	1.50	(38,1)	.15	(3,8)	48	10	Black Only

- Available from Strobelis supply, https://www.strobelssupply.com

Heat Shrink Connector Insulators



Heat Shrink Tubing

- Shrunk by adding heat from a hot air gun, propane torch, etc.
- If there is a large difference in diameters between the cable connector and cable to the point that the selected cold shrink tubing will not properly compress on the cable, build up the diameter of the cable where the cold shrink will cover with 3M Scotch 13 tape before installing the heat shrink

Heat Shrink Tubing

- Advantages
  - For heat shrink tubing that contain an adhesive lining, as the tubing is shrunk the internal adhesive flows and seals the structures covered by the tubing
- Disadvantages
  - Glue adhesive bonds weaken and fail over time
  - Must destroy tubing to remove it by cutting
  - Higher price than sealants or tape wrap methods, but far more effective to prevent corrosion

Tape Wrap Systems

- Consists of layers of various tapes wrapped around the connector and cable adjacent to the connector
  - 1st layer typically a self-amalgamating tape (a special rubber tape that can bond to itself without heat or adhesive, creating a waterproof and airtight seal)
    - Scoth 23 is an example, which is a thick, highly conformable, self-amalgamating EPR (Ethylene Propylene Rubber) based tape can be stretched up to 100% for void-free, moisture-resistant insulation

Tape Wrap Systems

Tape Wrap Systems

- Consists of layers of various tapes wrapped around the connector and cable adjacent to the connector
  - 1st layer may also be a butyl tape
    - Scotch-Seal Mastic Tape Compound 2229 is an example, which is a highly conformable, tacky mastic which offers good adhesion to metals, rubbers, synthetic cable insulations and jackets
    - Scotch tape 2229 can also be used for cold and heat shrink applications to build up the diameter of the cable when needed

Tape Wrap Systems

- Consists of layers of various tapes wrapped around the connector and cable adjacent to the connector
  - Last layer is typically a pressure-sensitive vinyl electrical tape to protect the previous layers from abrasion, moisture, solvents, acids, UV and ozone
    - Scotch Super 33+ or Super 88 are examples, which has a pressure-sensitive, rubber-resin adhesive and PVC backing

Tape Wrap Systems

- Advantages
  - A lower cost system compared to cold or heat shrink
  - Does not require tools to install other than a heavy duty scissors
- Disadvantages
  - Effectiveness highly dependent on attention to detail
  - Outer tape layer adhesion can weaken an unravel in time with continuous UV and ozone exposure
  - Must destroy tape system to remove it by cutting

Tape Wrap Systems

- There have been significant technology advances which can replace the tape systems previously mentioned and do not have as many disadvantages
  - These technologies incorporate vapor corrosion inhibitors (VCIs) which are infused into the tape
  - These technologies are more forgiving to surface conditions (i.e., corrosion)
  - Are a one-step application process

Tape Wrap Systems

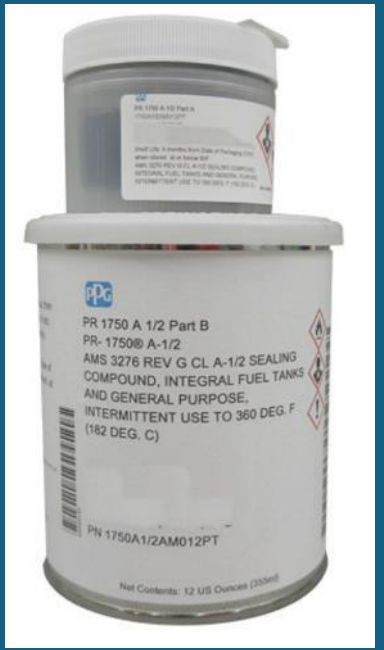
- Valkyrie offers a PLID Wrap Anti-Corrosion Tape
- Comes in grey or black and 2, 4”, or 6” widths

