



## Applications Engineering Notes

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Document Title	24 Fiber MTP® Connector Installation Onto 2x12 Fiber 3.0 mm Jacketed Round Cable With Loose Fibers
Document Number	AEN-1409
Revision Number	1.1
Effective Date	April 15, 2010



## **THE USE OF SAFETY GLASSES FOR EYE PROTECTION IS RECOMMENDED**

### **1.0 Document Purpose**

This document describes the ribbonization, termination and housing assembly procedure for US Conec MTP<sup>®</sup> fiber optic connectors onto 2x12 fiber 3.0 millimeter jacketed round cable containing loose fibers.

### **2.0 Required Equipment and Materials**

- 100 millimeter ruler or other measuring device
- 30 millimeter piece of ¼” glue-lined shrink tubing
- Permanent marker
- IDEAL<sup>®</sup> Coaxial Cable Stripper # 45-163
- Scissors
- US Conec fiber ribbonizing tool (P/N 8040)
- ½” Scotch<sup>®</sup> 810 Magic<sup>™</sup> Tape
- New razor blade or XACTO<sup>®</sup> knife
- Tweezers
- Ribbon holder modified for 2x12 fiber 3.0 mm jacketed round cable (P/N 12726)
- Thermal ribbon matrix stripper
- US Conec fiber cleaver (P/N MFA-004) or other fiber cleaving device
- 2x12 fiber 3mm jacketed round cable spring compression fixture (P/N 12013)
- Isopropyl alcohol and lint free wipes
- Centrifuge or other outgassing device
- Epoxy Technologies 353 N/D epoxy bi-pak

- 3 cc syringe with a barrel tipped cap installed
- #25PPS .014 x .50 plastic needle tip
- Vacuum pump with MT nozzle (MT nozzle P/N 400025-01)
- US Conec 24 port curing oven (P/N 5545)
- US Conec scribing tool (P/N 2104076-01)
- Standard MTP® crimp tool and die set (P/N 400053-03)
- OPTIPOP optical connector cleaner (Male P/N 6226, Female P/N 6227)

### 3.0 Cable Preparation

3.1 Slide MTP® hardware onto the cable in the following order:

- 1) 2x12 fiber 3mm round cable MTP® boot (P/N 9757)
- 2) 30 millimeter ¼” glue-lined shrink tubing
- 3) oval crimp band (P/N MTP-A12 05)

Place a piece of tape around the cable to keep the parts from falling off



3.1

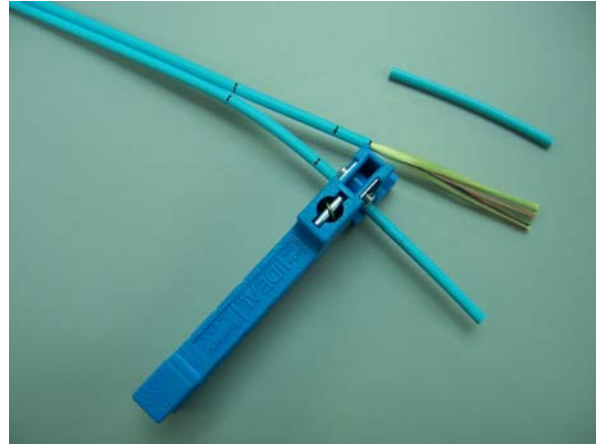


3.2

- 3.2 Place marks on the cable jacket at 50 mm, 60 mm, and 90 mm from the end.
- 3.3 Separate the sub-units to the 90 mm mark.



3.3



3.4

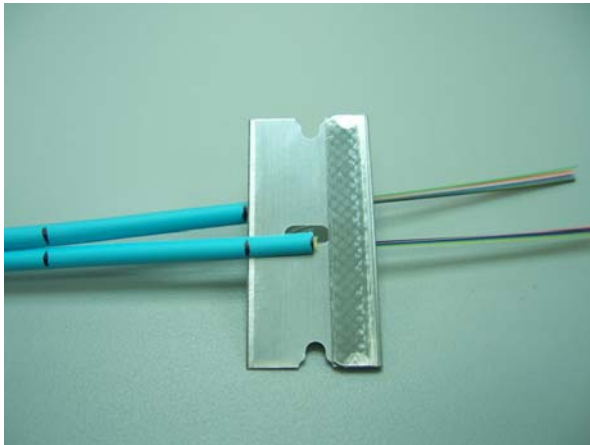
- 3.4 Using the coaxial cable tool, etch and remove the jacket at the 50 mm mark, exposing the aramid yarn.

*NOTE: The coaxial cable tool must first be set to the proper cutting depth before use. Follow the directions in the packaging and a piece of 3 mm cable to adjust the blade.*

- 3.5 Trim the aramid yarn to within 2 mm of the jacket.



- 3.6 Using a new razor blade or XACTO® knife, split the jacket of each sub-unit back to the 60 mm mark. Care must be taken to avoid nicking the fibers.



3.6



3.7

- 3.7 Remove half of the jacket on opposite sides of the legs to reduce the amount of jacket material to be crimped.

