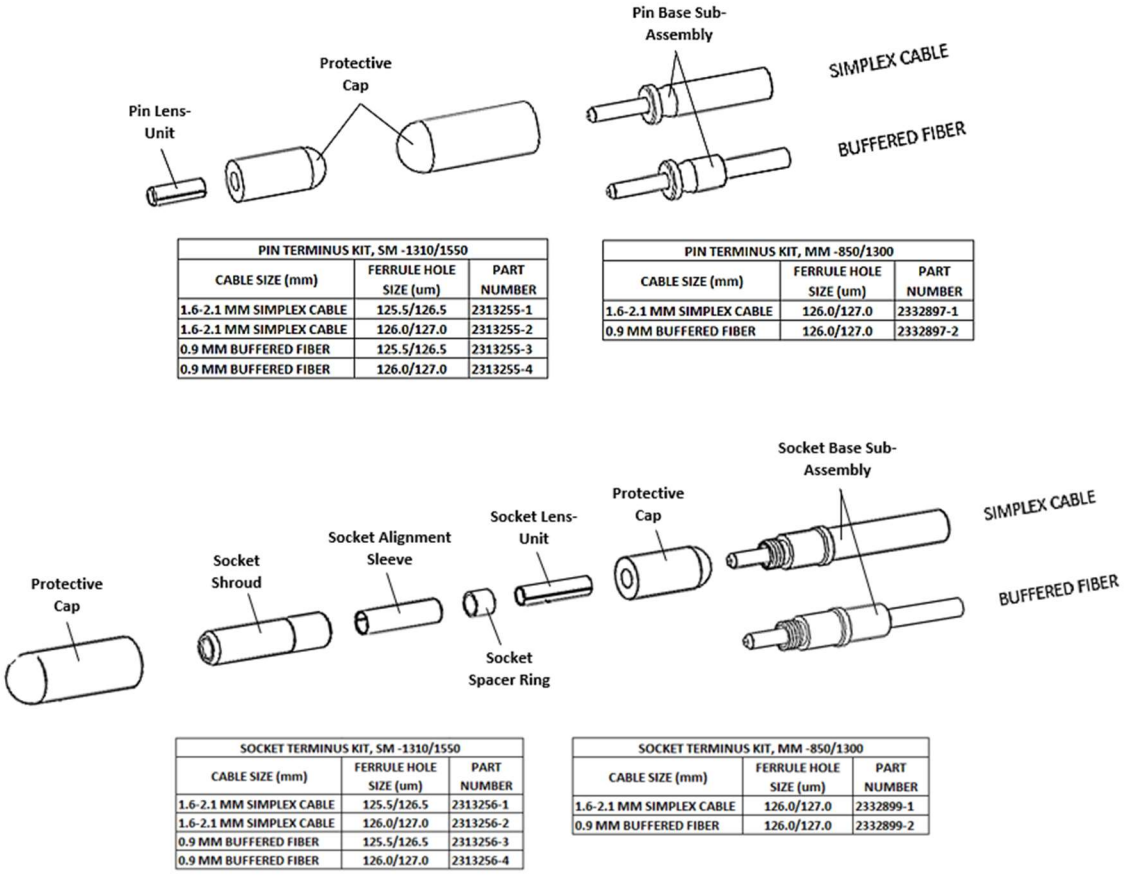
Size 16-Type I Fiber Optic Expanded Beam Single Mode and Multimode Pin and Socket Terminus Kits



PIN TERMINUS KIT, SM -1310/1550		
CABLE SIZE (mm)	FERRULE HOLE SIZE (um)	PART NUMBER
1.6-2.1 MM SIMPLEX CABLE	125.5/126.5	2313255-1
1.6-2.1 MM SIMPLEX CABLE	126.0/127.0	2313255-2
0.9 MM BUFFERED FIBER	125.5/126.5	2313255-3
0.9 MM BUFFERED FIBER	126.0/127.0	2313255-4

PIN TERMINUS KIT, MM -850/1300		
CABLE SIZE (mm)	FERRULE HOLE SIZE (um)	PART NUMBER
1.6-2.1 MM SIMPLEX CABLE	126.0/127.0	2332897-1
0.9 MM BUFFERED FIBER	126.0/127.0	2332897-2

