

Figure 1

1. INTRODUCTION

This instruction sheet covers the application of all SC- and FC-type Singlemode, Multimode, Simplex, and Duplex Connector Kits. See Figure 1.

These connectors are used in telephone company central offices, CATV head-ends, inter-building backbones and customer premise applications. This instruction sheet covers the termination of the connector kits (shown in Figure 1) to fiber optic cable.

These connector kits are available for termination to 250- μ m coated and 900- μ m buffered fiber, 1.6- to 2.4-mm and 3.0-mm jacketed cable. With the use of a field-installable clip, all simplex connectors can be joined into a duplex form.

NOTE



Throughout this instruction sheet, references made to connectors will include both the SC- and FC-type connectors, unless otherwise specified.

Read these instructions thoroughly before starting assembly.

NOTE



Dimensions in this instruction sheet are in millimeters [with inches in brackets]. Figures are not drawn to scale.

2. DESCRIPTION (Figure 1)

Each SC-type connector kit consists of a housing, a protective cover, a connector subassembly, and either a crimp eyelet and boot or a buffer boot.

Each FC-type connector kit consists of a housing, protective cover, a connector subassembly, and either a crimp eyelet and boot or a buffer boot.

Refer to Figure 1 for component descriptions and related connector kit information.

3. ASSEMBLY PROCEDURE

3.1. Required Tools and Consumables

The following tools and consumables are required for assembling the connector kits (the 408 numbers in parentheses indicate the related instruction sheet).

NOTE



Kits are provided with a protective cover installed onto the connector subassembly. Keep the cover in place until ready for installation.

A. Tools

- Combination Strip Tool 1754708-1 or 1278947-1 (408-4577)
- Aramid Shears 1278637-1
- Cable Preparation Template 1754636-1
- SC Fiber Protector 502656-1
- FC Fiber Protector 502862-1
- Fiber Optic Sapphire Scribe Tool 504064-1 (408-4293)
- LC/ SC/FC 1.6–2.4-mm Jacket Die Set 1588175-1
- SC/FC 3.0-mm Long Eyelet Die Set 492025-1
- SC/FC 3.0-mm Short Eyelet Die Set 492131-1
- PRO-CRIMPER* II Hand Tool Frame Assembly 58532-1 (408-4020)
- Heat Cure Oven 502134-1 (120V) or 502134-2 (240V) (408-9460)
- Oven Block Assembly 1457628-1
- Epoxy Mixer 501202-1
- Fiber Optic Inspection Microscope 1754767-1 (adapter included)
- SC Polishing Bushing 502631-1
- FC Polishing Bushing 504862-1
- Polishing Plate 501197-1
- Polishing Pad 501858-1 (Green Pad)

B. Consumables

- Epoxy, EPO-TEK™ 353-ND 504035-1, or anaerobic adhesive and anaerobic primer (LOCTITE® 648™ Anaerobic Adhesive and LOCTITE® Activator 7649 are recommended, respectively, replacing the manufacturer-obsoleted 3405 LOCTITE® OPTILOC® Anaerobic Adhesive Primer)

EPO-TEK is a trademark of Epoxy Technology Inc. LOCTITE and OPTILOC are trademarks of Henkel Corporation

NOTE



Refer to manufacturers Material Safety Data Sheet (MSDS) for characteristics, reactivity data, and handling of the epoxy.

- Epoxy Applicator Kit 501473-3
- Alcohol pads or isopropyl alcohol and lint-free cloths
- 5-μm Polishing Film 228433-8
- 1-μm Polishing Film 503887-1
- 0.3-μm Polishing Film 228433-5

3.2. Fiber Preparation (Strip and Dip)

DANGER



To avoid personal injury, ALWAYS wear eye protection when working with optical fibers. NEVER look into the end of terminated or unterminated fibers. Laser radiation is invisible but can damage eye tissue. Never eat, drink, or smoke when working with fibers. This could lead to ingestion of glass particles.

DANGER



BE VERY CAREFUL to dispose of fiber ends properly. The fibers create slivers that can easily puncture the skin and cause irritation.

A. 250-μm Coated Fiber and 900-μm Buffered Fiber

1. Slide the buffer boot (small diameter end first) onto the fiber buffer. See Figure 2, Detail A.
2. Using the combination strip tool, strip the coated or buffered fiber according to the dimensions shown in Figure 3.

NOTE



This operation will expose the glass cladding.

3. Clean the glass cladding using the alcohol pad or lint-free cloth dampened with alcohol to remove any coating residue.

CAUTION



NEVER clean buffer or fiber with a dry cloth.

NOTE



For best results, the primer must be applied properly and allowed to dry.