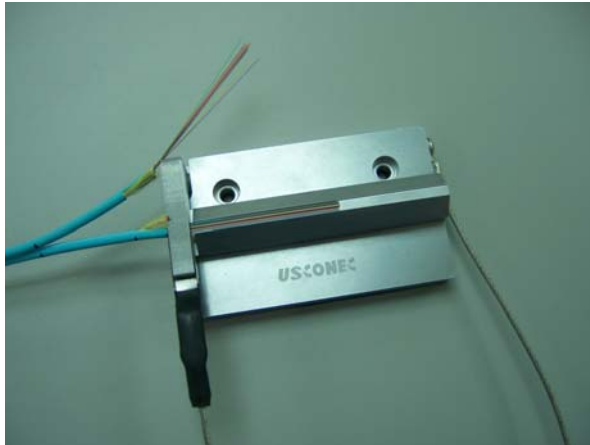
*NOTE: Failure to perform this step will make it very difficult to slide the crimp band over the crimp body in Step 7.4.3.*

#### 4.0 Fiber Ribbonization

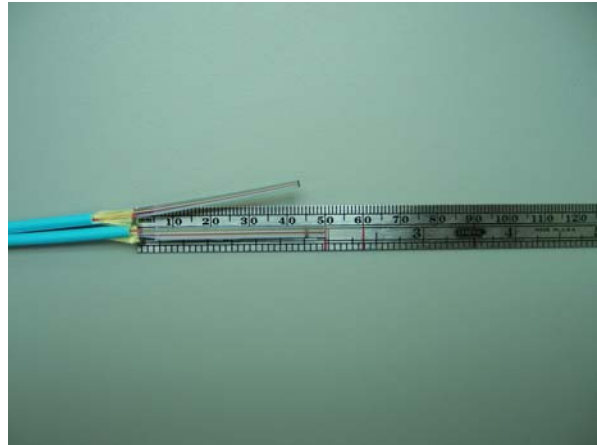
- 4.1 See US Conec Document # AEN-1408, “Operating Instructions for the US Conec Loose Fiber Ribbonizing Tool” for complete instructions for loose fiber ribbonization.



4.2 Ribbonize the fibers of each of the sub-units.



4.2



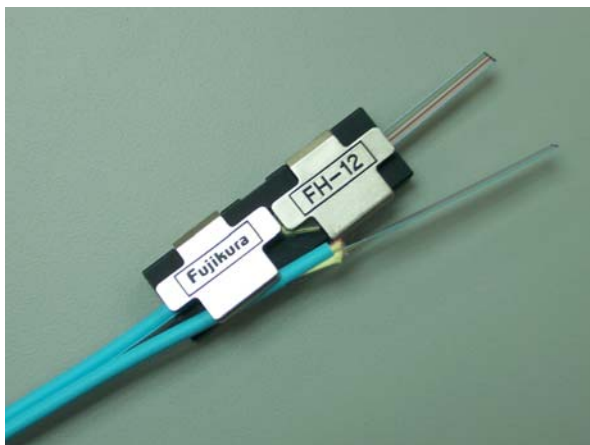
4.3

4.3 Trim the ribbonized fiber to 45 mm length.

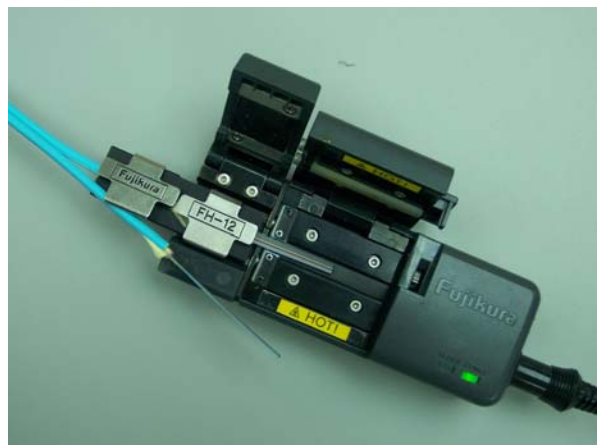
## 5.0 MT Ferrule Termination

5.1 Fiber Ribbon Preparation

5.1.1 Position the cable into the ribbon holder (P/N 12726) with the tape side of the ribbon facing up. Close the holder lids to secure the cable in place.



5.1.1



5.1.2a

5.1.2 Using a thermal ribbon matrix stripper, remove the tape and the fiber coating.

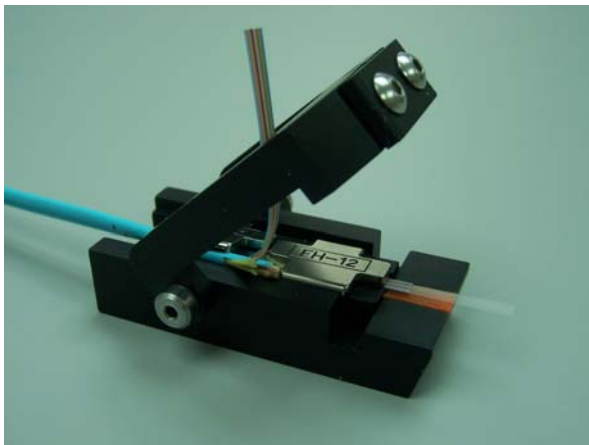


5.1.2b



5.1.2c

5.1.3 Place the ribbon holder into a fiber cleaving device and cut the fibers evenly at a length of 10 ( $\pm$  2) millimeters. Check for damaged or broken fibers.



