



The Fibreoptic Industry Association

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CLEANING
by
FIA PROJECT TEAM CIC

This White Paper covers the issue of cleaning of optical fibre interfaces, including those within the receptacles of the optical ports of transmission equipment. However, before providing information to the cleaning process, it is important to consider cleaning only as one part of the general process intended to minimise both degradation of optical transmission performance and the risk of optical fibre end-face damage.

As a starting point we have to be very careful about distinguishing contamination from damage on the optical fibre end-face. As indicated in the White Paper addressing "Camera-based Inspection" of optical fibre en-faces, contamination is particulate or fluidic debris on an optical fibre end-face or within an adaptor "barrel" which, once identified, can be removed by appropriate cleaning techniques. End-face damage is permanent and comprises scratches and defects (such as chips and other marks) which either result from the polishing process or from subsequent damage - some of which is caused by the mating of contaminated end-faces within a connection.

It is not possible to remove end-face damage by cleaning.

Unfortunately, the fibre optics industry tends to be populated by individuals who take two opposing positions to the cleaning of optical fibre connector end-faces. Some individuals never clean any connections until network problems occur whilst others clean connections every time they are mated - whether or not such cleaning is required. Both approaches are ill-advised.

The FIA position is that no cleaning should be applied to either a connector ferrule end-face or within an adaptor "barrel" until an inspection has determined it to be necessary. To be clear, cleaning is one part, but not an automatic part, of the process which should be adopted to maintain transmission performance and end-face quality of any optical fibre connection. The process is shown in Figure 1.

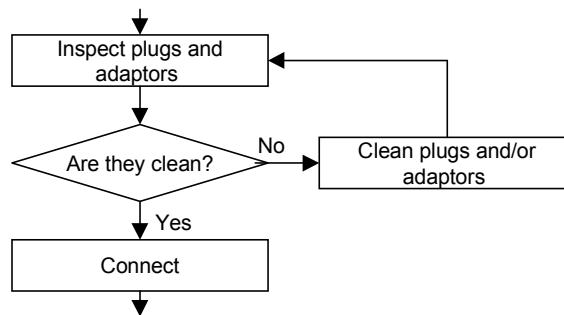


Figure 1 - The Inspect - Clean (if necessary) - Re-inspect - Connect Approach

Consistent use of the approach of Figure 1 will ensure that optical fibre end-faces are clean prior to mating the connectors, eliminating the installation of dirty or potentially damaging components into the network and optimizing network performance.

Other White Papers in this series cover "Camera-based inspection" and "The impact of contamination" while ShortForm Guidance Notes provide information on how these processes apply during procurement, installation, operation and troubleshooting.

If inspection of any interface shows the presence of contamination, some form of cleaning process is required - but the specific process to be applied depends on the nature of the contamination.

45 Before we discuss cleaning methods, we draw attention to two standards covering the topic. These are  
46 • BS PD IEC/TR 62627-01: 2010: *Fibre optic active components and devices - Reliability - Part 1: Fibre*  
47 *optic connector cleaning methods*;  
48 • a future IEC TR 62572-4: *Fibre optic active components and devices - Reliability - Part 4: Guideline for*  
49 *optical connector end-face cleaning methods for receptacle style optical transceivers*  
50 NOTE; this document will in due course be published in the UK as BS PD IEC/TR 62572-4  
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52 While these documents have the status of Technical Reports, and contain no requirements, they do provide a  
53 sound foundation upon which to develop procedures for the effective maintenance of connection performance.  
54 This White Paper recommends their application but takes the opportunity to highlight some of the key issues.  
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56 BS PD IEC/TR 62627-01:2010 contains a version of the FIA approach indicated in Figure 1 but only discusses the  
57 cleaning of the plugs involved in a connection (whether or not one is accommodated within an adaptor – but does  
58 not address the cleaning of the adaptor alignment sleeves).  
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60 The future IEC TR 62572-4 defines a range of cleaning options for receptacle style optical transceivers,  
61 dependent on the receptacle design.  
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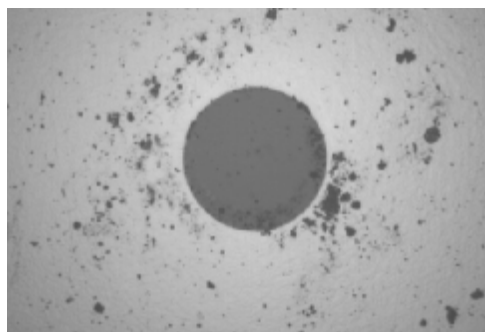
63 The FIA recommend that all installers and users of fibre optic cabling base their cleaning methods using these  
64 Technical Reports.  
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### 66 **Types of contamination**

