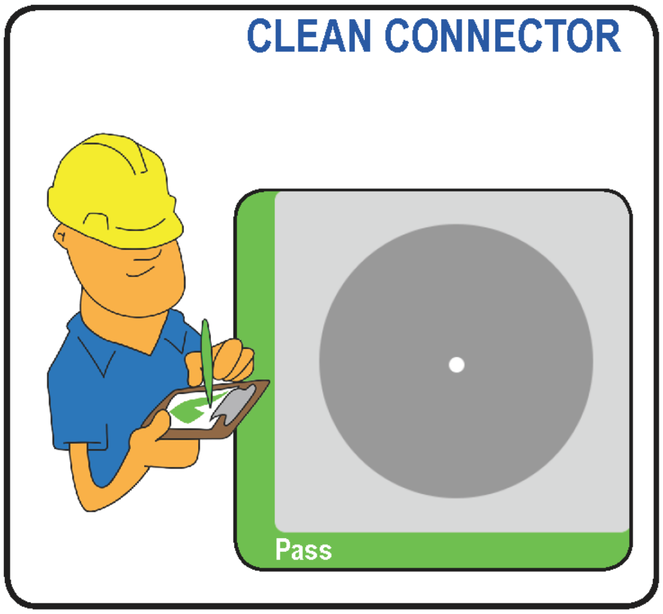
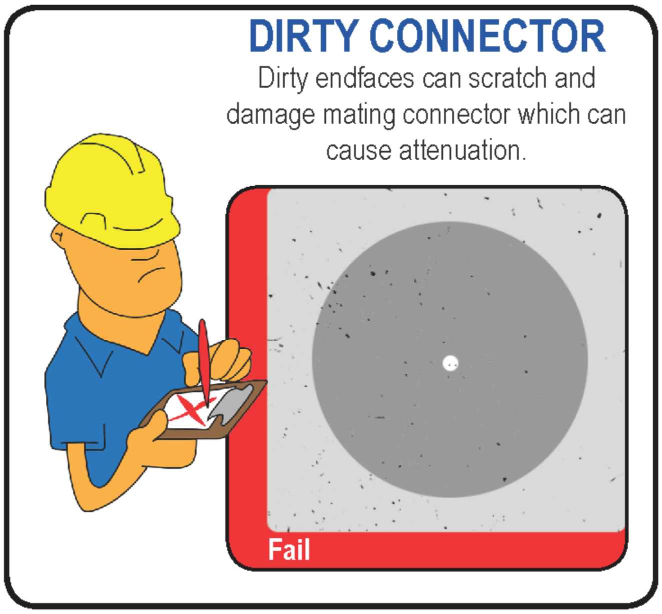
Engineering Standards and Technology

Inspect then Connect Cleaning Instructions

CLEARFIELD

Inspect and clean EVERY connector before inserting into adapter.





Product	Clearfield Part Number	Contents
LC Cleaning Kit	CleanKit-LC-01	• Ferrule and V-groove cleaning swab 50/tube • SFF Connector Flat Swab 500/bag • 1.25mm ferrule swab (LC) 50/tube • Portable platform 400perforated/box • Fiber Wash MX Precision Cleaner Pen
SC Cleaning Kit	CleanKit-SC-01	• Ferrule and V-groove cleaning swab 50/tube • SFF Connector Flat Swab 500/bag • 2.5mm foam swab SC only 50 per tube • Portable platform 400perforated/box • Fiber Wash MX Precision Cleaner Pen
MPO Cleaning Swab	CleanMPO-01	MPO Chamois Swab 25/tube
Replacement V-groove Swab	018886	Ferrule and V-groove cleaning swab 50 per tube
Replacement Flat Swab	018887	SFF Connector flat swab 500 per bag
Replacement 2.5mm Swab	018888	2.5mm foam swab SC only 50 per tube
Replacement 1.25mm Swab	018889	1.25mm ferrule swab LC only 50 per tube
Replacement Platform	018891	Portable platform perforated 400 per box
Replacement Cleaning Pen	018892	Cleaning Pen, MX Precision ordered separately
Replacement Nylon Bag	018932	Nylon bag, empty, blue
MPO Swiping Tool	016558	Tool for cleaning through MPO adapter
SC Swiping Tool	016313	Tool for cleaning through SC adapter
LC Swiping Tool	016312	Tool for cleaning through LC adapter

Engineering Standards and Technology

Inspect then Connect Cleaning Instructions

CLEARFIELD

Connector Cleaning Procedure

Whether factory terminated or field spliced, clean connectors are essential for proper system operation. Even the smallest dust particle can cause transmission problems, so for optimal network performance inspect, and if necessary, clean connectors and adapters prior to mating.

Inspect Then Connect

These are Clearfield recommended products/applications. Use the product you feel will complete your cleaning procedures. Create a “best practice” for your company and follow those procedures.

The use of Chemtronics end face and bulkhead cleaning products and techniques ensures a clean end face, no matter the type of contamination.

Before cleaning any connector, be sure you know what type of contaminate you are cleaning (dry, fluidic, or combination). All the available products are good, it’s the process that you need to be aware of. Using a dry cleaning method to clean “dirt” can lead to scratching of the end face. Learn the process of cleaning properly.

Note: It is **NOT** recommended to use isopropyl alcohol to clean the end face.

Figure 1

Cleaning an SC/LC Connector

Cleaning the End Face

- Place one wiping paper on QbE-2 FiberSafe™ Cleaning Platen. (Figure 1)
- Apply small amount of precision cleaner (about 1” in diameter) with Electro-Wash MX pen on to one end of the wipe. (Figure 2)
- Hold end face at a 90 degree angle. For APC connection, adjust by slightly tilting the container or end face. Angle is correct when no drag is felt on the end face. (Figure 3)
- Draw end face from wet to dry part of the wipe 3 times. Use just enough pressure to ensure complete contact between end face and the wipe.

Note: DO NOT retrace previous step.