SOCKET TERMINUS KIT, SM -1310/1550		
CABLE SIZE (mm)	FERRULE HOLE SIZE (um)	PART NUMBER
1.6-2.1 MM SIMPLEX CABLE	125.5/126.5	2313256-1
1.6-2.1 MM SIMPLEX CABLE	126.0/127.0	2313256-2
0.9 MM BUFFERED FIBER	125.5/126.5	2313256-3
0.9 MM BUFFERED FIBER	126.0/127.0	2313256-4

SOCKET TERMINUS KIT, MM -850/1300		
CABLE SIZE (mm)	FERRULE HOLE SIZE (um)	PART NUMBER
1.6-2.1 MM SIMPLEX CABLE	126.0/127.0	2332899-1
0.9 MM BUFFERED FIBER	126.0/127.0	2332899-2

Figure 1

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

1. REQUIRED TOOLS AND MATERIALS

1.1 Required Tools and Consumables

The following tools and consumables are recommended for the cable termination of the EB16 kits.

A. Tools

(TE Connectivity part numbers in parentheses)
—Safety goggles (for eye protection)
—Ruler with metric and US customary units
—Aramid shears (1278637-1)
—Fiber jacket stripper (1278531-1)
—Stripping tool (1754708-1)
—Syringe, 3cc
---Needle, 20-gauge (.023 x 1.0 inches)
—Dedicated table-top centrifuge
—Heat cure oven
—Curing block (for cure oven)
—Fiber optic sapphire scribe tool (504064-1)
---Threadlocker, Locktite® 222, low strength
—Terminus polishing puck (2828087-1)
(or Polishing machine/plate)
—200X (minimum) Microscope
— Cure Fixture, Socket (black), (2828502-1)
— Cure Fixture, Pin (red), (2828502-2)

B. Consumables

—Alcohol fiber wipe packet (501857-2)
—Lint--free cloth or tissue
—Isopropyl alcohol
—Epoxy EPO-TEK® 353ND-T
—Epoxy EPO-TEK® 353ND
—Cleaning swab for 1.25mm terminus

For characteristics, safety and reactivity data, and handling instructions for the adhesives, refer to the respective material safety data sheets.

Locktite is a trademark of Henkel Corporation
EPO-TEK is a trademark of Epoxy Technology Inc. Corporation

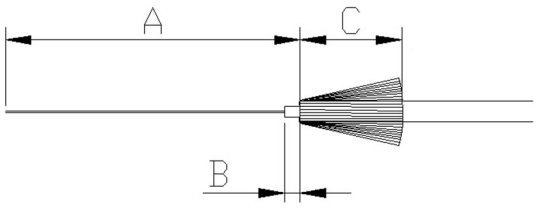
2. ASSEMBLY PROCEDURE

NOTE: *Always wear approved eye protection when working with optical fibers*
CAUTION: *Never eat, drink, or smoke when working with fibers. This could lead to ingestion of glass particles.*

2.1 Cable Preparation

1. Each terminus kit is designed to be used with a simplex cable of diameter 1.8 mm typical having a cable structure as shown on Figure 2 or with a 900um buffered fiber (as Figure 2, but without the cable jacket and strength members).

2. Using a ruler, aramid shears, fiber jacket stripper and stripping tool, prepare the cable to the dimensions shown in Figure 2.



Terminus	A	B	C	
Socket	17.0 / 19.0 [.700 / .750]	4.0 / 5.0 [.157 / .197]	8.5 / 10.0 [.335 / .400]	mm [inches]
Pin	17.0 / 19.0 [.700 / .750]	1.0 / 2.0 [.040 / .080]	7.0 / 8.5 [.275 / .335]	mm [inches]

Figure 2.

3. Using the alcohol pad or a lint-free cloth dampened with isopropyl alcohol, clean the glass fiber to remove any residual coating.

2.2 Epoxy Application

1. Using the EPO-TEK® 353ND-T epoxy kit, remove the separating clip from the bag of epoxy. Mix the epoxy inside the bag thoroughly for a minimum of 3 minutes. Insufficient mixing of the two components may result in poor bonding properties.

2. Cut the epoxy bag diagonally at one corner and squeeze the mixed epoxy into the syringe.

3. Using the dedicated table-top centrifuge, extract air bubbles from the epoxy by centrifuging the syringe (with empty section upwards) for a minimum of ten minutes.

