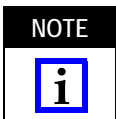


Figure 1

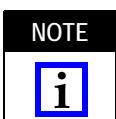
1. INTRODUCTION

This instruction sheet covers the termination of all SC and FC singlemode, multimode, simplex, and duplex connector kits to fiber optic cable. See Figure 1. The connectors are used in telephone company central offices, CATV head-ends, inter-building backbones, and customer premise applications.



Dimensions in this instruction sheet are in metric units [with U.S. customary units in brackets]. Figures are not drawn to scale.

The SC connector kits are available for termination to 250- μ m coated fiber, 900- μ m buffered fiber, 1.6- to 2.0-mm, 2.4/2.5-mm, or 3.0-mm jacketed cable. The FC connector kits are available for termination to 250- μ m coated fiber, 900- μ m buffered fiber, or 2.0-mm, 2.4/2.5-mm, or 3.0-mm jacketed cable.



References made to connectors include both SC and FC connectors, unless otherwise specified.

Read these instructions thoroughly before starting.

Reasons for reissue of this instruction sheet are provided in Section 7, REVISION SUMMARY.

2. DESCRIPTION (Refer to Figure 1)

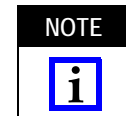
Each SC connector kit consists of a housing, protective cover, connector subassembly, and either a crimp eyelet and boot or bend-limiting boot or a buffer boot. The crimp eyelet/heat shrink tube assembly is included with the 1.6- to 2.0-mm connector kit only. With the use of a field-installable duplex clip, SC simplex connectors can be joined to form a duplex connector.

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

3. ASSEMBLY PROCEDURE

3.1. Required Tools and Consumables

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



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

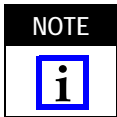
A. Tools

- 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 1.6-2.0 Jacket Die Set 1588175-1
- SC/FC Long Crimp Eyelet Die Set 492025-1
- SC/FC Short Crimp Eyelet Die Set 492131-1
- PRO-CRIMPER* III Hand Tool Frame Assembly 58532-1 (408-4020)
- heat gun
- Heat Cure Oven 502134-1 (120V) or 502134-2 (240V) (408-9460) ■
- Oven Block Assembly 1457628-1
- 200X 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)

B. Consumables

- Epoxy 504035-1 or anaerobic adhesive and anaerobic primer (Loctite 648 retaining compound and Loctite 7649 activator are recommended respectively to replace Loctite 3405 OptiLOC anaerobic adhesive)



Refer to material safety data sheet (MSDS) for characteristics, reactivity data, and handling of epoxy.

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

3.2. Fiber Preparation (Strip and Dip)



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.

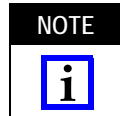


BE VERY CAREFUL to dispose of fiber ends properly. The fibers create slivers that can easily puncture the skin and cause irritation.

- Not required if using anaerobic adhesive. Loctite, 648, and OptiLOC are trademarks.

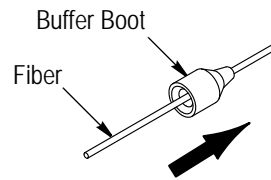
A. 250-mm Coated Fiber and 900-mm Buffered Fiber

1. Slide the buffer boot (small diameter end first) onto the fiber buffer. See Figure 2.
2. Using the combination strip tool, strip the coated or buffered fiber to the dimensions given on the cable preparation template shown in Figure 2.

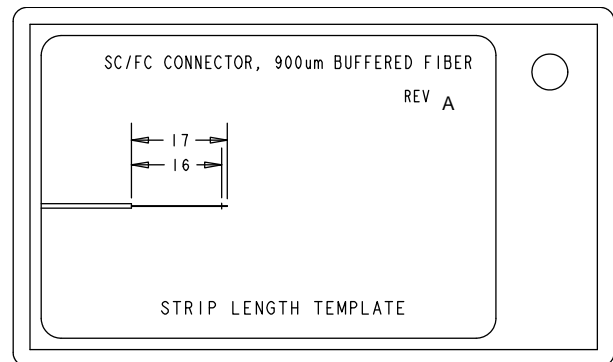


This operation will expose the glass cladding.

