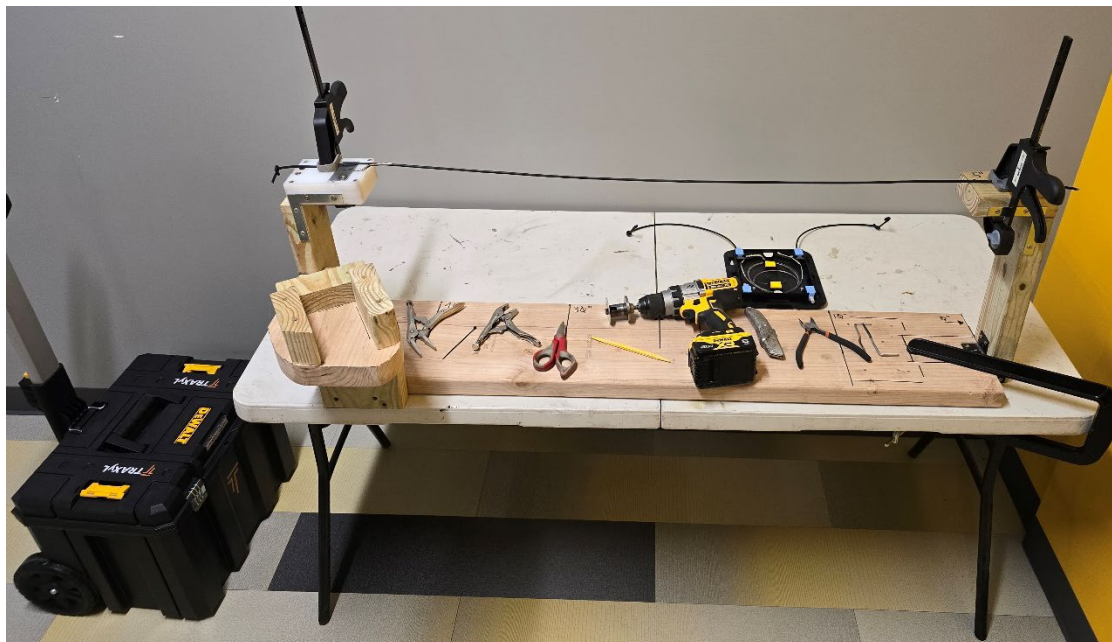


Mid-span Access Tool Kit Procedure

This is a specific procedure to perform a mid-span access on a 4mm OD 24-count SM fiber cable from NanoFiber. This procedure is not meant for any other cable. The length of removed armor and exposed fiber is approximately 36 inches and is meant to be used in conjunction with the PLP Coyote DTC-1. Other splice enclosures could probably be used but are untested. The first-generation tools used in this procedure are prototypes and are not guaranteed to work. The tools and methods suggested are to be used at your own risk. This set of procedures should be considered in DRAFT form and will be updated from time to time, and will greatly consider any feedback from you, the operator of the tool.

CAUTION

- Eye protection is strongly recommended for any operators and bystanders witnessing the procedure. The armor used in the cable is very “springy” and caution must be taken especially both when cutting the armor as well as winding the armor.
- The armor is sharp, especially when snipped, and care must be taken when handling. Gloves are strongly encouraged during these steps.
- Other parts of the procedure utilize sharp tools, with hazards that include both puncture and cutting. Please use caution throughout the entire procedure.
- During the winding process, the drill may generate large amounts of tension, both within the armor, and within the tool fixture itself. Pay careful attention to any signs of over tension and stop winding immediately if this occurs.



Kit Includes:

- LH Fixture
- RH Fixture
- Dewalt rolling Toolbox

- (3) Armor D-Coil Tool
- (1) Armor D-Coil Tool Holder Bracket [to hold Armor D-Coil Tool]
- (1) T20 Torx Bit
- (8) T20 Torx Screws [for Far Base Bracket and Near Base Bracket]
- (2) T20 Torx Screws [for Armor D-Coil Tool Bracket]
- (2) T20 Torx Screws [spare]
- (2) Quick Clamps [to secure cable to fixture]
- (1) 4mm 24-count Test Cable [enough for five practice runs]
- (1) Red Handle Kevlar/Aramid Yarn cutting scissors
- (2) Yellow Fiber Picks
- (2) Deep C-Clamps [for mounting fixture to table]
- (1) Spool Winder Bit [for winding armor]
- (1) Drill
- (1) Drill Battery
- (1) Drill Battery Charger
- (2) Side Cutters
- (2) Mini Side Cutters
- (2) Box Cutters
- (1) Regular Locking Pliers
- (1) Needle Nose Locking Pliers
- (1) Small Locking Pliers
- (1) Fiber Stripper
- (3) Safety Glasses

