

Installation Guidelines – HELIAX® Solutions

Hybrid Cables:

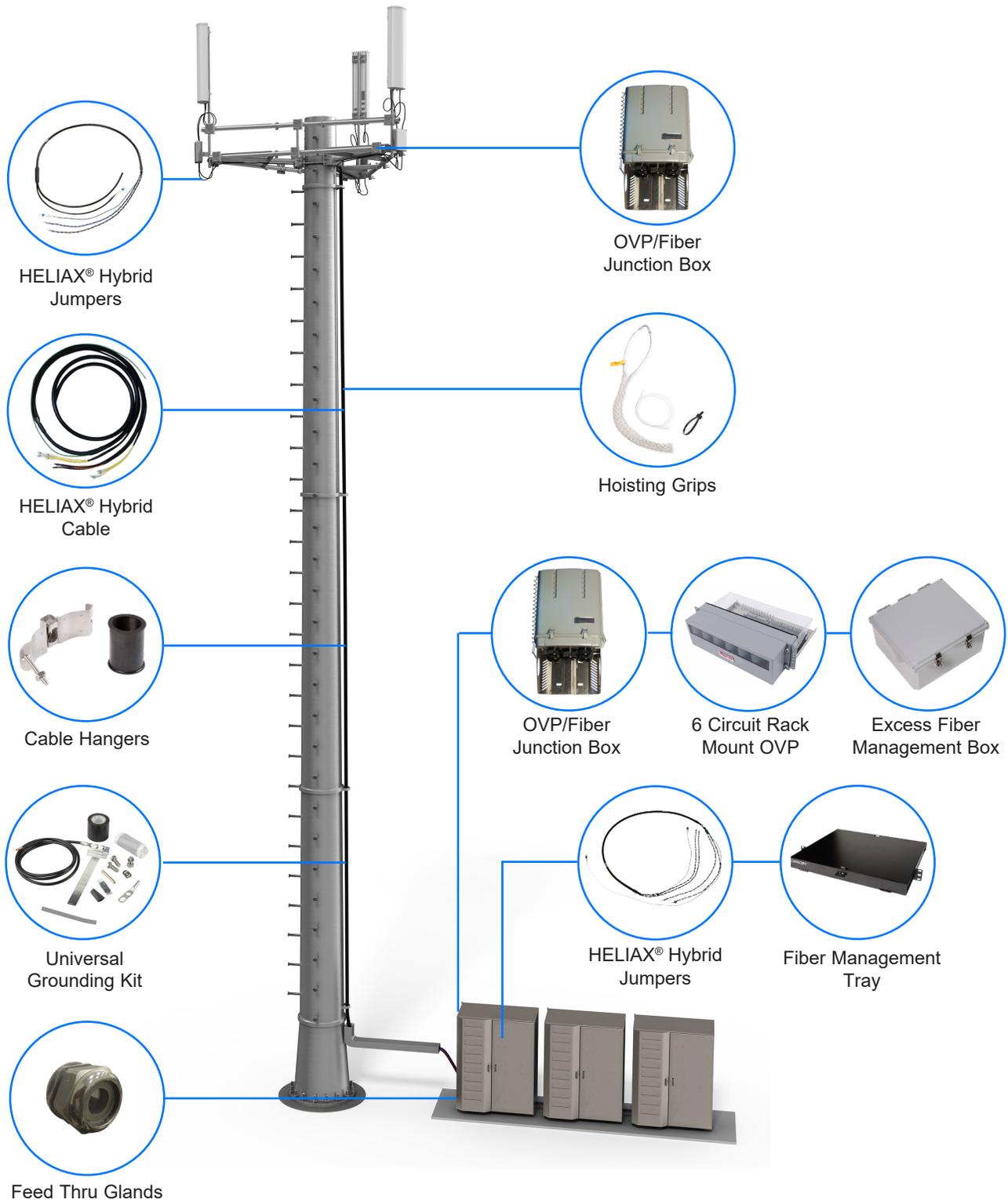
HFT1206-24SV4 | HFT1206-24SV2 Low Inductance | HFT406-8SV2 Low Inductance |
HFT206-3SV1 | HFT410 and HFT412 Jumper Assemblies

Related Support and Learning Opportunities Offered by the CommScope Infrastructure Academy

The insights and expertise contained in this manual represent just one small part of CommScope's global learning initiative. Few industries are evolving as quickly as wireless communications. Every technological innovation impacts what happens in the field. Our customers look to the CommScope Infrastructure Academy to make sure their technicians and installers are well trained, well-prepared, and well-educated to take advantage of opportunities as they evolve. To access a course, go to www.commscopetraining.com/coursecatalog.php, course #6107

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Section 1: HELIAX® Verizon System Components



Jumper length is not field adjustable. Coil excess length and secure to tower or use a Verizon approved slack storage box.

CommScope Hybrid cables require the use of approved installation accessories.

Section 2: General Specifications

Cable Type	HFT1206-24SV4-*G	HFT1206-24SV2-*G	HFT406-8SV2-*G
Rating	UL Type RHC	UL Type RHC	UL Type RHC
Center Conductor Gauge	6 AWG / Non-low inductance	6 AWG / Low inductance	6 AWG / Low inductance
Conductors, quantity	12	12	4
Total Fiber Quantity	24	24	8
Shielding Type	Corrugated aluminum	Corrugated aluminum	Corrugated aluminum
Fiber Type	Bend insensitive single mode	Bend insensitive single mode	Bend insensitive single mode
Alarm Wire (Qty Gauge)	8 18 AWG	18 18 AWG	10 18 AWG
Gland Kit Included	Yes	Yes	Yes
Dimensions			
Cable Weight	1.88 lb/ft	1.88 lb/ft	.76 lb/ft
Diameter Over Jacket	1.55 in	1.55 in	1.07 in
Physical Specifications			
Minimum Bend Radius	18.6 in	18.6 in	12.8 in

General Specifications

Cable Type	HFT206-3SV1-*G	HFT410-2SXX-*G	HFT410-4SXX-*G
Rating	UL Type RHC	UL Type TC-OF-ER	UL Type TC-OF-ER
Center Conductor Gauge	6 AWG Low inductance	12 AWG	12 AWG
Conductors, quantity	2 (none low inductance)	4	4
Total Fiber Quantity	3	2	4
Shielding Type	Copper tape	Corrugated aluminum	Corrugated aluminum
Fiber Type	Bend insensitive single mode	Single mode	Single mode
Gland Kit Included	Yes	Yes	Yes
Dimensions			
Cable Weight	.34 lb/ft	.306 lb/ft	.306 lb/ft
Diameter Over Jacket	0.72 in	.72 in	.72 in
Physical Specifications			
Minimum Bend Radius	8.7 in	8.7 in	8.7 in