Figure 2

Figure 3

Cleaning the Ferrule

- Lightly moisten the fiber optic swab (2.5mm/38542F or 1.25mm/38040) by spotting a small amount (about 1") of Electro-Wash PX or Electro-Wash MX pen onto the QbE. Hold the swab, 1 side down to the wetted area and hold for a count of 1-2-3-4-5. (Figure 4)

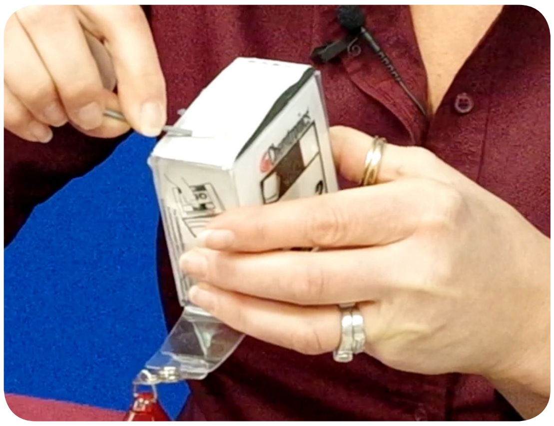


Figure 4

- Insert swab into side of ferrule, wet side to the ceramic ferrule and circle around 2-3 times and remove. Turn swab to dry side and repeat. (Figure 5)

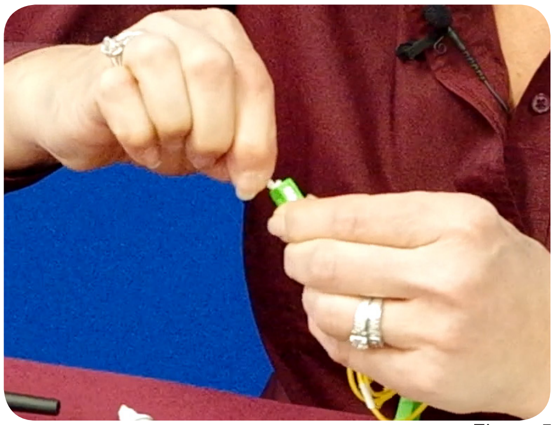


Figure 5

Cleaning the Mate Through an Adapter AND the Adapter Itself

- Lightly moisten the fiber optic swab (2.5mm/38542F or 1.25mm/38040) by spotting a small amount (about 1") of Electro-Wash PX or Electro-Wash MX pen onto the QbE. Hold the tip of the swab onto the wetted area and hold for a count of 1-2-3-4-5.
- Insert the swab into the adapter to the connector, press lightly against the connector, twist 2-3 times, remove and discard.
- Dry with a second dry swab.
- Inspect, repeat cleaning if necessary, and test for signal strength.
- Use additional swabs to clean inside the actual adapter. Moisten swab, like above, and insert through hole and remove while twisting. (Figure 6)

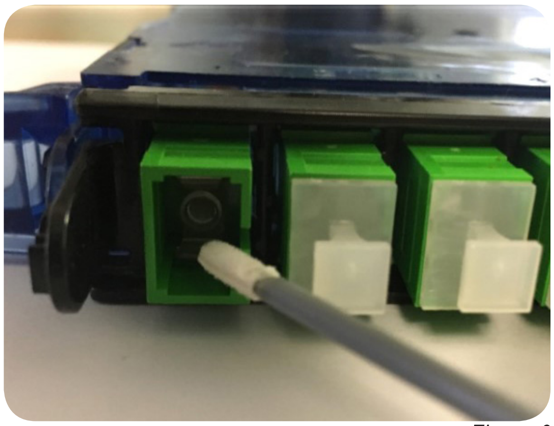
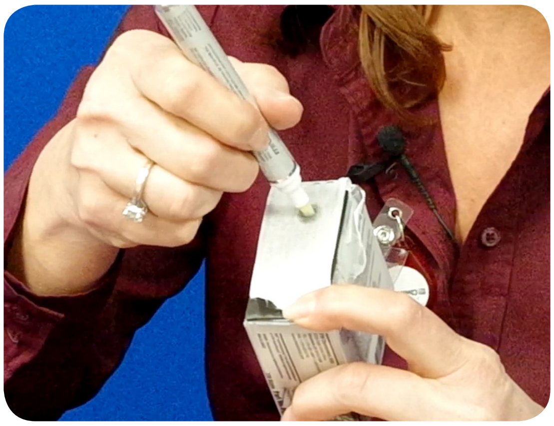


Figure 6

Cleaning an MPO/MTP Connector

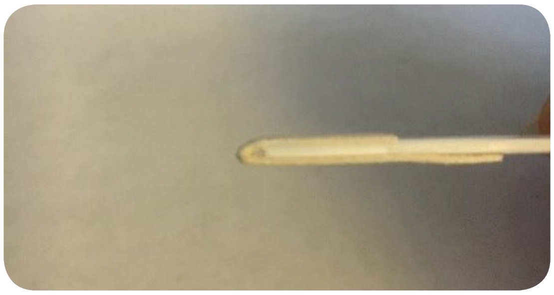
Male Connector

- Use of Chemtronics MTP Connector Cleaning Swabs (CC505F) is recommended. Even after cleaning with a probe cleaner, you should always clean the pins with this (or an equivalent) type swab. Cleans ALL MTP/MPO connector end faces. This swab also cleans the “pins” of the male connector

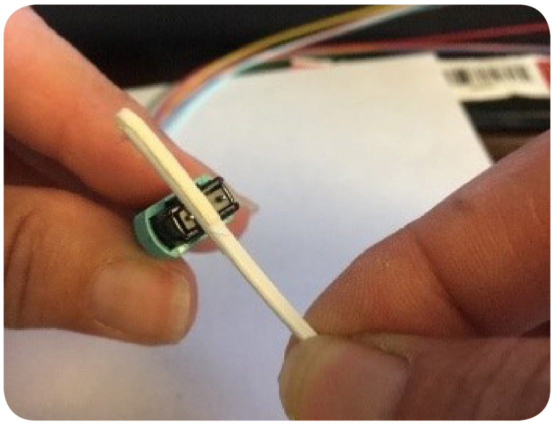


- Lightly “spot” a QbE-2 wipe on the platen with Electro-Wash PX Fiber Optic Cleaner, the FiberWash or MX Pen.

