SENKO®
Advanced Components

Application Note

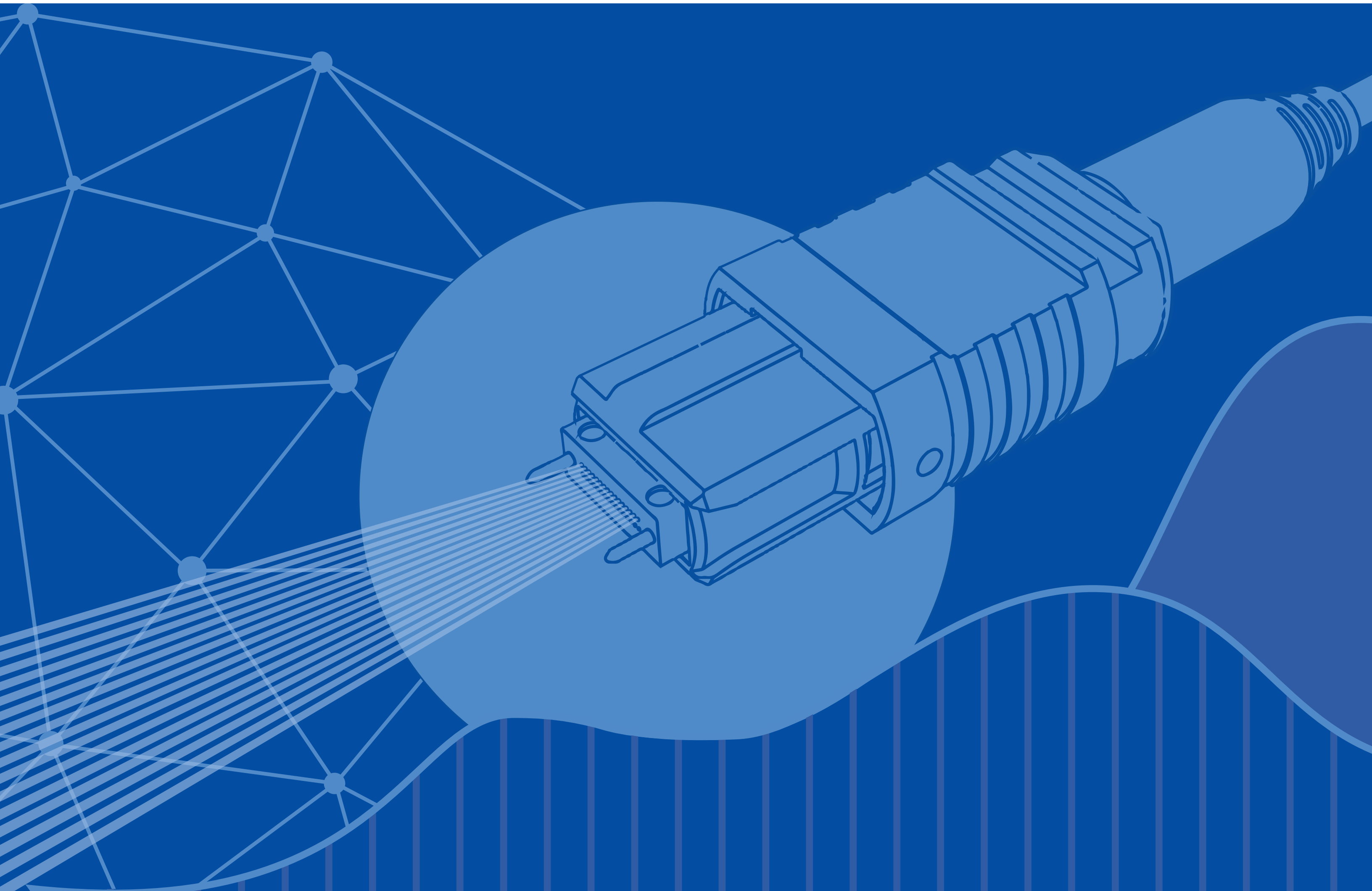
senko.com

MPO
Best Practices

DECEMBER 2023
Rev. 01

Issued by:
Engineering Department

Created by:
Andrei Vankov



MPO
Best Practices

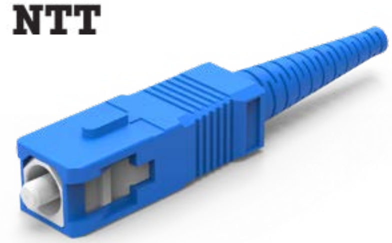
Contents

Purpose

In the late 1980s, Nippon Telegraph and Telephone Corp. (NTT) invented a physical contact connection technology that significantly improved the performance and reliability of fiber optic connectors. These connectors were named Single Fiber Coupling (SC) and Multifiber Push-On (MPO). The compact size and easy push-pull installation were major advantages of both connectors. The SC connector accommodates a single fiber, while the MPO connector is capable of terminating up to 72 fibers simultaneously. Since the early 1990s, MPO connectors have been widely adopted by carriers and data centers. This technology revolutionized global digital communication systems by simplifying interconnect routing. The ability to bundle multiple fibers onto a single connector is the greatest advantage of MPO connectors. In high-density scenarios, MPO connectors save space compared to duplex connectors or other alternatives.

For over twenty years, SENKO has been providing high-quality MPO connectors for various fiber optic applications. Their product range includes different MPO connector sizes and styles, MT ferrule grades, and MPO adapters that address various network challenges. You can explore the complete SENKO portfolio on their website.

