THORLABS

GUIDE TO CONNECTORIZATION AND POLISHING OPTICAL FIBERS

- Cable Assembly
- Manual Fiber Polishing
- Manual Fiber Cleaving

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FN96A

INTRODUCTION

These connectorization and polishing notes have been written assuming the user has no prior experience with optical fibers. Part I details the assembly of the fiber optic cable. Part II details the steps involved in polishing the cable and connector end faces, and Part III details the steps for cleaving the end of a fiber.

These procedures may be used for both single and multimode fibers. Note, that although this manual utilizes an ST connector, the procedures are intended as general guidelines which may also be used with FC, SMA, and other connector types.

CAUTION NOTICE:

1. For some hard clad fibers, such as Innovaquartz TEQ cladded fibers, DO NOT use TRA-CON'S F112 epoxy. It will damage the TEQ coating. Use TRA-CON'S F123 epoxy instead.

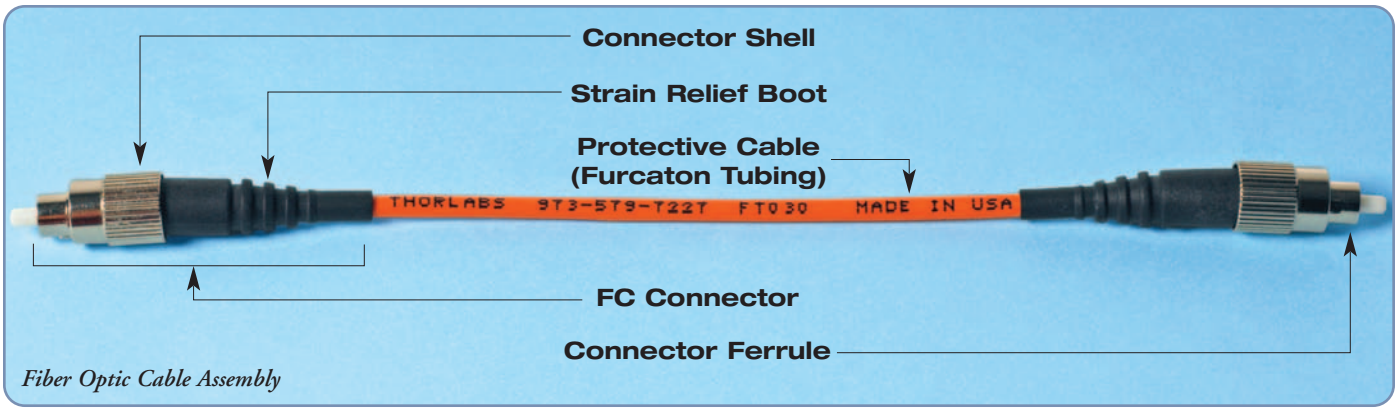
2. Be cautious about fiber fragments - also known as sharps - when working with optical fiber. Safety goggles must be worn when working with fiber. The fiber fragments are small and can penetrate the skin. The fiber fragments may be picked up with clear tape and discarded during the procedures to minimize the chance of injury.

3. Be cautious not to touch your eyes when working with fiber. The small fragments may cause serious eye damage.

4. The solvents and epoxy used during these procedures should be handled in accordance with the manufacturers' recommendations. Rubber gloves and eye protection should be worn.

NOTE: This document is intended as a general guideline to help individuals build and polish a fiber optic cable. Thorlabs does not claim that these procedures have been recommended by any fiber or connector manufacturer. Some steps in the procedures will vary with regards to the fiber and connectors being used. It is expected that individuals will modify these procedures as they develop their own technique.

PART I: FIBER OPTIC CABLE ASSEMBLY



Fiber Optic Cable Assembly

TOOLS NEEDED

Available From Thorlabs:

- Fiber to be Connectorized
- Fiber Optic Connectors
- Fiber Optic Epoxy
- Fiber Connector Crimp Tool
- X-Acto™ Knife or Razor Blade
- Small Wire Snippers, or Kevlar Cutting Scissors
- Furcation Tubing
- Fiber Stripper
- Epoxy Syringe
- Kimwipes®
- Caliper

Not Available from Thorlabs:

- Reagent Grade Isopropyl Alcohol
- Glass Beaker (or equivalent)
- Safety Goggles/Glasses

STEP 1

CLEAN CONNECTOR

Clean as many connectors as you anticipate using by placing them in a glass beaker and covering the connectors with reagent-grade isopropyl alcohol (up to 50 connectors can be easily cleaned at once). Let the connectors soak for a few minutes. After soaking, remove the connectors to a clean surface. Shake out any excess solvent and let the remaining solvent evaporate.

SAFETY NOTE: *Follow manufacturers' guidelines for safe handling of all solvents mentioned throughout these notes. Safety goggles must always be worn when handling chemicals. Avoid contact with skin and use only with adequate ventilation. Be aware that isopropyl alcohol has a low flash point.*

Visually inspect the ferrule to ensure the capillary is clear by holding the connector up to a light. With the connector 30cm to 45cm from your eye, light should be clearly visible through the connector body. This holds true for both single mode and multimode connectors.

STEP 2

ADD STRAIN RELIEF BOOTS AND CRIMP SLEEVES

Slip the strain relief boot and crimp sleeve onto the end of the furcation tube as shown in Photo A. A piece of tape will help hold the two items in place.

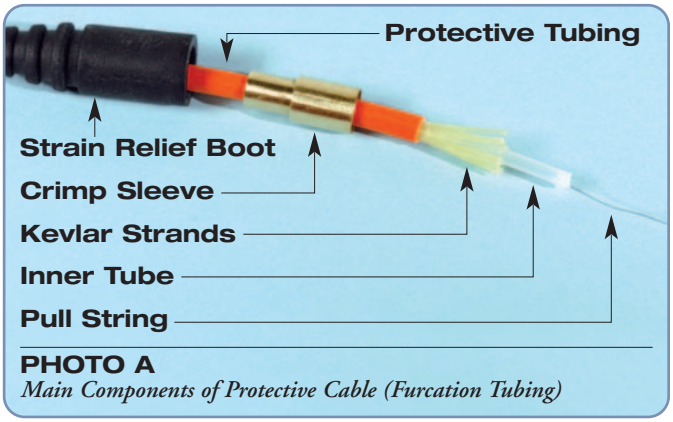


PHOTO A
Main Components of Protective Cable (Furcation Tubing)

STEP 3

CUT PROTECTIVE CABLING

Cut the protective cabling (furcation tubing) to a length 26mm longer than the desired length (13mm per end, which will be inserted into each connector). Small wire snips, or Kevlar scissors (Thorlabs Item # T865), are useful for cutting through the tough Kevlar threads. (Reference Figure 1, Dimension A).

STEP 4

PREPARE CABLE (FURCATION TUBE) FOR FINAL ASSEMBLY

Strip back the PVC outer jacket of the furcation tubing with an X-Acto™ knife to expose about 13mm of the Kevlar threads, and inner tubing (Reference Figure 1, Dimension A, for other style connectors). Take care not to cut the Kevlar threads. The final results should look like Photo B. Repeat this process for all ends being connectorized.

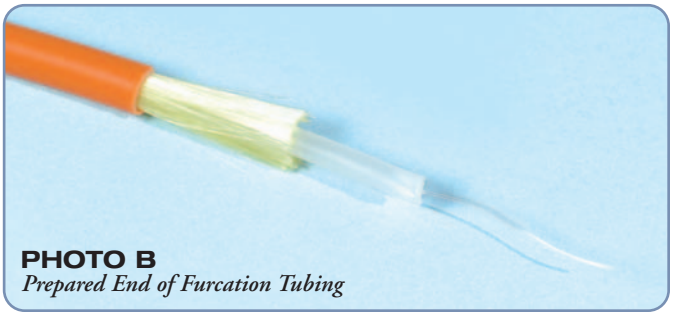


PHOTO B
Prepared End of Furcation Tubing

STEP 5

INSERT THE FIBER THROUGH THE FURCATION TUBE AND THEN TRIM FIBER TO LENGTH

The furcation tube has a pull-string to facilitate insertion of the fiber. If the pull string will not be used, remove the pull string and trim the fiber so that 40mm of fiber protrudes from each end of the furcation tube. If the pull-string is used, extra fiber, at least 50mm, should be added. This pull-string may be used for fibers with relatively small outer diameters. For larger diameter fibers, the fibers are rigid and are easily pushed through the furcation tubing.