Preparing Coated/Buffered Fiber



Cable Preparation Template



Note: Illustration not drawn to scale. Dimensions are given in millimeters.

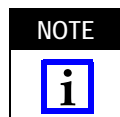
Figure 2

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



NEVER clean the buffer or fiber with a dry cloth.

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



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

B. 1.6- to 2.0-mm and 3.0-mm Jacketed Cable

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

See Figure 3, Detail A for crimp eyelet/heat shrink assembly installation.

See Figure 3, Detail B 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 given on the cable preparation template 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 isopropyl 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 and Epoxy

A. Selection

The recommended anaerobic adhesive 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 packaged in pre-measured components. It will cure in approximately 30 minutes at 120°C [248°F].

B. Preparation

—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. Re-assemble 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 3 to 5 ml) of primer into the applicator.

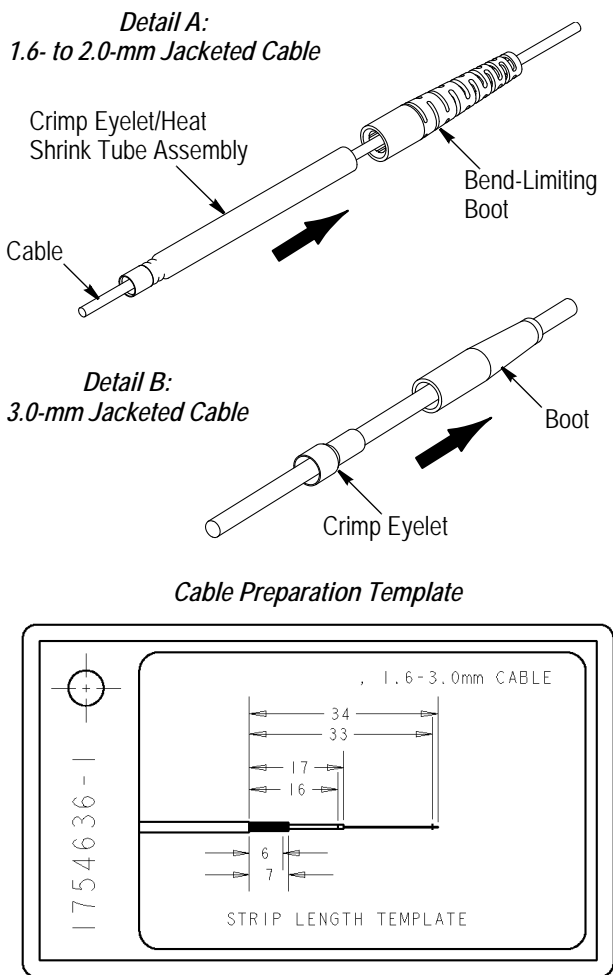
—Epoxy

1. Remove the separating clip from the epoxy bag, and manually 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.



Note: Illustration not drawn to scale. Dimensions are given in millimeters.

Figure 3

3. Cut the epoxy bag diagonally at one corner. Squeeze the epoxy into the back of the applicator. Re-assemble 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 lint-free cloth dampened with isopropyl alcohol.

C. Application

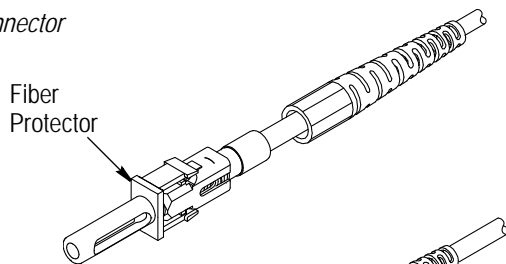
NOTE



A 20-gage syringe is recommended for epoxy application.

1. Remove the protective cover and attach the appropriate fiber protector, as shown in Figure 4, for buffer or jumper connector subassemblies. Fiber protectors are not required for use with anaerobic adhesive or retaining compound.

