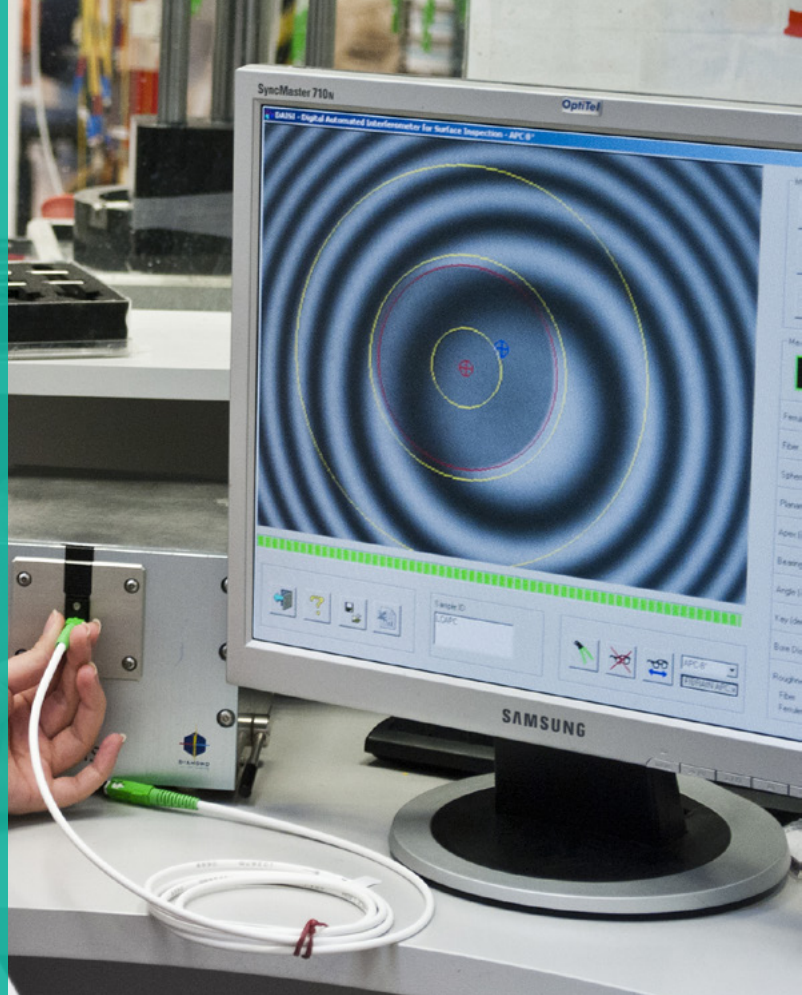


# Ferrule and endface GEOMETRY

In fact, fiber optic technology has dominated data transmission segment in the market because of its numerous benefits, which should not surprise anyone. Do you bear in mind the quality of each element even the smallest ones while designing your own connection?

If not, you definitely should, as they affect the whole network. The fiber optic connections are inseparable elements of optical network. The simplicity of a network design, its configuration, stability and easy access are only some advantages of fiber optic connections. Consequently, these connectors are used wherever frequent configuration as well as measuring tests are necessary. Also, they are appropriate to connect fiber optic cables with measuring equipment.



When it comes to network design, we need to remember about a few important aspects. To begin with, Insertion Loss (IL) and Return Loss (RL) are crucial parameters which determine the quality and the ferrule's class. No to mention that it is the ferrule, which is the core component of each fiber optic connector. An optical fiber is placed in its opening, and then ferrule with a fiber is carefully polished.

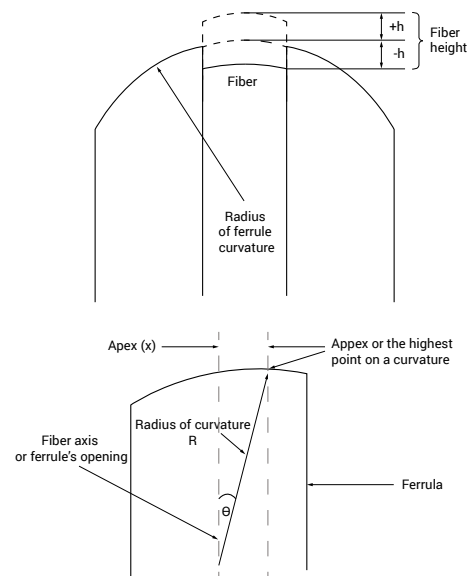
Undoubtedly, the polishing process is the most important manufacturing stage, as it not only provides proper shape and smoothness of the ferrule's end face but it also guarantees first-rate parameters. As a result, such parameters ensure low IL and maintain RL at the desirable level.