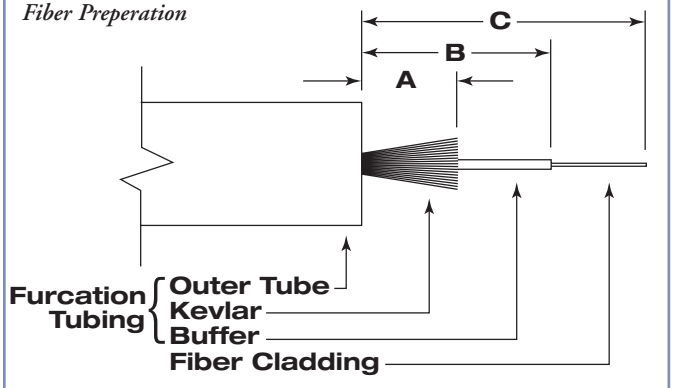
To use the pull-string, clean about 25mm of each end of the fiber and pull-string with isopropyl alcohol. Using a quick cure adhesive, adhere the fiber and pull-string together with about 25mm of overlap. If the adhesive is still tacky, sprinkle some talcum powder on the adhesive. This will help when pulling the fiber through the tubing. Check that the bond is strong before pulling through the tubing. With the furcation tube pulled straight, gently pull the pull-string from the far end of the furcation tube. As the fiber is drawn into the furcation tube, make sure the fiber does not knot up. Be careful not to pull too quickly; the fiber and pull-string bond may break, or too much fiber may be pulled through the tubing, leaving no fiber at one end.

STEP 6

STRIP AND TRIM FIBER TO LENGTH

The goal is to strip enough of the jacket from the fiber to allow about 10mm of stripped fiber to protrude through the fiber optic connector. Simultaneously, the total length of the fiber must be controlled to allow proper assembly of both ends of the cable. Using the drawing and table in Figure 1 for guidance, trim and strip the fiber such that the prescribed amount of fiber (Dimension C) protrudes out each end of the furcation tube.

FIGURE 1
Fiber Preperation



Connector Type	A	B	C
SMA	9.5mm	28.5mm	38mm
ST	13mm	25mm	38mm
FC	13mm	25mm	35mm

The values included in Figure 1 are approximate. You may need to adjust the fiber length depending on connector manufacturer. The values assume that you are using the crimp style connectors purchased from Thorlabs. In Step 8, the cable will be assembled dry, i.e., no glue. At that time, the optical fiber may need adjusting to allow about 10mm of fiber to protrude through the end of the assembled connectors.

Thorlab's stripping tool (Photo C) comes completely assembled (see Appendix A for details). Adjust the amount of coating to be stripped by setting the stripper slide bar. The stripper scale on the right handle allows a prescribed length of fiber to be stripped. For best results, remove the fiber optic jacket in a series of 3mm to 7mm pieces.

HELPFUL HINT *(Use on silica/silica fibers only): Soak the fiber end to be stripped, submerging only the length of fiber that will be stripped, in acetone for a few minutes to soften the acrylate jacket. Acetone should only be used on glass fibers, many of the special coatings used on multimode fiber can be damaged by acetone.*

SAFETY NOTE: *Follow manufacturers' guidelines for safe handling of all solvents. Avoid contact with skin and use only with adequate ventilation.*

PHOTO C
Fiber Stripping Tool

PHOTO D
Remove Fiber Jacket in 3mm to 7mm Pieces

NOTE: *The values are approximate, and may need to be adjusted per the connector manufacturer's recommendation.*

STEP 7
CLEAN STRIPPED FIBER

Clean the stripped fiber with reagent grade isopropyl alcohol. A Kimwipe moistened with a little alcohol works well. It is critical that this step be carried out carefully. Any jacket debris left on the fiber will make the assembly of the fiber with the connector difficult.

STEP 8
TEST FIT FIBER AND CONNECTOR

After the solvent has had sufficient time to evaporate from the clean connectors, test the fit of the fiber and connector. This test should be done before any epoxy is added to the connector or fiber. Slip the stripped fiber into the back end of the connector. Slowly rotate the connector to ease the entry of the fiber into the ferrule of the connector. If the optical fiber will not pass through the connector, see Appendix B for troubleshooting guidelines. Slip the furcation tubing into the back end of the first connector. The Kevlar threads should fan around the connector as shown in Photo El. Press the connector fully against the furcation tube. Repeat this for both ends of the cable. The stripped section of fiber should extend through the connector ferrule by about 10mm, see Photo E2. If the fiber does not protrude the recommended distance, adjust the length of the stripped section of optical fiber, or the length of the furcation tube.

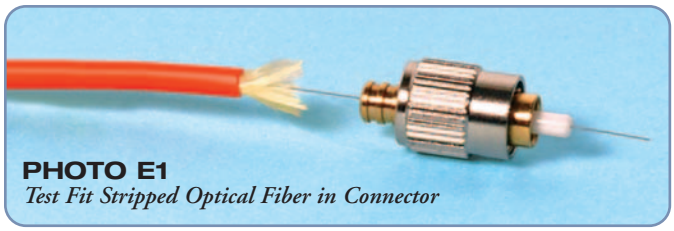


PHOTO E1
Test Fit Stripped Optical Fiber in Connector

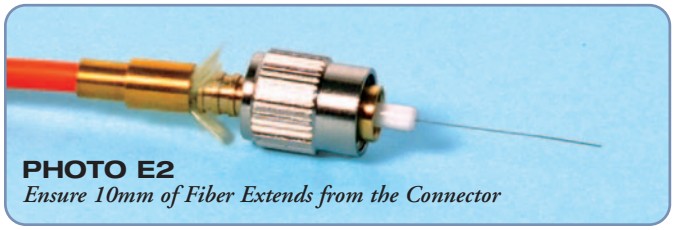


PHOTO E2
Ensure 10mm of Fiber Extends from the Connector

STEP 9
REMOVE CONNECTORS AND SET THEM ASIDE

STEP 10
PREPARE EPOXY-FILLED SYRINGE

For general purpose use on silica fibers, the F112, 2 gram epoxy BI-PAX is recommended. If you are using a TEQ coated fiber or any other fibers which are not made exclusively of glass, we recommend the F123 Epoxy. Call Thorlabs for details. The F112 Epoxy has a working life of about 30 minutes, and does not require a curing oven. Remove the separator bar on the epoxy BI-PAX and mix the two parts by rubbing the package on the edge of your work table for one minute (see Photo F). After thoroughly mixing the epoxy, cut off the corner of the BI-PAX in preparation for loading the syringe. With the syringe tip firmly threaded onto the syringe body, add the mixed epoxy to the syringe as shown in Photo G1. Once the epoxy has been loaded, insert the syringe plunger and invert the syringe as shown in Photo G2. Leave the plunger positioned as shown in the photo until the epoxy settles on the rubber piston, then slowly press the plunger into the syringe body expelling the trapped air through the needle. Continue pressing the plunger into the syringe until only epoxy is expelled. Wipe off any excess epoxy from the tip. Since the single mode fiber is not as rigid as multimode fiber, the syringe will now have a useful working time of about 30 minutes for large core multimode fiber, and about 15 minutes for single mode fiber.

