Just How Useful Is IEC 61300-3-35?

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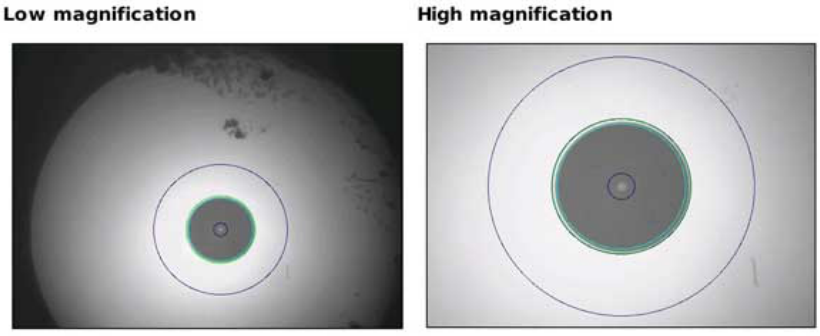
The cleanliness of optical connectors is one of the important factors affecting the reliability of optical networks, yet its importance is often underestimated in practice. Connectors are often either not cleaned at all or are cleaned improperly. Contamination can increase insertion loss and reflectance, and it can even cause the interruption of one or all services on a network. In addition, it can cause permanent damage to connector end faces. And a dirty connector can contaminate or damage clean connectors.

Connectors, as well as the contamination present on them, have a three-dimensional structure. This is something we must always keep in mind if we want to ensure proper cleaning and reliably clean connectors.

IEC 61300-3-35, Edition 3.0, defines visual inspection procedures and criteria for assessing the condition of connector end faces. However, visual assessment is limited to specific surface zones, while the vertical dimension — that is, the height and three-dimensional structure of contamination — is not assessed in the same way. In other words, inspection is based primarily on a two-dimensional image of a three-dimensional surface and its contamination. The purpose of the standard is to provide a consistent assessment of scratches, defects, and contamination using clearly defined acceptance criteria for use by factories terminating cables for patchcords, making SOCs, etc.

The standard also describes cleaning procedures. Dry cleaning is performed first, and if it does not produce satisfactory results, the combined wet-to-dry cleaning method is used. If the connector cannot be cleaned after five attempts, it is considered permanently damaged.



This raises the question: how useful is this standard in practice in the field, and does a PASS result necessarily mean that a connector is clean enough for reliable operation?

Compared with the previous edition, the latest version of IEC 61300-3-35 introduces revised inspection criteria, reducing the zone of inspection even further. For connectors, Zones A and B are defined (up to 110 µm), with the assessment based on the permitted size and number of contaminants and scratches. Based on these criteria, automated connector inspection systems display a PASS or FAIL result.

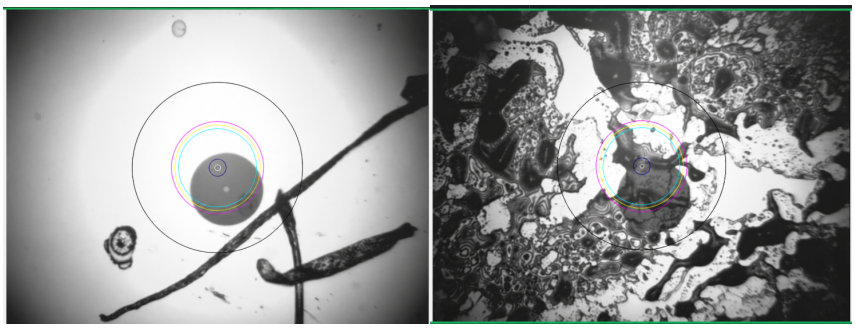
This approach is useful because it reduces the likelihood of different technicians making subjective assessments of the same connector. Standardized inspection is particularly important in networks with large numbers of connectors, where consistent quality control is essential.

However, a PASS result does not necessarily mean that the end face is completely free of contamination or scratches. It means that their size, number, and location within the zones assessed by the system fall within the acceptance limits defined by the applied criteria.

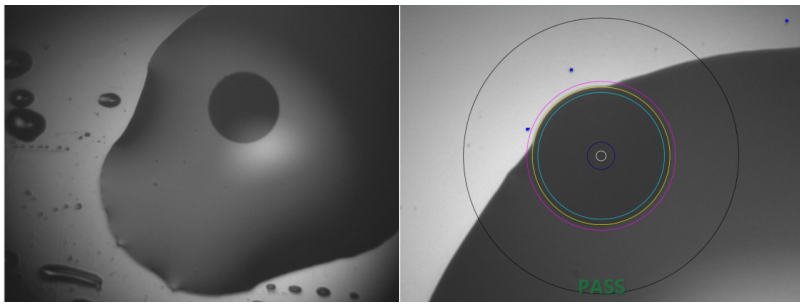
The location and type of contamination are also very important. During connector mating, solid particles can move or transfer from one surface to another. Fluid contamination can spread and move across the surface due to gravity, capillary forces, and other factors, even when the connector is not mated again. Improper cleaning, particularly the use of excessive amounts of cleaning solution, can cause fluid contamination to form or spread, potentially reaching zones that are critical for connector assessment.

Relying entirely on automated inspection systems can lead to incorrect conclusions. First, contamination initially located outside the critical inspection zones may eventually migrate into them. Second, an automated system may incorrectly classify the condition of the end face and display PASS even when contamination is present in Zones A and B. This is particularly common with fluid contamination, such as vegetable oil, machine oil, water, and isopropyl alcohol (IPA).

The following photographs illustrate these situations, connectors that passed automatic inspection:



Improperly cleaned connector (L) combined contamination (R)



Fluid contamination

In such situations, it is advisable to repeat the inspection. The connector should be removed from the microscope, repositioned, and the automated inspection run again. In practice, the system may display FAIL during the second inspection, even though it displayed PASS during the first.

Neither PASS nor FAIL should be interpreted as a universal guarantee.

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