General Specifications

Cable Type	HFT412-2SXX-*G	HFT412-4SXX-*G
Rating	UL Type TC-OF-ER	UL Type TC-OF-ER
Center Conductor Gauge	12 AWG	12 AWG
Conductors, quantity	4	4
Total Fiber Quantity	2	4
Shielding Type	Corrugated aluminum	Corrugated aluminum
Fiber Type	Single mode	Single mode
Gland kit Included	Yes	Yes
Dimensions		
Cable Weight	.220 lb/ft	.220 lb/ft
Diameter Over Jacket	.62 in	.62 in
Physical Specifications		
Minimum Bend Radius	6.2 in	6.2 in

* length

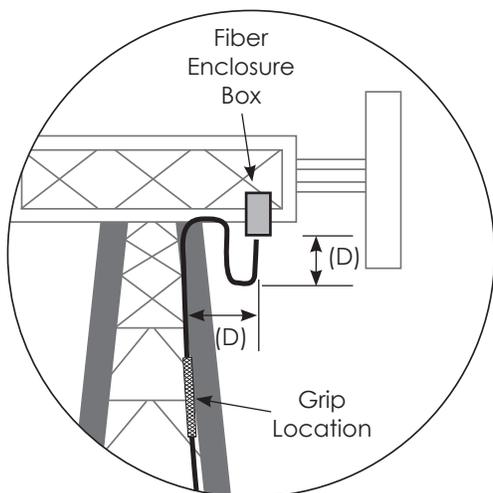
Section 3: HELIAX® Trunk Cable Hoisting Considerations

- In general this cable will handle similarly to coaxial cable, and similar installation techniques apply. All cables are individually serialized, be sure to write down the cable serial number for future reference.
- The terminated fiber ends (the broken out fibers plus connectors) however are fragile, and these must be protected during the installation process.
- Leave the protective tube and sock around the fiber tails and connectors in place during hoisting and securing the cable. Remove this only just prior to making the final connections to the Junction box.
- DO NOT BEND THE FIBER ENDS (in the furcation tubes) TIGHTER THAN 1.2 in (30 mm) BEND RADIUS ELSE THERE IS A RISK OF BREAKING THE GLASS FIBERS.
- Be sure that the lace up ends and fiber connectors are not damaged by attachment of a hoisting grip or during the hoisting process. Attach a hoisting grip on the jacketed cable no less than 6" below the fiber breakout point. If a hoisting grip is not easily attached, use a simple line attached below the fiber break-out point (i.e. at the cable outer jacket). Prevent the fiber tails (in protective tube) at the cable end from undue movement during hoisting by securing the protective tube (with outer sock) to the hoisting line.
- During hoisting ensure that there is a free path and that the cable, and especially the fiber ends, will not be snagged on tower members or other obstacles.
- Installation temperature range is -40°F to +176°F (-40°C to +80°C)
- Minimum cable bend radii can be found in this document or on-line.
- Maximum cable tensile load can be found in this document or on-line.
- **CommScope Lace-Up Hoisting Grip 43094 required for HFT206, 19256B-C required for HFT406, 29961-C required for HFT1206 installations.**
- **Maximum hanger spacing 3 ft (0.9 m) - 4 ft (1.2 m)**

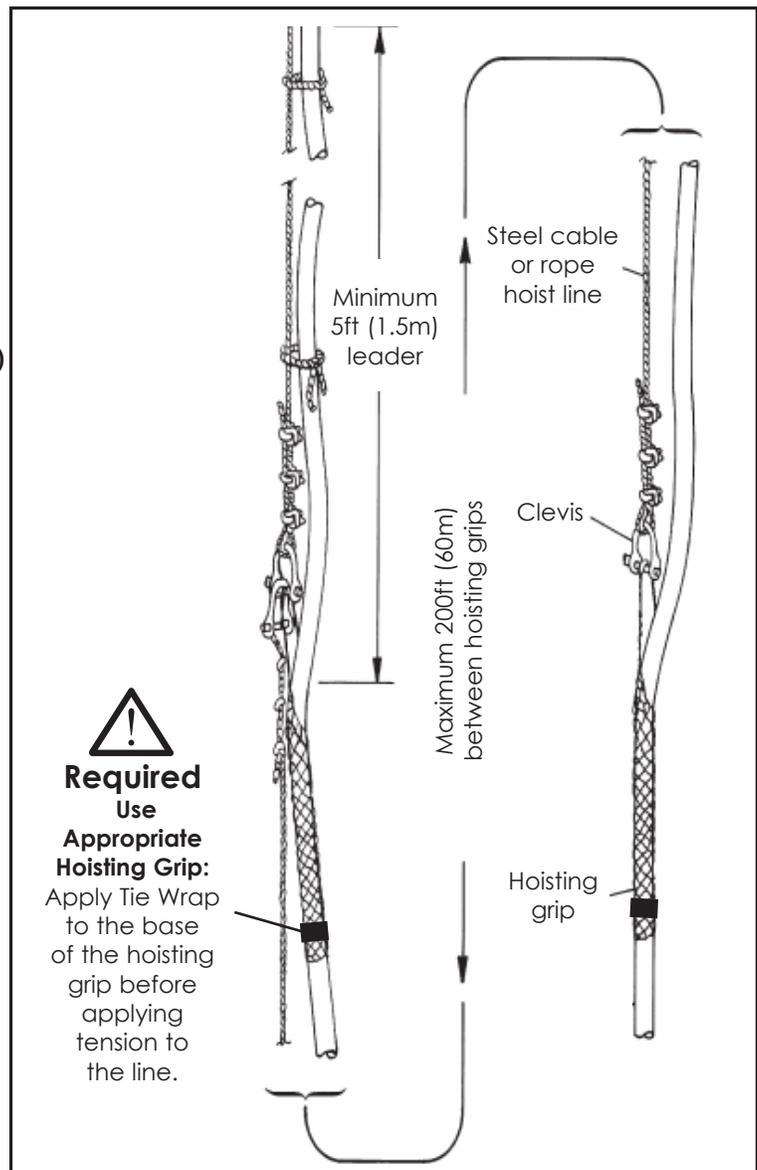
Hybrid Fiber Cables weigh more than traditional coaxial cables. Be sure to follow proper hoisting and attachment procedures.



Hoisting Recommendations



Reminder: Plan grip location by measuring distance (D) from Fiber Enclosure Box to tower support member.