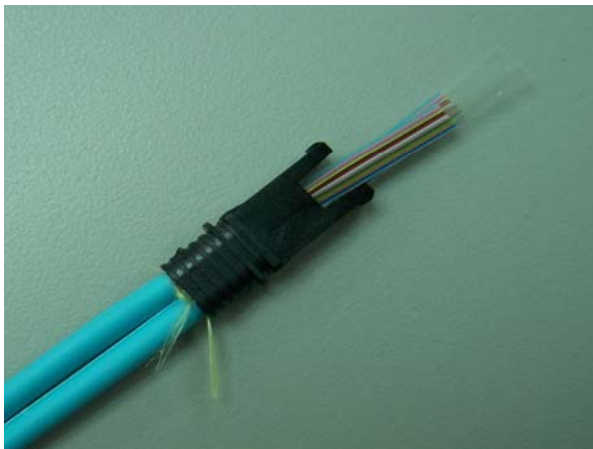
5.1.3a



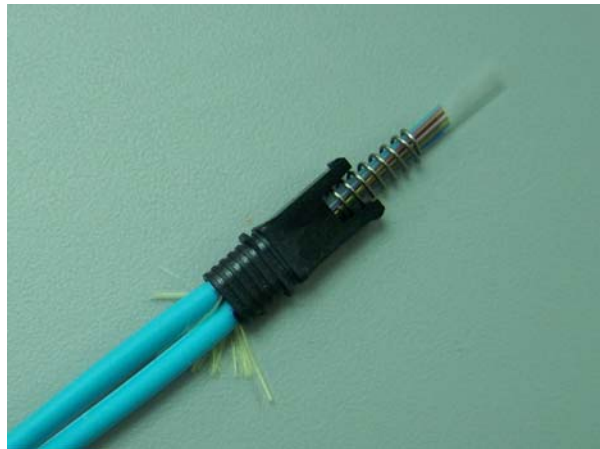
5.1.3b

*NOTE: Smooth, evenly cut fibers will aid insertion into the ferrule.*

- 5.1.4 Remove the cable from the ribbon holder. The length of unstripped ribbon extending from the jacket should be 23 mm (+0/-1) millimeters.
- 5.1.5 Install an oval spring push/crimp body (P/N 6106) on the ribbons so that the cable jacket and aramid yarn are inserted into the opening at the rear of the crimp body. Take care not to break the bare fibers.



5.1.5

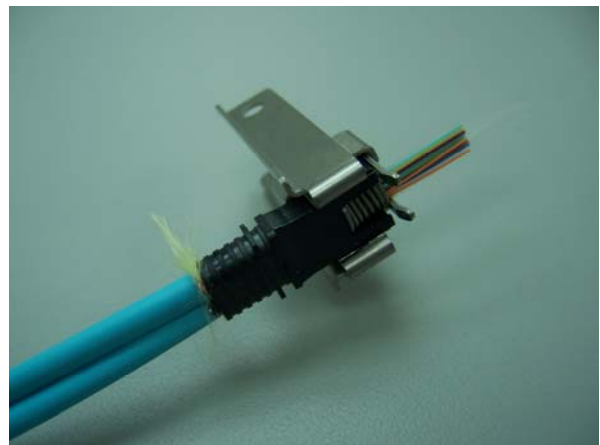


5.1.6

- 5.1.6 Install an oval spring (P/N MTP-A12-03) over the ribbons. Take care not to break the bare fibers.
- 5.1.7 Install the spring compression fixture (P/N 12013).



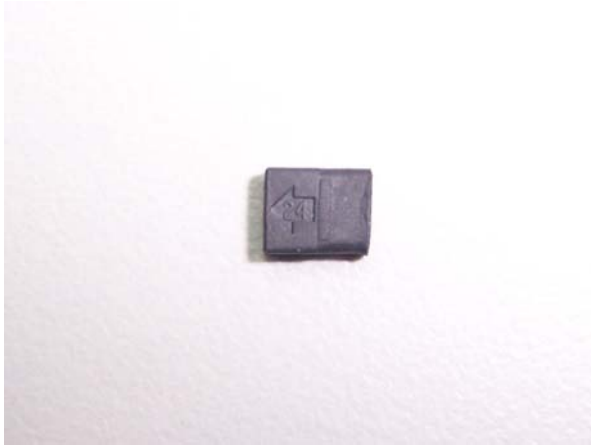
5.1.7a



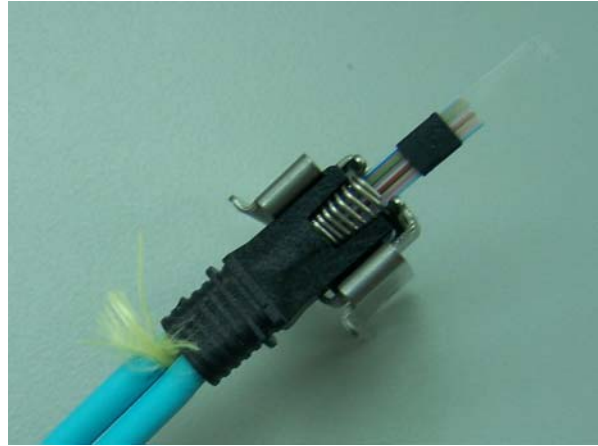
5.1.7b



- 5.1.8 Install a 24 fiber rubber ferrule boot (P/N 7094) onto the ribbons with the arrow pointing towards the bare fibers. Take care not to break the bare fibers.



5.1.8a



5.1.8b

- 5.1.9 Carefully clean the bare fibers with lint-free wipes and isopropyl alcohol to remove any remaining coating residue and other contaminants.

*NOTE: Take care not to pull the boot and spring off of the fibers while cleaning.*

*NOTE: Do not allow isopropyl alcohol to penetrate the tape of the ribbons. Doing so will cause the tape to lose adhesive properties, releasing the fibers.*

## 5.2 Epoxy Preparation

*US Conec recommends use of EPO-TEK 353ND epoxy for all MTP® products. However, different cure schedules are required for multimode and single-mode products.*

*The recommended cure schedule for multimode products is 85°C (±5°) for 55 minutes minimum.*

*The recommended cure schedule for single-mode products is 100°C (±5°) for 20 minutes minimum.*

5.2.1 Obtain an EPO-TEK 353ND epoxy bi-pak.



5.2.1

5.2.2 Slide the plastic clamp (divider) off of the epoxy bi-pak. Mix thoroughly for approximately 2 minutes until the epoxy has a consistent color throughout.



5.2.2a



5.2.2b

- 5.2.3 Put the mixed epoxy into a 3 cc syringe with a barrel tipped cap installed. Place the syringe into the centrifuge (or other outgassing device) and spin (outgas) for ten (10) minutes.



