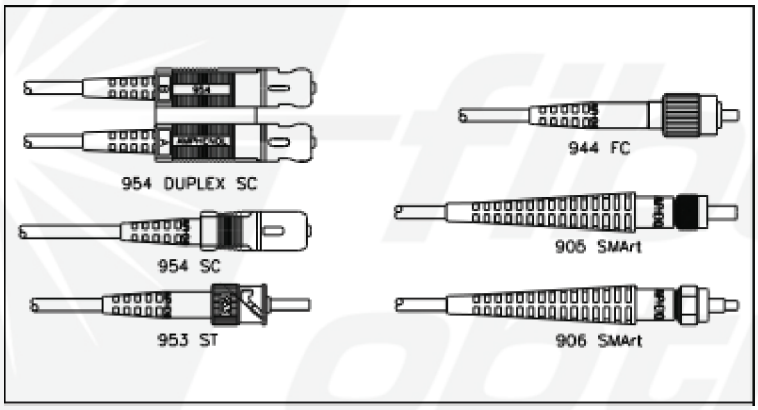
Universal Termination Procedure

Amphenol

949-1048

The Universal Termination Procedure is recommended for ceramic 905 and 906 series Smart connectors, 953 Series ST connectors, 944 series FC connectors, and 954 series SC connectors. For successful results, Amphenol recommends following this procedure using the referenced tools and supplies which are available in the tool kits listed on page 11. For stainless steel 905 and 906 series SMA connectors not covered in this handout, please refer to Amphenol Fiber Optic Products SMA Termination Procedure 949-1008.



JACKETED CABLE PREPARATION (for cable > 2.6mm)

1. Insert the end of the cable into the small end of the rubber boot and then into the small end of the metal crimp ferrule (figure 1).

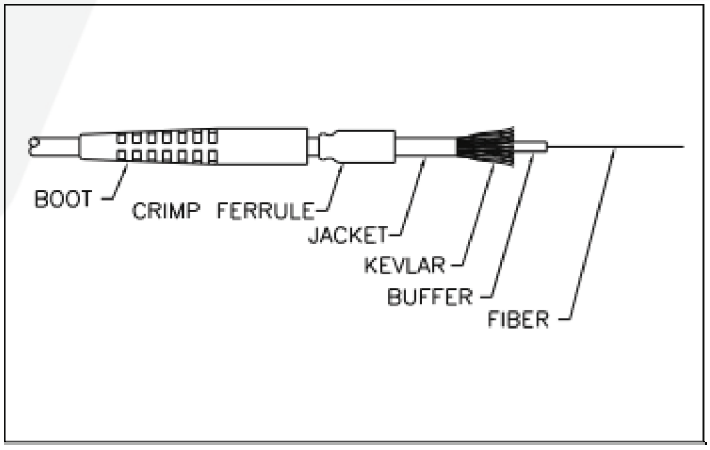


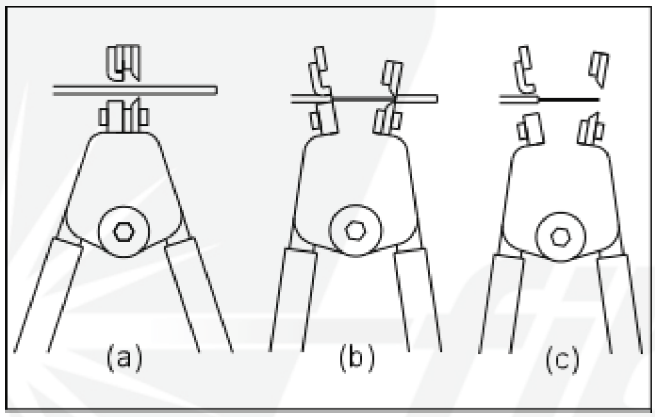
Figure 1: Insert Cable into the boot and crimp ferrule

2. Using the Ideal Stripmaster tool , remove approximately 1.5" of the outer jacket.

a. First, with the open jaws toward you, place the cable between the jaws in the proper sized blade hole. To find the proper sized blade hole, begin with the largest hole and continue with step b and c. If the cable does not strip cleanly, proceed to the next smaller hole size and so on until the jacket strips smoothly (figure a).

b. To strip cable, just squeeze the handles together. DO NOT PULL. This “one squeeze action” neatly cuts the outer jacket and removes it without crushing or fraying (figure b) if the proper blade hole was used. Partially release pressure on handles to open jaws and remove cable (figure c).

c. Full release of the handles returns the tool to starting position.



Jacket Stripping

3. Twist the Kevlar strength members with the thumb and forefinger tightly and cut with a pair of snips - use Figure 2 as a guide.

4. Mark the appropriate buffer strip length (figure 2) using a felt tip pen. Do not use a hard tip pen as this may damage the fiber.

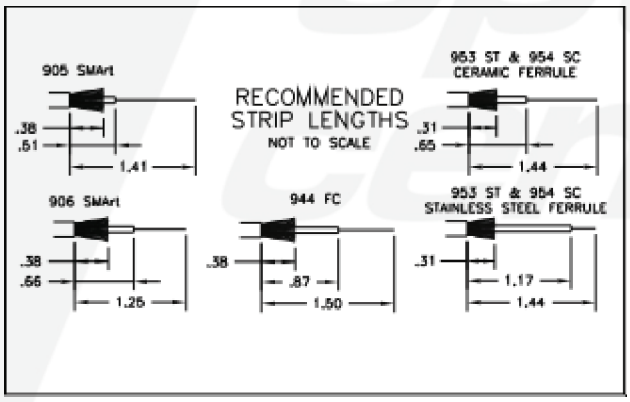


Figure 2: Recommended strip length

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5. Strip the buffer using the Tec-Cut tool for 900 µm tight buffer or the adjustable Miller stripper for other cable construction types (loose tube, 200 µm or 500 µm buffer).