SC Connector



FC Connector

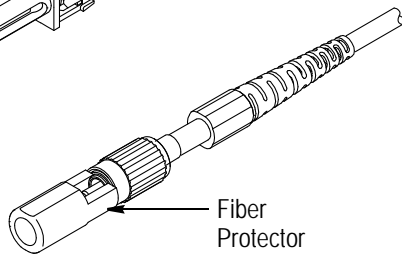


Figure 4

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 5.

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.

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.

CAUTION



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

Applying Adhesive/Epoxy

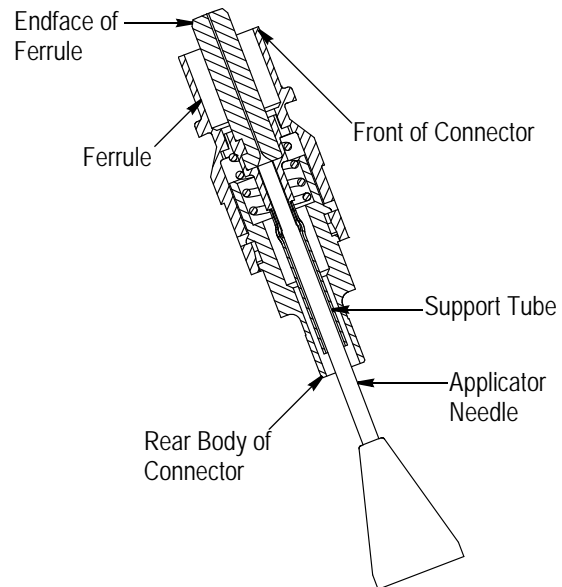


Figure 5

3.4. Fiber Termination

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 rear body and support tube (which is recessed inside the connector subassembly) 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 epoxy, proceed to Paragraph 3.5. 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.

NOTE



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

B. 1.6- to 2.0-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.

3. Uniformly distribute the cable strength members around the rear body of the connector. See Figure 6, Detail A.



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

4. Slide the crimp eyelet/heat shrink tube assembly forward over the cable strength members until the crimp eyelet bottoms against the connector. See Figure 6, Detail B.

**1.6- to 2.0-mm Jacketed Cable
Using Crimp Eyelet/Heat Shrink Tube Assembly**

Detail A



Detail B

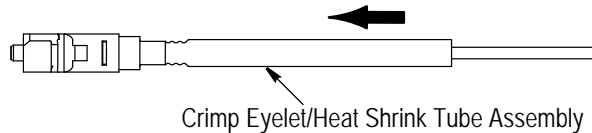


Figure 6

5. Place the crimp eyelet of the crimp eyelet/heat shrink tube assembly into the crimping chamber of the die. Align the back of the connector with the edge of the die as shown in Figure 7.

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

Crimping Crimp Eyelet/Heat Shrink Tube Assembly

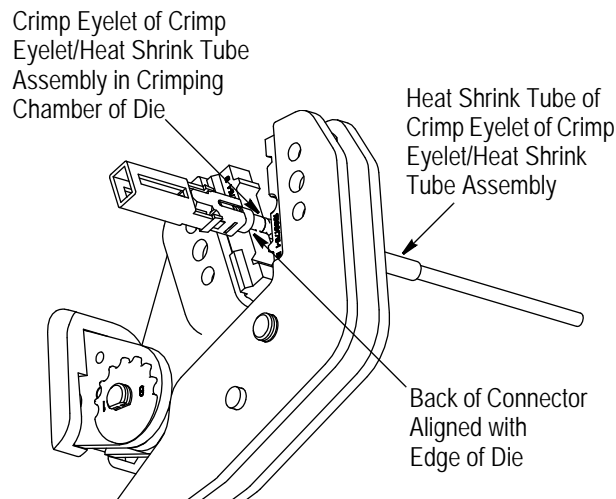


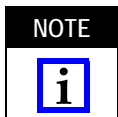
Figure 7

7. Remove the assembly from the 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 epoxy, proceed to Paragraph 3.5. 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). When curing is complete, use a heat gun to heat the crimp eyelet/heat shrink tube assembly evenly to a temperature between 90 and 100°C [194 and 212°F] and shrink it into place. Proceed to Paragraph 3.6.