NTT



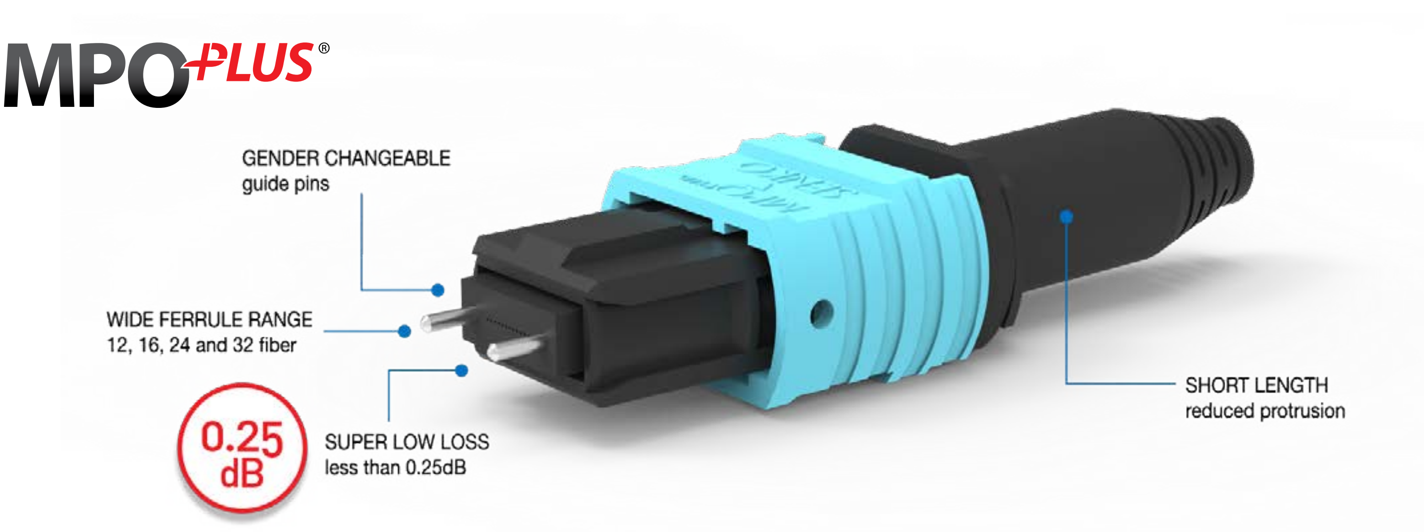
SC Connector

MPO Connector

MT Ferrule

While MPO connectors offer numerous advantages, particularly in crowded racks, they can be more challenging to terminate, polish, and test compared to ceramic ferruled connectors. Since multiple fibers are housed in a single ferrule, maintaining the cleanliness of the connector can also be a challenge.

Lastly, there is often a question about why MPO connectors are sometimes referred to as MTP®. The answer lies in the fact that MTP® is an acronym for Multi-fiber Termination Push-On, which is a registered trademark of US Conec. The MTP® connector is essentially an MPO connector. Both MTP® and MPO fiber optic connectors comply with the international Fiber Optic Connector Intermateability Standards "IEC-61754-5" and the North American "TIA-604-5 (FOCIS-5)", ensuring full compatibility between the two.



Termination

In this paper, we will omit the detailed description of the ribbon making process, as it is planned to be covered in future works. The process begins with the insertion of a fiber ribbon into an MT ferrule. The essential steps of this process are outlined in SENKO's Application Note titled "*MT Ferrule Epoxy Injection Techniques*," which can be accessed here.

The paper emphasizes the significance of injecting the correct amount of epoxy, as it plays a crucial role in securing all the fibers while ensuring that excess epoxy is neither deposited on the sides of the ferrule nor protruding over the MT ferrule window. Selecting the appropriate epoxy type and achieving the proper amount are essential factors in this process.

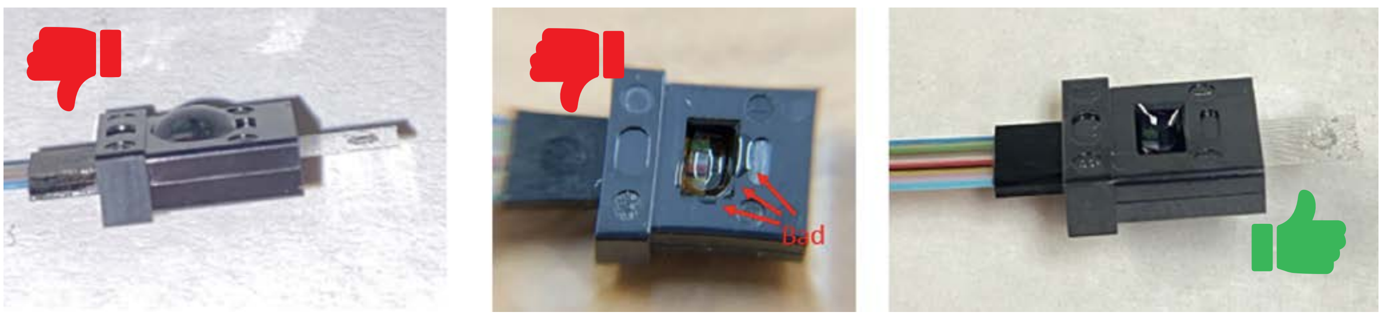


Figure 1 *MT Ferrule epoxy amounts: excessive vs correct on the right.*

What other factors should be considered? The tolerance of the MT ferrule's guide pin and fiber holes is important. SENKO provides two types of ferrules with their MPO kits: Standard and Super Low Loss. The primary distinctions between the two lie in the tolerances for individual fiber holes [1] and guide pin holes [2]. The tolerances for the Low Loss grade are notably stricter. The misalignment of fiber cores along the axis is the primary contributor to connection loss in MPO connectors. Theoretical calculations indicate that to achieve a target connection loss of, for example, ≤ 0.5 dB, the total fiber cores misalignment must be ≤ 1.6µm, with an allowable stackable tolerance for the fiber positions and guide pins of ≤ 0.8 µm per ferrule. Based on tolerance analysis results, the practical permissible axis misalignment that meets the target loss of ≤ 0.5 dB was set at ≤ 0.9µm per ferrule.

