

# **Instructions for Preparing AFL Optical Ground Wire (OPGW) in the AX Series Connector Kit**

## **Covers AlumaCore, CentraCore, PentaCore, HexaCore, TriCore & MiniCore Designs of OPGW**

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## LIST OF MATERIALS

### Included in the AX Series Connector Kit

- Connector Kit Body
- Wire Retaining Ring
- Retaining Ring Set Screws
- Bushing
- Retaining Nut
- Filler Sleeve (only for stranded stainless cables)
- Strength Member Eyebolt
- Bolt, Washer, & Nut for Eyebolt

### Suggested Tools

- 3/8" Socket Driver
- 5/32" Hex Driver
- Tape Measure
- Cable Cutter
- Pipe Ring Cutter (for aluminum pipe)
- Stainless Steel Pipe Ring Cutter (for stainless steel pipes)

### Additional Consumables

- Furcation Kit - AFL Part Number: AXOFK01
- RTV Silicone Sealant - AFL Part Number: 0070050

# 1.0 Purpose of Installation

The purpose of installing an Optical Ground Wire (OPGW) into a splice box is to connect one OPGW to another and protect the connection in a sealed enclosure. To install OPGW into the Apex series of splice enclosures, use of the AX Series Connector Kit is required.

## 2.0 Scope

This document describes and illustrates the installation of Optical Ground Wire into the AX Series Connector Kit. This connector kit has the following advantages:

1. Utilization of the same core hardware design which allows for use with AlumaCore, CentraCore, MiniCore, TriCore, HexaCore and PentaCore designs of OPGW with minor hardware changes.
2. The ability to be used inside of the Apex X-2 and Apex X-2S sealed splice closures without modification of the body design because they utilize the same base design.
3. Ability to use standard Apex hardware without the need for specialized tools.

## 3.0 Precautions

### 3.1 Health

Optical fibers are very thin, fragile, and sharp. Therefore, careful handling is required to avoid either damage to the delicate glass fibers or, more importantly, injury to the technician or bystander. Small fiber scraps should be deposited on strips of adhesive tape, placed in a bottle or vinyl bag, properly disposed. Do not eat or drink when working with optical fibers as small pieces of glass may inadvertently be ingested. Never look directly at the end of a fiber unless you are certain that no laser light is being transmitted through the fiber.

### 3.2 Work Environment

Handle optical fiber and fiber cable carefully, taking care to impose no damage by physical shock or sharp bends. During the actual splicing, care must be taken to keep hands and work area clean in order that the fibers may be kept clean. Dirty fibers mean poor splices! Keep all tools and equipment in their proper cases or storage pouches when not in use. Consideration should be given to the work area in which the splice box will be organized. A clean, snag-free horizontal surface (protected from wind) is necessary.

## 4.0 Precautions

Prepare the connector body for installation into the Apex unit, by installing the cable attachment unit (CAU) onto the connector kit body. The connector kit body is the large aluminum section that makes up much of the assembly. Remove any of the additional items (retaining ring, bushing, retaining nut, & filler sleeve) from the connector kit body. The Cable Attachment Unit (**Figure 1**) should be used with all installations. For all OPGW cables the bottom of the CAU should be detached so that the CAU looks like **Figure 2**.



Figure 1



Figure 2

Start by unscrewing the hose clamp completely so that it can be opened into a "U" Shape. Then place the connector kit body into the CAU and tighten down the hose clamp to 40 in-lbs. The hose clamp should be positioned on the knurled section of the connector kit body about 7/16" from the triangular flange on the connector kit body. The set screws should be facing upwards. The result should look like **Figure 3**.



Figure 3

## 5.0 Cable Preparation

### 5.1 Initial Preparation

Slack cable lengths should be identified based on the cable and coil bracket used. For installation into the AX Series Connector Kit, a section of cable 10 feet in length should be utilized. This provides enough length to route the cable through the connector kit and the fiber trays.

1. Mark the cable 10 feet from the ends of the fibers to be spliced. The cable should be through cut on the right end of the cable.
2. Slide the retaining ring onto the cable past the 10 ft marking (**Figure 4**).
3. Unlay the outer wire layers and cut them at the 10 ft marking. Unlaying the wires past the 10 ft marking allows the wires to be cut without bending them. Extra care should be taken with stranded stainless cable designs to avoid cutting, nicking, or prying against the stainless tubes when unlaying and cutting the outer strands. Ensure that all the wires are cut evenly as offset wires can leave a gap for moisture.

