Applications Engineering Notes

Document Title	US Conec Recommended MT Ferrule Endface Geometries
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1.0 Background

Ferrule and, ultimately, connector performance is highly dependent on the overall end face geometry to achieve physical contact. For this reason, IEC SC86B WG6 continues to study the influence of various end face parameters on connector performance. For SM 8º angled physical contact (APC) ferrules, the IEC has released the International Standard (IS) IEC 61755-3-31. It identifies end face geometry parameters and dimensional limits for 4 through 12 fiber rectangular end face ferrules to ensure effective performance. The IEC end face geometry parameters and dimensional limits are shown in Figure 1 and Table 1, respectively. The MM optical interface IS is in early development, but separate guidelines do not currently exist for MM. Therefore, SM specifications are generally accepted as a guideline for MM applications.

During the IEC end face geometry analysis and standard development, new parameters have been introduced. This includes three new parameters called minus-side coplanarity (CF), geometry limit (GL), and fiber tip spherical radius (RF).

IEC defines CF as the unilateral distance from a least squares fit line through the array of protrusions, to the minimum height fiber. It allows for more variation in fiber protrusion without impacting performance.

IEC defines GL as being a calculated merit function, which relates x-slope angle (SX), minus-side coplanarity (CF), and fiber tip spherical radius (RF) in comparison to the defined ferrule compression force. It is a mathematical function of these three parameters and can be used to quantitatively assess the acceptability of an end face.

IEC defines RF simply as the spherical radius of the individual fiber tips.

An additional parameter, core dip, will exist in the MM optical interface IS. At this time, no values are recommended for core dip as much work still needs to be done with the correlation of interferometric measurements and performance. US Conec recommends that the core dip parameter currently reported through interferometry reports be monitored only for process stability and to use return loss measurements to determine proper physical contact is being maintained between mated cores.

