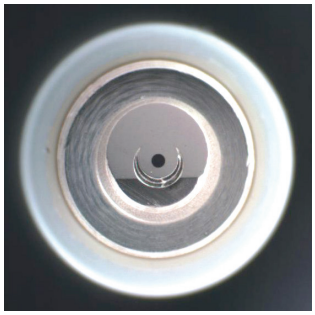
DIAMOND Active Core Alignment (ACA)

PERFORMANCE IN OPTICAL NETWORKS

The demand for real time information continues to grow placing high demands on today's communication networks. As a result there is an ongoing need to increase bandwidth throughout the entire network.
Dense Wavelength Division Multiplexing (DWDM) technology has become one of the more common methods for expanding network bandwidth. The use of DWDM allows you to transmit multiple signals (wavelengths) in parallel on a single fiber. A direct impact of using DWDM is significantly higher power levels transmitted throughout the infrastructure (e.g. 64 channels {λ's} at 5mW = 320mW total transmitted power).
History has shown that most network failures occur at or within close proximity to a termination point. As a result component performance and reliability over time has become a critical factor in ensuring network performance. The introduction of significantly higher power levels magnifies the risk of component failure as well as human exposure (specifically to the eye) to hazardous levels of infrared light. It is not uncommon to find permanent fiber damage caused by intense localized heating at the optical interface of connectors in DWDM networks operating at power levels as low as 100mW.

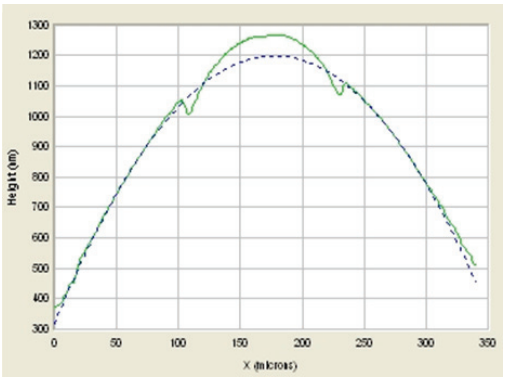
THE OPTICAL CONNECTOR



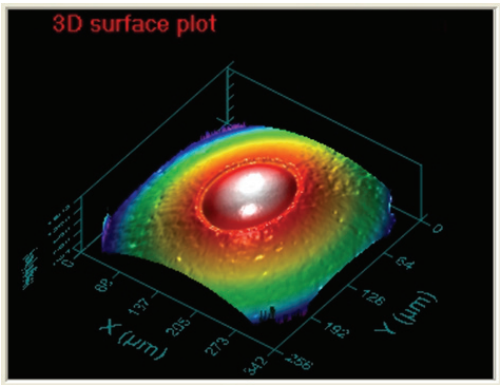
The primary function of a connector is to provide a repeatable low loss connection between optical fibers. High performance (low loss max. 0.1 dB) connectors must be able to minimize the factors, which lead to power loss. The primary drivers behind power loss are fiber-to-fiber eccentricity, contamination at the optical interface, and physical contact.

Front-face 8° APC

In order to minimize the power loss at the optical interface, it is recommended to use a connector, which is able to provide less than 0.15 microns of eccentricity. Material selection also plays a critical role in maintaining the sub-micron tolerances noted above while minimizing particulate contamination, which can accumulate during connector mating cycles. Fiber optic connectors are a usually specified for a service life of 500 to 1,000 mating cycles and over a wide operating temperature range (typically –45 to 85° C). As a result, critical components (alignment sleeves and ferrules components) are made from zirconia. Zirconia is an ideal material for these types of applications because unlike some other materials (Bronze, steel, or plastic) it is a very hard and stable material (low coefficient of expansion), which can be manufactured to very tight tolerances.
Ensuring fiber-to-fiber physical contact, the last major factor behind power loss in optical connectors, is accomplished by maintaining proper connector end face geometry (Fig 1).



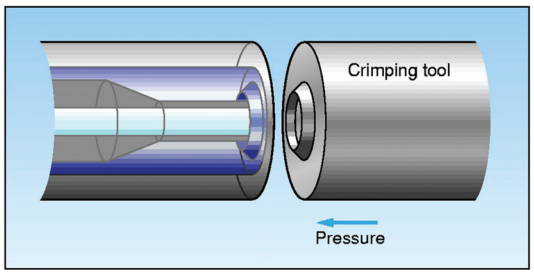
(Fig.1)



DIAMOND ACTIVE CORE ALIGNMENT

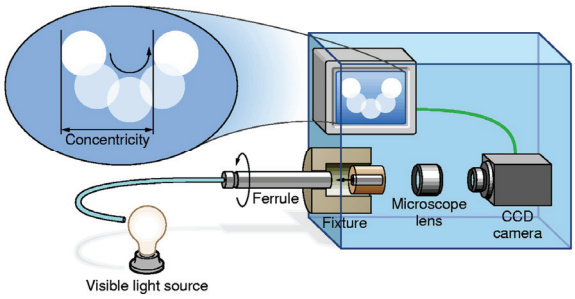
Diamond's high performance connectors are manufactured using only the highest quality materials coupled with our advanced fiber optic component manufacturing processes developed over the last 25 years. Our goal was to reduce IL by minimizing fiber-to-fiber eccentricity. The result is our patented two-part ferrule and "Active Core Alignment" technology.

The assembly process starts with the ferule, which is made up of high quality zirconia and a titanium end face insert. The ferrule is then precision ground (< 0.5 μm OD tolerance) and drilled out to approximately 128μm. The fiber to be terminated is then stripped, cleaned, and inserted into the ferrule with epoxy. A circular crimp tool is then applied to the end face, which calibrates the drilled opening to the around the outside diameter (OD) of the fiber and pre-centers the fiber with respect to the OD of the ferrule (Fig. 1).



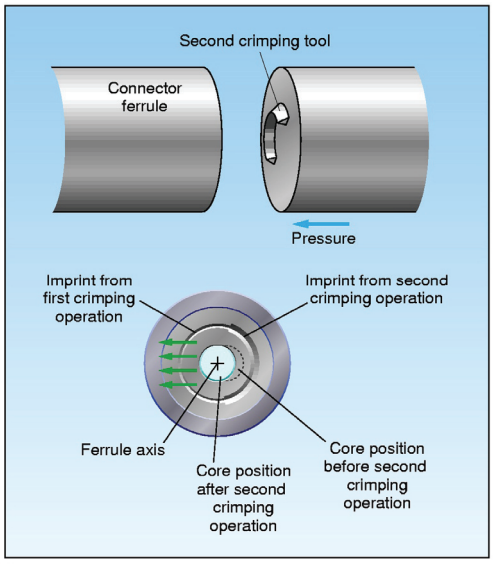
(Fig. 1)

Once the epoxy is fully cured, we place the ferrule assembly into a high precision measuring system, inject visible incoherent light into the fiber, and rotate the ferrule 360°.
The PC based system and advance software algorithm can then determine the eccentricity of the fiber core with respect to the ferrule OD.
(Fig. 2).



(Fig. 2)

With this information and a 2nd crimping tool we are able to reduce the fiber core eccentricity to <0.125μm (Fig. 3).
This process is used on both PC and APC terminations with all results (Eccentricity, angle, IL, and RL) automatically tracked and logged for each termination.



(Fig. 3)

DIAMOND's "Actively Aligned" connectors are available in most common body styles (E-2000™, F-3000™, ST™, SC, MU, FC, DIN, HMS, etc.) and are fully compatible with conventional ceramic connectors.