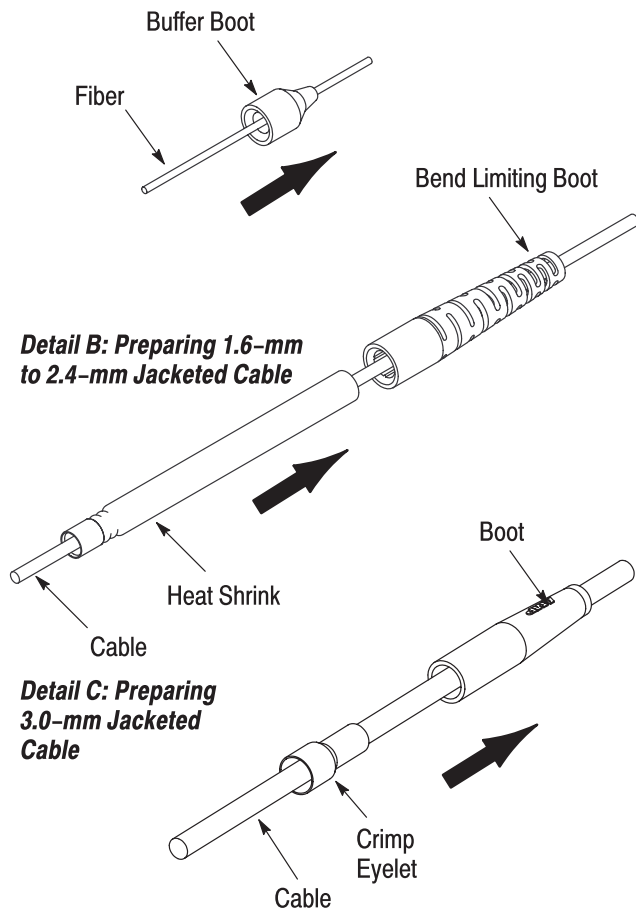
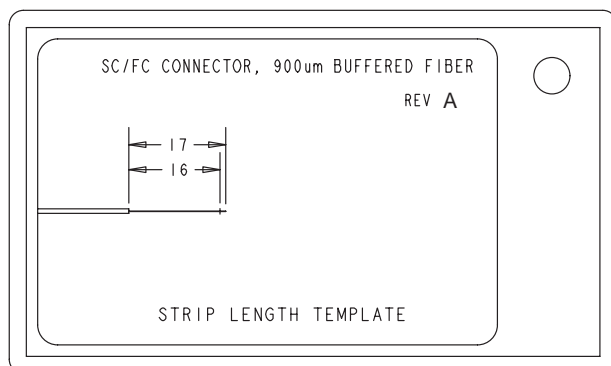
Detail A: Preparing Coated/Buffered Fiber

Figure 2

4. If terminating with anaerobic adhesive, dip the fiber and buffer into the primer or apply to the buffer and fiber with a brush. Allow 30 seconds for the primer to dry.



NOTE: Not to scale. Dimensions are in millimeters.

Figure 3

B. 1.6- to 2.4-mm and 3.0-mm Jacketed Cable

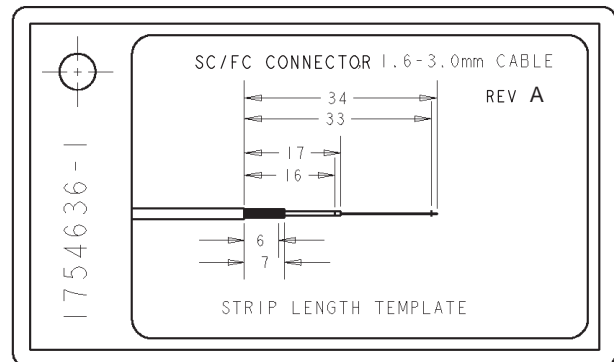
1. Slide the boot (small diameter end first) onto the cable. Then slide the heat shrink assembly (heat shrink end first) or crimp eyelet onto the cable.

- Refer to Figure 2, Detail B for heat-shrink installation.
- Refer to Figure 2, Detail C for crimp eyelet installation

NOTE

If duplex cord is used, unzip the jacket into separate cords at least 230 mm [9.0 in.] from the cable end.

2. Using the combination strip tool and Aramid shears, strip the cable according to the dimensions shown in Figure 4.



NOTE: Not to scale. Dimensions are in millimeters.

Figure 4

NOTE

This operation will expose the glass cladding.

3. Clean the glass cladding using the alcohol pad or lint-free cloth dampened with alcohol to remove any coating residue.

CAUTION

NEVER clean buffer or fiber with a dry cloth.

4. If terminating with anaerobic adhesive, dip the fiber and buffer into the primer or apply with the brush, allowing 30 seconds for the primer to dry.

NOTE

For best results, the primer must be applied properly and allowed to dry.

3.3. Selection, Preparation, and Application of Adhesive/Epoxy

A. Selection

- The recommended anaerobic adhesive is easy to use and is packaged in two bottles — adhesive and primer. It will cure at 22° C [71.6° F] in approximately three minutes.
- The recommended epoxy is easy to work with and is packaged in pre-measured components. It will cure in approximately 30 minutes at 120° C [248° F].

B. Preparation of Anaerobic Adhesive

1. Install the needles on the two applicators, making sure they are secure.
2. Remove the plunger from one of the applicators and load adhesive into the back.
3. Replace the plunger.
4. Holding the applicator vertically (needle upward), allow the adhesive to drain away from the needle and slowly push the air out of the applicator until a bead of adhesive appears at the tip of the needle.
5. Using the second applicator for primer (with the plunger fully forward), draw a small amount (approximately three-to-five ml) of primer into the applicator.

C. Preparation of Epoxy

1. Remove the separating clip from the epoxy bag and, using the epoxy mixer, mix the epoxy inside the bag thoroughly for two minutes.

NOTE

When mixed properly, the epoxy should have a uniform, translucent, amber color.