In the past, the manufacturing techniques for MT Ferrules and the sizes of fiber ODs were limited by available materials and molding technology. As a result, the tolerances were not as tight as they are today, which posed challenges in meeting the demand for low optical losses. However, with advancements in technology, the tolerances between the fiber ODs and the MT ferrule IDs have significantly improved.

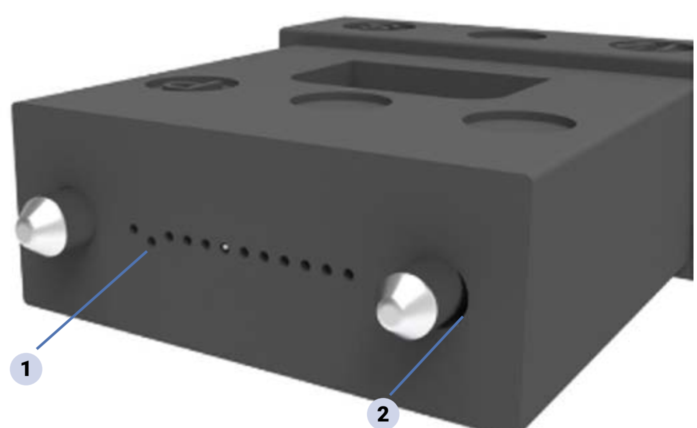


Figure 2 *MT ferrule tolerances.*

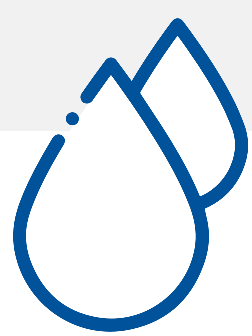
These tighter tolerances now enable successful termination, with insertion losses expected to be below 0.35 dB per channel, regardless of the number of channels. To achieve this, it is crucial to ensure that the ferrule axis misalignment between the fibers is ≤ 1.40 µm, in addition to employing proper termination and polishing techniques. Specifically, for individual Low Loss MT ferrules, the overall fiber misalignment should be ≤ 0.70 µm. In order to efficiently terminate ferrules with such tight tolerances, SENKO offers the following suggestions that will simplify the manufacturing process:

Simplify the Manufacturing Process:

A **Fibers** Ensure that the ribbon contains fibers of the highest quality, manufactured by a reputable supplier. SENKO provides global support to its customers and has discovered that certain fibers may have OD tolerances slightly higher compared to the average variations from the world's most widely used fiber suppliers. When these individual fibers are formed into a ribbon, if even one fiber exceeds 125.0 µm by a few tenths of a micron, it can prevent the entire ribbon from being inserted into the ferrule. SENKO's Low Loss MT ferrules are specifically designed to accommodate fibers with world-class OD tolerances. Even with these high-quality fibers, the insertion fit with an MT Low Loss ferrule will be noticeably tighter compared to a standard ferrule. This tighter fit is normal and precisely how it should be. Additionally, the concentricity of the core relative to the fiber OD is important for good performance. If the core is not centered, this will lead to poor performance.

B **Cleaving** Once the ribbon is ready for insertion into an MT ferrule, it is always better to cleave the fiber ends evenly using a ribbon fiber cleaving device, rather than cutting them with scissors or cutters. Scissor cuts can result in uneven and cracked fiber ends, which poses additional challenges during insertion, particularly for tighter tolerance ferrules.

C **Cleaning** After cleaving, it is necessary to clean the bare fibers with lint-free wipes and isopropyl alcohol to remove any remaining residue and other contaminants, even if the fibers were previously cleaned after the stripping process.



Fiber Cleaving Process - *Automated Cleaving vs Manual*

After termination and epoxy curing, prior to starting the polishing process, SENKO recommends using automated fiber cleavers, which are particularly advantageous when cleaving MT ferrules. In a typical manual operation, a curved scribing is performed just above the epoxy bead that has a naturally curved shape. This manual cleave requires careful handling and is time-consuming, followed by flattening the curve of the epoxy with fibers. This process is necessary to prevent fiber breakage below the ferrule surface before polishing.

In contrast, an automated cleaver uses a laser to cut wider, resulting in a flat surface with more uniform fiber protrusion. Alternatively, automated mechanical cleavers with rotating blades are equipped with precision adapters to ensure accurate and reproducible positioning of the ferrules during cleaving, leading to highly consistent fiber heights. Both, laser and automated mechanical cleaving, eliminates fiber nubs, and the resulting perfect flat planar surface significantly reduces the potential for fiber breakage. Additionally, it drastically reduces the air-polish time required before starting the automated polishing process. See figure 3.

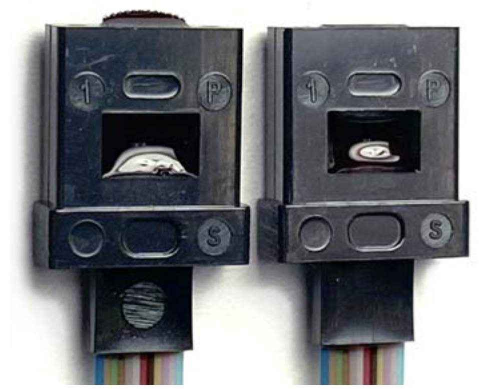


Figure 3 *MT ferrule manual cleave (left) vs automated cleave (right).*

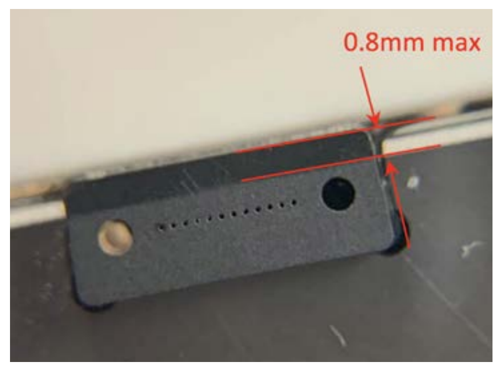


Figure 4 *MT/APC Ferrule allowable flat area after polishing.*

Polishing MT/APC

It should be emphasized that Low Loss and other single-mode MT ferrules require angled polishing. The detailed process for MT/APC single-mode polishing is described in SENKO's Application Note titled "*Direct MT Angle Polishing for MT Flat Ferrules,*" which can be accessed here.