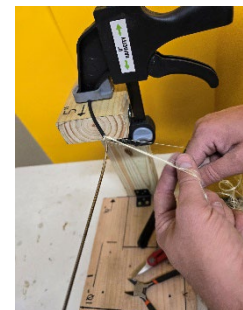
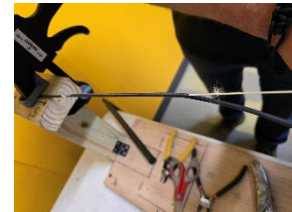
*Note, folding table not included

Procedure

1. The drill and drill battery provided are brand new. **Get the drill battery charging before first use.**
 - a. Tools: Drill Battery, Drill Battery Charger
2. The fixture was cut into two halves for shipping. **Assemble the fixture with the attached brackets and screws on each half of the fixture.** Use the same screws that are holding each bracket.
 - a. Tools: Drill, T20 drill bit
 - b. Parts: LH Fixture, RH Fixture, Far Base Bracket, Near Base Bracket, (8) T20 Torx screws
 - c. Note 1: The images in the procedure show the fixture before it was cut in half.
 - d. Note 2: The two halves can be separated further to generate even more length in the removed armor if desired.
3. **Clamp the fixture to a table or other working surface.**
 - a. Tools: Deep C-Clamps
 - b. Parts: LH Fixture, RH Fixture
4. **Quick clamp the cable to each fixture tower.**
 - a. Tools: Quick Clamp
 - b. Parts: LH Fixture, RH Fixture



5. **Staying within the confines of the fixture towers, separate the cable jacketing a couple inches from each tower.** These ring cuts can be performed with the yellow handled Fiber Stripper tool. Grip the cable just enough to bite slightly into the jacketing, and use your other hand to push the tool slightly and the jacket should separate. **Caution:** Do not squeeze the tool completely closed or damage to the fibers may occur. Alternatively, a wire saw technique can be used, or properly sized wire strippers, cable sheath cutter, or even a razor blade.
 - a. Tools: Fiber Stripper or Box Cutter
6. **In the middle of the cable, remove roughly a one-to-two-inch section of jacketing to access the aramid yarns.**
 - a. Tools: Box Cutter
7. **Cut enough of the aramid yarns to create a pull string.**
 - a. Tools: Red Handle Kevlar/Aramid Yarn cutting scissors
8. **Pull the aramid yarn “pull string” towards the ring cuts to split the jacketing.** Start in one direction, then the other (i.e. middle to right, then middle to left). Sometimes, starting the pull might require pliers.
 - a. Tools: Locking Pliers
9. **Remove the jacketing between ring cuts.** It should easily pull away from the armor.
10. **In the middle of the cable, cut any remaining intact aramid yarns**
 - a. Tools: Red Handle Kevlar/Aramid Yarn cutting scissors
11. **Braid the aramid yarns at each ring cut approximately four to five inches and then make a simple knot at the end.**
 - a. Note 1: Refer to the Coyote DTC-1 installation guide for how the braided aramid yarns attach to the splice enclosure for extra strength to avoid cable pullout.
12. **Cut the aramid yarns below the knot.**
 - a. Tools: Red Handle Kevlar/Aramid Yarn cutting scissors
13. **Secure the braid out of the way on each fixture tower so as to not get in the way for the remainder of the procedure.**
 - a. Can use electrical tape, or reposition the cable quick clamp to secure the braid.
14. At this point, there might be some slack generated between each tower and the cable might be drooping. **Loosen a quick clamp, remove the slack from the drooping cable, and retighten the clamp.**
15. **Using the small locking pliers, adjust the pliers so that the clamping force barely grips the armor. Position the pliers at the very edge of the ring cut.** Let the small locking pliers hang from the cable. Note that approximately four loops of armor are covered by the locking pliers.
 - a. Tools: Small Locking Pliers



16. Continue letting the small locking pliers hang from the cable. **Using the needle nose locking pliers, adjust the pliers so that the clamping force barely grips the armor. Position the needle-nose locking pliers at a 45 degree angle, and grip the armor one or two armor loops away from the small locking pliers.**

a. Tools: Needle nose locking plies

17. Continue letting the small locking pliers hang from the cable. **Twist the needle nose locking pliers around the cable in a clockwise orientation when looking from the center of the cable towards either tower.** The armor should “bubble” out or bulge out, as the loop between the locking pliers grows.

18. **Cut the bulging loop with a pair of side cutters, or mini side cutters.**

a. Tools: Side Cutters or Mini Side Cutters

19. Repeat steps 15 through 18 at the ring cut on the other end.

20. Check to make sure the armor is now separated on both ends. The armor should slide easily along the white tube below, and that the armor shouldn't pinch the white tube at the points where it was cut with the side cutters. **Caution:** The end of the armor is sharp.