- Lightly touch short side of the MTP/MPO Connector Swab to the wetted area (3-5 secs) to absorb some cleaning solution (DO NOT over saturate the swab).



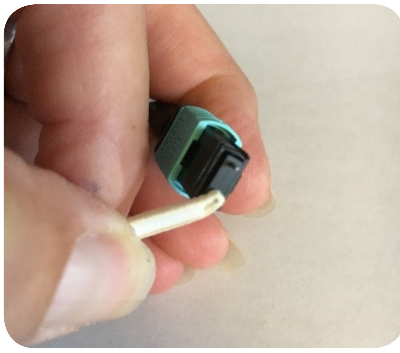
- Wipe connector areas to be cleaned, sliding pad from bottom of pad across and forward to tip of swab, from 1 side to the other, turn over and use long side to dry in same movement.

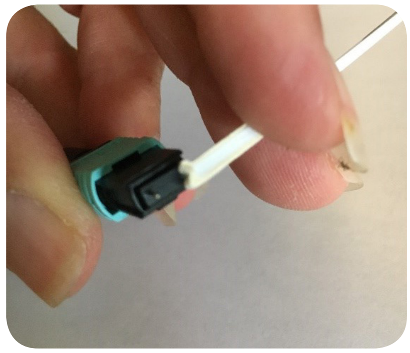


Engineering Standards and Technology

Inspect then Connect Cleaning Instructions

- Use the hole on end of pad to clean one alignment pin, then press the end of the swab into the other pin to clean.
- Check your work with a fiber scope. This can take several attempts to get the endface clean.

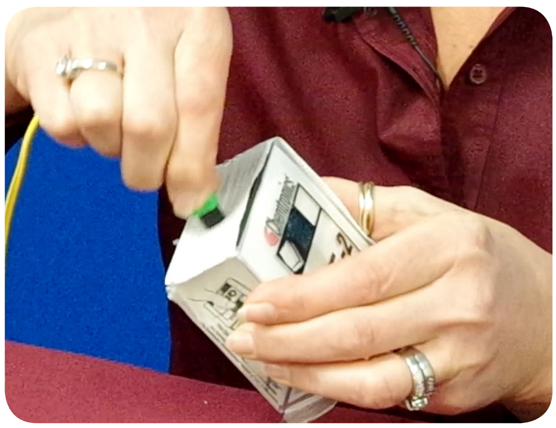




Female Connector (without pins)

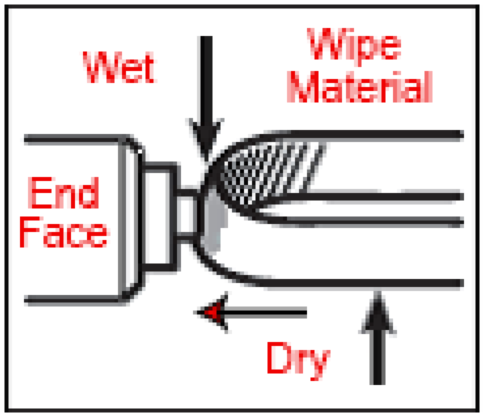
- Cleaned like a single fiber connector, using a cleaning platform. The receptacles will be cleaned as long as you are using a combination cleaning process as recommended.
- Again, using a platen, moisten the platen with cleaning solvent on one end to accommodate 3 swipes of the MPO female endface.

- Holding the connector (If APC, slightly at an angle to accommodate for 8° angle) swiping with medium pressure, from the wet area into the dry area 3 times, without wiping over previous area.
- Inspect, and if clean, make the connection. If NOT, repeat above steps until clean or if determined that the end face is damaged (based on standards of 5 cleanings per connection), replace.

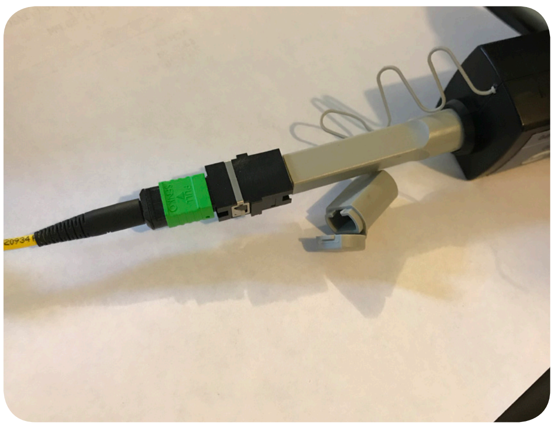


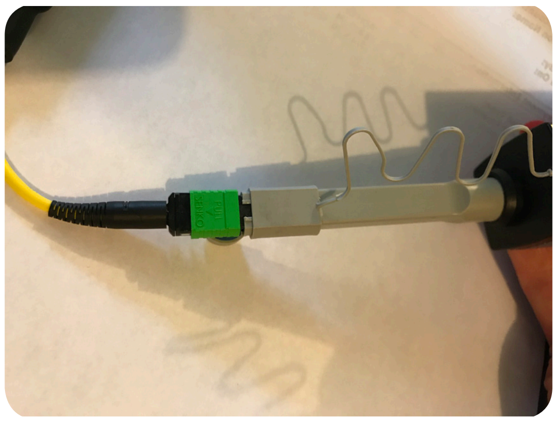
Cleaning Using a Probe-Style Cleaning Tool

- The probe style cleaning tools are capable of cleaning a connector end face separately or through the adapter.
- Slightly engage probe by pulling back but do not allow to click. Lightly “spot” a QbE-2 wipe on the platen with Electro-Wash PX Fiber Optic Cleaner, this will help alleviate “over saturation” of the material.
- Lightly touch the tip of probe and release.