This paper discusses key factors for achieving successful polishing outcomes, starting from the termination process, proper mixing and application of epoxy, to polishing in the most efficient manner without using a flat MT fixture prior to transitioning to an MT/APC fixture for MT/APC polish. Control of ferrule length is crucial, and it is important not to over-polish. Over-polishing can affect the length of the ferrule, thus impacting the force required to ensure proper physical contact between mated end-face fibers. According to IEC 61754-7, the unpolished (flat) area of an angle-polished ferrule (single-mode) should not exceed 0.8 mm. Measuring this area can be challenging, and it is not recommended to remove the ferrule from the polishing fixture for measurement.

Creating an APC angle is achieved in the initial step, typically using 15 µm or 30 µm SiC lapping film. A general guideline is to polish in this first step until the angle slightly passes the guide pin holes, which can be checked at 20-30 second intervals.

MT Geometry Challenges

MT geometry is specified in the document titled "Fiber optic connector optical interfaces" (IEC 61755-3-31). This document provides detailed parameters such as Minus Side Coplanarity, ferrule X and Y angles, Fiber height, Adjacent fiber height, Geometry Limits (GL), and more.

Minus Side Coplanarity refers to the distance between the lowest fiber and the "best-fit plane" through the array of fibers. It measures the variation in fiber height within the fiber array. A lower number indicates better uniformity, with an ideal value of "0" indicating that all fibers are the same height. Fiber height differential is a related measurement that indicates the maximum allowable difference between the highest and lowest fibers in the array.

Geometry Limit (GL) is a parameter developed to estimate the minimum normal force required to achieve physical contact across a mated fiber array. It depends on factors such as ferrule angle X, Minus Side Coplanarity, and fiber tip radius of curvature. It is possible for ferrules with angles close to 0.15 degrees to pass GL, while ferrules with smaller angles may fail GL. According to IEC 61755-3-30 standard, GL is measured for multifiber connectors with more than 2 fibers, and only in cases where more than half of the fibers have negative Core Dips. GL is a calculated metric that considers the x-slope angle, coplanarity, and fiber tip radius in comparison to the defined ferrule compression force. In single-mode MT ferrules, where core dip is small and practically non-measurable, GL is omitted. However, for multimode (MM) ferrules with larger cores that are softer due to Germanium doping, GL is a practical value.

This explains why the Geometry Limit may be displayed in the interferometry report in some cases and not in others. The software representation of measured values depends on the chosen calculation standard. For example, in IEC 61300-30/Ed1 SM, the software shows the radius of curvature (RoC) for each fiber and does not calculate GL (shows N/A). In IEC 61300-30/Ed1 MM, the software shows Core dip for each fiber and does not calculate GL (shows N/A). In IEC 61300-30/Ed2, if the core dip value is less than 10 nm, the software shows the fiber RoC value (core dip - N/A). If the core dip value is greater than 10 nm, the software shows the core dip value (RoC - N/A). GL is calculated when more than half of the fibers have RoC, otherwise it is marked as N/A and not shown in the latest software versions.

The overall fiber height specified in IEC 61755-3-31 ranges from 1000 nm to 3500 nm, which is quite broad. Parameters like Minus Side Coplanarity and Fiber height differential are influenced by the overall fiber height. Generally, as the overall fiber height increases, fiber height variation also increases. This means that lower overall fiber height results in lower variation in fiber height, Minus Side Coplanarity, and differences between fiber heights. SENKO recommends keeping MT fiber height in the range of 1800 to 2200 nm. Adjusting the overall fiber height is a relatively simple modification that requires minimal changes to just one step in the existing polishing process.

Maintaining the MT ferrule X and Y angles is straightforward when using a high-quality polishing fixture and ensuring no epoxy is present on the surface or above the MT window. The quality of the polishing fixture can be assessed by running epoxy-less blank MT ferrules through the polishing process and testing the angles interferometrically upon completing the polishing steps.

Special Glass Plate for MT Polish

During polishing if the lapping film does not have adhesive called "PSA backing" it could slide out of the polishing glass plate. SENKO recommends using a special glass plate for MT ferrules with tacky surface that helps keeping the polishing film in place. SENKO part number PG5X-490-SR3/3.

Cleaning Tips

Another challenge encountered during and after the polishing process is cleaning. The use of slurry chemicals creates a mixture of particles, including epoxy and ferrule plastic material, which tend to adhere to every cavity, particularly the guide pin holes. Thoroughly cleaning the polishing fixture after each process step is essential, preferably utilizing pressurized deionized water. This approach helps minimize process variables associated with contamination.

Figure 5 *MT ferrule brush for guide pin holes.*

After the final polishing step, it is highly recommended to utilize SENKO's MT Guide Pin Hole Brush, PN SCK-SS-MPO-GPB. This specialized brush is designed specifically for cleaning the guide pin holes of MT ferrules. The bristles easily slide into the guide pin hole openings, effectively removing slurry particles trapped inside. The soft bristles and thoughtful design of the guide pin hole brush ensure that no damage is caused to the guide pin hole openings, while greatly facilitating the testing process.

The final recommendation is to conduct a visual inspection immediately after cleaning the ferrules and removing them from the polishing fixture. It is important to note that once the ferrule endface dries out, it can be challenging to remove new advanced slurries, such as based on SiO2. During visual automated inspection, slurry particles may appear as dark spots on the fiber, causing the automated visual software scan to register them as non-removable defects. However, these defects are removable, and the best approach is to remove them while they are still wet. In cases where the slurry particles have dried out, SENKO's cleaning felt (PN LFFCL-000-50R-P) is the recommended tool to use. This felt resembles a lapping polishing film and is typically employed for 15-20 seconds with distilled water, using the same pressure settings as the last step in the polishing process.

