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FIRE RESISTANT - CIRCUIT INTEGRITY CABLES

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Introduction

This White Paper has been developed following questions from members of the FIA concerning the performance of optical fibre cables which are advertised as being fire resistant. The principal issue is a lack of understanding of the conditions under which the specified transmission performance delivered. For example if a cable is advertised as being a fire resistant "Category OM3" cable, then when is OM3 performance delivered – before or during the fire. In almost all cases, it will only provide OM3 performance before the fire – and not during the fire.

CPR –
CONSTRUCTION PRODUCTS REGULATION

Before dealing with the topic of this White Paper we take this opportunity to highlight the fact that CPR does not address "circuit integrity" cables.

The two issues should not be conflated.

The standards for testing of "fire resistant", more correctly termed "circuit integrity", cables allow a specified deterioration under certain fire conditions. Unfortunately some users do not realise this and expect the quoted transmission performance to be delivered under real fire scenarios. This can lead to contractual issues for FIA members supplying and installing such cables.

This White Paper seeks to clarify the situation, provide advice to members and is applicable to balanced as well as optical fibre cables.

Technical details

This White Paper seeks to clarify the function and specification of fire resistant cables – more properly called circuit integrity cables. This type of cable may be specified as comply with international standards (IEC 60331 series) or EN standards. The EN standards are published as BS EN documents whereas the IEC standards are not endorsed by BSI.

IEC 60331-23 (electric data cables) and IEC 60331-25 (optical fibre cables) require only the continuity of circuits during and following exposure to 750 degrees C. For a metallic data cable that means no short circuit (or open circuit) and for an optical fibre that means no open circuit (optical fibre break). However, there is no maximum resistance or attenuation specified respectively. Unlike the EN standards, there is no classification system for survival times. It is assumed that other cable standards may contain their own survival time requirements - although in their absence a 90 minute survival is applicable.

There are two European standards for cables intended for use within fire safety circuits – EN 50289-4-16 (balanced and coaxial cables) and EN 50582 (optical fibre cables). These standards define an allowed performance deterioration, short of open/short circuit conditions, when the cable is subjected to one of two fire tests defined by EN 50200 and EN 50577 leading to a classification of PH xx or P xx respectively – where xx relates to the number of minutes that the cables survived without exceeding the specified level of deterioration. This is summarised in the table below.

Cable type	Performance deterioration	Fire test	Temp (ºC)	Classification
Optical fibre	EN 50582	EN 50200	850	PH 15, PH 30, PH 60, PH 90, PH 120
		EN 50577	850	P 15, P 30, P 60, P 90, P 120
Balanced and coaxial	EN 50289-4-16	EN 50200	850	PH 15, PH 30, PH 60, PH 90, PH 120
		EN 50577	850	P 15, P 30, P 60, P 90, P 120

Allowed deterioration

As mentioned above the IEC standards consider all levels of performance deterioration until open/short circuits as acceptable. Therefore any transmission performance specifications quoted for circuit integrity cables in accordance with IEC 60331 standards have to be considered as being only viable under conditions of no-fire. In fact under fire conditions any system design has to assume that all that will provided is continuity of circuit (but without any defined transmission performance).

For optical fibre, EN 50582 specifies the allowed deterioration in transmission performance to be 1,0 dB/m for multimode optical fibres (of all types) and 2,0 dB/m for singlemode optical fibres (of all types). It should therefore be obvious that a Category OM3 cable subjected to the specified fire conditions over a one metre length will no longer remain OM3 – and neither will a Category OS1a or OS2 product retain its performance.

For balanced cables, of Category 5 and above, the allowed deterioration is a mix of return loss, NEXT and attenuation degradation (and an absence of short circuits). In all cases the allowed deterioration would render the cables unable to meet the requirements of their specified Category. We need to remember that while copper has a melting point above the fire test temperature, the polyethylene primary insulation has a melting point substantially lower (~120°C).

The problems

The confusion lies in how “circuit integrity” cables are marketed to the user community.

The original intention is that these cables are used as part of a fire safety system in such a way that the system will operate when the performance of the cable deteriorates within the boundary of the specification when subjected to defined fire conditions.

The design of a fire safety system is obviously of significant importance and a number of standards exist to control the design, installation and operation of such systems including BS 8519.

The question is whether someone who requests a “fire resistant” Category OM3 optical fibre cable or Category 5 balanced cable understands that those cables will not have that transmission performance when “on fire”.

Advice to members

If you are requested to supply “fire resistant” or “circuit integrity” cables with an advertised transmission performance be cautious and ensure that either:

- the supplier of the cable confirms that the advertised performance is maintained under fire conditions or
- you advise your customer that the advertised performance is only provided in “non-fire” conditions and that some degree of deterioration will occur under real fire conditions and that deterioration has to be taken into account in any system created which is expected to function under those conditions.

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BIBLIOGRAPHY

BS 8519 Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications. Code of practice

EN 50200: Method of test for resistance to fire of unprotected small cables for use in emergency circuits

EN 50289-4-16: Communication cables. Specifications for test methods. Environmental test methods. Circuit integrity under fire conditions

EN 50577: Communication cables - Specifications for test methods: Part 4-16: Environmental test methods - Circuit integrity under fire conditions

EN 50582: Procedure to assess the circuit integrity of optical fibres in a cable under resistance to fire testing

IEC 60331-23 Tests for electric cables under fire conditions - Circuit integrity. Procedures and requirements - Electric data cables

IEC 60331-25 Tests for electric cables under fire conditions - Circuit integrity. Procedures and requirements - Optical fibre cables

End of report

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