

Access to Fiber Optic Microcable

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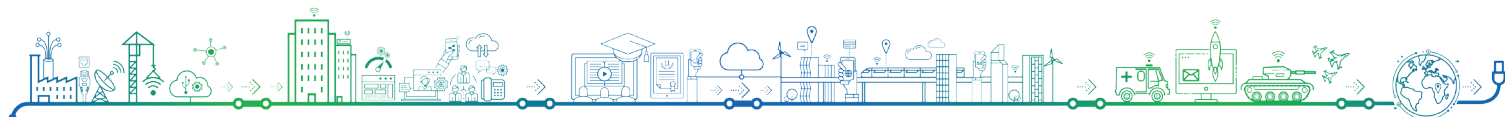
Abstract

Microcables have been developed in purpose to utilize existing and new duct systems more effectively by accommodating more fibers in given sub-duct network. Another benefit is its light weight compared to conventional loose tube cables. By reducing cable weight installation lengths increases. For example in blowing installations cable weight is one of the main parameters that defines how long lengths can be blown in to the duct. Also overall cable handling becomes easier because lighter cables do not require that robust and heavy drums nor heavy equipments. This all could lead to cost reduction during cable deployments.

This application note provides the guidelines for end and mid-span access of fiber optic microcable.

Keywords

Duct, Microducts, Microcables, Dielectric, Tools, End-Access, Mid-span access.



1. General

This document provides instructions on how to access fibers from a small diameter Micro DUCT-LITE Optical Cable. It has a cross-sectional diameter in the range from 0.29" (6.0 mm) to 0.41" (10.5 mm) for cables ranging from 12 to 288 fibers. Its cross-section consists of between 1 and 24 loose buffer tubes wrapped around a dielectric central strength member (CSM). It is an all dielectric cable so bonding and grounding issues are more relaxed. In its present configuration it has a dry core and wet buffer tubes

This document specifically describes preparing Sterlite's Micro DUCT-LITE Multitube Fiber Optic Cable for end or mid-span access.

Most optical micro cables are joined into longer fiber links with end-to-end fusion spliced of similar color coded optical fibers. An end-to-end splice can be used in passthrough splice closures (one cable enters one end of the closure and is spliced to a cable that leaves the opposite end of the closure) or in butt splice closures (spliced cables enter the same end of the closure that they exit). This cable preparation notes includes information on preparing dielectric, micro-duct cables containing bundled individual fibers. These procedures can be used for aerial, buried, and underground plant and all applications including FTTX architectures.

These cable preparation procedures do not include directions for fusion or mechanical splicing or instructions on the use of specific splice closures. These instructions should be used as a supplement to the work plan and the instructions provided by the splice closure manufacturer and fusion equipment manufacturer.

The mid-span entry procedures presented herein would be used anytime fibers are dropped off the main cable mid-span and the remaining fibers continue for service beyond the drop-off location. This type of fiber access is called cable mid-span access. During this activity, care is required to ensure that the integrity, continuity, and safety of the all fibers are maintained.

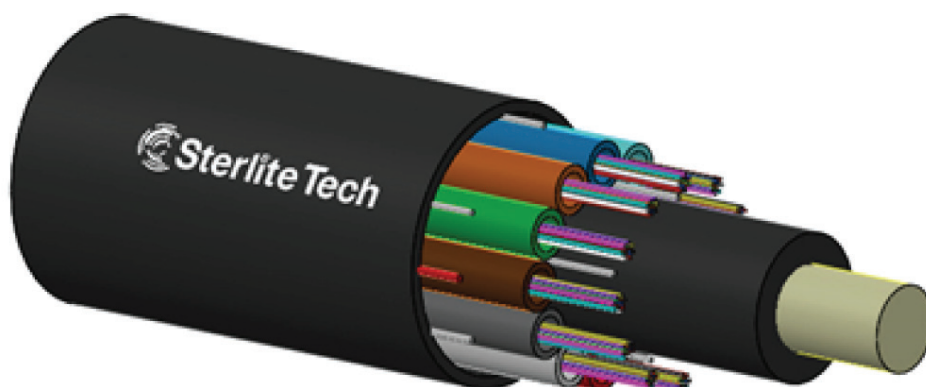


Figure 1 Drawing Showing End-View of Sterlite's Micro DUCT-LITE Multitube Fiber Optic Cable



2. Safety

2.1 Safety classes

Wearing safety glasses to protect your hands from accidental injury is strongly recommended when working with fiber cables, especially when cutting the strength member or fibers.

2.2 Safety gloves

Wearing safety gloves to protect your hands from accidental injury is strongly recommended when working with cutting tools on fiber jackets or when cutting the strength member. Exercise extreme care when working with an exposed knife blade. Dispose all blades in a safe manner.

2.3 Fiber cleaning wipers

These wipers contain alcohol. Use in a ventilated room away from open flames and any sources of possible ignition. Avoid eye contact. Wash eyes with clean water for 15 minutes if eye contact occurs. If taken internally, do not induce vomiting, and consult a physician.