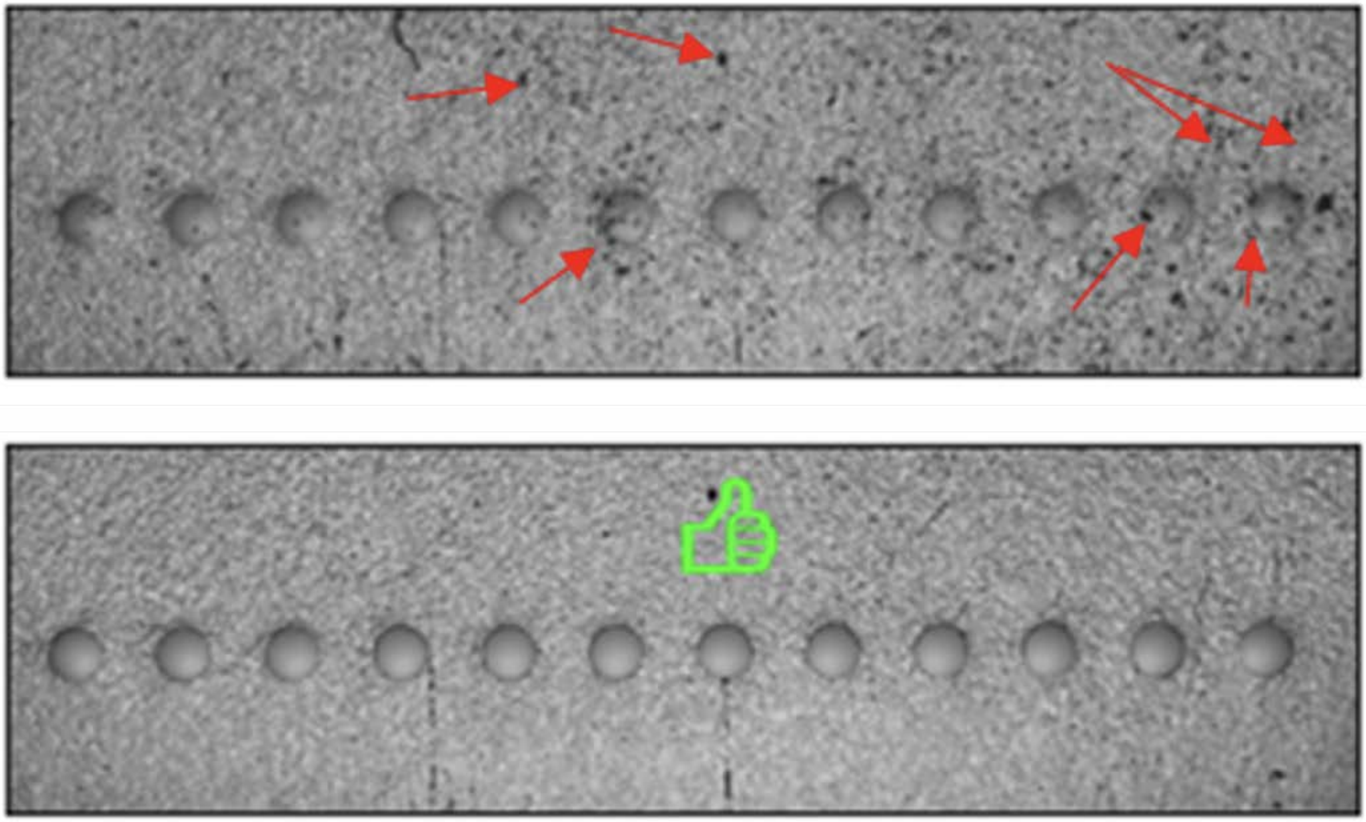


Figure 6 *Leftover SiO2 particles on top image.*

Connector Assembling

Try to insert the guide pins straight into the ferrule from the back for male connectors. Inserting the guide pins at an angle into the guide pin holes may damage the ferrule.

Figure 7 *Proper pins Insertion - straight.*

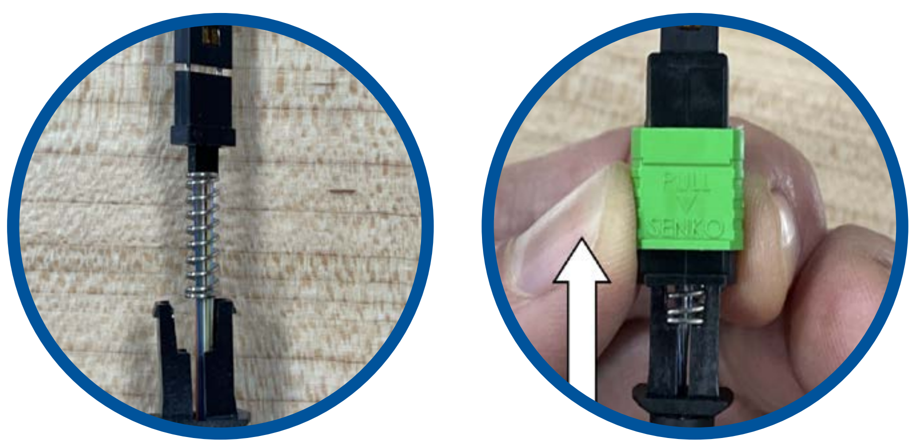


Figure 8 *Proper usage of MT male dummy ferrule to aid MPO housing installation.*