2. Using the epoxy applicator kit, install the needle tip onto the epoxy applicator. Make sure that the tip is secure. Remove the plunger.
3. Cut the epoxy bag diagonally at one corner. Squeeze the epoxy into the back of the applicator. Reassemble the plunger. Loosen, but do not remove, the cap. Hold the applicator vertically (needle tip upward), and slowly push the plunger

until the entrapped air escapes and a bead of epoxy appears at the tip. Remove the cap.

4. Clean the tip of the applicator needle using the alcohol pad or alcohol-dampened lint-free cloth.

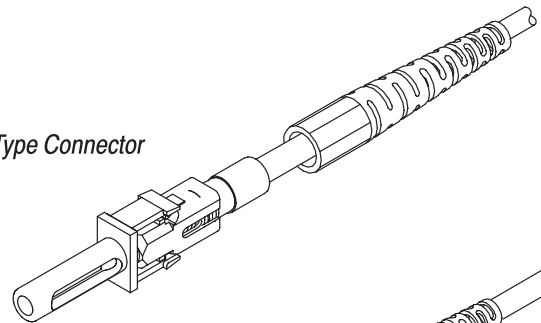
D. Application of Adhesive/Epoxy

NOTE

A 20 gage syringe is recommended for epoxy application.

1. Remove the protective cover and attach the appropriate cure protector, as shown in Figure 5, for buffer or jumper connector subassemblies. Cure protectors are not required for use with anaerobic adhesive.
2. Hold the connector subassembly in an upright position. Insert the needle tip into the rear body and support tube until the needle tip touches the bottom of the ferrule. See Figure 6.
3. Keeping the base of the ferrule against the needle tip, *slowly* inject adhesive/epoxy into the connector subassembly until a small bead of adhesive/epoxy exits from the endface of the ferrule at the front of the connector.

SC-Type Connector



FC-Type Connector

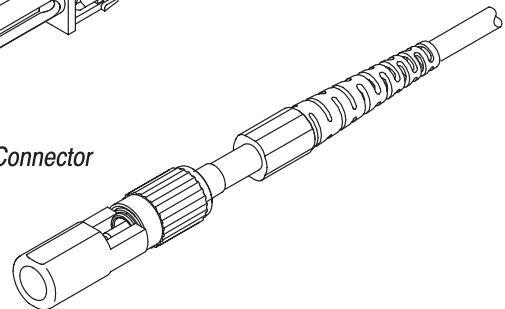


Figure 5

4. Retract the applicator slightly (approximately 1.0 mm [.04 in.]). Hold for one second, then withdraw the applicator needle quickly without injecting more adhesive/epoxy into the connector subassembly.

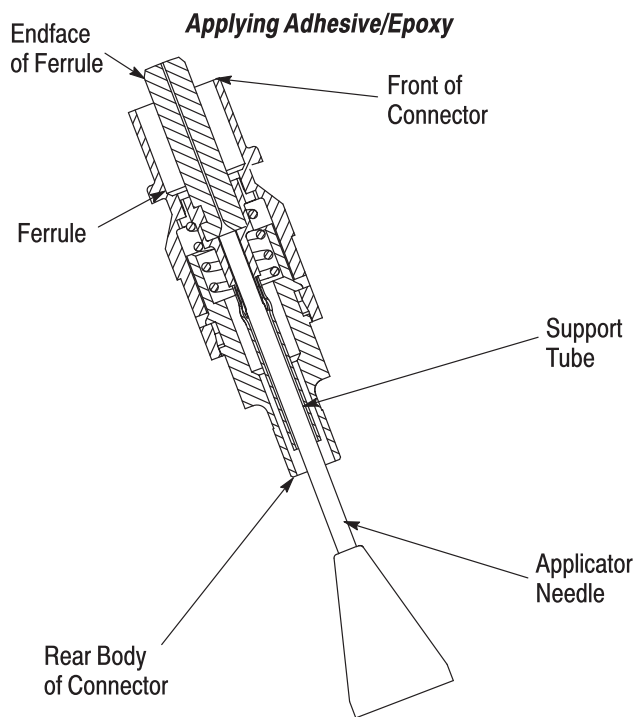


Figure 6



If too much epoxy is injected into the connector subassembly, the connector subassembly will not function properly.

3.4. Termination of the Fiber

A. 250- μ m Coated Fiber and 900- μ m Buffered Fiber

1. While holding the connector between the thumb and forefinger (with the ferrule facing away), look into the back, where the fiber is to be placed.

2. Carefully insert the fiber into the support tube (which is recessed inside the connector subassembly) and rear body until the buffer bottoms on the base of the ferrule. The fiber should extend approximately 6.4 mm [.25 in.] from the ferrule endface.

3. For parts terminated with anaerobic adhesive, dispense a drop of primer from the applicator onto the tip of the ferrule over the adhesive bead, and set the part aside to allow the adhesive to finish curing (approximately one to three minutes). Proceed to Paragraph 3.6.



For best results, the adhesive must be applied correctly and allowed to dry.

B. 1.6- to 2.4-mm Jacketed Cable

1. While holding the connector between the thumb and forefinger (with the ferrule facing away), look into the back, where the fiber is to be placed.

2. Carefully insert the fiber into the rear body and support tube (which is recessed inside the connector subassembly) until the buffer bottoms on the base of the ferrule. With the buffer bottomed, the cable jacket should be just short of the rear body. The fiber should extend approximately 6.4 mm [.25 in.] from the ferrule endface.



DO NOT allow the cable strength members to enter the connector.