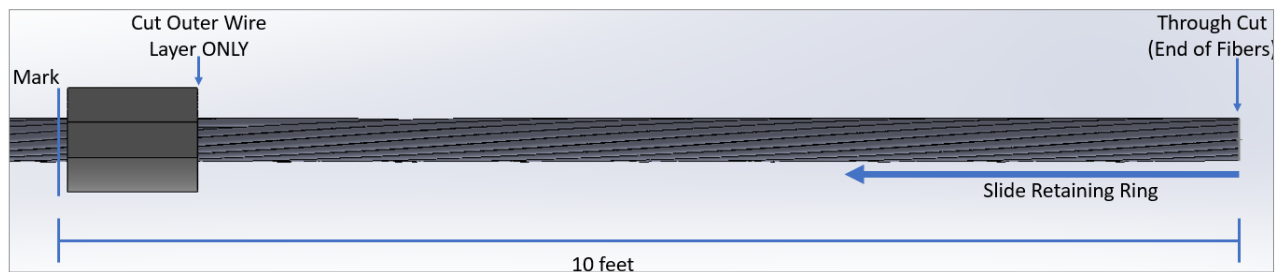


Figure 4

4. Return the outer strands to their original lay around the inner layer. Slide the retaining ring back down the cable flush with the cut strands (**Figure 5**).

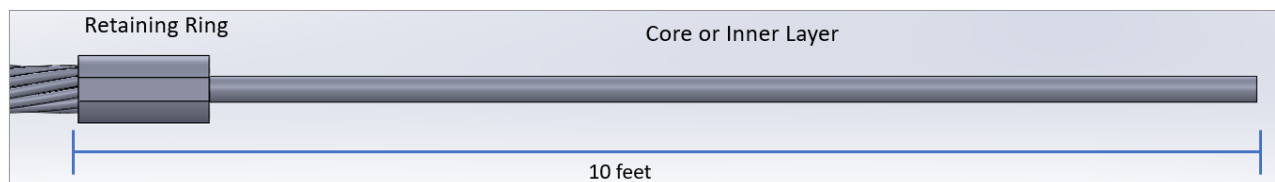


Figure 5

Different types of OPGW cores have different instructions for completing preparation into the AX series Connector Kit. Each type will be discussed below.

## 5.2 Preparation for AlumaCore and CentraCore

For AlumaCore and CentraCore designs, measure from the retaining ring up to 6.75" and use a pipe ring cutter to gently score the aluminum pipe at this location. At this point the installer should add a ring of RTV around the cable wire ends (*Figure 6*).

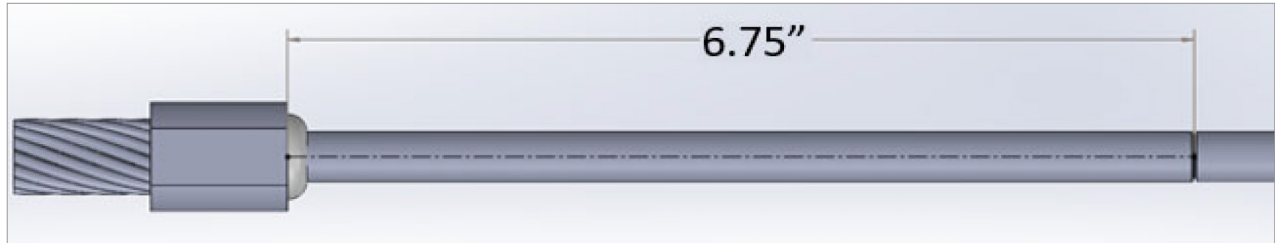


Figure 6

Thread a section of pipe through the connector kit for easier retrieval of the fibers, then gently bend the pipe back and forth no more than 10 degrees at a time to break the pipe free (*Figure 7*).