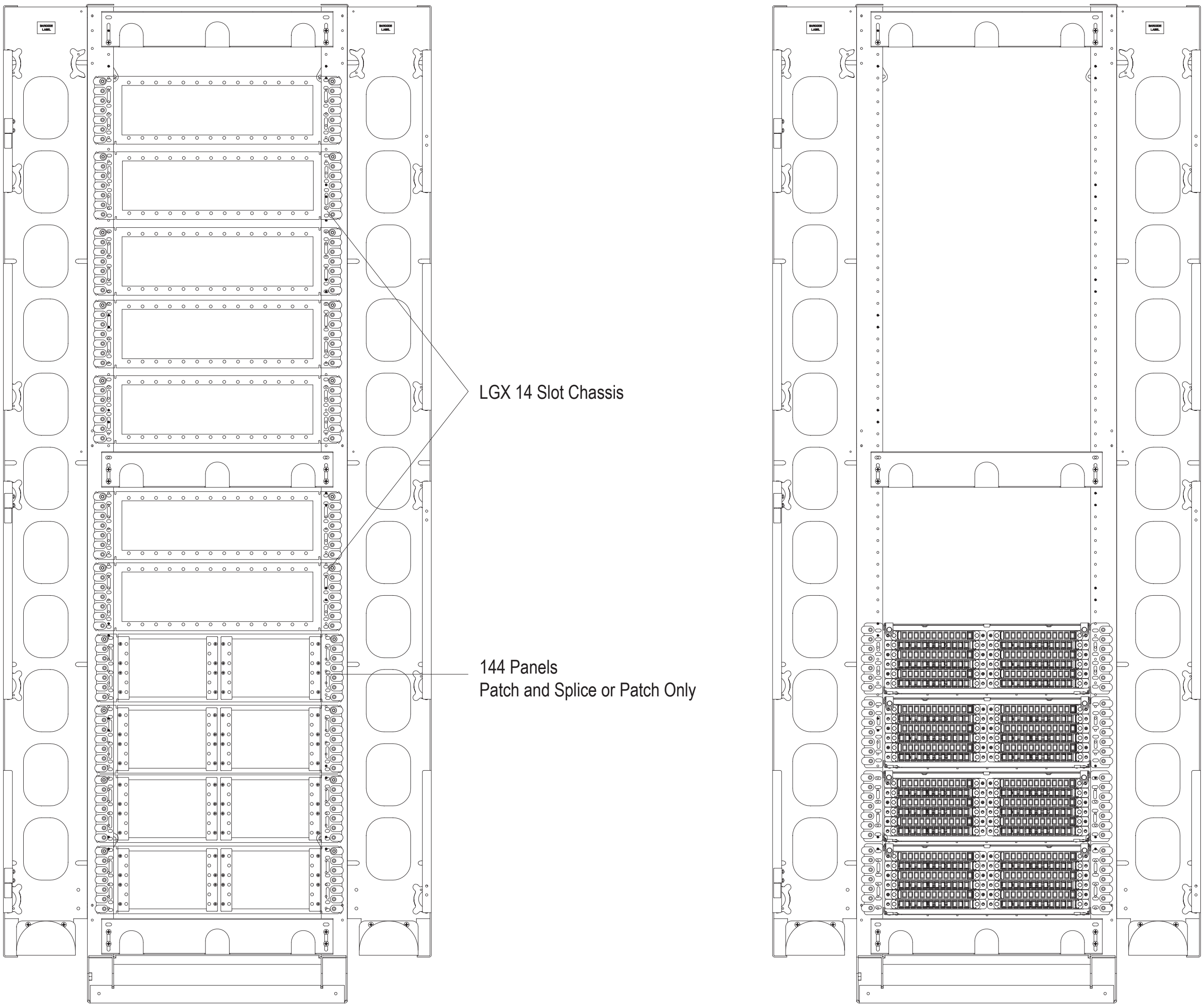


- Insert connector or insert probe though adapter and click 2-3 times to move past the wet area and allow material to dry wipe.





- Inspect connector, repeat if necessary (following standards)
- If cleaning a male connector, clean the pins (see above)



LGX 14 Slot Chassis
144 Panels
Patch and Splice or Patch Only

Engineering Standards and Technology
Grounding Recommendations

Panels
Patch only panels with an IFC cable, containing no metallic materials, does not need the cable grounded at the panel.

If the panel itself needs to be grounded, scrape some paint from the panel and the frame at the point of contact where a ground wire running from the frame to the panel makes contact. If an isolation kit was used when the frame was mounted to the floor, the frame will need a ground wire from the frame to a common ground. NOTE: If bonding/grounding is needed for the FxMP panel, a threaded screw hole is available to address this need.

Patch and splice panels with an OSP armored cable, where the metallic armoring (shield) is entering from the exterior of the building to the panel, will need to be grounded at the panel.

After the shielding has been removed back to the green cable clamp used for mounting the cable to the panel, install a shield bonding clamp to the metallic shield. Then, connect a ground wire from the bonding clamp to the appropriate building ground.

No metallic material should make contact with the panel when not grounding to the frame.

Cabinets
Patch only cabinets, with a non-armored cable being spliced outside the cabinet, the cabinet will need to be the only thing grounded.

Using the ground bar mounted in the cabinet, install a ground wire from the ground bar to a ground rod. The ground rod will also be used to ground any metallic armored (shielded) cable that will be spliced to the terminated cable coming from the cabinet.

Patch and splice cabinet, with an OSP armored cable where the metallic armoring (shield) is continuous entering into the cabinet will need to be grounded to the cabinet ground bar.

After the shielding has been removed from the cable entering the cabinet back to the liquid tight strain relief fitting, attach a shield bond to the metallic shield and install a ground wire from the bond to the cabinet ground bar. The ground bar will need to be installed with a ground wire connecting the ground bar to the ground rod.