5.2.3a



5.2.3b

*NOTICE: Failure to outgas will result in air being trapped in the epoxy. During curing, the air will expand, causing voids which will reduce the adhesive properties of the epoxy. This in turn may result in fiber pistoning, which will adversely affect the optical performance of the connector.*

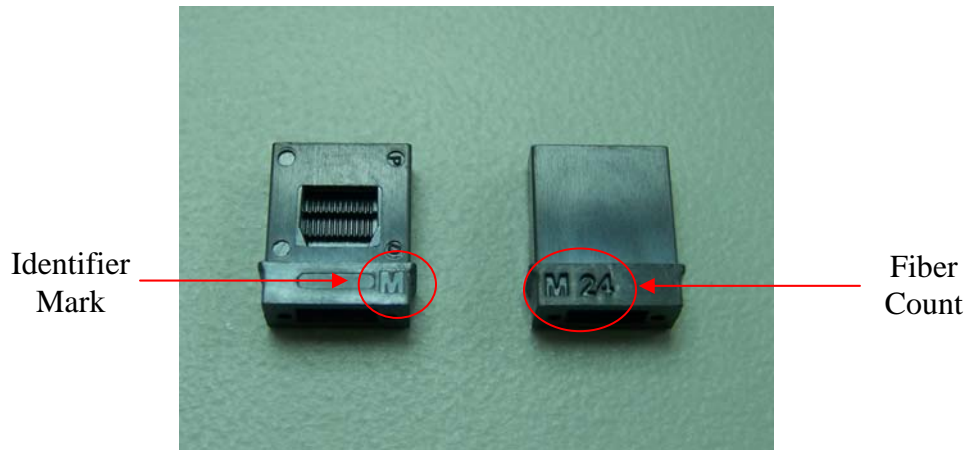
- 5.2.4 Remove the syringe from the centrifuge and install the plunger into the syringe approximately ½ inch. Invert the syringe and allow the epoxy to thoroughly settle against the plunger.
- 5.2.5 Remove the barrel tipped cap from the syringe and replace with a #25PPS .014 x .50 plastic needle tip. Compress the plunger until all air has been removed from the syringe.



5.2.5

### 5.3 Ferrule Installation

5.3.1 Obtain a 24-fiber ferrule for the fiber type you are working with and locate the “M” (multimode), “S” (single-mode) or “E” (single-mode MT Elite®) identifier mark located on the ferrule shoulder in the lower right-hand corner below the window. The fiber count is visible on the back shoulder.

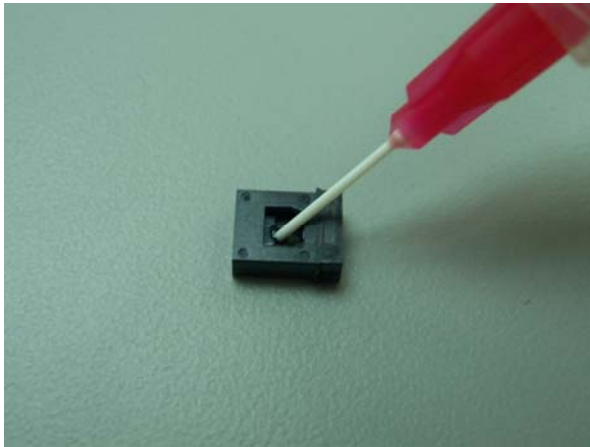


5.3.1

**NOTE:** Multimode MT Elite® ferrules have an “M” on the window side and an “ME” on the fiber count side.

5.3.2 Turn on the vacuum pump with the MT nozzle (P/N 400025.01) installed.

- 5.3.3 Apply epoxy through the front edge of the ferrule window along the fiber u-grooves. Ensure all fiber grooves are covered.



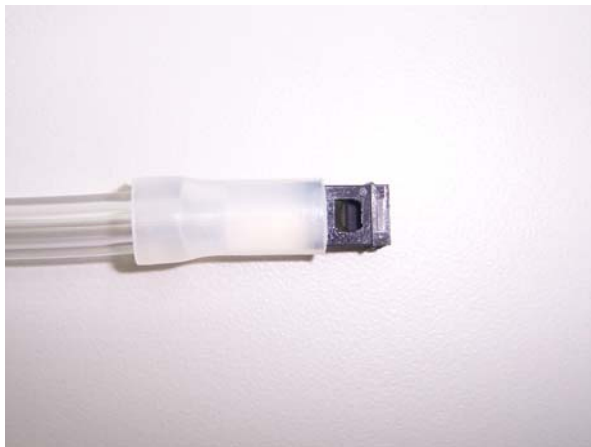
5.3.3a



5.3.3b

- 5.3.4 Place approximately 2 ( $\pm$  1) millimeters of the ferrule, endface first, into the suction nozzle. Continue for approximately 5 seconds or until epoxy has filled all the fiber holes.

**NOTICE:** *Failure to perform the previous step or performing it improperly could yield an inconsistent epoxy bond between the fibers and ferrule material. This may cause fiber pistoning, which will adversely affect the optical performance of the connector.*



5.3.4a



5.3.4b

After removal from the nozzle, an epoxy bead should be visible on the ferrule endface covering the fiber holes and should remain there through fiber insertion.

*CAUTION: Keep the guide pin holes free of epoxy. Epoxy in the guide pin holes will prevent connector mating.*

5.3.5 With the #1 (dark blue) fiber aligned with the “M” or “S” identifier mark, insert the fibers into the opening in the rear of the ferrule.