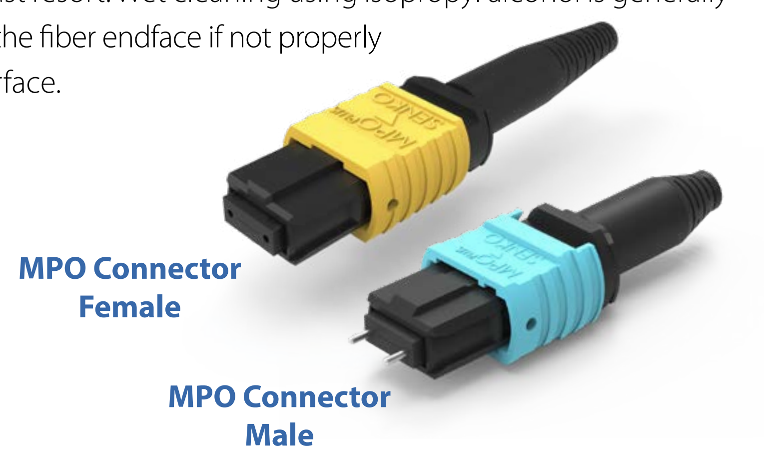
It's advisable to use an MT Male dummy ferrule as a guide to slide the MPO outerhousing

Cleaning and Testing

During testing, both the Master Reference cable and the tested connectors will require cleaning. There are two options available: dry cleaning or wet cleaning. Dry cleaning typically involves using an Optipop cassette-style cleaner without isopropyl alcohol. Male connectors should be cleaned with two passes to ensure thorough cleaning of the ferrule endface. Optipop for Male MPO connectors includes grooves that accommodate the male pins. The cleaning passes should be completed at slight angles, as depicted in the picture below in figure 9.

Figure 9 *Male MPO proper cleaning using Optipop cassette.*

Female MPO connectors are cleaned using an Optipop without grooves, typically with two passes on two new cassette surfaces. For MPO connectors with 16 or more fibers, SENKO recommends dry cleaning. Dry cleaning can be performed using Optipop PN CRE-03 for Male MPO connectors and PN CRE-01 for Female MPO connectors, or Optres Gel Cleaning Pad (PN SCK-PT-MPO-01) for both genders. For traditional 12-fiber MPOs, a combination of wet and dry cleaning is acceptable, as there is a lower risk of scratching the fibers due to the lower fiber count but is recommended as a last resort. Wet cleaning using isopropyl alcohol is generally more effective but carries a higher risk of damaging the fiber endface if not properly dried, as particles can be more mobile on a wet surface.



Sometimes, inconsistent optical loss readings may occur during repeatable testing, indicating a variation of ± 0.15-0.20dB per channel. In such cases, the following checks can be performed:

Troubleshooting Inconsistent Optical Loss Readings:

A **Geometry** Ensure that the reference cable and the connector under test comply with the latest requirements of "Fiber optic connector optical interfaces" (IEC 61755-3-31). It is practically impossible to polish an array of fibers to the exact same heights, and there will always be some deviation in height between the fibers. However, when the fibers and ferrule are mated and under load, they experience a degree of compression and distortion that allows for sufficient fiber-to-fiber contact to be achieved. Therefore, maintaining consistent fiber height, ferrule flatness, and angularity is crucial to comply with the IEC 61755-3-31 standard.

B **Spring** Once the test equipment is set up and referenced, it is important to ensure that high-count MPO connectors, such as MPO-16, 24, 32, and higher, typically use a 20N spring, while MPO-12 connectors use a 10N spring. It is essential to verify that your MPO connector kit contains the appropriate spring load for the specific connector type.

C **Pins** Senko offers SM Grade, SM Super Low Loss grade, MM Grade, and MM Super Low Loss grade pins. These pins are available in sizes to fit both 12/24 fiber center key MPO connectors and 16/32 fiber offset key connectors. It is important to select the appropriate pin sizes for the specific fiber count, as the pin sizes differ significantly between 12 and 16 fiber counts. Ensure that the correct pins are selected accordingly. Refer to figure 10 for dimensional differences between MPO-12 and MPO-16.

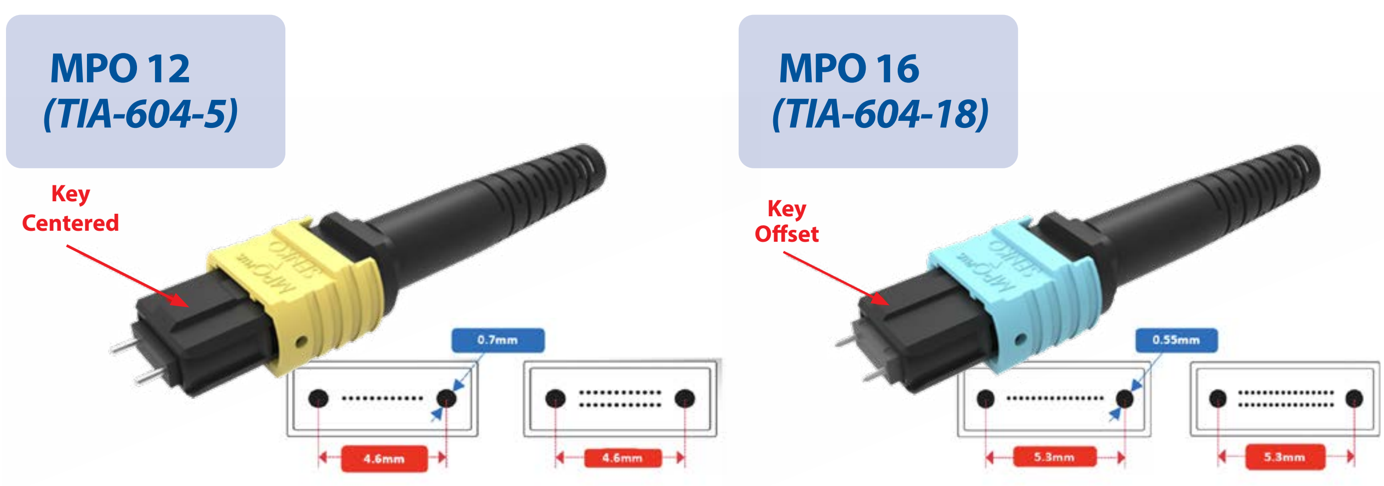


Figure 10 *MPO-12 vs MPO-16 Dimensional Differences*

MPO Maximum Loss per Channel vs Mean Loss per Connector

SENKO supports that the criteria for Insertion Loss (IL) should be based on Random mating, as described in the document IEC 61753-1 titled *"Attenuation of Random Mated Connectors."* This document defines a minimum number of channels below allowable maximum IL value in percentage (97%) for randomly mated connectors in a field setting and categorizes them into four different grades. It is important to note that the IEC 61753-1 categorizes connection performance grades for single-mode and multimode jumpers in a controlled environment and for ceramic ferrules only at the time of publishing this work.