2.4 Isopropyl alcohol

Isopropyl alcohol is flammable with a flashpoint of 15°C (59°F). Alcohol should only be used in a ventilated room away from open flames and any sources of possible ignition. Avoid eye contact. Wash eyes with clean water for 15 minutes if eye contact occurs. If taken internally, do not induce vomiting, and consult a physician.

2.5 Gel cleaning

Consult the Material Safety Data Sheet (MSDS) provided with each of these products before use. Use of these solvents may be irritating to skin. Gloves should be worn when using these products to avoid extended exposure to unprotected skin. Avoid getting these solvents in your eyes. They should be used in a well ventilated area to avoid breathing large amounts of the vapor. Some of these products may be flammable and should not be used around open flames or live electrical equipment. Swallowing may cause vomiting which in turn can lead to aspiration into lungs. If ingested follow the instructions on the MSDS. If the solvent is spilled, contact safety officials so the spill can be safely cleaned. Dispose used materials in a manner that is safe and complies with the procedures required in the product's MSDS.

2.6 Cable handling precautions

Fiber cable is sensitive to excessive stresses from mechanical loading caused by tension, bending, impact, torsion or crushing. The cable specification should be carefully examined before construction starts to understand the cable's mechanical and environmental limits. The minimum bend radius as well as all other mechanical limits of the cable and its components must not be violated.



Safety gloves		Safety glasses	
Utility knife with hook-blade		Splicer's knife	
Tape measure		Electrician's vinyl tape	
Splicer's shears		Aramid fiber shears	
Alcohol dispenser		Isopropyl alcohol or safe solvent	
Side-cutter pliers		Needle-nose pliers	
Solvent saturated wipers		Small cable cutter	
Typical gel cleaning solvents		Permanent marker pen	
Lint-free wipers		Fiber cleaning	



Ideal coaxial jacket splitter 45-164		Miller Ripley RCS round cable cutter RCS 114	 RCS 114
Miller Series 400, M1-80830-002, Fiber Cable Tube Slitter		Draka buffer tube access tool	
Ideal buffer tube splitter 45-162		Miller MSAT and MSAT-5 tube slitter	
Multitube Miller FTTH tube cutter		Miller fiber stripping tool	

4. End-Access of Cable

4.1

Consult the work instructions to determine where the location of the splice for the fibers between the two mating cables will be positioned. The ends of the two cables to be joined will need to be prepared. Normally, at least one meter of cable will be cut from the end of each fiber cable after placement, before preparation, to avoid any problems that may have occurred during cable placement. Trim this length from each end of the mating cables.

4.2

Refer to the instructions for the splice closure to determine how much of the cable jacket needs to be removed from each of the mating cables to make the splice. If no length is recommended, remove one meter of cable jacket from the cable end to make the splice. Place a tape marker or pen mark on the cable sheath at the recommended distance for end of cable sheath removal.

4.3

Place a wrap of tape around the cable sheath at the specified distance from the end of the cable corresponding to the sheath length to be removed to fit the splice closure being used that is recommended by the closure manufacturer. If no length is specified, use 1 meter.



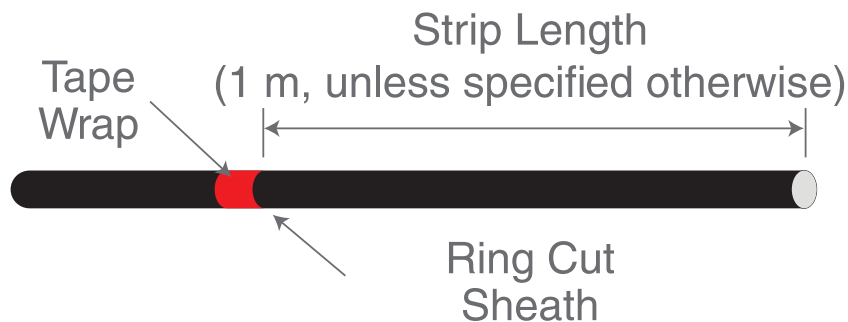


Figure 2 Selection of location to begin end of sheath removal.

4.4

Using a rotating sheath cutter (such as the Miller Ripley RCS114 or Ideal 45-164) or hooked knife, carefully ring cut the end portion of the cable jacket from both cables to be spliced approximately 10 to 15 cm from its end. This cut should not penetrate the cable core. Care should be taken not to damage the cable core while cutting through the cable sheath. It is unnecessary to cut completely through the cable jacket to the cable core. Some experimentation may be required to adjust the depth of cut to cut the jacket, without cutting the rip cords under jacket.