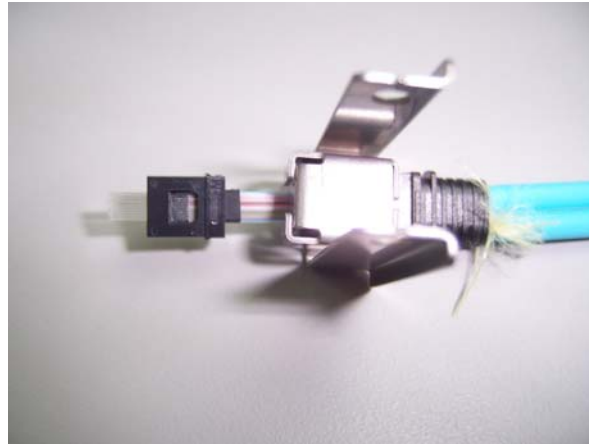
5.3.5.1 Tilt the ribbon slightly. Watch through the ferrule window as the fibers settle into the u-grooves of the shelf. This may be aided by gently moving the fibers within the ferrule window.

5.3.5.2 Slowly push the fibers along the u-grooves and insert them into the fiber holes in the ferrule. The fibers should slide smoothly into the holes and pass through the ferrule end face; however, if any resistance is felt, back out slightly and try again, watching through the window to ensure all fibers are in the proper groove. Any bending of a fiber signifies misalignment and will cause fiber breakage.

5.3.5.3 Push the fibers through the ferrule until 0.5 to 1.0 millimeter of fiber coatings are visible through the window. Do not push the fiber coatings beyond the step marking the end of the guide grooves.

*CAUTION: Pushing the edge of the fiber coatings beyond the guide grooves may cause the fibers to break inside the ferrule.*

5.3.6 Carefully slide the ferrule boot into the opening in the rear of the ferrule until it stops. When in proper position, the edge of the boot will be visible in the lower edge of the window.



5.3.6

#### 5.4 Ferrule Curing

5.4.1 Apply epoxy into the window until the cavity is full and even with the top of the ferrule. Take care that no air pockets are formed inside the ferrule cavity.

*NOTICE: Care should be taken not to overfill the cavity as excess epoxy must be removed after curing.*

5.4.2 Place the ferrules window up into the ports of the US Conec curing oven. Secure the cables under the clamp for that port. Once all connectors to be cured are placed in the oven, close the curing oven lid.



5.4.2

*NOTE: Recheck epoxy level after five (5) minutes.*

- 5.4.3 Set the oven to the cure schedule for the type of epoxy being used. See US Conec Document # AEN-1809, “US Conec Ferrule Curing Oven Operation” for instructions on setting oven cure time and temperature.



5.4.3

- 5.4.4 After the cure time has elapsed, open the lid and remove the cured connectors. Allow to cool for ten (10) minutes.
- 5.4.5 Scribe the fibers along the epoxy bead. Grasp the fibers between the thumb and forefinger and gently pull the fibers straight away from the ferrule endface. See US Conec Document # AEN-1906, “Recommended US Conec Diamond Usage Procedure” for more information.

## 6.0 Ferrule Polishing

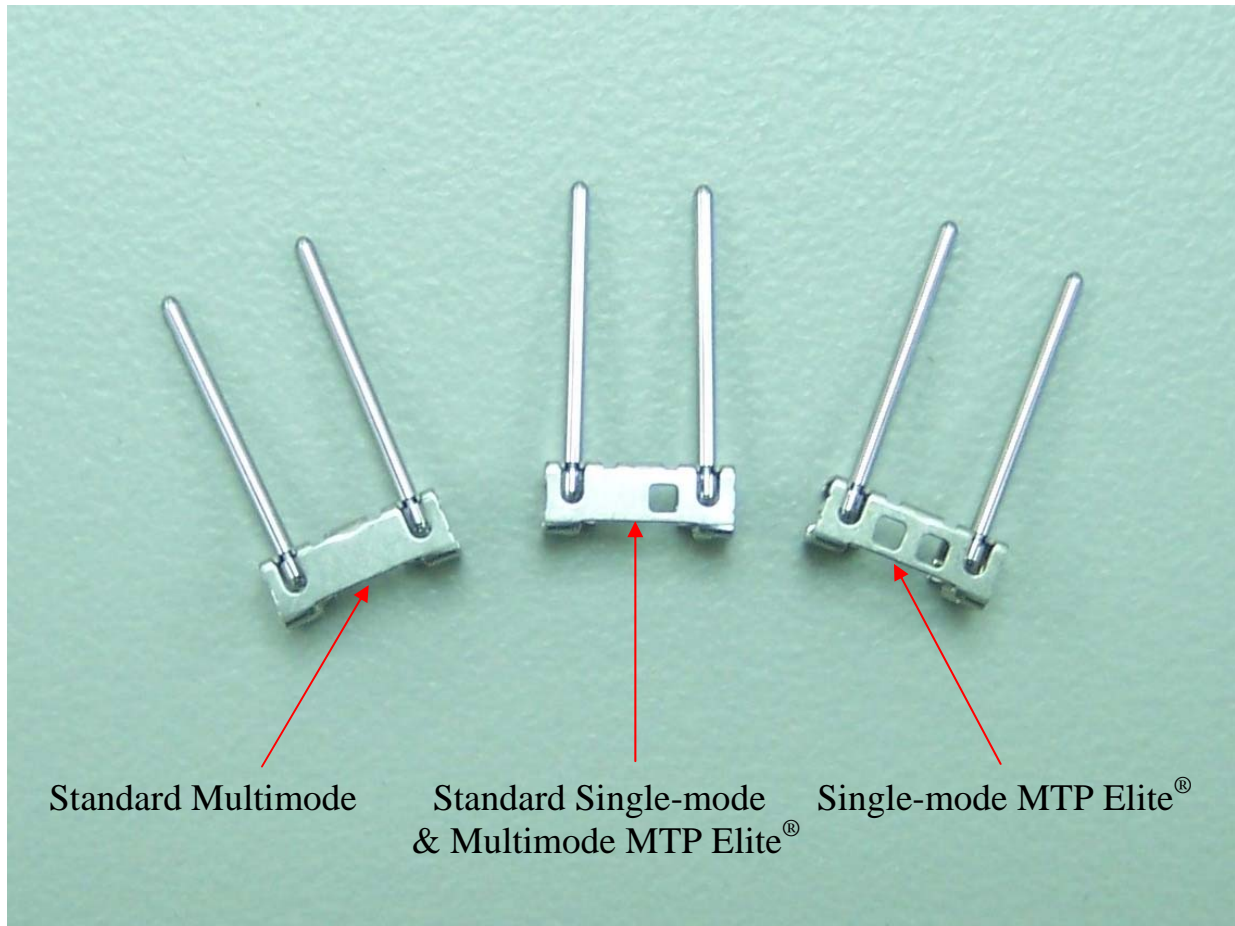
For ferrule polishing please refer to the polishing equipment manufacturers’ guide for recommended processes or contact US Conec for more information.