Section 4: HELIAX® Assemblies / Trunks



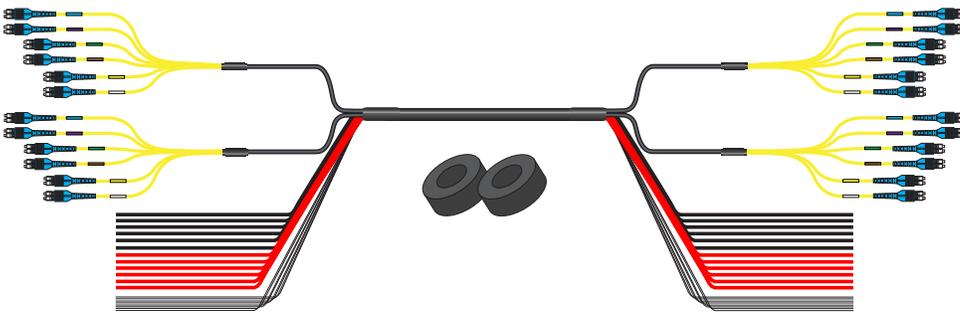
HFT206



HFT406



HFT1206 V2



HFT1206 V4

RRU's Supported	# of Power Conductors	# of Fibers	End 1 Power/Alarm Breakout (mm)	End 1 Fiber Breakout (mm)	End 2 Power/Alarm Breakout (mm)	End 2 Fiber Breakout (mm)	Part Number
Hybrid Trunk Cables; Low Inductance 6 AWG power conductor wire, OVP Gland kits Included							
1	2	3	2 x 550 (no alarm)	3 x 1250	2 x 550 (no alarm)	3 x 1250	HFT206-3SBVSJ-*G
2	4	8	2 x 150 2 x 226	4 x 535 4 x 585	4 x 600	4 x 1195 4 x 1245	HFT406-8SV2-*G
6	12	24	4 x 257 4 x 333 4 x 435	8 x 460 8 x 510 8 x 560	12 x 725	8 x 460 8 x 510 8 x 560	HFT1206-24SV2-*G
6	12	24	12 x 725	8 x 460 8 x 510 8 x 560	12 x 725	8 x 460 8 x 510 8 x 560	HFT1206-24SV4-*G

* length

Jumpers

- In general this cable will handle similarly to a coaxial cable.
- The terminated fiber ends however are fragile and must be protected during installation. Leave the packaging around the fiber ends in place until ready to connect the jumper between OVP box and RRU or BBU.
- DO NOT BEND THE FIBER ENDS (in the furcation tubes) TIGHTER THAN 1.2 in (30 mm) BEND RADIUS ELSE THERE IS A RISK OF BREAKING THE GLASS FIBERS.
- Attach the main cable securely to the structure or equipment using hangers and/or cable ties to prevent strain on connections from movement in wind or snow / ice conditions.
- Ensure the DLC fiber connectors are seated firmly in the OVP box, RRU or in BBU equipment.
- Ensure the weatherproof boots for both fiber and power connections and seated firmly in the RRU.
- Heat shrink tube of the jumper should be 1 in (25.40 mm) inside of the OVP box.
- Installation temperature range is -40°F to +176°F (-40°C to +80°C).
- Minimum cable bend radii can be found in this document or on-line.
- Power connector is supplied with the RRU
- Blue power conductor is -48V
- Black power conductor is 0V (return)
- RRU/BBU connectivity per OEM instruction

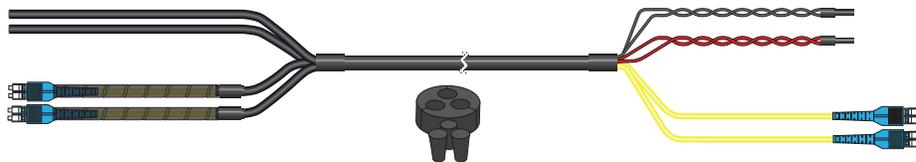


Jumper length is not field adjustable. Coil excess length and secure to tower or use a Verizon approved slack storage box.

Hybrid Jumpers for High-Power Radios

END 1 (RRU)

END 2 (Junction box)

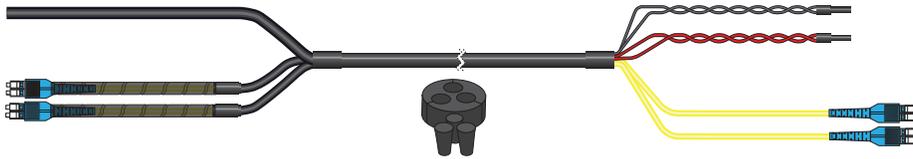


Descrip. RRU OEM	# of Fibers (strands)	RRU				OVP				Part Number
		End 1 Power Breakout (mm)	End 1 Conductor Size (AWG)	Fiber Conn	End 1 Fiber Breakout (mm)	End 2 Power Breakout (mm)	End 2 Conductor Size (AWG)	Fiber Conn	End 2 Fiber Breakout (mm)	
Hybrid Jumpers for High-Power RRUs with Y-Cable Power Cord, OVP Gland kits Included										
Ericsson	2	2 X 1000	8	1 x DLC	1000	2 x 550	10	1 x DLC	1250	HFT410-2SVHY-*G
Ericsson	4	2 X 1000	8	2 x DLC	2 x 1000	2 x 550	10	2 x DLC	2 x 1250	HFT410-4SVHY-*G
Ericsson	1 (Bi-Di)	2 X 1000	8	1 x SLC	2 x 1000	1 x 550	10	1 x SLC	1 x 1250	HFT410-1SBVY-*G
Ericsson	2 (Bi-Di)	2 X 1000	8	2 x SLC	2 x 1000	2 x 550	10	2 x SLC	2 x 1250	HFT410-2SBVY-*G

FullAxs versions available, part number example: HFT410-2SVHYF-G

* length

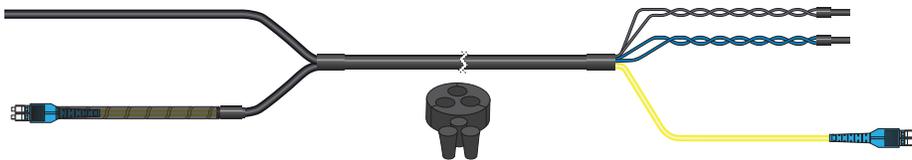
Hybrid Jumpers



Descrip. RRU OEM	# of Fibers (strands)	RRU				OVP				Part Number
		End 1 Power Breakout (mm)	End 1 Conductor Size (AWG)	Fiber Conn	End 1 Fiber Breakout (mm)	End 2 Power Breakout (mm)	End 2 Conductor Size (AWG)	Fiber Conn	End 2 Fiber Breakout (mm)	
Hybrid Jumpers for High-Power RRUs with Single Power Cord, OVP Gland kits Included										
Ericsson/ Nokia	2	2 X 1000	8	1 xDLC	1 x 1000	2 x 550	10	1 x DLC	1 x 1250	HFT410-2SVHE-*G
Ericsson/ Nokia	4	2 X 1000	8	2 x DLC	2 x 1000	2 x 550	10	2 x DLC	2 x 1250	HFT410-4SVGE-*G
Ericsson/ Nokia	1	2 X 1000	8	1 x SLC	1 x 1000	2 x 550	10	1 x SLC	1 x 1250	HFT410-1SBVE-*G
Ericsson/ Nokia	2	2 X 1000	8	2 x SLC	2 x 1000	2 x 550	10	2 x SLC	2 x 1250	HFT410-2SBVE-*G
Ericsson	3	2 X 1000	8	3 x SLC	3 x 1000	2 x 550	10	3 x SLC	3 x 1250	HFT410-3SBVE-*G
Ericsson	4	2 X 1000	8	4 x SLC	4 x 1000	2 x 550	10	4 x SLC	4 x 1250	HFT410-4SBVE-*G