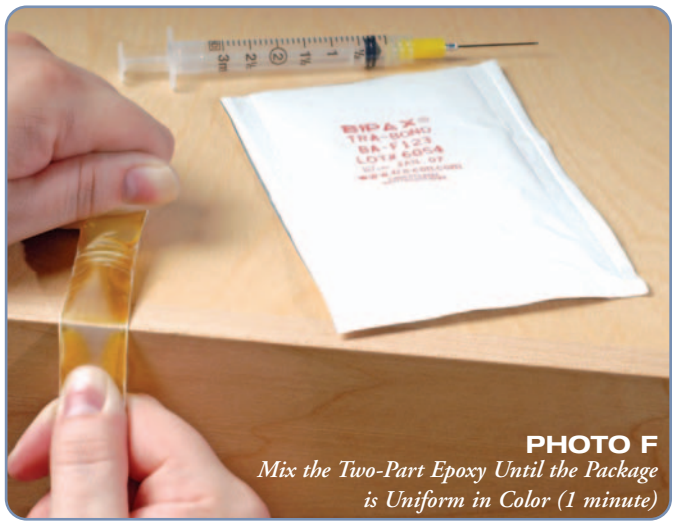


PHOTO F
Mix the Two-Part Epoxy Until the Package is Uniform in Color (1 minute)

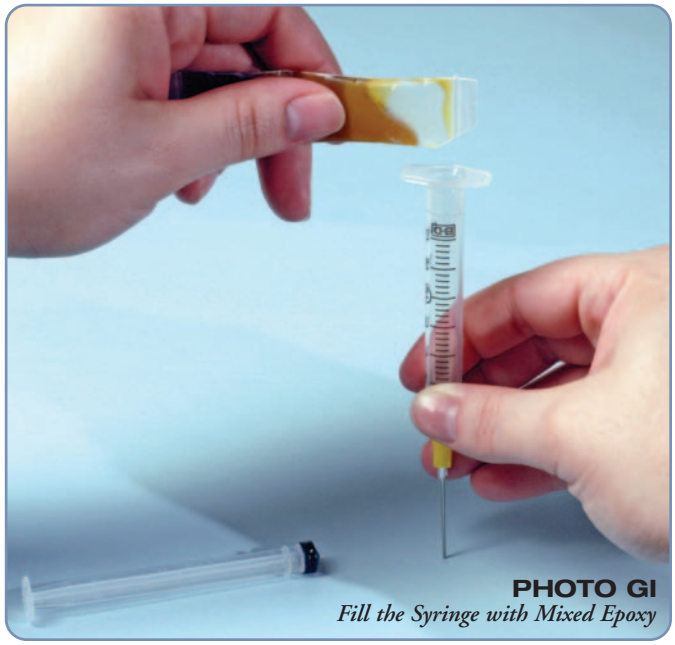


PHOTO GI
Fill the Syringe with Mixed Epoxy

PHOTO G2
Insert Plunger and Invert Syringe, Allowing the Epoxy to Settle on the Plunger

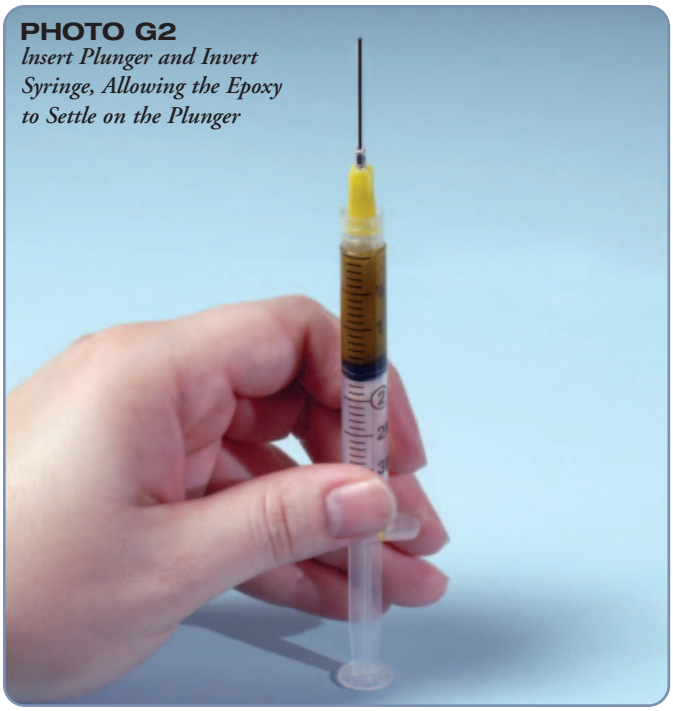
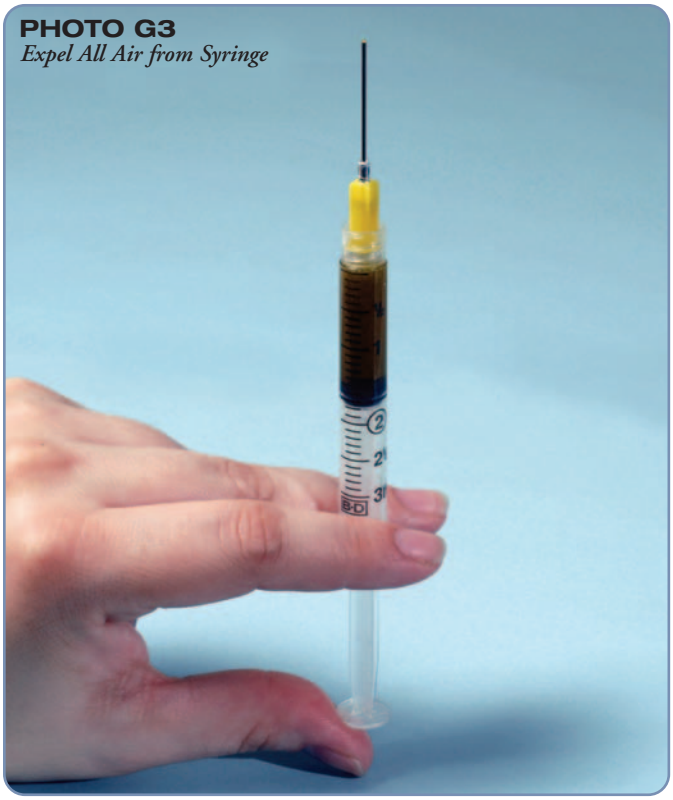


PHOTO G3
Expel All Air from Syringe



STEP 11

ADD EPOXY TO CONNECTOR

Insert the syringe into the back of the connector until it bottoms out within the connector. While pressing the syringe plunger, maintain pressure between the syringe tip and the connector body. This pressure will ensure the epoxy injected into the connector flows mainly into the ferrule hole, rather than filling the rear area of the connector (see Photo H). Continue injecting epoxy through the connector ferrule until a small bead appears on the outside face of the connector ferrule.

PHOTO H
Eject Epoxy Through the Connector Ferrule

STEP 12

INSERT FIBER INTO EPOXIED CONNECTOR

Slide the fiber out of the furcation tube about 50mm, and grasp the tube and fiber as shown in Photo I. Push the connector onto the fiber while slowly rotating the connector, as shown in Photo J. This helps to funnel the fiber into the connector, and also helps to evenly distribute the epoxy between the fiber and the connector ferrule. Check for fiber breakage by sliding the connector back and forth while watching to ensure the protruding fiber moves in and out of the connector. If the fiber breaks, clean the connector with a wire cleaner (WC100).