See US Conec Document # AEN-1512, “US Conec Recommended Between-Step Cleaning Procedure for Flocked Cloth Polishing of MT Ferrules” for more information on ferrule cleaning during and after polishing.



## 7.0 MTP® Housing Assembly

*MTP® connectors may be assembled as either males or females.  
Male connectors have a pin clamp with guide pins pre-installed.  
Female connectors have a pin clamp spacer, which has no guide pins.  
Follow the instructions for the type connector you are assembling  
Male pin clamps are available for standard multimode products (no punch-outs),  
standard single-mode products and multimode MTP Elite® products (single punch-out),  
and single-mode MTP Elite® products (double punch-outs).*



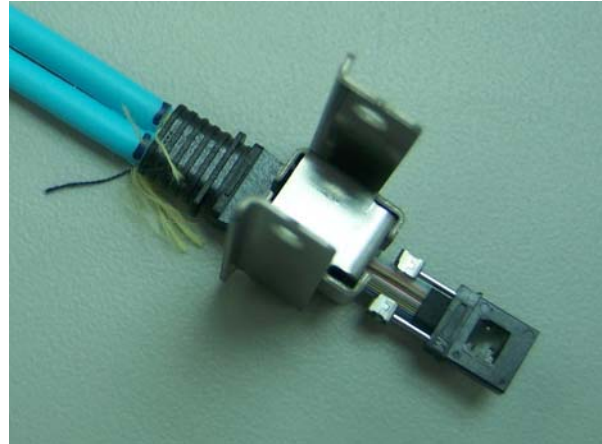
Pin Clamps

## 7.1 Male Connectors:

7.1.1 Obtain a male pin clamp assembly and position it on the ribbon.

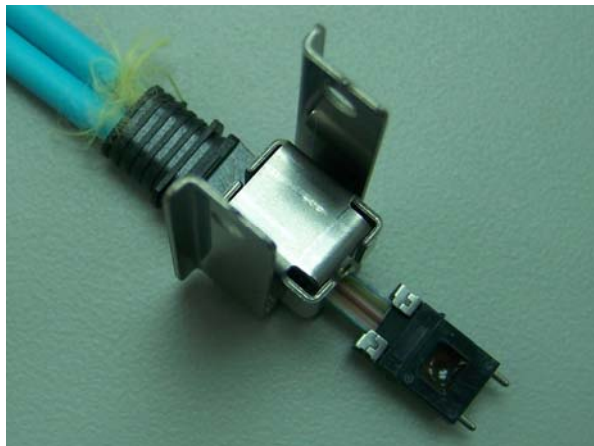


7.1.1a

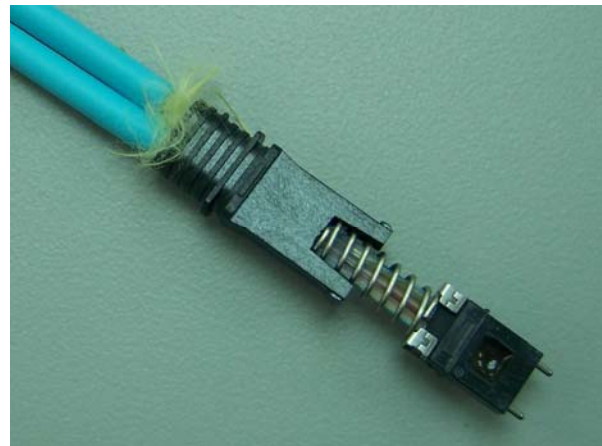


7.1.1b

7.1.2 Insert the guide pins into the holes in the rear of the ferrule. Push the clamp over the ferrule boot and securely against the rear of the ferrule. It is important for the pin clamp to seat securely against the ferrule in order for the housing to assemble properly.



7.1.2

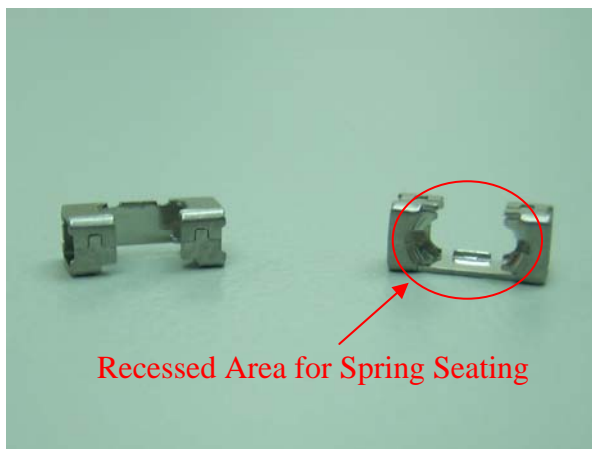


7.1.3

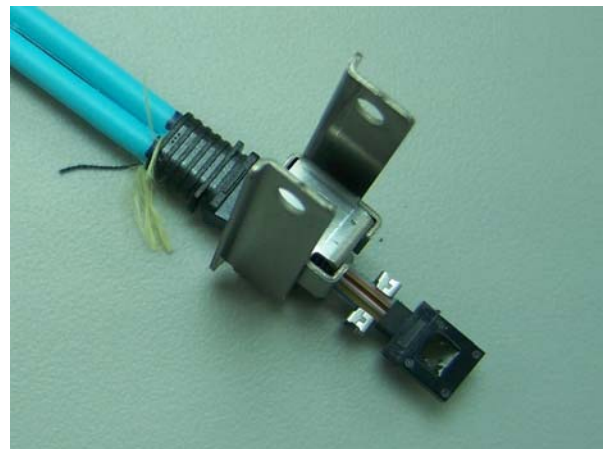
7.1.3 Remove the spring compression tool and allow the spring to slide against the clamp.