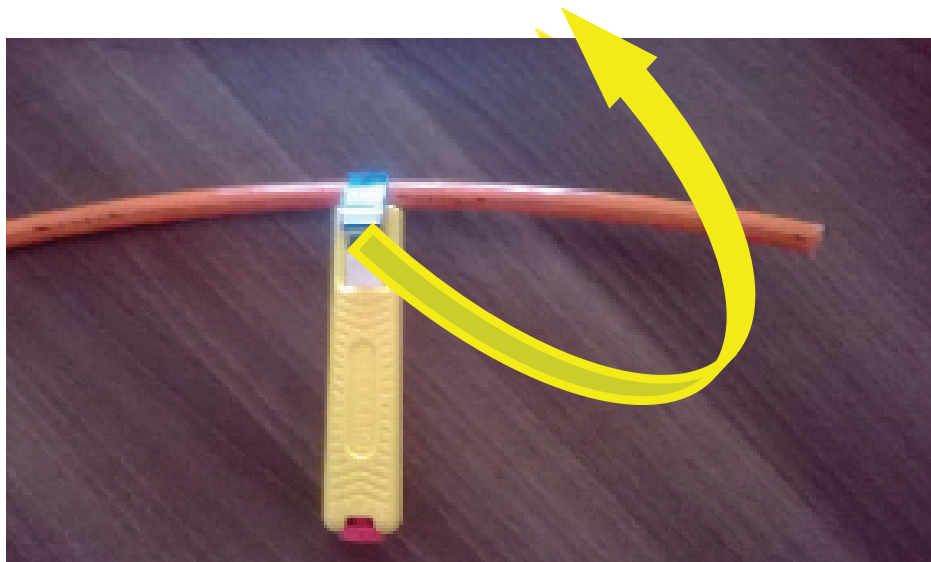


Figure 3 Ring cut cable jacket using a ring cutting tool (“Jokari 4-16mm” tool) or hook blade knife or one of the cable sheath cutting tools.



RCS 114 is designed to strip cables from 178"(4.5mm) to 1.14"(29mm) diameters.
RCS 158 is designed to strip cables from .75"(19mm) to 1.58"(40mm) diameters.

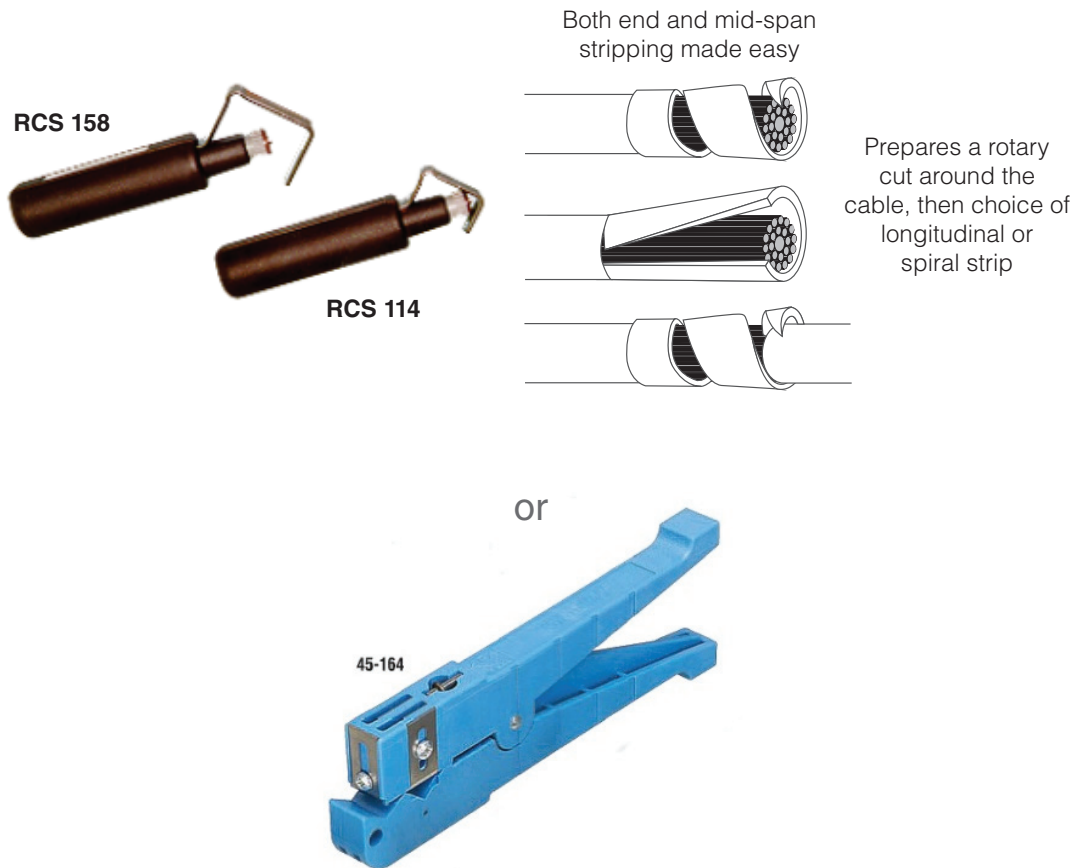


Figure 4 Miller Ripley RCS-114 and Ideal 45-164 sheath cutting tools.

4.5

After ring cutting the sheath, grasp the cable jacket on either side of the cut and flex the jacket of the cable. The cable jacket will open along the ring cut. Pull off the end 10 to 15 cm of cable jacket from the cable core, being careful not to damage the fibers in the buffer tubes. Expose the rip cords that were located just under the cable jacket.



Figure 5 Flexing cable at the ring cut to open its jacket.