3. Uniformly distribute the cable strength members around the rear body of the connector. See Figure 7, Detail A.

4. Slide the heat shrink assembly forward over the cable strength members until the crimp eyelet bottoms against the connector. See Figure 7, Detail B.

5. Place the crimp eyelet of the heat shrink assembly into the crimping chamber of the die assembly. Align the back of the connector with the edge of the die as shown in Figure 8.

6. Hold the connector subassembly in place and actuate the tool handle. This operation retains the strength members.

7. Remove the assembly from the hand tool and inspect it for a straight and even crimp. Be sure the crimp is centered on the crimp eyelet.

8. For parts terminated with anaerobic adhesive, dispense a drop of primer from the applicator onto the tip of the ferrule over the adhesive bead and set the parts aside to allow the adhesive to finish curing (approximately one to three minutes). Heat the shrink tubing evenly and shrink it into place.



Overheating can cause fiber bending, breakage, and high insertion loss.



For best results, the adhesive must be applied correctly and allowed to dry.

9. Proceed to Paragraph 3.6.

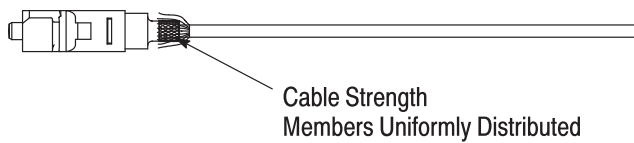
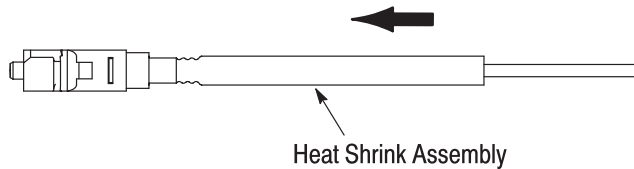
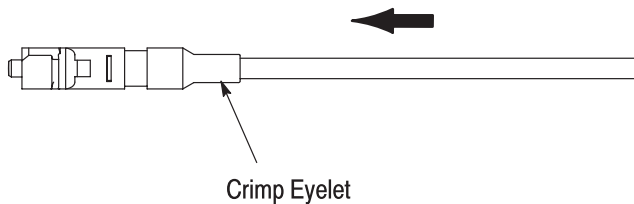
Detail A**Detail B****Detail C**

Figure 7

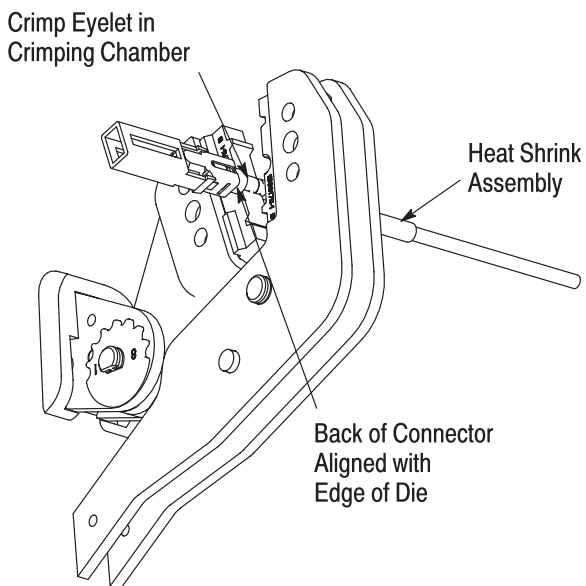
Crimping Heat Shrink Assembly

Figure 8

C. 3.0-mm Jacketed Cable

1. While holding the connector between the thumb and forefinger (with the ferrule facing away), look into the back, where the fiber is to be placed.
2. Carefully insert the fiber into the rear body and support tube (which is recessed inside the connector subassembly) until the buffer bottoms on the base of the ferrule. With the buffer bottomed, the cable jacket should be just short of the rear body. The fiber should extend approximately 6.4 mm [.25 in.] from the ferrule endface.

CAUTION

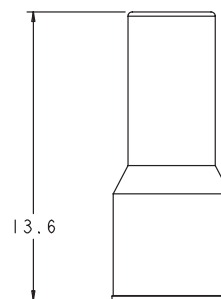
Do NOT allow the strength members to enter the connector.

3. Uniformly distribute the cable strength members around the rear body of the connector. See Figure 7, Detail A.
4. Slide the crimp eyelet forward over the cable strength members until it bottoms against the connector. See Figure 7, Detail C.

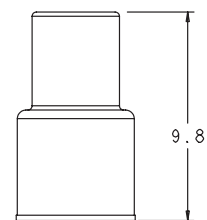
NOTE

Be SURE to use the proper crimp die-set with the appropriate eyelet. See Figure 9.

5. Place the crimp eyelet into the appropriate crimping chamber of the die assembly. Align the edge of the large diameter end of the crimp eyelet with the edge of the die, as shown in Figure 10.
6. Hold the connector in place and actuate the tool handle. This operation retains the strength members.