5(a). Hold the Tec-Cut tool with the self-guide mechanism toward the center of the cable (Figure 3). For best results, remove the entire buffer in two or three segments. Spread the handles apart and place the buffer in the self-guide mechanism. Close the handles together until the blade “bites” into the buffer. Hold the tool firmly - perpendicular to the fiber - and pull the tool and buffer material away from you in a smooth fashion until the buffer material is removed from the fiber. Remove any buffer residue remaining in the tool. The blade should occasionally be cleaned with a dry brush. Note: Use the Tec-Cut tool for buffer removal only.

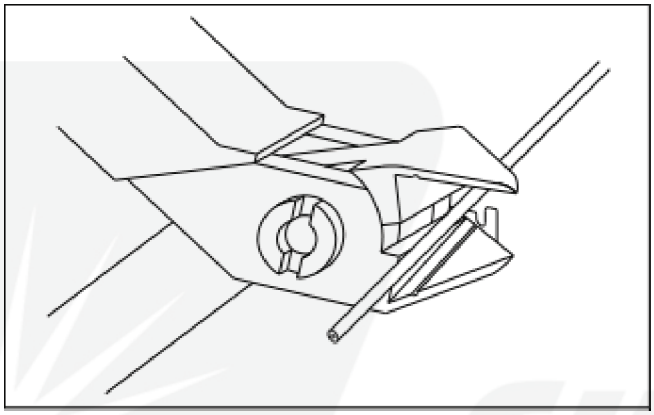

Figure 3: Strip the buffer material as shown

5(b). Place the fiber in the V-groove and close the handle. Tilt the tool 45 degrees and, squeezing the handles lightly, strip the buffer with a straight forward motion.

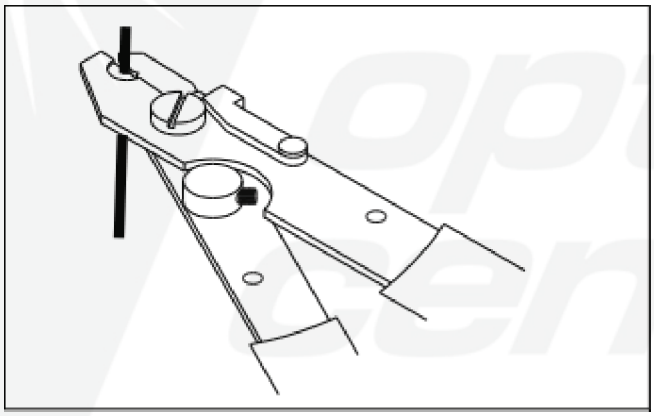

Figure 4: The Miller stripper is used for all buffer sizes.

Clean the fiber with alcohol or as recommended by the manufacturer. Cleanliness of the fiber is essential to the success of the termination.

6. Insert the clean fiber into the connector to ensure the buffer strip length is correct and the ferrule hole is the proper size. If properly stripped, the rear body of the connector should not be resting on the outer jacket, but should be as close as possible - refer to Figure 5. If the fiber meets resistance, rotate the ferrule while applying light forward pressure. If still unsuccessful, back the fiber out and check to see if the fiber hole is obstructed by holding the ferrule up to a light. If obstructed, use cleaning wire to remove the obstruction. Simply draw the cleaning wire through the ferrule hole by feeding the wire through the ferrule or rear body of the connector. It may be necessary to repeat this process to ensure that all of the obstruction has been removed. Re-cleaning the fiber may also be necessary. For single mode applications, a larger hole size may be required if the clean fiber will not fit into a clean, unobstructed ferrule.

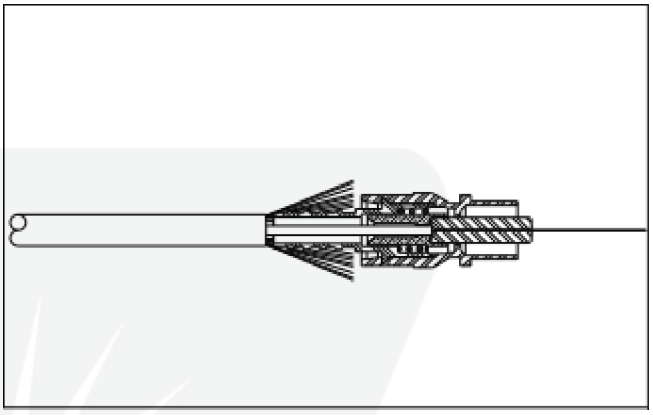

Figure 5: Drawing of buffer properly seated against the ferrule (954 SC connector shown).

EPOXY PREPARATION

7. For dependable results, cable manufacturers recommend Epo-Tek 353ND or AngstromBond AB9119 epoxy when heat curing.

AngstromBond AB9113SC epoxy is recommended for an overnight cure at room temperature. These epoxies demonstrate the proper viscosity and bonding characteristics for successful terminations. Substitute epoxies may hinder fiber insertion and cause the fiber to crack during the curing cycle or during environmental changes. For more information please contact Fiber Optic Center, Inc.

First, determine which epoxy will be used and prepare it as follows:

- Check the date on the envelope to ensure the epoxy is within the expiration date.
- Remove the package from the envelope and remove the two piece plastic clip.
- Placing the package over the edge of a table. Use a back and forth motion to thoroughly mix the epoxy together.