FullAx versions available, part number example: HFT410-2SVHEF-G

* length



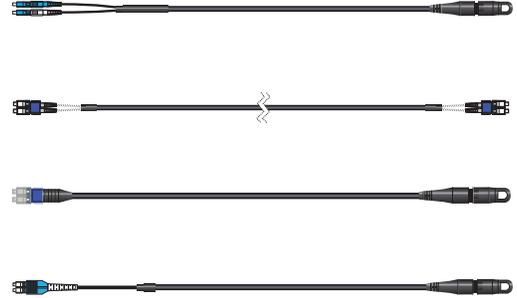
Descrip. RRU OEM	# of Fibers (strands)	RRU				OVP				Part Number
		End 1 Power Breakout (mm)	End 1 Conductor Size (AWG)	Fiber Conn	End 1 Fiber Breakout (mm)	End 2 Power Breakout (mm)	End 2 Conductor Size (AWG)	Fiber Conn	End 2 Fiber Breakout (mm)	
Hybrid Jumpers, OVP Gland kits Included										
Ericsson/ Nokia	2	1 X 1000	12	1 x DLC	1 x 1000	2 x 660	12	1 x DLC	1 x 800	HFT412-2S28-*G
Ericsson/ Nokia	2	1 X 1000	12	1 x DLC	1 x 1000	2 x 850	12	2 x DLC	1 x 1250	HFT412-2S29-*G
Ericsson/ Nokia	4	1 X 1000	12	2 x DLC	2 x 1000	1 x 660	12	1 x SLC	2 x 800	HFT412-4S28-*G
Ericsson/ Nokia	4	1 X 1000	12	2 x DLC	2 x 1000	2 x 850	12	2 x SLC	2 x 1250	HFT412-4S29-*G

FullAx versions available, part number example: HFT410-2S28F-G

* length

Discrete Jumpers to support Small Cells

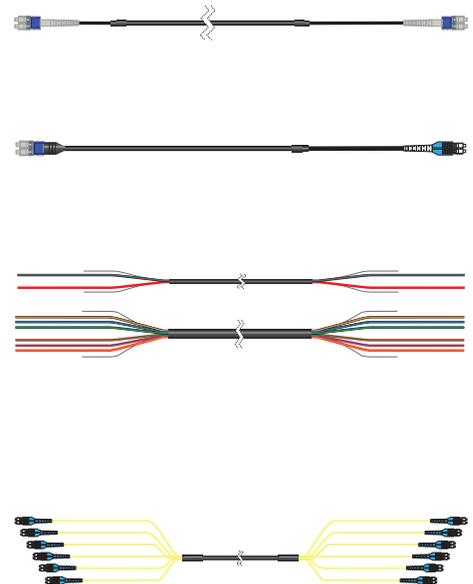
Description	Part Number
HELIX Discrete Fiber Jumpers 2 Singlemode bend insensitive fibers	
HMFOC to 2 Simplex LC Hardened HMFOC for MST connection 2 Simplex LC for Nokia radio	DFJ-2S320-*
DLC to DLC Duplex LC connection for Ericsson 2203 radios Armored cable design	DFJ-2S123-*
HMFOC to DLC Hardened HMFOC for MST connection Duplex LC for Samsung radio with Jonhon Adapter (FJ28/FJ30)	DFJ-2S320J-*
HMFOC to DLC Hardened HMFOC for MST connection Duplex LC for Ericsson 2208 radio	DFJ-2S320E-*



* length

Discrete Fiber and Power Cables

Description	Part Number
HELIX Jumpers 2 singlemode fibers terminated to DLC connectors on each end UL listed OFNR UL1666 for indoor/outdoor use	
	FJ-2SM-002-*M
HELIX Jumpers - Ruggedized 2 singlemode fibers terminated to DLC connectors on each end UL listed OFNR UL1666 for indoor/outdoor use	
	FJ-2SM-015-*M
Shielded Power Tray Cable (issued per foot) Braided shielding and a 10 AWG ground wire UL listed type TC-ER for indoor/outdoor use	
Two 8 AWG conductors	PWRT-208-S
Six 8 AWG conductors	PWRT-608-S
OVP Gland Inserts RC3DC-3315-PF-48, for separate fiber and power at the shelter/ cabinet	FA-JSK
HELIX Discrete Fiber Trunks 12 singlemode fibers, terminated to DLC connectors on each end UL listed OFNR UL 1666 for indoor/outdoor use	
	DFT-12SM-011-*M



* length

Section 5: Installation Accessories

Description	Part Number
Hoisting Grips (Maximum 150ft (45.7m) between hoisting grips)	
For HFT206 series cables	43094
For HFT406 series cables	19256B-C
For HFT1206 series cables	29961-C
For HFT2406 series cables	24312A
Standard Hangers (kit of 10)	
For HFT406-8SV2 series cables	42396A-5
For HFT1206-24S49 and HFT1206-24SV2 series cables, with grommet	FA-3540-STH
For HFT412 series hybrid tails	43211A
SnapStak® Hanger	
For HFT2406 and HFT1206-24SV2 series cables, no grommet required	SSH-XL
For HFT406-8SV2 series cables	SSH-L
For HFT206 and HFT410 series hybrid tails	SSH-M
For HFT412 series hybrid tails	SSH-12
Cable Entry Seals	
HFT410 and HFT412 series hybrid tails, four entry holes	FA-102993-HC3
HFT406 and HFT1206 series cables, one entry hole	FA-102997-HC3
Grommets	
For HFT1206-24SV2 cable used with BHD-158 block hanger	HG-37MM-158
For HFT406-8SV2 cable used with BHD-114 block hanger	HG-27MM-114
Miscellaneous Accessories	
Anchor rail adapter for snap-in cable hangers	ARA-22
Universal grounding kit	UG12158-15B4-T
Grounding kit for HFT206	GK-12158-154-T
Fiber connection kit, ALU	FA-R2CT
Power cable seal kit, ALU RRU	FA-PCS10
Power connector, Infinity interface (package of 6)	FA-PCK
Connector cleaning tool	FCCT-L
Ericsson cabinet hybrid jumper feed thru	FA-ERIC-FITTING
Cable splitter tool for length management with a power drill	FA-RCRT-PD
Fiber protection sleeve, Ericsson RRU	FA-FWS-E-250
Excess Discrete Fiber Coiling Reel, PIM free	FBR-COIL-S

Section 6: Breakout Procedure

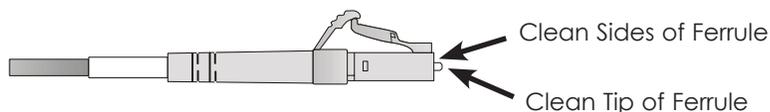
After the trunk cable has been installed and you are ready to make the final connection to the OVP box follow these steps for the removal of fiber protection tube.