## 7.2 Female Connectors:

- 7.2.1 Obtain a female pin clamp and position it on the ribbon. *Take note of the recessed area on the clamp. This is to aid in seating the spring correctly within the connector. Make sure the clamp is positioned on the ribbon so this area is facing the spring.*

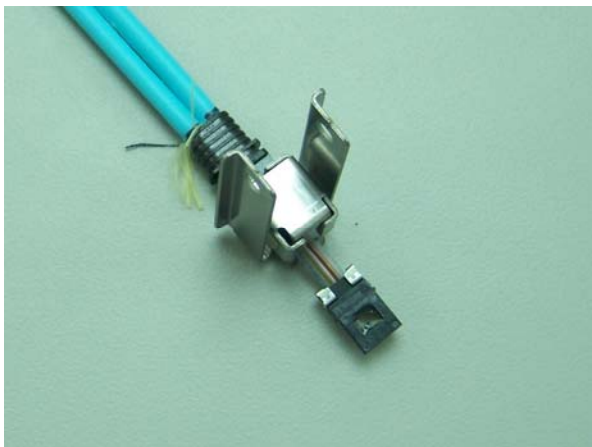


7.2.1a

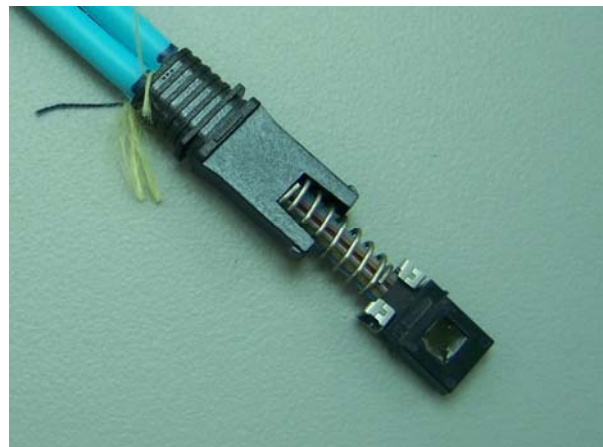


7.2.1b

- 7.2.2 Push the clamp over the ferrule boot and securely against the rear of the ferrule. It is important for the pin clamp to seat securely against the ferrule in order for the housing to assemble properly.



7.2.2



7.2.3

7.2.3 Remove the spring compression tool and allow the spring to slide against the clamp.

### 7.3 Housing Installation

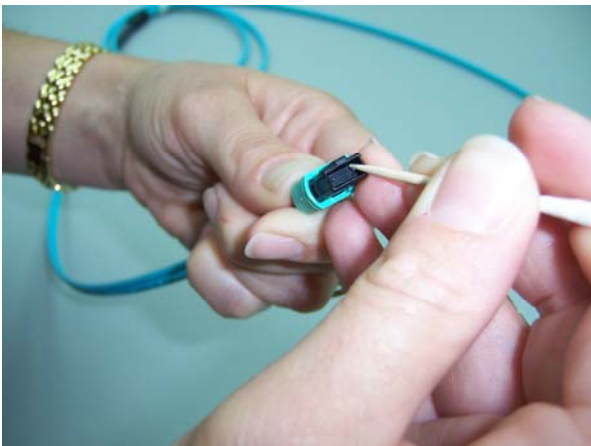
*62.5μ multimode applications use beige housings (P/N MTP-A12-11)  
Standard 50μ multimode applications use black housings (P/N MTP-A12-02))  
Laser-optimized 50μ multimode applications use aqua housings (P/N 7871)  
Single-mode 8° angled applications use green housings (P/N MTP-A12-12)*

7.3.1 Slide the ferrule into the outer housing, making sure the dot on the housing and the identifier mark on the ferrule are aligned.

7.3.2 Slide the spring push/crimp body against the rear of the housing. Gently insert into the housing until the initial resistance is overcome and the spring push is inserted into the housing approximately one-quarter of the way, creating slight tension on the spring.

7.3.3 Using a toothpick or other soft instrument, gently manipulate the ferrule until it penetrates through the end of the housing.