353ND: This epoxy should be a light amber color when thoroughly mixed. The workable pot life is 4 hours and a 4 minute cure time at 150°C is required. The epoxy will experience a color change from amber to red upon cure. This epoxy should not be refrigerated.

AB9119: The AB9119 has a working time of approximately two hours. If refrigerated, the working time can be extended. Once the viscosity has substantially increased, the epoxy should be discarded. The AB9119 epoxy takes five minutes at 150°C to cure.

AB9113SC: This epoxy should be dark blue when thoroughly mixed. The working time is approximately 20 minutes and will cure overnight at room temperature. This epoxy cannot be refrigerated and reused.

8. Remove the plunger from the syringe. Remove the plastic cap from the syringe and replace it with the green dispensing tip. Do not substitute syringe tips. Cut the corner of the epoxy packet and squeeze all of the epoxy into the rear of the syringe. Insert the plunger just inside the rear of the syringe without pushing on it to prevent epoxy from spilling. While tilting the syringe upward, slowly push the plunger forward to evacuate any air from the syringe.

9. Holding the syringe vertically on the bench top, place the connector onto the dispensing tip to a positive stop as shown in Figure 6. Apply downward pressure on the connector and syringe until a tiny spot of epoxy appears on the face of the ferrule. Relieve pressure immediately by pulling back on the plunger and then back out the syringe.

NOTE: Excessive amounts of epoxy within the connector may adversely affect the performance of the Termination

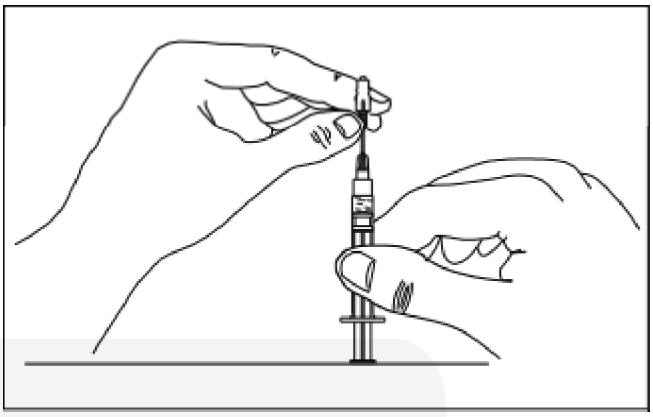

Figure 6: Place the connector on syringe tip to inject epoxy through the ferrule hole.

FIBER INSERTION

10. Hold the connector and cable as shown in Figure 7 and insert the fiber carefully into the connector until .25" of fiber protrudes. Slight rotation of the connector may assist the insertion.

(TIP: It may be helpful to place both elbows on the work surface for support and stability.)

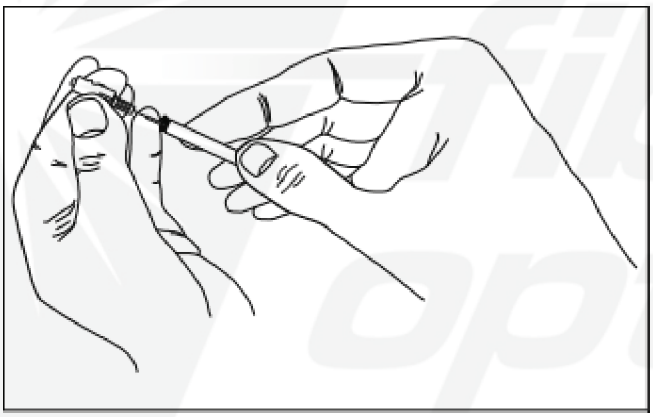

Figure 7: Rotate the connector slightly to ease fiber insertion.

11. Holding the connector and cable in one hand as shown in Figure 8, back the fiber slowly out of the connector until the tip of the fiber is just inside the ferrule. With the other hand, thoroughly clean ALL epoxy from the face of the ferrule with a dry wipe. Once cleaned, fully insert the fiber with a slow and continuous motion. Epoxy should be absent from the ferrule surface upon completion of this step. With the edge of a wipe, also gently remove any epoxy remaining on the fiber near the ferrule surface.

NOTE: For a successful termination, all epoxy must be removed from the ferrule surface.

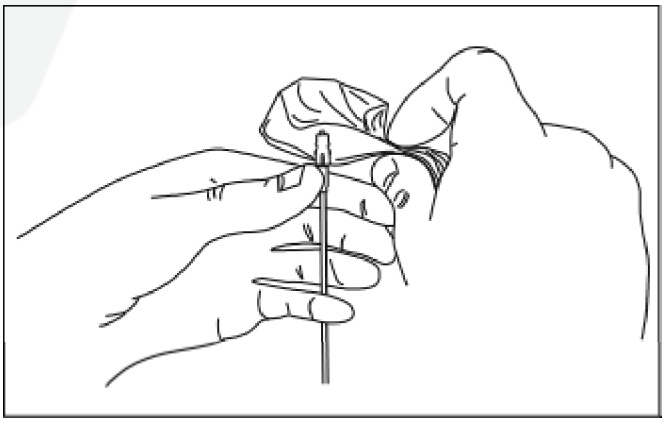

Figure 8: Wipe any epoxy from the face of the ferrule.