21. On the LH Fixture Tower, remove the Armor D-Coil Tool Holder Bracket, install the Armor D-Coil Tool, and replace the Armor D-Coil Tool Holder Bracket.

a. Tools: T20 Torx Bit, Drill,

b. Parts: Armor D-Coil Tool, T20 Torx Screws, Armor D-Coil Holder Bracket

22. Reposition the cable so it is directly in line with the Armor D-Coil Tool. Remove any additional slack in the cable as needed.

23. Pull back the armor and place the white tube into the Armor D-Coil Tool Channel. The tube may need to be worked gently into the channel by slowly and gently pressing and working the tube into the channel.

24. Place a small zip tie around the tube and Armor D-Coil Tool at the very edge of the horizontal part of the tool before it drops down in elevation and enters the tower. This is used to protect the white tube from the very end of the armor as it is unwinding and pulling itself up the tool at the end of the process.

a. Parts: Ziptie

25. Install the Spool Winder Bit into the drill and place at the ready to grab with your right hand.



26. **Twist the armor up and around the front of the Armor D-Coil Tool.** One technique is to use the regular locking pliers to grip the end of the armor and then twist the armor up and over the tip of the tool using your fingers.
27. **Pull the armor towards the left but at a 30 to 45 degree angle away from the tower and slightly upwards.** There may be some trial and error to get the correct feel. This is the beginning of the unwinding process. The armor should uncoil and come off from the tool with relative ease while utilizing the correct angle and proper application of force.



28. **After pulling away 12 inches or so of armor, while holding the armor with the regular locking pliers in your left hand, place the drill into the drill holder on the left tower with your right hand.**
29. **Position the armor along the side of the bit where the capture washer can be tightened to grip and hold onto the armor.** Plan on the drill **rotating clockwise (forward direction)** to pull the armor towards the bottom of the Spool Winder Bit and then up and over the bit.
30. **Finger-tighten the bolt holding the capture washer.** This should lock onto the armor. A twist or two from the drill should set the armor into a held state and the regular locking pliers can be disengaged from the tip of the armor.
31. **Slowly, wind the drill to engage the armor and make sure the armor doesn't come off the capture washer.**
32. **Caution:** This step is the most delicate part of the procedure. Careful monitoring of the drill, the armor tension, the D-Coil Tool tension, the Fixture tension, the Spool Winder Bit, and the armor as it interfaces the D-Coil Tool, are all required to make sure this step is performed successfully. The tension is sometimes significant and holding the drill with an overhand is required to counter the force trying to pull the drill towards the D-Coil Tool. Prevent the tip of the drill from flexing too much towards the D-Coil tool. There should only be one or two loops of armor winding up the D-Coil tool. If the loops get to three or more, it might be too much friction and the drill needs to be reversed to remove the tension. The loops need to be encouraged back to two or one loops around the D-Coil Tool. While winding, the drill can slowly be pulled towards the operator and out of the drill holder to reduce the coils on the D-Coil tool.

Make sure to watch for any moment that the armor coil slides between the tip of the D-Coil channel and the center tube and stop immediately



Stop immediately if the tension feels too high, the drill is pulling hard towards the D-Coil Tool, or the D-Coil Tool is flexing hard towards the drill, or anything seems out of place.

33. **Slowly continue winding until all the armor comes off the cable.** Toward the end of the unwinding process, the armor has a tendency to come shooting up towards the D-Coil Tool. If the zip tie is not in place, it can damage the white tube as the white tube leaves the D-Coil Channel, and the armor comes spinning fast around it.
34. If you got to this step, then congratulations on successfully removing the armor from the cable, but not out of the woods yet! Removing the white tube can be a challenge. But first, let's remove the armor from the Spool Winding Bit. There is a spring force on the armor, so take caution and remove the drill away from the drill holder and the exposed cable. Loosen the bolt holding the capture washer. Pliers or a wrench might be required as the bolt has tightened up beyond finger tight. Once the bolt and capture washer are removed, some of the coiled armor might spring off. Carefully grab the remaining armor and gently rotate the armor in the direction opposite of the winding to generate some slack and work the armor off the tip of the bit. The armor should eventually slide off and be discarded. Reinstall the capture washer and bolt and leave loose for next time.
35. Use either finger nails or the fiber stripper to peel open the rubbery white tube. Inside is the 24 fibers and also a pull string that can be found with the fiber pick. The pull string can be used, however, I haven't had very much luck with it and found it can break fibers. It might be better to use the entire bundle as a pull string and the rubber tube can be ripped away from them.