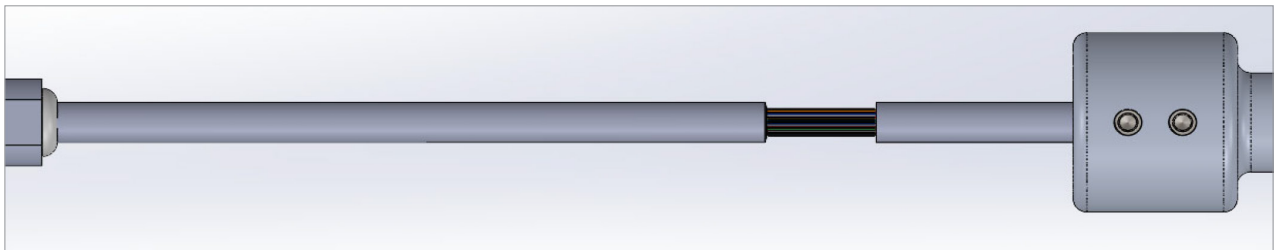


Figure 7

Remove the pipe from the fiber. This may be done in sections to make removal easier and protect the fibers. Take great care not to damage the fibers during this process.

For CentraCore designs, care should be taken to not kink or damage the inner stainless steel tube when removing the aluminum pipe. After the aluminum pipe is removed, follow the instructions in Section 5.3 for the handling and removal of the central stainless steel tube.

Apply a bead of RTV inside the connector kit near the base (*Figure 8*).

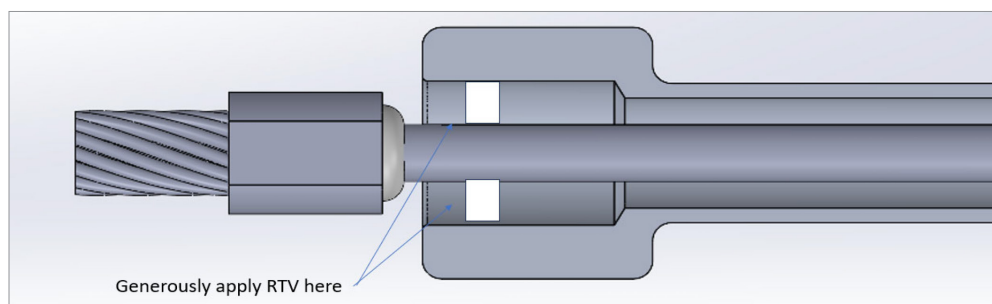


Figure 8

Seat the retaining ring in the connector kit (**Figure 9**). The flat side of the retaining ring should face the set screw holes.

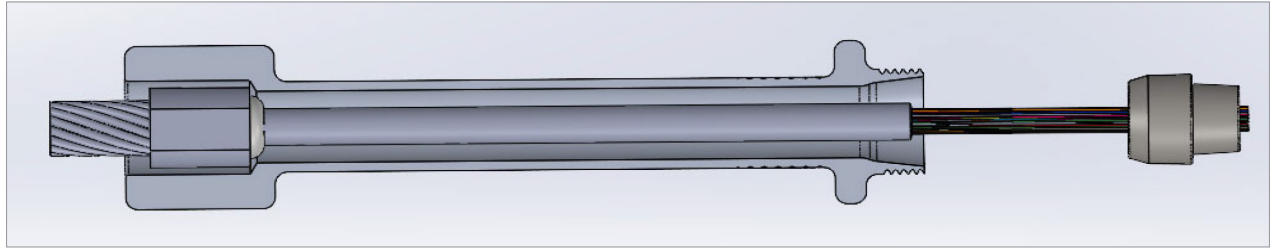


Figure 9

Install the set screws to a torque value of 100 in-lb. Apply RTV around the inside of the connector kit by the pipe opening. Apply RTV around the grommet and then seat the grommet on the pipe. Finally, apply RTV to the outside opening (**Figure 10**).

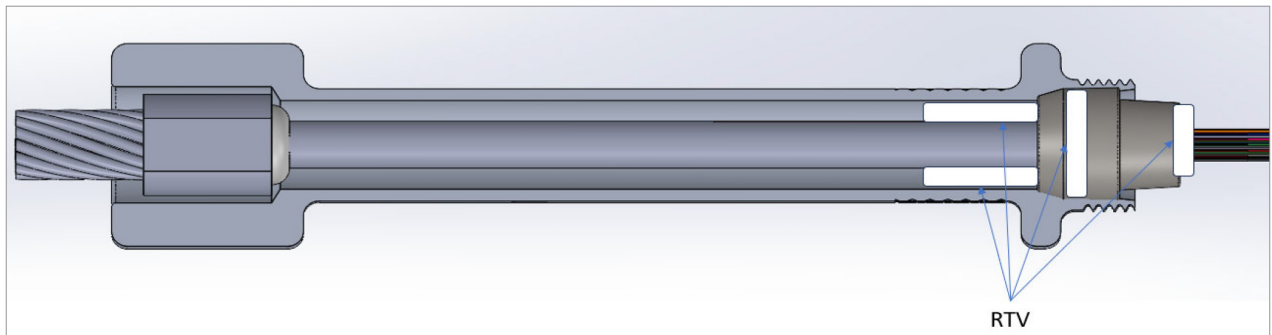


Figure 10

Thread the retaining nut over the fibers and install it on the connector kit body, ensuring it seats and compresses the grommet (**Figure 11**).