CRIMPING

12. Pull any Kevlar strength members from under the connector body and distribute them evenly around the connector body. With the dispensing tip, apply one small drop of epoxy to the knurled portion of the rear body. Slide the crimp ferrule up onto the rear portion of the connector over the strength members until it seats just under the coupling nut. Hold the connector with the forefinger applying light downward pressure to ensure that the connector is fully seated onto the buffer (see Figure 9). If the straight crimp ferrule is used, position the .178" cavity of the crimp tool up against the rear portion of the connector. Crimp the entire length of the ferrule. If the stepped crimp ferrule is used, crimp the large diameter with the .178" cavity and the smaller diameter with the .151" cavity, as shown in Figure 10. The .151" die used with the stepped crimp ferrule will accommodate a jacket with a minimum outer diameter of 2.6 mm. For 953 terminations, slide the boot over the crimp ferrule. Optional: The boot may be slid up on the 905 or 906 Smarts, 944, or the 954 connectors for ease of handling after heat curing. Then, pull back the boot so the connector can be correctly inserted into the polishing tool.

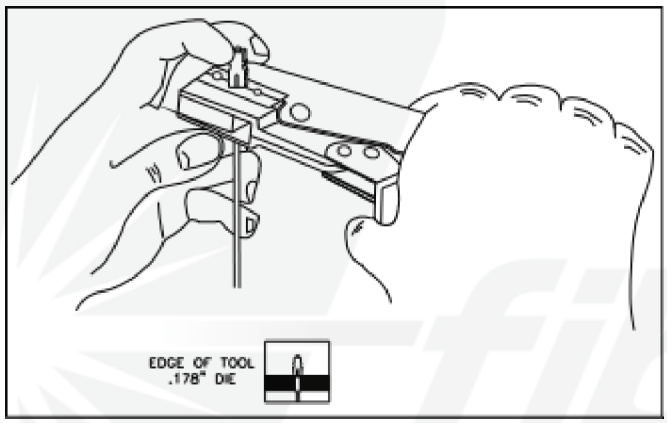

Figure 9: Use the .178" cavity die to crimp the entire length of the straight crimp ferrule.

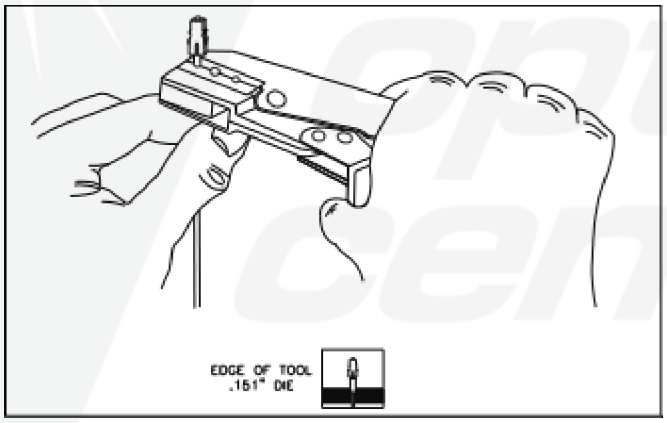

Figure 10: Use the .178" and .151" cavity dies to crimp the stepped crimp ferrule.

HEAT CURING

13. Use the Amphenol oven (p/n 927-100-2084 for the multi-port oven shown in Figure 11) to provide the proper cure temperature, 140 - 150°C, for the TRA-BOND F253 and Epo-Tek 353ND epoxies. Turn on the oven. The indicator light will illuminate in approximately 3 minutes when the oven has reached the appropriate temperature. Carefully place the connector into the curing oven. The connector is to be heated for 4 minutes. CAUTION: The connector will be hot. The boot, however, does not get hot and can be handled immediately.

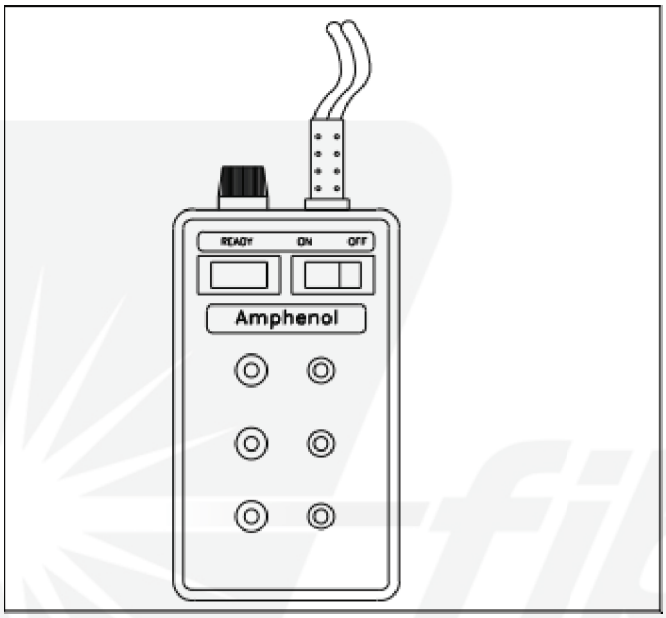

Figure 11: Top view of multi-port curing oven.

CLEAVING

14. Hold the cleave tool as shown in Figure 12. Guide the fiber along the slot on the side of the tool and insert the ferrule into the cleave tool to a positive stop. Caution should be exercised not to break the fiber. Holding the connector away from you, completely depress the trigger to cleave the fiber. The cleave tool is factory adjusted to a height of approximately 125 micron above the ferrule surface. See page 10 for troubleshooting tips should poor cleave result. Remove the connector from the tool and, with a piece of tape, dispose of the fiber waste. NOTE: Epoxy on the ferrule face or fiber may damage the diamond blade in the cleave tool. If necessary, contact the factory for blade refurbishment.

CAUTION: SAFETY GLASSES SHOULD BE WORN DURING CLEAVING.