Tape Wrap Systems

- Valkyrie also offers a product line called sailor putty, designed for US military, which is a VCI infused paste
- Can order from Valkyrie at https://s2srequests.valkyrie.com/f/request.html

Sealant Systems

- Consists of applying a sealant to the assembled connector by brush
- Common materials include polysulfide, liquid electrical tape (vinyl polymer), and silicon sealants
- Some contain Vapor Corrosion Inhibitors (VCIs)



Sealant Systems

- Polysulfide sealant is a two-part compound
  - Recommend PR1750 A-1/2, gray in color
  - Comes in a 6-oz. self-contained SemKit

Sealant Systems

- Liquid electrical tape (vinyl polymer) and silicon sealants are single component materials
  - Liquid electrical tape recommend Permatex 85120 black liquid electrical tape, 4 oz. bottle from Amazon
  - Silicon sealant recommend = GE Supreme Silicone 10.1-oz Window Door Black Silicone Caulk available from Lowe’s or Home Depot

Sealant Systems

- In terms of performance from best to worst = polysulfide, liquid electrical tape, silicon sealant
- Regardless of what system is used, need two separately applied coats of selected sealant to ensure that there are no missed areas or voids

Roll On Sealing Sleeves

- Similar to cold shrink, but the sleeve can be moved down the cable by a rolling action then put back over the connector when it is reassembled
  - Thus, do not have to destroy the insulator when you need to access the cable connector electronics or wiring
- Typically sold under the product name Rayolon and sold by TE Conductivity

Roll On Sealing Sleeves

Base Part No.	Available Kit	Sleeve Diameter	Sleeve Length	Recommended Usage Range	Connection Length
LNCL-11-125	GK	0.51 [13.0]	4.92 [125]	0.22 - 0.68 [6 - 17]	3 [75]
LNCL-11-205	GK	0.51 [13.0]	8.07 [205]	0.22 - 0.68 [6 - 17]	6 [150]
LNCL-12-140	GK, CK-N	0.56 [14.2]	5.51 [140]	0.48 - 0.90 [12 - 23]	4 [100]
LNCL-12-240	GK, CK-N	0.56 [14.2]	9.45 [240]	0.48 - 0.90 [12 - 23]	7 [175]
LNCL-13-155	GK	0.75 [19.0]	6.10 [155]	0.69 - 1.20 [18 - 30]	4 [100]
LNCL-13-305	GK	0.75 [19.0]	12.00 [305]	0.69 - 1.20 [18 - 30]	9 [225]
LNCL-14-185	GK	1.02 [25.9]	7.28 [185]	0.96 - 1.50 [25 - 38]	5 [125]
LNCL-14-355	GK	1.02 [25.9]	14.00 [355]	0.96 - 1.50 [25 - 38]	10 [250]
LNCL-15-185	GK	1.45 [36.8]	7.28 [185]	1.40 - 2.00 [36 - 46]	5 [125]
LNCL-15-260	GK, SS	1.45 [36.8]	10.2 [260]	1.40 - 2.00 [36 - 46]	7.5 [190]
LNCL-15-450	GK, SS	1.45 [36.8]	17.72 [450]	1.40 - 2.00 [36 - 46]	12 [300]

Note: Dimensions are Inch [mm]
To specify a kit, add the kit identifier to the end of the base part number: LNCL-12-240-CK-N

TE Components . . . TE Technology . . . TE Know-how . . .
AMP | Agastat | CII | Hartman | Kilovac | Microdot | Nanonics | Raychem | Rochester | DEUTSCH
I.I. Rowe | Phoenix Optix | SEACON

Roll On Sealing Sleeves

- Advantages
  - Don’t have to destroy the weatherproofing system to access the cable or cable connector then reinstall new material after reconnecting electrical components
  - Does not require tools
- Disadvantages
  - Only one size readily available, LNCL-15-260-SS, with a useful range of 1.40 - 2.00 inches diameter
  - Need to contact TE Connectivity, https://www.te.com/en/home.html, (800)522-6752 about getting other sizes