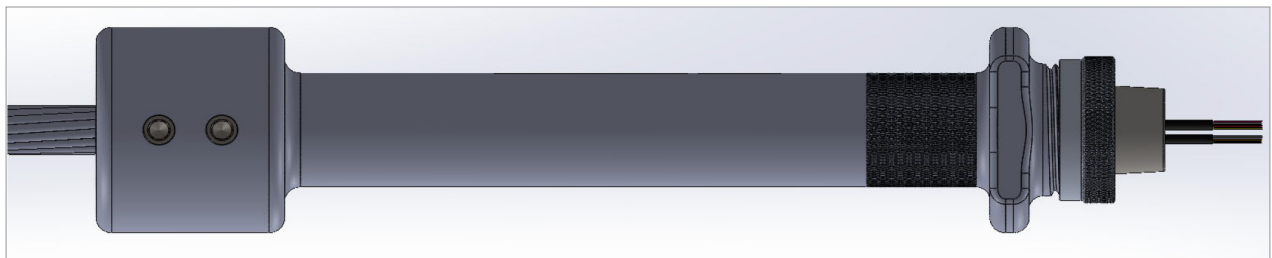


Figure 11

### 5.3 Preparation for Stainless Steel Designs

For HexaCore, PentaCore, and MiniCore designs, after the outer wire strands are removed, the inner wires should be marked and cut 5.75" from the retaining ring. Remove the cut inner wires so that the cable looks like the figure below (**Figure 12**).

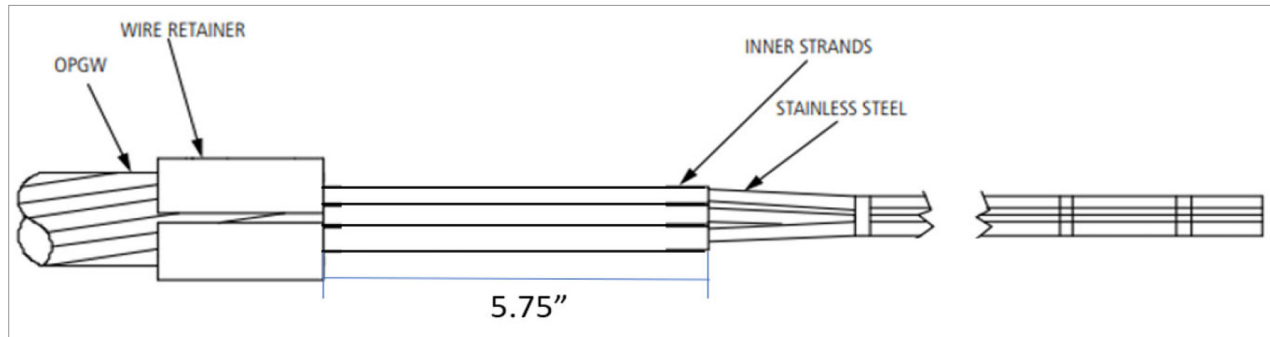


Figure 12

Run a two-inch piece of heat shrink down to each stainless-steel tube at this point. The heat shrink inner diameter is much larger than the stainless-steel tube outer diameter so this should be a relatively quick process.

Add a ring of RTV around the cable wire ends (**Figure 13**). Thread the stranded stainless-steel tubes first through the filler sleeve and then the connector kit body for easier retrieval of the fibers (**Figure 13**), then mark the stainless-steel tube(s) 8" to 10" from the end of the retaining ring. From the marked location, make addition markings in 4-foot increments until the free end of the cable is reached. One tube at a time, carefully score the marking closest to the free end using a stainless-steel pipe ring cutter. Flex the tube at the scored location to break and separate the tube. Continue to score and remove each 4-foot section of tube until you all the tubing is removed up to the 8"-10" marking as shown in **Figure 13**. Special care should be taken to ensure that the fibers do not scrape against the ends of the tubes during the removal.