The standard provides four grades for IL, ranging from A (best) to D (worst), as well as grades for Return Loss (RL), ranging from 1 (best) to 4 (worst). Grade "A" is not officially ratified by the IEC document, but it is likely to have similar optical performance as reflected in Table 1 below.

Table 1 *IEC 61753-1 proposed ceramic ferrule grades.*

Attenuation Grade	Attenuation Random Mated IEC 61300-3-34	
Grade A*	≤ 0.07 dB mean	≤ 0.15 dB max. for >97% of samples
Grade B	≤ 0.12dB mean	≤ 0.25 dB max. for >97% of samples
Grade C	≤ 0.25 dB mean	≤ 0.50 dB max. for >97% of samples
Grade D	≤ 0.50 dB mean	≤ 1.00 dB max. for >97% of samples

Return Loss Grade	Return Loss Random Mated IEC 61300-3-6
Grade 1	≥ 60 dB (mated) and ≥ 55 dB (unmated)
Grade 2	≥ 45 dB
Grade 3	≥ 35 dB
Grade 4	≥ 26 dB

Specification	Each-to-Each Values	Budget for 10 Connections
Grade 1	approximately 0.2 dB *(possibly higher if different manufacturers are combined or unadjusted connectors are used)*	approximately 2 dB *(unclear range of tolerance)*
Grade 2	Mean ≤ 0.25 dB, max. ≤ 0.50 dB	≤ 2.5 dB
Grade 3	Mean ≤ 0.12 dB, max. ≤ 0.25 dB	≤1.2 dB
Grade 4	Mean ≤ 0.07 dB, max. ≤ 0.12 dB	≤ 0.70 dB

* *Note, Grade A is not specified at time of writing, but assumed to be as shown*

It is important to note that the IEC 61753-1 document was developed specifically for ceramic ferrules and not for MPO connectors. However, SENKO believes that its principles can be applicable to MPO testing. MPO connectors typically have a minimum fiber count of 12. When a connector manufacturer states that the MPO connector's maximum loss is, for example, 0.5dB, this typically refers to being tested against a Master Grade assembly. See paper "Random Mating IL versus IL by Master Jumper".

In a random mating condition, it is more practical to consider the mean result among the same interconnect with an allowable double value from 0.5 dB, which would be 1.00 dB in a few channels. This approach allows for greater deployment of the product, as it accounts for the possibility of a few channels slightly exceeding 0.5 dB while remaining below 0.5 x 2 = 1.00 dB in over 97% of the readings. By using this method, the loss expectations align with real-world scenarios when considering that today's transceivers' dynamic ranges and that it is more likely that the tested MPO connector will perform reliably.

Below is another example of the random mating study. Let's assume that MPO Grade B specifies a maximum loss per channel of 0.35 dB, while Grade C specifies a maximum loss of 0.50 dB. In Grade B, a few channels exceeded the maximum stated loss of 0.35 dB, but over 97% of the channels measured were under 0.35 dB, with the mean value below 0.35 dB.

Table 2 *Example of compilation of random mating data.*

Grade	IL (dB)				Result
	Pass Rate		Mean		
	1310nm	1550nm	1310nm	1550nm	
Grade B Mean ≤0.35 dB MIN 95% < 0.35 dB	98.06%	97.08%	0.15	0.11	PASS
Grade C Mean ≤ 0.5 dB MIN 95% < 0.5 dB	100.00%	100.00%			PASS

At SENKO, we continually strive to push the limits of our MT ferrule technology to achieve lower losses. When determining your network budget requirements, it is crucial to understand the optical losses that are necessary. While using top-of-the-line premium MT ferrules can help achieve the lowest loss, it may not always be required. However, utilizing SENKO MT low loss ferrules compared to standard ones will reduce the average loss in random mating by half.

MPO Optical Testing Troubleshooting

Testing cables with MPO connectors can be challenging. Below is a recommended troubleshooting guide for high optical loss.

Troubleshooting Inconsistent Optical Loss Readings:

1. **MPO Equipment Reference Error** A bad reference in your test equipment will result in bad measurements. Check and ensure the equipment reference is correct. The reference may be contaminated which is the leading cause of failure with fiber optic interconnect. Check your detector adapter for contamination as well, this is an area often overlooked.

2. **Cleanliness of MPO endfaces** Always inspect the MPO connectors first using an inspection scope. This includes the one in the adapter, and the one that is connecting to it. After inspect, be mindful of the MPO as any contact end-face can lead to debris. You don't need to clean a connector if it's already clean, as cleaning a clean connector could accidently make it dirty. Only use fiber optic grade cleaning products to clean the end-face.

3. **Polarity** Polarity refers to different possible fiber paths in ribbon cables. Ensure proper polarity validation. Currently there are four types of polarity for MPO jumpers:
   Type A (Straight)
   Type B (Reversed)
   Type C (Cross Pair)
   Type U (Universal System)

   SENKO offers a few polarities verification equipment's that can check polarity type and channels continuity fast and efficiently. If the polarity is wrong, you may see no power at the receiver or detector.