Figure 6 Removing last 15 cm of Cable sheath from cable-core with a pulling action.

4.6

Following the same procedure as described above, ring cut the cable jacket at the tape marker that shows the extent of the sheath removal for an end-of-cable splice (approximately 1 meter from the cable end, unless otherwise specified).

4.7

Each mating cable jacket is removed to the marking tape (approximately 1 meter into the cable) using the rip-cords accessed from the 10 to 15 cm portion of the jacket just removed in Section 4.5. Place a notch in the plastic cable jacket for the rip-cord to follow as it is pulled back along the cable jacket. As the rip-cord is pulled, it tears its way through the jacket. Continue pulling the rip-cord until the end marker is reached for the end sheath removal. If a second rip-cord is present, use it to tear a second slit in the jacket 180° opposite the first.



Figure 7 Figure Rip-cord (s) are used to rip open cable jacket. Notching the cable jacket to provide a starting pathway for the rip-cord

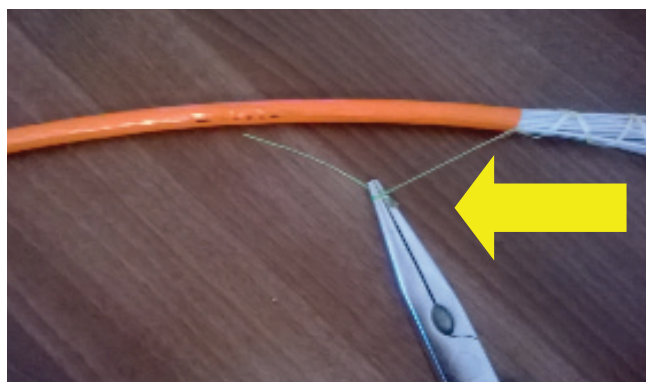


Figure 8 Pull on the rip-cord with a needle-nose pliers (or by hand with gloves) to open a longitudinal slit to the cable jacket.



4.8

The sheath is removed from the cable as before, at the ring cut marked with the tape (approximately 1 meter from the cable end).



Figure 9 Longitudinal slit in cable sheath is made with the rip cord(s).



Figure 10 Removal of the cable jacket from the cable core.

4.9

Using splicer shears or knife cut the binding yarns over the bundled loose-tubes in the cable core and water swellable (WS) tape. Remove the WS tape from cable core (if applicable). Then cut the binding yarns over the loose buffer tubes to free them.





Figure 11 Cut the binder yarns over the bundled loose tubes.



Figure 12 Cut the water blocking tape (in case of 288F microcable design).



Figure 13 Remove the binder yarns which bundles tubes on the inner cable core (in case of dual layer microcable design).





Figure 14 Unwind the loose buffer tubes in the cable core from around the CSM.

4.11

All fibers will generally be accessed in end access splices in most applications. However, if that is not the case, locate the fiber buffer tube or tubes housing the fibers that will be dropped off at this location (spliced to a second cable). It will be necessary to use the buffer tube color coding to determine the tubes containing the fibers to be spliced and those to be dropped off.

4.12

Locate any spacer buffer tubes filled with non-optical quality fibers (if there are any in the cable) or filler elements. Using a cable cutter or splicer's shears cut the spacer buffer tubes / fillers.

4.13

Cut the strength members in the cable to the appropriate length as specified by the splice closure assembly instructions. If no length is specified by the closure instructions, 15 cm can be used. It is necessary, however, for the strength members to be long enough to engage with the clamping mechanisms in the splice closure.



Figure 15 Trim the cable strength members to mate properly with the splice closure.

NOTE: Be careful not to bend, kink, or damage any buffer tube.



4.14

Clean the gel or water blocking material from the cable core and buffer-tubes using lint-free, wipers and an approved gel cleaning agent.

NOTE: Treated wipers to remove gel that are safe to use on the materials within the cable core can be purchased. These treated wipers or an approved gel cleaning agent with wipers should be used with a pulling action on each core unit, pulling the wiper from cable opening towards the cable end. Continue to use clean wipers until the cable core is free of gel or water blocking material. Dispose soiled wipers in an approved and safe manner.

4.15

From this point on, follow the specific instructions that are provided for the closure that will house and protect the cable ends and fiber splice. Specific instructions should be provided by the closure manufacturer for the splicing and storing of cable, buffer tubes, and fiber. Since Sterlite Micro DUCT-LITE Optical Cable is all dielectric, bonding and grounding of the cable will not be required. Any metallic parts in the closure must be bonded to the ground of the splice chamber.

4.16

The cable core consists of water blocking tape (additional, in case of 288F microcable design) and binder yarns with a central-strength member surrounded by buffer-tubes containing bundled fibers. The optical fibers are organized in 12 fiber bundles inside loose-buffer tubes. All fibers, and buffer tubes are color coded to help identify individual fibers within the cable.