1		<p>Remove electrical tape from the trunk cable and corrugated protection tube. While holding the protection tube straight pull the tube away from cable.</p>
2		<p>After you have pulled the fiber and power conductors into the OVP box remove electrical tape from the trunk cable and remove clear tube for access to all optical connectors.</p>

DLC Connectors and Adapter cleaning

Clean exposed connector ferrule by lightly moistening lint-free wipe with fiber optic cleaning solution (Sticklers MCC-FCC03M BLUE or equivalent), and by applying medium pressure, first wipe against wet area and then onto dry area to clean potential residue from end face. Clean connector ferrule inside adapter by inserting lightly moistened cleaning stick with fiber optic cleaning solution (Sticklers MCC-FCC03M BLUE or equivalent) inside the adapter until contact is made with connector on opposite end. Rotate cleaning stick with medium pressure in one circular motion as it is pulled away from the adapter. Repeat process using dry cleaning stick.

Caution: Signal strength will be affected if end and sides of ferrule are not thoroughly cleaned. Discard cleaning sticks after each use. Do not turn cleaning sticks back and forth pressing against connector end face. This may cause scratches if large contamination is present. Always inspect connector end face for contamination after each cleaning.



Clean adapter by inserting adapter cleaning stick (or fiber adapter sleeve brush) moistened with fiber optic cleaning solution (Sticklers MCC-FCC03M BLUE or equivalent) inside the adapter and gently pull out with twisting motion. Repeat process with a dry cleaning stick.

Caution: Do not try to clean adapter with a standard pipe cleaner. The sleeve inner diameter of DLC adapters is too small. Do not try to clean the adapter with cleaning stick if a connector is mounted in one side. Discard cleaning sticks after each use.

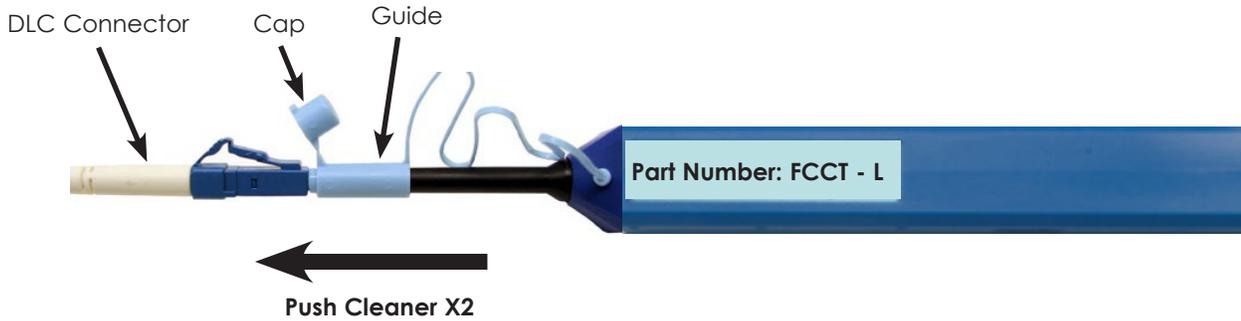


Section 7: All-in-one cleaner

Device designed for cleaning the ferrule end faces of DLC connectors

Open guide cap, insert DLC connector into guide, push the outer shell to start cleaning the DLC connector interface, a "click" sound indicates end of a cleaning process, repeat, close cap immediately after use.

Caution: Be careful not to slant DLC connector while inserting into the Guide cap. Do not overly exert force during insertion as this may cause damage to both the connector and the cleaner.



Inspecting

There are 3 basic principles that are critical to achieving an efficient fiber optic connection:

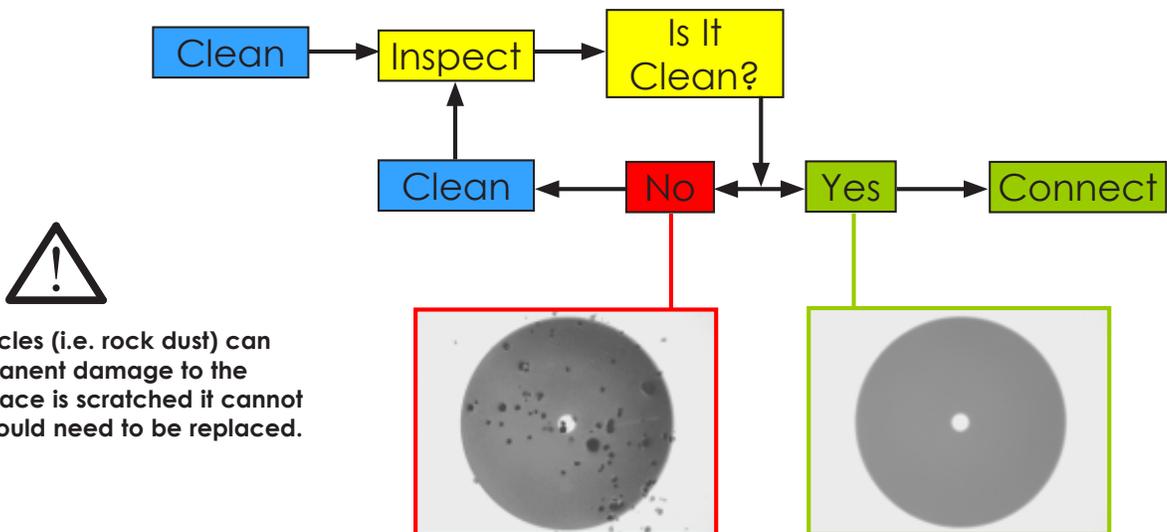
1. Perfect Core Alignment
2. Physical Contact
3. Pristine Connector Interface

Today's connector design and production techniques have eliminated most of the challenges to achieving core alignment and physical contact. What remains challenging is maintaining a pristine end-face. As a result, CONTAMINATION is the #1 reason for troubleshooting optical networks.

Implementing the process of cleaning and inspecting before mating can reduce the time spent troubleshooting, optimize signal performance and prevent damage.



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Abrasive particles (i.e. rock dust) can cause permanent damage to the interface. If interface is scratched it cannot be repaired, it would need to be replaced.