Long Eyelet

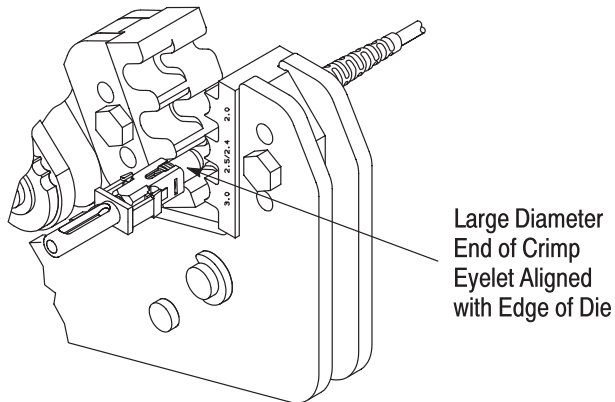
Use Die-Set
492026-1

Short Eyelet

Use Die-Set
492131-1

Figure 9

7. For parts terminated with anaerobic adhesive, dispense a drop of primer from the applicator onto the tip of the ferrule over the adhesive bead.

Hand Tool Frame with Die Assembly

NOTE: SC-type connector shown. Crimp procedure is the same for FC-type connectors.

Figure 10

- Set the parts aside to allow the adhesive to finish curing (approximately one to three minutes). Proceed to Paragraph 3.6.

NOTE

For best results, the adhesive must be applied correctly and allowed to dry.

3.5. Curing Epoxy Terminated Parts**CAUTION**

BEFORE CURING, make sure all excess epoxy is removed from the connector subassembly; it will be difficult to remove epoxy after curing.

- Insert the connector subassembly (with attached cure protector) into the cure oven as shown in Figure 11. Heat cure the epoxy at 115° to 120°C [239° to 257°F] for a minimum of 15 minutes. For jumper connector kits, this operation will shrink the heat shrink assembly.

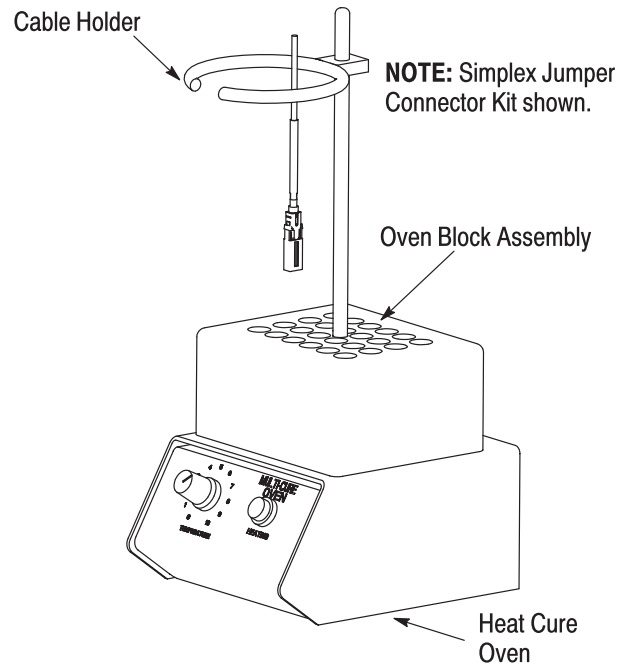
CAUTION

To avoid damage to the assembly, **DO NOT** expose assembly to excessive temperatures.

- After curing, use the cable to gently lift the assembly out of the oven.

CAUTION

Upon removal from the cure oven, the assembly will be **HOT**. Allow sufficient time for cooling.



NOTE: Simplex Jumper Connector Kit shown.

Figure 11

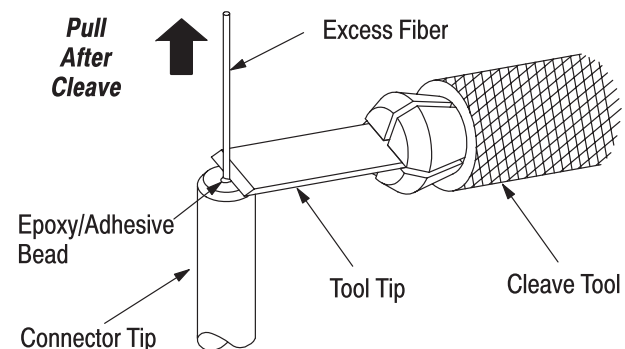


Figure 12

3.6. Cleaving the Fiber**DANGER**

ALWAYS wear safety glasses when cleaving optical fibers. **CAREFULLY DISPOSE OF FIBER ENDS.** The fibers create slivers that can easily puncture the skin and cause irritation.

- If using a fiber protector, rotate it to remove it, then hold the connector subassembly firmly in one hand.
- Place the sapphire cutting tip just above the epoxy/adhesive, as shown in Figure 12.

CAUTION

Do NOT allow the sapphire cutting tip to make contact with the epoxy or adhesive, as they may damage, chip, or crack the sapphire cutting tip.

3. Gently score the fiber by drawing the beveled edge of the sapphire blade across the fiber.

4. After lightly scoring the fiber, pull the fiber straight away from the connector to finish the cleave process. The fiber should shear cleanly at the scribe point.

3.7. Assembly of the Connector

1. Slide the boot forward until it touches the rear of the connector body.

CAUTION

Avoid twisting the boot while sliding it over the crimp eyelet. Permanent damage could result.

See Figure 13. (The FC type connector is complete. Proceed to Section 4, POLISHING PROCEDURES.)

2. For SC-type connectors, slide the connector housing over the connector assembly until it clips into place. The chamfer must be aligned as shown in Figure 14, Detail A. For duplex SC-type connectors, identify the channel “A” connector.