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



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

C. 2.0, 2.4/2.5, and 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.

3. Uniformly distribute the cable strength members around the rear body of the connector. See Figure 8, Detail A.



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

4. Slide the crimp eyelet forward over the cable strength members until it bottoms against the connector. See Figure 8, Detail B.

**2.0, 2.4/2.5, and 3.0-mm Jacketed Cable
Using Crimp Eyelet**

Detail A



Detail B



Figure 8

5. Place the crimp eyelet into the appropriate crimping chamber of the die of the tool. Align the edge of the large diameter end of the crimp eyelet with the edge of the die as shown in Figure 9. Make SURE to use the proper die set with the crimp eyelet being used. See Figure 10.

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

Crimping Crimp Eyelet

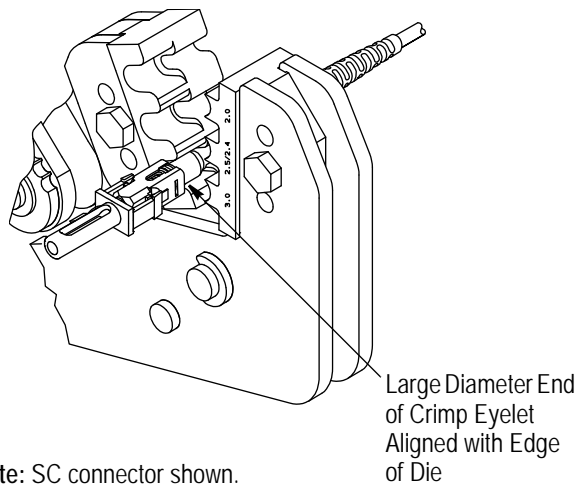


Figure 9

Long Crimp Eyelet	Short Crimp Eyelet
Use Die Set 492025-1	Use Die Set 492131-1

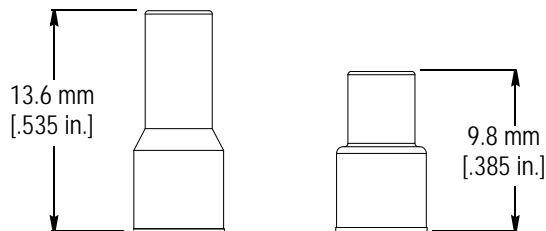


Figure 10

7. For parts terminated with epoxy, proceed to Paragraph 3.5. 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). Proceed to Paragraph 3.6.

NOTE For best results, the primer 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.

1. Insert the connector subassembly (with attached fiber 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 connectors, this operation will shrink the crimp eyelet of the crimp eyelet/heat shrink tube assembly.

CAUTION



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

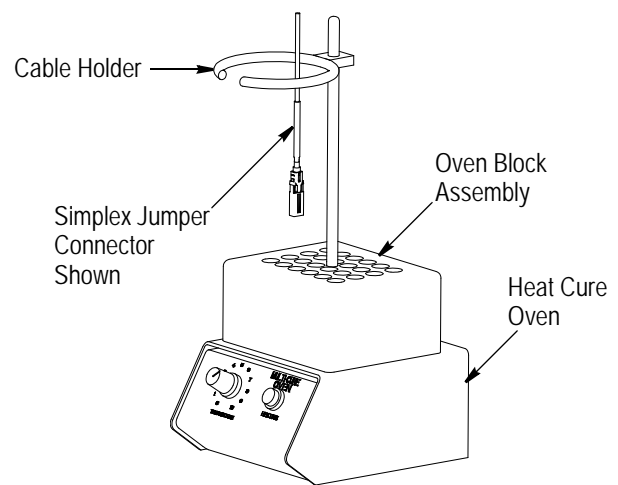


Figure 11

2. 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.

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.

1. If using a fiber protector, rotate it to remove it, then hold the connector subassembly firmly in one hand.
2. Place the cleave tool 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; otherwise, the sapphire cutting tip could be damaged, chipped, or cracked.