Figure 13

Slide the heat shrink tubing so that it covers one inch of the fibers and one inch of the stainless-steel tubes as shown (**Figure 14**). Using a heat gun on a low setting, shrink the tubing around the stainless-steel tube and fibers. Ensure that the heat is applied evenly to the heat shrink tubing so that the result is straight and even. The heat shrink tube will not shrink completely onto the fibers. Particular care should be taken to ensure that the hot air blast does not remain on the optical fibers for an extended period. Never use a torch to shrink the tubing. Allow the tubing to cool for approximately 10 minutes.

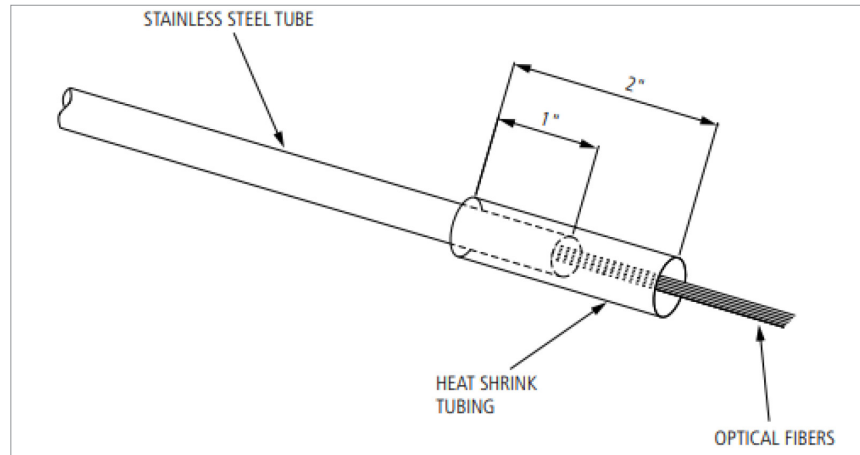


Figure 14

Slide the filler sleeve over the fibers until it butts up against the retaining ring. Situate the filler sleeve as shown, then fill the sleeve generously with RTV using the 2 ports in the filler sleeve (**Figure 15**) by filling the sleeve as it sits, then rotating the sleeve 180 degrees and filling the other side. It is alright if some RTV leaks out of the filler sleeve as this will show that it has been filled correctly. Apply electrical tape on the filler sleeve at the indicated locations in **Figure 15** to increase friction and keep the filler sleeve aligned as the connector kit body is added.

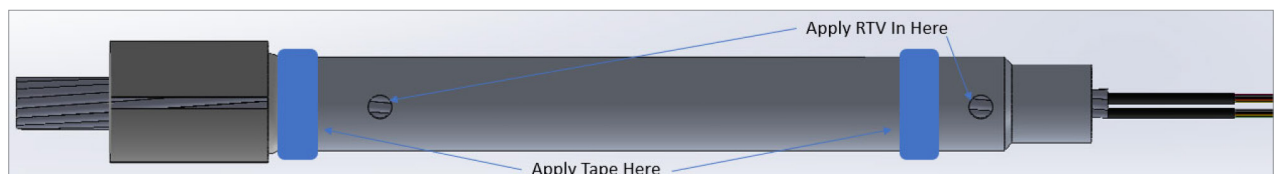


Figure 15

Place a layer of RTV inside the connector kit at the base (**Figure 16**).

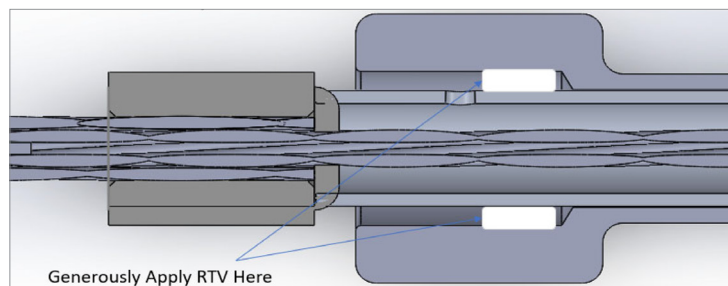


Figure 16



Seat the retaining ring in the connector kit (**Figure 17**), and install the set screws to a torque value of 100 in-lbs.