4.17

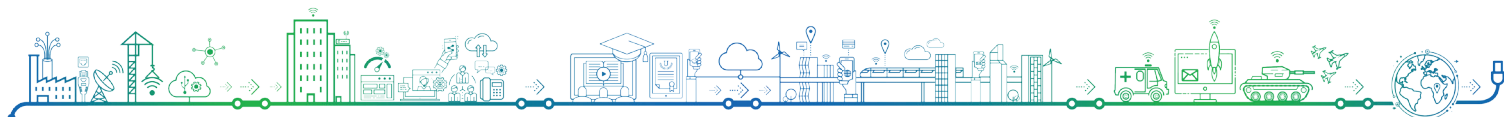
Cut the buffer tubes to length as prescribed by the closure manufacturer's instructions to enable them to be organized properly within the splice organizer and closure.

4.18

Use a buffer tube cutter and remove the portion of the loose buffer-tubes required to splice the fibers in the splice closure. It will be necessary to select a tool designed to accommodate the diameter of the cable's buffer-tubes. The Ideal Cable Slitter 45-162 is recommended. It is good practice to carefully adjust the depth of cut of the buffer-tube cutter to assure that the tube wall is scored, but the fibers inside the tube remain unmarked. If possible, check the tool's performance on a small section of the buffer tube. A properly adjusted tool will score the buffer tube without completely cutting through the tube. When the tube is gently flexed it will break along the score.

4.19

Use the cutting tool to ring cut the fiber buffer tube. It is necessary to score the buffer tube then snap it open by applying a flex to the scored portion of the tube.



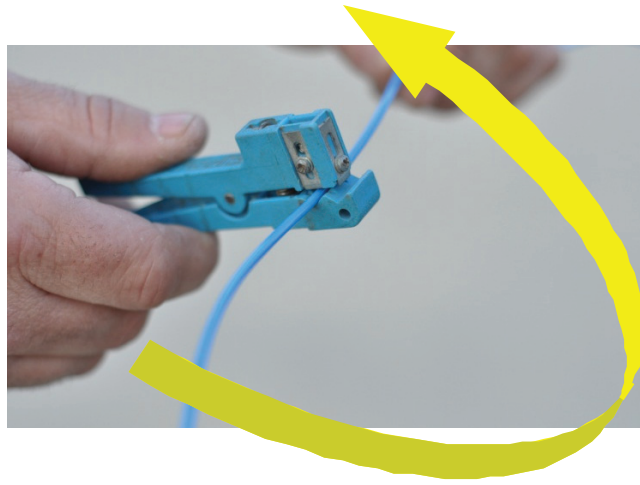


Figure 16 Ideal buffer cutting tool is used to ring cut and separate a buffer tube.

4.20

After ring cutting the buffer tube carefully slide the buffer tube off the fibers.

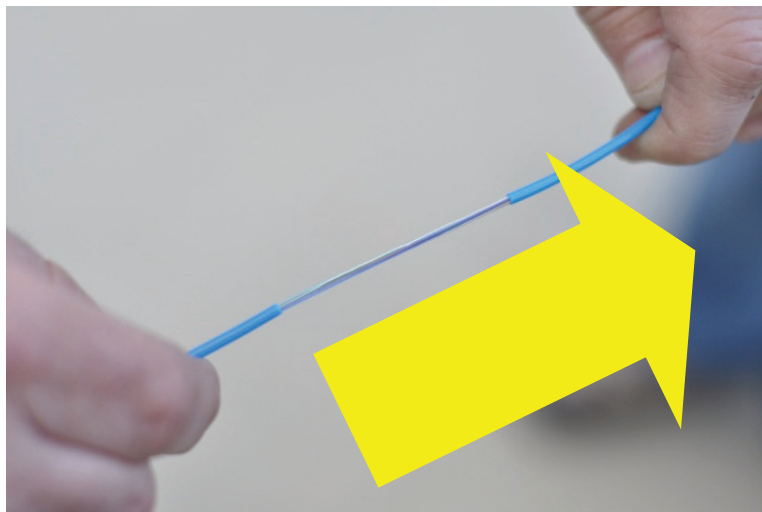


Figure 17 Carefully slide the severed buffer tube off the fibers.

4.21

Gently wipe the excess water proofing gel from the exposed fibers with an appropriate lint free wiper and an approved safe solvent impregnated wiper.





Figure 18 Wipe the water blocking gel from the fibers.

5. Mid-Span Access of Cable

The following instructions are provided as guidance on how to prepare Sterlite Micro DUCT-LITE optical cables for mid-span access. These instructions should be used as a supplement to the instructions for the closure and tools being employed.

5.1

Determine where the location of the mid-span splice for the fibers will be. Mid-span splices often will occur at points where fibers are dropped off from the cable under preparation and spliced to a second cable to redirect fibers in a second direction. The mid-span point on the cable will serve as the “center of (the preparation) loop” for the cable being accessed.