4. Optionally, use premixed, degassed and frozen EPO-TEK® 353ND-T epoxy kit

5. Install the needle on the syringe.

6. Insert the needle into the back of the base subassembly until it butts against the ferrule entrance. While pressing the base subassembly against the needle, inject the epoxy until it is visible at the front ferrule end face.

7. With the base subassembly balanced on the needle only (not pressed against it), inject a short burst of epoxy.

8. Apply 2 shots (for cable) or 1 shot (buffered fiber) inside the barrel along the length of internal diameter of the subassembly while retracting of the needle. Distribute the epoxy on the internal diameter.

   NOTE: *For the cable termination it is recommended to use EPO-TEK353® ND-T which has a high viscosity and therefore will not wick into the cable. When it comes to the lens unit installation (section 2.5), we recommend using EPO-TEK353® ND which has a low viscosity.*

2.3 Termination and Epoxy Cure

1. Arrange the strength members so they are free to evenly bend over backwards over the cable jacket during the insertion into the subassembly.

2. It is important to apply a drop of epoxy to the cable jacket and distribute it around the cable jacket right under the strength members exit and apply a drop to the exit area of the strength members. See Fig.3a.

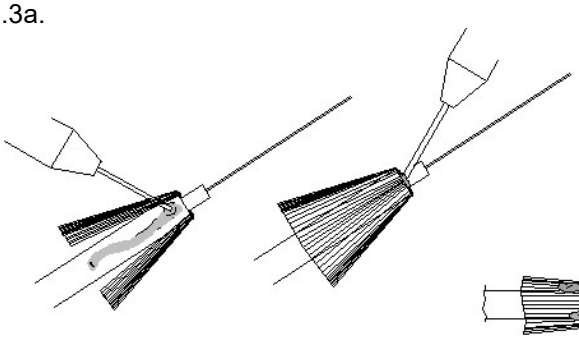


Figure 3a.

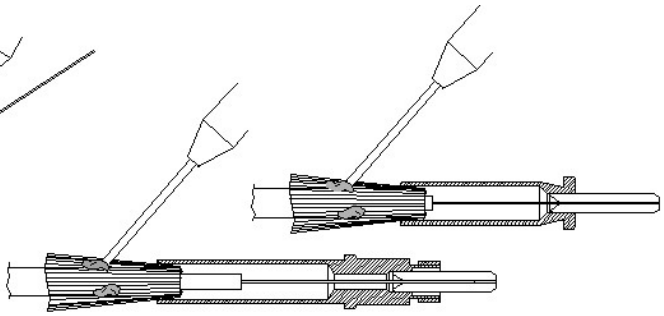


Figure 3b.

3. Carefully insert the fiber into the base subassembly making sure the fiber enters the ferrule hole. Continue the insertion, until the strength members start bending backwards. Pause to apply a few drops of epoxy making sure to wet the strength members. Insert fully and let any trapped air bubbles escape. Wipe off any excess epoxy. See Figure 3b.

4. Termination with a buffered fiber requires the same process but without the strength members and jacket present.

5. Use a heat cure oven to cure the epoxy. For product, which is intended for high humidity and temperature applications, the best cure is obtained at 150˚C [302˚F] for 60 minutes. Make sure to protect the protruding glass fiber during the cure process.

6. If the product application is intended for use at normal environmental humidity and temperature exposure (below 100˚C [212˚F]), a cure process at 125˚C [257˚F] for 30 minutes may suffice.

   NOTE: *Make sure not to exceed the temperature rating of the fiber cable if a cable section is included inside the oven during the cure.*

2.4 Fiber Cleaving and Polishing

1. Place the blade of the sapphire scribe tool just above the cured epoxy bead on the end face of the ferrule and score the fiber with a light transverse motion. See Figure 4.

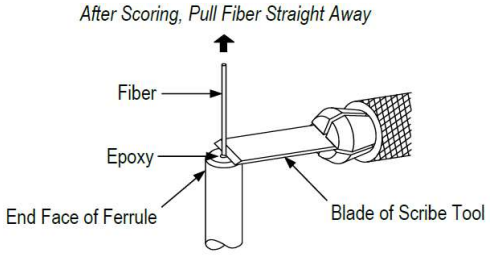


Figure 4

2. Pull the fiber straight away from the ferrule and safely dispose of the fiber stub.

3. Make sure to use a polishing plate which can accommodate a polish of the 1.25mm socket and pin ferrule protrusions.

4. For both Multimode (MM) and Single Mode (SM) termini, the best optical result is achieved by using a single mode polishing process according to the procedure provided by the polishing machine manufacturer. Use a process with low ferrule material removal.