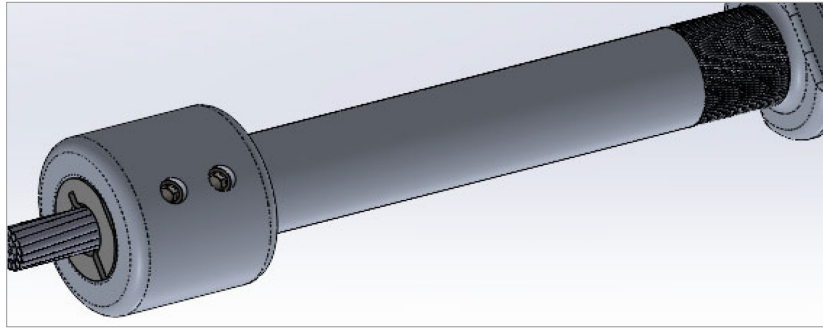


Figure 17

Apply RTV to the inside edge of the grommet and seat the grommet on the filler sleeve edge. Then apply RTV to the outside opening (**Figure 18**).



Figure 18

Thread the retaining nut over the fibers and install it on the connector kit, ensuring it seats and compresses the grommet (**Figure 19**). The connector kit is now installed properly. Furcation tubing must be applied prior to installing and routing the fibers into the Apex closure.

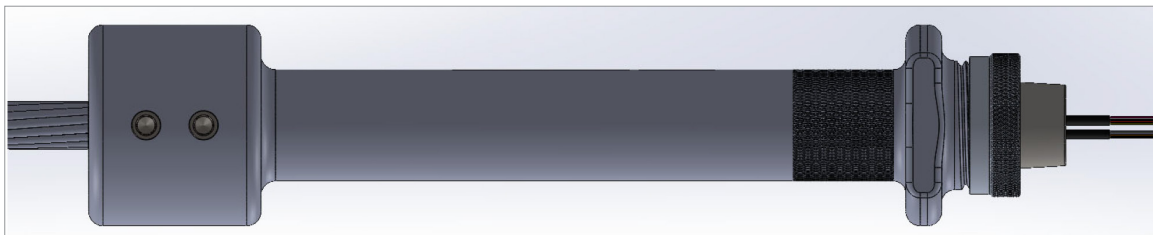


Figure 19

## 6.0 Connector Body Installation

Now that the cable is installed in the connector kit, the cable can be installed into the Apex unit. Remove locking ring from the Apex to allow the base of the Apex to be removed from the housing. Remove the sealing wedge from one of the cable entry locations. It is recommended to start with the cable entry location marked with a 1 and proceed with the next available number for each subsequent cable, as this will allow for the easiest cable routing into the splice trays. Place the connector kit body inside the Apex base so that the CAU can be bolted into the base. Each installation should look like **Figure 20**. After all needed connector kit bodies are installed, install the Apex gel wedges (**Figure 21**) per Apex installation instructions.

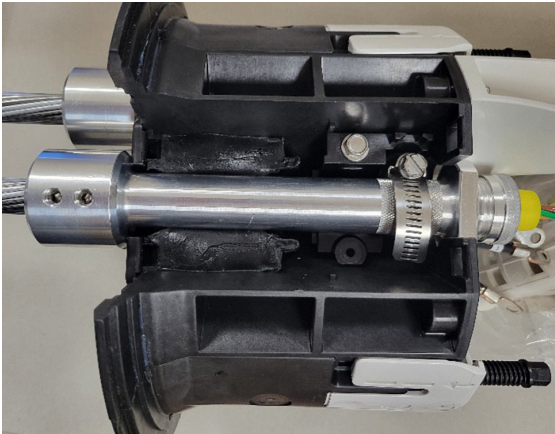


Figure 20

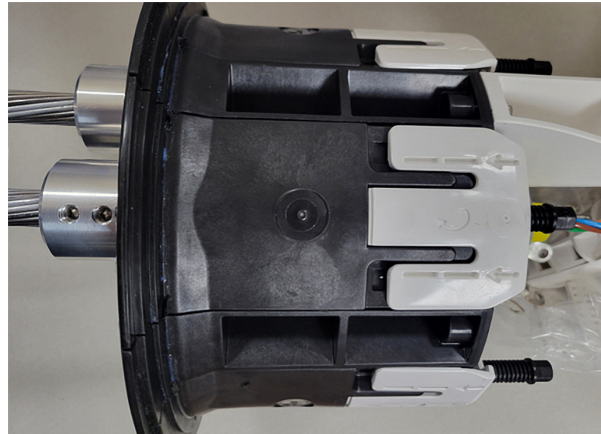


Figure 21

If two cables are installed the base of the connector kit should look like **Figure 22** with the cables in positions 1 and 2 adjacent to each other.