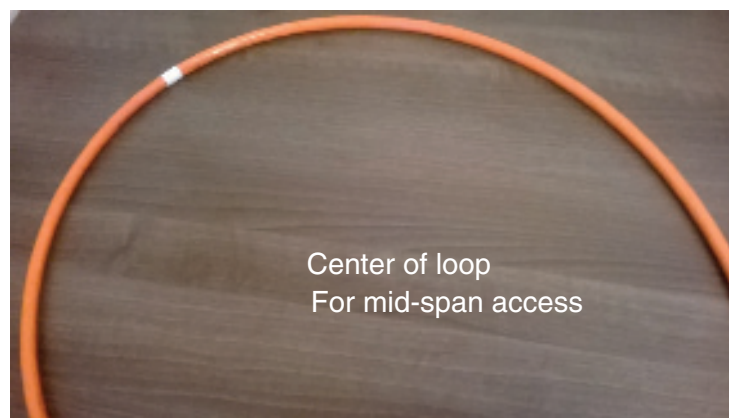


Figure 19 Cable layout for mid-span access

The apex of the loop should be marked with a marking pen or a ring of tape. Place a tape marker on the cable at the distance from the “center of loop marker” prescribed by the instructions for the splice closure being used, or if no distance is prescribed, use 1 meter. Place a tape marker or pen marking 1 meter on the cable sheath to the left and to the right of the “center of the loop” marker.



5.2

Finally, place a sheath mark or a tape marker 15 cm to left or right of the “center of loop” marker. The two most distant markers (2 meters apart, as described above) on either side of the “center of loop” marker demarcate the ends of the portion of the cable which will have its sheath removed for the mid-span access. The “center of loop” marker and the marker 15 cm away will demarcate the sheath window that will be opened to provide access to the rip cords for removal of the remainder of the cable jacket for the mid-span access.

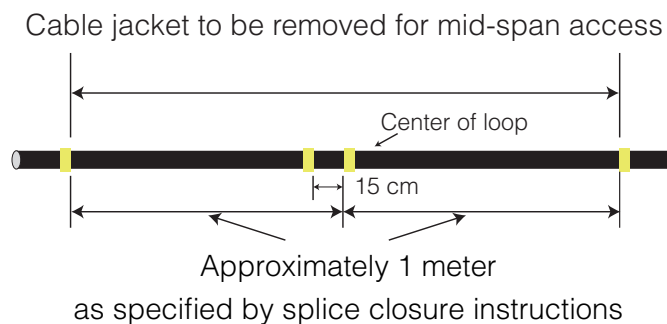


Figure 20 Markers for mid-span access.

5.3

At all four markers (two extreme markers, “center of loop” marker, and marker at 15 cm) make circumferential scores around the cable through its outer jacket to just above its cable core.



Figure 21 Cable sheath being scored with sheath cutting and slitting tool at the 15 cm window near the center of mid-span access window.

5.4

The Miller Ripley RCS114 cable sheath slitter tool shown below is recommended by Sterlite to remove the outer jacket for mid-span access to their optical cables. The depth of cut for each blade needs to be adjusted to cut nearly through the intended layer without damaging the cable core.



RCS 114 is designed to strip cables from 178"(4.5mm) to 1.14"(29mm) diameters.
RCS 158 is designed to strip cables from .75"(19mm) to 1.58"(40mm) diameters.