**WARNING:** Care should be taken to avoid damaging the ferrule.



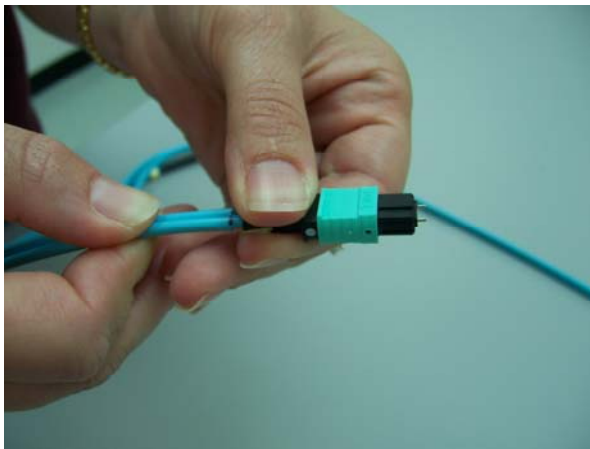
7.3.3a



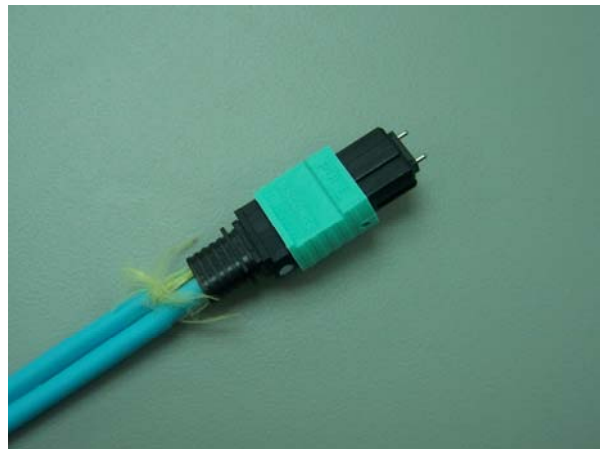
7.3.3b

7.3.4 While holding the crimp body (knurled) portion of the spring push, gently pull the cable until the ferrule moves up and down within the housing.

**NOTE:** *If the ferrule does not move freely within the housing, remove the spring push/crimp body from the housing and inspect the jacket and strength members to insure they are not binding within the housing. Repeat steps 7.3.2 & 7.3.3.*



7.3.4



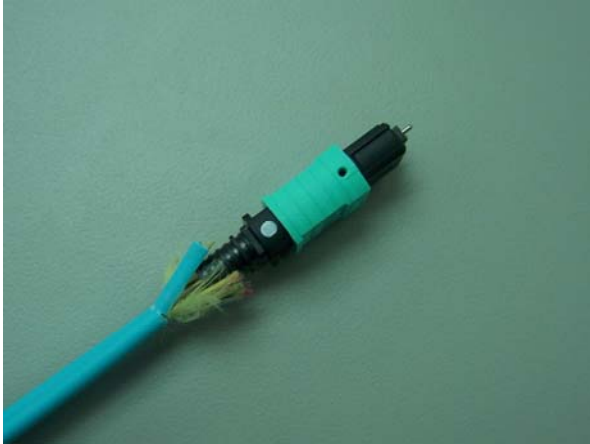
7.3.5

7.3.5 Once it is determined the ferrule moves freely within the housing, continue gently pushing the spring push/crimp body into the housing until a “click” is heard.

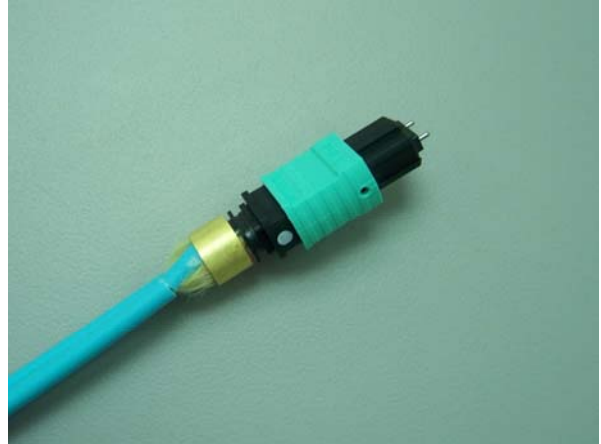
#### 7.4 Connector Crimping

7.4.1 Carefully pull the cable jacket and aramid yarn from the under the crimp body. ***EXTREME CARE MUST BE TAKEN TO NOT BREAK FIBERS!***

7.4.2 Gently pull the aramid yarn to insure it is tight within the cable jacket. If necessary, trim the aramid yarn even with the stop tab on the knurled portion of the crimp body. Distribute approximately ½ of the yarn on each side of the crimp body.



7.4.2



7.4.3

- 7.4.3 Pull the crimp band over the crimp body until it seats securely against the stop tab, capturing the cable jacket and aramid yarn between the crimp body and crimp band.
- 7.4.4 Crimp the crimp band to the crimp body. Place the connector into the cavity of the crimp tool. Ensure the crimp band does not slide out of position. Squeeze the handles of the crimp tool together until a click is heard. Release the handles and remove the crimped connector.



7.4.4a



7.4.4b



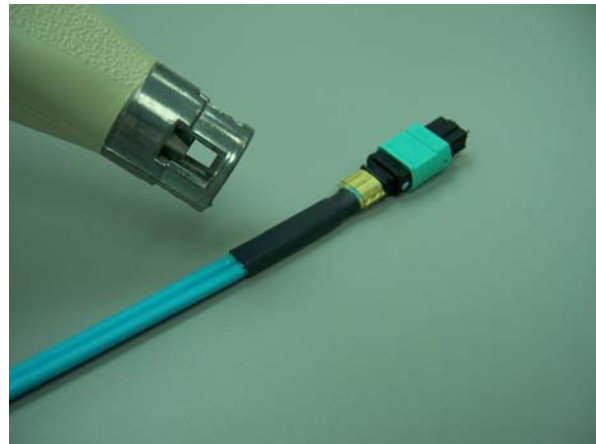
7.4.4c

## 7.5 Connector Completion

7.5.1 Slide the ¼” glue-lined shrink tubing against the crimp band.



7.5.1



7.5.2

7.5.2 Using a heat gun, shrink the tubing into place. Allow the tubing to cool before proceeding to step 7.5.3

7.5.3 Slide the boot over the shrink tubing crimp band until it seats completely against the back of the crimp body/housing assembly.



7.5.3



7.5.4

7.5.4 Clean the ferrule endface with the OPTIPOP optical connector cleaner.

7.5.5 Install the protective cap over the endface of the completed connector.



7.5.5