PHOTO I
Grasp Fiber and Furcation Tube in One Hand

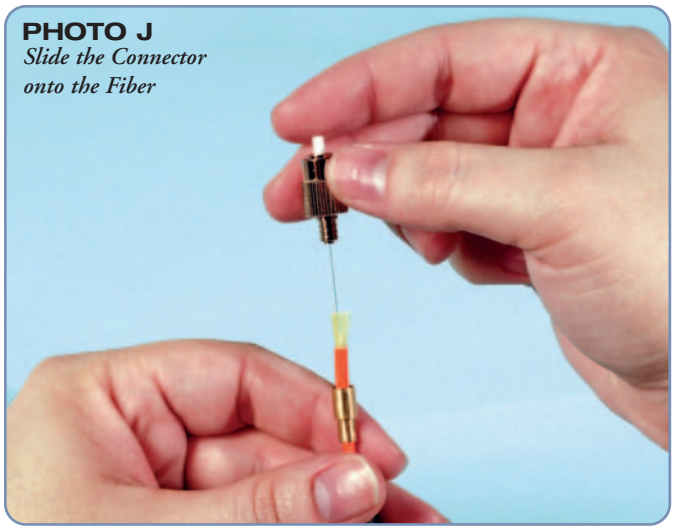


PHOTO J
Slide the Connector onto the Fiber

STEP 13

FULLY SEAT CONNECTOR

With the back end of the connector seated against the furcation tube, slide the crimp ring over the back end of the connector, and the Kevlar (see Photo K).

PHOTO K:
Full Seat the Connector on the Furcation Tube

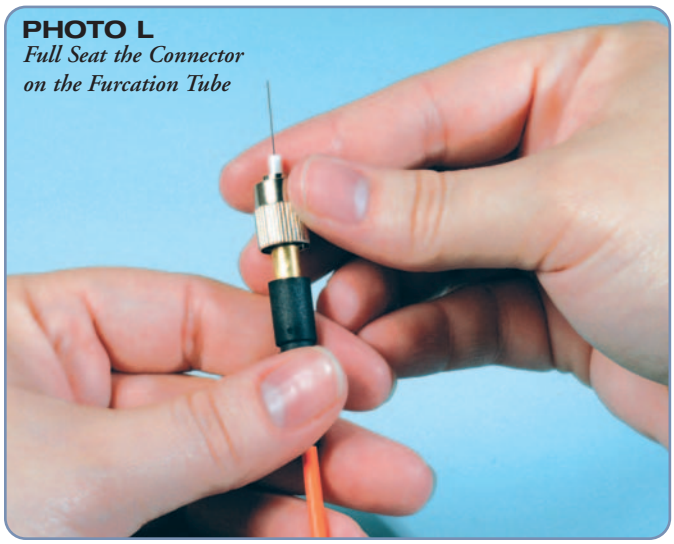


PHOTO L
Full Seat the Connector on the Furcation Tube

STEP 14

SECURE CRIMP SLEEVE

With the connector seated against the PVC jacket and Kevlar, crimp the crimp sleeve in two locations using the proper crimp tool. Use the 0.178" hex section of the die to crimp the section over the back end of the connector.

STEP 15

EXAMINE THE EPOXY BEAD

The end of the connector must have a sufficient bead of epoxy to support the end of the fiber during polishing. Visually compare the connector end to Photo M. If there does not appear to be a sufficient epoxy, some can be added by dabbing on a small amount.

A 50mm-75mm scrap of fiber makes an ideal applicator of epoxy. It is rigid enough and large enough to pick up a small bead of epoxy; yet it is flexible enough to minimize the danger of breaking the fiber that protrudes through the connector.

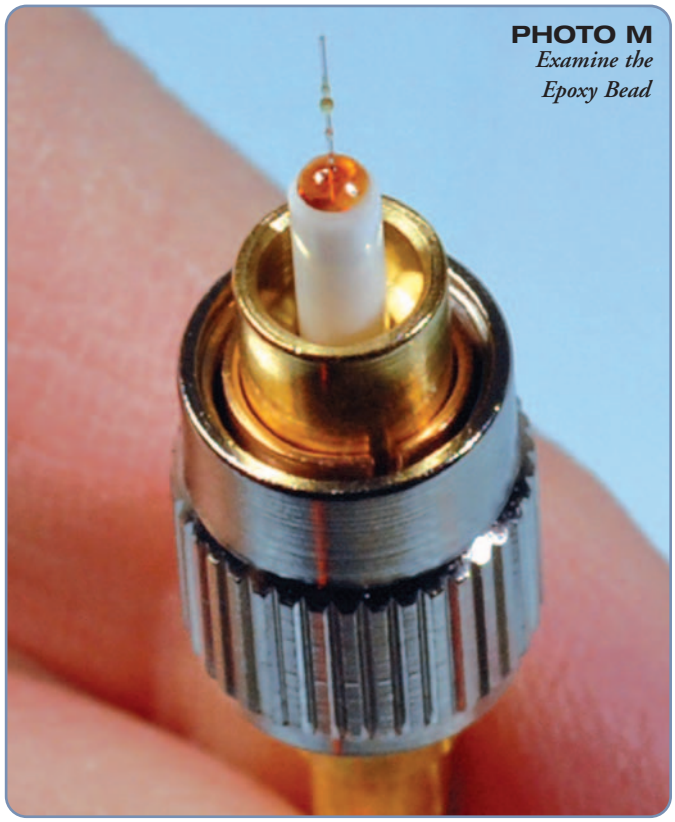


PHOTO M
Examine the Epoxy Bead

STEP 16:

SECURE THE STRAIN RELIEF BOOT

Slip the strain relief boot partially onto the connector as shown in Photo N. Insert the syringe into the boot as shown and inject a small amount of epoxy. Remove the syringe and slide the boot up onto the connector. Leaving a small gap between the connector shell and the relief boot.

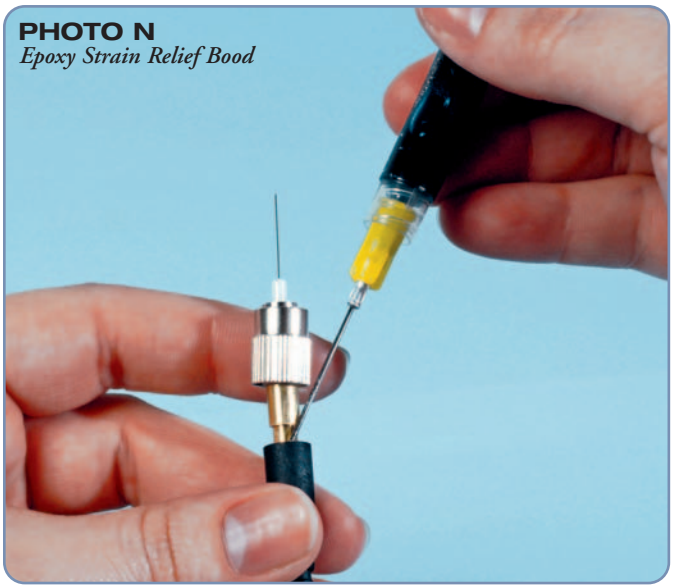


PHOTO N
Epoxy Strain Relief Bood

NOTE: *If there is excess epoxy on the boot, it is possible to seize the outer shell of the connector (which needs to spin freely) by inadvertently gluing the boot and the connector shell together.*

STEP 17:

CHECK FIT OF SECOND CONNECTOR

Test the connector on the second end of the fiber. The stripped section should protrude from the tip of the connector by approximately 10mm. If the fiber is too long it may break during installation of the final connector. Trim the fiber, and strip it, so that 10mm protrudes from the connector.

STEP 18:

ADD EPOXY TO SECOND CONNECTOR

Repeat Step 11 on the second connector.

STEP 19:

INSERT SECOND EPOXIED CONNECTOR ONTO CABLE ASSEMBLY

Slide the second epoxied connector onto the end of the fiber cable, as shown in Photo P. Remember to rotate the connector while you gently push the fiber into the connector. This will help the fiber to pass through the connector while also helping to center the fiber in the ferrule.