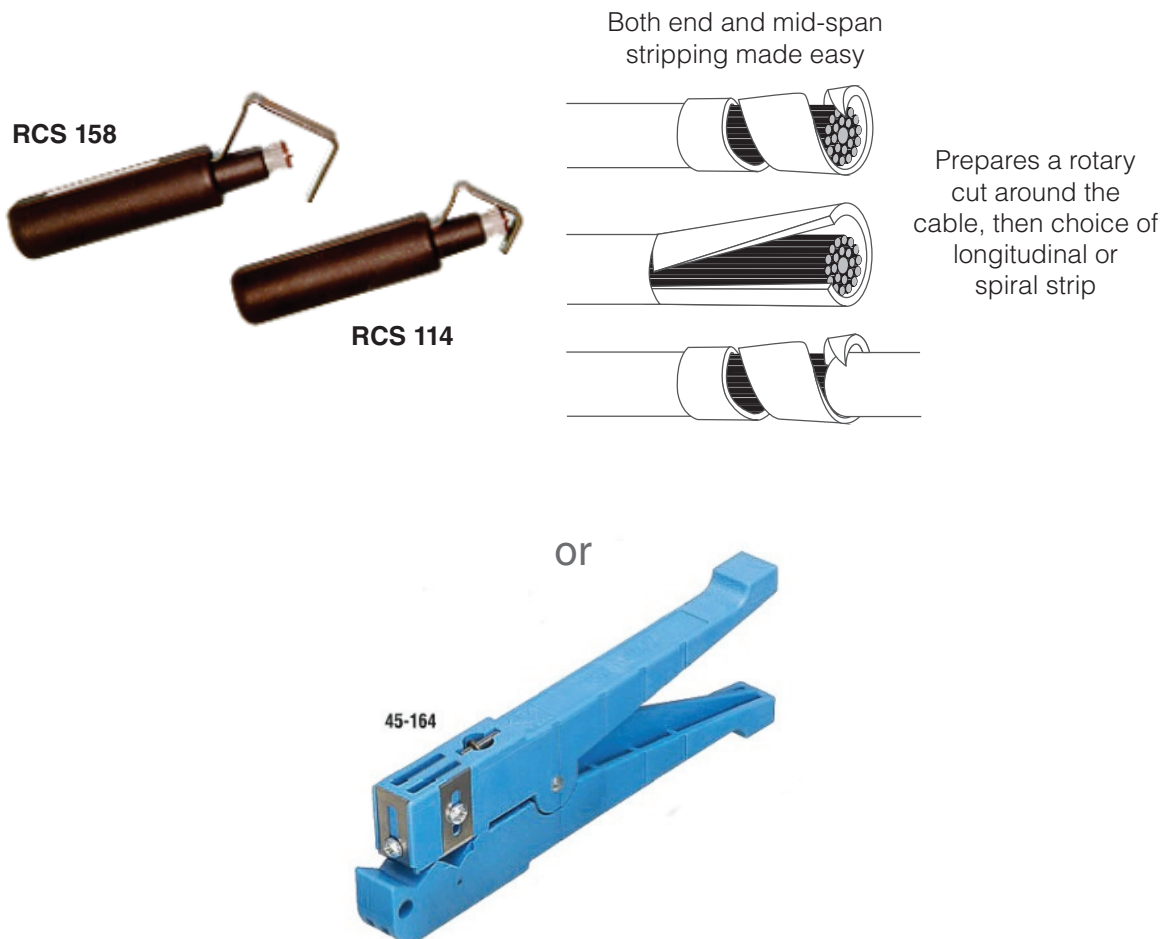


Figure 22 Miller Ripley RCS 114 sheath removal tools and Ideal 45-164 sheath splitter.

5.5

The RCS 114 tool can be used to remove the entire cable jacket between end markers for the mid-span access in one or several increments. This tool is provided with detailed instructions by its manufacturer which should be carefully followed during the mid-span sheath removal procedure.

5.6

If the choice is made to use more traditional procedures to remove the cable sheath for the mid-span access (see paragraphs 4.7 and 4.8), the 15 cm portion of the cable sheath adjacent to the "center of loop" should be removed first. The RCS 114 tool can be used to remove this 15 cm section of cable jacket to expose the rip cords.





Figure 23 15 cm mid-span access window is exposed to cable core with rip-cords after the jacket has been removed.

5.7

Once the 15 cm section of cable sheath adjacent to the “center of the loop” is removed, the remainder of the mid-span cable sheath can be removed using the rip-cords that are exposed.



Figure 24 Slitting of cable jacket using rip-cord.

Remove the cable sheath for the mid-span access using the ripcords following the procedures described in the End-Access sheath removal technique presented in Sections 4.7 and 4.8.

5.8

Using a splicer's shears or knife, cut the threads, tape, and water blocking material that surrounds the bundled loose-tubes in the cable core. Remove the binding yarns from cable core. Then cut the water blocking tape (if applicable) over the loose buffer tubes to free them.





Figure 25 Cutting the binder yarns.

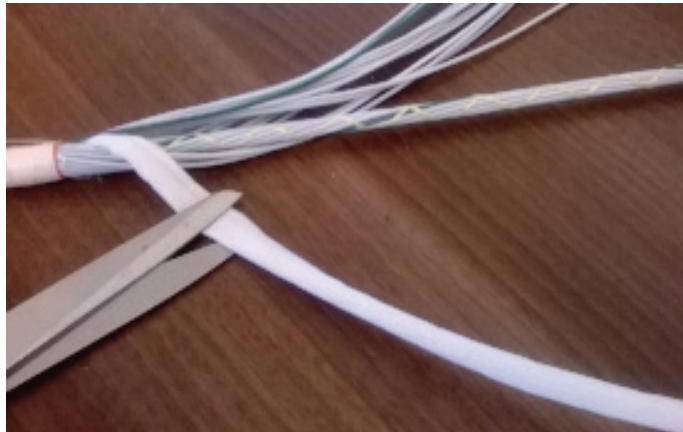


Figure 26 Cut the water blocking tape (in case of 288F microcable design).



Figure 27 Remove the binder yarns which bundles tubes in the inner cable core.

5.9

Because of the SZ wrap of the buffer tubes used by Sterlite, the buffer tubes can be unstranded from the central strength member by unwrapping starting at the turning point (point where the wrap reverses).





Figure 28 Unwind the loose buffer tubes in the cable core from around the CSM.

5.10

From this point on, follow the specific instructions that are provided for the closure that will be used. Specific instructions should be provided with the closure for the splicing and storing of cable, buffer tubes, and fiber. Specific procedures will also be provided for bonding and grounding the closure to ensure that the cable interface with the closure is safe, mechanically sound, and environmentally sealed.

NOTE: Fibers being expressed through mid-span access splice closures need to have their buffer tubes removed in the mid-span closure. Express routing of buffer tubes is not recommended with micro-duct cables. All buffer tubes should be opened and removed from the fibers. The expressed fibers must be stored in splice trays or routed in furcation tubing or a protective mechanical wrap. An increase in fiber attenuation at colder temperatures may occur if the fiber buffer tubes remain intact and are expressed through the splice closure.