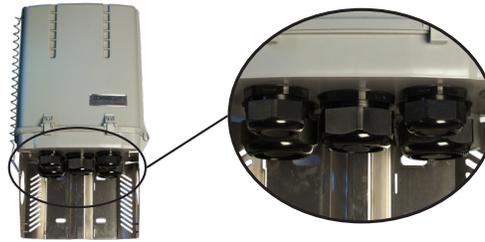
Section 8: OVP Identification

Part Number	Description	Excess Fiber Storage
RC3DC-6627-PF-48*	Distribution box with 12 Strikesorb modules	25ft per trunk
RC3DC-3315-PF-48*	Distribution box with 6 Strikesorb modules	55 ft
RC3DC-4750-PF-48*	Distribution box with out Strikesorb modules	55 ft
RC3DC-1064-PF-48*	Sector box with 2 Strikesorb modules	45 ft
RCMDC-2260-RM-48*	6 circuit rack mount OVP	N/A



* RC3DC-XXXX-PF-48 couples with HFT series cables (accommodates expanded alarm wire pairs)

Gland Installation



At the base of the OVP boxes there are glands that provide weatherproofing for the enclosure. The CommScope -G assemblies include the gland inserts. The following steps will show how to install the Hybrid trunk cable properly.

1

Remove compression nut

2

Slide the compression nut over the breakout. Compress provided insert to slide over the breakout. Leaving protective polly tubing on will simplify this procedure. Be careful not to damage the fiber connectors.

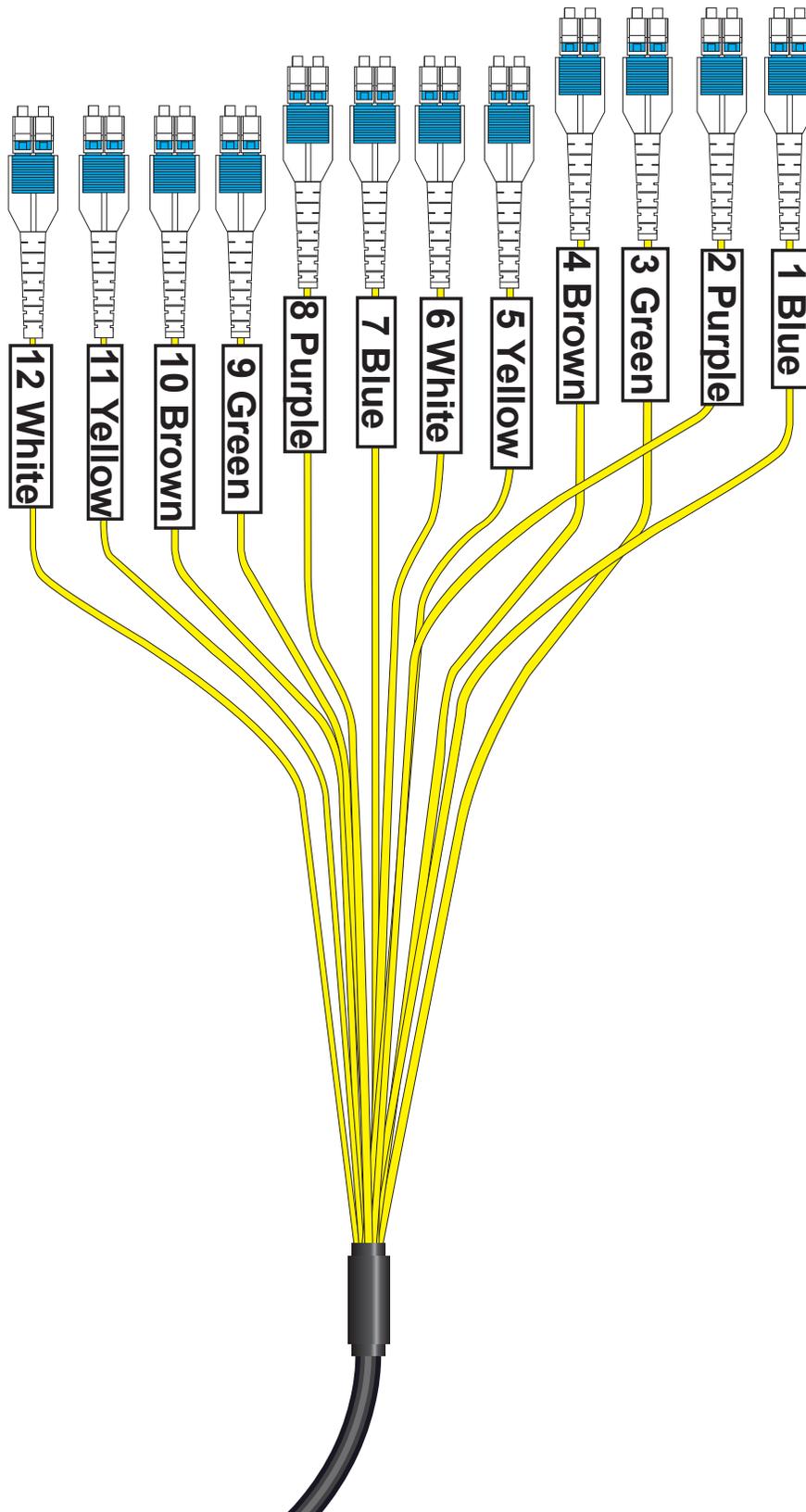
3

Gasket needs to be 1 inch behind heat shrink tube.

