The Fibreoptic Industry Association
www.fia-online.co.uk

Secretary: Jane Morrison

The Manor House
BUNTINGFORD
Hertfordshire SG9 9AB
United Kingdom

Tel: +44 (0) 1763 273039 Fax: +44 (0) 1763 273255

e-mail: jane@fiasec.demon.co.uk

MANAGING THE TRANSFER OF OWNERSHIP OF AN OPTICAL FIBRE CABLING INFRASTRUCTURE

By Mike Gilmore,
Director, **standards@FIA**.
Chairman, CENELEC TC215

Background

The transfer of ownership of a cabling infrastructure (be it metallic or optical fibre) to a 3rd party is fundamentally different than a clients acceptance of such an infrastructure which has been subject to a supply contract.

The latter relies on the terms of the supply contract - and a well written technical and acceptance testing specification will enable contractual disputes between the installer and the client to be resolved based upon the contents of that specification.

By comparison, the transfer of ownership of the cabling infrastructure to a 3rd party leaves the 3rd party in an unenviable position of not having been in control of the either the installation or its specification but being required to be responsible for its ongoing performance.

In such circumstances, there are number of steps that can minimize the risk of the transfer process and the 3rd party has to satisfy themselves that such steps have been applied - or to invest, possibly heavily, in backtracking to institute such steps if they have not already been applied.

This document provides an overview of the process. Detailed technical matters are left to other FIA documents.

Installation specification

BS EN 50174 series standards act as the de-facto documents relating to installation specification, quality assurance, installation planning and practices. They are normatively required by BS 6701 which in turn is a directly quoted support standard within the “Wiring Regulations” as defined in BS 7671.

As a result BS EN 50174-1 is frequently highlighted in contractual disputes (and their legal resolution) whether or not they have been addressed in the applicable contract.

BS EN 50174-1 defines the minimum requirements for inclusion within an installation contract. Many clients and their consultants call up BS EN 50174-1 as a requirement to be placed on the installer without realising that they also have significant responsibilities for its application.

In relation to the topic of this White Paper, the bare minimum is for the installation specification to accurately specify the components to be used and their installed performance. In the case of optical fibre cabling infrastructures this means:

- the transmission performance specification of the cabled optical fibre;
- the mechanical and environmental performance of the optical fibre cable and its compatibility with the installation conditions and operating environment;
- the selection of optical fibre connecting hardware by reference to specific IEC standards (i.e. not by a simple reference to a “connector type”);
- the transmission performance specification of the connections made using that connecting hardware;
  NOTE: connecting hardware covers both demountable connectors and fusion or mechanical spliced joints.
- the required testing to prove that such performances have been achieved following installation.
  NOTE: component acceptance tests (i.e. incoming component test results do not meet this requirement - they are only supply chain quality assurance.

Within BS EN 50174-1, the installer is required to agree the Quality Plan with the client that defines how, i.e. which tests or inspection criteria are to be applied, to prove the installed performance.

So, there are four parts that are important to managing the transfer of responsibility process:

1) identification of the components;
2) proof of component performance;
3) the correctness of the installation process and the compatibility of that process with the mechanical and environment specification of the components;
4) the transmission performance of the installed cabling.

A fifth and vitally important aspect is not defined by the management of the installation - and that is

5) the condition of the end-faces of the terminations of the installed cabling.

Termination end-face condition and connector sourcing

No transfer of ownership can take place unless it is established that the all the termination end-faces within the infrastructure are both contamination-free (i.e. the barrels of any adaptors have been properly cleaned and the complete ferrule end-face is free from loose contamination). This has to be managed via a manual, visual inspection process and is resource-heavy but if CCD-based microscopes are used then they can produce a permanent record of the inspection outcome.

If the installation is to be transferred “as new” then an additional requirement is that the end-faces are “as new”. A standard (BS EN 61300-3-35) exists to support that assessment and requires the use of a test tool that can undertake such an assessment. Different criteria exist for multimode, singlemode PC and APC end-faces.

Once it is established that the termination end-faces are of adequate quality and do not represent a risk to the mated end-faces of any test cords (or affect any results that are obtained), any failure to obtain appropriate installation test results can be corrected.

This brings in the next major factor - the “consistency” of the connection components. Assuming that the optical fibre on either side of the connection is the same, connection losses are dependent on three components - that is

- the plug the installed cable is terminated with
- the adaptor into which that plug is inserted and, finally,
- the connector of any cord that is connected to it.

In situations where transfer of ownership is under discussion, it is critical that the source of the three components is identified and compatibility is agreed. This normally means that the two connectors and the adaptor are provided by the same supplier since it will be impossible to obtain problem resolution otherwise. An alternative, but secondary approach, is to delve into the standard-based conformance of the components but this requires substantial technical knowledge (which can be provided by the FIA Technical Directorate).

As mentioned above, incoming component test results are of no value in determining installed performance. This included components as cables, connectors, connection modules or pre-terminated cables (acting as cords). It is recognised that the use of “pre-terminated cable” test results is tempting but there are two flaws in this approach:

- it takes no account any possible installation damage to the cable;
- connection losses are dependent on the three components mentioned above.

As a result a pre-installed test result is irrelevant to the final installed result of the component within the uninstalled cabling “channel”.

Moving forward with ownership, if there is a lack of knowledge in relation to connector component sourcing, it is impossible to determine the appropriate process for the future procurement of cords.

Installed transmission performance assessment

Finally, once it has been determined that the cabling is free from contamination and that sourcing of connector components is under control, it is useful to consider the testing of the installed cabling to provide a performance base-line. While it is tempting to rush into this stage, it is pointless unless the first two steps have been undertaken.

There are typically two parts to the testing - overall and localised attenuation. These can be assessed using LPSM and OTDR test procedures as defined in British, European and international standards and outlined in FIA Technical Support Documents).

For certain singlemode applications, return loss (connector reflectance) is also very important. Testing and isolating this parameter is more difficult and time consuming but can be achieved, again using established British, European and international standards. This is emphasised here because small variations in connection attenuation can be associated with substantial variations in return loss. If applications that are susceptible to

return loss problems (e.g. broadcast video). This type of application tends to rely on APC connections to provide high levels of return loss performance and consistent connector sets are critical to managing this performance.

Avoidance of system test information

One final aspect of transfer of ownership is the need to avoid test results based on system demands. System demands include parameters such a received power. All type of transmission systems requires a minimum level of received power but this must not, under any circumstances, be the basis of transfer of ownership for the following reasons:

- even if the received power is adequate it does not qualify the quality of the installation (overall and localised insertion losses can be hidden);
- received power may not be the only transmission criterion (e.g. video broadcast and return loss will go unaddressed.
-

References

BS 6701, *Telecommunications equipment and telecommunications cabling - Specification for installation, operation and maintenance*
BS 7671:2008+A3:2015, *Requirements for Electrical Installations - IET Wiring Regulations*
BS EN 50174-1:2009+A2:2014, *Information technology - Cabling installation: Installation specification and quality assurance*
BS EN 50174-2:2009+A2:2014, *Information technology - Cabling installation: Installation planning and practices inside buildings*
BS EN 61300-3-35, *Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Examinations and measurements: Visual inspection of fibre optic connectors and fibre-stub transceivers*

Mike Gilmore
12th April 2017