The following instructions in this document are provided as guidance on how to work with Sterlite Technologies fiber optic cables. These instructions should be used as a supplement to the closure instructions being employed. They are not intended as fusion splicing instructions.

5.11

Locate the fiber buffer tube or tubes housing the fibers that will be dropped off at this location (spliced to a second cable). It will be necessary to use the buffer tube color coding to determine the tubes that contain the fibers to be spliced.

5.12

Locate the spacer buffer tubes filled with non-optical quality fibers or fillers (if there are any in the cable). Using a cable cutter, cut filler buffer tubes and the central strength member (CSM). Examine each buffer tube for any damage. The length and location of the buffer tube cut and the central strength member cut will be dictated by the splice closure being used.





Figure 29 Removal of the center strength member using small cable cutter.

NOTE: Strength members will need to be affixed to the mechanical clamps in the splice closure being used. Their length will therefore be dictated by the design of the splice closure.

Cutting the central strength member frees all the loose buffer tubes from their mechanical protection provided by the cable. Take extreme care while handling the free loose buffer tubes. Any excess bend or tension to a free buffer tube could break fiber inside that tube.

NOTE: Be careful not to bend, kink, or damage any buffer tube.

5.13

Clean the gel or water blocking material from the buffer tubes and cable core using lint free wipers and approved gel solvent.

NOTE: Treated wipers to remove gel that are safe to use on the materials within the cable core can be purchased. These treated wipers should be used with a pulling action on each core unit for its entire length. Continue to use clean wipers until the cable core is free of gel or water blocking material.

5.14

It is necessary to enter one or more of the buffer tubes to access its fibers to splice them to a second independent cable. The remaining fibers in the original cable will continue beyond this branch point. However they must be removed from their buffer tubes.

Make a ring cut at both end locations in the buffer tube with the Ideal 45-162 Cable Slitter / Cutter to demarcate the amount of fiber to be exposed in the splice closure.

NOTE: To make a ring cut in the buffer tube, use a buffer tube cutter such as the Ideal 45-162 coaxial cable splitter, sized to fit the buffer tube. Ring the buffer tube with several complete revolutions around the tube leaving the tube's surface scored through most of its thickness. The buffer tube can be opened by applying a bending motion on each side of the cut location.



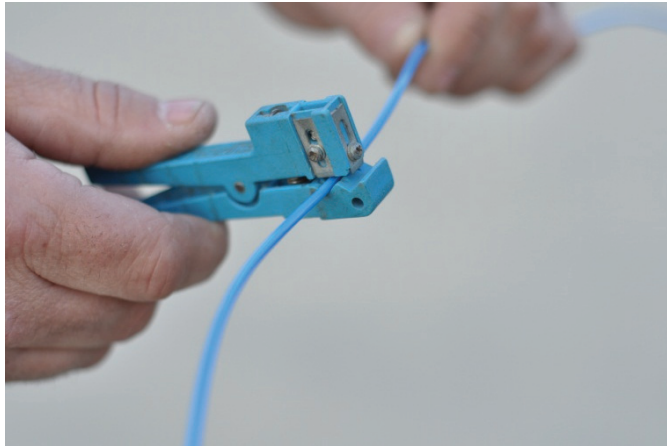


Figure 30 Ideal tube cutting tool 45-162 is used to ring cut and separate a buffer tube.

NOTE: It is necessary to properly adjust the depth of cut of the buffer tube splitting tool. Be careful not to damage any fiber when slitting the buffer tubes.

The fibers that are to be dropped off at the closure location must be cut at the appropriate location so they can be spliced to the branching cable. Their buffer tubes are cut and then slipped off the end of the cut fibers.

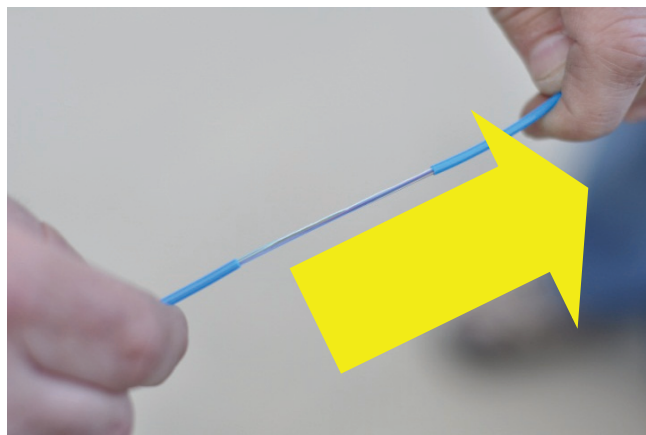


Figure 31 Carefully slide the severed buffer tube off the fibers.

5. 15

Clean the gel or water blocking material from all the fibers passing through this closure using material safe wipers. The fibers that are to be dropped off at the closure location must be cut at the appropriate location so they can be spliced to the branching cable, the remainder of the fibers are mechanically protected following instructions from the splice manufacturer as they pass through the closure.



6. Additional information

If there are additional questions on this topic or other fiber optic issues, please contact Sterlite Technologies at:

Contact Information

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