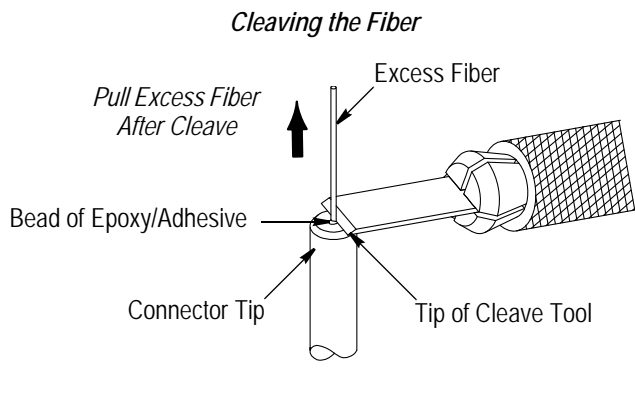


Figure 12

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. Connector Assembly

1. Slide the boot forward until it touches the rear of the connector body. See Figure 13.



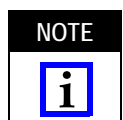
Avoid twisting the boot while sliding it over the crimp eyelet; otherwise, permanent damage could result.

2. For FC connectors, proceed to Paragraph 3.8, Polishing.

For SC connectors, slide the housing over the connector subassembly until it clips into place. The chamfer must be aligned with the key as shown in Figure 14, Detail A.

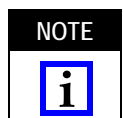
For duplex SC connectors, proceed as follows:

- a. Identify the channel “A” connector.

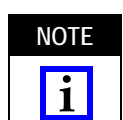


If the polarity is undetermined, light up one fiber path. One of the two connectors should be illuminated. Designate the lit channel as Channel A and the other as Channel B.

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



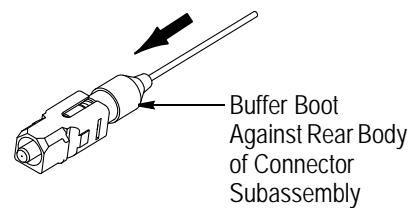
DO NOT join the two halves together at this time.



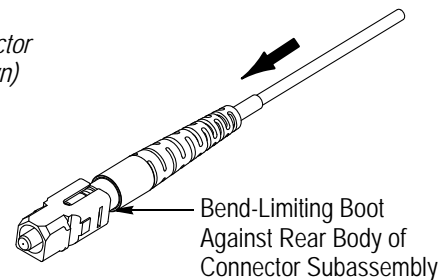
For buffered fiber applications, use the SC duplex insertion tool to assemble the housing and connector subassembly.

Installing the Boot

Buffer Connector (Simplex Shown)



1.6- to 2.0-mm Jumper Connector (Simplex Shown)



2.0-, 2.4/2.5, and 3.0-mm Jumper Connector (Simplex Shown)

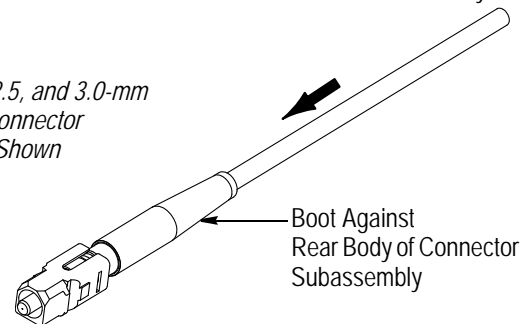
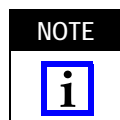


Figure 13

3.8. Polishing

The following procedure describes hand polishing. For machine polishing, refer to the polishing machine manufacturer for recommended process.