There are two methods of polishing fiber optic connectors. PC -the first way, means slightly oval shape which is perpendicular towards connection axis, and the other-APC, in which the ferrule's end face is polished at the 8° angle.

More importantly, there are three key parameters determined by the geometry: a radius of curvature, a fiber height and an apex of set. Not to mention that only detailed control over polishing process can guarantee premium quality connectors. Thus, these parameters are carefully scrutinized with the use of interferometer.

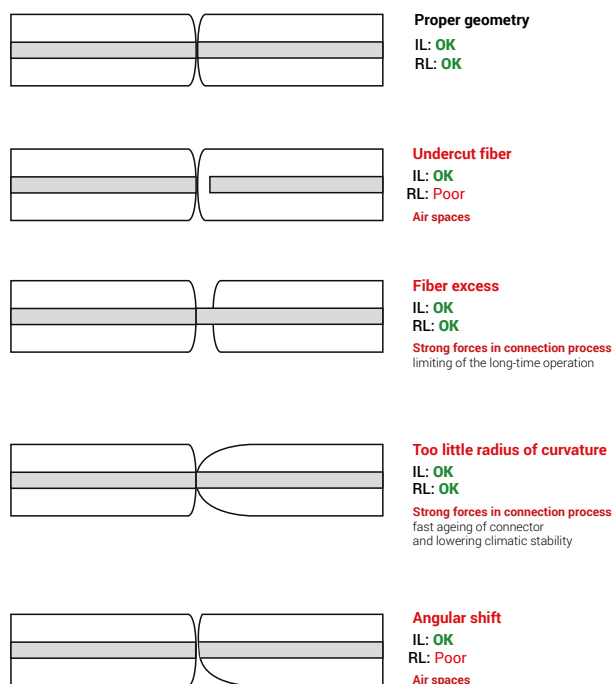
As PC and APC polishing require physical contact with optical fibers placed in ferrules, all ins and outs matter. It is absolutely necessary to polish the connectors with high precision to get spherical surfaces and fiber placed in the highest ferrule's point.

The radius of area, which has been formed during the polishing process formed on a ferrule is called a radius of curvature. If this area is too small, consequently we'll get smaller area of a connector, which results in higher force value.



Therefore, the connector is wearing, which generates extra costs for its maintenance. What is even worse, an extended radius of curvature inhibits the physical contact so the return loss is decreasing drastically!

The apex offset defines the distance between the highest point of the polished ferrule's end face and fiber's axis. The best premium quality connectors have offset at zero level, where the highest point covers itself with a fiber's axis.



If the value of this parameter exceeds the norms, it will result in shorter work longevity and significantly lower connector's stability!

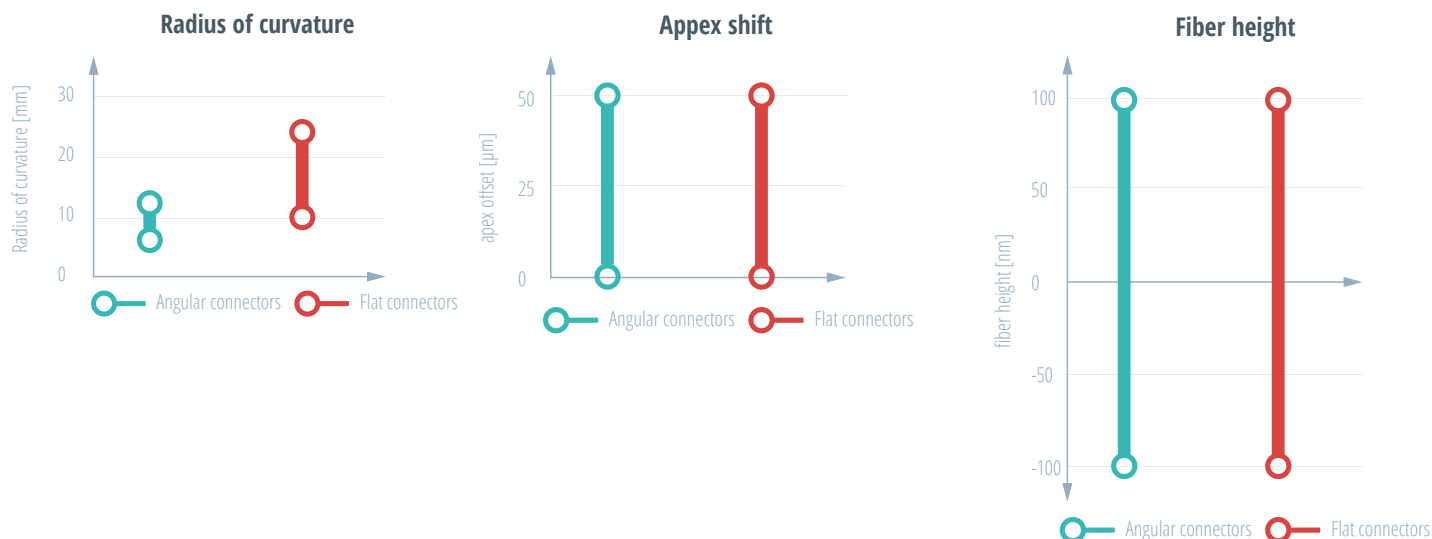
Is it really worth buying a connector from a supplier who does not have necessary equipment to verify these parameters? At the end, our network will pay the price for neglecting this decision.