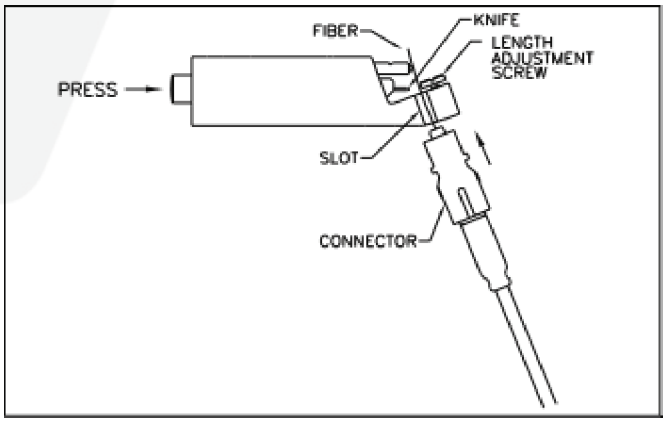

Figure 12: Ensure the ferrule is fully seated against the length adjustment screw.

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GRINDING

15. Hold the connector in one hand and a sheet of yellow 12 micron lapping film in the other. Very gently and with very little pressure, complete 10-15 circular strokes, 1 mm in diameter, to remove any sharp burrs or “hackle” from the cleaved fiber. (See Figure 13).

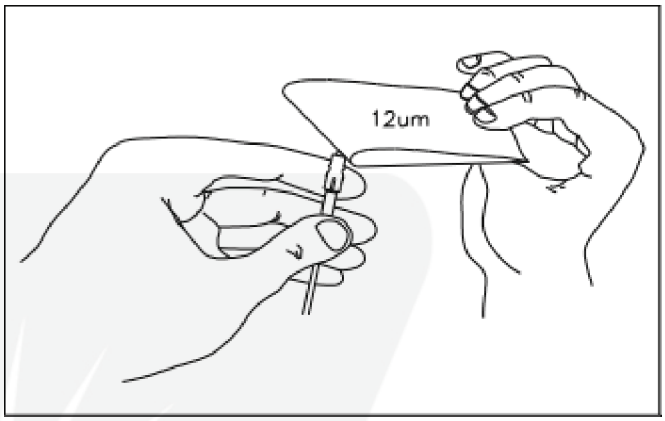

Figure 13: Use only the weight of the film as pressure.

16. Slide a sheet of 12-micron lapping film (gritty side up) into the grinding track. The lapping film should fit beneath the lips on the interior borders of the track. Install the connector into the Amphenol constant force polishing fixture (see Figures 14a and 14b). If the connector is assembled into the polishing tool correctly, slight pressure on the ferrule (be careful not to touch the fiber) with the thumbnail should result in a spring action. If this is not the case the connector should be removed and reinserted.

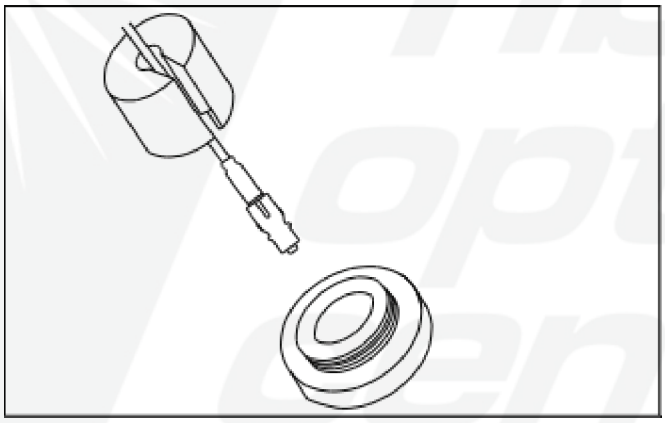

Figure 14a: Insert the 906 or 906 SMArt, 944 FC or 954 SC connector into the appropriate polishing disk and assemble the handle until it seats completely.

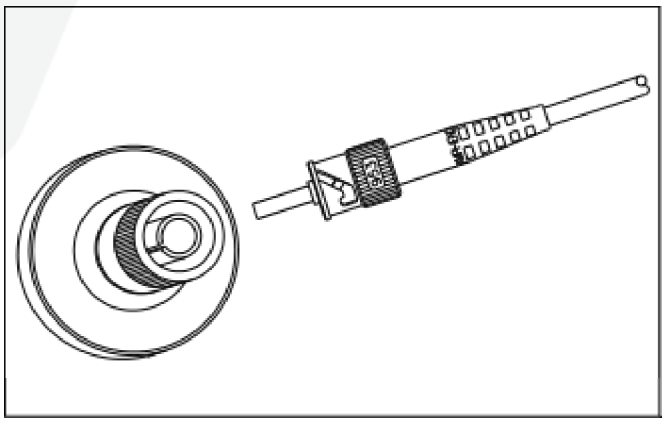

Figure 14b: Insert the 953 ST connector by aligning the key to the slot on the tool. Push and lock the connector into position by rotating the nut until it seats.

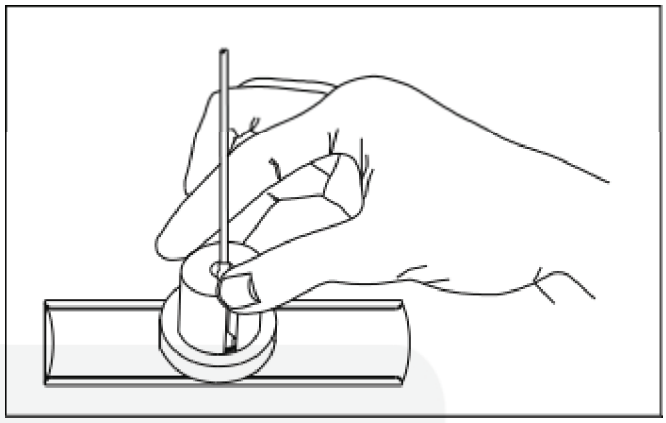

Figure 15: Hold the polishing fixture, not the connector nut. Do not allow the polishing tool to leave the track during grindings.

