Optical Fiber Handling & Care

General Fiber Handling

Since the core of fiber optic cable is Fused Silica (glass), proper handling procedures need to be observed at all times. Below is a partial list of the most important fiber handling procedures. The intent of these procedures is to maintain optimum performance and a safe working environment.

General Handling Rules:	
1	Protect the exposed fiber end from coming in contact with <u>all</u> surfaces. *Reason: Contact with hard surfaces may scratch or chip the end. Touching the exposed fiber with your finger will leave oil residue.*
2	Never use high-pressure compressed air to clean an optical fiber. *Reason: Propellants may be discharged onto the surface of the fiber end, which may condense moisture or contaminants during use.*
3	Clean the connector (plug) end each time it is inserted into an adapter (receptacle). *Reason: A dirty connector (plug) can contaminate an adapter (receptacle).*
4	The minimum bend radius of the fiber must be maintained. *Reason: A tight bend radius may fracture the optical fiber internally.*
5	If a fiber is secured in position with tie-wraps, do not over tighten. *Reason: An over-tightened tie wrap will cause attenuation through micro-bend loses.*
6	When disconnecting an optical fiber, always pull on the connector strain relief. *Reason: Pulling on the optical fiber itself may fracture the optical fiber internally*.
7	Protective covers (end caps, plugs, etc.) should be stored in a clean container. *Reason: Dirty covers may result in a contaminated optical fiber. Clean suspect or contaminated protective covers prior to use or dispose and replace with new covers.*
8	Unterminated adapters and connectors should always be covered. *Reason: Protective covers will prevent contamination and collection of residue.*
9	Use fiber-cleaning materials only once. *Reason: Previously used cleaning materials are contaminated*.
10	Never use your hands to clean a fiber work area. *Reason: If you wipe a work area with your hands, a piece of glass (not visible to the naked eye) may get lodged in your hands.*
11	Never inspect a fiber optic cable while connected to a Laser Welder. *Reason*: Eye damage may occur if you stare directly at an active fiber end. Always insure that the fibers are disconnected from the laser source, prior to inspection.

In summary, proper care and cleaning of optical fibers and connectors will improve the long-term performance, quality and will minimize the potential for injury.