Patch and splice cabinet with ground box will be grounded the same as the path and splice cabinet, with an additional ground wire being installed from the cabinet ground bar to the ground box ground bar.

Wall Boxes
Exterior and interior wall boxes can be grounded using the wall box ground lug.

A ground wire will need to be installed from the lug to the appropriate ground; this could be a ground rod, building steel, water pipe or the buildings common ground. If armored cable enters the panel, it will need to be grounded using the same steps as OSP cabinets.

Clearfield's ground bonding kit part number is FMA-JZZ.

Optical Splitters are used in PON (Passive Optical Network) architectures.

PON (Passive Optical Networks)

There are two common types of systems that make up fiber networks: Active Optical Networks and Passive Optical Networks. Each offer ways to separate data and route it to multiple locations, and each have advantages and disadvantages as compared to the other. An active optical system uses electrically powered switching equipment, such as routers or switch aggregators, to manage signal distribution and direct signals to specific locations. A passive optical network, on the other hand, does not include electrically powered switching equipment and instead uses optical splitters to separate and collect optical signals as they move through the network. A passive optical network shares fiber optic strands for portions of the network and are then split to feed the signal to multiple locations. Powered equipment is required only at the source and receiving ends of the signal.

A Passive Optical Network (PON) is a point-to-multi-point fiber to the premise network architecture. This type of network uses unpowered Optical Splitters along with WDM/CWDM/DWDM to enable a single optical fiber to be split into many separate fibers to serve multiple locations. A PON consists of an optical line terminal (OLT) at the service provider's central office and optical network units (ONUs) near or at the end users location. A PON reduces the amount of fibers and central office equipment required in the network, especially when compared to typical point-to-point architecture. A passive optical network is one form of a fiber-optic access network.

Passive optical networks or PONs have some distinct advantages. They are efficient in that each fiber optic strand can be split many times and can serve many users. The majority of the existing networks are splitting the signal 32 times, while newer systems have gone even further by splitting 64 times. There are even some networks pushing the envelope even further by splitting a signal 128 times. PONs have a low building cost relative to active optical networks along with lower maintenance costs. Because there are few moving or electrical parts, there's simply less that can go wrong in a PON.

Splitters play an important role in Fiber to the Home (FTTH) networks by allowing a single PON network interface to be shared among many subscribers. They are the network element that put the passive in Passive Optical Network. In some cases, FTTH systems may combine elements of both passive and active architectures to form a hybrid system.

Technologies used to fabricate splitters and couplers.

Planar Lightwave Circuit (PLC or Planar)

PLC splitters are used to separate or combine optical signals. A PLC is a micro-optical component based on planar lightwave circuit technology and provides a low cost light distribution solution with small form factor and high reliability. PLCs are manufactured using silica glass waveguide circuits that are aligned with a V-groove fiber array chip that uses ribbon fiber. Once everything is aligned and bonded, it is then packaged inside a miniature housing. PLC Splitters have high quality performance, such as low insertion loss, low PDL, high return loss and excellent uniformity over a wide wavelength range from 1,260 nm to 1,620 nm and have an operating temperature -40ºC to 85ºC. Clearfield® products meet or exceed Telcordia GR-1209 and GR-1221 certifications.

FBT Splitter Specifications

FBT is the traditional technology in which two fibers are placed closely together, typically twisted around each other and fused together by applying heat while the assembly is being elongated and tapered. A signal source controls the desired coupling ratio. The fused fibers are protected by a glass substrate and then protected by a stainless steel tube, typically 3 mm diameter by 54 mm long. As this technology has developed over time, the quality of FBT splitters has improved and they can be deployed in a cost-effective manner. FBT splitters are widely accepted and used in passive optical networks, especially for instances where the split configuration is not more than 1x4. The slight drawback of this technology is when larger split configurations such as 1x16, 1x32 and 1x64 are needed. FBT technology is limited to the number of splits that can be achieved with one coupling. If more than four splits are required, multiple FBT splitters can be spliced together in concatenation to multiply the amount of splits available. This is also known as a tree splitter or coupler. When using this design, the package size increases due to multiple FBT splitters and splices needed to concatenate. The insertion loss also increases with the additional splitters and splices used. When high split counts are needed and small package size and low insertion loss is critical, a PLC splitter is more ideal.

Planar Lightwave Circuit (PLC) Optical Splitter Specifications

Type	IL	RL	PDL	Uniformity	Directivity	Operating-Temp	Storage-Temp
1 x 32	< 16.8 dB	> 50 dB	< 0.3 dB	< 1.7 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
2 x 32	< 17.8 dB	> 50 dB	< 0.3 dB	< 1.8 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
1 x 16	< 13.8 dB	> 50 dB	< 0.3 dB	< 1.2 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
1 x 8	< 10.8 dB	> 50 dB	< 0.3 dB	< 0.8 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
1 x 4	< 7.5 dB	> 50 dB	< 0.3 dB	< 0.6 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C

Fused Biconic Taper (FBT) Dual Window - Wavelength Flattened (Terminated Specifications)

	1 x 2	1 x 4	1 x 8	1 x 16	1 x 32
Maximum Insertion Loss (dB)	3.6	7.2	10.7	14.0	17.6
Maximum Uniformity (dB)	0.8	1.0	1.3	1.6	1.9
Maximum PDL (dB)	0.2	0.3	0.4	0.5	0.6
Center Wavelengths (nm)	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550

Engineering Standards and Technology

Optical Splitter Product Notes

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1 x 16	< 13.8 dB	> 50 dB	< 0.3 dB	< 1.2 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
1 x 8	< 10.8 dB	> 50 dB	< 0.3 dB	< 0.8 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C
1 x 4	< 7.5 dB	> 50 dB	< 0.3 dB	< 0.6 dB	> 55 dB	-40°C to 85°C	-40°C to 85°C

Fused Biconic Taper (FBT) Dual Window - Wavelength Flattened (Terminated Specifications)

	1 x 2	1 x 4	1 x 8	1 x 16	1 x 32
Maximum Insertion Loss (dB)	3.6	7.2	10.7	14.0	17.6
Maximum Uniformity (dB)	0.8	1.0	1.3	1.6	1.9
Maximum PDL (dB)	0.2	0.3	0.4	0.5	0.6
Center Wavelengths (nm)	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550	1,310 and 1,550

Engineering Standards and Technology

Fiber Optic Assemblies

Scope

This Engineering Specification is written to provide a summary of the performance criteria for terminated optical fiber connectors on optical fiber cable. This document will summarize product performance requirements based on the following established criteria: EIA/TIA-455, Fiber Optic Test Procedures (FOTP), and parts of Telcordia GR-326. This document may be revised, without notice, in accordance with standard Clearfield® document change procedures.