17. Place the polishing tool on the track and perform 7 strokes along the entire length of the track (See Figure 15). NOTE: Back and forth is considered two strokes. Using an alcohol wipe, dab the connector face to remove any abrasive particles before continuing to the next step. Replace the lapping film every 6 connectors.

FINAL POLISHING

18. Remove the backing of a piece of 0.3-micron white lapping film and place the film onto the polishing board. Using an alcohol wipe, ensure the surface is clean and the film is free of any air bubbles. Begin polishing slowly and with light pressure. Complete 15-25 circular strokes approximately 2'' in diameter using the entire length of film. As the tracks on the film become wider, gradually add more pressure. If the film tears the fiber is too and should receive two additional strokes on the grinding track. Remove the connector from the polishing tool and clean it with an alcohol wipe. Clean the film after every connector is Polished and replace it every 4-5 connectors.

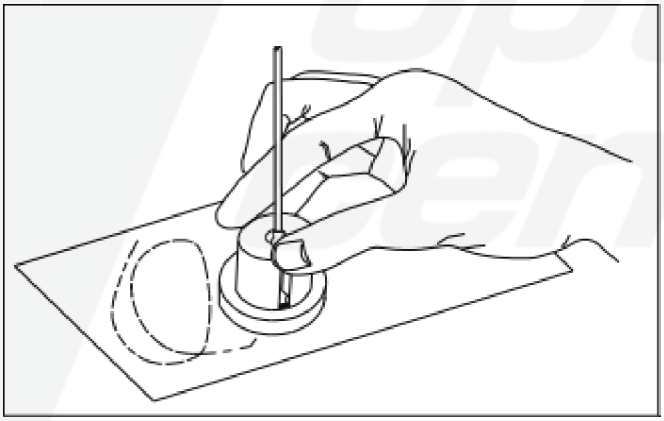

Figure 16: Wipe the film with an alcohol wipe between polishes.

FINAL ASSEMBLY
(SC SIMPLEX OR DUPLEX CONNECTOR ONLY)

19. After a successful polish has been completed, assemble the blue coupling sleeve. This is achieved by first sliding up the bend relief boot. Insert the coupling sleeve, knurled end first, over the white body. Orient the sleeve so the tapered side of the sleeve fits into the tapered side of the body (see Figure 17). Hold onto the rear body of the connector tightly so the cable doesn't bend while assembling the sleeve. The coupling sleeve should lock into place when properly seated. Pulling on the sleeve in an outward motion should not free the coupling sleeve from the body. It should, however, be free to slide back and forth with little resistance.

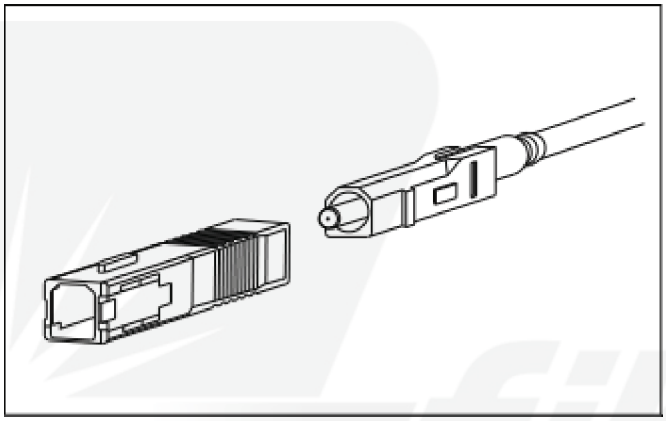

Figure 17: The coupling sleeve and plug frame must be oriented correctly to ensure proper assembly.

INSPECTION

20. Place the appropriate adapter (see inset in Figure 18) on the microscope. Separate the arms of the microscope to turn on the light. Slowly adjust the focus knob on the side of the scope until the connector face comes into sharp focus. Note: FC/SC - Check for frozen springs by depressing the ferrule on a padded surface. If the ferrule resists movement, it is likely that too much epoxy was used and the connector is "frozen." Use only the Amphenol recommended syringe tip for epoxy injection. Figures 19a-d below show examples of acceptable and unacceptable polishes as viewed under the microscope. An acceptable polish will show the core free of any imperfections (Figure 19a). Figure 19b shows an unacceptable polish due to excess epoxy that was not properly removed from the top face of the ferrule - see Step 11. Another example of an unacceptable polish shows the core with pits, scratches, cracks, or darkness (Figure 19c). Figure 19d depicts the result of excessive grinding on the grinding track - see Step 18. If a poor polish results, refer to the troubleshooting tips.

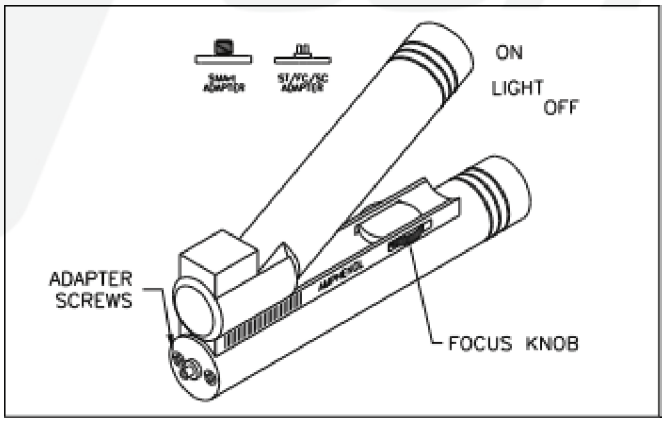

Figure 18: The fiber end face should be inspected after polishing.