STEP 20:

ALLOW THE EPOXY TO CURE

If the F112 epoxy was used, allow the cable assembly to cure overnight. The curing process can be accelerated by heating the connectorized ends of the cable. Refer to the table below for a list of commonly used epoxies and curing times.

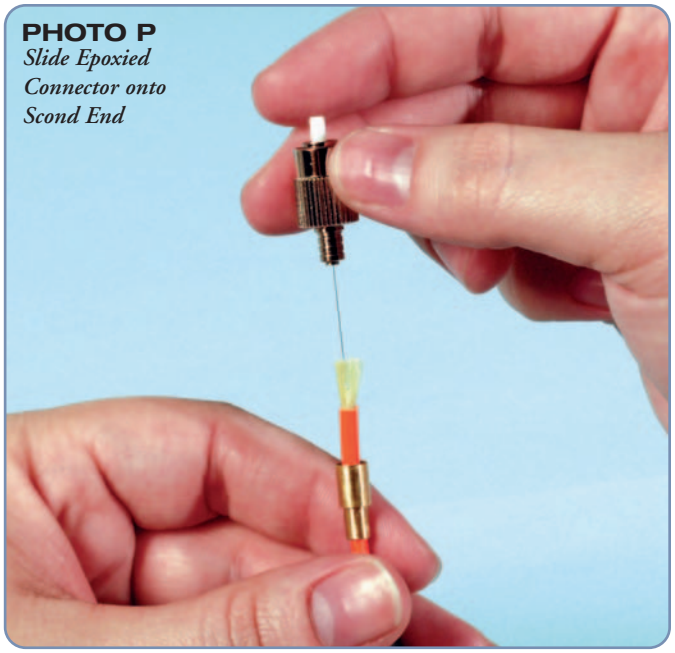


PHOTO P
Slide Epoxied Connector onto Scond End

Item#	Pot Life	Cure Time 25°C	Typical Cure Schedule	Operating Temperature	Cured Color
F112*	40 Minutes	18 Hours	15 Minutes@65°C	-60 to 110°C	Blue
F120*	5 Minutes	18 Hours	1 Hour@25°C	-60 to 115°C	Straw
F123	4 Hours	No Cure@Room Temp.	5 Minutes@100°C	-60 to 175°C	Reddish-Amber
353NDPK	4 Hours	NA	1 minute@150°C	-50 to +200°C	Dark Red
	4 Hours	NA	2-5 minute@120°C	-50 to +200°C	Dark Red
	4 Hours	NA	5-10 minute@100°C	-50 to +200°C	Dark Red
	4 Hours	NA	15-30 minute@80°C	-50 to +200°C	Dark Red

*Not recommended for hard polymer clad fiber.

PART II: MANUAL FIBER POLISHING

PHOTO A
Wedge Shaped Diamond Scribe

Please refer to Thorlab's current catalog or www.thorlabs.com for tools required to complete polishing of fiber optic cables.

STEP 1:
SCORING THE FIBER

Hold the connector as shown in Photo B. Using a fiber scribe (Thorlabs Item # S90W, Photo A), very lightly score the fiber just above the epoxy bead with the cutting edge held parallel to the connector tip. Ideally, the scribe should contact the fiber about one fiber diameter above the epoxy.

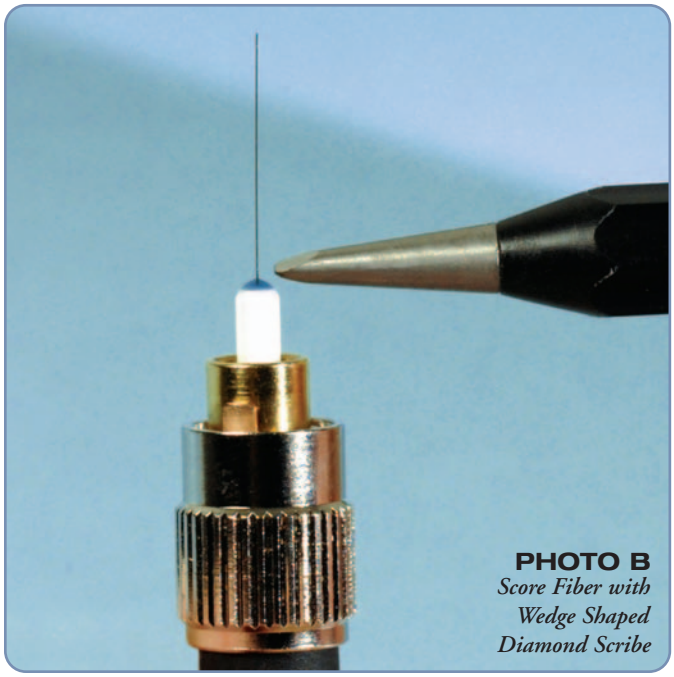


PHOTO B
Score Fiber with Wedge Shaped Diamond Scribe

HELPFUL HINT: *The fiber should not break during scoring, the fiber need only to be touched with the scribe to produce a score mark that will allow a clean cleave of the fiber.*

STEP 2:
CLEAVING THE SCORED FIBER

From the scored side of the fiber, gently squeeze the tip of the fiber and pull along the mechanical axis of the fiber. The fiber should cleave easily at the score. If the fiber does not cleave easily, rotate the fiber 180 degrees and re-score it. Then attempt to cleave the fiber at the new score. Multimode fibers will require significantly more force to pull and cleave because they have a larger core diameter.

STEP 3:
INSPECTION OF CLEAVE

With a 5 to 10X magnifier, look at the cleaved end of the fiber. An ideal cleave would leave the fiber protruding no more than one fiber diameter above the epoxy bead. If the fiber is below the epoxy bead, it is possible that the fiber end will not polish correctly, however, since the process is nearly complete, continue with the polishing procedure. If the fiber is protruding more than a fiber diameter above the surface, special care must be taken to prevent the fiber end from shattering during the initial stages of the polishing procedure.

STEP 4:

HAND POLISHING OF PROTRUDING FIBER

Cut a strip of 5µm polishing film (Thorlabs Item # LFG5P) 1" x 9 1/2" and hold it as shown in Photo C.

Polish the tip of the fiber until the fiber is flush with the epoxy bead, and is smooth to the touch. Repeat Step 4 for all prepared connectors.

PHOTO C
Pre-Polish Fiber End

STEP 5:

PREPARE POLISHING PLATE WITH 5µm FILM

Clean the surface of the glass plate (Thorlabs Item # CTG913) with a lint-free towel moistened with isopropyl alcohol. If the connectors are PC style (with pre-radius) then clean and add the rubber polishing pad (Thorlabs Item # NRS913) to the top of the glass plate[1]. Blow the surface of the plate and pad clean with clean compressed air (Thorlabs Item # CA3).

PHOTO D
Load Fiber Connector Into Polishing Disc

STEP 6:

CLEAN THE POLISHING DISC AND CONNECTOR, THEN ASSEMBLE

Clean the bottom surface of the polishing disc with a lint free towel moistened with isopropyl alcohol. Blow the disc dry with clean compressed air. Blow the connector clean with compressed air; then insert the connector into the polishing disc. Do not allow the fiber end to protrude past the bottom surface of the polishing disc. This is to ensure that the fiber end does not fracture upon initial contact with the polishing film.