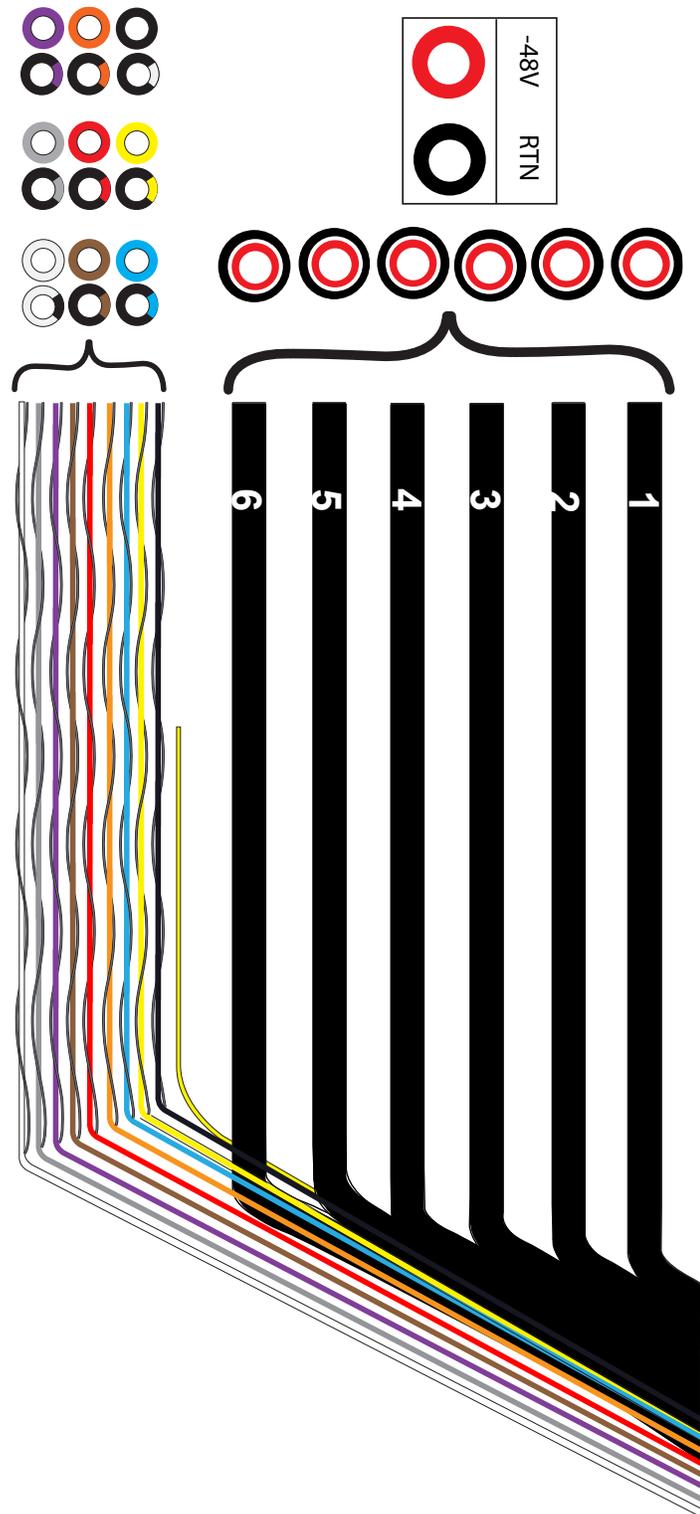
4

Carefully feed fiber and power conductors into the OVP box and tighten the compression nut.

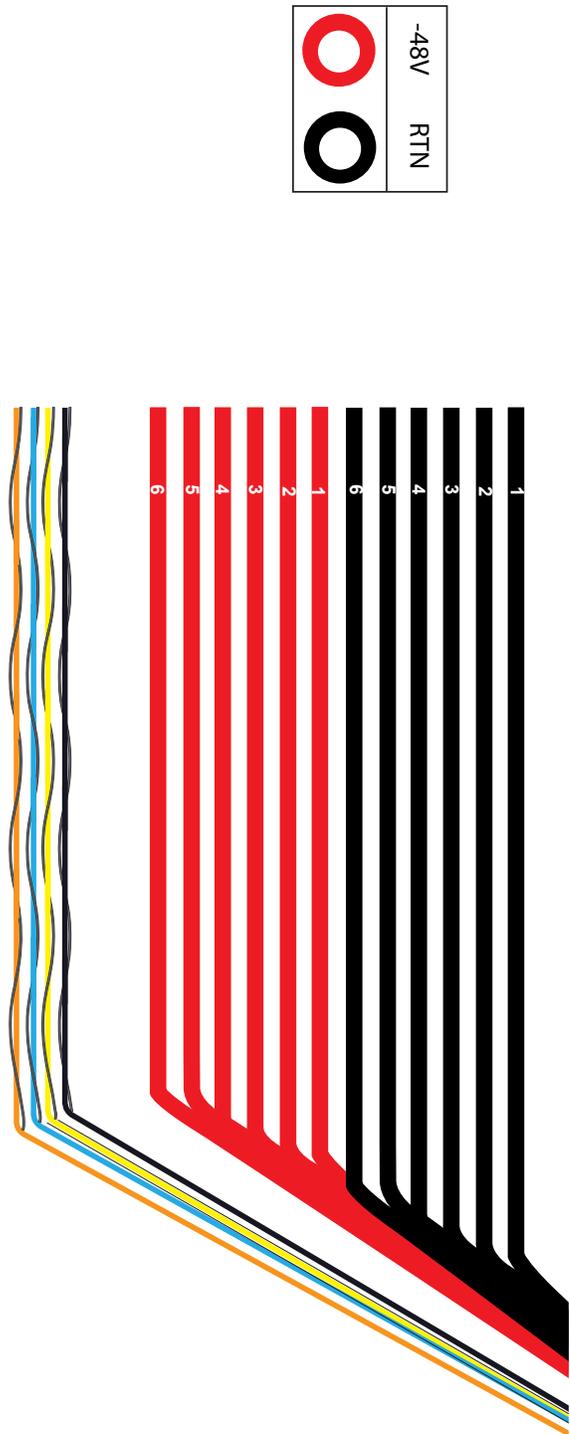
Section 9: Fiber coding (6 X 12 V2 shown)



Power coding (V2 6 X 12 shown)



Power coding (V4 6 X 12 shown)





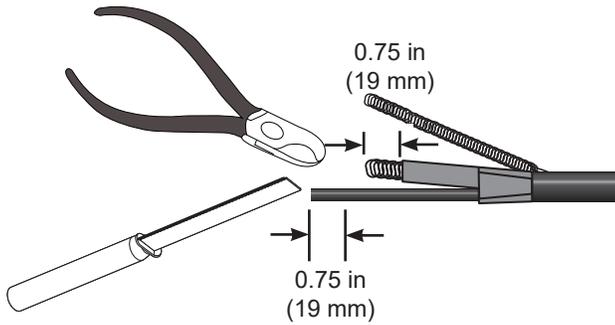
The assembly power conductors are prepped for use with Raycap 3315 and 4470 series units. When using Raycap 6627 series units additional length needs to be removed from the power conductors. When the trunk is secured in the cable gland mark power conductor for new length and trim. After length is removed re-prep for terminal connection using instructions below.



Section 10: Low Inductance Boot Installation

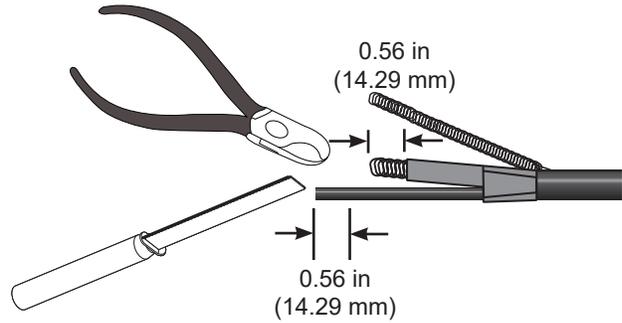
<p>1</p> <p>5 in (127 mm)</p> <p>With a cable stripping tool or knife remove 5 in (127 mm) of outer jacketing. DO NOT nick the braid or copper wires; this may cause ground issues and voltage drop at the RRU.</p>	<p>2</p> <p>Separate the braid wires from the rest of the cables by combing with a wire brush to separate. If braid was cut during jacketing removal re-prep the end.</p>
<p>3</p> <p>Use a pair of lineman pliers to twist the braid wires together to create a tight bundle to the cable jacketing. Trim the braid flattened by the pliers with compact cutters to have a rounded end.</p>	<p>4</p> <p>0.75in (19mm) Min.</p> <p>Remove aluminum foil tape, remove jacketing leaving 0.75in (19mm) as insulator from ground. Separate the bare copper wires and the red insulated copper wire by following the natural cable twist.</p>
<p>5</p> <p>Use a pair of lineman pliers to twist the bare copper wires together to create a tight bundle to the cable jacketing. Trim the copper braid flattened by the pliers with compact cutters to have a rounded end.</p>	<p>6</p> <p>3.5in (89mm) Min.</p> <p>4in (101mm) Min.</p> <p>Insure there is a minimum of 3.5in (89mm) bare copper and 4in (101mm) of jacketed wire. Slide the boot over both conductor ends with longer portion covering the bare copper.</p>