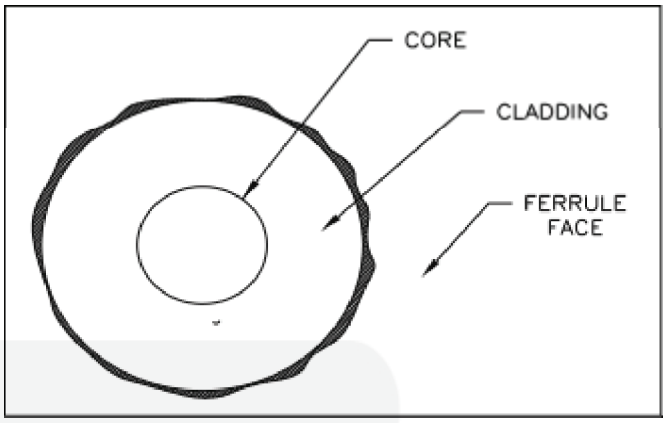

Figure 19a: Acceptable polish

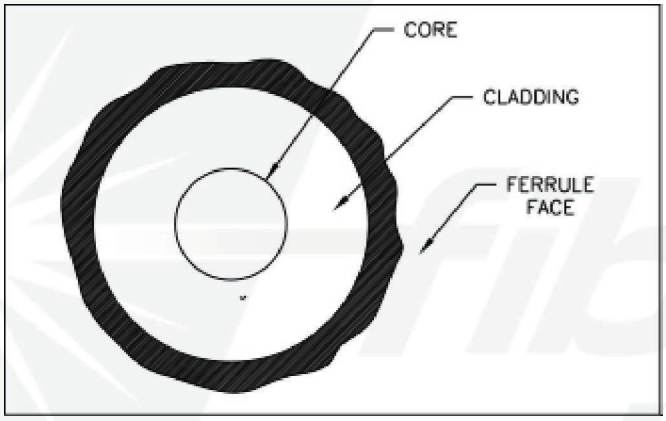

Figure 19b: Unacceptable Polish Excess Epoxy

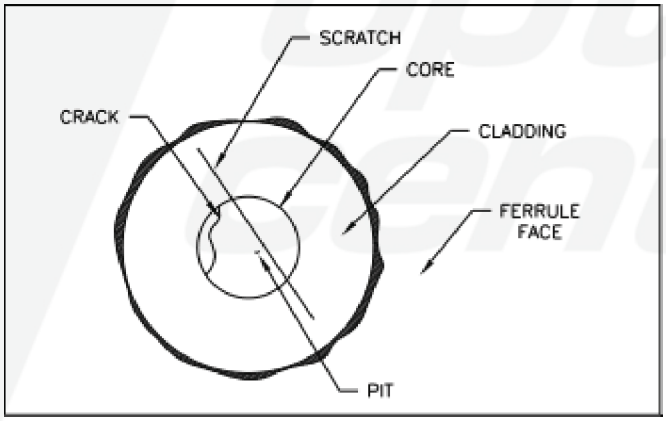

Figure 19c: Unacceptable Polish

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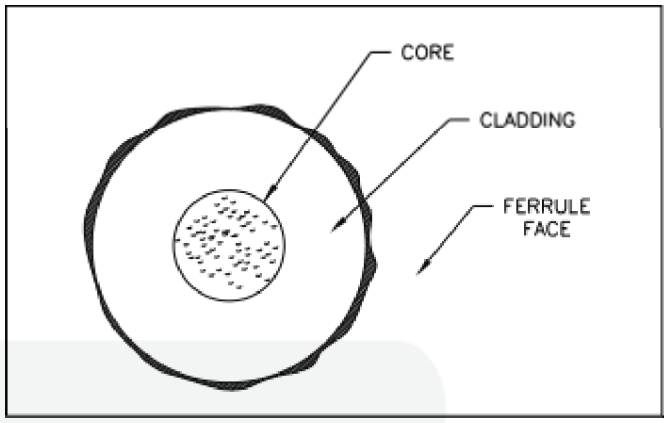

Figure 19d: Unacceptable Polish
Excessive Polishing

BARE FIBER CABLE PREPARATION

1. Place the bare fiber bend relief boot on the bare fiber cable. The tapered portion of the boot should be placed toward the center of the cable.
2. Use Figure 20 below to determine the proper strip length for the bare fiber.

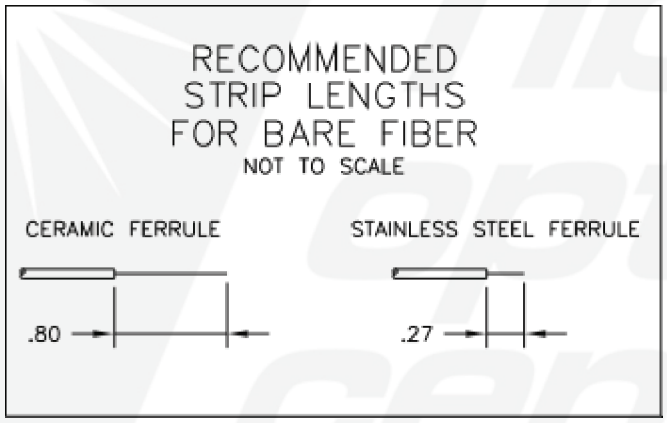

Figure 20: Bare fiber strip lengths for various connector types - SMArt, ST, FC, and SC.