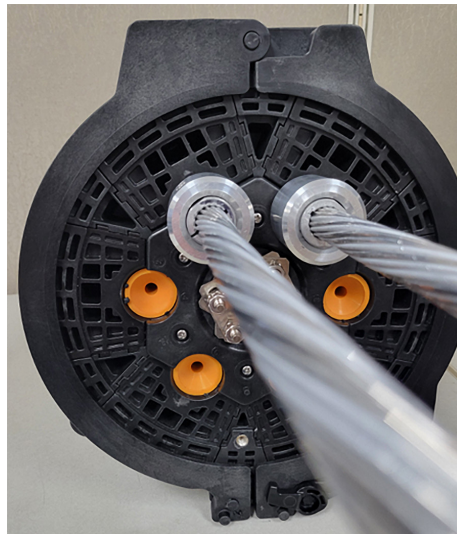


Figure 22

For AlumaCore designs with an aramid strength member the eyebolt supplied with the connector kit assembly is used. The aramid should be tied to the eyebolt to prevent the fibers from retracting into the cable. Cut off any excess aramid after tying it to the eyebolt. As shown in **Figure 23**. For AlumaCore designs with a Fiberglass Reinforced Plastic (FRP) strength member the bolt, nut, and washer combo supplied with the eyebolt is used. Push the FRP through the eyebolt and tighten the nut to clamp the FRP to the eyebolt. Apply RTV to the top of the grommet if a strength member is used.

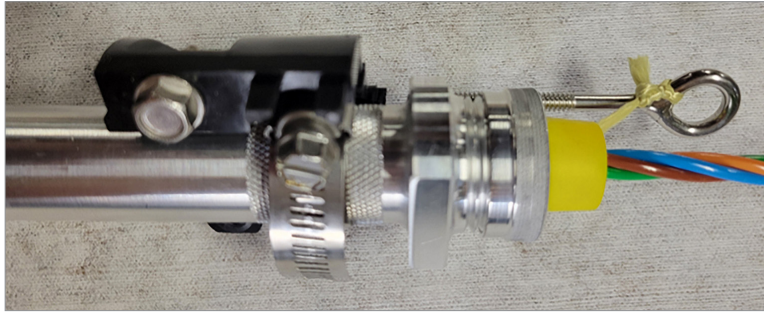


Figure 23



Figure 24

Finally, place one last bead of RTV over the outside of the retaining sleeve (**Figure 25**).

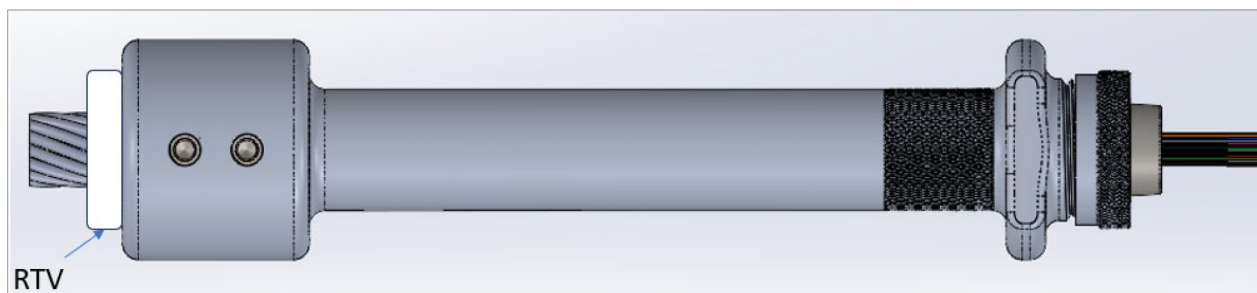


Figure 25

The connector kit is now installed properly, and the fibers may be routed according to Apex specifications.

## 7.0 Torsional Resistance

If torsional forces are expected to be placed on the cables, then an FDOA downlead clamp should be installed to tie two cables together and prevent damage from torsional forces. If more than two cables are installed in the Apex enclosure, then additional FDOA clamps can be used to secure the additional cables. The FDOA clamps should be placed approximately two feet from the bottom of the Apex enclosure (**Figure 26**). Please follow the FDOA specific installation instructions when installing.



Figure 26