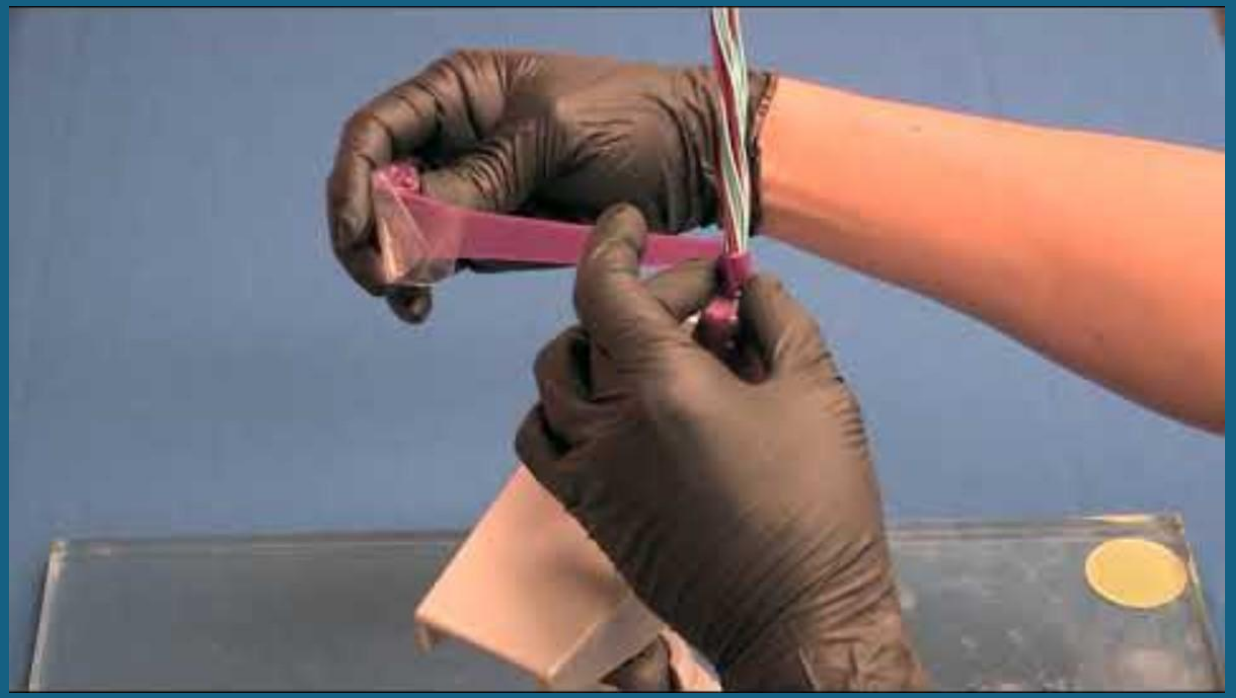
Specialized Tape + Potting Compound System

- Consists of wrapping the connector and cable with AD89503 HI-TAK StretchSeal® tape, following by application of HT3326-5 or HT3326-5FR Self-Leveling® Green FR (HT3326-5FR) injected into wire gaps and connector base, then finishing with AD59163FR-01-432-1 Flame Retardant Self Fusing Silicone Tape wrapped around the previously applied StretchSeal tape and connector
  - StretchSeal tape is a stretchable foam, impregnated with polyurethane, designed for sealing and moisture-proofing
  - Self-Leveling Green is a two-component fast-cure polyurethane material

Specialized Tape + Potting Compound System

Specialized Tape + Potting Compound System

- Less robust system is to not do the Self-Leveling Green injection step



Weatherproofing Technologies Ranked

- From best to worst performance
  - Tape wrap + potting compound system
  - Tape wrap (new technologies)
  - Cold shrink/reenterable sleeves
  - Sealants
  - Heat shrink
  - Tape wrap (traditional materials)

Air Canon Throw Line Demonstration

- Uses PVC piping, ball valve, and compressed air to accurately aim and propel antenna throw line over large distances
- Future workshops planned as a club activity to build the device

Questions?