STEP 7:

5µm POLISH

> ***NOTE:*** *This is probably the most sensitive step in the polishing process. If the exposed fiber tip breaks below the epoxy bead, or if the fiber shatters, it is most likely that the end will be excessively damaged and will not be salvageable.*

Without allowing the fiber end to contact the polishing film, gently place the polishing disc on the film. Allow the fiber end to gently contact the film. Without applying downward pressure on the connector, begin polishing the fiber in a figure eight pattern. If the fiber is contacting the polishing film, a light figure eight pattern should appear on the polishing film. If no pattern appears, gently slide the connector into the polishing disc until light contact is made between the film and the fiber end. As the epoxy bead (and fiber) is polished down, gradually increase the amount of pressure between the connector and the polishing film. When the polished area of the epoxy is about 80% of the bead area, the downward pressure may be substantially increased. As the polishing process is being learned, it is recommended to visually inspect the tip frequently until your connector is properly polished and looks like Photo's F1 and F2. Use

PHOTO E
Begin 5µm Polish Using Figure-8 Patterns

[1] This is to add or maintain the radius of the end of the connector. For SMA type connectors no rubber pad is used. These connectors have a flat end face.

compressed air to blow the film and the bottom of the polishing disc clean each time you inspect the fiber. Continue polishing until a thin film of epoxy remains on the ferrule tip (see Photos F1 and F2). This is reached when the outer edges of the epoxy begin to break up. When proper pressure is applied, this should require about 10 figure eights (this number will vary depending on the epoxy bead thickness). The 5µm polishing film can be reused for about 8-10 connectors. Using isopropyl alcohol and a lint-free cloth, carefully clean the film, polishing disc and polishing plate after each connector is polished. After polishing all of the prepared connectors, clean and remove the polishing film from the polishing plate.

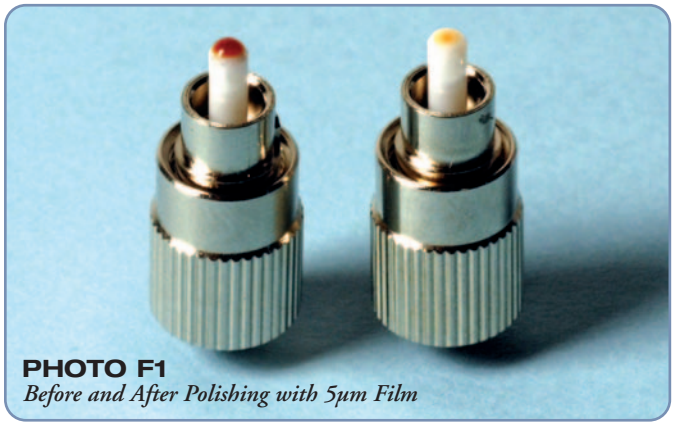


PHOTO F1
Before and After Polishing with 5µm Film

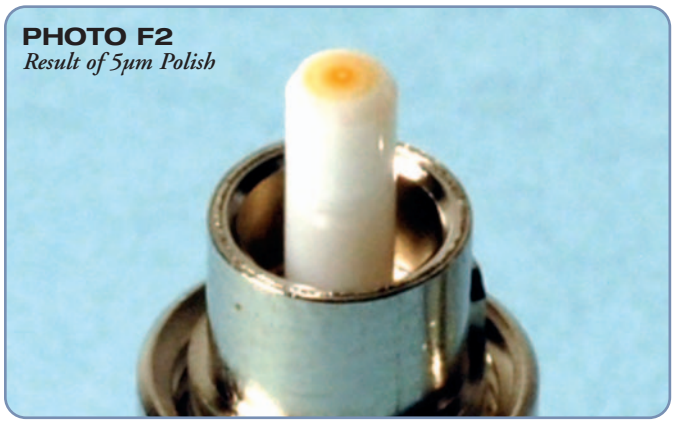


PHOTO F2
Result of 5µm Polish

STEP 8:

3µm POLISH

Clean the polishing plate and polishing disc with isopropyl alcohol and a lint-free cloth. Use clean compressed air to blow them dry. For PC connectors, the rubber polishing pad must be used on the plate. Place a sheet of 3µm polishing film on the polishing plate with the shiny surface down. Wipe the shiny surface and the rubber pad clean with a lint-free cloth moistened with isopropyl alcohol. Clean the connector ferrule before inserting it into the polishing disc. Gently place the polishing disc on the polishing film. Applying light downward pressure on the connector, begin polishing the fiber in a figure eight pattern. Polish the connector until a faint hint of epoxy remains on the connector end (Photo G). The 3µm polishing film can be reused for about eight connectors. Carefully clean the film, polishing disc and polishing plate after each connector. After polishing all of the prepared connectors, clean and remove the polishing film from the polishing plate.

PHOTO G
Result of 3µm Polish

STEP 9:

1µm POLISH

Clean the polishing plate and polishing disc with isopropyl alcohol and a lint-free cloth. Use clean compressed air to blow them dry. For PC connectors, the rubber polishing pad must be used on the plate. Place a sheet of 1µm polishing film on the polishing plate with the shiny surface down. Wipe it clean with a lint-free cloth moistened with isopropyl alcohol. Clean the connector ferrule before inserting into the polishing disc. Place 3 to 4 drops of water on the 1µm polishing film. Gently place the polishing disc on the polishing film off to one side. Applying light downward pressure on the connector, begin polishing the fiber in a traversing figure eight pattern as shown in Photo H. Approximately 15 figure eight's should be made while traversing the film. This should be sufficient to finish polishing one connector. Inspect the connector with a 200x fiber microscope (Thorlabs Item # CL-200). If any epoxy remains on the connector, clean the film and repeat this step.

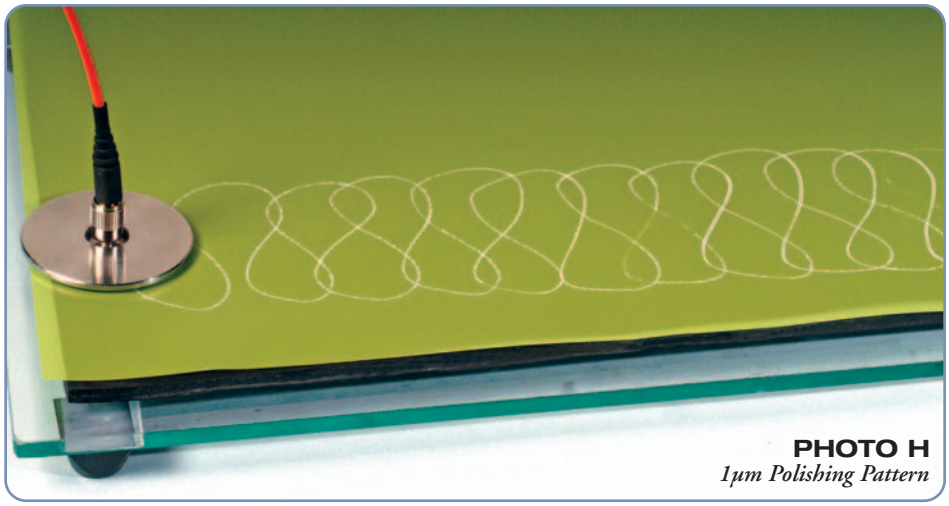


PHOTO H
1µm Polishing Pattern

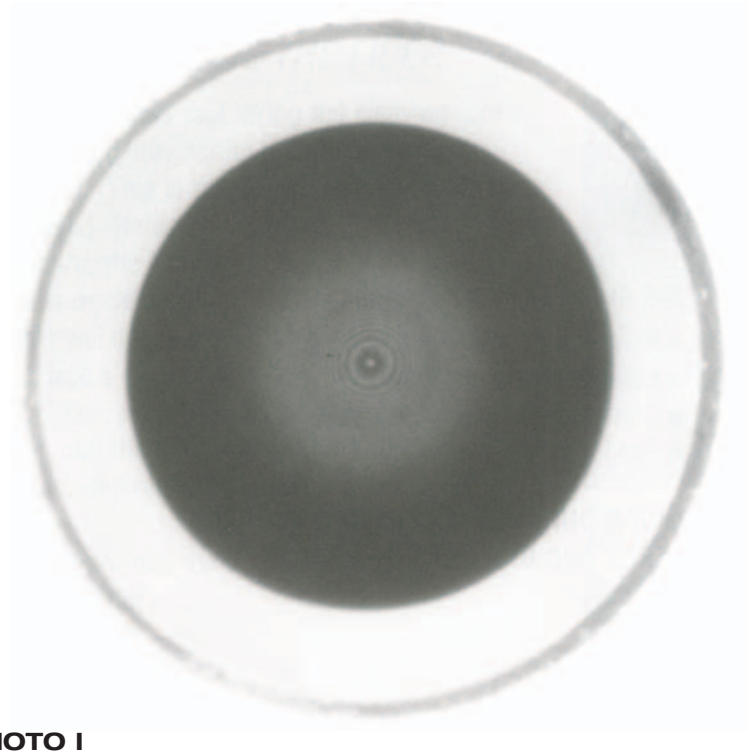


PHOTO I
Magnified View

Clean the 1µm film with a lint-free wipe and isopropyl alcohol. The 1µm film can be reused about 2 to 4 times as long as no deep scratches appear in the film. It is not recommended to use the 1µm film more than 4 times.