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

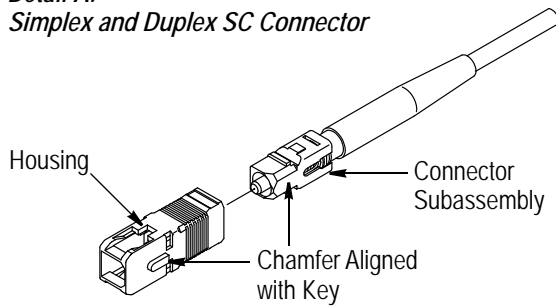
1. To level the fiber, lightly polish the end face with hand-held 5- μ m polishing film (air polish). Use a small circular motion to remove the fiber stub down to the level of the epoxy/adhesive and until the fiber stops leaving a trace on the film.
2. Install the connector onto polishing bushing. See Figure 15.
3. Place the polishing pad on the polishing plate. Perform the remainder of the polishing procedure on this pad and plate.
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.

Assembling Housing and Connector Subassembly

Detail A: Simplex and Duplex SC Connector



Detail B: Duplex SC Connector

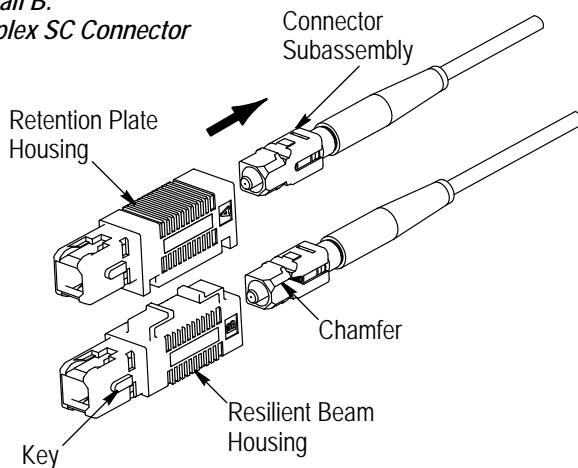


Figure 14

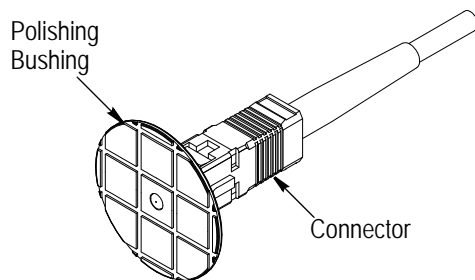


Figure 15

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.

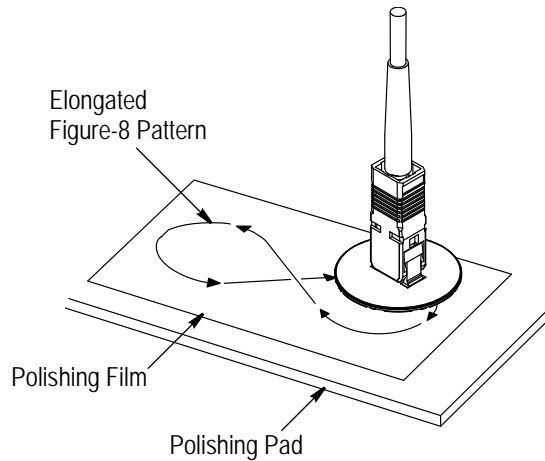


Figure 16



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 using the alcohol pad or lint-free cloth dampened with isopropyl alcohol.
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 using the alcohol pad or lint-free cloth dampened with isopropyl alcohol.

3.9. Inspecting the Fiber

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

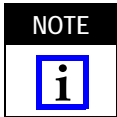


Disconnect cable from any power signal source before inspecting. The light used can cause injury to the eye.

— 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.

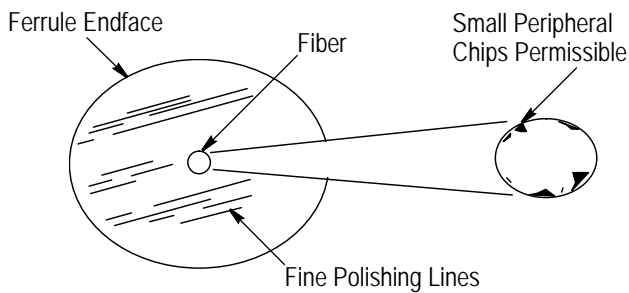


If not installing the connector immediately, place the protective cover over the ferrule.



DO NOT use damaged components. Replace damaged or defective components.