5. The fiber can also be polished manually using a polishing puck.

   NOTE: *Do not over-polish the socket ferrule as excessive removal of ferrule material can result in a ferrule being too short. This means that a small airgap between the fiber and the lens will result and therefore yield a return loss lower than expected. Particular care is required if the ferrules are polished manually in a puck.*

2.5 Ferrule Cleaning

1. Using the alcohol pad or the lint-free cloth dampened with isopropyl alcohol, clean the entire surface of the ferrule and its end face.

2. Under a microscope, inspect the ferrule end face for cleanliness. If necessary, repeat the cleaning process.
   It is important that the end face and the fiber is pristinely clean.

2.6 Lens-Unit Installation.

NOTE: *During this installation, the lens-unit will be pushed down so the lens makes physical contact with the fiber. It is very important that once contact is made, the lens-unit is not rotated. A rotation, while in contact with the lens, will scratch the lens and degrade the performance. If necessary, the lens-unit can be backed out straight (without rotation) and then re-inserted.*

A. Socket Terminus

1. Taking care not to touch or otherwise contaminate the lens, slide the socket lens-unit onto the ferrule (with the open end first which is opposite the lens) - but not all the way. Stop when it has engaged an approximate ferrule length of 1.5 - 2.5 mm [.060 -.100 inches]. Apply EPO-TEK® 353ND epoxy to the ferrule just below the lens-unit, see Figure 5.

   NOTE: *EPO-TEK® 353ND epoxy has a low viscosity which is necessary for good epoxy penetration and bond strength of the assembly.*

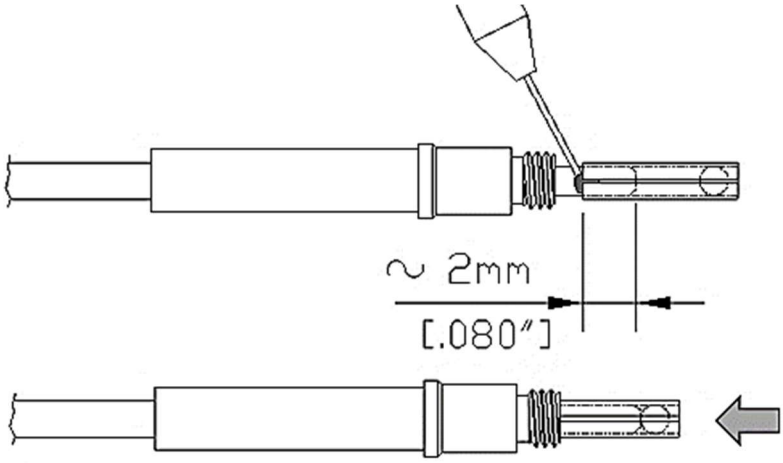


Figure 5

2. While making sure the ferrule does not contact the lens, rotate the lens-unit a couple of times to distribute the epoxy and then continue to push the lens-unit straight down (without rotation) until the ferrule front (fiber) is pressed against the lens and makes positive contact.

3. Insert the socket assembly into the 2828502-1 socket cure fixture (black), see Figure 6. The spring-loaded plunger will assure that physical contact between the fiber and the lens is maintained throughout the curing process. This is necessary to assure good RL performance at temperature extremes.

   NOTE: *Make sure that the plunger tip of the cure fixture is well aligned and positioned centrally on the top of the lens sleeve to provide an evenly distributed force application. While the Cure Fixture 2828502 is designed to fit into a cavity of a cure oven block, optionally, it can also simply be placed in a regular oven.*