STEP 10:
OPTIONAL 0.3µm POLISH

An optional final polishing step can be performed using 0.3µm polishing film. Place 3-4 drops of water on the film. Make two or three figure 8 patterns, always polishing on fresh, clean film. This step should result in a finer polish that exhibits lower losses.

NOTE: *If one is not careful, this step may cause additional scratches. If this happens, redo the 3µm and 1µm polish steps to remove the scratches.*

STEP 11:
FINAL INSPECTION

After polishing, remove the connector from the polishing disc and clean the connector ferrule with isopropyl alcohol. If the connector fails to pass the final inspection checklist detailed below, repeat steps 9 through 10.

Using a 200X inspection microscope, ensure the following:

1. The connector end surface is free of epoxy
2. The fiber is flush with the end of the connector ferrule
3. There are no heavy scratches through the core of the fiber. Light random scratches in the fiber cladding are acceptable. However, the majority of the area of the fiber should be free of all visible scratches or defects. The core of a multimode fiber can have a few light random scratches. However, the core and region around the core of a single mode fiber should have no visible scratches. Typically, there are light random scratches across the connector end. This is acceptable, providing:
   - There are ONLY light random scratches, and the fiber region is free of large scratches.
   - There are no chips in the edges of the fiber that extend into the core of the fiber.
   - There are no more than two chips in the edges of the fiber, such that the length plus the width of the chips does not exceed 20% of the circumference of the fiber.

PART III: MANUAL FIBER CLEAVING

TOOLS NEEDED:

Available from Thorlabs:

- Fiber Scribe or Cleave Tool
- Fiber Stripping Tool
- Fiber
- Water Dispenser
- Eye Loupe, or Microscope

Not Available from Thorlabs:

- Masking or Cellophane Tape (3/4" to 1" wide)
- Safety Glasses
- Container to Hold Cleaved Fiber Ends

STEP 1:

STRIP THE FIBER

SAFETY NOTE: *Safety glasses should be worn during the cleaving process. All fiber fragments should be gathered and disposed of properly. Do not touch eyes while stripping fiber.*

Using the proper stripping tool (reference Appendix A), remove approximately 50mm of the jacket and buffer from one end of the fiber. For best results, remove the cladding in sections of 3mm to 7mm in length.

HELPFUL HINT *(Use on silica/silica fibers only): Soak the fiber end to be stripped, submerging only the length of fiber that will be stripped, in acetone for a few minutes to soften the acrylate jacket. Acetone should only be used on glass fibers, many of the special coatings used on multimode fiber can be damaged by acetone.*

STEP 2:

SECURE FIBER TO BENCH

Carefully tape the stripped edge of the fiber to the edge of a bench or work station, allowing approximately 6mm between the edge of the table and tape and the jacket and buffer. Reference Photo A.

HELPFUL HINT *Secure the free end of the fiber to prevent it from breaking on the edge of the bench.*

STEP 3:

SCRIBE AND CLEAVE THE FIBER

While pulling the fiber taut, bring the cleaving tool to the fiber and gently scribe the fiber, perpendicular to the fiber. (This is the critical step in obtaining a good cleave.) Reference Photo B. If the scribe is made too hard, the fiber will break, not cleave. If the cleave is made too light, the fiber will not cleave. This will not be known until after the fiber is cleaved. Place a drop of water on the cleave site (Photo C). Then, while pressing on the taped end of the fiber, pull the fiber straight back until the fiber cleaves. Reference Photo D.

SAFETY NOTE: *Do not pull the fiber at an angle or the fiber will break, not cleave. Multimode fibers will require significantly more force to pull because they have a larger cleave core diameter.*