NOTE

If the polarity is undetermined, light up one fiber path. One of the two connectors should be illuminated. Designate the lit channel as “Channel A” and the other as “Channel B.”

3. Install the duplex housings accordingly. Be sure to orient the resilient beam and retention plate housings as shown in Figure 14, Detail B.

NOTE

Do NOT join the two halves together at this time.

NOTE

For buffer fiber applications, the SC-type duplex insertion tool must be used to assemble the connector housing and the connector subassembly.

4. POLISHING PROCEDURES**4.1. Hand Polishing****NOTE**

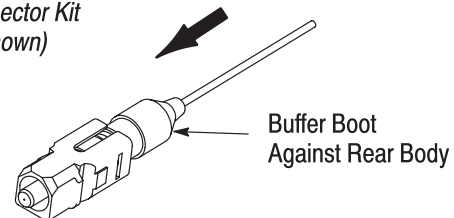
For best results, the polishing films MUST be kept clean.

1. To level the fiber, lightly polish the end face with hand-held 5- μ m polishing film (air polish). Use a small circular motion to remove the fiber stub down to the level of the epoxy/adhesive and until the fiber stops leaving a trace on the film.

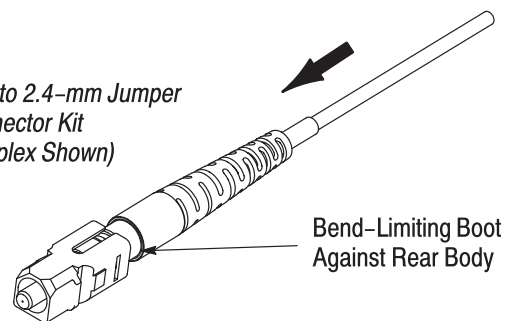
2. Install the connector into polishing bushing. See Figure 15.

3. Place the polishing pad on the polishing plate. The remainder of the polishing procedure is performed on this pad and plate.

Buffer Connector Kit
(Simplex Shown)



1.6- to 2.4-mm Jumper
Connector Kit
(Simplex Shown)



3.0-mm Jumper Connector Kit
(Simplex Shown)

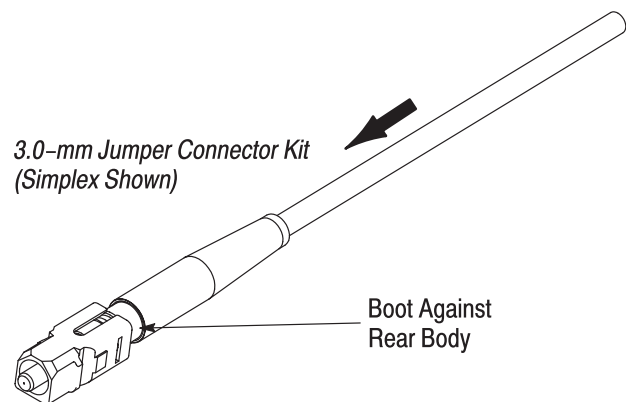


Figure 13

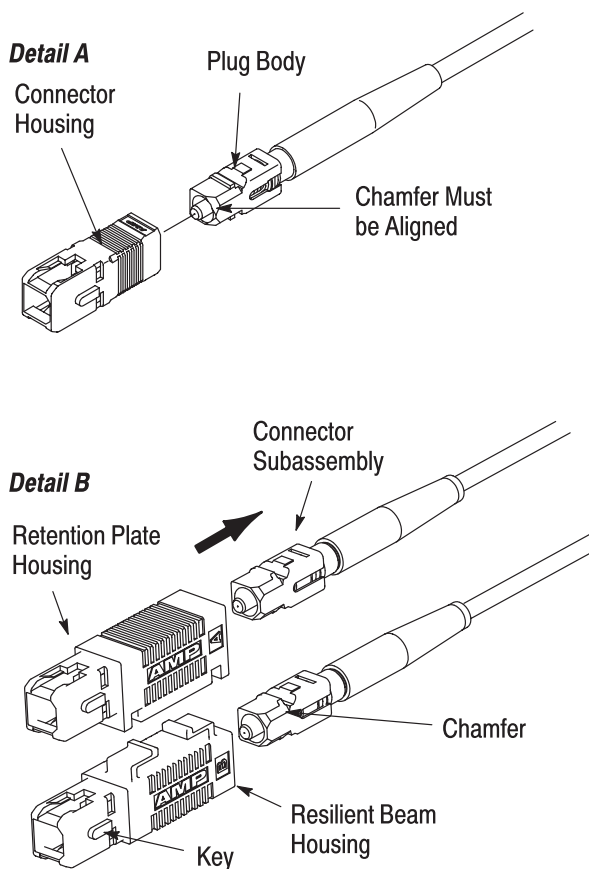


Figure 14

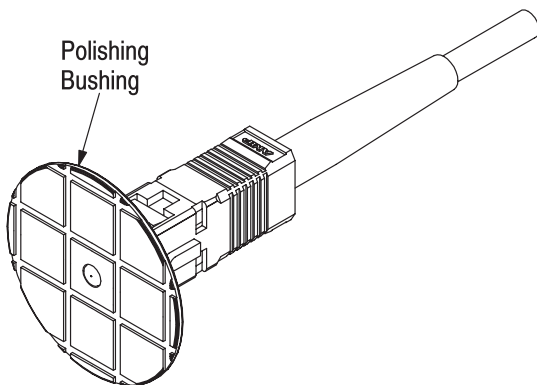


Figure 15

4. Place the 5- μ m polishing film on the polishing pad.



Always place the polishing bushing on a clean area of the polishing film. Never start polishing on or across a dirty section of the film.