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68 Field operations present a very diverse set of challenges in terms of contamination.  
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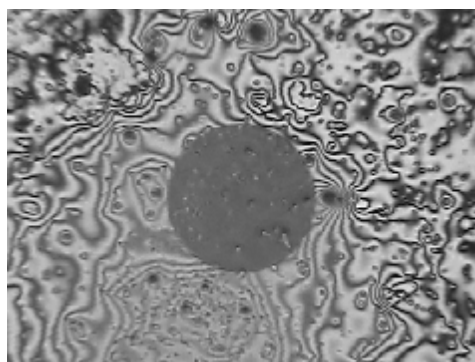
70 This document considers the following three types:

- 71 a) dry contaminants (see illustration in Figure 2);
  - 72 b) fluidic contaminants (see illustration in Figure 3);
  - 73 c) combinations of a) and b) or unknown contaminants.
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Figure 2 - Example of dry contamination



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78 Figure 3 - Example of fluidic contamination

79 It should be noted that contamination may exist outside the boundaries of the areas examined by BS EN 61300-3-  
80 35 (which defines acceptance criteria for scratches and other permanent defects on optical fibre end-faces). The  
81 removal of contamination should address both the complete plug end-faces and the alignment sleeves of any  
82 adaptors or receptacles.  
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84 **Cleaning of optical fibre connector ferrule end-faces**

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86 In all cases, the rule is “if it is already clean, do not clean it”.

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88 In an ideal world it would be possible to specify a single universal cleaning method that would simplify, and  
89 maximise the efficiency of, the cleaning process. The problem is that there are many types of contamination –  
90 some of which would respond to dry cleaning solution while others would require some form of a solvent-based  
91 approach.

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93 For free plugs, BS PD IEC/TR 62627-01:2010 describes two cleaning methodologies:

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1) dry cleaning (dry wipes and cassettes);

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2) a solvent in conjunction with dry cleaning.

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97 For optical fibre cabling ports, the TR describes the use of purpose-built swabs or mechanical port cleaning  
98 devices. These provide mechanical action and absorbency to remove contamination - which may be combined  
99 with a solvent.

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101 BS PD IEC/TR 62627-01:2010 does not differentiate between cleaning methods for specific types of a  
102 contamination but suggests that cleaning is multi-stage: trying a dry cleaning method followed, if necessary, by a  
103 wet-to-dry cleaning method.

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105 The critical issues are that:

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- in some cases, dry cleaning which may be suitable for the removal of fluidic contamination can generate static electricity which attracts further particulate contamination on to the cleaned surface;
- a wet cleaning process is able to remove a wider range of contaminants but excessive use of solvent-based cleaning agents risks incomplete removal of the residues.

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108 There are cleaning products and solutions which adopt a single “wet-to-dry” process by controlling the amount of  
109 solvent in conjunction with a defined dry cleaning action.

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**Cleaning of alignment sleeves**

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A technique using a swab tool which has two cleaning surfaces (a tip that is not contaminated by passing through an alignment sleeve and a side wall that separately cleans the alignment sleeve) is one potential solution. Another is to use a probe tool as noted in 5.3 of BS PD IEC/TR 62627-01. In this case the tip of the tool is not contaminated by passing through the alignment sleeve; however the side of the probe tool cleans the alignment sleeve prior to cleaning the end-face of the plug within the adaptor.