3. Follow the buffer stripping procedure as described in Step 5 of the Cable Preparation procedure for Jacketed Fiber.
4. Proceed with the steps as previously described in both Epoxy Preparation and Fiber Insertion.
5. Slide the bare fiber bend relief boot up over the rear body of the connector
6. After placing the connector into the curing oven, ensure the buffer is bottomed on the inside of the connector (as indicated in Figure 21). This may be accomplished by applying a gentle downward force on the buffered fiber toward the connector. NOTE: The remaining buffered fiber should be supported to ensure the buffer remains seated in the connector throughout the heat cure process.

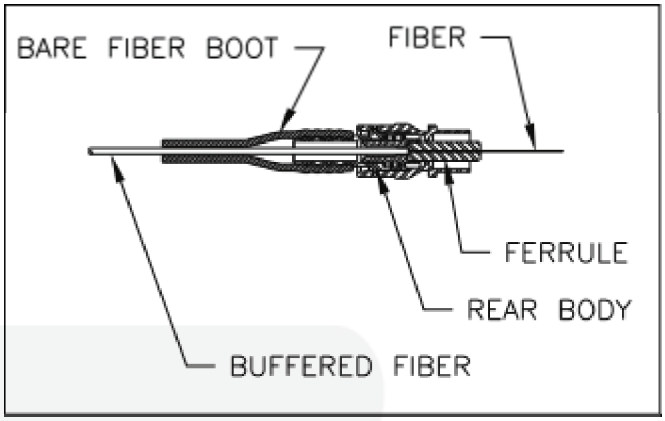

Figure 21: The bare fiber is properly seated against the ferrule.

7. When the epoxy has fully cured, the connector may be removed from the curing oven.
8. Proceed with Cleaving, Grinding, Polishing, Final Assembly and Inspection, as previously described.

*SMArt connectors are not supplied with bare fiber boots as standard product. However, packaged solutions are available.

TROUBLESHOOTING TIPS

CRACKS

- ferrule was not bottomed against length adjustment screw on cleave tool (step 9)
- cleave tool blade may be contaminated with dirt (clean tool)
- fiber may have broken before cleaving (check the end)
- excessive downward pressure was used when polishing (steps 10 and 12)
- cleave tool blade may need adjusting or replacing (call the factory)

SCRATCHES/PITS

- lapping film is contaminated with dirt of fiber particles (clean with alcohol wipe between polishes)
- over grinding with the 12 micron film will not allow proper buffing with the 0.3 micron film (steps 10 and 12)
- polishing disk may not be clean (clean with alcohol before using)

NO LIGHT

- fiber broke internally while inserting into connector (step 6)
- buffer strip length is too short (reterminate making sure the length is correct)

HIGH INSERTION LOSS

- mated connector pair under test is not thoroughly cleaned (clean both end faces with alcohol)
- either of the mated terminations may be cracked or scratched (examine with microscope and re-polish if needed)
- incorrect wavelength source used in testing (see cable specifications)
- terminations may be over polished (steps 10 and 12)
- adapter sleeve may be cracked or contaminated (use a new adapter sleeve)

CLEAVE TOOL CARE AND PRECAUTIONS

The following steps for proper care and handling will increase the longevity of the cleave tool:

- remove cleaved fibers from the tool immediately with a piece of tape and dispose of properly
- keep tool protected when not in use

The cleave tool is factory adjusted and set to a proper cleave tool height. Most cleave tool malfunctions are caused by dirt or chips on the diamond blade and not due to improper adjustments. Clean the blade thoroughly and gently with an alcohol saturated swab. Inspect under a microscope to ensure that it is clean and undamaged. Handle the cleave tools with care for long lasting blade usage. If the blade is damaged, do not attempt to adjust the tool. The cleave tool is properly adjusted in the factory prior to shipping. Amphenol can rebuild the tool

10 STEPS TO TERMINATE!

This is a quick reference to the termination procedure detailed previously.

1. Place boot and crimp ferrule on cable and strip to appropriate lengths. Size the connector to determine if the 125 micron or 126 micron connector ferrule should be used.
2. Mix epoxy thoroughly and load syringe. Place the connector on the dispensing tip to a positive stop and inject the epoxy until a bead appears on the ferrule surface. Remove the syringe.
3. Insert the fiber into the connector until .25" protrudes. Retract the fiber just beneath the ferrule surface and clean the surface with a dry wipe. Reinsert the fiber until the buffer material is seated against the ferrule. The fiber and ferrule surface must be epoxy free at this point.
4. Slide the crimp ferrule up and over the strength members. Use the .178" die if the straight crimp ferrule is used and the .178" and .151" dies if the stepped crimp ferrule is used.
5. Allow to cure 4 minutes using the Amphenol curing oven.
6. Cleave the fiber.
7. Hold a piece of 12 micron film over the fiber and lightly complete 10-15 small circular strokes.
8. Place the connector into the constant force polishing tool. Slide a sheet of 12 micron film in the grinding track, and complete 8 strokes (back and forth is two strokes).
9. Clean the connector face. Place a sheet of .3 micron film on a smooth hard surface. Complete 820 circular strokes approximately 2" in diameter. Begin polishing slowly and with light pressure. If the film tears, the fiber should receive an additional 2 strokes on the 12 micron film in the grinding track.

(If terminating a 954 SC connector, place the blue coupling sleeve onto the white body.)

10. Clean and inspect the fiber.

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