5. Holding the polishing bushing and connector, start polishing very lightly. Polish in an elongated figure-8 pattern. See Figure 16. Initially, a small

amount of exposed fiber will be worn away. This is indicated by a narrow white trace on the film. As the exposed fiber wears away, the trace will widen and darken, indicating that adhesive/epoxy is being removed. At this point, a slight downward force may be applied while polishing. Check the tip often and stop polishing on the 5- μ m film when the adhesive/epoxy is medium red-pink and about one-third the ceramic ferrule diameter in size.

CAUTION

When polishing ceramic ferrule connectors, it is essential that not all of the adhesive/epoxy is removed when using the 5- μ m film.

6. Clean the polishing bushing and connector assembly with an alcohol pad.

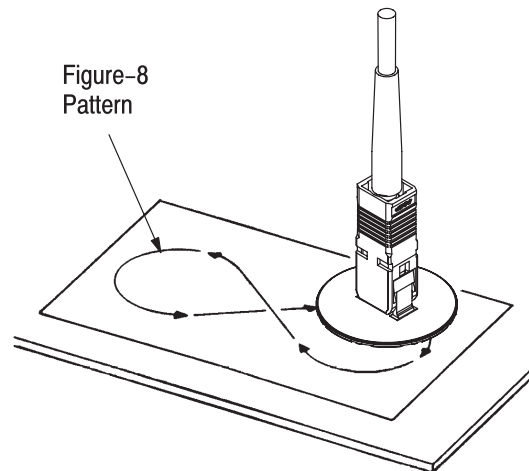


Figure 16

7. Remove the 5- μ m film from the polishing pad and replace it with the 1- μ m film.
8. Holding the connector and polishing bushing, polish on the 1- μ m film for about 20 seconds.
9. Clean the polishing bushing and connector assembly with an alcohol pad.
10. Remove the 1- μ m film from the polishing pad and replace it with the 0.3- μ m film.
11. Hold the connector and polishing bushing. Using light force, polish on the 0.3- μ m film until the adhesive/epoxy is gone. Do not overpolish.
12. Clean the polishing bushing and connector assembly with an alcohol pad.

4.2. Machine Polishing

Refer to the polishing machine manufacturer for recommended polishing process.

5. INSPECTING THE FIBER

Using the microscope, inspect the fiber for the following criteria (refer to Figure 17):



Disconnect cable from any power signal source before inspecting. The light used can cause injury to the eye.

- Be sure all epoxy/adhesive is removed from the ferrule. Use a sharp blade to remove epoxy/adhesive from the chamfered edge of the ferrule. DO NOT touch the fiber.
- Dirt may be mistaken for small pits. If dirt is evident, clean with an alcohol pad or alcohol-dampened lint-free cloth, and then dry.
- Fine polishing lines are acceptable.
- Small chips at the outer rim of the fiber are acceptable. Large chips in the center of the fiber render the polish unacceptable, and the fiber must be re-terminated.



If not installing the connector immediately, place the protective cover over the ferrule.



Damaged components must not be used. They must be replaced with new components.

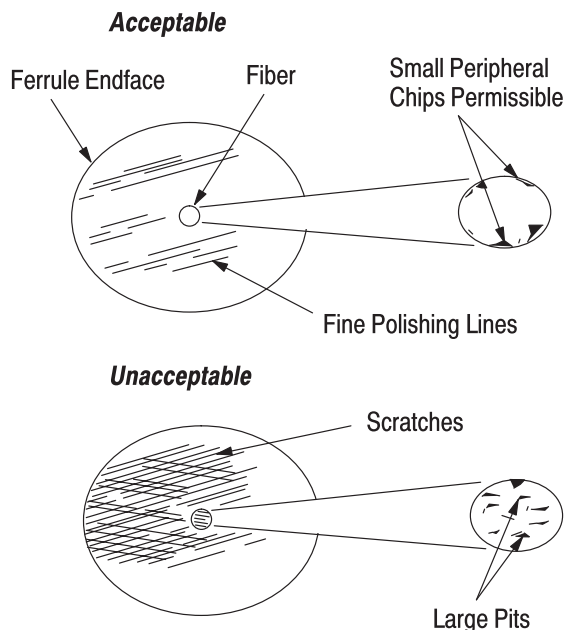


Figure 17

6. DUPLEX CONNECTOR ASSEMBLY

6.1. Duplex Housings



Once joined, the resilient beam and retention plate housings are NOT separable.

1. The retention plate housing will retain the resilient beam housing when the two are joined.

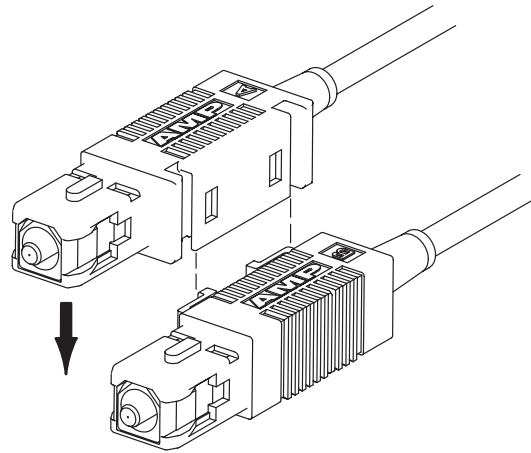


Figure 18

Join the two housings by holding the resilient beam housing and sliding the retention plate housing over the beams until they latch in place. See Figure 18.