Note: Information in this document is proprietary to Clearfield and shall not be used, copied reproduced or disclosed in whole or in part without prior written permission of Clearfield.

General Product Descriptions

Optical Fiber:

- Singlemode full Spectrum fiber meets ITU-T G.652.D (06/05) specification. Reduced Water Peak (RWP) fibers are considered. Full Spectrum because the reduction of loss in the water absorption spectral region (the E band)
- Singlemode Bending Loss Insensitive optical fiber meets ITU-T G.657 Class A (12/06). Fully compliant with the G.652 singlemode fibers specification
- Multimode 50/125 µm Graded Index Optical Fiber meets ITU-T G.651 (02/98). Multimode 50/125 µm Graded Index Optical Fiber for the optical access network meets ITU-T G.651.1 (07/07)
- Optical fiber cable for the optical access network recommends a quartz multimode fiber to be used for the access network in specific environments
- Color Coding of Fiber Optic Cable must be in accordance with TIA/EIA 598-A

Fiber Optic Jacketing:

- All riser and plenum cables will meet requirements described in TR-NWT-000409. Fiber optic cable for plenum environments shall be NEC type OFNP and listed as UL 910. Fiber optic cable for riser environments shall be listed as NEC type OFNR and listed as UL 1666. Fiber optic cable for outside plant environments shall meet Telcordia GR-20 requirements

Connectors Optical Fiber:

- GR-326: Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies

Performance Requirements

The following specifications refer to terminated optical fiber connectors on optical fiber cable. All measurements performed using standard procedures with a non-contacting interferometer. Insertion Loss and Return Loss figures are measured using a launch cable meeting the criteria specified in WIO 900.

Applicable Documents

The following documents form a part of this specification to the extent defined herein. In the event of a conflict, this document shall govern:

Applicable Documents	
GR-326-CORE	Generic requirements for singlemode optical connectors and jumper assemblies, Issue 4
EIA/TIA-455	Fiber optic test procedures (FOTP), EIA/TIA
Clearfield® Drawing #17012	Connector end-face polish geometry, Clearfield®
Clearfield Drawing #17010	Specification for multimode connector end-face visual inspection criteria
Clearfield Drawing #17011	Specification for multimode connector end-face visual inspection criteria
ITU-T G.652.D (06/05)	Characteristics of singlemode optical fiber and cable
ITU-T G.657 Class A (12/2006)	Characteristics of a bending loss insensitive singlemode optical fiber and cable for the access network

CLEARFIELD

Minimum Performance Specifications for Terminated Singlemode Connectors

Connector Type	Ferrule Material	Polish Type	Ins. Loss Typical	Max. Ins. Loss	Min. Ret. Loss	Polish Radius (mm)	Fiber Height, Max.	Fiber Height Typical	Apex Offset	Polish Angle
ST	Ceramic	UPC	0.15 dB	0.30 dB	55.00 dB	7 - 25	±50 nm	±30 nm	< 50 μm	N/A
SC	Ceramic	UPC	0.15 dB	0.30 dB	55.00 dB	7 - 25	±50 nm	±30 nm	< 50 μm	N/A
FC	Ceramic	UPC	0.15 dB	0.30 dB	55.00 dB	7 - 25	±50 nm	±30 nm	< 50 μm	N/A
LC	Ceramic	UPC	0.15 dB	0.30 dB	55.00 dB	7 - 25	±50 nm	±30 nm	< 50 μm	N/A
D4	Ceramic	UPC	0.15 dB	0.30 dB	55.00 dB	7 - 25	±50 nm	±30 nm	< 50 μm	N/A
SC	Ceramic	APC	0.20 dB	0.30 dB	65.00 dB	5 - 12	±50 nm	±30 nm	< 50 μm	8.0° ± 0.3°
FC	Ceramic	APC	0.20 dB	0.30 dB	65.00 dB	5 - 12	±50 nm	±30 nm	< 50 μm	8.0° ± 0.3°
LC	Ceramic	APC	0.20 dB	0.30 dB	65.00 dB	5 - 12	±50 nm	±30 nm	< 50 μm	8.0° ± 0.3°
MPO/MTP*	Thermoplastic	APC	0.20 dB	0.35 dB	60.00 dB	N/A	N/A	N/M	N/A	N/A

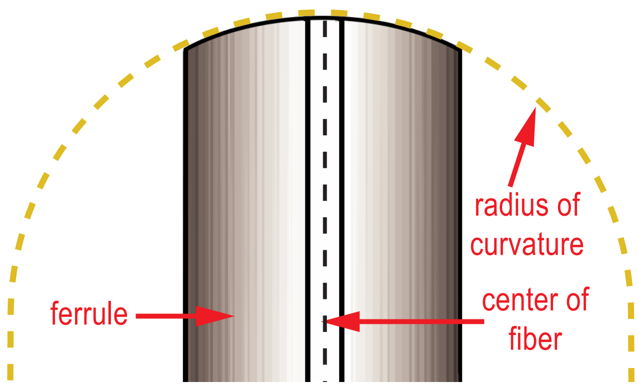
**MPO/MTP Connector Specifications are for 12 fiber cable assembly connectors*
Note: All Clearfield® fiber optic patch cords are designed and tested to operate between -40°C and 85°C.