Minimum Fiber Bend Radius

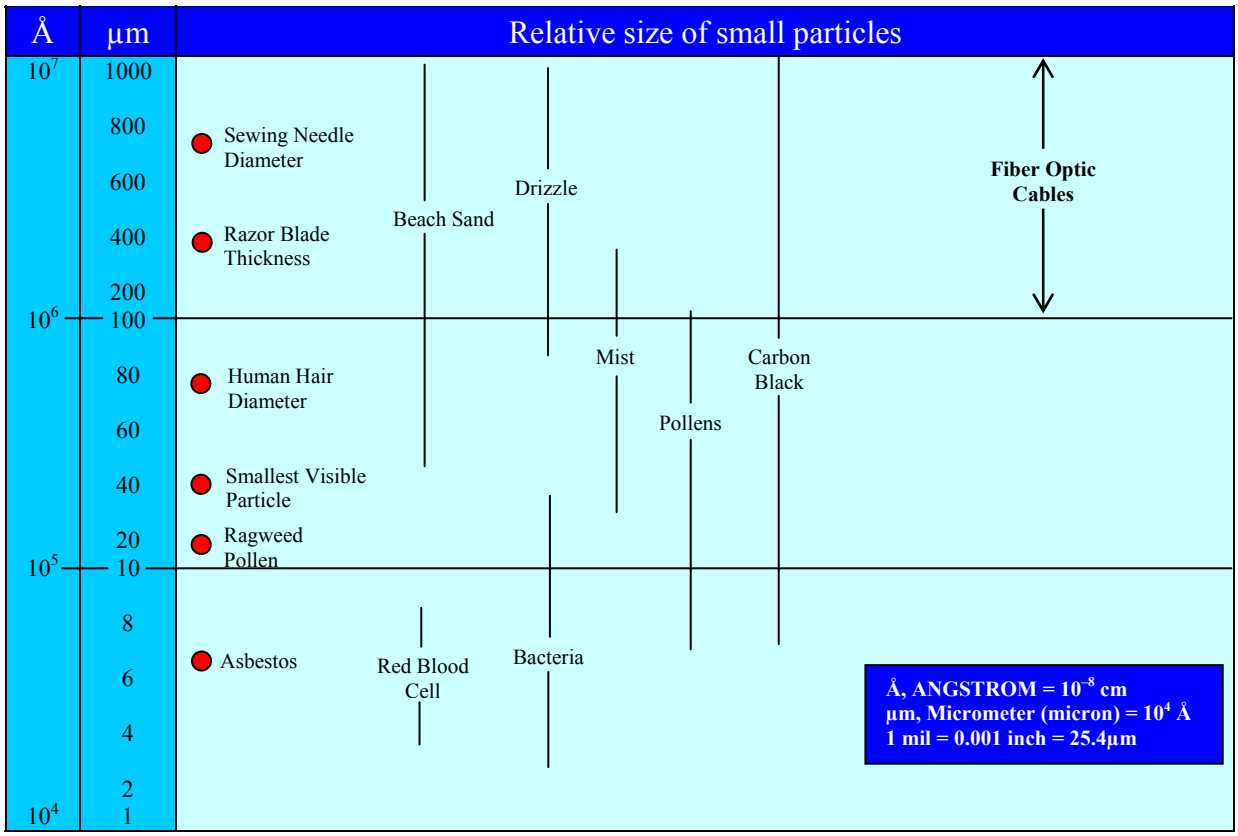
As mentioned in the handling rules above, bending the fiber optic cable beyond the minimum bend radius may cause the optical fiber to fracture internally. It is also equally important not to introduce a twist into the cable for the same reasons. This can easily occur if care is not taken during the "uncoiling" of the cable. It is recommended that the fiber be uncoiled as if pulling wire from a spool, where the spool (coil) is free to rotate.

Minimum Bend Radius for Specified Core Diameters

Core Diameter (µm)	Minimum Bend Radius	
	Operational	Storage
100	7" (175mm)	6" (150mm)
200	7" (175mm)	6" (150mm)
300	7" (175mm)	6" (150mm)
400	7" (175mm)	6" (150mm)
600	10" (255mm)	8" (205mm)
800	12" (305mm)	10" (255mm)
1000	14" (355mm)	12" (305mm)

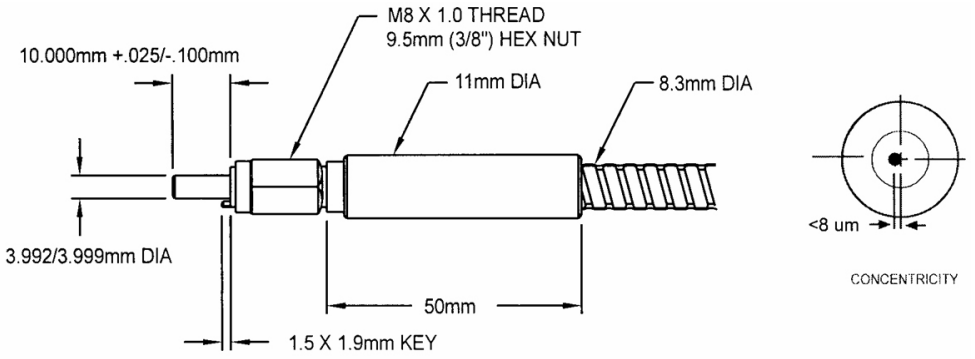
Particle Size

A "dirty" fiber optic cable is the primary cause of poor fiber performance. The size of the particle contaminants is proportional to the signal degradation (performance drop). To understand the size of the particles that can affect performance, please review the chart below:



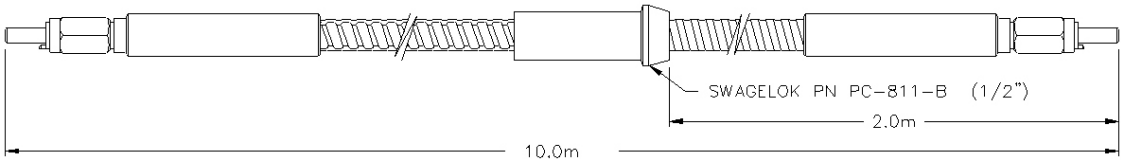
Available Optical Fibers:

Standard Optical Fibers



Diameter (µm)	SI (Stepped Index) Fiber		GI (Graded Index) Fiber	
	5M Length	10M Length	5M Length	10M Length
100	4-62167-01	4-62168-01	4-62169-01	4-62170-01
200	4-60106-01	4-60170-01	4-60100-01	4-60122-01
300	4-60255-01	4-60256-01	4-60259-01	4-60260-01
400	4-60099-01	4-60085-01	4-60087-01	4-60088-01
600	4-60001-01	4-60086-01	4-60002-01	4-60089-01
800	4-60093-01	4-60115-01	4-60128-01	4-60131-01
1000	4-60118-01	4-60119-01	4-60133-01	4-60134-01

Hermetically Sealed Optical Fibers



Diameter (µm)	SI (Stepped Index) Fiber
	10M Length
100	4-65335-01
200	4-64892-01
300	4-64865-01
400	4-64866-01
600	4-64867-01
800	4-65336-01
1000	4-65337-01

The anatomy of the SI (stepped index) and GI (graded index) fibers differ. SI tends to homogenize the beam structure, whereas the GI fiber tends to maintain the mode structure of the laser throughout the fiber length. The type of fiber used is dependent on the application. Consult the Laser Applications Department at *Amada Miyachi America* for more details.

Fiber Optic cleaning procedure

Equipment required:

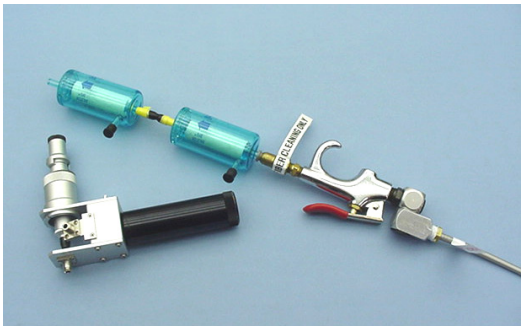
- Fiber Optic End Scope (AMYA # 4-60091-01 or equivalent)
- Acetone 9006-01 (J.T. Baker or equivalent)
- “Lint free” lens/optic paper (AMYA # 900-314 or equivalent)
- “Powder Free” Latex or Optics Handling Gloves (AMYA # 055-046 or equivalent)
- Filtered air

Fiber Optic Cleaning Rules:

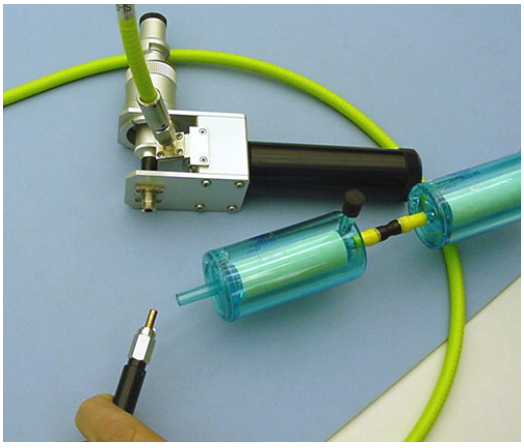
- The person performing the cleaning must be properly trained.
- The area where the cleaning is to be done must be as clean as possible and away from moving air that may blow contaminates onto the fiber end.
- Never remove the end cap until just prior to inspection or installation.
- Always keep the end of the fiber pointed down to prevent any falling debris from landing on the end of the optical fiber.
- Never touch the end of the fiber or blow on it with your mouth.
- When cleaning the fiber end with lint free optic paper, apply only *light* pressure.
- Always assure that the acetone applied to the “lint free” optic paper is not contaminated.