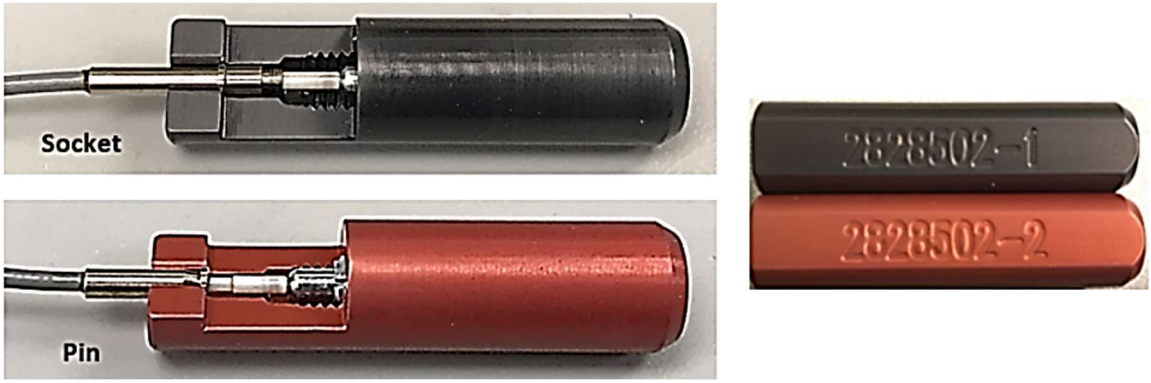


Figure 6

4. Cure in the oven per sections 2.3.4 and 2.3.5.

5. After cooling, remove the socket terminus from the cure fixture.

6. Inspect the front of the lens-unit for cleanliness under magnification. Sometimes, some minor deposits from the cure fixture plunger can occur.

B. Pin Terminus Assembly

1. Taking care not to touch or otherwise contaminate the lens, slide the pin lens-unit onto the ferrule (with the end first which is opposite the lens) - but not all the way. Stop when it has engaged an approximate ferrule length of about 1.5 mm [.060 inches].

2. Apply EPO-TEK353® ND epoxy to the ferrule just below the lens unit, see Figure 7 and then continue to push the lens-unit straight down onto the ferrule (without rotation) until the ferrule front (fiber) makes positive contact with the lens.

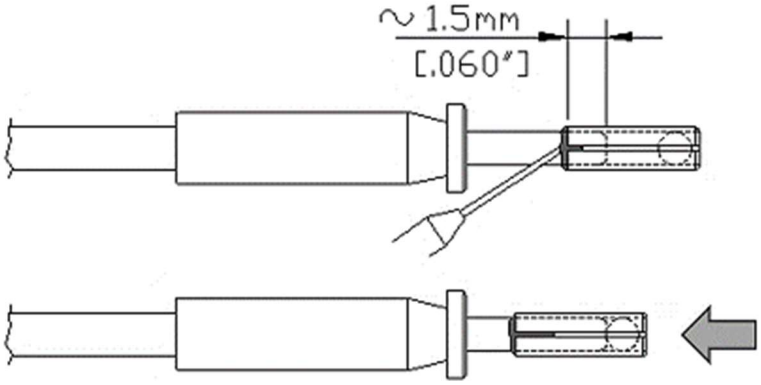


Figure 7

3. Insert the pin assembly into the 2828502-2 pin cure fixture (red), see Figure 6. The spring-loaded plunger will assure that physical contact between the fiber and the lens is maintained throughout the curing process. This is necessary to assure good RL performance at temperature extremes.

   NOTE: *Make sure that the plunger tip of the cure fixture is well aligned and positioned centrally on the top of the lens sleeve to provide an evenly distributed force application. While the Cure Fixture 2828502 is designed to fit into a cavity of a cure oven block, optionally, it can also simply be placed in a regular oven.*

4. Cure in the oven per sections 2.3.4 and 2.3.5.

NOTE: *Make sure that the plunger tip of the cure fixture is well aligned and positioned centrally on the top of the lens sleeve to provide an evenly distributed force application.*

5. After cooling, remove the socket terminus from the cure fixture.

6. Inspect the front of the lens-unit for cleanliness under magnification. Sometimes, some minor deposits from the cure fixture plunger can occur.

7. Mount the protective cap onto the pin assembly.

2.7 Finalize the Socket Assembly

1. Slide the spacer ring over the barrel (see Figure 8).

2. Next, slide on the alignment split sleeve with its slit orientation approximate opposite that of the lens-unit (see Figure 8).

3. Apply a drop of Loctite® Threadlocker-222 to the threads of the base assembly (do not let the adhesive flow onto the ceramic components) and then thread on the shroud until it is tight. Mount the protective cap.