7a (Box OVP / BBU end)



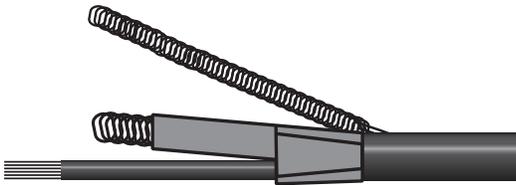
Use a pair of compact cutters to cut the bare copper wires to a length of 0.75 in (19 mm) from the end of the boot. Using a cable stripping tool or knife remove 0.75 in (19 mm) of jacketing from the red insulated copper wire.

7b (Rack mounted OVP / BBU end)



Use a pair of compact cutters to cut the bare copper wires to a length of 0.56 in (14.29 mm) from the end of the boot. Using a cable stripping tool or knife remove 0.56 in (14.29 mm) of jacketing from the red insulated copper wire.

8



Wires are now ready for crimp lugs.
Boot Part Number: 7703768

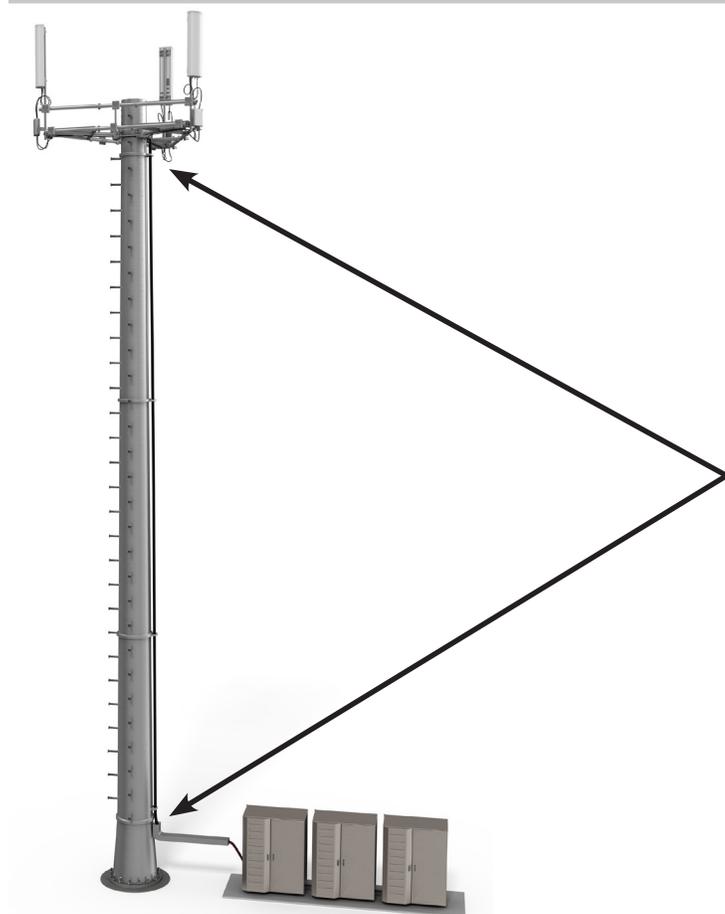
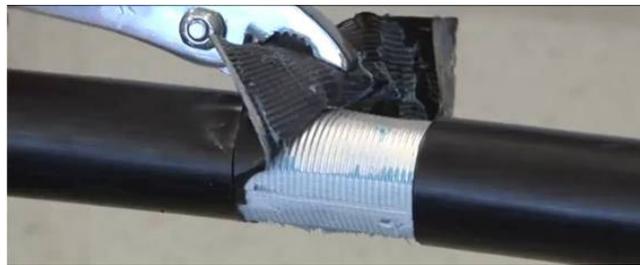
Section 11: Grounding

Removing Jacketing for Grounding Kit installation

1. Score the jacketing 360°
2. Measure 2 in (51 mm) and repeat
3. Identify where the aluminum shielding overlaps, this will feel like a flat spot in the cable
4. With a knife flat on the cable remove a section of jacketing between score marks
5. Lift edge of jacketing with knife tip
6. Grab lifted edge of jacketing with a pair of pliers and roll on the cable
7. Remove excess adhesive with a piece of emery cloth



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Ground Kit UG12158-15B4-T is a universal solution for all HFF trunk cables.

Only use Tin Plated grounding kits



Ground kits required at the top and bottom before entering the shelter / cabinet

NOTE: Additional ground kits may be required by local engineering standards.

Section 12: Excess Cable Management

If length of cable installed needs to be adjusted you can split the cable at the BBU end using the process below and then coiling the excess fiber subunits in a storage box. Fiber management trays are available to manage any excess fiber length in the breakouts at the BBU.

<p>1 Mark cutback length</p> 	<p>2 Notch Armor using flush cutter in-line with Kevlar strings</p> 
<p>3 Place Rip Cord in Notches</p> 	<p>4 Pull Rip Cord Parallel to Cable (while supporting breakout)</p> 
<p>5 Stop at Length Marker</p> 	<p>6 Separate Armor</p> 
<p>7 Cut Armor Using Side Cutter</p> 	<p>8 Remove Water Blocking Tape</p> <p>NOTE: Step can be expedited by using a sewing seam ripper that can be purchased at local hobby stores</p> 
<p>9 Remove Excess Rip Cord</p> 	<p>10 Apply Electrical Tape to Protect Breakout</p> <p>NOTE: Remember to slide identifier labels down the power conductors before trimming the cable to its final length</p> 



Cable Splitter tool
Part Number:
FA-RCRT-PD



Seam Ripper



Excess Fiber
storage
Part Number:
FBR-COIL-S

Section 13: Installation Check List

- Jumpers are properly supported to prevent strain on fiber during severe weather
- Bend radius minimums haven't been exceeded
- CommScope approved installation accessories are used
- Maximum hanger spacing of 3 ft (0.9 m) - 4 ft (1.2 m) is maintained
- Visually inspected end face for residual dirt and damage
- Avoid migration of contaminations from one connector to another
- Check continuity by using LED or laser light source from one end face and look for light from other end to identify any broken fiber (Do not look directly at cable with laser source)
- Fiber Connections are engaged and the sectors are consistent with requirements
- Cable serial number has been documented in the closeout paperwork and a copy has been left on-site

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