Fiber Optic Cleaning Procedure:

1. Before you start the cleaning process, be sure that you have all of the necessary tools.

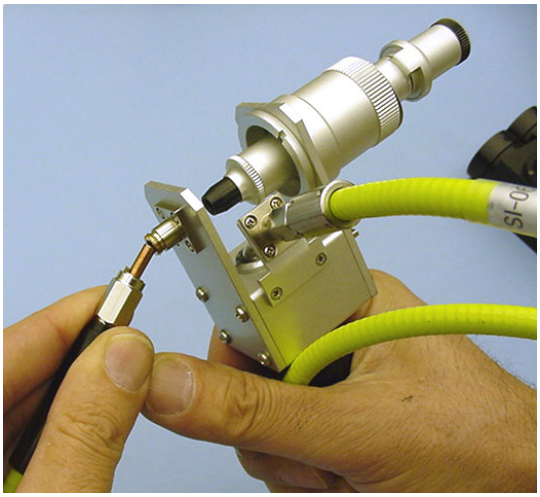


2. Blow air at an angle across each end of the fiber optic cable to remove any loose dirt or particulates.

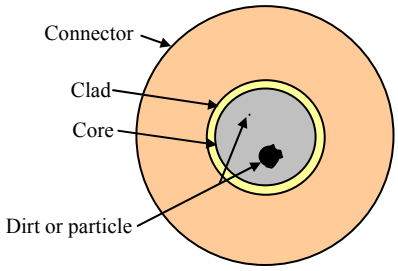


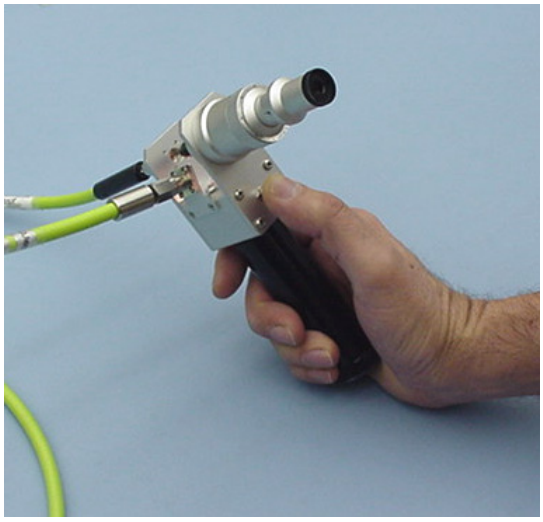
3. Connect each end of the fiber optic cable to the fiber optic end scope. Take care when inserting the fiber optic cable. Insert the cable at a slight angle to prevent the fiber end from getting scratched on the end face of the fiber optic end scope (as shown in the picture).

   Once the fiber end is inserted, align the key and finger-tighten the cable end.



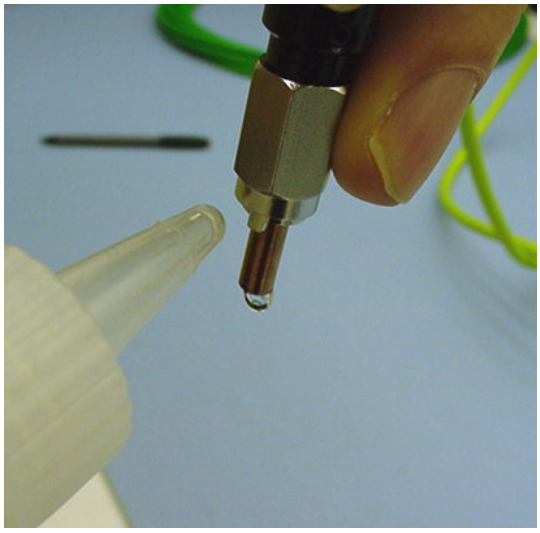
4. Inspect the fiber end for dirt or contamination. The fiber end will look similar to the following:





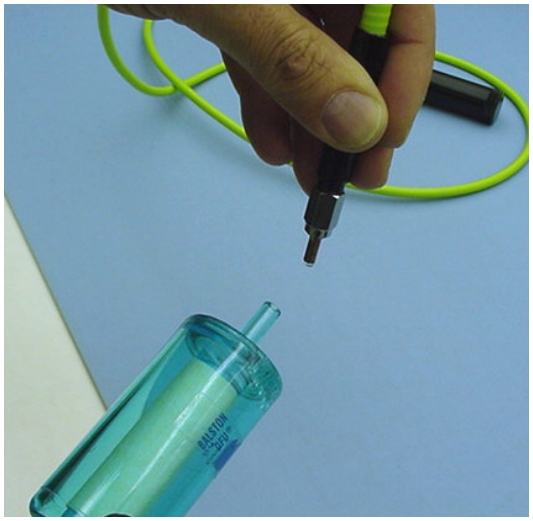
   Note: You can only inspect one end of the cable at a time. To inspect the opposite end, reverse the cable to inspect.

5. If the cable is dirty, remove the fiber end from the end scope and apply some acetone. To apply the acetone, point the fiber end downward and add a drop of acetone to the side of the connector body. The acetone will naturally collect at the end of the fiber.



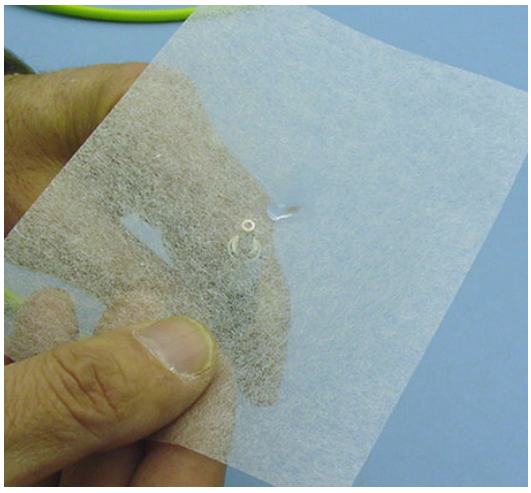
6. Blow air across the fiber end to remove the acetone and any loose dirt or particulates. Re-inspect the fiber end.

   If you are unable to clean the end of the fiber, continue on with the cleaning steps outlined below. If it is clean, repeat for the other end of the fiber.

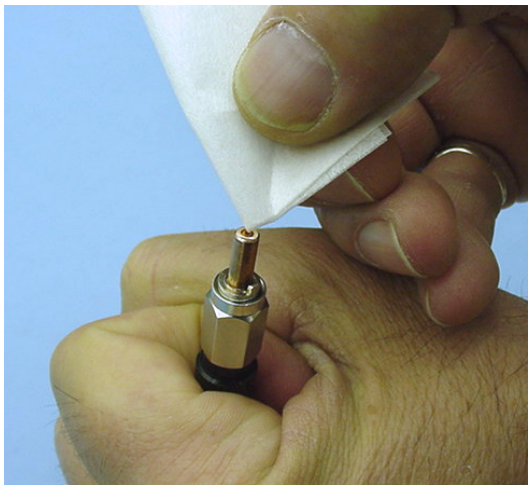


7. Take a piece of lens cleaning paper and hold it in a horizontal position. Add a drop of acetone to the topside of the lens cleaning paper. Gently rub the fiber end in a circular motion on the bottom side of the lens cleaning paper. Repeat steps 5 and 6 and re-inspect the fiber end with the fiber end scope.

   If you are unable to clean the end of the fiber, continue on with the cleaning steps outlined below. If it is clean, repeat for the other end of the fiber.



8. If the fiber end is still dirty, then fold a new piece of lens cleaning paper three times to make a rigid "cleaning" corner. Place a drop of acetone on the "cleaning" corner, and gently rub the fiber end. Concentrate the rubbing action to the middle of the fiber (core) and avoid rubbing the connector body. Repeat steps 5 and 6 and re-inspect the fiber end with the fiber end scope. If you are unable to clean it, then it must be replaced.



It is important to remember where the particulates are on the fiber end each time you make a cleaning pass. If the particulate appears in the same spot after numerous cleanings, then the fiber may be damaged. When the image in the fiber end scope appears clear and free of particulates, then the fiber end is "clean". If you can see any particulate in the fiber end scope *no matter how tiny*, it is considered dirty.