Engineering Standards and Technology

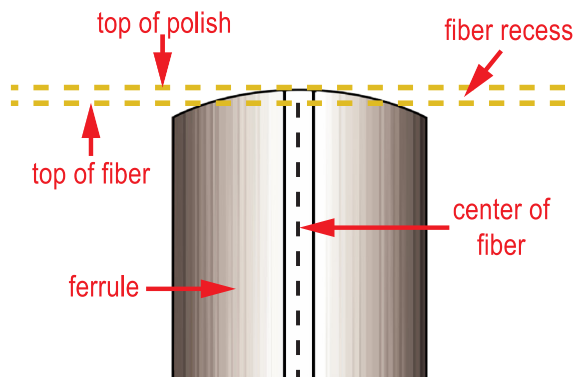
Fiber Optic Assemblies

CLEARFIELD

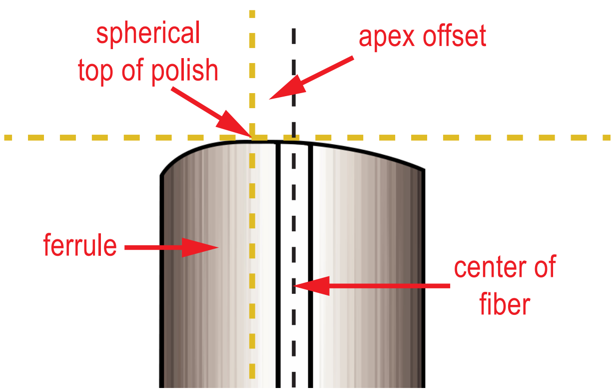
Specifications



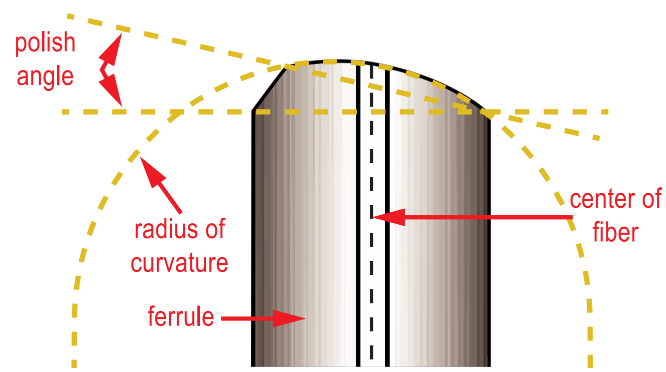
1.0 POLISH RADIUS
The radius of curvature is defined as the radius of the end-face surface as measured from the ferrule axis.



2.0 FIBER UNDERCUT / PROTRUSION
Fiber undercut or protrusion is defined as the distance between the top of the glass fiber as measured against the surrounding material in a spherical plane.
Undercut = -.02R3 + 1.3R2 - 31R + 325.



3.0 APEX OFFSET
Apex offset is measured as the distance between the spherical center of the polished end-face and the center of the fiber.



4.0 ANGLED POLISH
The end face is polished at an angle relative to the axis perpendicular to the ferrule axis.

What is IL?

Insertion loss (IL) is the loss of signal power resulting from the insertion of a device in a transmission line or optical fiber. Usually expressed as a ratio in dB relative to the transmitted signal power, it can also be referred to as attenuation.

What is RL?

Return loss or reflection loss (RL) is the reflection of signal power resulting from the insertion of a device in a transmission line or optical fiber. It is usually expressed as a ratio in dB relative to the transmitted signal power.

Test and Measurement

Your minimum requirements should include data that meets insertion loss and return loss (reflectance). Insertion loss should meet the 326-Core minimum of 0.4 dB, with reflectance meeting 55 dB for UPC connectors and 65 dB for APC. Asking the typical performance measures of a manufacturer's process can save you on link loss budgets over a long fiber run through a FTTH network.

Apex offset, the measurement for how well the center core of the fiber is centered in relationship to the spherical apex of the polished tip, minimizes lateral offset between two fibers and maintains a better physical contact. Apex offset describes a physical condition of the polished fiber, rather than a performance parameter. It is also an acceptance criteria for Telcordia. An excessive apex offset contributes to high insertion loss and high back reflection readings.

Fiber undercut or protrusion affects the physical contact zone. This metric measures, in nanometers, the height of the fiber under or below the ceramic end-face. Too much undercut minimizes the chance of a good physical contact, while too much protrusion causes excessive fiber deformation when mating occurs resulting in degradation of signal. When two connectors are mated, the ceramic compresses around the fiber core which allows the fibers to squeeze up and make good contact with each other. When they do not touch (because of too much undercut), an air gap is created and loss happens. If the fiber is protruding too far (beyond 50nm), chipping and cracking can occur during the mate.

Radius of curvature is the measurement of the connector end-face spherical condition. The radius generated affects the performance because the radius, when mated with another connector, should be compressing most of the material surrounding the core (ceramic ferrule). A proper radius, 5 to 12 micron, allows for the right compression and max performance. Too tight of a radius will put too much compression on the glass and too loose will put too much on the surrounding ferrule with not enough glass compression. Too much or too little radius can cause light scatter or inadequate physical contact for optimal signal transfer.

Apex offset, fiber undercut/protrusion, and radius of curvature are the main ingredients that work in concert to deliver good IL and RL performance. Processes that drift out of this geometry range can still yield acceptable IL/RL, but sensitive traffic will be affected (such as video) and long term performance of the connector will be compromised.

Your vendor should be able to provide these geometry test reports with on-hand interferometer testing. While you may not require this data for each and every connector, you should require that random testing is being performed to ensure the process is capable and not drifting out of spec. "Garage shops" will not be able to deliver this test data on demand.

Your test reports should account for each connector independently and not a total report that summarizes both ends.

End-face Quality & Cleanliness

Currently, there is not an industry standard for this topic. To be sure, end-face and cleanliness has a direct impact on the performance of the connector.