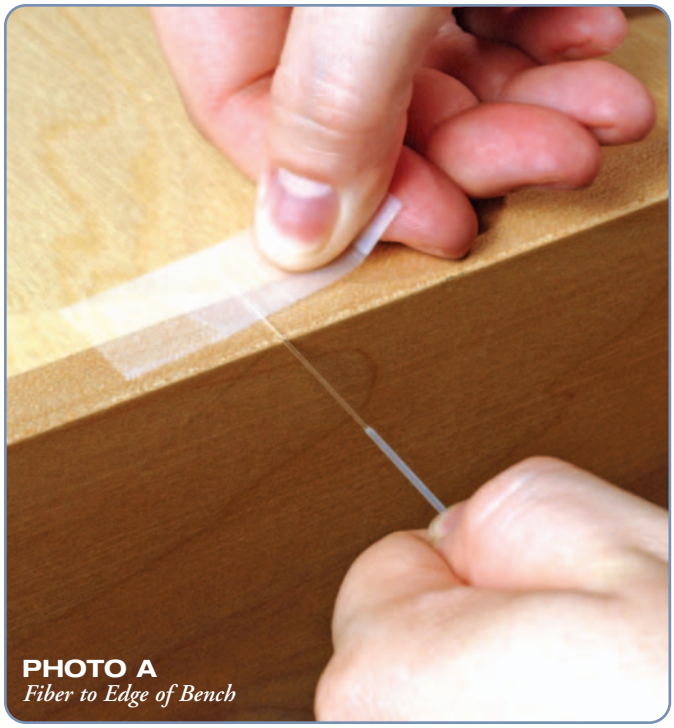


PHOTO A
Fiber to Edge of Bench

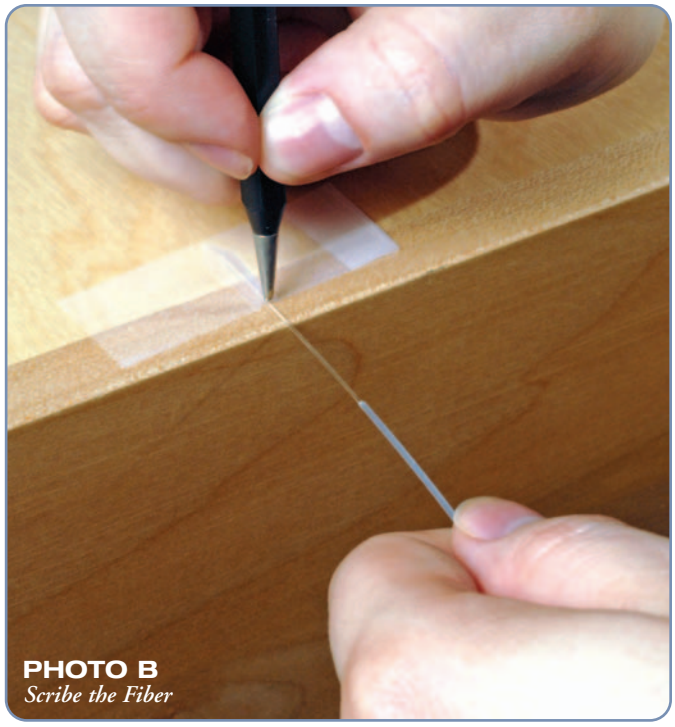


PHOTO B
Scribe the Fiber

PHOTO C
Place a Drop of Water on the Scribed Site

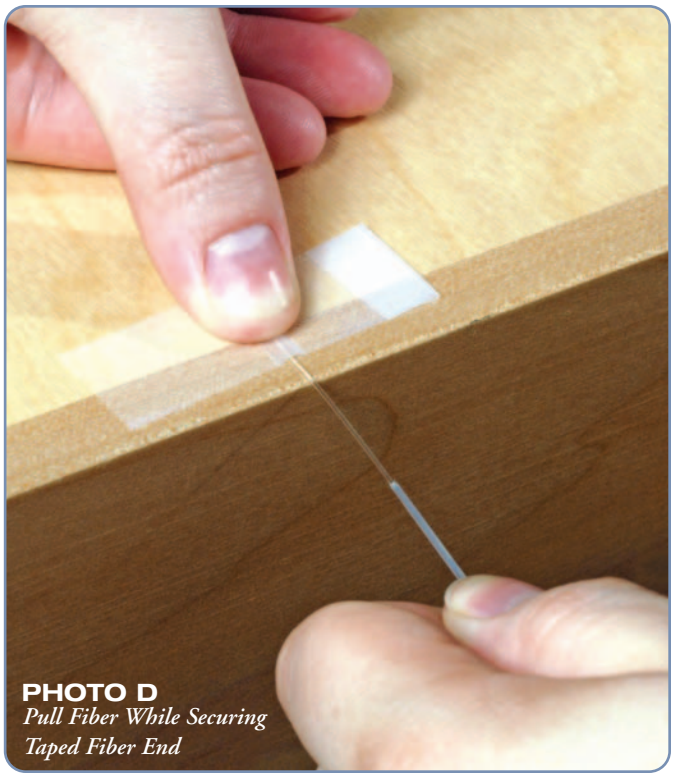


PHOTO D
Pull Fiber While Securing Taped Fiber End

STEP 4:

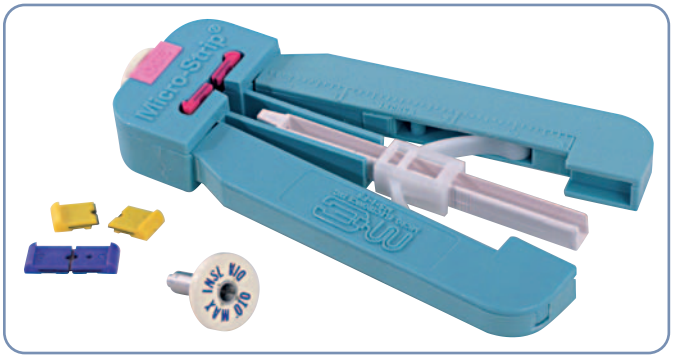
INSPECT THE CLEAVED END

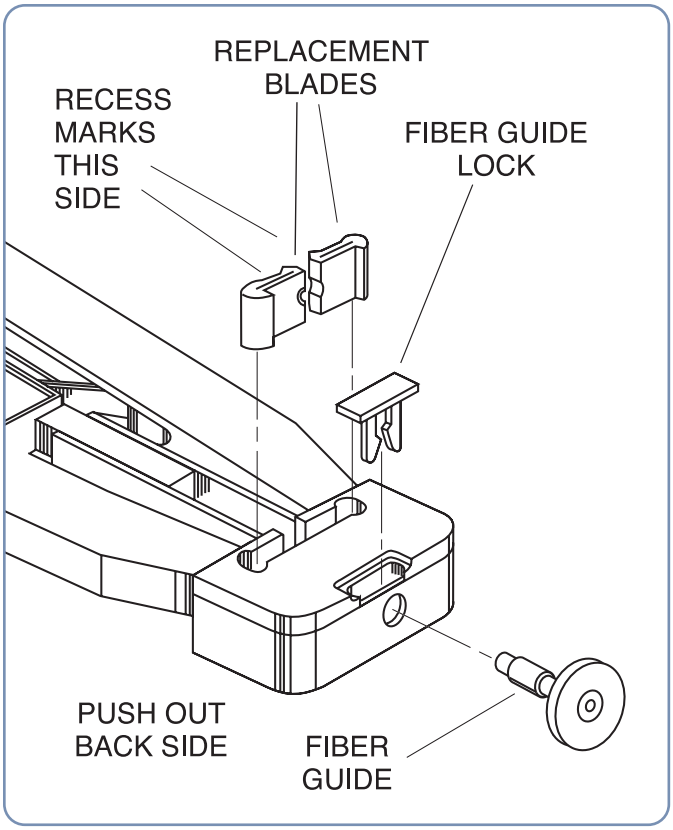
The end of the fiber may be inspected with an eye loupe or microscope. A good cleave will be flat across the fiber, and perpendicular to the optic axis. There should be no 'tag', protrusion, from the edge of the fiber. The region where the initial scribe was made may be visible. It should be less than 5% of the core diameter.

If the cleave is not acceptable, repeat steps 1 through 4. Be patient. It will take a little practice.

Please be aware that the large core fibers will be more difficult.

FIBER OPTIC STRIPPING TOOL





Tool Selection

A. Note your CLADDING and COATING diameters along with their respective high side tolerances.
B. Look down the second column of the table below for your fiber size.
C. With your fiber size identified in the chart below, scan across to the corresponding CLADDING RANGE & COATING RANGE columns. Ensure that your fiber dimensions plus the high side tolerances fall within the range listed. If the maximum fiber dimensions fall outside the range shown, go to the next larger tool.

Standard Tool Selection

Item#	Typical Fiber Cladding/Coating	Cladding Range	Coating Range
T04S10	80µm/200µm	65-80µm	150-250µm
T05S10	100µm/200µm	85-120µm	150-250µm
T06S13	125µm/250µm	125-135µm	250-343µm
T08S13	140µm/250µm	125-175µm	250-343µm
T08S40	125µm/900µm	125-175µm	889-1016µm
T12S16	240µm/400µm	235-280µm	343-407µm
T12S18	240µm/400µm	235-280µm	407-457µm
T12S21	230µm/500µm	235-280µm	457-533µm
T12S25	250µm/600µm	235-280µm	533-635µm
T16S31	325µm/650µm	335-380µm	635-787µm
T18S31	400µm/730µm	385-430µm	635-787µm
T21S31	430µm/730µm	435-500µm	635-787µm
T23S46	500µm/1000µm	505-550µm	1016-1168µm
T28S46	630µm/1040µm	605-680µm	1016-1168µm
M34S52	750µm/1250µm	755-830µm	1168-1321µm
M37S46	860µm/1080µm	835-900µm	1016-1168µm
M44S63	1035µm/1400µm	905-1050µm	1397-1600µm
M44S67	1400µm/1600µm	905-1050µm	1600-1702µm
M54S76	1250µm/1850µm	1055-1350µm	1778-1930µm
M63S86	1550µm/2000µm	1390-1600µm	2057-2184µm

TROUBLE SHOOTING

If the fiber does not fit through the connector check the following:

- The connector ferrule diameter is sufficient to accept the maximum fiber cladding diameter.
- Ensure that enough of the fiber buffer (jacket) has been removed to allow the fiber to pass through the connector. If in doubt, strip off some extra buffer.
- Visually inspect the ferrule to ensure the capillary is clear by holding the connector up to a light. With the connector 30cm to 45cm from your eye, light should be clearly visible through the connector body. This holds true for both singlemode and multi-mode connectors.
- Try another connector. The tolerances on the ferrule hole size allows some variation from connector to connector.

If none of these suggestions solve the problem, contact Thorlabs technical support for assistance.