2.0 End Face Geometry Recommendations

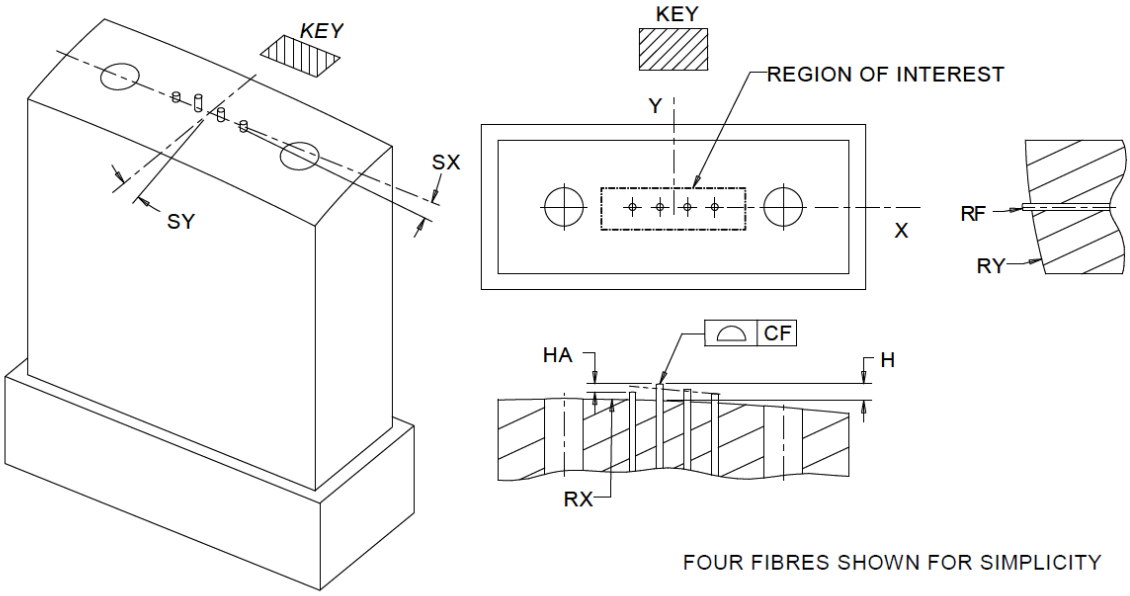

Figure 1. End face geometry parameters as defined by IEC 61755-3-31

PARAMETER	REMARKS	IEC 61755-3-31	
		MIN	MAX
CF	Minus Side Coplanarity	-	0.4 µm
SX	Ferrule Surface X-angle	-0.15º	+0.15º
SY	Ferrule Surface Y-angle	7.8º (-0.2º*)	8.2º (+0.2º*)
H	Fiber Height	1 µm	3.5 µm
HA	Adjacent Fiber Height	0	0.3 µm
RF	Fiber Tip Spherical Radius	1 mm	-
RX	Ferrule Surface X-radius	2000 mm (convex) |-10,000mm| (concave)	-
RY	Ferrule Surface Y-radius	5 mm	-
GL	Geometry Limit	-	22.6 (4 fiber) 17.9 (8 fiber) 17.4 (12 fiber)

* Indicates US Conec recommended MM values, which are not currently specified by IEC.

Table 1. End face geometry parameters and dimensional requirements

Appendix A Guidance on MT Ferrule Length (Post-Polish)

A common question associated with end face geometry is the proper overall length of the MT ferrule after polishing. An over-polished/short ferrule situation can impact the performance in two ways: (1) the potential for inadequate spring force, which is key to achieving physical contact and/or (2) the fiber hole position (i.e. eccentricity) begins to deviate as you move away from the front face of the ferrule, where the accuracy is the highest. Therefore, continuing to polish the ferrule, hoping to improve the optical performance results, will typically only make matters worse. The following sets of figures and tables provide guidance on acceptable MT ferrule length.

Note: The overall MT ferrule length can only be measured if the MTP housing is removed. If the MTP housing is in place, the location of the back end of the ferrule cannot be properly located.

Note: Figure 3 and Figure 4 give guidance on the remaining "endface flat" (Dimension T) associated with APC MT ferrules. This is consistent with industry standards TIA-604-5, TIA-604-18, and the IEC-61754-7-x family of documents. Two images are shown in each figure to illustrate how Dimension T decreases after polishing.

Figure 2. Flat MT Ferrule (PC)

	Dimension L (mm)	
Description	**Minimum**	**Maximum**
Unpolished	8.0	8.15
Post-Polish	7.9	8.1

Table 2. Acceptable dimensions (PC)

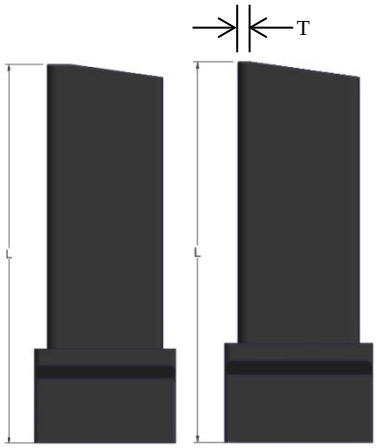

Figure 3. Angled MT Ferrule (APC, Pre-Angled, 1-Row)

		Dimension L (mm)		Dimension T (mm)	
Figure Number	**Description**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
3a.	Unpolished	8.0	8.1	---	---
3b.	Post-Polish	7.9	8.1	---	0.8

Table 3. Acceptable dimensions (APC, Pre-Angled, 1-Row)

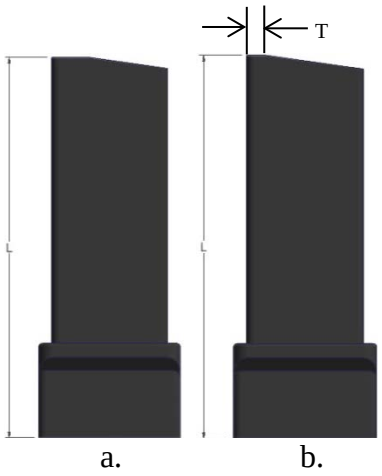

Figure 4. Angled MT Ferrule (APC, Pre-Angled, 2-Row)

		Dimension L (mm)		Dimension T (mm)	
Figure Number	**Description**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
4a.	Unpolished	8.0	8.1	---	---
4b.	Post-Polish	7.9	8.1	---	0.6

Table 4. Acceptable dimensions (APC, Pre-Angled, 2-Row)