NOTE: *Apply the adhesive to the threads only. Excessive amounts can (with time) migrate up to the optical surface and deteriorate the signal).*

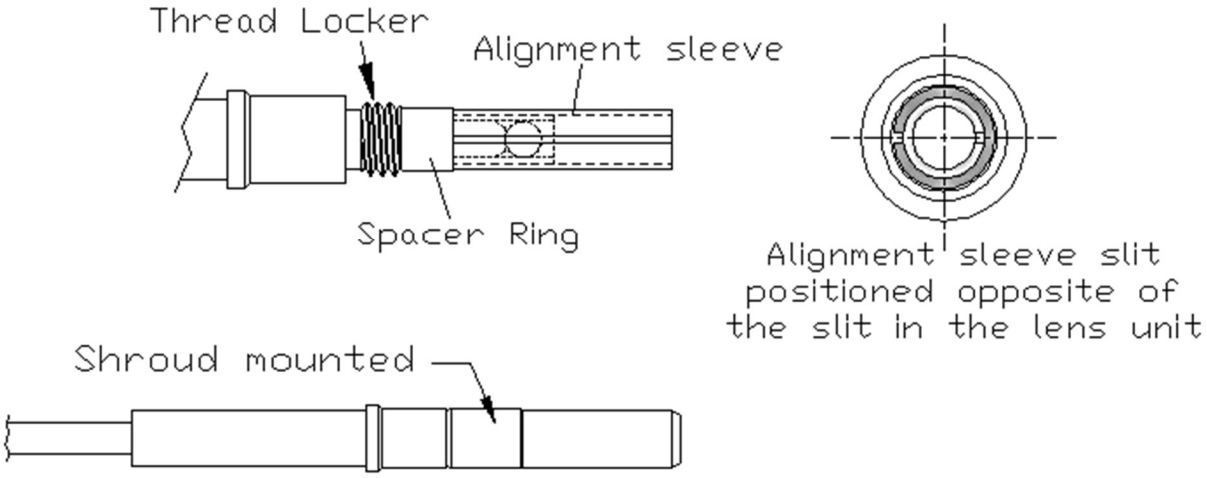


Figure 8

3.0 Evaluation of Cable assembly Performance

1. The pin and socket assemblies are now ready to be tested for insertion loss and return loss. Follow the procedures and methods described in the pertinent industry standards. For example, use guidance for insertion loss measurements from TIA/EIA-455-171 (method D1 for MM and method D3 for SM) and for return loss in the TIA/EIA-455-107 for both MM and SM.

2. **Optical Acceptance Criteria for EB16 MM and SM cable assemblies.**
It is required to use a Quality EB16 Test Lead as a reference launch lead.
Due to the many tolerances in play, it is impossible to create a perfect optically centered EB16 Launch Test Lead and likewise a perfect EB16 cable assembly. Therefore, there will always be a loss contribution from even the slightest mating misalignments in the system. These loss contributions can arise from concentricity offsets to small relative tilts. Since the EB-termini do not have keying, the rotational mating position is always random. At the best-case mating position, one will measure the minimum loss (least relative center offset) and in the worst-case position the highest loss possible (worst relative center offset) when measuring optical loss against the Test Lead. Statistically, it is most likely that the mating position ends up somewhere in between the extreme best and worst positions. Therefore, to assure that the worst-case loss is within an acceptable range, we recommend the following screening procedure:
Rotate the EB16 terminus under test (DUT) relative to the EB16 Launch Test Lead terminus to find the positions with minimum and maximum loss. Record these values. (For Multimode it is only necessary to find the max value).
It is important to avoid holding onto both ends while taking the measurement. The connection is sensitive to angular forces, therefore, make sure to only hold onto one side (either one) when the measurement is taken.

2.a Multimode:
At the applicable wavelength a Multimode DUT terminus mated and rotated 360 degrees relative to the Test Lead Terminus requires:

MM @ 360: Maximum IL ≤ 0.85dB

2.b Single mode:
At the applicable wavelength mate and rotate a Single Mode DUT terminus relative to the Test Lead Terminus to find the Min and Max loss. Calculate the difference between the Min and Max loss (Delta IL).

SM @ 360: Maximum IL ≤ 1.25dB & Delta IL of ≤ 0.65dB

These criteria will assure a good performance when the termini later are mated randomly in a fiber optic MIL-38999 style connector.