4. **Proper MPO Assembly** per relevant manufacturing procedure with no induced bends on the fiber. Any fiber that is bent due to improper strip length, crimping or assembling will manifest itself with the optical loss on higher wavelength (such as 1550nm) being consistently higher compared to lower wavelength (such as 1310nm). If the lower wavelength is higher this typically is an indication of misalignment.

5. **Pins** correct pins in the male connector are used with specified tolerance avoiding concentricity error. Never use MM pins in SM connectors.

continued on page 15

Troubleshooting Inconsistent Optical Loss Readings *continued*

6 **Pin holes** must be clean and free of any debris. This debris can cause severe misalignment and even air-gaps

7 **Fiber Geometry** MPO connectors are polished so that the fibers evenly protruded so when mated the fibers have physical contact. For this the geometry must be compliant to IEC 61755-3-31:2015 standard.

8 **Check Your Adapter** Some adapters have opposing keys, and some align the keys. Ensure that when mating your connector make note of the key direction and that it would align with the direction of the APC angle.

Conclusion

SENKO offers a wide range of MPO interconnects designed to meet the GR-1435-CORE requirements for multi-fiber optical connectors. SENKO MPO kits incorporate numerous technological features, making them industry-leading in terms of design and performance. These connectors boast SM and MM super low loss and standard MT ferrules, which are manufactured in Japan by the pioneers in MT ferrule technology.

SENKO provides a comprehensive lineup of MPO connectors and solutions for various applications and operating environments, ranging from Data Centers to outdoor harsh environments. SENKO MPO connector design includes patented features that facilitate easier termination and installation, enhanced precision, proven reliability, and significant performance improvements compared to the competition. Furthermore, SENKO MPO connectors have user-friendly outer housings with a unique back post design, allowing for easy assembly and hassle-free removal for rework. The MPO kits are available for various diameters of flat and round cables.

In addition, SENKO offers a line of MPO interconnects with changeable gender (male to female and vice versa) and polarity types from A to B or B to A in a simple and straightforward manner. Typically, changing the gender and polarity of standard MPO connectors in the field is not recommended for installers, as it usually requires removing the MPO outer housing with special tools, which can be difficult, especially with crimped cable jackets. Apart from the level of difficulty, changing the gender and polarity can potentially damage the exposed fiber when attempting to replace the connector housing. However, when the need arises to change these factors, SENKO provides MPO adapters that can change polarity and connectors that can change gender in seconds, ensuring and efficient and easy switch.

Please visit SENKO's homepage to learn more about the MPO product line, or view the full MPO Plus catalog here.

At SENKO, we encourage our customers to invest in quality connectors that not only incorporate the latest technological advancements but also align with their specific optical budget requirements. For further information or technical support, please contact your local SENKO representative or email us at **sales@senko.com**.

Contact SENKO

References

1. IEC 61754-5:2005 Standard Fibre optics - Fibre optic connector interfaces - Part 5: Type MT connector family

2. TIA-604-5 FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO

3. IEC 61754-7-3:2019 Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 7-3: Type MPO connector family

4. IEC 61755-3-31:2015 Fibre optic interconnecting devices and passive components

5. IEC 61753-1:2018 © IEC 2018 Fibre optic interconnecting devices and passive components - Performance standard – Part 1: General and guidance

6. IEC 61300-3-4. Edition 3.0 2009-01 Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation of random mated connectors

7. Telcordia Technologies Generic Requirements for Multi-Fiber Optical Connectors GR-1435-CORE

8. MT Ferrule Epoxy Injection Techniques, SENKO Application Note, Released Date: April 6th, 2021

9. Direct MT Angle Polishing for MT Flat Ferrules, SENKO Application Note, Released Date: February 19th, 2021

10. The Importance of Proper Cleaving for Fiber Optic Connectors, SENKO Application Note, Released Date: February 24th, 2022

11. The Relationship between Insertion Loss and Premium Ferrules, SENKO Application Note, Released Date: February 26th, 2021

12. SENKO MPO Catalogue https://www.senko.com/wp-content/uploads/2021/09/MPO-Plus-Brochure-2022_pages.pdf

Biography

Andrei Vankov, is an Application Engineer at SENKO Advanced Components. He received his BS from Thomas Edison State College and his MSEE from Pennsylvania State University. He began his career in 1993 at Sumitomo Electric Lightwave Corp as a Fiber Optic Manufacturing Engineer where he worked on active and passive components using Kaizen methods in Yokohama, Japan. As a Senior Optical Design Engineer in Franklin, MA (founded as Advanced Interconnect) Andrei Vankov developed various passive optical components and packaging integration to meet Telcordia industry standards. He designed optical interconnects, including optical backplanes (MTP, HBMT, PHD, OGI), and a fiber optic SMPTE compatible Broadcast Connector for HD applications. In 2013-2020 Andrei worked at Nokia division Radio Frequency Systems (RFS) where he provided leadership for an LTE RAN launch project team. Andrei holds several US and European Patents in fiber optics interconnect technology.

SENKO®
Advanced Components

CALL 1-888-32-SENKO

America
USA EAST 1-888-32-SENKO
USA WEST 1-858-623-3300
TEXAS 1-972-661-9080
Sales-Americas@senko.com

Asia
HONG KONG +852-2121-0516
SHANGHAI +86-21-5830-4513
SHENZHEN +86-755-2533-4893
Sales-Asia@senko.com

Europe
UK +44 (0) 118 982 1600
ITALY +39 011 839 98 28
POLAND + 48 71 396 36 59
Sales-Europe@senko.com

South America
BRAZIL +55-21-3736-7065
Sales-Brazil@senko.com

Japan
TOKYO +81 (0) 3 5825-0911
Sales-Japan@senko.com

Asia Pacific
AUSTRALIA +61 (0) 3 9755-7922
Sales-Asia-Pacific@senko.com

Middle East North Africa
DUBAI +971 4 8865160
Sales-MENA@senko.co

www.senko.com