Several organizations (most notably, NEMI) have studied the impact of end-face defects and cleanliness. The influence of the contamination/scratches becomes more evident if they are located in the core/cladding areas. Particle contamination can cause a significant increase in IL (up to 10 times) and decrease in RL (up to three times). Scratches applied to the fiber contact zones 1a and 1b, which is an area from the core out to the cladding (125 µm), decreased RL by up to 25%. On the other hand, scratches located in the cladding layer showed little effect on IL and RL. Multiple heavy scratches passing through the core caused severe performance degradation in IL/RL and can be catastrophic.

Connectors with particle contamination will pass on contamination to mated connectors. Contaminant can prevent direct physical contact, creating an air gap. Multiply this by the number of re-mates over time and the problem spreads. Pits and scratches, in the critical contact zone 1a, will collect particulates over time and the same contamination-spread occurs. Long term reliability in dynamic circuits is severely reduced as opposed to those that are static. Scratches and polishing marks outside of critical contact areas are acceptable and do not have any impact on signal performance.

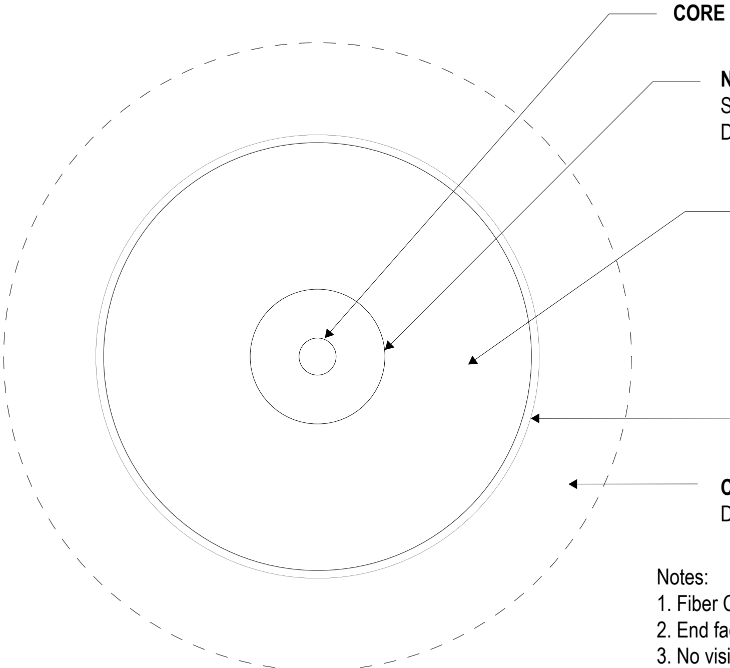
The quality fiber assembly manufacturers and OEMs will have their own inspection criteria. However, these specifications differ from company to company and the differences can cause materials to be "non-conforming" at user/customer sites.

Engineering Standards and Technology

End-Face

Singlemode

Acceptable Fiber End Face



CORE (9 µm shown)

NO DEFECT ZONE (0-25 µm)
Scratches: Fails if there are any scratches at all
Defects: Fails if there are any defects at all

CLADDING (25-115 µm)
Scratches: Fails if any width is more than 3 µm
Defects: Fails if any diameter is more than 5 µm
Fails if there are more than five defects
Exclude if the diameter is less than 2 µm

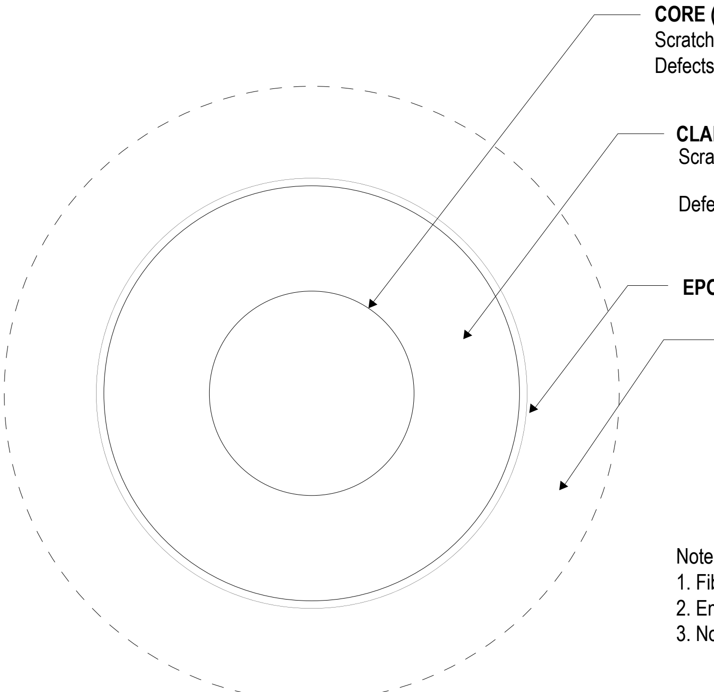
EPOXY RING (115-135 µm)

CONTACT ZONE (135-250 µm)
Defects: Fails if any diameter is more than 10 µm

Notes:
1. Fiber Core: 9 µm diameter
2. End face viewed at a minimum of 400x magnification
3. No visible contamination

Multimode

Acceptable Fiber End Face



CORE (0-65 µm shown)
Scratches: Fails if any width is more than 3 µm
Defects: Fails if any diameter is more than 5 µm
Fails if there are more than four defects

CLADDING (65-115 µm)
Scratches: No limit ≤ 5 µm
None > 5 µm
Defects: No limit < 5 µm
5 from 5 µm to 10 µm
None > 10 µm

EPOXY RING (115-135 µm)

CONTACT ZONE (135-250 µm)
Scratches: No limit
Defects: No limit < 20 µm
5 from 20 µm to 30 µm
None > 30 µm

Notes:
1. Fiber Core: 50 µm or 62.5 µm
2. End face viewed at a minimum of 400x magnification
3. No visible contamination