4.0 Inspection

1. The design of the lens assembly ensures that the lens surface is positioned below the front of the sleeve barrel for protection. This means that the lens surface is not directly exposed to airborne dust particles and the barrel protrusion will prevent fingerprints from being deposited on the lens.

2. The lens subassembly is cleaned and capped before shipping and no further cleaning is typically needed; however, if it should be desired to verify the cleanliness and to ensure that no contamination has occurred during the assembly process, the external and internal surfaces of the lens can be inspected using a microscope before installation.

5.0 Cleaning Process

1. Using a blast of clean compressed nitrogen or air is typically enough to clean the surface of the lens.

2. If fluids have been spilled onto the lens, the surface can be cleaned using a soft cleaning swab or a bristle tipped cleaning stick either dry or moistened with isopropyl alcohol.
   Examples of commercially available cleaning sticks are shown in Figure 9.

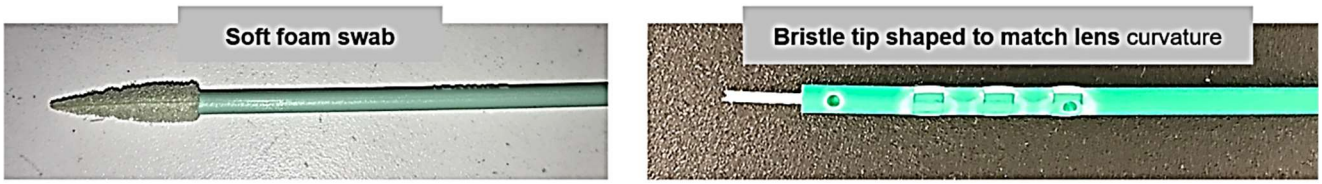


Figure 9.

3. If this is insufficient, then rub, in a twirling motion, a swap moistened with alcohol against the lens surface.

4. In the rare case that a stubborn blemish, epoxy drop, or a permanent contaminant cannot be removed, simple leave it be if it is located outside a central diameter of approximately 0.75 mm (see Figure 10).

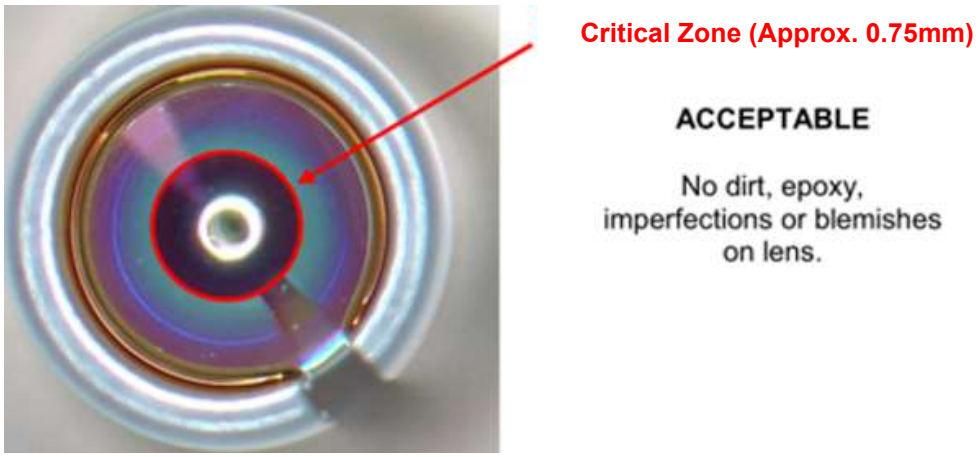


Figure 10

DOCUMENT REVISION

Modifications have been added to the updated 408-163020, Rev F version of 120820. The main update to this revision is the addition of termini for 900 um buffered fibers. This and a few clarifying comments constitute the updated Revision F in the following sections: Figure 1, 2.1.1, 2.2.8, 2.3.4, 2.3.5, 2.3.6, 2.4.4, 2.4.4 NOTE, 2.6.A.3 NOTE, 2.6.A.4, 2.6.B.3 NOTE, 2.6.B.4

408-163020 has been updated to rev G. Reason: removal of the suggested cure oven and block since TE Connectivity does not carry these items anymore. (04 03 23 – SG)