2. Figure 19 shows a completely assembled multimode duplex connector.

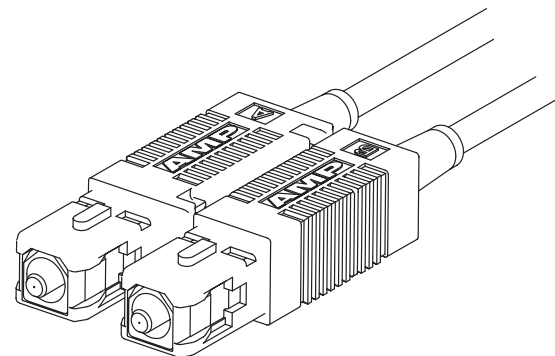


Figure 19

6.2. Duplex Clip (For Use with Simplex Connector Housing Only)

1. Place the simplex connector housings in one half of the duplex clip. See Figure 20.
2. Place the other half of the duplex clip over the housings and snap the two clips together. See Figure 20.

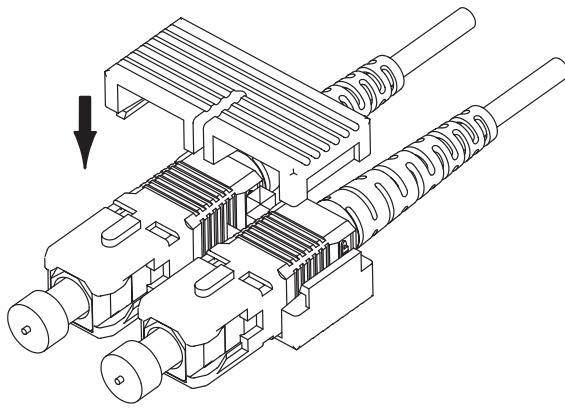


Figure 20

7. CLEANING PROCEDURES

DANGER



To avoid personal injury, compressed air used for cleaning must be reduced to less than 207 kPa [30 psi], and effective chip guarding and personal protective equipment (including eye protection) must be used.

7.1. Connector

1. Wipe completely around the ferrule with an alcohol pad or lint-free cloth dampened with isopropyl alcohol.
2. Wipe completely around the ferrule using a dry lint-free cloth.
3. Place the dry lint-free cloth on a smooth, flat surface. Holding the connector perpendicular, wipe the ferrule endface across the cloth.
4. Blow compressed air across the endface of the ferrule.
5. Examine the endface for debris, using the microscope. If debris is present, repeat Steps 1 through 4.

CAUTION



This is the final step prior to connector insertion. **DO NOT** wipe the ferrule or allow it to touch anything before mating the connector.

6. Mate the connector to the receptacle.
7. If the attenuation is too high, unmate both connectors (if applicable), repeat Steps 1 through 5, and follow procedures in Paragraph 7.2, Receptacle.

7.2. Receptacle

1. Blow compressed air through the receptacle.

NOTE



If both connectors are not removed, blow compressed air into the open end of the receptacle.

2. Re-mate the connector(s) to the receptacle following the procedures in Paragraph 7.1.

NOTE



Steps 7.1 and 7.2 may have to be repeated if the connector loss is still too high.

8. RECOMMENDED TUNING PROCEDURES

Tuning Tool 1693383-1 is used to rotate the ferrule into the position of lowest loss. The tool has numbered flats, spaced every 60 degrees that are used to identify the position of the ferrule. The end of the tool has a machined key that will engage into the ferrule in only one position. The corresponding number that matches up with the key on the connector identifies the the current tuning position.

8.1. Setup

Before testing a connector, insert the tuning tool into the front of the connector, to obtain the "initial tuning position." Note this position.

Inspect the ferrule for dirt and debris.

DANGER



NEVER look into the end of terminated or unterminated optical fibers. Laser radiation is invisible, but can damage the eye.

CAUTION



Damage will occur to the ferrule if the tool is rotated without the tool being bottomed all the way toward the connector.

Damage may occur to the cable assembly if the ferrule is rotated more than 180 degrees (three tuning positions) in either the clockwise or the counterclockwise direction.

8.2. Tuning Operation

1. Mate the offset end of the tuned launch lead to the connector to be tuned using a ceramic sleeve adapter.
2. Record the power level of the detector.
3. Unmate the connector and insert the tuning tool to the previously noted (initial tuning) position.
4. Press the tuning tool axially toward the connector until it bottoms and rotate it clockwise one numerical position, or 60 degrees.

5. Release the tool and remove it.
6. Repeat steps one through five, for a total of three tuning positions.
7. After the third tuning measurement is taken, tune the connector counterclockwise five positions.
8. Repeat steps one through five for the other three tuning positions.
9. Tune the connector as described in steps two through five to the position of greatest power (lowest loss), going in the direction of least rotation.

NOTE

Be sure not to exceed 180 degrees of rotation from the original position.

9. REVISION SUMMARY

Revisions to instruction sheet 408-8674 include:

- Updated document to corporate requirements
- New format