Primary parameter is the fiber's height as it determines the fiber's length which stands beyond a fiber or it is embedded in a ferrule. The consequences of improper and inaccurate polishing process are poor quality connectors with inadequate transmission parameters. And to make matters even worse, too long polishing process badly affects Return Losses (RL) which are then completely unacceptable. In a polished connector there is an effect called "cut the fiber" which creates air gap, thus the values of back reflection are undesirably low. However, when the polishing process is too short it also has negative consequences like high values of forces during putting connectors together, which get fiber to step back. After that, we can examine whether it would be worthwhile to buy cheap patchcords? You should deeply consider whether only apparent savings guarantee successful network connection. Certainly, only experienced producers are able to deliver highest quality connectors.

The normalized values and their ranges are presented below in table 1 (PN-EN-61755-3-1 & PN-EN-61755-3-2),

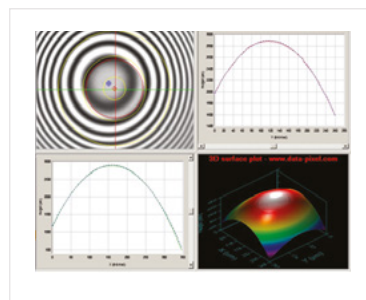
Parameter	Values for PC connectors		Values for APC connectors		Unit
	min	max	min	max	
Radius of curvature	5	30	5	12	[mm]
Appex shift	0	50	0	50	[ $\mu$ m]
Fiber height	-100	100	-100	100	[nm]

Tab.1. Normalized values of ferrule endface geometry



ELMAT uses the state-of-the-art equipment thanks to which our company is able to produce the highest quality connectors.

In line with the principle that there is no room for a compromise while speaking about quality, our company is the exclusive producer of premium quality connectors. Our ultimate aim is to produce state-of-the-art and of the highest quality connectors. As we are striving for perfection we have narrowed the geometric parameters of the ferrules with regard to norms and regulations. As an example the range of radius of curvature for angle connectors reaches 7-12 mm, for the PC flat connectors reaches 10-25 mm.



Thanks to high-tech equipment including modern interferometers and electric microscope, a precise analysis concerning end face geometry parameters of ferrules is possible. Therefore, it is the interferometer, which is the most accurate device to control optical elements. Apart from it, both an automatic glue dispenser and a machine designed for automatic cutting and stripping, provide the highest precision in the fiber optic connectors placement process. Therefore, the specialists and experts who work in our company, high class components and attention to each tiny detail, are the guarantee of the highest quality components.

Consequently, we have no doubts, that our products like patchcords, pigtailed or splitters are of the premium quality and have excellent geometry parameters.

proper physical contact and surface,  too little provides high forces in connection process which causes fast connection ageing	the lower value of this parameter, the better contact	air space can lead to further breaks and damages of fiber surface	<b>100% interferometric measurements</b>  <b>100% control over quality process</b>
<b>RADIUS OF CURVATURE</b>	<b>APEX OFFSET</b>	<b>FIBER HEIGHT</b>	<b>FIBRAIN CONNECTION</b>

Finally, one thing must be clear-we do not shorten the technological processes to reduce the manufacturing costs or limit the required time!

Written and prepared by  
Anna Łożańska  
Connectivity Product Manager