Acceptable



Unacceptable

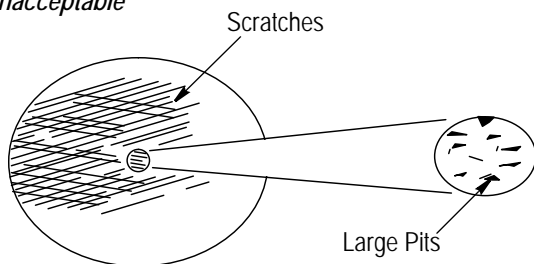
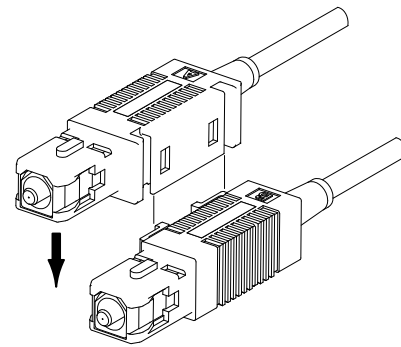


Figure 17

Assembling Duplex Connectors

Detail A



Detail B

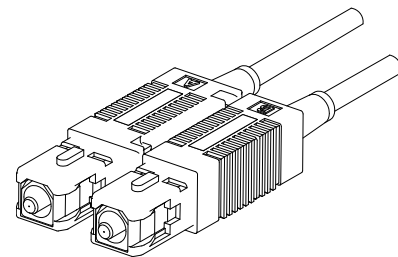


Figure 18

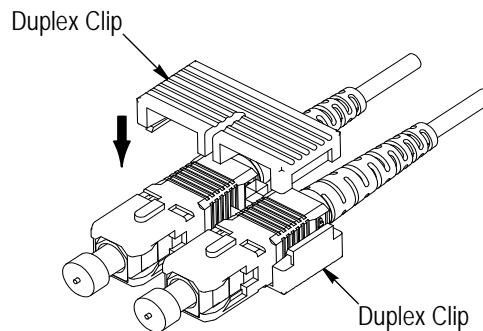
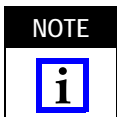


Figure 19

4. DUPLEX CONNECTOR ASSEMBLY

4.1. Duplex Housings



Once joined, the resilient beam and retention plate housings are NOT separable. The retention plate housing will retain the resilient beam housing when the two are joined.

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, Detail A. A completely assembled multimode duplex connector is shown in Detail B.

**4.2. Duplex Clip
(For Use with Simplex Connector Housings Only)**

1. Place the simplex connector housings in one half of the duplex clip. See Figure 19.

2. Place the other half of the duplex clip over the housings and snap the two clips together. See Figure 19.

5. CLEANING PROCEDURE




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

5.1. 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. If the attenuation is too high, unmate both connectors (if applicable), repeat Steps 1 through 5, and follow Paragraph 5.2., Receptacle.

5.2. 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 5.1., Connector.

The steps in Paragraphs 5.1 and 5.2 may have to be repeated if the connector loss is still too high.


6. RECOMMENDED TUNING PROCEDURE


Use Tuning Tool 1693383-1 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 the key on the connector identifies the current tuning position. Proceed as follows:

6.1. 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.*

CAUTION 

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.

6.2. Tuning

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 1 through 5 for a total of three tuning positions.
7. After the third tuning measurement is taken, tune the connector **COUNTERCLOCKWISE** five positions.
8. Repeat Steps 1 through 5 for the other three tuning positions.
9. Tune the connector as described in Steps 2 through 5 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.

7. REVISION SUMMARY

Revisions to this instruction sheet include:

- Changed company name and logo
- Removed "type" from SC and FC
- Modified Sections 1 and 2
- Added jacketed cable size
- Re-arranged and combined Figures 2, 3, and 4
- Separated previous Figure 7 into Figures 7 and 9
- Corrected die set part number for long crimp eyelet in Figure 11
- Removed epoxy mixer and added heat gun to Paragraph 3.1.A
- Modified Epoxy, Step 1 and Step 8 of Paragraph 3.4,B