

Field Service and Production Line Considerations When Precision Cleaning and Inspecting Fiber Optic Surfaces

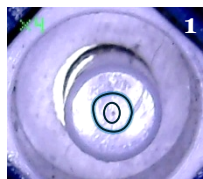
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Abstract: *The primary standard for fiber optic inspection is generally considered by IEC 61300-3-35. There is a lesser-known standard, Telcordia GR-2923-Core written for field services. IEC TR-62627 attempts to detail cleaning procedures.*

In recent times, IEC 61300-3-35 has been updated to increase through-put on the production line floor by lowering the field-of-view. Telcordia GR-2923-Core is written for field services with clear instructions. Connectors are three-dimensional surfaces with [unseen and heretofore uncharacterized] crevasses and surfaces.

Does The Transmission Fiber know or care where it is deployed?

The production line is a well-considered work area with technicians performing repeated actions in a controlled work area. Field Service is the opposite, a diverse workforce performing in irregular ambient conditions. With the latest update of IEC 61300-3-35 there was a major change from four horizontal zones to two. There is no consideration for other than a limited horizontal surface of a three-dimensional structure.



This SC “end face” is 2.5mm which is a 2,500 μ m. diameter. The surface is contaminated not only on the ‘horizontal’, but also on ‘vertical surfaces’. [Image-1]

The ‘core’ or transmission fiber is 9 μ m and the ‘area of concern’, per the latest edition of IEC 61300-3-35, is that which is within the sketched circle @ 125-150 μ m. This is a significant decrease from previous editions of that standards. As an example, a standard “SC” 2.5mm horizontal end face as a diameter of 2500 μ m. Image-3 reveals the perspective of a partially cleaned horizontal surface while images 1 and 2 reveal the remaining areas that can cross-contaminate as a result of improper cleaning and limited awareness of the three-dimensional nature of all connector types.

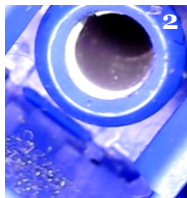
While contamination to this level is not likely on the production line, “field service” can readily encounter such debris. Many tools are designed only to clean the area within the circle. This ‘production line standard’ is not acceptable to field service

applications. Generally applicable to micro-bacteria, cross-contamination is also relative to other surfaces. In this instance, 'fluidic debris' will compress with mating to foul the transmission fiber. Debris such as 'dust' tends to stay in place until touched and removed. Methods and procedures that consider all types of debris are best practice. The images in this paper are captured using an RMS-1 MKII inspection device.

Considering the connector as a three-dimensional surface

Both production line and field service are critical facets of all fiber optic deployments. However, there is a disservice to both when one is compromised for the other. Much of my professional career was wonderfully spent within the confines of electronic production lines! As FTTx emerged, time was enjoyed in that world as well.

These are not the same procedures with the same flexibilities or limitations. In this specific instance [Image-1] considering only 10% of the surface to increase production line through-put mistrains the field service worker. Costly potential of component replacement is avoided when proper precision cleaning techniques and awareness procedures are understood and trained.



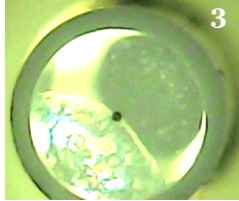
Other surfaces that impact field service are not considered by any standard. These include adapters and alignment sleeves.

In the Image-2 portrait, debris not only within the alignment sleeve but also on the adapter shell is to be considered for field service installations. As one connector is inserted into the 'alignment sleeve' debris can be forced to the mated pair. Use of a compressed gas duster to remove debris, as on the adapter shell, can excite ambient dust to cross-contaminate in the time of post-cleaning. Training these potentials for field service is the responsibility of the OEM, trade organizations and professional trainers.

Tips, Tools and Tricks of the Trade

IEC TR-62627 speaks to actual cleaning procedures and was updated in 2023. The Telcordia GR-2923-Core field service standard remains relevant. IEC TR-62627 enables multiple cleaning efforts and includes use of compressed gas dusters for specific applications such as 'dust caps'.

The Telcordia GR-2923-Core standard presents first time cleaning, presents techniques to clean beyond the end face, and cautions against use of compress gas dusters in field service. This is relevant to data centers as well. Image-3 presents a partially pristine surface with cross-contamination potential. Detailed precision cleaning installation instructions from the OEM to field service is essential and re-train the trainer is required.



IEC standards are established using simple soils such as organic oils and test dust. A higher standard considers complex debris such as inorganic oils and debris in combination with proper tool selection and clear procedures based on situational awareness of the specific installation. This knowledge eliminates the 'bottleneck' of signal attenuation because of a contaminated or improperly cleaned fiber optic surface. Digital color photographic inspection of the surfaces can be enhanced for increased resolution characteristics.

Conclusions: Fiber optic surfaces are three-dimensional [3D] precision structures that are not unlike those in other critical applications such as wafer fabs and medical applications. Cost-effective tools and time-efficient methods and procedures exist to enhance field service operations as well as support manufacturers with clear end-user installation instructions beyond the production line.

Standards are written as a 'snapshot in time' and may be outdated between updates. Standards are an essential baseline: best practice considers them as minimum requirements in an applications specific, situational awareness manner.

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